FLIGHT MANUAL
B-52C and B-52D

USAF SERIES AIRCRAFT

AF 34(601)-25900
F34601-73-D-2438

Commanders are responsible for bringing this publication to the attention of all Air Force personnel cleared for operation of subject aircraft.

CHANGE NOTICE

LATEST CHANGED PAGES SUPERSEDE THE SAME PAGES OF PREVIOUS DATE

Insert changed pages into basic publication. Destroy superseded pages.

See Technical Order Index T.O. 0-1-1-2 for current status of Flight Manuals, Safety and Operational Supplements, and Flight Crew Checklists.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE.

THIS PUBLICATION IS INCOMPLETE WITHOUT T.O.'s 1B-52C-1-1 (FORMALLY 1B-52C-1B), 1B-52B-1-2, 1B-52B-1-5, 1B-52C-1-1-1, 1B-52D-1-2, 1-1C-1, AND 1-1C-5. SUPPLEMENTARY PUBLICATIONS ARE PROVIDED TO SUPPLY OPERATIONAL COVERAGE IN NONSTANDARD CONFIGURATIONS. SEE T.O. 0-1-1-2 FOR NUMERICAL INDEX OF BOMBER TECHNICAL PUBLICATIONS.

Air Force OC, 17 May 74-4600

20 JUNE 1967
CHANGE 34 — 15 APRIL 1974

Technical orders are normally distributed promptly after printing. Date(s) shown on the title page (lower right corner) are for identification only. These are not distribution dates. Processing time sometimes causes distribution to only appear to have been delayed.

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue of original and changed pages are:

Original 0 20 Jun 67
Change 1 10 Aug 67
Change 2 15 Sep 67
Change 3 11 Dec 67
Change 4 15 Dec 67
Change 5 15 Mar 68
Change 6 22 Apr 68
Change 7 15 Jun 68
Change 8 15 Sep 68
Change 9 15 Oct 68
Change 10 15 Dec 68
Change 11 31 Jan 69
Change 12 5 Mar 69
Change 13 30 Mar 69
Change 14 30 Jul 69
Change 15 15 Nov 69
Change 16 30 Jan 70
Change 17 10 Apr 70
Change 18 10 Jul 70
Change 19 10 Sep 70
Change 20 30 Oct 70
Change 21 1 Dec 70
Change 22 15 Apr 71
Change 23 15 Jun 71
Change 24 15 Aug 71
Change 25 15 Oct 71
Change 26 15 Feb 72
Change 27 15 Apr 72
Change 28 15 Jul 72
Change 29 15 Nov 72
Change 30 15 Mar 73
Change 31 15 Jul 73
Change 32 15 Nov 73
Change 33 15 Mar 74
Change 34 15 Apr 74

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 1088 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.	Page No.	Change No.	Page No.	Change No.
*Title	34	1-22	2	1-55	22	1-106	13
*A - D	34	1-23	22	1-56	33	1-107	21
E Blank	31	1-24	1	1-57 - 1-59	22	1-108 - 1-109	24
Flyleaf 1	33	1-25 - 1-26 Deleted	10	*1-60	34	1-110	33
Flyleaf 2 Blank	26	1-27	10	1-61	25	1-110A - 1-110B	33
i	0	1-28 - 1-29	24	*1-62	34	1-111	33
ii	30	1-30	2	1-63	28	1-112	20
iii	26	1-31	18	1-64	31	1-112A - 1-112B	
iv	32	1-32	5	1-65 - 1-66	28	Deleted	20
v	30	1-33	18	1-66A - 1-66B	28	1-113	29
vi	18	1-34	2	1-67	28	1-114	31
*vii	34	1-35	18	1-68 - 1-69	0	1-115	33
viii	20	1-36	14	1-70	13	1-116	0
ix - x Deleted	20	1-37	0	1-71	0	1-117	29
xi - xvi Deleted	13	1-38	25	1-72	13	1-118	14
1-1	28	1-39 - 1-41	0	1-73	0	1-119	30
1-2 Blank	0	1-42	18	1-74	13	1-120	31
1-3	13	1-43 - 1-45	14	1-75	22	1-121	25
1-4	2	1-46	13	1-76 - 1-78	0	1-122 - 1-124	0
1-5	25	1-47	29	1-79	18	1-124A	31
1-6	5	1-48	30	1-80	4	1-124B Added	28
1-7	25	1-49 - 1-50	13	1-81 - 1-82	0	1-125	31
1-8 - 1-10	18	1-50A - 1-50B		1-83	5	1-126 - 1-127	0
1-11	25	Deleted	22	1-84	10	1-128	7
1-12 - 1-13	18	1-51	22	1-85 - 1-88	0	1-129	0
1-14	13	1-52	28	1-89	10	1-130	31
1-15	2	1-52A - 1-52D		1-90	0	1-130A - 1-130B	
1-16	4	Deleted	22	1-91	22	Deleted	31
1-17	20	1-52E - 1-52H		1-92 - 1-95	0	1-131	31
1-18	30	Deleted	13	1-96 - 1-97	13	1-132	18
1-19	31	1-53	25	1-98	8	1-133	31
1-20 - 1-21	21	1-54 Blank	22	1-99 - 1-105	0	1-134 - 1-135	18

CURRENT FLIGHT CREW CHECKLISTS

T.O. 1B-52C-1CL-1	20 Jun 67	Change 26 - 15 Mar 74
T.O. 1B-52C-1CL-2	15 Apr 71	Change 11 - 15 Mar 74
T.O. 1B-52C-1CL-3	15 Apr 71	Change 11 - 15 Mar 74
T.O. 1B-52C-1CL-4	15 Sep 68	Change 16 - 15 Mar 74
T.O. 1B-52C-1CL-5	15 Sep 68	Change 16 - 15 Mar 74
T.O. 1B-52C-1CL-6	15 Dec 67	Change 2 - 30 Mar 69

The above checklist dates are effective at the time of preparation of this page but are subject to change by safety or operational supplements or supplemental publications which affect the checklist.

Upon receipt of the second and subsequent changes to this technical order, personnel responsible for maintaining this publication in current status will ascertain that all previous changes have been received and incorporated. Action should be taken promptly if the publication is incomplete.

* The asterisk indicates pages changed, added, or deleted by the current change.

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED BY USAF ACTIVITIES IN ACCORDANCE WITH T.O. 00-5-2.

USAF

LIST OF EFFECTIVE PAGES (continued)

Page No.	Change No.
1-136	5
1-137	25
1-138 Blank	0
2-1	31
2-2	7
2-3	8
2-4	22
2-5	0
2-6	20
2-7 - 2-8A	18
2-8B Blank Added	5
2-9	17
2-10	31
2-10A Added	31
2-10B Blank Added	31
2-11	32
2-12	33
2-13 - 2-14	31
2-15	32
2-16	33
2-17	13
2-18	31
2-19	18
2-20 - 2-20A	32
2-20B	33
2-21	29
2-22	0
2-23	29
2-24	16
2-25	29
2-26	33
2-27	31
2-28	8
2-29	5
2-30	14
2-31	18
2-32	16
2-32A Added	16
2-32B Blank Added	16
2-33	16
2-34	17
2-35	31
2-36	0
2-37	5
2-38 - 2-39	31
2-40	0
2-41	20
2-42 - 2-42A	31
2-42B Blank Added	4
2-43	31
2-44 - 2-45	0
2-46	8
2-47	5
2-48	17
2-49	2
2-50	0
2-51	16
2-52	5
2-53 - 2-54	18
2-55	0
2-56	28
2-57	0
2-58	13
2-59	17
2-60	13
2-61	33
2-62	0
2-62A Added	20
2-62B Blank Added	20
2-63	20
2-64	18
2-65	0
2-66	30
2-67	4
2-68	30
2-69	29
2-70	33
2-71	31
2-72 - 2-73	28
2-74	29
2-74A	28
2-74B Blank Added	7
2-75 - 2-77	29
2-78	20
2-78A	22
2-78B Blank Added	20
2-79	20
2-80 - 2-81	0
2-82 - 2-83	18
2-84	20
2-84A Added	22
2-84B Blank Added	22
2-85 - 2-86	22
2-87	17
2-88	29
2-89 - 2-90	31
2-91	28
2-92	21
2-93 - 2-94	31
2-94A	30
2-94B Blank Added	29
2-95	31
2-96	13
2-97	8
2-98 - 2-100	0
2-101	31
2-102 - 2-103	30
2-104	32
2-105	31
2-106	8
2-106A	18
2-106B Blank Added	5
2-107	28
2-108	24
2-109	27
2-110	30
2-110A	33
2-110B Blank Added	27
2-111	31
2-112 - 2-113	26
2-114 Blank	17
2-115	31
2-116	26
2-117	20
2-118 - 2-122	31
3-1	29
3-2	31
3-2A - 3-2B Deleted	25
3-3	29
3-4 - 3-5	25
3-6	28
3-7 - 3-8	25
3-9	28
3-10 - 3-12	25
3-13	31
3-14	25
3-15	31
3-16 - 3-17	25
3-18 - 3-19	29
3-20 - 3-22	25
3-22A - 3-22B Deleted	25
3-23 - 3-24	25
3-25 - 3-26	26
3-27	25
3-28 - 3-29	25
3-30	32
3-31	31
3-32 - 3-33	25
3-34	31
3-34A Added	31
3-34B Blank Added	31
3-35 - 3-39	25
3-40 - 3-42	30
3-42A Added	28
3-42B Blank Added	28
3-43 - 3-45	31
3-46 - 3-47	30
3-48	32
3-48A Added	32
3-48B Blank Added	32
3-49 - 3-50	31
3-51 - 3-52	29
3-52A - 3-52B Added	29
3-53 - 3-56	25
3-56A - 3-56H Deleted	25
3-57 - 3-66	25
3-67	29
3-68	25
3-69	29
3-70 - 3-75	25
3-76	31
3-77 - 3-78	25
3-79	30
3-80	25
3-81 - 3-82	29
3-82A - 3-82B Deleted	25
3-83	29
3-84	30
3-84A - 3-84B Deleted	25
3-85 Blank	25
3-86 - 3-88	29
3-89 - 3-90	28
3-90A - 3-90B Added	28
3-90C Added	29
3-90D Blank Added	29
3-91 - 3-92	29
3-92A	33
3-92B - 3-92D Added	28
3-93	28
3-94 - 3-95	25
3-96	29
3-97 - 3-98	32
3-98A - 3-98B Deleted	25
3-99 - 3-102	25
3-102A - 3-102B Deleted	25
3-103 - 3-108	25
3-108A - 3-108B Deleted	25
3-109 - 3-114	25
3-114A - 3-114B Deleted	22
3-115 - 3-116	25
*3-117	34
3-118 Added	25
3-119 - 3-122	25
3-123 Added	25
3-124	33
*3-125	34
3-126 Added	25
3-127	33
3-128 Added	25
3-129	33
3-130 - 3-131 Added	25
3-132	29
3-133 - 3-134 Added	25
3-135	33
3-136 - 3-137 Added	25
3-138	31
3-139 - 3-142 Added	25
4-1	31
4-2	14
4-3	7
4-4 - 4-5	14
4-6	7
4-6A	20
4-6B Blank Added	7
4-7 - 4-9	0
4-10	16
4-11	20
4-12	31
4-13	16
4-14	18
4-15	0
4-16 - 4-17	13
4-18	0
4-19	21
4-20	10
4-21	0
4-22	20
4-23	21
4-24	0
4-25	20
4-26	30
4-27	0
4-28 - 4-29	20
4-30	10
4-30A	20
4-30B Blank Added	1
4-31	20
4-32 - 4-33	0
4-34 - 4-36	10
4-37 - 4-38	20
4-38A - 4-38B	21
4-39	30
4-40	21
4-40A	26
4-40B Added	21
4-41	26
4-42 - 4-43	30
4-44 - 4-47	0
*4-48	34
4-49	0
4-50	31
4-51	13
4-52 - 4-54	31
4-55 - 4-56 Deleted	18
4-57	31
4-58 - 4-59	2
4-60	0
4-61	10
4-62	22
4-63	10
4-64	4

LIST OF EFFECTIVE PAGES (continued)

Page No.	Change No.
4-65 - 4-66	20
4-67	9
4-68 - 4-69	20
4-70	0
4-71	20
4-72 - 4-74	10
4-75	24
4-76	5
4-77	10
4-78	5
4-79 - 4-81	2
4-82	0
4-83	26
4-84	10
4-85	26
4-86 - 4-87	25
4-88	24
4-89	10
4-90 - 4-91	30
4-92	31
4-93	4
4-94	13
4-95	0
4-96	2
4-97 - 4-100	0
4-101	5
4-102 - 4-105	0
4-106	13
4-107	22
4-108	0
4-109	26
4-110 - 4-111	30
4-112	4
4-113 - 4-117	0
4-118 - 4-125	30
4-126	0
4-127	22
4-128 - 4-131	30
4-132 - 4-133	0
4-134	13
4-134A - 4-134 Deleted	13
4-135 - 4-136	33
4-137	30
4-138 - 4-139	18
4-140 - 4-141	13
4-142	28
4-143	33
4-144	13
4-145	25
4-146	20
4-147 - 4-148	13
4-149	33
4-150	28
4-151 - 4-166 Deleted	13
4-167	0
4-168	20
4-169 - 4-176	0
4-177	5
4-178	24
4-179 - 4-180	0
4-181	18
4-182	30
4-182A - 4-182B Added	24
4-183	30
4-184 - 4-185	0
4-186	31
4-186A Added	18
4-186B Blank Added	18
4-187	32
4-188 - 4-189	18
4-190	13
4-191	0
4-192	31
4-192A - 4-192B Deleted	31
4-193	31
4-194	28
4-195	21
4-196	22
4-197	31
4-198	2
4-199	19
4-200	20
4-200A - 4-200B Deleted	7
4-201 - 4-202	20
4-203	18
4-204	0
4-205	30
4-206	14
4-207 Added	30
4-208 Blank Added	30
5-1	16
5-2	8
5-3 - 5-4	0
5-5	13
5-6	0
5-7	18
5-8	0
5-9	14
5-10 - 5-11	16
5-12	8
5-13	20
5-14	26
5-15	29
5-16	13
5-16A	33
5-16B Blank	31
5-17	20
5-18	0
5-19	28
5-20	0
5-21	18
5-22	17
5-22A Added	10
5-22B	22
5-23 - 5-24	33
5-24A - 5-24B	33
5-25	0
5-26	5
5-27 - 5-30	0
6-1	0
6-2 - 6-3	24
6-4	29
6-5	32
6-6	24
6-7	22
6-8	24
6-9	0
6-10 - 6-12	22
6-13 - 6-14	24
6-15	22
6-16	13
6-17	30
6-18 - 6-20	29
6-20A Added	29
6-20B Blank Added	29
6-21 - 6-22	29
6-22A - 6-22B Added	29
6-23 - 6-24	22
6-25	0
6-26	22
6-27	4
6-28	16
6-28A Added	16
6-28B Blank Added	16
6-29	29
6-30 - 6-31	22
6-32	24
7-1 - 7-5	0
7-6 - 7-7	8
7-8	0
7-9	20
7-10	12
7-11 - 7-12	8
7-12A Blank Added	13
7-12B Added	13
7-13	13
7-14 - 7-16	0
7-17	13
7-18	2
7-19	13
7-20	0
7-21	13
7-22	14
7-22A - 7-22B Added	24
7-23 - 7-25	0
7-26	10
7-27	5
7-28	0
7-29	22
7-30 - 7-32	0
7-33	17
7-34 - 7-36	0
7-37	19
7-38	21
7-39	19
7-40	22
8-1	33
8-2	13
8-2A Added	31
8-2B Blank Added	31
8-3	33
8-4	26
8-5	33
8-6	26
8-7	27
8-8	30
8-9	22
8-10	33
8-11 - 8-12	31
8-12A Added	27
8-12B Blank Added	27
8-13	26
8-14	23
8-15	30
8-16 - 8-17	31
8-18	33
8-18A - 8-18B Deleted	22
8-19	22
8-20	31
8-20A - 8-20B Deleted	31
8-21 - 8-22	31
8-22A - 8-22B	31
8-22C - 8-22D Deleted	31
8-23 - 8-24	22
8-25 - 8-27	31
8-28	33
8-28A - 8-28D	33
8-29 Blank	32
8-30	32
8-31 - 8-33	31
8-34	33
8-35	28
8-36	31
8-36A - 8-36B Deleted	22
8-37 - 8-40	33
8-41	32
8-42 - 8-42A	33
8-42B Blank Added	32
8-43	22
8-44	27
8-45 - 8-46	33
8-46A - 8-46D Deleted	22
8-47 - 8-48	31
8-49 - 8-50	27
8-50A - 8-50B Deleted	22
8-51	23
8-52	33
8-53	22
8-54	31
8-55 - 8-56 Deleted	31
8-57	29
8-58 - 8-59	22
8-60	33
8-61 - 8-62	22
8-63	33
8-64 - 8-70	31
8-71	33
8-72	22
8-73	32
8-74 - 8-76	31
8-77	33
8-78	32
8-78A - 8-78B Added	31
8-78C	32
8-78D	33
8-79 - 8-80	31
8-80A - 8-80C	32
8-80D Added	31
8-81	32
8-82	33
8-82A Added	31
8-82B	32
8-82C	33
8-82D Added	31
8-83	33
8-84	31
8-84A - 8-84C	33
8-84D Added	31
8-84E - 8-84F Deleted	22
8-85 - 8-86	33
8-86A - 8-86C	33
8-86D - 8-86F	31

LIST OF EFFECTIVE PAGES (continued)

Page No.	Change No.
8-86G - 8-86H Deleted	31
8-87	33
8-88 - 8-88A	31
8-88B	30
8-88C	28
8-88D	31
8-88E	28
8-88F	33
8-88G - 8-88H	31
8-88-I - 8-88J Deleted	17
8-89	31
8-90	23
8-90A	31
8-90B Blank	17
8-90C - 8-90D Deleted	17
8-91	32
8-92	22
8-92A - 8-92C	33
8-92D - 8-92G	31
8-92H	33
8-92-I - 8-92J	31
8-92K	32
8-92L Blank	32
8-93	32
8-94 Blank	0
8-95 - 8-96 Deleted	32
8-97 - 8-98 Deleted	30
8-99 - 8-100 Deleted	32
8-101 - 8-104 Deleted	30
8-105	0
8-106 Blank	0
8-107	30
8-108	18
8-109	22
8-110	28
8-111 - 8-116	0
8-117	30
8-118	32
8-119	30
8-120 Blank	30
8-121 - 8-124 Deleted	30
8-125 - 8-126	0
8-126A - 8-126B Added	13
8-126C	23
8-126D Added	13
8-126E	33
8-126F Added	13
8-126G Added	32
8-126H Blank Added	32
8-127	13
8-128	31
8-129 - 8-130A	33
8-130B Blank Added	31
8-131	31
8-132	33
8-133 - 8-134	31
8-135 - 8-136	33
8-137	31
8-138	32
8-139 - 8-142	33
8-142A - 8-142B Deleted	32
8-143 - 8-144	33
8-144A - 8-144C	33
8-144D Blank	33
8-145 - 8-148	33
8-148A - 8-148B Deleted	32
8-149 - 8-150	33
8-151 - 8-154 Deleted	33
8-155 - 8-156 Deleted	32
8-157 - 8-160 Deleted	33
8-160A - 8-160B Deleted	33
8-161 - 8-164 Deleted	33
8-164A - 8-164D	33
8-164D-1 - 8-164D-2 Deleted	33
8-164E - 8-164F	33
8-164G	31
8-164H	20
8-164-I	19
8-164J	30
8-164K	19
8-164L - 8-164M	31
8-164N	13
8-164-O	17
8-164P - 8-164Q	29
8-164R	30
8-164S	26
8-164T - 8-164U	31
8-164V	30
8-165	32
8-166	13
8-167	31
8-168	8
8-169	20
8-170	33
8-171 - 8-172	8
8-172A	26
8-172B Added	8
8-172C	28
8-172D Added	8
8-172E - 8-172F	31
8-172G	20
8-172H - 8-172J Added	8
8-173	13
8-174 - 8-175	30
8-176	16
8-177	4
8-178	13
8-179	8
8-180	0
8-181	31
8-182	0
8-183 - 8-184	14
8-185	32
8-186	14
8-187	31
8-188 Blank	0
9-1	0
9-2	16
9-3 - 9-4	17
9-5 - 9-6 Deleted	10
9-7 - 9-9	10
9-10	0
9-11	10
9-12	13
9-13	24
9-14	29
9-14A - 9-14B Added	26
9-14C Added	30
9-14D	31
9-15	30
9-16	32
9-17 - 9-19	0
9-20	2
9-21	0
9-22	14
9-23 - 9-25	0
9-26 Blank	0
Index 1	28
Index 2 - Index 3	31
Index 4	30
Index 5	32
Index 6	33
Index 7	31
Index 8	30
Index 9	33
Index 10	30
Index 11	33
Index 12	32
Index 13	30
Index 14	31
Index 15	29
Index 16	30
Index 17	31
Index 18	25

STATUS OF SAFETY AND OPERATIONAL SUPPLEMENTS

This supplement status page is based on information available to the manual editor as of the date of this publication. The information may not be current as it must be updated by any subsequent supplement status pages and by reference to T.O. 0-1-1-2.

SUPPLEMENTS IN THIS CHANGE

NUMBER	DATE	SHORT TITLE	SECTION AFFECTED
S-124	3 Dec 73	Altimeter Update	Sections I and II and T.O. 1B-52C-1CL-1

OUTSTANDING SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	SECTION AFFECTED
SS-116	31 May 73	HBU-2B/A Belt Warning	
SS-122	1 Oct 73	Flight Restrictions	

TABLE OF CONTENTS

TO AVOID COMPLICATIONS READ THE FOLLOWING PAGES CAREFULLY!!!!

SCOPE. This manual provides you with a general knowledge of the aircraft, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized; therefore, basic flight principles are avoided.

SUPPLEMENTARY MANUALS. This manual must be used with one or more of the following supplementary manuals to obtain all the information necessary for safe and efficient operation of B-52C and D aircraft. These manuals have been separated from this manual for your convenience in handling information which may be classified, applicable only to certain aircraft configurations, or used only by certain crew members.

T.O. 1B-52C-1-1	Supplement, Flight Manual - B-52C and B-52D (SECRET) (Title Unclassified)
T.O. 1B-52B-1-2	Flight Manual - Appendix 2, Performance Data - B-52B thru E
T.O. 1B-52B-1-5	Gunner's Manual - Inflight Operation, MD-9 Fire Control System - B-52B thru F
T.O. 1B-52D-1-2	Electronic Warfare Officer's Manual - Inflight Operation - B-52C thru H (SECRET) (Title Unclassified)
T.O. 1B-52C-1-1-1	Radar Navigator's/Navigator's Manual - Inflight Operation, AN/ASQ-48 Bombing Navigational System, Optical and Radar - B-52C and D
T.O. 1B-52C-1-1-2	Radar Navigator's/Navigator's Manual - Inflight Malfunction Isolation and Correction Procedures - AN/ASQ-48 Bombing Navigational System, Optical and Radar - B-52C and D
T.O. 1B-52C-25-1	Nuclear Bomb Delivery Technical Manual - Basic Information (SECRET RESTRICTED DATA) (Title Unclassified)
T.O. 1B-52C-25-2	Nuclear Bomb Delivery Technical Manual - Bomb Operating Procedures (SECRET RESTRICTED DATA) (Title Unclassified)
T.O. 1B-52C-25-3	Nuclear Bomb Delivery Technical Manual - Ballistics (CONFIDENTIAL-FORMERLY RESTRICTED DATA) (Title Unclassified)
T.O. 1B-52C-30-1	Aircrew Weapon Delivery Technical Manual - B-52/AGM-28
T.O. 1B-52C-34-2-1	Aircrew Conventional Munitions Delivery Manual, Strategic Mission (Description and Procedures) - B-52C thru H
T.O. 1B-52C-34-2-2	Aircrew Conventional Munitions Delivery Manual, Strategic Mission (Ballistics) - B-52C thru H
T.O. 1-1C-1	Flight Manual - Basic Flight Crew Air Refueling Procedures
T.O. 1-1C-1-5	Flight Manual B-52B thru F - Flight Crew Air Refueling Procedures with KC-135, Supplement V

SOUND JUDGMENT. Instructions in this manual are for a crew inexperienced in the operation of this aircraft. This manual provides the best possible operating instructions under most circumstances, but it is a poor substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc may require modification of the procedures.

PERMISSIBLE OPERATIONS. The Flight Manual takes a "positive approach" and normally states only what you can do. Unusual operations or configurations (such as asymmetrical loading) are prohibited unless specifically covered herein. Clearance must be obtained from the Flight Manual Manager (OCAMA/MMEAF) before any questionable operation is attempted which is not specifically permitted in this manual.

STANDARDIZATION AND ARRANGEMENT. Standardization assures that the scope and arrangement of all Flight Manuals are identical. The manual is divided into nine fairly independent sections to simplify reading it straight through or using it as a reference manual.

SAFETY AND OPERATIONAL SUPPLEMENTS. B-52C and D aircraft information involving flight crew safety will be promptly forwarded to you by Safety Supplements issued against this basic flight manual. Safety Supplements covering loss of life will get to you in 48 hours by TWX (called Interim Safety Supplements) and those concerning serious damage to equipment within 10 days by mail (in a formal printed form). Operational information not involving safety but of an urgent nature will be forwarded to you by Operational Supplements issued against this basic flight manual. These will be forwarded by TWX (interim) or by mail (formal), depending on the urgency of the information. Interim supplements are normally replaced by formal printed supplements at an early date. Formal printed supplements are identified by red letters "SS" for safety supplements and black letters "OS" for operational supplements printed around the borders of the pages. The currency of safety and operational supplements affecting your aircraft and flight manual can be determined by referring to the Monthly Index of Bomber Aircraft Safety Supplements (T.O. 0-1-1-2). The title block of each supplement and the title page of this manual should also be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements – current supplements must be complied with, but there is no point in restricting your operation by complying with a replaced or rescinded supplement. As a further aid, a supplement summary is included in this manual following the A pages for both safety and operational supplements; however, this summary can be only as current as this manual. Safety and Operational Supplements will be filed in accordance with Section VI of the Air Force Technical Order System, T.O. 00-5-1.

CHECKLISTS. The Flight Manual contains only amplified checklists. Abbreviated checklists have been issued as separate technical orders - see the back of the title page for T.O. number and date of your latest checklist. Line items in the Flight Manual and checklists are identical with respect to arrangement and item number. Whenever a Safety or Operational Supplement affects the abbreviated checklist, write in the applicable change on the affected checklist page. As soon as possible, a new checklist page incorporating the supplement will be issued. This will keep hand-written entries of Safety and Operational Supplement information in your checklist to a minimum.

HOW TO GET PERSONAL COPIES. Each flight crew member is entitled to personal copies of the Flight Manual, Safety and Operational Supplements, and Checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your supply personnel - it is their job to fulfill your Technical Order requests. Basically, you must order the required quantities on the Numerical Index and Requirement Table, Bomber Aircraft Technical Orders (T.O. 0-1-1-2). Technical Orders 00-5-1 and 00-5-2 give detailed information for properly ordering these publications. Make sure a system is established at your base to deliver these publications to the flight crews immediately upon receipt.

FLIGHT MANUAL AND CHECKLIST BINDERS. Loose leaf binders and sectionalized tabs are available for use with your manual. These are obtained through local purchase procedures and are listed in the Federal Supply Schedule (FSC Group 75, Office Supplies, Part 1). Binders are also available for carrying your abbreviated checklist. These binders contain plastic envelopes into which individual checklist pages are inserted. They are available in three capacities and are obtained through normal Air Force supply under the following stock list numbers: 7510-766-4268, -4269, and -4270 for 15, 25, and 40 envelope binders respectively. Check with your supply personnel for assistance in securing these items. Normally a checklist will be contained in one binder but, if not feasible, additional binders may be used as required.

WARNINGS, CAUTIONS AND NOTES. The following definitions apply to "Warnings," "Cautions," and "Notes" found throughout the manual.

WARNING	Operating procedures, techniques, etc, which will result in personal injury or loss of life if not carefully followed.
CAUTION	Operating procedures, techniques, etc, which will result in damage to equipment if not carefully followed.
NOTE	An operating procedure, techniques, etc, which is considered essential to emphasize.

CHANGE SYMBOLS Changes to existing material and addition of new material are indicated by one of three types of symbols determined by the nature of the material affected. Text material utilizes a vertical line in the margin adjacent to the affected area. New illustrations (figures) utilize a vertical line in the outer margin of the page. Photographs and line drawings use a miniature pointing hand to highlight the affected area. Diagrams and schematics utilize a grey tone (screening) to highlight the affected area. Change symbols are not used for blank space resulting from deletions, indexes, and tabular data where changes cannot be identified, relocation of material, or correction of minor inaccuracies unless such correction changes the meaning.

YOUR RESPONSIBILITY — TO LET US KNOW. Every effort is made to keep the Flight Manual current. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. These should be forwarded to your local standardization/evaluation unit and routed as directed by AFR 60-9 to OCAMA/MMEAF, Tinker AFB, Oklahoma 73145.

SHALL, WILL, SHOULD, AND MAY. The following definitions apply to the words "shall," "will," "should," and "may."

- SHALL or WILL - The instructions or procedures prefaced by "shall" or "will" are mandatory.
- SHOULD - Normally used to indicate a preferred but nonmandatory method of accomplishment.
- MAY - An acceptable or suggested means of accomplishment.

AIRCRAFT CODING

The information in this manual covers all B-52C and B-52D aircraft. Code symbols are used to distinguish information related to one aircraft or group of aircraft from that which is applicable to the other aircraft. When code symbols appear by a paragraph or illustration, the information applies only to the aircraft represented by the code symbols. Where no code symbols appear on a paragraph or illustration, the information is applicable to all aircraft. Three kinds of aircraft code symbols are used.

- AIRCRAFT MODEL CODING **B-52C** AND **B-52D**. These code symbols are used to differentiate between aircraft models.
- AIRCRAFT UNIT CODING **54** AND **W8**. Seattle built- and Wichita-built aircraft are separately coded. Unit coding permits reference to individual aircraft or to a continuous series of aircraft. Symbol ▶ means "thru" or "on." Example:

54▶**63** Aircraft AF53-399 thru AF53-408

57▶**W4**▶Aircraft AF53-402 and on and AF55-052 and on

- AIRCRAFT GROUP CODING **B-52** **1** . This coding applies to a selected group of aircraft which have a common modification incorporated in that group which is no longer identified by TCTO number. Group **B-52** **1** applies to a modification of the conventional munitions bombing system. Refer to T. O. 1B-52C-34-2-1 for information on this configuration. See explanatory notes below for aircraft in this group.

SEATTLE AIRCRAFT

NOTE

Code **B-52** **1** applies to the following designated B-52C aircraft (example: **56** 53-401 **1**) and to all B-52D aircraft.

Symbol	AF Serial No.
B-52C	
54	53-399
55	53-400
56	53-401 **1**
57	53-402
58	53-403
59	53-404 **1**
60	53-405
61	53-406
62	53-407
63	53-408
64	54-2664
65	54-2665
66	54-2666
67	54-2667
68	54-2668
69	54-2669
70	54-2670
71	54-2671
72	54-2672
73	54-2673
74	54-2674
75	54-2675
76	54-2676
77	54-2677
78	54-2678
79	54-2679
80	54-2680
81	54-2681 **1**
82	54-2682
83	54-2683
84	54-2684
85	54-2685
86	54-2686
87	54-2687
88	54-2688
B-52D	
89	55-068
90	55-069
91	55-070
92	55-071
93	55-072
94	55-073
95	55-074
96	55-075
97	55-076
98	55-077
99	55-078
100	55-079
101	55-080
102	55-081
103	55-082
104	55-083
105	55-084
106	55-085
107	55-086
108	55-087
109	55-088
110	55-089
111	55-090
112	55-091
113	55-092
114	55-093
115	55-094
116	55-095
117	55-096
118	55-097
119	55-098
120	55-099
121	55-100
122	55-101
123	55-102
124	55-103
125	55-104
126	55-105
127	55-106
128	55-107
129	55-108
130	55-109
131	55-110
132	55-111
133	55-112
134	55-113
135	55-114
136	55-115
137	55-116
138	55-117
139	56-580
140	56-581
141	56-582
142	56-583
143	56-584
144	56-585
145	56-586
146	56-587
147	56-588
148	56-589
149	56-590
150	56-591
151	56-592
152	56-593
153	56-594
154	56-595
155	56-596
156	56-597
157	56-598
158	56-599
159	56-600
160	56-601
161	56-602
162	56-603
163	56-604
164	56-605
165	56-606
166	56-607
167	56-608
168	56-609
169	56-610
170	56-611
171	56-612
172	56-613
173	56-614
174	56-615
175	56-616
176	56-617
177	56-618
178	56-619
179	56-620
180	56-621
181	56-622
182	56-623
183	56-624
184	56-625
185	56-626
186	56-627
187	56-628
188	56-629
189	56-630

AIRCRAFT CODING (cont)

WICHITA AIRCRAFT

NOTE

Code **B-52** **1** applies to all B-52D aircraft.

Symbol	AF Serial No.
B-52D	
W1	55-049
W2	55-050
W3	55-051
W4	55-052
W5	55-053
W6	55-054
W7	55-055
W8	55-056
W9	55-057
W10	55-058
W11	55-059
W12	55-060
W13	55-061
W14	55-062
W15	55-063
W16	55-064
W17	55-065
W18	55-066
W19	55-067
W20	55-673
W21	55-674
W22	55-675
W23	55-676
W24	55-677
W25	55-678
W26	55-679
W27	55-680
W28	56-657
W29	56-658
W30	56-659
W31	56-660
W32	56-661
W33	56-662
W34	56-663
W35	56-664
W36	56-665
W37	56-566
W38	56-667
W39	56-668
W40	56-669
W41	56-670
W42	56-671
W43	56-672
W44	56-673
W45	56-674
W46	56-675
W47	56-676
W48	56-677
W49	56-678
W50	56-679
W51	56-680
W52	56-681
W53	56-682
W54	56-683
W55	56-684
W56	56-685
W57	56-686
W58	56-687
W59	56-688
W60	56-689
W61	56-690
W62	56-691
W63	56-692
W64	56-693
W65	56-694
W66	56-695
W67	56-696
W68	56-697
W69	56-698

PERSONNEL CODING

Where necessary to distinguish between crew members, the following code letters will be used: ▶

(P)	Pilot
(CP)	Copilot
(N)	Navigator
(RN)	Radar Navigator
(EW)	EW Officer
(G)	Gunner
(IP)	Instructor Pilot
(IN)	Instructor Navigator
(GC)	Ground Crew

RETROFIT CODING

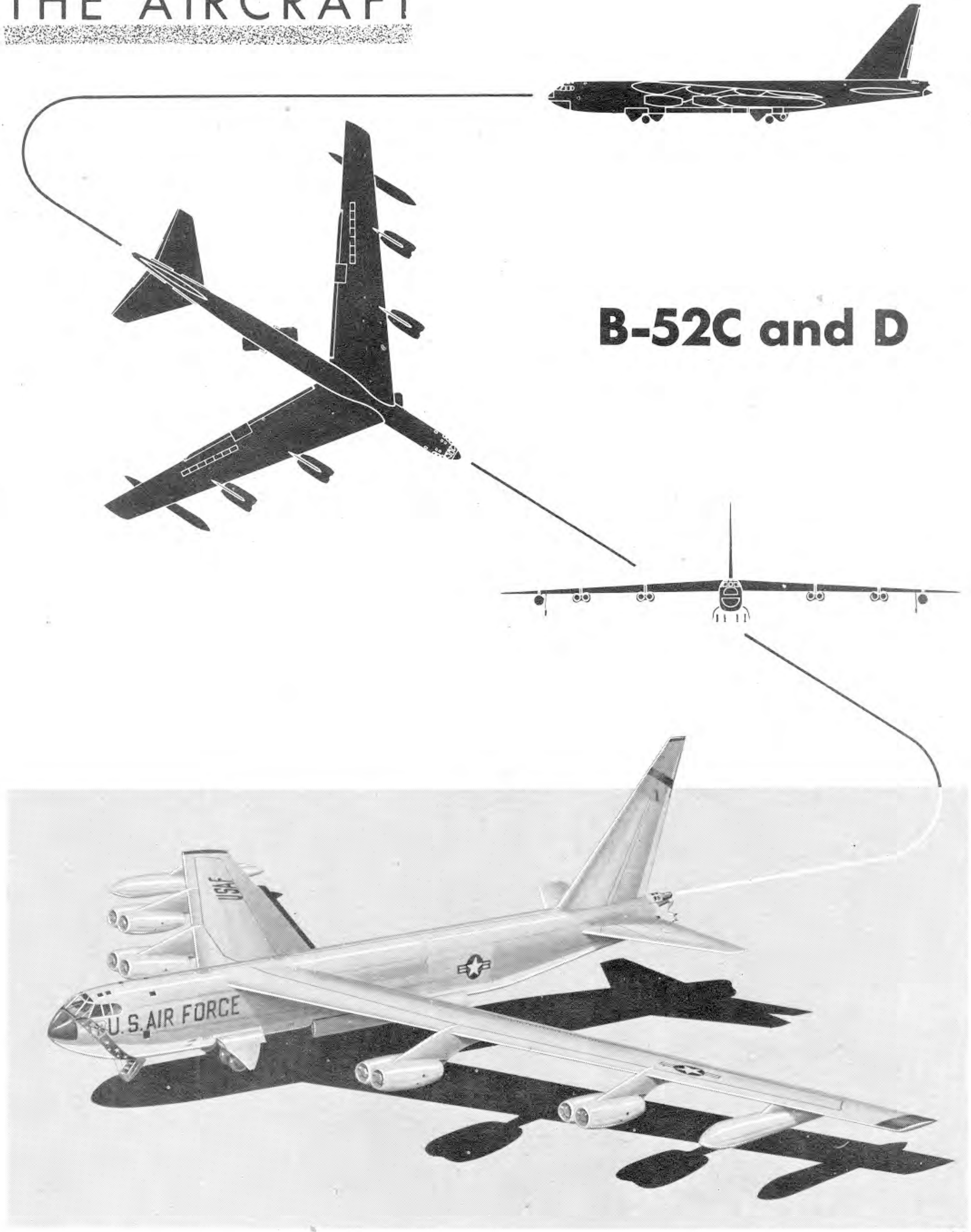
The following code symbols along with the words "Less" and "Plus" are used to distinguish information related to aircraft that have the described retrofit change incorporated from that which is applicable to aircraft not yet retrofitted. This list contains only TCTO's currently active. Those known to be completed are not included.

CODING EXAMPLE: ZV T. O. 1B-52-1978, Installation of AN/APX-64 (AIMS). Information applicable to aircraft until they are modified in accordance with T. O. 1B-52-1978 will be coded **Less** ZV. Information applicable to aircraft modified in accordance with T. O. 1B-52-1978 will be coded ZV .

SYMBOL	T. O. NO.	TITLE
ZR	1B-52-1930	Section 49 Crew Ground Escape Improvement (ECP 1387-5)
ZV	1B-52-1978	Installation of AN/APX-64 (AIMS)
ZX	ECP 1417-4K	Provisions for External Carriage of Aerial Mines B-52D
A	1B-52-1983	Installation of Coded Switch Set (ECP 1386)
D	1B-52D-567	Installation of Additional Offsets AN/ASQ-48 BNS B-52D (ECP 1339K)
J	1B-52D-574	Installation of MADREC Monitoring Capability of the Special Weapon Rack Select Switch B-52D
V	1B-52-2081	Installation of Modified AN/ALR-20A. ECM
X	1B-52-2080	Emergency Instrument Lighting Revision

THE AIRCRAFT

B-52C and D



B1-2

All data on pages ix and x (Deleted)

section I
DESCRIPTION

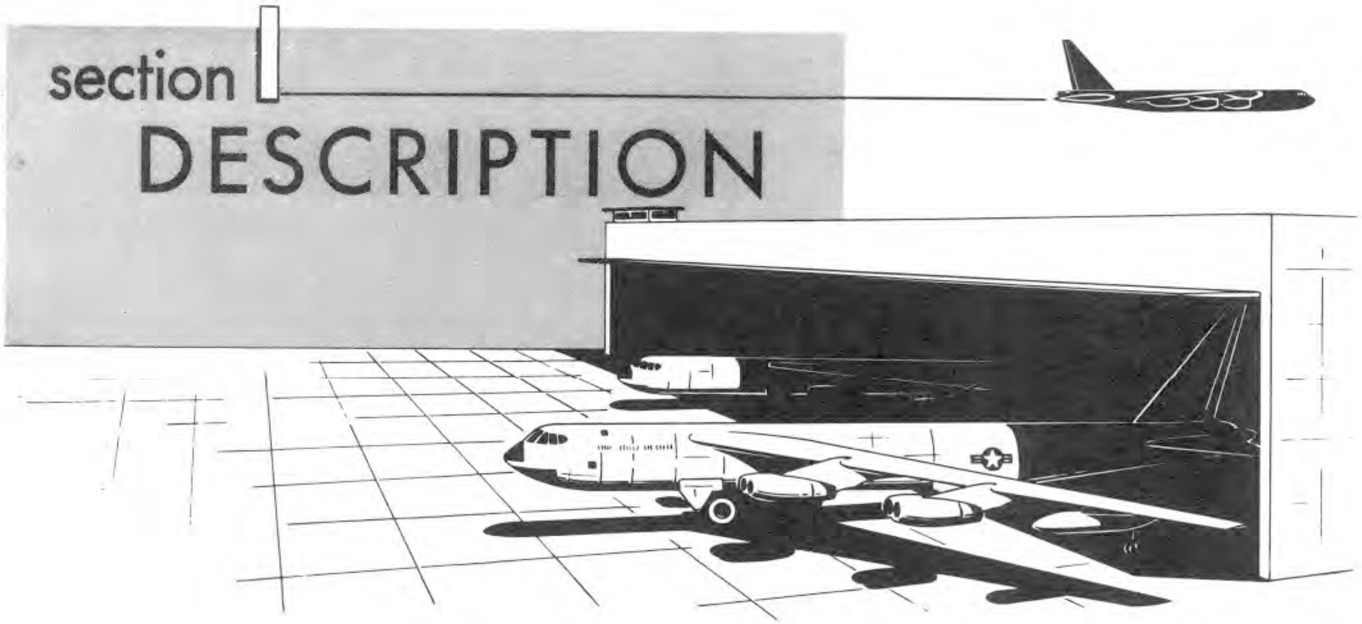


TABLE OF CONTENTS

Page

THE AIRCRAFT

The Boeing B-52C and B-52D "Stratofortress" aircraft are land based and of the heavy bombardment class designed for long range flight at high speed and altitude. The tactical mission is the destruction of surface objectives by bombs and missiles. These aircraft are equipped to carry two AGM-28 (Hound

ITEM	B-52C	B-52D	B-52E	B-52F	B-52G	B-52H
J-57-P-19W OR -29WA ENGINES	✓	✓	✓			
J-57-P-43W, -43WA, OR -43WB ENGINES				✓		
J-57-P-43WB ENGINES					✓	
TF33-P-3 ENGINES						✓
PNEUMATIC-DRIVEN ALTERNATOR PACKS	✓	✓	✓			
ENGINE-DRIVEN A-C GENERATORS				✓	✓	✓
PNEUMATIC-DRIVEN HYDRAULIC PACKS	✓	✓	✓	✓		
ENGINE-DRIVEN HYDRAULIC PUMPS					✓	✓
LATERAL CONTROL BY SPOILERS AND AILERONS	✓	✓	✓	✓		
LATERAL CONTROL BY SPOILERS ONLY					✓	✓
JETTISONABLE EXTERNAL TANKS – 3000 GALLONS	✓	✓	✓	✓		
FIXED EXTERNAL TANKS – 700 GALLONS					✓	✓
AUXILIARY TANK FUEL TRANSFER TO MAIN TANK	✓	✓	✓	✓		
AUXILIARY TANK FUEL FEED DIRECTLY TO ENGINES					✓	✓
TALL VERTICAL TAIL	✓	✓	✓	✓		
SHORT VERTICAL TAIL					✓	✓
OCCUPIED TAIL COMPARTMENT	✓	✓	✓	✓		
REMOTELY-OPERATED TAIL TURRET					✓	✓
AGM-28 CAPABILITY	✓	✓	✓	✓	✓	✓
ADM-20 CAPABILITY			✓		✓	✓
EXTERNAL STORES (CONVENTIONAL MUNITIONS RACKS)		✓		✓		
ALE-25 ROCKET PODS					✓	✓
HI-DENSITY BOMBING SYSTEM		✓				

MAIN DIFFERENCES TABLE

Figure 1-1.

Dog) air-to-surface missiles to within tactical range of the objective and launch them. The aircraft has a six-man crew comprising a pilot, copilot, radar navigator, navigator, EW (Electronic Warfare) officer, and gunner.

SPECIAL FEATURES

The aircraft is characterized by swept wings and empennage, four underslung nacelles housing eight turbojet engines, a quadricycle main landing gear, and a tip gear near each outboard engine nacelle. The engine configuration is clean and free of accessories due to the use of an air bleed (pneumatic power supply) system. Engine bleed air drives a-c alternators and hydraulic packs and, in addition, provides the air supply for air conditioning and anti-icing. Primary aircraft electrical power is 205-volt ac. Cartridge starters are installed on engines 2 and 8 to provide for engine starts without assistance from an auxiliary air cart or auxiliary electrical power cart. Hydraulic pressure is supplied by 10 individual hydraulic power supply systems. Primary control of the aircraft is accomplished by tab-operated floating control surfaces. The entire stabilizer is moved by a hydraulic mechanism to provide pitch trim. The ailerons are small and are located between the two wing flap sections on the trailing edge of each wing. Lateral control is augmentated by hydraulically actuated spoilers. By varying the method of control, these same spoilers serve as airbrakes. A steering and crosswind crab system provides steering of the forward main landing gear and also properly positions both forward and rear main landing gear for crosswind landings. These aircraft have provisions for mounting and controlling two AGM-28 missiles. The missiles are mounted on pylons attached to the left and right wings between the fuselage and the inboard engine nacelles. The copilot has the controls and indicators for missile engine operation and the missile fire warning system switches and indicators. The navigator has the controls and indicators for missile arming, launch, and guidance. The pilot and radar navigator have jettison switches. The radar navigator can release the missile by means of the BNS. These aircraft are painted in the following configurations:

- A white undercoating which provides increased heat reflectivity and weapons capability.
- A white undercoating and three-color camouflage paint added to the sides and upper surfaces of the airframe.
- Three-color camouflage paint on the upper sides and upper surfaces of the airframe and a black glossy paint on the fin, lower sides, and all bottom surfaces of the airframe.

DIMENSIONS

Wing Span	185 feet
Fuselage Length (including guns)	156 feet 6 inches
Height (to top of fin)	48 feet 3 inches
Height (fin folded)	21 feet 6 inches
Tread (centerline outboard main tires)	11 feet 4 inches
(centerline tip gear to tip gear)	148 feet 5 inches

GROSS WEIGHT

The aircraft is in the 400,000-pound gross weight class. For specific weight and loading information, see "Weight Limitations," Section V.

INTERIOR ARRANGEMENT

All crew members except the gunner perform their normal crew duties in the control cabin. The gunner is located in the tail compartment. The control cabin extends from a forward pressure bulkhead ahead of the pilots' stations to a pressure bulkhead aft of the EW officer's station. There is an upper and a lower deck in the cabin. Pilots' stations are located at the forward end of the upper deck. A celestial navigation station and EW officer's station are on the upper deck aft of the pilots' stations. The radar navigator's and navigator's stations, left and right respectively, are on the lower deck directly above the forward entry door (66, figure 1-2). An auxiliary crew member station is located aft of the radar navigator's station. The gunner sits facing aft in a pressurized tail compartment.

MOVEMENT OF FLIGHT PERSONNEL

Movement of the crew between the upper and lower decks in the control cabin is facilitated by a ladder on the right side of the cabin. Movement through the entire length of the aircraft is possible during unpressurized flight via a crawlway (figure 1-2) on the right side of the fuselage which extends from a pressure door (56, figure 1-2) in the control cabin aft pressure bulkhead to the aft equipment compartment. From this compartment, access to the tail compartment is gained by crawling under the center section of the stabilizer and entering through a pressure door (78, figure 1-2) in the tail compartment forward pressure bulkhead. Entrance to the tail compartment from the exterior of the aircraft is gained through an aft entry door (77, figure 1-2) on the right side of the fuselage. Windows are provided in bulkheads along the crawlway to allow inspection of the alternator deck, forward wheel well, bomb bay, and aft equipment compartment during flight. Movement of personnel between the control cabin and the tail compartment is not generally required for normal flight operations and will be avoided, particularly at high altitudes. If an inflight emergency requires such movement, see "Emergency Inflight Movement Between Control Cabin and Tail Compartment."

ENGINES

Eight Pratt and Whitney J-57 Turbojet engines are used to power the aircraft. These engines are mounted in pairs in four nacelles suspended below the wings. The engines are numbered in the conventional manner from left to right, one thru eight. The nacelles are also numbered in this manner with engines 1 and 2 in No. 1 nacelle, engines 3 and 4 in No. 2 nacelle, engines 5 and 6 in No. 3 nacelle, and engines 7 and 8 in No. 4 nacelle. For further information, see figure 1-3.

ENGINE AIR BLEED

Pneumatic power for operating the aircraft hydraulic, air conditioning, and alternator packs is derived from air which is bled from the compressors of each engine and supplied to the "Air Bleed (Pneumatic Power Supply) System" manifolds for distribution. High pressure hot air direct from the engine compressor is used to anti-ice engine compressor sections on all aircraft. Engine bleed air temperatures and pressures are directly dependent on engine throttle settings, OAT, altitude, and airspeed, with a maximum possible pressure and temperature of 200 psi and 800° F. For further information on the uses of engine bleed air, see "Air Bleed (Pneumatic Power Supply) System," this section.

ENGINE FUEL CONTROL SYSTEM

An engine fuel control system (figure 1-4) on each engine automatically provides optimum engine performance for any throttle setting. This system makes it unnecessary to make throttle adjustments to compensate for variations in inlet temperature, altitude, or airspeed. Fuel from the main tanks is routed through the fuel feed system to fuel control units which meter fuel to each engine. The throttle provides basic engine power control and operates through the fuel control unit to position a throttle valve. Engine fuel from the fuel feed system is also controlled by an electrically operated firewall shutoff valve. This valve is supplied power to open through the firewall fuel shutoff switch when the throttles are moved from CLOSED. This allows fuel under boost pump pressure to reach a two-stage engine-driven fuel pump. Output from the pump is delivered to the fuel control unit.

Fuel Control Unit

The fuel control unit is of the hydro-mechanical type and provides a means of obtaining optimum engine performance at any power setting. This unit contains a speed setting governor and pressure, speed, and temperature sensing servos which act in conjunction with the throttle to position the throttle valve. Fuel pressure at the throttle valve is maintained by a pressure regulator which bypasses fuel to the interstage area of the fuel pump. The amount of fuel metered to the engine by the throttle valve is determined by a combination of compressor discharge pressure, engine inlet temperature, engine rpm, and throttle position. A minimum pressure and shutoff valve, downstream from the throttle valve, is opened by metered fuel pressure from the throttle valve. When the throttle is closed, a pilot valve is opened which allows high pressure fuel to close the minimum pressure and shutoff valve. A flowmeter transmitter, flowmeter, and total fuel flow indicator are also provided. Metered fuel under pressure flows to the primary discharge nozzles and, when fuel pressure is sufficient, a pressurizing valve is opened which allows fuel to flow to the main discharge nozzles. A manifold drain valve, which is held closed by fuel pressure, is opened by return spring pressure when the throttle is moved to the CLOSED position shutting off fuel pressure to the valve. The opening of this valve as fuel pressure drops allows fuel to drain from the fuel manifolds.

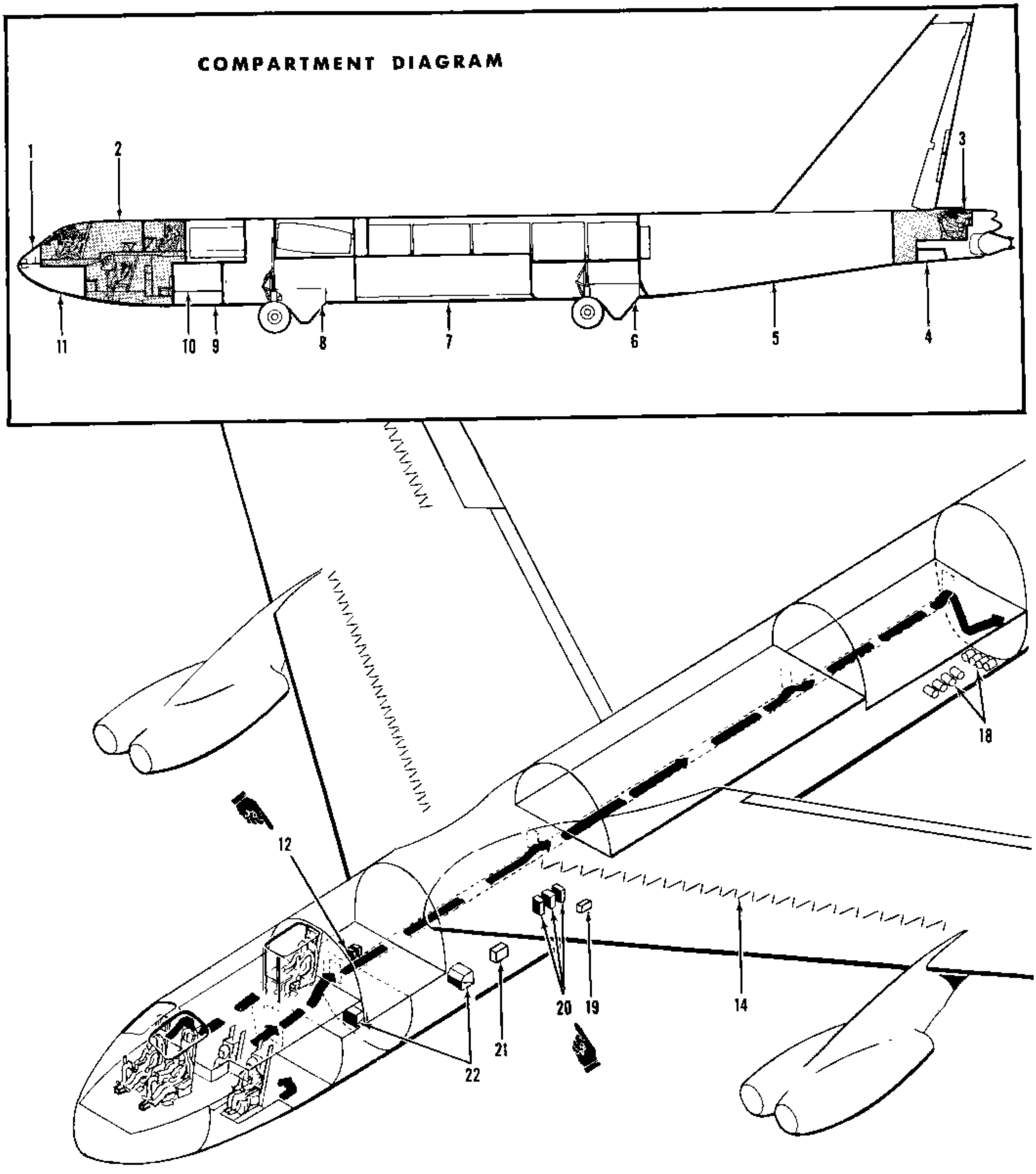
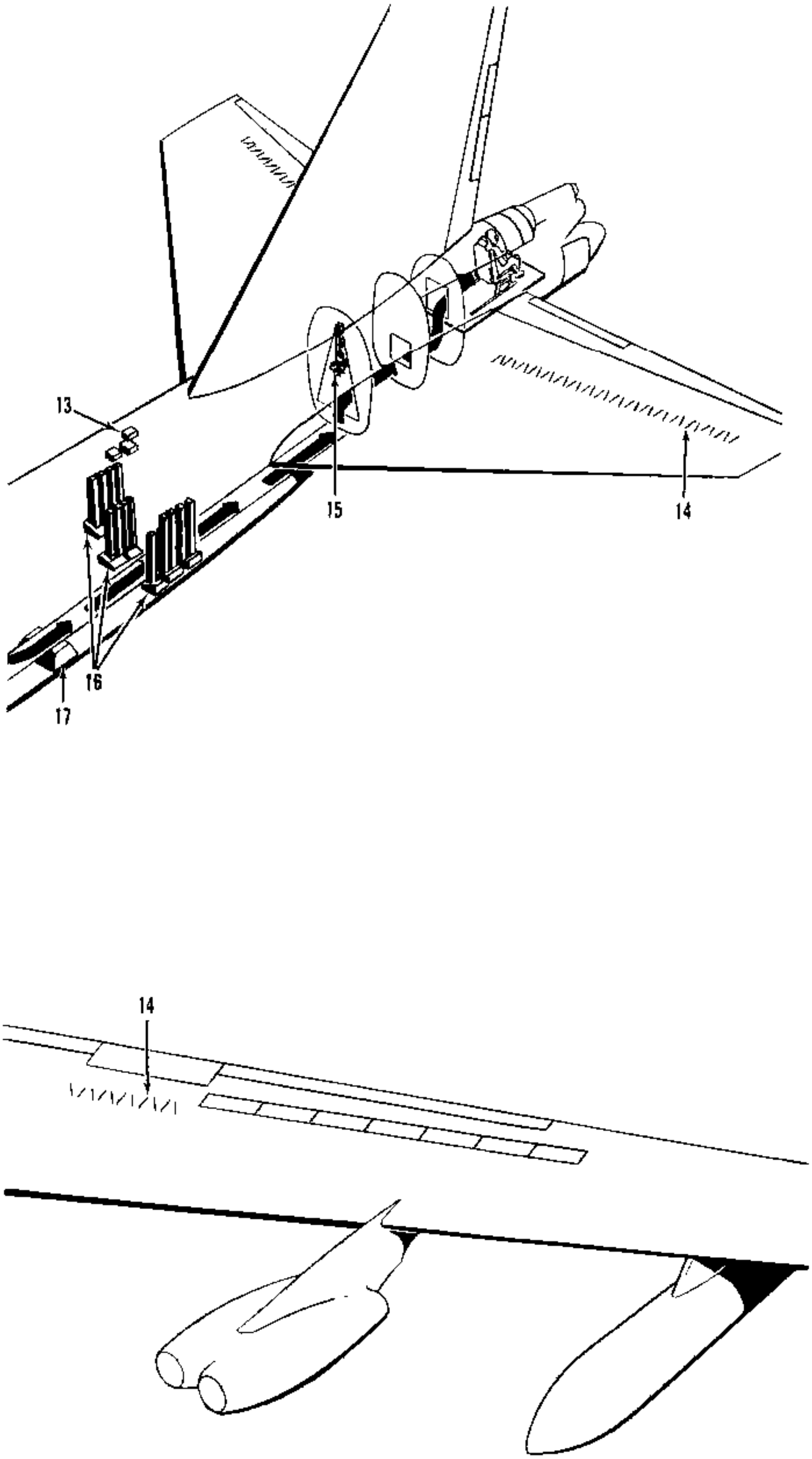


Figure 1-2 (Sheet 1 of 4).



1. NOSE ANTENNA COMPARTMENT
2. CONTROL CABIN
3. TAIL COMPARTMENT
4. DRAG CHUTE COMPARTMENT
5. AFT EQUIPMENT COMPARTMENT
6. REAR WHEEL WELL
7. BOMB BAY
8. FRONT WHEEL WELL
9. FORWARD ECM ANTENNA COMPARTMENT
10. ALTERNATOR DECK
11. NOSE RADOME COMPARTMENT
12. FORWARD TRANSFORMER RECTIFIER (TR) UNITS 1 AND 2
13. AFT TRANSFORMER RECTIFIER (TR) UNITS 6, 7, AND 8
14. VORTEX GENERATORS
15. STABILIZER TRIM JACKSCREW
16. CHAFF DISPENSERS
17. STRIKE CAMERA
18. STARTER CARTRIDGE STOWAGE
19. SWESS BATTERY **Less** **A**
20. FORWARD TRANSFORMER RECTIFIER (TR) UNITS 3, 4, AND 5
21. AGM-28 ARMAMENT PROVISIONS BATTERY
22. BATTERIES

▭ PRESSURIZED CREW COMPARTMENTS

■ CREW MOVEMENT

GENERAL ARRANGEMENT (Typical)

Figure 1-2 (Sheet 2 of 4).

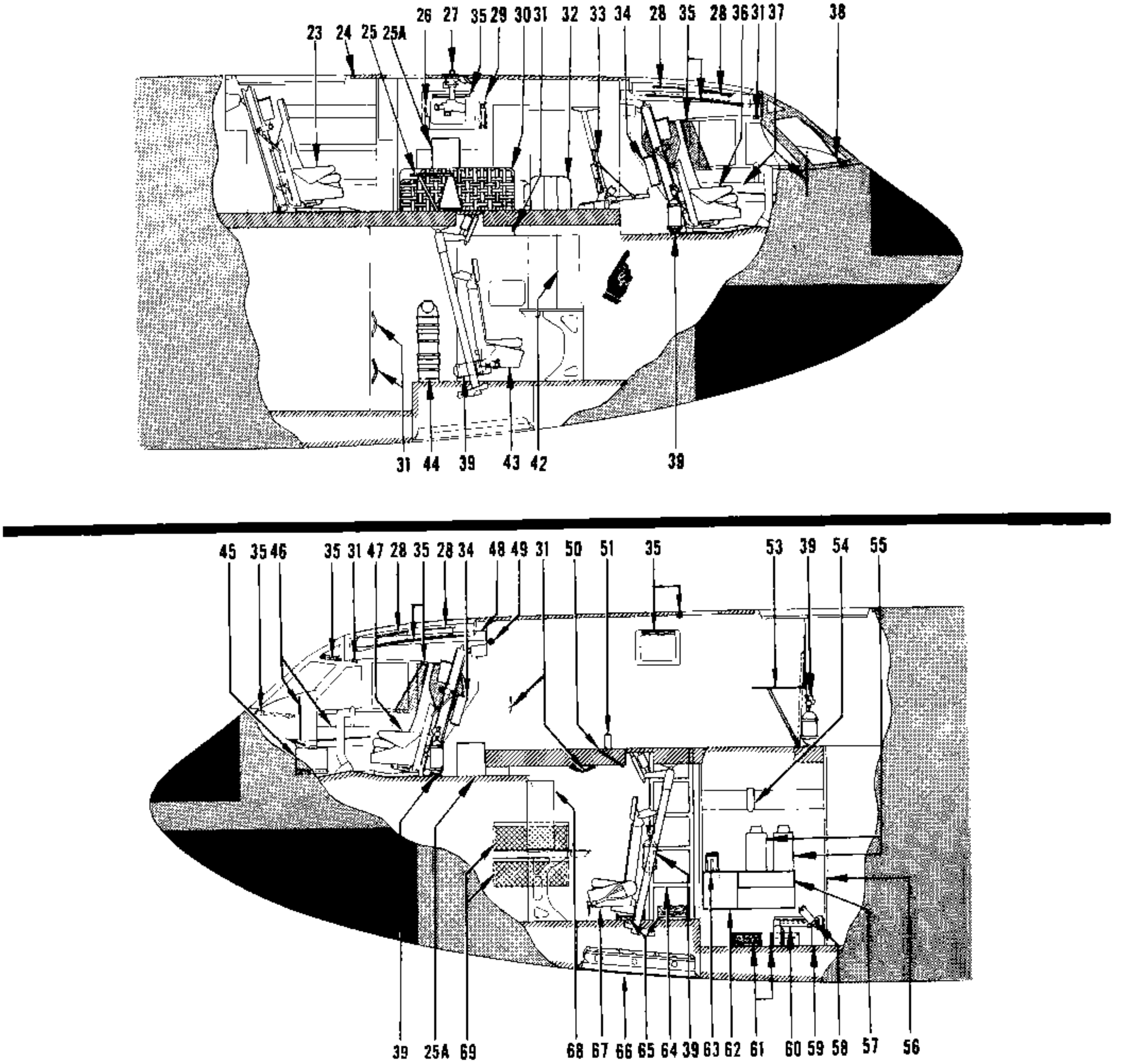
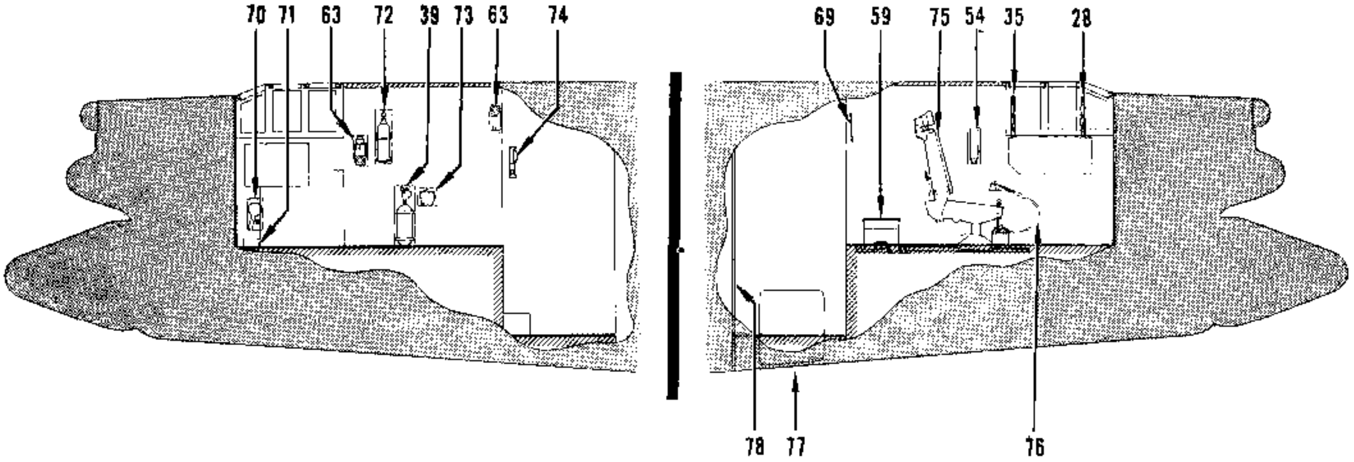


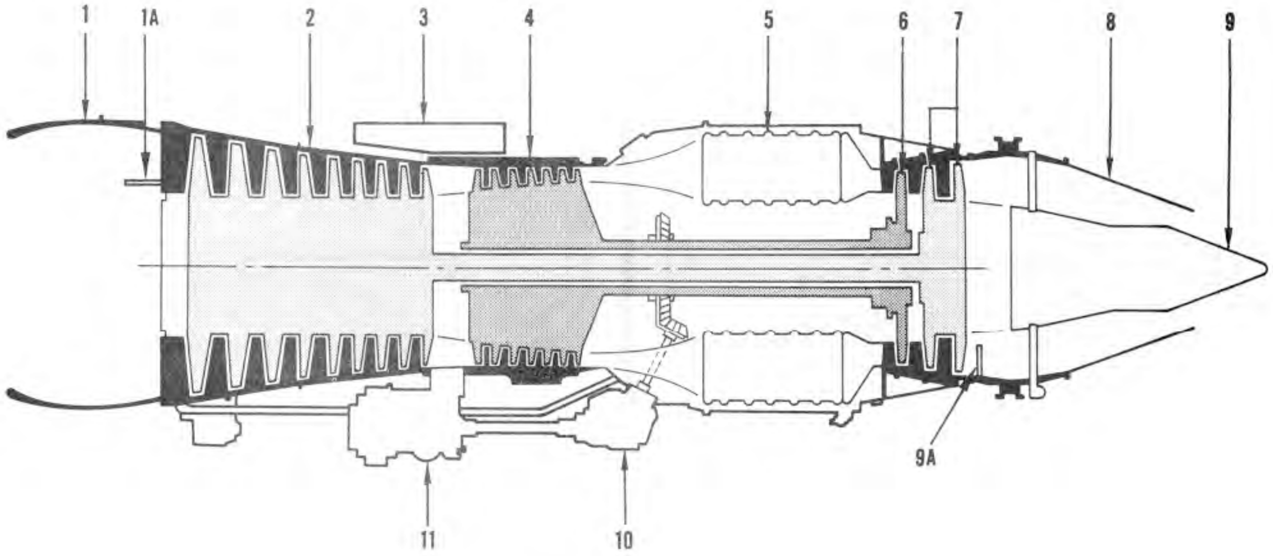
Figure 1-2 (Sheet 3 of 4).



23. EW OFFICER'S SEAT
24. EW OFFICER'S CONSOLE
25. CELESTIAL NAVIGATION SEAT
25A. PERISCOPIC SEXTANT CARRYING CASE
26. FILTERS FOR SCANNING LAMP
27. PERISCOPIC SEXTANT
28. SUNSHADES
29. SCANNING LAMP
30. CREW BUNK
31. ASSIST HANDLES
32. FOOD WARMING OVEN
33. INSTRUCTOR PILOT'S SEAT
34. FLIGHT REPORT HOLDER 54▶ 88 W1▶ W12
35. CREW HOODS
36. PILOT'S SEAT
37. PILOT'S INSTRUMENT PANELS
38. WINDSHIELD WIPERS
39. PORTABLE OXYGEN BOTTLE
40. (Deleted)
41. (Deleted) ☛
42. RADAR NAVIGATOR'S CONSOLE
43. RADAR NAVIGATOR'S SEAT
44. RELIEF TANK
45. COPILOT'S CLIP BOARD
46. COPILOT'S INSTRUMENT PANELS
47. COPILOT'S SEAT
48. PILOT'S OVERHEAD PANEL
49. NIGHT FLYING CURTAIN
50. BLACKOUT CURTAIN
51. SPARE LAMPS
52. DELETED
53. EW OFFICER'S SIDE TABLE (FOLDING)
54. CUP DISPENSER
55. DRINKING WATER CONTAINERS
56. CONTROL CABIN PRESSURE BULKHEAD DOOR
57. SHELF AND FOOD STOWAGE
58. INSTRUCTOR NAVIGATOR'S SAFETY BELT
59. CHEMICAL TOILET
60. INSTRUCTOR NAVIGATOR'S SEAT
61. LANDING GEAR LOCK STOWAGE 170▶ WS2▶
62. TRASH CONTAINER
63. HOT CUP
64. LADDER
65. LANDING GEAR LOCK STOWAGE 54▶ 169 W1▶ W51
66. FORWARD ENTRY DOOR
67. NAVIGATOR'S SEAT
68. NAVIGATOR'S CONSOLE
69. STOWAGE HAMMOCKS
70. ALTERNATE LOCATION FOR SIGNAL LIGHT
71. SAFETY PIN AND STREAMER STOWAGE
72. THERMOS BOTTLE
73. TOILET PAPER HOLDER
74. SIGNAL LIGHT
75. GUNNER'S SEAT
76. GUNNER'S RELIEF TANK AND TUBE
77. AFT ENTRY DOOR
78. GUNNER'S COMPARTMENT PRESSURE BULKHEAD DOOR

GENERAL ARRANGEMENT (Typical)

Figure 1-2 (Sheet 4 of 4).

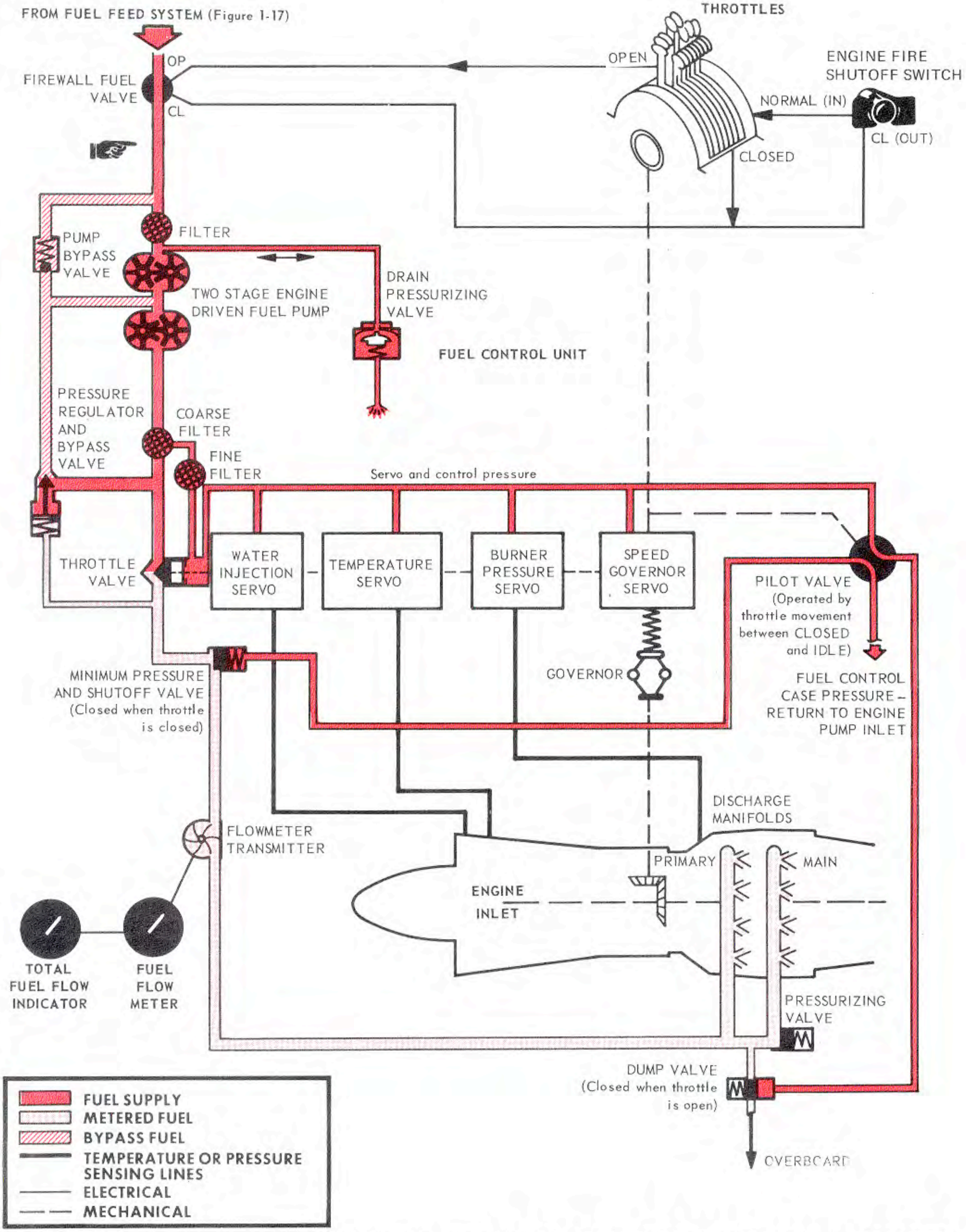


1. AIR INLET DUCT
1A. EPR PROBE (INLET PRESSURE)
2. LOW PRESSURE (N_1) COMPRESSOR
3. OIL SUPPLY TANK
4. HIGH PRESSURE (N_2) COMPRESSOR
5. BURNER CANS
6. 1ST STAGE TURBINE
7. 2ND AND 3RD STAGE TURBINE
8. TAILPIPE
9A. EPR PROBE (EXHAUST PRESSURE)
10. ACCESSORY DRIVE ELBOW
11. ACCESSORY DRIVE HOUSING

	THRUST IN POUNDS AT SEA LEVEL-NACA STANDARD DAY				
ENGINES	TAKEOFF RATED THRUST		MILITARY RATED THRUST	NORMAL RATED THRUST	MATERIAL
	WITH WATER	NO WATER			
J-57-P-19W	12,100	10,500	10,500	9000	TITANIUM
J-57-P-29WA	12,100	10,500	10,500	9000	STEEL

THE ENGINE

Figure 1-3.



ENGINE FUEL CONTROL SYSTEM

Figure 1-4.

Engine Fuel Control System Controls

THROTTLES. Eight throttles (18, figure 1-13) on the aisle stand control the firewall fuel shutoff valves and throttle valves. In addition to these functions, the throttles control water injection. The throttle quadrant is marked CLOSED--IDLE--OPEN. In CLOSED position, 24-volt d-c switched-battery power is supplied to close the firewall fuel shutoff valves. With the throttles advanced approximately 18° from CLOSED, fuel pressure closes the manifold drain valves and metered fuel under pressure is then supplied to the primary manifold. Advancing the throttles out of CLOSED position provides power to open the firewall fuel shutoff valves provided the firewall shutoff switches have not been pulled. At the same time, provided the engine starter switch is in START, 24-volt d-c switched-battery power is supplied to the engine ignition circuit. Advancing the inboard nacelle engine throttles to approximately 80% NRT completes the flaps up warning circuit which sounds the warning horn if the aircraft is on the ground and flaps are not fully extended. When the throttles are advanced to OPEN with the water pump switches ON, 24-volt d-c TR power will be supplied to provide water injection. Retarding a throttle near IDLE position, when the landing gear is not down and locked, completes a circuit providing 24-volt d-c TR power to the landing gear warning horn. Each throttle has a different height and is separated from the others by being slightly bent outboard for selectivity and ease of operation of individual engines. This facilitates ground handling of the aircraft and power settings at pilot discretion. A mechanical stop is provided on the throttles which prevents their being retarded to CLOSED unless the upper knobs are raised approximately 1/4 inch. An individual smaller throttle lever and knob is integrally connected to each large throttle to serve as a one-hand multiple grip for operation of the eight engines simultaneously. These are located aft of the large throttles and are spaced close together for convenience of use by the pilots.

THROTTLE BRAKE LEVER. A throttle brake lever (6, figure 1-13) on the aisle stand to the right of the throttles is used to adjust the amount of force necessary to move the throttles. When in the OFF (aft) position, the throttle brake is released. Moving the throttle brake lever in the INCREASE (forward) direction increases throttle friction.

ENGINE FIRE SHUTOFF SWITCHES. Eight engine fire shutoff switches are provided on the pilots' instrument panel. For a complete description of these switches, see "Emergency Equipment," this section.

Engine Fuel Control System Indicators

FUEL FLOWMETER. Fuel flow to the engine is shown by eight fuel flowmeters (22, figure 1-15) on the pilots' instrument panel. These indicators read in pounds per hour and operate on 28-volt a-c power through a circuit breaker marked "Flow" on the "Fuel Indicators" portion of the copilot's circuit breaker panel.

TOTAL FUEL FLOW INDICATOR. A total fuel flow indicator (29, figure 1-15) is located on the pilots' instrument panel. This instrument uses 28-volt a-c power from a circuit breaker marked "Total Flow" on the "Fuel Indicators" portion of the copilot's circuit breaker panel to electrically add the flow rates indicated on the eight individual fuel flowmeters.

WATER INJECTION SYSTEM

A water injection system (figure 1-6) is provided which allows water to be sprayed into the air inlet of each engine for high power operation. Water injected in this manner serves to increase the density of inlet air allowing increased thrust but does not cool any of the engine components. The engines of each wing are supplied by two turbine-driven water pumps. Operation of both pumps is required for full water injection to four engines at takeoff rated thrust. Engine bleed air, controlled by a solenoid-operated water pump shutoff valve, is used to drive the turbine-operated water pumps. A pump bypass valve allows excess water to be bypassed back to the water tank when the pumps are operating. Water flows from the pump through a strainer to a water injection shutoff valve. Advancing the throttles to OPEN provides 24-volt d-c TR power to open a water injection valve which allows compressor discharge pressure to position the water injection control valve. Water then passes through a water regulator to the discharge nozzles in the engine inlet. Orifice plate restrictors are incorporated in the water discharge tube immediately downstream of the pump outlet port. These restrictions reduce high surge pressures to an acceptable level. A drain valve is provided to drain the system after use to prevent remaining water from freezing in the lines. A pressure switch and light are also provided to indicate whether or not sufficient water pressure is available for injection. See "Water Limitations," Section V, and figure 1-57 for water servicing information. Two tanks having a total capacity of 300 US gallons provide water for approximately 110 seconds at maximum wet rated thrust with the J-57-P-19W or -29WA engines.

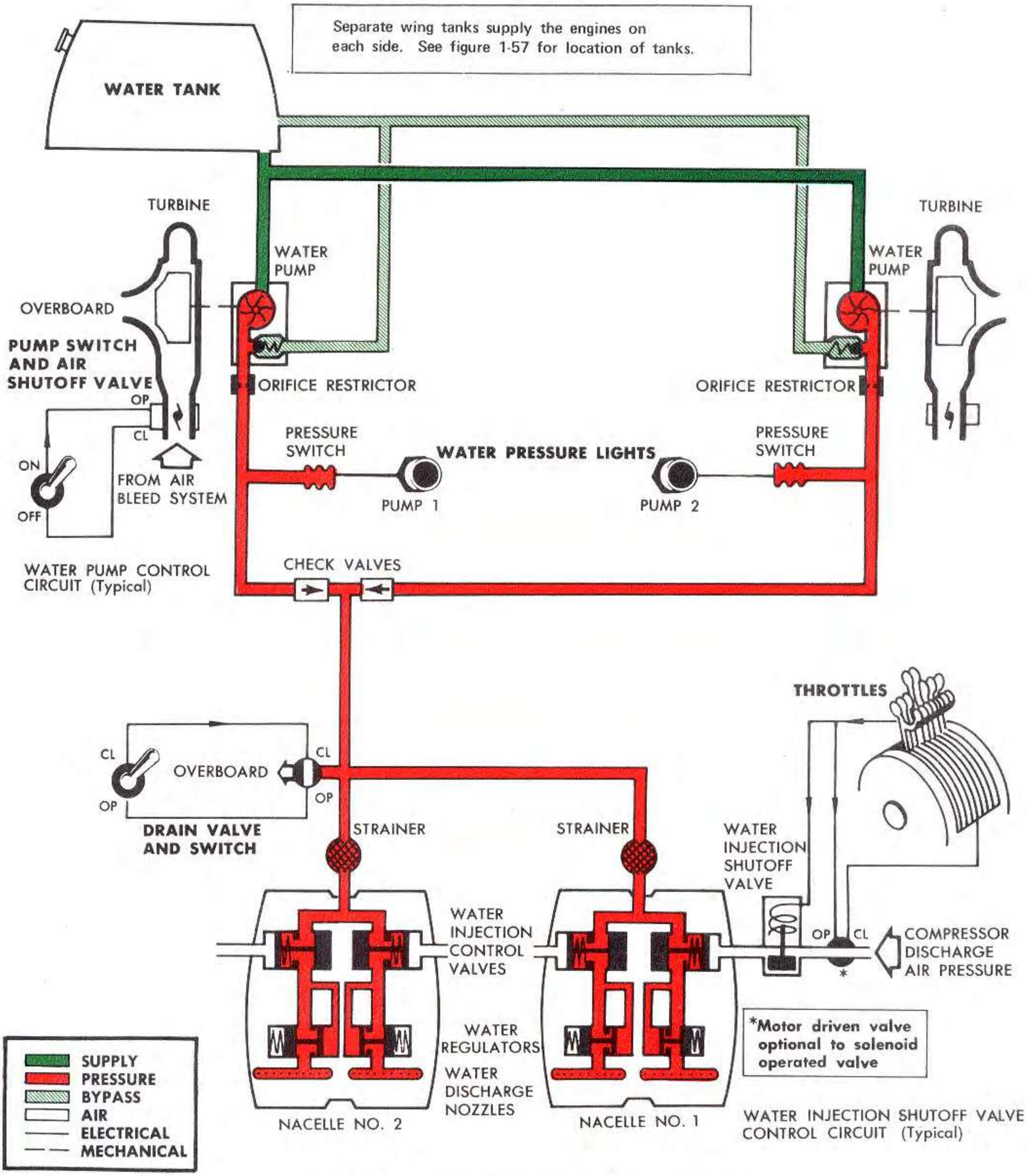
THROTTLES POSITION	PERCENT RPM	FIREWALL FUEL SHUTOFF VALVE POSITION	IGNITION	MANIFOLD DRAIN (DUMP) VALVE	WARNING HORN	WATER INJECTION
CLOSED	0%	CLOSED	Not Available	Open		Inactive
Advanced		Open unless engine fire shutoff switch is pulled	Available when throttle is advanced from CLOSED with engine starter switch in start			
13% approx	(Starting)			Closed. Metered fuel under pressure is supplied to primary manifold		
IDLE					Energized if throttle is retarded when landing gear is not down and locked	
80% approx					Energized if airplane is on the ground and the flaps are not fully extended	
OPEN						Initiated (de-activated by retarding throttle) provided the water injection system switch is in the ON position
Cruise	85% to 97%					
OPEN	105% max					

THROTTLE POSITIONS CHART

Figure 1-5.

Water Injection System Controls

WATER INJECTION PUMPS SWITCHES. Engine bleed air used to operate the water pumps is controlled by two ON--OFF pumps switches (3, figure 1-7) on the water injection panel. Turning the pumps switches ON supplies TR power through circuit breakers marked "Nac 1 & 4 Cont" and "Nac 2 & 3 Cont" on the "Water Injection" portion of the pilot's auxiliary circuit breaker panel to open the shutoff valves, allowing bleed air to operate turbine-driven water pumps which pressurize the water injection system. No water reaches the engines until the throttles are advanced to OPEN, allowing compressor discharge pressure to position the water injection control valves. Each turbine is supplied with overspeed trip protection and speed regulation. To reset a turbine tripped by overspeeding, move the water injection pumps switch momentarily to OFF position.



Separate wing tanks supply the engines on each side. See figure 1-57 for location of tanks.

*Motor driven valve optional to solenoid operated valve

LEFT SIDE SHOWN—RIGHT SIDE SIMILAR

WATER INJECTION SYSTEM (Typical)

Figure 1-6.

THROTTLES. Advancing engine throttles to OPEN position supplies TR power to open the solenoid- or motor-operated water injection valves. This allows compressor discharge pressure to position the water injection control valves and permit water to flow to the discharge nozzles. The water shutoff valves are controlled by microswitches installed at each engine fuel control unit. The microswitches are actuated by mechanical linkage when the throttles are advanced to the full power position. In throttle positions other than OPEN, the solenoid-operated water shutoff valves are not energized for operation. When energized, the solenoid-operated valves receive operating force from engine compressor discharge air pressure. On aircraft with electric motor-operated water shutoff valves, the valves are a sliding-gate type and are closed when the throttles are retarded from OPEN position.

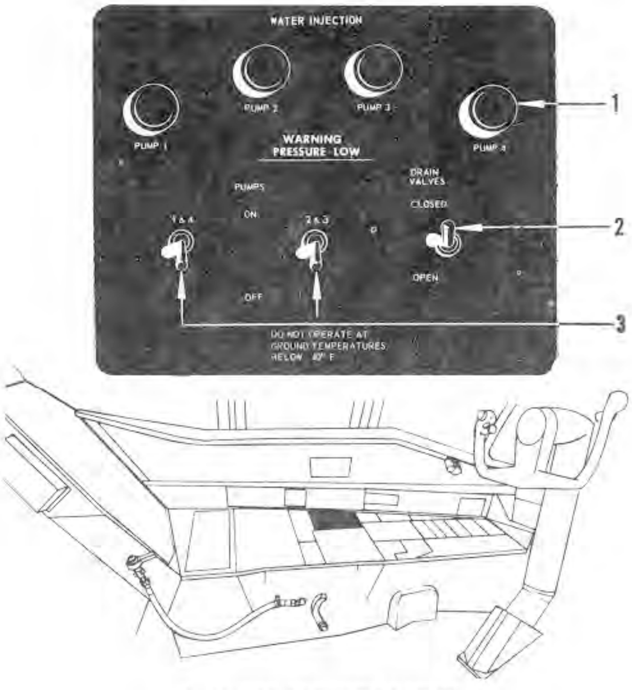
WATER INJECTION DRAIN VALVES SWITCH. An OPEN--CLOSED drain valves switch (2, figure 1-7) is located on the water injection panel. In OPEN position, TR power is supplied to open the motor-operated drain valves. In CLOSED position, the drain valves remain in their normally closed position. There are 12 drain valves controlled by a single switch for the purpose of draining unused water from the system to prevent freezing. When part or all of the water is not used during takeoff, the remaining water may be drained rapidly by turning the pumps switch(es) ON while the drain valves switch is in OPEN position. Drain valve circuits are controlled through two circuit breakers marked "Drain Valve Left Wing" and "Drain Valve Right Wing" on the "Water Injection" portion of the pilot's auxiliary circuit breaker panel.

CAUTION

During water drainout with pumps switches ON, regulate throttles to maintain 125 psi minimum air bleed manifold pressure. This prevents pump damage by insuring immediate shutdown of the turbine-driven pumps after water depletion.

Water Injection System Indicators

WATER PRESSURE LIGHTS. Four red water pressure lights (1, figure 1-7) on the water injection panel illuminate when water pressure is too low for water injection. The lights operate on TR power controlled by pressure switches located immediately downstream from the water injection pumps and will illuminate when water pressure from the pumps is inadequate. The water pressure lights circuit breaker is marked "Pump Ind Lts" on the "Water Injection" portion of the pilot's auxiliary circuit breaker panel.



1. WATER PRESSURE LIGHTS
2. DRAIN VALVES SWITCH
3. PUMPS SWITCHES

WATER INJECTION PANEL (Typical)

Figure 1-7.

NOTE

The water pressure light system indicates water pressure only. The light system does not indicate quantity of water available or flow of water into the engines.

ENGINE IGNITION AND STARTING SYSTEM

A turbine-driven starter is provided on each engine. Air obtained from a ground air source or from an operating engine can be routed through the air bleed system to drive each engine starter. See "Air Bleed System," this section, for further information about the use of this system. The starters installed on engines 2 and 8 are combination cartridge-pneumatic starters which can be energized by firing a solid propellant (gas generating) cartridge or by compressed air from an auxiliary air supply or from another engine. A pneumatically operated starter air valve, controlled by a solenoid valve, regulates bleed air supplied to the starter turbine. Engine ignition is accomplished by spark ignitors located in the combustion chambers of each engine. Switched battery power for engine ignition is supplied through circuit breakers marked "Norm Ignition" - "1," "2," "3," "4," "5," "6," "7," and "8" on the "Engine Control" portion of the copilot's circuit breaker panel.

Pneumatic Starters

Each pneumatic engine starting unit consists of an air turbine-driven starter, a starter control valve, and the electrical components necessary for starter control. Each starter is geared to the high pressure compressor of the engine on which it is installed. The control valve is installed in the starter air inlet duct and functions as an air pressure regulating and shutoff valve. A solenoid within each control valve is energized when the respective engine starter switch on the copilot's auxiliary side panel is placed in START position, allowing the valve to be opened by high pressure air supplied by an operating engine or an external pneumatic ground source. When the maximum starting rpm is reached during engine start, an overspeed device in the starter housing breaks the circuit to the solenoid, allowing the control valve to close and shut off the starter air supply.

Cartridge Starters

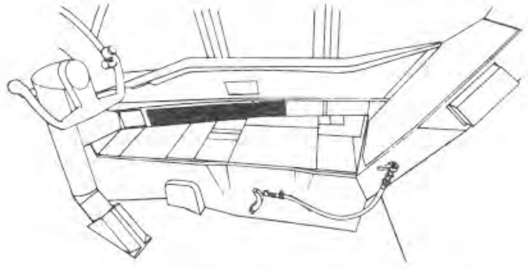
Cartridge starters installed on engines 2 and 8 are comparable in operation to the MB-3 starters installed on engines 1, 3, 4, 5, 6, and 7. The cartridge starter may be energized by gas from a burning Air Force Type MXU-4/A solid propellant cartridge or by compressed air from an auxiliary air cart or from an operating engine. The primary purpose of these starters is to provide for engine starts without assistance from an auxiliary air cart or auxiliary electrical power cart. Starter operation is basically the same for cartridge or pneumatic operation with the major difference being the temperature of the two gases. The cartridge-produced gas enters the starter turbine at a temperature in excess of 2100° F while the compressed air enters the starter turbine at a temperature of 500° F or less. The cartridge starter is composed of the same basic parts as the MB-3 starter; i.e., turbine, gear train, overrunning clutch with a speed sensing device, and an overspeed disengagement mechanism with shear pin. In addition, the cartridge starter has a breech chamber with breech cap and locking handle, a two-stage pressure relief valve, an aerodynamic brake, and the necessary electrical components for cartridge ignition. Actuation of a cartridge starter switch located on the copilot's side panel initiates the start by completing the electrical circuit to ignite the cartridge. The cartridge cannot be ignited unless the breech is properly installed and the lock handle is in the proper position. The two-stage pressure relief valve maintains proper operating pressure and, in case of malfunction, relieves pressure to safe limits. As engine rpm exceeds starter rpm, the overrunning (sprag-type) clutch releases to prevent the starter turbine from being driven to an overspeed condition. Should the overrunning clutch not release, the overspeed disengagement mechanism will isolate the starter turbine from the starter gear train. An aerodynamic brake is attached to the starter turbine to prevent turbine overspeed. When starting with compressed air, a centrifugal switch monitors rpm at the starter mounting pad and, as a specified rpm is reached, breaks the circuit to the starter control valve solenoid, allowing the valve to close and shut off the starter air supply. Since the primary purpose of the cartridge-pneumatic starter is to provide for operation without need for auxiliary air and electrical power supply, provision (18, figure 1-2) has been made to carry eight spare cartridges in the aircraft.

Engine Ignition and Starting System Controls

STARTER SELECTOR SWITCH. A FLIGHT START --GROUND START starter selector switch (2, figure 1-8) is located on the copilot's auxiliary side panel. The position of this switch determines whether ignition only or both starter and ignition are provided when the starter switch is operated. When placed in the FLIGHT START position with a starter switch in START, only power for engine ignition will be provided and the starters are not operable. With the switch in GROUND START position, TR power is supplied on engines 3, 4, 5, and 6 to allow opening of the starter air valves when each circuit is completed by use of the engine starter switch. Forward switched battery power is supplied for opening starter air valves on engines 1 and 2 and aft switched battery power is supplied for opening starter air valves on engines 7 and 8. Circuit breakers are marked "Engine Starter," "1 & 2," "3 & 4," "5 & 6," and "7 & 8" on the "Engine Starter" portion of the pilot's auxiliary circuit breaker panel. The starter selector switch circuit breaker is marked "Sw Pos" on the "Engine Starter" portion of the pilot's auxiliary circuit breaker panel.

STARTER SWITCH. Eight START--OFF starter switches (1, figure 1-8) are provided on the copilot's auxiliary side panel. These switches electrically control bleed air for starter turbine operation and electrical power for engine ignition. Placing the starter switch in START with the starter selector switch in GROUND START position supplies TR power for engines 3, 4, 5, and 6 and switched battery power for engines 1, 2, 7, and 8 to open the starter air valve and to arm the ignition circuits. With the above conditions, advancing the engine throttles out of CLOSED provides power to the engine spark igniters. Placing this switch in START with the starter selector switch in FLIGHT START position provides power only for engine ignition when

1. ENGINE STARTER SWITCHES
2. STARTER SELECTOR SWITCH
3. STARTER NOT OFF WARNING LIGHT
4. CARTRIDGE START SWITCH



ENGINE IGNITION AND STARTING CONTROLS (Typical)

Figure 1-8.

the throttles are advanced. When moving the throttles out of CLOSED and just prior to IDLE position, continuous ignition will occur until the starter switch is placed in OFF position. In any case, placing this switch in START position provides power for engine ignition when the respective "Firewall Fuel Shutoff Valve" circuit breaker is pulled.

CARTRIDGE START SWITCH. Two momentary-type cartridge start switches (4, figure 1-8) with ON--OFF positions are located on the copilot's side panel. The switches marked "Cartridge Start," "Eng 2," and "Eng 8" supply switched battery power to initiate firing of respective No. 2 and No. 8 engine starter cartridges. The controlling circuit breakers marked "Ctg Start Eng 2" and "Ctg Start Eng 8" are on the "Water Injection" portion of the pilot's auxiliary circuit breaker panel. In ON position, power is supplied to fire the respective cartridge and to deenergize the starter air valve circuits for that starter. The cartridge start switches also supply the respective engines with forward switched battery power for ignition; however, ignition circuits are not completed until No. 2 and 8 throttles are moved out of CLOSED to just prior to IDLE position, at which time fuel is also supplied. After the cartridge start switches are released to OFF position, ignition is no longer supplied through the cartridge start switch; however, ignition may be energized through the engine starter switches as required. Engine shutdown, when desired, may be accomplished by returning the throttles to the CLOSED position.

Engine Ignition and Starting System Indicators

STARTER SWITCH NOT OFF WARNING LIGHT. An amber starter switch not off warning light (3, figure 1-8) on the copilot's auxiliary side panel is illuminated by forward switched battery power when a starter switch is left in the START position. The light receives power through a circuit breaker marked "Sw Pos" on the "Engine Starter" portion of the pilot's auxiliary circuit breaker panel.

ENGINE INSTRUMENTS

Engine instruments that are not described as part of an engine system are described below.

Tachometers

Speed of the high pressure compressor rotor in percent rpm is indicated by eight tachometers (16, figure 1-15) on the pilots' instrument panel. Engine-driven tachometer generators supply power to operate the indicators which are independent of the aircraft electrical system. Each instrument has two pointers. The larger pointer indication is read on a dial calibrated from 0 to 100 percent rpm. The small pointer indication is read on a dial calibrated from 0 to 10 percent rpm.

Exhaust Gas Temperature Gages

Exhaust gas temperature of each engine is indicated by eight gages (17, figure 1-15) on the pilots' instrument panel. These gages are calibrated in degrees Centigrade and indicate the temperature of the exhaust gases of each engine. Engine thermocouples supply power to operate the gages which are independent of the aircraft electrical power system.

Engine Pressure Ratio (EPR) Gages

An engine pressure ratio gage (15, figure 1-15) for each engine is located on the pilots' instrument panel. These gages indicate the ratio of engine inlet to exhaust pressures which is used as a measure of engine thrust. The engine inlet and exhaust indications are compared by a computer-transmitter which electrically transmits an indication to the engine pressure ratio gage. The computer-transmitter operates on 118-volt single-phase a-c power obtained from the aircraft electrical system. Pressure ratio gage circuit breakers are marked "Nacelle" - "1," "2," "3," and "4" on the "Eng Pressure Ratio Ind" portion of the pilot's auxiliary circuit breaker panel.

NOTE

> To more readily identify a malfunctioning engine, a yellow vertical stripe is painted between the left-hand and right-hand back of engine instruments (engines 4 and 5).

Oil Pressure Gages

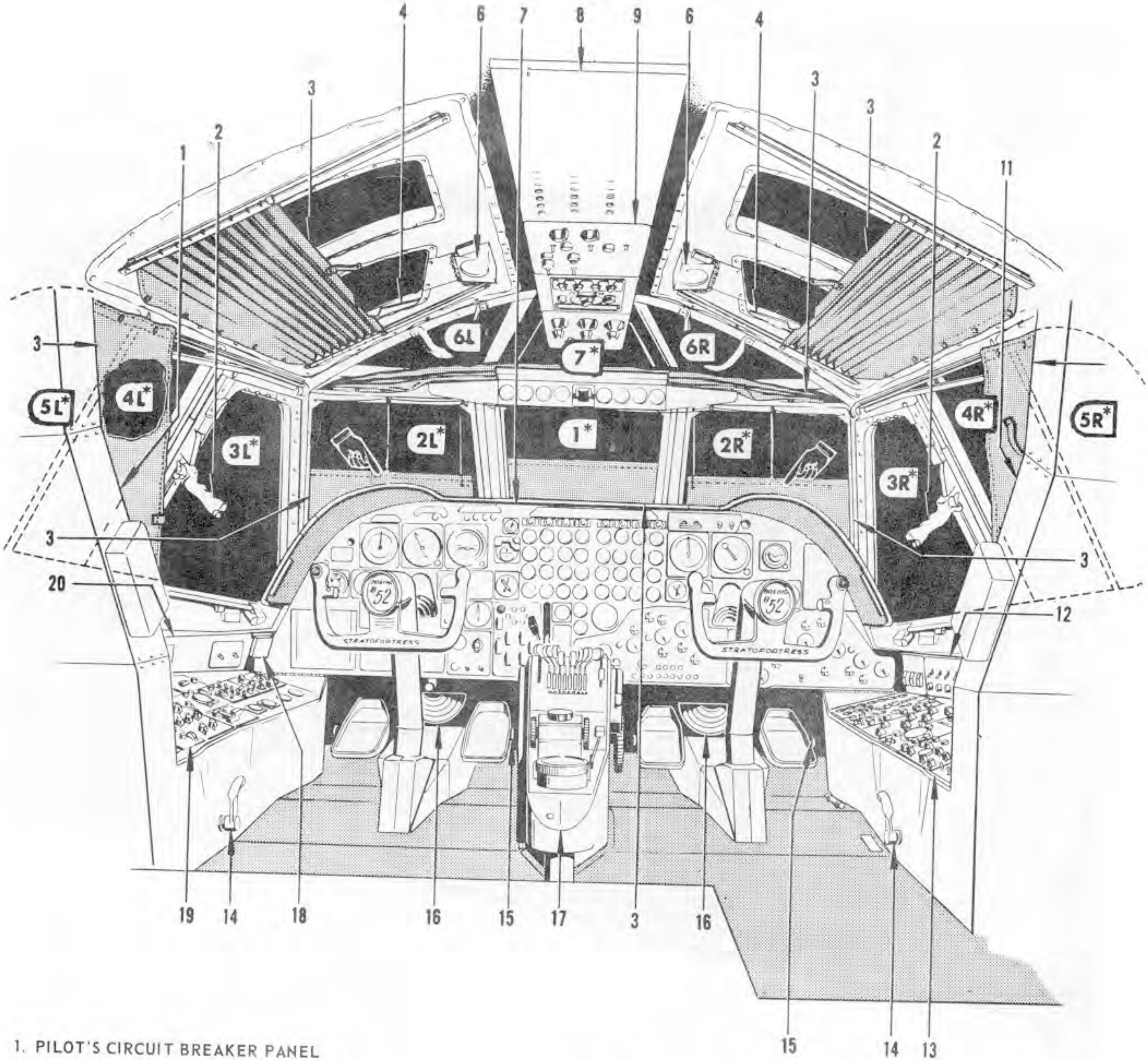
Engine oil pressure is indicated by eight oil pressure gages (19, figure 1-15) above the pilots' instrument panel. These gages operate on 28-volt a-c power supplied through pressure transmitters in each engine oil system. A single circuit breaker marked "Oil Press Ind" for the eight oil pressure gages is on the pilot's auxiliary circuit breaker panel.

NOTE

- If the oil pressure circuit breaker has popped, oil pressure indications are unreliable.
- Oil pressure will have a tendency to follow the throttle due to the type of oil pressure relief valve installed. This condition is normal provided the oil pressure stabilizes between the minimum and maximum limits.

OIL SUPPLY SYSTEMS

Each engine is provided with an integral oil system which includes an oil tank with a usuable capacity of 13.75 gallons and a total capacity of 16 gallons. This tank supplies gear-type engine-driven oil pressure pumps. Oil is supplied by the pressure pumps to the engine bearings and accessory drives in various engine compartments. Scavenge pumps remove oil from the engine compartments, route it through an oil cooler, and return it to the tank for reuse. Oil temperature is maintained by oil cooler flaps which regulate the airflow through the oil cooler. The oil cooler flaps are operated by 118-volt single-phase a-c power and are automatically controlled by a thermostat. When the oil supply is exhausted, approximately 1 to 1 1/2 gallons of oil remains trapped in the lines and oil cooler. No manual controls are provided for the engine oil system. For oil servicing information, see figure 1-57.

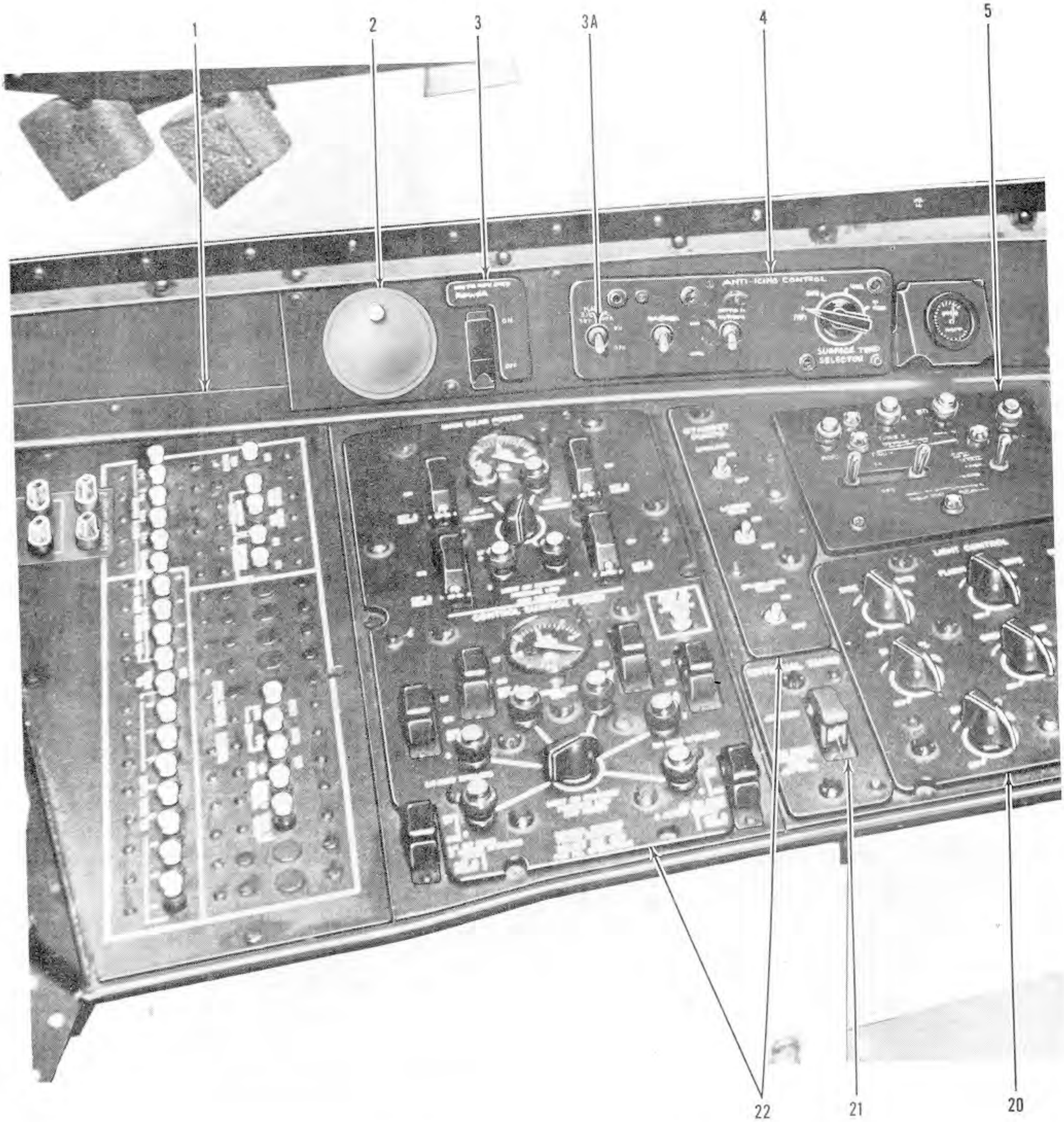


1. PILOT'S CIRCUIT BREAKER PANEL
2. SLIDING WINDOW HANDLE
3. CREW HOODS
4. EMERGENCY HATCH RELEASE HANDLE
5. (DELETED)
6. DOME LIGHT
7. PILOTS' INSTRUMENT PANEL
8. PILOTS' OVERHEAD CIRCUIT BREAKER PANEL
9. OVERHEAD PANEL
10. (DELETED)
11. COPILOT'S CIRCUIT BREAKER PANEL
12. COPILOT'S AUXILIARY SIDE PANEL
13. COPILOT'S SIDE PANEL
14. CONTROL COLUMN DISCONNECT LEVER
15. RUDDER PEDAL ADJUSTMENT LEVER
16. HEATED AIR OUTLET
17. AISLE STAND
18. ALTIMETER CORRECTION CARD AND HOLDER
19. PILOT'S SIDE PANEL
20. PILOT'S AUXILIARY SIDE PANEL

*** Window number corresponds with anti-ice control circuit breaker number**

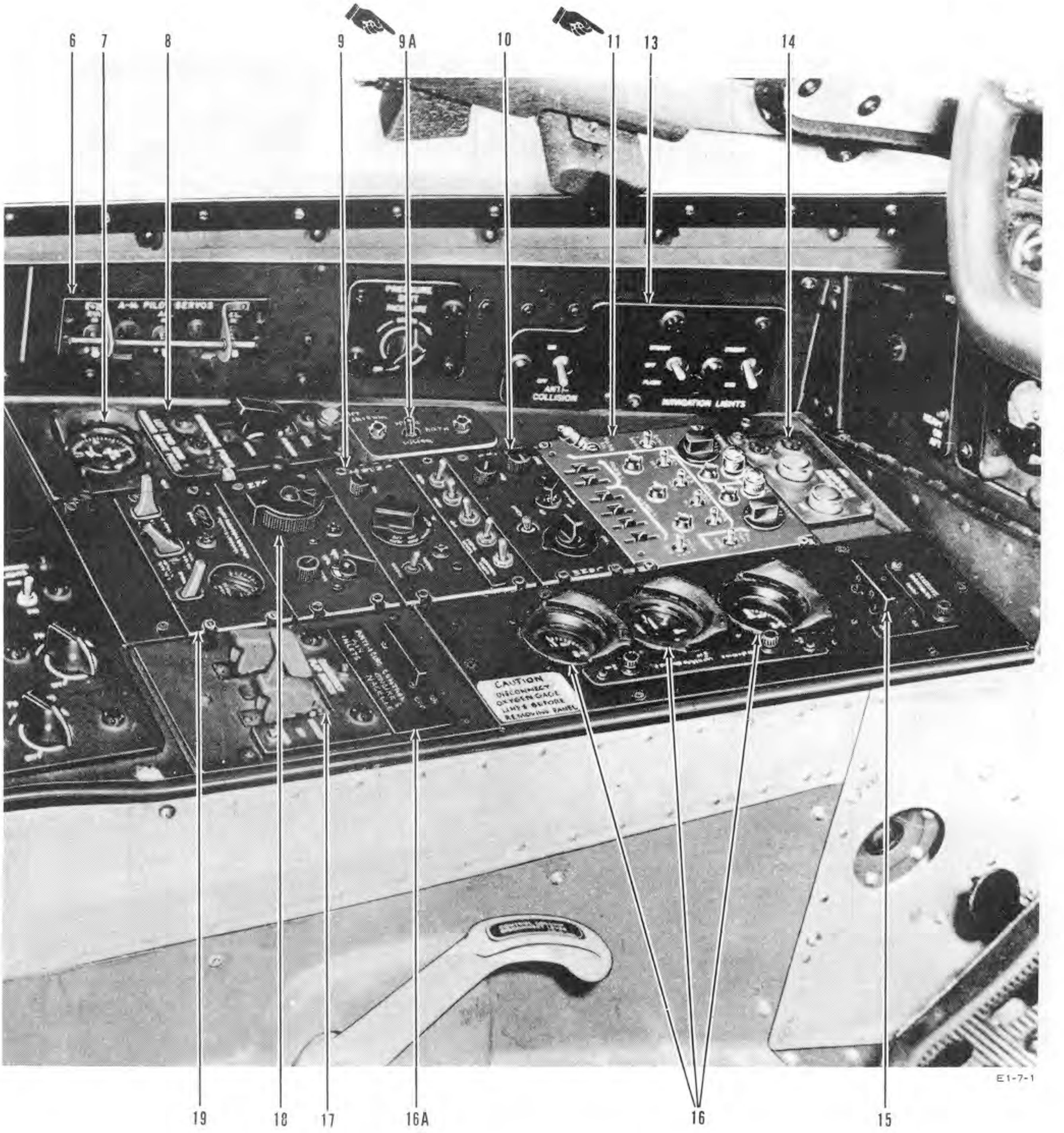
PILOTS' STATION (Typical)

Figure 1-9.



1. PILOT'S AUXILIARY CIRCUIT BREAKER PANEL
2. ASHTRAY
3. INTERPHONE (SYSTEM) POWER SWITCH
3A. FLARE EJECTOR SWITCH
4. ANTI-ICING CONTROL PANEL **54** ▶ **169** **W1** ▶ **W51**
5. WATER INJECTION PANEL
6. AUTOPILOT SERVOS CUTOUT SWITCH PANEL
7. PARKING BRAKE PRESSURE GAGE
8. INTERPHONE POWER SWITCH PANEL
9. PILOT'S INTERPHONE PANEL
9A. IFF ANTENNA SWITCH **ZV**
10. LIAISON RADIO CONTROL PANEL
11. IFF CONTROL PANEL **ZV**
12. (Deleted)

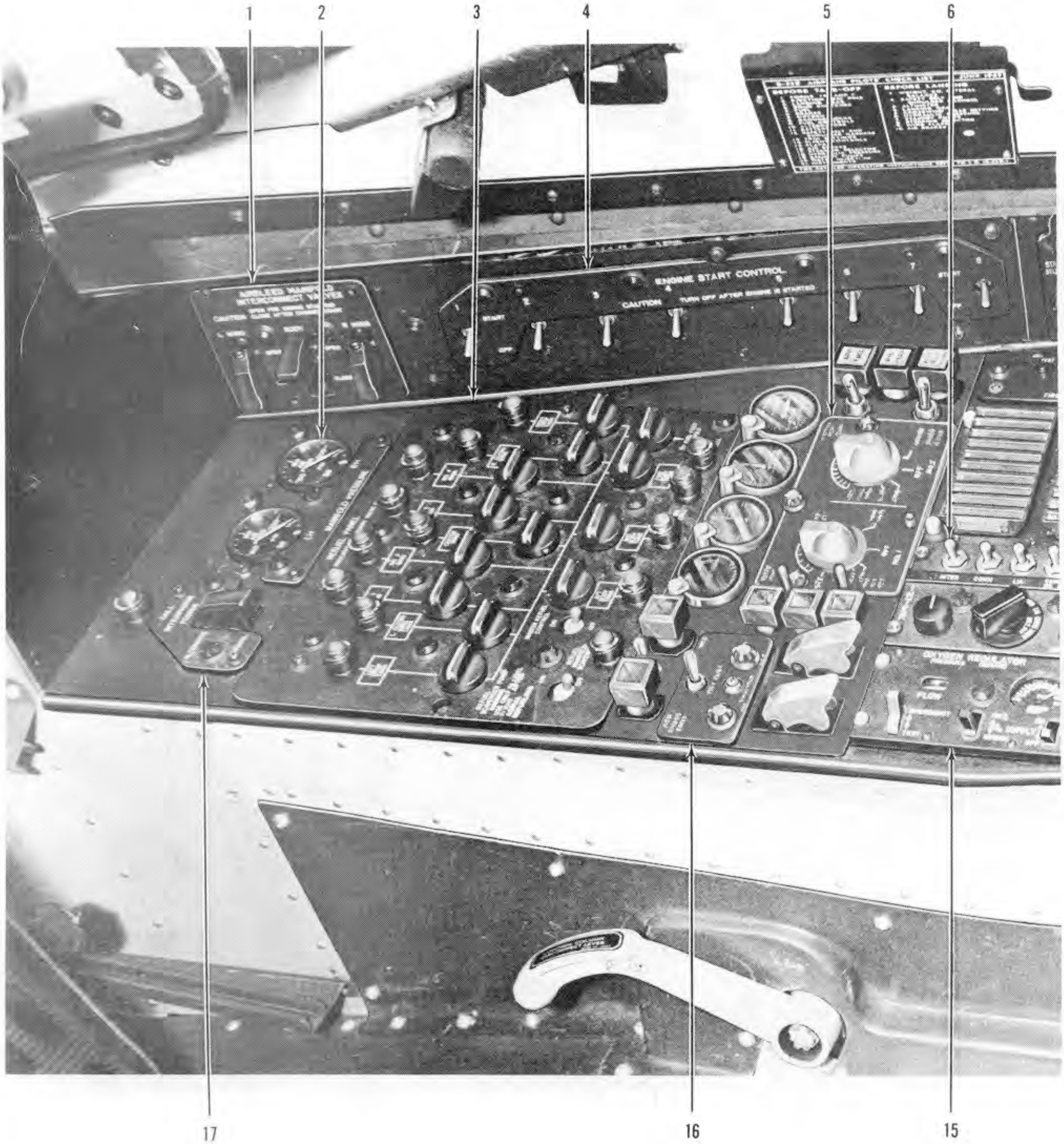
Figure 1-10 (Sheet 1 of 2).



13. NAVIGATION LIGHTS CONTROL PANEL
14. AN/APS-54 RADAR WARNING RECEIVER INDICATOR **B-52C**
15. ATTITUDE AND DIRECTIONAL GYRO POWER SWITCH
16. OXYGEN CONVERTER QUANTITY GAGES
16A. ANTI-ICING CONTROL PANEL **170▶** **W52▶**
17. WING FLAP EMERGENCY SWITCHES
18. TACAN RADIO CONTROL PANEL
19. PILOT'S OXYGEN REGULATOR
20. PILOT'S LIGHTING PANEL
21. DROP TANKS JETTISON SWITCH
22. HYDRAULIC CONTROL PANEL

PILOT'S SIDE PANELS

Figure 1-10 (Sheet 2 of 2).



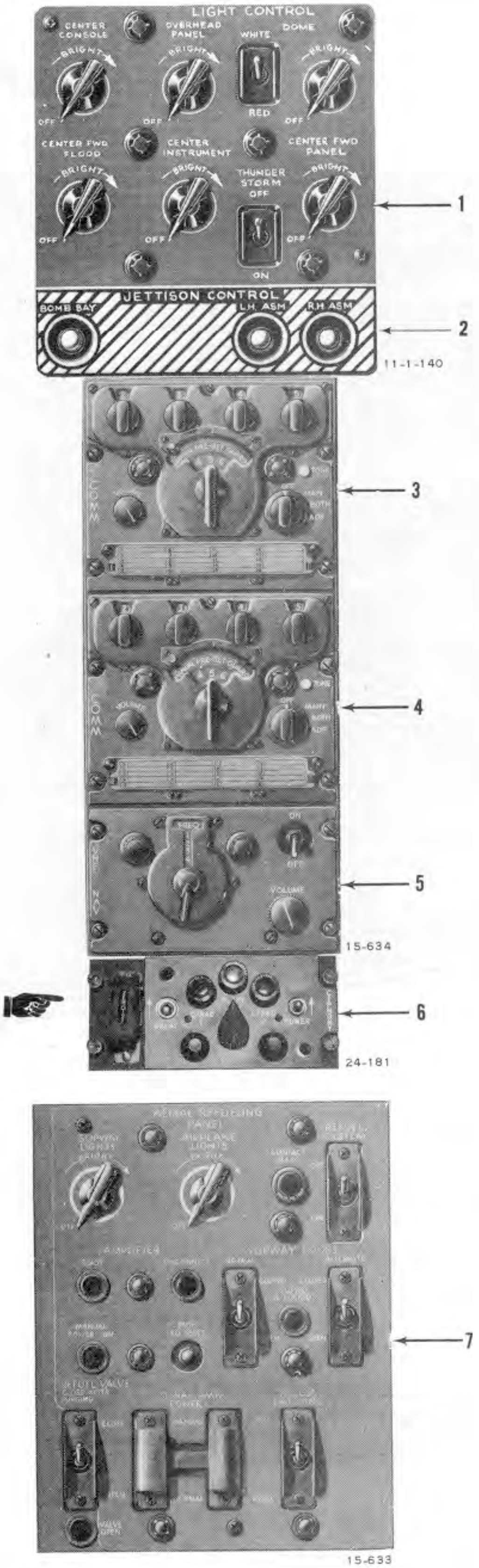
1. AIR BLEED MANIFOLD INTERCONNECT SWITCHES
2. AIR BLEED MANIFOLD PRESSURE GAGES
3. REFUEL PANEL
4. ENGINE IGNITION AND STARTER CONTROLS
5. AGM-28 ENGINE CONTROL PANEL
6. COPILOT'S INTERPHONE PANEL
7. FUSELAGE OVERHEAT (FIRE) WARNING PANEL
8. CARTRIDGE START PANEL
9. EMERGENCY BATTERY SWITCH

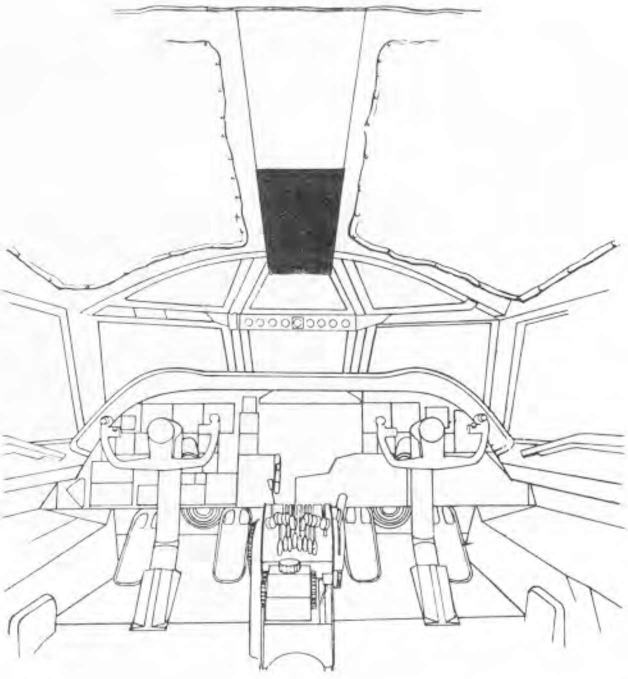
Figure 1-11 (Sheet 1 of 2).

10. REFUEL GROUND CHECKOUT SWITCH
11. AUTOPILOT RUDDER LIMIT BYPASS SWITCH
12. D-C CONTROL PANEL
13. FORWARD AIR CONDITIONING PANEL
14. A-C CONTROL PANEL
15. COPILOT'S OXYGEN REGULATOR
16. AGM-28 EMERGENCY CONTROL PANEL
17. INTERPHONE POWER SWITCH PANEL

COPILOT'S SIDE PANELS

Figure 1-11 (Sheet 2 of 2).





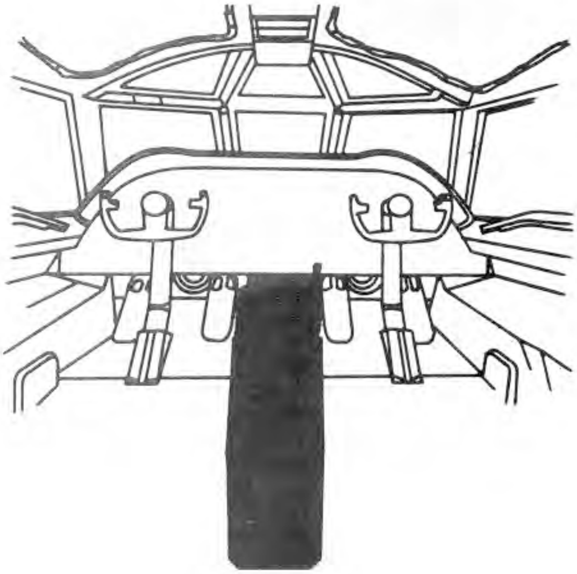
1. OVERHEAD LIGHTING PANEL
2. JETTISON CONTROL PANEL
3. NO. 2 UHF COMMAND RADIO CONTROL PANEL
4. UHF COMMAND RADIO CONTROL PANEL
5. VOR CONTROL PANEL
6. CIPHONY CONTROL PANEL
7. AIR REFUELING (IFR) PANEL

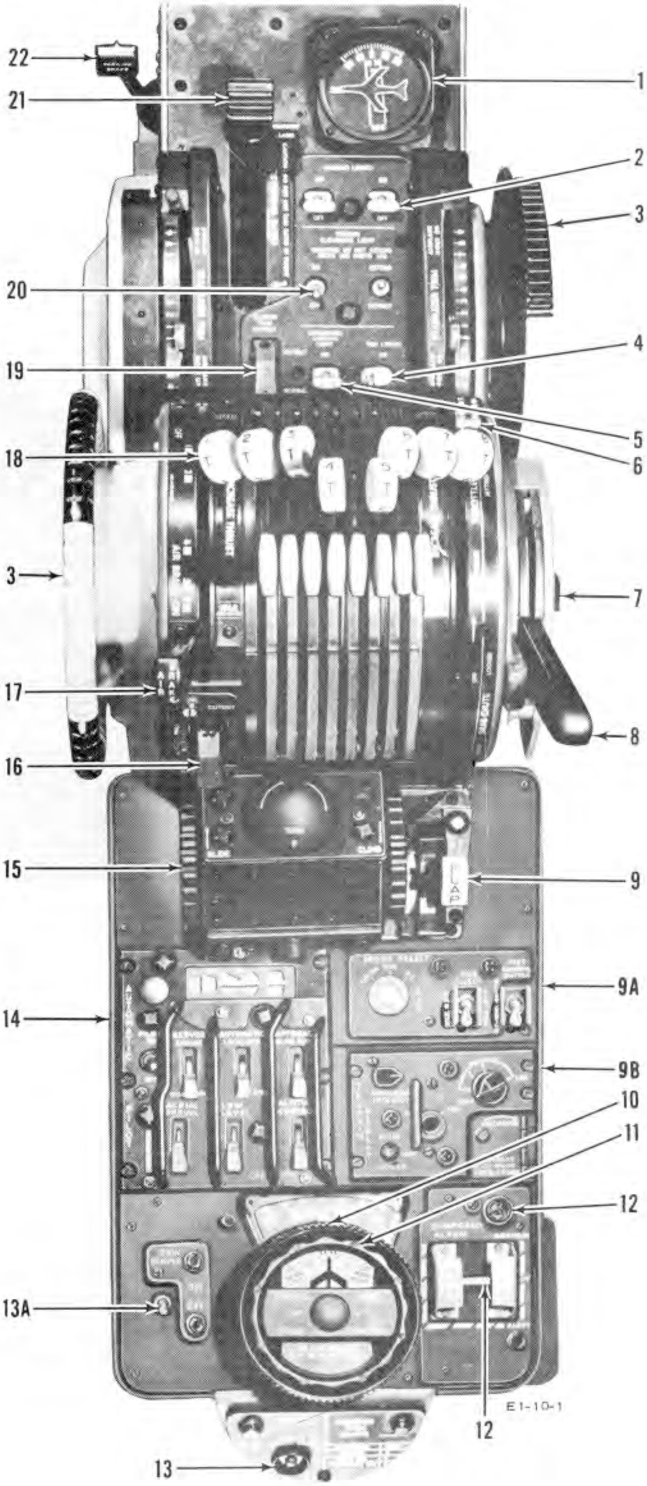
OVERHEAD PANEL (Typical)

Figure 1-12.

All data on pages 1-25 and 1-26 (Deleted)

1. CROSSWIND CRAB POSITION INDICATOR
2. LANDING LIGHT SWITCHES
3. STABILIZER TRIM WHEELS AND INDICATORS
4. TAXI LIGHTS SWITCH
5. CROSSWIND LANDING LIGHT SWITCH
6. THROTTLE BRAKE LEVER
7. WARNING HORN SHUTOFF BUTTON
8. DRAG CHUTE LEVER
9. WING FLAP LEVER
9A. NAVIGATION SYSTEM SELECT PANEL
9B. TERRAIN DISPLAY CONTROL PANEL
10. RUDDER TRIM KNOB AND INDICATOR
11. CROSSWIND CRAB CONTROL KNOB
12. EMERGENCY ALARM SWITCH AND MONITOR LIGHT
13. CROSSWIND CRAB CONTROL CENTERING BUTTON
13A. YAW DAMPER SWITCH
14. AUTOPILOT COMMAND SELECTOR PANEL
15. AUTOPILOT FLIGHT CONTROLLER
16. STABILIZER TRIM CUTOUT SWITCH
17. AIRBRAKE LEVER
18. THROTTLES
19. AILERON TRIM CUTOUT SWITCH
20. TERRAIN CLEARANCE LIGHT SWITCHES
21. STEERING RATIO SELECTOR LEVER
22. PARKING BRAKE LEVER

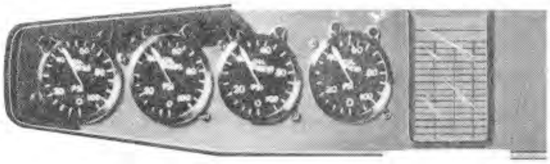


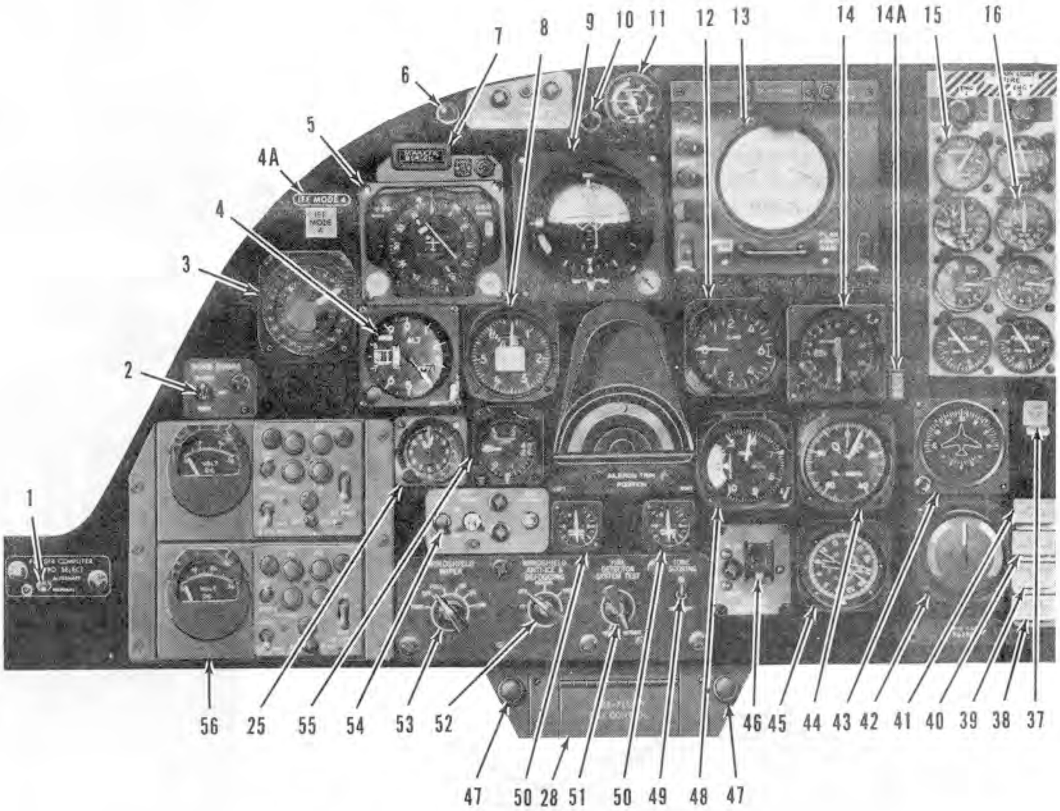


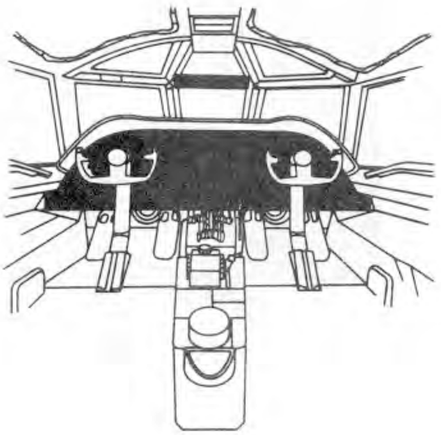
AISLE STAND (Typical)

Figure 1-13.

Figure 1-14. (Deleted)







1. FLIGHT DIRECTOR COMPUTER GYRO SELECT SWITCH
2. BOMB DOORS SWITCH
3. PILOTS' DATA INDICATOR (PDI)
4. ALTIMETER (AAU-19/A SHOWN) ZV

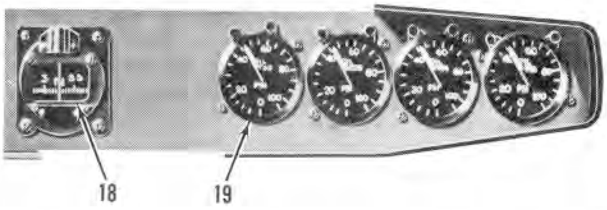
4A. IFF MODE 4 CAUTION LIGHT ZV

5. HORIZONTAL SITUATION INDICATOR
6. AUTOMATIC PILOT DISENGAGED LIGHT
7. MARKER BEACON LIGHT
8. AIRSPEED INDICATOR
9. ATTITUDE-DIRECTOR INDICATOR
10. HYDRAULIC PACK PRESSURE-LOW MASTER LIGHT
11. CLEARANCE PLANE INDICATOR
12. VERTICAL VELOCITY INDICATOR
13. TERRAIN DISPLAY INDICATOR
14. RADAR ALTIMETER

14A. RADAR ALTIMETER CAUTION LIGHT

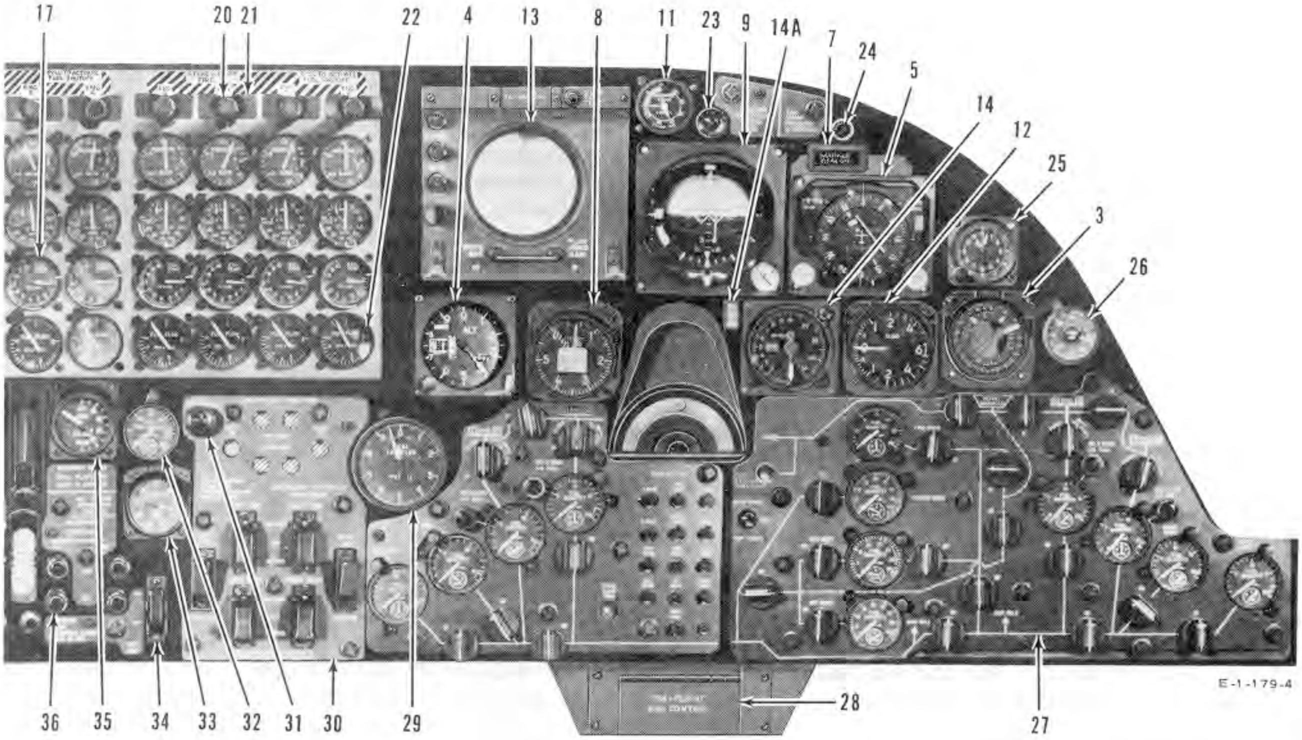
15. ENGINE PRESSURE RATIO GAGES
16. TACHOMETERS
17. EXHAUST GAS TEMPERATURE GAGES
18. MAGNETIC STANDBY COMPASS
19. OIL PRESSURE GAGES

Figure 1-15 (Sheet 1 of 2).



NOTE ZV

Until fully modified, the copilot may not have an AAU-19/A altimeter due to a shortage of altimeters.



20. ENGINE FIRE WARNING LIGHTS
21. ENGINE FIRE SHUTOFF SWITCHES
22. FUEL FLOWMETERS
23. MASTER FUSELAGE OVERHEAT (FIRE) WARNING LIGHT
24. GUNNER'S CABIN PRESSURE WARNING LIGHT
25. CLOCK
26. OUTSIDE AIR TEMPERATURE GAGE
27. FUEL SYSTEM CONTROLS (FIGURE 1-18)
28. TERRAIN PREFLIGHT ADJUST CONTROL
29. TOTAL FUEL FLOW INDICATOR
30. LANDING GEAR CONTROLS (FIGURE 1-41)
31. STORE JETTISONED LIGHT
32. TOTAL FUEL QUANTITY GAGE
33. TAIL COMPARTMENT ALTIMETER
34. ANTISKID SWITCH
35. WING FLAP POSITION INDICATOR
36. ALTERNATOR OVERLOAD LIGHTS
37. ANTI-ICING SURFACE OVERHEAT LIGHT
38. HATCHES NOT CLOSED AND LOCKED LIGHT
39. BOMB DOORS NOT LATCHED LIGHT
40. BOMB DOORS OPEN LIGHT
41. BOMB RELEASED LIGHT
42. LATERAL ERROR METER
43. HEADING INDICATOR (GYRO)
44. TRUE AIRSPEED INDICATOR
45. RADIO MAGNETIC INDICATOR
46. AUTOPILOT TURN CONTROL SELECTOR SWITCH
47. AIR OUTLET KNOB
48. MACH INDICATOR
49. TONE SCORING INTERRUPT SWITCH
50. AILERON TRIM INDICATOR
51. ENGINE FIRE DETECTOR SYSTEM TEST SWITCH
52. WINDSHIELD ANTI-ICE AND DEFOGGING SWITCH
53. WINDSHIELD WIPER SWITCH
54. PITOT HEAT SWITCHES
55. ACCELEROMETER
56. T-18 CONTROL PANELS

PILOTS' INSTRUMENT PANEL

Figure 1-15 (Sheet 2 of 2).

FUEL SUPPLY SYSTEM

The aircraft fuel supply system (figure 1-17) consists of a fuel feed system and a fuel transfer system. A refuel system, which is normally independent of the other two systems but may be connected to them through valves, is fully described under "Air Refueling System" and "Single Point Refueling System" in Section IV. Boost pumps in four main fuel tanks normally supply engine fuel. Each main tank normally supplies fuel to the engines in one nacelle. Auxiliary tanks used to replenish the main tanks include two outboard wing tanks, a center wing tank, three body tanks, and two external drop tanks. Routing of fuel from the auxiliary tanks to the main tanks is accomplished with the fuel transfer system. Provisions are made to supply fuel to the AGM-28 missiles from the fuel transfer manifold through wing valves (fuel) and self-sealing quick-disconnect couplings. An AGM-28 wing valve (fuel) switch and an AGM-28 emergency shutoff switch on the copilot's side panel control the flow of fuel to each AGM-28 missile. For additional information regarding tie-in of the aircraft fuel supply system with the AGM-28 fuel system, refer to T.O. 1B-52C-30-1. A crossfeed manifold is provided which makes it possible to interconnect the fuel feed systems of each nacelle. Fuel system valves are numbered to simplify their identification. The valve numbers appearing on the fuel section of the pilots' instrument panel correspond to the valve identification numbers appearing in this manual. Circuit breakers for electrical power used to operate the fuel valves are also numbered and are on the copilot's circuit breaker panel. For correct fuel specification grade, see figures 1-57 and 5-3.

FUEL TANK VENTING

Body fuel tanks and cavities are vented through a common manifold which opens to the atmosphere through a port located aft of the rear wheel well on the underside of the fuselage. A sump in the body tank vent system routes fuel discharged through the vents to the aft body tank. Wing tanks and cavities are vented overboard through vent outlets located on the lower surface of the wings. Aircraft **76**▶ **W1**▶ have a smaller capacity vent system which is designed for JP-4 fuel only. See "Rate of Climb Limitations With Emergency Fuel (Aviation Gasoline)" under "Fuel Grade Properties and Limits," Section V, for operating restrictions when using aviation gasoline.

FUEL FEED SYSTEM

The fuel feed system normally supplies fuel to the engines from the main fuel tanks. Three boost pumps in each main tank supply pressure to the fuel control system of the engines. Each main tank has a tank valve which controls fuel flow from the boost pumps. A crossfeed manifold is provided which makes it possible to interconnect the four main tanks to engine fuel feed system lines. This manifold also makes it possible to connect the fuel feed system directly with the refuel or fuel transfer systems.

Fuel Checkout System

Fuel pressure gages and warning lights are not provided for each tank. To save weight, a fuel checkout system is provided in the fuel feed system. This system allows ground pressure checking of each boost and transfer pump and each valve in both the fuel feed and transfer systems. To use the fuel checkout system, fuel under pressure is routed to three pressure switches by positioning various valves. These switches are located in the fuel feed line of the No. 2 main tank. The pressure switches will close and supply power to illuminate a pressure checkout light, indicating proper system operation.

Fuel Feed System Controls

MAIN TANK VALVE SWITCHES. Main tank valve switches (4, figure 1-18) on the fuel section of the pilots' instrument panel electrically control the tank valves (No. 13, 14, 15, and 16) and corresponding boost pumps in the main tanks. When the switch is rotated to align the white stripe on the switch with the flow line on the fuel panel, the switch is ON. The switch is of the push-to-turn type to avoid inadvertent operation. In ON position, switched battery power is supplied through circuit breakers marked "13," "14," "15," and "16" on the "Fuel Feed Valve Control" portion of the copilot's circuit breaker panel to open a motor-driven main tank valve and close the boost pump relays which provide 205-volt three-phase a-c power to the boost pumps in the corresponding main tanks. Turning the switch ON also arms a main tank fuel low warning light circuit. With the main tank valve switch OFF, power is supplied to close the main tank valve, the boost pump relays are deenergized, and the fuel low warning light circuit is open

CROSSFEED VALVE SWITCHES. Four crossfeed valve switches (3, figure 1-18) are located on the fuel section of the pilots' instrument panel. These rotary switches control the crossfeed valves (No. 9, 10, 11, and 12). When the white stripe on the switch is aligned with the flow line on the fuel panel, the switch is ON and switched battery power for valves No. 9 and 12, or TR power for valve No. 10 or 11, is supplied to open the corresponding crossfeed valve. In OFF position, power is supplied to close the crossfeed valve. Control power for the crossfeed valve switches is supplied through circuit breakers marked "Left Wing" - "9" and "10" and "Right Wing" - "11" and "12" on the "Fuel Transfer Valve Control" portion of the copilot's circuit breaker panel.

ENGINE FIRE SHUTOFF SWITCHES. Eight engine fire shutoff switches are provided on the pilots' instrument panel. For a complete description of these switches, see "Emergency Equipment," this section.

Fuel Feed System Indicators

FUEL QUANTITY GAGES AND TEST BUTTONS. The quantity of fuel in each main tank is indicated in pounds by four fuel quantity gages (5, figure 1-18) on the fuel section of the pilots' instrument panel. A fuel probe in each tank senses quantity indications. A fuel quantity test button (10, figure 1-18) is provided for each gage. Depressing the individual fuel quantity gage test button will cause counterclockwise rotation of the individual fuel quantity gage pointer. This rotation will continue as long as the test button is depressed.

NOTE

> Normally the gage pointer will travel from empty to full through two complete rotations; however, in some instances due to low amplifier gain or friction in components, the pointer may stop rotating at a below empty indication. When the lack of inertia does not allow the pointer to indicate the "full" position, the test button should be released.

The fuel probe indications are amplified by 118-volt single-phase a-c operated amplifiers which operate the gages. Due to the type of fuel quantity probes used, changes in fuel density have little if any effect upon quantity indications. A full (by weight) indication of the fuel quantity gage completes circuits which will supply power through relays to close the corresponding refuel secondary valve if the master refuel control switch is ON and a refuel secondary valve switch is ON. A 1/4 full or less reading of a main tank fuel quantity gage completes circuits which supply power to a fuel low warning light provided the main tank fuel valve switch is ON. The fuel quantity gages are supplied 118-volt a-c power through circuit breakers marked "1," "2," "3," "4," "Left Drop," "Left Outbd," "Fwd Body," "Ctr Wing," "Mid Body," "Aft Body," "Right Outbd," and "Right Drop" on the "Fuel Indicators" portion of the copilot's circuit breaker panel.

TOTAL FUEL QUANTITY GAGE. A total fuel quantity gage (1, figure 1-18) is located on the pilots' instrument panel. This gage shows the total of individual fuel system indicator readings and receives its indication by electronic addition of indications of the individual fuel gages. The fuel totalizer system operates on 118-volt single-phase a-c power supplied through a circuit breaker marked "Total Qty" on the "Fuel Indicators" portion of the copilot's circuit breaker panel.

NOTE

- If a malfunction causes an individual fuel quantity gage pointer to rotate continuously, the total fuel quantity gage pointer will oscillate over a range equal to the fuel scale quantity of the malfunctioning individual gage. The pointer of the individual gage may be stopped at zero by pulling the circuit breaker just before the pointer reaches zero. If the malfunctioning individual fuel quantity gage is stopped as much as 1/4 inch below zero, it is possible to render the total fuel quantity gage inoperative. If the fuel quantity gage for any tank is stopped at any point, this quantity will be the amount reflected for that tank in the reading of the total fuel quantity gage. The total fuel quantity gage will be in error by the amount that the individual quantity gage is in error.
- If an individual fuel quantity gage pointer falls below the zero mark, the total fuel quantity gage may rotate continuously clockwise. Depressing the individual fuel quantity gage test button will cause counterclockwise rotation of the individual gage pointer. The individual gage pointer may be set at zero by pulling the circuit breaker just before the pointer reaches zero, and rotation of the total fuel quantity gage pointer will stop.
- Operation of the aileron trim tab motor will cause a slight upscale movement of the fuel quantity gage indicator pointers. The magnitude of movement will be less than 1% of full scale indication. The pointer will return to original indication as soon as operation of trim tab motors is discontinued. Similar upscale movements occur when the bomb bay floodlights are turned on.
- This fuel totalizing system is not the type which subtracts total fuel flow from a preset takeoff fuel quantity. The flow subtraction type system is not corrected for fuel density and thus accumulates errors which make it inaccurate at low fuel quantities.
- There is an allowable tolerance of 2700 pounds between the total fuel quantity gage and the sum of all individual fuel quantity gage readings.

FUEL SYSTEM CHECKOUT LIGHT AND SWITCH. A green fuel system checkout light (2, figure 1-18) and a fuel system checkout switch (9, figure 1-18) on the fuel section of the pilots' instrument panel are used for ground checking of fuel pressure. The switch has three positions MAIN TANKS--OFF--AUX TANKS. The MAIN TANKS position supplies 24-volt d-c TR power to a 17 psi pressure switch and a fuel system checkout valve. When fuel pressure reaches this setting, a fuel system checkout light on the fuel panel is illuminated by power from the pressure switch and will remain illuminated approximately 5 to 30 seconds following use of the pressure switches. In the AUX TANKS position, 24-volt d-c TR power is supplied to a 12 psi pressure switch. When closed, this pressure switch supplies power to illuminate the same fuel system checkout light for all auxiliary tanks except the drop tanks. When in the AUX TANKS position, with an auxiliary tank valve switch for a drop tank ON, power is directed to a similar 4 psi pressure switch. The fuel system checkout valve located between tank No. 1 and the fuel checkout pressure switches allows fuel pressure to bleed continuously at a restricted rate into tank No. 1 during use of the checkout system. This solenoid-operated spring-loaded closed valve is actuated when the fuel system checkout switch is in either MAIN TANKS or AUX TANKS position. TR power is supplied to the fuel system checkout light and switch through a circuit breaker marked "Fuel System" on the "Ground Checkout" portion of the pilot's auxiliary circuit breaker panel.

NOTE

The engine air bleed system must be pressurized to complete checkout of drop tanks.

FUEL LOW WARNING LIGHT. A red fuel low warning light (6, figure 1-18) is provided next to each main tank fuel quantity gage. This light is illuminated when a main tank fuel quantity drops to one-quarter full or less provided the corresponding main tank valve switch is ON. A microswitch in the fuel quantity gage is actuated when the fuel indication drops to one-quarter full or less. TR power for the light is provided through a circuit breaker marked "Warn Light Main Tanks" on the "Fuel Level Control" portion of the copilot's circuit breaker panel.

FUEL TRANSFER SYSTEM

The fuel transfer system allows replenishing of the main tanks from the auxiliary tanks during flight. Each auxiliary tank is connected to the fuel transfer manifold which in turn supplies the main tanks. Fuel transfer pumps are provided in all auxiliary tanks except the drop tanks. The drop tanks are pressurized by air from the air bleed system to provide transfer fuel pressure. Tank valves at each auxiliary tank control fuel flow to the transfer manifold. Transfer valves control routing of fuel from the auxiliary to the main tanks. Fuel level valves control fuel flow from the transfer manifold to the main fuel tanks.

Drop Tanks

Constant engine bleed air is supplied from the air bleed system to the drop tank pressurization system to pressurize the drop tank for fuel transfer. A depressurizing valve is incorporated in the system to vent the drop tank and is energized by the respective drop tank transfer valve switch. When the transfer valve switch is in the closed position, the depressurizing valve is in the open position, venting the tank. When the transfer valve switch is in the open position, the depressurizing valve is closed allowing bleed air to pressurize the drop tank for fuel transfer through the transfer manifold. An electrically operated drop tank jettison system is provided. When operated, this system initiates a series of actions which closes the tank valves and jettisons the tanks.

Fuel Transfer System Controls

AUXILIARY TANK VALVE SWITCHES. Auxiliary tank valve switches (12, figure 1-18) are provided for each auxiliary tank. These switches are located on the fuel section of the pilots' instrument panel and are used to control the auxiliary tank valves and to provide fuel pressure for transfer operations. These switches are similar to other fuel switches and are ON when the white line on each switch is aligned with the flow lines on the fuel panel. For all auxiliary tanks, moving the switch to ON position provides TR power to open the motor-driven auxiliary tank valve and to energize the corresponding transfer pump relays which supply 205-volt three-phase a-c power to the transfer pumps. Rotating the switch to OFF position provides power to close the tank valve and to deenergize the transfer pumps. The drop tanks do not have transfer pumps but instead are pressurized by air from the air bleed system to provide fuel pressure for transfer operations. For the drop tanks, placing the auxiliary tank valve switch (No. 17 or 21) in ON position supplies TR power through the drop (external) tank jettison switch to open the tank valve and close the depressurizing valve. This provides fuel under pressure to the fuel transfer manifold. Moving the switch for the respective drop tank to OFF position provides power to close the tank valve and to open the depressurizing valve. The auxiliary tank valve switches are supplied TR power through circuit breakers marked "Left Drop 17," "Left Outbd 18," "Ctr Wing 19," "Right Outbd 20," "Right Drop 21," "Fwd Body 22," "Mid Body 23," "Mid Body 24," and "Aft Body 25" on the "Fuel Feed Valve Control" portion of the copilot's circuit breaker panel.

TRANSFER VALVE SWITCHES. Rotary-type transfer valve switches (8, figure 1-18) on the fuel section of the pilots' instrument panel provide individual control of the fuel transfer valves (No. 26 thru 32). Aligning the white stripe on the switch with the fuel panel flow line turns the switch ON. This completes a circuit supplying TR power to open the corresponding transfer valve. In OFF position,

TANK CAPACITIES

TANKS	NO.	USABLE FUEL (EACH)		FULLY SERVICED (EACH)	
		POUNDS	GALLONS	POUNDS	GALLONS
NO. 1 AND 4 MAIN	2	15,275	2350	15,366	2364
NO. 2 AND 3 MAIN	2	17,947	2761	18,044	2776
MID BODY	1	33,111	5094	33,170	5103
FORWARD BODY (FWD CELL)	1	15,503	2385	15,568	2395
FORWARD BODY (AFT CELL)	1	12,916	1987	12,955	1993
AFT BODY	1	38,428	5912	38,532	5928
OUTBOARD WING	2	14,540	2237	14,580	2243
CENTER WING	1	35,613	5479	35,770	5503
DROP	2	19,500	3000	19,539	3006

USABLE FUEL TOTALS

TANKS	POUNDS	GALLONS
NO. 1, 2, 3 AND 4 MAIN	66,443	10,222
MAIN AND MID BODY	99,554	15,316
MAIN, MID BODY, FORWARD BODY AND AFT BODY (Total Self Sealing)	166,401	25,600
MAIN, ALL BODY, OUTBOARD AND CENTER WING	231,094	35,553
ALL TANKS INCLUDING DROP	270,094	41,553

NOTES

Fully serviced quantities include both trapped and drainable fuel.

The tanks will have the quantities shown when 6.5 lb/gal fuel is used.

NOTE: See data supplied in Section V, OPERATING LIMITATIONS, to determine fuel loading

FUEL QUANTITY DATA

Figure 1-16.

power is supplied to close the valve. The transfer valve switches are supplied TR power through circuit breakers marked "Left Wing 26," "Body 27," "Right Wing 28," "Body 29," "30," "31," and "32" on the "Fuel Transfer Valve Control" portion of the copilot's circuit breaker panel.

MASTER REFUEL CONTROL SWITCH. An ON--OFF master refuel control switch (3, figure 4-80) on the refuel panel provides control of the valves used in replenishing the main tanks and in refueling both main and auxiliary tanks. With this switch ON, refueling of the main as well as auxiliary tanks is accomplished by the refuel secondary valves (No. 33 thru 45) through the refuel system (figure 4-77) OFF position allows normal replenishing of the main tanks from the auxiliary tanks through the fuel level valves (No. 47, 48, 49, and 50). In OFF position, switched battery power is supplied through float switches to the main tank fuel level valves. ON position supplies switched battery power for control of all refuel secondary valves through the float switches and fuel gage full by weight switches. The switch is supplied switched battery power through circuit breakers marked "Master" - "Left" and "Right" on the "Fuel Level Control" portion of the copilot's circuit breaker panel. For further information on the master refuel control switch, see "Air Refueling System," Section IV.

AUXILIARY FUEL TANKS

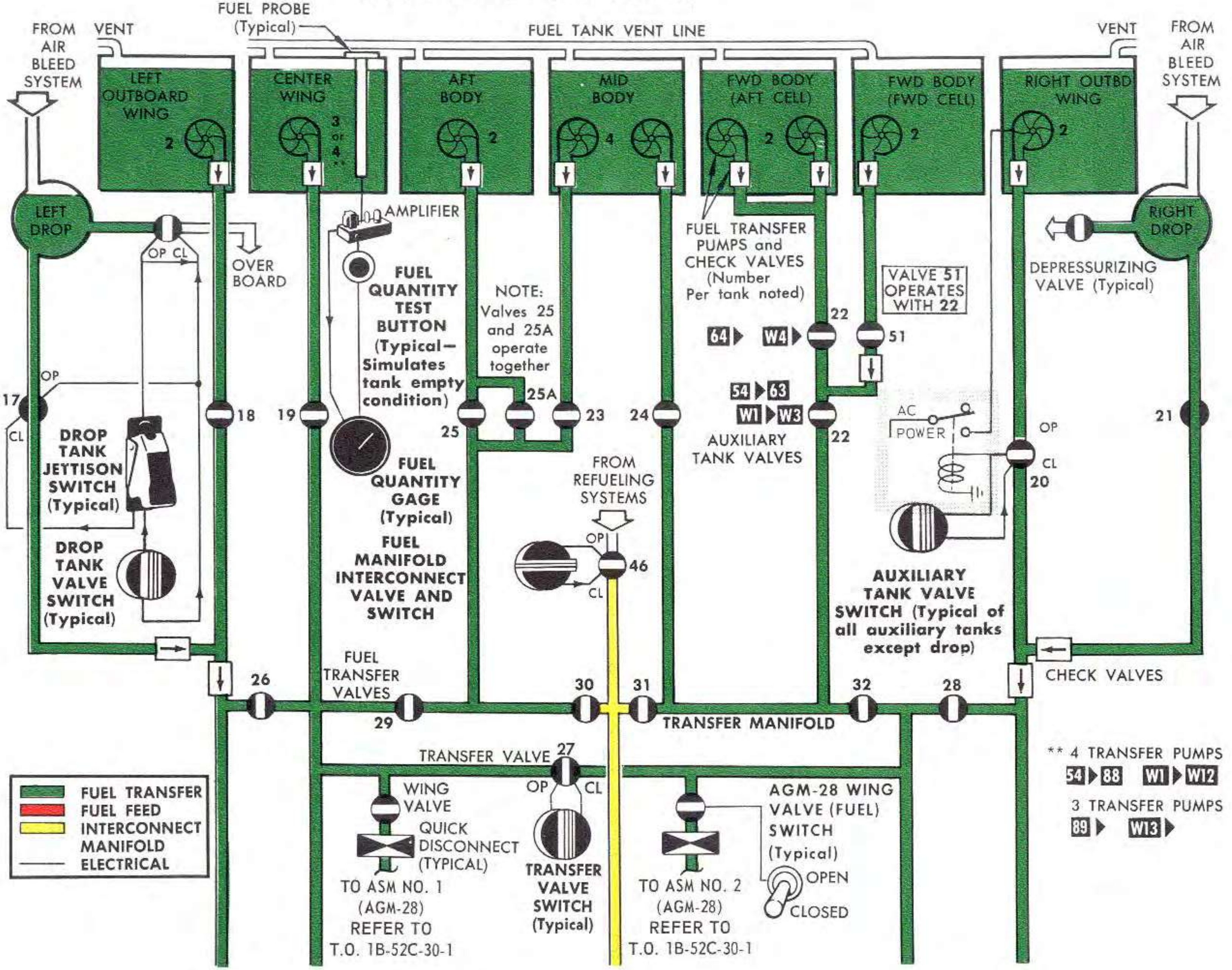
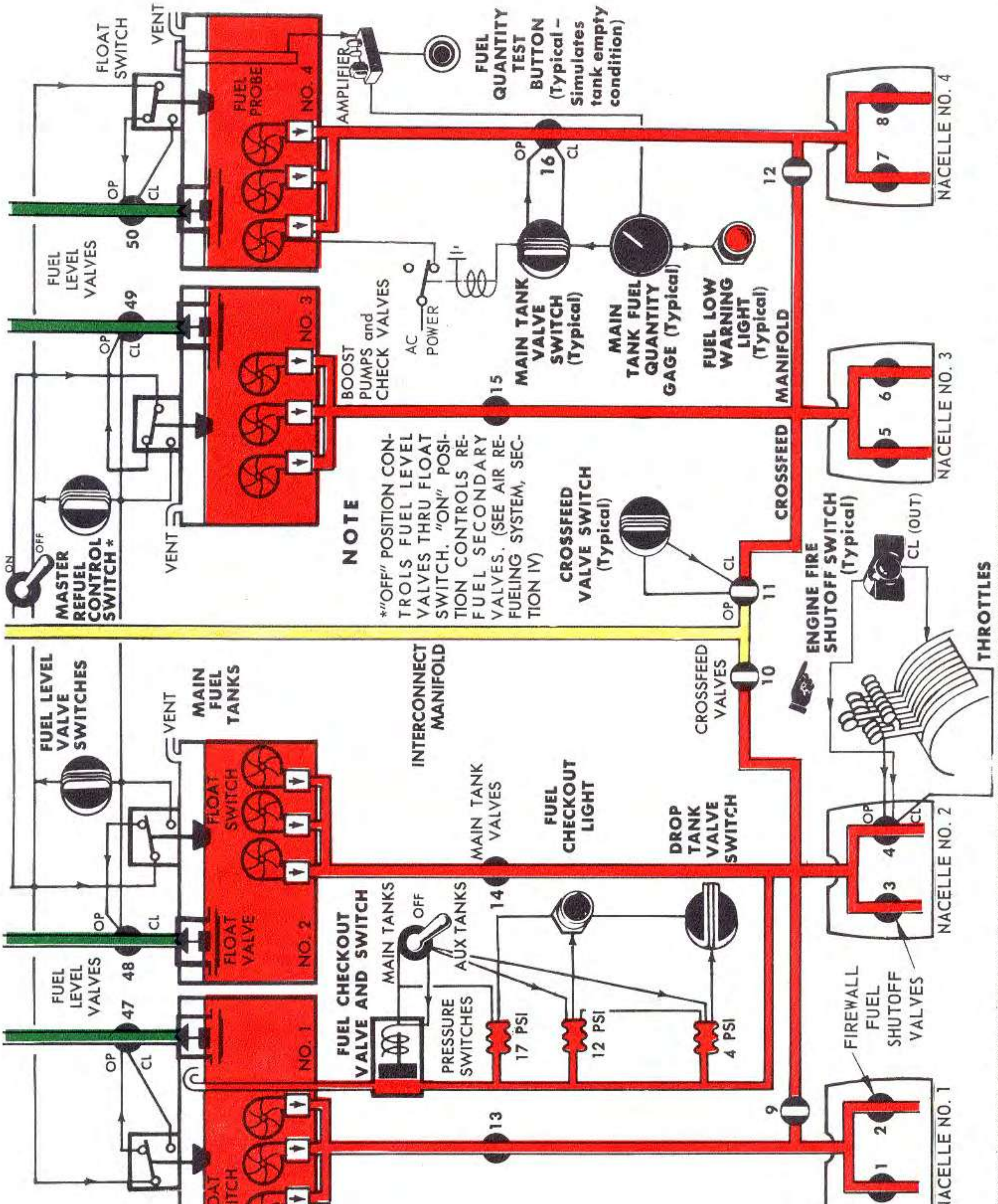


Figure 1-17 (Sheet 1 of 2).

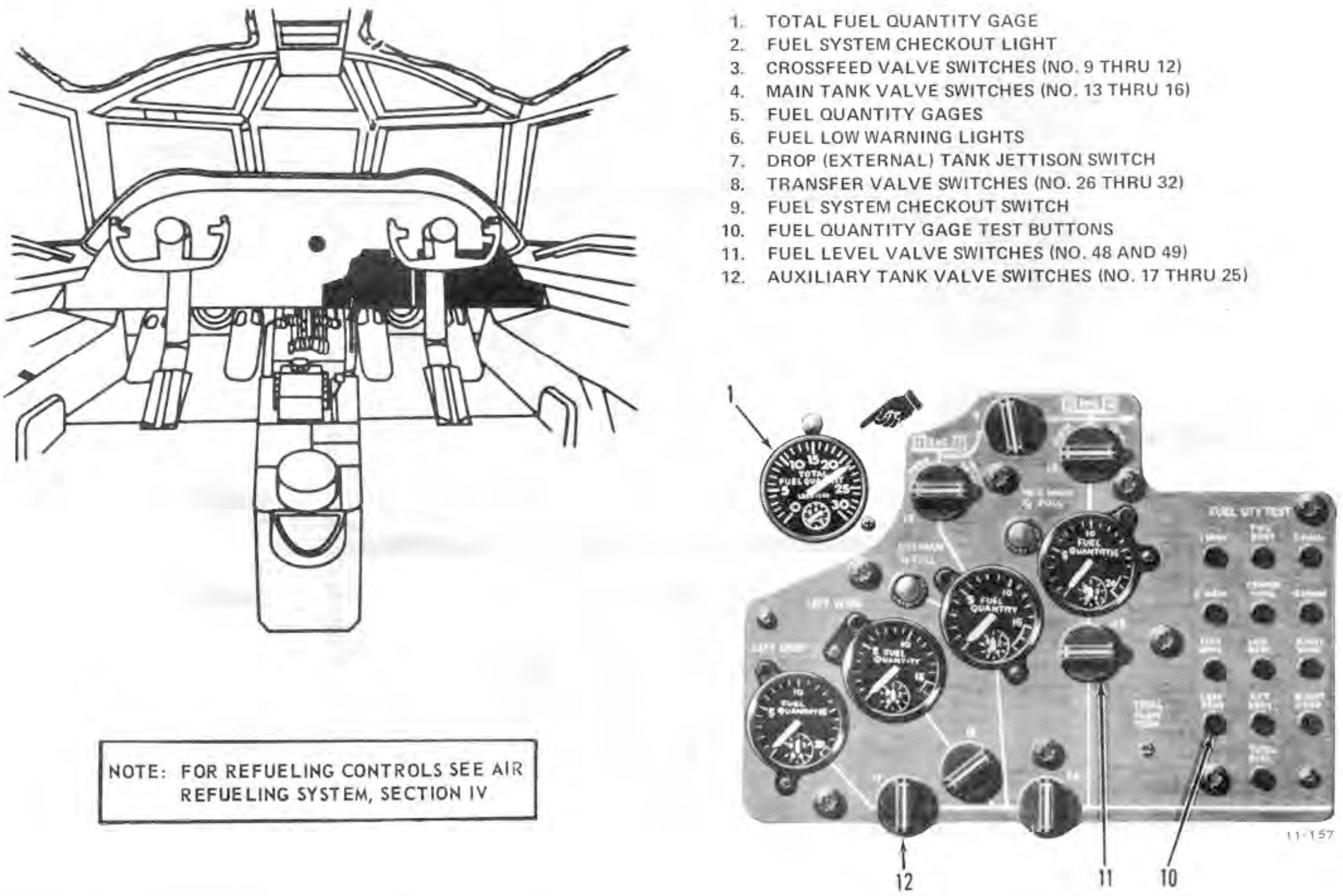


NOTE

*"OFF" POSITION CONTROLS FUEL LEVEL VALVES THRU FLOAT SWITCH. "ON" POSITION CONTROLS REFUEL SECONDARY VALVES. (SEE AIR REFUELING SYSTEM, SECTION IV)

FUEL SUPPLY SYSTEM (Typical)

Figure 1-17 (Sheet 2 of 2).



1. TOTAL FUEL QUANTITY GAGE
2. FUEL SYSTEM CHECKOUT LIGHT
3. CROSSFEED VALVE SWITCHES (NO. 9 THRU 12)
4. MAIN TANK VALVE SWITCHES (NO. 13 THRU 16)
5. FUEL QUANTITY GAGES
6. FUEL LOW WARNING LIGHTS
7. DROP (EXTERNAL) TANK JETTISON SWITCH
8. TRANSFER VALVE SWITCHES (NO. 26 THRU 32)
9. FUEL SYSTEM CHECKOUT SWITCH
10. FUEL QUANTITY GAGE TEST BUTTONS
11. FUEL LEVEL VALVE SWITCHES (NO. 48 AND 49)
12. AUXILIARY TANK VALVE SWITCHES (NO. 17 THRU 25)

NOTE: FOR REFUELING CONTROLS SEE AIR REFUELING SYSTEM, SECTION IV

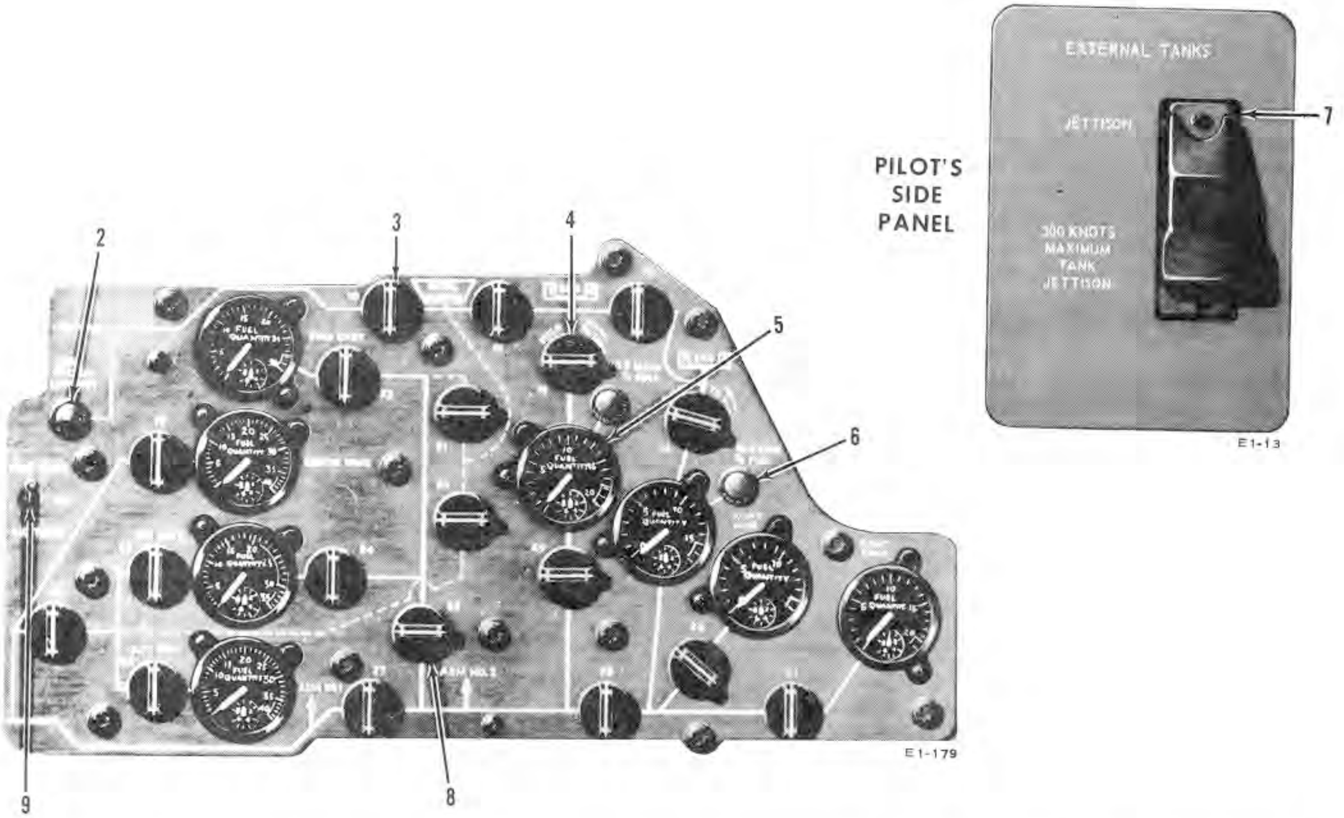
Figure 1-18 (Sheet 1 of 2).

FUEL LEVEL VALVE SWITCHES. Two fuel level valve switches (11, figure 1-18) are located on the fuel section of the pilots' instrument panel. These rotary switches provide manual control of the level valves (No. 48 and 49) for No. 2 and 3 main tanks. The fuel level valves are normally controlled by float switches in each main tank provided the master refuel control switch is OFF. When the white stripe on the switch is aligned with the flow lines on the fuel panel, the switch is ON and switched battery power is supplied through float switches to the fuel level valve to allow automatic replenishing of the main tanks. When the switch is OFF, power is supplied directly to close the fuel level valves. The fuel level valve switches are supplied switched battery power through a circuit breaker marked "Main Tanks Level" on the "Fuel Level Control" portion of the copilot's circuit breaker panel.

NOTE

> Turning the master refuel control switch ON transfers float switch control of fuel level to the refueling secondary valves in the refuel system. This will cause the fuel level valves to remain in their last previous position. If they were closed at that time, no replenishing of the main tanks will occur from the fuel transfer system until the master refuel control switch is returned to OFF position.

DROP (EXTERNAL) TANK JETTISON SWITCH. A guarded drop (external) tank jettison switch (21, figure 1-10) is located on the pilot's side panel. This switch has NORMAL and JETTISON positions and is guarded in the unmarked NORMAL position. Lifting the guard and moving the switch to JETTISON posi-



FUEL SYSTEM CONTROLS

Figure 1-18 (Sheet 2 of 2).

tion supplies TR power through a circuit breaker marked "Drop Tank Jet" on the "Miscellaneous" portion of the pilot's circuit breaker panel to close drop relays. The drop relays supply 118-volt single-phase a-c power to start a series of actions which includes the firing of a pair of explosive nuts. This pair of explosive nuts initiates action resulting in the release of the tank parachute. Deployment of the parachute activates a switch through a lanyard to fire another pair of explosive nuts which support the tank, thereby jettisoning the tank. Landing gear safety relays prevent accidental jettisoning of the drop tanks while on the ground. Positioning of this switch to JETTISON also supplies TR power through circuit breakers marked "Left Drop 17" and "Right Drop 21" on the "Fuel Feed Valve Control" portion of the copilot's circuit breaker panel to close the drop tank valves (No. 17 and 21) and to shut off the drop tank fuel quantity indicating system.

Fuel Transfer System Indicators

AUXILIARY TANK FUEL QUANTITY GAGES. Fuel quantity gages for the auxiliary tanks (5, figure 1-18) are provided on the fuel section of the pilots' instrument panel. These gages indicate pounds of fuel available in the auxiliary tanks. Fuel quantity indications from a fuel probe in each auxiliary tank are amplified by a 118-volt single-phase a-c powered amplifier. The amplifier provides the fuel quantity gage with fuel quantity indications. Fuel tank quantity test buttons are provided for all auxiliary tank fuel gages. The auxiliary tank fuel quantity gages are supplied 118-volt a-c power through circuit breakers marked "Left Drop," "Left Outbd," "Fwd Body," "Ctr Wing," "Mid Body," "Aft Body," "Right Outbd," and "Right Drop" on the "Fuel Indicators" portion of the copilot's circuit breaker panel. Also see "Fuel Feed System Indicators," this section.

ELECTRICAL POWER SUPPLY SYSTEMS

A 205-volt three-phase 400-cycle a-c electrical system provides the primary aircraft electrical power. Use of this high voltage a-c power permits a considerable weight saving in wire gages, actuators, and motor sizes over the conventional low voltage direct current aircraft electrical system. Primary and secondary distribution buses supply power to the aircraft. Primary power is generated by four alternating current generators, called alternators, which are powered by pneumatic drives. This 205-volt three-phase a-c power is used for heavy loads such as boost pumps and wing flap motors. Single-phase 118-volt a-c power, obtained by tapping single phases of the three-phase power, is used for small motors, actuators, and electronic equipment. Transformers reduce single-phase power to 28 volts for most lighting and heating units. Secondary power is 24-volt dc supplied by transformer-rectifier (TR) units fed from the primary system. This TR power is used for control circuits, instruments, small motors, actuators, and electronic equipment. Batteries provide an auxiliary source of 24-volt d-c power to certain TR-operated equipment in an emergency. The 24-volt d-c switched battery power supplied this equipment is normally obtained from the TR units but, in the event of a-c or TR failure, these busses automatically switch to battery power. The batteries also supply power directly to some emergency equipment. Both a-c and d-c power are distributed throughout the aircraft by busses contained in units variously labeled as boxes, panels, or shields. Within these power distribution units, some of which are described in later paragraphs, indicator lights are provided which illuminate when power is being supplied to their corresponding busses. The position of the most important units in the power distribution network can be determined by studying the electrical schematics (figure 1-19, 1-20, and 1-22) in this section. A nickel-cadmium battery (19, figure 1-2) is installed to provide power for the special weapons emergency separation system (SWESS) **Less** **A** . A nickel-cadmium battery (AGM-28 armament provisions battery) is installed to provide power for release and arming of the AGM-28 missiles during emergency missile release. These two batteries are completely independent of the aircraft power distribution system. Aircraft a-c and d-c power is also provided for the operation of certain AGM-28 missile systems. For additional information regarding missile circuit breakers, the AGM-28 armament provisions battery, and the tie-in of aircraft electrical systems and AGM-28 systems, refer to T.O. 1B-52C-30-1.

A-C POWER SYSTEM

The a-c power system (figure 1-20) consists of alternator packs, power distribution boxes, a central bus tie, power load boxes and shields, and circuit breaker panels. An a-c control panel (figure 1-21) at the copilot's station provides all of the controls and indicators for the a-c system except for a group of four alternator overload lights on the pilots' instrument panel.

Alternators

The primary power supply (a-c) is obtained from four alternators designated left forward, right forward, left aft, and right aft. The forward alternators are in a compartment in front of the forward wheel well and the aft alternators are in the forward wheel well. Alternators provide two kinds of power, real and reactive. Real power, where voltage and current are in phase, supplies loads such as motors and lights and is designated in watts or kilowatts. Reactive power serves no useful purpose except to furnish excitation energy for motors and is designated in vars or kilovars. See "Electrical System Operation," Section VII, for a discussion of these two types of power.

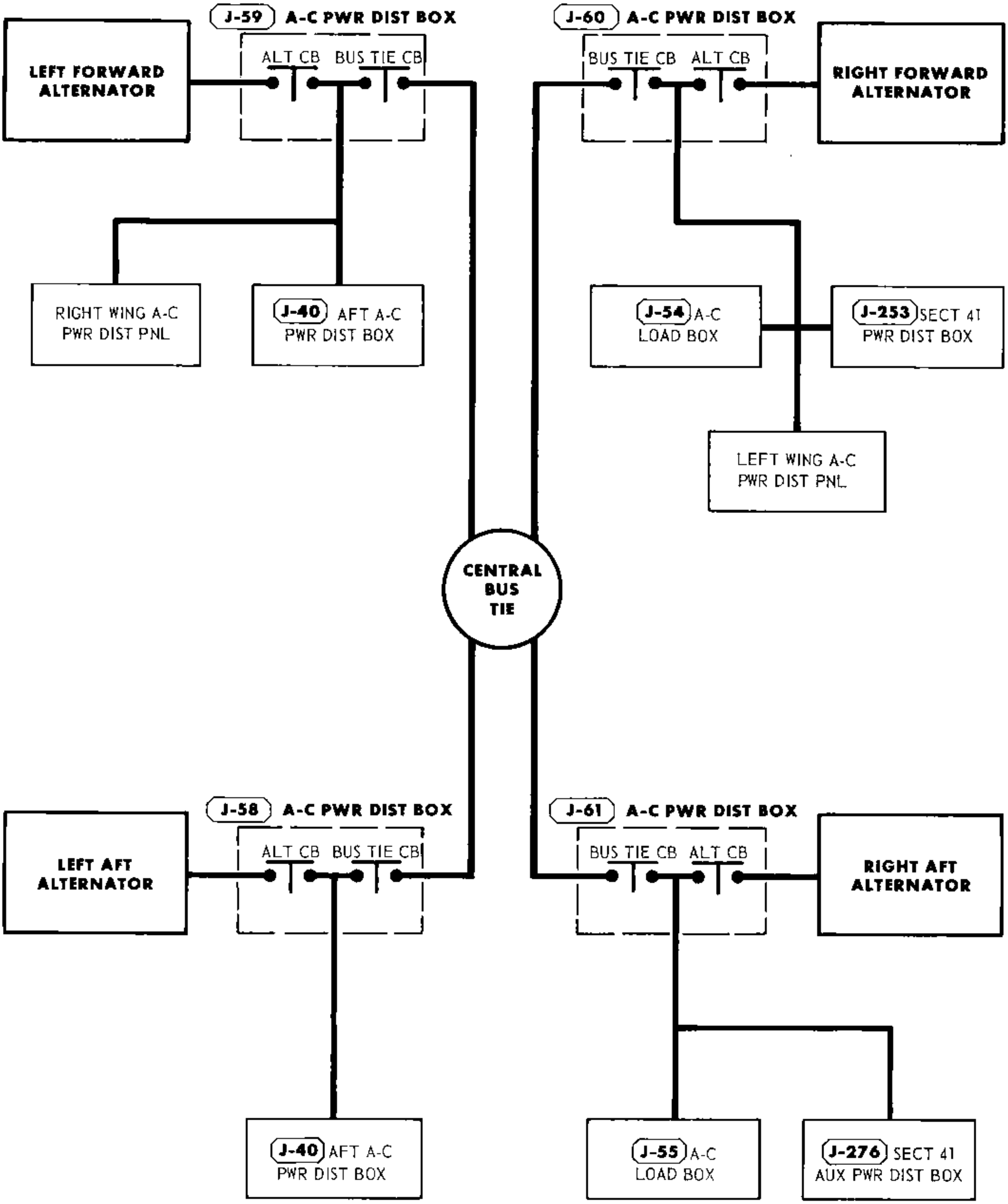
Alternator Packs

Each alternator is bolted to an air turbine drive unit, the entire assembly being termed an alternator pack. The frequency of the primary power output depends on the speed with which the alternator is driven. Therefore, the turbine drive, with its speed control system, will determine the frequency of the power furnished to the electrical systems by the alternators.

Alternator Turbine Drives

The drives have serrated speed trim rheostat knobs labeled KWATTS DIV and INCREASE--DECREASE in addition to an AUTO PARALLEL pushbutton control. These features can be noted in figure 1-21.

AUTOMATIC PARALLELING TURBINE DRIVE. The alternator drive turbine receives engine bleed air through two butterfly valves in series. The first valve is a shutoff valve which controls starting and stopping. Actuation of the valve is controlled manually by an alternator switch on the copilot's a-c control panel and automatically by protective shutdown relays. The second valve is a modulating valve whose function is to supply the correct amount of bleed air for maintaining a constant alternator output regardless of electrical load. This is accomplished by the action of a frequency discriminator which senses deviations between desired speed and actual alternator speed and, in turn, sends a speed control signal to position the modulating valve. Speed trim of the drive is achieved directly through the frequency rheostats on the copilot's a-c control panel. In parallel operation, a real load division loop senses the differential signal between the average load signal and that resulting from the load actually



TYPICAL A-C POWER ROUTING

Figure 1-19.

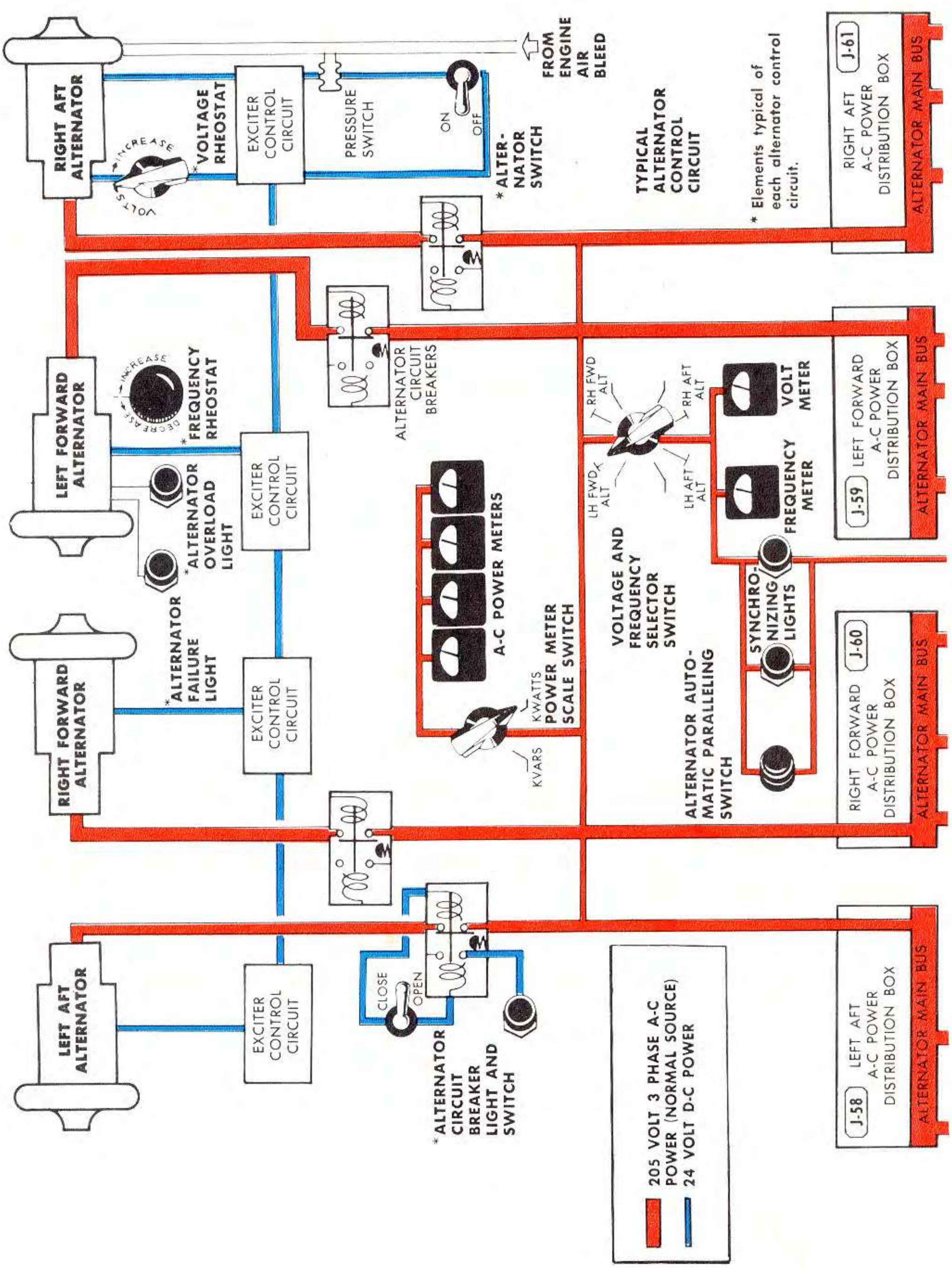


Figure 1-20 (Sheet 1 of 2).

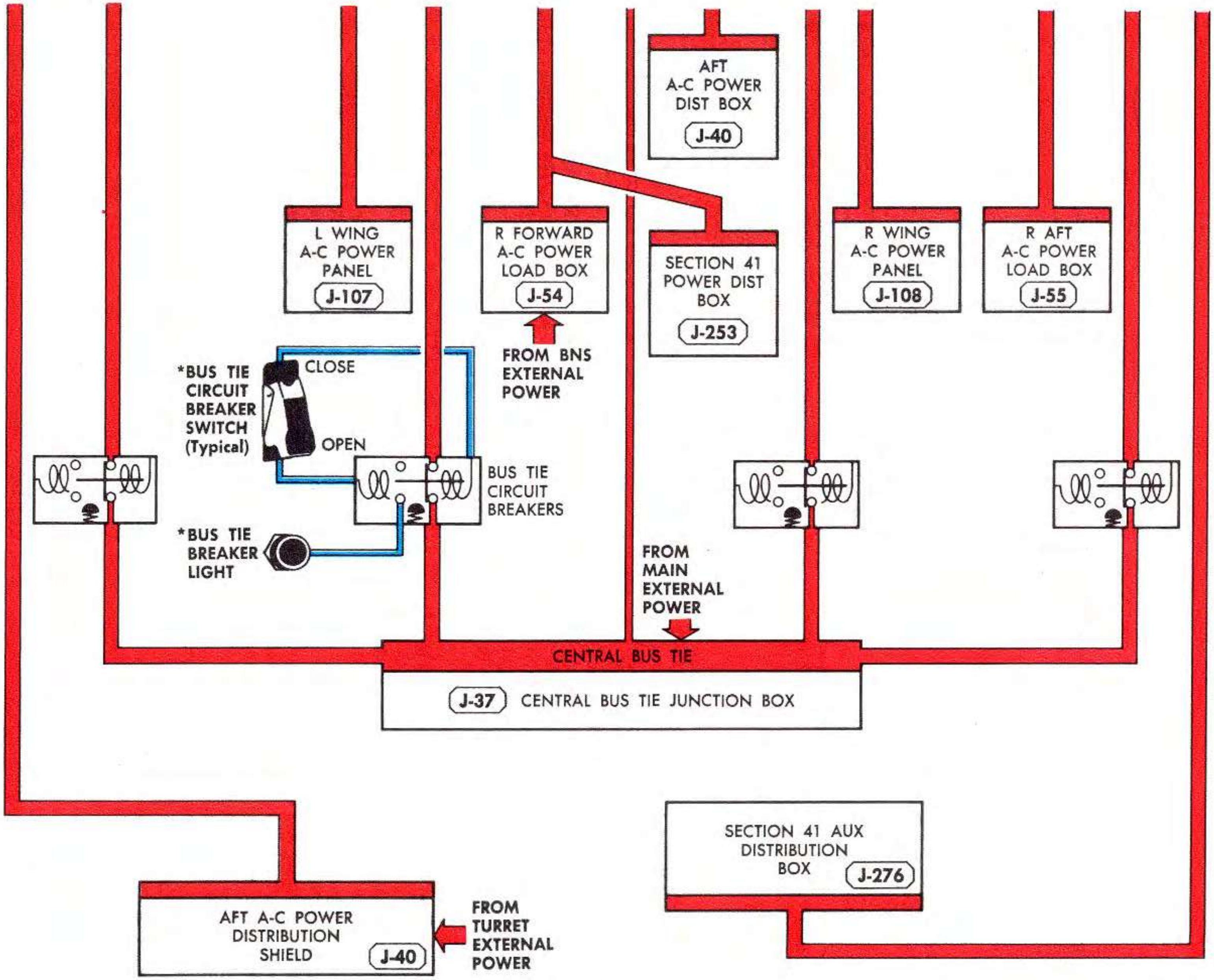


Figure 1-20 (Sheet 2 of 2).

being carried by its own alternator. This differential signal is of such phase and magnitude as to change the setting of the modulating valve which controls the amount of bleed air routed to the drive. If the drive is too lightly loaded, the valve will open and increase the pneumatic energy imparted to the drive. Since the drive speed will be held constant, the alternator will then assume more of the electrical load. Conversely, the signal will close the modulating valve of a too heavily loaded drive thus reducing its output. As a result, each alternator can carry exactly its share of the load. The speed trim frequency rheostats can be used to adjust the speed and frequency of the alternator before paralleling. An automatic paralleling system with pushbutton control is provided. After paralleling, the frequency rheostats can be used to adjust the real load (KWATTS) division. Constant fine adjustment is not necessary. The drive is cooled by ram air in flight and by blowers on the ground. Selection of cooling air is automatic since the circuits are wired through the landing gear switches.

Protective Features

Automatic relays are installed for each alternator to protect the electrical system in the event of a malfunction. In some cases a warning circuit is energized but the alternator pack will continue running until it is manually shut down. In other cases a relay will shut the pack down automatically. Should this occur, the affected pack could probably be restarted but would shut down again unless the fault was cleared in restarting. See "Electrical System Emergency Operation," Section III, for information on restarting alternators.

SPEED PROTECTION. An underspeed protection feature is provided which will shut down the pack at 320 cycles. This provides adequate underspeed protection for aircraft electrical equipment. Primary overspeed protection is provided by a centrifugal switch and an overspeed generator which act to close the air bleed shutoff valve and, in some cases, also the modulating valve when the frequency exceeds 450 to 460 cps. Additional overspeed protection is assured by several mechanical fuses in series in the circuit which holds the shutoff valve open. When any one or more of these mechanical fuses are broken, the unit will be shut down. The fuses can be cut by an overspeed trip bolt on the turbine shaft or by the turbine wheel itself if it becomes broken or misaligned. When a shutdown occurs because of a broken mechanical fuse, the unit cannot be restarted in flight. If the primary overspeed protection system (centrifugal switch and overspeed generator assembly) becomes inoperative during normal operation, it will automatically shut down the drive. However, should it be necessary to restart the drive, the speed (or system frequency) would then be sensitive to pneumatic duct pressure. The frequency would reach a maximum of 430 cps with high duct pressure and decrease to below normal governed frequency with low duct pressure.

NOTE

- An alternator bus tie circuit breaker will close automatically if not already closed when the alternator is turned OFF manually or automatically. When the alternator circuit breaker is opened manually, the bus tie circuit breaker must be closed manually.

- In the event repeat tripoffs of an alternator have occurred on previous flights and cannot be duplicated on the ground, maintenance personnel may elect to install a trip indicator box (annunciator) on the discrepant alternator system. Installation of this tool on either of the forward alternator systems deactivates the automatic reclosure of the bus tie breaker during trip off. This will be reflected by an entry in the 781 forms.

EXCITER PROTECTION RELAY. This relay continuously senses the exciter voltage in the alternator. When a fault occurs which causes sustained exciter ceiling voltage, this relay will disconnect the alternator from the line and shut it down. The complete relay consists of a voltage relay and a thermal delay relay. If exciter voltage increases to approximately 50 volts or more, the voltage relay will supply power to the thermal delay relay. After about 6 seconds at this voltage, the pack will be shut down. The time delay varies with voltage magnitude and is provided to override transient power surges and allow time for fuses to blow and clear faults in multi-wire feeders. This relay, therefore, is a backup device to protect the alternator in case faults are not cleared or the alternator shuts down by other protective relay.

DIFFERENTIAL CURRENT PROTECTION RELAY. This relay (one for each phase of each alternator) functions to remove from service an alternator which is internally faulted or has grounded leads. It is actuated by loops which sense any difference between the current passing through the line of any phase and the current in the ground return line of that phase. This device includes the main buses so the relay will be energized in the event a phase to phase fault occurs. A differential current due to a fault will induce current in a transformer causing the relay to be energized when the fault current exceeds 20 amperes. This directs power to trip off the alternator pack without further delay.

DIFFERENTIAL REACTIVE CURRENT PROTECTION RELAY. This relay functions to remove an alternator from parallel operations when it senses an excessive reactive current differential between paralleled alternators. Should an alternator supply more than its share of reactive load, even though real load was equal on all alternators, the alternator would become overloaded and should be removed for isolated operation. When a reactive current differential exists because of this unbalance, a voltage is induced in an equalizer transformer secondary which will supply power to one bank of a selenium rectifier. This causes current to flow through a polarized relay coil to a control relay which trips off the bus tie breaker for the respective alternator. The alternator, now in isolated operation, can supply power only to those units on its own bus. If an alternator supplies less than its share of reactive load, the control relay will be actuated in the opposite direction and supply power to illuminate the alternator failure light.

OVERVOLTAGE RELAY. This relay is part of the differential reactive current protection relay and functions only when the alternator is operating isolated. It provides overvoltage protection by closing and directing power to shut down the alternator when line to neutral (ground) voltage increases to 127 volts.

ALTERNATOR FAILURE RELAY. This relay senses the voltage on phase C of the respective alternator main bus. Loss of voltage on the main bus causes the relay to deenergize and close contacts to direct power through the alternator circuit breaker to the alternator failure light on the copilot's a-c control panel.

A-C Power Distribution Boxes

Primary power from each alternator is fed to separate main buses in the four power distribution boxes from which the power load boxes are supplied in an isolated manner during nonparallel operation. There is no alternate source of power since the automatic transfer relays have been removed. When operating isolated and an alternator malfunction occurs, its loads must be fed from the central bus tie (figures 1-19 and 1-20).

Central Bus Tie Junction Box

For parallel operation, power is supplied to a central bus tie from the four distribution boxes. Greater reliability is obtained from the almost equal distribution of loads upon the alternators from this kind of operation for, if an alternator fails, the total load will be automatically distributed equally to the remaining three. Fast clearing of faults will also occur because of the large currents available. The central bus tie also receives the external power through the external power receptacle and distributes it to the load boxes.

A-C Power Load Boxes, Panels and Shields

The a-c power load boxes, wing power panels, and aft shields are supplied through multiwire feeders of three or four wires for each phase. The buses in these boxes supply all of the 205-volt 3-phase loads and, in addition, furnish 118-volt single-phase power to the circuit breaker panels and to two 28-volt transformers.

A-C Power System Controls

ALTERNATOR SWITCHES. Four ON--SWITCH OFF--OFF alternator switches (7, figure 1-21), spring loaded to the neutral SWITCH OFF position, on the a-c control panel control the alternator packs. When a switch is held in ON position, switched battery power is directed through a safety pressure switch to open the air shutoff valve. This permits a flow of air to drive the turbine. The pressure switch will prohibit this start by remaining open if insufficient air is supplied by the air bleed system. When an alternator switch is held in OFF position, switched battery power is directed to the exciter control relay. This disconnects the alternator from its distribution box and shuts down the pack. The alternator switches receive switched battery power through circuit breakers marked "Left Fwd Alternator," "Right Fwd Alternator," "Left Aft Alternator," and "Right Aft Alternator" on the "Alternator Control" portion of the copilot's circuit breaker panel.

ALTERNATOR CIRCUIT BREAKER SWITCHES. Four CLOSE--SWITCH OFF--OPEN alternator circuit breaker switches (5, figure 1-21), spring loaded to the neutral SWITCH OFF position, on the a-c control panel control the alternator circuit breakers. When a switch is held in CLOSE position, switched battery power closes the circuit breaker connecting the alternator to its distribution box and opens the external power circuit. When a switch is held in OPEN position, switched battery power will open the circuit breaker. This disconnects the alternator from its distribution box and illuminates its alternator circuit breaker light. The alternator circuit breaker cannot be closed if the drive for that alternator is not running. The alternator circuit breaker switches receive switched battery power through circuit breakers marked "Left Fwd Cir Brkr," "Right Fwd Cir Brkr," "Left Aft Cir Brkr," and "Right Aft Cir Brkr" on the "Alternator Control" portion of the copilot's circuit breaker panel.

NOTE

> When an alternator circuit breaker switch is placed in CLOSED, and paralleling requirements are met, the autoparalleling control circuit will close the alternator circuit breaker and bus tie circuit breaker. This is a peculiarity of the circuit and not the normal procedure for paralleling of alternators.

BUS TIE BREAKER SWITCHES. Four CLOSE--SWITCH OFF--OPEN bus tie breaker switches (15, figure 1-21) on the a-c control panel control the central bus tie circuit breakers. The switches are guarded and spring-loaded to the neutral SWITCH OFF position. When a switch is held in CLOSE position, switched battery power will close the bus tie circuit breaker to connect the alternator main bus to the central bus tie. The four switches are placed in this position for operation on ground external power. The bus tie breaker switches receive switched battery power through circuit breakers marked "Left Fwd Bus Tie," "Right Fwd Bus Tie," "Left Aft Bus Tie," and "Right Aft Bus Tie" on the "Alternator Control" portion of the copilot's circuit breaker panel.

NOTE

When a bus tie circuit breaker switch is placed in CLOSED, and paralleling requirements are met, the autoparalleling control circuit will close the bus tie circuit breaker and alternator circuit breaker. This is a peculiarity of the circuit and not the normal procedure for paralleling of alternators.

VOLTAGE RHEOSTATS. Four voltage rheostats (9, figure 1-21) are provided to adjust the voltage for each alternator. When a rheostat is rotated clockwise, the voltage output is increased and opposite rotation will decrease it. Voltage from all four alternators is read from a single voltmeter (3, figure 1-21). The voltage rheostats also provide a means of adjusting the KVARS division between alternators when operating in parallel. When a rheostat is rotated clockwise, the KVARS (reactive load) will increase for the respective alternator and decrease for all others operating in parallel. When a rheostat is rotated counterclockwise, the KVARS will decrease for the respective alternator and increase for all others operating in parallel. KVARS are read on the power meters with the power meter scale switch in the KVARS position.

FREQUENCY RHEOSTATS. Four frequency rheostats (10, figure 1-21) on the a-c control panel provide control for alternator speed and frequency. These controls are serrated knobs which are not spring loaded and will stay in whatever position they are left in. When a rheostat is rotated clockwise, the speed, and consequently, the frequency of the respective alternator is increased. Counterclockwise rotation will decrease frequency. Frequency for all four alternators is read from a single frequency meter. In addition to operating as a speed trim control, these rheostats also provide a means of adjusting the KWATTS division between alternators operating in parallel. Rotating a rheostat clockwise increases the KWATT real load of the respective alternator and decreases the load on the other alternators. Rotating it counterclockwise decreases the KWATTS on the respective alternator and increases the load on the others. KWATTS are read on the power meters with the power meter scale switch in the KWATTS position. The frequency rheostat knobs are guarded to prevent accidental movement.

VOLTAGE AND FREQUENCY SELECTOR SWITCH. An eight-position voltage and frequency selector switch (16, figure 1-21) provides selection of voltage and frequency readings between each alternator and the central bus tie. When the switch is placed in the LH FWD ALT position, the voltage and frequency of the left forward alternator is read on the voltmeter and frequency meter. In addition, the synchronizing lights and the automatic paralleling system are placed in operation for this alternator. Three other positions will perform the above operations for their respective alternators as decaled. Four other positions, each adjacent to an alternator position, connect the voltmeter and frequency meter to the central bus tie for respective voltage and frequency readings.

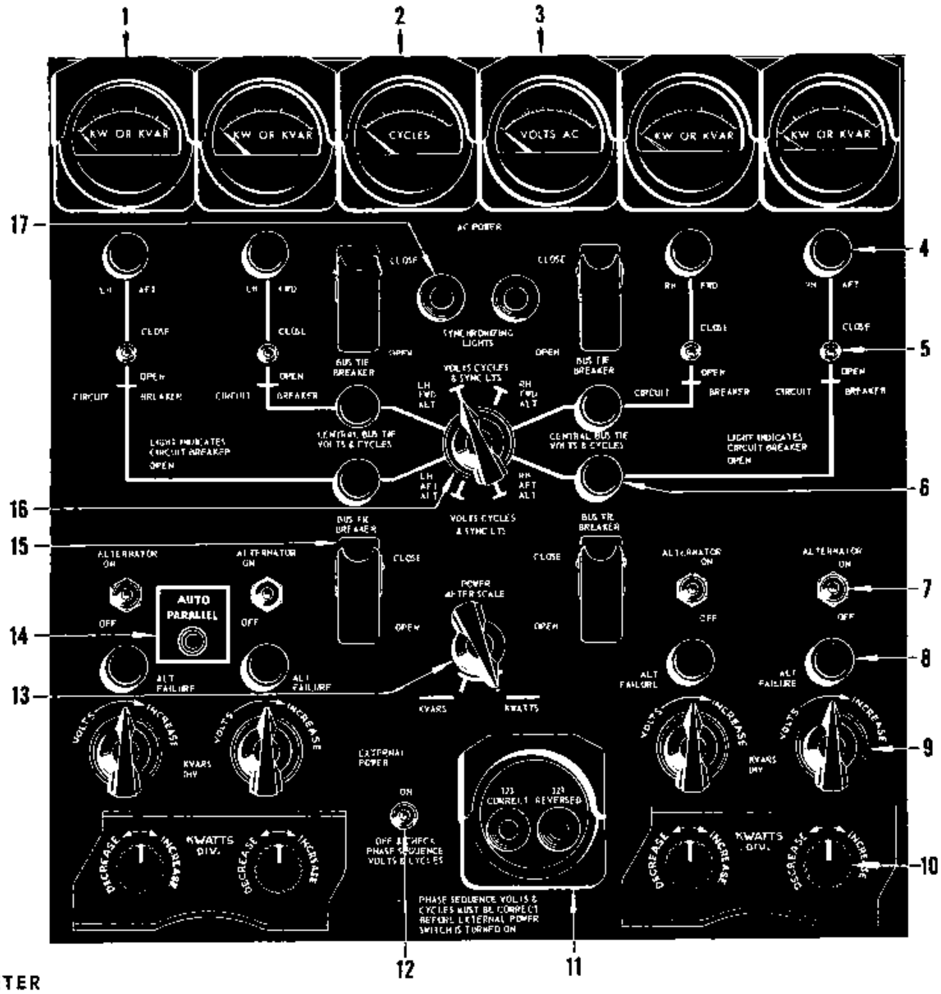
ALTERNATOR AUTOMATIC PARALLELING SWITCH A PARALLEL--OFF pushbutton-type alternator automatic paralleling switch (14, figure 1-21) on the a-c control panel enables the copilot to parallel the alternators while using only one hand. When pushed to the PARALLEL (in) position it will automatically parallel a selected alternator to the central bus tie at a moment when the two units are synchronized. During this action electrical pulses are sent to close the alternator and bus tie circuit breakers. When released, the spring loaded-switch returns to the OFF (out) position and the automatic paralleling system becomes inactive. The alternators also may be paralleled by manually closing either the alternator or bus tie circuit breaker but is not the normal procedure for paralleling alternators. The alternator to be paralleled is selected by the voltage selector switch. The automatic paralleling switch receives switched battery power through a circuit breaker marked "Alt Auto Parallel" on the "Alternator Control" portion of the copilot's circuit breaker panel.

A-C Power System Indicators

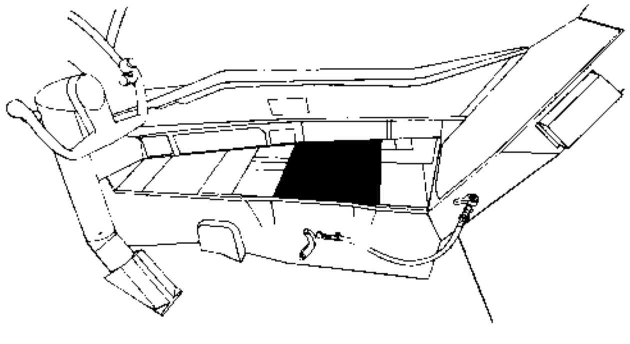
POWER METERS AND POWER METER SCALE SWITCH. Four power meters (1, figure 1-21) on the a-c control panel provide an indication in kilowatts of either the real or the reactive power supplied by each of the alternators. Selection between real and reactive power is obtained by a KVARS--KWATTS power meter scale switch (13, figure 1-21) for all four meters.

VOLTMETER, FREQUENCY METER AND SYNCHRONIZING LIGHTS. One frequency meter (2, figure 1-21) and one voltmeter (3, figure 1-21) on the a-c control panel provide individual readings for each alternator and the central bus tie. Two synchronizing lights (17, figure 1-21) assist in the adjustment of the voltage and frequency of an alternator to those of the central bus tie.

ALTERNATOR CIRCUIT BREAKER LIGHTS. Four red alternator circuit breaker lights (4, figure 1-21) on the a-c control panel illuminate to indicate open alternator circuit breakers. Each light circuit is closed to switched battery power through a contact of its alternator circuit breaker when the circuit breaker is open. The alternator circuit breaker lights receive switched battery power through circuit breakers marked "Cir Brkr Ind Lights" - "Fwd" and "Aft" on the "Alternator Control" portion of the copilot's circuit breaker panel.



1. POWER METERS
2. FREQUENCY METER
3. VOLTMETER
4. ALTERNATOR CIRCUIT BREAKER LIGHTS
5. ALTERNATOR CIRCUIT BREAKER SWITCHES
6. BUS TIE BREAKER LIGHTS
7. ALTERNATOR SWITCHES
8. ALTERNATOR FAILURE LIGHTS
9. VOLTAGE RHEOSTATS
10. FREQUENCY RHEOSTATS
11. PHASE SEQUENCE INDICATOR
12. EXTERNAL POWER SWITCH
13. POWER METER SCALE SWITCH
14. ALTERNATOR AUTOMATIC PARALLELING SWITCH
15. BUS TIE BREAKER SWITCHES
16. VOLTAGE AND FREQUENCY SELECTOR SWITCH
17. ALTERNATOR SYNCHRONIZING LIGHTS



A-C CONTROL PANEL

Figure 1-21.

BUS TIE BREAKER LIGHTS. Four red bus tie breaker lights (6, figure 1-21) on the a-c control panel illuminate to indicate open central bus tie circuit breakers. Each light circuit is closed to TR power on aircraft 54▶ 75, switched battery power on aircraft 76▶ W1▶, through a contact of its bus tie circuit breaker when the circuit breaker is open. The bus tie breaker lights receive switched battery power through a circuit breaker marked "Bus Tie Ind Lights" on the "Alternator Control" portion of the copilot's circuit breaker panel.

ALTERNATOR FAILURE LIGHTS. Four red alternator failure lights (8, figure 1-21) on the a-c control panel provide alternator failure warning. During parallel operation, if an alternator is not supplying its share of reactive power, the respective differential reactive current protection relay will direct switched battery power to the light. During isolated operation, if the alternator voltage output is low, the alternator failure relay for the respective alternator will direct switched battery power to the light. In this case, the alternator circuit breaker must be closed before power can be directed to the light; therefore, the light will not be on when the alternator is shut down. The alternator failure lights receive switched battery power through circuit breakers marked "Left Fwd Bus Tie," "Right Fwd Bus Tie," "Left Aft Bus Tie," and "Right Aft Bus Tie" on the "Alternator Control" portion of the copilot's circuit breaker panel.

NOTE

> The alternator failure lights will only illuminate to show low alternator output. They will not illuminate for such conditions as overvoltage, excessive reactive power, or a fault in the alternator circuits.

ALTERNATOR OVERLOAD LIGHTS. Four red alternator overload lights (36, figure 1-15) on the pilots' instrument panel provide alternator pack electrical overload low air pressure warning. When air pressure to drive the alternator pack is low with respect to electrical loads, the governor of the pack will open the speed control valve as required to maintain constant frequency. If the air pressure continues to decrease or loads continue to increase, the speed control valve will open further until it causes a microswitch to close and direct switched battery power to the respective light. This power is routed through the exciter control relay so that the light will not be on when the drive is shut down. The alternator overload lights receive switched battery power through circuit breakers marked "Left Fwd Alternator," "Right Fwd Alternator," "Left Aft Alternator," and "Right Aft Alternator" on the "Alternator Control" portion of the copilot's circuit breaker panel.

POWER ON BUS LIGHTS. Each a-c power bus in the main system is provided with three power on bus lights, one for each phase. The lights are visible through windows in the various boxes, panels, and shields and, when illuminated, indicate when power is on the bus. The following units contain power on bus lights: the central tie junction box, all four a-c power distribution boxes, both right forward and right aft a-c power load boxes, both right and left wing a-c power panels, and the aft a-c power distribution shield.

D-C POWER SYSTEM

The d-c power system (figure 1-22) consists of transformer-rectifier (TR) units, d-c power shields with TR buses, batteries with battery buses, switched-battery buses, and circuit breakers, controls, and indicators. A d-c control panel (figure 1-23) at the copilot's station provides all the controls and indicators for the d-c system except for the emergency battery switch which is located on the copilot's side panel.

Transformer-Rectifier (TR) Units, Buses, and Circuit Breakers

Direct current power for normal operation is 24-volt output transformer-rectifier (TR) units which operate directly off the three-phase 205-volt a-c load boxes. In normal operation, TR No. 1 receives a-c power from the right forward alternator, TR No. 2 receives a-c power from left forward alternator, TR's No. 3, 6, 7, and 8 receives a-c power from left aft alternator, and TR's No. 4 and 5 receive a-c power from right aft alternator. In the event one or more alternators fail or shut down, the TR units can receive a-c power from the central bus tie, providing one alternator is operating within limits and all bus tie circuit breakers are closed. The several TR units are divided into two groups, forward and aft. The forward units, which are located in the forward wheel well, provide power through the forward d-c junction boxes to the crew members' circuit breaker panels. From there, the TR power is routed either through relays to the switched battery buses, through the battery switch to the battery charging relays, or directly to certain d-c operated equipment. The aft TR units are located in the aft equipment compartment. They provide power through distribution buses in the aft d-c power shield or the turret d-c power junction box to the gunner's circuit breaker panel. The forward TR units are bused together, as are the aft TR units, so that partial TR unit failure will not result in a loss of power to any d-c operated equipment. In the event of complete aft TR unit failure, the gunner will lose heat control and the air conditioning pressurization will have to be dumped manually in the aft compartment. In addition, d-c power to the fire control system will be lost. The bus voltage depends upon the inherent regulating qualities of the units; therefore, the voltage varies from approximately 24 volts at full load to 29.5 volts at light loads. In the event of complete forward/aft TR unit failure, all equipment controlled by TR power such as flaps, fuel, stabilizer trim, etc, will be inoperative.

NOTE

> All TR units are rated at 100 amperes each. There are five forward TR units and three aft TR units.

Batteries

An auxiliary source of d-c power is furnished by two 24-volt, 24 ampere-hour batteries in the forward wheel well designated as the forward and aft batteries. Each battery supplies power directly (through fuses and circuit breakers) to battery buses in the radar navigator's and pilot's circuit breaker panels and to several switched-battery buses. These switched-battery buses are supplied battery power through switched-battery bus relays when the battery switch is on and TR power is not available. When forward TR power is available, the relays energize to the opposite position so that the loads are then supplied from forward TR power. Should ac or TR power fail, switched-battery bus loads are assured of a source of power from the batteries for a short period of time. Loads such as landing gear emergency control, bomb jettison (except jettison power for hi-density), emergency alarm, interphone, entry lights, fuselage overheat warning, and airbrake control are connected directly to the battery buses to assure a source of power at all times. The batteries are charged from the TR buses. See Section III for emergency operation of battery power.

NOTE

Although control circuits for bomb jettison (except hi-density) and landing gear emergency operation are on direct battery, completion of these operations requires the battery switch be in ON position to provide power to start the four utility hydraulic packs and to operate the bomb door control valves.

D-C Power System Controls

BATTERY SWITCH. An ON--OFF battery switch (5, figure 1-23) on the d-c control panel routes battery power to the switched-battery buses and controls battery charging. In ON position, battery power is directed to the switched-battery buses through switched-battery bus relays and, when TR power is available, relays are energized to direct charging power to the batteries. In OFF position, no battery power is available to the switched-battery buses and no charging power is available to the batteries. Battery power is supplied directly from each battery to individual battery buses at all times, regardless of the position of the battery switch.

EMERGENCY BATTERY SWITCH. A NORMAL--EMERG emergency battery switch (9, figure 1-11) is located on the copilot's side panel. In EMERG position, this switch connects emergency battery power from the aft battery to the pilot's turn and slip indicator, pilot's emergency flight instrument lights, interphone power, emergency alarm system, fuselage fire warning system, airbrake control, and the landing gear position indicator. In NORMAL position, some loads receive power from the forward switched battery bus and some directly from the forward battery bus. Emergency battery power and its control is routed through circuit breakers on the pilot's overhead circuit breaker panel.

NOTE

Placing the emergency battery switch to the EMERG position will not necessarily provide emergency lighting in flight after partial ac power loss. See "Instrument Lighting Failure," Section III.

TR GROUP SELECTOR SWITCH. This switch (3, figure 1-23) on the d-c control panel provides selection of either the forward or aft TR unit groups for reading group bus voltage on the voltmeter. Positioning this switch is also necessary when reading the individual unit load on the loadmeter. The switch has positions FWD T-R UNITS 1--2--3--4--5; AFT T-R UNITS 6--7--8.

TR UNIT SELECTOR SWITCH. This switch (4, figure 1-23) on the d-c control panel provides individual selection of TR units for readings on the loadmeter. It is a rotary type switch decaled FWD--AFT and with TR unit numbers at their corresponding switch positions. Some switch positions are shared by two TR units, one forward and one aft. The TR group selector switch must be positioned to the correct group (forward or aft) so that a load reading for the desired unit can be obtained.

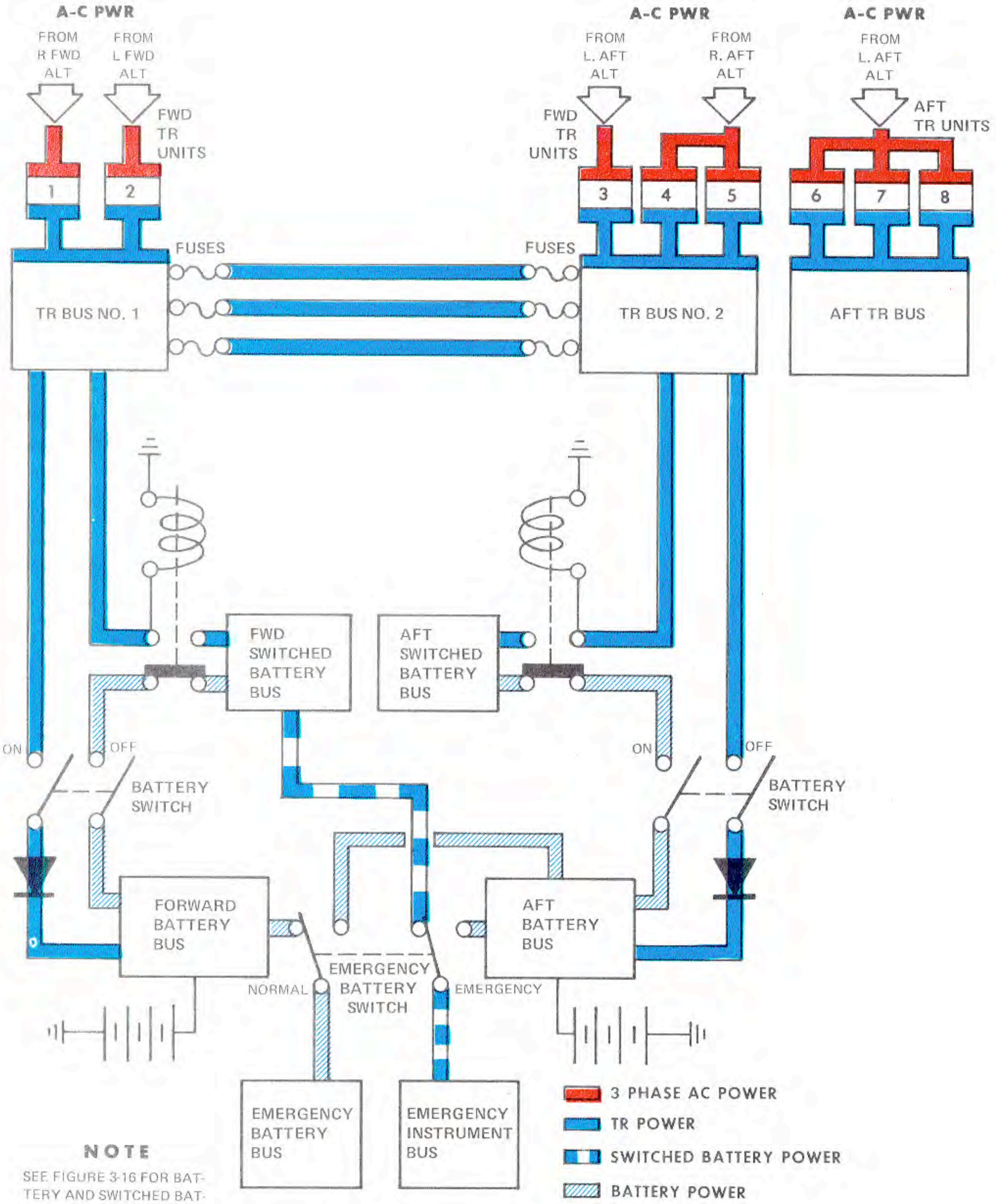
BATTERY VOLTAGE TEST BUTTONS. Two buttons (7, figure 1-23) on the d-c control panel enable battery voltage to be read on the voltmeter. The buttons are decaled BATT NO. 1 VOLTS and BATT NO. 2 VOLTS on aircraft **54**▶ **75**, and are marked FWD BATT VOLTS and AFT BATT VOLTS on aircraft **76**▶ **W1**▶ . On the earlier aircraft the forward battery was called the number one battery while the aft battery was labeled number two. When depressing a battery voltage test button, battery voltage will be read only when power is off the aircraft or the battery switch is OFF. When power is on the aircraft and the battery switch is ON, the voltage read, when depressing a battery voltage test button, will be TR voltage with a drop of approximately 1.5 volts because of the charging rectifiers.

D-C Power System Indicators

D-C VOLTMETER. A d-c voltmeter (2, figure 1-23) on the d-c control panel provides readings from 0 to 30 volts for either the forward or aft TR bus and for either the forward or aft battery.

D-C LOADMETER. A d-c loadmeter (1, figure 1-23) on the d-c control panel indicates individual TR unit load in tenths of TR unit capacity. Loadmeter readings can be obtained for the output of any TR unit.

BATTERY NOT CHARGING LIGHTS. Two red battery not charging lights (6, figure 1-23) on the d-c control panel illuminate to indicate a battery not charging condition. The lights will illuminate when charging power (forward TR power) is available and the battery switch is OFF or when charging power is not available and the battery switch is ON. The battery not charging lights receive switched battery power through a circuit breaker marked "Copilot Sw Battery Fwd Bus" on the "TR Power" portion of the copilot's circuit breaker panel.

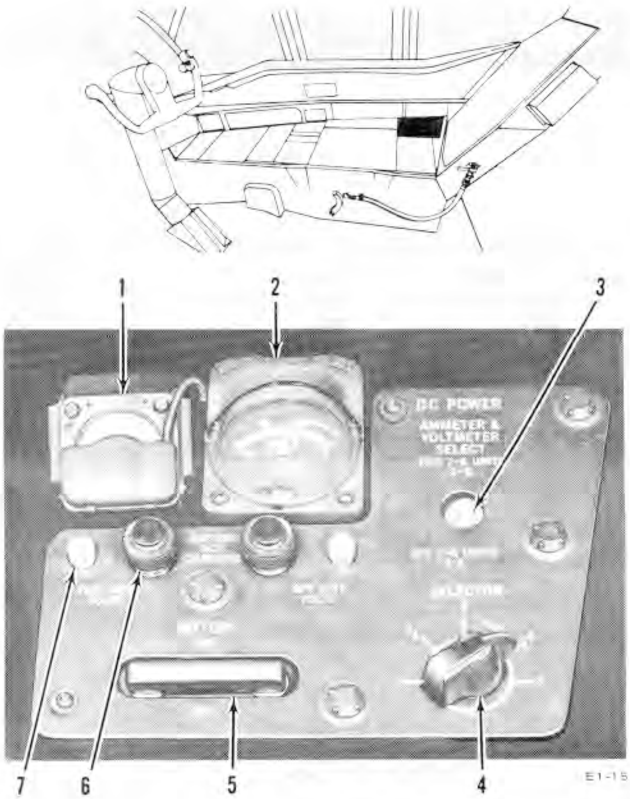


NOTE

SEE FIGURE 3-16 FOR BATTERY AND SWITCHED BATTERY BUS LOADS AND FIGURE 3-17 FOR TR BUS LOADS.

D-C POWER SYSTEM (Typical)

Figure 1-22.



1. D-C LOADMETER
2. D-C VOLTMETER
3. TR GROUP SELECTOR SWITCH
4. TR UNIT SELECTOR SWITCH
5. BATTERY SWITCH
6. BATTERY NOT CHARGING LIGHTS
7. BATTERY VOLTAGE TEST BUTTONS

D-C CONTROL PANEL (TYPICAL)

Figure 1-23.

EXTERNAL ELECTRICAL POWER SYSTEMS

Three external power receptacles are provided for energizing aircraft equipment from an external source: a main receptacle, a bombing-navigational system receptacle, and a gunnery system receptacle.

Main External Power

The main external power is routed into the central tie junction box by means of a main external power receptacle (23, figure 1-57) located on the right side of the fuselage adjacent to the forward wheel well. This receptacle has a total of five pins: three pins take 205-volt three-phase power, one pin is for ground, and one is for 24-volt d-c power to operate the connection relay. This relay, which connects the a-c power to the aircraft, is closed through actuation of a switch on the copilot's a-c control panel. In addition, the relay is closed through the open side of the alternator circuit breakers so that when any alternator circuit breaker is CLOSED, external power is isolated from the aircraft. D-C power is provided by aircraft TR units utilizing external a-c power.

Bombing — Navigational System External Power

External power for the bombing-navigational system is routed to the radar navigator's circuit breaker panel by means of a double receptacle (26, figure 1-57) located on the right side of the fuselage adjacent to the forward wheel well above and forward of the main external power receptacle. This unit consists of two receptacles: one for a-c power, which is identical with the main external power receptacle, and one for d-c power. The d-c receptacle has three pins: two to take 24-volt dc for control and power and one for ground.

Gunnery System External Power

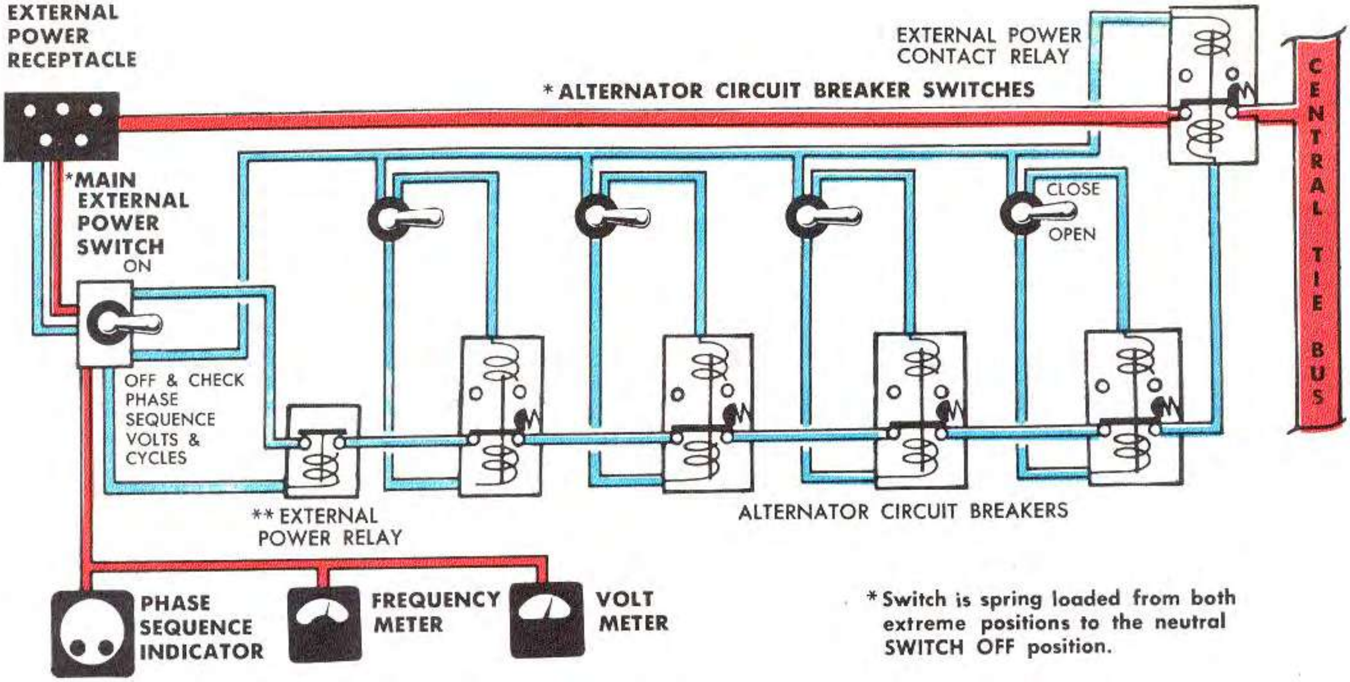
The external power for the gunnery system is routed to the aft ac power shield by means of a receptacle (10, figure 1-57) aft of and adjacent to the right rear wheel well. The gunnery system external power receptacle supplies both 205-volt three-phase ac power and 24-volt dc power to the system. It is essentially the same as the bombing-navigational system external power receptacle.

External Electrical Power System Controls

EXTERNAL POWER SWITCHES. A three-position switch for controlling external power is provided for each external power system. The main external power switch (12, figure 1-21) on the a-c control panel is marked ON--OFF & CHECK PHASE SEQUENCE VOLTS & CYCLES. The switch is spring loaded to the neutral unmarked OFF position. When the switch is held to OFF & CHECK PHASE SEQUENCE VOLTS & CYCLES position with ground cart power on the main receptacle, the phase sequence is read on the phase sequence indicator, the voltage and frequency are read on the voltmeter and the frequency meter, and the external power control circuit is armed. When the switch is then placed in ON position, d-c power closes an external power circuit breaker which will connect external power to the aircraft distribution system. This circuit breaker will remain closed only as long as the four alternator circuit breakers remain open. The main external power circuit breaker is tripped by any one of the following actions:

1. Failure of the external power or removal of the external power plug.
2. Placing an alternator circuit breaker switch in the CLOSE position.

MAIN EXTERNAL POWER



* Switch is spring loaded from both extreme positions to the neutral SWITCH OFF position.

BOMBING-NAVIGATIONAL SYSTEM EXTERNAL POWER

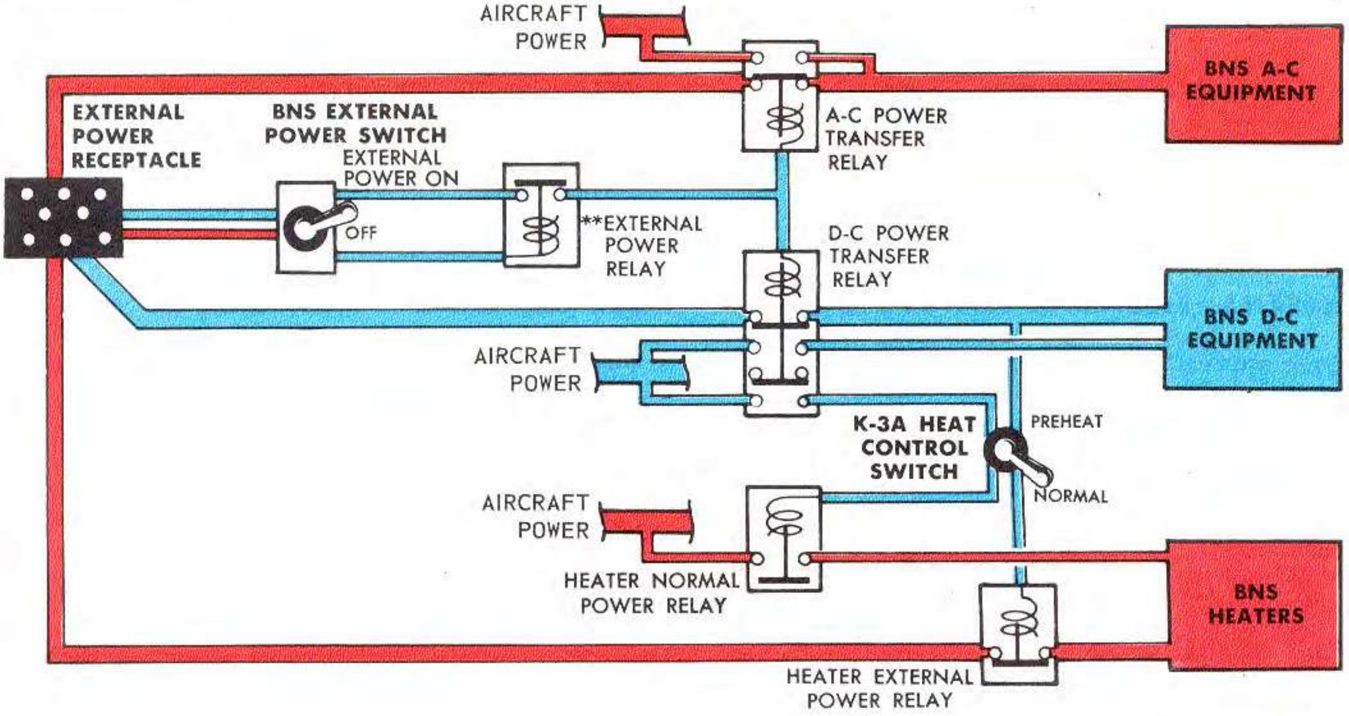
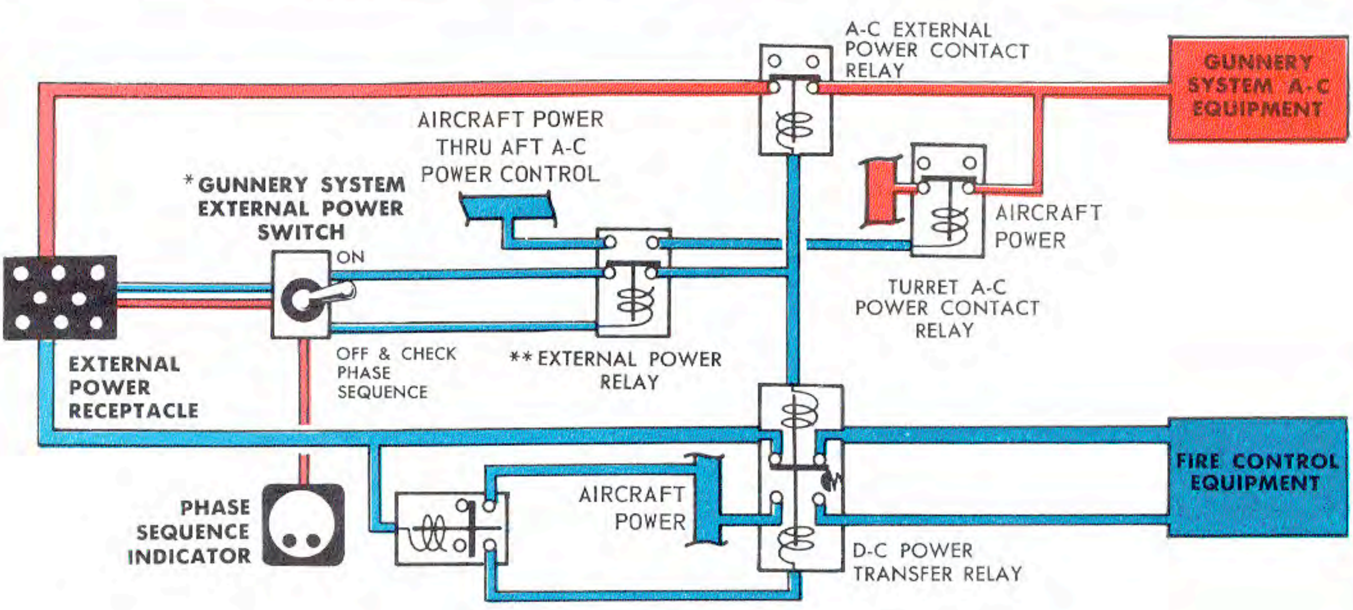


Figure 1-24 (Sheet 1 of 2).

All data on pages 1-50A and 1-50B (Deleted)

GUNNERY SYSTEM EXTERNAL POWER



*Switch is spring loaded from the OFF & CHECK PHASE SEQUENCE position to the neutral SWITCH OFF position.

🟥 205/118 VOLT 3-PHASE A-C POWER 🟦 24 VOLT DC POWER	**Once closed (circuit completed) the external power relays will be held closed electrically until the external power is removed from the airplane.

EXTERNAL POWER SYSTEMS

Figure 1-24 (Sheet 2 of 2).

3. Placing the main external power switch in the OFF & CHECK PHASE SEQUENCE VOLTS & CYCLES position.

CAUTION

> In order to disconnect external power, the EXT PWR CB TRIP circuit breaker on the copilot's circuit breaker panel must be in.

The bombing-navigational system external power switch (61, figure 4-35) is on the radar navigator's side panel and the gunnery system external power switch (8, figure 4-61) is on the gunner's panel. They operate in a manner similar to the main receptacle external power switch except that the external power relay circuits are not connected through the alternator circuit breakers. The BNS external power switch has ON--OFF positions and is spring loaded to the OFF position. The gunner's external power switch has ON--OFF & CHECK PHASE SEQUENCE positions and is spring loaded from the OFF & CHECK PHASE SEQUENCE position to the neutral unmarked OFF position. Voltage and frequency of these two external power systems are not read on the aircraft indicators.

External Electrical Power System Indicators

PHASE SEQUENCE INDICATORS. Indicators are provided to indicate external power phase sequences (except BNS) since three-phase motors will run backward if phase sequence is incorrect. An indicator (11, figure 1-21); figure 1-24; 1, figure 4-35; and 9, figure 4-76) is adjacent to each external power switch and operates through the switch. Each indicator has two lights marked 1 2 3 CORRECT and 3 2 1 REVERSED.

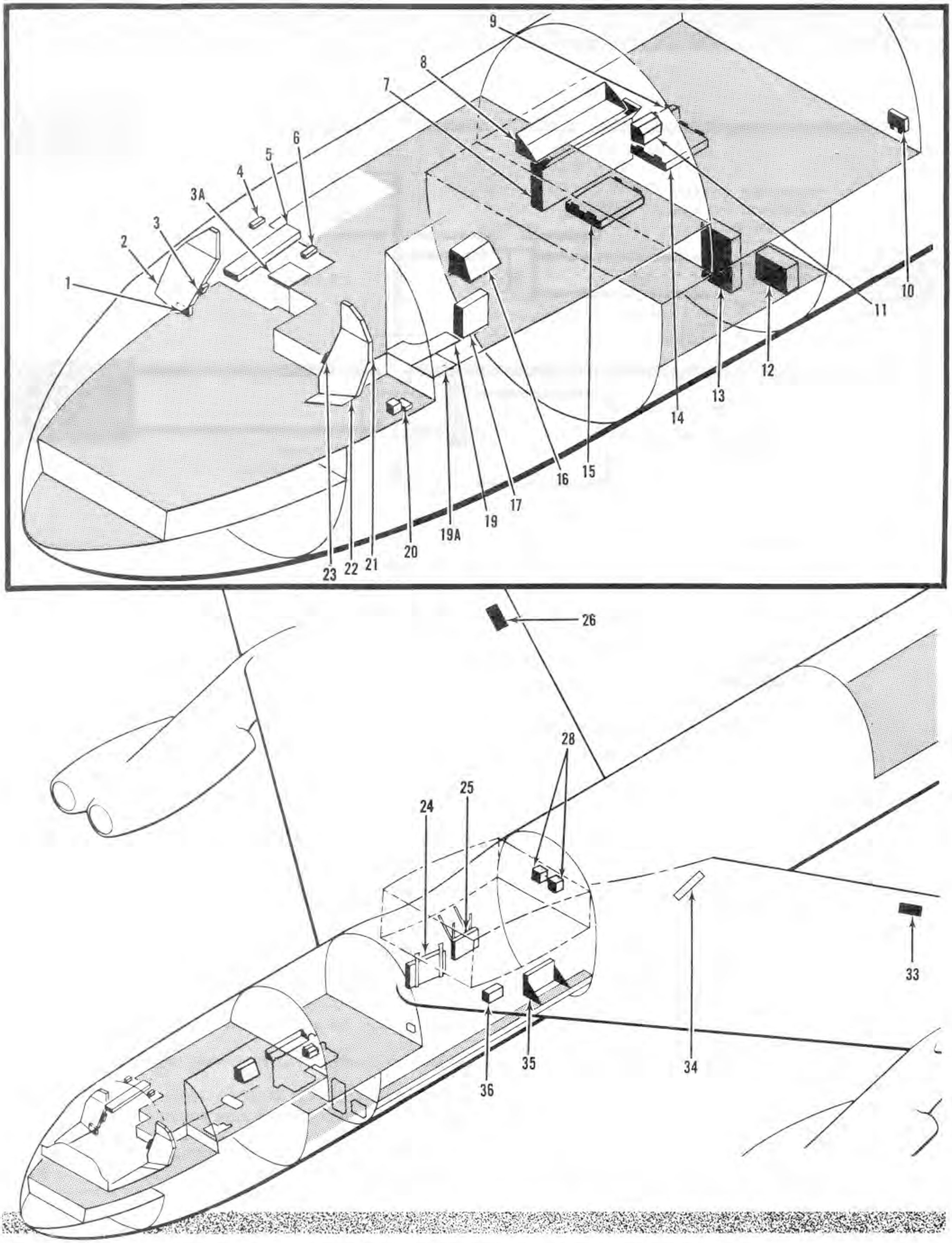
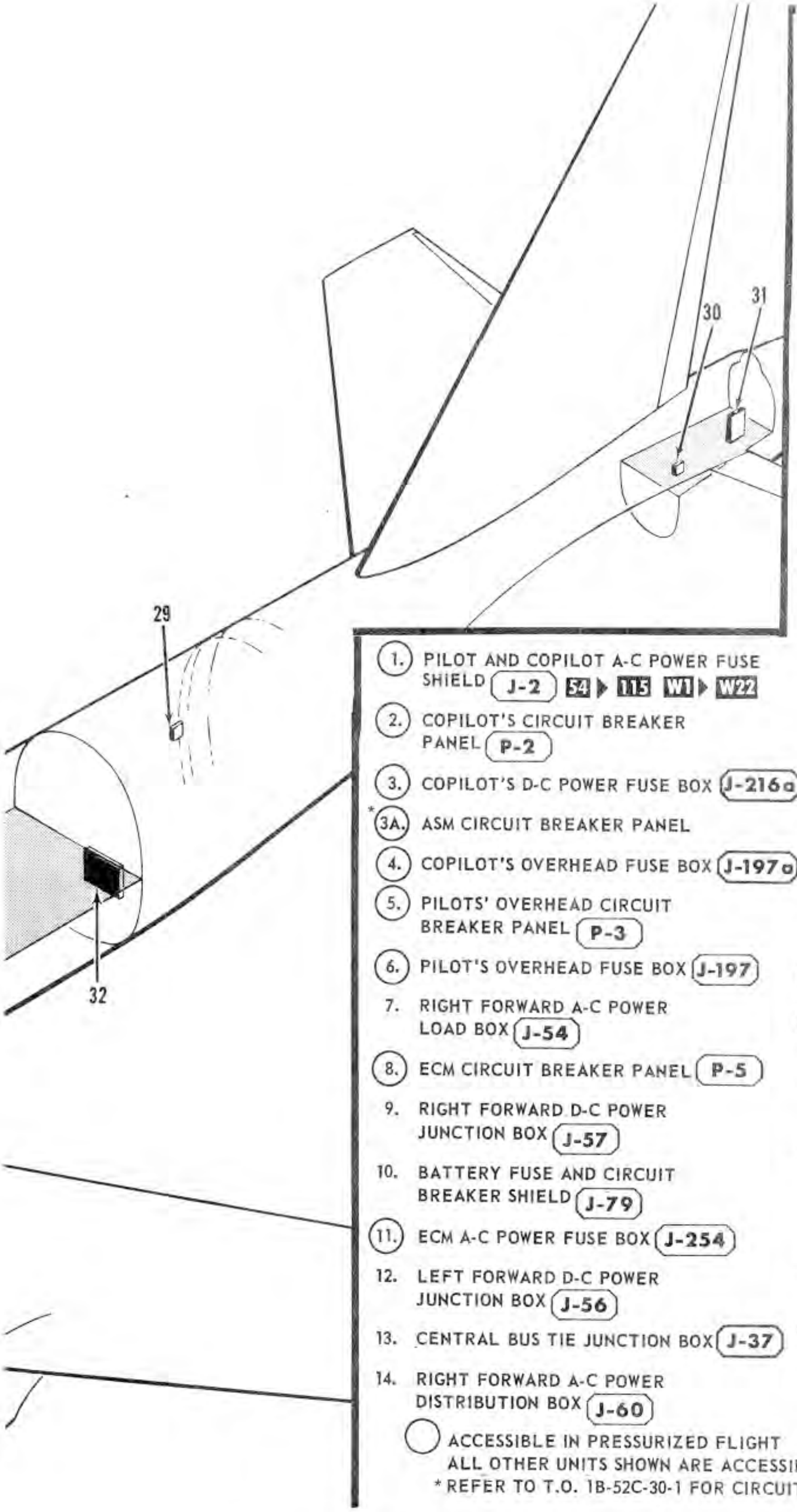


Figure 1-25(Sheet 1 of 9).



①. PILOT AND COPILOT A-C POWER FUSE SHIELD J-2 **54** ▶ **115** **W1** ▶ **W22**

②. COPILOT'S CIRCUIT BREAKER PANEL P-2

③. COPILOT'S D-C POWER FUSE BOX J-216a

*(3A.) ASM CIRCUIT BREAKER PANEL

④. COPILOT'S OVERHEAD FUSE BOX J-197a

⑤. PILOTS' OVERHEAD CIRCUIT BREAKER PANEL P-3

⑥. PILOT'S OVERHEAD FUSE BOX J-197

7. RIGHT FORWARD A-C POWER LOAD BOX J-54

⑧. ECM CIRCUIT BREAKER PANEL P-5

9. RIGHT FORWARD D-C POWER JUNCTION BOX J-57

10. BATTERY FUSE AND CIRCUIT BREAKER SHIELD J-79

⑪. ECM A-C POWER FUSE BOX J-254

12. LEFT FORWARD D-C POWER JUNCTION BOX J-56

13. CENTRAL BUS TIE JUNCTION BOX J-37

14. RIGHT FORWARD A-C POWER DISTRIBUTION BOX J-60

15. LEFT FORWARD A-C POWER DISTRIBUTION BOX J-59

⑯. SECTION 41 POWER DISTRIBUTION BOX J-253

⑰. SECTION 41 AUXILIARY POWER BOX J-276

⑱. (Deleted)

⑲. RADAR NAVIGATOR'S CIRCUIT BREAKER PANEL P-4

(19A) AUXILIARY BNS CIRCUIT BREAKER PANEL P-119

⑳. 28-VOLT A-C POWER PANEL (FORWARD) J-217

㉑. PILOT'S CIRCUIT BREAKER PANEL P-1

㉒. PILOT'S AUXILIARY CIRCUIT BREAKER PANEL P-7

㉓. PILOT'S D-C POWER FUSE BOX J-216

24. RIGHT AFT A-C POWER LOAD BOX J-55

25. RIGHT AFT A-C POWER DISTRIBUTION BOX J-61

26. RIGHT WING A-C POWER PANEL J-108

27. (Deleted)

28. WING FLAP MOTOR BOXES J-52 & J-53

29. AFT D-C POWER SHIELD J-70

㉚. TAIL SECTION FUSE PANEL J-187

㉛. GUNNER'S CIRCUIT BREAKER PANEL P-6

32. AFT A-C POWER DISTRIBUTION SHIELD J-40

33. LEFT WING A-C POWER PANEL J-107

34. SWESS EQUIPMENT PANEL **Less** **A**

35. LEFT AFT A-C POWER DISTRIBUTION BOX J-58

*36. AGM-28 ARMAMENT PROVISIONS BATTERY CIRCUIT BREAKER PANEL

○ ACCESSIBLE IN PRESSURIZED FLIGHT
ALL OTHER UNITS SHOWN ARE ACCESSIBLE IN UNPRESSURIZED FLIGHT ONLY
* REFER TO T.O. 1B-52C-30-1 FOR CIRCUIT BREAKER INFORMATION

EQUIPMENT POWER SOURCE, CIRCUIT BREAKER AND FUSE PANEL LOCATIONS

Figure 1-25 (Sheet 2 of 9).

SYSTEM	POWER SOURCE				CONTROL	
	ALT BUS	TR BUS	SWITCHED BATTERY BUS	BATTERY BUS	POWER	CIRCUIT BREAKER PANEL
AIR CONDITIONING						
Aft						
Aft Cabin Pressure Warning		No. 1			TR	CP
Aft Ram Air Bleed	Left Aft				AC	FCS
Body Bleed	Left Aft				AC	FCS
Cabin Control		Aft			TR	FCS
Cabin Temperature Modulating Valve	Left Aft				AC	*
Water Separator Bypass Valve		Aft			TR	*
Fwd						
Air Bleed (Body)	Right Fwd				AC	P
Air Bleed Ram Air	Right Fwd				AC	P
Air Bleed (Wings)	Right Fwd				AC	P
Cabin Control		No. 2			TR	P
Cabin Temperature Modulating Valve	Right Fwd				AC	*
Cabin Temperature Regulator	Right Fwd				AC	P
Water Separator Bypass Valve		No. 2			TR	P
ANTI-ICE AND HEAT						
AGM Anti-Ice (Controlled by Nacelle Control No. 1 Circuit Breaker)		No. 2			TR	P
Altitude Computer Pitot Heat LH ZV	Right Fwd				AC	P
Altitude Computer Pitot Heat RH ZV	Right Fwd				AC	P
Anti-Ice Control		No. 2			TR	P
Auxiliary Window Relays		No. 2			TR	P
Escape Hatch	Right Aft				AC	P
Indicator and Overheat Warning		No. 1			TR	P
Nacelle Control No. 1 and 2		No. 2			TR	P
Nacelle Control No. 3 and 4		No. 1			TR	P
Nacelle Modulating Valves No. 1 and 2	Right Fwd				AC	*
Nacelle Modulating Valves No. 3 and 4	Left Fwd				AC	*
Nacelle Shutdown No. 1 and 2		No. 2			TR	P
Nacelle Shutdown No. 3 and 4		No. 1			TR	P
Pilot's Airspeed Pitot Heat ZV	Right Fwd				AC	P
Copilot's Airspeed Pitot Heat ZV	Right Aft				AC	*
Pitot Tube Heat (Pilot) **Less** ZV	Right Fwd				AC	P
Pitot Tube Heat (Copilot) **Less** ZV	Right Aft				AC	*
Q-Spring Scoop	Left Aft				AC	*
Scoop Anti-Ice		No. 2			TR	P
Stabilizer Trim Heat	Left Aft				AC	FCS
Window Anti-Ice (Forward)	Right Aft				AC	P
Window Anti-Ice (Gunner)	Left Aft				AC	FCS
Windshield and Window Relays		No. 2			TR	P
Wing Anti-Ice (Left) SS▶ 170 W1▶ W51	Right Fwd				AC	*
Wing Anti-Ice (Right) SS▶ 170 W1▶ W51	Left Fwd				AC	*
ELECTRONICS						
Altitude computer ZV	Right Fwd				AC	P
Astrocompass	Right Fwd	No. 2			TR	R/N
Autopilot	Right Fwd	No. 1			TR	P Ovhd
BNS	Right Fwd	No. 2			TR	R/N
Doppler	Right Fwd	No. 2			TR	Aux BNS
ECM System Deactivation Relay		Aft			TR	FCS
ECM Transmitters						
No. 1 (ALT-15) or (ALT-32)	Right Aft	No. 2			TR	*
No. 2 (ALT-6B) or (ALT-22)	Right AFt	No. 2			TR	ECM
No. 3 (ALT-6B) or (ALT-22)	Right Aft	No. 1			TR	ECM
No. 5 (ALT-13) or (ALT-28)	Left Aft	Aft			TR	*
No. 6 (ALT-13) or (ALT-28)	Left Aft	Aft			TR	*
No. 7 (ALT-13) or (ALT-28)	Left Fwd	Aft			TR	*

* Not in pressurized compartment

EQUIPMENT POWER SOURCE, CIRCUIT BREAKER AND FUSE PANEL LOCATIONS

Figure 1-25(Sheet 3 of 9).

SYSTEM	POWER SOURCE				CONTROL	
	ALT BUS	TR BUS	SWITCHED BATTERY BUS	BATTERY BUS	POWER	CIRCUIT BREAKER PANEL
ELECTRONICS (Cont)						
ECM Transmitters (Cont)						
No. 8 (ALT 13) or (ALT-28)	Left Fwd	Aft			TR	★
No. 9 and No. 10 (ALT-13) or (ALT-28)	Left Fwd				TR	★
No. 11 (ALT-16)	Left Fwd	Aft			TR	★
No. 12 (ALT-16 or ALT-6B) or (ALT-22)	Left Fwd	Aft			TR	★
No. 13 (ALT-15) or (ALT-32)	Left Fwd	Aft			TR	★
No. 14 (ALT-15) or (ALT-32)	Left Fwd	Aft			TR	★
No. 15 (ALT-6B) (ALR-18)	Left Fwd	Aft			TR	★
No. 16 (ALT-6B) (ALR-18)	Right Aft	No. 2			TR	ECM
Fire Control System	Left Aft	Aft			TR	FCS
Glide Slope	Right Fwd	No. 2			TR	P
IFF (AN/APX-25) **Less ZV** ; AN/APX-64 **ZV**	Right Fwd	No. 1			TR	P
IFF Mode 4 Light **ZV**			Aft		Batt	P
Interphone (AN/AIC-10A)				Fwd	Batt	P Ovhd
Liaison Radio (AN/ARC-65)	Left Aft	Aft			TR	FCS
Monitoring Set (AN/AJM-14)	Right Fwd	No. 1			TR	★
N-1 Compass	Right Fwd	No. 2			TR	R/N
Omni-Range Radio		Aft			TR	FCS
Radar Altimeter (AN/APN-150)	Left Aft	Aft			TR	★
Radio Command UHF (Auxiliary) No. 2		No. 1			TR	Sec 41 Pwr Dist Pnl
Radio Command UHF NO. 1		Aft			TR	Aft DC Pwr Shield
Radio Navigation Indicator	Right Fwd	No. 1			TR	P
Rate-of-Turn Indicator			Fwd			
Receivers (ECM)						
AN/ALR 18		Aft			TR	★
AN/ALR-20/ALR-20A **B-52D**		No. 1			TR	ECM
AN/APR-9 **B-52C**	Right Aft	No. 2				ECM
AN/APR-14 **B-52C**	Right Aft	No. 2				ECM
AN/APR-25 **B-52D**					AC	ECM
AN/APS-54 **B-52C**	Right Aft	No. 2			TR	ECM
Rendezvous Beacon (AN/APN-69)	Left Aft	No. 2			TR	ECM
TACAN (AN/ARN-21)	Right Fwd	No. 1			TR	P
Transponder Beacon **B-52D**		No. 1			TR	R/N
ELECTRICAL MISCELLANEOUS						
Aft Emergency Alarm Control				Fwd	Batt	★
Alternator Control – Left and Right Aft			Fwd		Batt	CP
Alternator Control – Left and Right Forward			Aft		Batt	CP
Alternator Control – Left Aft and Right Aft			Fwd		Batt	CP
Alternator Control – Left Fwd and Right Fwd			Aft		Batt	CP
Alternator Ground Blowers	Right Aft				AC	★
Alternator Overload Lights Left Aft and Left Fwd		No. 2			TR	CP
Alternator Overload Lights Right Fwd and Right Aft		No. 1			TR	CP
Aft Battery Charging		No. 2			TR	★
Battery Not Charging Lights				Fwd	Batt	CP
Body Fire Detection				Fwd	Batt	P Ovhd
Camera Control	Right Fwd	No. 2			TR	R/N
Copilot's Turn-and-Slip Indicator			Fwd		Batt	P
Depressurization Warning (Forward Cabin)			Fwd		Batt	P
Dim Control Indication (Lights)		No. 2			TR	P
Ejection Hatch Warning Light		No. 2			TR	P
External Power Trip			Aft		Batt	P
Flare Ejector Program	Right Aft	No. 1			TR	ECM
Flight Gyro (Pilot)	Right Aft				AC	P Ovhd
Flight Gyro (Copilot)	Right Fwd				AC	P Aux

★ Not in pressurized compartment

Figure 1-25 (Sheet 4 of 9).

SYSTEM	POWER SOURCE				CONTROL	
	ALT BUS	TR BUS	SWITCHED BATTERY BUS	BATTERY BUS	POWER	CIRCUIT BREAKER PANEL
ELECTRICAL MISCELLANEOUS (Cont)						
Food Warming Oven	Right Fwd				AC	★
Hot Cup (Forward Cabin)	Right Fwd				AC	R N
Hot Cup (Gunner)	Left Aft				AC	FCS
IFC Lighting Transformer	Right Fwd				AC	★
Seat Position (EW)	Right Aft				AC	EW
Seat Position (P CP-N-RN)	Right Fwd				AC	P-R N
Slipway Door Control		No. 2			TR	P Ovhd
TR Unit No. 1 Forward	Right Fwd				AC	★
TR Unit No. 2 Forward	Left Fwd				AC	★
TR Units No. 3 Forward and No. 6, 7 & 8 Aft	Left Aft				AC	★
TR Units No. 4 and 5 Forward	Right Aft				AC	★
Windshield Wiper		No. 2			TR	P
Wing Chaff No. 1, 2, 3 & 4	Left Aft	Aft			TR	★
Wing Chaff No. 5, 6, 7 & 8	Left Fwd	Aft			TR	★
Wing Chaff Control		No. 1			TR	ECM
ENGINES						
Engine Pressure Ratio	Right Fwd				AC	P Aux
Fire Detection			Fwd		Batt	P Aux
Firewall Fuel Shutoff Valves No. 1, 2, 3, and 4			Fwd		Batt	CP
Firewall Fuel Shutoff Valves No. 5, 6, 7, and 8			Aft		Batt	CP
Fuel Flow Indicators	Right Fwd				AC	CP
Fuel Flow Totalizer	Right Fwd				AC	CP
Ignition No. 1, 3, 5, and 7			Aft		Batt	CP
Ignition No. 2, 4, 6, and 8			Fwd		Batt	CP
Oil Cooler Flaps	Right Fwd				AC	P Aux
Oil Pressure Indicator	Right Fwd				AC	P Aux
Starter No. 2 (Cartridge)			Fwd		Batt	P Aux
Starter No. 8 (Cartridge)			Aft		Batt	P Aux
Starters No. 1 and 2			Fwd		Batt	P Aux
Starters No. 3, 4, 5, and 6		No. 2			TR	P Aux
Starters No. 7 and 8			Aft		Batt	P Aux
Starter Select Switch			Fwd		Batt	P Aux
Water Injection Drain Valves (Left Wing)		No. 1			TR	P Aux
Water Injection Drain Valves (Right Wing)		No. 2			TR	P Aux
Water Injection Indicator Lights		No. 2			TR	P Aux
Water Injection Pump Control No. 1 and 4		No. 2			TR	P Aux
Water Injection Pump Control No. 2 and 3		No. 1			TR	P Aux
FUEL						
Fuel Pumps – Auxiliary						
Tank Pump No.						
Aft Body 27	Right Aft	No. 2			TR	CP
Aft Body 28	Left Aft	No. 1			TR	CP
Center Wing 29	Right Fwd	No. 2			TR	CP
Center Wing 30	Right Fwd	No. 2			TR	CP
Center Wing 31	Right Aft	No. 2			TR	CP
Center Wing 32 **W54** ▶ **88** **W1** ▶ **W12**	Right Fwd	No. 1			TR	CP
Forward Body 19	Right Fwd	No. 2			TR	CP
Forward Body 20	Right Aft	No. 2			TR	CP
Forward Body 21	Right Fwd	No. 1			TR	CP
Forward Body 22	Left Aft	No. 1			TR	CP
Left Outboard 1	Right Fwd	No. 2			TR	CP
Left Outboard 2	Right Aft	No. 1			TR	CP

★ Not in pressurized compartment

EQUIPMENT POWER SOURCE, CIRCUIT BREAKER AND FUSE PANEL LOCATIONS

Figure 1-25(Sheet 5 of 9).

SYSTEM	POWER SOURCE				CONTROL	
	ALT BUS	TR BUS	SWITCHED BATTERY BUS	BATTERY BUS	POWER	CIRCUIT BREAKER PANEL
FUEL (Cont)						
[illegible]	Left Aft	No. 2			TR	CP
[illegible]	Right Aft	No. 2			TR	CP
[illegible]	Left Aft	No. 1			TR	CP
[illegible]	Right Aft	No. 1			TR	CP
[illegible]	Right Fwd	No. 2			TR	CP
[illegible]	Left Fwd	No. 1			TR	CP
[illegible]						
[illegible]						
[illegible]	Right Fwd	No. 2			TR	CP
[illegible]	Right Aft	No. 1			TR	CP
[illegible]	Left Aft	No. 1			TR	CP
[illegible]	Right Fwd	No. 2			TR	CP
[illegible]	Right Aft	No. 1			TR	CP
[illegible]	Right Fwd	No. 1			TR	CP
[illegible]	Right Aft	No. 2			TR	CP
[illegible]	Right Fwd	No. 1			TR	CP
[illegible]	Left Fwd	No. 1			TR	CP
[illegible]	Right Aft	No. 2			TR	CP
[illegible]	Right Fwd	No. 1			TR	CP
[illegible]	Left Fwd	No. 1			TR	CP
[illegible]						
[illegible]		No. 1			TR	CP
[illegible]		No. 2			TR	CP
[illegible]		No. 2			TR	CP
[illegible]			Aft		Batt	CP
[illegible]		No. 2			TR	CP
[illegible]			Fwd		Batt	CP
[illegible]		No. 1			TR	CP
[illegible]		No. 1			TR	CP
[illegible]		No. 2			TR	CP
[illegible]		No. 2			TR	CP
[illegible]		No. 2			TR	CP
[illegible]		No. 1			TR	CP
[illegible]		No. 1			TR	CP
[illegible]		No. 1			TR	CP
[illegible]			Fwd		Batt	CP
[illegible]			Aft		Batt	CP
[illegible]			Fwd		Batt	CP
[illegible]			Aft		Batt	CP
[illegible]						
[illegible]		No. 1			TR	CP
[illegible]		No. 1			TR	CP
[illegible]		No. 2			TR	CP
[illegible]		No. 2			TR	CP
[illegible]		No. 1			TR	CP
[illegible]		No. 1			TR	CP
[illegible]		No. 1			TR	CP
[illegible]		No. 1			TR	CP
[illegible]						
[illegible]		No. 2			TR	CP
[illegible]		No. 2			TR	CP
[illegible]						
[illegible]		No. 2			TR	CP
[illegible]	Right Fwd	No. 2			TR	CP

Figure 1-25(Sheet 6 of 9).

SYSTEM	POWER SOURCE				CONTROL	
	ALT BUS	TR BUS	SWITCHED BATTERY BUS	BATTERY BUS	POWER	CIRCUIT BREAKER PANEL
FUEL (Cont)						
Fuel Miscellaneous (Cont)						
Fuel Level Control – Main Tank			Fwd		Batt	CP
Fuel Quantity	Right Fwd	No. 1			TR	CP
Main Tank Warning Lights (Fuel Level Control)		No. 1			TR	CP
Refuel System, Ground Checkout		No. 1			TR	P Aux
Scavenge	Right Fwd	No. 1			TR	CP
Tank Purge Control		No. 1			TR	CP
FLIGHT CONTROLS						
Aileron Trim Control		No. 2			TR	P Ovhd
Aileron Trim Power	Right Fwd				AC	P
Aileron Trim Indicator		No. 1			TR	P
Airbrakes				Fwd	Batt	P Ovhd
Autopilot	Right Fwd	No. 1			TR	P Ovhd
Flap Brake (Emergency)		No. 2			TR	★
Flap Brake (Normal)		No. 1			TR	★
Flap Control (Emergency)		No. 2			TR	P
Flap Control (Normal)		No. 1			TR	P
Flap Indicator		No. 1			TR	P
Flap Motor Power						
Left	Right Fwd				AC	★
Right	Right Aft				AC	★
Stabilizer Trim Power	Left Aft				AC	★
Stabilizer Trim Control		No. 2			TR	P Ovhd
Yaw Damper Control	Right Fwd	No. 1			TR	P
HYDRAULICS						
Hydraulic Package Control Left Forward No. 1			Fwd		Batt	P
Hydraulic Package Control Right Forward No. 2			Aft		Batt	P
Hydraulic Package Control Left Aft No. 3			Aft		Batt	P
Hydraulic Package Control Right Aft No. 4			Fwd		Batt	P
Hydraulic Package Control No. 5			Fwd		Batt	P
Hydraulic Package Control No. 6			Fwd		Batt	P
Hydraulic Package Control No. 7			Aft		Batt	P
Hydraulic Package Control No. 8			Aft		Batt	P
Hydraulic Package Control No. 9			Aft		Batt	P
Hydraulic Package Control No. 10			Fwd		Batt	P
Hydraulic Package Reservoir Oil Heaters No. 1, 2, 5, and 6	Right Fwd				AC	★
Hydraulic Package Reservoir Oil Heaters No. 3 and 4	Right Aft				AC	★
Hydraulic Package Reservoir Oil Heaters No. 7 and 8	Left Fwd				AC	★
Hydraulic Package Reservoir Oil Heaters No. 9 and 10	Left Aft				AC	★
Hydraulic Pressure Indicator	Right Fwd				AC	P
Hydraulic Warning Lights		No. 1			TR	P
Hydraulic Warning Control Power		No. 1			TR	P
Standby Pump Control Left Forward No. 1	Right Aft	No. 1			TR	P
Standby Pump Control Right Forward No. 2	Right Fwd	No. 1			TR	P
Standby Pump Control Left Aft No. 3	Left Aft	No. 2			TR	P
Standby Pump Control Right Aft No. 4	Left Fwd	No. 2			TR	P
Standby Pump Control No. 5	Right Fwd	No. 1			TR	P
Standby Pump Control No. 6	Right Fwd	No. 1			TR	P
Standby Pump Control No. 7	Left Fwd	No. 1			TR	P
Standby Pump Control No. 8	Left Fwd	No. 2			TR	P
Standby Pump Control No. 9	Left Aft	No. 2			TR	P
Standby Pump Control No. 10	Left Aft	No. 2			TR	P

★ Not in pressurized compartment

EQUIPMENT POWER SOURCE, CIRCUIT BREAKER AND FUSE PANEL LOCATIONS

Figure 1-25 (Sheet 7 of 9).

SYSTEM	POWER SOURCE				CONTROL	
	ALT BUS	TR BUS	SWITCHED BATTERY BUS	BATTERY BUS	POWER	CIRCUIT BREAKER PANEL
LANDING GEAR						
Antiskid Control (Aft)			Aft		Batt	P
Antiskid Control (Forward)			Fwd		Batt	P
Antiskid Valves (Aft)				Aft	Batt	★
Antiskid Valves (Forward)				Fwd	Batt	★
Centering Control			No. 2		TR	P
Crosswind Crab Indicator			No. 2		TR	P
Emergency Landing Gear Control						
Left Aft			Fwd		Batt	P
Left Forward			Aft		Batt	P
Right Aft			Aft		Batt	P
Right Forward			Fwd		Batt	P
Normal Landing Gear Control						
Left Aft			Aft		Batt	P
Left Forward			Fwd		Batt	P
Right Aft			Fwd		Batt	P
Right Forward			Aft		Batt	P
Position and Flap Warning Horn		No. 2			TR	P
Position Indicator			Fwd		Batt	P
Switch and Position Warning		No. 2			TR	P
Safety Switch Relay No. 1			Fwd		Batt	P
Safety Switch Relay No. 2			Aft		Batt	P
Tip Gear Control						
Left (Emergency)			Aft		Batt	P
Left (Normal)			Fwd		Batt	P
Right (Emergency)			Aft		Batt	P
Right (Normal			Fwd		Batt	P
LIGHTS (EXTERIOR)						
Air Refueling	Right Fwd				AC	P Ovhd
Anticollision	Right Aft				AC	P Ovhd
Crosswind Landing	Right Fwd				AC	P Ovhd
Landing Light Control	Right Fwd				AC	P Ovhd
Landing Light Power	Right Fwd				AC	P Ovhd
Navigation **B-52C**	Right Fwd	No. 2			TR	P Ovhd
Navigation **B-52D**		No. 2			TR	P Ovhd
Terrain Clearance	Right Fwd				AC	P Ovhd
Wing Taxi	Right Fwd				AC	P Ovhd
LIGHTS (INTERIOR)						
Aisle and Ladder	Right Fwd				AC	Individual CB Panels
Dome (Cabin)	Right Fwd				AC	
Dome (Gunner)	Left Aft				AC	
Emergency Flight Instrument Lights **Less** **X**			Fwd		Batt	P
Emergency Flight Instrument Lights **X**		No. 1			TR	P
Entry				Fwd	Batt	R/N
Flood	Right Fwd				AC	Individual CB Panels
Instrument (Except Pilot's Side Panel and Gunner)	Right Fwd				AC	
Instrument (Gunner)	Left Aft				AC	
Instrument (Pilot's Flight and Side Panel)	Right Aft				AC	
Panel (EW Officer's)	Right Aft				AC	
Panel (Gunner's)	Left Aft				AC	
Panel (P-CP-N-RN)	Right Fwd				AC	
Scan Receptacle	Right Fwd				AC	
Spot	Right Fwd				AC	

★ Not in pressurized compartment

Figure 1-25(Sheet 8 of 9).

SYSTEM	POWER SOURCE				CONTROL	
	ALT BUS	TR BUS	SWITCHED BATTERY BUS	BATTERY BUS	POWER	CIRCUIT BREAKER PANEL
LIGHTS (INTERIOR) (Cont)						
Table	Right Fwd				AC	
Thunder	Right Fwd				AC	
Walkway	Right Fwd				AC	
Work	Right Fwd				AC	
MISSILE (AGM-28)						
ASM Armament Control No. 1			Fwd		Batt	ASM
ASM Control No. 2			Aft		Batt	ASM
ASM Provisions	Right Fwd				AC	ASM
Autonavigator		No. 1			TR	★
Emergency Shutoff No. 1			Fwd		Batt	CP
Emergency Shutoff No. 2			Aft		Batt	CP
Fire Detection Power, No. 1, Test and Reset		No. 1			TR	CP
Fire Detection Power, No. 2		No. 2			TR	CP
Fuel Control No. 1			Fwd		Batt	CP
Fuel Control No. 2			Aft		Batt	CP
Jettison Control A			Fwd		Batt	ASM
Jettison Control B			Aft		Batt	ASM
Lock Control A (ASM No. 1 and 2)			Fwd		Batt	ASM
Lock Control B			Aft		Batt	ASM
Separation A			Fwd		Batt	ASM
Separation B			Aft		Batt	ASM
Temperature Control No. 1			Fwd		Batt	ASM
Temperature Control No. 2			Aft		Batt	ASM
WEAPONS						
Aft Bomb Bay IFI Power		No. 1			TR	★
Aft Alternate Parachute Static Line Control		No. 2			TR	R/N
Aft Alternate Weapon IFM		No. 2			TR	R/N
Aft Emergency Bomb Door Control Valve B-52C			Fwd		Batt	P
Alternate Weapon Rack Select		No. 1			TR	R/N
Aft Weapon Release Heater Control		No. 2			TR	R/N
BNS Timer Door Close		No. 1	Aft		TR	R/N
Bomb Door Check Valve		No. 1			TR	R/N
Bomb Door Control Relays			Aft		Batt	P
Bomb Door Hold Open		No. 2			TR	P
Bomb Door Pressure Low		No. 1			TR	R/N
Bomb Door Not Latched		No. 1			TR	R/N
Coded Switch Set A		No. 1				
Emergency Door Open and Release B-52D		No. 1			TR	P R/N
Emergency Manual Bomb Release (Fwd & Aft) A						
External Jettison B-52D		No. 1			TR	R/N
External Weapons Arm and Release B-52D		No. 1			TR	R/N
Forward Alternate Parachute Static Line Control		No. 1			TR	R/N
Forward Alternate Weapon Release Heater Power		No. 1			TR	R/N
● Forward Bomb Bay IFI Power (DCU-9A)		No. 2			TR	★
Forward Emergency Bomb Door Control Valve			Fwd		Batt	P
High Density Bomb Release No. 1 and 2 B-52D		No. 2			TR	★
High Density Bomb Release No. 3 B-52D		No. 1			TR	★
● IFC Power, Aft Weapon (DCU-9A)		No. 2			TR	R/N
● IFC Power, Forward Alternate Weapon (DCU-9A)		No. 1			TR	R/N
Normal Release Bomb System		No. 1			TR	R/N
SWESS **Less** A		No. 2				R/N
SWESS Battery Heat **Less** A		No. 2			TR	R/N
Weapon Sequence Control B-52D		No. 2			TR	R/N

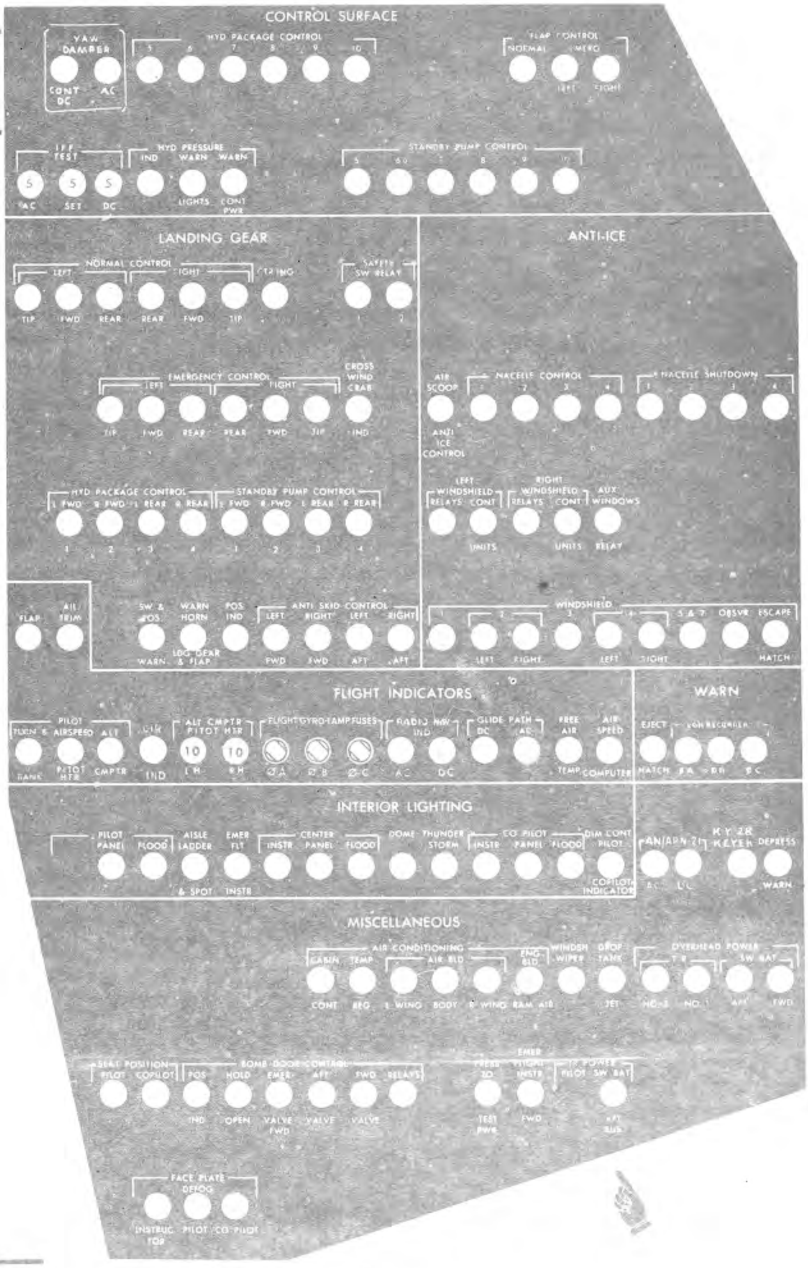
● Source of power depends upon the IFC power select switch position

★ Not in pressurized compartment

EQUIPMENT POWER SOURCE, CIRCUIT BREAKER AND FUSE PANEL LOCATIONS

Figure 1-25 (Sheet 9 of 9).

PILOT'S CIRCUIT BREAKER PANEL (P-1)



SEE FIGURE 1-25 FOR LOCATION OF CIRCUIT BREAKER PANELS

PILOT'S AUXILIARY CIRCUIT BREAKER PANEL (P-7)

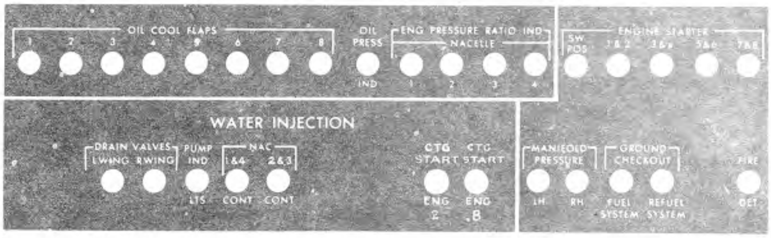
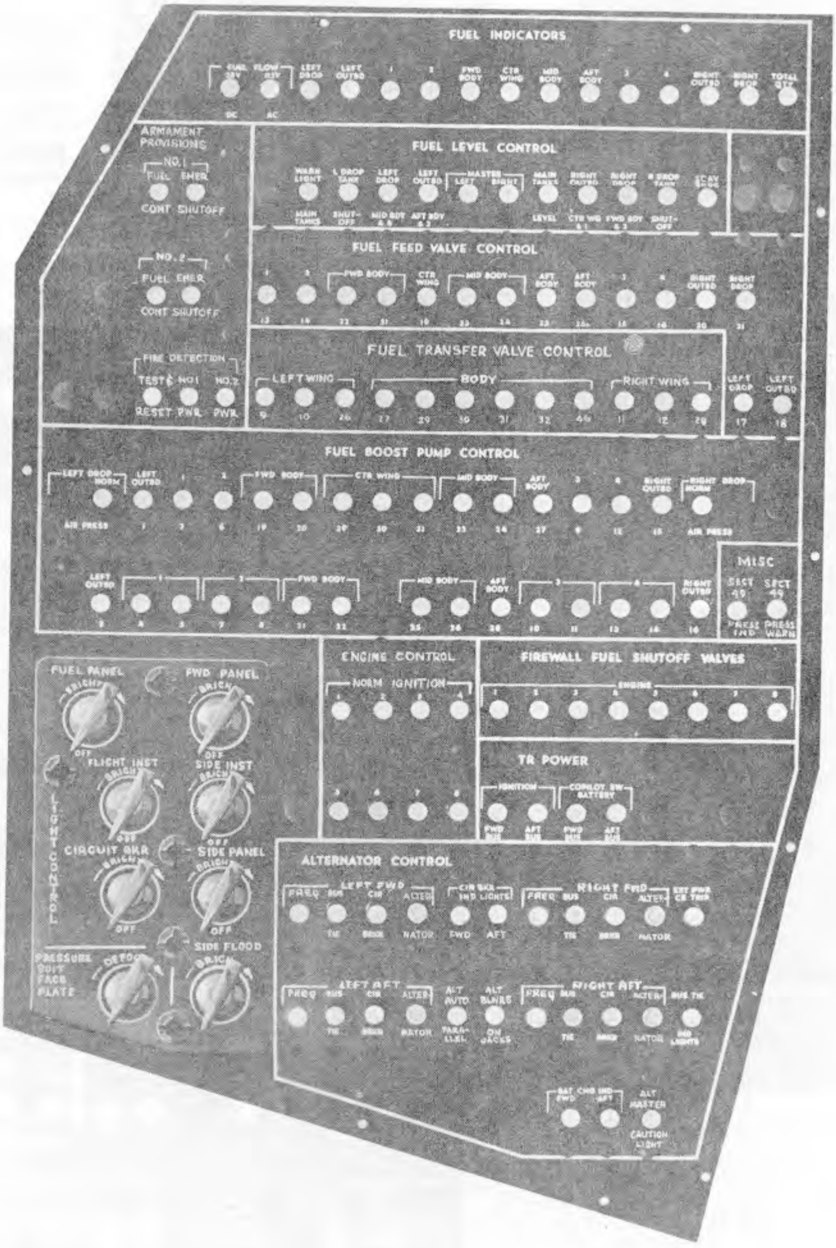


Figure 1-26 (Sheet 1 of 8).

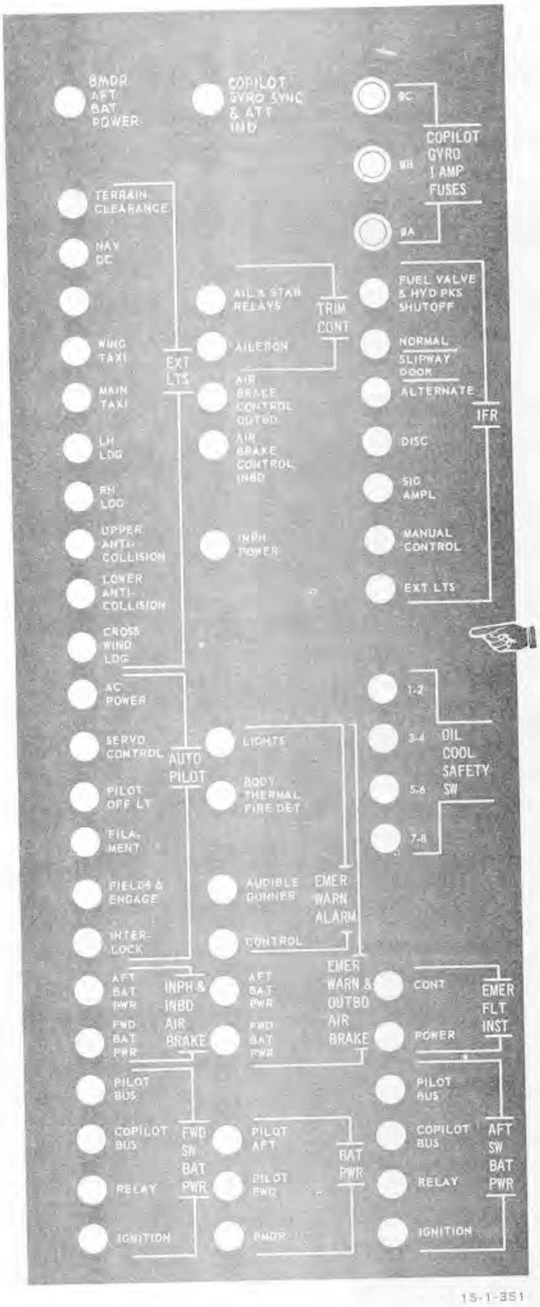
COPILOT'S CIRCUIT BREAKER PANEL (P-2)



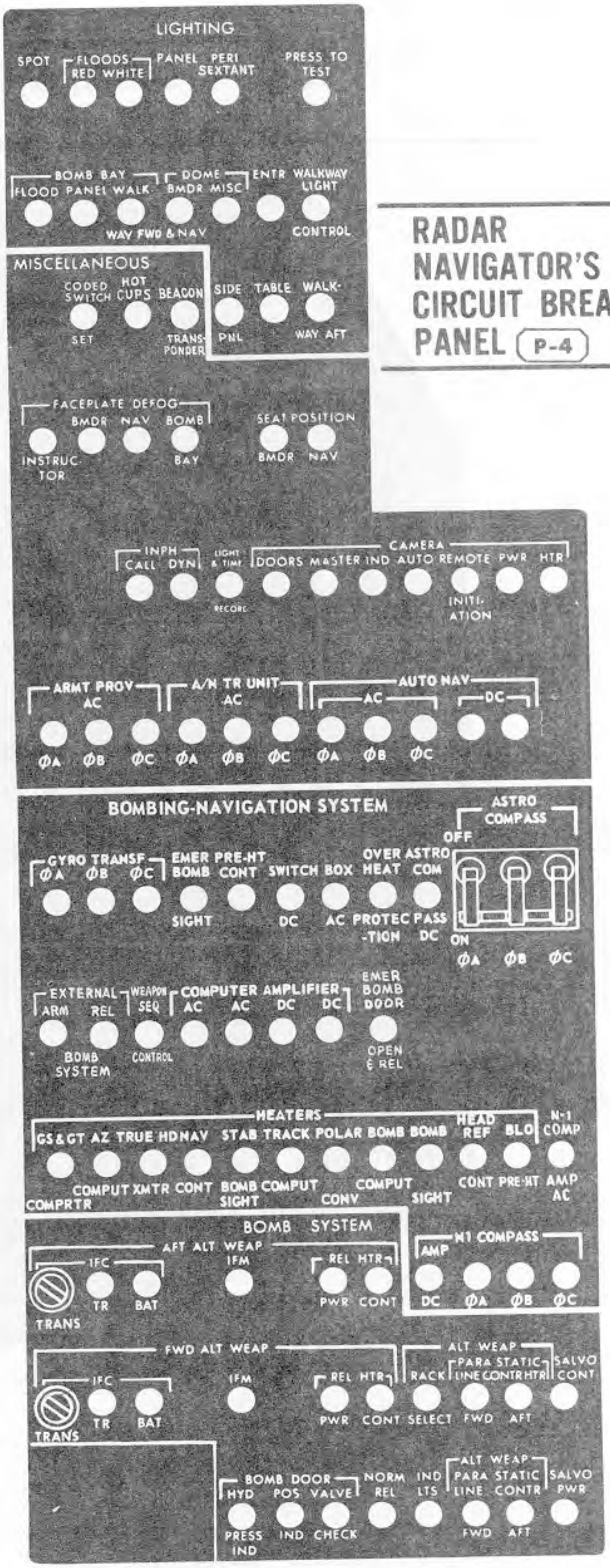
E1-202-1

CIRCUIT BREAKER PANELS (Typical)

Figure 1-26 (Sheet 2 of 8).



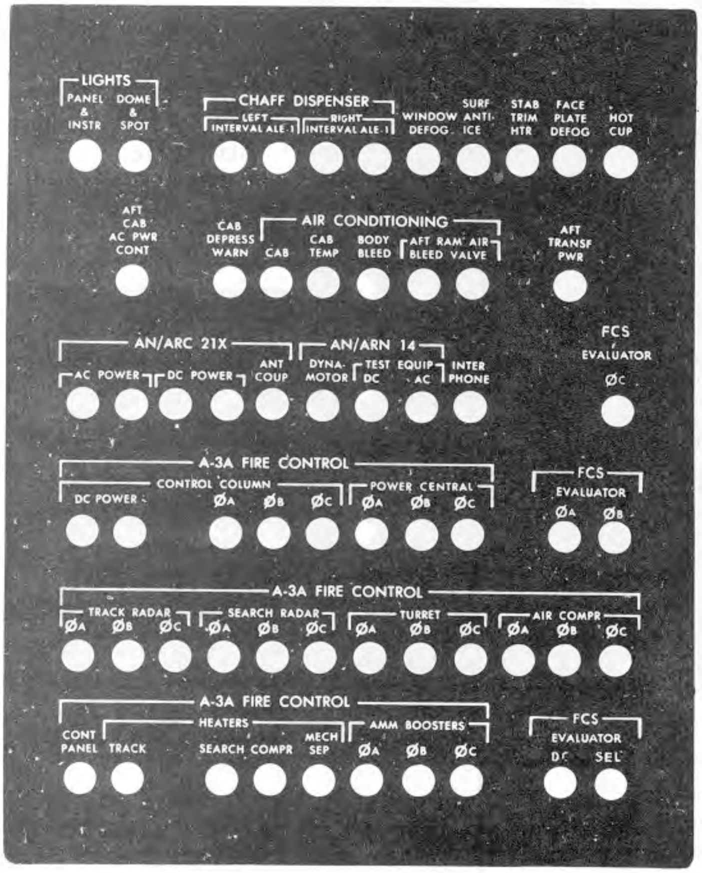
PILOTS' OVERHEAD CIRCUIT BREAKER PANEL (P-3)



RADAR NAVIGATOR'S CIRCUIT BREAKER PANEL (P-4)

Figure 1-26 (Sheet 3 of 8).

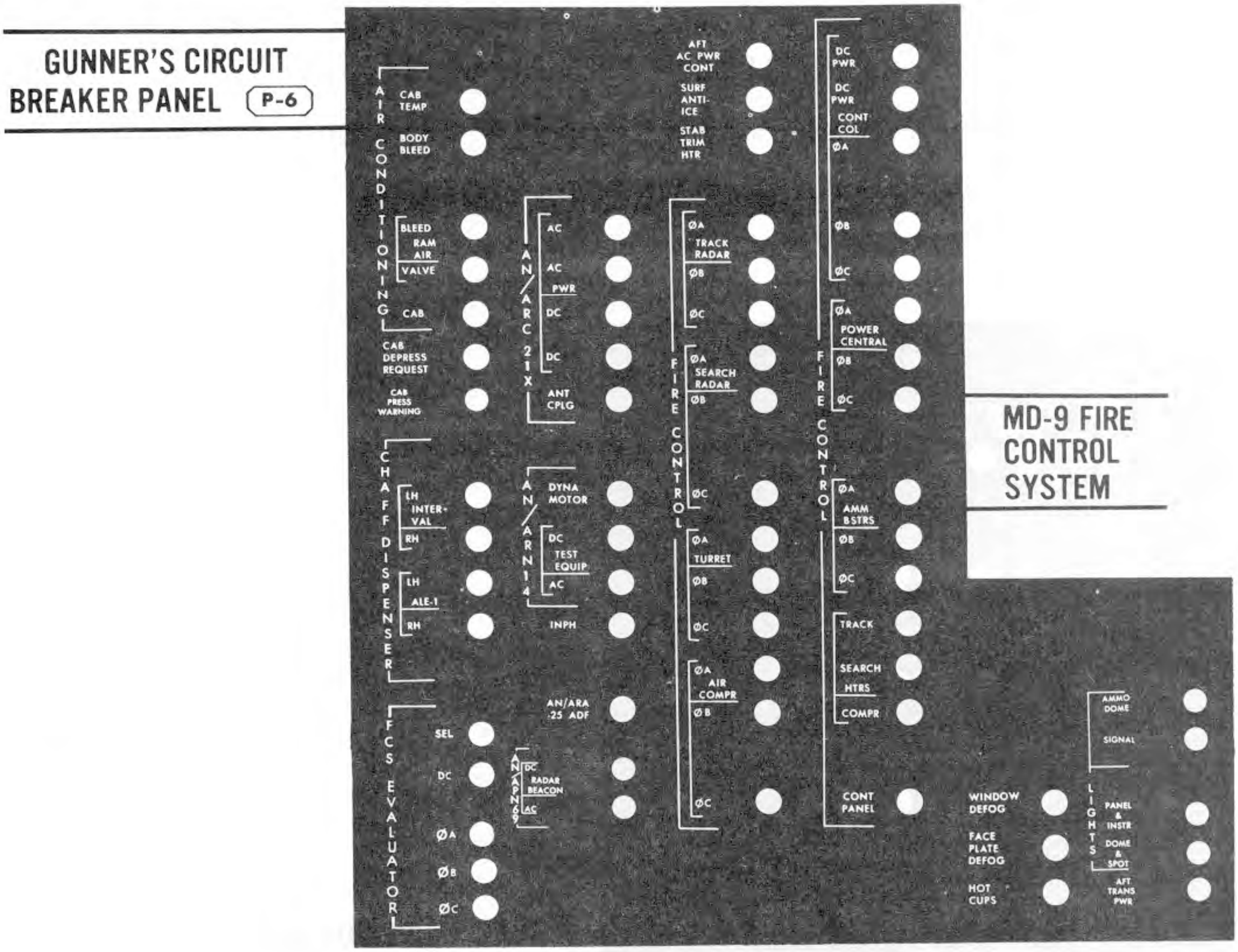
GUNNER'S CIRCUIT BREAKER PANEL (P-6)



A-3A FIRE CONTROL SYSTEM

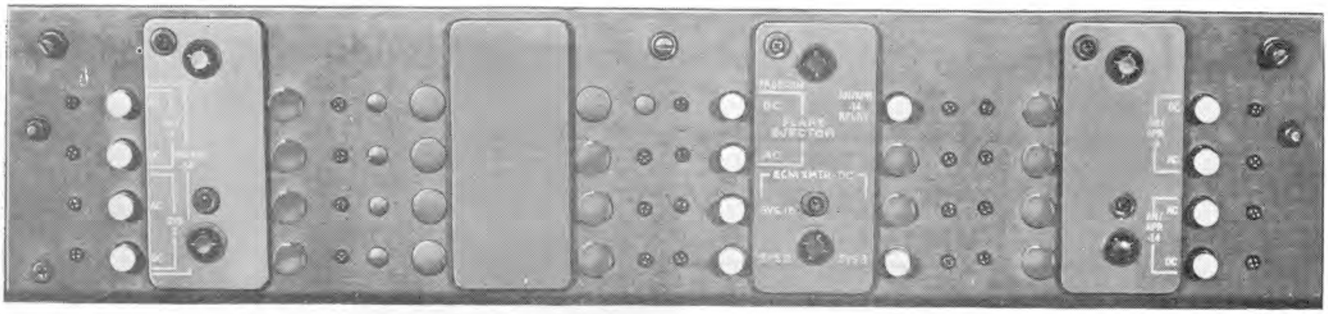
CIRCUIT BREAKER PANELS (Typical)

Figure 1-26 (Sheet 4 of 8).

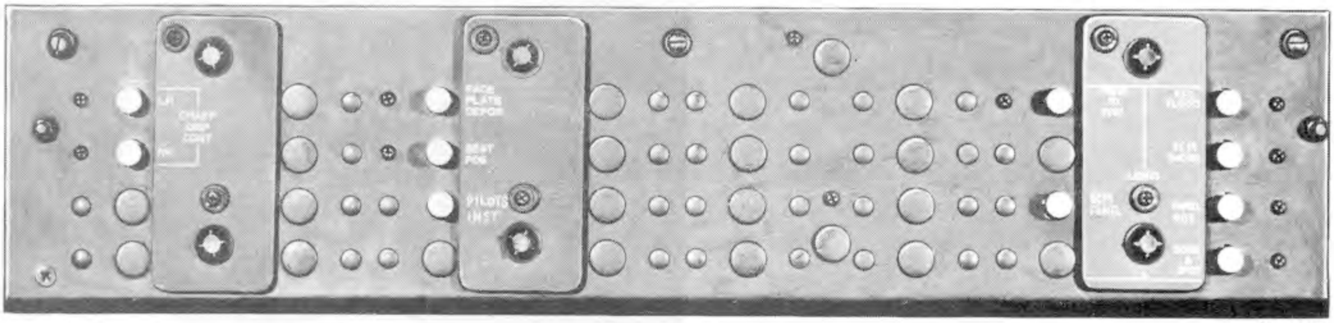


SEE FIGURE 1-25 FOR
LOCATION OF CIRCUIT
BREAKER PANELS

Figure 1-26 (Sheet 5 of 8).

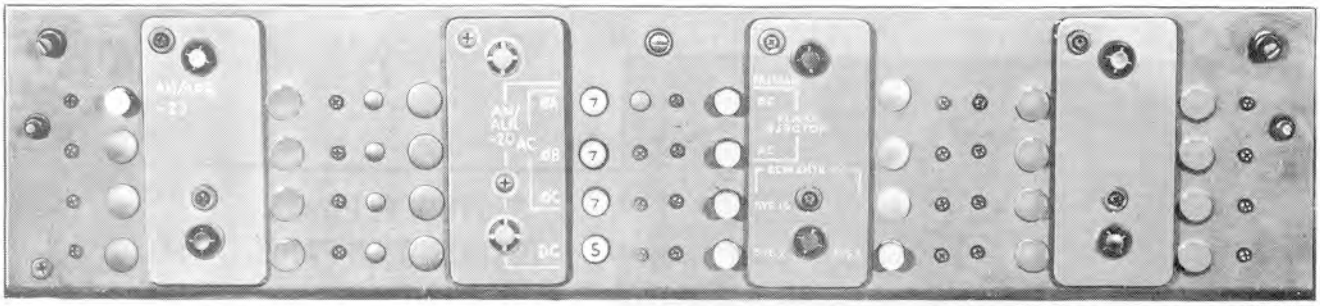


E1-180-1

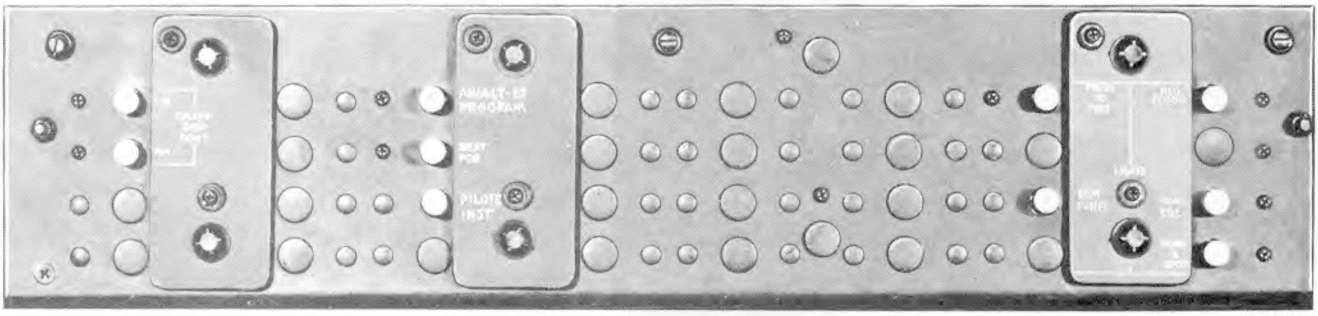


E1-180-2

B-52C



E1-180-1



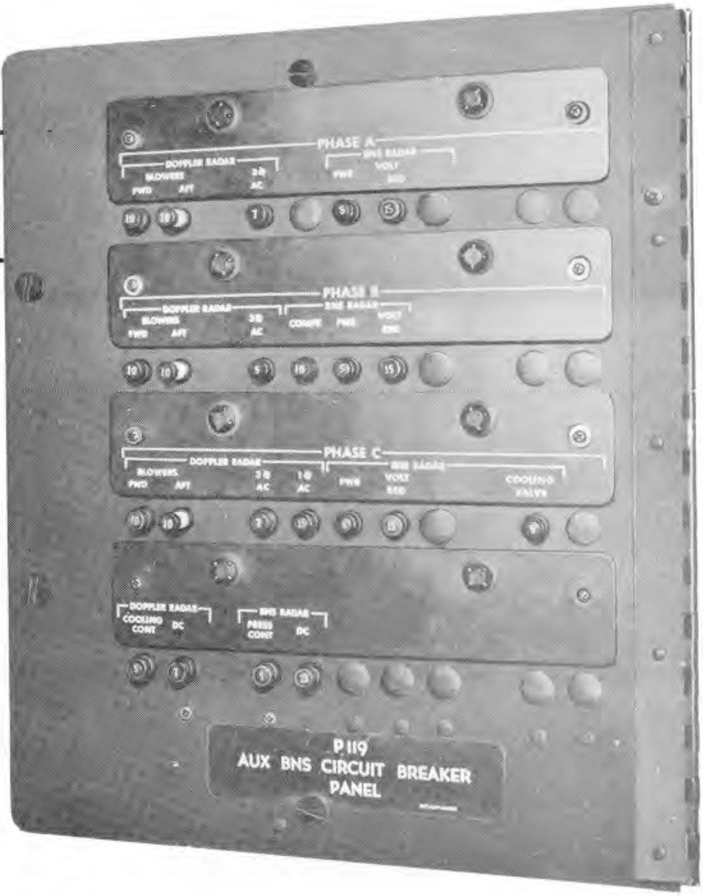
E1-180-2

B-52D

ECM CIRCUIT BREAKER PANELS (P-5)

CIRCUIT BREAKER PANELS (TYPICAL)

Figure 1-26 (Sheet 6 of 8).



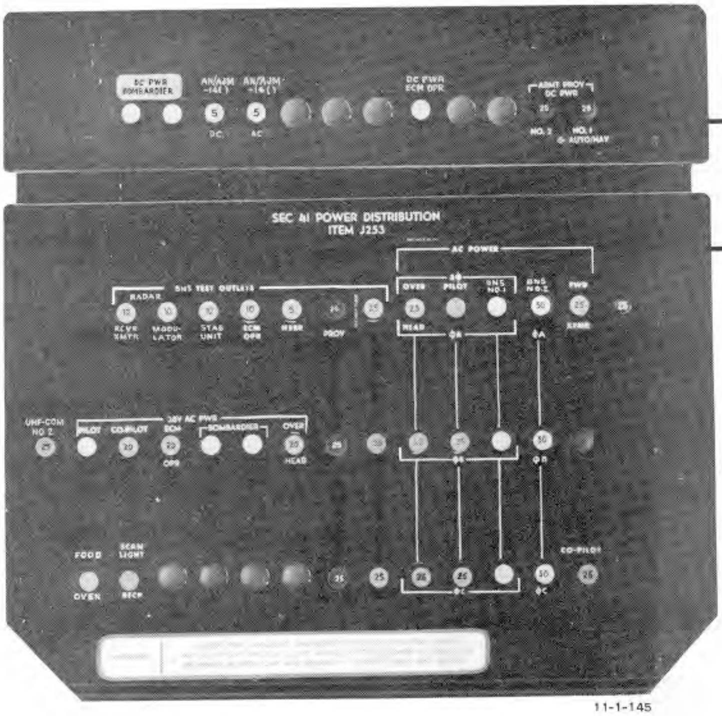
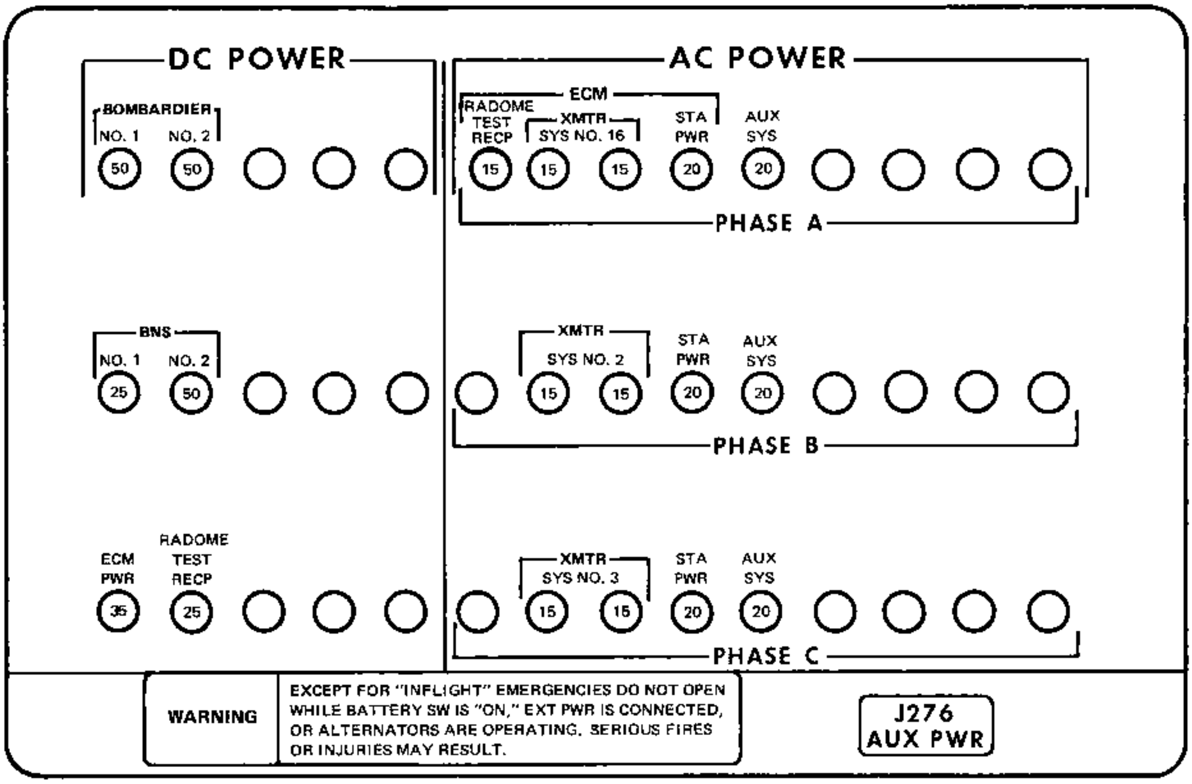


Figure 1-26 (Sheet 7 of 8).

SECTION 41 AUXILIARY POWER BOX (J-276)



CIRCUIT BREAKER PANELS (Typical)

Figure 1-26 (Sheet 8 of 8).

HYDRAULIC POWER SUPPLY SYSTEMS

The hydraulic power supply system of this aircraft differs from a conventional system in its decentralization. Instead of the usual single main hydraulic system serving an entire aircraft, there are 10 individual hydraulic systems (figure 1-27) supplying power to the various hydraulic mechanisms of the aircraft. Hydraulic systems 1, 2, 3, and 4 supply the main landing gear, wheel brake, steering and crosswind crab, bomb door, and slipway door systems. Hydraulic systems 5, 6, 7, and 8 supply the spoiler, airbrake, and tip gear systems. Hydraulic systems 9 and 10 supply the stabilizer trim system. As a safety feature, all essential hydraulically operated equipment is provided with two unrelated sources of pressure; thus, if one system should fail, the alternate system will permit continued operation on either an emergency or a normal basis. A turbine-driven hydraulic pack (operated by air from the air bleed system) in each of the 10 hydraulic systems is the source of supply for hydraulic pressure. Supplementary pressure is available upon demand from an electrically driven hydraulic standby pump. Decentralization of the hydraulic system saves weight (shorter tubing runs and less fluid). It also reduces battle vulnerability from the standpoint that shorter tubing runs present smaller targets. In addition, the alternate sources of hydraulic pressure give increased life to vital equipment during either combat or routine missions.

NOTE

Slight damage to an air bleed duct will not seriously impair operation of the hydraulic system.

TYPICAL HYDRAULIC POWER SUPPLY SYSTEM

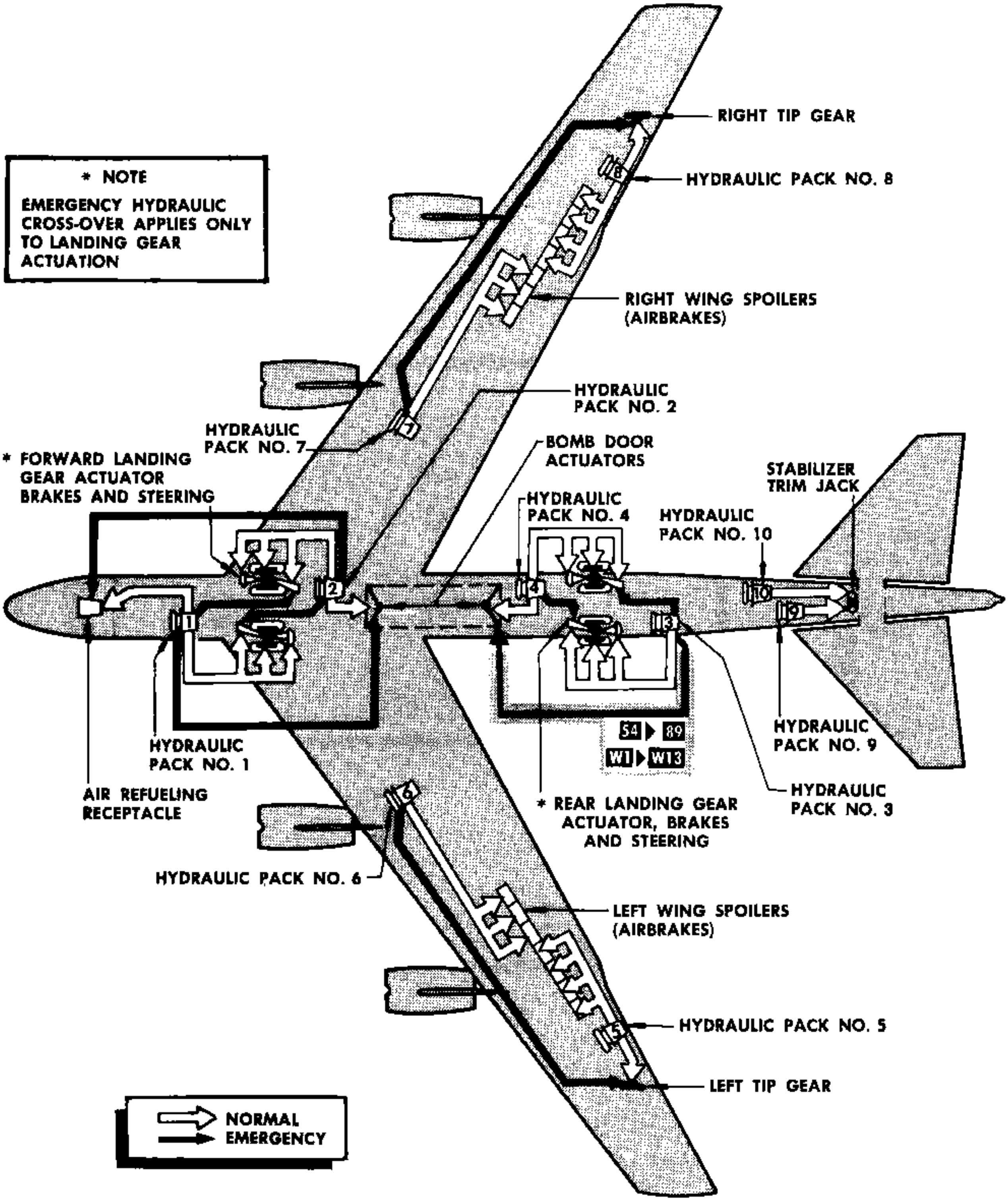
Each of the individual hydraulic power supply systems (figure 1-28) has the function of supplying hydraulic fluid under pressure for the distribution systems (brakes, steering, landing gear, etc). Each hydraulic system includes a hydraulic pack which normally provides the hydraulic pressure for the system and a pressure switch-operated standby pump to supply system pressure for emegencies. A pressure bypass valve permits the standby pump to start under a no-load condition by bleeding pressure between the standby pump and the check valve. A restrictor is provided between the pressure and return lines to allow a quick pressure drop to indicate pack failure through a pressure switch and warning light. Check valves separate the two sources of pressure and allow the pack and/or standby pump to furnish system pressure. A pressure relief valve limits maximum pressure in the system to 3750 (±100) psi at full flow and a pressure transmitter gives the system pressure through a hydraulic pressure gage. Oil-air type accumulators with attached air gages are provided. Systems 1, 2, 3, 4, 9, and 10 have an accumulator and a restrictor valve to prevent momentary drops in pressure, caused by small service demands, from overtaxing the standby pump. There are two accumulators on each of systems 5, 6, 7, and 8. There are no restrictor valves in systems 5, 6, 7, and 8. Systems 1, 2, 3, and 4 operate continuously during gear down operation. With the landing gear up and locked, these systems operate exclusively on a pressure-demand basis for bomb bay and slipway door actuation. If there are no pressure demands these packs remain inoperative. Systems 5, 6, 7, 8, 9, and 10, however, are continuous duty systems with packs operating at all times.

Hydraulic Pack

There are three parts to each hydraulic pack: the turbine driven by air from the air bleed system; the gear box driven by the turbine and including the governor and overspeed control; and the reservoir containing the hydraulic oil and housing a main hydraulic pump, a control oil pump, and a scavenge pump. Turbine speed is controlled by two valves which are located in the turbine air duct. The shutoff valve which starts and stops the pack is controlled by a shutoff valve control unit. Located between the shutoff valve and the pack is a speed control valve. This valve is controlled by the governor unit which automatically regulates turbine speed. A visual sight gage to indicate the quantity of hydraulic oil in the reservoir is located on the end of the hydraulic pack opposite the turbine. The reservoir has a maximum capacity of 4 gallons. The main hydraulic pump, a variable displacement piston type, is submerged in the reservoir. Rated output of the pack is 8 gpm at 2650 psi or 3000 (+50/-0) psi at no flow. Adding gage tolerance, pack operation is considered normal at 3000 (±250) psi indicated on the hydraulic control panel gage. The control oil pump supplies oil for actuating the speed control valve. It also provides the oil supply to lubricate the gear box and overspeed control unit. A low oil pressure shutoff circuit is incorporated which will automatically shut off the pack in the event of low control oil pressure. The reservoir is pressurized by an air line from the turbine at sea level from 14 to 16 psi to minimize the boiling effects of fluid at high altitudes. A negative "g" tank in the reservoir provides the pumps with hydraulic fluid during periods of negative gravitational force.

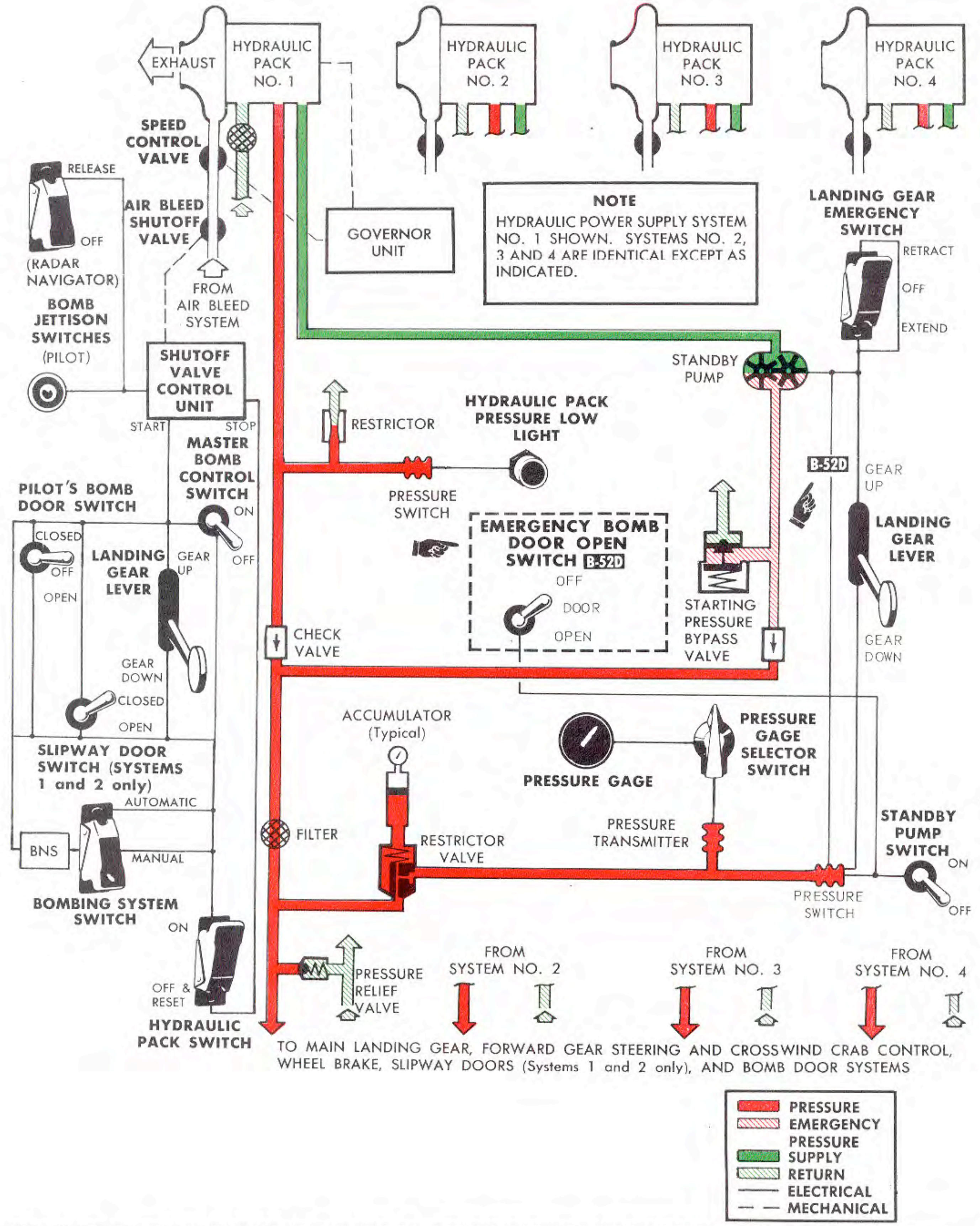
Shutoff Valve Control Unit

The shutoff valve control unit mechanically opens or closes the shutoff valve located in the turbine air duct. This mechanical action is performed by a motor-driven actuator in the control unit which is electrically operated by the hydraulic pack switch. A cam on the drive shaft on the control unit acts as a limit switch for the extreme positions of the shutoff valve.



HYDRAULIC SYSTEM LOCATIONS (Typical)

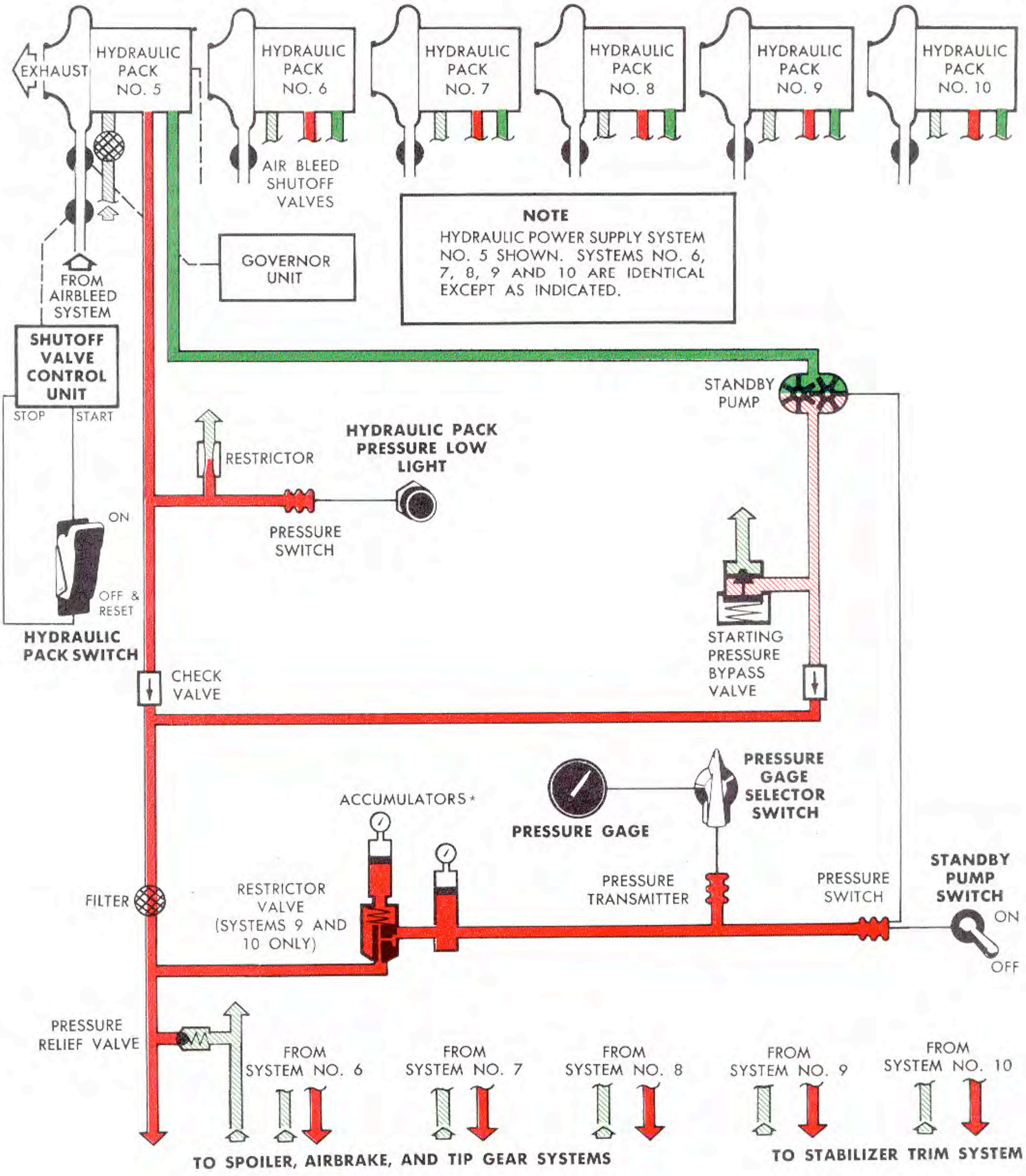
Figure 1-27.



NOTE

HYDRAULIC POWER SUPPLY SYSTEM NO. 1 SHOWN. SYSTEMS NO. 2, 3 AND 4 ARE IDENTICAL EXCEPT AS INDICATED.

Figure 1-28 (Sheet 1 of 2).



* One accumulator each on systems 9 and 10 only

HYDRAULIC POWER SUPPLY SYSTEMS (Typical)

Figure 1-28 (Sheet 2 of 2).

Governor Unit

The function of the governor unit is to actuate the speed control valve in the turbine air duct. A hydraulic shuttle valve in the governor unit controlled by a flyball governor directs hydraulic pressure from a control oil pump in the pack reservoir to a hydraulic actuator in the governor unit. The actuator mechanically positions the speed control valve which regulates the quantity of engine bleed air admitted to the hydraulic pack turbine. Speed of the turbine is thus regulated by controlling the incoming air flow.

Control Oil Low Pressure Cutoff Switch

A control oil low pressure cutoff switch is incorporated on all hydraulic packs to shut off the pack automatically in the event of low control oil pressure, thereby preventing damage to the pack due to inadequate lubrication. For starting purposes, provisions are made in hydraulic packs 5, 6, 7, 8, 9 and 10 to override the cutoff switch when the hydraulic pack switch is in the ST position. Hydraulic packs 1, 2, 3, and 4 employ a time delay relay which automatically overrides the cutoff switch during starting operations.

Overspeed Control

The overspeed control is a device to prevent an overspeed condition of the hydraulic pack turbine. Whenever overspeeding occurs, a mechanical latch trips to actuate a linkage which closes the shutoff valve. Closing the shutoff valve in the turbine air duct eliminates the supply of engine bleed air and the turbine can no longer operate. The overspeed control will automatically override the shutoff valve control unit. The overspeed control can be reset with the hydraulic pack switch.

NOTE

An exhaust air orifice is installed immediately downstream of the turbine wheel. Back pressure created by this restriction acts as a safety feature by preventing turbine wheel destructive overspeed.

Standby Pump

The standby pump in each hydraulic system supplies sufficient hydraulic pressure to operate the system should a hydraulic pack fail. The standby pump is an electric motor-driven, gear-type pump which delivers 0.45 gpm at 3000 psi. In emergencies, this pump is capable of maintaining system pressures up to 2850 (±250) psi. However, the operating speed of hydraulic equipment is reduced 15 times when the system is solely dependent upon the standby pump. Three quarts of hydraulic fluid are trapped in the pack reservoir for exclusive use by the standby pump during emergencies.

NOTE

- There is no time limit on continuous operation of the hydraulic standby pumps except when the main landing gear is extended with the emergency switches and the switches are left in the EXTEND position.
- The standby pumps for systems 1, 2, 3, and 4 are each provided with an emergency hydraulic standby pump relay. The relays permit operation of the standby pumps regardless of standby pumps switch, pressure switch, turbine control, or bomb door relay position. The relays are energized when the landing gear emergency extension switches are placed in the EXTEND position.
- On **B-52D** aircraft, the standby pump circuits for systems 1 and 2 are automatically controlled by their respective pressure switches when the emergency bomb door open switch, located at the radar navigator's station, is positioned to DOOR OPEN position and the landing gear standby pumps switch is ON. Upon pressure demand, the pressure switches will energize standby pumps 1 and 2 regardless of turbine control relay or landing gear emergency switch position. For additional information, see "Bomb Door System," Section IV.

HYDRAULIC POWER SUPPLY SYSTEM CONTROLS

The hydraulic power supply system controls are arranged on the hydraulic control panel (figure 1-29). The hydraulic pack switches and the pressure gage selector switch for hydraulic systems 1, 2, 3, and 4 are grouped under the "Main Gear Power" section of the panel. Pack switches and the pressure gage selector switch for systems 5, 6, 7, 8, 9, and 10 are grouped under the "Control Surface Power" section. Adjacent to the hydraulic control panel on the pilot's side panel are the switches for the standby pumps grouped under "Standby Pumps."

Hydraulic Pack Switches

Ten hydraulic pack switches (6, figure 1-29) which control the starting and stopping of individual hydraulic packs are located on the hydraulic control panel. Switches for hydraulic packs 1, 2, 3, and 4 have ON--OFF & RESET positions and are guarded to the ON position. The toggle switch must be placed in the ON position before the switch guard can be manually closed. With a switch in the ON position, 24-volt d-c switched battery power actuates the shutoff valve control unit. A time delay relay automatically overrides the low pressure cutoff switch during starting operations. Positioning the hydraulic pack switch to OFF & RESET either closes the shutoff valve or resets the overspeed control unit, whichever is required. Switches for hydraulic packs 5, 6, 7, 8, 9, and 10 have ST--ON--OFF & RESET positions and are guarded to the ON position. The ST position enables the pilot to override the low pressure cutoff switch during pack starting. Normally, placing the toggle switch in the ST position will extinguish the low pressure warning light in approximately 3 seconds. The switch is then placed in the ON position.

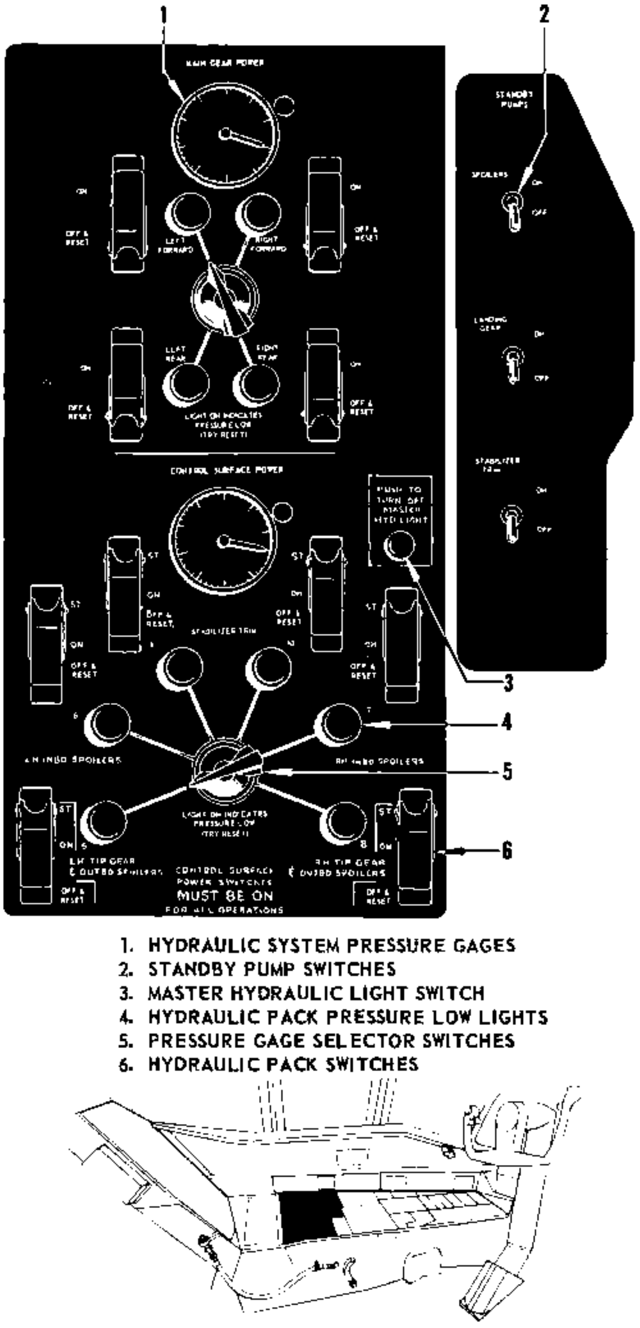
CAUTION

> No hydraulic pack switch should remain in ST position longer than 6 seconds as this could result in running the pack in a dry condition if the pack hydraulic oil is depleted.

Hydraulic packs 1 (left forward), 2 (right forward), 3 (left aft), and 4 (right aft) have electrical power from the hydraulic switches under various conditions. These four packs operate any time the landing gear is not up and locked. When the gear is up and locked, the packs will shut down except under the following conditions. On aircraft 54▸ 88 W1▸ W12 , packs 1, 2, 3, and 4 will operate when the master bomb control switch is in ON position, when the bomb salvo switch is actuated, or when the pilot's bomb door switch is in OPEN position. On aircraft 89▸ W13▸ , packs 1, 2, and 4 only will operate under these conditions. Pack No. 1 will operate when the normal slipway door switch is in OPEN position. Pack No. 2 will operate when the alternate slipway door switch is in OPEN position. The hydraulic pack switches 1 thru 4 receive switched battery through circuit breakers marked "Hyd Package Control" - "L Fwd 1," "R Fwd 2," "L Rear 3," and "R Rear 4" on the "Landing Gear" portion of the pilot's circuit breaker panel. Hydraulic pack switches 5 thru 10 receive switched battery power through circuit breakers marked "Hyd Package Control" - "5," "6," "7," "8," "9," and "10" on the "Control Surface" portion of the pilot's circuit breaker panel.

Standby Pump Switches

Three standby pump switches (2, figure 1-29) are conveniently grouped on the pilot's side panel adjacent to the hydraulic control panel. One switch marked "Landing Gear" controls each standby pump for hydraulic systems 1, 2, 3, and 4. Another switch marked "Spoilers" controls each standby pump for hydraulic systems 5, 6, 7, and 8. A third switch marked "Stabilizer Trim" controls each standby pump for hydraulic systems 9 and 10. Each switch has ON--OFF positions. When a switch is in the OFF position, its respective pumps are inoperative. ON position insures automatic operation of the



1. HYDRAULIC SYSTEM PRESSURE GAGES
2. STANDBY PUMP SWITCHES
3. MASTER HYDRAULIC LIGHT SWITCH
4. HYDRAULIC PACK PRESSURE LOW LIGHTS
5. PRESSURE GAGE SELECTOR SWITCHES
6. HYDRAULIC PACK SWITCHES

HYDRAULIC CONTROL PANEL (Typical)

Figure 1-29.

standby pumps. On systems 5, 6, 7, 8, 9, and 10, with the standby pump switch in ON position, 24-volt d-c TR power is fed to a pressure switch. The switch is closed when the gage reads 2550 (+250/-200) psi and is opened when the gage reads 2850 (±250) psi. When the switch is closed, power is fed through a pressure switch to a power relay which connects 205-volt three-phase a-c power to the standby pump for starting operation. The standby pumps for systems 1, 2, 3, and 4 have a turbine control relay connected between the pressure switch and the three-phase power relay. With the standby pump switch in ON position, the standby pumps will operate whenever the landing gear emergency switch is actuated or when the normal pack is inoperative and the landing gear is not fully up and locked. Standby pump switches 1 thru 4 are provided power through circuit breakers marked "Standby Pump Control" - "L Fwd 1," "R Fwd 2," "L Rear 3," and "R Rear 4" on the "Landing Gear" portion of the pilot's circuit breaker panel. Standby pump switches 5 thru 10 receive power from circuit breakers marked "Standby Pump Control" - "5," "6," "7," "8," "9," and "10" on the "Control Surface" portion of the pilot's circuit breaker panel.

HYDRAULIC POWER SUPPLY SYSTEM INDICATORS

Pressure Gages and Selector Switches

Two gages (1, figure 1-29) on the hydraulic control panel indicate hydraulic pressure of the hydraulic systems. These gages are calibrated from 0 to 4000 psi. The gage on the section of the hydraulic control panel labeled "Main Gear Power" indicates the pressure of hydraulic system 1, 2, 3, or 4. The gage on the section of the panel marked "Control Surface Power" indicates the pressure of hydraulic system 5, 6, 7, 8, 9, or 10. A pressure gage selector switch (5, figure 1-29) near each gage controls the 28-volt a-c power which connects the pressure transmitter and the pressure gage. The switch on the main gear power section of the panel has LEFT FORWARD--RIGHT FORWARD--LEFT REAR--RIGHT REAR positions. These positions correspond to hydraulic systems 1, 2, 3, and 4 respectively. The other switch on the control surface power section of the panel has LEFT TIP GEAR & OUTBD SPOILER--LEFT SPOILER INBD--RIGHT SPOILER INBD--RIGHT TIP GEAR & OUTBD SPOILER--STABILIZER TRIM 9--STABILIZER TRIM 10 positions. These positions correspond to hydraulic systems 5, 6, 7, 8, 9, and 10 respectively. The pressure gages are provided power through a circuit breaker marked "Hyd Pressure Ind" on the "Control Surface" portion of the pilot's circuit breaker panel.

Hydraulic Pack Pressure Low Light

Each of the 10 individual hydraulic systems has a red hydraulic pack pressure low light (4, figure 1-29) on the hydraulic control panel at the pilot's station. Whenever pressure from the main hydraulic pump falls below approximately 1300 ± 200 psi, a warning light illuminates and remains illuminated until the pressure from the main hydraulic pump rises above approximately 1500 ± 150 psi. Since the light indicates hydraulic pack failure, it will remain on even though system pressure is restored to normal by the standby pump. Only a return of the affected pack to proper operation will extinguish the light. The light operates on TR power through a pressure switch in the hydraulic line. On packs 1, 2, 3, and 4, the electrical power will be fed to the pressure switch only when the landing gear is not up and locked or the bomb door or slipway door switch is actuated or the landing gear emergency switch is actuated. The hydraulic pack pressure low lights are provided TR power through a circuit breaker marked "Hyd Pressure Warn Lights" on the "Control Surface" portion of the pilot's circuit breaker panel.

Hydraulic Pack Pressure Low Master Light

A red hydraulic pack pressure low master light (10, figure 1-15) is located on the forward instrument panel at the pilot's station. On some aircraft, this light will illuminate simultaneously with an individual hydraulic pack low pressure light and provide the pilot with a convenient means of monitoring the hydraulic packs. On other aircraft, this light has a time delay controller which provides a 10- to 15-second delay before the master warning light illuminates in the event of low hydraulic pressure. This time delay controller was installed to keep the hydraulic pack pressure low master light from flashing upon actuation of the various hydraulic systems. A "Push To Turn Off Master Hyd Light" spring-loaded switch (3, figure 1-29) located on the hydraulic control panel controls TR power. Pushing the switch in extinguishes the red master low pressure light so that subsequent pack failures may be detected. The individual low pressure light will remain on until the affected pack is returned to normal operation. The hydraulic pressure low master light is provided TR power through a circuit breaker marked "Hyd Pressure Warn Lights" on the "Control Surface" portion of the pilot's circuit breaker panel.

AIR BLEED (PNEUMATIC POWER SUPPLY) SYSTEM

The air bleed system is supplied high pressure, high temperature bleed air from the final compressor stage on all eight engines. This bleed air is ducted through four wing and two body manifolds to pneumatic equipment located along the manifolds. Engines 1 thru 4 normally supply bleed air for pneumatic equipment on the left side of the aircraft and engines 5 thru 8 supply bleed air for pneumatic equipment on the right side. A system of manifold interconnect valves permits all manifolds to be interconnected for engine starting and for providing an emergency supply of bleed air in the event both engines in a nacelle are shut down. Systems that receive power directly from the air bleed system are the a-c electrical system, hydraulic systems, air conditioning systems, engine and nacelle anti-icing systems, engine starting system, drop tank pressurizing system, and water injection system. The air bleed system ground source connection (24, figure 1-57), which is used to supply air to the system when the aircraft engines are not in operation, is located in the lower left surface of the fuselage just forward of the forward wheel well.

AIR BLEED SYSTEM CONTROLS

Wing Manifold Interconnect Switches

Two OPEN--CLOSED wing manifold interconnect switches (1 and 3, figure 1-31), guarded to the CLOSED position, are located on the copilot's auxiliary side panel. These switches electrically control the opening and closing of the wing interconnect valves. When a switch is in the OPEN position, the wing valve is open so that the inboard and outboard engines on that side of the aircraft mix their bleed air freely and flow is allowed either way through the valves. When a switch is in the CLOSED position, the wing valve is closed so that the outboard systems on that side of the aircraft will be isolated from the inboard systems as shown in figure 1-30. The wing interconnect valves are motor driven and operate on 118-volt single-phase a-c power through circuit breakers marked "Air Conditioning Air Bld" - "L Wing" and "R Wing" on the "Miscellaneous" portion of the pilot's circuit breaker panel. Normally, these valves are closed and the switches are in the CLOSED position.

Body Manifold Interconnect Switch

An OPEN--CLOSED body manifold interconnect switch (2, figure 1-31), guarded to the CLOSED position, is located on the copilot's auxiliary panel. This switch, in conjunction with the air conditioning master switch and the air bleed selector switch, electrically controls the opening and closing of the two body interconnect valves. When the body manifold interconnect switch is in the OPEN position, both valves are open. When the body manifold interconnect switch is in the CLOSED position and the air conditioning master switch is in either the OFF or RAM position, both valves are closed. When the body manifold interconnect switch is in the CLOSED position and the air conditioning master switch is in either the 7.45 PSI or COMBAT 4.50 PSI position, the left body interconnect valve is open and the right body interconnect valve is closed (provided the air bleed selector switch is in the NORMAL position). When the air bleed selector switch is moved from NORMAL to ALTERNATE position, the body interconnect valves reverse their positions. The valves are motor driven and operate on 118-volt single-phase a-c power through circuit breakers marked "Air Conditioning Air Bld" - "Body" on the " Miscellaneous" portion of the pilot's circuit breaker panel.

WARNING

If the body manifold interconnect valves are opened when a pneumatic duct leak exists, it is possible for pneumatic pressure on both sides of the aircraft to drop below the minimum required for alternator operation, causing a complete loss of ac electrical power. Since the interconnect valves are a-c operated, it is not possible to close these valves in order to regain alternator operation.

Air Conditioning Master Switch

An air conditioning master switch (3, figure 4-3) is located on the forward air conditioning panel and has OFF-RAM--7.45 PSI--COMBAT 4.50 PSI positions. This switch affects the operation of the body interconnect valves only when the body air bleed interconnect switch is in the CLOSED position. The OFF or RAM position of the air conditioning master switch closes both of the body interconnect valves. The 7.45 PSI or COMBAT 4.50 PSI position of the air conditioning master switch closes one body interconnect valve and opens the other. Which body interconnect valve is opened and which body interconnect valve is closed depends upon the position of the air bleed selector switch. For additional information on the air conditioning master switch, see "Air Conditioning System," Section IV.

Air Bleed Selector Switch

The air bleed selector switch (4, figure 4-3) is located on the forward air conditioning panel. The air bleed selector switch affects the operation of the body interconnect valves only when the body air bleed manifold interconnect switch is in the guarded CLOSED position and the air conditioning master switch is in either the 7.45 PSI or COMBAT 4.50 PSI position. The air bleed selector switch has two positions, NORMAL--ALTERNATE. When in NORMAL position, the left body manifold interconnect valve is open, the right body manifold interconnect valve is closed and the forward air conditioning system is supplied bleed air from engines 3 and 4. When in ALTERNATE position, the left body manifold interconnect valve is closed, the right body manifold interconnect valve is open, and the forward air conditioning system is supplied bleed air from engines 5 and 6. For additional information on the air bleed selector switch, see "Air Conditioning System" Section IV.

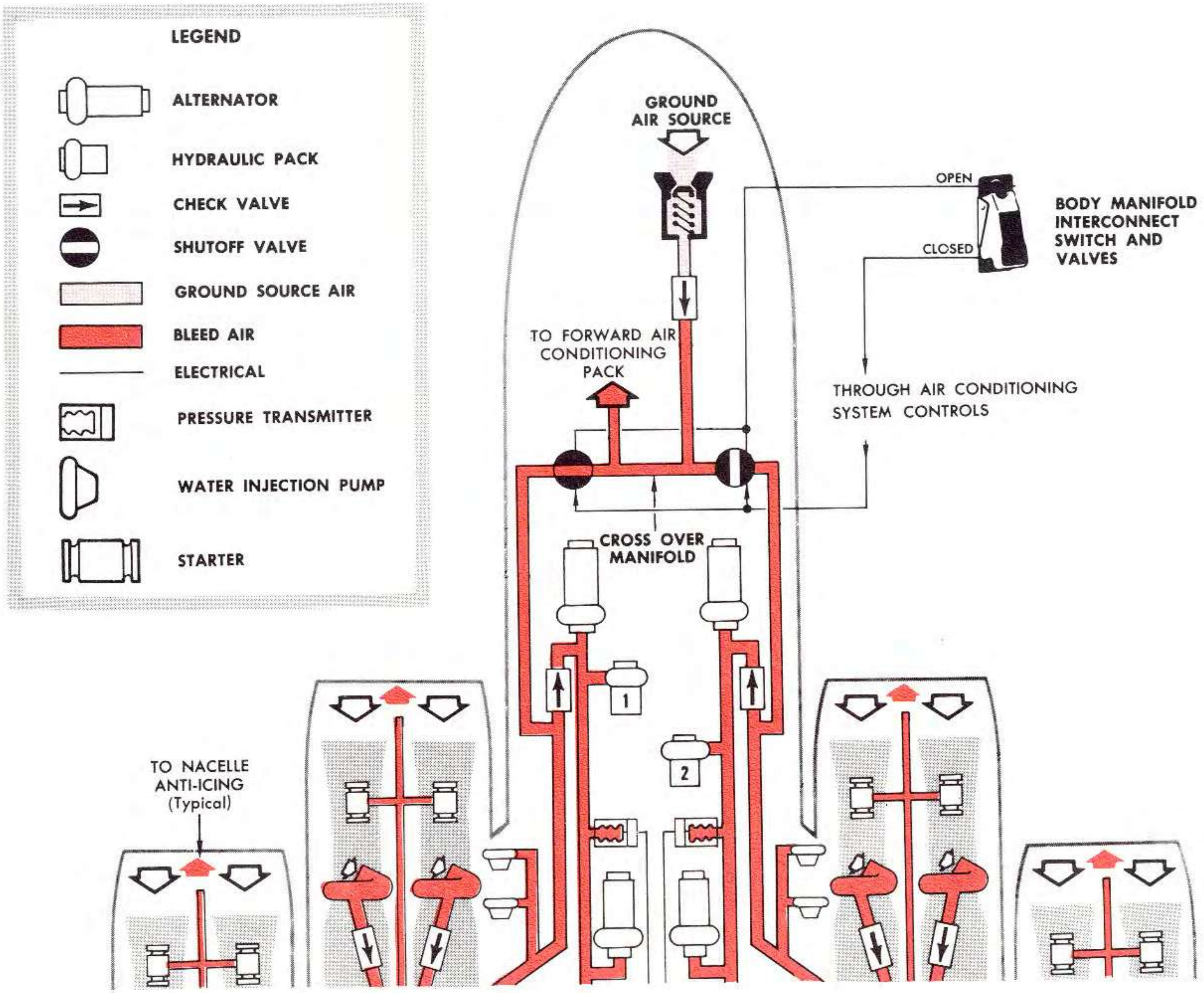
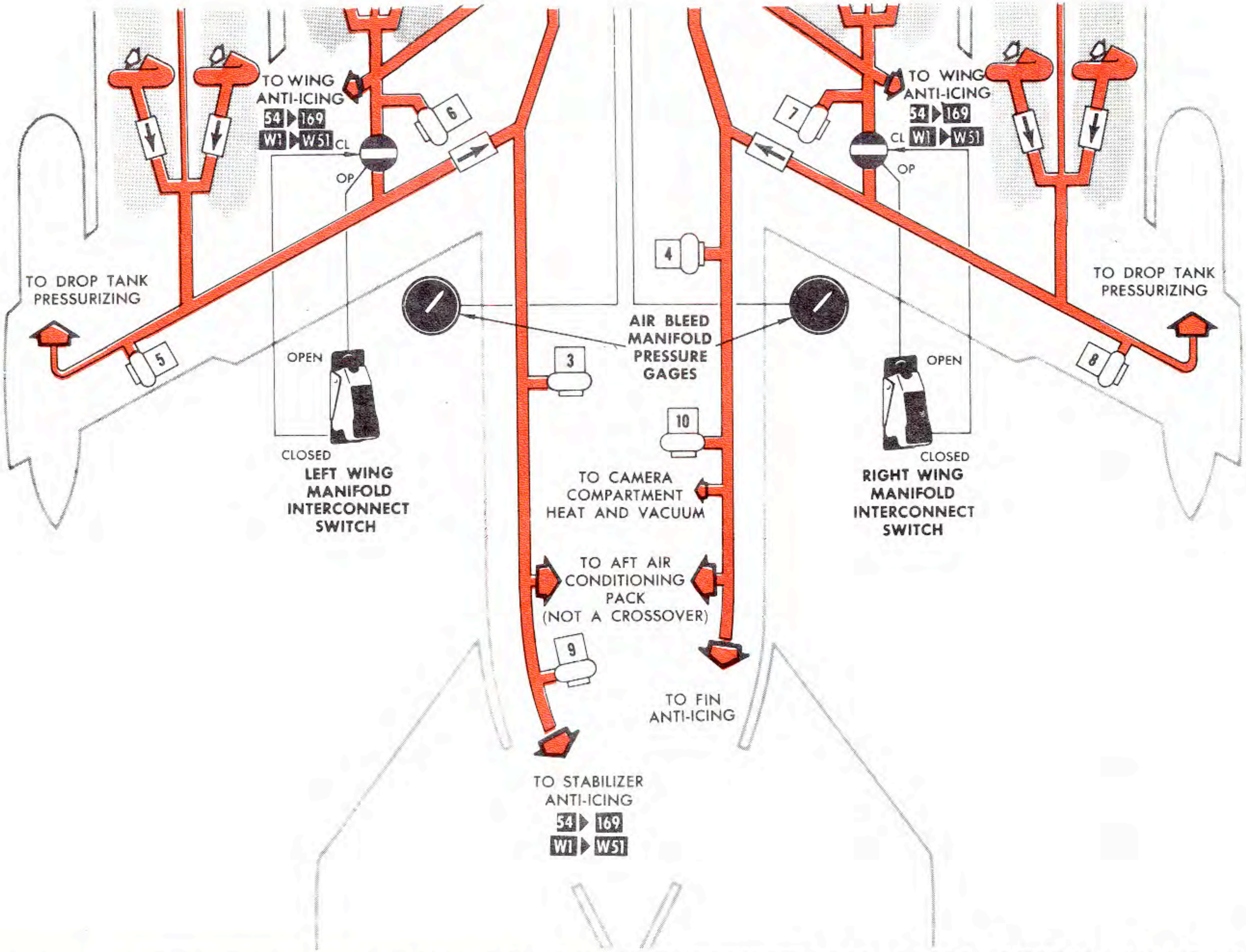
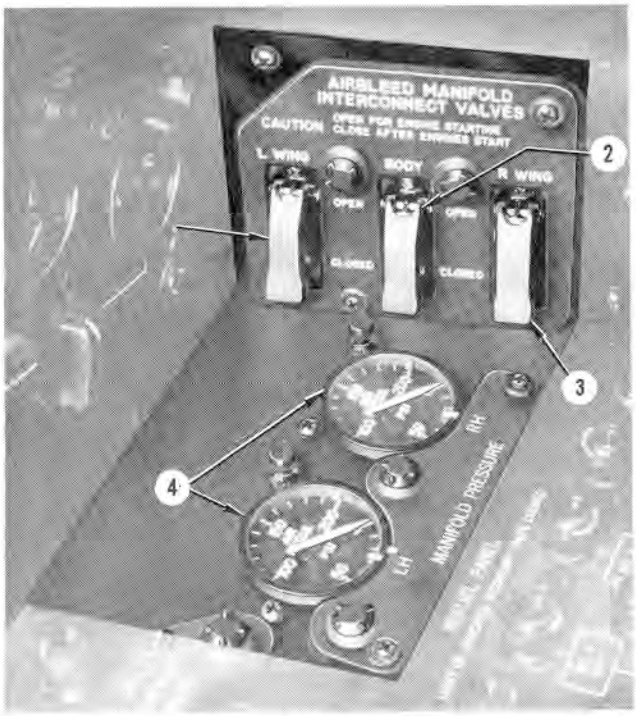


Figure 1-30 (Sheet 1 of 2).

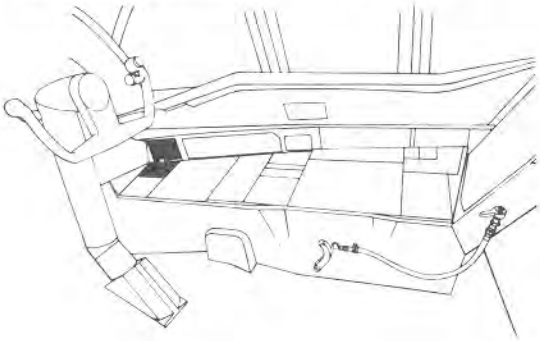


AIR BLEED SYSTEM (Typical)

Figure 1-30 (Sheet 2 of 2).



1. LEFT WING MANIFOLD INTERCONNECT SWITCH
2. BODY MANIFOLD INTERCONNECT SWITCH
3. RIGHT WING MANIFOLD INTERCONNECT SWITCH
4. AIR BLEED MANIFOLD PRESSURE GAGES



AIR BLEED SYSTEM CONTROLS

Figure 1-31

AIR BLEED SYSTEM INDICATORS

Air Bleed Manifold Pressure Gages

Two air bleed manifold pressure gages (4, figure 1-31) on the copilot's side panel measure the pressure in each of the air bleed manifolds. The gages are calibrated from 0 to 200 psi and are electrically operated from 28-volt a-c power by a pressure transmitter which receives power through circuit breakers marked "Manifold Pressure" - "LH" and "RH" on the pilot's auxiliary circuit breaker panel.

FLIGHT CONTROL SYSTEMS

Primary flight control of the aircraft is accomplished by three basic systems: the aileron, elevator, and rudder systems. The control surfaces of each system are moved to desired control positions by air forces acting upon control tabs. These tabs, in turn, are moved by cables which are connected to dual control wheels, control columns, and rudder pedals located at the pilots' stations. Lateral control is augmented by spoilers which are part of a spoiler and airbrake system. Lateral trim is obtained from a trim tab on each aileron. The entire stabilizer, however, moves to provide pitch trim. Directional trim is achieved by resetting a centering mechanism in the rudder control tab cable system.

VORTEX GENERATORS

The aircraft is equipped with vortex generators which are installed on the upper surface of each wing forward of the ailerons. For further information on vortex generators, see "Aileron Buffeting," Section VI.

GUST DAMPERS

No internal or external surface locks are provided for the flight controls. To prevent damage due to gusts, hydraulic dampers are provided for each primary surface. These dampers are completely self-contained and are automatic in operation. They will prevent damage to the flight controls from gusts up to 65 knots. The damping action will not be felt during normal flight control movement.

CAUTION

> When gusts above 65 knots (75 mph) are experienced, it is advisable to park the aircraft headed into the wind. Landing gear down locks should be installed and wheels chocked. If the aircraft is subjected to ground gusts of 65 knots or more, the elevator and rudder structures will be overloaded. All of the gust dampening mechanism and its supporting structure, together with the rudder and elevator hinge No. 1 supporting structure and all of the aileron gust dampening mechanism, should be thoroughly inspected for damage.

RUDDER SYSTEM

Directional control and trim are achieved with the rudder system. The rudder is a control tab-operated floating surface.

Rudder Pedals

The rudder pedals are conventional and are adjustable fore and aft by levers on the outboard side of each pedal. Movement of the rudder pedals is transmitted by cables to control tabs which then serve to move the control surface to the desired position.

Stability Tab

The rudder is moved by a stability tab as well as a control tab. This stability tab is the upper of two tabs on the rudder and acts to damp lateral oscillations (Dutch roll). It is moved by a bob-weight for small deflections and the pilot for large deflections. When the rudder is in the neutral position, full deflection of the bob-weight results in a 5° deflection of the stability tab: introducing control tab motion by the pilot can increase the stability tab travel to 12°. The directional damping action cannot overcome pilot control of the rudder. For further information on the stability tab, see "Rudder Stability Tab," Section VI. The rudder stability tab is further controlled by an electromechanical yaw damper which operates in parallel with the magnetic yaw damper and senses the yaw rate of the aircraft through a rate gyro. The electromechanical yaw damper acts on the existing bob-weight which in turn controls the stability tab. For additional information, see "Electromechanical Yaw Damper" under "Autopilot," Section IV.

Rudder Artifical Feel

Rudder feel and centering is provided by a rudder Q-spring in the cable system. This device is a bellows which reacts according to ram air pressure from the leading edge of the fin. The bellows resists rudder control tab deflections in proportion to dynamic pressure and control deflection, thus simulating air loads on a conventional rudder system.

Rudder Trim

Rudder trim is accomplished by resetting the centering action of the rudder Q-spring on the rudder control tab cable system. The trim linkage is set by a screw acting on Q-spring linkage. This screw is cable operated by the rudder trim knob on the aisle stand.

RUDDER TRIM KNOB AND INDICATOR. The rudder trim knob and indicator (10, figure 1-13) on the aisle stand are the only controls provided for rudder trim. Rotation of the knob will reset the center position in which the rudder Q-spring will hold the rudder pedals and the rudder control tab. The mechanically operated indicator is calibrated up to 12 units maximum trim nose left and right.

ELEVATOR SYSTEM

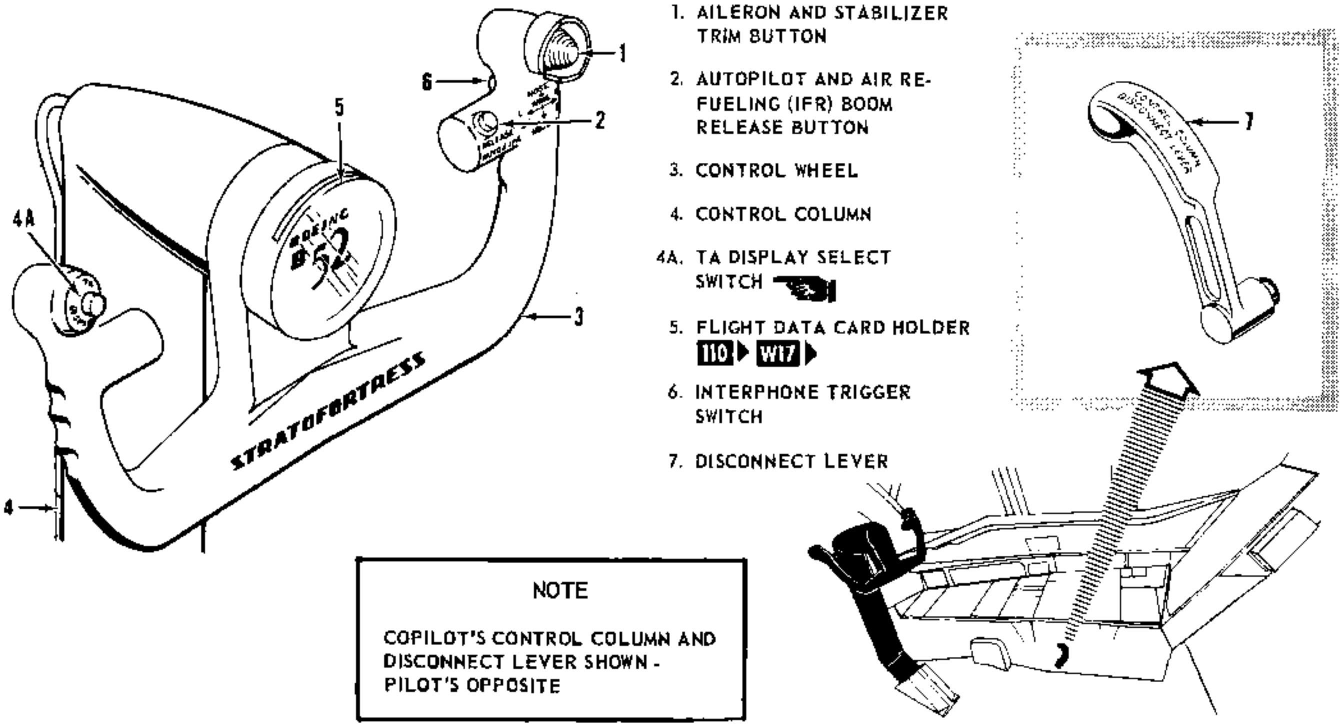
Pitch control is provided by the elevator system. The elevators are floating surfaces operated by control tabs located on the trailing edge of each elevator at the inboard end. The left and right elevator halves are independently hinged and may move independently of each other on the ground. (Since the control tabs are interconnected, the elevator halves will always act together in flight.) The control tabs are cable operated from the pilots' control columns. The control columns transmit control movements through separate control column disconnect mechanisms to the respective right and left forward control cable quadrant where a pair of cables joins them into a single system. A force switch assembly is contained in each of the control rods located between the control column transverse shaft bellcranks and the forward elevator control quadrants. These switches, although having no effect on the elevator system, provide the pilots with a means of quickly terminating unscheduled stabilizer trim movements that may result from stabilizer or autopilot system malfunction (except stabilizer trim reversal). For further information on force switch operation, see "Force Switches" under "Stabilizer Trim System," this section. Either or both control columns may be manually disconnected from the cable system and stowed forward against the instrument panel. A connection is provided between the disconnect linkage and the seat ejection system so that the column will be automatically disconnected and stowed during the seat ejection cycle.

Elevator Artificial Feel

Elevator feel and centering is provided by an elevator Q-spring in the cable system. The Q-spring consists of a single bellows chamber attached to the empennage structure operating in conjunction with a steel coil spring preloaded in tension to provide control centering force in the low speed range. Operation of the elevator control system in either direction from neutral immediately places a cable in tension against the resistance of the Q-spring and the coil spring. An additional tension spring provides supplemental artificial feel and a positive control column neutral position. For further information, see "Elevator Feel Characteristics," Section VI. The Q-spring obtains ram air pressure from the leading edge of the fin and operates as described under "Rudder System," this section. Conventional elevator trim is not provided but pitch trim is accomplished by hydraulically moving the entire stabilizer.

Control Columns and Disconnect Levers

Conventional pilot's and copilot's control columns (4, figure 1-32) are provided which can be manually disconnected from the elevator system by pushing



1. AILERON AND STABILIZER TRIM BUTTON
2. AUTOPILOT AND AIR REFUELING (IFR) BOOM RELEASE BUTTON
3. CONTROL WHEEL
4. CONTROL COLUMN

4A. TA DISPLAY SELECT SWITCH ☞

5. FLIGHT DATA CARD HOLDER 110 ▶ W17 ▶
6. INTERPHONE TRIGGER SWITCH
7. DISCONNECT LEVER

NOTE

COPILOT'S CONTROL COLUMN AND DISCONNECT LEVER SHOWN - PILOT'S OPPOSITE

CONTROL COLUMN AND DISCONNECT LEVER

Figure 1-32.

forward and downward on control column disconnect levers (7, figure 1-32). These levers are located near each pilot's outboard armrest and below their respective side panels. When disconnecting a control column, grasp the control wheel, push down on the disconnect lever, and assist the control column into its stowed position. The columns tend to remain in position when manually disconnected. Reconnection of control columns after depressing disconnect lever is dependent on column being cycled through stowed detent or the disconnect lever being pulled up before being reconnected.

WARNING

Whenever either control column is disengaged and subsequently reengaged in flight, positive engagement will be confirmed by holding the other column rigid near neutral while applying a push-pull force to the column being engaged. This may be accomplished with the autopilot operating provided care is taken not to displace either column sufficiently to cause force switch disengagement.

NOTE

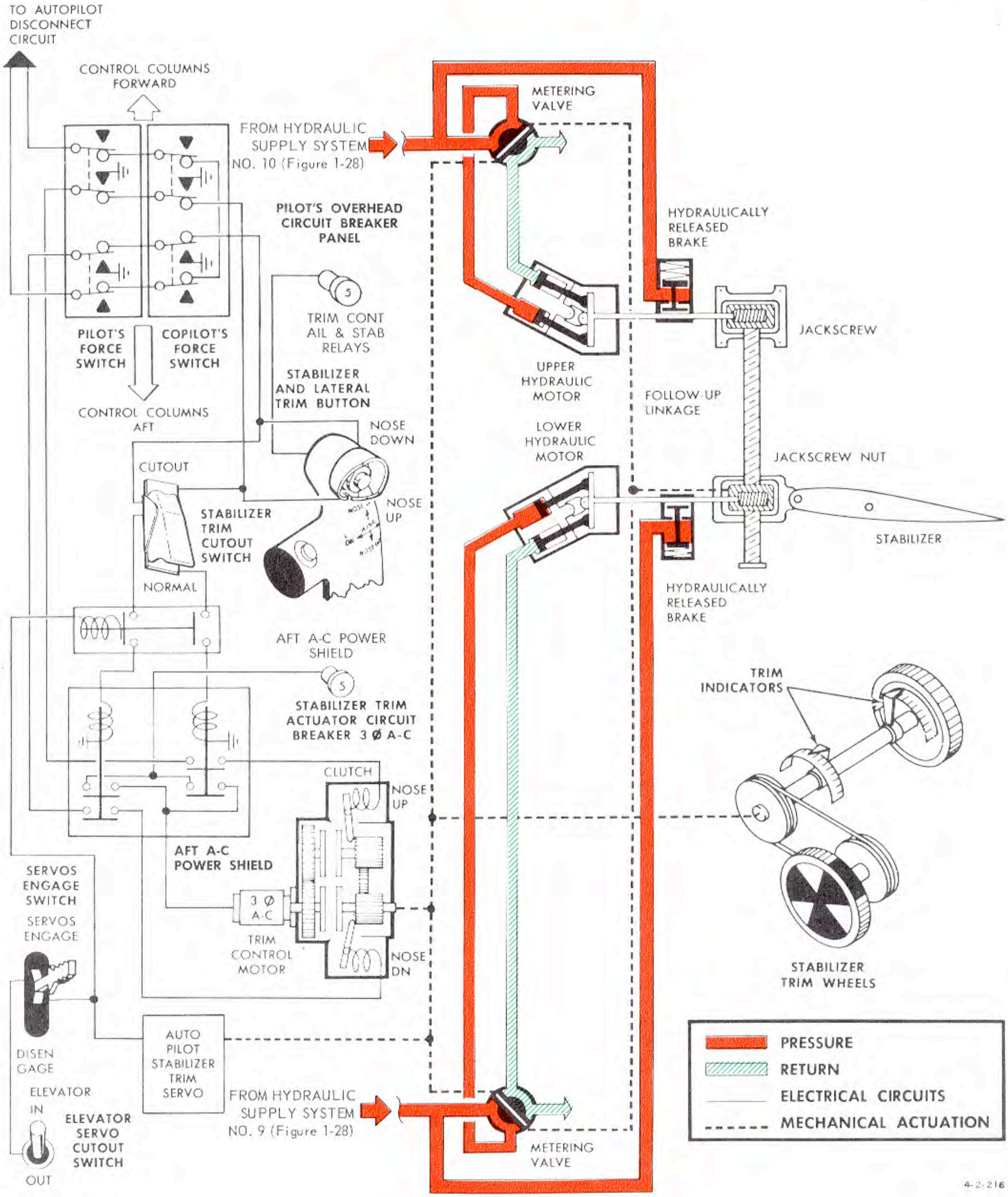
After ejection sequence has been initiated, the control column can be reengaged by pulling the disengage lever up as far as possible and holding until the control column is pulled aft and engagement occurs.

WARNING

When the column has been reengaged after ejection sequence has been initiated, the column must be manually stowed for subsequent ejection.

STABILIZER TRIM SYSTEM

Pitch trim of the aircraft is provided by the stabilizer trim system (figure 1-33). The leading edge of the stabilizer is raised and lowered by a jackscrew driven by two hydraulic motors. One of the



STABILIZER TRIM SYSTEM (Typical)

Figure 1-33.

motors drives the screw and the other drives the nut. The motor driving the screw is supplied pressure from hydraulic system No. 10 while hydraulic system No. 9 supplies the motor driving the nut. The hydraulic pressure to the motors is metered by valves which are controlled by the cable system or a parallel electric trim control system through a followup system. Trim position creeping due to air loads on the stabilizer is prevented by a hydraulically released brake on each hydraulic motor drive. Pitch trim is not automatically adjusted when the wing flaps are raised and lowered. An automatically operated heating element is installed in each followup screw to prevent icing of the screw threads. For operating limitations of the stabilizer trim system, see "System Limitations," Section V.

NOTE

> If heater elements are not installed or are inoperative, the stabilizer trim system may become inoperative under certain conditions of temperature and humidity. This inoperative condition could be caused by frost or ice buildup on the followup screws which may jam the screws and prevent stabilizer operation either manually or electrically until the frost or ice is melted. Operation without heaters after cold soak at altitude may result in an electrically reduced operation rate and sponginess in the operation of the manual trim wheel.

Stabilizer Trim Wheels and Indicators

Manual control of the stabilizer trim metering valve is provided by rotation of the stabilizer trim wheels (3, figure 1-13) on the aisle stand. The pilot's trim wheel is attached to the throttle shaft and operates through a chain sprocket linkage to move a trim indicator located forward and inboard of the wheel. The copilot's trim wheel and trim indicator are located opposite to the pilot's trim indicator. The indicators are calibrated in units of stabilizer leading edge movement from 9 units "Aircraft Nose Dn" to 4 units "Aircraft Nose Up" with 1 unit equaling 1 degree of stabilizer travel. Any trim accomplished using the electric trim control system will feed back through the cable system rotating the manual trim wheels and indicators. The manual trim wheels can be used to override the electric trim control system or autopilot trim system. One degree of stabilizer movement is equal to one revolution of the manual trim wheel. During ground checks of the stabilizer trim system when hydraulic packs 9 and 10 are operating and their respective accumulators are fully charged, the hydraulic system is cabable of driving the stabilizer at a rate of approximately 6 units every 10 seconds. If the stabilizer trim is actuated continuously for periods longer than 8 seconds, the trim rate will slow to about 4 units every 10 seconds, caused by the depletion of the system accumulators. For this reason, trim operation should be interrupted for approximately 4 seconds after the stabilizer has been driven about 4 units to allow time for the accumulators to recharge. When the system is functioning normally, the manual trim wheel should rotate at the rate of two-thirds revolution per second. In flight, trim rates will be slightly less than 6 units every 10 seconds because of aerodynamic loads on the stabilizer. Trim rates are also reduced to about one-half the normal rate when only one hydraulic pack is operating. The trim wheel face and periphery is painted in alternate black and white segments as a visual aid and reminder when the electric trim control system is being used.

Aileron and Stabilizer Trim Buttons

An aileron and stabilizer trim button (1, figure 1-32) is located on the outboard grip of each pilot's control wheel. Guards are provided on the pilot's and copilot's control wheels at the stabilizer trim switch housing to prevent inadvertent actuation of the trim switch. To initiate electrical control of the stabilizer trim, either the NOSE UP or NOSE DN position is used. The buttons are spring loaded to an unmarked center OFF position.

CAUTION

> The spring loaded feature of the stabilizer trim switch should not be relied on to return the switch to neutral. The pilot should manually return the switch to neutral with a positive thumb movement each time it is used. To aid in recognizing a malfunctioning electrical trim system before reaching an extreme out-of-trim condition, the trim switch will be actuated in short intermittent bursts when used during flight. Due to the possibility of the switch sticking, care should also be taken to avoid inadvertent actuation of the switch when flying on autopilot. A runaway trim condition would result if a trim switch was stuck and the autopilot was disengaged.

Actuation of the stabilizer trim button produces the following visible results: 1) Noseup trim moves the trim indicator aft toward "Aircraft Nose Up," the manual trim wheel rotates aft, and the stabilizer leading edge moves down; and conversely 2) Nosedown trim moves the trim indicator forward toward "Aircraft Nose Dn," the manual trim wheel rotates forward, and the stabilizer leading edge moves up. Moving a button to either trim position closes a circuit to supply TR power to one of two power relays. These relays will switch 205-volt three-phase a-c power to operate the trim control motor. Positioning a button to a trim position will also supply TR power to the respective noseup or nosedown clutch solenoid in the control motor. TR power is supplied to the relays and clutch solenoid through a circuit breaker marked "Ail & Stab Relays" on the "Trim Cont" portion of the pilots' overhead circuit breaker panel. The stabilizer trim function of the aileron and stabilizer trim buttons is inoperative when the autopilot elevator servo cutout switch is positioned to IN and the autopilot servos engage switch is positioned to ENGAGE. This is accomplished by electrically disconnecting the control circuits between the trim buttons and the actuator clutches. For operating limitations of the stabilizer trim system, see "Systems Limitations," Section V. For information on the aileron trim function of these buttons, see "Aileron System," this section.

Stabilizer Trim Cutout Switch

A guarded CUTOUT--NORMAL stabilizer trim cutout switch (16, figure 1-13) on the aisle stand is provided to deactivate the electrical operation of the stabilizer trim buttons for stabilizer trim. In CUTOUT (guard up) position, the stabilizer trim cannot be operated electrically. For normal electrical control of stabilizer trim, this switch must be in NORMAL (guard down) position. Manual control of stabilizer trim is not affected by the cutout switch in either CUTOUT or NORMAL position. The switch is provided TR power through a circuit breaker marked "Ail & Stab Relays" on the "Trim Cont" portion of the pilots' overhead circuit breaker panel.

Force Switches

Force switches are installed within the control column linkage to provide the pilots with an effective means of immediate interruption of unscheduled stabilizer trim movement (except for stabilizer trim reversal as noted below). A pilot's natural reaction in responding to an aircraft pitch movement with an opposing control column force is utilized. When such an opposing force on either control column reaches 24 to 36 pounds, two microswitches are actuated to open; one switch disengages the autopilot and the other deactivates the stabilizer trim in the unscheduled direction only. Electrically controlled trim opposing the unscheduled trim movement continues to be available by means of the trim buttons unless deactivated by the trim cutout switch or circuit breakers. Note that as control column force is reduced below the 24 to 36 pounds required to actuate the microswitches, the switches close and restore any unscheduled stabilizer trim not originally caused by the autopilot which will not reengage. For further information, see "Force Switch Operation" under "Flight Control System Emergency Operation," Section III.

NOTE

> Certain malfunctions within the aircraft electrical system can create a condition wherein the stabilizer trim motor may drive in the opposite direction to the input signal commanded by the stabilizer trim button. In event of such stabilizer trim motor reversal, the pilot's natural reaction in responding to an aircraft pitch movement with an opposing control column force will not interrupt driving of the reversed trim motor. The force switches interrupt the power to the trim motor clutch on the side opposite that required for proper trim direction. In the reversed motor situation, the correct clutch is engaged but the direction of rotation is reversed. Stabilizer trim reversal can be interrupted by repositioning the trim button to neutral or by actuating the stabilizer trim cutout switch to the CUTOUT position.

AILERON SYSTEM

Lateral control of the aircraft at normal flight speeds is provided by the aileron system (figure 1-34). The ailerons are control tab-operated floating surfaces of comparatively small size. They are supplemented by spoilers to insure effective lateral control at the slower speeds. Rotation of the control wheels will mechanically operate the aileron control tabs which control aileron movement. In addition, rotation of the control wheels positions hydraulic valves to operate the spoilers simultaneously with the ailerons. See "Spoiler and Airbrake System," this section, for further information on spoilers. Centering springs in the aileron cable system will center the control wheels and provide aileron feel.

Control Wheels

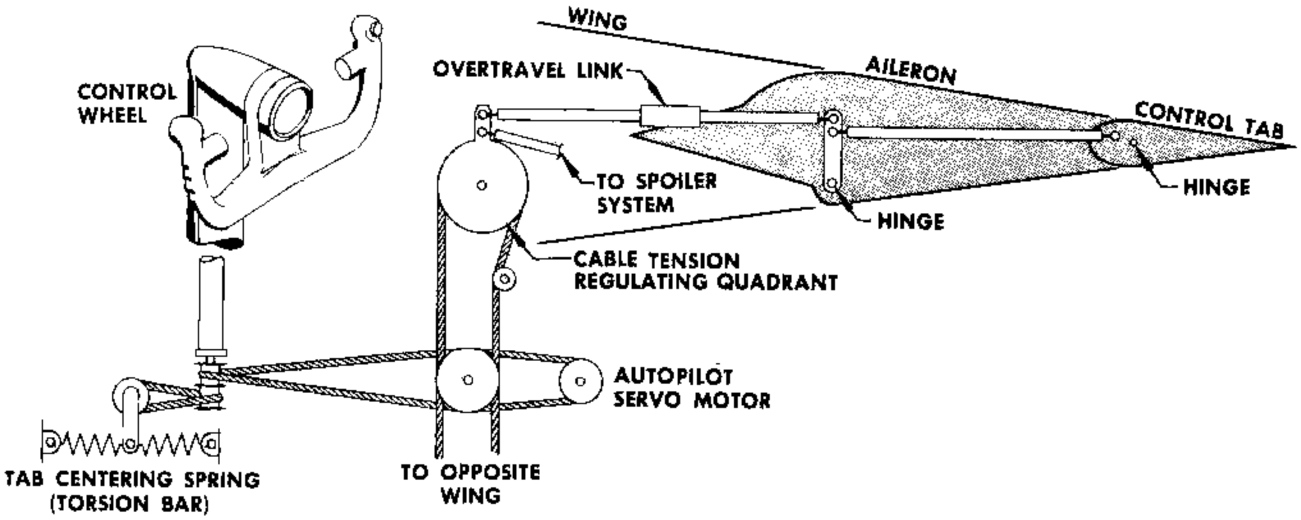
The pilots are provided dual control wheels (3, figure 1-32). Each wheel has, on its outboard grip, an aileron and stabilizer trim button, an autopilot and air refueling (IFR) boom release button, and an interphone trigger switch. On aircraft 110▶ W17▶, a flight data card can be placed in a slot (5, figure 1-32) in front of the medallion on the pilot's and copilot's control wheels.

NOTE

> The control wheels are not disconnected from the lateral controls when the control columns are disconnected.

Aileron and Stabilizer Trim Buttons

For electrical control of the aileron trim, each pilot is provided with an aileron and stabilizer trim button (1, figure 1-32) on the outboard handgrip of his con-



AILERON SYSTEM

Figure 1-34.

trol wheel. These buttons have L WING DN--R WING DN--NOSE DN--NOSE UP--OFF positions. Only the first two positions and the unmarked center OFF position affect the aileron trim. The other two trim positions control stabilizer trim. When slid sideways to the L WING DN or R WING DN positions, this button will close contacts to supply TR power through a circuit breaker marked "Ail & Stab Relays" on the "Trim Cont" portion of the pilots' overhead circuit breaker panel to one of two aileron trim relays. This relay, when energized, will close contacts to supply 118-volt single-phase a-c power through a circuit breaker marked "Aileron" on the "Trim Cont" portion of the pilots' overhead circuit breaker panel to an aileron trim motor in each aileron. These motors drive the aileron trim tabs. Limit switches prevent damage to the system when the aileron control tabs have reached their limit of travel. The d-c control circuit to each aileron trim relay is closed only when the other relay is deenergized. Thus, when one pilot is trimming the ailerons, the other pilot's trim circuit is disconnected. The trim buttons energize either the aileron or the stabilizer trim circuits but not both at the same time. The function of the buttons for stabilizer trim is described under "Stabilizer Trim," this section.

CAUTION

Continuous actuation of the aileron trim mechanism is limited to two complete duty cycles followed by a 10-minute cooling period. See "Aileron Trim Mechanism Limitations," Section V.

Aileron Trim Cutout Switch

The 118-volt single-phase a-c circuit for the aileron trim motors can be disconnected by actuating a guarded CUTOUT--NORMAL switch (19, figure 1-13) on the aisle stand. In CUTOUT position, aileron trim is inoperative. The NORMAL (guard down) position will allow operation of aileron trim by the aileron and stabilizer trim buttons. The switch is provided power through a circuit breaker marked "Aileron" on the "Trim Cont" portion of the pilots' overhead circuit breaker panel.

Aileron Trim Indicators

Two aileron trim indicators (50, figure 1-15) on the pilots' instrument panel indicate the position of aileron trim tabs in units of aileron trim. An individual unit corresponds to a degree of aileron trim tab travel. The aileron trim tab has a travel of 14° (±2°) up and 14° (±2°) down from the neutral position. The neutral position is 2° up, on tab, with no followup ratio. The aileron trim position indicating system operates on TR power through a circuit breaker marked "Ail Trim" on the "Flight Indicators" portion of the pilot's circuit breaker panel.

Synchronizing Aileron Trim Tab Actuators

Aileron trim tabs can be synchronized in flight or on the ground by actuating the aileron trim button until either the extreme left wing down or right wing down position is reached and both actuators are shut off by their respective limit switches. The tabs will then be synchronized and normal operation can be resumed.

CAUTION

> Synchronizing aileron trim tab actuators in flight is not recommended unless a serious control problem exists. Should the actuator clutch stick or the actuator motor fail, it will be impossible to move the tab.

NOTE

> Different vendors supply the trim tab actuators, any combination of which may be used on the same aircraft. Since these actuators do not all have the same operating speed, some combinations will show different trim tab displacements even after resynchronizing. This condition does not affect ability to trim the aircraft. The resynchronizing procedure outlined above restores maximum synchronization when necessary.

SPOILER AND AIRBRAKE SYSTEM

Supplementary lateral control and airbrake action are provided by a spoiler and airbrake system (figure 1-35). Each wing is provided with seven spoilers which perform a dual function. When initiated by control wheel rotation, the spoilers provide additional surface to aid in lateral control at low airspeeds. When an airbrake lever is actuated, the spoiler metering valves open simultaneously, raising the spoilers of each wing symmetrically to act as airbrakes. The spoilers are numbered from left to right: left outboard being No. 1 and right outboard being No. 14. The spoilers have been divided into two groups: group A and group B. Group A includes the No. 1, 2, 3, 4, 11, 12, 13, and 14 outboard spoilers while group B comprises the No. 5, 6, 7, 8, 9, and 10 inboard spoilers. Full spoiler actuation for lateral control is still available when the spoilers are raised as airbrakes.

NOTE

> Above 250 knots IAS, the spoiler actuators do not have sufficient force to raise the spoilers full up. Adequate roll control is still available under these conditions. Because of this force limitation, the roll response with wheel position is not the same with airbrakes up as with zero airbrakes. In the area of spoiler blowdown, a dead area exists, but when the control wheel is rotated beyond this area, spoiler control will be regained and roll control will still be obtained.

SPOILER ACTUATION

The spoiler action is initiated by control wheel rotation which mechanically opens hydraulic metering valves to supply pressure to the spoiler actuators. A mechanical followup system automatically returns the metering valves to the closed position when the spoilers reach the position called for by the control wheels. In case of hydraulic failure, the spoilers will be returned to the down position by air loads. On aircraft 54▶ 63 and W1▶ W3, spoiler return is assisted by spoiler down springs.

AIRBRAKE ACTUATION

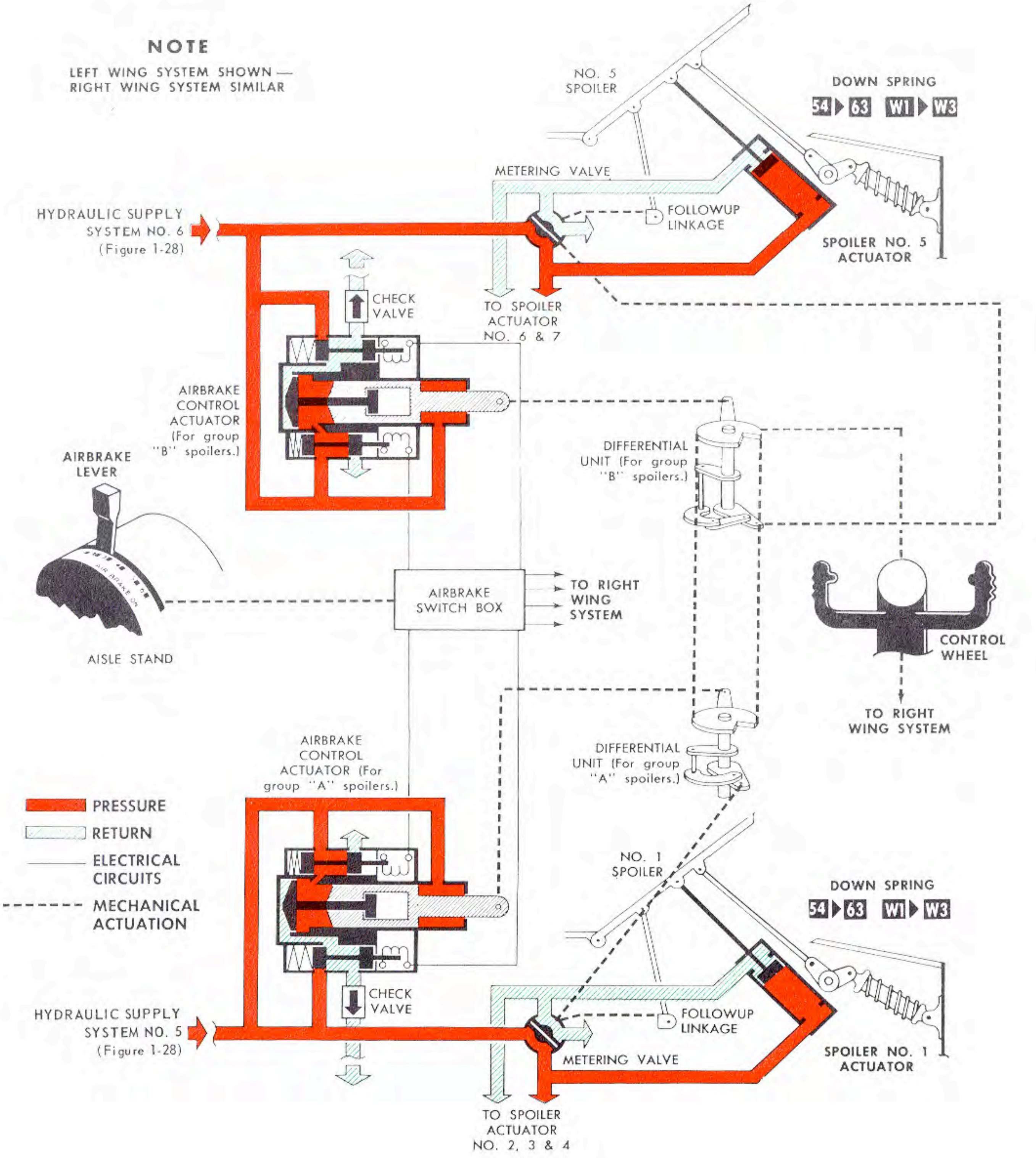
Use of the spoilers as airbrakes is controlled by an airbrake lever which electrically controls solenoid valves and hydraulic control units at each spoiler differential unit. The hydraulic control units reset the spoiler differential units to open the spoiler metering valves simultaneously. Opening both metering valves at once raises the spoilers symmetrically to produce airbrake action. All power and control circuit breakers for the airbrakes are on the pilot's overhead circuit breaker panel. For normal airbrake operation, forward battery power is supplied through two circuit breakers marked "Fwd Bat Pwr," one on the "Inph & Inbd Air Brake" portion and one on the "Emer Warn & Outbd Air Brake" portion of the panel. Emergency aft battery power is supplied through two circuit breakers marked "Aft Bat Pwr" on the same portions of the panel, providing the emergency battery switch is in the EMERG position. Control power for the airbrakes is provided through circuit breakers marked "Air Brake Control Outbd" and "Air Brake Control Inbd."

SPOILER AND AIRBRAKE HYDRAULIC PRESSURE

The hydraulic pressure for spoiler and airbrake actuation is provided by hydraulic systems 5, 6, 7, and 8. The left wing group A spoilers are supplied pressure by hydraulic system No. 5, left wing group B by hydraulic system No. 6, right wing group B by hydraulic system No. 7 and right wing group A by hydraulic system No. 8. No crossfeeding of hydraulic pressure between systems is provided. The same actuators raise the spoilers for airbrake action as for lateral control. A hydraulic control unit resets the spoiler control linkage for airbrake actuation. Actuation of the hydraulic control units is controlled by solenoid valves. These valves are energized in accordance with the position selected by the airbrake lever.

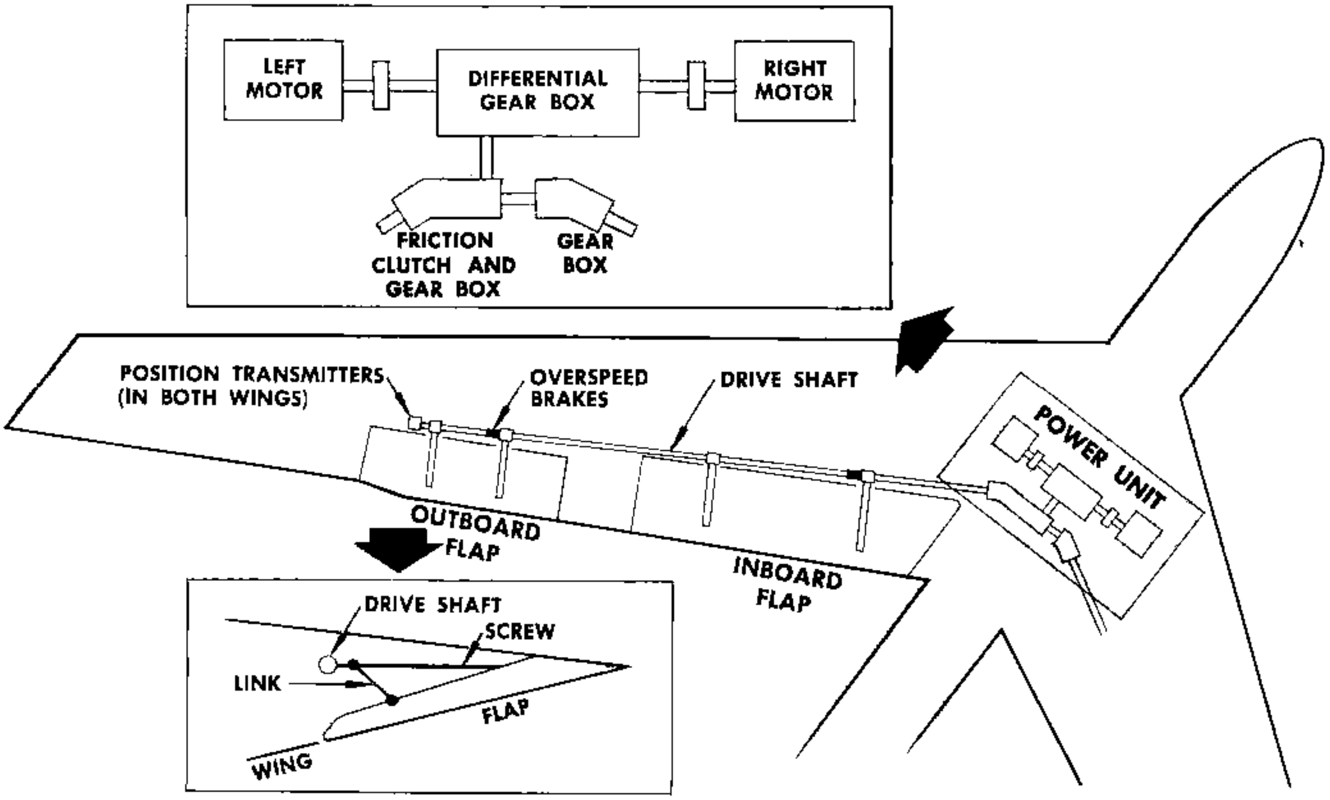
AIRBRAKE LEVER

An airbrake lever (17, figure 1-13) on the pilot's side of the aisle stand operates six contacts in the airbrake switch box supplying switched battery power to the solenoid valves at the hydraulic control units. These units mechanically open the metering valves



SPOILER AND AIR BRAKE SYSTEM (Typical)

Figure 1-35.



WING FLAP DRIVE

Figure 1-36.

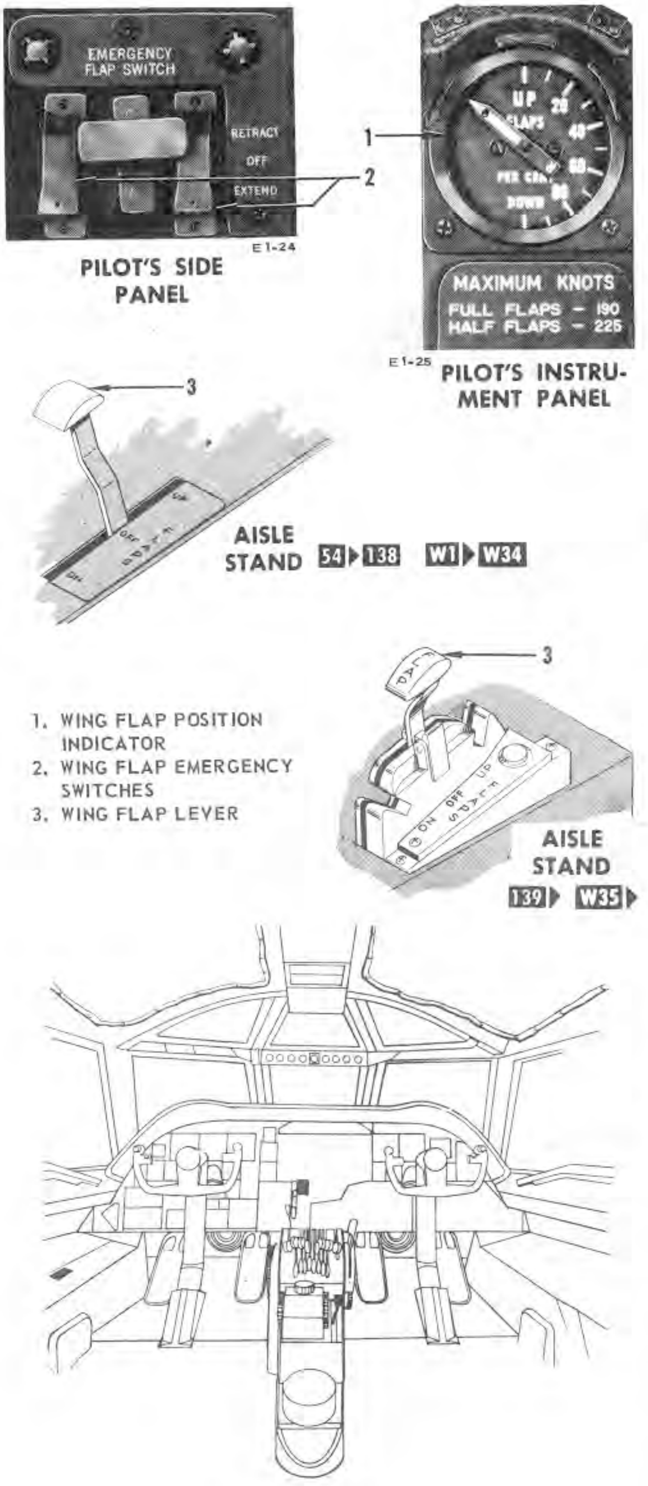
which direct hydraulic pressure to actuate the spoilers. The lever has an OFF position and six operating positions marked 1--2--3--4--5--6. Detents are provided at OFF and at positions 2, 4, and 6. Position 1 marked "AR" is used primarily for air refueling and gives increased roll rate authority. OFF position of the airbrake lever deenergizes the airbrake control circuits and permits the spoilers to provide lateral control only. When the airbrake lever is progressively moved through its full range (with control wheel in neutral), the outboard spoilers and the inboard spoilers will be operated alternately as follows:

LEVER POSITION	OUTBOARD SPOILERS	INBOARD SPOILERS
OFF	0°	0°
1	10°	0°
2	10°	20°
3	40°	20°
4	40°	40°
5	50°	40°
6	50°	60°

Two controlling circuit breakers marked "Air Brake Contr" "Inbd" and "Outbd" are located on the pilot's overhead circuit breaker panel.

WING FLAP SYSTEM

The wing flaps are modified Fowler flaps. Two flap sections are provided on each wing. Flap movement consists of both rotation and rearward travel. During the first 37 1/2% of extension, the flaps rotate downward 35° with little rearward movement. For the remainder of the extension, the flaps move rearward only. During flap extension, most of the drag increase occurs during the first 20% of the flap motion. This initial 20% rotates the flaps down 29° in approximately 10 seconds, leaving only 6° of rotation in the remaining 80% of flap extension. (See figure 6-9 for additional information on flap characteristics.) Each flap section is driven by two screws. All wing flap screws are driven by a common driveshaft which is operated by a power unit in the center wing equipment bay (figure 1-36). This power unit contains two 205-volt three-phase a-c motors and a differential



WING FLAP SYSTEM CONTROLS

Figure 1-37.

gearbox. Each motor is provided with an electrically released brake which will be released only when the motor is energized and putting out torque. Wing flap motors are controlled by either a normal or an emergency control system. These systems differ from each other in power source, circuit, and in that the emergency system has no limit switches. All wing flap control and indicating circuits are supplied 24-volt d-c TR power. When the normal control system is used, the right motor will run for both extension and retraction of the wing flaps. The emergency system has a separate switch to control each motor. A guard is provided to prevent simultaneous operation of both emergency switches so that either motor, but not both, can be used for either extension or retraction of the wing flaps. Extension or retraction time is approximately 40 seconds. For information on the aerodynamic characteristics of the wing flaps, see Section VI.

WING FLAP SYSTEM CONTROLS

Wing Flap Lever

Normal control of the wing flaps is accomplished by use of an UP--OFF--DN wing flap lever (9, figure 1-13) on the aisle stand. The knob of this lever is shaped like a miniature airfoil to facilitate easy recognition. When the lever is placed in the UP or DN position, the wing flaps will retract or extend until limit switches open the circuits. When the lever is on OFF, the wing flaps are held in their last position. On aircraft 139▶W35▶, the wing flap lever quadrant has a positive stop in the neutral or OFF position. The lever knob must be pulled up and the stop depressed inboard before the lever can be moved to either the UP or DN detent. The wing flap lever is provided TR power through a circuit breaker marked "Flap Control Normal" on the "Control Surface" portion of the pilot's circuit breaker panel.

Wing Flap Emergency Switches

Emergency control of the wing flap motors is accomplished by actuation of one of two RETRACT--OFF--EXTEND switches (17, figure 1-10) on the pilot's side panel. These switches are spring loaded and guarded to the OFF position. A switch interlock guard is provided, in addition to the individual switch guards, to prevent the pilot from lifting more than one individual guard at a time. This eliminates inadvertent use of both motors at once. The emergency control system is not equipped with limit switches. If a switch is held in either RETRACT or EXTEND, the motor will drive the wing flaps into mechanical stops and a clutch in the power unit will start slipping. The emergency wing flap switches are provided TR power through circuit breakers marked "Flap Control Emer" - "Left" and "Right" on the "Control Surface" portion of the pilot's circuit breaker panel.

WING FLAP SYSTEM INDICATORS

Wing Flap Position Indicator

A dual wing flap position indicator (35, figure 1-15) is provided on the pilots' instrument panel. This indicator reads from 0% to 100% of wing flap travel. The indicator transmitters are located on the outboard ends of the wing flap drive shaft. The dual indicating system is provided to show any difference in position of the left and right wing flap sections such as would result from a broken drive shaft. The top needle in the indicator, having a hole in it and marked R, indicates the right wing flaps and the bottom needle marked L indicates the left flaps. The wing flap position indicators are provided TR power through a circuit breaker marked "Flap" on the "Flight Indicators" portion of the pilot's circuit breaker panel.

Wing Flaps Up Warning Signal

The wing flaps up warning signal is sounded by the landing gear warning horn. The signal will sound only when the aircraft is on the ground, throttles for engines 3 and 5 or 4 and 6 are at or beyond approximately 80% of NRT, and flaps are not fully extended. A series circuit energized by TR power through the horn, throttles for engines 3 and 5 or 4 and 6, landing gear squat switches, and flap limit switches actuates the horn. Engines 1, 2, 7, and 8 are not included in this circuit. The wing flap warning horn is provided aft switched battery power through a circuit breaker marked "Warn Horn Ldg Gear & Flap" on the "Landing Gear" portion of the pilot's circuit breaker panel.

LANDING GEAR SYSTEM

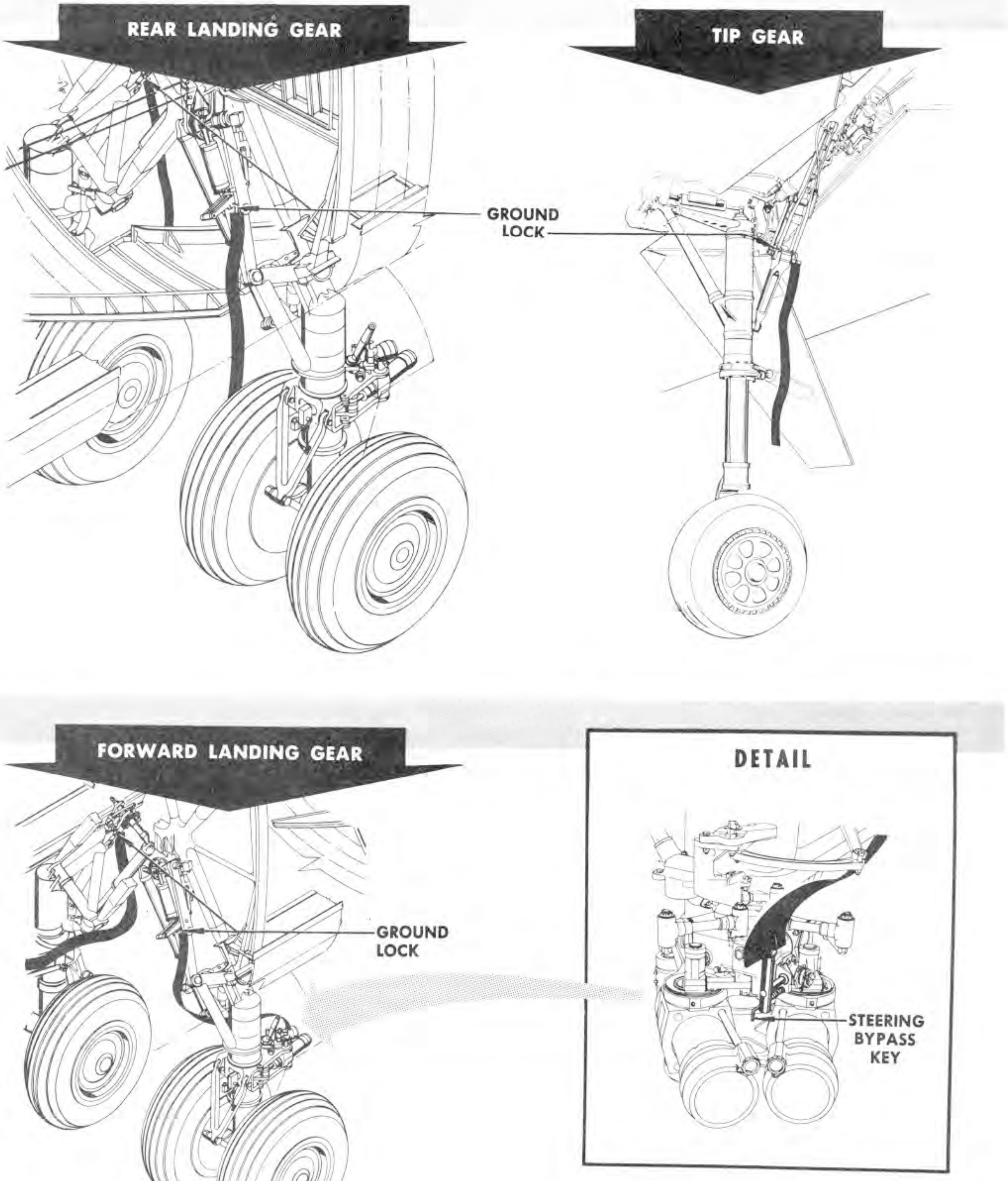
The landing gear system is a composite of the main landing gear system and the tip gear system. The dual wheel main landing gear are in a quadricycle arrangement with two side-by-side forward and two side-by-side rear. The left forward and left rear gear retract forward into fuselage wheel wells while the right forward and right rear gear retract aft into fuselage wheel wells. The tip gear are located between the outboard engine strut and the drop tank strut and retract inboard and slightly forward into each wing. The function of the tip gear is to prevent damage to the wing tips during abnormal ground maneuvers and/or high gross weight conditions. Normally the tip gear tires contact the ground only under maximum weight conditions. All landing gear are hydraulically actuated through electrically operated valves. Retraction and extension of each landing gear is accomplished by its hydraulic actuator with pressure supplied from individual hydraulic systems. A single mechanical lock on the main landing gear drag strut locks the main landing gear in either the extended or the retracted position. Safety switches prevent inadvertent gear retraction on the ground. There are no provisions for overriding these switches in an emergency. The landing gear is fully retracted in 8 to 10 seconds or extended in 10 to 12 seconds. The main landing gear doors are connected to the main landing gear and follow the cycle of operation selected by the normal landing gear lever or the landing gear emergency switches. The tip gear doors, however, are in two sections. The strut section is connected to the tip gear and follows the cycle of operation for the gear. The wheel well section is hydraulically actuated and is controlled for proper sequence operation by mechanical linkage in the tip gear system. For information on landing gear brakes, see "Wheel Brake System," this section. For information on landing gear steering and crosswind crab operation, see "Steering and Crosswind Crab System," this section.

LANDING GEAR GROUND LOCKS

Three pairs of landing gear ground locks (figure 1-38) prevent retraction of the landing gear on the ground. Each ground lock is a pin-type lock with a red warning streamer attached. Each pair of locks differs from the other two pairs for identification purposes. The tip gear locks are the smallest of the three types. The rear main gear locks are of a larger type and have the pin on only one end of the streamer. The front main gear locks have the ground lockpin on one end of the streamer and a two-pin arrangement on the other. The two-pin arrangement is the steering valve bypass key. The ground lockpins are inserted in each main landing gear drag strut and each tip gear side brace.

MAIN LANDING GEAR SYSTEM

Each landing gear of the main landing gear system (figure 1-39) is supplied with hydraulic pressure by an individual hydraulic system. An emergency source for extension and retraction is provided by an alternate system. The left forward main landing gear receives its normal pressure from hydraulic system No. 1 with hydraulic system No. 2 supplying emergency pressure. The pressure sources are reversed for the right forward main gear, with No. 2 serving as normal and No. 1 as emergency. The left rear main gear normal pressure is provided by hydraulic system No. 3 with hydraulic system No. 4 as emergency. Normal pressure for the right rear main gear is supplied by hydraulic system No. 4 and emergency pressure is from hydraulic system No. 3. Normal hydraulic pressure is directed to the main landing gear through solenoid-actuated normal control valves and through shuttle valves. The solenoids are energized by a series of switches which are controlled by the landing gear lever. The shuttle valves, spring loaded for normal pressure and hydraulically



LANDING GEAR GROUND LOCKS

Figure 1-38.

actuated for emergency pressure, route either normal or emergency pressure to the landing gear actuators. To prevent hydraulic system failure due to a malfunctioning shuttle valve, a relief valve is installed to bypass excessive hydraulic pressure that may result from shuttle valve blockage. When the pressure on the retract side of the actuator reaches 3500 (±50) psi, the relief valve opens and routes the retract pressure around the shuttle valve and the normal control valve into the main system return line. The normal gear-up circuit supplies power to the crosswind crab centering motor through centering switches to insure centering of the main landing gear prior to retraction. This circuit also includes oleo safety switches which prevent inadvertent retraction when either the left front or right rear main landing gear is on the ground and the oleo strut is compressed more than 0.75 inch. A gear uplock switch deenergizes the hydraulic pack circuits when the gear is up and locked. With the landing gear up and locked, the hydraulic packs will operate when the master bomb control switch, the BNS through the bombing system and door control switch, the slipway door switch, the pilot's bomb door switch, and the bomb salvo switch are actuated. Since the landing gear will free fall almost to the locked position, a position switch is included in the circuit. This switch keeps the circuit energized until the landing gear reaches the full down and locked position. If a failure of the normal system occurs, actuation of the desired main landing gear emergency switch will route hydraulic pressure from the proper alternate hydraulic pack to the system which failed. Actuation of emergency landing gear switches does not automatically center the landing gear.

LANDING GEAR SAFETY SWITCHES

Microswitches are installed on each landing gear main strut so that compression of the landing gear oleos actuates the switches which, through relays, operate various systems. Compression of the oleos sufficient to actuate the safety switches may take place in either of two ways: 1) when the weight of the aircraft is supported on the ground by the landing gear or 2) when in flight with the gear extended, the crosswind crab is actuated to an angle of 14° or more. The following described actions take place upon actuation of the landing gear safety switches:

- Cabin pressure dump valve is opened.
- The electromechanical yaw damper becomes inoperative.
- Air for oil cooling will be transferred to the ground flap system.
- Air for the air conditioning system is drawn from the forward wheel well.
- Airscoop and Q-spring anti-icing, if on, will be turned off.
- The antiskid valves will be deenergized and application of brakes prior to landing will result in locked brakes. Normal braking may be applied during the landing roll.
- Drop tanks cannot be released.
- The BNS ground cooling system blowers will operate.
- The BNS overheat system automatic shutdown thermal switch will become armed.
- The flap warning horn will sound if the throttles are at or beyond approximately 80% of NRT and the flaps are not fully extended.
- IFF Mode 4 zeroize if Mode 4 selector switch is not placed in HOLD position.
- The AGM-28 anti-ingestion systems become operative.
- The AGM-28 anti-ice systems become inoperative.
- The ground interphone panels become operative.
- The landing gear cannot be retracted by either the normal or emergency controls.
- The alternator blowers will be turned on.
- The AN/ALE-20 flare ejection circuits will become dearmed, preventing flares from being ejected.

TIP GEAR SYSTEM

The tip gear system (figure 1-40) for each gear receives normal hydraulic pressure from an individual hydraulic system. Hydraulic system No. 5 supplies the left tip gear and hydraulic system No. 8 supplies the right tip gear. Hydraulic systems No. 6 and 7 are used to provide hydraulic pressure for emergency extension of the left and right tip gear, respectively. Standby pressure is also available from No. 6 and 7, if the spoiler standby pump switch is on. There are no provisions for emergency retraction. The tip gear system operates in an indirect manner. In gear-down operation, the normal landing gear lever actuates switches which energize the down circuit. When the solenoid in the normal control valve is energized, hydraulic pressure is directed to the wheel well door actuator and to the normal sequence valve. When the wheel well door opens, mechanical linkage opens the normal sequence valve permitting hydraulic pressure to enter the tip gear actuator thus extending the tip gear. A reverse sequence insures proper door and gear timing during the retraction cycle. The tip gear circuits pass through the main landing gear oleo safety switches to prevent inadvertent retraction on the ground.

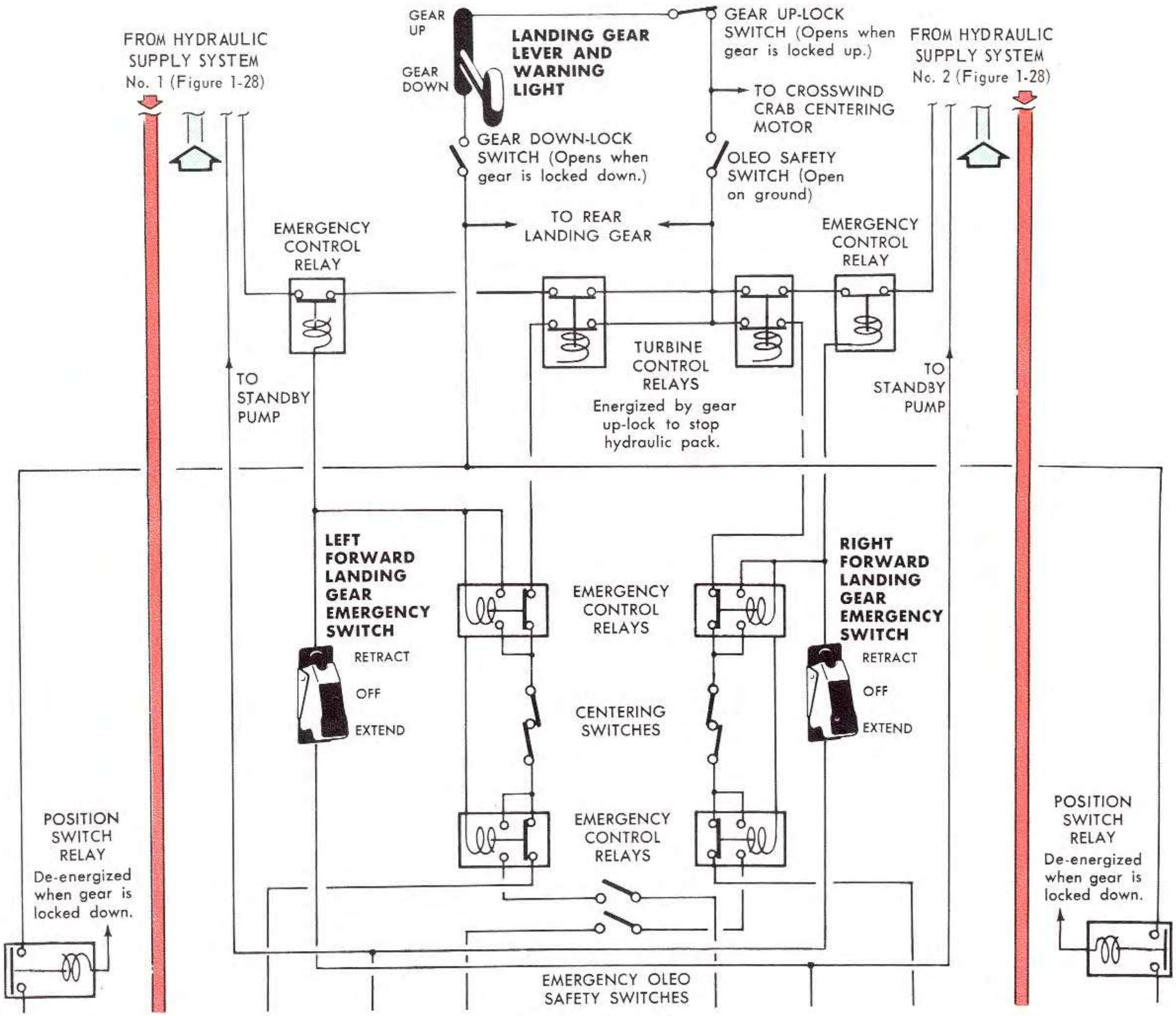
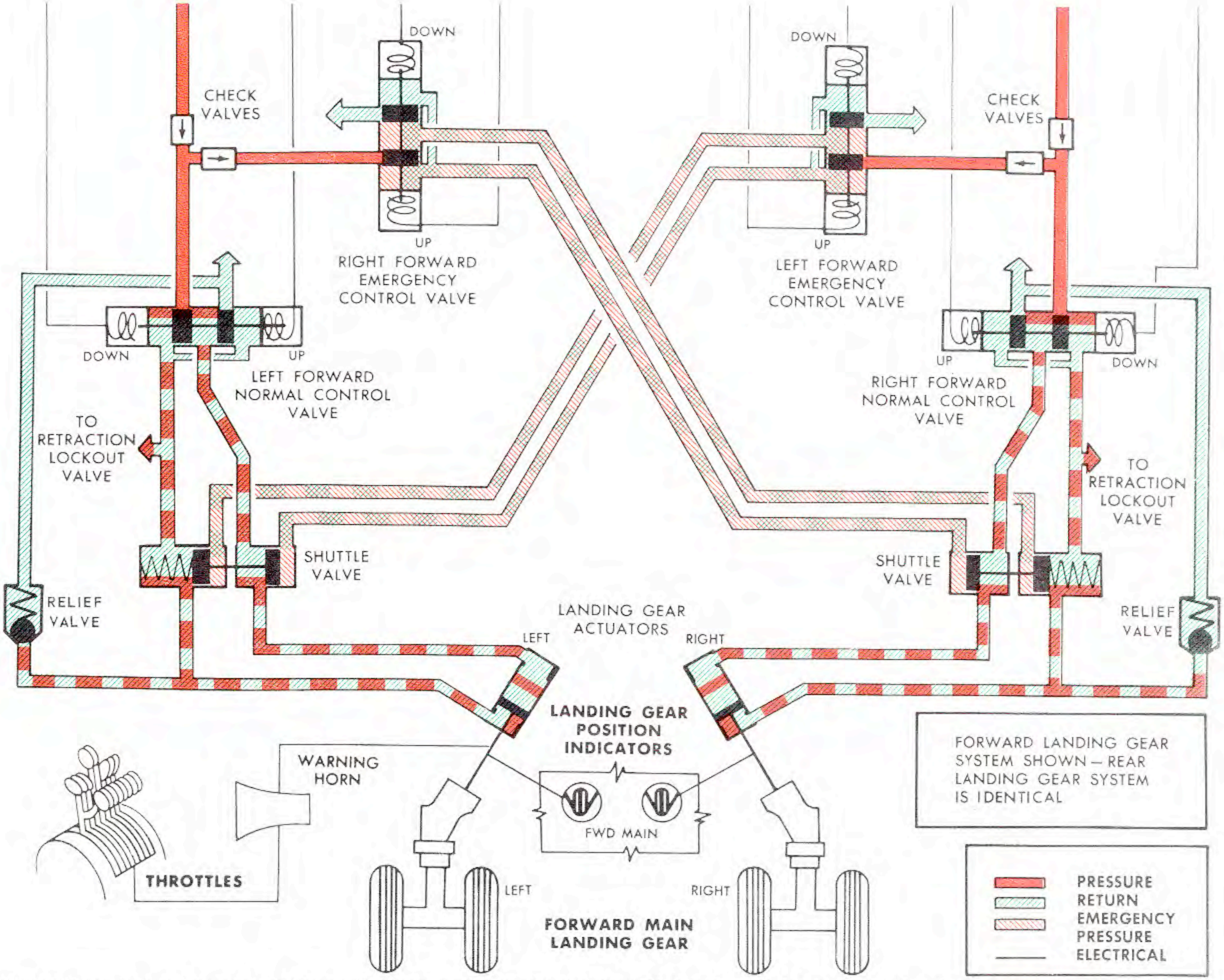
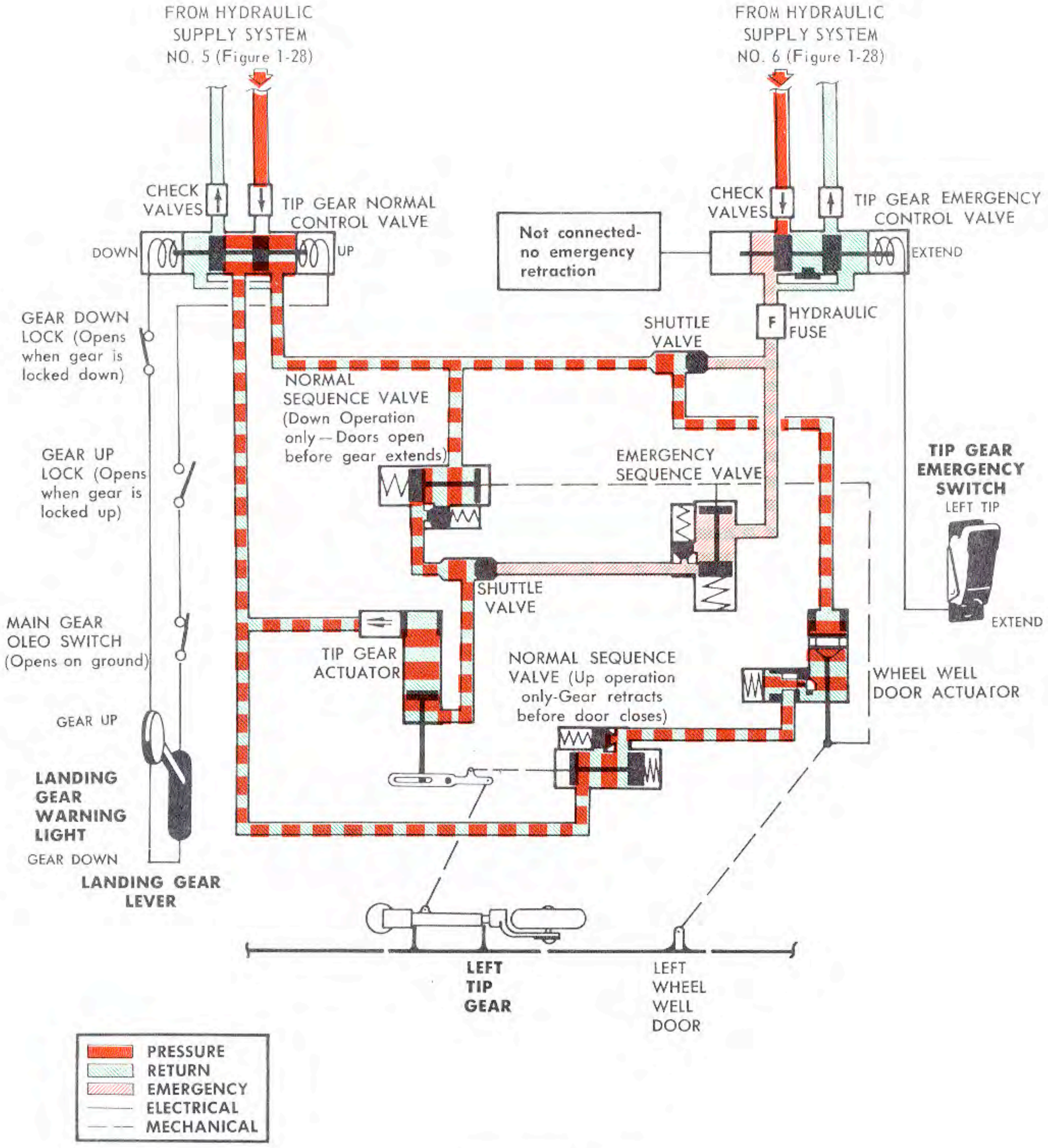


Figure 1-39 (Sheet 1 of 2).



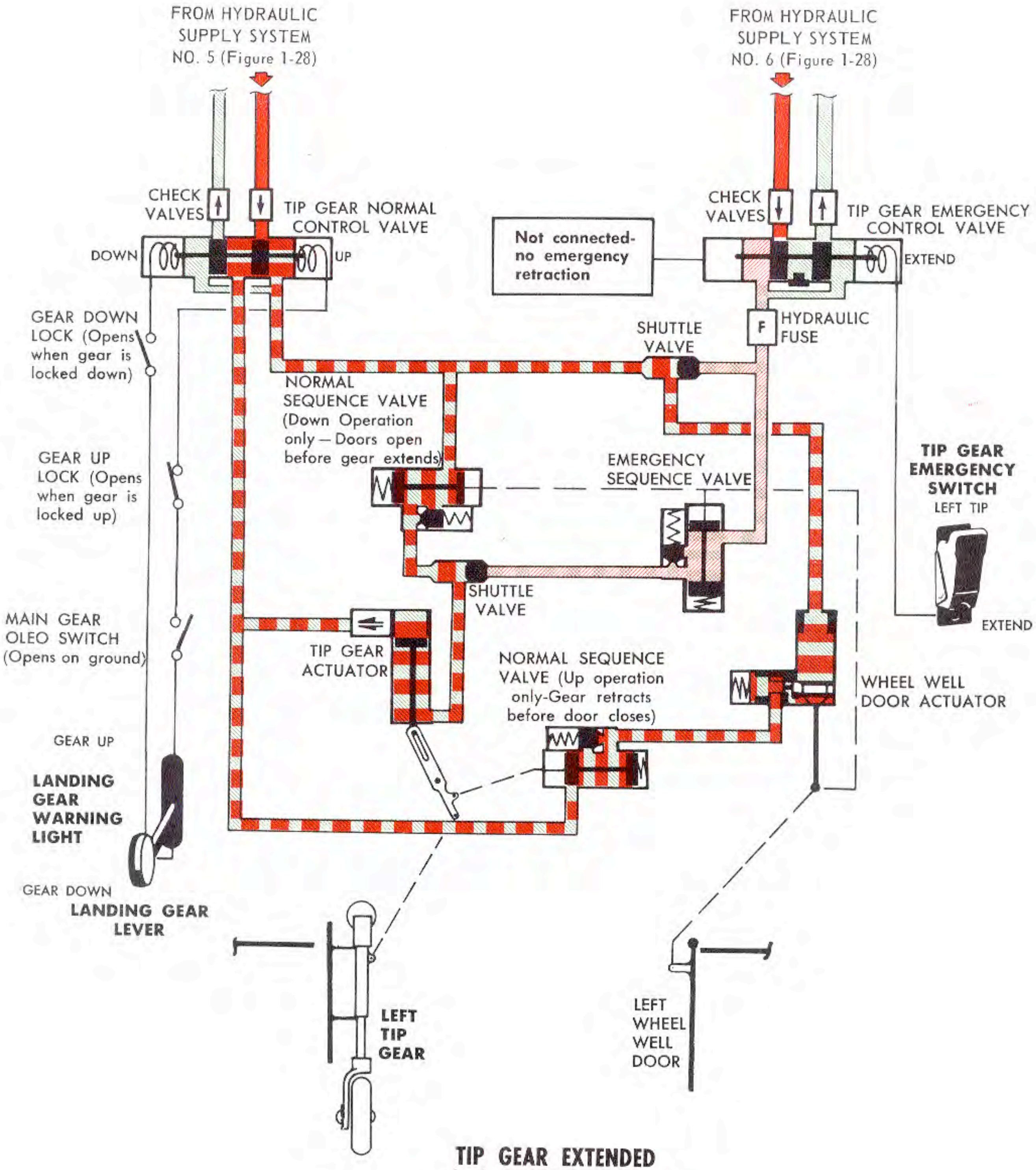
MAIN LANDING GEAR SYSTEM (Typical)

Figure 1-39 (Sheet 2 of 2).



TIP GEAR RETRACTED
(Left Tip Gear Shown
Right Tip Gear — Opposite)

Figure 1-40 (Sheet 1 of 2).



TIP GEAR EXTENDED
(Left Tip Gear Shown
Right Tip Gear — Opposite)

TIP GEAR SYSTEM

Figure 1-40 (Sheet 2 of 2).

LANDING GEAR SYSTEM CONTROLS

CAUTION

- During retraction or extension of the landing gear by either the normal or emergency system, do not change the position of the control handle or the emergency switch while the gear is in motion since this procedure may rupture a hydraulic line.

- During retraction or extension of the landing gear by one system, do not actuate the other system while the gear is in motion since this procedure may rupture a hydraulic line.

Landing Gear Lever

A landing gear lever (2, figure 1-41) is located on the pilots' instrument panel ahead of the aisle stand. The lever handle is in the shape of a miniature landing gear wheel to facilitate recognition. Positions of the lever are GEAR UP--GEAR DOWN. The landing gear lever is held by a spring-loaded pawl and a detent on the inside end of the lever making it necessary to pull out on the handle approximately 1/4 inch to move the lever from one position to the other. In changing positions of the landing gear lever, the pawl travels over the lever quadrant surface which has detents at each end for engaging the pawl in the GEAR UP or GEAR DOWN position. The quadrant has a safety stop at a midpoint position between the detents. This safety stop provides a GEAR DOWN latched position if the pawl on the landing gear control lever fails to remain in the GEAR DOWN detent. Movement of the lever actuates a group of switches which control the solenoids of the control valves and the first motion of the landing gear hydraulic actuator will unlock the locks for gear actuation in either the up or down position. The landing gear lever is mechanically linked to a steering ratio selector unit which prevents movement to GEAR UP until the steering ratio selector lever is in TAKE OFF, LAND position. This mechanical linkage also adjusts the steering ratio selector unit to zero ratio when the landing gear lever is moved to GEAR UP. The GEAR DOWN position of the landing gear lever energizes the landing light and crosswind landing light circuits. The landing gear lever controls forward switched battery power for the right aft and left forward main landing gear and aft switched battery power for the right forward and left aft main landing gear. Normal operating power is through circuit breakers marked "Normal Control" - "Left" - "Tip," "Fwd," and "Rear" and "Right" - "Tip," "Fwd," and "Rear." Emergency power is provided through circuit breakers marked "Emergency Control" - "Left" - "Tip," "Fwd," and "Rear" and "Right" - "Tip," "Fwd," and "Rear." All circuit breakers are on the "Landing Gear" portion of the pilot's circuit breaker panel.

NOTE

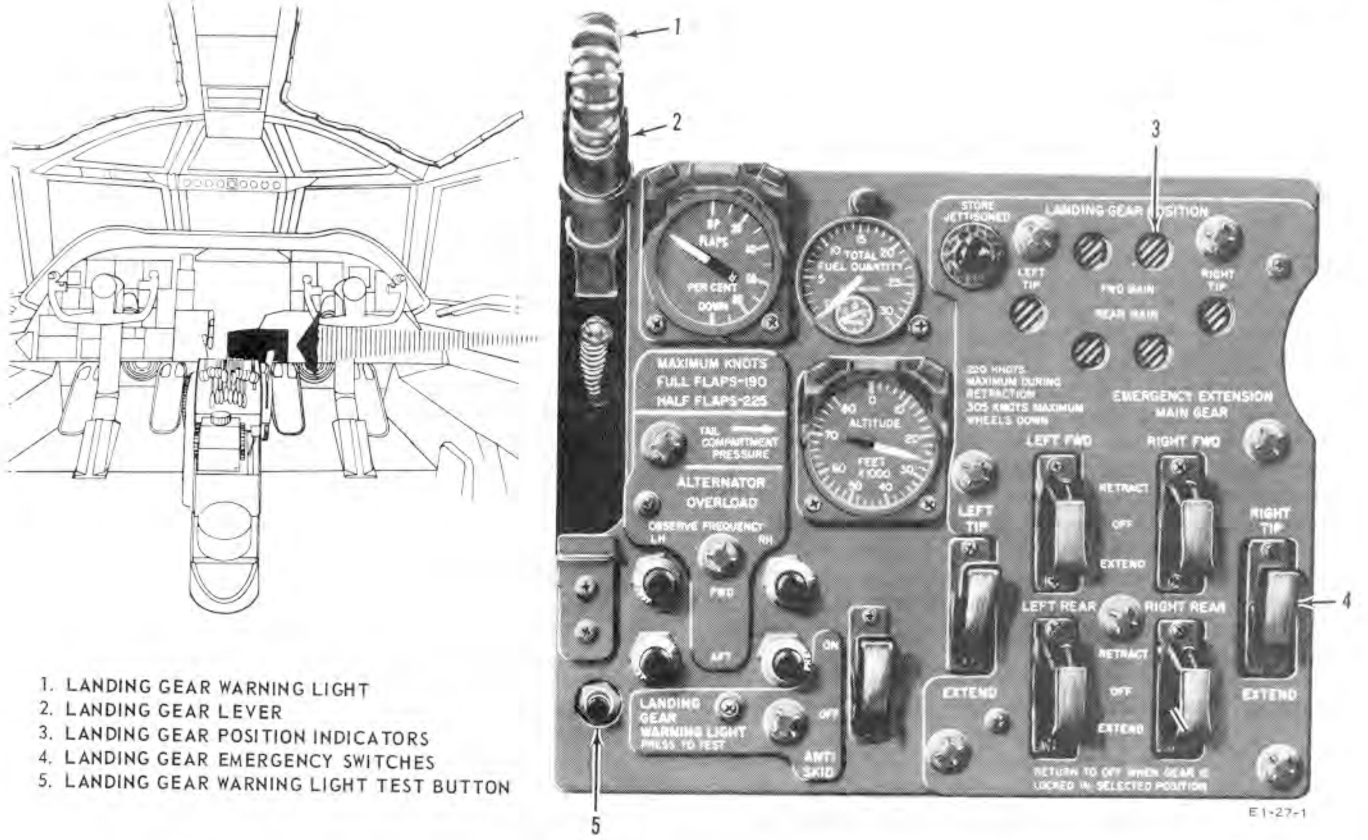
- An automatic double-lock arrangement is provided at the down position of the landing gear lever to insure a positive lock.

- A spring-loaded second locking pawl is permanently attached to the underside of the landing gear lever. This engages to a mating latch attached to the surface of the instrument panel. When the landing gear is placed in the GEAR DOWN position, the locking pawl slides over the top of the mating latch and is engaged on the lower surface in a positive locked position. The locking pawl is disengaged from the mating latch by normal operation of the landing gear lever.

- The effort required to operate the landing gear lever is increased if the rudder pedals are not in neutral. With the rudder pedals displaced to their maximum limit, the effort required to move the lever is about 30 pounds. This increase in operating effort is caused by picking up the centering spring cam in the steering system ratio selector.

Landing Gear Emergency Switches

Six guarded switches (4, figure 1-41) on the right of the landing gear lever are used for emergency actuation of the landing gear. Four switches, one for each main landing gear, have EXTEND--OFF--RETRACT positions. The other two switches, one for each tip gear, have only EXTEND--OFF positions since there are no emergency retraction provisions for the tip gear. The switch guards are spring loaded and are designed to return the switches from other positions to OFF position when the guards are closed. On aircraft 83▶ W9▶, the guards are hinged at the top on main landing gear switches; on other aircraft, the switches are all hinged at the bottom. The emergency switches control forward direct battery power for the right forward and left aft main landing gear and aft direct battery power for the left forward and right aft main landing gear. Each main gear switch operates an emergency control valve to direct pressure from an alternate hydraulic system for gear actuation and, at the same time, energizes the standby pump of the alternate hydraulic system. Each tip gear emergency extend switch operates an emergency control valve of the alternate system, but not the alternate standby pump (figure 1-40). Each separate landing gear may be actuated independently of the others by use of the individual emergency switches. Operation of the main landing gear control lever does not affect the position of the landing gear when the emergency switches are placed in



1. LANDING GEAR WARNING LIGHT
2. LANDING GEAR LEVER
3. LANDING GEAR POSITION INDICATORS
4. LANDING GEAR EMERGENCY SWITCHES
5. LANDING GEAR WARNING LIGHT TEST BUTTON

LANDING GEAR CONTROLS (TYPICAL)

Figure 1-41.

EXTEND position. Actuation of the emergency landing gear switches does not automatically center the landing gear. There are no limit switches in the emergency circuits; therefore, the emergency retract and extend circuits are energized until the emergency switches are returned to OFF position. Due to actuation of the main landing gear oleo squat switches by the weight of the aircraft, either the normal or the emergency retract circuits cannot be energized for retraction when the aircraft is on the ground. Landing gear actuation is provided by individual emergency switches when certain gear has failed to actuate after positioning of the main landing gear control lever to the position desired. Emergency control circuit breakers marked "Left - Tip, Fwd, and Rear" and "Right - Rear, Fwd, and Tip" are located on the "Landing Gear" portion of the pilot's circuit breaker panel.

NOTE

- Limit emergency landing gear switch actuation to 10 seconds maximum if gear has failed to extend or retract after unlocking by use of the normal system.
- Should a single battery be the only electrical power source available, the main landing gear can still be extended or retracted through the combined use of the landing gear lever and emergency switches. See "Electrical System Emergency Operation," Section III.

LANDING GEAR SYSTEM INDICATORS

Landing Gear Position Indicators

Six tab-window type landing gear position indicators (3, figure 1-41) in the lower center of the pilots' instrument panel and a red landing gear warning light (1, figure 1-41) in the end of the landing gear lever indicate landing gear position. Each tab indicator has three visual indicators to register landing gear position. When the landing gear is up and locked, the word UP appears in the tab window. A gear in an intermediate position is indicated by slanting alternate red and yellow stripes. The appearance of a wheel symbol indicates a gear down and locked. Whenever gear actuation is taking place and the landing gear position does not agree with the landing gear lever position or the landing gear warning horn is blowing, the red light in the landing gear lever illuminates. As soon as the landing gear is locked in the selected position, the red light goes out provided the warning horn is not blowing. The indicators operate normally on switched battery power and are provided power from the aft battery when the emergency battery switch is in the EMERG position. A landing gear warning light test button (5, figure 1-41) is located near the landing gear lever on the instrument panel. The landing gear warning light will be illuminated when this button is depressed. On aircraft 89▶ 125 W1▶ W26, it is possible that actuation of this button will also result in sounding of the landing gear warning horn. However, failure of the horn to respond does not necessarily indicate a faulty condition and therefore this should not be considered a method of testing the horn. The landing gear position indicators are provided power through a circuit breaker marked "Pos Ind." The warning light is provided power through a circuit breaker marked "Sw & Pos Warn." Both circuit breakers are on the "Landing Gear" portion of the pilot's circuit breaker panel.

Landing Gear Warning Horn and Shutoff Button

The landing gear warning horn is flush mounted on the pilot's side panel. The horn sounds a warning when any throttle is retarded near IDLE while any one landing gear is not down and locked. A single shutoff button (7, figure 1-13) on the copilot's side of the aisle stand may be used for silencing the horn. The horn will, however, sound again when another throttle is retarded. The warning horn operates on TR power through a circuit breaker marked "Warn Horn Ldg Gear & Flap" on the "Landing Gear" portion of the pilot's circuit breaker panel.

NOTE

> When all throttles have been retarded and the shutoff button has been used to silence the warning horn, a throttle must be advanced to reactivate the warning horn system. This is necessary to insure proper warning horn operation for an unsafe gear condition.

STEERING AND CROSSWIND CRAB SYSTEMS

A means of steering the aircraft on the ground and of presetting the crab angle of the landing gear during crosswind landings and takeoffs is furnished by two separate yet integrated systems known as the steering and the crosswind crab system (figure 1-42). The need for a system to steer the aircraft on the ground becomes obvious when one considers that no differential wheel braking is available and that differential engine thrust is ineffective at low speeds. The steering system and crosswind crab system are integrated through mechanical and cable linkage to a differential coordinating unit. Cable and mechanical linkage from this unit operate steering metering valves on both forward and rear main gear. The steering metering valves meter hydraulic pressure to the actuating cylinders which position each forward gear for steering or all four gear for crosswind crab.

NOTE

> Actuation of the crosswind crab system sets up a new neutral position for steering which does not affect the turning angle available with the takeoff and landing steering ratio but limits the turning angle available with the taxi steering ratio. With crosswind crab set and the steering ratio selector in the taxi range, the available turning angle is 55 degrees minus the crab setting in the direction of crab.

STEERING SYSTEM

The forward main landing gear is steered by hydraulic pressure controlled by movement of the rudder pedals. The left forward gear uses pressure from hydraulic system No. 1 and the right forward gear uses pressure from hydraulic system No. 2. There is no emergency source of hydraulic pressure provided for steering. In the event of steering failure on one front gear, it will trail the other front gear which has steering available. Steering is accomplished when the rudder pedals move mechanical and cable linkage through a ratio selector unit and a differential coordinating unit to the metering valves which hydraulically position the forward main gear. The steering ratio selector unit mechanically limits steering angles for two conditions. A taxi ratio allows the forward gear to be turned to a maximum angle of 55 degrees right or left of a center position with full rudder pedal travel. The second ratio is used for takeoff and landing and restricts the turning angle to 12 degrees right or left of center. The differential coordinating unit has three main components, a forward drum, a jackscrew, and a rear drum; all three are interconnected. Rudder pedal movement for steering mechanically moves the forward drum in an amount determined by the ratio selector. Movement of the forward drum moves the rear drum through linkage to mechanically operate the steering metering valves on each of the forward main gear. These valves meter hydraulic pressure to the actuating cylinders to position the gear as desired. During towing operations, a valve between the steering actuating cylinders on each forward gear must be opened by a steering bypass key to bleed pressure. This is to prevent damage caused by hydraulic locking of the pistons in the actuating cylinders. The bypass keys are on one end of each of the forward gear ground lock streamers. Each bypass key has a two-pin arrangement. When the key is inserted into the steering metering valve receptacle, one pin secures the key in place and the other moves the bypass valve to bleed pressure. Centering springs are provided near each steering valve which only assist in returning the gear and rudder pedals to neutral whenever pressure on the rudder pedals is removed.

NOTE

> For maximum steering and rudder control, no rudder trim should be used. The maximum steering angle is reduced when rudder trim in the opposite direction is used. For example, steering to the left is reduced when nose-right trim is introduced. The steering angle is reduced proportionally to the amount of trim used to displace the rudder pedals.

Steering Ratio Selector Lever

A steering ratio selector lever (2, figure 1-43) on the left forward end of the aisle stand is used to select one of two steering ratios. The two ratios are TAXI--TAKEOFF, LAND which allow steering of up to 55 degrees and 12 degrees respectively. To move the lever from either one of these positions, a knob on the lever must be pulled up to free the lever from a detent position. When the lever is moved from one position to the other, it mechanically adjusts the steering ratio selector unit to limit the angles of turn available. The ratio selector lever is mechanically linked to the landing gear lever. This is done to prevent moving the landing gear lever up unless the ratio selector lever is in TAKEOFF, LAND and to prevent moving the ratio selector lever while the landing gear are retracted. When the landing gear lever is moved to GEAR UP, the linkage will adjust the steering ratio selector unit to a zero steering ratio. This prevents any actuation of the steering metering valves by rudder pedal movement and returns the steering control system to center. Since normally the landing gear lever will be positioned before using the emergency landing gear switches, the ratio selector will usually be adjusted accordingly. Centering cams in each gear maintain the gear at centered position as soon as oleos are fully extended. A trunnion swivel shutoff valve is on each main gear and shuts off hydraulic pressure to the steering valves when the landing gear is approximately 38 to 60 degrees from the fully extended position. This prevents steering action before the gear has cleared the wheel well during landing extension.

NOTE

> With the steering ratio selector lever in either the TAXI or TAKEOFF, LAND position, the landing gear will follow the rudder pedal displacement by a predetermined amount. Moving the selector lever from one to the other position will be met by increasing resistance as the rudder displacement is increased from the neutral position. This is the result of attempting to steer the landing gear to the new position as required by the steering ratio selector unit through use of the selector lever. This condition can be avoided by placing the rudder pedals in the neutral position before moving the steering ratio selector lever.

CROSSWIND CRAB SYSTEM

A crosswind crab system is provided on this aircraft to facilitate making crosswind landings and takeoffs and to reduce the hazards of crosswind conditions. The crosswind crab system provides a means of turning all four main gear to align with the runway while the aircraft is flown on wings-level heading into the wind. This system utilizes the steering actuators on the front main gear and a similar set on the rear main gear. The landing gear can be preset and turned up to 20 degrees left or right of center during the approach. The maximum of 20 degrees crab will accommodate landings in crosswinds up to and including 43 knots blowing 90 degrees to the runway at a landing weight of 270,000 pounds. The direction of the landing gear is preset by a crosswind crab control knob which mechanically operates the steering metering valves on each main gear. These valves meter hydraulic pressure to the actuating cylinders to position the gear as desired. The crosswind crab system is automatically centered when the landing gear lever is moved to the GEAR UP position. On the ground, after landing, the gear is quickly centered by a pilot-operated centering button or by turning the crosswind crab control knob to center.

Crosswind Crab System Controls

CROSSWIND CRAB CONTROL KNOB. The crosswind crab control knob (3, figure 1-43) is recessed in the rudder trim control knob on the aft end of the aisle stand. The control has an indicator in the form of a miniature aircraft which points to a degree scale to indicate the amount of nose left or right trim selected. To move the control it is necessary to lift up before turning. When the crosswind crab control knob is turned for trim, cable linkage moves the jackscrew at the differential coordinating unit. The jackscrew positions the rear drum of the coordinating unit to move cable and mechanical linkage to operate the forward gear steering metering valves. The jackscrew also moves cable and mechanical linkage to operate the rear gear steering metering valves. It is to be noted that the rear main gear can be steered only through movement of the jackscrew of the coordinating unit while the forward main gear is steered by movement of the rear drum of the coordinating unit. The rear drum can be moved both by the jackscrew for crosswind crab and by the forward drum of the coordinating unit for steering by

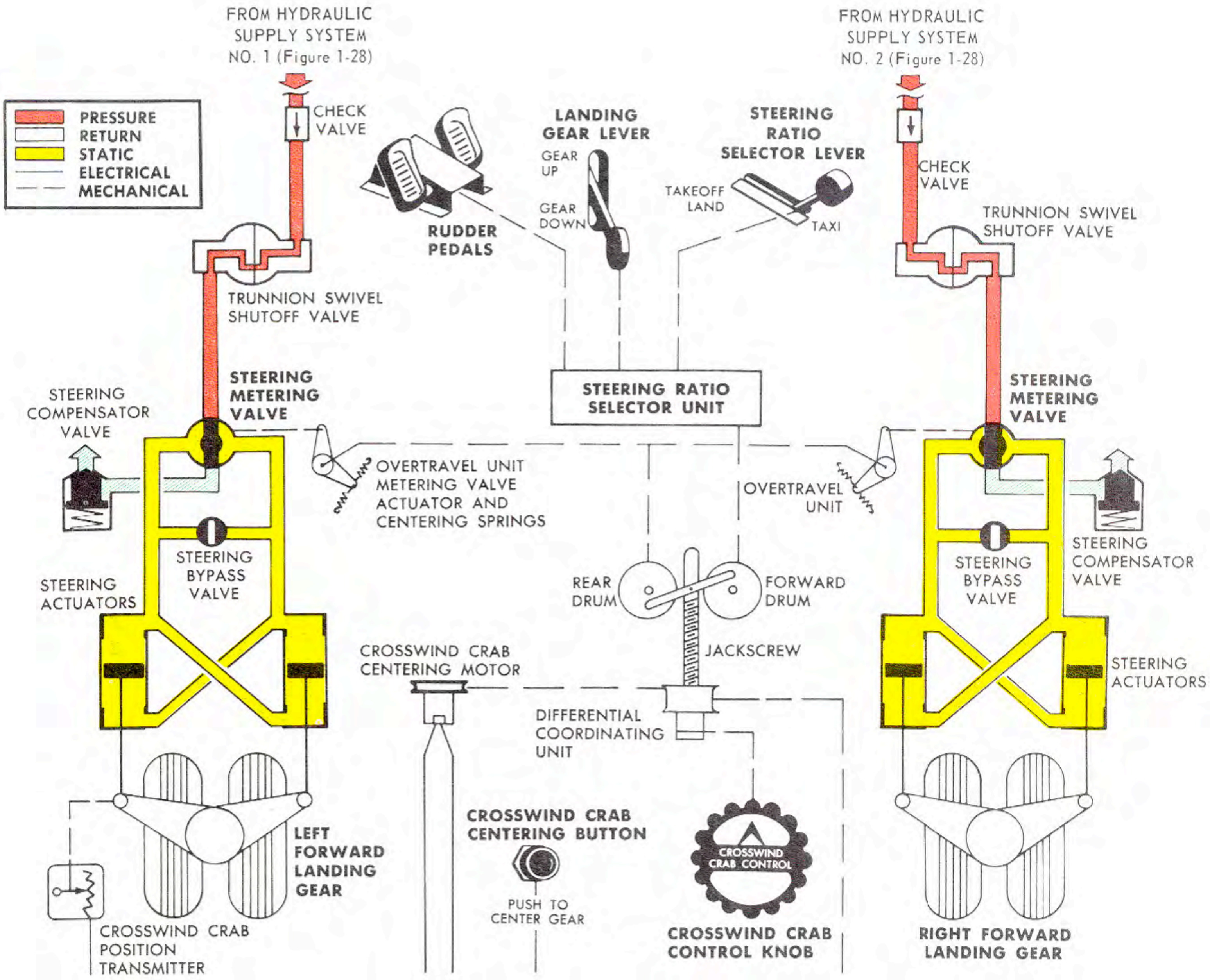
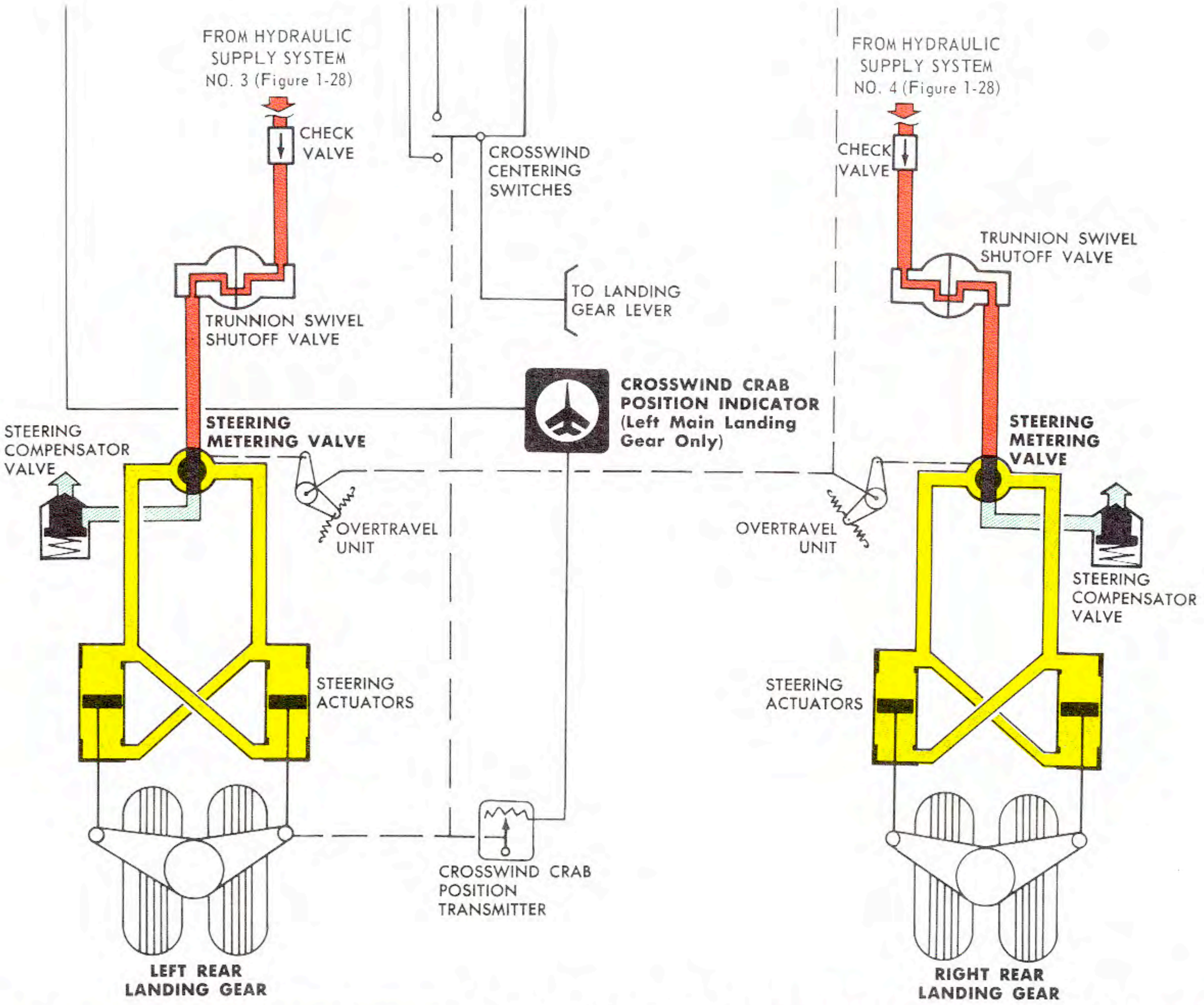
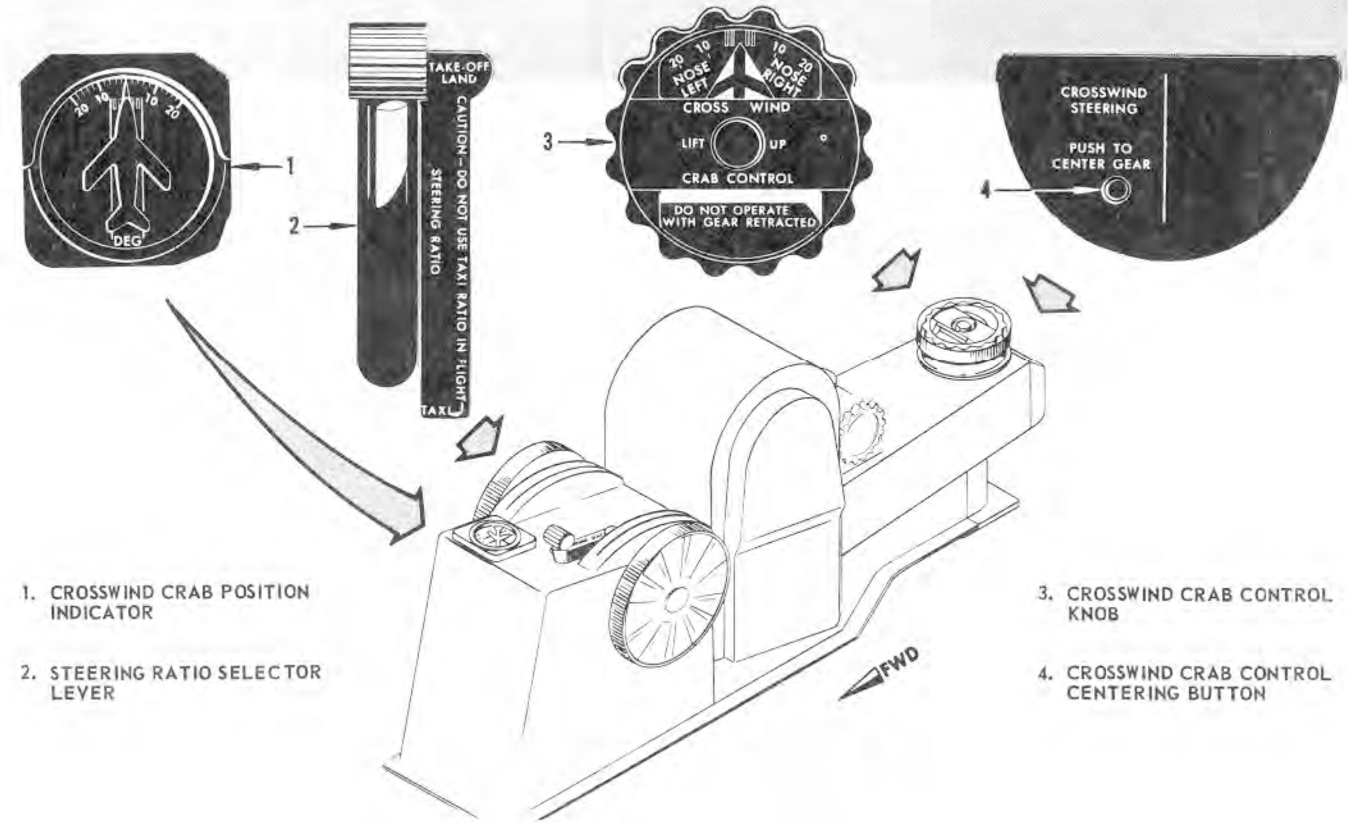


Figure 1-42 (Sheet 1 of 2).



STEERING AND CROSSWIND CRAB SYSTEM

Figure 1-42 (Sheet 2 of 2).



STEERING AND CROSSWIND CRAB CONTROLS

Figure 1-43.

the rudder pedals. This action allows steering of the forward gear even when the forward gear is preset for crosswind crab.

NOTE

> When the main landing gears are extended and crabbed in flight to an angle equal to or exceeding 14° through any combination of crosswind crab setting and rudder pedal movement, the landing gear safety switches will be actuated. See "Landing Gear Safety Switches," this section.

CROSSWIND CRAB CENTERING BUTTON. A crosswind crab centering button (4, figure 1-43) aft of the crosswind crab control knob on the aisle stand is used to center all four main landing gear from a turned position to neutral. The crosswind crab centering button controls an electric motor which turns the jackscrew in the coordinating unit in the desired direction to center all four gear. When the left rear gear is centered, power to the motor is interrupted causing all centering action to stop. The centering button is a push-type switch spring-loaded to OFF position. Electrical TR power is supplied through a circuit breaker marked "Ctring" on the "Landing Gear" portion of the pilot's circuit breaker panel. The direction of the motor is governed by two cam-actuated centering switches on the left rear main landing gear. When either of these switches is actuated by the cam and the centering button is pushed, the circuit is energized to operate the centering motor.

Crosswind Crab System Indicators

CROSSWIND CRAB POSITION INDICATOR. The indicator (1, figure 1-43) on the forward right side of the aisle stand shows, in a relative plan view presentation, the amount in degrees that the landing gear is turned to compensate for aircraft crab during crosswind conditions. The indicator is an electrically operated instrument and receives TR power through a circuit breaker marked "Cross Wind Crab Ind" on the "Landing Gear" portion of the pilot's circuit breaker panel which is carried through two position transmitters, one on the left forward gear and one on the left rear gear. The indicator has a diagram marked with a miniature runway and a scale calibrated from 0 to 20 degrees both right and left. Two movable pointers, one mounted above the other, indicate the degree of turn. The lower pointer, a simple needle, indicates the forward gear and the upper pointer in the form of a miniature aircraft indicates the rear gear. Since the gear position is in the opposite direction from that indicated by the pointers, it is always considered that the aircraft is being turned into the wind at an angle to the runway. When the aircraft is steered, the lower pointer will move in a direction opposite that of the turn and the upper pointer will remain in the position of the crab angle.

NOTE

> After crosswind crab has been set, both pointers of the crosswind crab indicator should match crab angle within ±2°.

WHEEL BRAKE SYSTEM

Each wheel of the main landing gear has hydraulic brakes. The brakes are of the multiple-disc type. Braking is accomplished by toe pressure on any or all of the rudder pedals. No differential braking is provided. A hand-operated pump is available in the forward wheel well. An anti-skid system to automatically detect and correct a skid condition is on each wheel of the main landing gear. Parking brakes are also provided.

WHEEL BRAKE HYDRAULIC PRESSURE

Each main landing gear has an individual brake system as shown in figure 1-44. Hydraulic pressure to each main gear is supplied by an individual hydraulic system. There is an accumulator in each main gear brake system. The two forward main gear brakes are actuated simultaneously and the two rear main gear brakes are slaved to the forward brake systems. This provides equal braking on all four main gear. Hydraulic system No. 1 supplies pressure to the left forward main gear brakes and normal slave pressure to the rear main gear. Hydraulic system No. 2 supplies pressure to the right forward main gear brakes and alternate slave pressure to the rear main gear. The left rear main gear brakes are supplied pressure by hydraulic system No. 3. The right rear main gear brakes receive pressure from hydraulic system No. 4. Toe pressure on the rudder pedals is transmitted to two main metering valves through mechanical linkages and a spring system of feel and return springs. The feel springs absorb linkage travel and hold spring tension on the metering valves. The return springs return and hold the metering valves in the off position. Lockout retraction valves, operated by hydraulic pressure from the normal landing gear retraction lines, act on the spring system so that braking action during retraction will be reduced to one-fourth of normal braking. Hydraulic pressure from the main metering valves is used for two purposes. One purpose is brake actuation on each wheel of the forward main gear. The second purpose is hydraulic actuation of the two slave metering valves, one for each rear main gear. Pressure is supplied to the two slave metering valves through the normal slave line or the alternate slave line. Differential pressure in the normal slave line holds a control valve in the alternate slave line closed. The alternate slave line control valve will open if the pressure in the normal slave line becomes appreciably less than the pressure in the alternate slave line. Either slave line pressure can enter the two slave metering valves through a shuttle valve on each metering valve. The shuttle valve positions according to pressure differential. Positioning of the slave metering valves controls the hydraulic pressure from hydraulic systems No. 3 and No. 4 to the rear wheel brakes. Hydraulic pressure to the brakes is further controlled by an antiskid system.

ANTISKID SYSTEM

The antiskid system consists of a skid detector on each main gear wheel, an antiskid valve for each wheel, a relay unit for each main gear, and an antiskid switch. Switched battery power for the antiskid system is supplied through circuit breakers marked "Anti Skid Control" - "Left Fwd," "Right Fwd," "Left Aft," and "Right Aft" on the "Landing Gear" portion of the pilot's circuit breaker panel. The antiskid valve for each wheel is electrically actuated through relays from a skid detector unit on each wheel. This valve is spring loaded to the open position to allow pressure to reach the brakes. When any wheel is in a skid condition, a signal is transmitted by the skid detector unit through the relay unit to actuate the valve. The antiskid valve is then positioned to shut off pressure to the brake and opens a port to the return line releasing the brake pressure on that wheel. At the end of the skid signal, following a very short time delay, brake pressure is again restored to the wheel. If the skid continues until wheel rotation stops, a locked wheel signal is transmitted through an additional relay to release brake pressure from that wheel. Upon brake pressure release, the wheel is free to rotate and again starts to accelerate. After a short time delay to permit the

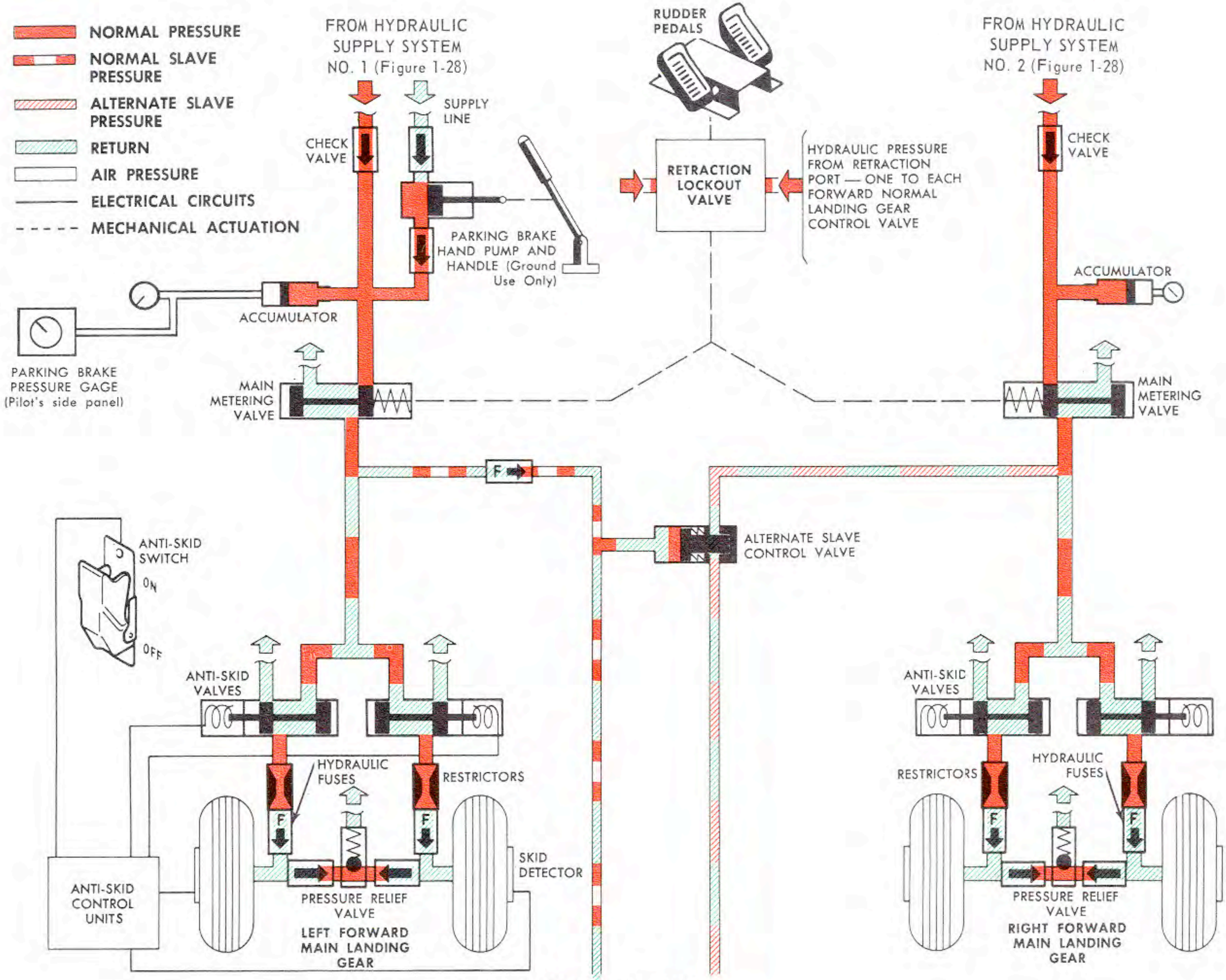
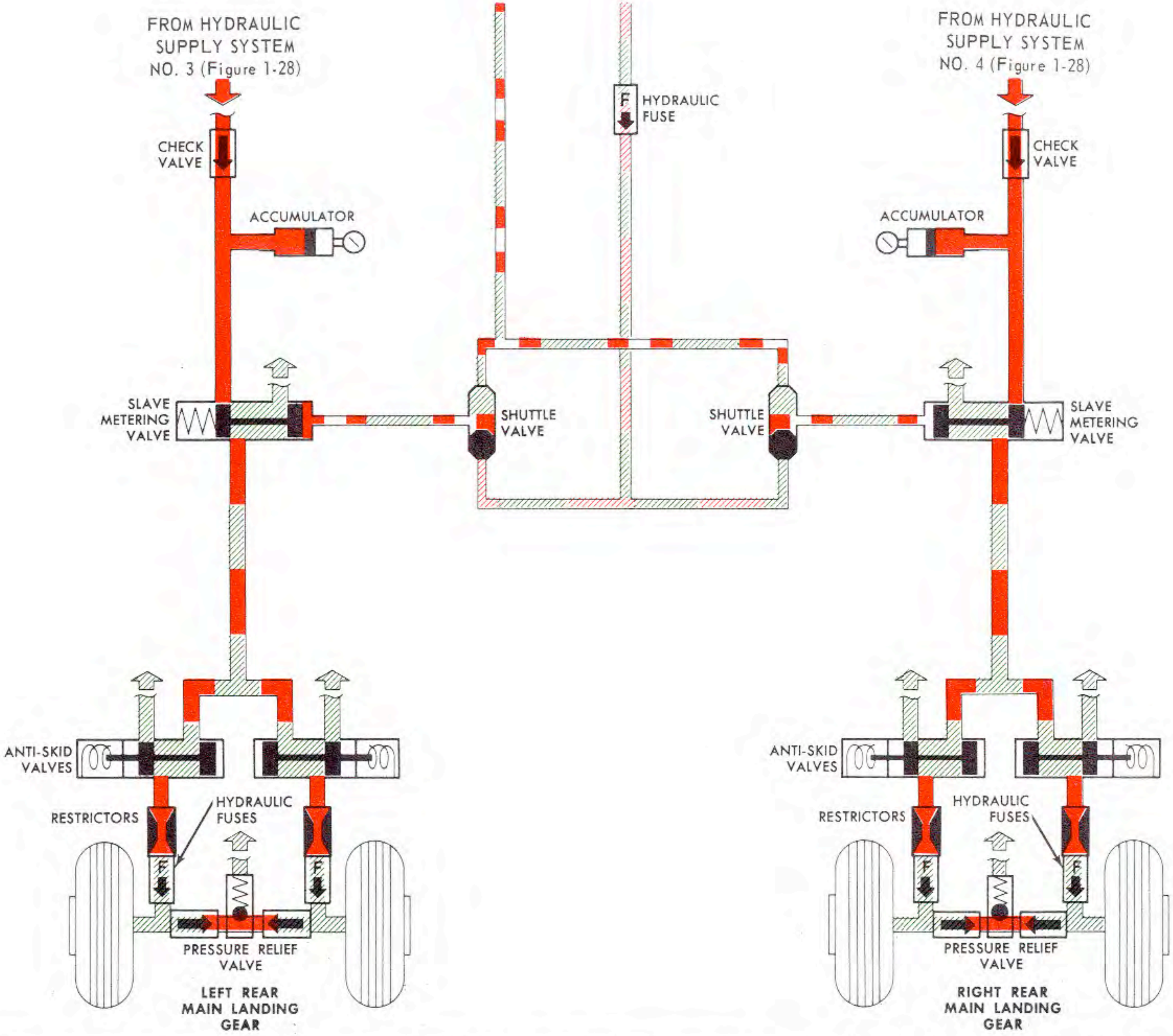
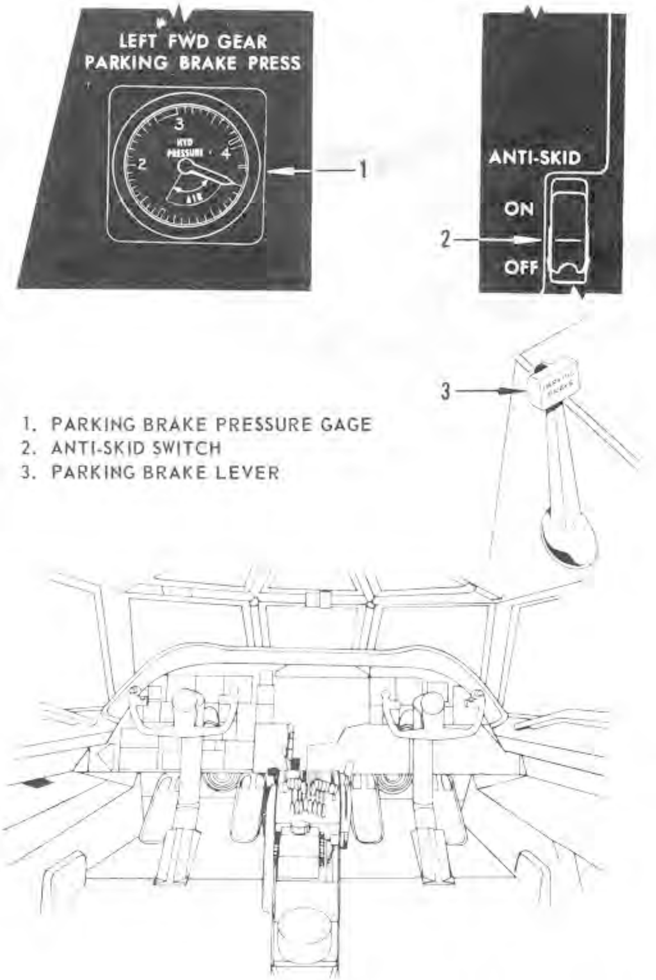


Figure 1-44 (Sheet 1 of 2).



WHEEL BRAKE SYSTEM

Figure 1-44 (Sheet 2 of 2).



WHEEL BRAKE SYSTEM CONTROLS (Typical)

Figure 1-45

wheel to reach nonskid speed, the brake pressure is again restored to the wheel. For further information, see "Landing Gear Safety Switches," this section.

54▶ 149 W1▶ W39

At taxi speeds, a skid on one wheel can release brakes on both wheels of that gear and only rotation of the wheel at a sufficiently higher speed (or turning the antiskid OFF) will allow brake pressure to be restored to both wheels.

NOTE

> A skid or locked wheel condition on any one wheel does not affect braking on any other gear 54▶ 149 W1▶ W39 or on any other wheel 150▶ W40▶ .

WHEEL BRAKE SYSTEM CONTROLS

Rudder Pedals

Toe pressure on any one of the four rudder pedals will actuate the wheel brakes.

Parking Brake Lever

The parking brake lever (22, figure 1-13) is on the left forward side of the aisle stand. Moving the lever aft while depressing the rudder pedals sets the parking brakes. A mechanical linkage from the parking brake lever locks the rudder pedals in a brake-applied position. As long as hydraulic pressure is available, the brakes will remain on. The parking brake may be released by merely depressing the brake pedals until the parking brake lever releases, then release the brake pedals.

Antiskid Switch

The antiskid switch (34, figure 1-15) on the pilots' instrument panel to the right of the landing gear lever has ON--OFF positions and is guarded to ON position. When the switch is ON, the antiskid system is in operation.

Parking Brake Hydraulic Hand Pump

The parking brake hydraulic hand pump is a ground handling facility, used to charge the left front gear accumulator pressure during towing operations. Approximately 70 double strokes are required on the hand pump to charge the accumulator for one or two brake applications with the antiskid switch OFF. The hand pump and handle are located on the right-hand side of the forward wheel well.

WHEEL BRAKE SYSTEM INDICATORS

Parking Brake Pressure Gages

There are four gages to indicate the hydraulic pressure of the four main gear brake accumulators. There is one brake accumulator in each wheel well. A gage is on the end of each of the brake accumulators for the left and right rear and right forward main landing gear. The gage (1, figure 1-45) for the left forward main landing gear brake accumulator is on the pilot's side panel and is marked "Parking Brake Pressure." See figure 1-57 for air pressure preload values.

DRAG CHUTE SYSTEM

A 44-foot ribbon-type drag chute is provided for deceleration during the landing roll. This parachute is contained in a compartment (4, figure 1-2) in the bottom of the tail compartment. Deploying the drag chute is accomplished by lowering the aft end of the chute compartment into the slip stream. This pulls a rip cord and a pilot chute drags the main chute out of the compartment. The risers of the main chute are attached to the aircraft through a terminal held by a jettison mechanism. The terminal incorporates a shear pin which will shear if the drag chute is deployed at airspeeds above approximately 160 to 180 knots IAS on the ground and approximately 170 to 190 knots IAS in the air. Drag chute deployment and jettisoning are accomplished manually by a cable system. This cable system operates a deploy mechanism to open the compartment when operated in one direction. After the release mechanism has been actuated, the cable system can be operated in the opposite direction to actuate the jettison mechanism. For operating limits of drag chute, see "Airspeed Limitations," Section V.

NOTE

> A locking device in the control system operated by the drag chute compartment door prevents actuation of the jettison mechanism when the door is closed.

DRAG CHUTE LEVER

Operation of the drag chute is controlled by a DEPLOY--LOCKED--JETTISON lever (8, figure 1-13) on the aisle stand. This lever manually controls the drag chute release and jettison mechanisms through the cable system. It must be moved to the DEPLOY position before it can be moved to the JETTISON position. The LOCKED position holds the spring loaded drag chute compartment door securely closed.

NOTE

> If the door opens accidentally, thus deploying the drag chute, the chute can be jettisoned by moving the drag chute lever directly to the JETTISON position from the LOCKED position.

TURRET—DRAG CHUTE INTERCONNECT CONTROL KNOB

A turret-drag chute interconnect system is provided to facilitate the gunner's exit following turret jettison. A push-pull type control knob (10, figure 4-75), provided at the gunner's station, controls drag chute deactivation when jettisoning the tail turret. When in the normal knob down position, the drag chute is deactivated (i.e., not available for pilot use) if the turret is jettisoned. With the control knob in the down position, and the drag chute deployed, jettisoning the turret will automatically jettison the drag chute. With the control knob pulled up, the drag chute remains activated (i.e., available for pilot use) whether the turret is jettisoned or not. If, subsequently, the pilot decides prior to turret jettison that the drag chute will not be required, the control knob may be readily reset (full down). However, following turret jettison, it may be possible to reset the control knob by exerting a downward force of approximately 30 pounds.

INSTRUMENTS

Only those instruments which are not properly a part of a complete system are listed in the chart (figure 1-46). The instruments listed include pitot-static operated instruments, direct-current operated instruments, and alternating-current operated instruments.

PITOT STATIC INSTRUMENTS

Less ZV

The pitot-static system (figure 1-47) contains two pitot tubes and eight static ports 54▶87. Aircraft 88▶ W1▶have only six static ports. The pitot tubes are located aft of the forward radome on the lower left and lower right of the control cabin. The right pitot tube supplies impact pressure to the pilot's airspeed indicator and machmeter. The left pitot tube supplies impact pressure to the copilot airspeed indicator, true airspeed computer, autopilot equipment 54▶87, W1▶W8. The static pressure ports are symmetrically located on both sides of the aircraft with opposite ports interconnected. The top ports third from the bottom supply static pressure to the autopilot system. Those next to the bottom supply the pilot's flight instruments which include the Mach indicator, airspeed indicator, altimeter, and vertical velocity indicator. The bottom ports supply the copilot's airspeed indicator, altimeter and vertical velocity indicator, along with the fire control equipment 54▶87, W1▶W8 and the BNS equipment. For information on pitot head anti-icing, see Section IV.

NOTE

> Due to the location of static ports relative to airflow under different conditions of flight, instruments depending upon a static source may vary in accuracy. Refer to the "Position Correction" charts in Part 1 of the Appendix for the correction desired under a particular condition.

ZV

Two pitot tubes, two pitot-static tubes, and six static ports (figure 1-47) provide impact and static pressures to operate the pitot static instruments. Two pitot tubes are located aft of the forward radome on the lower left and lower right of the control cabin. The right pitot tube supplies impact pressure to the pilot's airspeed indicator and machmeter. The left pitot tube supplies impact pressure to the copilot's airspeed indicator, true airspeed indicator, autopilot equipment, and BNS equipment. Two pitot-static tubes are located forward of the wing leading edge on the upper left and upper right of the aft control cabin. These pitot-static tubes provide impact and static pressure to the AIMS altitude computer. The static lines from both tubes are connected and supply static pressure to the altitude computer. The right pitot tube provides impact pressure to the altitude computer. The static pressure ports are symmetrically located on both sides of the aircraft with opposite ports interconnected. The top ports supply static pressure to the autopilot system and true airspeed computer. The center ports supply the pilot's flight instruments which include the Mach indicator, airspeed indicator, altimeter, and vertical velocity

INSTRUMENTS	OPERATING POWER	CIRCUIT PROTECTION
INDICATED AIRSPEED INDICATORS	Pitot-static	None
ALTIMETERS **ZV**	115V A-C ★★★	Pilot's circuit breaker panel
ALTIMETERS **Less ZV**	Pitot-static	None
VERTICAL VELOCITY INDICATORS	Pitot-static	None
MACH INDICATOR (PILOT'S)	Pitot-static	None
TRUE AIRSPEED INDICATOR(S)	A-C Electric ★	Pilot's circuit breaker panel
PILOT'S ATTITUDE DIRECTOR INDICATOR		
TURN-AND SLIP FUNCTION	D-C Electric ★★	Pilot's circuit breaker panel
ATTITUDE GYRO FUNCTION	A-C Electric	Pilot's circuit breaker panel
COPILOT'S ATTITUDE DIRECTOR INDICATOR		
TURN AND SLIP FUNCTION	D-C Electric ★★	Pilot's circuit breaker panel
ATTITUDE GYRO FUNCTION	A-C Electric	Pilot's circuit breaker panel and pilots' overhead circuit breaker panel
PILOT'S HEADING INDICATOR (GYRO)	A-C Electric	Pilot's circuit breaker panel
OUTSIDE AIR TEMPERATURE GAGE	D-C Electric	Pilot's circuit breaker panel
ACCELEROMETER	None	None
MAGNETIC STANDBY COMPASS	None	None
CLOCKS	None	None

★ Remotely operated from the true airspeed computer.

★★ Receives emergency power through the emergency battery switch.

★★★ Remotely operated from altitude computer.

INSTRUMENTS

Figure 1-46.

indicator. The bottom ports supply the copilot's airspeed indicator, altimeter and vertical velocity indicator, along with the fire control equipment, BNS equipment, and the navigator's altimeter. For information on pitot head anti-icing, see Section IV.

NOTE

> Due to the location of static ports relative to airflow under different conditions of flight, instruments depending upon a static source may vary in accuracy. Refer to the "Position Correction" charts in Part I of the Appendix for the correction desired under a particular condition.

Airspeed Indicators

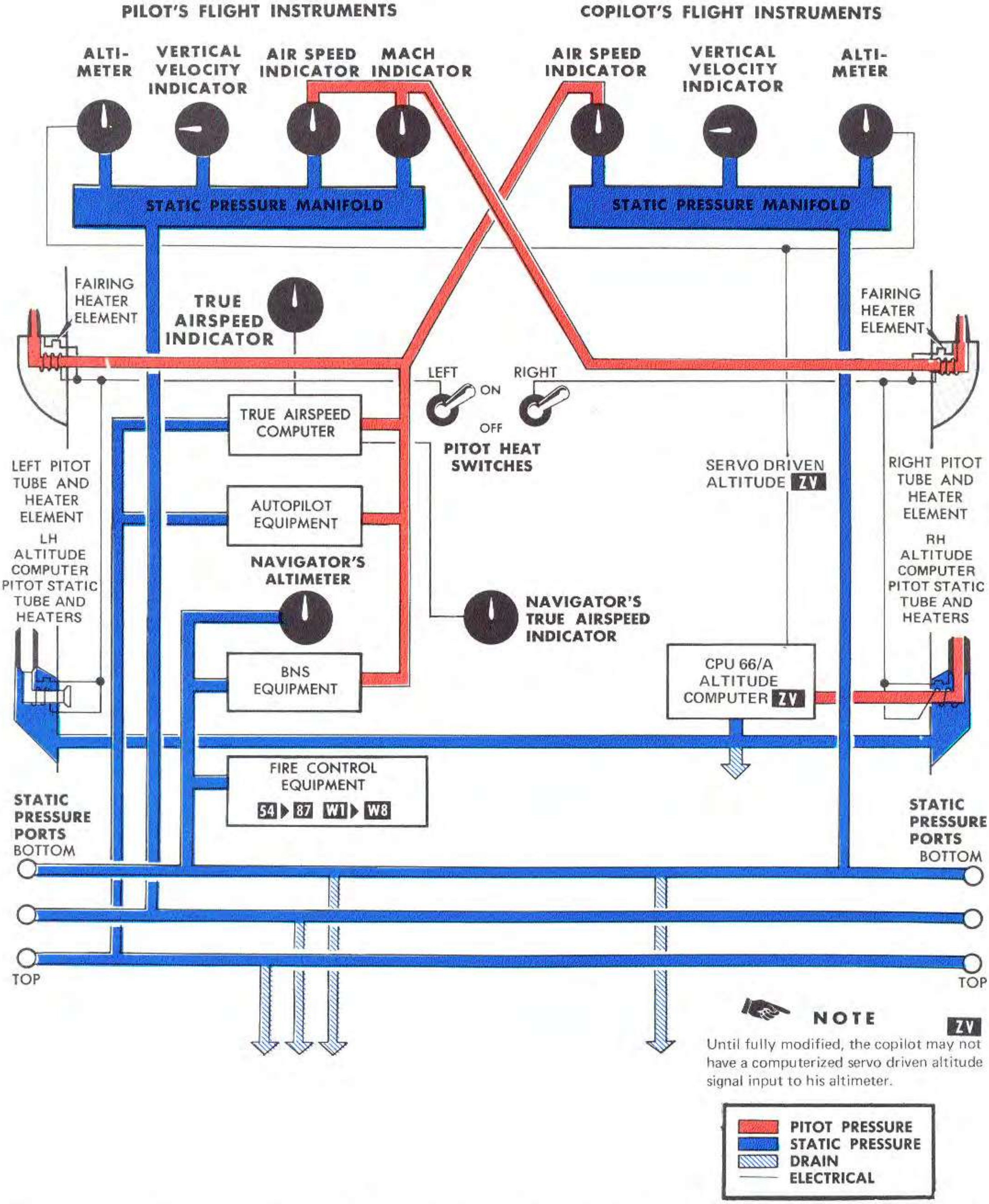
A Type L-7A airspeed indicator (8, figure 1-15) is located at both left and right side of pilots' instrument panel. By the use of two pointers, the pilots can observe the airspeed indication and the maximum allowable airspeed reading at the same time. The airspeed dial is graduated from 50 to 650 in 10-knot increments. A rotating drum, visible through a window in the dial, is graduated from 0 to 100 in 2-knot increments for sensitive indications. Stops limit the maximum speed pointer travel in the range from 200 to 600 knots. Mach number indications from 0.6 to 1.0 are also provided in this range as a reference for the Mach number index adjustment. A triangular index at the edge of the dial is set to the aircraft maximum allowable Mach number by an adjustment made at the rear of the instrument case. This adjustment governs the rate of change of the maximum airspeed pointer to indicate the Mach airspeed of the aircraft for any flight altitude or airspeed. In operation, the maximum airspeed pointer moves down the scale, from the upper limits, with lowering pressure altitude and the indicated airspeed pointer moves up the scale with increasing airspeed. When the pointers coincide, the Mach airspeed for the existing flight condition has been reached.

Altimeters (Radar Navigator's and Less ZV Pilot's)

NOTE

> Until fully modified, the copilot may have an AAU-8/A or MA-1 altimeter due to a shortage of AAU-19/A altimeters.

A Type MA-1 or AAU-8/A altimeter (4, figure 1-15) is located on the pilots' and radar navigator's instrument panels. Three pointers indicate hundreds, thousands, and tens of thousands of feet with reference to a single dial scale uniformly graduated from 1 to 10. The long pointer indicates 1,000 feet in one revolution, the intermediate pointer 10,000 in one revolution, and the small pointer 10,000 feet for each major graduation on the dial up to the maximum possible altitude reading of 80,000 feet. The small 10,000-foot pointer is part of a black disc next to the main dial with a 60° segment cut out of the side opposite the pointer. At zero altitude indication (and below), the 60° cutout in the disc is filled with alternate diagonal fluorescent and black stripes. With increasing altitude, the diagonal stripes are progres-



NOTE ZV

Until fully modified, the copilot may not have a computerized servo driven altitude signal input to his altimeter.

PITOT-STATIC SYSTEM (Typical)

Figure 1-47.

sively covered until, at 16,000 feet, no stripes are showing. This provides a conspicuous warning of approaching lower altitudes when descending from operational altitudes. The cutout filled with the diagonal stripes is also used as an indication of a correctly zeroed altimeter during the preflight check. The zero setting knob on the front of the instrument sets the pointers to read from any ground pressure altitude between 28.1 and 31.0 inches of mercury as displayed in the Kollsman window between the "2" and "3" on the main dial.

Less ZV

ALTIMETER CORRECTION CARD. Altimeter correction cards and holder (18, figure 1-9) are located on the pilot's side glare shield. Two altimeter correction cards are necessary, one for clean configuration and one for AGM-28 configuration. These cards reflect position error only and are based on an average gross weight and a standard day temperature. For further information concerning the use of the altimeter correction card, refer to Part 1 of the Appendix.

WARNING

The card for the current aircraft configuration must be used to fly corrected altitude for traffic separation.

Altimeters **ZV**

See "Electrically Operated Instruments."

Vertical Velocity Indicators

An AN5825-7 vertical velocity indicator (12, figure 1-15) is located at both the right and left side of the pilots' instrument panel. These instruments measure the rate of climb or rate of descent. The dial is graduated from 0 to 6000 feet per minute on two adjoining scales. A single pointer indicates rate of climb or rate of descent from the common zero.

Mach Indicator

A Type A-1 Mach indicator (48, figure 1-15) located on the left side of the pilots' instrument panel indicates the ratio of aircraft speed to the speed of sound at the particular pressure altitude at any time during flight. A single pointer indicates the Mach number on a dial face graduated in tenths having a range of 0.3 to 1.0. The instrument is connected directly to the pitot-static system.

NOTE

The Mach indicator ideally would give a true Mach reading; however, there are two sources of error in the system. One is the position error inherent in the pitot-static system and the other is the instrument error which is inherent in the mechanism of the instrument itself. The magnitude of the position error is shown on the "Position Error" chart in Part 1 of the Appendix. Since no calibration is available, the magnitude of the instrument error is not known to the pilot but will be within the maximum allowable tolerance of ±0.01. Refer to Part 1 of the Appendix for a further discussion of these errors and a method of inflight determination of the Mach number. All Mach numbers given in this flight manual are indicated Mach unless otherwise noted.

ELECTRICALLY OPERATED INSTRUMENTS

Altimeters (Pilot and Copilot) **ZV**

NOTE

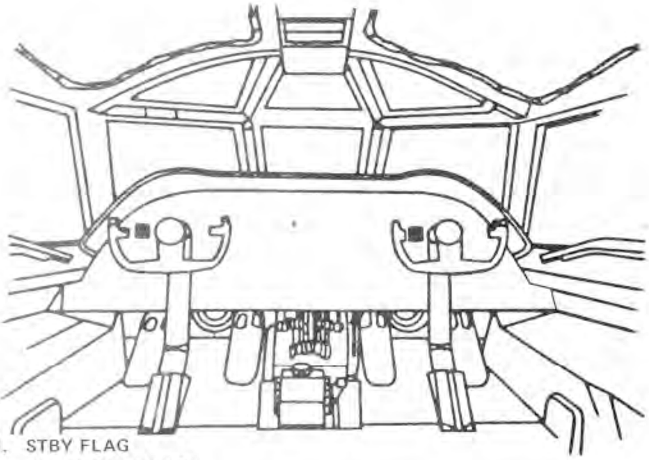
Until fully modified, the copilot may not have an AAU-19/A altimeter due to a shortage of altimeters. During any phase of flight which requires an altitude comparison between electric mode and static mode the pilot and radar navigator's altimeters should be used.

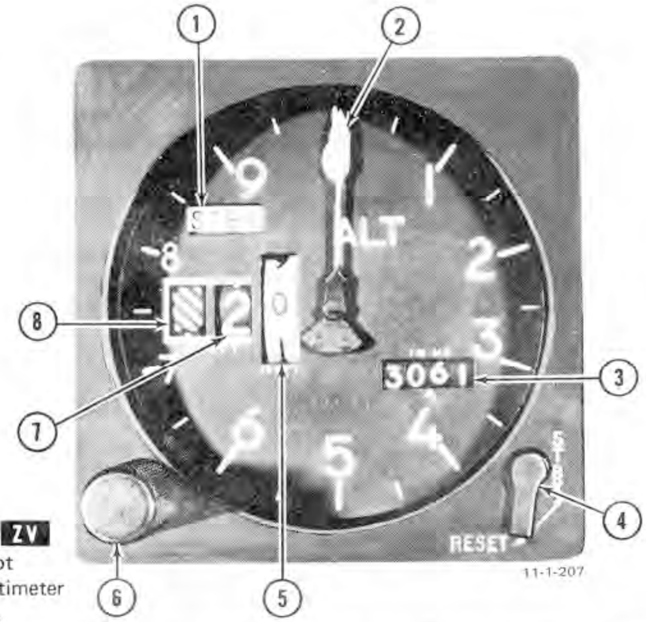
A type AAU-19/A altimeter (figure 1-47A) is on the pilot's and copilot's instrument panels. The altimeter has a counter-drum-pointer display. The counters (5 and 7, figure 1-47A) and drum provide a direct digital readout in hundreds and thousands of feet. The single pointer (2, figure 1-47A) repeats the 100-foot indications of the drum, serving both as a vernier for the drum and as a quick indication of the rate and direction of altitude change. The altimeter can be operated in either the servo (computer controlled) mode or the standby (static pressure) mode as selected by the reset-stby lever (4, figure 1-47A). The reset-stby lever is spring loaded to an unmarked neutral position between RESET and STBY positions. When in the standby mode, a STBY flag (1, figure 1-47A) will be in sight on the instrument face. A barometric pressure set knob (6, figure 1-47A) and barometric scale (3, figure 1-47A) are provided for adjusting the altimeter setting. A field elevation check should be made in both modes using ±75 feet as the maximum altimeter error allowable in either case. In addition, readings between the two modes should correspond within 75 feet.

SERVO MODE. Servo mode is designed to be the primary mode of operation and should be used unless failure prohibits. In the servo mode, the basic pressure altitude indication of the instrument is servo-corrected for position error by the CPU-66 altitude computer. Inflight, the allowable difference between servo mode readings of two altimeters is 75 feet at all altitudes and speeds. The altimeter is placed in servo mode by momentarily positioning the reset-stby lever to RESET. It may be necessary to hold the lever in RESET position up to 3 seconds. The STBY flag will disappear. A failure monitor circuit will automatically return the system to standby mode and the STBY flag will appear for any of the following malfunctions:

- Primary power failure or interruption (normally in excess of 1 to 3 seconds)
- Servo amplifier or motor failure
- Switch failure
- Relay failure
- Monitor failure

The CPU-66 computer error sensing system senses error in a servo loop that takes its input from a pneu-





1. STBY FLAG
2. 100-FOOT POINTER
3. BAROMETRIC SCALE
4. RESET – STBY LEVER
5. 100-FOOT DRUM
6. BAROMETRIC PRESSURE SET KNOB
7. 1000-FOOT COUNTER
8. 10,000-FOOT COUNTER

NOTE **ZV**

Until fully modified, the copilot may not have an AAU-19/A altimeter due to a shortage of altimeters.

ALTIMETER ZV

Figure 1-47A.

matic sensor within the computer. All error sensing is downstream of the sensor and as a result there is no monitor function applied to the sensor itself. The AAU-19/A altimeter also has a means of monitoring internal failures which will revert the altimeter to STBY. In addition, it is designed to be capable of accepting electrical signals from the computer which differ from the uncorrected pneumatic altitude (standby mode) by as much as ±4500 feet without the altimeter monitor inadvertently switching the altimeter to the standby mode. This is to compensate for large altitude position errors in some aircraft. Since a single CPU-66 computer drives both altimeters in the SERVO mode, no means of comparison between AAU-19/A altimeters is available if both are in RESET. This condition can be circumvented by operating the pilot's altimeter in RESET and the copilot's altimeter in STBY. Both altimeters will then display data derived from separate sources and provide a means of comparison and independent backup.

WARNING

- If the computer pneumatic sensor were to fail or become locked in a particular position, or system failures, such as pitot or static source icing, ice or water blockage in static lines, leaks, or pitot head damage, were to occur, the computer could deliver erroneous data to the altimeters. The aircraft could experience a large change in altitude before the AAU-19/A error detection circuit would react and switch the system to standby. Erroneous data would also be delivered to the transponder and relayed, on interrogation, to the ground radar agency.
- If it is determined that the altitude computer (CPU-66) has failed or is delivering erroneous data, place the mode C enabling switch to the OUT position and advise the ARTC center.

If the altimeter reverts to standby mode automatically, attempt should be made to reset to the servo mode. If the malfunction was transient, the altimeter will reset. If the fault remains, the altimeter will not reset but will operate normally in the standby mode.

NOTE

- If the altimeter cannot be switched to STBY manually due to a switch malfunction, the STBY mode can be acquired by momentarily opening the computer circuit breaker (for approximately 3 seconds). The altimeter will revert to standby and operate as a pneumatic altimeter.
- The altimeter correction card is not used in the servo mode.

STANDBY MODE. In the standby mode, the altimeter operates solely from the static pressure system. A red-on-black STBY flag will be in view, indicating that the instrument is providing a normal static pressure reading and that the displayed altitude is not corrected for position error. The instrument will be in standby mode when aircraft power is first applied and will remain in standby mode until the reset-stby lever is momentarily placed to RESET. The altimeter may be shifted from servo to standby mode by holding the reset-stby lever in the STBY position until the STBY flag appears. Normally 1 to 3 seconds are required for this to happen due to the time delay built into the instrument to prevent nuisance tripoffs.

When the altimeter is in the standby mode, an internal vibrator will operate continuously. The vibrator minimizes mechanical friction, enabling the instrument to provide a smoother display during altitude changes. Should vibrator failure occur, the altimeter will continue to function but a less smooth movement of the instrument display will be evident with changes in altitude. The pilot's and copilot's altimeter vibrators receive dc power from the emergency instrument power bus through a circuit breaker marked "Emer Flt Instr" on the pilot's circuit breaker panel.

CAUTION

> During normal use of the barometric setting system, momentary locking of the barocounters may be experienced. If this occurs, do not force the setting. Application of force may cause internal gear disengagement and result in excessive altitude errors in both standby (STBY) and servo (RESET) modes. If locking occurs, the required setting may sometimes be established by rotating the knob a full turn in the opposite direction and approaching the setting carefully.

WARNING

- When the altimeter is operating in standby mode, the altimeter correction card for the current aircraft configuration must be used to fly corrected altitude for traffic separation.
- If the altimeter's internal vibrator is inoperative, the 100-foot pointer may momentarily hang up when passing through "0" or 12 o'clock position. The pointer hangup can be minimized by tapping the altimeter case. Pilots should be especially watchful for this failure when their minimum approach altitude lies within the 800 to 1000 foot part of the scale, such as 1800 to 2000 feet or 2800 to 3000 feet, and should use any appropriate altitude backup information available.

ZV

ALTITUDE COMPUTER (CPU-66). The CPU-66 altitude computer provides the same inputs to both the AAU-19/A altimeter and the AN/APX-64 IFF. The operating mode of the AAU-19/A altimeter (RESET or STBY) has no effect on the CPU-66 computer inputs to the IFF transponder. The computer measures pressure altitude referenced to standard sea level pressure of 29.92 and corrects for position error. For IFF functions this corrected altitude is encoded to the nearest 100-foot level and is furnished to the IFF transponder, which in turn automatically relays the corrected altitude as a pulse train to the Ground Control Center upon interrogation, provided the mode C enabling switch on the control panel is in the ON position. For altimeter functions, this corrected altitude is used to drive the altimeter display when the altimeter is in servo mode. With an altimeter setting of 29.92, the altimeter altitude displayed will correspond to the computer altitude. Altimeter settings other than 29.92 introduce a corresponding difference between the altimeter altitude displayed and the computer altitude. If either the pilot's, copilot's, or both altimeters fail (STBY flag showing) the computer may still operate properly and transmit correct altitude data to the transponder. With both altimeter flags showing simultaneously, it may be determined if the altimeters or computer failed by using the IFF self-test feature for mode C. When both flags are showing and the system does not self test in mode C, the computer may be assumed to have failed. If both altimeter flags are showing and the system self tests in mode C properly, the two altimeters have failed in the SERVO mode or have been placed in STBY. In this case, a subsequent failure of the computer would not be indicated to the pilots since the same AAU-19/A STBY flag is used to indicate a failure in the altimeter or the computer. Periodic mode C checks while cruising and a check prior to a change of altitude should be made to assure correct computer operation. The mode C self-test check will not detect blockage of static lines to the computer, only a failure within the computer. The computer receives ac power from a circuit breaker marked "ALT CMPTR" on the "Flight Indicators" portion of the pilot's circuit breaker panel.

ZV

ALTIMETER CORRECTION CARD. Altimeter correction cards and holder (18, figure 1-9) are located on the pilot's side glare shield and (43A, figure 4-35) located on the radar navigator's side panel. Two altimeter correction cards are necessary, one for clean configuration and one for AGM-28 configuration. These cards reflect position error only and are based on an average gross weight and a standard day temperature. For further information concerning the use of the altimeter correction card, refer to Part I of the Appendix.

WARNING

> When the altimeter is operating in standby mode, the altimeter correction card for the current aircraft configuration must be used to fly corrected altitude for traffic separation.

Radar Altimeter AN/APN-150

See "Communication and Associated Electronic Equipment," Section IV.

True Airspeed Indicator

A true airspeed indicator located on the pilots' instrument panel (44, figure 1-15) and on the radar navigator's front panel (21A, figure 4-35) is a remote indicating unit. A main dial and subdial in the true airspeed indicator repeat airspeed information transmitted from the true airspeed computer. A cutout and reference mark on the main dial permit reading of the subdial. The power to operate this indicator is supplied by the true airspeed computer. The true airspeed computer uses static pressure, pitot pressure, and temperature to compute true airspeed. The computer is supplied 118-volt single-phase a-c power through a circuit breaker marked "Air Speed Computer" on the "Flight Indicators" portion of the pilot's circuit breaker panel. For further information concerning the true airspeed indicator, see "Navigation Equipment," Section IV.

Attitude — Director Indicators

An integrated instrument, Type ARU-2B/A attitude-director indicator (figure 1-48), located on both sides of the pilots' instrument panel (9, figure 1-15) provides an indication of aircraft pitch and roll attitudes and rate of turn and slip indications. In addition, it provides glide slope and localizer information in that it shows the aircraft position above or below the glide slope and whether the aircraft has the correct bank angle and rate of turn to intercept and maintain a heading or course. In the event of loss of a-c electrical system power, the pilot's and copilot's attitude-director indicators will display rate of turn information only. The pitch steering bar and bank steering bar will be in view but will be inoperative on both instruments. A description of the various components of the ARU-2B/A is given below.

NOTE

> An error in the pitch indication of the attitude indicators is generated during accelerations or decelerations. The error is indicated in a nose high direction during and after a forward acceleration and in a nosedown direction during and after deceleration. The longer the duration of acceleration (or deceleration), the greater will be the indicated error and the longer it will persist when acceleration (or deceleration) ceases. The erection system will reduce the error at about the same rate it was generated. Pitch error may reach one bar width during a high gross weight takeoff.

PITCH AND ROLL ATTITUDES. Pitch and roll attitudes are identical to those displayed on the MM-4 attitude indicator except that the bank scale (7, figure 1-48) is located on the lower half instead of the upper half of the instrument. The pilot's and copilot's attitude indicators receive pitch and roll signals from their respective MD-1 vertical gyros. The pilot's MD-1 gyro receives power from the right aft alternator bus and the copilot's MD-1 gyro receives power from the right forward alternator bus. Attitude information is transmitted from each MD-1 gyro to the respective attitude indicator through synchro servos. With the flight director computer gyro select switch in NORMAL, the synchro servo systems are independent. (Pilot's system receives power from the right aft alternator bus while the copilot's system receives power from the right forward alternator bus.) With the flight director computer gyro select switch in ALTERNATE, both synchro servo systems receive power from the right forward alternator bus. See "Attitude and Directional Gyro Power Switch" for additional power source information.

PITCH TRIM KNOB. A pitch trim knob (8, figure 1-48) permits zeroing the horizon line with reference to the miniature aircraft (12, figure 1-48).

TURN AND SLIP INDICATORS. Indications of aircraft rate of turn and slip are provided by the needle and ball arrangement at the bottom center of the instrument (10, figure 1-48). The pilot's and copilot's turn and slip indicators receive power through a circuit breaker marked "Rate of Turn" on the "Flight Indicators" portion of the pilot's circuit breaker panel. Emergency power is provided through the emergency battery switch for both the pilot's and copilot's turn and slip indicators.

ATTITUDE WARNING FLAG. An attitude warning flag (11, figure 1-48) will appear upon interruption of any one phase of the three phase a-c power to the flight gyro transformer. When the gyro power switch is OFF, the attitude warning flag will be in view. When the gyro power switch is turned ON, the attitude warning flag should disappear in approximately 60 seconds.

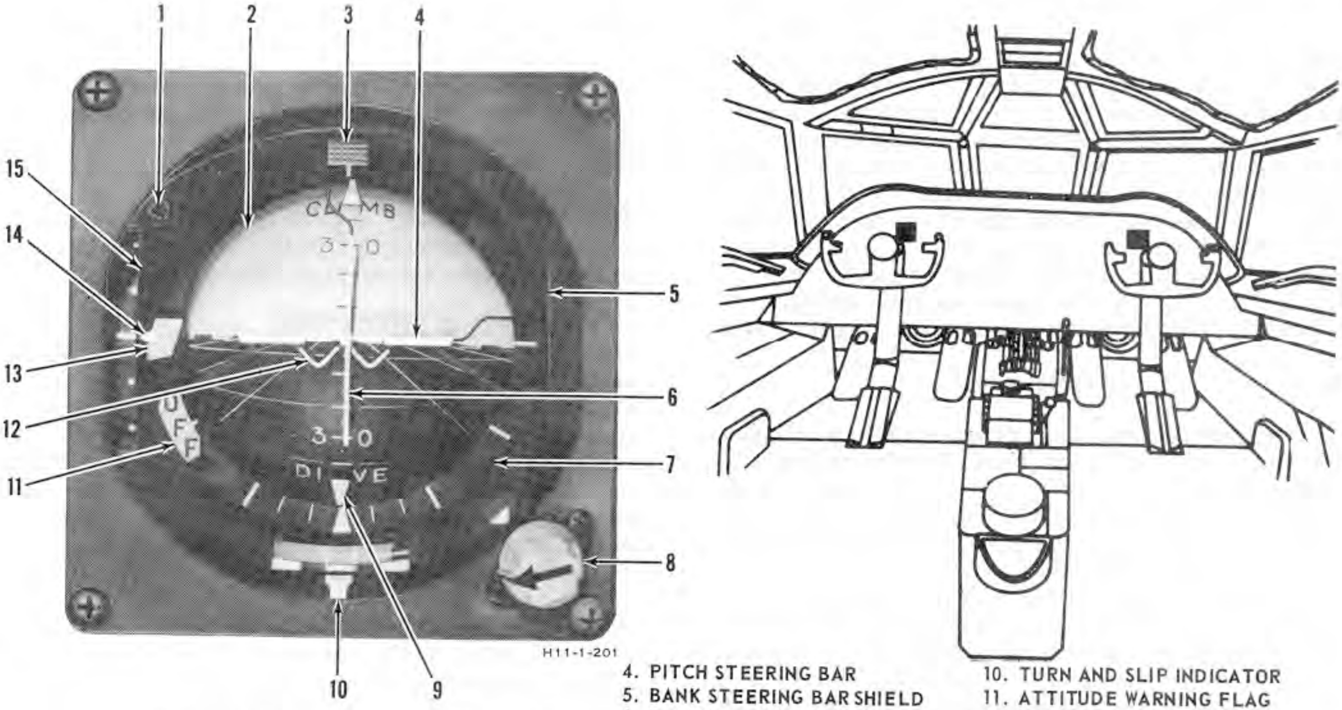
See "Attitude and Directional Gyro Power Switch" for additional power source information.

WARNING

> The attitude warning flag will not appear during every attitude indication failure. Therefore, it is possible that a malfunction of the attitude indicator portion of the attitude-director indicator might be determined only by cross-checking it with the turn and slip indicator and the other remaining flight instruments.

GLIDE SLOPE INDICATOR. A glide slope indicator (14, figure 1-48) indicates on a glide slope deviation scale (15, figure 1-48) whether the aircraft is above or below the glide slope. The indicator will operate when the nav mode selector switch (on the navigation system select panel located on the pilots' aisle stand) is in either ILS or ILS APP position and the ARN-14 is tuned to an ILS frequency. When not in operation, the glide slope indicator will be out of view (1, figure 1-48).

PITCH STEERING BAR. A pitch steering bar (4, figure 1-48) will indicate whether the aircraft has the proper pitch to intercept the glide slope correctly. The bar will operate in ILS APP mode only. When not in operation and normal power is available, the pitch steering bar will be out of view.



1. GLIDE SLOPE INDICATOR (OUT OF VIEW)
2. ATTITUDE SPHERE
3. COURSE WARNING FLAG
4. PITCH STEERING BAR
5. BANK STEERING BAR SHIELD
6. BANK STEERING BAR
7. BANK SCALE
8. PITCH TRIM KNOB
9. BANK POINTER
10. TURN AND SLIP INDICATOR
11. ATTITUDE WARNING FLAG
12. MINIATURE AIRCRAFT
13. GLIDE SLOPE WARNING FLAG
14. GLIDE SLOPE INDICATOR
15. GLIDE SLOPE DEVIATION SCALE

ATTITUDE-DIRECTOR INDICATOR

Figure 1-48.

BANK STEERING BAR. A bank steering bar (6, figure 1-48) will indicate whether the aircraft has the correct bank angle and rate of turn to intercept the localizer beam "on course" if the ARN-14 is tuned to an ILS frequency. It performs the same function with respect to an omni-range beam if the ARN-14 is tuned to an omni-range station and the nav mode select switch is in ILS. In addition, the bank steering bar will operate when the heading select switch (located adjacent to the navigation system select panel on the pilots' aisle stand) is in MAN position. The bar will then operate in conjunction with the heading set by the heading set knob and will indicate the correct bank angle and rate of turn to intercept the desired heading "on course." When the nav mode select switch is in TACAN or VOR and normal power is available, the bank steering bar will be out of view.

WARNING

If the CPU-4/A computer is calibrated properly and when centering the bank steering bar, an initial bank angle of 30° (±0°/-5°) will be indicated. Cross-check the bank steering bar with the bank pointer on the attitude-director indicator to preclude the possibility of exceeding a bank angle of 30°.

NOTE

When in TACAN, VOR, ILS, or ILS APP mode of operation, the course warning flag will appear when the ARN-21 or ARN-14 fails or signals from the URN-3 beacon or the VOR or ILS stations are lost or become unreliable. Continued display of this warning flag after the heading select switch has been positioned to MAN does not indicate faulty operation of the bank steering bar.

All data on page 1-112A (Deleted)

COURSE WARNING FLAG. A course warning flag (3, figure 1-48) will come into view during TACAN, VOR, ILS, or ILS APP mode of operation when the ARN-21 or ARN-14 fails or signals from the URN-3 beacon or the VOR or ILS stations are lost or become unreliable.

GLIDE SLOPE WARNING FLAG. A glide slope warning flag (13, figure 1-48) will come into view during ILS or ILS APP mode of operation when the ARN-18 fails or a glide slope signal of dependable strength is not being received.

NOTE

For further information regarding navigation functions (glide slope indicator and pitch and bank steering bars) of the ARU-2B/A attitude-director indicator, see "Flight Director System Controls," Section IV.

Flight Director Computer Gyro Select Switch

A flight director computer gyro select switch (1, figure 1-15) located on the pilot's instrument panel has NORMAL--ALTERNATE positions. The switch serves two purposes. First, it selects either the pilot's or copilot's MD-1 gyro input to the flight director computer for bank steering bar display on the ADI. Second, for the pilot's ADI, it controls alternate sources of gyro synchro power and ADI power from the right forward or right aft alternator bus. The power change (second purpose of the switch) is necessary to maintain signal compatibility between the flight director computer and its source of information. In NORMAL position, information from the copilot's MD-1 gyro is directed to the computer and synchro power for the pilot's attitude indicator is provided from the right aft alternator bus through the "Flight Gyro" B phase fuse on the pilot's circuit breaker panel. In ALTERNATE position, information from the pilot's MD-1 gyro is directed to the computer and synchro power for the pilot's synchro servo is provided from the right forward alternator bus through the "Radio Nav Ind AC" circuit breaker on the pilot's circuit breaker panel. Power for the copilot's synchro servo and ADI is provided from the right forward alternator bus through the "Copilot's Gyro Sync and Att Ind" circuit breaker on the pilot's overhead circuit breaker panel in either NORMAL or ALTERNATE position. Power to the switch is supplied through a circuit breaker marked "Radio Nav Ind DC" on the "Flight Indicators" portion of the pilot's circuit breaker panel.

WARNING

The flight director computer gyro select switch should only be placed in the ALTERNATE position when an internal failure of the copilot's MD-1 vertical gyro has been determined, and only if the use of the bank steering bars is mandatory. When this switch is in the ALTERNATE position, a loss of the RH forward alternator bus will cause a loss of both pilot's and copilot's ADI systems.

NOTE

The CPU-4/A flight director computer receives signals from the pilot's or copilot's MD-1 vertical gyro, VOR/localizer receiver, glide slope receiver, and horizontal situation indicator. The computer combines heading, roll, and localizer signals in the roll channel, and pitch and glide slope signals in the pitch channel. Depending on the mode of operation selected, the computer supplies either command heading steering or computed localizer steering signals to the bank steering bar and computed glide slope steering signals to the pitch steering bar.

Heading Indicator (Gyro)

A Type C-2A heading indicator (gyro) (43, figure 1-15) is located on the lower left center of the pilots' instrument panel. This instrument receives 115-volt three-phase a-c power as controlled by the gyro power switch. See "Attitude and Directional Gyro Power Switch" for additional power source information. The heading indicator is an unslaved-type gyro which provides auxiliary headings for navigational purposes and is also used to provide headings in the event of failure of the main compass system. A calibrated compass card located on the upper portion of the instrument is read against a lubber line fixed on the instrument mask. The mask has a cutout in the lower portion which shows reciprocal heading. A spring-loaded push-to-set type synchronizing knob is located on the lower left portion of the indicator and is used to realign or calibrate the compass card to known references. D-C power for compass card setting purposes is supplied to the heading indicator clutch at all times through a circuit breaker marked "Dir Ind" on the "Flight Indicators" portion of the pilot's circuit breaker panel.

NOTE

> The allowable drift rate is ±8° per hour minus the earth's rate; therefore, the instrument should be periodically reset to correct for drift beyond the capabilities of the leveling system.

Horizontal Situation Indicators

See "Flight Director System," Section IV.

Attitude and Directional Gyro Power Switch

An attitude and directional gyro power switch (15, figure 1-10) on the pilot's side panel, is a ganged two-way toggle switch with ON--OFF positions. In ON position, power is supplied to the pilot's and copilot's attitude indicating systems and the heading indicator. The 205-volt primary aircraft power is routed through the switch from two separate sources of power. One source supplies power to the flight gyro transformer which operates the pilot's attitude indicating system and the heading indicator (gyro). The other source supplies power to the additional flight gyro transformer which operates the copilot's attitude indicating system. These power sources are supplied to the equipment through instrument-type fuses in individual indicating-type fuse holders marked ØA, ØB, ØC under "Flight Gyro" on the pilot's circuit breaker panel for the pilot's attitude indicating system and on the overhead circuit breaker panel for the copilot's attitude indicating system. This switch also provides gyro synchro power for the copilot's attitude indicating system from the "Copilot Gyro Sync & Att Ind" circuit breaker on the pilot's overhead circuit breaker panel.

NOTE

> A burned-out fuse light will illuminate dimly when the gyro power switch is in OFF position and brightly when the gyro power switch is ON.

Outside Air Temperature Gage

A Type G-10 outside air temperature gage (26, figure 1-15) is located on the right side of the pilots' instrument panel. The air temperature gage is operated by an electrical resistance thermometer bulb located flush with the body skin on the lower left side of the forward pressurized section aft of the radar navigator's escape hatch. The temperature range of the gage is -70° to +50° C. The pointer should rest off the scale with power off and should register outside air temperature with power on. Electrical TR power is supplied through a circuit breaker marked "Free Air Temp" on the "Flight Indicators" portion of the pilot's circuit breaker panel.

SELF-POWERED INSTRUMENTS

Accelerometer

An accelerometer (55, figure 1-15) located on the left side of the pilots' instrument panel is a self-contained unit requiring no external connections. The dial is calibrated in "g" units from -2 to +4 "g's." With the aircraft in straight and level unaccelerated flight, the main pointer indicates +1 "g," the normal force of gravity. The instrument contains three pointers, the main pointer giving continuous indications. Two auxiliary pointers indicate and maintain maximum plus and minus accelerations until they are reset, using the reset knob on the front of the instrument.

Magnetic Standby Compass

A pilot's magnetic standby compass (18, figure 1-15) is located on top of the forward center window between the oil pressure gages.

Clocks

A Type A-13A clock (25, figure 1-15) is provided on the left and right side of the pilots' instrument panel and (6, figure 4-35) on the radar navigator's panel. The clocks are spring wound, 8-day clocks with a winding knob on the lower left corner and should be wound prior to flight or at least every 8 days. A sweep second hand and minute totalizer, both controlled by successive depressions of a START--STOP--RESET knob on the upper right-hand corner, are also provided.

EMERGENCY EQUIPMENT

For location of emergency equipment, see figure 3-2.

ENGINE FIRE DETECTION SYSTEM

The aircraft is not equipped with an engine fire extinguishing system. The aircraft is equipped with an electrically operated fire detection system. The system consists of separate fire detection circuitry for each engine and a test switch for simultaneous test of all circuits. Each engine is protected by thermally actuated fire detectors and wired in parallel, which provide fire warning signals through a light on the pilots' instrument panel. The system utilizes forward switched battery power supplied through a circuit breaker marked "Fire Det" on the pilot's auxiliary circuit breaker panel.

Engine Fire Warning Lights

Eight red engine fire warning lights (20, figure 1-15) are an integral part of the engine fire shutoff switches on the pilots' instrument panel. A fire warning light will illuminate when a fire detector unit on the affected engine is thermally actuated because of a fire or a pneumatic duct air bleed leak.

Engine Fire Detector System Test Switch

An engine fire detector system test switch (51, figure 1-15) is located on the left side of the pilots' instrument panel. The switch is of the rotary type, has two positions TEST -- NORMAL, and is used to test continuity of the engine fire detection system. In the spring-loaded TEST position, illumination of the warning lights indicates that the warning light circuits have continuity. Conversely, failure of the lights to illuminate indicates that the warning light circuits are broken provided the bulbs glow on press-to-test. In NORMAL position, the circuits are armed for fire warning.

ENGINE FIRE SHUTOFF SWITCHES

The eight engine fire shutoff switches (21, figure 1-15) are located on the pilots' instrument panel. These switches, together with the throttle, control the firewall fuel shutoff valves. With the engine fire shutoff switches in NORMAL (in) position and a throttle advanced out of CLOSED, a throttle microswitch closes a circuit to supply 24-volt d-c switched battery power to open the firewall fuel shutoff valve. With a throttle retarded to CLOSED, the throttle microswitch routes the same power to close the firewall fuel valve. When the engine fire shutoff switch is pulled, the close circuit of the firewall fuel shutoff valve is energized regardless of the throttle position.

NOTE

The engine fire shutoff switches are provided for use only in case the throttle linkage jams. Emergency shutdown of an engine can be accomplished approximately 20 seconds faster by retarding the throttle to CLOSED.

FUSELAGE OVERHEAT WARNING (FIRE WARNING) SYSTEM

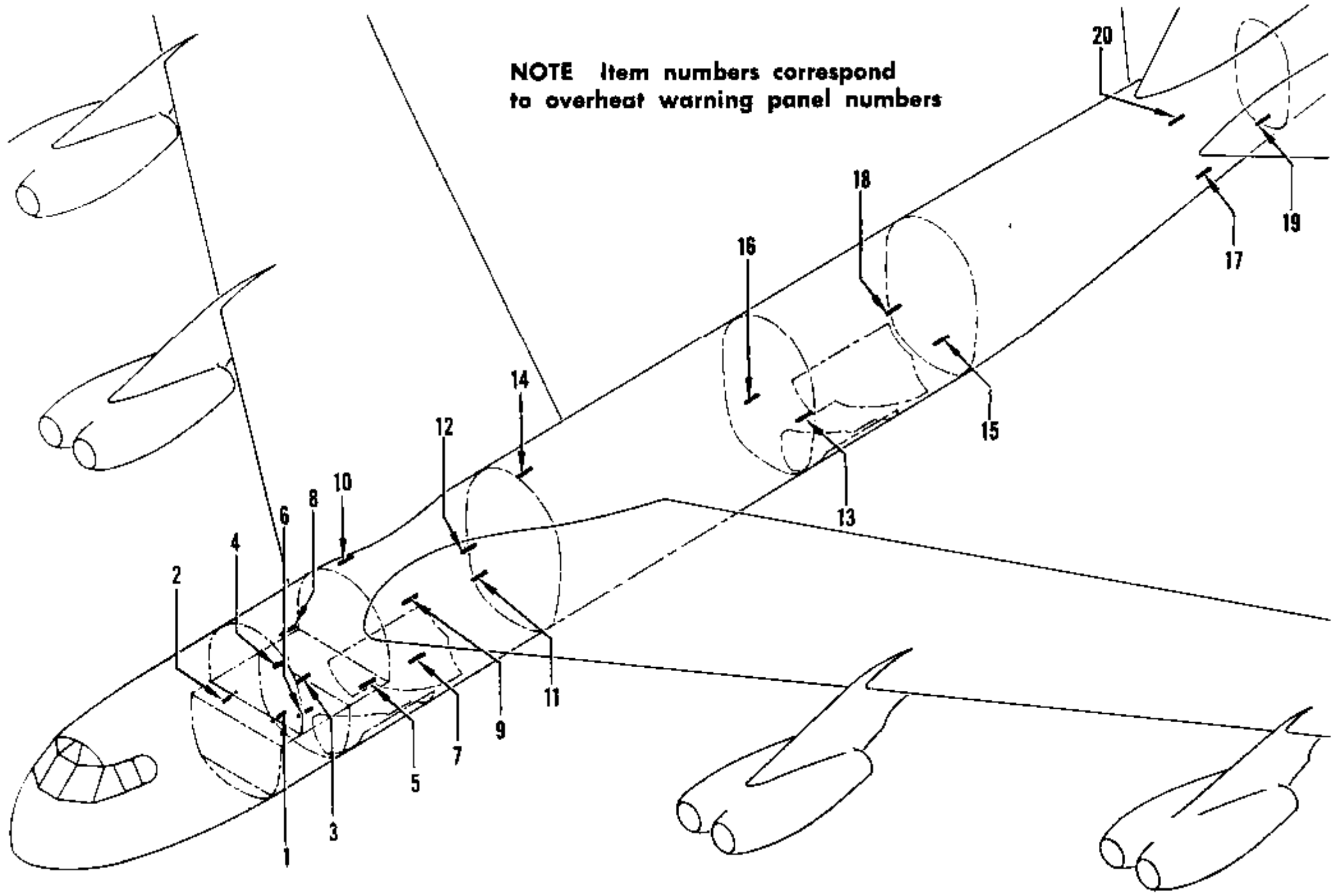
The fuselage overheat warning system is provided to indicate an overheat condition occurring within the uninhabited areas of the fuselage. The system includes 20 thermal detectors strategically placed throughout the fuselage, warning indicators at the copilot's station, and a means of testing the indicators. See figure 1-49 for thermal detector locations. All power circuit breakers are on the pilot's overhead circuit breaker panel. Normal power is supplied through a circuit breaker marked "Fwd Bat Pwr" on the "Emer Warn & Outbd Air Brake" portion of the panel. Emergency power is supplied through a circuit breaker marked "Aft Bat Pwr" on the same portion of the panel. The emergency battery switch must be placed in the EMERG position before emergency power is available.

Fuselage Overheat Warning Lights

Indication of an overheat condition is provided by 20 fuselage overheat warning lights (figure 1-50) on the copilot's side panel and a master warning light (23, figure 1-15) on the right side of the forward instrument panel. Each of the warning lights on copilot's side panel corresponds to one of the thermal detectors in the fuselage. These lights are "word warning" panels which, when energized, illuminate to show black letters on a red background thus locating the area of the overheat condition. The master fuselage overheat warning light will illuminate whenever any one of the word warning panels is energized. Both lights will remain on as long as the overheat conditions exist. The master light, however, can be reset to off so that it will again illuminate to alert the pilots in the event of additional indication on the word warning panels. Since the detectors are set for 300° F, a lighted warning panel is primarily a warning of an overheat condition; however, the possibility of fire should always be considered. See "Fuselage Overheat Indications" under "Fire" in Section III for a discussion of warning light indications and actions which should follow.

Master Fuselage Overheat Warning Light Reset Switch

The master warning light reset switch (figure 1-50) is a pushbutton switch adjacent to the fuselage overheat warning lights on the copilot's side panel. It is



LEFT SIDE FUSELAGE

1. ALTERNATOR DECK FORWARD L.H.
3. FORWARD L.H. ALTERNATOR
5. FORWARD AIR CONDITIONING PACK
7. HYDRAULIC PACK NO. 1
9. FORWARD WHEEL WELL UPPER L.H.
11. AFT L.H. ALTERNATOR
13. AFT WHEEL WELL FORWARD L.H.
15. HYDRAULIC PACK NO. 3
17. AFT AIR CONDITIONING PACK
19. HYDRAULIC PACK NO. 9

RIGHT SIDE FUSELAGE

2. ALTERNATOR DECK FORWARD R.H.
4. FORWARD R.H. ALTERNATOR
6. ECM RADOME
8. FORWARD WHEEL WELL FORWARD R.H.
10. FORWARD WHEEL WELL UPPER R.H.
12. AFT R.H. ALTERNATOR AND HYDRAULIC PACK NO. 2
14. WING REAR SPAR - CENTER BODY
16. HYDRAULIC PACK NO. 4
18. AFT WHEEL WELL AFT R.H.
20. HYDRAULIC PACK NO. 10

FUSELAGE OVERHEAT WARNING SYSTEM THERMAL DETECTOR LOCATIONS

Figure 1-49.

used to reset the master warning light to off after it has been illuminated due to an overheat condition in the fuselage. Resetting the master light will not affect the other fuselage overheat warning lights but serves only to ready it for further indication.

Fuselage Overheat Warning Light Test Switch

A push-to-test switch (figure 1-50) located adjacent to the fuselage overheat warning lights is used to test operation of the fuselage overheat word warning panels. When the switch is pushed in, the 20 fuselage overheat warning lights and the master warning light should illuminate. Operation of this switch does not test the thermal detectors.

HAND FIRE EXTINGUISHERS

Stored pressure bromochloromethane (CB) type extinguishers are installed in the aircraft. One extinguisher is located at the EW officer's station, one to the right and aft of the navigator's seat, and one to the right of the gunner's seat. A trigger-type handle located on top of the extinguisher permits the extinguisher to be operated with one hand. A pressure gage on each extinguisher indicates the CB pressure in the extinguisher. When fully serviced, the extinguishers are effective within a range of 20 feet in combating all types of fires. However, the closer the extinguisher can be used to the source of the fire, the greater its effectiveness. The supply of extinguishing agent is depleted in approximately 22 seconds during continuous operation. The fully serviced pressure is 165 (±10) psi at 70° F.

WARNING

Repeated or prolonged exposure to high concentrations of bromochloromethane (CB) or decomposition products should be avoided. CB is a narcotic agent of moderate intensity but prolonged effect. It is considered to be less toxic than carbon tetrachloride, methyl bromide, or the usual products of combustion. In other words, it is safer to use than previous fire extinguishing agents. However, normal precautions should be taken including the use of oxygen when available. Crew members should go on 100% OXYGEN immediately with emergency toggle lever in OFF (NORMAL, pilot and copilot) position, if exposed to fumes. When using a portable oxygen bottle, the regulator setting will be 30M or higher, commensurate with aircraft altitude.

CAUTION

Bromochloromethane is highly corrosive to aircraft metal, paint, and Plexiglas. In the event the fire extinguisher starts to leak, the extinguisher should be inverted and the control valve depressed (cover the nozzle with a cloth or aim into a container to catch any liquid which may be discharged). This will release the stored charge of pressurizing gas with a minimum discharge of fluid and render the extinguisher harmless. The extinguisher should be returned to its bracket and be reported for replacement in Form 781.

NOTE

The type A-20 (CB) hand fire extinguisher should be held upright to fight fire. The extinguishing agent pickup is in the bottom of the extinguisher. In the inverted position, the gas pressure charge will bleed off rapidly and render the extinguisher inoperative.

FIREFIGHTING GLOVES CONTAINERS

Three containers (4A, figure 3-2) with asbestos gloves for firefighting are installed in the crew compartment. One container is located on the EW officer's console forward and to the right of his seat. Another container is located on the right side of the aircraft just to the rear of the navigator's seat. A third container is located in the gunner's compartment just forward and to the left of the gunner's seat.

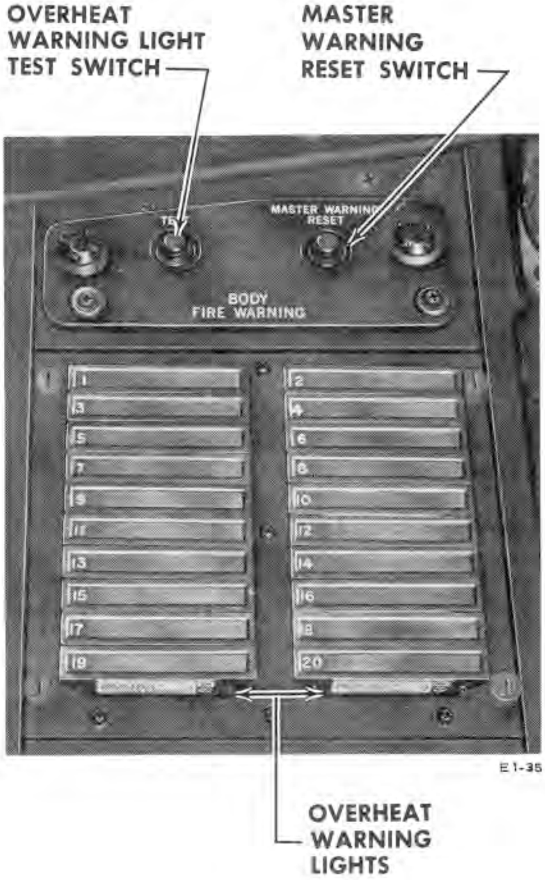
EMERGENCY ALARM SYSTEM

NOTE

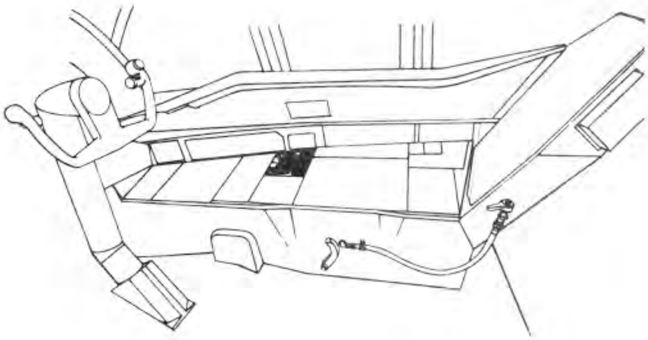
- This system is independent of the battery switch position. The system operates on emergency battery power when the emergency battery switch is in EMERG position.
- The interphone is considered the primary means for crew warning. The emergency alarm system is designed to warn personnel while off interphone.

Emergency Alarm Lights

Red emergency alarm lights are installed at the radar navigator's station, the celestial navigation station, the EW officer's station, the bomb bay forward and aft work stations, and the gunner's normal and auxiliary stations. A monitor light (figure 1-51) is provided on the pilots' aisle stand. The lights are controlled by a guarded ALERT--OFF--ABANDON emergency alarm switch on the pilots' aisle stand. In ALERT position, switched battery power is supplied to the circuit and a flasher mechanism flashes all alarm lights at a frequency of approximately 30 to 60 times a minute. In ABANDON position, the same power supply bypasses the flasher causing the lights to glow continuously. In addition, the lights glow continuously when either the pilot's or copilot's control column is stowed during the ejection sequence. The lights normally are supplied forward battery power through a circuit breaker marked "Fwd Bat Pwr." The lights are also supplied aft battery power through a circuit breaker marked "Aft Bat Pwr" when the emergency d-c power switch is in the EMERG position. Both circuit breakers are on the "Emer Warn & Outbd Air Brake" portion of the pilots' overhead circuit breaker panel. Control and lighting power is supplied from the same circuit



1. ALT. DECK FWD L. H.	2. ALT DECK FWD. R. H.
3. FWD. L. H. ALT.	4. FWD. R. H. ALT.
5. FWD. A/C PACK	6. ECM RADOME
7. HYD. PACK 1	8. FWD. W/W FWD. R.H.
9. FWD. W/W UPR. L. H.	10. FWD. W/W UPR. R. H.
11. AFT L. H. ALT.	12. AFT R. H. ALT. & HYD. 2
13. AFT W/W FWD L. H.	14. WING R/S CTR. BODY
15. HYD. PACK 3	16. HYD. PACK 4
17. AFT A/C PACK	18. AFT W/W AFT R. H.
19. HYD. PACK 9	20. HYD. PACK 10



FUSELAGE OVERHEAT WARNING PANEL

Figure 1-50.

through circuit breakers marked "Control" and "Lights" on the "Emer Warn Alarm" portion of the pilots' overhead circuit breaker panel.

Gunner's Emergency Alarm Audio Signal

An alarm circuit consisting of a signal generator energized by battery power is installed in the gunner's interphone circuit. When the emergency alarm switch is in the ALERT position, the signal generator sends a pulsating signal to the gunner's headset. With the switch in the ABANDON position, a steady signal replaces the pulsating signal. The alarm system is automatically energized to signal "abandon" when either the pilot's or copilot's control column is stowed in the ejection sequence. The gunner's signal generator is normally supplied forward battery power through a circuit breaker marked "Fwd Bat Pwr." The signal generator is also supplied aft battery power through a circuit breaker marked "Aft Bat Pwr" when the emergency d-c power switch is in the EMERG position. Both circuit breakers are on the "Emer Warn & Outbd Air Brake" portion of the pilots' overhead circuit breaker panel. Control power is supplied through a circuit breaker marked "Audible Gunner" on the "Emer Warn Alarm" portion of the pilots' overhead circuit breaker panel.

NOTE

> With the emergency alarm switch in either the ALERT or ABANDON position, other crew positions may not be able to understand gunner's interphone transmission due to bleed through of the emergency alarm audio signal.

TERRAIN CLEARANCE LIGHT

A retractable terrain clearance light located on the fuselage bottom just forward of the forward main landing gear provides illumination during night ditching or crash landing. The light is controlled by two toggle switches (20, figure 1-13) on the aisle stand. One switch has EXTEND--SWITCH OFF--RETRACT positions. In EXTEND position, 118-volt a-c power is supplied to a motor which extends the light out of the fuselage. In RETRACT position, the light retracts into the fuselage. The neutral SWITCH OFF position allows the light to be stopped at any degree of travel during extension or retraction. However, the light will not illuminate within 10° of the retracted position. The motor will automatically shut off when the light reaches the end of its travel at either position. The other switch has ON--OFF positions. ON position supplies 28-volt a-c power to illuminate the light unless it is within 10° of the retracted position. A circuit breaker marked "Terrain Clearance" on the "Ext Lts" portion of the pilots' overhead circuit breaker panel supplies 118-volt a-c power through the switches for the motor and the stepdown transformer which supplies 28-volt ac for the light.

FIRST AID KITS

First aid kits (23, figure 3-2) are provided at convenient locations throughout the aircraft; two in the control cabin lower deck and one in the tail compartment.

AXES

Axes (25 and 33, figure 3-2) are installed in the control cabin lower deck and in the tail compartment.

CRASH LANDING AND DITCHING STATIONS

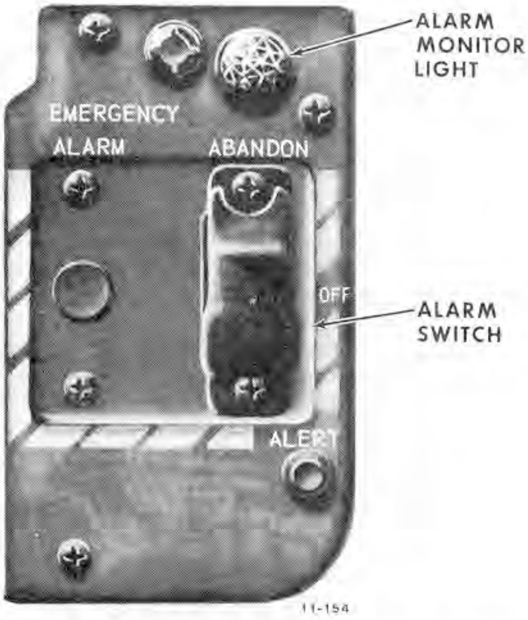
Stations to be used for both crash landing and ditching are provided on the upper deck of the control cabin for the navigator, radar navigator, instructor pilot, and instructor navigator. All stations are equipped with safety belts.

Instructor Pilot's Crash Landing and Ditching Station

The instructor pilot's station is aft facing and is located at the back of the instructor pilot's seat. The seat is prepared for crash landing or ditching use by pulling aft on a release cable under the seat. The lower end of the seat will swing to an aft position; the seating platform is then folded down into the use position. The instructor pilot sits facing aft with the safety belt fastened. The forward seating platform may be raised to the stowed position if desired.

Navigator's Crash Landing and Ditching Station

The navigator's crash landing and ditching station is located forward and to the left of the celestial navigation seat. A ditching hammock, stowed behind a zipper panel near the ceiling of the compartment above this station and installed in fittings on the floor when in use, is provided to properly support the crew member. To use the station, the crew member sits on the compartment floor facing aft with his back against the hammock and the safety belt fastened.



EMERGENCY ALARM PANEL

Figure 1-51.

WARNING

Do not sit on a survival kit when using the ditching hammock. The hammock is not designed to be used with a crew member seated on a survival kit. Use of a survival kit with the hammock could result in side loads removing the crew member from the protection of the hammock.

Radar Navigator's Crash Landing and Ditching Station

The radar navigator's crash landing and ditching station is located behind the copilot's seat. A safety belt is fastened to the back of the seat. In order to occupy the station, the portable oxygen bottle stowed on the back of the seat must be removed and placed in the lower crew compartment.

WARNING

Place the portable oxygen bottle and bracket in the lower deck compartment to prevent them from inflicting injury to crew members during a crash landing or ditching.

To use the station, the radar navigator sits on his own and the navigator's survival kits, stacked one atop the other on the compartment floor behind the copilot's seat. The radar navigator sits with his back braced against the copilot's seat and the safety belt fastened.

Instructor Navigator's Crash Landing and Ditching Station

The instructor navigator's crash landing and ditching station is located forward and to the right of the celestial navigation seat. A ditching hammock, stowed behind a zipper panel near the ceiling of the compartment above his station and installed in fittings on the floor when in use, is provided to properly support the instructor navigator. To use the station, the instructor navigator sits on the compartment floor facing aft with his back against the hammock and the safety belt fastened. The hammock is not designed to be used with a crewmember seated on a survival kit.

WARNING

Do not sit on a survival kit when using the ditching hammock. Use of a survival kit with the hammock could result in side loads removing the crewmember from the protection of the hammock.

Crew Bunk

The stowable bunk is not stressed for crash landing or ditching. The bunk must be stowed to utilize the ditching station forward and to the left of the celestial navigation seat.

SURVIVAL KITS

Provision for seat-type survival kit (figure 1-56) is made for each of the ejection seats. (See Section IV for information on the gunner's global survival kit.) This container consists of seat cushion, magnesium or fiberglass seat pan, outer and inner containers, tab zipper, and the attachment straps. Provision for an inflatable raft, sleeping bag, rations, battery radio, M-4 rifle and ammunition, and assorted items of survival equipment are contained in the kit.

WARNING

Use of an extra cushion or a cushion other than the type provided for the survival kit may result in injury to the occupant if seat is ejected. If the cushion is too thick, the crewman's body does not begin accelerating at the proper time and injury from excessive forces may result.

The survival kit is attached to the parachute harness by engaging both attachment snaps of the kit harness to the accessory rings of the parachute. Snub the kit against the buttocks by pulling up on the free ends of the webbing. The kit harness snap webbing must be threaded through the slide bar adjusting adapter of the kit harness sling in a reverse direction so the loose end is to the inside. This permits the adapter to ride under the snap and flatten against the side of the cushion when the kit is snubbed against the buttocks.

WARNING

If the kit harness snap webbing is inproperly threaded through the slide bar adjusting adapter of the kit harness sling, it is possible for the kit hardware to hang up on the ejection seat and delay man-seat separation.

Normally the survival kit is not detached from the parachute except for emergency reasons such as a crash landing, or when accomplishing an alternate bailout. After ejection from the aircraft and opening of the parachute, the survival kit should be deployed. To operate the kit, grasp the pull knob on the right side of the container and pull sharply to the right to pull the barrel keeper from the slide fastener. Continue the pulling force until actuation of the CO_2 bottle is accomplished, thereby inflating the raft and forcing the container open. The liferaft will hang about 15 feet below the descending crewman and the kit about 25 feet.

Liferaft Deflation Tool

WARNING

Instances of inadvertent liferaft inflation have occurred in flight resulting in full forward control column displacement. Pilots must be alert to this possibility and be prepared to immediately puncture the liferaft should inadvertent inflation occur.

A knife-like tool (10A, figure 3-2) located on the pilot's and copilot's glare shield above their respective side panels is provided for liferaft deflation. In the event the liferaft becomes inadvertently inflated at either pilot's position, the pilot or copilot will puncture the inflated raft with the deflation tool and use a ripping action to make a large opening for rapid deflation.

PARACHUTE STATIC LINE

An emergency parachute static line is installed in the control cabin lower deck to the right of the aft end of the entrance hatch under the raised deck. The line is used to facilitate bailout of an injured crew member through the navigator's hatch. At high altitudes (above 14,000 feet), the line should be connected to the automatic parachute arming lanyard. At lower altitudes, the line should be connected directly to the ripcord T-handle of the parachute. A parachute static line and parachute static line reel assembly are provided for the gunner. This assembly is located on the left side of the reclining portion of the gunner's seat and will allow the gunner to move freely about in the seat without arming the parachute, yet will automatically arm the parachute following bailout.

ESCAPE ROPES

Escape ropes are located at the pilot's, copilot's, EW officer's, and gunner's positions. The rope is folded into the fuselage structure at the gunner's left (aircraft right) and is long enough to reach the ground through the aft entry door. The ropes at other positions are stowed in a box behind the headrest. The escape ropes are provided to help personnel escape from the aircraft in any conceivable normal or crash attitude.

ESCAPE HATCHES

The escape hatches (2, 10, 13, 14, and 17, figure -2) in the aircraft are of metal construction. The ilot's, copilot's, and EW officer's hatches are located in the upper surface of fuselage over their respective stations. The radar navigator's and navigator's hatches are located in the lower surface of the fuselage below their respective stations. Windows are provided in the pilot's and copilot's escape hatches to provide side vision when the aircraft is in a banked attitude on landing approach and to provide better vision during air refueling. The navigator's hatch also serves as the forward entry door. The escape hatches for the EW officer's, radar navigator's, and navigator's positions are equipped with aerodynamic hatch lifters. The purpose of the lifter is to insure positive jettisoning of the hatch during the automatic ejection sequence regardless of crew member order of ejection. The lifter consists of a flap mounted flush on the outside of the hatch. The flap is hinged at the aft edge of the hatch and is actuated by the automatic hatch jettison mechanism. Two push rods connect the flap to the jettison mechanism. When the jettison mechanism is actuated, the flap is pushed into the airstream where the flap acts to pull the hatch from the aircraft. The flaps on the ECM hatch and on the main entry door are provided with ccess doors to permit the use of the outside handle to open the hatch. The hatch lifter is actuated by the ballistics thruster during the automatic ejection sequence only. Operation of the manual hatch release handle merely unlocks the hatch.

NOTE

At airspeeds in excess of 300 knots IAS, the EW officer's escape hatch lifter may extend approximately 2 inches. This condition is considered normal and does not constitute a hazard to crew members. It does not affect the functional reliability of the escape system.

WARNING

Removing a hatch without first disconnecting the arming link will fire the catapult safety pin pull initiator and leave the seat catapult in an armed condition.

Escape Hatch Manual Release

All the hatches (figure 1-52) can be opened from the inside, and all except the radar navigator's can be opened from outside the aircraft by pulling the handle away from the hatch. In addition, there is a manual hatch jettison handle to the right of the radar navigator's seat (18, figure 4-84) near the bottom of the seats. These hatches are all part of the various seat ejection systems and will open independently of the handles when the appropriate ejection seat mechanism is actuated. The handles are for emergency use only and should not be opened indiscriminately.

WARNING

At the radar navigator's station, the ejection seat must be electrically positioned to the full down and full aft position in order to reach the manual hatch jettison handle with parachute harness fastened. Crew members of small stature may not be able to reach the manual hatch jettison handle with the seat correctly positioned. If the crew member is unable to jettison the hatch with the manual hatch jettison handle, he must proceed to alternate exit for bailout.

A safety guard is installed on the radar navigator's manual hatch jettison handle to prevent inadvertent actuation of the handle. The manual hatch jettison handle can be raised only when the safety latch is simultaneously pushed down.

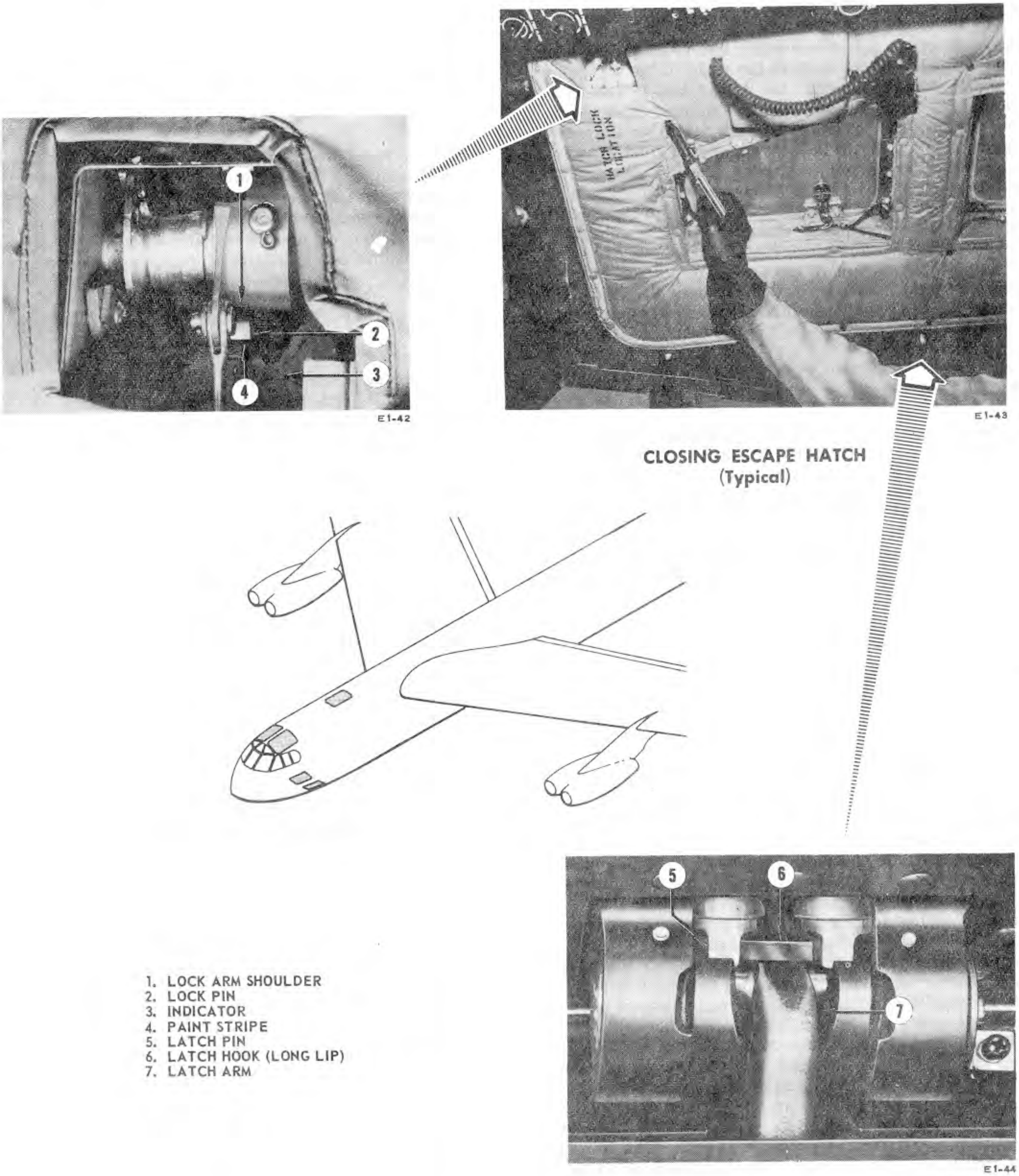
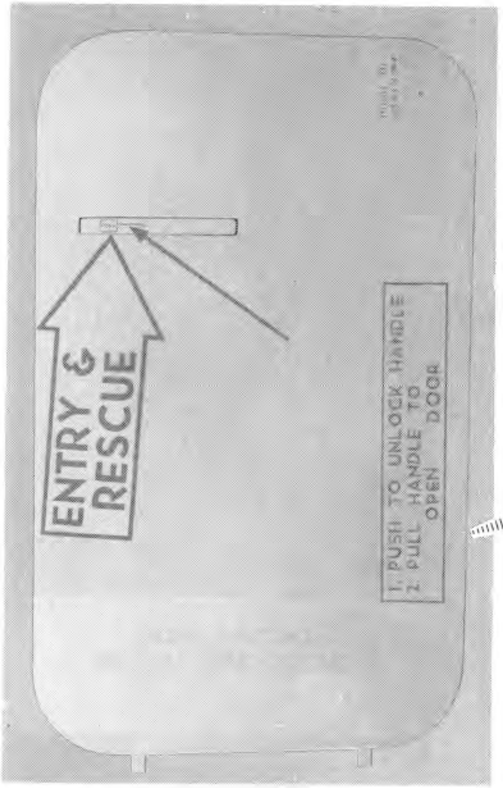


Figure 1-52 (Sheet 1 of 3).

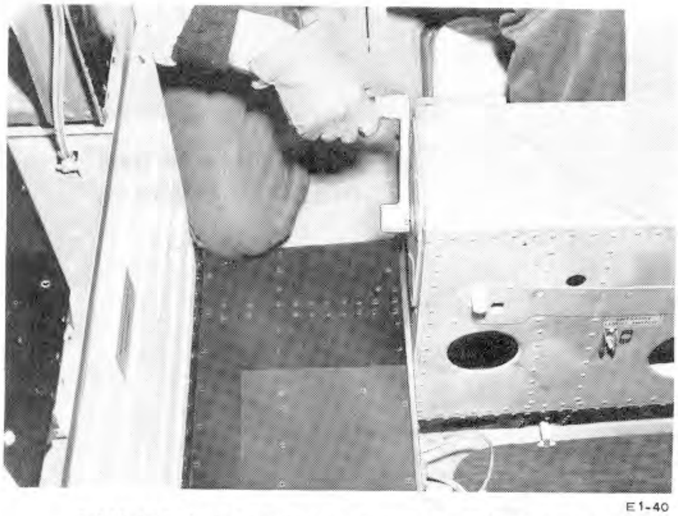


E1-38

OUTSIDE VIEW, CLOSED AND LOCKED

E1-39

MAIN ENTRY DOOR



E1-40

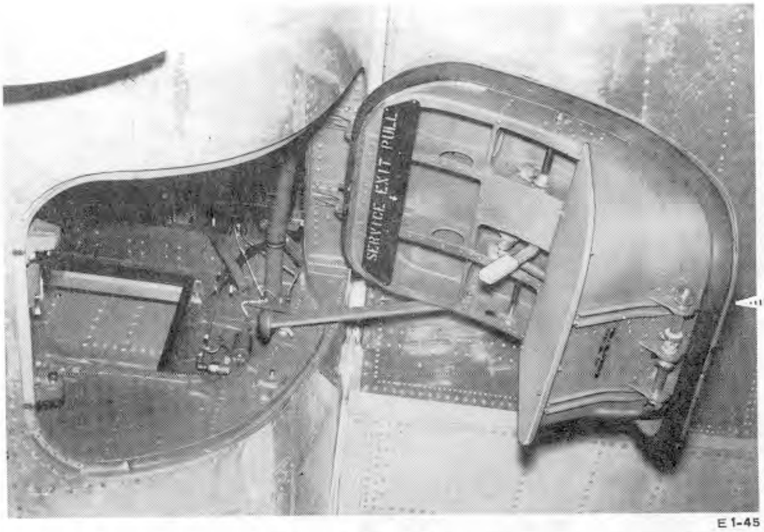
RAISING (LOWERING) MAIN ENTRY DOOR

E1-41

LOCKING MAIN ENTRY DOOR

ENTRY AND ESCAPE HATCH CONTROLS

Figure 1-52 (Sheet 2 of 3).



E 1-45

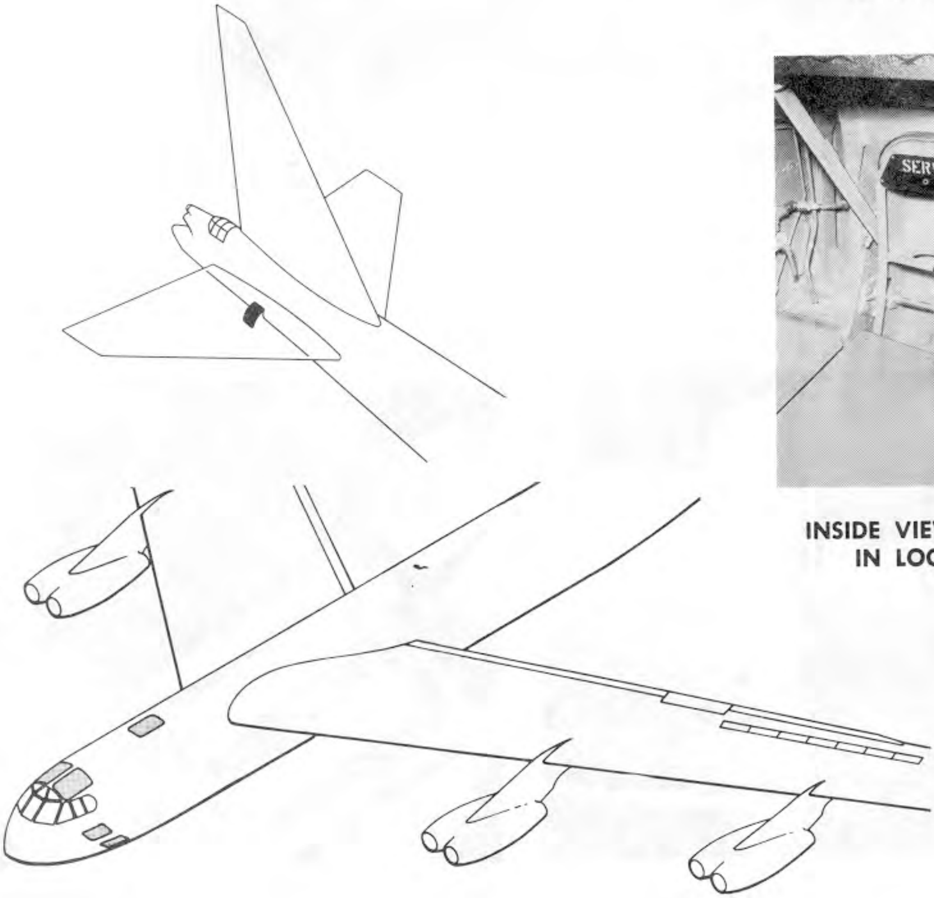
AFT ENTRY DOOR

E 1-46

OUTSIDE VIEW,
CLOSED AND LOCKED

E 1-47

INSIDE VIEW, INSIDE HANDLE
IN LOCKED POSITION



ENTRY AND ESCAPE HATCH CONTROLS

Figure 1-52 (Sheet 3 of 3).

Hatch Not Closed and Locked Light (Hatch Warning Light)

An amber warning light (38, figure 1-15) on the left side of the pilots' instrument panel illuminates to warn when any of the five escape hatches or the aft entry door into the tail compartment or the aft equipment compartment access door is not closed and locked. The light utilizes TR power through a circuit breaker marked "Eject Hatch" on the "Warn" portion of the pilot's circuit breaker panel.

DOORS

MAIN ENTRY DOOR (NAVIGATOR'S ESCAPE HATCH)

A main entry door (figure 2-1) opening into the control cabin lower deck is provided for access into the aircraft. An entrance ladder (figure 2-1) to aid in entering the aircraft is installed inside the main entry door. The door can be opened from both inside and outside the aircraft by pulling either handle away from the hatch. The door is held in the open position by two cables, the right cable is hooked to a rewind unit and the left cable is attached to a hand-operated hoist. The handcranked hoist raises and closes the door, and torsion springs in the hoist and rewind unit prevent the door from falling too fast when opened for ground entry.

CAUTION

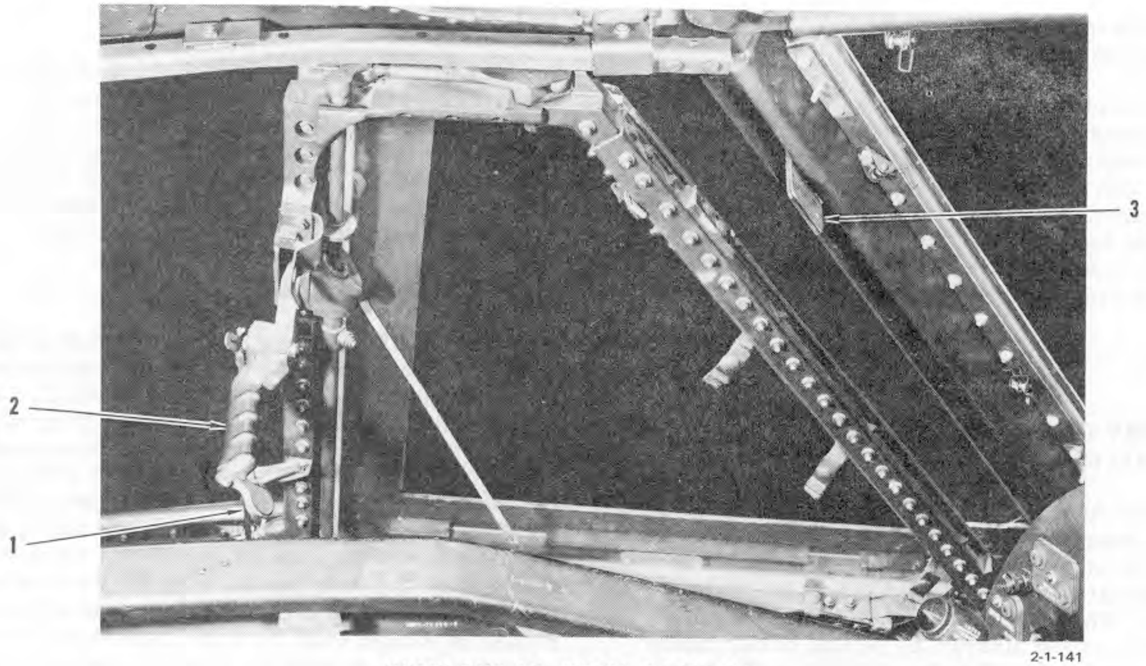
Engage handcrank and hold firmly prior to opening hatch lever from inside. Lower the hatch by turning the handcrank slowly.

AFT ENTRY DOOR

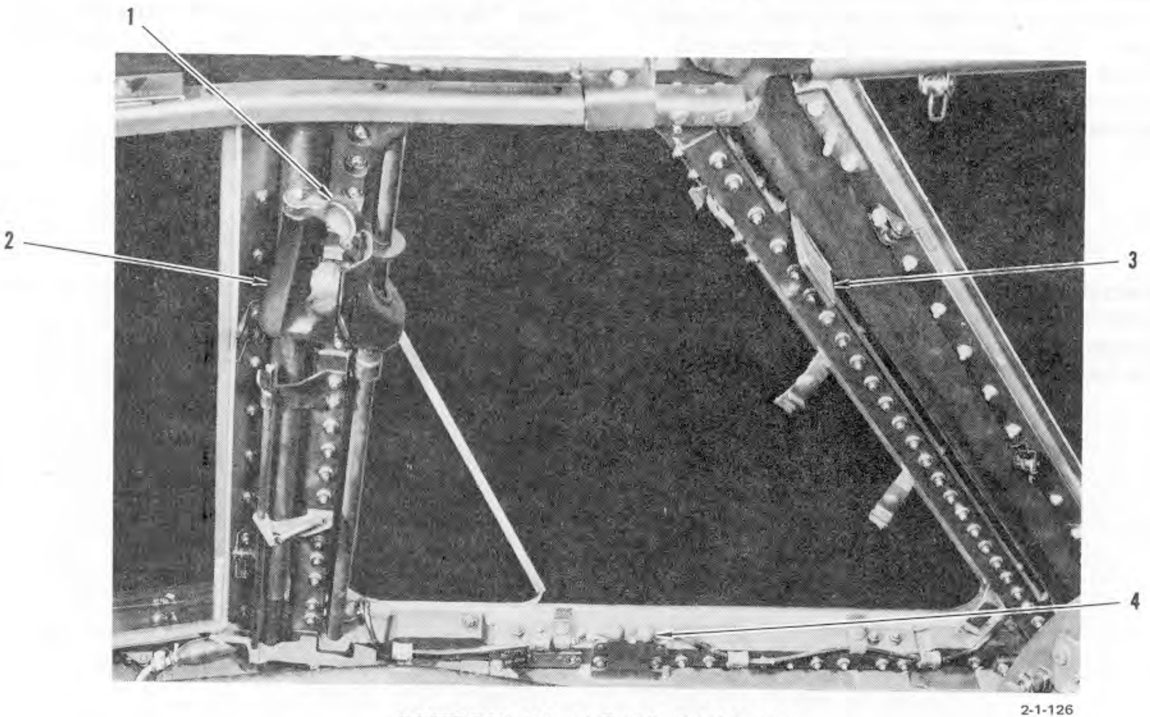
An aft entry door (figure 2-1) opening into the tail compartment is provided for access into the aircraft. The aft entry door can be operated from both inside and outside the aircraft by pulling either handle away from the hatch. The door has a ratchet mechanism which enables it to be held open in various positions for easier use as a ground emergency exit.

PRESSURE BULKHEAD DOOR

A pressure bulkhead door (56, figure 1-2) at the aft end of the lower deck is provided for inflight access to the unpressurized portion of the fuselage. This door can be opened from either side. The crew compartment must be depressurized before opening the door. The door can be locked from the crew compartment side by disabling the door handle. To lock the pressure bulkhead door, the door must be closed and latched and the lock pin removed. This action disconnects the door handle from the vertical latching bar. To unlock the pressure bulkhead door, the handle is rotated until the hole in the door handle extension lines up with the holes on the end of latching bar and the lock pin is inserted. Rotating the door handle on either side of the door with the pin in place lifts the latching bar to the unlatched position and the door can be opened.



WINDOW IN OPEN POSITION



WINDOW IN CLOSED POSITION

NOTE

PILOT'S WINDOW SHOWN -
COPILOT'S OPPOSITE

1. HANDLE LOCKBOLT
2. WINDOW HANDLE
3. FORWARD STOP
4. ELECTRICAL CONNECTOR

PILOTS' SLIDING WINDOWS

Figure 1-52A

TAIL COMPARTMENT PRESSURE BULKHEAD DOOR

A pressure bulkhead door (78, figure 1-2) at the forward end of the pressurized tail compartment is provided for inflight access to the unpressurized portion of the fuselage. This door can be opened from either side. The tail compartment must be depressurized before opening the door. A window in the door permits visual inspection of the adjacent compartment.

PILOTS' SLIDING WINDOWS

Pilot's and copilot's sliding windows (figure 1-52A) may be opened or closed (as required) while on the ground. The sliding window assembly is made up of an electrically heated window, tubular window frame, latching mechanism, rubber seal, and an electrical plug connector. Closing the window is accomplished by rolling it forward along the tracks to the forward stop and rotating the latching handle upward until the seal is pressed against its seat. A lockbolt within the handle retains the window in the closed position. Opening the window is accomplished by releasing the handle lockbolt, rotating the handle downward, and pulling the window aft.

WARNING

To prevent injury to ground crewmembers, one of the pilots' sliding windows will be opened approximately 2 inches before the main entry door is opened.

UPWARD EJECTION SEATS

NOTE

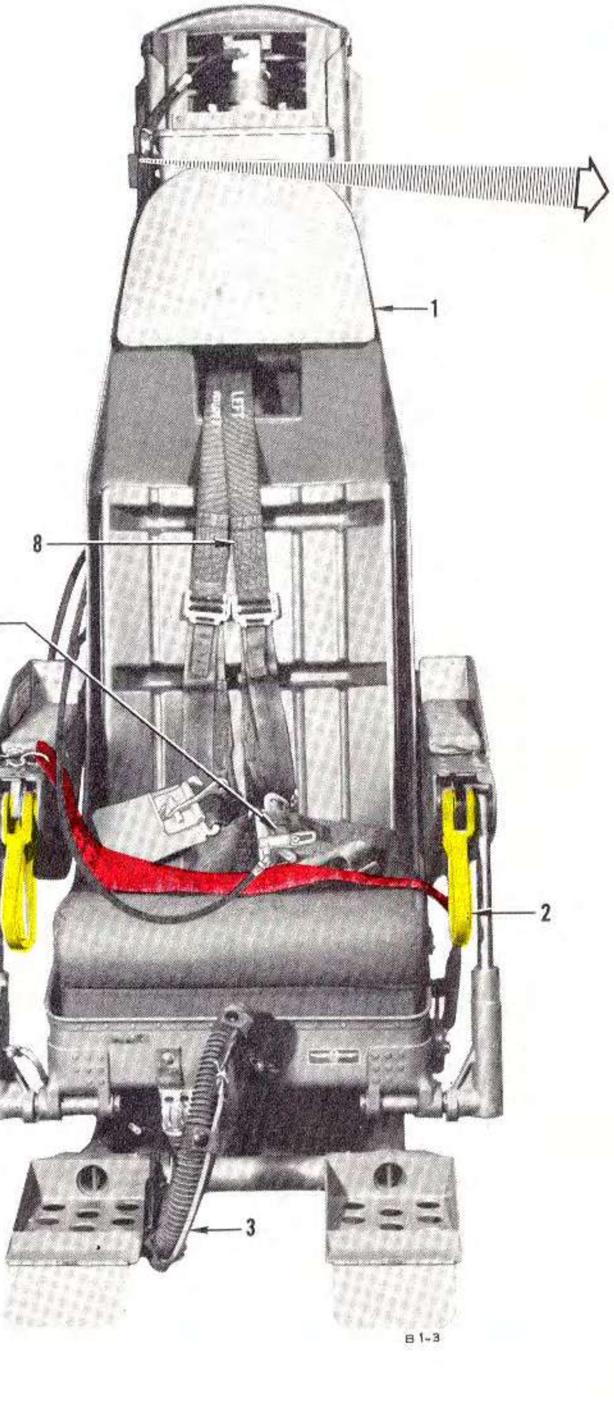
For complete description of downward ejection seats, see "Downward Ejection Seats," Section IV.

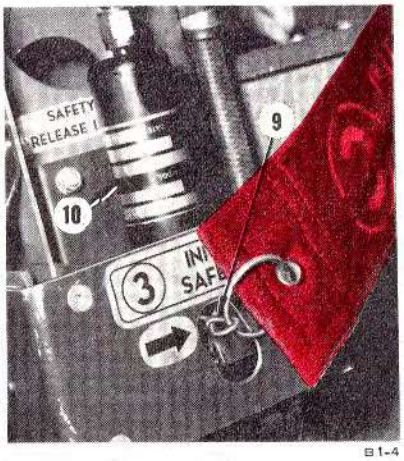
Bucket-type upward ejection seats (figure 1-53) are installed at the pilots' positions. The seats are normally used as standard seats; however, in emergencies, they provide a safe and effective means for bailout. Each seat accomodates a back-type parachute and survival kit or seat cushions. Utilizing the wrong seat cushions and/or survival kit or too much cushioning material does not provide comfort but actually creates a definite injury hazard and may position the seat occupant where it is difficult to reach the controls. Chance of vertebral injury is increased considerably by the seat occupant sitting on too thick a compressible mass. When utilizing the ejection seat in this circumstance, it will not exert a direct force on the occupant until the seat has traveled 2 or 3 inches upward. After this amount of travel, the seat has gathered such momentum that excessive impact is produced when the seat initially lifts the seat occupant. During crash landing or ditching, the same compression factor will permit the seat occupant to sink far enough down to loosen the shoulder straps, thus allowing the seat occupant to slump forward, possibly incurring severe back injury. Additional cushioning may also raise the seat occupant to such a height that his arms will not be held by the arm retainers on either armrest, thus exposing them to possible injury from flailing in the wind blast following ejection.

WARNING

Do not use any form of shock absorbing device other than the survival kit and/or the seat cushion designated as standard equipment for the ejection seat. To do so would create a definite possibility of serious injury during ejection and/or crash landing/ditching.

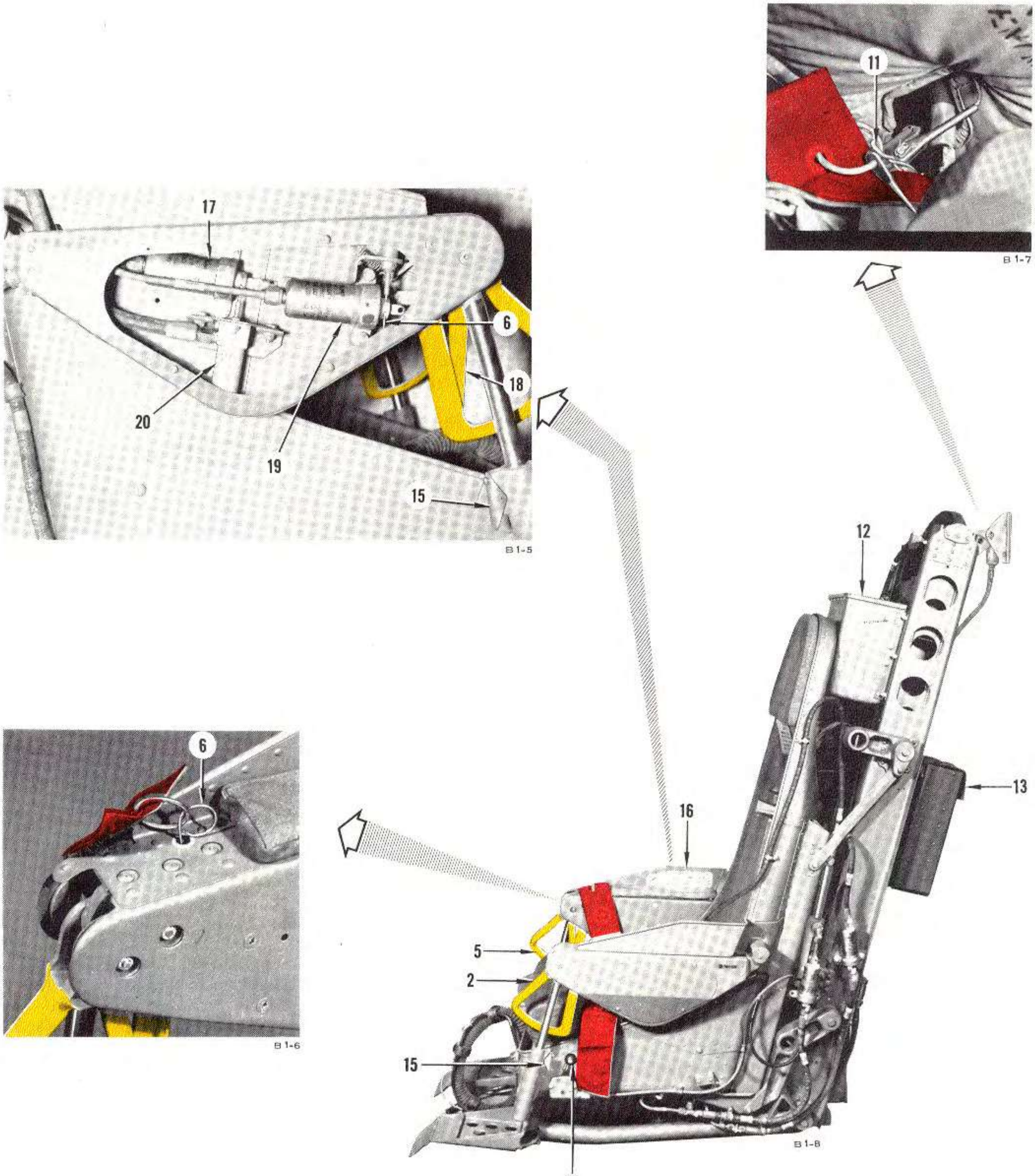
Footrests and headrests are provided with each seat to aid the occupant in maintaining proper position during ejection. Each seat has emergency disconnect plugs containing both electrical and oxygen connections which automatically release at the time of ejection. Each seat is provided with an inertia reel type





1. HEADREST
2. LEFT ARMING LEVER
3. OXYGEN SUPPLY HOSE
4. POSITIONING SWITCH
5. RIGHT ARMING LEVER
6. FLIGHT SAFETY PIN, NO. 1 (ARMING INITIATOR)
7. AUTOMATIC OPENING SAFETY BELT
8. SHOULDER HARNESS
9. MAINTENANCE SAFETY PIN NO. 3 (SAFETY BELT RELEASE INITIATOR)
10. SAFETY BELT RELEASE INITIATOR
11. MAINTENANCE SAFETY PIN NO. 2 (CATAPULT SAFETY PIN-PULL INITIATOR)
12. ESCAPE ROPE
13. FLIGHT REPORT HOLDER 54▶88 W1▶W12
14. INERTIA REEL CONTROL HANDLE
15. ARM REST POSITIONING CATCH
16. ARM REST
17. CATAPULT INITIATOR
18. FIRING TRIGGER
19. ARMING INITIATOR
20. CATAPULT INITIATOR SAFETY PIN PULL CYLINDER

Figure 1-53 (Sheet 1 of 2).



UPWARD EJECTION SEAT (Typical)

Figure 1-53 (Sheet 2 of 2).

shoulder harness and automatic opening safety belt. See "Automatic Opening Safety Belts" and "Automatic Opening Parachutes," this section, for a discussion of the automatic opening safety belts. The seat can be electrically positioned up and forward or down and aft by a seat positioning switch. The armrests can be folded into a stowed position if the armrest positioning catch (15, figure 1-53) on the armrest post is released. For a detailed discussion of ejection seat sequence, see "Escape Systems Operation," Section VII.

UPWARD EJECTION SEAT CONTROLS

Arming Levers

Loop-type arming levers (2 and 5, figure 1-53) installed in the armrest of each seat are used to prepare the seat for ejection. The arming levers also provide a grip to help keep the occupant's hands and arms in place during ejection. The left arming lever locks the inertia reel and the right arming lever arms the seat. When the right arming lever (5, figure 1-53) is rotated forward and upward to the locked arming position, the arming initiator is fired. Firing the arming initiator fires a series of thrusters and initiators which bottom the seat, stow the control column, and jettison the hatch. Simultaneously, as either the pilot's or copilot's control column stows, the alarm system is energized to signal abandon. The link connected to the hatch fires the catapult pin-pull initiator when the hatch is jettisoned, which actuates the pin-pull, which removes the pin from the catapult initiator, thus arming the seat. See figure 1-54 for arming lever sequence of operation.

WARNING

In order to accomplish ejection, armrests should be raised prior to rotating arming levers. Seat can be fired with armrests lowered; however, this could cause injury to occupant of the seat.

Catapult Firing Trigger

A catapult firing trigger (18, figure 1-53) is installed in the right arming lever and maintains a 25° lag as the arming lever is moved to the armed position. The firing trigger is locked and cannot be actuated until the hatch is jettisoned. When the trigger is pulled, the catapult is fired and the seat is ejected.

SEAT SAFETY PINS AND STREAMERS

Seat Safety Pins

Each upward ejection seat is provided with a safety pin (6, figure 1-53) (numbered 1) to be used by the flight crew member to prevent inadvertent initiation of the seat ejection sequence. The pin is attached to the end of a single red streamer and is inserted in the arming initiator through a hole in the armrest structure. This pin should be in place in the armrest at all times on the ground and whenever the crew member leaves his seat in flight.

WARNING

In event the arming lever has been rotated, the seat cannot be safetied. Installation of the safety pin with the arming lever rotated to the up position will not prevent the seat from firing if the firing trigger is squeezed.

In addition, each upward seat is provided with two safety pins (numbered 2 and 3) to be installed by the maintenance crew only. The two pins are attached to a single red streamer and are stowed in the box provided when the seat is on flight status.

Seat Positioning Switch

A seat positioning switch (4, figure 1-53) on the right side of the seat bucket is provided to control seat adjustment. The switch is spring loaded to OFF position. To move the seat up and forward or down and aft, move the switch up or down. The switch is supplied 118-volt a-c power through circuit breakers marked "Seat Position" - "Pilot" and "Copilot" on the "Miscellaneous" portion of the pilot's circuit breaker panel.

CAUTION

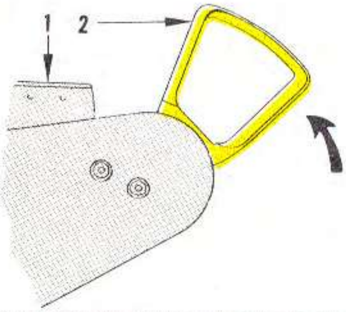
Excessive operation of the positioning motors will shorten their normal duty cycle. A full actuation in one direction should be followed by at least a 30-second rest. If another full action is required after the 30-second delay, a 5-minute rest must follow before another actuation of any degree.

Inertia Reel Control Handle

The inertia reel control handle (14, figure 1-53) with LOCKED--RELEASED positions is located on the left side of each seat. A detent is provided for retaining the handle at either position of the quadrant. When the handle is in the RELEASED position, the reel harness strap will extend to allow the crew member to lean forward; however, the reel harness strap will automatically lock when an impact force of 2 to 3 "g's" is encountered. When the reel is locked in this manner, it will remain locked until the handle is moved to the LOCKED position and then returned to the RELEASED position. When the handle is in the LOCKED position, the reel harness strap is manually locked so the crew member is prevented from bending forward. The LOCKED position is used for ditching and crash landing. The left arming lever locks the inertia reel. (The right arming lever has no effect on the inertia reel.) The LOCKED position may be used as an additional safety feature over the automatic operation of the inertia reel system.

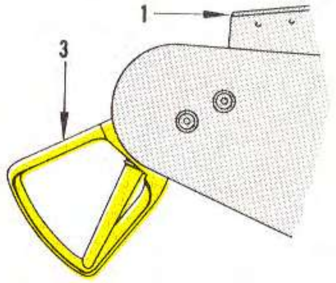
LEFT ARMING LEVER

- RAISE ARMRESTS (1) TO LOCKED POSITION.
- ROTATE THE LEFT ARMING LEVER (2) TO LOCK THE SHOULDER HARNESS.



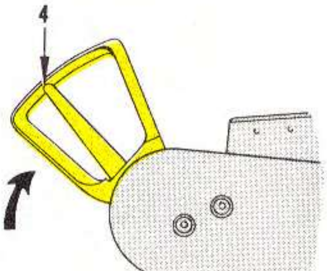
RIGHT ARMING LEVER

- ROTATE THE RIGHT ARMING LEVER (3) FORWARD AND UPWARD TO THE MECHANICAL STOP. FIRING TRIGGER (4) WILL ROTATE TO FIRING POSITION.

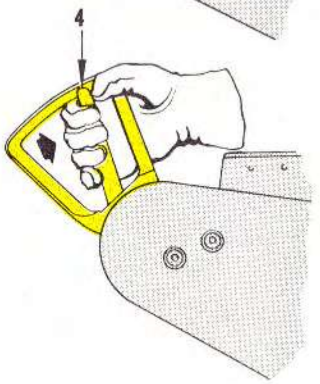


NOTE

- EJECTION CONTROLS ARE ALL IN THE RIGHT ARMING LEVER (3).
- ROTATING THE ARMING LEVER POSITIONS SEAT, STOWS CONTROL COLUMN, JETTISONS ESCAPE HATCH, AND ARMS SEAT. THE ALARM SYSTEM IS ENERGIZED TO SIGNAL ABANDON SIMULTANEOUSLY AS EITHER THE PILOT'S OR COPILOT'S CONTROL COLUMN STOWS.



- SQUEEZE THE FIRING TRIGGER (4) TO FIRE THE CATAPULT.



UPWARD EJECTION SEAT ARMING LEVER TRIGGER SEQUENCE

Figure 1-54.

AUTOMATIC OPENING SAFETY BELTS AND AUTOMATIC PARACHUTES

AUTOMATIC OPENING SAFETY BELTS

In order to provide a quick, sure, and dependable separation from the seat after ejection, an automatic safety belt release mechanism is incorporated in each ejection seat. The system consists of a trigger, a safety belt release initiator, necessary ballistics tubing, and an automatic opening safety belt (figures 1-55 and 1-55A). The safety belt initiator is triggered by the seat as it leaves the aircraft; after a 1-second delay, the initiator fires and the expanding gas operates the seat belt automatic opening mechanism. The safety belt is designed to allow the shoulder harness and the parachute arming lanyard anchor to be installed by manual operation of the belt (figures 1-55 and 1-55A). Upon automatic operation of the belt, only the shoulder harness will be released; the arming lanyard will be securely attached to the belt and release of the shoulder harness leaves the occupant free to separate from the seat, and since the arming lanyard is attached to the belt, the automatic opening feature of the parachute is activated by the occupant's separation from the seat. Figures 1-55 and 1-55A show the automatic release safety belt in the locked, manually opened and automatically opened conditions. The belt is designed to be used with the automatic opening parachute and is provided with a means of retaining the parachute arming lanyard when the crewmember is separated from the seat. A metal retaining ring is fastened to the end of the parachute arming lanyard as an anchor. On figures 1-55 and 1-55A, note that the anchor or metal ring is retained and the lanyard pulled only if the belt is opened automatically. If the belt is opened manually, the anchor will not be retained to pull the lanyard and the parachute will not open automatically unless the parachute arming lanyard knob is pulled by hand.

Type HBU-2B/A Automatic Opening Safety Belts

The HBU-2B/A belt (figure 1-55) consists of two seat belt halves, one side having a link assembly and the opposite side the buckle assembly. It is provided with a manual latching and release mechanism for normal operation and a gas-operated automatic release mechanism for emergency operation during seat ejection. Gas for actuating the automatic release is supplied from a ballistic initiator through a flexible hose. The link side of the belt engages the two harness loops. The buckle mechanism incorporates an interlock device which prohibits fastening the lap belt without first inserting the parachute automatic ripcord lanyard anchor (gold key) into the lanyard latch located at the top of the buckle. The automatic seat belt halves cannot be connected until this key has been inserted into the buckle assembly. Once inserted, the key remains locked in the buckle throughout the automatic release phase and can only be released manually.

In the operation of the HBU-2B/A belt, a parachute arming lanyard anchor (gold key) on the parachute lanyard is inserted into the lanyard latch located at the top of the lap belt mechanism assembly housing (belt buckle). To close the belt, insert the lanyard anchor into the lanyard latch first. This enables the lap belt link to be latched within the buckle assembly. The right shoulder harness loop is then placed on the link, followed by the left loop. Pushing the seat belt link into the side of the buckle assembly allows the lap belt halves to be connected. To open the belt manually, rotate the manual release lever on the buckle assembly. This allows the lap belt halves to separate and the parachute arming lanyard anchor to be released.

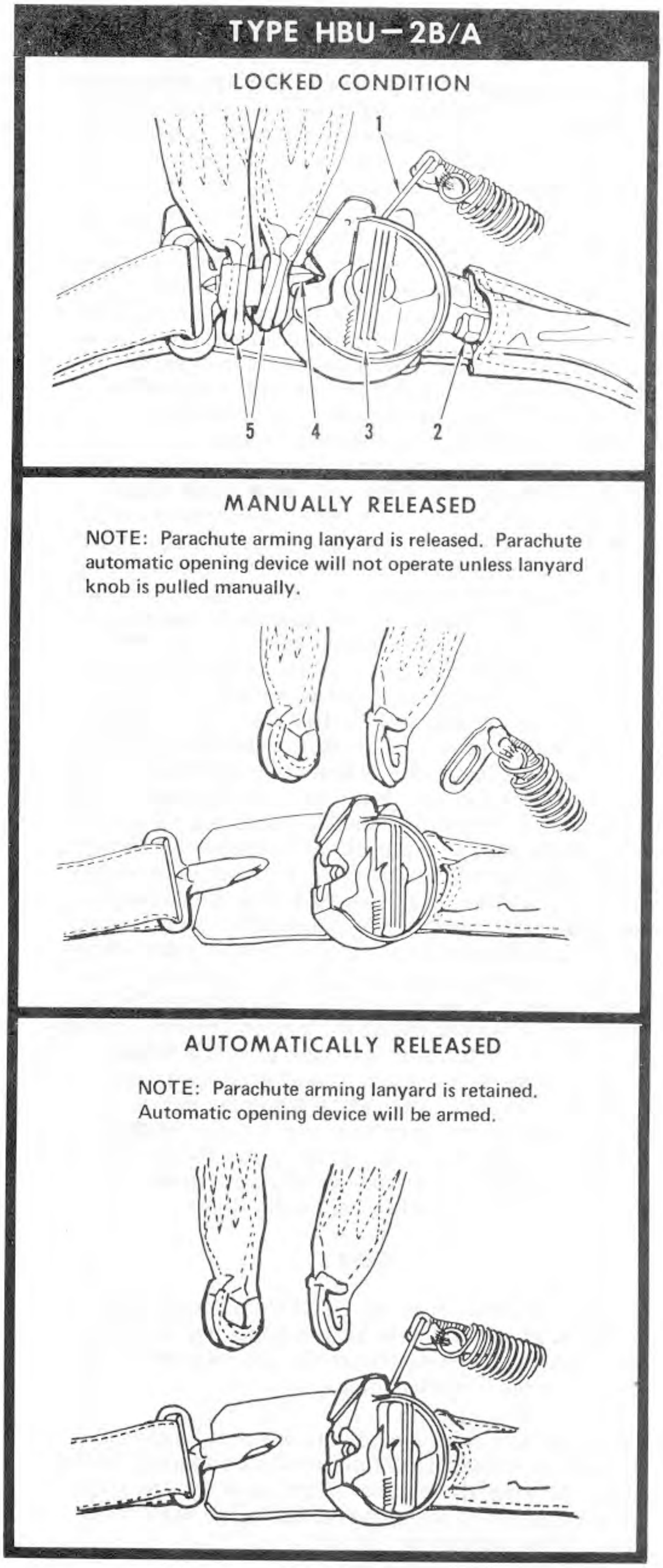
WARNING

- Do not open the automatic release safety belt prior to ejection, regardless of altitude. Since the deceleration of a crewmember alone is considerably greater than that of the crewmember and seat together, immediate separation would result if the belt were manually opened prior to ejection. This could result in the parachute pack being blown open and injuries caused by a high opening shock of the parachute.
- Parachute arming lanyard anchor must be installed as shown (figure 1-55) or the parachute will not open automatically if ejection is necessary. An audible click may be heard as the lanyard latch locks. Pull on the lanyard to check that the lanyard anchor (gold key) is locked and secured.
- Care must be taken to preclude inadvertent release of the parachute arming lanyard anchor. The manual release lever can be rotated slightly, resulting in the lanyard anchor being released without opening the lap belt attaching link. Periodically during flight, check that the lanyard anchor is locked.
- Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.
- If the belt is manually opened during ejection, the parachute will not open automatically upon separation from the seat.

NOTE

Manual release lever may be used to unlock belt at any time, even if automatic opening sequence has been initiated.

All data on pages 1-130A and 1-130B (Deleted)



TYPE HBU—2B/A

LOCKED CONDITION

MANUALLY RELEASED

NOTE: Parachute arming lanyard is released. Parachute automatic opening device will not operate unless lanyard knob is pulled manually.

AUTOMATICALLY RELEASED

NOTE: Parachute arming lanyard is retained. Automatic opening device will be armed.

1. PARACHUTE ARMING LANYARD ANCHOR (GOLD KEY)
2. BALLISTICS HOSE FITTING
3. MANUAL RELEASE LEVER
4. LAP BELT ATTACHING LINK
5. SHOULDER HARNESS LOOPS

AUTOMATIC OPENING SAFETY BELTS

Figure 1-55.

Figure 1-55A (Deleted)

AUTOMATIC OPENING PARACHUTES

The ejection seats and gunner's seat are designed to utilize a back-type automatic opening parachute (figure 1-56) attached to a survival kit. A bailout oxygen bottle and gage is contained in the parachute and may be inspected by opening the flap (19, figure 1-56) located under the right side of the parachute lining. Normal bailout bottle pressure is 1800 psi based on 80° F. A reduction in temperature causes reduction in cylinder pressure of 3.5 psi for each degree F. The bailout bottle is operated by pulling the green knob (5, figure 1-56) on the right front of the harness. The gunner's modified B-5 parachute is equipped with shoulder straps which are sewn onto the parachute harness for attachment to the inertia reel fittings. Automatic release from the seat following ejection and automatic opening of the parachute results in safer and, especially advantageous at low altitudes, quicker deployment of the parachute. In order to accomplish automatic opening, the parachute is equipped with an automatic ripcord release mechanism. An aneroid device is incorporated in the release mechanism to enable the mechanism to pull the ripcord when the desired altitude is reached. A timer is also included which causes a delay in opening the parachute. When the parachute is used in an ejection seat, the F-1B timer is set for the number of seconds delay recorded in the parachute log book. When the parachute is used in other than ejection seats, as in the gunner's seat, the timer is set for 5 seconds. The aneroid device is set according to instructions contained in applicable technical publications. The release mechanism is activated by a lanyard which is attached to the automatic opening safety belt by a metal anchor for automatic operation. A red knob is attached to the lanyard for manual operation. Upon separation from the seat, the lanyard remains attached to the safety belt thus activating the ripcord release mechanism. When activated above the preset altitude, the parachute will remain closed until the preset altitude is reached; then after the delay set on the timer expires, the parachute will open. When the release mechanism is activated below the predetermined altitude, the parachute will open after the number of seconds delay set on the timer.

NOTE

When bailout from the gunner's position is attempted at minimum altitude, the use of the automatic opening feature is not recommended due to the 5-second delay.

The parachute is equipped with a manual ripcord T-handle for opening the parachute in addition to the automatic opening feature. Provision is also made for attachment of the survival kit to the parachute-survival kit attachment fitting.

WARNING

- For automatic parachute deployment:
  1. The automatic release safety belt initiator safety pin (9, figure 1-53) must be removed.
  2. The parachute arming lanyard anchor (metal ring) must be fastened to the belt.
  3. The safety belt must be allowed to open automatically.

  If any one of the above conditions is not met:
  4. The parachute arming lanyard knob must then be pulled for automatic deployment.
- When attaching the survival kit to the parachute harness, care must be taken to insure that the straps are not entangled in the safety belt. The survival kit should always be fastened to the parachute before fastening the safety belt.

NOTE

- The automatic opening parachute can be opened manually at any time by pulling the ripcord T-handle.
- If it is necessary that either the ripcord or the arming lanyard be pulled to open the parachute, it is desirable to use the ripcord T-handle if below 14,000 feet and the arming lanyard knob if above.

Zero Delay Lanyard

A detachable zero delay lanyard (11, figure 1-56) provides for improved low altitude escape capability. The lanyard is attached to the automatic release device arming knob. When the hook on the other end of the lanyard is hooked to the ripcord T-handle, the automatic release device is bypassed and the manual ripcord release is pulled simultaneously as separation from the seat occurs. (In effect this is zero-second delay in deployment of the automatic parachute following separation from the seat.) The zero delay lanyard should be hooked to the T-handle before takeoff, after takeoff, during low level tactics, and before landing. During all flight above minimum altitudes, the hook must be detached from the T-handle and stowed in the stowage ring provided on the parachute harness. "Hooking" and "stowing" are manually accomplished by each crew member.

WARNING

Zero second delay parachute configuration should never be used at speeds in excess of approximately 400 knots IAS since the opening shock will be excessive.

PERSONAL LOCATOR BEACONS

Most parachutes are equipped with personal locator beacons. The beacon equipped parachutes may have an AN/URT-21, AN/URT-27, or AN/URT-33 installed. Except for size and range, all three beacons are almost identical. Each beacon is designed to begin transmitting automatically when a plastic plug is pulled from the radio by a lanyard during chute deployment. The beacons are accessible to the crew member after a parachute landing and have complete metalcal instructions for manual operation attached to the unit.

Personal Locator Beacon Lanyards

Parachutes equipped with a personal locator beacon, have a nylon cord lanyard with a tab and a female snap fastener. The lanyard can accommodate all three personal locator beacons. For automatic action of the beacon with this type of lanyard, the tab fastener is snapped to a male snap fastener located below the right canopy release. For nonautomatic (manual) operation, the tab is left unsnapped (3A and 3B, figure 1-56). For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation.

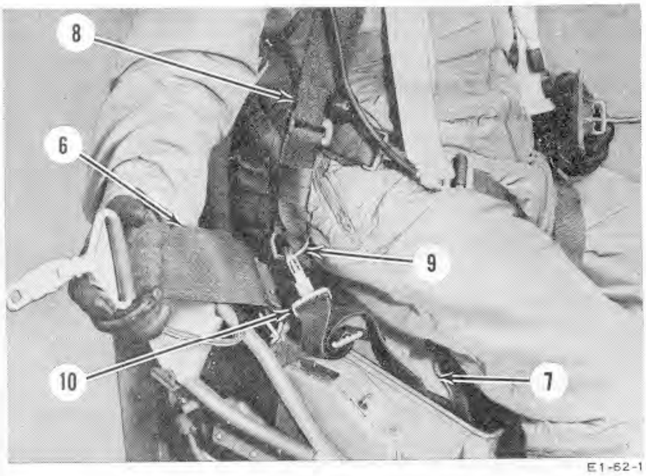
NOTE

> The sole purpose of the beacon lanyard is to assure automatic operation (if desired) after bailout in case the crew member is injured or incapacitated during the egress cycle. For this reason, the beacon lanyard must be configured to the desired operation (automatic or nonautomatic) during the interior preflight and rechecked just prior to bailout.
>
> Recent experience has indicated that some beacons are unreliable when configured for automatic actuation due to lanyard rigging defects. Operation (transmitting) can be readily confirmed after parachute landing by checking that the plastic plug has been pulled from the radio.

AUXILIARY EQUIPMENT

The following equipment and its operation is described in Section IV, "Auxiliary Equipment."

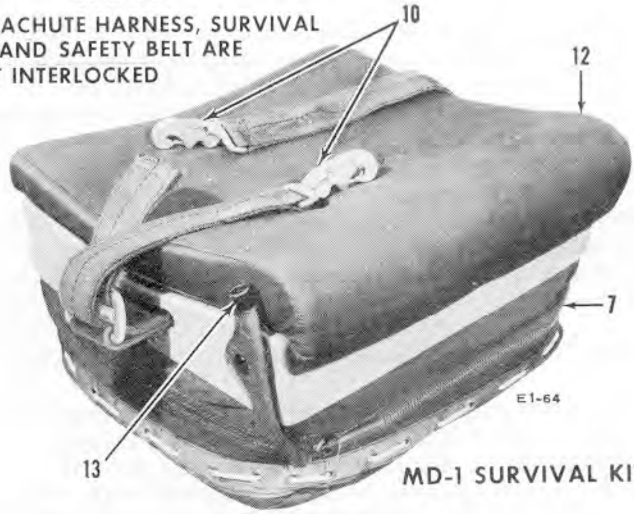
Air Conditioning Systems
Anti-Icing Systems
Communication and Associated Electronic Equipment
ECM Equipment (Refer to T.O. 1B-52D-1-2)
Lighting Equipment
Oxygen Systems
Autopilot
Instrument Landing System (ILS) Equipment
Flight Director System
Automatic Approach Equipment
Navigation Equipment
Aircraft Weapons Control System Monitoring Set (AN/AJM-14(V))
AN/ASQ-48 Bombing Navigational System (BNS)
Terrain Avoidance System
Bombing System
Bomb Door System
Missile System (AGM-28)
Gunnery System (MD-9) (Also Refer to T.O. 1B-52B-1-5)
Air Refueling System (Also Refer to T.O. 1-1C-1 and T.O. 1-1C-1-5)
Single Point Ground Refueling System
EW Officer's Ejection Seat
Downward Ejection Seats
Automatic Opening Safety Belts and Automatic Parachutes
Turret Jettison System
Miscellaneous Equipment



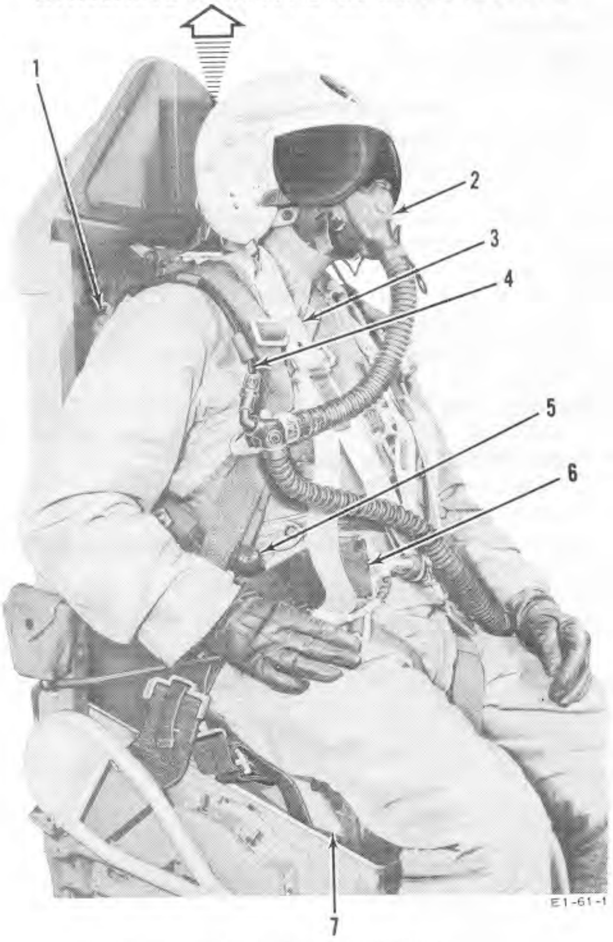
ATTACHING SURVIVAL KIT TO PARACHUTE

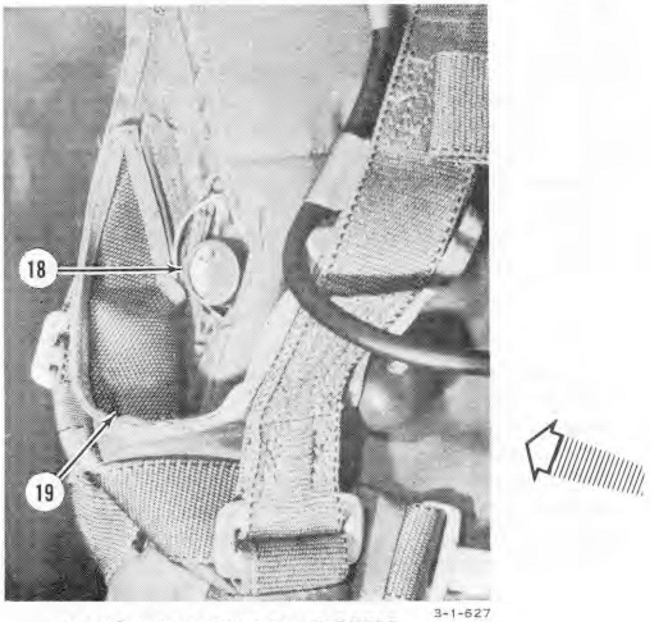
NOTE

PARACHUTE HARNESS, SURVIVAL KIT AND SAFETY BELT ARE NOT INTERLOCKED



MD-1 SURVIVAL KIT





BAILOUT OXYGEN BOTTLE

1. PARACHUTE, AUTOMATIC OPENING
2. OXYGEN MASK
3. SHOULDER HARNESS

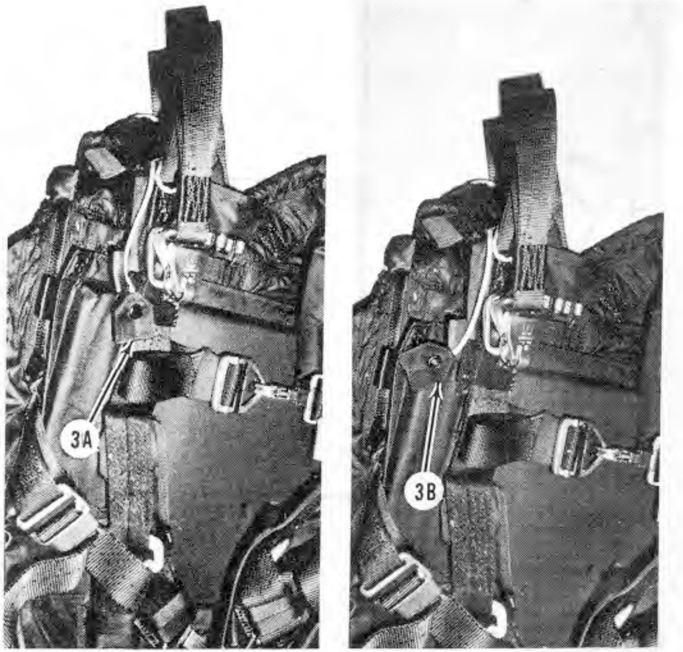
3A. PERSONAL LOCATOR BEACON LANYARD SNAPPED (AUTOMATIC BEACON ACTUATION)
3B. PERSONAL LOCATOR BEACON LANYARD UNSNAPPED (NONAUTOMATIC BEACON ACTUATION)

4. BAILOUT OXYGEN HOSE
5. BAILOUT OXYGEN BOTTLE RELEASE KNOB
6. AUTOMATIC OPENING SAFETY BELT
7. SURVIVAL KIT
8. PARACHUTE HARNESS
9. SURVIVAL KIT ATTACHMENT RING
10. SURVIVAL KIT ATTACHMENT FITTING
11. ZERO DELAY LANYARD
12. SEAT CUSHION
13. SURVIVAL KIT RELEASE KNOB
14. PARACHUTE CANOPY RELEASE
15. PARACHUTE RIPCORD MANUAL D-RING (RIPCORD T-HANDLE)
16. PARACHUTE AUTOMATIC RELEASE MANUAL ARMING KNOB
17. PARACHUTE ARMING LANYARD ANCHOR
18. BAILOUT OXYGEN BOTTLE PRESSURE GAGE
19. BAILOUT BOTTLE INSPECTION FLAP

Figure 1-56 (Sheet 1 of 2).

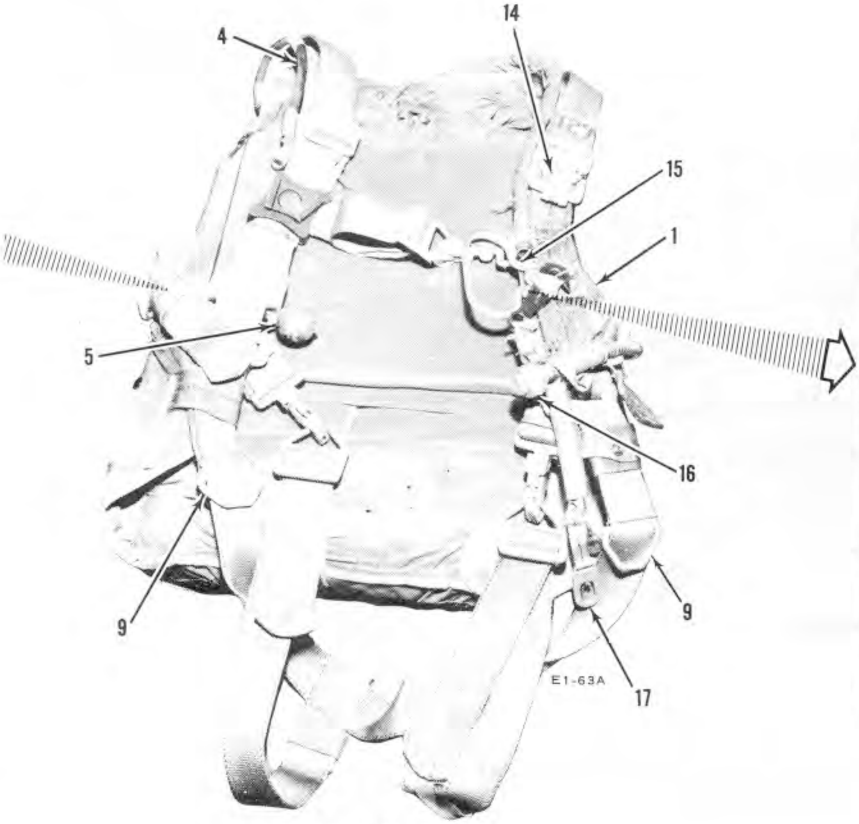
NOTE

EQUIPMENT SHOWN MAY NOT BE TYPICAL.



Automatic　　Nonautomatic

PERSONAL LOCATOR BEACON LANYARD



B-5 AUTOMATIC OPENING PARACHUTE

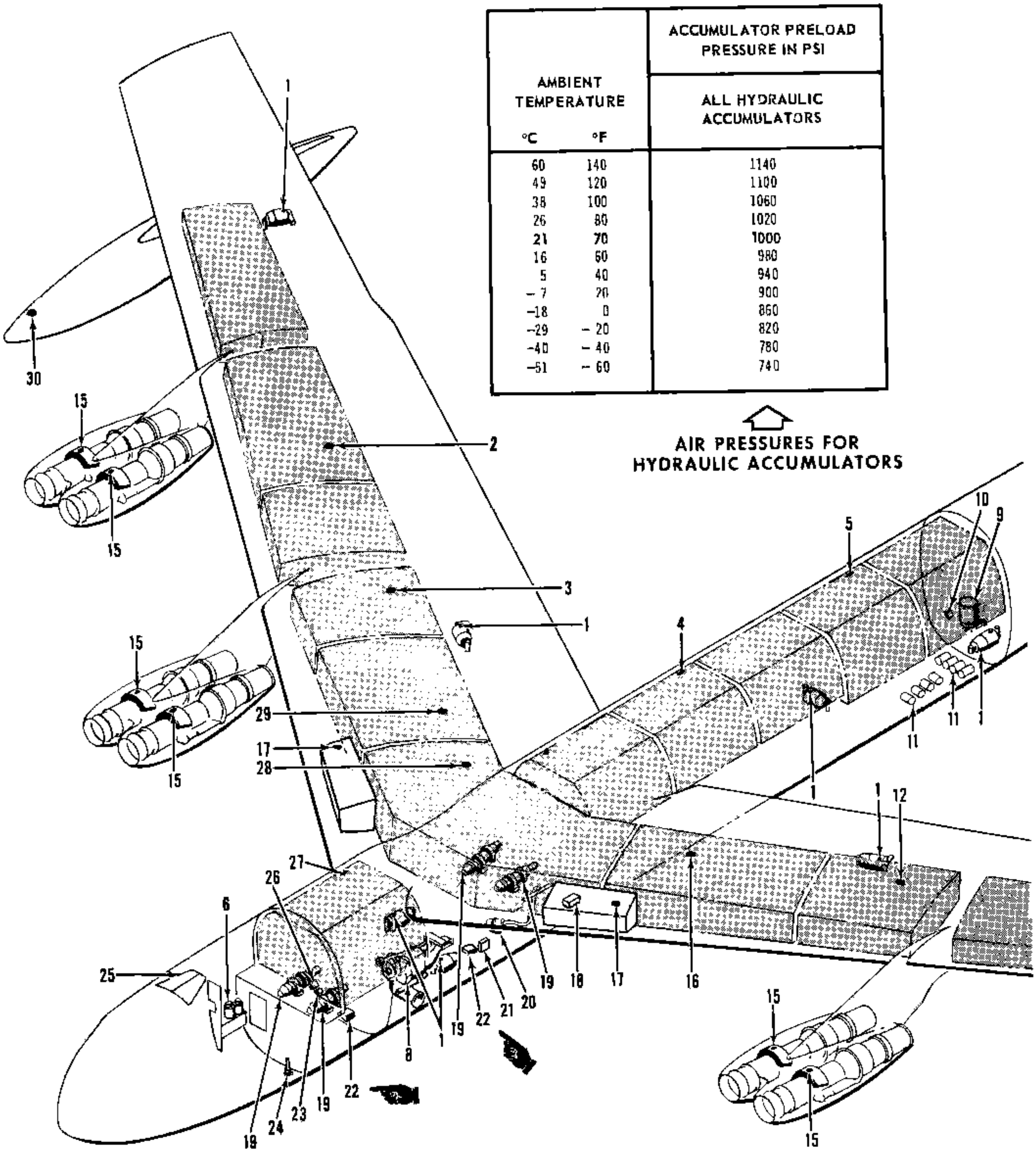
ZERO DELAY LANYARD ATTACHED TO D-RING

BAILOUT EQUIPMENT

Figure 1-56 (Sheet 2 of 2).

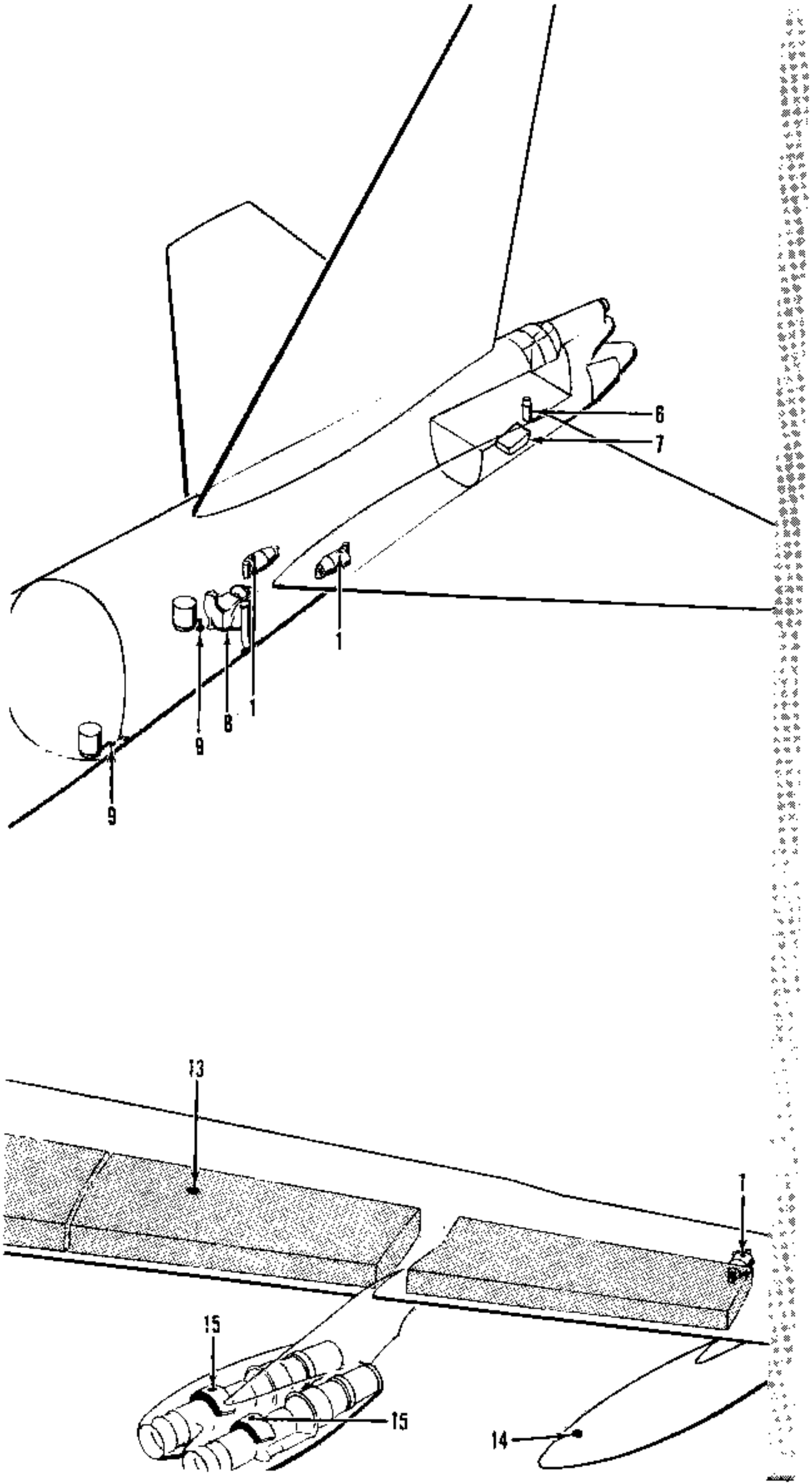
AMBIENT TEMPERATURE °C	AMBIENT TEMPERATURE °F	ACCUMULATOR PRELOAD PRESSURE IN PSI ALL HYDRAULIC ACCUMULATORS
60	140	1140
49	120	1100
38	100	1060
26	80	1020
21	70	1000
16	60	980
5	40	940
−7	20	900
−18	0	860
−29	−20	820
−40	−40	780
−51	−60	740

AIR PRESSURES FOR HYDRAULIC ACCUMULATORS



1. HYDRAULIC PACK RESERVOIRS
2. RIGHT OUTBOARD WING TANK
3. NO. 4 MAIN TANK
4. MID BODY TANK
5. AFT BODY TANK
6. DRINKING WATER CONTAINERS
7. DRAG CHUTE COMPARTMENT
8. AIR CONDITIONING PACK RESERVOIRS
9. LIQUID OXYGEN SYSTEM CONVERTER FILLER VALVES
10. GUNNERY SYSTEM EXTERNAL POWER RECEPTACLE
11. STARTER CARTRIDGES
12. NO. 1 MAIN TANK
13. LEFT OUTBOARD WING TANK
14. LEFT DROP TANK
15. ENGINE OIL TANKS
16. NO. 2 MAIN TANK

Figure 1-57 (Sheet 1 of 2).



SPECIFICATIONS

FUEL
MIL-J-5624 JP-4 (NATO F-40)
12 TANKS

FUEL (ALTERNATE)
MIL-J-5624 JP-5 (NATO F-44)

FUEL (AV GAS)
MIL-G-5572 (NATO F-12)

OIL (TURBINE)
MIL-L-007808F (NATO O-148)
8 TANKS

HYDRAULIC FLUID
MIL-H-5606 (NATO H-515)
6 RESERVOIRS

ALTERNATOR PACK OIL
MIL-O-6081 GRADE 1005
4 PACKS

AIR CONDITIONING PACK OIL
AS SPECIFIED ON PACK NAME PLATE
2 PACKS

WATER INJECTION
CLEAN UNDISTILLED WATER WITH LESS THAN 10 PARTS SOLIDS PER MILLION PARTS. WATER WITH MORE IMPURITIES MUST BE RESTRICTED TO EMERGENCY USE ONLY
2 TANKS

NOTE

WATER INJECTION IS NOT USED BELOW 40°F

BATTERY WATER
DISTILLED WATER
4 BATTERIES A
3 BATTERIES A

LIQUID OXYGEN
MIL-O-27210, TYPE II
3 CONVERTERS

STARTER CARTRIDGES MXU/4A
8 CARTRIDGES

POWER CARTS
COMPRESSOR, TYPE MA-1A (OR EQUIVALENT)
EXTERNAL HYDRAULIC TEST STAND, TYPE D-5A (OR EQUIVALENT)
GENERATOR SET, TYPE MD-3 (OR EQUIVALENT)
EXTERNAL GROUND BLOWER, TYPE A-2 (OR EQUIVALENT)
EXTERNAL GROUND SUPPORT BLOWER, TYPE MC-1 (OR EQUIVALENT)

NOTE

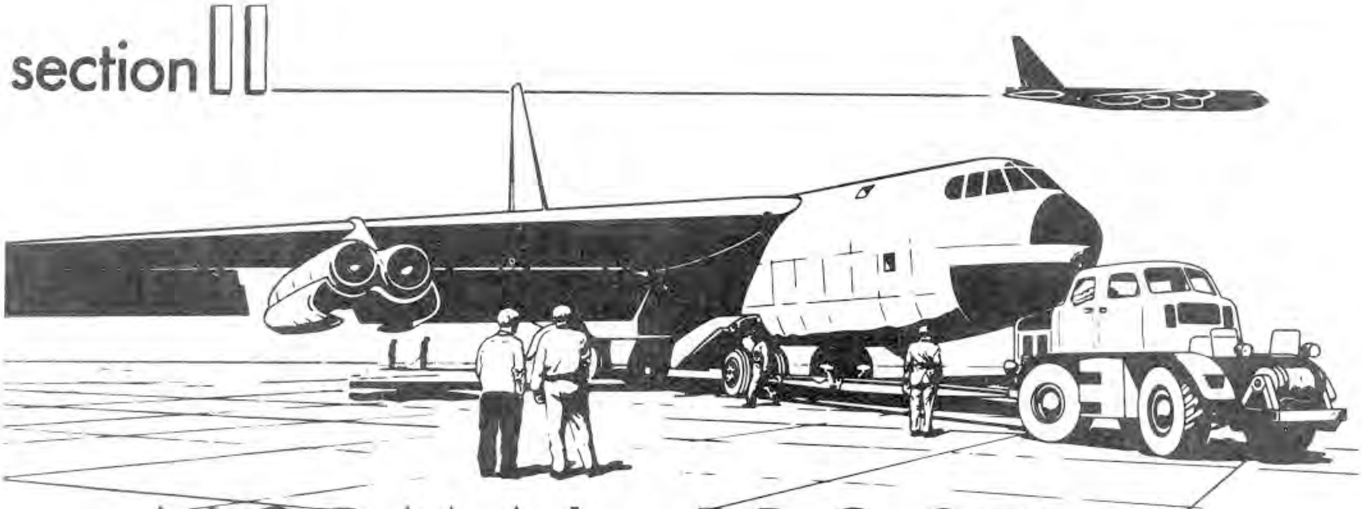
FOR AGM-28 FLUID SPECIFICATIONS AND SERVICING, REFER TO T.O. 1B-52C-30-1.

17. WATER INJECTION TANKS
18. SWESS BATTERY **Less** A
19. ALTERNATOR PACK RESERVOIRS
20. SINGLE POINT REFUELING RECEPTACLE
21. AGM-28 ARMAMENT PROVISIONS BATTERY
22. BATTERIES
23. MAIN EXTERNAL POWER RECEPTACLE
24. AIR BLEED SYSTEM GROUND SOURCE CONNECTION
25. AIR REFUELING RECEPTACLE
26. BOMBING-NAVIGATIONAL SYSTEM EXTERNAL POWER REREPTACLE
27. FORWARD BODY TANK
28. CENTER WING TANK
29. NO. 3 MAIN TANK
30. RIGHT DROP TANK

SERVICING (Typical)

Figure 1-57 (Sheet 2 of 2).

section II



NORMAL PROCEDURES

NOTE

- This section contains text and an amplified checklist. The text is divided into primary paragraphs which form the phases of a normal flight. Most of these paragraphs are followed by an amplified checklist for the particular phase of the flight. The amplified checklist is presented in a chronological form that will enable the flight crew to complete their inspection, checks, and operation of the aircraft in an expedient yet thorough manner. The amplified checklist describes in detail the steps to be completed. Each major part has been assigned to one of the pilots or a crewmember to be read by him, and to be accomplished by others in the crew. However, there are exceptions as some of the checklists will be read and completed silently. To show which crewmember will accomplish certain steps, the normal crew coding will be used and the code letters will appear after the response to each step. At times it may be advantageous for the copilot to accomplish certain items designated for the pilot and vice versa. The terms "As required," "Climatic," and "Cross-checked" as used in the checklist indicates equipment operation or settings which may vary according to prevailing conditions. In practice, the response to these items will be the required switch or control position or actual indicator reading. The amplified checklist has also been designed to accommodate the production of the abbreviated checklist to be used during aircraft operation.
- Some system control switches are provided with a guard, such as stabilizer trim cutout, antiskid, etc. In practice, when these switches are actuated, the desired toggle position must be ascertained and then the guard positioned.

TABLE OF CONTENTS

TABLE OF CONTENTS (cont)

TABLE OF CONTENTS (cont)

PREPARATION FOR FLIGHT

FLIGHT RESTRICTIONS

All limitations imposed on the aircraft are described in "Operating Limitations," Section V.

FLIGHT PLANNING

The necessary fuel, airspeed, and thrust settings required to complete a proposed mission should be determined by using the operating data from the Appendix. A mission problem in Part 12 contains complete information on fuel distribution, cg control, and other problems which occur during a long mission. (See "Fuel Servicing.") With AGM-28 missiles installed, accomplish mission planning for simulated launch only.

FUEL SERVICING

Fuel tank and fuel gage calibration to date has not become sufficiently accurate to be relied upon. For this reason, dipsticks have been provided for use by the servicing crew. In order that the pilot may check the fuel loading, a refueling and distribution log will be with the aircraft Form 781 and will be checked and signed by the pilot during the "Interior Inspection." For information on the "Refueling and Distribution Log," refer to Part 12 of the Appendix.

TAKEOFF AND LANDING DATA CARDS

Compute all takeoff and landing data and complete the takeoff and landing data cards as illustrated in Parts 2 and 9 of the Appendix. This data should be rechecked just prior to flight to determine the effect of any changes in runway conditions or aircraft configuration.

WEIGHT AND BALANCE

Obtain and check the takeoff and anticipated landing gross weight and balance before flight. Check that the required fuel, ammunition, and bomb load have been loaded. See "Operating Limitations," Section V, for weight and cg limitations. Do not attempt takeoff or landing with cg outside the specified limits. Refer to T.O. 1-1B-40, Handbook of Weight and Balance Data, for weight and loading information. This information is supplemented by a load adjuster. The current load adjuster to use is E1175. Also check Form 365F (Form F) for specific weights and cg information for each flight. Refer to Part 12 of the Appendix for sample copy.

ENTRANCE

Two main entrance doors (figure 2-1) provide access into the aircraft. The forward pressurized compartment has a door on the lower right side of the fuselage ahead of the forward landing gear wheel well. A door on the right rear side of the fuselage underneath the horizontal stabilizer is used for entrance into the tail pressurized compartment. A flush-type handle is pulled out to unlatch each door. An entrance light switch is located to the right of each door upon entering. The entrance light operates on direct battery power.

CHECKLISTS

The flight manual checklists have been designed so that they may be used for training missions with or without bombs/missiles, for alert posture, and for EWO missions which are launched from other than a ground alert posture. Ground alert checklist implementation and instructions are contained in "Alert Procedures," this section.

NOTE

> When no bombs or missiles are loaded, safety wires and seals are not required on the associated monitor control and release system controls.

Nuclear Bombs

Nuclear bomb strike mission amplified checklists appear in Section I of T.O. 1B-52C-25-2. The Pre-Takeoff and Inflight sections, only, have been integrated within the flight manual checklists. The integrated items appear without amplification in both the amplified and abbreviated checklists. T.O. 1B-52C-25-2CL-1, "Nuclear Bomb Delivery Procedures," will be maintained as a separate checklist and will be available for use as required. The following additional checklists also appear in T.O.'s 1B-52C-25-2 and 1B-52C-25-2CL-1:

- Tactical Ferry Procedures
- EWO Restrike Procedures (MMS not available)
- Emergency Procedures

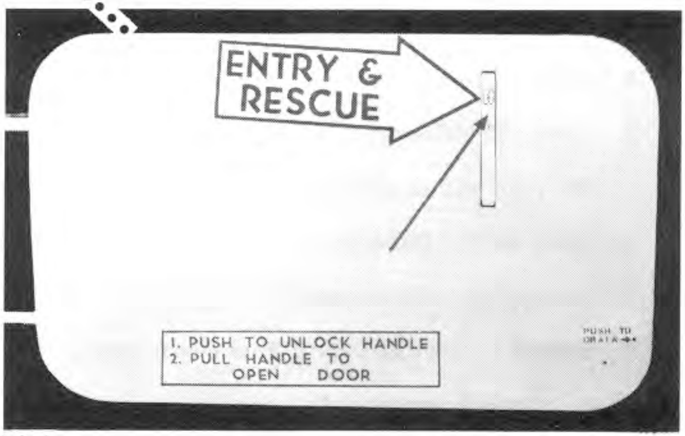
Conventional Munitions

Conventional munitions procedures from T.O. 1B-52C-34-2-1 have been integrated with the affected flight crew checklists.

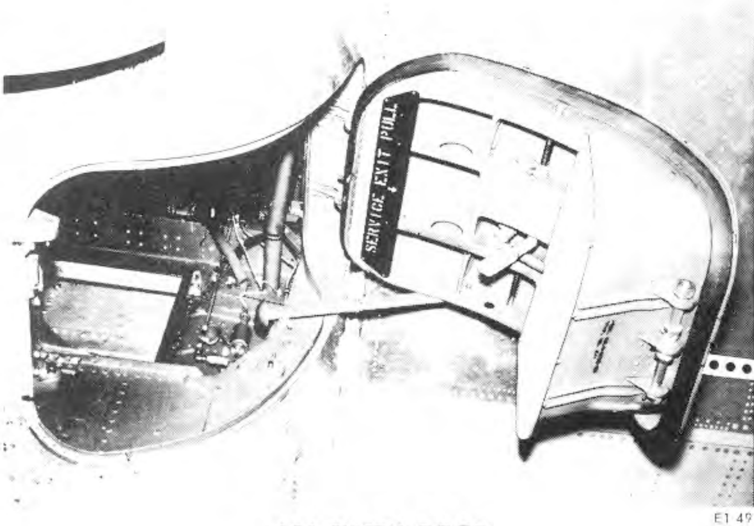
Missiles

The procedures that lend themselves to integration in existing checklists have been so integrated for applicable crew members. Otherwise, the procedures have been integrated as complete checklists. The integrated procedures appear as line items without amplification in both the amplified and abbreviated checklists. Amplification of the line items pertinent to missile normal procedures may be found in Section II of the appropriate publication as listed below. Numbering of checklist items in the abbreviated checklists will not coincide with the numbering in the amplified checklists as listed below unless the procedure has been integrated as a complete checklist.

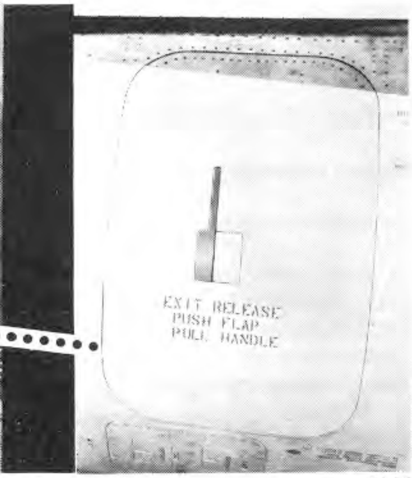
MAIN ENTRY DOOR



MAIN ENTRY DOOR LATCH



AFT ENTRY DOOR



AFT ENTRY DOOR LATCH

ENTRANCE TO AIRCRAFT

Figure 2-1.

AGM-28 CHECKLISTS. The AGM-28 normal procedures amplified checklists will appear in the B-52/AGM-28 Aircrew Weapon Delivery Technical Manual, T.O. 1B-52C-30-1. The abbreviated checklists for certain AGM-28 normal procedures are integrated in the "Normal" part of the pilots', navigator's, and radar navigator's abbreviated flight crew checklists. However, "AGM-28 Inflight Procedures" and "Tactical Ferry Procedures" will appear nonintegrated in the "Missile" part of the pilots', navigator's, and radar navigator's abbreviated flight crew checklists. "Unscheduled Landing With AGM-28 Missiles" will appear in the navigator's and radar navigator's abbreviated flight crew checklists only. The emergency procedures for AGM-28 will appear in the "Emergency" portion of the aircrew abbreviated checklists as nonintegrated items. In the pilots' checklists, these are the "Emergency Shutdown," "Engine Fire During Ground Start," and "Missile Safe Jettison." In the navigator's checklists, these are the "Armament System Malfunction Indications" and "Missile Safe Jettison."

Bomb Runs

The bomb run checklists in Section VIII have been designed so that they may be used for both training and EWO missions. They have been consolidated for use by both the navigator and radar navigator. Large charge tactics have been incorporated in each bomb run checklist.

PREPARATION FOR FLIGHT CHECKLIST

NOTE

The following items will be checked by the pilot prior to flight.

1. Pilots'/Crew Information File - Checked (P)
2. Form 175 - Checked (P)

   The pilot will complete Form 175 with related attachments in accordance with perscribed procedures.

3. Form 365F - Completed (CP)

   The copilot will compute the Form 365F in accordance with the Appendix, Part 12, "Mission Planning."

4. Takeoff & Landing Data & Fuel Prediction Curve Form 200 - Completed (CP)
   - a. Copilot computes this data in accordance with appropriate flight manual Appendix.
   - b. Minimum items to be accomplished will include all entries on the takeoff data checklist card.
5. Pilots' Route Map - As required (P-CP)
6. Review Takeoff Abort Procedures (P-CP)
7. Crew Briefing - Completed (P)
   - a. Announce assembly time.
   - b. Brief crew and extra crew members on required clothing, equipment, etc.
   - c. Brief extra crew members to configure personal locator beacon lanyards per mission requirements. For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 1-56).
   - d. Brief extra crew members on crew report procedures.
   - e. The pilot will brief crew members and extra crew members on uncontrolled bailout procedures. In the event of loss of control of the aircraft, those crew members occupying ejection seats should eject immediately upon receiving the bailout order over the interphone, or when the abandon light comes on. Extra crew members will bail out any opening available.
   - f. The pilot will determine qualification of all personnel for the flight. At the discretion of the pilot, fully qualified personnel may be dismissed from the briefing at this time.

PREPARATION FOR FLIGHT CHECKLIST (cont)

g. Crew members emergency briefing (as required). Each crew member not fully qualified will report his position and exit for crash landing during takeoff and his primary and secondary bailout exit. In the event of planned crash landing, all crew members not essential to flight will bail out if time and conditions permit. Review gunner's emergency call light signals if gunner not fully qualified. Brief gunner to exercise extreme caution when using the aft handholds during unstable flight conditions to preclude inadvertent activation of the turret jettison system.

h. Extra crew members emergency briefing (as required):

(1) Instructor Pilot Position - Take off and land strapped in position, remain in position for crash landing on takeoff, exit out pilot's/copilot's escape hatch.

Controlled Bailout - Primary, navigator's escape hatch; secondary, radar navigator's escape hatch.

Uncontrolled Bailout - Any open hatch available.

(2) Instructor Navigator Position - Take off and land strapped in position, remain in position for crash landing on takeoff, exit out pilot's/copilot's escape hatch.

Controlled Bailout - Primary, navigator's escape hatch; secondary, radar navigator's escape hatch.

Uncontrolled Bailout - Any open hatch available.

(3) Bunk Position - Take off and land in position, remain in position for crash landing on takeoff, exit out pilot's/copilot's escape hatch.

Controlled Bailout - Primary, navigator's escape hatch; secondary, radar navigator's escape hatch.

Uncontrolled Bailout - Any open hatch available.

(4) 10th Position (if applicable) - Take off and land strapped in position, remain in position for crash landing on takeoff, exit out pilot's/copilot's escape hatch.

Controlled Bailout - Primary, navigator's escape hatch; secondary, radar navigator's escape hatch.

Uncontrolled Bailout - Any open hatch available.

(5) Any crew member occupying the EW position - Assure that the ALR-20 rack is stowed and locked before ejection.

PREPARATION FOR FLIGHT CHECKLIST (cont)

i. Emergency Signals - Interphone is the primary means of crew warning. For bailout, pilot will give the command "Bail out." Interphone will be supplemented by the alarm system. Extreme care will be taken to avoid inadvertent actuation of the alarm system during seat changes.

(1) Alert or intermittent signal - Prepare for crash landing or ditching, alert signal repeated prior to impact.

(2) Abandon or steady signal - Abandon aircraft. If above minimum altitude, bail out. On land or water, exit out escape hatches on abandon signal after aircraft has stopped.

(3) Minimum bailout altitudes.

Gunner and extra crew members ________ ft
Downward ejection ________________ ft
Upward ejection __________________ ft

Bailout Order - G, N, IN, #10, Bunk, IP, EW, RN, CP, P for controlled bailout.

WARNING

When the aircraft is below 2000 feet above the terrain or if aircraft control is lost at any altitude, crew members occupying ejection seats should eject immediately upon receiving the bailout command by either interphone or abandon signal.

j. Personnel occupying ejection seats will normally wear parachutes at all times except when leaving their position for short periods. Personnel not occupying ejection seats will wear parachute during critical phases of flight, i.e., takeoff, landing, air refueling, cell tactics, formation, low level operations, or when directed by the pilot. Parachutes, when not being worn, will be located in a manner so as to be immediately available. Spare parachutes will be located in each crew area.

k. Lifevests will be worn as required.

l. Oxygen Masks - The pilot will tell the crew when to use oxygen based on applicable regulations and mission requirements.

m. Fire Extinguishers - One in tail, one at galley, one at EW officer's position

n. First Aid Kits - One in tail, two at galley

o. Crash Axes - One in tail, one at galley

p. Escape Ropes - One in tail, one at each upward ejection seat. Use for emergency ground exit.

PREPARATION FOR FLIGHT CHECKLIST (cont)

q. Oxygen Report Briefing:

During the climb, copilot requests an oxygen check at 12,000 feet. Copilot notifies aircrew and receives gunner's acknowledgment when passing through 25,000, 35,000, and 40,000 feet. The sequence for oxygen report is gunner, EW officer, radar navigator, and copilot. During cruise, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes and initiate the oxygen checks at 30-minute intervals when both cabin altitudes are below 12,000 feet, at 15-minute intervals when either cabin altitude is 12,000 to 25,000 feet, and at no longer than 10-minute intervals when either cabin altitude is above 25,000 feet. If cabin altitude is below 12,000 feet, only the gunner and copilot/pilot will report. The remaining crew members will check their equipment and report if abnormal. Oxygen checks are not required below 10,000 feet MSL.

NOTE

On extended flights (flights in excess of 17 hours duration), the gunner may be relieved of crew duties for periods of crew rest by the copilot. Before the gunner is relieved from crew duties, the copilot will request a cabin pressure and oxygen check and ascertain that the gunner is on interphone and oxygen. During the period of the gunner's crew rest, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes. Close crew coordination between the pilot and copilot is mandatory to insure frequent monitoring.

r. Station Checks:

Pilot and copilot must accomplish station checks at level-off, at 30-minute intervals during cruise, and prior to leaving crew positions during flight. A check for system operation and proper switch settings for prevailing conditions will be made during each station check. Station checks will include:

(1) Circuit breakers

(2) TR loads and bus voltages

(3) Alternator loads and system frequencies

(4) Fuel panel

(5) Engine instruments

(6) Oxygen quantity

(7) Hydraulic systems

s. Equipment Stowage:

Brief crew and extra crew members regarding stowing and securing of personal equipment, extra parachutes and extra equipment, and the need for constant vigilance during flight to assure that hot air ducts, outlets, electrical wiring, and electronic equipment areas are free of combustible materials.

t. Long Endurance Flights:

Special missions requiring long endurance flights are authorized to carry additional items to facilitate aircrew rest and provide for necessary food and liquid nourishment. Additional crew rest and food stowage/preparation equipment is restricted to those items authorized by the flight manual and the major air command. Specific equipment loading plans will be standardized and published by each unit and approved by the major subordinate command. This extra equipment will be stowed, in accordance with approved unit plans, and secured so as to avoid hazardous locations near air conditioning ducts/outlets, electrical equipment/wiring, flight controls, ejection seats, and emergency exits. Briefing and preflight checklists requirements on proper stowage of extra equipment will be completed in accordance with applicable crew members checklists.

PREFLIGHT CHECK

BEFORE EXTERIOR INSPECTION CHECKLIST

NOTE

The crew chief will have the Form 781 available to the pilot and the wing flaps extended when the flight crew arrives at the airplane (station time). Station time will normally be no longer than 1 1/2 hours prior to takeoff.

1. Fire & Security Guards - Posted (if applicable) (P)
2. Check Aircraft Form 781 - Completed (P)
   a. Equipment Status - Checked

      Pilot checks Form 781 to ascertain the status of equipment necessary for anticipated flight

   b. Discrepancies - Noted and discussed

      Each discrepancy noted will be discussed with the crew member concerned.

   c. Armament & Electronics Configuration & Load Status - Checked

      Pilot or applicable crew member checks all entries on Form 781C to ascertain that equipment status, loading, and configuration of items such as ammunition, chaff, photographic equipment, etc, conforms to the mission requirements.

   d. Squibs - Connected; Squib Shorting Caps - Stowed

      If AGM-28's are carried, verify that the firing head assemblies (squibs) have been connected and that the squib shorting caps have been stowed aboard the aircraft.

   e. Fuel Load & Distribution Forms - Checked

      Pilot compares the fuel load and distribution as planned on Form 200 with that shown on line 3 of block 1 of Form 6.

3. Check AGM-28 Missile Forms 781 (if applicable) - Completed (P-N)
   a. Engineering Status - Checked

      Pilot checks each missile Form 781 to ascertain engineering status and to make certain each missile has been serviced with fuel, oil, ammonia, and nitrogen.

   b. Proper Store - Checked

      Pilot checks that the proper store (NTI, ballast, or warhead) has been loaded for the intended mission.

4. Brief Ground Crew - Completed (P)
   a. Stabilizer Trim Check - Briefed

      Brief the ground crew member that he will report the movement of the leading edge of the stabilizer and when the stabilizer reaches 0° position during the trim check.

BEFORE EXTERIOR INSPECTION CHECKLIST (cont)

b. Alarm System Check - Briefed

Brief the ground crew member that he will check the alarm system in the bomb bay during the crew report and report condition to the pilot.

c. Cooling Air Check - Briefed

Brief the ground crew member to check for alternator cooling air after engine start and report if no cooling air is detected.

d. AGM-28 Start Procedure - Briefed (if applicable)

e. Bomb Door Closing Procedure (if conventional internal munitions are aboard) - Briefed

Brief the ground crew member if bomb doors are to be closed prior to taxi (conventional internal munitions only).

f. Taxi-Out Procedures - Briefed

Brief the ground crew member on the direction of taxi out and sequence (if MITO or Cell is scheduled) in relation to other aircraft.

g. Connect External Power for Lighting (as required) - Briefed

Exterior and interior lights may be utilized at the discretion of the pilot to assist in loading equipment and in the interior preflight. Brief the air and ground crew members that power (aircraft or external) will not be applied until the navigator's and EW officer's "Before Exterior Inspection" and the radar navigator's and navigator's "Exterior Inspection (Power Off)" has been accomplished. Ground crew member(s) or other crew member(s) may then enter the aircraft and place external power on central bus. (Two-man policy will apply as directed.) In addition, all crew members (ground and air) will be briefed on the following:

NOTE

If nuclear bombs are aboard, the applicable bomb preflight checklist of T.O. 1B-52C-25-2CL-1 will be used. The normal two-man policy will be observed. Radar navigator and navigator must complete the "Before Exterior Inspection Checklist" prior to the bomb preflight.

EW OFFICER NOT FLYING CHECKLIST

The pilot or other designated crewmember will accomplish the following checklist as required.

BEFORE EXTERIOR INSPECTION (POWER OFF)

1. Ejection Seat Arming Levers - Stowed, No. 1 safety pin installed

WARNING

If the right arming lever is rotated on a stowed or raised armrest, the arming initiator will fire. If the arming lever has been rotated or the arming lever safety pin is not installed, call maintenance immediately and stay clear of the seat.

2. ECM Equipment, Chaff, Flare & Liaison Radio Power Switches - OFF

EW OFFICER NOT FLYING CHECKLIST (Cont)

3. Chaff, Flare & APR-25 **B-52D** Circuit Breakers - Out

WARNING

Prior to application of electrical power, insure that all systems are deactivated to prevent inadvertent jamming or dispensing of expendables with the application of electrical power.

EXTERIOR INSPECTION

1. ALE-20 Safety Interlock Switch Door - Streamer removed, closed

INTERIOR INSPECTION

1. Section 41 Power Distribution Panel Circuit Breakers - Set
2. Celestial Oxygen Regulator - OFF & 100% OXYGEN
3. EW Officer's Oxygen Regulator - OFF & 100% OXYGEN
4. Air Outlet Knobs:
    - a. Upper - 1/2 to full out
    - b. Lower - Full out
    - c. Spray Bar - Full out

POSTFLIGHT

1. ALE-20 Safety Interlock Switch Door - Opened, streamer installed

EXTERIOR INSPECTION

NOTE

The exterior inspection is designed to be accomplished normally by an experienced pilot and copilot, each inspecting one side of the aircraft simultaneously, one pilot starting with nose section (right) through empennage and the other pilot starting with the left aft wheel well through the nose section (left). However, in the event only one pilot is available, he can perform the complete inspection.

Because of the size and complexity of the aircraft, the detailed inspection will have been completed by qualified ground crew personnel. The flight crew exterior inspection is an inspection of general aircraft condition. This inspection is based on the assumption that the flight crew is merely accepting the aircraft for flight with emphasis on the items that affect the safety of flight. During the inspection, emphasis will be directed toward a checking for hydraulic leaks, fuel leaks, and general condition. Additional flight crew preflight will not be accomplished. If normal ground support is not available, see "Strange Field Procedures," this section, for amplified checklist. If AGM-28's are being carried, an exterior inspection will be accomplished as outlined in the abbreviated checklist. Amplification for this checklist can be found in T.O. 1B-52C-30-1. If the gunner is not flying, see "Strange Field Procedures," this section.

INTERIOR INSPECTION CHECKLIST (PILOT)

1. Equipment - Stowed

WARNING

Insure that no equipment is stowed on or near heating ducts, outlets, electrical wiring, or electronic equipment.

2. Pilot's Ejection Seat:

   a. Arming Levers - Stowed, No. 1 safety pin installed

WARNING

If the right arming lever is rotated on either a stowed or raised armrest, the arming initiator will fire. If the arming lever has been rotated or the arming lever safety pin is not installed, call maintenance immediately and stay clear of the seat.

   b. Hatch Lanyard - Checked

   Check lanyard connecting escape hatch to catapult safety pin-pull initiator.

   c. Maintenance Safety Pins - Checked removed

   Check No. 2 and 3 pins removed. Take care that no streamer was torn free of a safety pin during removal, thus inadvertently leaving the pin installed. Also make certain that no safety pin is overlooked because the streamer has been detached previously. See figure 1-53 for location of safety pins.

   d. Catapult Initiator Safety Pin-Pull Cylinder - Pin in place

   Visually check pin installed in catapult initiator. If not installed, call maintenance immediately.

INTERIOR INSPECTION CHECKLIST (PILOT) (cont)

e. Initiator Tube Runs - Checked connected

Check tubes for proper and secure connections.

f. Inertia Reel - Checked

Check inertia reel lock for proper functioning.

3. Parachute Preflight:

a. Inspection Record:

(1) Inspection & Repack Date - Checked

(2) Automatic Release Time & Altitude Setting - Checked

b. Personal Locator Beacon Lanyard - Snapped/Unsnapped (as required)

For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 1-56).

c. Bailout Bottle Pressure & Hose Connector - Checked

d. Zero Delay Lanyard - Hooked

e. Parachute Straps - Adjusted (as required)

3A. MD-1 Survival Kit Preflight:

a. Kit Release Knob Snapped - Checked

b. Zipper Closed & Seal Intact - Checked

c. Kit Straps to Parachute - As required

WARNING

Care must be taken to assure the survival kit attachment straps are not entangled in the safety belt. Always fasten the survival kit to the parachute before fastening the safety belt.

INTERIOR INSPECTION CHECKLIST (PILOT) (cont)

3B. Thermal Curtains - Checked and positioned

During initial acceptance check for an alert aircraft, a check will be made of thermal curtains at all transparent openings for condition and proper fit. The curtains over the pilot and copilot escape hatches and those over the eyebrow windows will remain closed while the aircraft is on alert. Curtains for cockpit windows No. 1, 2R&L, 3R&L, 4R&L, and 5R&L will be returned to the stowed/open position. For further information, see "Thermal Curtains," Section IV.

WARNING

Thermal curtains must be kept free from grease, oil, and mold as any discoloration will seriously impair the value of the curtains. Oil or grease base materials will ignite upon exposure to thermal radiation. Dirty or cracked thermal curtains must be replaced.

3C. TA Polarization Filter - Stowed

The TA polarization filter will be stowed except when required for inflight use.

4. Readiness Switch Cover - Closed, sealed
5. Circuit Breakers - Set
6. Pilot's Flare Set Power Switch - OFF

The OFF position of the switch is the center position of a three-position switch. The switch locks in the center position and is ON in the up position. The down position has no function.

7. Water Injection Switches - OFF and CLOSED (OPEN if not serviced with water)

Water injection pump switches OFF; water injection drain valves switch CLOSED.

8. Autopilot Servos Cutout Switches - IN
9. SWESS Arm-Safe Switch **Less** **A** - SAFE, sealed
10. SIF/IFF Master Switch - STBY (STDBY) codes set as briefed
11. Clock - Checked

Check and set in accordance with current instrument flying directives.

12. Anti-Icing Control Switch(es) - OFF
13. Flight Director Computer Gyro Select Switch - NORMAL

INTERIOR INSPECTION CHECKLIST (PILOT) (cont)

14. Windshield Anti-Ice & Defogging Switch - OFF
15. Air Outlet Knobs:
    a. Upper - 1/2 to full out
    b. Lower - Full out

NOTE

These knob settings are approximate settings only. After the cabin temperature has stabilized, knob adjustment may then be varied slightly for crew comfort.

16. Emergency Landing Gear Switches - Guards closed
17. Landing Gear Lever - GEAR DOWN, in detent
18. Antiskid Switch - As required

    Turn antiskid switch OFF if icy (slippery) taxiing conditions exist or if gross weight is less than 250,000 pounds. If these conditions do not exist, leave antiskid switch ON.

19. Steering Ratio Selector Lever - TAKEOFF LAND
20. Aileron Trim Cutout Switch - Guard closed
21. Airbrake Lever - OFF
22. Stabilizer Trim Cutout Switch - Guard closed
23. Throttles - CLOSED

INTERIOR INSPECTION CHECKLIST (COPILOT)

1. Equipment - Stowed

WARNING

Insure that no equipment is stowed on or near heating ducts, outlets, electrical wiring, or electronic equipment.

2. Overhead Circuit Breakers - Set

2A. IP Oxygen Regulator - OFF and 100% OXYGEN (IP not flying)

3. Copilot's Ejection Seat:

   a. Arming Levers - Stowed, No. 1 safety pin installed

   WARNING

   If the right arming lever is rotated on either a stowed or raised armrest, the arming initiator will fire. If the arming lever has been rotated or the arming lever safety pin is not installed, call maintenance immediately and stay clear of the seat.

   b. Hatch Lanyard - Checked

   Check lanyard connecting escape hatch to catapult safety pin-pull initiator.

   c. Maintenance Safety Pins - Checked removed

   Check No. 2 and 3 pins removed. Take care that no streamer was torn free of a safety pin during removal, thus inadvertently leaving the pin installed. Also make certain that no safety pin is overlooked because the streamer has been detached previously. See figure 1-53 for location of safety pins.

   d. Catapult Initiator Safety Pin-Pull Cylinder - Pin in place

   Visually check pin installed in catapult initiator. If not installed, call maintenance immediately.

   e. Initiator Tube Runs - Checked connected

   Check tubes for proper and secure connections.

   f. Inertia Reel - Checked

   Check inertia reel lock for proper functioning.

INTERIOR INSPECTION CHECKLIST (COPILOT) (cont)

4. Parachute Preflight:

   a. Inspection Record:

      (1) Inspection & Repack Date - Checked

      (2) Automatic Release Time & Altitude Setting - Checked

   b. Personal Locator Beacon Lanyard - Snapped/Unsnapped (as required)

   For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 1-56).

   c. Bailout Bottle Pressure & Hose Connector - Checked

   d. Zero Delay Lanyard - Hooked

   e. Parachute Straps - Adjusted (as required)

4A. MD-1 Survival Kit Preflight:

   a. Kit Release Knob Snapped - Checked

   b. Zipper Closed & Seal Intact - Checked

   c. Kit Straps to Parachute - As required

WARNING

Care must be taken to assure the survival kit attachment straps are not entangled in the safety belt. Always fasten the survival kit to the parachute before fastening the safety belt.

4B. Thermal Curtains - Checked and positioned

During initial acceptance check for an alert aircraft, a check will be made of thermal curtains at all transparent openings for condition and proper fit. The curtains over the pilot and copilot escape hatches and those over the eyebrow windows will remain closed while the aircraft is on alert. Curtains for cockpit windows No. 1, 2R&L, 3R&L, 4R&L, and 5R&L will be returned to the stowed/open position. For further information, see "Thermal Curtains," Section IV.

WARNING

Thermal curtains must be kept free from grease, oil, and mold as any discoloration will seriously impair the value of the curtains. Oil or grease base materials will ignite upon exposure to thermal radiation. Dirty or cracked thermal curtains must be replaced.

4C. TA Polarization Filter - Stowed

The TA polarization filter will be stowed except when required for inflight use.

INTERIOR INSPECTION CHECKLIST (COPILOT) (cont)

5. Circuit Breakers - Set

6. Cabin Pressure Release Switch - Guard Closed

7. Air Conditioning Master Switch - RAM

8. Air Bleed Selector Switch - NORMAL

9. Temperature Selector - AUTOMATIC (temperature as desired)

   Optimum air conditioning is obtained using an initial setting between 60° and 70°.

10. Cartridge Start Switches - Checked OFF (CP)

    Check that the spring-loaded switches are in OFF position.

11. Engine Starter Switches - OFF and GROUND START (for pneumatic start); No. 2 and 8 START and FLIGHT START (for cartridge start)

12. Refuel Panel Switches - CLOSED and OFF

13. AGM-28 Emergency Control Panel:

    a. Fire Test Switch - OFF

    b. Fire Reset Switch - OFF

    c. Emergency Shutoff Switches - Normal (guard closed)

14. AGM-28 ASM Engine Control Panel:

    a. Ready for Launch Switches - OFF

    b. Wing Valve Switches - CLOSE

    c. Engine Control Knobs - OFF

15. Air Bleed Switches - OPEN

16. Clock - Checked

    Checked and set in accordance with current instrument flying directives.

INTERIOR INSPECTION CHECKLIST (COPILOT) (cont)

17. All Fuel Panel Switches - OFF

18. Drag Chute Lever - Checked and LOCKED

    Move the drag chute lever toward JETTISON. If resistance is encountered, the drag chute door is closed and locked. If no resistance is encountered, the drag chute door has opened and the drag chute is deployed. The drag chute will have to be checked and the door locked prior to flight.

19. Wing Flap Lever - OFF

20. Terrain Display Mode Selector Switch - OFF

BEFORE STARTING ENGINES

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads)

1. Oxygen System - Checked (P-CP)

   The following items may be accomplished silently:

   a. Regulator Diluter Lever - 100% OXYGEN.

   b. Shutoff Lever - OFF

   c. Mask & Hose - Check disconnect, then reconnect

      Check for 10- to 20-pound pull for disconnect, then reconnect mask and hose.

   d. Diluter Valve - Checked

      Attempt to draw air through the oxygen mask. Ability to draw air indicates a defective diluter valve, oxygen hose and/or connections, or mask. Then place the diluter valve to NORMAL position, draw air through the mask, if unable, this would indicate that only 100% oxygen will be available.

      NOTE

      If the diluter valve is stuck in the 100% position, this will prohibit the detection of smoke or fumes when use of normal oxygen is required.

   e. Shutoff Lever - ON

   f. Pressure - Checked

      Pressure gage reads approximately 300 psi.

   g. Emergency Toggle Lever - TEST MASK

      With mask disconnected at one side of helmet the flow indicator should indicate continuous flow.

   h. Mask - Test

      Attach mask to helmet and hold breath; indicator should indicate no flow.

      NOTE

      Flow condition may be indicated by a slight leak around the face form. If light hand-pressure against the mask does not stop the flow, the mask is unacceptable.

   i. Emergency Toggle Lever - NORMAL

   j. Regulator Diluter Lever - NORMAL/100% (as required).

2. Oxygen Quantity - Checked (P)

3. Interphone - Checked (P-CP)

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (cont)

4. Battery Switch - OFF, voltage checked (CP)

   Battery switch OFF, check the no-load condition of the batteries by separate actuation of the battery voltage buttons (24 volts minimum, 26 volts maximum).

5. Emergency Battery Switch - EMERG, checked, NORMAL (P-CP)

   Copilot positions the emergency battery switch to EMERG. Pilot checks illumination of essential flight instrument lights on emergency battery power. Pilot actuates the emergency alarm switch to ALERT to check the alarm system on emergency battery power. While in ALERT, returns emergency battery switch to NORMAL, checking continuous operation of the alarm system. Pilot then turns emergency alarm system to OFF.

6. Battery Switch - ON, not charging light on (CP)

7. Alternator Panel:

   a. Alternator Circuit Breakers - Lights on (CP)

      Momentarily hold alternator circuit breaker switches to OPEN if necessary.

      CAUTION

      Alternator circuit breakers should be open to avoid possibility of damage to electronic equipment due to low frequencies during engine start.

   b. Bus Tie Breakers - Checked CLOSE, lights out (CP)

8. External Power - Checked and on, battery not charging lights out (CP)

   CAUTION

   If "321 Reversed" indicator light comes on, external power phase sequence is reversed. Disconnect external power, turn off the batteries, and obtain another power cart.

9. Radios - On (P-CP)

   CAUTION

   On aircraft not having white paint on the top exterior of section 47, continuous operation of the command radio is prohibited if the OAT is above 81° F unless air from an A-2 blower is directed on the receiver-transmitter. On aircraft having white paint, 45-minute operation is allowed up to 100° F OAT.

10. Warning & Indicator Lights - Press to test (P-CP)

    Pilot and copilot press to test all warning and indicator lights that are not illuminated. Copilot will press to test the fuselage overheat warning test switch and check illumination of the pilot's master warning light and the fuselage overheat warning lights on the copilot's side panel.

11. Engine Fire Shutoff Switches - IN and checked (P-CP)

    Push the engine fire shutoff switches to NORMAL (in) and check the fire detector system and lights by moving the fire detector switch to TEST.

12. Gyro Switch - ON (P/CP)

13. Navigation Lights - BRIGHT and FLASH (P)

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (cont)

14. Ground, Connect & Clear Bomb Door - Connected and clear (GC)

15. Fuel Quantity - Checked (P-CP)

Copilot depresses the fuel quantity test buttons to assure proper operation of the fuel gages. He calls off individual tank identity with gage reading to the pilot who records them in the No. 2 column of the fuel log (Form 200). The pilot cross-checks the fuel load dipstick readings from Form 6 with individual tank gage readings and planned fuel load as recorded in the No. 1 column of the fuel log. The pilot totals the individual tank gage readings and compares the total with the totalizer reading.

NOTE

- Except when carrying one missile, fuel must be loaded symmetrically in the main, outboard, and external tanks. If the difference between a gage reading and dipstick reading, or planned fuel for tank and dipstick reading, appears abnormal, consult the Mission Planning Section of the Appendix for allowable tolerances. If the tolerance between planned fuel and dipstick reading is exceeded, yet accepted for flight, the pilot will insure that the cg% MAC is within allowable takeoff and landing limits by making necessary corrections to Form 365F and recomputing a new stabilizer trim setting.
- Stabilizer trim should be recomputed for any one tank dipstick reading differing from the planned fuel loading by 1000 pounds or if the absolute total of the differences for all tanks between planned fuel loading and dipstick reading exceeds 2000 pounds.

16. Gyro Instruments - Checked (P-CP)

Check gyro indicators for indication of power application by noting gyros properly erected and warning flags not showing. Rotate attitude indicator pitch trim knob clockwise and attitude indicator should read not less than 10° dive. Rotate pitch knob counterclockwise and attitude indicator should read not less than 5° climb. Set heading indicator (gyro) to aircraft heading.

17. Wing Flaps - UP, lever OFF (lever UP **54**▶**138** **W1**▶**W34**) (CP-GC)

Flaps should be full down at the time the crew enters the aircraft. Ground personnel will be on interphone and advise the pilot of flap position and movement. Place flap lever to UP position and note movement to full up. Move lever to OFF position. On aircraft **54**▶**138** **W1**▶**W34**, handle will be left in UP position.

CAUTION

- Wing flap operation shall be discontinued within 10 seconds if flaps fail to start moving. Any additional attempt to start the flaps shall be limited to 10-second intervals of actuation. Do not use either flap motor for more than eight attempted starts in any 30-minute period.
- To prevent inadvertent movement of the wing flaps after the desired flap position is obtained, the wing flap lever will be left in DN position at all times when full flap extension is desired. To prevent flap motor damage which may be caused by limit switch actuation after flap retraction, the lever will be moved to OFF when the flaps up indication is received. On aircraft **54**▶**138** **W1**▶**W34**, handle will be left in UP position.

NOTE

Flaps are limited to three complete duty cycles (extension and retraction) in any 30-minute period (eight starts allowed in any 30-minute period).

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (cont)

18. Radios - Checked (P-CP)

    a. Copilot checks primary and secondary radios and obtains altimeter setting. On B-52D aircraft, check ciphony control panel as outlined under "UHF Command Radio," Section IV.

    WARNING

    B-52D

    Simultaneous keying of an unsecure HF or UHF transmitter is prohibited when No. 1 or 2 UHF command radio is being used for classified conversation in the same aircraft compartment or area.

    b. Pilot checks VOR and TACAN equipment:

        (1) Nav Mode Select Switch - VOR/TACAN

        (2) Tune and identify a VOR/TACAN station.

        (3) Check that bearing pointer points to the station.

        (4) Set bearing pointer indication in the course selector window and check that the CDI centers and the TO-FROM indicator indicates TO.

        (5) Rotate the course set knob (±5°) to check for proper CDI displacement.

        (6) Rotate course set knob and check that TO changes to FROM indication after approximately 90° of course selector change.

        (7) Check TACAN range indicator warning flag out of view and distance indicates correctly.

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (Cont)

19. Altimeter:

   a. Altimeters (MA-1 or AAU-8/A) - Set (P-CP)

   Set in accordance with AFM 51-37. Altimeters should read (±75) feet of a known checkpoint elevation. Pilot checks that an altimeter correction card is installed for proper aircraft configuration.

WARNING

> When setting altimeters, special attention should be given to the altimeter to ensure that the 10,000-foot pointer is reading correctly.

   a. Altimeters (AAU-19/A) **ZV** - Checked and RESET (P); Checked and STBY (CP)

      (1) Altimeters - Set, STBY flag in sight

      Set in accordance with AFM 51-37. Ensure that each altimeter indicates (±75) feet of a known checkpoint elevation. Pilot checks that an altimeter correction card is installed for proper aircraft configuration.

      (2) RESET-STBY Lever - RESET

      Hold in RESET position 2 to 3 seconds.

      (3) STBY Flag - Out of sight

      Compare altimeter readings with standby mode reading. Altimeter should read within 75 feet of standby mode reading. Ensure that each altimeter indicates (±75) feet of a known checkpoint elevation. Pilot's and copilot's (if AAU-19/A is installed at both stations) altimeters should read within 75 feet of each other. This allowable difference of 75 feet between servo mode readings also applies in flight at all altitudes and speeds.

NOTE

> If the STBY flag appears and mission requirements allow, the mission may be continued.

19A. Navigators' Altimeter - Set (RN)

20. AIMS **ZV** - Checked (P)

   a. IFF Antenna Switch - BOTH

   b. RAD-TEST/MON Switch - OUT

   c. Master Switch - NORM

   d. Modes 1, 2, 3A, and C - Tested

   Check for test light illumination as each mode switch is held in TEST position.

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (Cont)

e. Mode 4 - As briefed

Place the mode 4 code switch to the HOLD position after the mode 4 computer has been encoded.

NOTE

Place the mode 4 code switch to the HOLD position a minimum of 15 seconds prior to removal of electrical power from the aircraft.

f. Mode Switches - Set as briefed

g. Master Switch - STBY

20A. Spoiler Standby Pump Switch - ON (P)

21. AGM-28 Emergency Control Panel:

a. Fire Test Switch - Actuate (CP)

22. AGM-28 Engine Control Panel:

a. Low Fuel Light(s) - ON (CP)

b. Oil Pressure Light(s) - ON (CP)

c. Wing Valve Switches - CLOSE, lights on (CP)

23. Airbrake, Control & Trim Check, AAER - Completed (P-CP)

AAER = airbrake, aileron, elevator, and rudder

NOTE

- This check made in coordination with ground crew observer.
- All responses made by the ground observer during this check should be in terms of the actual observed movement of the particular flight control being checked. The responses listed in this checklist should serve as a guide only.
- Spoiler and airbrake rigging tolerances are such that the spoiler groups on each wing may not exactly line up during partial or full extension of either the spoilers or airbrakes. Also, when airbrakes are in position 6, a slight additional raising of the spoilers on a wing when the control wheel is moved out of neutral is normal. The outboard segments will rise from 50° to 60° as more control wheel rotation is applied.

a. Airbrake & Control Check:

(1) Airbrake Lever - Position 6

Ground reports: Inboard 60°, Outboard 50°

NOTE

Wing droop associated with high gross weight fuel loads may make it impossible to see the outboard airbrake segments from the cockpit. These segments will be at 50° instead of 60°.

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (cont)

(2) Control Wheel - Full left

Ground reports: Left spoilers up, left aileron control tab down, right aileron control tab up, right spoilers down.

(3) Control Wheel - Full right

Ground reports: Left spoilers down, left aileron control tab up, right aileron control tab down, right spoilers up.

(4) Control Wheel - Neutral

Ground reports: Inboard 60°, outboard 50°

(5) Airbrake Lever - OFF

Ground reports: All airbrakes down

NOTE

Full control wheel travel will still result in both inboard and outboard spoiler segments assuming the full 60° extension (i. e., with airbrakes in position 6, control wheel displacement to full left will cause the left spoilers to move from inboards 60°, outboards 50° to both segments 60°, and right spoilers from inboards 60°, outboards 50° to both segments zero. Returning control wheel to neutral with airbrakes in position 6 will cause spoilers to assume the position of inboards 60°, outboards 50°.

b. Aileron Trim Check:

(1) Aileron Trim Button - L WING DN

Copilot actuates trim button to L WING DN and pilot actuates aileron trim cutout when both trim indicators reach approximately 5°. Copilot releases trim button and pilot places trim cutout switch in NORMAL guard down. Ground observer reports, "Left aileron trim tab down, right aileron trim tab up" and pilot notes movement of left and right trim indicators.

(2) Aileron Trim Button - R WING DN

Pilot returns aileron trim to neutral, ground observer reports movement of aileron trim tabs, and pilot observes trim indicators for correct indications.

CAUTION

Continuous actuation of the aileron trim mechanism is limited to two complete duty cycles followed by a 10-minute cooling period. (See "Aileron Trim Mechanism Limitations," Section V.)

NOTE

If the left and right aileron trim tabs are not displaced an equal amount during this check, they can be synchronized by actuating the aileron trim button until either the extreme L WING DN or R WING DN position is reached and both actuators are shut off by their respective limit switches. The tabs will then be synchronized and normal operation can be resumed.

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (cont)

c. Elevator Check:

(1) Control Column - Full forward

Ground reports position of elevator and elevator control tabs.

(2) Control Column - Full back

Ground reports position of elevator and elevator control tabs.

d. Rudder & Rudder Trim Check:

(1) Rudder Pedal - Full left

Ground reports position of rudder control tab.

(2) Rudder Pedal - Full right

Ground reports position of rudder control tab.

(3) Rudder Pedals & Rudder Trim Knob - Centered

Ground reports position of rudder control tab.

23A. Spoiler Standby Pump Switch - OFF (P)

24. Ground, Start External Air - 30 psi desired (CP)

25. Pack 9 & 10 Switches - ON and checked (P)

Hydraulic pack switches 9 and 10 to start until hydraulic pack pressure low warning light is out (or 6 seconds, whichever is shorter), then ON, pressure checked.

26. Autopilot Safety Check - Completed (P)

a. Check turn knob and roll trim knob in detent position.

b. Place autopilot master switch in ON.

c. Note trim indicators centered and place servos engage switch to ENGAGE.

NOTE

If autopilot cannot be initially engaged or if disengagement of autopilot occurs during checkout due to rudder contacting the rudder limit switch, the copilot should hold the autopilot rudder limit bypass switch in BYPASS position throughout remainder of check.

d. Depress pilot's autopilot release button; autopilot should disengage and the disengage warning light should flash.

e. Turn autopilot master switch OFF.

27. Stabilizer Trim - Checked, takeoff trim set (P-CP)

NOTE

After initiating a trim change, the stabilizer trim switch will always be returned to neutral using a positive movement of the pilot's thumb.

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (cont)

CAUTION

During ground operation of the stabilizer trim mechanism, observe system limitations as given in Section V.

a. Ground observer reports direction in which leading edge is moving for both directions operated.

b. Nose Down Trim & Force Switch Operation - Checked

   (1) Copilot applies nose down trim electrically, checking that stabilizer trim wheel and indicator move in correct direction.

   (2) Pilot momentarily actuates the trim cutout switch, at approximately 1 unit nose down position, to check interruption of electrical trim power and abrupt stoppage of manual trim wheel.

   (3) Copilot pulls back on his control column while still trimming until trim actuation stops to check force switch operation.

   (4) Copilot reduces force on control column and continues nose down trim until trim actuation starts, then releases trim switch noting that wheel stops abruptly.

   (5) Copilot trims electrically toward zero and pushes forward on the control column while still trimming until trim actuation stops to check force switch operation in opposite direction.

   (6) Copilot trims to zero with the pilot again checking operation of trim cutout switch after approximately 1 unit of travel.

c. Nose Up Trim & Force Switch Operation - Checked

   (1) Pilot applies nose up trim electrically checking that stabilizer trim wheel and indicator move in correct direction.

   (2) Pilot pushes forward on his control column while still trimming until trim actuation stops to check force switch operation.

   (3) Pilot reduces force on control column and continues nose up trim until trim actuation starts, then releases trim switch noting that wheel stops abruptly.

   (4) Pilot trims electrically toward zero and pulls back on control column while still trimming until trim actuation stops to check force switch operation in opposite direction.

   (5) Pilot returns stabilizer trim to zero electrically.

d. Ground observer reports leading edge position after pilot returns stabilizer to zero. Acceptable difference between pilot/copilot zero indication and zero indication as reported by ground observer is ±0.25 unit.

e. Pilot manually moves stabilizer trim approximately 1 unit in each direction. Ground observer reports corresponding movement of stabilizer leading edge.

f. Pilot sets stabilizer trim for takeoff. Acceptable difference between pilots' indicators is 0.50 unit.

28. Pack 9 & 10 Switches - OFF (P)

29. External Air - Off, if delay expected before starting engines (GC)

When a delay is expected prior to engine starting, the power cart should be shut down to conserve its limited fuel supply.

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (cont)

30. Ground, Remove Ground Locks & Bypass Keys - Roger (GC)

31. Fuel Switches 13, 14, 15 & 16 - ON (CP)

32. Standby Pump Switches - All ON (CP)

33. Steering Ratio - TAXI (P)

34. Windshield Anti-Icing - NORMAL (P)

35. Circuit Breakers - Set (P-CP)

36. Ground Locks & Bypass Keys - Counted and stowed (N)

36A. Standby Pump Pressures - Checked (P)

37. Stabilizer & Spoiler Standby Pumps - OFF (P)

38. Crew Report - Completed (P)

a. Pilot actuates emergency alarm switch to ABANDON, switches interphone to CALL, and announces "Crew report."

b. The sequence for crew reporting is as follows: gunner, navigator, EW officer, radar navigator, copilot, pilot, instructor navigator, 10th man, bunk, and instructor pilot.

c. All crew members will switch to CALL and report, "Station check complete."

Station check consists of seat, oxygen, interphone, abandon signal, call light, and zero delay lanyard check.

d. Pilot checks his call light when each crew member switches to CALL.

e. Ground crew checks the alarm system in the bomb bay and reports condition to pilot.

NOTE

- For normal training missions, disregard the remaining items in this checklist and proceed to "Starting Engines and Before Taxiing Checklist."
- The aircrew may leave their stations provided they can assure that the configuration of the various controls and switches will not be changed. If not, they must accomplish the "Before Leaving Aircraft" checklist. Upon returning to the aircraft for flight, the "Interior Inspection" and "Before Starting Engines" checklists must be reaccomplished for switch positioning prior to starting engines. This requirement does not apply when preparing the aircraft for alert posture.

39. Ground, Close Hatches - Roger (GC); light out (P); emergency escape hatch secure (N)

CAUTION

If lockpin indicator line is not visible or the flat surface of the lockpin does not extend 1/4 inch from its housing, the hatch is not locked and it is unsafe to pressurize the aircraft.

40. Ground, Reopen Navigator's & Gunner's Hatches - Roger (GC)

WARNING

The MA-3 external air conditioning unit can build up sufficient cabin pressure to cause the entrance hatch to blow even though the air conditioning master switch is in RAM. Ascertain that a sliding window is open prior to opening the hatch.

BEFORE STARTING ENGINES CHECKLIST (Pilot/Copilot reads) (cont)

41. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - ST (climatic) (P)

    Hydraulic pack switches will be placed in ST only when OAT is 0° C (32° F) or below if external air is going to be applied for heating.

42. Oxygen - OFF and 100% OXYGEN (ALL)
43. Interior Lights - On (P-CP)
44. Cartridge Start Circuit Breakers (if cartridges are to be installed) - Pulled (P)
45. Cartridges Installed on Engines 2 & 8 - Accomplished (if required) (GC)
46. Cartridge Start Circuit Breakers - Set (if required) (P)
47. Flash Blindness Equipment - Checked (if applicable) (ALL)

    Flash blindness equipment (gold goggles, eye patches, etc) will be checked and positioned in accordance with command directives.

48. External Power - OFF (CP)
49. Battery - OFF (CP)
50. Pitot Heat - ON (P)
51. Interphone Switch - OFF (P)
52. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET (climatic) (P)

    To be accomplished only when OAT is 0° C (32° F) or below.

53. Entrance Light - Off (P)

NOTE

For alert posture, if engines must be started to taxi to the alert parking area, the recocking checklist will be used to recock the aircraft provided no maintenance is required subsequent to arrival at alert parking area. See "Alert Procedures," this section.

STARTING ENGINES AND BEFORE TAXIING

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads)

NOTE

- Only the **boldface** items need be accomplished for Scramble. All items will be reviewed during climb or as soon as practicable.
- During EWO alert operations, takeoff will not be delayed for items pertaining to crew equipment, radio checks, and SIF/IFF settings.
- Engines will not be started until both pilots are in position.

1. **PARKING BRAKES — SET (P)**
2. **BATTERY — ON (CP)**
3. **INTERPHONE SWITCH — ON (P)**
4. **EXTERNAL POWER — OFF, CHECKED, ON (OFF, IF NOT USED) (CP)**
5. Ground, Close Hatches - Roger (GC); light out (P); emergency escape hatch secure (N)

CAUTION

If lockpin indicator line is not visible or the flat surface of the lockpin does not extend one-fourth inch from its housing, the hatch is not locked and it is unsafe to pressurize the aircraft.

6. Ground, Start External Air - Roger (GC); 30 psi desired (CP)

NOTE

Satisfactory starts may be made at less than 30 psi although starting time will be increased. See "Strange Field Procedures," this section.

7. **STAND BY TO START ENGINES - FIRE GUARD POSTED AND CLEAR (GC)**

Ground crewman will have microphone and headset plugged into the external microphone system: pilot states "Stand by to start engines." When equipment and personnel are clear of intake and exhaust ducts, chocks are in place, and fire guards posted, ground crew replies, "Fire guards posted and clear."

WARNING

If aircraft is directly behind another operating jet aircraft or will be run up with its tail into the wind, the following procedure will be used:

1. All crew members will go on oxygen and place diluter lever at 100% OXYGEN position.
2. Whenever contamination is suspected, 100% oxygen will be used during ground operation and takeoff.
3. After contamination is no longer suspected, place diluter lever of oxygen regulator in NORMAL OXYGEN position.

CAUTION

When practicable, start and run up engines with aircraft on a clean paved surface to reduce possibility of dirt or other objects being drawn into engine compressors and damaging engines.

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads) (cont)

8. START ENGINES — STARTED (CP)

NOTE

- If maintenance or other conditions require starting engines in a sequence other than outlined below, engines will be started individually to preclude possible hot starts.
- MD-3 power units will be used on all engine starts. Battery starting procedures may be used in the event of MD-3 power failure. While on alert, battery starting procedures will be used in the event of MD-3 power failure.
- If AGM-28's are to be started on the ground, the AGM-28's may be started before the aircraft engines. Refer to missile engine ground start checklist.

The following procedures are designed to be used for starting engines with or without external electrical power. The battery system may not be dependable at low temperatures. When battery start procedures are used, all normal engine and alternator starting precautions will be used; engine oil pressure and fuel flow indication will be inoperative until alternator is on the line.

NOTE

- Pilot monitors starting sequence to prevent engines exceeding limitations.
- Combustion must occur within 20 seconds after throttle is advanced. Exhaust gas temperature is the best indication of combustion. Fuel flow for a normal start should be between 575 and 1250 pph prior to combustion; it may increase to 2000 pph during acceleration, then should drop to between 575 and 1250 pph at stabilized idle rpm. A hot start is best indicated by rapidly increasing exhaust gas temperature but excessive fuel flow can also warn of this condition.
- If the ambient temperature is -22° F (-30° C) or below, idle the engine for a 2-minute warmup period. See "Cold Weather," Section IX, for engine starting in cold weather.
- Hung starts, usually characterized by failure of the engine to accelerate to idle rpm, are more likely to occur at temperatures below 45° F (7° C) or above 100° F (38° C). EGT may rise slowly but should not be allowed to exceed the starting limit. If engine does not accelerate to idle rpm within 90 seconds or if a tendency to exceed other limits is observed, proceed with engine shutdown and applicable maintenance instructions for obtaining a satisfactory start.

CAUTION

- Advancing the throttle before 15% rpm is reached increases the possibility of a hot start.
- Starter dropout should occur at approximately 35% to 45%. In order to prevent starter internal failure in case starters fail to drop out, the starter switches are moved to OFF as the engines attain 45% rpm.
- Oil pressure must be 35 psi minimum within 30 seconds.
- If external electrical power is lost during an engine start and the engine being started is below approximately 35% rpm, immediately retard the throttle to CLOSED and discontinue the start until electrical power is restored. Loss of ac power (and TR power) will close the starter air valves on engines 3, 4, 5, and 6, depriving these engines of starter assistance which may result in hot starts if throttles are not closed. To prevent starter damage due to bleed air surge, engine(s) operating above idle rpm should be retarded to idle before any subsequent attempt to restart.

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads) (cont)

- All cases of overspeed and overtemperature operation will be recorded in Form 781. See figure 5-2 for engine operating limitations.
- Avoid reengaging the engine starter while the engine is still rotating unless it becomes necessary to do so. Such practice may reduce starter service life.
- If fuel flow or EGT exceeds limits, retard throttle to CLOSED, place starter switch to OFF, allow at least 30 seconds for fuel drainage, and check for malfunction before attempting a restart.
- To prevent damage to wing flap structure, operation at engine rpm greater than 92% with wing flaps extended should be kept to a minimum.

Pneumatic Start— With External Electrical Power

NOTE

Check all engine starter switches OFF and GROUND START.

Pilot announces "Starting No. 4." Copilot positions No. 4 starter switch to START. At a minimum of 15% rpm, pilot advances No. 4 throttle to 90% rpm. As No. 4 engine reaches 45% rpm, copilot places No. 4 starter switch to OFF. As No. 4 engine accelerates through IDLE rpm, copilot places all remaining starter switches to START. As the engines reach a minimum of 15% rpm, pilot advances throttles No. 1, 2, and 3 and copilot advances throttles 5, 6, 7, and 8 to IDLE. As the engines reach 45% rpm, copilot places the respective starter switches OFF.

Pneumatic Start—Without External Electrical Power

NOTE

- Check all engine starter switches OFF and GROUND START.
- Engine oil pressure and fuel flow indication, standby pump pressure for braking, and TR power for opening Eng No. 3, 4, 5, and 6 starter air valves will not be available until the alternator is on the line.
- With a dead forward battery, none of the engines can be started. The forward battery provides power to the forward switched battery bus to energize the starter relay for each engine. The starter relay must close before forward (engines No. 1 and 2) and aft (engines No. 7 and 8) switched battery power can open the starter air valve. If aircraft is on alert status, obtain an MD-3 power unit or a serviceable forward battery.

Pilot announces "Starting No. 1." Copilot positions No. 1 starter switch to START. At a minimum of 15% rpm, pilot advances No. 1 throttle to IDLE rpm. As No. 1 engine reaches 45% rpm, copilot places No. 1 starter switch OFF and, as No. 1 engine accelerates to IDLE rpm, starts the left aft alternator and closes the alternator circuit breaker. Do not advance No. 1 throttle past IDLE rpm until the alternator is on the line. Pilot then advances No. 1 throttle to 90% rpm position while copilot places all remaining starter switches to START. As the engines reach a minimum of 15% rpm, pilot advances throttles No. 2, 3, and 4 and copilot advances throttles No. 5, 6, 7, and 8 to IDLE. As the engines reach 45% rpm, copilot positions the respective starter switches OFF.

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads) (cont)

Cartridge Start — With External Electrical Power

NOTE

Check No. 2 and 8 engine starter switches START and FLIGHT START.

Pilot announces "Starting No. 2 and 8." Copilot positions "Eng 2" and "Eng 8" cartridge start switches to ON momentarily, then releases. At a minimum of 15% rpm, pilot advances No. 2 and 8 throttles to 90% rpm. As No. 2 and 8 engines reach 45%, copilot positions No. 2 and 8 starter switches to OFF, positions the starter selector switch to GROUND START, then positions No. 1, 3, 4, 5, 6, and 7 starter switches to START. At a minimum of 15% rpm, pilot advances throttles 1, 3, and 4 and copilot advances throttles 5, 6, and 7 to IDLE. As the engines reach 45% rpm, copilot positions the respective starter switches OFF.

WARNING

In the event starter cartridge does not fire, pilot designates engine on which cartridge did not fire to ground crew over interphone. Copilot places that starter switch to OFF. Cartridge will not be removed until there is no evidence of exhaust smoke at the starter exhaust duct and minimum time interval has elapsed since initiation. Prior to removal of a cartridge, insure that the cartridge start switches are OFF and the cartridge start circuit breakers are pulled. The ground crew must observe the handling precautions outlined in Section V. Pilot makes entry on Form 781.

CAUTION

During operation of the cartridge-pneumatic system, observe limitations given in Section V.

Cartridge Start — Without External Electrical Power

NOTE

- Check No. 2 and 8 engine starter switches START and FLIGHT START.
- Engine oil pressure and fuel flow indication, standby pump pressure for braking, and TR power for opening Eng No. 3, 4, 5, and 6 starter air valves will not be available until the alternator is on the line.
- Neither engines No. 2 nor 8 can be started if the forward battery is dead. Power to fire No. 2 engine starter cartridge and ignition for engines No. 2 and 8 comes from the forward switched battery bus. If aircraft is on alert status, obtain an MD-3 power unit or a serviceable forward battery.

Pilot announces "Starting No. 2 and 8." Copilot positions "Eng 2" and "Eng 8" cartridge start switches ON momentarily, then releases. At a minimum of 15% rpm, pilot advances No. 2 and 8 throttles to IDLE rpm. As No. 2 and 8 engines reach 45% rpm, copilot positions No. 2 and 8 starter switches to OFF and positions the starter selector switch to GROUND START. After No. 2 and 8 engines accelerate to IDLE rpm, copilot starts the left aft alternator and closes the alternator circuit breaker. Do not advance No. 2 and 8 throttles past IDLE rpm until the alternator is started and on the line. Pilot then advances No. 2 and 8 throttles to 90% rpm position while copilot places all remaining starter switches

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads)(Cont)

to START. As the engines reach a minimum of 15% rpm, pilot advances throttles No. 1, 3, and 4 and copilot advances throttles 5, 6, and 7 to IDLE. As the engines reach 45% rpm, copilot positions the respective starter switches OFF.

WARNING

In the event starter cartridge does not fire, pilot designates engine on which cartridge did not fire to ground crew over interphone. Copilot places that starter switch to OFF. Cartridge will not be removed until there is no evidence of exhaust smoke at the starter exhaust duct and minimum time interval has elapsed since initiation. Prior to removal of a cartridge, insure that the cartridge start switches are OFF and the cartridge start circuit breakers are pulled. The ground crew must observe the handling precautions outlined in Section V. Pilot makes entry on Form 781.

CAUTION

During operation of the cartridge-pneumatic system, observe limitations given in Section V.

Cartridge Malfunction During Alert Response

When encountering a cartridge malfunction during alert response, start the remaining engines as expeditiously as possible using bleed air from a started engine or external air, as applicable. All cartridge start restrictions will be observed unless the alert is determined to be actual EWO or an impending disaster makes moving the aircraft necessary. Under these conditions, if a malfunction occurs in both cartridges, the waiting period between start of initiation and removal of unfired cartridge may be reduced to not less than 1 minute provided the specific ground handling precautions outlined in Section V are met. Cartridge malfunctions of two types may occur during the start attempt; hangfire or misfire. Malfunction indications and appropriate alert reactions are as follows:

1. HANGFIRE. A delay in the functioning of a propelling charge at the time of firing. The amount of delay is unpredictable, but in most cases will fall within the range of a split second to several minutes. There will be evidence of smoke at the starter exhaust duct. The engine rpm will increase rapidly and the cartridge will give evidence of nearly normal operation. In this type malfunction, the energy is expended and presents no hazard to engine operation.

2. MISFIRE. A cartridge that fails to ignite. There will be no physical evidence of smoke at the starter exhaust duct and no engine rotation. If a misfire occurs, observe the proper waiting period from start of initiation prior to removing the unfired cartridge. Upon removal of the defective cartridge, a normal pneumatic start can be accomplished. For actual EWO or if an impending disaster makes moving the aircraft necessary, no attempt should be made to remove the defective cartridge provided the affected engine can be expeditiously started by other means.

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads) (cont)

AGM-28 Missile Engine Ground Starts

If AGM-28's are to be used for takeoff, as soon as copilot has placed remaining starter switches to START, he will request ground crew to make air available for ASM 2. ASM 2 will be started as outlined below. After ASM 2 has been started, copilot requests ground crew to provide air for ASM 1, which will be started in same manner.

PNEUMATIC START (COPILOT)

1. B-52 Power Switches - ON (CP-N)
2. External Air - Connected
3. Engine Control Knob(s) - GRD START
4. Engine Control Knob(s) - IGN (at 12%)
5. EGT & Rpm - Check
6. Engine Control Knob(s) - IDLE (at 58% to 62%)
7. Oil Pressure & Low Fuel Lights - Off
8. Missile Engines Stabilized - Navigator notified

Disconnecting External Air

Ground will disconnect external air after engines are started and throttles are retarded to IDLE.

9. Starter Switches & Light - OFF and out (CP)

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads) (cont)

10. ANTI-ICING SYSTEMS — CLIMATIC (P)

If icing conditions exist or are anticipated during taxiing, takeoff, or before initial climbout is completed, turn engine, nacelle, and scoops anti-icing ON.

54 ▶ 169 W1 ▶ W51

Operation with the surface anti-icing switch OFF is permissible at outside air temperatures of 2° C (35° F) or above.

CAUTION

In severe icing conditions (heavy supercooled fog, freezing rain, or wet snow), ice buildup can form on engine inlet guide vanes and first stages of the compressor during extended ground idle operations with anti-icing air ON. Periodic engine runups to a nominal 88% rpm can minimize the ice buildup. Such runups should approximate 10- to 20-second duration at a maximum of 10-minute intervals. The number of engines to be run up at a time will be dependent upon taxiway surface conditions. Subsequent takeoff under these conditions should be immediately preceded by a static engine runup to assure normal engine operation. Signs of engine icing could include abnormal EPR/EGT relationship, abnormally slow rpm response to throttle movement and indications of engine surge or stall. If taxiway surface conditions preclude advancing power enough to dissipate or prevent the inlet ice accumulation, takeoff should not be attempted.

WARNING

- Engine icing can occur during ground operation and at speeds below 250 knots IAS if the OAT is 5° C (41° F) or below and the dew point is within 4° C (7° F) of the OAT. Engine icing can also occur within this speed and temperature range at any time visible moisture is present.

170 ▶ W52 ▶

- Due to engine performance loss, the use of engine, nacelle, and scoops anti-icing during takeoff will reduce EPR settings, increase both takeoff ground roll and minimum runway required by 2.5%, and reduce the initial climb rate. Refer to Parts 2 and 3 of the Appendix for specific effects on performance.

54 ▶ 169 W1 ▶ W51

- Aircraft takeoff ground roll and minimum runway required will be increased by 1% when using surface anti-icing and increased by 2.5% when using engine and nacelle anti-icing. Therefore, if both systems are on during takeoff, a 3.5% increase in takeoff ground roll and minimum runway required and a reduction in initial climb rate should be expected. Refer to Parts 2 and 3 of the Appendix for specific effects on performance.

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads) (cont)

11. AIR BLEED SWITCHES — CLOSED (CP)

12. ALTERNATORS — STARTED, CHECKED (CP)

a. Notify ground crew observer to stand by to check for cooling air on all alternators. Ground crew chief will report if no cooling air is available when all alternators are started.

CAUTION

- An alternator which does not have cooling air within 5 minutes must be shut down. An alternator may be restarted within 5 minutes of takeoff without ground cooling air.
- If an alternator shows no voltage or frequency indication, it must be presumed that the drive has tripped off during starting. If this occurs or if drive is known to have tripped, do not attempt to restart drive until the overspeed latch arm on the drive has been inspected.

b. Start all four alternators by momentarily holding each alternator switch in ON. Starting sequence: right aft, right forward, left forward, left aft.

c. Using the voltage and frequency selector switch, check operation of each alternator; voltage should read 205 (±5) volts. Adjust by means of voltage rheostats if necessary. Frequency should be 395 to 405 cps.

13. A-C POWER — CHECKED, ALTERNATORS ON THE LINE (CP)

NOTE

- If for any reason the alternators cannot be automatically paralleled, takeoff will not be attempted until the deficiency is corrected and the automatic paralleling feature restored.
- On aircraft equipped with ARC-34A command radio, when switching from ground power to aircraft power, the command radio off-main-both-ADF switch may have to be turned OFF, then back to MAIN or BOTH to obtain proper system operation. This procedure is necessary since the master voltage oscillator circuit in the power supply may be unable to recover itself and start oscillation after momentary interruption of power.

a. Position voltage and frequency selector switch to RH AFT ALT.

b. Position right aft alternator circuit breaker switch to CLOSE.

c. Position voltage and frequency selector switch to RH FWD ALT.

d. Push automatic paralleling switch; hold until alternator circuit breaker open light goes out. If alternator circuit breaker open light does not go out, adjust the frequency of the right forward alternator until the synchronizing light blinks very slowly, then push automatic paralleling switch again.

e. Adjust and parallel the remaining two alternators (left forward and left aft) in the same manner. Check all alternator and bus tie circuit breaker lights out.

f. Check the load division. Maximum allowable difference in real load between any two alternators is 9 kwatts after the units are stabilized. Stabilization period is approximately 15 minutes. Adjust, using frequency rheostat controls.

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads) (cont)

g. The reactive load should be so adjusted that the difference between any two alternators is no greater than 4 kvars. The reactive load division is adjusted by use of the voltage rheostats.

NOTE

Constant fine adjustment of kwatt and kvar load division is not required.

14. HYDRAULIC PACKS — ON, PRESSURES CHECKED (P)

Hydraulic Packs 1, 2, 3 & 4 - ON

Hydraulic Packs 5, 6, 7, 8, 9 & 10 - ST until hydraulic low pressure warning light is out (or 6 seconds, whichever is shorter), then ON, pressures checked (P)

This should be accomplished while copilot is paralleling alternators. Pilot checks each pack for pressure buildup (3000 (±250) psi), low pressure warning lights out, and sets selector to No. 2 pack.

CAUTION

Any pack which does not produce a system pressure increase that can be positively identified as a pressure increase above system pressure existing prior to pack startup shall be rechecked in the following manner to verify operation. With the pilot's hydraulic pressure indicator selector switch positioned on the system to be checked, open the respective standby pump circuit breaker. Partially depressurize system being checked by actuating, as required, the applicable controls which are supplied hydraulic power by the system being checked. Pressure shall drop temporarily, but should rapidly build back up and stabilize at 3000 (±250) psi. Close standby pump circuit breaker. Repeat the above procedures for other systems as required.

WARNING

If it is necessary to actuate spoilers and airbrakes, clear personnel from spoiler area prior to actuation.

15. GROUND, CLEAR AIRCRAFT FOR TAXI — ROGER (GC)

Ground will disconnect and remove all ground support equipment and stand by on interphone.

16. AIR CONDITIONING MASTER SWITCH — 7.45 PSI, NOTIFY RN (CP)

Notify radar navigator that alternators are on the line and cooling air is available. If subsequent re-entry to the forward cabin is required, cabin pressure must be relieved by opening one of the pilot's sliding windows prior to opening the entrance hatch.

STARTING ENGINES AND BEFORE TAXIING CHECKLIST (Pilot reads) (cont)

17. Crew Equipment - On and adjusted (P-CP)

Crew equipment should be donned at this time for normal training missions.

WARNING

- Adjusting the shoulder harness loosely increases the amount of play before the inertia reel locks. A tight harness is necessary to avoid injury during impact deceleration.
- To insure operation of the automatic opening parachute, arming lanyard anchor must be assembled on the safety belt in the manner shown in figure 1-55. Failure to properly assemble these units may cause fatal delay in separating from the seat and in opening the parachute.
- Failure to attach the parachute arming lanyard anchor to the HBU-2B/A safety belt will necessitate manual operation of the parachute.
- Insure that the parachute arming lanyard is not entangled in the parachute harness. Lanyard entanglement could cause failure in seat separation and failure of the automatic features of the parachute.

18. Bomb Doors (conventional internal munitions only) - CLOSED (P-GC)

Bomb doors will be closed at this time if conventional internal munitions are aboard (alert scramble not in progress). Ground personnel will be on interphone and confirm that bomb doors are clear. Pilot will place the bomb doors switch to OPEN to insure that both latches are unlatched, check that the bomb doors not latched light is on, and then place bomb doors switch to CLOSED.

CAUTION

Copilot monitors manifold air pressure and verifies that manifold pressure is 30 psi minimum just prior to bomb door closing operation in order to maintain sufficient hydraulic pack output to prevent damage to the bomb doors. Hydraulic packs 1, 2, and 4 must be operating.

NOTE

Whenever bomb bay is empty or during any alert scramble, the bomb doors will be closed while accomplishing the taxiing checklist.

19. GROUND, REMOVE WHEEL CHOCKS & DISCONNECT INTERPHONE — ROGER (GC)

20. ANTICOLLISON & NAVIGATION LIGHTS — ON AND STEADY (P)

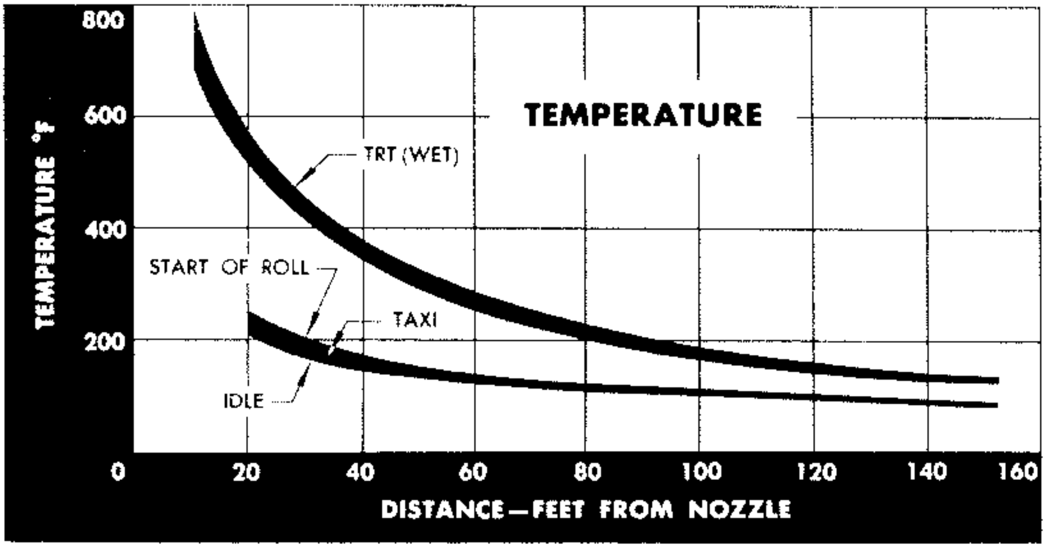
Turn lights to ON and STEADY immediately prior to taxiing to indicate the aircraft is ready to taxi.

21. TAXI ON CREW CHIEF'S SIGNAL (P-G)

Pilot announces "Crew, stand by to taxi." Gunner reports "Gunner ready to taxi."

CAUTION

The aircraft may be taxied over the ground power unit. It is imperative that carts be properly positioned to avoid contact with aircraft when taxiing out. Wing flaps must be up. Pilot taxies aircraft straight ahead until ground crew signals that he is clear of the power units. As soon as the aircraft starts rolling, throttles will be retarded to minimum power required for taxiing to avoid upsetting the power carts by jet blast. Aircraft must be positioned so that no aircraft will have to taxi over the power carts of another aircraft.



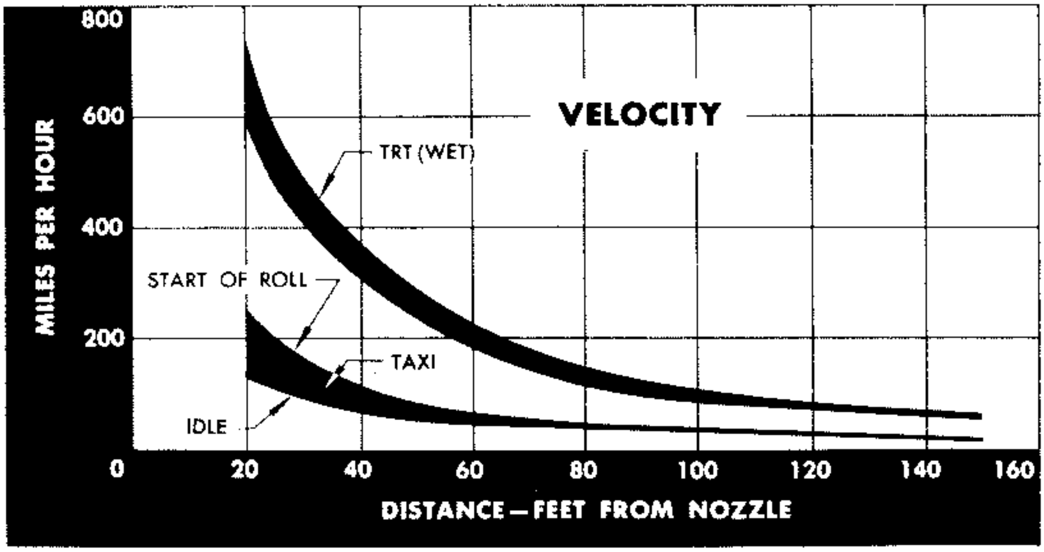
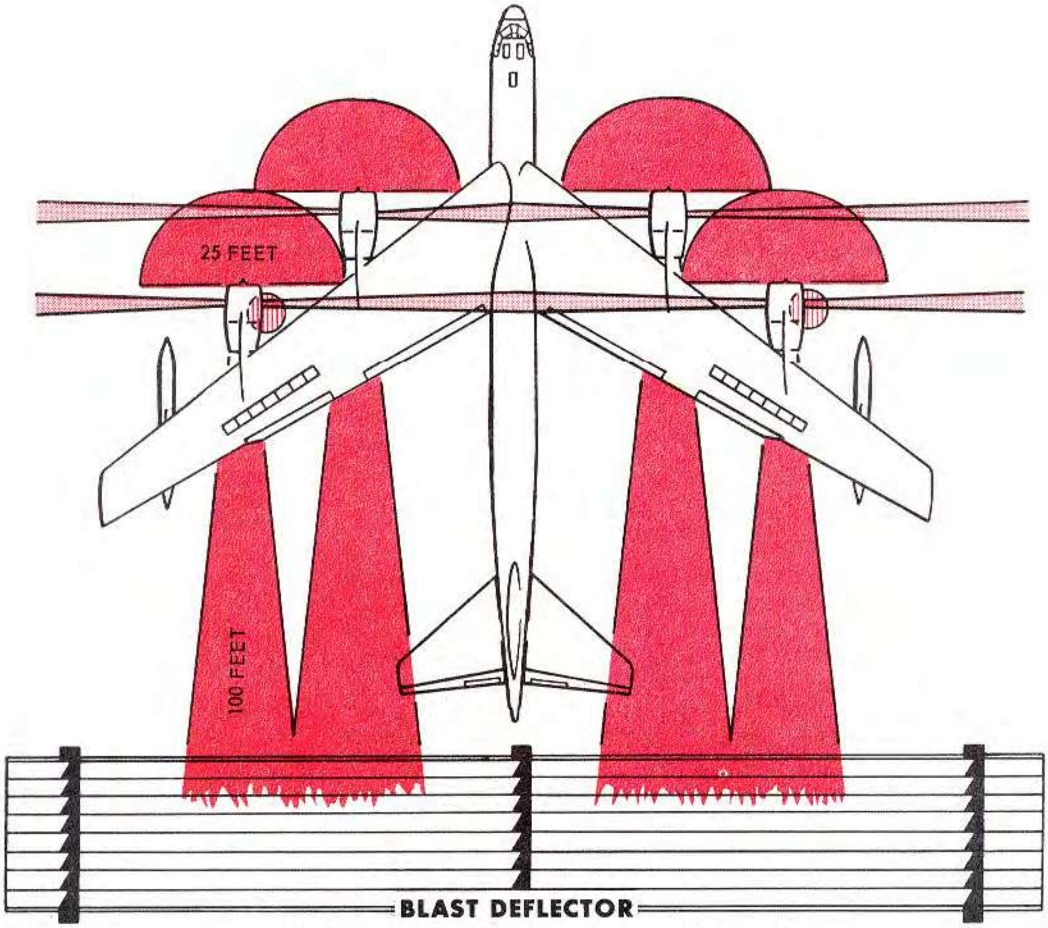


Figure 2-2 (Sheet 1 of 2).



IF DEFLECTOR NOT AVAILABLE CLEAR AREA BEHIND AIRPLANE FOR A DISTANCE OF 200 FEET.

WARNING

- DURING CARTRIDGE STARTS, THE ENGINE CARTRIDGE STARTER EXHAUST IS 850° F. THEREFORE, REMAIN CLEAR OF A 4-FOOT RADIUS AREA AROUND THE CARTRIDGE STARTER EXHAUST DIRECTLY BELOW NACELLES OF ENGINES 2 AND 8.
- A STARTER TURBINE DISINTEGRATION AREA EXISTS TO THE SIDE OF THE STARTER TURBINE AREA.
- THE AREA 25 FEET IN FRONT AND 100 FEET BEHIND (200 FEET IF DEFLECTOR IS NOT AVAILABLE) IS THE ENGINE INLET DANGER AND EXHAUST BLAST DANGER AREA.

🟥 **EXHAUST BLAST (AND INLET DANGER) AREA**
▨ **STARTER TURBINE DISINTEGRATION AREA**
▥ **CARTRIDGE STARTER EXHAUST DANGER AREA**

NOTE

FOR AGM-28 ENGINE DANGER AREAS REFER TO T.O. 1B-52C-30-1.

ENGINE DANGER AREAS

Figure 2-2 (Sheet 2 of 2).

ENGINE GROUND OPERATION

Except for ambient temperatures of -30° C (-22° F) and below, no warmup period is required for the engines. Normally, as soon as the engines stabilize at idle rpm, the throttles can be advanced to full open. After starting, however, the engines (with the exception of engines which are advanced for starting the remaining engines) should be allowed to run at idling speed until readings have stabilized and ground check has been completed. Rapid movement of the throttles should be avoided at all times to prevent exceeding allowable exhaust gas temperatures. A minimum of 3 to 4 seconds should be used for transition from IDLE to maximum allowable.

TAXIING

PILOT

The pilot will release his brakes upon receiving "clear to taxi" signal from the crew chief. When the aircraft starts to roll, a check of brakes should be made. To steer the aircraft, use rudder pedals. Differential braking is not possible and thrust from the outboard engines is ineffective for turning unless used in conjunction with normal steering. Use the largest radius of turn possible and never attempt to steer when the aircraft is not rolling. For minimum turning radius, see figure 2-3. To avoid severe landing gear oscillations during low speed braking and to obtain acceptable brake and tire lift and adequate brake performance, especially with regard to potential refused takeoffs, observe the limitations outlined under "Ground Operating Limitations," Section V. To prevent overheating of the forward brakes and exceeding brake energy limits, use minimum power to maintain adequate airbleed pressure during taxi. If possible, when braking is required, use a firm steady application of brakes until aircraft slows to below desired taxi speed without applying additional power.

CAUTION

- Brake chatter is normally observed at lower speeds (below 30 knots) and not in a hard braking mode. Pilots can minimize valve and/or brake chatter by maintaining hard braking pressure when brakes are applied. Chatter is readily induced by lightly tapping the brake pedals and is most common during taxiing. Any brake chatter which does not cease under maximum brake pedal deflection must be checked/resolved by maintenance prior to further taxi or flight.
- To prevent structural damage when making a turn with full rudder travel, maximum ground turning speeds should be 5 knots with ratio selector lever in TAXI or 27 knots with ratio selector lever in TAKEOFF LAND position.
- To prevent structural damage during high speed taxi runs, place the steering ratio selector lever in TAKEOFF LAND. Steering in TAXI during high speed taxi runs produces excessive steering when small amounts of rudder pedal displacement are induced which can produce critical side loads on aircraft structure.
- During taxiing, both tip gears should be on or over maintained surfaces. Structural damage to the tip gear can be sustained while taxiing if the tip gear is permitted to run on rough terrain, particularly if the tip gear is heavily loaded.
- One or both tip protection gear wheels may remain in the trail-forward position (strut inboard) after having been reversed during a sharp turn or rearward towing. This is particularly true when wing and drop tanks are full. For a reversed right tip gear, introduce 20° nose left crosswind crab at a rate of approximately 2.5° per foot while moving forward at 2 or 3 knots until the gear casters. A minimum distance of 20 feet forward and 5 feet to the side is required for this procedure. If the gear does not caster, apply right steering, with the steering ratio selector in TAXI position, until the gear casters. Realign the aircraft with the runway by reverse steering. If necessary, use reverse crosswind crab to recenter the aircraft on the runway. For a reversed left tip gear, the above procedure should be followed using the opposite directions to those stated. If space does not permit use of this procedure, stop the aircraft and have the gear turned manually with the use of a turning bar.

NOTE

The high fuel consumption during taxiing makes it necessary to hold engine speed and taxi time to a minimum.

COPILOT

The copilot will monitor the tower and assist in maintaining a clearance of all obstacles during taxiing. The copilot will monitor air pressure and overload lights to assure sufficient pneumatic air to maintain normal alternator operation. If adequate manifold air pressure is not maintained, the alternator will decrease in frequency and, upon advancing throttles, the turbine controls may not react fast enough to prevent the alternator from shutting down from an overspeed condition.

PAINTED SURFACES

Painted areas on runways, taxiways, and ramps are significantly more slippery than nonpainted areas.

In addition, painted areas sometimes serve as condensation surfaces and it is possible to have wet, frosty, or even icy conditions on painted areas when the overall weather condition is dry.

CAUTION

Use caution when taxiing over wet painted areas because braking conditions may deteriorate to the extent that the braking coefficient is near that for an icy condition.

TAXIING CHECKLIST (Copilot/EW reads)

NOTE

- Only the **boldface** items need be accomplished for Scramble. All items will be reviewed during climb or as soon as practicable.
- The taxiing checklist should not be performed while taxiing through a congested area.

1. BRAKES — CHECKED (P)

Check wheel brakes for proper operation as soon as possible after aircraft starts to move. Pilot monitors hydraulic pack pressure low master light while taxiing. Hydraulic pressure fluctuations due to loss of fluid or other malfunctions may be observed on the pressure gages.

CAUTION

- Maintain manifold pressure above 15 psi while making sharp turns. Power should then be adjusted for normal taxi operation to prevent excessive use of brakes.
- Do not attempt to use either steering or crosswind crab when aircraft is not rolling as severe loads would be applied to tires and landing gear.

2. FLAP LEVER — ON (CP)

Copilot lowers flaps after taxiing to insure clearance from ground equipment.

3. BOMB DOORS — CLOSED (P)

Pilot will place the bomb door switch to OPEN to insure that both latches are unlatched, check that the not-latched light is on, and then place the switch to CLOSED position.

CAUTION

Copilot monitors manifold air pressure and verifies that manifold pressure is 30 psi minimum just prior to bomb door closing operation in order to maintain sufficient hydraulic pack output to prevent damage to bomb doors. Hydraulic packs 1, 2, and 4 must be operating.

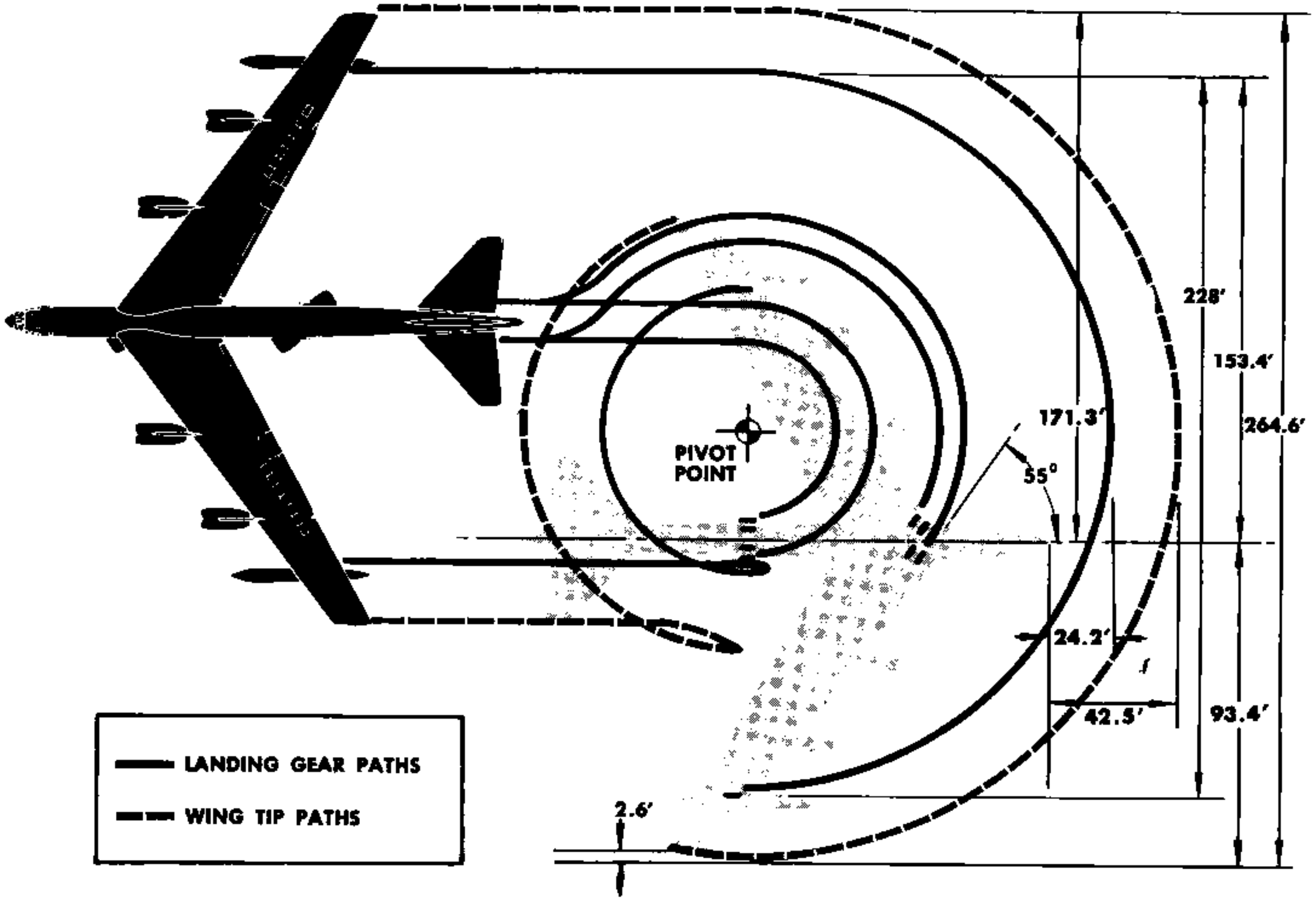
4. Radar Altimeter - ON (P)

5. FLIGHT INSTRUMENTS — CHECKED (P-CP)

Check needle for turn indication and ball for freedom of movement; attitude indicator erected and flag out of sight; compass for movement in turns; and all pitot-static pressure instruments for correct indications.

6. Crosswind Crab - Checked and down (P/CP)

If time permits, check operation of the crosswind crab to insure positive response in both directions. Manually turn the crosswind crab knob in each direction, recentering the crosswind crab control with the centering button each instance. Check both indicator needles for correct indication.



MINIMUM GROUND CLEARANCE	
WING TIP (FULL DROP TANKS)...	3.8'
WING TIP (NO DROP TANKS)....	5.5'
DROP TANK (FULL)...............	1.8'
OUTBOARD NACELLE............	3.7'
INBOARD NACELLE..............	5.8'
FUSELAGE BOTTOM.............	4.3'
AGM-28 MISSILE	2.2'

TURNING RADIUS AND GROUND CLEARANCE

Figure 2-3.

BEFORE TAKEOFF

BEFORE LINEUP CHECKLIST (Copilot/EW reads)

NOTE

Only the **boldface** items need be accomplished for Scramble. All items will be reviewed during climb or as soon as practicable.

1. Parking Brakes - Set (P)
2. **WATER INJECTION PUMP SWITCHES (IF APPLICABLE) — ON,** system primed, lights checked (P)

   If time and/or conditions permit, prime water injection pumps by operating No. 3, 4, 5, and 6 engines at 85% to 90% rpm until water pressure lights go out or for 1 minute maximum. If any water pressure light fails to go out within 1 minute, recycle pump switches to OFF for 15 seconds then back to ON and repeat the above procedure.

3. AC & DC Power - Checked (CP)

   a. Copilot monitors alternator loads (kvars and kwatts) and system frequency and voltage.

   NOTE

   - Constant fine adjustment of kwatt and kvar load division is not required.
   - In the event the alternator overload lights illuminate, throttle No. 4 or 5 will be advanced to supply more air bleed pressure for alternator operation.

   b. Copilot checks TR units for positive load indication, TR bus voltage (25 to 29.5 volts), and excessive load unbalance. If a positive load is not indicated on a forward TR unit, the crew will be directed to turn on the following equipment: ECM systems 2, 3, and 16 ON & STDBY; BNS primary control function switch to TRACK. For an aft TR unit, the EW officer will be directed to turn on the following equipment: ECM systems 12 and 15 ON & STDBY. The copilot will again check the loadmeter and if a positive indication does not appear, the TR unit will be considered a malfunctioning unit.

   WARNING

   If a positive load indication is not obtained or if TR bus voltage did not read between 25 and 29.5 volts dc, correction of malfunctioning TR units is required prior to takeoff.

   c. EW officer will turn ECM equipment OFF and radar navigator will return BNS primary control function switch to STAB prior to takeoff.

4. **ANTISKID SWITCH — ON, GUARD CLOSED (P)**

BEFORE LINEUP CHECKLIST (Copilot/EW reads) (cont)

5. **STANDBY PUMPS — ON (P)**

6. Pitot Heat - ON (P)

7. Control Surface Trim - Set (P-CP)

Pilot and copilot check aileron and rudder trim for takeoff setting.

8. **STABILIZER TRIM — CHECKED FOR TAKEOFF SETTING (P-CP)**

WARNING

To preclude the possibility of inadvertent actuation of the stabilizer trim switch, the pilot should rest his thumb between the horizontal spur and the upright position of the control wheel grip during all normal operations. Special care should be taken during takeoff, landing, and air refueling operations. In addition, the copilot monitors the stabilizer trim indicator during the takeoff roll.

NOTE

During flight, the stabilizer trim switch should be operated in short intermittent bursts to aid in recognizing a malfunctioning electrical trim system before reaching an extreme out-of-trim condition.

9. **CONTROL COLUMNS — CONNECTED (P-CP)**

Copilot holds column rigid near neutral while pilot applies push force and pull force on his column to confirm columns connected.

10. Airbrake Lever - OFF (P)

11. **WING FLAPS — 100%, LEVER DN (P-CP)**

Pilot and copilot check wing flap indicators full down, wing flap lever in DN.

12. **FUEL SWITCHES 9, 12, 13, 14, 15 & 16 — ON, INITIAL TRANSFER STARTED (CP)**

This sets the fuel system controls for takeoff.

WARNING

Crossfeed valve switches No. 9 and 12 must be ON to provide an alternate source of fuel to nacelle during takeoff.

NOTE

- During takeoff-climb, with crossfeed valves 9 and 12 open, a temporary lateral unbalanced fuel condition can occur in the main tanks because of differential pressure output of the fuel boost pumps in the individual mains. This condition will be corrected when crossfeed valves 9 and 12 are closed and normal transfer from the auxiliary tanks to main tanks is begun.
- Monitor main tank fuel gages frequently during fuel transfer so that overfilling due to transfer valves failing in the open position may be prevented.

BEFORE LINEUP CHECKLIST (Copilot/EW reads) (cont)

13. **WINDOWS & HATCHES — CLOSED AND LOCKED (P-CP)**

14. Flight Instruments - Rechecked and set (P-CP-RN-N)

    a. Pilot, copilot, and radar navigator recheck their altimeters with a known elevation.

    NOTE

    Pilot and copilot should check the AAU-19/A altimeter in the desired mode of operation.

    b. Pilot, copilot, and navigator crosscheck heading indicators and magnetic standby compass.

    c. Pilot positions the heading selector switch to MAN and checks bank steering bar for proper operation. The selector switch will be left in MAN during takeoff and the bank steering bar used to aid in directional control. Set the heading marker to runway heading (with crosswind crab correction applied, i.e., if the crosswind crab correction is 10° left, the heading marker should be set 10° left of the runway heading.)

    NOTE

    Cross-checking of bank steering bar, turn needle, and heading indicator will provide indication of attitude indicator failure in the roll axis. If the roll axis of the ADI is inoperative on takeoff, the bank steering bar will aid in maintaining a wings level attitude until a new heading is selected.

    d. Pilot and copilot set attitude indicators to indicate level flight.

    WARNING

    Any time during critical phases of flight and especially during night and/or instrument conditions, the pilot not flying the aircraft will closely monitor his flight instruments and cross-check them against the instruments of the other pilot. If an apparent error in aircraft attitude is detected, the pilot flying the aircraft will be advised immediately.

15. Radio Navigation Instruments - Checked (if applicable) (P/CP)

    When a certified ground check point is available (and time permits), check VOR/TACAN equipment within prescribed tolerances.

16. Nav Mode Select Switch - As desired (P-CP)

    Select the appropriate navigational aids to be used for the departure and set the navigational instruments and switches as required.

17. **STARTER SELECTOR — FLIGHT START (CP)**

18. AGM-28 Engine Control Knobs - GRD START (engines not running) (CP)

19. **TAKEOFF DATA — REVIEWED (P-CP-N)**

    Review EPR, S_1 speed, time, and S_2 speed. Review takeoff procedures and emergency considerations with the copilot. Emergency procedures after S_1 speed will be particularly emphasized to insure both pilots are prepared for any emergency and have a complete understanding of procedures to be followed in continuing the takeoff in the event a loss of thrust or other emergency occurs after S_1 speed has been attained.

BEFORE LINEUP CHECKLIST (Copilot/EW reads) (cont)

20. SEAT, RUDDER PEDALS & CONTROL COLUMN — ADJUSTED AND CHECKED (P-CP)

Pilot and copilot adjust seat and check full displacement of control column and control wheel; then adjust rudder pedals to enable full displacement.

CAUTION

Do not attempt to check rudder pedal travel as severe loads would be applied to tires and landing gear.

21. Arming Lever Safety Pins (No. 1) - Removed (P-CP-EW)

22. Trigger Ring - Unstowed (RN-N)

23. Zero Delay Lanyard - Hooked (P-CP-EW-G)

24. Crew, Stand By for Takeoff (CP-G)

Gunner will make appropriate checks and respond over the interphone. Any crew member noting discrepancies which may compromise the successful completion of the mission will so advise the pilot at this time.

25. SIF/IFF - NORM (mode and code as briefed) (P)

TAKEOFF

Close attention must be given to the recommended procedures in order to obtain the best takeoff performance. The normal takeoff technique is that which will be required to produce the results stated in the takeoff charts in the Appendix. These procedures have been selected as being the most desirable from the consideration of safety and the attainment of minimum practical takeoff distance. For brake energy limits, see figure 5-12.

CAUTION

- If it is absolutely necessary to fly the aircraft immediately following a heavily braked landing or refused takeoff, a check of the brake energy limit chart (figure 5-12) should be made prior to takeoff.
- If a tire failure is suspected on takeoff before decision speed is reached, the takeoff should be discontinued. This is to preclude the possibility of landing gear failure caused by takeoff with a partially disintegrated tire.

TAKEOFF PERFORMANCE

Performance Data

All takeoff performance data should be determined prior to takeoff. This assures accurate planning and close monitoring of all takeoffs. The data includes such items as takeoff gross weight, runway OAT, field length and altitude, wind direction and velocity, aircraft cg, the runway gradient, and anti-icing requirements. From such items, whether water injection is needed, the stabilizer setting, the crosswind crab setting, and what the takeoff distance will be, may be determined. A change in any one of these items will have a large effect on takeoff performance as shown by figure 2-4. Relative humidity, which appreciably affects reciprocating engines, has a negligible effect on turbojet engines. Sufficient charts to accurately determine takeoff performance are included in Parts 2 and 3 of the Appendix.

S_1S_2 Acceleration Monitor System

The S_1S_2 acceleration monitor system is based on a timed acceleration check between two indicated airspeeds which can be compared against a precomputed acceleration rate taken from charted values

FOR SEA LEVEL AND GROSS WT. OF 380,000 POUNDS

AN INCREASE OF	Changes Takeoff Distance Approx.	
	WITH WATER-FT	NO WATER-FT
1000 Feet in Altitude at 100°F	+ 600	+ 1050
1000 Pounds in Weight at 100°F	+ 60	+ 70
10°F on 100°F OAT	+ 400	+ 900
10 Knots Headwind	- 950	- 1250

FACTORS AFFECTING TAKEOFF DISTANCE

Figure 2-4.

prior to takeoff. Use of this system virtually eliminates wind error, airspeed indicator calibration error is minimized, and no reference point outside the aircraft is necessary. The S_1S_2 system checks acceleration only after takeoff power is set, increasing accuracy during rolling takeoffs. Excellent crew coordination is essential when using the S_1S_2 acceleration check.

NOTE

> When the computed takeoff distance is 4000 feet or less, the S_1S_2 takeoff procedure will not be used. In lieu of timing acceleration, a check of all engine instruments will be made when 70 knots is reached during the takeoff roll. At this point, the decision will be made to continue or abort the takeoff.

INITIAL TIMING SPEED. Initial timing speed is the speed (70 knobs IAS) at which timing is started to determine acceleration characteristics of the aircraft.

S_1. S_1 is the computed decision speed (S_1 speed) which must be reached at the termination of the acceleration check time (S_1 time).

S_2. S_2 is the takeoff indicated airspeed (unstick speed).

Takeoff Planning

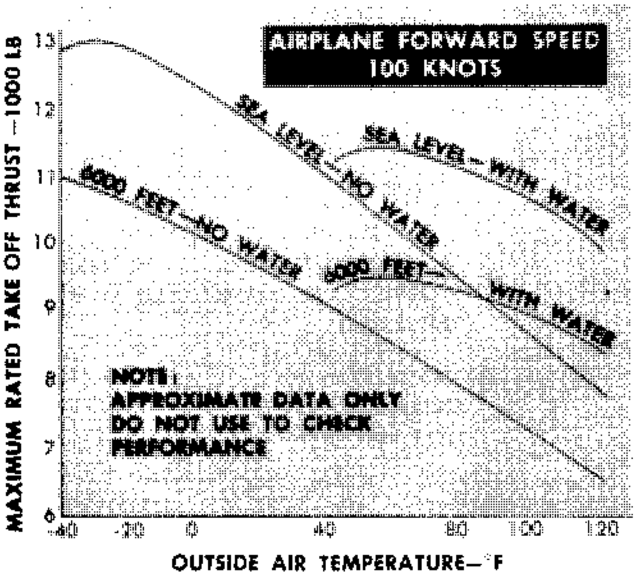
Adequate takeoff planning must always include the possibility of poor acceleration during the takeoff run. Although many factors may cause poor acceleration, the most probable cause is engine failure. If such a failure occurs, it must be possible either to stop in the runway distance remaining or to continue the takeoff safely on seven engines. The decision whether or not a stop can be made in the remaining runway must be made immediately and with the aid of predetermined criteria. This information is shown graphically for all RCR conditions in Part 2 of the Appendix. The minimum runway required is the runway length required to accelerate to S_1, experience an engine failure, and take off with seven engines. Minimum runway required charts in Parts 2 and 3 of the Appendix are used to determine the maximum gross weight for a specific runway length. It should be pointed out, however, that climbout performance must be considered when determining the maximum gross weight for operation from a given runway. This is necessary because it is possible under certain runway pressure altitude and temperature conditions to load the aircraft so that, although the takeoff could be accomplished, very poor and sometimes unsafe climbout performance exists. This is discussed more fully under "After Takeoff," this section. To determine the maximum takeoff weight, enter the appropriate minimum runway required chart with the runway length available and arrive at a weight as determined by the existing field pressure altitude and temperature. Check the climbout performance for this weight, temperature, and field pressure altitude by referring to the charts in Part 4 of the Appendix, keeping in mind terrain clearance and flap retraction problems. Once this weight has been determined, the only other information required is that which will enable the pilot to properly monitor the takeoff; namely, the minimum EPR settings, the decision speed and time, and the takeoff speed (S_2).

Engine Thrust

The characteristics of a turbojet engine are such that the engine thrust for takeoff decreases considerably with increases in outside air temperature and field elevation. To alleviate this condition, a water injection system has been added to each engine so that reasonable takeoff performance is retained at high OAT's and high field elevation. Typical values for engine thrust with changes in temperature and altitude for a takeoff with forward speed of 100 knots are shown in figure 2-5 (approximate values only).

CAUTION

- The scaling effect of water with various impurities tends to decrease engine efficiency; therefore, use of water injection should not be indiscriminate but rather should be reserved for heavy weight, high temperature takeoff, when it is actually needed as a safety factor, and for periodic functional checks of the system.
- Water injection should not be used at pressure altitudes greater than 8000 feet. Use of water injection above this altitude will result in harmful overspeed of the low speed compressor.
- Due to venturi effect at the engine inlets, engine icing may be expected during a water injection takeoff when the runway temperature is approximately 40° F and the temperature of the water in the water injection tanks is 40° F or less. The engine and nacelle anti-icing system will not prevent icing which will occur under this combination of air and water temperatures. Prior to any planned water injection takeoff with runway temperatures forecast to be approximately 40° F, the aircraft should be serviced with water warm enough to remain above 40° F at takeoff time.
- Water injection must not be used if the runway OAT is less than those shown under the minimum temperature limit column in figure 2-7.



ENGINE TAKEOFF THRUST (Typical)

Figure 2-5.

TAKEOFF PROCEDURES

Correct takeoff procedures may vary under different takeoff conditions. There are, however, some procedures which are standard for every takeoff. These procedures, which are discussed in "All Takeoffs," should always be adhered to. For the takeoff calculations and a summary of the takeoff procedures, see Parts 2 and 3 of the Appendix. See figure 2-6 for a diagram of the typical takeoff and initial climb operations. This diagram serves to illustrate where various actions outlined in the checklist are taken.

All Takeoffs

Takeoff rated thrust (TRT) or military rated thrust (MRT) will be used for all takeoffs except touch-and-go. The correct stabilizer trim setting will be used for all takeoffs. The wing flaps will be set for 100% down and intermediate settings will never be used.

ROLLING TAKEOFF. In order to minimize the fatigue damage effects to the wing structure, all takeoffs will normally be made from a rolling start. In those situations when safety may be compromised by performing a rolling takeoff or when runway conditions dictate, takeoff may be made from a braked condition; however, maximum thrust operation with brakes locked will be kept to a minimum. When making a rolling takeoff, the aircraft will be aligned with the runway at normal taxi speeds using the radius guide lines.

CAUTION

The maximum turn-on speed for a 140- to 150-foot turn radius is 15 knots. This limit is based on aircraft strength and must not be exceeded.

NOTE

- THE TAKEOFF SHOWN IS FOR NORMAL CONDITIONS. MODIFICATIONS MAY BE USED TO MEET VARIOUS REQUIREMENTS.
- REFER TO PARTS 2 AND 3 OF THE APPENDIX FOR COMPLETE DATA ON DETERMINATION OF DECISION TIME AND TAKEOFF SPEEDS.

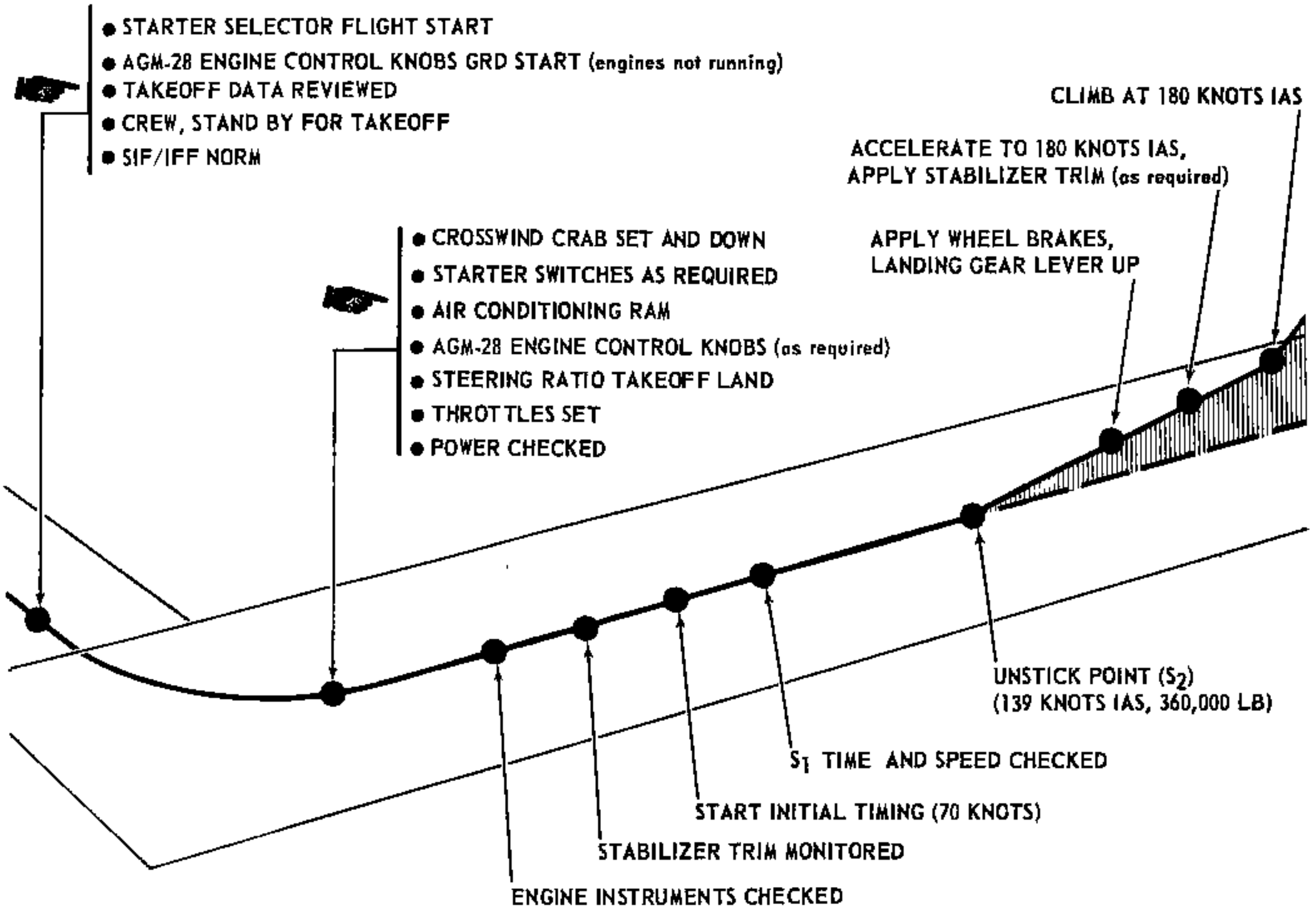
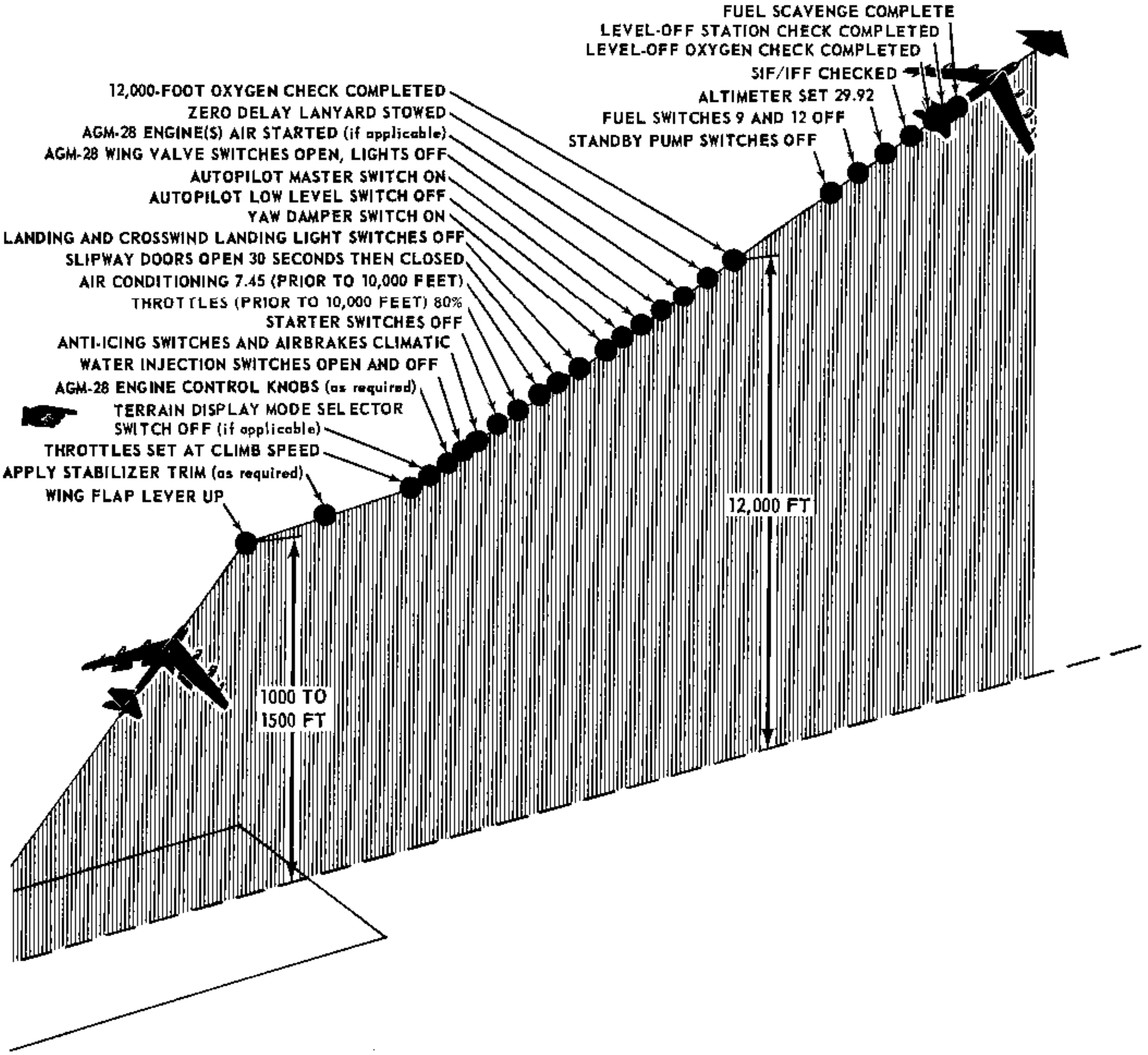


Figure 2-6. (Sheet 1 of 2)



NOTE

AIRSPEEDS BASED ON AN AVERAGE GROSS WEIGHT OF 360,000 LBS

TAKEOFF AND INITIAL CLIMB DIAGRAM (Typical)

Figure 2-6 (Sheet 2 of 2).

Steering ratio selector may be placed in TAKEOFF LAND after completion of the "Before Lineup Checklist" if the runway turn radius permits; not permitting, it will be placed in TAKEOFF LAND when aligned with the runway. Power will never be advanced to TAKEOFF setting until within 15° of runway heading.

THROTTLES. The throttles will be advanced slowly and evenly to the OPEN position. Minimum time for movement from IDLE to OPEN is 3 to 4 seconds. No attempt will be made to steer by throttles as differential thrust is ineffective and reduction of thrust on one side will increase the takeoff ground run. The pilot flying the aircraft will maintain throttle control until passing S_1 speed. He will maintain throttle control throughout light gross weight takeoffs (computed takeoff distance 4000 feet or less), touch-and-go, or taxi-backs to include climb through flap retraction (if applicable).

STABILIZER TRIM. The stabilizer trim setting required for takeoff depends upon the center of gravity location and the aircraft weight. The correct stabilizer trim setting may be determined from charts in Parts 2 and 3 of the Appendix.

CAUTION

Failure to set the stabilizer correctly could result in:

1. An accelerated stall if the stabilizer trim is set too high (aircraft noseup).
2. Longer than predicted takeoff ground runs if the stabilizer trim is set too low (aircraft nosedown).

WING FLAPS. The wing flaps are so designed that the highest lift-drag ratio is achieved at the 100% down position. For this reason they are always used in this position. Because wing flap extension time is 40 seconds and intermediate settings are ineffective, the lowering of flaps during the takeoff roll is not recommended.

CONTROL TECHNIQUE. Steering should be accomplished with the rudder pedals throughout the ground run. The steering system will be effective until sufficient speed is established for rudder control. The takeoff will require a pull force on the control column approximately 5 to 10 knots prior to unstick speed. The control column will be pulled back as required to achieve the computed unstick speed. At the appropriate speed, the forward wheels will come off the runway first and the aircraft will tend to rotate about the rear wheels. Relaxing back pressure at the time the aircraft leaves the ground will stop this pitching action. If, however, stabilizer trim is set too high (aircraft noseup), the control column must be pushed well forward to stop the pitching action. Should rearward control column movement be delayed until just before the takeoff point, the takeoff ground run may be increased as much as 5%. See Parts 2 and 3 of the Appendix for determination of takeoff distances.

Water Injection Takeoff

Following alignment with the runway as described under "Rolling Takeoff," advance all throttles slowly to the OPEN position, noting that the water pressure lights are out. The water injection throttle microswitches will have been actuated just before the throttles reach the full OPEN position, allowing the water shutoff valves to open and permit water to be injected into the engines. The most positive indication that the water injection system is operating correctly will be an increase in the fuel flow and EPR of each engine above that normally attained without water. The duration of the water supply varies between aircraft and engine configurations as shown in figure 2-7. It is desirable to have sufficient water to last during takeoff, landing gear retraction, and acceleration to flaps-down initial climb speed. The time required for this will generally be less than 110 seconds if prescribed procedures are employed. At sea level on a standard day with no forward speed, the use of water injection increases fuel flow approximately 1800 pounds per hour per engine. A corresponding increase will also result in the engine pressure ratio but no change will occur in rpm. Move the drain valves switch to OPEN position. When water supply is depleted, turn the water injection pump switches OFF. Leave the drain valves switch in OPEN position.

CAUTION

After moving the drain valves switch to OPEN position, do not actuate the switch in flight at or above the freezing level. Operation of a frozen valve may cause valve failure.

NOTE

If the water injection pumps require priming prior to takeoff, place the water injection pump switches to ON and operate engines momentarily (1 minute maximum) at sufficient rpm until the water pressure lights go out. If any water pressure light fails to go out, recycle pump switches to OFF for 15 seconds, then back to ON, and repeat the above procedure.

ENGINE	MINIMUM OAT FOR WATER INJECTION	WATER CAPACITY	DURATION WITH FULL TANK(S)	DRAINAGE RATE	
				PUMPS ON	PUMPS OFF
J57-P-19W	40° F	300 GAL	110 SECONDS	4.0 MIN	25 MIN
J57-P-29WA	40° F	300 GAL	110 SECONDS	4.0 MIN	25 MIN

WATER INJECTION DATA

Figure 2-7.

PARTIAL WATER TAKEOFF. Water takeoffs may be safely made without water augmentation on all engines; however, the following criteria is established for partial water takeoffs for normal training missions:

1. Water takeoffs will not be planned for an aircraft with any known system malfunction such as an inoperative water pump.
2. Takeoff will not be continued with more than two engines without water augmentation.
3. Minimum runway required with all eight engines dry will not exceed runway available.
4. Subtract 2 knots per engine without augmentation from the decision speed.

Light Weight Takeoff

When the computed takeoff distance is 4000 feet or less, the takeoff will be considered a lightweight takeoff. The decision to continue or abort the takeoff will be made at the 70-knot IAS check. When takeoff is made at lightweight, the airspeed and rate of climb increase rapidly after unstick. This condition reduces the time during which trim changes can be made. The pilot should control any noseup rotation with forward control column and nosedown trim and check for proper movement of the manual trim wheel. After the landing gear is retracted, the thrust should be adjusted during climb to flap retraction altitude to produce a rate of climb of approximately 1500 to 2000 feet per minute.

NOTE

A wet takeoff will not be made at a gross weight of less than 300,000 pounds.

Obstacle Clearance Takeoff

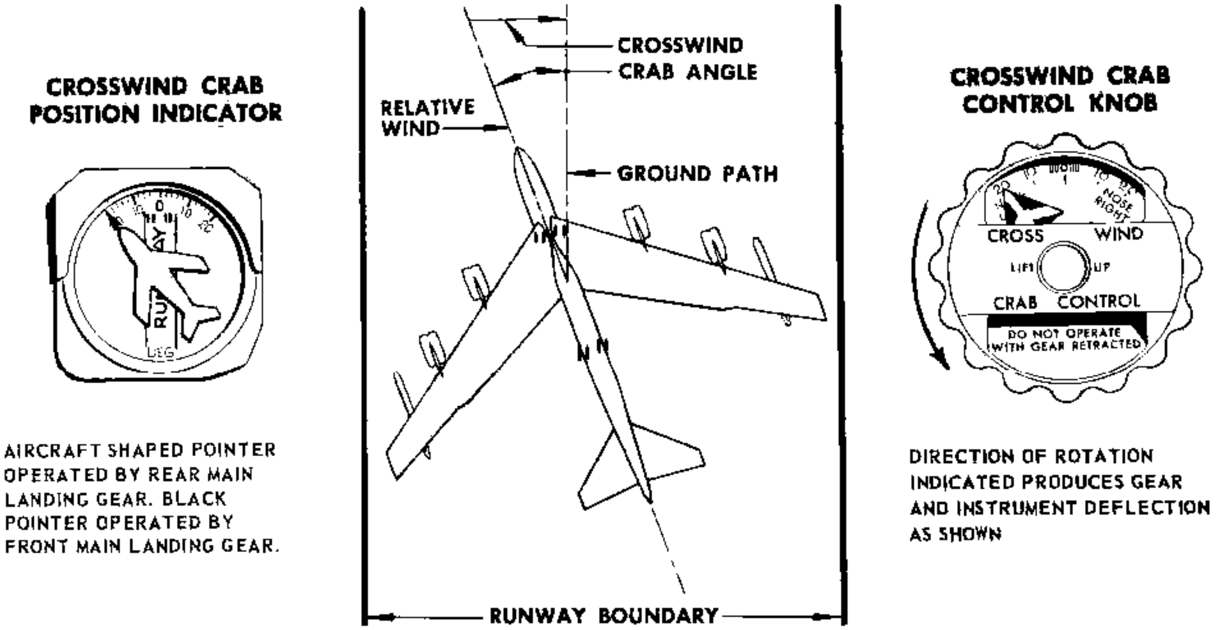
If obstacle clearance is marginal, retract the landing gear as soon as possible after becoming airborne, leave wing flaps fully extended, and climb at 10 knots above takeoff speed until the obstacle is cleared. The charts in Parts 2 and 3 of the Appendix show the distance required from point of brake release to clear a 50-foot obstacle with seven and eight engines. Since an engine failure may be encountered after S_1, it is recommended that the charts be entered using the seven-engine ground run distance. After the climb from C to F (figure 2-10), allow the aircraft to accelerate to 180 knots IAS and continue climb to at least 1000 feet above the terrain before starting flap retraction. See "Obstacle Clearance Climbout," this section, for maximum climb angle discussion.

Crosswind Takeoff

NOTE

- Sustained runway wind velocity plus one-third of the gust factor will be used to compute crosswind crab settings for a takeoff with gusty wind conditions.
- If a crosswind cannot be compensated for by use of the crosswind crab system, a takeoff is not recommended.
- If the wind is a variable wind, the average heading of this variable wind should be used.

Prior to the time of takeoff, the takeoff weight and local field wind velocity and direction should be ascertained and the crosswind crab setting determined for these conditions. If uncorrected tower wind is obtained, it is recommended that 50% of the velocity be used. See Parts 2 and 3 of the Appendix for applicable crosswind takeoff information. While taxiing to takeoff position, set the crosswind crab control knob in the direction the nose of the aircraft is to be crabbed into the wind. Taxi into takeoff position so that the nose of the aircraft is pointing into the direction of the wind component (figure 2-8). The miniature aircraft and pointer located on the crosswind crab indicator should be in alignment at the degree setting corresponding to the degrees of



CROSSWIND CRAB POSITION INDICATOR

AIRCRAFT SHAPED POINTER OPERATED BY REAR MAIN LANDING GEAR. BLACK POINTER OPERATED BY FRONT MAIN LANDING GEAR.

CROSSWIND CRAB CONTROL KNOB

DIRECTION OF ROTATION INDICATED PRODUCES GEAR AND INSTRUMENT DEFLECTION AS SHOWN

CROSSWIND CRAB OPERATION

Figure 2-8.

crab angle previously determined for the wind and gross weight. The miniature aircraft and pointer should be crabbed across the imaginary runway on the indicator in the same direction that the aircraft is crabbed across the runway on the takeoff run.

CONTROL TECHNIQUE. The takeoff procedure used is the same as that for a normal takeoff except that the aircraft will be crabbed into the wind, a condition which may seem strange the first few times a pilot uses this crosswind crab technique. Engine thrust may pull the aircraft toward the side of the runway from which the wind is blowing before the aircraft becomes airborne. This effect is easily overcome by use of the proper amount of rudder pedal steering. If the crosswind is of a large enough magnitude, it may cause the aircraft to heel over on the downwind tip gear at low speeds. Such a differential tip gear loading can cause high stresses in the tip gear tire as airspeed increases. An attempt to level the wings with lateral control can be initiated when passing through 60 knots IAS on the takeoff roll but full control wheel travel may be necessary at this airspeed. A slight increase in the ground roll of not more than 1% can be anticipated because of the drag imposed by the raised spoilers. The lateral control required to maintain a wing-level attitude will diminish as the airspeed increases to the takeoff speed if the crab angle setting being used was determined for the correct wind and gross weight. Forward gear steering becomes less effective as the wheels become lightly loaded; however, the rudder control becomes more effective and compensates for decrease in effectiveness of forward gear steering.

LANDING GEAR RETRACTION. After the aircraft is airborne and brakes have been applied, retract the landing gear. The crosswind crab control knob and indicator will be automatically centered prior to the time the gear retracts.

Night Takeoff

When making a night takeoff, use the same procedure as for a day takeoff. If the pilot wishes to energize the fluorescent dials on his instruments so that they glow with maximum intensity, the white spotlight may be used for focusing on the applicable instruments for a few seconds while the pilot's eyes are covered. The landing lights, terrain clearance light, and crosswind landing light may be used at the pilot's discretion.

NOTE

The landing lights are in the leading edge of the front landing gear doors. On aircraft **54**▶ **63** **W1**▶ **W3**, the lights will be deenergized when the landing gear lever is moved out of the GEAR DOWN position. On aircraft **64**▶ **W4**▶, the landing lights will remain on until the landing gear is up and locked.

TAKEOFF CHECKLIST

NOTE

This checklist need not be read during takeoff.

WARNING

Do not attempt to take off unless stabilizer trim has been properly set for takeoff and airbrakes are down.

1. Crosswind Crab - Set and down (CP)

   Copilot sets crosswind crab control while taxiing to takeoff position.

2. Starter Switches - As required (CP)

   Place engine starter switches to START for all wet takeoffs. If icing conditions exist or are anticipated during or after a dry takeoff, place the engine starter switches to START before advancing throttles to takeoff thrust.

3. Air Conditioning Master Switch - RAM (CP)

   NOTE

   If for any reason takeoff is not begun immediately after switching to RAM, it is necessary to return the switch to 7.45 psi. The BNS will automatically shut down within approximately 10 to 20 seconds after illumination of the navigator's low airflow warning light. Sufficient ram airflow for BNS cooling is provided by the time takeoff airspeed reaches approximately 60 knots.

4. AGM-28 Engine Control Knobs - As required (CP)

   Rotate the engine control knobs to the TAKEOFF position if missile engine thrust is required for thrust augmentation during takeoff.

   CAUTION

   If icing conditions are anticipated or encountered, the missile engine must be operated at MAX CONT (with aircraft anti-icing control switch ON) before sufficient heated air will be available for anti-icing of the missile engine inlet guide vanes.

   When missile engines have not been ground started, the control knobs should remain in the GRD START position for takeoff.

TAKEOFF CHECKLIST (cont)

5. Steering Ratio - TAKEOFF LAND (P/CP)

WARNING

If the steering ratio selector lever is placed in TAXI position in flight, it is possible to steer the front gear to the full 55° position. Under some conditions, it would be impossible to return the gear from the 55° position which would cause a hazardous landing condition. If the steering ratio lever is not in TAKEOFF LAND, the landing gear cannot be retracted.

CAUTION

Center the rudder pedals before repositioning the steering ratio selector lever. Actuation of the lever when the rudder pedals are deflected is very difficult and will result in a sudden change in steering angle.

6. Throttles - Set (P-CP)

Throttles advanced to full open. Check four red lights out for wet takeoff.

CAUTION

Rapid throttle movement could cause mild compressor stalls resulting in slow acceleration. This is due to premature water injection actuation by advanced throttles movement and engine acceleration lag.

NOTE

When making a takeoff from a standing start, pilots should be alert for possible airplane movement when throttles are advanced since the parking brakes were not designed to hold the airplane with all engines at MRT. If movement is detected, depressing the brakes beyond parking brake position will bring the airplane to a stop.

WARNING

- If the warning horn sounds as throttles are advanced beyond approximately 80% NRT, the flaps should be rechecked at 100% down.
- To eliminate or reduce the possibility of flameout, it is recommended that if engine, nacelle, and scoops anti-icing is not ON before power is set for takeoff, its use be delayed until water, if used is expended, and power is reduced to NRT. Delay actuation of anti-ice system approximately 1 minute after reducing power to NRT as an engine stall or flameout is possible due to water collecting in the engine anti-ice system.

CAUTION

Exceeding charted EPR can cause structural damage to the engine causing rapid engine deterioration.

TAKEOFF CHECKLIST (cont)

7. Power - Checked (P-CP)

   In the event that three engines are not more than 0.05 below the minimum EPR and the rest of the engines equal or exceed the recommended value and all other instruments indicate normal operation, the takeoff may be continued if the decision speed is attained within the acceleration check time.

8. Engine Instruments - Checked (CP)

   During initial portion of the takeoff roll, copilot checks oil pressure, EPR, rpm, and EGT indicators within limits and monitors engine instruments during remainder of takeoff roll.

9. Stabilizer Trim Indicator - Monitor (CP)

   Copilot monitors the stabilizer trim indicator during the takeoff roll in order to detect any inadvertent change in takeoff trim setting.

10. 70 Knots - Now (P)

    Pilot announces over interphone "70 knots" at approximately 60 knots. At 70 knots, pilot announces "Now." As pilot announces "Now," the navigator will start his stopwatch. (Radar navigator backs up navigator's timing on all takeoffs. If the navigators are not aboard, the pilot not flying the aircraft accomplishes the time check.) Copilot checks his airspeed indicator at the 70-knot check. Airspeed indicators will be written up in Form 781 if difference exceeds 3 knots. Takeoff will be aborted if difference exceeds 6 knots.

NOTE

Crosswinds or wind gusts will affect airspeed indicators. Fluctuations of both indicators can be observed (not necessarily in the same direction) and should be considered during cross-check.

11. S_1 - Now (N)

    The navigator announces over interphone "Coming up on ________ seconds" approximately 3 seconds prior to S_1 time. At S_1 time, navigator will announce "Now." The pilot will check his airspeed and announce to the crew his decision to take off ("Committed") or abort ("ABORT"), based on the time-speed relationship. Pilot not flying the aircraft will take control of the throttles and set the throttle brake. (Radar navigator backs up navigator's timing on all takeoffs.)

WARNING

Takeoff will not be aborted after S_1 unless, in the opinion of the pilot, the emergency renders the aircraft definitely unsafe to attain emergency bailout altitude. In those cases where the pilot attempts to abort after S_1, he must accept the fact that he will probably fail to stop within the confines of the runway.

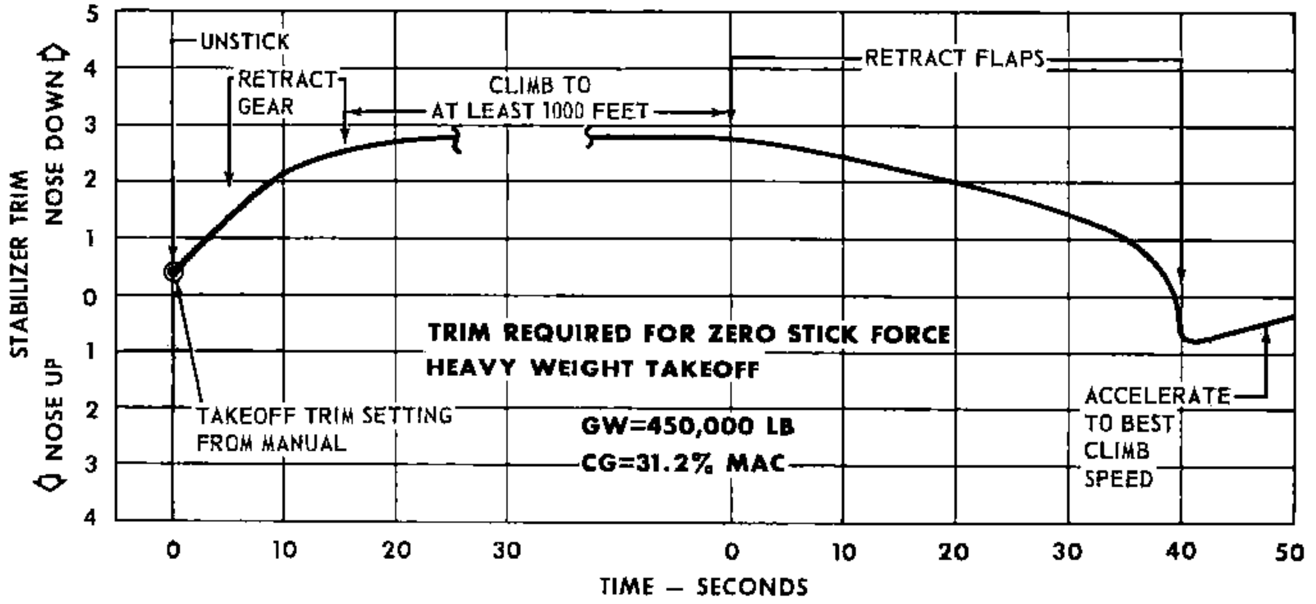
12. Unstick Speed (S_2) - Now (CP)

    Copilot calls over interphone, "Coming up on unstick speed" approximately 5 knots before reaching unstick speed. At unstick speed, copilot announces over interphone "Now."

AFTER TAKEOFF

CLIMBOUT PLANNING

Under some operation conditions, climbout can be the most critical phase of aircraft operation. For this reason, it is essential that the climbout technique be planned during mission planning prior to the flight. The climbout procedures essentially fall into two categories which are explained in the following paragraphs. These are a normal climbout and an obstacle clearance climbout. The "Takeoff



TAKEOFF — CLIMB STABILIZER TRIM SCHEDULE

Figure 2-9.

Ground Run" and "Minimum Runway Required" charts in Parts 2 and 3 of the Appendix show a line for the flaps down rate of climb equal to 300 feet per minute on seven engines using no water injection. If during mission planning, it is found that the combination of gross weight, runway pressure altitude, and OAT are such that the required ground run falls above this line (giving less than 300 feet per minute rate of climb), the gross weight must be reduced or a marginal climbout will result. If an obstacle must be cleared, the obstacle clearance climbout procedure will be used.

AFTER TAKEOFF PROCEDURES

After leaving the ground, the wheel brakes will be applied before starting gear retraction to avoid wheel well damage from spinning wheels. The landing gear retraction should be started as soon after unstick as possible.

Stabilizer Trim Use After Takeoff

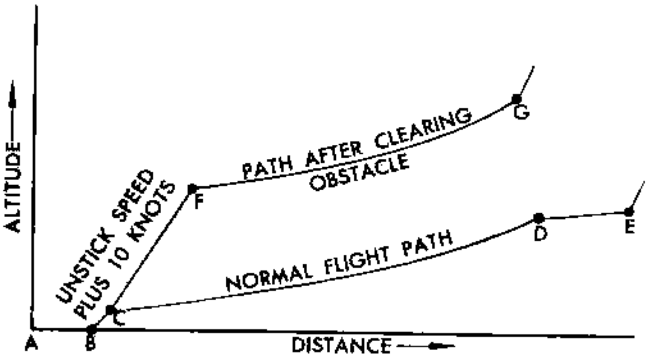
The period from takeoff to flaps up requires active stabilizer trim use by the pilot to meet the rapidly changing trim requirements. Stabilizer trim should be utilized as required to maintain stick forces near zero to preclude the rapid development of an out-of-trim condition. Stick forces associated with flaps down are very light even at full travel of the control column and can lead to the false impression that stabilizer trim is not required.

NOTE

> Control column force is a function only of control column position and airspeed; this force is not dependent on stabilizer position. If the control column is at full travel and stabilizer trim is being used, no change in control column force will occur until the control column is repositioned by the pilot. A positive method of determining whether or not the trim is working is to note the action of the trim wheel.

Excessive force is not required to position the control column at full travel in the flaps down configuration. Therefore, if a condition develops in which the pilot is holding the control column hard against the stops and not effecting positive control of the aircraft, he must make a conscious effort to utilize stabilizer trim. If this condition has developed and trimming action has been started, the response of the aircraft may not be immediately apparent. Continue trimming until control is regained.

A typical profile of trim requirements is given in figure 2-9. When the aircraft is out of ground effect, landing gear is retracted, and the aircraft is accelerated to 180 knots IAS, a nosedown stabilizer trim requirement of approximately 3 units exists. During the first 80% of flap retraction, approximately 1.5 units of stabilizer noseup trim is needed. An additional 1.5 units of noseup trim is required during the last 20% of flap retraction. For these trim requirements, the manual trim wheel is too slow to maintain zero stick force; therefore, the stabilizer trim button should be used. During flap retraction, stick forces are light and a few seconds of holding a rearward control column rather than retrimming



POINT A.	Start takeoff roll using takeoff rated thrust (TRT) with wing flaps down.
POINT B.	Takeoff point; start gear retraction.
PATH CD.	Leave flaps down and climb out at 180 knots IAS to 1000 to 1500 feet above the terrain.
POINT D.	Start flap retraction at 1000 to 1500 feet altitude above the terrain.
PATH CF.	Along path CF leave flaps extended and climb at unstick speed plus 10 knots until the obstacle is cleared.
POINT F.	Maximum desired altitude for clearing obstacle. (At least 1000 feet above terrain)
PATH FG.	Start flap retraction at 180 knots; maintain a rate of climb sufficient to keep from exceeding flap placard limits.
POINTS E AND G.	Points at which flaps are up. Accelerate to the best climb speed as given in Part 4 of the Appendix.

AFTER TAKEOFF FLIGHT PATHS

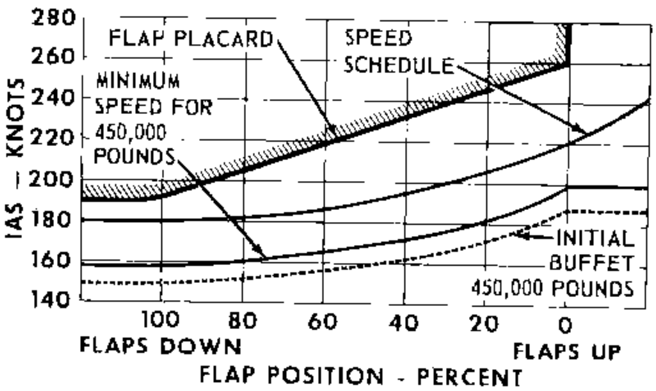
Figure 2-10.

can result in an aircraft out-of-trim condition of 3 or 4 units nosedown trim and an approaching loss of elevator authority. Application of noseup trim and full-up elevator will result in immediate recovery. See "Flight Control System Characteristics," Section VI, for information on elevator and stabilizer characteristics. After the flaps are fully retracted, nosedown trim change will be required during acceleration to best climb speed.

WARNING

- When holding full-up elevator, the pilot must be certain that he is engaging the trim button in NOSE UP position. Due to the position of the control column, he may be pushing in on the button or down on the trim button guard.

- During initial climb phase, since a severe attitude change occurs requiring considerable manipulation of the stabilizer trim, pilots should be especially alert for a stabilizer trim malfunction during this critical phase of flight and initiate immediate action as outlined in "Flight Control System Emergency Operation," Section III.



FLAP RETRACTION SPEEDS

Figure 2-11.

Normal Climbout Procedure

After unstick, the aircraft is accelerated to 180 knots IAS and a flaps down climbout made to at least 1000 feet above the terrain (path CD in figure 2-10). At this point, flap retraction will be initiated. The aircraft will be accelerated on takeoff heading during flap retraction whenever possible. The airspeed must be maintained above the minimum recommended with flaps up.

Obstacle Clearance Climbout Procedure

When obstacles near the field must be cleared on takeoff, the climbout performance becomes very important. A high angle of climb for clearing close obstacles is maintained by leaving flaps down and climbing at 10 knots above unstick speed until the obstacle is cleared.

Flap Retraction Precautions

During flap retraction, the speed schedule shown in figure 2-11 should be maintained within +10 knots. This schedule gives a safe margin between flap placard and minimum speeds. If flap retraction is started at 180 knots and a climbing attitude is maintained, it will be practically impossible to exceed the flap placard speed limit. If the airspeed is low, the rate of climb should be reduced or power added. During the flap retraction cycle it is required that the pilot monitor the aircraft altitude as closely as possible, keeping the aircraft trimmed to a zero stick force, especially during the last 20% of flap retraction. If the climbout has been properly planned and no emergency develops, a satisfactory vertical velocity can be maintained while accelerating during flap retraction. However, under conditions of high gross weight, high OAT, and high field elevation, or any combination of these factors, it may be impossible to maintain a positive vertical velocity during the latter part of the flap retraction period. Flaps should not be retracted in a turn, and the speed schedule of 180 knots IAS at 100% flaps down, 190 knots IAS-flaps 50%, 200 knots IAS-flaps 30%, and 220 knots IAS-flaps full up should be followed. In any event, maintain a sufficient positive vertical velocity to keep from exceeding the flap placard speed of 225 knots IAS at the 50% position and 253 knots at the 10% position.

CAUTION

An altitude loss can be expected during flap retraction if the maximum allowable dry thrust flaps down positive vertical velocity at 180 knots IAS is less than 1500 feet per minute. At a vertical velocity of 500 feet per minute, the loss at the completion of flap retraction will be about 500 feet.

NOTE

An error in the pitch indication of the attitude indicators is generated during accelerations or decelerations. The error is indicated in a nose-high direction during and after a forward acceleration and in a nosedown direction during and after deceleration. The longer the duration of acceleration (or deceleration), the greater will be the indicated error and the longer it will persist when acceleration (or deceleration) ceases. The erection system will reduce the error at about the same rate it was generated. Pitch error may reach one bar width during high gross weight takeoff.

WARNING

The attitude warning flag will not appear during every attitude indication failure. Therefore, it is possible that a malfunction of the attitude indicator might be determined only by cross-checking it with the turn and slip indicator and the other remaining flight instruments.

SUMMARY OF AFTER TAKEOFF PROCEDURES

Climb out with flaps full down at 180 knots IAS to an altitude of at least 1000 feet above the terrain and retract the flaps. If a positive vertical velocity of 1000 feet per minute is not attained when reaching 1000 feet above the terrain, flap retraction will be delayed until an altitude of 1500 feet above the terrain is reached. If an obstacle must be cleared, climb out with flaps down at unstick speed plus 10 knots until a safe altitude has been reached.

AFTER TAKEOFF — CLIMB CHECKLIST

NOTE

Only the circled items need be accomplished after "Low Altitude Tactic" or low and/or missed approach when followed by a climb to cruise or initial penetration altitude.

1. Wheel Brakes - Apply (P)

Apply wheel brakes firmly for approximately 3 seconds before landing gear retraction. Under slush and wet runway conditions in winter weather, leave landing gear down approximately 30 seconds after takeoff to allow moisture to be blown from landing gear prior to braking wheels and retraction.

AFTER TAKEOFF — CLIMB CHECKLIST (cont)

2. Landing Gear Lever - GEAR UP (P); Six up (CP)

WARNING

To prevent flying the airplane into the ground, the pilot will exercise caution not to exert inadvertent forward pressure on the control column when reaching forward to raise the landing gear lever.

CAUTION

To prevent system damage, if any gear fails to indicate up and locked, do not recycle the landing gear system prior to initiating emergency procedure.

3. Flap Lever - UP and OFF (lever UP 54▶ 138 W1▶ W34) (CP)

At 180 knots IAS and a minimum altitude of 1000 feet above the terrain, the pilot directs the copilot to raise the flaps. If a positive vertical velocity of 1000 feet per minute is not attained when reaching 1000 feet above the terrain, flap retraction will be delayed until an altitude of 1500 feet above the terrain is reached. At the appropriate time, the copilot advises, "Flaps coming up, flaps 50%, flaps 30%, and flaps full up." In addition, the copilot monitors the flight instruments, including the airspeed, during flap retraction. As a guide, the normal speed schedule during flap retraction should be approximately 180 knots IAS at 100%, 190 knots IAS at 50%, 200 knots IAS at 30%, and 220 knots IAS when flaps reach the full up position. If the actual indicated airspeed varies from these values by 10 knots or more, the copilot should so advise the pilot so he can make necessary pitch changes. On airplanes 139▶ W35▶, when the flaps-up indication is received, move the flap lever to OFF to prevent flap motor damage which may be caused by limit switch actuation after flap retraction. On airplanes 54▶ 138 W1▶ W34, the handle will be left in the UP position.

CAUTION

If flaps fail to start moving within 10 seconds, wing flap operation should be discontinued to prevent damage to the flap drive system. See "Wing Flap Limitations," Section V.

WARNING

- During last 20% of flap retraction, maintain zero stick force using the stabilizer trim button. In event of adverse nose down pitching tendency, airbrakes may be used to correct to a normal nose up condition.
- Any unusual rolling moment encountered during flap operation could indicate an asymmetrical flap condition for which corrective action must be taken immediately. (A discussion of flight characteristics with asymmetrical flaps is included in Section III.)
- If power is reduced during initial climb, it may be necessary to add power during flap retraction to maintain the desired speed schedule and to preclude loss of altitude.

AFTER TAKEOFF — CLIMB CHECKLIST (cont)

4. Throttles - Set (CP)

An NRT climb at a specific airspeed or Mach number is accomplished by adjusting to the EPR tabulated in the appropriate abbreviated checklist chart in T.O. 1B-52C-1CL-1 for the correct altitude and cockpit OAT gage reading. Computation may be accomplished by the navigator when aboard. EPR settings can also be obtained from the "Thrust Settings" charts contained in Part 4 of the Appendix. It is necessary to recheck the EPR setting by one of the above methods approximately every 10,000 feet during the climb to ensure that NRT is not being exceeded. For practical purposes, this check can be made at oxygen check (12,000 feet) and every 10,000 feet thereafter.

CAUTION

Due to characteristics of the engine, it is important to set NRT by use of EPR. EGT is not to be used as a means for setting climb thrust.

NOTE

- EPR setting to be used in climb should not be made until water supply is exhausted.
- NRT will normally be used for all climbs. MRT may be used for emergency conditions or as mission requirements dictate.
- When EPR computation is accomplished by the navigator, he will be notified as to whether anti-ice is on or off to insure proper EPR setting.
- All asterisk (*) items will be read by copilot and response given over interphone. All other items will be completed silently by the appropriate crew member.

4A. Terrain Display Mode Selector Switch - OFF (if applicable) (P/CP)

The TA system should remain on until aircraft has reached either the IFR altitude or the minimum safe altitude as applicable to the mission being flown.

5. AGM-28 Engine Control Knobs - As required (CP)

If the missile engines were used for takeoff, select IDLE or MAX CONT position as dictated by mission requirements.

* 6. Water Injection Switches - OPEN and OFF (P)

Move the drain valves switch to OPEN. After the water supply is completely exhausted, turn the water injection pump switches OFF (if system was used during takeoff). If system was serviced but not used during takeoff, move the drain valves switch to OPEN and turn the water injection pump switches ON until water supply is depleted. Leave drain valves switch in OPEN at all times, except when the system is serviced, to drain water from the lines and to prevent damage to valves.

CAUTION

- When substantial amounts of water are to be drained, the water injection pump switches must be in ON position to force all water out of the system before the airplane reaches high altitude.
- After moving the drain valves switch to OPEN position, do not actuate the switch in flight at or above the freezing level. Operation of a frozen valve may cause valve failure.

AFTER TAKEOFF — CLIMB CHECKLIST (cont)

* 7. Anti-Icing Switches & Airbrakes - Climatic (P)

Engine and nacelle anti-icing switch ON, if required. Windshield anti-ice and defogging switch remains on NORMAL (HIGH if required). If airbrake position 4 was used with the inboard airbrake control circuit breaker pulled and airbrakes are no longer required, reset the circuit breaker.

WARNING

Actuating the engine and nacelle anti-icing above NRT may cause engine surge and flameout. To prevent flameout, check that starter switches are in START before turning on anti-icing. Leave starter switches in START until rpm and EPR have stabilized.

CAUTION

Indiscriminate or prolonged use of engine and nacelle anti-icing may cause cracking of inlet guide vanes. Anti-icing should be used only as necessary in prevention of icing and not for prolonged periods in dry air. When the possibility of encountering icing conditions no longer exists, engine and nacelle anti-icing should be turned off.

8. Starter Switches - OFF (CP)

When rpm and EPR have stabilized, turn starter switches OFF.

WARNING

To prevent flameout, do not turn starter switches OFF until rpm and EPR have stabilized.

* 9. Throttles (prior to 10,000 feet) (only on engines supplying air conditioning) - 80% (CP)

NOTE

To prevent nuisance tripoff of the air conditioning pack, retard throttles to 80% rpm on engines supplying air before switching from RAM to 7.45 PSI. When turning the air conditioning system on or off at higher power settings, the automatic pressure limiter valve at the air conditioning pack may be tripped off, which mechanically shuts off the air conditioning system. To restore air conditioning after such tripoff, it is necessary to enter the forward wheel well and reset the pressure limiter valve.

* 10. Air Conditioning Master Switch - Checked 7.45 psi (prior to 10,000 feet) (CP)

* 11. Slipway Doors - Open 30 seconds, then closed (CP)

CAUTION

Slipway doors will not be opened above 300 knots IAS.

AFTER TAKEOFF — CLIMB CHECKLIST (cont)

12. Landing & Crosswind Landing Light Switches - OFF (CP)

* 13. Yaw Damper Switch - ON (P/CP)

* ⑭ Autopilot Low Level Switch - OFF (P/CP)

15. Autopilot Master Switch - ON (CP)

16. AGM-28 Wing Valve Switch(es) - OPEN, light(s) off (CP)

NOTE

For fuel sequences with AGM-28 missiles installed, see figures 7-4 thru 7-7.

17. AGM-28 Engine(s) - Air started (if applicable) (CP)

* ⑱ Crew, Stow Zero Delay Lanyard (crew members occupying upward ejection seats and gunner accomplish this action) - Stowed (P-CP-EW-G)

The zero delay lanyard should be disconnected when climbing through 10,000 feet pressure altitude when this altitude will be exceeded for prolonged periods.

WARNING

When operating above terrain over 8000 feet high, the zero delay lanyard should remain connected until the aircraft is at least 2000 feet above the terrain.

* ⑲ 12,000-Foot Oxygen Check - Completed (G-EW-RN-CP)

NOTE

On extended flights (flights in excess of 17 hours duration), the gunner may be relieved of crew duties for periods of crew rest by the copilot. Before the gunner is relieved from crew duties, the copilot will request a cabin pressure and oxygen check and ascertain that the gunner is on interphone and oxygen. During the period of the gunner's crew rest, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes. Close crew coordination between the pilot and copilot is mandatory to insure frequent monitoring.

a. During climb, copilot requests an oxygen check at 12,000 feet. The sequence for oxygen report is gunner, EW officer, radar navigator, copilot. The reporting crew member will visually check other crew members for alertness. He will report oxygen check for other crew position(s). Oxygen panel at each occupied crew position will be checked on all oxygen checks for:

    (1) Oxygen Supply Shutoff Lever - ON

    (2) Regulator Diluter Lever - As required

    (3) Pressure - 300 psi

    (4) Flow Indicator - Functions normally

    (5) Emergency Toggle Lever - NORMAL

AFTER TAKEOFF — CLIMB CHECKLIST (cont)

b. Gunner and copilot report, "Cabin altitude ________ feet. Oxygen panel checked."

c. EW officer and radar navigator report, "Oxygen panel checked."

d. Copilot notify aircrew and receive gunner's acknowledgment when passing through 25,000, 35,000, and 40,000 feet.

* ⑳. Standby Pump Switches - OFF (P)

Pilot depresses brake pedals several times and checks pressures on packs 1 thru 4 to insure that all utility packs have been shut down.

* 21. Fuel Switches 9 & 12 - OFF (CP)

Copilot closes crossfeed valve switch 9 and monitors engines 1 thru 4 for approximately 30 seconds. If no flameout occurs, copilot then closes crossfeed valve switch 12 and monitors engines 5 thru 8 for approximately 30 seconds.

* ㉒. Altimeter - Set 29.92 (P-CP-RN/N)

Pilot and copilot will periodically cross-check altimeter readings in flight.

WARNING

- If altimeter indications fail to move during climbs or descents while in the reset mode, the altimeter should be placed in the standby mode.
- When the altimeter is operating in standby mode, the altimeter correction card for the current aircraft configuration must be used to fly corrected altitude for traffic separation.

22A. IFF - Checked (P)

On aircraft **ZV**, check that the mode 4 caution light is not illuminated.

* ㉓. Level-Off Oxygen Check - Completed (CP-G)

The copilot will request an oxygen check at level-off. During cruise, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low-pressure warning light at intervals not to exceed 15 minutes and initiate the oxygen checks at 30-minute intervals when both cabin altitudes are below 12,000 feet, at 15-minute intervals when either cabin altitude is 12,000 to 25,000 feet, and at no longer than 10-minute intervals when either cabin altitude is above 25,000 feet. If cabin altitude is below 12,000 feet, only the gunner and copilot will report. The remaining crew members will check their equipment and report if abnormal.

* ㉔. Level-Off Station Check - Completed (P-CP)

Pilot and copilot must accomplish station checks at level-off, at 30-minute intervals during cruise, and prior to leaving crew positions during flight. A check for system operation and proper switch settings for prevailing conditions will be made during each station check. Station checks will include circuit breakers, TR loads and bus voltages, alternator loads and system frequencies, fuel panel, engine instruments, oxygen quantity, and hydraulic systems.

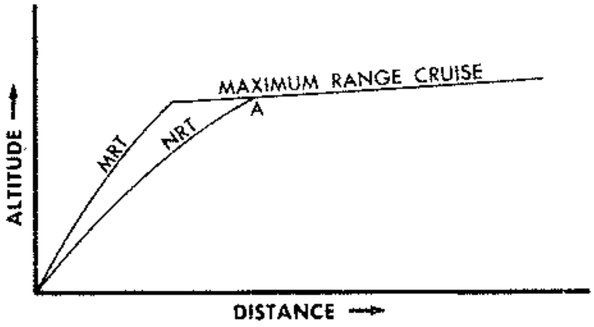
NOTE

If TR unit fails, see "DC Power System Failure," Section III.

25. Fuel Scavenge - Complete (CP)

a. Refuel Scavenger Pump Switch - ON

b. Refuel Manifold Scavenged Light - On; Refuel Scavenger Pump Switch - OFF



CLIMB FLIGHT PATHS

Figure 2-12.

CLIMB

The normal climb technique described herein will be required to produce the results stated in Part 4 of the Appendix. NRT will normally be used for climb. MRT may be used for emergency conditions or as mission requirements dictate. Referring to figure 2-12, it should be noted that Point A will be reached at approximately the same time regardless of whether military rated thrust or normal rated thrust is used for the climb. Approximately 300 pounds less fuel will be required when military rated thrust is used but engine life probably will be shortened slightly since higher engine speeds and higher temperatures will be encountered.

CAUTION

76▶ W1▶

If the aircraft was serviced with aviation gasoline in any tanks, see "Rate of Climb Limitations," Section V.

NOTE

Climbs should not be made at less than normal rated thrust since this procedure will result in a loss of range because of the excessive time spent in climbing.

CLIMB DATA

A study of the climb charts, Part 4 in the Appendix, will show that a constant airspeed, determined by the gross weight at the start of climb, is maintained during climb until the proper constant climb Mach number is reached. The loss of one engine during a climb will decrease the aircraft rate of climb. See Part 4 of the Appendix for data on eight- and seven-engine climb performance.

ICING DURING CLIMB

If icing conditions are known to exist within the climb flight path, the engine and nacelle anti-icing system should be turned on prior to the time icing conditions are encountered.

FUEL MANAGEMENT FOR LATERAL TRIM

Normally, a correctly rigged aircraft will need no more than 1 unit of rudder and 2 units of aileron trim to fly "hands off" in level flight when all engines are developing equal thrust and there is no lateral unbalance due to fuel loading. When maximum range or maximum endurance is desired; zero lateral trim, zero rudder trim, and zero sideslip should be established and maintained. This may be accomplished through fuel management by performing the "emergency emptying of an auxiliary tank" procedure in Section III.

Fuel weight differential between left and right outboard wing tanks shall be limited as follows:

1. Not more than 1,500 pounds for gross weights of 390,000 pounds or above. If additional trim is required, turbulence must be avoided and maneuver load factors limited to 1.5 g. A maximum of 1 unit of rudder and 2 units of aileron trim may be used under these conditions.
2. Not more than 3,000 pounds for gross weights less than 390,000 pounds. If additional trim is required, turbulence must be avoided and maneuver load factors limited to 1.5 g. A maximum of 1 unit of rudder and 2 units of aileron trim may be used under these conditions.

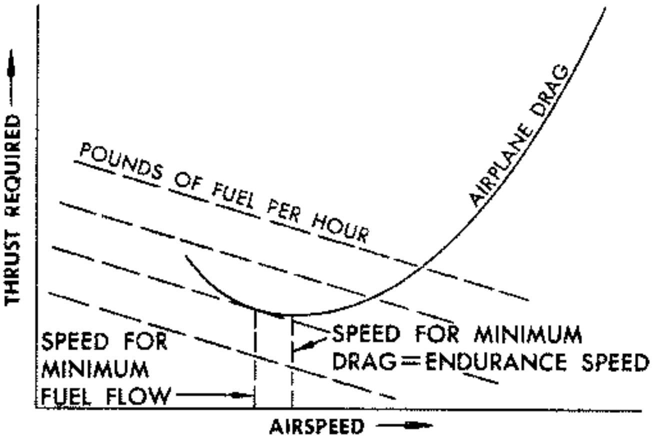
If wings level with zero sideslip cannot be attained within the limits noted in items 1 and 2 above; the fuel differential should be returned to zero, and rudder and aileron trim utilized within the limits noted in Section V. As this is an abnormal condition the following items should be investigated at the earliest opportunity:

1. Fuel gage error
2. Lateral and rudder rigging
3. Trim indicator not agreeing with trim tab deflection.
4. Asymmetrical thrust due to:
    EPR gage error
    Engine(s) out of trim
    Fuel flow gage error
5. Possible structural damage

CRUISE

RANGE

Normally a combat mission will be flown using procedures which will produce maximum range. The performance of a jet aircraft is such that maximum range is attained by flying at one particular Mach number and gradually increasing altitude as aircraft weight is decreased through fuel consumption. Such a climbing flight path is accomplished by setting the throttles so as to provide a given engine pressure ratio (EPR) for a corresponding cruise Mach number and checking the altitude frequently to make certain it agrees with that specified by the altitude curve. The rate of climb required is very small (averaging from 16 to 20 feet per minute or about 1000 to 1200 feet per hour). Therefore, rather than attempt to fly at some specified rate of climb, check the flight altitude with that given in the altitude curve at frequent intervals (not to exceed 30 minutes) to assure that the proper climbing flight path is being maintained. Adjust charted EPR as necessary to maintain airspeed and altitude for aircraft gross weight. The autopilot altitude hold position may be used until the airspeed increases, at which time a shallow climb should be initiated to place the aircraft at the correct altitude for the decreased gross weight. This step climb procedure will be repeated as necessary. The cruise true Mach number should be checked frequently by means of the airspeed indicator. The mach indicator may be inaccurate, causing a range loss of several percent. There is only one weight-altitude schedule which will result in maximum range. Such information is provided in Part 5 of the Appendix and is the maximum range curve on the charts. The remaining curves on these charts are called best range for the particular flight condition and result in slightly less range than that attained by flying maximum range. Best range (constant altitude) cruise is usually used for a noncombat mission because the difference in range between this type of cruise and maximum cruise is not great if the altitude flown is above 35,000 feet. Also see "Fuel Management for Lateral Trim," under "Climb," this section.



ENDURANCE AIRSPEED

Figure 2-13.

CAUTION

Cruise at airspeeds in excess of best range or maximum range airspeeds are detrimental to engine life and should be avoided except when mission requirements dictate. Refer to Part 5 of the Appendix for engine thrust settings.

CENTER OF GRAVITY

Control of the center of gravity of this aircraft during any cruise operation is quite simple if fuel is transferred to the main tanks using the recommended procedure in Section VII. As fuel is consumed, the cg location will shift slightly, and a running check should be maintained so that the approximate cg

location is known at all times. The stabilizer trim wheel may be used to make such a check by referring to the chart in Part 5 of the Appendix. For maximum range cruise operation at the chart Mach number, the stabilizer trim indicator should be in the vicinity of zero units. If the stabilizer setting is within the limits of 1 unit noseup and 1 unit nosedown, the cg could be expected to be within normal limits. If the stabilizer trim is set outside of these limits, the cg location should be checked against the stabilizer trim chart in Part 5 of the Appendix and compared to calculations based on fuel distribution.

WARNING

Loss of an engine or engines, use of any unusual combination of engines, or any fuel usage problems will require close attention to fuel panel settings to assure lateral balance and desirable cg location are maintained. It is essential that any required deviation from the aircraft configuration fuel sequence be planned to maintain the proper differential/balance between paired main/auxiliary tanks. This will preclude an adverse effect on cg location.

NOTE

- The normal limits of 1 unit noseup and 1 unit nosedown for the stabilizer trim setting are valid only for maximum range cruise operation (maximum range altitude and chart Mach number) and then for gross weights of 410,000 pounds or less. At gross weights above 410,000 pounds, 1 unit of noseup trim would indicate that the aircraft is out of the forward cg flight limit.
- Normal fuel usage sequence is designed to assure maximum aircraft service life. Wing structural life, lateral balance, and cg location are the primary factors which dictate the development and use of normal fuel sequence. All of these factors are interrelated. Therefore, use of other than the normal fuel sequence to overcome a lateral balance problem will also have an effect upon cg location.
- If engine shutdown or other emergency precludes the proper fuel sequence steps, compute the center of gravity for the landing condition. This may be accomplished by use of the load adjuster or by reference to the "Approximate CG Location Landing Configuration" chart in the "Approach and Landing" section of the Appendix.

ENDURANCE

Maximum endurance is frequently desired during operational missions when it becomes necessary to hold over a check point, rendezvous with a tanker, accomplish a navigational check, or to provide time to correct aircraft functional difficulties. Maximum endurance can be attained only if the recommended airspeeds are observed within ±10 knots, by operating the number of engines specified in Part 6 of the Appendix, and by maintaining zero trim using "Fuel Management for Lateral Trim," under "Climb," this section.

Endurance Procedures

Maximum endurance is accomplished by flying at a gradually decreasing airspeed and gradually increasing altitude as the gross weight is decreased through fuel consumption. If endurance operation lasts less than 4 hours, the gain in endurance by flying a climbing flight path is negligible and constant altitude operation is recommended. The optimum endurance airspeed for any weight and altitude is the airspeed at which the pounds of fuel per hour is at a minimum. This is slightly less than the airspeed at which the aircraft drag is at a minimum (figure 2-13). The recommended endurance speed schedule is at the minimum drag point. This results in a negligible penalty in fuel flow while the increased speed is desirable from a piloting standpoint. Shutting down some engines at certain altitudes and airspeeds will result in the remaining engines operating in a more favorable range of rpm with higher efficiencies. See Part 6 of the Appendix.

FLIGHT CHARACTERISTICS

See Section VI for information regarding flight characteristics.

AIR REFUELING

See Section IV for all air refueling descriptive and operational information.

AGM-28 INFLIGHT OPERATION

Amplified checklists for B-52/AGM-28 operation are published in T.O. 1B-52C-30-1. The corresponding abbreviated checklists are published in T.O.'s 1B-52C-1CL-1, pilots'; 1B-52C-1CL-2, navigator's; and 1B-52C-1CL-3 radar navigator's.

LOW ALTITUDE TACTIC

WARNING

> During training missions, if any flight control system malfunction exists which denies the pilot a safe margin of control in any axis, the low level portion of the mission will be aborted.

Penetration airspeed to the low altitude entry point will normally be 280 KIAS, unless aircraft restrictions apply or using commands direct otherwise. If icing conditions are encountered during cruise at low altitude, airbrakes may be used, not to exceed position 4, as necessary to maintain sufficient power for engine anti-icing; however, this will impose range penalties. Refer to "Range Correction Factors" and "Fuel Flow Correction for Anti-Ice" in part 5 of the Appendix. If conditions require the use of airbrake position 2 during low level flight, the following procedure is recommended:

1. Pull the "Inboard Airbrake Control" circuit breaker located on the pilot's overhead circuit breaker panel.
2. Move airbrake lever to position 4.

Drag and range degradation will be approximately the same as that when operating normally in position 2. Buffet level will be substantially reduced. Roll response will be the same since spoiler operation is not affected by pulling the airbrake control circuit breaker.

NOTE

> The engine and nacelle anti-icing control switch will be turned on below 20,000 feet when the indicated OAT is below 10° C during night flights or in areas of forecasted or suspected icing conditions. This serves to preheat the anti-icing surfaces even though the EPR may be below that required to anti-ice. During icing conditions, the EPR must be above a minimum prescribed value to anti-ice. Two methods are available to insure proper anti-icing. One is to fly at a speed of 340 knots IAS or greater. The other is to maintain the following EPR by extending drag items as necessary.

ALTITUDE (FEET)	MINIMUM EPR BELOW 280 KNOTS IAS	MINIMUM EPR 280 KNOTS IAS AND ABOVE
Sea Level	1.60	1.50
5,000	1.60	1.50
10,000	1.70	1.60
15,000	1.82	1.72
20,000 & Above	1.95	1.85

When climbing back to altitude, accomplish the circled items of the "After Takeoff-Climb Checklist."

OPERATION

Present low altitude operational information is based upon the results of low altitude flight tests. During these tests, the aircraft and its systems were operated at near maximum design capability. With the requirement of all-weather flying at airspeeds up to the design limit of the aircraft, adequate preflight planning is especially essential to successful completion of a low altitude mission. Icing conditions at low altitudes and high speeds can be more severe than those normally encountered. Also, it is extremely difficult to anticipate icing conditions during low altitude operation, particularly at night. Crew coordination is considered critical when flying at low altitude. There have been some unusual psychological effects on crew members and fatigue is found to increase much more repidly at low altitude than at high. There is considerable difficulty for pilots in interpreting readings of certain instruments while bouncing due to turbulence; however, it is fairly easy to determine the range of scale which the instrument needle is in, and generally this is sufficient. Adverse effects which are frequently encountered at low altitude and which must be considered when planning a mission are increased turbulence, reduced vision, reduced radar range, the inconsistency of winds due to terrain effect, and extreme difficulty in the use of celestial navigation because of turbulence and the frequency of overcasts. Noise interference with interphone and radio communication is experienced when the air conditioning pack is in operation during high power settings. This interference may be avoided by positioning the air conditioning master switch to RAM. On climbout, place the air conditioning master switch in 7.45 before reaching 10,000 feet as shown in the "After Takeoff-Climb Checklist." Another obvious consideration while flying at low altitude is that of planning the mission to insure an awareness of any hazardous terrain conditions and an avoidance of dangerous aircraft-terrain relationships. See "Low Altitude Flight Characteristics," Section VI. There is no necessity to deviate from normal fuel management sequences during operation at low altitudes.

NOTE

- For operation of terrain avoidance system, see Section IV.
- For operation of the autopilot during low altitude tactic, see "Low Level Mode" under "Autopilot," Section IV.

DESCENT

Descent to low altitude will normally be made at 4000 fpm; however, the rate of descent may be reduced provided the aircraft crosses published fixes at the specified altitude.

INFLIGHT TA FUNCTIONAL CHECK

An inflight functional check of the TA system must be accomplished on every mission.

LOW LEVEL DESCENT

The "Low Level Descent" checklist must be accomplished during entry to a low level tactic.

TA SYSTEM CALIBRATION

A TA system calibration check must be performed prior to entry into a TA low level tactic or when a check of the TA system accuracy is required.

TA SYSTEM ERROR COMPENSATION PROCEDURES

TA system error compensation procedures are included in Section IV and provide a means of compensating for errors determined during the TA system calibration check.

TA SYSTEM ADJUSTMENT PROCEDURES

TA system adjustment procedures are included in Section IV and provide a means of adjusting the pilots' terrain display indicators.

INFLIGHT TA FUNCTIONAL CHECK CHECKLIST (Pilot/ Copilot reads)

NOTE

- All asterisk (*) items will be read by pilot/copilot and response given over interphone. All other items will be completed silently by the appropriate crew member.
- This check will be accomplished after level-off but prior to descent.
- This check will be accomplished after a 30-minute warmup period of the terrain computer. Refer to figure 4-59 for TA adjustment procedures. Coordination with the radar navigator will be made before accomplishing these checks. Pilots' terrain display mode selector switch must be positioned to an operational mode at least 2 minutes prior to performing these checks.

*1. Terrain Display Mode Selector Switch - PLAN (P/CP)

*2. Waveguide Selector Switch - MAN LOAD (RN)

*2A. MADREC - RADAR (N)

3. Stabilization Reference Selector Switch - FRL (P/CP)

*4. Terrain Display Indicators - Checked (P-CP)

   a. Centering (±1/16 inch)

   Observe that the bright spot at the start of the sweep is centered ±1/16 inch under the intersection of the ground track line and the bottom of the indicator.

   b. Persistence

   The persistence should be such that the failure warning cursor is completely faded at the ground track line just prior to new information being painted at the ground track line.

   c. Full Sweep

   d. Range Gate Indicator Lights

*5. Set Failure Warning Cursor at 3-Mile Range Mark and Check that Clearance Plane is at 2200 (±200) Feet - Checked (P-CP)

Pilot and copilot observe movement of failure warning cursor while pilot changes selection of clearance plane elevation throughout its range. As clearance plane is raised, failure warning cursor moves progressively toward shorter ranges. When clearance plane is lowered, failure warning cursor moves out in range.

NOTE

The failure warning cursor should be continuously displayed for all values of clearance plane settings.

*6. Clearance Plane Set to 800 Feet - Checked (P-CP)

INFLIGHT TA FUNCTIONAL CHECK CHECKLIST (Pilot/Copilot reads) (Cont)

7. TA Warning Press-to-Test - Checked (P/CP)

Check that both failure warning cursors disappear and that both TA warning lights illuminate.

NOTE

During plan mode checks, the TA warning light should not illuminate except when the TA warning press-to-test button is pressed.

8. Profile 10 Display Mode - Checked (P/CP)

NOTE

After switching to a profile mode with the terrain display mode selector switch, if plan mode display is present, depress TA display select switch on either pilot's control wheel to obtain a profile display.

   a. Range Gate Lights

   b. Horizontal Reference Lines

   Observe that both 10-mile range gate lights illuminate and both horizontal reference lines are present and centered.

9. Profile 6 Display Mode - Checked (P/CP)

   a. Range Gate Lights

   b. Horizontal Reference Lines

   Observe that both 6-mile range gate lights illuminate and both horizontal reference lines are present and centered.

10. Profile 3 Display Mode - Checked (P/CP)

   a. Range Gate Lights

   b. Horizontal Reference Lines

   Observe that both 3-mile range gate lights illuminate and both horizontal reference lines are present and centered.

11. TA Warning Press-to-Test - Checked (P/CP)

Check that both horizontal reference lines disappear and that both TA warning lights illuminate.

NOTE

During the profile mode checks, the TA warning light should not illuminate except when the TA warning press-to-test button is pressed.

12. TA Display Select Switch - Pressed (P)

   a. Plan Displays Present

13. TA Display Select Switch - Pressed (CP)

   a. Profile 3 Displays Present

INFLIGHT TA FUNCTIONAL CHECK CHECKLIST (Pilot/Copilot reads) (Cont)

14. Terrain Display Mode Selector Switch - PROFILE CAL (P/CP)

*15. Profile Cal Display - Checked (P-CP)

   a. Horizontal Reference Line (HRL) Centered (±1/32 inch)

   b. HRL Full Coverage & Horizontal (±2°)

   The horizontal reference line should provide full coverage of the terrain display indicator viewing area and shall be horizontal (±2°) with respect to the three horizontal etch marks.

   c. Pro Cal Cursor Coincides (±1/4 inch)

   The profile calibration cursor should coincide (±1/4 inch) with the profile calibration etch mark.

16. Terrain Display Mode Selector Switch - OFF (if applicable) (P/CP)

*17. Waveguide Selector Switch - AUTO (RN)

*18. MADREC - STDBY (N)

*19. Terrain Computer Power Switch - As required (RN)

LOW LEVEL DESCENT CHECKLIST (Pilot/Copilot reads)

1. Altimeter Settings & "D" Values - Obtained (CP)

Obtain updated forecast altimeter settings and "D" values from a designated PFSV station. "D" values at the low level entry point for calibration altitude will also be furnished for designated mountainous routes.

   a. Altimeter Settings & "D" Values:

	Preflight		In-Flight PFSV	
	Altimeter	"D"	Altimeter	"D"
Low Level Entry	________	____	________	____
Calibration Altitude if applicable		____		____
Midpoint Low Level Route	________	____	________	____
Target Area	________	____	________	____

2. Nav Mode Select Switch - As desired (P-CP)

3. Stabilization Reference Selector Switch - FRL (P/CP)

4. Clearance Plane Set to 800 Feet - Checked (P-CP)

5. Radar Altimeter Cursor Set to 800 Feet - Checked (P-CP)

5A. Radar Altimeter Caution Lights - Press to test (P-CP)

6. Standby Pump Switches - All ON (P)

7. Anti-Icing System - Climatic (P)

If suspected icing conditions exist in the descent area, turn ON the engine, nacelle, and surfaces anti-icing switches 54▶ 169 W1▶ W51 (anti-icing control switch 170▶ W52▶) 5 minutes prior to descent and check for a noticeable EPR drop on all engines at time of switch actuation to indicate proper operation of the system.

LOW LEVEL DESCENT CHECKLIST (Pilot/Copilot reads) (Cont)

8. Autopilot - Disengaged (P/CP)

   Autopilot will be disengaged for descent to low level.

9. Altimeters - Reset (P-CP-RN/N)

   Reset altimeters to station pressure immediately prior to initiating penetration or upon passing through transition altitude. ARTC furnished altimeter setting will be used if available.

10. Throttles - Set (P)

11. Airbrakes - Set (P)

    The airbrake lever will normally be set at position 4; however, the airbrakes may be used as required.

12. Starter Switches - Climatic (CP)

    When descending under possible inlet icing conditions, starter switches should be placed in START and remain in START until sufficient power for anti-ice heat has been reestablished and stable engine operation obtained.

    CAUTION

    Insure that the starter switches for engines which have been shut down are off and remain off for the remainder of flight unless intentional engine air starting is accomplished.

13. Crew, Hook Zero Delay Lanyards - Hooked (P-CP-EW-G)

    Crewmembers occupying upward ejection seats and gunners will accomplish this action prior to reaching 10,000 feet pressure altitude during descent. The lanyard should remain connected at all times below 10,000 feet pressure altitude including conditions wherein this altitude may be temporarily exceeded.

    WARNING

    When operating above terrain over 8000 feet high, the zero delay lanyard should be connected at least 2000 feet above the terrain on descent.

14. BNS Radar Set to Alignment Frequency - Accomplished (RN)

15. Terrain Display Mode Selector Switch - PROFILE 10 (P/CP)

16. TA Display Select Switch - Select plan mode (P/CP)

    NOTE

    Allow at least a 2-minute warmup period any time the terrain display mode selector switch is moved from OFF position to an operational mode.

17. Retract Airbrakes - As required (P)

LOW LEVEL DESCENT CHECKLIST (Pilot/Copilot reads) (Cont)

18. Level Off at IFR Altitude/Emergency Minimum Safe Altitude ________ - Accomplished (P-CP-RN-N)

The preplanned level-off altitude will be noted during mission planning.

NOTE

For descent into Low Altitude High Speed routes (VFR), initial level-off should be made at the planned emergency minimum safe altitude for that segment.

19. Autopilot Low Level Switch - LOW LEVEL (P/CP)

20. Starter Switches - OFF (if applicable) (CP)

21. Engine & Nacelle Anti-Icing Switches - OFF (if applicable) (P)

22. Radar Altimeter Indicators & Pressure Altimeters - Cross-checked (P-CP-RN-N)

Compute true altitude by adding radar altimeter reading to terrain elevation and cross-check with the pressure altimeters. If the IFR altitude/emergency minimum safe altitude exceeds 5000 feet absolute altitude (radar altimeter capability), the cross-check must be made as soon as a lower absolute altitude permits.

23. Altimeters - Reset (P-CP-RN)

Forecast altimeter setting obtained from PFSV will be used for TA calibration. Current altimeter setting obtained by radio from nearby FSS radios will be used for all low level operations except TA calibration check. If unable to obtain FSS altimeter settings while at low level, use PFSV forecast altimeter settings.

NOTE

- A TA calibration check must be performed prior to entry into a TA low level tactic or when a check of the TA system accuracy is required.
- The TA calibration altitude for each calibration point/area will be established during mission planning and clearly annotated on the pilot's, radar navigator's and navigator's charts.

WARNING

- Prior to descent to the TA calibration altitude, both pilot and copilot will insure that the surface is visible, ceiling is not less than 3000 feet, and visibility is not less than 5 miles. In addition to these weather criteria, during night operation both pilot and copilot must positively determine that unlighted terrain/obstacles can be seen.
- Terrain display indicator polarizing filters must be used on both pilot's and copilot's scopes during all TA operations at night.

TA SYSTEM CALIBRATION CHECKLIST (Pilot/Copilot reads)

TERMINAL AREA PREPARATION

These items will be accomplished only when TA system calibration in terminal area is required. Run will be performed at 220 KIAS, gear and flaps up, airbrakes down, during day under VFR conditions or night with a minimum ceiling of 3000 feet and visibility of 5 miles while under positive radar surveillance.

1. Stabilization Reference Selector Switch - FRL (P/CP)
2. Clearance Plane Set to 800 Feet - Checked (P-CP)
3. Radar Altimeter Cursor Set to 800 Feet - Checked (P-CP)
4. BNS Radar Set to Alignment Frequency - Accomplished (RN)
5. MADREC - AUTO (RN)
6. FRL Angle of Attack Indicator - Set (N)
7. Terrain Display Mode Selector Switch - PROFILE 10 (P/CP)
8. TA Display Select Switch - Select plan mode (P/CP)

NOTE

Allow at least a 2-minute warmup period any time the terrain display mode selector switch is moved from OFF position to an operational mode.

NOTE

- If it is determined that profile mode is inoperative, then all the TA calibration check and subsequent TA activity must be accomplished in plan mode.
- The navigator will record all readings made by the pilot during this check on SAC Form 449.
- The radar navigator is responsible for monitoring terrain beyond the range selected on the pilots' terrain display indicators. The radar navigator will alert the pilot when approaching the preselected calibration area and will make a 10-mile range call and continue 1-mile range calls until the pilot acknowledges that the calibration feature is present on the terrain display indicator. The pilot will call range and clearance plane settings at each required fade point.

1. Level-Off at Predetermined TA Calibration Altitude - Accomplished (P-CP-RN-N)

   Level-off will be accomplished 800 feet above the immediate terrain or 800 feet above the calibration terrain feature or point, whichever is higher. Calibration altitude will be adjusted for latest altimeter setting and "D" value to assure 800-foot clearance.

2. Autopilot - Altitude hold (P-CP)

   If turbulence prohibits the use of "Altitude Hold" but is not of such magnitude to require discontinuing low level operation, use the autopilot low level mode.

TA SYSTEM CALIBRATION CHECKLIST (Pilot/Copilot reads) (cont)

3. Radar Altimeter Indicators & Pressure Altimeters - Cross-checked (P-CP-RN-N)

NOTE

Upon completion of item "3," aircraft control will be transferred to the copilot and he will be responsible for flying the aircraft.

WARNING

During the TA calibration checks, the copilot will continually monitor the aircraft visually for safe terrain clearance. In addition, he must insure that weather conditions do not deteriorate to less than 3000-foot ceiling and 5-mile visibility, and during night operation, that he be able to see unlighted terrain or obstacles. If these conditions cannot be maintained, he will take positive action to climb to the published IFR altitude or emergency minimum safe altitude as applicable.

4. TA Display Select Switch - Select PROFILE 10 (P/CP)
5. TA System Error - Checked (P/CP)
   a. Stabilization Modes - Compared

   Between 9 and 6 miles, change stabilization modes and estimate and record the number of feet represented by difference between horizontal reference line and terrain trace for each stabilization mode (1/8 inch represents 100 feet).

NOTE

- If terrain trace is above the horizontal reference line, the trace deviation is positive. If it is below the horizontal reference line, the trace deviation is negative.
- If profile mode is inoperative, select plan mode, then between 9- and 6-mile range, momentarily change stabilization modes, fade returns, and record clearance plane settings.

   b. Stabilization Reference Selector Switch - FRL

NOTE

- If FRL mode is inoperative or unreliable, accomplish calibration check in horizontal stabilization mode.
- Tilt error compensation can only be accomplished using data collected in FRL stabilization mode.

TA SYSTEM CALIBRATION CHECKLIST (Pilot/Copilot reads) (cont)

c. Terrain Display Mode Selector Switch - PROFILE 3

d. TA Display Select Switch - Select plan mode

e. Returns Faded at 6-Mile Range -__________(Ft)

Adjust the clearance plane to fade returns on ground track at 6-mile range. As an actual fadeout is approached, actuate the clearance plane control switch in short spurts until just prior to complete fadeout. Note the clearance plane setting and range then immediately lower the clearance plane and begin the fade procedure for the next fade point.

f. Returns Faded at 5-Mile Range -__________(Ft)

g. Returns Faded at 4-Mile Range -__________(Ft)

h. Returns Faded at 3-Mile Range -__________(Ft)

NOTE

Obtain plan fade points every mile from 6- to 3-mile range if possible. A minimum of three plan fade points are necessary to obtain valid data for error determination.

i. Profile Mode Check - Accomplished

(1) Select PROFILE 3 Mode

After fading target at 3-mile range, select profile 3 display with TA display select switch. Adjust clearance plane so that terrain trace becomes coincident with the horizontal reference line. Read the clearance plane setting to the navigator.

j. Determine Zero Range Absolute Altitude -__________(Ft)

When using a peak or prominent feature for calibration, care must be taken to fly the aircraft directly over the feature or point being tracked in order to obtain a valid radar altimeter reading.

NOTE

For terminal area calibration check, the following steps will not be performed and the TA system will be turned off. Execute locally prescribed withdrawal procedure to enter normal traffic/instrument pattern. Proceed with "Before Landing Checklist."

6. Autopilot Low Level Switch - LOW LEVEL (CP)

7. TA System Error Compensation - Accomplish if applicable (P-CP-N/RN)

If a system error exists, the TA system error compensation procedures in Section IV should be accomplished, time and/or conditions permitting. Normally a minimum of 60 miles will be required prior to commencing the bomb run to facilitate accomplishment of calibration and error compensation, if required. If time and/or conditions do not allow the necessary compensation procedures to be accomplished, the published IFR altitude will be maintained. In any event, inflight calibration data and TA system error computations will be recorded on SAC Form 449.

8. Stabilization Reference Selector Switch to FRL - Checked (P/CP)

WARNING

Use of horizontal stabilization mode is restricted to only the calibration check portion of the low level run except during combat TA altitude operations when FRL stabilization mode is inoperative or unreliable. When using horizontal stabilization mode, strict adherence to its use as described in Section IV should be followed.

TA SYSTEM CALIBRATION CHECKLIST (Pilot/Copilot reads) (cont)

9. Clearance Plane Set to Briefed TA Altitude (plus or minus proper error compensation) - Checked (P-CP)

WARNING

Clearance plane will never be set to a value less than 200 feet.

10. Radar Altimeter Cursor Set to Briefed TA Altitude - Checked (P-CP)

11. Final Descent to TA Altitude - Accomplished (P/CP)

NOTE

- Final descent will normally be accomplished in profile 3 mode with FRL stabilization. Check that clearance plane is set as desired. Maintain the terrain trace at or below the horizontal reference line within 1/2 inch each side of ground track.
- If required, select plan mode with FRL stabilization. Maintain plan display free of returns 1/8 inch each side of ground track line from the 3-mile range mark to vertex of scope (except for "ticking" of a prominent terrain feature until it enters the failure warning cursor).
- Pilot flying aircraft monitors TA display, radar altimeter, and flight instruments. The radar altimeter is to be used in conjunction with the TA system. It will be included in the pilot's normal instrument scanning pattern for continuous cross-check with other terrain clearance information and for observing peak passage before following a fly-down command. Pilot not flying aircraft monitors aircraft position and aircraft systems operation.
- After descending to final TA altitude, further compensation of the clearance plane setting may be required. Observe the radar altimeter indications to verify TA system performance. If clearance altitude is not within 100 feet of desired clearance, readjust the clearance plane setting to obtain the desired clearance. At the termination of the TA tactic, the pilot must provide the final plan and profile mode clearance plane settings used in the TA tactic to the navigator.

WARNING

- The clearance plane will never be set to a value less than 200 feet.
- The primary duty of pilot not flying the aircraft is to visually monitor the terrain clearance of the aircraft.
- TA operation without a properly operating radar altimeter is extremely hazardous if visual terrain clearance cannot be maintained.

BOMBING

All bombing procedures and operational information are contained in Section VIII. Those procedures involving the pilots are prepared in such a manner as to be performed upon notification from the navigators. Therefore, no abbreviated checklists pertaining to bombing will be prepared for the pilots. A description of bombing equipment, especially the pilot's last resort bombsight, is given in Section IV.

NOTE

Mild buffeting may occur when high drag munitions are released.

DESCENT

NORMAL DESCENT

This is the recommended procedure for all letdowns where there is no range emergency and should be accomplished as follows:

1. Maintain cruising altitude until approximately 40 miles from the landing base. This distance will depend upon the aircraft altitude at the end of mission. Normally voice radio communication can be established between the pilot and the tower at this distance.
2. Place the landing gear lever down and retard all throttles except 4 and 5 to the IDLE stops. Leave throttles 4 and 5 advanced during landing gear extension to insure adequate pneumatic pressure for alternators and hydraulic packs. After landing gear indicates down, throttles may be set as required. Observe the gear extension placard limits in Section V.

WARNING

Care should be taken to retrim between each 2-unit increment of airbrake operation.

3. Extend airbrakes to position 4 or as required.
4. Make descent at 240 KIAS or Mach .75, whichever is slower.

NOTE

Rate of descent may be varied (by airbrake position) to satisfy local penetration procedures.

TACTICAL DESCENT

Assuming the descent will start from cruise altitude and airspeed, the initial task is to retard the throttles to idle and establish a nosedown attitude of approximately 10°. Extend airbrakes to position 6 in increments of 2, trimming to approximate zero stick force prior to raising the airbrakes to the next position. Maintain approximately zero stick force by continually trimming the aircraft during descent. Maintain approximately 10° nosedown attitude and a speed schedule of .85 Mach until reaching 305 KIAS. Maintain 305 KIAS during the remainder of the descent. Close coordination between the pilot and copilot is required to insure that a transition is made from indicated mach to indicated airspeed. Pilot will coordinate with the radar navigator as to level-off altitude to be used for this maneuver. Radar navigator will call off altitude to the pilot every 5000 feet starting with the first multiple of 5000 feet. Upon reaching level-off altitude plus 5000 feet, the radar navigator will inform the pilot every 1000 feet and at the level-off altitude. Initiate level off approximately 1000 feet above the desired level flight altitude by retracting airbrakes from position 6, to position 4, to position 2, and retrimming. Complete airbrake retraction at approximately 500 feet above the desired level flight altitude, retrim, and add power as required.

NOTE

If turbulence is encountered such that the airspeed indicators are hard to read, hold a 10° nosedown attitude until the turbulence has been penetrated. Aircraft attitude should not exceed 12° nosedown.

DESCENT CHECKLIST (Pilot/Copilot/EW reads)

NOTE

To preclude the possibility of pilot distraction, this checklist should be completed through step "12" prior to descent.

1. Penetration & Approach - Reviewed (P-CP-RN-N)

   Obtain approach/landing weather and review the planned penetration and approach with the applicable crewmembers. Intermediate altitude restrictions, ceiling and visibility minimums, MDA/DH, and missed approach procedures will be emphasized.

2. Landing Data - Computed and checked (CP-N)

   Compute gross weight and best flare speed for planned airbrake position. Check landing data card and recompute required items.

3. Nav Mode Select Switch - As required (P-CP)

4. Anti-Icing Switches - Climatic (P)

   If suspected icing conditions exist in the descent area, turn ON the engine, nacelle, and surfaces anti-icing switches 54▶ 169 W1▶ W51 (anti-icing control switch 170▶ W52▶) 5 minutes prior to descent and check for a noticeable EPR drop on all engines at time of switch actuation to indicate proper operation of the system.

5. Engine Control Knob(s) (AGM-28B) - MAX CONT (CP)

   On AGM-28B missiles, operate missile engine(s) at MAX CONT for 15 minutes (desired) at as low an altitude as practical (1500 feet or below desired).

6. AGM-28 Wing Valve Switches - As required (CP)

   If touch-and-go landings, low approaches, etc, are scheduled, delay closing the AGM-28 wing valve switches until a minimum of 10 minutes prior to final landing and/or missile engine shutdown. This is to lower the fuel level in the missile fuel tank to prevent spillage due to thermal expansion after landing.

7. Fuel Panel - Checked (CP)

   Crossfeed valve switches 9 and 12 will be positioned to OPEN when any main tank indicates 5000 pounds or less.

8. Standby Pump Switches - All ON (P)

9. Autopilot - Disengaged (P/CP)

   Autopilot will be disengaged for penetration.

10. Altimeter Setting - Compared and reset (P-CP-RN/N)

    Compare forecast altimeter setting with the setting obtained from the controlling agency. Reset altimeters to station pressure immediately prior to initiating penetration or upon passing through transition altitude.

    a. Altimeter Settings:

	FORECAST	CURRENT
Destination		
Alternate		

DESCENT CHECKLIST (Pilot/Copilot/EW reads) (cont)

11. Landing Gear Lever - GEAR DOWN (P); Six down and checked (P-CP)

Pilot moves landing gear lever to GEAR DOWN and checks for positive engagement of the pawl in the gear down detent by forcibly and positively pushing in on the landing gear handle after the handle is in GEAR DOWN. Pilot checks operation of the landing gear warning light. Both pilots check that the warning light is out and that all six gear indicate down and locked.

a. Gunner reports position of the tip gear if not down.

b. Radar navigator visually checks the two forward trucks and reports the position and alignment of the forward landing gear if not down.

CAUTION

To prevent system damage, if any gear fails to indicate down and locked, do not recycle the landing gear system prior to initiating emergency procedure.

12. Throttles - Set (P)

Leave throttles 4 and 5 advanced during landing gear extension to insure adequate pneumatic pressure for alternators and hydraulic packs.

13. Airbrakes - Set (P)

The airbrake lever will normally be set at position 4; however, the airbrakes may be used as required.

14. Starter Switches - Climatic (CP)

When descending under possible inlet icing conditions, starter switches should be placed in START and remain in START until sufficient power for anti-ice heat has been reestablished and stable engine operation obtained. When landing is anticipated under inlet icing conditions, starter switches should be in START prior to final power reduction.

CAUTION

Insure that the starter switches for engines which have been shut down are off and remain off for the remainder of flight unless intentional engine air starting is accomplished.

15. Crew, Hook Zero Delay Lanyard - Hooked (P-CP-EW-G)

Crewmembers occupying upward ejection seats and gunners will accomplish this action prior to reaching 10,000 feet pressure altitude during descent. The lanyard should remain connected at all times below 10,000 feet pressure altitude including conditions wherein this altitude may be temporarily exceeded.

WARNING

When operating above terrain over 8000 feet high, the zero delay lanyard should be connected at least 2000 feet above the terrain on descent.

16. Starter Switches & Anti-Icing Systems - OFF (if applicable) (P-CP)

BEFORE LANDING

BEFORE LANDING CHECKLIST (Copilot/EW reads)

1. Nav Mode Select Switch - As required (P-CP)
2. Fuel Panel - Checked (CP)

   Crossfeed valve switches 9 and 12 will be positioned to OPEN when any main tank indicates 5000 pounds or less.

   NOTE

   Copilot computes minimum landing gross weight with lateral unbalance if significant wing fuel disparities exist.

3. Landing Gear Lever - GEAR DOWN (P); Six down and checked (P-CP)

   Pilot checks gear lever in detent. Both pilots check that the gear warning light is out and that all six gear indicate down and locked.

4. Airbrake Lever - As required (P)
5. Wing Flaps - 100%, lever DN (CP)

   Allow aircraft to decelerate to 220 knots IAS. Copilot extends flaps at the request of the pilot and monitors flap indicator to ascertain both flaps are extending simultaneously. Copilot will report when the flaps are 50% and full down. Flap lever will be left in DN position. Flap extension time is 40 seconds. Flaps may be extended during the penetration descent as required.

   CAUTION

   Wing flap operation shall be discontinued within 10 seconds if flaps fail to start moving. Any additional attempt to start the flaps shall be limited to 10-second intervals of actuation. Do not use either flap motor for more than eight attempted starts in any 30-minute period.

6. AGM-28 Engine Control Knob(s) - As required (CP)
7. Crosswind Crab - Checked/Set, knob down (CP)

   Obtain wind direction and velocity from the control tower. Compute and set crosswind crab as required. If crosswind crab is not to be used, knob and position indicator must be checked for zero setting and gear position.

   CAUTION

   150▶ **W40**▶

   If wheel brakes are applied immediately before and held during touchdown when the main gear is turned more than 14° (by any combination of crosswind crab setting and steering), the aircraft will land with wheels locked because the antiskid system is inoperative in this condition. When the landing gear is turned, the landing gear centering cams compress the landing gear. At more than 14° from center, the landing gear is compressed enough to actuate landing gear safety switches as if the aircraft were actually on the ground. The antiskid system (which is tied into the landing gear safety switches) allows the wheels to be locked when the aircraft is on the ground and not moving. Releasing the brakes will activate the antiskid system.

BEFORE LANDING CHECKLIST (Copilot/EW reads)

8. Best Flare Speed________Knots - Rechecked (CP-N)

Copilot computes best flare speed for planned airbrake position and cross-checks airspeed indicator with pilot's indicator. Best flare speed for airbrake position 4 is approximately 15 knots above the minimum touchdown speed. Minimum touchdown speed is the same value as unstick speed and provides a 7- to 12-knot margin above initial stall buffet speed.

9. Airbrake Lever - Position 4 or as required (P)

10. Center of Gravity - Checked (P/CP)

After proper landing configuration has been established, note the stabilizer trim setting for zero stick force at best flare plus 30 knots IAS, or 180 knots IAS, whichever is less. At landing gross weights of 290,000 pounds or less with airbrakes 4, the stabilizer trim should be between 4 and 6 units nose down. If the stabilizer trim is not within the specified range or when conditions prohibit landing in the above configuration, gross weight of 290,000 pounds or less, and airbrakes in position 4, the cg must be computed by use of the "Approximate CG Location Landing Configuration" chart in the Appendix or the load adjuster. The requirement to relate stabilizer trim setting on downwind to approximate cg location will enable pilots to recognize an abnormal cg and the related handling characteristics.

11. Landing Light & Crosswind Landing Light Switches - As required (P/CP)

Landing lights and crosswind landing lights will be turned on during both daytime and nighttime conditions for base leg and final approach unless reflection from these lights reduces pilot visibility.

12. Target Trim - Noted (P/CP)

When aircraft is established on final approach in landing configuration (landing gear and flaps down and airbrakes in planned position) at best flare speed plus 10 KIAS, pilot not flying the aircraft will note the stabilizer trim setting for zero stick force. He will call out this value as target trim during an approach with airbrakes in position 0 or 2. For an approach with airbrakes in position 4 or 6, he will compute a trim value two units in the noseup direction from that noted and call out this computed value as target trim.

NOTE

It is preferable to note stabilizer trim while in straight and level flight. In VFR traffic patterns or situations where it is not readily feasible to establish straight and level on final approach, the stabilizer trim target setting during descent may be used, provided rate of descent does not exceed 1000 feet per minute.

13. Yaw Damper Switch - OFF for touch-and-go (P/CP)

For touch-and-go landings, the yaw damper switch will be turned OFF during the latter portion of final approach prior to landing flare.

14. Anti-Icing Systems - As desired (P)

APPROACH

Since conditions at airports are continually changing, the landing approach techniques must be varied to meet existing conditions. In general, a normal landing pattern can be used. With full airbrakes, the gliding angle is approximately the same as that for a propeller-driven aircraft.

APPROACH PROCEDURE

Referring to figure 2-17, the downwind leg is entered at the altitude specified in applicable regulations. The "Before Landing Checklist" will be completed at this point and the airspeed reduced to 30 knots above computed best flare speed. The turn from downwind leg will be a descending 90° turn to base leg with a reduction in airspeed and altitude.

Figure 2-14 (Deleted)

Roll out to a wings-level attitude while descending on base leg for sufficient duration (approximately 10 seconds) to allow for visual clearance of other aircraft in all directions. Maintain 20 knots above computed best flare speed until starting turn to final approach. A 90° descending turn to final approach will then be initiated and, at the completion of rollout on final approach, the airspeed will be 10 knots above computed best flare speed, minimum altitude as specified in applicable directives.

A 30° bank will be the maximum allowable in the traffic pattern. During the final approach, the airspeed will be held constant and the glide path maintained by throttle adjustment and further extension or retraction of the airbrakes as needed. The 10 knots above best flare speed will be maintained until the flare point is reached. As the flare point is reached and the aircraft is rotated for landing, the throttles will be retarded so as to cross the end of the landing runway at best flare speed. After touchdown, the airbrakes should be fully extended and the drag chute deployed.

NOTE

- During the approach and landing, the copilot should monitor the altitude and airspeed and warn the pilot when above or below safe altitude or airspeed or whenever the angle of bank exceeds recommended values.
- Anticipate higher control column forces during all low speed operation. Be especially alert to this condition during the landing flare. See "Elevator Feel Characteristics" under "Flight Control System Characteristics," Section VI.
- Pitch response of the aircraft becomes more sensitive with aft center of gravity conditions particularly in the landing gross weight range. In lightweight aft cg landings, there may be a tendency to flare high and hold the aircraft off the runway in a higher than normal noseup attitude due to lower stick force characteristics and reduced requirements for stabilizer trim during landing flare.
- If a crosswind leg is flown, the aircraft will be rolled out to a wings-level attitude on the crosswind leg for sufficient duration to permit visual clearance of other aircraft in all directions.
- The pilot's and/or copilot's sliding window may be opened at normal traffic pattern speeds while in the traffic pattern, provided all escape hatches are in place. If an escape hatch has been released, the opening of a sliding window should be avoided as inward acting airloads may cause the sliding windows to blow into the cockpit.

Heavy Weight Landing

It is possible to make landings at any weight up to the maximum gross weight as long as rates of descent at touchdown are limited. (See "Weight Limitations," Section V.) Since most landing experience will have been obtained at gross weights less than 290,000 pounds, landings below this weight will be considered a routine operation. For landings at gross weights below 290,000 pounds, airbrake position 4 will be used. If necessary to land the aircraft above 290,000 pounds but below 325,000 pounds, use airbrake position 2 and normal landing techniques. If it should become necessary to land the aircraft above 325,000 pounds gross weight, the following techniques are recommended:

1. Do not use airbrakes. Approach speed will be 10 knots above the no airbrake best flare speed. The slower approach and flare speed with zero airbrakes will give less flare distance. The danger of a hard landing will also be less because of the slower deceleration when not using airbrakes.
2. Intercept the approach path farther out than usual. Maintain a fairly normal approach slope with rates of descent on the order of 500 feet per minute. Plan to arrive over the end of the runway at the best flare speed at a lower altitude than for a normal landing.
3. Reduce thrust cautiously during the landing flare to insure that the rate of descent is controlled. The key to a good heavyweight landing is not the attitude but speed control using thrust after crossing the end of the runway. The aircraft may settle very rapidly if thrust is suddenly reduced.
4. The landing attitude will be approximately the same as for a normal landing.

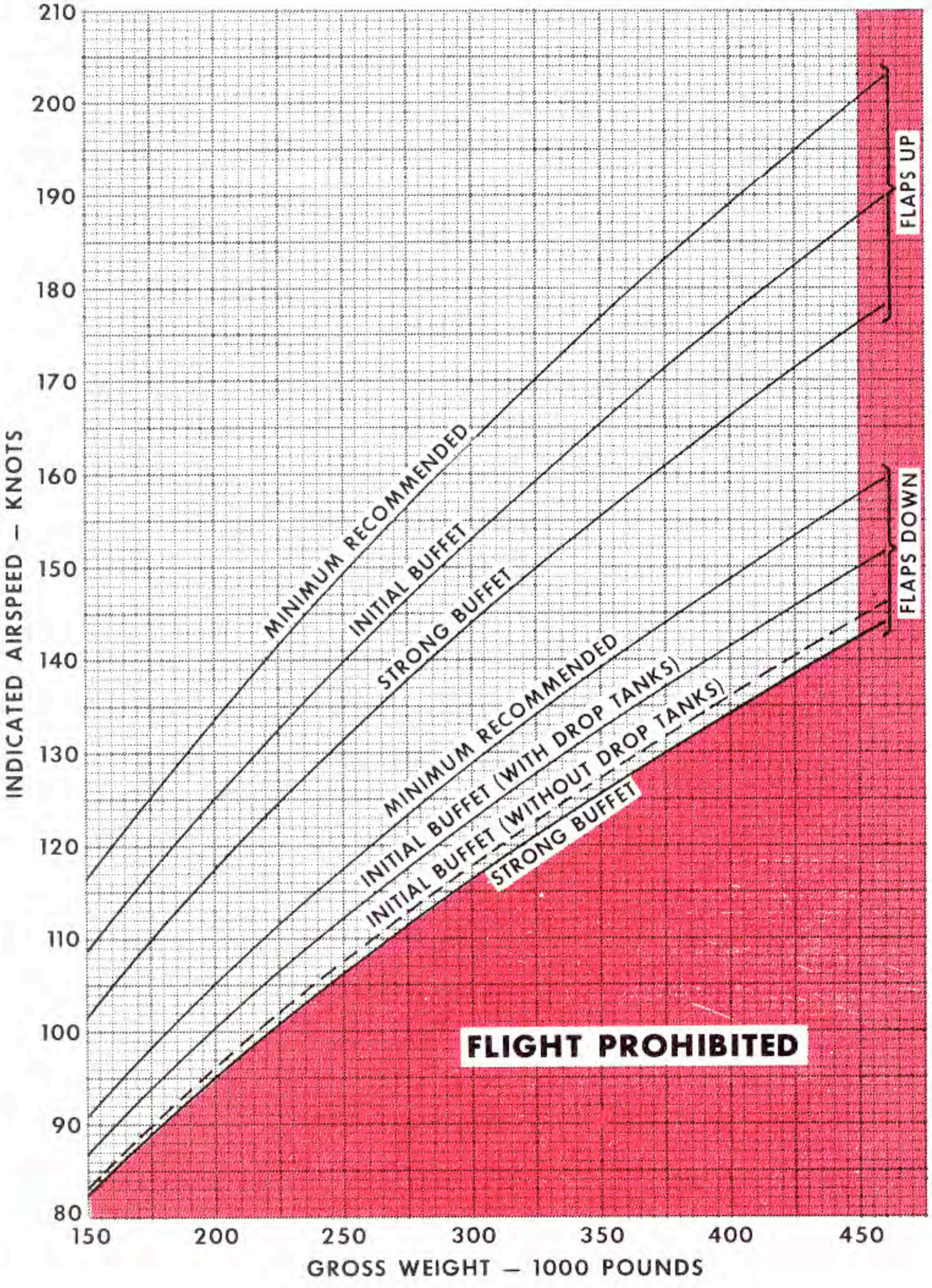
To determine approach speeds and to estimate flare and runway stopping distances, refer to Part 9 of the Appendix.

Airbrakes

The airbrakes are operated by a throttle type control located next to the throttle quadrant. The aircraft noses up when airbrakes are extended. Although the trim change can be handled by elevator use, retrimming should be accomplished after each position change. Position 4 should be used for landings at gross weights below 290,000 pounds, position 2 for gross weights from 290,000 pounds to 325,000 pounds, and airbrakes zero above 325,000 pounds gross weight. When a reduced thrust condition is encountered, airbrake position 2 may be selected instead of position 4 to preclude excessive drag due to airbrakes. Any airbrake position from 0 through 6 may be used for an approach and landing under unusual conditions. If changes in airbrake position are made on final approach, the change in trim requirements must be observed, particularly between airbrake positions 2 and 4. Airspeeds flown must be based on the actual airbrake position used during final approach. The airspeed versus airbrake position relationship becomes critical at the start flare point due to the change in trim and in airspeed bleed off with various airbrake settings. Therefore, final airbrake selection should be made to allow stabilization at the proper airspeed and trim condition prior to the start flare point. Best flare speed for airbrake position 4 is approximately 10 knots faster than the no airbrake best flare speed and for airbrake position 2 is approximately 5 knots faster than the no airbrake best flare speed. Regardless of airbrake position utilized for approach, a normal glide path (2.5° to 3.0°) should be established as early as practical on the final approach. The minimum touchdown speed is not changed regardless of the amount of airbrake extension although there is some change in landing attitude. Using full airbrake extension changes the touchdown attitude to such an extent that at minimum touchdown speed the aircraft will touch down rear gear first with the front gear about one-third of a wheel diameter in the air. Touching down all wheels simultaneously with airbrakes fully extended will add 11% to the minimum touchdown speeds. Stalling speeds are not affected by airbrake position. With practice, airbrakes can be used to a great extent to vary the approach and landing pattern, to steepen the final approach, or to reduce airspeed rapidly.

NOTE

If touchdown is to be made with full airbrakes, maintain higher approach speed to the flare point. Refer to Part 9 of the Appendix for precise best flare speeds with full airbrakes.



CONDITIONS:

- NO GROUND EFFECT
- WITH OR WITHOUT DROP TANKS EXCEPT AS NOTED
- LANDING GEAR UP OR DOWN
- SEA LEVEL TO 10,000 FEET

REMARKS:

- Landing gear extension or retraction has no effect on speeds shown.
- Increase chart airspeed by 1% for each 5,000 feet above 10,000 feet pressure altitude.

MINIMUM SPEEDS — LOW ALTITUDE

Figure 2-15.

Minimum Speeds

The minimum recommended airspeeds at which the aircraft should be flown in straight flight with flaps either up or down are given in figure 2-15. It must be remembered that in turns the minimum speeds must be increased from those shown.

LANDING

LANDING WITH GUSTY WIND CONDITIONS

Gusts seldom exceed ±50% of the average wind velocity. It is not necessary to increase the final approach speed for gust velocities up to and including 15 knots. For gust velocities in excess of 15 knots, the final approach speed should be increased two-thirds of the gust velocity in excess of 15 knots. For example, with a wind velocity of 20 knots with gusts to 50 knots, 10 knots would be added to the final approach speed (total gust velocity 30 knots; 30 - 15 = 15 knots; 15 x 2/3 = 10 knots).

TOUCHDOWN

The recommended touchdown is with the rear gear first at minimum touchdown speed. (See Part 9 of the Appendix for landing speeds.) This allows an adequate flare and prevents a bounce; however, if the forward gear is too high when the rear gear touches, a hard landing may result. Full airbrakes should be applied immediately after touchdown provided there is no bounce. With the antiskid system operative, the wheel brakes may also be applied immediately after touchdown although this decreases brake service life. The runway available will determine when the wheel brakes should be applied. The normal landing charts in Part 9 of the Appendix show the landing ground roll distances with wheel brakes applied at 90 knots IAS. See "Minimum Run Landing," this section, for more details on use of brakes and drag chute.

NOTE

The front gear is well forward of the cg and, if allowed to touch down first, a bounce is almost certain to occur. This usually is the result of too much speed.

CROSSWIND LANDING

Prior to or during the time the aircraft is in the traffic pattern, a decision must be made as to whether or not the crosswind crab system is to be used. After obtaining the wind direction and velocity from the tower located at the field at which the landing is to be made, compute the crab angle for the wind and landing gross weight.

NOTE

- Sustained runway wind velocity plus one-third of the gust factor will be used to compute crosswind crab settings when landing with gusty wind conditions.
- If a crosswind cannot be compensated for by use of the crosswind crab system, a landing is not recommended.

CAUTION

150▶ W40▶

If wheel brakes are applied immediately before and held during touchdown when the main gear is turned more than 14° (by any combination of crosswind crab setting and steering), the aircraft will land with wheels locked because the antiskid system is inoperative in this condition. When the landing gear is turned, the landing gear centering cams compress the landing gear. At more than 14° from center, the landing gear is compressed enough to actuate landing gear safety switches as if the aircraft were actually on the ground. The antiskid system (which is tied into the landing gear safety switches) allows the wheels to be locked when the aircraft is on the ground and not moving. Releasing the brakes will activate the antiskid system.

With Use of Crosswind Crab System

Smooth landings can be made through use of the crosswind crab system even though crosswinds of high velocity are encountered. Such landings also require very little additional effort from the pilot. Touching down with the aircraft in a crabbed attitude may seem strange the first few times such landings are tried, but this technique is easily learned by the pilot.

CROSSWIND CRAB SETTING. After voice radio contact has been established with the tower, obtain the runway surface wind and direction. The most accurate wind measurements are obtained close to the ground. Limited experience indicates that 50% of tower values closely approximate runway winds. If only uncorrected tower wind values are used, it is recommended that the crab setting be established using 50% of tower values. From this data and with the aid of the chart located in a holder on the aisle stand and reproduced as figure 2-16, determine the crosswind crab setting to be used in the landing. A more precise setting can be obtained if desired by reference to the chart in Part 9 of the Appendix. After the landing gear has been extended, turn the crosswind crab control knob until the miniature aircraft and pointer on the indicator are in align-

CROSSWIND CRAB PRE-ALIGNMENT

RELATIVE WIND DIRECTION	CROSSWIND - KNOTS 10	20	30	40
20°	2°	3°	5°	7°
40°	3°	6°	10°	13°
60°	4°	9°	13°	17°
90°	5°	10°	15°	20°

Above data computed for gross weights between 225,000 and 270,000 pounds, flaps down. (Refer to Part 9 of the Appendix for flaps up.)

CROSSWIND CRAB SETTINGS

Figure 2-16.

ment at the crab angle setting determined for the wind and gross weight. Extend the flaps, raise airbrakes to position 4, and control the airspeed in the same manner as for a normal approach. After rolling out onto final approach and after the aircraft is crabbed into the wind to give a flight path straight down the runway, recheck the position of the miniature aircraft and pointer on the crosswind crab control indicator. The nose of the aircraft, as well as the nose of the miniature aircraft and pointer on the indicator, should always be pointed off the runway into the direction of the wind component. Lower the crosswind crab control knob after crab setting has been established.

WARNING

Make certain that the miniature aircraft on the crosswind crab position indicator is pointed the same direction as the actual aircraft is crabbed relative to the runway.

CAUTION

If rudder trim is used on landing, be certain that the crosswind crab control knob is not turned instead of the rudder trim knob since they are located near each other.

NOTE

The upper and lower pointers on the crosswind crab position indicator may show a difference in heading once crosswind trim is established. This condition is normal and is caused by the fact that only the forward gear are steerable and operate even when set for crosswind conditions. As a result, any rudder pedal deflections will show up as a difference in indication between the two pointers.

LANDING ROLL. After the aircraft is on the runway, more and more lateral control will be required to hold the wings level as the speed decreases. If difficulty is encountered in maintaining track down the runway at low speeds, the control wheel should be centered since an asymmetric spoiler condition will cause an unfavorable turning force. Do not change the crosswind crab setting until the aircraft is ready to turn off the runway. Under slippery runway conditions, the crosswind crab setting will help to maintain steering control. The crosswind crab system is not normally used to steer the aircraft on the ground. For further information, see "Landing with Crosswind on Slippery Runways" under "Ice and Rain," Section IX.

NOTE

Be alert for indication of a missetting of crosswind crab at touchdown. Corrections should be accomplished by normal rudder pedal steering. Do not use the crosswind crab control knob for steering except in an emergency. On very smooth landings, a missetting of crosswind crab will not immediately manifest itself by the aircraft diverging off either side of the runway; rather, a deceleration force will be noted due to tires scuffing.

Without Use of Crosswind Crab System

If the crosswind crab system is not to be used because of a malfunction, the landing may be made by approaching fully crabbed with rudder and ailerons centered. If desired, a combination of crabbing into the wind and a slight lowering of the upwind wing may be accomplished, but the wing should not be lowered to such an extent that the tip gear touches the ground first upon landing. Touchdown in the crabbed attitude with normal landing rates of descent will not induce detrimentally high side loads on the landing gear since the gear is lightly loaded at this time. By landing rear gear first, the aircraft will tend to pivot about the rear gear and thereby reduce the crab angle by the time the forward gear touches. Full airbrakes should be applied and the drag chute may be deployed at touchdown since forward gear steering will be adequate by the time the drag chute becomes effective. This procedure should only be used with a low crosswind component.

MINIMUM RUN LANDING

The approach for a minimum run landing should be planned so as to arrive over the end of the runway with the throttles at IDLE and at a speed as close to best flare speed as possible. A minimum run landing is accomplished by having the brake antiskid system operative, deploying the drag chute, using full airbrakes after touchdown, applying maximum effort to the wheel brakes immediately after touchdown, and continuing throughout the landing roll. The drag chute provides considerable deceleration force over the first portion of the landing roll while the wheel brakes have a small decelerating effect because the wheels are lightly loaded. As the aircraft decelerates, the drag chute becomes less effective while the brakes become more effective.

CAUTION

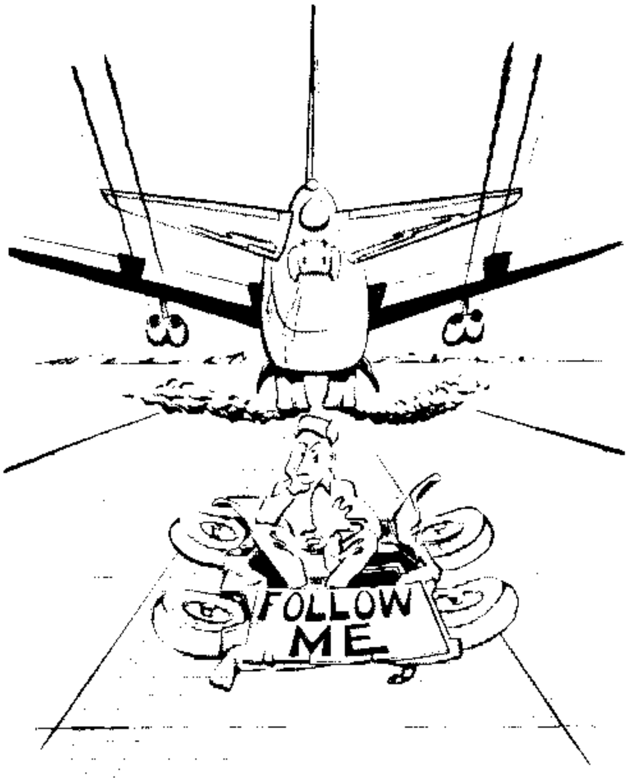
All landings should be planned from a landing distance standpoint as though the drag chute is not installed. The use of the chute should be considered only as an aid to braking and a means of reducing tire and brake wear.

NOTE

Deployment of the drag chute or application of brakes prior to touchdown is not recommended.

WHEEL BRAKE APPLICATION

Each wheel is equipped with an antiskid assembly. A skid or locked wheel condition on any one wheel does not affect braking on any other gear **54**▶ **149** **W1**▶ **W39** or on any other wheel **150**▶ **W40**▶. Regardless of this desired feature; however, the wings should be held as nearly level as possible during the landing roll so that all wheels are on the ground. If the wings are not level, the high tire on each landing gear becomes lightly loaded causing a loss in braking effectiveness because of the limited braking torque on the heavily loaded wheels. Optimum braking effectiveness with antiskid operative is obtained by depressing the rudder pedals fairly hard and letting the individual brakes cycle as required to prevent skids. Application of a fairly hard force on the brake pedals will result in the heavily loaded wheels being cycled at a slower and more desirable rate while the lightly loaded wheels are cycled quite rapidly. This cycling can be felt by the pilot and becomes quite noticeable, especially if several of the gears cycle on and off at approximately the same time. If several of the gears do start to cycle in unison and cause a violent vibration, the pedals should be released momentarily and then reapplied. The difference between conventional braking and use of antiskid is that, with antiskid operative, the brakes can be applied earlier in the landing roll and maximum braking can be maintained throughout the entire roll without excessive tire wear due to skids. See "Touchdown," this section, and Part 9 of the Appendix for maximum rolling speeds for brake application. For brake energy limits, see figure 5-12.



DRAG CHUTE DEPLOYMENT

Normally the drag chute will be deployed on all landings. The drag chute should be deployed only after touchdown. The time required for the drag chute to open is about 4 seconds after the drag chute lever is pulled to DEPLOY position. It is not recommended that the drag chute be deployed during the flare while the aircraft is floating since there is a tendency for the aircraft to pitch up or down, depending on the speed, and to drop in due to rapid deceleration. See Section V for drag chute limitations.

CAUTION

- When landing under conditions of high crosswinds, light gross weights, and a slippery runway, loss of steering may result. For further information, see "Landing with Crosswind on Slippery Runways" under "Ice and Rain," Section IX.
- Dragging the chute along the runway causes considerable wear on the chute suspension lines and canopy. If possible, keep engine thrust high enough at the lower ground run speeds to hold the chute off the ground until the aircraft can be turned off the runway. Request the ground crew to stand by to retrieve the chute as soon as the aircraft is clear of runway and chute is jettisoned.
- During prevailing surface winds of 15 knots or greater, do not turn more than 90° away from the wind while drag chute is deployed.

ALTERNATOR OPERATION

During the landing roll, sufficient engine bleed air will be available normally to operate all pneumatic-driven accessories. The copilot will monitor air pressure and overload lights to assure sufficient pneumatic air to maintain normal alternator operation. If adequate manifold air pressure is not maintained, the alternator will decrease in frequency and upon advancing throttles, the turbine controls may not react fast enough to prevent the alternator from shutting down from an overspeed condition. Advance throttles 4 and 5 if any lights come on.

CAUTION

When making a landing where high runway elevation and high outside air temperatures prevail, the possibility exists that insufficient pneumatic air may be available to the utility hydraulic packs. This condition may exist even though it is not indicated by the illumination of alternator overload lights. Under such conditions two alternators should be turned off during the ground roll.

NIGHT LANDING

The procedures and techniques used for a night landing are the same as those used for a normal day landing except that the landing lights should be turned on at pilot's discretion. In addition, the terrain clearance light and the crosswind landing lights may be used at the pilot's discretion. More electrical power is required during night operations and sufficient thrust should be maintained during the ground roll so as to provide the required air bleed for alternator and hydraulic pack operation.

OBSTACLE CLEARANCE LANDING

The distance to touchdown after clearing a 50-foot obstacle with full flaps is shown on charts in Part 9 of the Appendix. If a relatively high altitude must be maintained to clear some obstacle located within the traffic pattern, a steeper approach must be made after clearing the obstacle. A normal approach with full flaps and airbrake lever in position 4 is made with sufficient altitude to clear the obstacle. If a steeper approach is desired, airbrakes position 6 may be used. Should the obstacle be located close to the end of the runway, it may be necessary to place the airbrake lever in position 6 and steepen the approach before passing over the obstacle. In this case, the pilot should approach at a sufficiently high altitude to assure clearance with the steeper approach. If full airbrakes are used, the rate of descent will be higher than normal and the flare will have to be started earlier.

NOTE

If touchdown is to be made with full airbrakes, maintain higher approach speed to the flare point. Refer to Part 9 of the Appendix for precise best flare speeds with full airbrakes.

LANDING CHECKLIST

Accomplish after touchdown (need not be read).

1. Airbrake Lever - Position 6 (P)
2. Drag Chute Lever - DEPLOY (CP)

   In the event a go-around is not anticipated and the drag chute does not deploy, do not jettison the chute. This will permit the cause of the malfunction to be determined during the postflight inspection. See Section V for drag chute limitations.

3. Hydraulic System - Checked (P)

   Check No. 2 and emergency brake pressure 3000 (±250) psi, and all low pressure warning lights out.

4. Crosswind Crab Control Knob - Centered (P)

LANDING CHECKLIST (Cont)

5. Starter Switches - OFF (CP)

   Turn starter switches OFF as soon as possible after landing to keep operating time to a minimum. (See "Ignition System Limitations," Section V.)

6. Steering Ratio Selector Lever - TAXI (P)

CAUTION

Center the rudder pedals before repositioning the steering ratio selector lever. Actuation of the lever is very difficult when the rudder pedals are deflected and could result in a dangerously abrupt change in steering angle.

GO-AROUND

The decision to make a go-around should be made as early as possible since jet engine acceleration time is relatively high and approach speeds are relatively close to touchdown speeds. Normally this decision can be made prior to touchdown. As soon as it has been decided to go around, increase thrust, retract airbrakes, trim as required, and, after it is certain that the aircraft will not touch the ground, retract the landing gear. The increase in thrust alone, depending upon the airspeed and attitude of the aircraft, may require a considerable amount of nosedown trim.

WARNING

- In cases where a go-around is initiated just prior to or during the landing flare and where adequate runway is remaining, it may be necessary to maintain a touchdown attitude, contact the runway, then retrim the aircraft during the ground run before initiating power application for a go-around.
- The decision to go-around or land on the remaining runway must remain with the pilot based upon all factors involved. However, if a situation is allowed to develop, which in the pilot's judgment, requires a go-around from a low airspeed/low altitude condition, the pilot must be extremely aware of the hazards of aircraft pitch up and the items affecting pitch control. An unscheduled go-around with a mistrim condition can occur where several other trim items occur simultaneously due to fuel shift, thrust, airbrakes, and ground effect. Each item can be controlled by the use of elevator alone. But when several of these items are combined, the elevator, which is the primary flight control system, may not have sufficient authority and additional authority must be obtained from the stabilizer or airbrakes. A 20° pitch attitude and strong buffet can easily occur in 3 seconds from which a recovery may not be possible. See "Go-Around" under "Flight Characteristics Under Various Speed Conditions" in Section VI and "Go-Around With One Or More Engines Inoperative" in Section III.

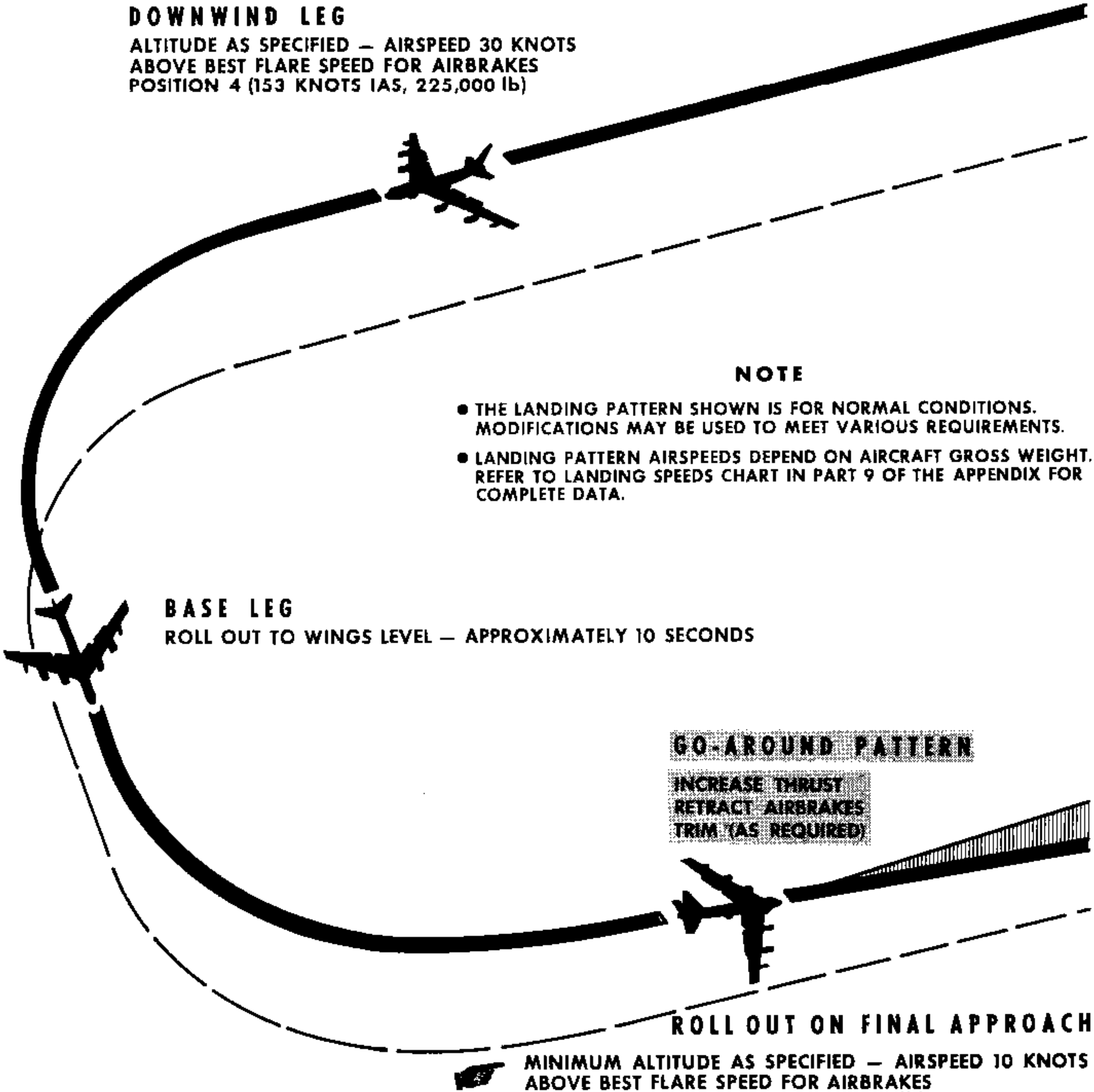
For pilot comfort and ease of flying, the power should be adjusted during climb to flap retraction altitude to a setting which will produce a rate of climb of approximately 1000 feet per minute. If power is reduced during this initial climb, it may be necessary to add power during flap retraction to maintain the desired speed schedule and to preclude loss of altitude. When the aircraft reaches 1000 feet and 180 knots IAS, the flaps may be retracted. However, if a positive vertical velocity of 1000 feet per minute is not attained when reaching 1000 feet above the terrain, flap retraction will be delayed until an altitude of 1500 feet above the terrain is reached. Flaps should not be retracted in a turn. During the flap retraction cycle, it is required that the pilot monitor his aircraft attitude as closely as possible keeping the aircraft trimmed to a zero stick force especially during the last 20% of flap retraction. The normal flap retraction speed schedule should be maintained. (See figure 2-17 for a go-around pattern.) In case the decision to go around is not reached until after the aircraft is on the ground and the drag chute has not been deployed, additional nosedown stabilizer trim will normally be required during the takeoff roll in order to keep the nose from pitching upward as soon as the wheels are off the ground. Allow approximately 7 minutes and 5000 pounds of fuel for a go-around.

WARNING

At gross weights above 220,000 pounds, a go-around should not be attempted if the drag chute has been deployed since it is possible that the drag chute may not jettison. The go-around then would be impossible. At gross weights up to 220,000 pounds, sufficient power is available to make a go-around successfully while pulling the drag chute. The climbout should be made at 10 knots above best flare speed for a go-around while pulling the drag chute.

NOTE

When go-around is accomplished during closed traffic pattern work, the pilot may at his discretion leave the landing gear and flaps down.



DOWNWIND LEG

ALTITUDE AS SPECIFIED — AIRSPEED 30 KNOTS ABOVE BEST FLARE SPEED FOR AIRBRAKES POSITION 4 (153 KNOTS IAS, 225,000 lb)

NOTE

- THE LANDING PATTERN SHOWN IS FOR NORMAL CONDITIONS. MODIFICATIONS MAY BE USED TO MEET VARIOUS REQUIREMENTS.
- LANDING PATTERN AIRSPEEDS DEPEND ON AIRCRAFT GROSS WEIGHT. REFER TO LANDING SPEEDS CHART IN PART 9 OF THE APPENDIX FOR COMPLETE DATA.

BASE LEG

ROLL OUT TO WINGS LEVEL — APPROXIMATELY 10 SECONDS

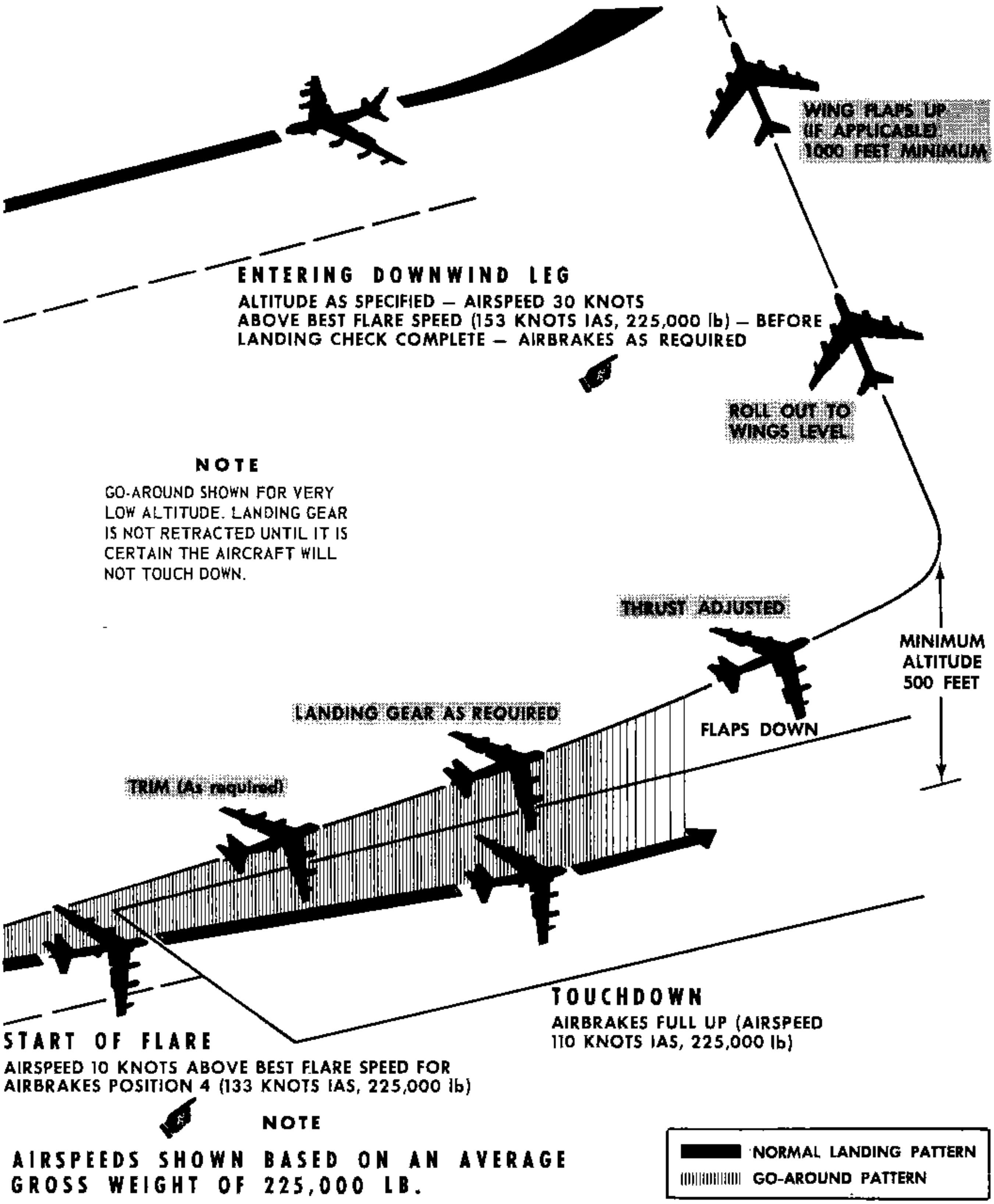
GO-AROUND PATTERN

INCREASE THRUST
RETRACT AIRBRAKES
TRIM (AS REQUIRED)

ROLL OUT ON FINAL APPROACH

MINIMUM ALTITUDE AS SPECIFIED — AIRSPEED 10 KNOTS ABOVE BEST FLARE SPEED FOR AIRBRAKES POSITION 4 (133 KNOTS IAS, 225,000 lb)

Figure 2-17 (Sheet 1 of 2).



ENTERING DOWNWIND LEG

ALTITUDE AS SPECIFIED — AIRSPEED 30 KNOTS ABOVE BEST FLARE SPEED (153 KNOTS IAS, 225,000 lb) — BEFORE LANDING CHECK COMPLETE — AIRBRAKES AS REQUIRED

NOTE

GO-AROUND SHOWN FOR VERY LOW ALTITUDE. LANDING GEAR IS NOT RETRACTED UNTIL IT IS CERTAIN THE AIRCRAFT WILL NOT TOUCH DOWN.

TOUCHDOWN

AIRBRAKES FULL UP (AIRSPEED 110 KNOTS IAS, 225,000 lb)

START OF FLARE

AIRSPEED 10 KNOTS ABOVE BEST FLARE SPEED FOR AIRBRAKES POSITION 4 (133 KNOTS IAS, 225,000 lb)

NOTE

AIRSPEEDS SHOWN BASED ON AN AVERAGE GROSS WEIGHT OF 225,000 LB.

LANDING AND GO-AROUND PATTERNS (Typical)

Figure 2-17 (Sheet 2 of 2).

GO-AROUND CHECKLIST (Copilot reads)

1. Go-Around Thrust - Set (P)

WARNING

If a go-around is initiated after starting landing flare, immediately counter the resultant pitching moment with nosedown elevator. Throttles will not be advanced beyond the near vertical position without simultaneously resetting the stabilizer toward target trim. Failure to retrim during the thrust application phase of a go-around can result in pitch-up which, combined with other pitch trim items, will exceed nosedown elevator authority. Also, with asymmetrical thrust, power must not be applied faster than any generated roll-yaw problem can be controlled.

2. AGM-28 Engine Control Knobs - Set (as required) (CP)
3. Airbrake Lever - OFF (P)

   Pilot will retract airbrakes, level off, and check for a positive increase of airspeed.

4. Trim - As required (P)

   At all times during go-around, pilot will make a conscious effort to keep the aircraft trimmed to zero stick force.

5. Landing Gear Lever - As required (P-CP)

   Pilot may retract the gear when it is established that aircraft will not contact the runway.

WARNING

To prevent flying the aircraft into the ground, the pilot will exercise caution not to exert inadvertent forward pressure on the control column when reaching forward to raise the landing gear lever.

6. Thrust - Adjusted (P)

   Pilot accelerates to desired IAS (best flare speed plus 30 KIAS or 180 KIAS) and adjusts thrust to establish a rate of climb of approximately 1000 fpm.

7. Wing Flaps - As required (CP)

   Flaps will be retracted in a wings-level attitude, using the normal speed schedule and in accordance with the flap retraction procedures outlined in the "After Takeoff-Climb Checklist," this section.

8. Landing Light & Crosswind Landing Light Switches - OFF (P/CP)

NOTE

- If climbing back to altitude, perform "After Takeoff-Climb Checklist."
- If remaining at traffic pattern altitude for closed traffic, GCA, ILS approaches, etc, perform "Before Landing Checklist."

TOUCH-AND-GO LANDING

Failure to lower airbrakes and retrim the aircraft for takeoff may result in excessive pitchup immediately following unstick. At any time that abnormal pitching tendencies are noted, stabilizer trim should be utilized immediately. Touch-and-go landings can normally be performed within the limits shown on the "Touch-and-Go Landing Checklist" unless additionally restricted by the major command concerned.

TOUCH-AND-GO LANDING CHECKLIST (Copilot reads)

NOTE

- While touch-and-go landings may be accomplished successfully under conditions more extreme than those listed below, in the interest of flying safety, they will not be performed when:
  (1) Gross weight exceeds 290,000 pounds.
  (2) Crosswind crab control setting requirement is more than 8°.
  (3) Any spoiler is inoperative.
  (4) Any hydraulic pack and associated standby pump is inoperative.
  (5) Any time hydraulic pack No. 1, 2, 9, or 10 is inoperative.
  (6) Any time more than one hydraulic pack or standby pump is inoperative.
  (7) Any time stabilizer trim cannot be electrically set.
- Touch-and-go landings are exempted from the requirement of continuous ignition during the takeoff or landing phase.
- Steps preceded by an asterisk (*) will be accomplished on the runway. Steps "5," "6," and "7" will be accomplished during climbout. Subsequent steps to include "Airbrake Lever - Position 4" will be accomplished while on the downwind leg. Remaining steps will be accomplished as indicated by step amplification.

*1. Airbrake Lever - Position 6 (P)

*2. Stabilizer Trim - **SET TO TARGET TRIM FOR TAKEOFF (P/CP)**

Pilot not flying the aircraft will position the stabilizer trim to target trim value noted and notify other pilot that trim has been reset.

WARNING

If the stabilizer trim is not reset prior to takeoff, the excessive amount of noseup trim will cause a pitchup after takeoff. Any pitch attitude changes following a takeoff must be countered immediately by continuous use of the stabilizer trim in addition to control column movement.

*3. Airbrake Lever - OFF (P)

It is essential that the airbrake lever be returned to OFF position before executing the takeoff following a touch-and-go to preclude an unexpected pitchup following takeoff.

*4. Throttles - Advanced

The pilot performing the takeoff after a touch-and-go landing will advance the throttles to near vertical position of the quadrant allowing engines to accelerate and stabilize before any additional power is applied. Do not advance throttles beyond the vertical position until the pilot resetting stabilizer trim has verbally verified that the trim has been reset for takeoff. The pilot occupying the other seat will monitor the engine instruments and notify the pilot making the takeoff of any abnormal engine acceleration characteristics. Premature liftoff prior to unstick speed (minimum touchdown speed) can be hazardous since there is only a 7- to 12-knot margin between unstick speed and initial stall speed. Premature liftoff can only occur when stabilizer is mistrimmed and/or excessive back column is introduced prior to unstick. Accelerate to best flare speed plus 30 KIAS on climbout.

5. Landing Light & Crosswind Landing Light Switches - As required (P/CP)

Landing lights and crosswind landing lights may be left on for the duration of traffic pattern operations to assist in traffic separation unless reflection from these lights reduce pilot visibility.

6. Yaw Damper Switch - ON (P/CP)

7. Nav Mode Select Switch - As required (P-CP)

TOUCH-AND-GO LANDING CHECKLIST (Copilot reads) (cont)

8. Landing Gear Lever - GEAR DOWN (P); Six down and checked (P-CP)

   Pilot checks gear lever in detent. Both pilots check that the gear warning light is out and that all six gear indicate down and locked.

9. Fuel Panel - Checked (CP)

   Crossfeed valve switches 9 and 12 will be positioned to OPEN when any main tank indicates 5000 pounds or less.

10. Best Flare Speed - ________ Knots (CP-N)

    Copilot computes best flare speed for airbrakes in position 4 or as required and cross-checks airspeed indicator with pilot's indicator.

11. Wing Flap Lever - DN (CP)

12. AGM-28 Engine Control Knob(s) - Set (as required) (CP)

13. Crosswind Crab - Set and down (CP)

14. Airbrake Lever - Position 4 or as required (P)

15. Landing Light & Crosswind Landing Light Switches - As required (P/CP)

    Landing lights and crosswind landing lights will be turned on during both daytime and nighttime conditions for base leg and final approach unless reflection from these lights reduces pilot visibility.

16. Target Trim - Noted (P/CP)

    When aircraft is established on final approach in landing configuration (landing gear and flaps down and airbrakes in planned position) at best flare speed plus 10 KIAS, pilot not flying the aircraft will note the stabilizer trim setting for zero stick force. He will call out this value as target trim during an approach with airbrakes in position 0 or 2. During an approach with airbrakes in position 4 or 6, he will compute a trim value two units in the noseup direction from that noted and call out this computed value as target trim.

NOTE

It is preferable to note stabilizer trim while in straight and level flight. In VFR traffic patterns or situations where it is not readily feasible to establish straight and level on final approach, the stabilizer trim target setting during descent may be used, provided rate of descent does not exceed 1000 feet per minute.

17. Yaw Damper Switch - OFF for touch-and-go (P/CP)

    For touch-and-go landings, the yaw damper switch will be turned OFF during the latter portion of final approach prior to landing flare.

TAXI-BACK LANDING

Full-stop taxi-back landings may be accomplished under the following limitations:

1. Aircraft gross weight will not exceed 250,000 pounds.
2. Dry runways must prevail during the period in which this activity is being conducted.
3. Touchdown will be accomplished in the first third of the existing runway to include the sterile portion at the end.
4. Normal no-brake-chute stopping distance will not exceed 50% of the available runway exclusive of the sterile portion of the approach end.
5. After establishing a stable ground roll, brakes will be checked for operation followed by intermittent application of brakes as required.
6. Landing gear will remain down in the traffic pattern for all subsequent landings. A minimum interval of 15 minutes air time will be established between landings or prior to retracting the gear to provide wheel and brake cooling.
7. A maximum of four full-stop taxi-back landings may be accomplished on one sortie. The fourth landing may be followed by a final full-stop landing utilizing the brake chute.

TAXI-BACK LANDING CHECKLIST (Copilot reads)

NOTE

Taxi-back landings may be accomplished using the following checklist and the "Before Landing Checklist."

1. Airbrake Lever - Position 6 (P)
2. Wheel Brakes - Check (P)

   After establishing a stable ground roll, brakes will be checked for operation, followed by intermittent application of brakes as required. Check No. 2 and emergency brake pressure (3000 (+250) psi) and all low pressure warning lights out.

3. Crosswind Crab Control Knob - Centered (P)
4. Steering Ratio Selector Lever - TAXI (P)
5. Antiskid Switch - As required (P)
6. Landing Light & Crosswind Landing Light Switches - OFF (if applicable) (P/CP)
7. SIF/IFF - STBY (STDBY) (P)
8. Airbrake Lever - OFF (P)
9. Stabilizer Trim - Set to target trim for takeoff (P/CP)
10. Control Surface Trim - Set (P)
11. Wing Flaps - 100%, lever DN (P/CP)
12. Fuel Panel - Set as required, valves 9 and 12 open (CP)

12A. Takeoff Data - Reviewed (P-CP-N)

Review EPR, S_1 speed, time, and S_2 speed. Takeoff abort procedures will be reviewed.

13. Antiskid Switch - ON, guard closed (P)
14. Crew - Stand by for takeoff (CP-G)
15. SIF/IFF - NORM (P)
16. Crosswind Crab - Set and down (P-CP)
17. Steering Ratio Selector - TAKEOFF LAND (P)
18. Throttles - Set
19. 70 Knots - Now (P)
20. S_1 - Now (N/CP)
21. Unstick (S_2) - Now (CP)
22. Stabilizer Trim - Monitor (CP)
23. Yaw Damper Switch - ON (P/CP)

AFTER LANDING

The after landing check shall be performed after the aircraft has been turned off the runway. Hard taxi braking or riding the brakes shall be avoided at all times, particularly after a landing or refused takeoff. See "Wheel Brake System Operation," Section VII, and "Brake Energy Limit Charts" (figure 5-12), Section V.

AFTER LANDING CHECKLIST (Copilot reads)

Accomplish after turning off the runway.

WARNING

Maintain manifold pressure above 15 psi while making sharp turns. Power should then be adjusted for normal taxi operations to prevent excessive use of brakes.

1. Landing Light & Crosswind Landing Light Switches - OFF (if applicable) (P/CP)

2. Drag Chute Lever - JETTISON (CP)

   The drag chute will be jettisoned by the copilot after the aircraft has turned off the runway and prior to being stopped for completion of the "After Landing Checklist."

3. Parking Brake - Set (P)

4. Antiskid Switch - As required (P)

   Turn antiskid switch OFF if icy (slippery) taxiing conditions exist or if gross weight is less than 250,000 pounds. If these conditions do not exist, leave antiskid switch ON.

5. SIF IFF - OFF (P)

   Turn SIF IFF off as soon after landing as possible. This will eliminate signals from taxiing or parked aircraft which would otherwise block the controller's scope and interfere with the control of airborne aircraft.

6. Arming Lever Safety Pins (No. 1) - Installed (P-CP)

6A. D-C Power - Checked (CP)

   Copilot checks TR units for positive load indication, TR bus voltage (25 to 29.5 volts), and excessive load unbalance. If a positive load is not indicated on a forward TR unit, the crew will be directed to turn on the following equipment: ECM systems 2, 3, and 16 ON & STDBY; BNS primary control function switch to TRACK. For an aft TR unit, the EW officer will be directed to turn on the following equipment: ECM systems 12 and 15 ON & STDBY. The copilot will again check the loadmeter and if a positive indication does not appear, the TR unit will be considered a malfunctioning unit.

7. Armrests - Stowed (P-CP)

8. Airbrake Lever - OFF (P)

9. Stabilizer Trim - Reset to zero and CUTOUT (P)

10. AGM-28 Engine Control Knobs - OFF (CP-N)

11. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET, master warning light reset (P)

12. Spoiler & Stabilizer Standby Pump Switches - OFF (P)

AFTER LANDING CHECKLIST (Copilot reads)(cont)

13. Aft Alternators - OFF (CP)

NOTE

The copilot will monitor air pressure and overload lights to assure sufficient pneumatic air to maintain normal alternator operation. If adequate manifold air pressure is not maintained, the alternator will decrease in frequency and, upon advancing throttles, the turbine controls may not react fast enough to prevent the alternator from shutting down from an overspeed condition.

14. Starter Selector Switch - GROUND START (CP)

15. Air Bleed Switches - OPEN (CP)

16. Unnecessary Electrical Equipment: (P-CP)

    a. Liaison Radio, TACAN & Omni Power Switches - OFF

    b. Pitot Heat Switches - OFF

    c. Windshield & Nacelle Anti-Ice - OFF

    d. Radar Altimeter - OFF

    e. Autopilot Master Switch - OFF

17. Readiness Switch Cover - Closed, latched (P)

18. Throttles 1, 2, 7 & 8 - 75% rpm, then CLOSED (P-CP)

While taxiing back to the ramp, advance throttles 1, 2, 7, and 8 to approximately 75% rpm for not less than 15 nor more than 30 seconds before moving to CLOSED position. This will insure complete scavenging of engine oil and prevent overservicing. This procedure will also prevent fuel from accumulating underneath the engines after shutdown.

NOTE

If the engine is allowed to idle for more than 27 seconds, the oil sump area will fill and require scavenging again.

19. Fuel Panel - Checked (CP)

Close all fuel valves not required.

20. Sliding Window - Open (P/CP)

Open sliding window approximately 2 inches to relieve cabin pressure.

21. Bomb Door Switch (nuclear and training missions only) - OPEN (P)

If munitions are aboard or have been released, bomb doors will not be opened until after parking.

CAUTION

Copilot monitors manifold air pressure and verifies that manifold pressure is 30 psi minimum just prior to bomb door opening operation in order to maintain sufficient hydraulic pack output to prevent damage to bomb doors.

AFTER LANDING CHECKLIST (Copilot reads) (Cont)

ENGINE SHUTDOWN

CAUTION

Normally an engine will be sufficiently cool after landing to permit an immediate shutdown. If an engine has been operating at above 85% rpm for a period exceeding 1 minute after landing, allow the engine to idle at least 5 minutes before shutting down. This will prevent damage resulting from rapid temperature change.

BEFORE LEAVING AIRCRAFT

BEFORE LEAVING AIRCRAFT CHECKLIST (Copilot reads)

1. Parking Brake Lever - ON (P)

1A. Anticollision & Navigation Lights - OFF and FLASH (P)

2. AGM-28 B-52 Power Switches - OFF (CP-N)

2A. BNS - OFF (RN)

CAUTION

The BNS, radar, and terrain computer power switch must be OFF to prevent power surge damage when switching from aircraft power to external power or if aircraft power is interrupted.

3. Air Conditioning Master Switch - RAM (CP)

4. Attitude & Directional Gyro Power Switch - OFF (P/CP)

5. Bomb Door Switch - OPEN (P)

Bomb doors will be opened at this time if conventional internal munitions were carried. Ground personnel will be on interphone and confirm that bomb doors are clear.

WARNING

If conventional internal munitions were carried, the flight crew must visually check bomb bay prior to opening bomb doors.

CAUTION

Copilot monitors manifold air pressure and verifies that manifold pressure is 30 psi minimum just prior to bomb door opening operation in order to maintain sufficient hydraulic pack output to prevent damage to bomb doors.

6. Standby Pump Switches - OFF (P)

7. Ciphony Control Panel - Zeroize KY-28 (if required) (P/CP)

8. Alternator Switches - OFF (CP)

BEFORE LEAVING AIRCRAFT CHECKLIST (Copilot reads) (Cont)

9. External Power (if available) - OFF, checked and ON (CP)

WARNING

When conventional munitions are aboard, do not apply external power until shackle locking pins or SUU-24/A dispenser locking clips are installed.

10. Throttles - 75% rpm, then closed (P)

NOTE

Before shutting down any engines, advance throttle to 75% rpm to accomplish scavenging. Sufficient engine scavenging will be accomplished by not less than 15 nor more than 30 seconds of engine operation at 75% rpm. Move throttle to CUTOFF within a few seconds after retarding throttle from the 75% setting. If the engine is allowed to idle for more than 27 seconds, the oil sump area will fill and require scavenging again.

11. UHF Radios - OFF (CP)

12. Fuel Switches - OFF (CP)

BEFORE LEAVING AIRCRAFT CHECKLIST (Copilot reads) (cont)

13. Hydraulic Pack Switches - OFF & RESET (guards open) (P)
14. Battery Switch - OFF (CP)
15. Oxygen System - OFF and 100% OXYGEN (P-CP)
    a. Oxygen Supply Shutoff Lever - OFF
    b. Regulator Diluter Lever - 100% OXYGEN
    c. Supply Hose - Disconnected and stowed
16. Wheel Chocks - In place (GC)
17. Parking Brake Lever - OFF (P)
18. Light Switches - OFF, or as required (P-CP)
19. Control Columns - Disconnected (P-CP)

    Do not allow control column to slam forward.
20. Seat Positioning Switch - DOWN (external power available) (P-CP)

    Pilot and copilot lower their seats.
21. Pilot's Flare Set Power Switch - OFF (P)
22. Interphone Switch - OFF (P)

POSTFLIGHT

POSTFLIGHT CHECKLIST

1. Brakes - Checked (CP)

   The copilot will check for possible cold brakes. He will consider the conditions contained in "Brake Design" under "Wheel Brake System Operation" in Section VII before writing up a cold brake discrepancy.
2. Applicable Forms - Completed (All)

   The pilot will assemble the crew to collect completed logs and forms and discuss items pertinent to the mission. If applicable, AGM-28 Form 781's and Form 650 will be completed. The pilot will interrogate each crew member to determine the proper entries in all applicable forms to facilitate maintenance inspections.

   a. Record any limits and/or tolerances that have been exceeded during the mission.

   NOTE

   All entries shall include (to the maximum extent possible) duration, degree, and prevailing conditions for each occurence.

   b. Record the occurrence of any of the following:

      (1) Stick forces in excess of 100 pounds.

      (2) If, in the pilot's opinion, the aircraft has encountered heavy loads due to turbulence (record highest and lowest accelerometer readings).

      (3) Flutter or buffet.

POSTFLIGHT CHECKLIST (cont)

c. Record any unusual or excessive operations, such as:

(1) Exceeding EPR by more than 0.10 during wet or dry power check prior to takeoff.

(2) Failure to obtain charted EPR setting at full throttle, or failure to obtain charted EPR values without exceeding the EGT limits.

(3) Wing flap clutch slippage.

(4) Jettisoning of drag chute or deployment of drag chute over 135 KIAS.

(5) Long taxi runs at high speed.

(6) Excessive braking during aborted takeoffs.

(7) A live starter cartridge being carried in the starter breech during flight.

(8) Landing or takeoff with wheel shimmy or hard vibrations.

(9) Emergency descent or spoiler buffet being encountered.

(10) Engine failure resulting in seizure or unbalance.

(11) An alternator automatically shutting down in flight.

(12) An alternator or drive tripoff during flight or ground operation.

(13) A leaking hot air duct.

(14) Flight through lightning.

(15) Hard landings (any landing with sink rate in excess of allowable limits).

(16) Takeoff with more water impurities than 10 parts solids per million parts.

(17) Excessive tail shake and/or abnormal twisting of aft body or empennage.

(18) Excessive dutch roll.

(19) Zero TR load indications and excessive load unbalance.

STRANGE FIELD PROCEDURES

If it is necessary to land the aircraft at an airfield where normal ground support is not available, there are several items which must be performed by the flight crew after parking the aircraft and prior to takeoff. To assist the flight crew in accomplishing these steps properly, the following checklists are provided:

NOTE

> Refer to T.O. 1B-52C-30-1 for strange field procedures when AGM-28 missiles are aboard.

AFTER PARKING

1. Parking Ramp - Checked

The pilot should ascertain that the parking ramp is constructed to withstand the aircraft gross weight after refueling.

2. Wheel Chocks - In place
3. Landing Gear Ground Locks - Installed
4. Bypass Keys - Installed
5. Bomb Door Actuators - Disconnected
6. Nuclear Bombs Aboard - Accomplish bomb "After Landing" checklist

Use the bomb "After Landing" checklist contained in T.O. 1B-52C-25-2CL-1.

7. Conventional Munitions Aboard - Install shackle locking pins, MER electrical safety pins, and SUU -24/A dispenser locking clips
8. Bomb Door Actuators - Connected (if nuclear bomb(s) aboard)
9. Bomb Doors - Closed (if nuclear bomb(s) aboard)

10. Duct Plugs - In place
11. Pitot Tube Covers - In place
12. Oxygen Buildup and Vent Valves Handles - Leave in SERVICE
13. Gunnery System - Guns unarmed (if applicable)
14. Outside Turret Jettison Handle Maintenance Safety Pin - Installed
15. Windows and Hatches - Closed
16. Security Guard - Posted
17. Drag Chute (if used) - Dried and repacked

PRIOR TO NORMAL PREFLIGHT

Due to unfamiliarity with this aircraft by maintenance personnel at strange fields, the following items must be closely checked by the flight crew:

1. Electrical and Air Power Carts - Available

NOTE

- Electrical power can be obtained from an MD-3 power cart or any source of 400-cycle three-phase 200 (±5)-volt a-c power having an AN3430 plug. About 10 amperes of 24-volt d-c power is needed on pin E to close the relays to energize the aircraft circuits with external a-c power.

- External electrical power is not required for starting. See "Starting Engines and Before Taxiing Checklist," this section. To provide starting for aircraft which do not require use of external pneumatic power, starter cartridges must be installed as given under "Installation of Starter Cartridges," this section.

- Pneumatic power to start an engine can be obtained from an MA-1, MA-1A, or 502 cart. If one of the above mentioned carts is not available, a source could be used that can supply approximately 1.8 pounds of air per second at a pressure of not more than 200 or less than 30 psi gage and at a temperature of 300° F for the length of time it will take to start an engine. If the air temperature is below 300° F, a flow of air greater than 1.8 pounds per second will be needed. The use of an air source not specifically designed for aircraft should be limited to starting one engine.

- If the available source of pneumatic power cannot supply air at a pressure of 30 psi, a start may be attempted at a lower pressure. With no other pneumatically operated equipment operating, allow available pressure to build up and stabilize, then follow normal starting procedures.

CAUTION

When attempting a start at less than 30 psi, monitor the exhaust gas temperature and starting time very closely. Close throttles immediately if EGT exceeds 450° C. Starting at reduced pressure may require starter operation longer than 2 minutes in which case the minimum rest period between starting attempts should be extended beyond the minimums set forth in "Starter Limitations," Section V.

NOTE

- See "Servicing" diagram (figure 1-57) for fuel, oil, and hydraulic oil grades and specifications, and for power cart types.

- For partial fuel loading charts, refer to T.O. 1-1B-40, "Handbook of Weight and Balance Data."

2. Drag Chute - Installed
3. Fuel System - Serviced
4. Oil Tanks - Serviced
5. Oxygen System - Serviced as necessary
6. Water Injection System - Serviced as necessary
7. Hydraulic Packs - Checked, serviced as necessary
8. Hydraulic Pack Accumulator Preload- Checked
9. Perform normal flight crew checklist.

Installation of Starter Cartridges

The following procedure is applicable to installation of starter cartridges on engines 2 and 8.

1. First release the three outboard and then the three inboard latches which secure the lower side cowl to the upper cowl panel and lower engine strut structure. Since the lower side cowl is suspended by outboard hinges, this allows the cowling to be lowered from inboard for access and permits securing the attached support rods to the engine housing with stud bolts provided at locations opposite the cowling support rod attach fittings.

CAUTION

- To prevent bending the cowling, the three outboard (one forward and two aft) latches must be released before the inboard latches are released.

- Only one man is required for opening the lower side cowl and installing the support rods.

2. Remove breech cap from starter by pulling disconnect handle and rotating breech cap clockwise until cap becomes free.
3. Check and, if necessary, clean inside of breech cap dome to assure good electrical contact with ground clip cartridge.
4. Remove Air Force MXU-4/A cartridge from its container.
5. Remove short-out clip from Olin Mathieson cartridge and bend ground clip up to assure good contact with breech cap. On Amoco cartridges, bend grounding clip away from electrical contact to release contact and to serve as a ground between cartridge and breech.
6. Insert cartridge in breech with ground clip against cap dome.

WARNING

Before installing cap and cartridge on engines, insure that cartridge starter switches remain in OFF position.

7. Place breech cap in position on breech chamber and engage locking lugs. Pull disconnect handle and rotate breech cap counterclockwise until breech connector mates properly.
8. Remove support rods and position the lower side cowl to the engine strut structure. Align the latch pins with pin receptacles and secure the pins.

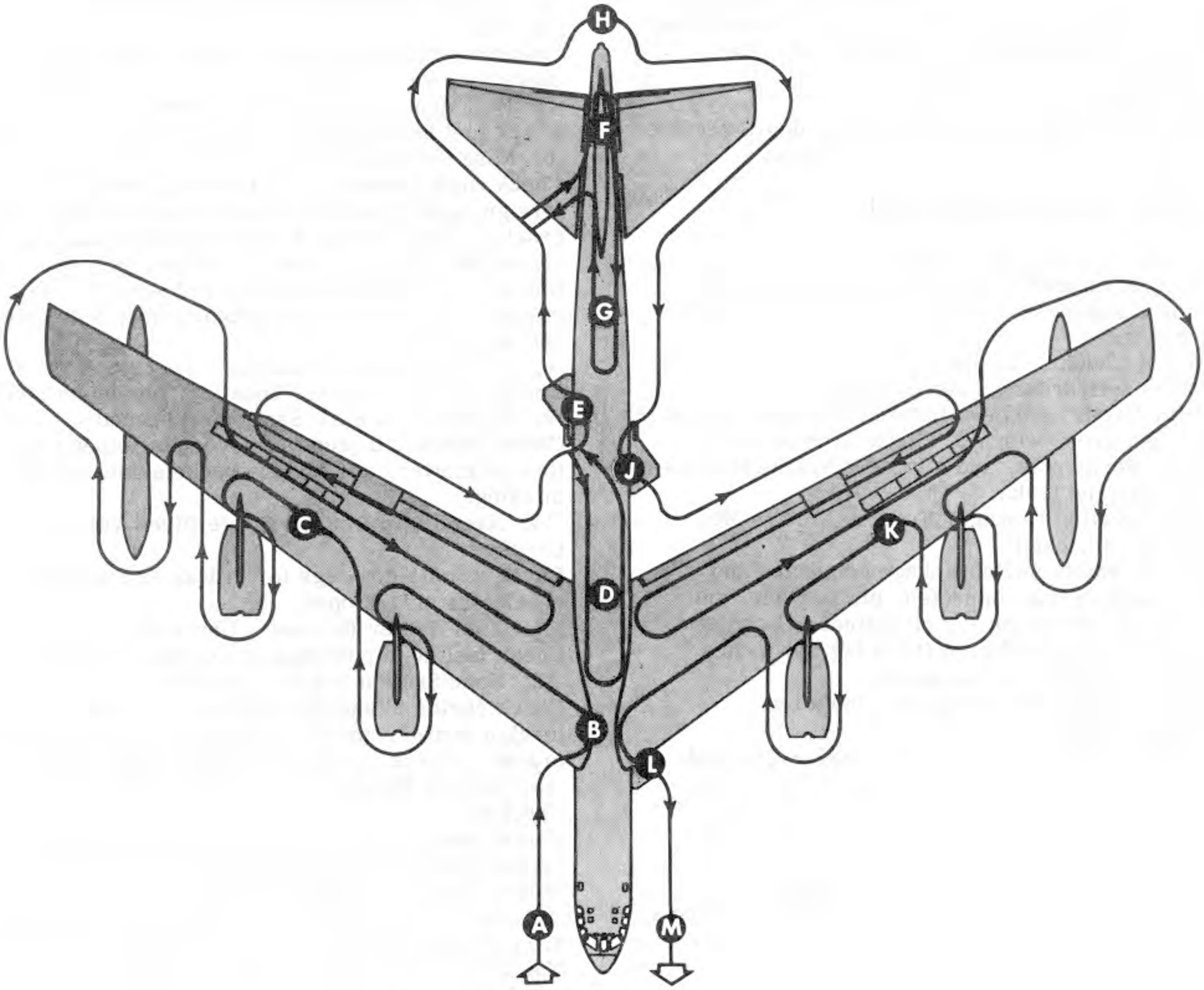
NOTE

With the exception of steps 4, 5, and 6, the above procedure may also be used for cartridge removal.

EXTERIOR INSPECTION CHECKLIST

NOTE

The exterior inspection is designed to be accomplished normally by an experienced pilot and copilot, each inspecting one side of the aircraft simultaneously, one pilot starting with nose section (right) through empennage and the other pilot starting with the left aft wheel well through the nose section (left). However, in the event only one pilot is available, he can perform the complete inspection. The following inspection is based on the assumption that appropriate maintenance personnel are not available to perform this preflight and that the flight crew is accomplishing the preflight with emphasis on the items that affect the safety of flight. See figure 2-18 for a diagram of the route to be followed during the exterior inspection. The fluid level on all hydraulic packs should be checked for the minimum readings listed in the appropriate sections of the "Exterior Inspection Checklist," regardless of pressure.



Ⓐ RIGHT NOSE SECTION

Ⓑ RIGHT FORWARD WHEEL WELL

Ⓒ RIGHT WING

Ⓓ BOMB BAY

Ⓔ RIGHT AFT WHEEL WELL

Ⓕ TAIL COMPARTMENT

Ⓖ AFT COMPARTMENT

Ⓗ EMPENNAGE

Ⓙ LEFT AFT WHEEL WELL

Ⓚ LEFT WING

Ⓛ LEFT FORWARD WHEEL WELL

Ⓜ LEFT NOSE SECTION

EXTERIOR INSPECTION DIAGRAM (Typical)

Figure 2-18.

Ⓐ Right Nose Section

1. Pitot Tube - Cover removed and clear
2. Static Ports & Drain Plugs - Checked
Check static ports clear and drain plugs installed. Static ports are located high on the right side of the fuselage and underneath the fuselage aft of the entrance door.
3. Air Ducts & Vents - Clear
Check all vent openings clear, access doors secure, duct plugs removed, and fuel cap in place.

Ⓑ Right Forward Wheel Well

1. Landing Lights - Checked
Check right landing light and crosswind and taxi light for cleanliness, security, and glass and filament intact.
2. Wheel Chocks - In place
3. Tires & Hydraulic Lines - Checked
Ascertain tires have been inflated to proper pressure for present gross weight. Check tires for cuts, blisters, worn spots, and slippage; hydraulic lines for security and leaks.
4. Safety Switch Linkage, Torsion Line & Oleo Extension - Checked
Check oleo safety switch linkage connected and secure; torsion link connected, pin in place, and safetied; and oleo strut for cleanliness, hydraulic leaks, and proper inflation (15.8 (±0.25) inches between centers of torsion links).
5. Landing Gear Ground Lock - Installed
6. Battery Cover - Secure
7. No. 1 Hydraulic Pack Fluid Level - Checked, 3.1 gallons minimum
Visually inspect pack for general condition and check fluid level sight gage for proper servicing (3.1 gallons minimum).
8. Leaks & General Condition - Checked
Check the entire wheel well area for foreign objects, hydraulic or fuel leaks, and security of all equipment.
9. Single Point Refuel Cap - Secure
10. No. 2 Hydraulic Pack Fluid Level - Checked, 3.1 gallons minimum
Visually inspect pack for general condition and check fluid level sight gage for proper servicing (3.1 gallons minimum).

Ⓒ Right Wing

1. Access Panels, Airscoops, Vents & Drains - Checked
Check access panels fastened and secure, plugs removed from all airscoops and vents, drains clear and unobstructed, and no leaks.
2. No. 3 Strut for Condition - Checked
Check strut for cracks, buckling, and loose rivets.
3. Engines 5 & 6 Aft Section - Checked
Check engine tail plugs removed, tailpipes free of foreign matter, and turbine buckets not nicked or missing.
4. Nacelle Cowlings & Surge Bleed Valves - Checked
Check nacelle cowlings for cracks and security and check four valves open.
5. Fuel Heater Exhaust - Checked
Check fuel heater exhaust for evidence of fuel leaks.
6. Nose Section 5 & 6 - Checked
Check engine intake plugs removed, intakes free of foreign matter, and oil coolers free of dents and cracks. Check for nicked compressor blades.
7. Access Panels, Vents & Drains - Checked
Check access panels fastened and secure, plugs removed from all vents, drains and weep holes clear, and no leaks.
8. No. 4 Strut for Condition - Checked
Check strut for cracks, buckling, and loose rivets.
9. Engines 7 & 8 Aft Section - Checked
Check engine tail plugs removed, tailpipes free of foreign matter, and turbine buckets not nicked or missing.
10. Nacelle Cowlings & Surge Bleed Valves - Checked
Check nacelle cowlings for cracks and security and check four valves open.
11. Fuel Heater Exhaust - Checked
Check fuel heater exhaust for evidence of fuel leaks.
12. Nose Section 7 & 8 - Checked
Check engine intake plugs removed, intakes free of foreign matter, and oil coolers free of dents and cracks. Check for nicked compressor blades.
13. Access Panels, Airscoops, Vents & Drains - Checked
Check access panels fastened and secure, plugs removed from all airscoops and vents, drains and weep holes clear, and no leaks.
14. No. 8 Hydraulic Pack Fluid Level - Checked, 3.0 gallons minimum
Visually inspect pack for general condition and check fluid level sight gage for proper servicing (3.0 gallons minimum).
15. Taxi Light & Door - Secure
Check for cleanliness, security, and glass intact; tip gear door hinges in place and secure.
16. Tip Gear Well - Checked
Check hydraulic lines and actuators secure, no leaks; wiring and other equipment secure.
17. Tip Gear Ground Lock - Installed
18. Oleo Strut, Wheel & Tire - Checked
Check oleo strut for cleanliness, hydraulic leaks, and proper inflating; shimmy damper installed. Inspect wheel for cracks and tire for cuts, blisters, worn spots, and slippage.
19. Drop Tank - Checked
Check tailcone for security.

20. Access Panels & Fuel Vents - Checked
Check access panels secure and fuel vents clear and unobstructed; no fuel leaks.

21. Wing Tip & Upper Surface - Checked
Check wing tip antennas for cracks and dents; upper wing surface for frost, snow, ice, or dust; and access openings and fuel caps in wing and fuselage for security. Check for missing or bent vortex generators.

22. Outboard Wing Trailing Edge - Checked
Check skin for cracks, buckling, and loose rivets.

23. Outboard Wing Flap Well - Checked
Check hydraulic lines for leaks and pneumatic ducts and wiring for security.

24. Inboard Wing Flap Well - Checked
Check hydraulic lines for leaks, pneumatic ducts and wiring control cables for security, and circuit breakers set.

25. No. 7 Hydraulic Pack Fluid Level - Checked, 2.8 gallons minimum
Visually inspect pack for general condition and check fluid level sight gage for proper servicing (2.8 gallons minimum).

26. Lower Surface of Wing Flaps, Aileron & Tabs - Checked
Check lower surfaces for loose rivets, cracks, or buckling in skin; security and condition of actuators and screws.

27. Upper Surface of Wing Flaps, Aileron & Tabs - Checked
Check upper surfaces for loose rivets, cracks, or buckling in skin; security and condition of rollers and connecting links.

28. Fuselage & Bomb Doors - Checked
Check fuselage and bomb doors for loose rivets, buckling, snow, and ice.

Ⓓ Bomb Bay

WARNING

The bomb door actuator struts must be disconnected before entering the bomb bay.

1. Oxygen Regulator(s) - OFF and 100% OXYGEN
Number of oxygen regulators in bomb bay varies from zero to two, depending on kit installation.

2. Bomb Bay for Leaks, Security of Wires, Cables & Ducts - Checked
Check bomb bay for fuel and hydraulic leaks; security of wires, cables, and pneumatic ducts.

3. Nuclear Bombs - Checked for proper configuration

Use the "Recovery and Ferry" or "EWO Restrike (MMS not available)" procedures (as applicable) of T.O. 1B-52C-25-2CL-1 to properly configure the nuclear bombs.

Ⓔ Right Aft Wheel Well

1. Tires & Hydraulic Lines - Checked
Ascertain tires have been inflated to proper pressure for present gross weight. Check tires for cuts, blisters, worn spots, and slippage. Check hydraulic lines for security and leaks.

2. Safety Switch Linkage, Torsion Link & Oleo Extension - Checked
Check oleo safety switch linkage connected and secure; torsion link connected, pin in place, and safetied; and oleo strut for cleanliness, hydraulic leaks, and proper inflation (15.8 (±0.25) inches between centers of torsion links).

3. Landing Gear Ground Lock - Installed

4. Leaks & General Condition - Checked
Check the entire wheel well area for foreign objects, hydraulic or fuel leaks, and security of all equipment.

5. No. 3 Hydraulic Pack Fluid Level - Checked, 3.1 gallons minimum
Visually inspect pack for general condition and check fluid level sight gage for proper servicing (3.1 gallons minimum).

Ⓕ Tail Compartment (Gunner not Flying)

1. Elevation Stow Pin - Installed
2. Air Conditioning Master Switch - OFF
3. Cabin Temperature Selector Switch - MANUAL
4. Radar & Fire Control System Switches - OFF/SAFE/wired or pinned
5. APR-25 Intensity Control **B-52D** - Minimum
6. Circuit Breaker Panel - Set
    a. Compressor three-phase and heater circuit breakers - Pulled
    b. All circuit breakers in unless otherwise directed.

Ⓖ Aft Compartment (Gunner not Flying)

1. The pilot performs a walkthrough inspection of the aft compartment; checks for general condition, loose or foreign objects, and/or leakage of any unit. Specified emphasis will be directed to:
    a. Control cables, ducting, and wiring
    b. Stabilizer nut and jackscrew
    c. Oxygen converters
    d. Hydraulic packs
    e. Air conditioning pack
    f. ECM transmitters for hydraulic leaks
2. Emergency Cabin Pressure Dump Handle - Checked
3. Pressure Bulkhead Door - Closed

Ⓗ Empennage

1. Access Panels, Air Ducts & Vents - Checked
Check all plugs removed from air ducts and vents, ducts and vents clear and unobstructed, and access panels secure.

2. Right Oxygen Buildup & Vent Valve Handle(s) - Checked
Check that liquid oxygen buildup and vent valve handle(s) has been placed in SERVICE; close and secure access panel.

3. Right Horizontal Stabilizer, Elevator & Tab - Checked and set at 0°

Check all surfaces for loose rivets, cracks, and buckling in skin, snow, ice, and general condition. Specifically check for ice on the seal between the stabilizer and fuselage.

4. Drag Chute Compartment - Checked

Check door locked indicator pin flush and door secure. Check that drag chute riser terminal is properly engaged in the jettison release jaws. If the drag chute has been in place during damp weather, check with crew chief to ascertain that chute is dry.

5. Ammunition Door - Closed

6. Sight Cover - Removed

Check that optical door protective cover is removed.

7. Turret - Stowed

8. Vertical Fin, Rudder & Tabs - Checked

Check all surfaces for loose rivets, cracks, and buckling in skin, snow, ice, and general condition.

9. Left Horizontal Stabilizer, Elevator & Tab - Checked

Check all surfaces for loose rivets, cracks, and buckling in skin, snow, ice, and general condition. Specifically check for ice on the seal between the stabilizer and fuselage.

10. Air Ducts & Vents - Clear

Check all plugs removed from air ducts and vents, ducts and vents clear and unobstructed, and Q-spring opening in leading edge of fin clear.

11. Left Oxygen Buildup & Vent Valve Handle - Checked

Check that liquid oxygen buildup and vent valve handle has been placed in SERVICE; close and secure access panel.

Ⓙ Left Aft Wheel Well

1. Tires & Hydraulic Lines - Checked

Ascertain tires have been inflated to proper pressure for present gross weight. Check tires for cuts, blisters, worn spots, and slippage. Check hydraulic lines for security and leaks.

2. Safety Switch Linkage, Torsion Link & Oleo Extension - Checked

Check oleo safety switch linkage connected and secure; torsion link connected, pin in place, and safetied; and oleo strut for cleanliness, hydraulic leaks, and proper inflation (15.8 (±0.25) inches between centers of torsion links).

3. Landing Gear Ground Lock - Installed

4. Leaks & General Condition - Checked

Check the entire wheel well area for foreign objects, hydraulic or fuel leaks, and security of all equipment.

5. No. 4 Hydraulic Pack Fluid Level - Checked, 3.1 gallons minimum

Visually inspect pack for general condition and check fluid level sight gage for proper servicing (3.1 gallons minimum).

Ⓚ Left Wing

Repeat procedures for right wing in the following order:

1. Fuselage & Bomb Doors - Checked
2. Upper Surface of Wing Flaps, Aileron & Tabs - Checked
3. Lower Surface of Wing Flaps, Aileron & Tabs - Checked
4. Inboard Wing Flap Well - Checked
5. No. 6 Hydraulic Pack Fluid Level - Checked, 2.8 gallons minimum
6. Outboard Wing Flap Well - Checked
7. No. 5 Hydraulic Pack Fluid Level - Checked, 3.0 gallons minimum
8. Outboard Wing Trailing Edge - Checked
9. Wing Tip & Upper Surface - Checked
10. Access Panels & Fuel Vents - Checked
11. Drop Tank - Checked
12. Oleo Strut, Wheel & Tire - Checked
13. Tip Gear Ground Lock - Installed
14. Tip Gear Well - Checked
15. Taxi Light & Door - Secure
16. Access Panels, Airscoops, Vents & Drains - Checked
17. No. 1 Strut for Condition - Checked
18. Engines 1 & 2 Aft Section - Checked
19. Nacelle Cowlings & Surge Bleed Valves - Checked
20. Fuel Heater Exhaust - Checked
21. Nose Section 1 & 2 - Checked
22. Access Panels, Vents & Drains - Checked
23. No. 2 Strut for Condition - Checked
24. Engines 3 & 4 Aft Section - Checked
25. Nacelle Cowlings & Surge Bleed Valves - Checked
26. Fuel Heater Exhaust - Checked
27. Nose Section 3 & 4 - Checked
28. Access Panels, Airscoops, Vents & Drains - Checked

CAUTION

Operation of an air conditioning unit with the wing duct plugs in place can result in overspeeding of the cooling (expansion) turbine driven blower and destruction of the unit.

Ⓛ Left Forward Wheel Well

1. Wheel Chocks - In place

2. Tires & Hydraulic Lines - Checked

Ascertain tires have been inflated to proper pressure for present gross weight. Check tires for cuts, blisters, worn spots, and slippage. Check hydraulic lines for security and leaks.

3. Safety Switch Linkage, Torsion Link & Oleo Extension - Checked

Check oleo safety switch linkage connected and secure; torsion link connected, pin in place, and safetied; and oleo strut for cleanliness, hydraulic leaks, and proper inflation (15.8 (±0.25) inches between centers of torsion links).

4. Landing Gear Ground Lock - In place
5. Battery Cover & Drain Lines - Secure

Check drain lines securely attached to drain ports and covers fastened.

6. Leaks & General Condition - Checked

Check the entire wheel well area for foreign objects, hydraulic or fuel leaks, and security of all equipment.

7. Water Injection Circuit Breakers **54**▶ **W7**▶ - Set (if serviced with water)

Water injection circuit breakers are located on the left and right forward d-c power junction boxes (J-56 and J-57).

NOTE

> The water injection valve control circuit breakers are located on the pilot's auxiliary circuit breaker panel.

8. Air Conditioning Pack Oil Level - Checked

Visually inspect pack for general condition. Check oil level approximately 1/4 inch minimum above "L" mark on sight gage.

9. Landing Light - Checked

Check the left landing light for cleanliness, security, and glass and filament intact.

Ⓝ Left Nose Section

1. Air Ducts & Vents - Clear

Check all vent openings clear, access doors secure, and duct plugs removed.

2. Static Ports & Drain Plugs - Checked

Check static ports clear and drain plugs installed.

3. Escape Hatch - Secure

Check left escape hatch secure and flush with aircraft skin.

4. Pitot Tube - Cover removed, clear

ALERT PROCEDURES

The normal checklists in Sections II and VIII are designed to permit use during alert. The additional checklists in this section are used in situations peculiar only to the alert cycle. Anytime bombs/missiles are aboard, the normal two-man policy will be observed. After maintenance has declared an aircraft ready for alert and the bombs/missiles have been loaded, the aircrew will conduct an initial acceptance check. When the aircrew declares the aircraft ready for alert and the aircraft is on the alert line, it will be placed in a "cocked" configuration. The daily alert preflight will be accomplished once each 24 hours, normally at a predesignated time. During crew changeover, the navigators' "Before Exterior Inspection," the "Missile Preflight," and the "Bomb Preflight" checklists will be accomplished by the new crew.

WARNING

- During the initial acceptance check for an alert aircraft, a check will be made of the thermal curtains at all compartment windows to insure that they are free of damage, abnormal wear, and that they fit properly. Damage, worn, or improperly fitted thermal curtains will not provide protection when exposed to thermal radiation.
- Thermal curtains must be kept free from grease, oil, and mold as any discoloration will seriously impair the value of the curtains. Oil or grease base materials will ignite upon exposure to thermal radiation. Dirty or cracked thermal curtains must be replaced.

INSTRUCTIONS

Security

Entrance to the designated "No Lone Zone" of a "cocked" configured aircraft will be in accordance with command directives.

Maintenance While On Alert

At any time while the aircraft is cocked, if a requirement exists to refuel (except external wing tanks), the aircrew will uncock the aircraft using the "Uncocking Checklist." Normal servicing requirements for water, oxygen, hydraulics, or penumatics, which do not require access to the cockpit, may be accomplished on a cocked aircraft. Maintenance may be performed without uncocking provided force timing is not degraded, power is not placed on the aircraft, access to the cockpit or bomb bay area is not required, and no electrical component is involved. When the aircraft is uncocked for maintenance/refueling and the maintenance/refueling is completed, the aircraft will be recocked by the alert crew using the "Exterior Inspection Checklist" as applicable, "Interior Inspection Checklist," and "Before Starting Engines Checklist." If other than the alert flight crew personnel have had access to the bomb bay and/or AGM-28's during the required maintenance, the navigator's "Before Exterior Inspection" and the bomb preflight and/or AGM-28 preflight inspections must also be completed.

NOTE

> If the aircraft has been towed for tire rotation, etc; insure that the ground locks and bypass keys are removed upon completion of the towing operation.

Pilot Procedures

1. AIRCRAFT AND BOMBS ACCEPTANCE
    a. Before Exterior Inspection

b. Bomb Preflight. If the bomb preflight is accomplished by a substitute crew, it must be reaccomplished by the crew assigned for alert prior to aircraft cocking.

c. Exterior Inspection. (This includes missile preflight.)

d. Interior Inspection

e. Before Starting Engines

f. Starting Engines and Before Taxiing. This checklist will not be accomplished unless the aircraft is to be taxied to the alert area.

2. AIRCRAFT COCKING

a. Interior Inspection

b. Before Starting Engines. Bomb bay doors may be left open or closed depending on local conditions.

3. SCRAMBLE. Pilots will use the normal checklist when the execution order is given. Engines will not be started until both pilots are in position. Boldfaced items contained in the checklist for "Starting Engines and Before Taxiing," "Taxiing," and "Before Lineup" checklists are the minimum items required for a fast reaction takeoff. If time permits, these checklists should be used in their entirety. During EWO alert operations, takeoff will not be delayed for items pertaining to crew equipment, radio checks, and SIF/IFF settings. After the aircraft is safely airborne, the "Starting Engines and Before Taxiing," "Taxiing," and "Before Lineup" checklists should be reviewed and applicable items not previously completed should be performed when time permits. Engine start will be in accordance with "Normal Procedures." "Before Lineup Checklist" will be completed as a continuation of the "Taxiing Checklist" without stopping the aircraft prior to taking the runway. Transfer of control of the aircraft between pilots will be accomplished to insure proper monitoring of aircraft movement and clearance. Upon completion of alert scramble procedures, pilots may recock the aircraft using the "Recocking Checklist."

4. UNCOCKING. Use "Uncocking Checklist."

Radar Navigator and Navigator Procedures

1. AIRCRAFT AND BOMBS ACCEPTANCE

a. Before Exterior Inspection

b. Exterior Inspection. This includes the bomb preflight.

c. Interior Inspection

NOTE

This completes the cocking procedures for the radar navigator and the navigator. If the aircraft is uncocked for maintenance or refueling, it will be recocked using the appropriate portions of the "Exterior Inspection" and the entire "Interior Inspection" checklists.

2. SCRAMBLE. The navigator will don ear protectors and accomplish the ground crew duties of Man No. 2 (See "Ground Crew Checklist," Section VIII, for amplified procedure.) Accomplish the "Before Takeoff Checklist." Upon completion of alert scramble procedures, the navigators may recock the aircraft using their "Recocking Checklist."

3. DAILY ALERT PREFLIGHT. There are no specific items that are to be accomplished by the radar navigator or navigator other than those called for by the copilot on his "Daily Alert Preflight Checklist."

4. UNCOCKING. Items to be accomplished by the radar navigator and navigator are on the pilot's "Uncocking Checklist" and will be accomplished at his direction.

EW Officer Procedures

1. AIRCRAFT ACCEPTANCE

a. Before Exterior Inspection

b. Exterior Inspection

c. Interior Inspection

d. ECM Equipment Operational Check - As required

e. After Landing

2. SCRAMBLE

a. Starting Engines

b. Read over interphone the "Taxiing Checklist" and "Before Lineup Checklist."

3. DAILY ALERT PREFLIGHT. There are no specific items that are to be accomplished by the EW officer other than those called for by the copilot on his "Daily Alert Preflight Checklist."

Gunner Procedures

1. AIRCRAFT AND FIRE CONTROL SYSTEM ACCEPTANCE

a. Before Exterior and Exterior Inspection

b. Interior Inspection

c. Before Engine Start

d. After Engine Start/Before Takeoff

e. After Landing and After Parking

2. DAILY ALERT PREFLIGHT. There are no specific items that are to be accomplished by the gunner other than those called for by the copilot on his "Daily Alert Preflight Checklist."

3. SCRAMBLE

a. On scramble, the gunner will enter the aircraft through the aft entrance door.

b. The gunner will close the aft entrance door after entering the aircraft.

c. Continue with the normal checklist beginning with "Before Engine Start Checklist" through "Postflight Checklist(s)" as the alert/exercise dictates.

NOTE

- During taxi for Alert/Scramble exercises and when within congested ground areas, extreme vigilance must be maintained. The gunner will visually clear the aircraft at all times during taxi. Scope adjustments will not be made at these times.
- For recovery from practice alerts, the FCS Control Panel fuses and FCS circuit breaker checklist items of the "After Landing Checklist" will not be accomplished.

RECOCKING CHECKLIST (Copilot reads)

NOTE

- The following checklist will be used to recock the aircraft after an alert exercise including checklist progression up through the "Before Lineup" checklist. It may also be used after starting engines to taxi to the alert parking area (if applicable).
- This checklist is valid provided no maintenance is required on the aircraft following any of the above actions.
- Following an alert scramble exercise, this checklist should be initiated after clearing the active runway, time and conditions permitting.

1. Antiskid Switch - As required (P)

   Turn antiskid switch OFF if icy (slippery) taxiing conditions exist or if gross weight is less than 250,000 pounds. If these conditions do not exist, leave antiskid switch ON.

2. SIF/IFF - STBY (STDBY) (P)
3. Anti-Icing Systems and Pitot Heat - OFF (P)
4. Water Injection Switches - OFF (P)
5. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET, master warning light reset (P)
6. Stabilizer & Spoiler Standby Pumps - OFF (P)

NOTE

Unless local conditions and/or command directives dictate otherwise, steps "7" and "8" should be accomplished as soon as practical to conserve fuel.

7. Aft Alternators - OFF (CP)
8. Throttles 1, 2, 7 & 8 - 75% rpm, then CLOSED (P-CP)
9. Arming Lever Safety Pins (No. 1) - Installed (P-CP)
10. Radar Altimeter - OFF (P)
11. AGM-28 Engine Control Knobs - OFF (CP)
12. Fuel Transfer - As required (CP)

    Fuel may be transferred as necessary for local refueling procedures.

13. Brakes - Set (P)
14. Anticollision & Nav Lights - OFF and FLASH (P)
15. Bomb Doors - As required (P)
16. Cartridge Start Switches - Checked OFF (CP)

    Check that the spring-loaded switches are in OFF position.

17. Engine Starter Switches - OFF and FLIGHT START (CP)
18. Air Bleed Switches - OPEN (CP)
19. Sliding Window - Open (CP)

RECOCKING CHECKLIST (Copilot reads) (cont)

20. Flaps - UP and OFF (lever up 54▶ 138 W1▶ W34) (CP)
21. Fuel Switches - 13, 14, 15, and 16 ON, all others OFF (CP)
22. Wheel Chocks - In place (GC)
23. Hydraulic Pack Switches (except No. 1) - OFF & RESET (guards open) (P)
24. Alternators (external power available) - OFF (CP)
25. External Power (if available) - OFF, checked, and ON (CP)
26. Throttles (except No. 3 and 5) - 75% rpm then CLOSED (P-CP)

    Copilot will monitor air pressure and overload lights to assure sufficient air to maintain normal alternator operation.

27. Air Conditioning - RAM (CP)
28. Cartridge Start Circuit Breakers - Pulled (P)
29. Cartridges Installed on Engines 2 and 8 (GC)
30. Forward Alternators - OFF (CP)
31. Throttles No. 3 & 5 - 75% rpm then CLOSED (P)

31A. Audible Engine Ignition System Check - Accomplish (P-CP-GC)

Ground crew member will stand to side of engine starter exhaust area of engine being checked.

a. Firewall Fuel Shutoff Valve Circuit Breakers (No. 1 thru 8) - Pulled (CP)

b. No. 1 Engine Starter Switch - Momentary start (CP)

NOTE

Check for operation of both igniters.

c. No. 1 Engine Starter Switch - OFF (CP)

d. Repeat Steps "b" & "c" for Remaining Engines - Accomplish (P-CP)

e. Firewall Fuel Shutoff Valve Circuit Breakers (No. 1 thru 8) - Reset (CP)

31B. Engine Starter Switches - OFF and GROUND START (CP)

RECOCKING CHECKLIST (Copilot reads) (cont)

32. No. 1 Hydraulic Pack - OFF & RESET (guard open) (P)

33. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - ST (climatic) (P)

34. External Power - OFF (CP-GC)

    Copilot checks with ground observer and flight crew to determine if further power is required prior to turning external power OFF.

35. Battery - OFF (CP)

36. Engine Starter Switches - No. 2 and 8 START and FLIGHT START (for cartridge start) (CP)

37. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET (climatic) (P)

38. Oxygen - OFF and 100% (ALL)

39. Parking Brakes - Off (P)

40. Pitot Heat & Windshield Anti-Ice - ON and NORMAL (P)

41. Interphone - OFF (P)

42. Sliding Windows - Closed (P-CP)

43. Circuit Breakers - Set (P-CP)

    Check that circuit breakers are reset after starter cartridges are installed.

44. Entrance Light - OFF (P)

45. Downlocks & Bypass Keys - Stowed (P/CP)

    If aircraft has been towed, ascertain that the downlocks and bypass keys have been removed and stowed.

RECOCKING CHECKLIST (RN-N)

NOTE

The following checklist will be used to recock the aircraft only at the termination of an alert exercise.

1. BNS:
   - a. Primary Control Function Switch - OFF (RN)
   - b. Bias Knob - CCW (RN-N)
   - c. Brilliance Mark Knob - CCW (RN-N)
   - d. Video Gain Control - CCW (RN-N)
   - e. Variac Control Knob - CCW (RN)
   - f. STC Receiver Gain Switch - CCW (RN)
   - g. Waveguide Selector Switch - MAN LOAD (RN)
   - h. RCU Power Switch - OFF (RN)
   - i. Ground Blowers Switch - OFF (RN)
2. Bomb Select Switch - L/S (RN)
3. Automatic Astrocompass: (N)
   - a. Star Selector Switch - OFF
   - b. Power Filter Switch - POWER OFF
4. Doppler Radar: (N)
   - a. Radar Silence Switch - SILENT
   - b. System Power Switch - OFF
5. APN-69 Power Switch (if installed) - OFF (N)
6. AGM-28 B-52 Power Switches - OFF (N)
7. Oxygen Regulator - OFF and 100% OXYGEN (RN-N)
8. Ejection Control Trigger Ring - Stowed (RN-N)
9. Pin No. 1 - Installed (RN-N)
10. ASM Auto Nav AC PWR A, B & C (3) Circuit Breakers - Out (N)
11. Pressure Bulkhead Door - Closed, latched, and locked (N)
12. Pin No. 6 - Installed (N)

UNCOCKING CHECKLIST (Aircraft on Alert Line — Copilot reads)

1. Interphone Switch - ON (P)

   Pilot and copilot connect interphone and check for operation.

2. SIF/IFF:

   a. Master Switch - OFF (P)

   b. Code - Classified setting removed (P)

3. Standby Pump Switches - OFF (P)

   Pilot places all standby pump switches to OFF.

4. Fuel Switches - OFF (CP)

5. Engine Starter Switches - OFF and GROUND START (CP)

6. Gyro Switch - OFF (P/CP)

7. Pitot Heat - OFF (P)

8. Anti-Icing Systems - OFF (P)

9. Battery - ON (CP)

   Copilot places battery switch in ON and checks not charging lights on.

10. External Power - Checked and ON (CP)

11. Flaps - As required (CP)

    Copilot contacts ground observer and ascertains that flap area is clear prior to placing flap lever in DN.

CAUTION

Discontinue wing flap operation within 10 seconds if flaps fail to move in order to prevent excessive slipping of the wing flap power unit slip clutch.

12. Bomb Door Actuators - Disconnected (GC)

    Ground crew observer disconnects bomb door actuators and installs bomb door strut locks (if applicable).

13. Downlocks & Bypass Keys - Installed (GC)

14. Lights - Off, or as required (P-CP)

15. Radios - OFF (P-CP)

16. External Power - Off (CP)

    Copilot checks with ground crew and other crew positions for power requirements prior to turning off electrical power.

17. Battery - OFF (CP)

18. Cartridge Start Circuit Breakers - Pulled (P)

19. AGM-28 B-52 Power Switches - OFF (N)

20. Interphone Switch - OFF (P)

21. ALE-20 Safety Interlock Switch Door - Open, streamer installed (EW)

DAILY ALERT PREFLIGHT CHECKLIST (Aircraft on Alert Line — Copilot reads)

1. Cartridge Start Switches - Checked OFF (CP)

   Check that the spring-loaded switches are in the OFF position.

2. Readiness Switch Cover - Closed and sealed (P)

3. Interphone Switch - ON (P)

3A. CSS Indicator Windows A - Checked "A" (RN)

NOTE

Cease all activity and request CSS custodians (through the Command Post) if any CSSC indicator window is found set to other than "A."

4. Special Weapons Manual Lock Handle - Sealed (EW)

5. SWESS Arm-Safe Switches **Less** A - SAFE and sealed (P-RN)

6. Radar Navigator's & Navigator's Station:

   a. Salvo Power Circuit Breaker - Checked out (RN)

   b. Normal Release Circuit Breaker - Checked out (RN)

   c. External Rel Circuit Breaker B-52D - Checked out (RN)

   d. Emer Door Open & Rel Circuit Breaker B-52D - Checked out (RN)

   e. ASM Separation (4) & Jettison Control (2) Circuit Breakers - Checked out (N)

   f. ASM Auto Nav AC PWR A, B & C (3) Circuit Breakers - Out

   g. All Other Circuit Breakers - In (RN-N)

   h. Release Circuits Disconnect - Disconnected, sealed (RN)

   i. Master Bomb Control Switch - OFF (RN)

   j. Bombing System Switch - MANUAL (RN)

   k. Forward & Rear Special Weapons Manual Release Handles - Stowed, sealed (RN)

   l. External Missile Manual Release Handle - Sealed (RN)

   m. DCU-9/A Control Levers - OS and sealed (RN/N)

   n. DCU-9A Selector Switches - OFF (RN/N)

   o. AGM-28 Armament Selector Switches - OFF, sealed (N)

   p. AGM-28 Launch Switches - OFF (guard closed) (N)

   q. Pressure Bulkhead Door - Closed, latched, and locked (N)

   r. Emergency Armed Release Switch B-52D - OFF, sealed (RN)

7. Parking Brake Preload Pressure - Normal (P)

8. Pitot Heat & Windshield Anti-Ice - OFF (P)

DAILY ALERT PREFLIGHT CHECKLIST (Aircraft on Alert Line — Copilot reads) (Cont)

9. Electronic Warfare Section:
    a. Chaff & Flare Circuit Breakers - Out (EW)
    b. APR-25 Circuit Breaker - Out (EW)
    c. DOC & SUD Dispense Switches - Guards down (EW)
    d. Transmitter Mode Switches - Standby (EW)
    e. ECM Power Switches - OFF (EW)

10. Gunner's Station:
    a. FCS Control Panel Switches - OFF/SAFE and pinned (G)
    b. Radar Control Panel Switches - Normal and OFF (G)
    c. Gun Charger Pressure Gage (if installed) - Checked (G)

11. Voltage - Checked (CP)

12. Battery - ON (CP)

13. External Power - Checked and ON (CP)

13A. IFF Mode 4 ZV - As briefed (P)

14. Flaps - Clear, down (CP)

15. Ground, check hydraulic pack preloads and flap well (P)

15A. Low Pressure Lights - Checked (G)

After external power is applied, turn standby switch on AUX radar panel ON and check for low pressure condition. If low pressure lights remain on for more than 5 minutes, maintenance should be called.

16. Crew Report - Station check complete (ALL)

17. Oxygen Quantity - Checked (P)

18. Forward TR Units - Checked (GC)

19. Hydraulic Pack Preloads & Flap Well - Checked (GC)

20. Portable Oxygen Bottles - Serviced and stowed (ALL)

21. Flaps - Clear, UP, lever OFF (Clear, lever UP 54▶ 138 W1▶ W34) (CP)

22. Landing Gear Standby Pump Pressures - Checked (P)

23. Special Weapons & ASM Lock Indicators - Indicate locked (RN)

DAILY ALERT PREFLIGHT CHECKLIST (Aircraft on Alert Line — Copilot reads) (cont)

23A. Coded Switch Set Controller (CSSC) A : (RN)

NOTE

> Cease all activity and request CSS custodians (through the Command Post) if the ENABLE light comes on at any time other than during the lamp test button check. For other abnormal indications, refer to "CSS Malfunction Analysis" in T.O. 1B-52C-25-2 or T.O. 1B-52C-30-1.

a. Oper/Mon Switch - MON, DISEN light on

Hold the OPER/MON switch in MON and check DISEN light on.

b. Lamp Test Button - Depressed

DISEN, ENABLE, and CODE lights should illuminate.

c. Sum Code_______ - Set

Set briefed sum code in CSSC by rotating thumbwheels.

NOTE

> Sum code need only be set and accomplished once during the current tour of alert unless there has been a change of aircraft or is required as a result of maintenance.

d. Oper/Mon Switch - OPER

Code light should blink until end of cycle (approximately 2 minutes).

e. Code & Disen Lights - On

Illumination of the CODE and DISEN lights verifies operation of system, that proper enable codes have been entered in the code enable switch, and that the system is disenabled.

f. Oper/Mon Switch - MON (momentarily)

CODE and DISEN lights should go off.

NOTE

> System status (enable/disenable) may be verified at any time by holding the OPER/MON switch in MON and observing DISEN and ENABLE light indication.

g. CSSC Indicator Windows - Set all "A's"

24. Special Weapons Monitor Check (multiple carriage): (RN)

a. SWK Monitor Select Switch - First bomb to be released

b. DCU-9A Selector Switch - SAFE

c. DCU-9A Warning Light - Off, tested

Check light off and tested for each position of the SWK box.

d. SWK Monitor Select Switch - OFF

e. DCU-9A Warning Light - Off, tested

If warning light comes on when pressed to test, call qualified personnel.

f. DCU-9A Selector Switch - OFF

DAILY ALERT PREFLIGHT CHECKLIST (Aircraft on Alert Line — Copilot reads) (cont)

25. Special Weapons Monitor Check (single carriage): (RN)
    - a. DCU-9A Selector Switch(es) - SAFE
    - b. DCU-9A Warning Light(s) - Off, tested
    - c. DCU-9A Selector Switch(es) - OFF
26. SWK Box Illumination Control - Full CCW (RN)
27. AGM-28 - Checked (N)
    - a. Safe Time Interval Knobs - 30 minutes
    - b. Flight Control Power Switches - OFF
    - c. Tactical Altitude Selector Switches - LOW
    - d. Missile Power Switches - OFF
    - e. B-52 Power Switches - ON
    - f. Armament Selector Switches - SAFE
    - g. Warning Lights - Off, tested

      If light does not illuminate during test, refer to T.O. 1B-52C-30-1A.
    - h. Warhead Lights - Off, tested
    - i. Armament Selector Switches - OFF, sealed
    - j. B-52 Power Switches - OFF (ground alert only)
28. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - ST (climatic) (P)

    Hydraulic pack switches will be placed in ST only when OAT is 0°C (32° F) or below if external air is going to be applied for heating.
29. External Power - Off (CP-GC)
30. Battery Switch - OFF (CP)
31. Interphone Switch - OFF (P)
32. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET (climatic) (P)
33. Circuit Breakers - Checked (P-CP)
34. Pitot Heat & Windshield Anti-Ice - ON and NORMAL (P)

NOTE

When a requirement exists to apply external power to a cocked aircraft, insure that pitot heat and windshield anti-ice switches are turned off prior to application of power. Reaccomplish steps "28" thru "34" of checklist before leaving the aircraft.

35. Flash Blindness Equipment - Checked (ALL)

    Flash blindness equipment (gold goggles, eye patches, etc) will be checked and positioned in accordance with command directives.

DAILY ALERT PREFLIGHT CHECKLIST (Aircraft on Alert Line — Copilot reads) (cont)

Exterior Check

1. Pilots will complete visual inspection checking for hydraulic leaks, fuel leaks, and general condition.
2. Bomb preflight inspections will include accomplishment of all steps in T.O. 1B-52C-25-2CL-1.

   The Bomb Preflight need only be accomplished once during the current tour of alert unless there has been a change of aircraft or is required as a result of maintenance.
3. Missile Preflight

   The Missile Preflight need only be accomplished once during the current tour of alert unless there has been a change of aircraft or is required as a result of maintenance.

POSTURE 3/4

Normally, POSTURE 3/4 will be assumed from one of the following aircraft configurations (based upon the degree of progression into the launch procedure):

- Alert configured and fully cocked
- One or more engines started
- All engines started

If engines have not been started, the "Starting Engines and Before Taxiing Checklist" will be accomplished up to "Start External Air." If the engines have been started, accomplish the following checklist to shut down the engines.

POSTURE 3/4 Shutdown (Pneumatic) Checklist

1. Hydraulic Packs 5, 6, 7, 8, 9, and 10 - OFF (P)

2. Air Conditioning - RAM (CP)

2A. IFF Mode 4 **IV** - As briefed (P)

3. Air Bleed Switches - OPEN (CP)

4. Alternator Switches - OFF (CP)

5. External Power - OFF, Checked, ON (CP)

6. Throttles - 75% rpm, then CLOSED (P-CP)

7. Ground, Connect External Air Hose - Roger (GC)

8. Hydraulic Pack Switches - OFF & RESET (guards open) (P)

NOTE

Reaccomplish the "Starting Engines and Before Taxiing Checklist" up to "Start External Air."

POSTURE 3/4 Shutdown (Cartridge) Checklist

1. Air Bleed Switches - OPEN (CP)

2. Air Conditioning - RAM (CP)

2A. IFF Mode 4 **IV** - As briefed (P)

3. Hydraulic Pack Switches (except No. 1) - OFF & RESET (guards open) (P)

4. Alternators (external power available) - OFF (CP)

5. Aft Alternators (external power not available) - OFF (CP)

6. External Power (if available) - OFF, checked and ON (CP)

7. Throttles (except No. 3 and 5) - 75% rpm then CLOSED (P-CP)

   Copilot will monitor air pressure and overload lights to assure sufficient air to maintain normal alternator operation.

8. Cartridge Start Switches - Checked OFF (CP)

   Check that the spring-loaded switches are in OFF position.

9. Cartridge Start Circuit Breakers - Pulled (P)

10. Cartridges Installed on Engines 2 & 8 (GC)

11. Cartridge Start Circuit Breakers - Set (P)

12. Forward Alternators - OFF (CP)

    Alternators will not be shut down until external power is available.

13. External Power - ON (CP)

14. Throttles No. 3 and 5 - 75% rpm then CLOSED (P)

15. No. 1 Hydraulic Pack Switch - OFF & RESET (guard open) (P)

16. Engine Starter Switches - No. 2 and 8 START and FLIGHT START (CP)

NOTE

Reaccomplish the "Starting Engines and Before Taxiing Checklist" up to "Start Engines."

POSTURE 5 RECOCKING CHECKLIST
(Power On Configuration — Copilot reads)

NOTE

- Posture 5 may be assumed from a normal alert posture. Assumption from this posture will require completion of the Posture 5 Cocking/Recocking Checklist. If engines are not started, accomplish only askerisked items.
- Posture 5 may also be assumed through normal generation procedures. Assumption from this method requires completion of all checklists through Starting Engines and Before Taxiing prior to accomplishing the Posture 5 Cocking/Recocking Checklist. The Posture 5 Cocking/Recocking Checklist may be used after starting engines to taxi to the Posture 5 parking area, if applicable.
- Windows may be left open as provided in the checklist but hatches will remain closed except as provided in local plans for crew relief and/or changeover.
- Flight crews will insure that takeoff data and trim are updated at all times as climatic conditions require. Any significant change will be reviewed by the pilot, copilot, and navigator.
- Insure that aircraft is parked where Command Post radio reception is possible.
- Ground crew support for engine start must be provided from additional sources. Ground power equipment will be hooked in tandem with the fast ride vehicle for quick removal by the crew chief prior to taxiing.

*1. SIF/IFF - STBY (STDBY) (P)

*2. Pitot Heat & Windshield Anti-Ice - OFF (P)

*3. Water Injection Switches - OFF (P)

4. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET, master warning light reset (P)

5. Stabilizer & Spoiler Standby Pumps - OFF (P)

NOTE

Unless local conditions and/or command directives dictate otherwise, steps "6" and "7" should be accomplished as soon as practical to conserve fuel.

6. Aft Alternators - OFF (CP)

7. Throttles 1, 2, 7 & 8 - 75% rpm, then CLOSED (P-CP)

8. Arming Lever Safety Pins (No. 1) - Installed (P-CP)

*9. Radar Altimeter - OFF (P)

10. AGM-28 Engine Control Knobs - OFF (CP)

11. Fuel Transfer - As required (CP)

Fuel may be transferred as necessary for local refueling procedures.

12. Brakes - Set (P)

*13. Anticollision & Nav Lights - OFF and FLASH (P)

14. Engine & Nacelle Anti-Icing Switch - OFF (P)

15. Bomb Doors - CLOSED (P/RN)

POSTURE 5 RECOCKING CHECKLIST
(Power On Configuration — Copilot reads) (Cont)

16. Cartridge Start Switches - Checked OFF (CP)

Check that the spring-loaded switches are in OFF position.

17. Engine Starter Switches - OFF and GROUND START (CP)

18. Air Bleed Switches - OPEN (CP)

19. Sliding Window - Open (CP)

20. Air Conditioning - RAM (CP)

21. Flaps - As required (CP)

Flap position may be up or down as dictated by climatic conditions and removal of ground power equipment.

*22. Fuel Switches - 13, 14, 15 & 16 ON, crossfeed valves 9 & 12 OPEN, all others OFF (CP)

22A. IFF Mode 4 **ZV** - As briefed (P)

23. Wheel Chocks - In place (GC)

24. Hydraulic Pack Switches (except No. 1) - OFF & RESET (guards open) (P)

25. Alternators (external power available) - OFF (CP)

26. External Power - OFF, checked, and ON (CP)

27. Throttles (except No. 3 & 5) - 75% rpm then CLOSED (P-CP)

Copilot will monitor air pressure and overload lights to assure sufficient air to maintain normal alternator operation.

28. Cartridge Start Circuit Breakers - Pulled (P)

29. Cartridges Installed on Engines 2 and 8 (GC)

30. Forward Alternators - OFF (CP)

31. Throttles No. 3 & 5 - 75% rpm then CLOSED (P)

32. No. 1 Hydraulic Pack - OFF & RESET (guard open) (P)

33. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - ST (climatic) (P)

34. Engine Starter Switches - No. 2 and 8 START and FLIGHT START (CP)

35. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET (climatic) (P)

36. Oxygen - OFF and 100% (ALL)

37. Parking Brakes - OFF (P)

*38. Antiskid Switch - ON, guard closed (P)

If the aircraft has been towed, reposition the antiskid switch to ON, guard closed.

39. Sliding Windows - As required (P-CP)

40. Circuit Breakers - Set (P-CP)

Check that circuit breakers are reset after starter cartridges are installed.

POSTURE 5 RECOCKING CHECKLIST
(Power On Configuration — Copilot reads) (Cont)

41. Downlocks & Bypass Keys - Stowed (N-GC)

If the aircraft has been towed, ascertain that the downlocks and bypass keys have been removed and stowed.

*42. Nav Lights - OFF (P)

*43. Landing Gear Standby Pump - OFF (P)

*44. Radios (except No. 2 UHF) - OFF (P-CP)

*45. Entrance Hatches - As required (P-N-GC)

*46. Fuel Switches 13, 14, 15 & 16 - OFF (CP)

*47. Heading Indicator (Gyro) - Checked and set (P/CP)

This could be the primary heading reference during takeoff.

*48. Circuit Breakers - As required (P-CP)

NOTE

To increase service life of equipment, the following circuit breakers should be pulled.

a. Oil pressure indicators

b. Fuel flow indicators

c. Fuel quantity indicators

d. Turn and slip indicators

e. Auto pilot (all)

f. Yaw damper

*49. Gyro Power Switch - OFF (P)

*50. Compass & True Heading Computer Shutoff Switch - OFF (RN/N)

POSTURE 5 SCRAMBLE CHECKLIST
(Power On Configuration — EW reads)

During Posture 5 Power ON configuration, use the following Scramble checklist.

1. **FUEL FLOW, OIL PRESSURE & TURN & SLIP INDICATORS CIRCUIT BREAKERS — RESET (P-CP)**

2. **STANDBY PUMP SWITCHES — ON (P)**

3. **GYRO POWER SWITCH — ON (P)**

4. **PITOT HEAT & WINDSHIELD ANTI-ICE — ON AND NORMAL (P)**

5. **RADIOS — ON (CP)**

No. 1 UHF and VOR radio should be turned on.

6. **FUEL SWITCHES 13, 14, 15 & 16 — ON (CP)**

Fuel transfer should be initiated as soon as practicable.

POSTURE 5 SCRAMBLE CHECKLIST
(Power On Configuration — EW reads) (Cont)

7. **PARKING BRAKES — SET (P)**

8. **START ENGINES — STARTED (P-CP)**

9. **ALTERNATORS ON THE LINE — CHECKED (CP)**

10. **HYDRAULIC PACKS — ON, LIGHTS OUT (P)**

11. **WINDOWS & HATCHES — CLOSED (P-CP-N-GC)**

12. **GROUND REMOVE WHEEL CHOCKS, CLEAR AIRCRAFT FOR TAXI, DISCONNECT INTERPHONE — ROGER (GC)**

NOTE

Taxiing may be initiated at any time when a visual signal is received indicating all equipment and personnel are clear.

13. **ANTICOLLISION & NAV LIGHTS — ON AND STEADY (P)**

14. **FLAP LEVER — DN (CP)**

Lower flaps after clear of ground power equipment.

15. **WATER INJECTION SWITCHES — ON (IF APPLICABLE), LIGHTS CHECKED (P)**

16. **SURFACE & NACELLE ANTI-ICE — CLIMATIC (P)**

17. **AIR BLEED SWITCHES — CLOSED (CP)**

18. Circuit Breakers - Reset (P-CP)

NOTE

Circuit breakers located on the pilot, copilot, and overhead panels may be reset prior to takeoff.

19. **COMPASS & TRUE HEADING COMPUTER SHUTOFF SWITCH — ON (RN/N)**

20. **STABILIZER TRIM — CHECKED FOR TAKEOFF SETTING (P-CP)**

21. **STARTER SELECTOR — FLIGHT START (CP)**

22. **STARTERS — ON (IF APPLICABLE) (CP)**

23. **TAKEOFF DATA — REVIEWED (P-CP-N)**

Review S_1 speed and time.

24. SIF/IFF (if applicable) - NORM (mode and code as briefed) (P)

25. **TAKEOFF — USE NORMAL TAKEOFF PROCEDURES (P-CP)**

NOTE

- Pilots will monitor extension of flaps to insure flaps are 50% extended taking the runway. Copilot will check flap indicator for full extension at the 70 knot call.

- After the aircraft is safely airborne, the "Starting Engines and Before Taxiing," "Taxiing," and "Before Lineup" checklists should be reviewed and applicable items not previously completed should be performed when time permits.

POSTURE 5 RECOCKING CHECKLIST
(Power Off Configuration — Copilot reads)

NOTE

- Posture 5 may be assumed from a normal alert posture. Assumption from this posture will require completion of the Posture 5 Recocking Checklist. If engines are not started, accomplish only applicable items. Posture 5 may also be assumed through normal generation procedures. Assumption from this method requires completion of all checklists through Starting Engines and Before Taxiing to cock the aircraft. The Posture 5 Recocking Checklist may be used after starting engines to taxi to the Posture 5 parking area, if applicable.
- Windows may be left open as provided in the checklist, but hatches will remain closed except as provided in local plans for crew relief and/or changeover.
- Flight crews will insure that takeoff data and trim are updated at all times as climatic conditions require. Any significant change will be reviewed by the pilot, copilot, and navigator.
- Insure that aircraft is parked where Command Post radio reception is possible.
- Ground crew support for engine start must be provided from additional sources.

1. SIF/IFF - STBY (STDBY) (P)
2. Pitot Heat & Windshield Anti-Ice - OFF (P)
3. Water Injection Switches - OFF (P)
4. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET, master warning light reset (P)
5. Stabilizer & Spoiler Standby Pumps - OFF (P)

NOTE

Unless local conditions and/or command directives dictate otherwise, steps "6" and "7" should be accomplished as soon as practical to conserve fuel.

6. Aft Alternators - OFF (CP)
7. Throttles 1, 2, 7 & 8 - 75% rpm, then CLOSED (P-CP)
8. Arming Lever Safety Pins (No. 1) - Installed (P-CP)
9. Radar Altimeter - OFF (P)
10. AGM-28 Engine Control Knobs - OFF (CP)
11. Fuel Transfer - As required (CP)

    Fuel may be transferred as necessary for local refueling procedures.
12. Brakes - Set (P)
13. Anticollision & Nav Lights - OFF and FLASH (P)
14. Engine & Nacelle Anti-Icing Switch - OFF (P)

POSTURE 5 RECOCKING CHECKLIST
(Power Off Configuration — Copilot reads) (Cont)

15. Bomb Doors - CLOSED (P/RN)

16. Cartridge Start Switches - Checked OFF (CP)

    Check that the spring-loaded switches are in OFF position.

17. Engine Starter Switches - OFF and GROUND START (CP)

18. Air Bleed Switches - OPEN (CP)

19. Sliding Window - Open (CP)

20. Air Conditioning - RAM (CP)

21. Flaps - As required (CP)

    Flaps may be up or down as dictated by climatic conditions and removal of ground power equipment.

22. Fuel Switches - 13, 14, 15 & 16 ON, crossfeed valves 9 & 12 OPEN, all others OFF (CP)

23. Wheel Chocks - In place (GC)

24. Hydraulic Pack Switches (except No. 1) - OFF & RESET (guards open) (P)

25. Throttles (except No. 3 & 5) - 75% rpm then CLOSED (P-CP)

    Copilot will monitor air pressure and overload lights to assure sufficient air to maintain normal alternator operation.

26. Cartridge Start Circuit Breakers - Pulled (P)

27. Cartridges Installed on Engines 2 and 8 (GC)

28. Forward Alternators - OFF (CP)

29. Throttles No. 3 & 5 - 75% rpm then CLOSED (P)

30. No. 1 Hydraulic Pack - OFF & RESET (guard open) (P)

31. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - ST (climatic) (P)

32. Battery - OFF (CP)

33. Engine Starter Switches - No. 2 and 8 START and FLIGHT START (CP)

34. Hydraulic Packs 5, 6, 7, 8, 9 & 10 - OFF & RESET (climatic) (P)

35. Oxygen - OFF and 100% (ALL)

36. Parking Brakes - OFF (P)

37. Pitot Heat & Windshield Anti-Ice - ON and NORMAL (P)

38. SIF/IFF - NORM (mode and code as briefed) (P)

39. Antiskid Switch - ON, guard closed (P)

    If the aircraft has been towed, reposition the antiskid switch to ON, guard closed.

40. Interphone - OFF (P)

POSTURE 5 RECOCKING CHECKLIST (Power Off Configuration — Copilot reads) (Cont)

41. Sliding Windows - As required (P-CP)

42. Circuit Breakers - Set (P-CP)

    Check that circuit breakers are reset after starter cartridges are installed.

43. Entrance Light - OFF (P)

44. Downlocks & Bypass Keys - Stowed (N-GC)

    If the aircraft has been towed, ascertain that the downlocks and bypass keys have been removed and stowed.

45. Entrance Hatches - As Required (P-N-GC)

POSTURE 5 SCRAMBLE CHECKLIST (Power Off Configuration — EW reads)

During Posture 5 Power OFF configuration, use the following Scramble checklist.

1. **INTERPHONE — ON (P)**
2. **BATTERY SWITCH — ON (CP)**
3. **PARKING BRAKES — SET (P)**
4. **START ENGINES — STARTED (P-CP)**
5. **ALTERNATORS — ON THE LINE (CP)**
6. **HYDRAULIC PACKS — ON, LIGHTS OUT (P)**

6A. **STANDBY PUMP SWITCHES — ON (P)**

7. **WINDOWS & HATCHES — CLOSED (P-CP-N-GC)**
8. **GROUND REMOVE WHEEL CHOCKS, CLEAR AIRCRAFT FOR TAXI, DISCONNECT INTERPHONE — ROGER (GC)**

NOTE

Taxiing may be initiated at any time when a visual signal is received indicating all equipment and personnel are clear.

8A. **ANTICOLLISION & NAV LIGHTS — ON AND STEADY (P)**

9. **FLAP LEVER — DN (CP)**

   Lower flaps after clear of ground power equipment.

10. **WATER INJECTION SWITCHES — ON (IF APPLICABLE), LIGHTS CHECKED (P)**
11. **SURFACE & NACELLE ANTI-ICE — CLIMATIC (P)**
12. **AIR BLEED SWITCHES — CLOSED (CP)**
13. **STABILIZER TRIM — CHECKED FOR TAKEOFF SETTING (P-CP)**

13A. **BOMB DOORS — CLOSED (IF APPLICABLE) (P/RN)**

POSTURE 5 SCRAMBLE CHECKLIST
(Power Off Configuration — EW reads) (Cont)

14. STARTER SELECTOR — FLIGHT START (CP)

15. STARTERS — ON (IF APPLICABLE) (CP)

16. TAKEOFF DATA — REVIEWED (P-CP-N)

Review S_1 speed and time.

17. TAKEOFF — USE NORMAL TAKEOFF PROCEDURES (P-CP)

NOTE

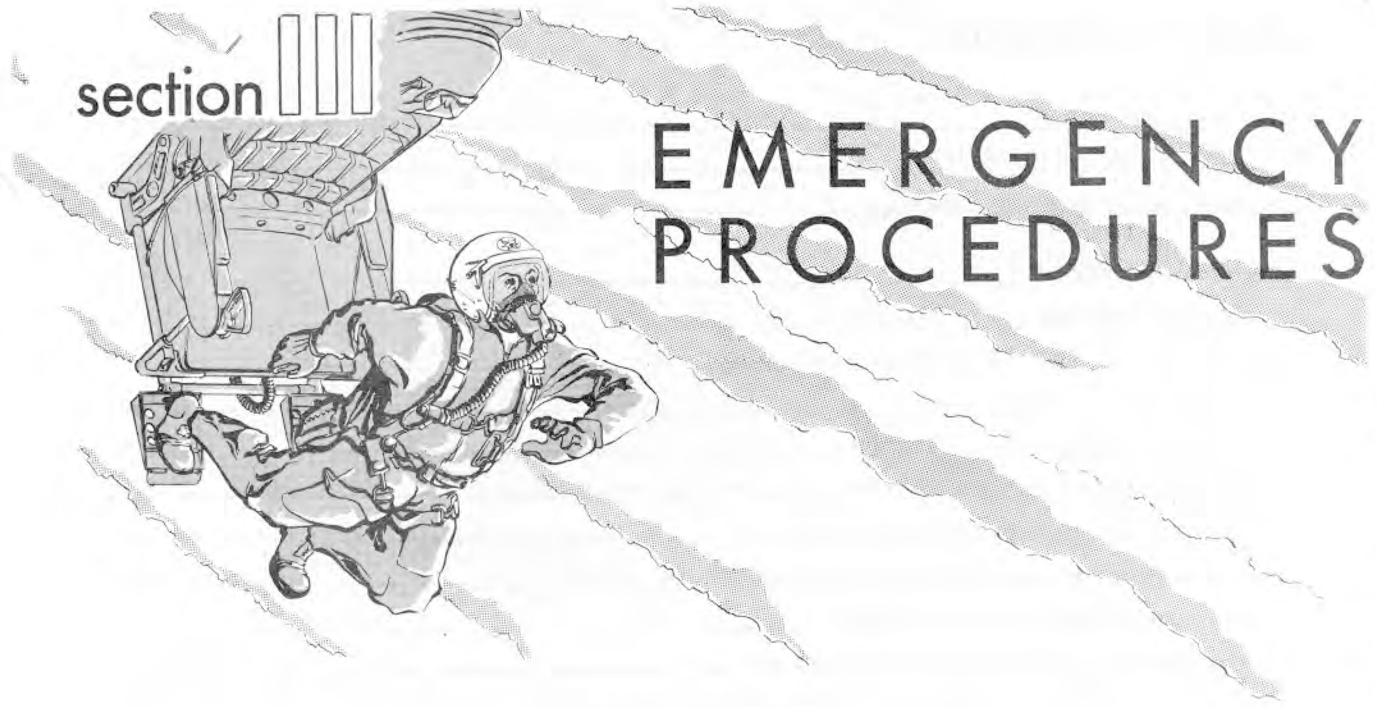
- Pilots will monitor extension of flaps to insure flaps are 50% extended taking the runway. Copilot will check flap indicator for full extension at the 70 knot call.
- After the aircraft is safely airborne, the "Starting Engines and Before Taxiing," "Taxiing," and "Before Lineup" checklists should be reviewed and applicable items not previously completed should be performed when time permits.

ACCEPTANCE AND/OR FUNCTIONAL CHECK FLIGHT CHECKS

Procedures and criteria for functional check flights will be accomplished in accordance with T. O. 1B-52B-6CF-1 and T. O. 1B-52B-6CF-1-1, Acceptance and/or Functional Check Flight Procedures Manuals. Each manual contains amplified checklists identified as "Before Inflight Checklists," "Inflight System Operational Checks," and "After Inflight Checklists." Flight crew abbreviated checklists are contained in T. O.'s 1B-52B-6CL-1 thru -5. The "Emergency Procedures" contained in T. O. 1B-52C-1 will be used. Aircraft requiring functional check flights are redelivered aircraft, modification maintenance aircraft, and aircraft wherein maintenance performed requires a functional check flight as specified in T. O. 1-1-300.

section III

EMERGENCY PROCEDURES



INTRODUCTION

This section contains text and amplified checklists to describe procedures to be followed in any emergency except those in connection with auxiliary equipment. The text is divided into primary paragraphs in accordance with the type of emergency and, where applicable, is followed by an amplified checklist for that particular emergency. The amplified checklists describe in detail the action to be taken. Certain actions are printed in capital and bold face type. These actions are called "critical actions" and constitute the minimum required steps to be taken by a crewmember to insure survival and must be committed to memory. Each crewmember should be thoroughly acquainted with that information covering emergencies which may directly affect his actions.

All steps in each checklist must be accomplished when time permits in order to insure complete control of each emergency. In the event a multiple malfunction or failure occurs and the emergency procedures conflict, perform that procedure which will best control the most critical emergency.

Line items directing standard actions such as alerting the crew and maintaining directional control or items involving a crewmember's analysis and judgment of the particular situation (i.e., land as soon as practical) are not included as critical emergency steps, but will apply to all critical emergencies. The procedures in this section are based on the assumption that all crewmembers will be alerted to the emergency condition as soon as possible.

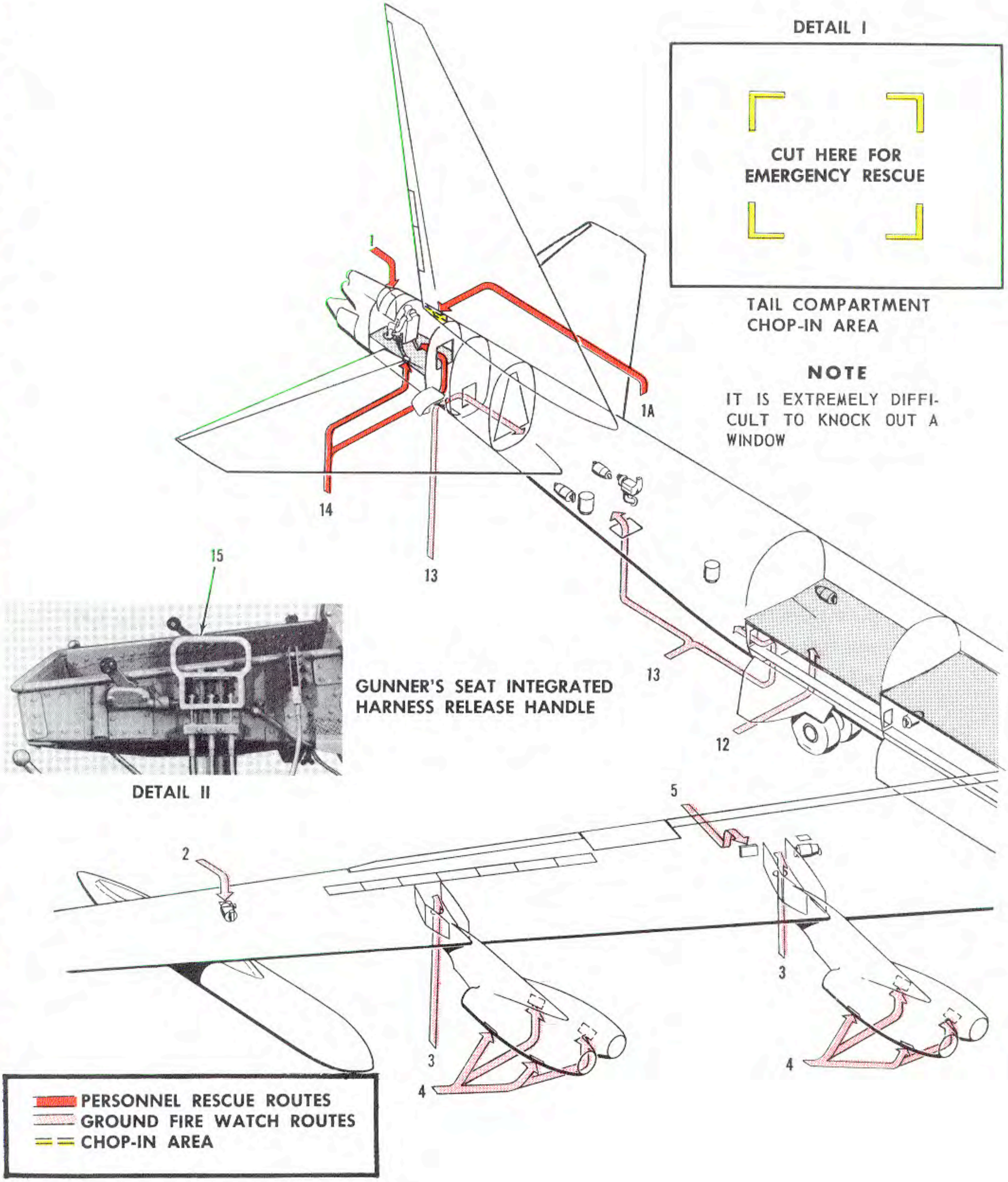
When accomplishing emergency steps, coordinated action by crewmembers is essential to insure each step is correctly completed in the proper sequence. Regular personnel coding is used to designate the crewmembers that will accomplish the actions.

STOP ——— THINK ——— COLLECT YOUR WITS

A thorough evaluation of each emergency should be made prior to initiating corrective action. Pilots must critically evaluate the necessity for an immediate landing versus continued flight or controlled bailout under emergency conditions.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT)



NOTE

IT IS EXTREMELY DIFFICULT TO KNOCK OUT A WINDOW

Figure 3-1 (Sheet 1 of 2).

1 Tail Compartment **ZR** – Access through Canopy by Use of Turret Jettison Handle which also Releases Canopy.

1A Tail Compartment Chop-In Area (See Detail I)

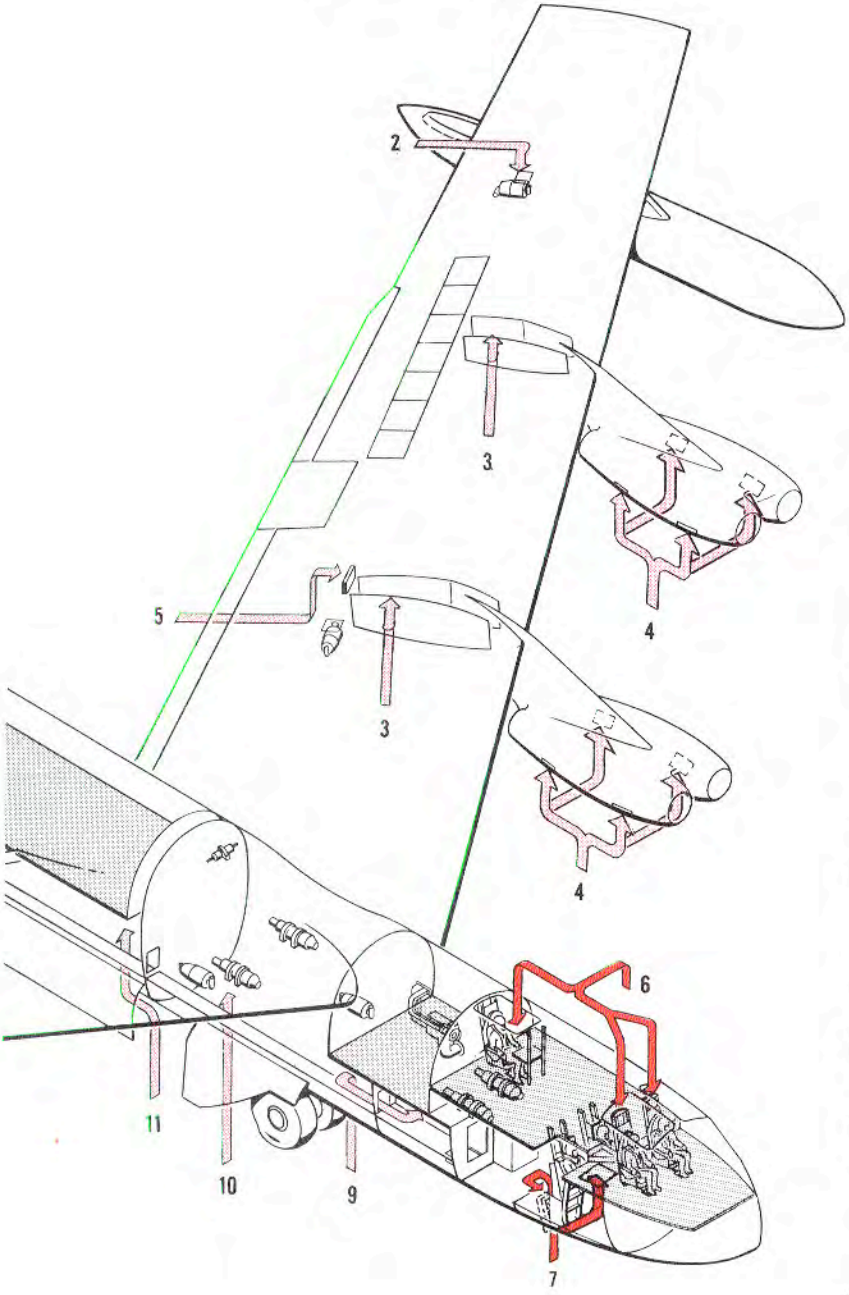
2 Hydraulic Packs – Access through Panels in Top and Bottom of Wing (2)

3 Wing Equipment Bays – Access through Panels in Bottom of Wing (4)

4 Engine Accessory and Combustion Section Knock-In Panels (Hinged, Spring-Loaded Doors on both sides of Nacelles) (4)

CAUTION

CO_2 should not be directed into the engine tailpipe unless a fire of serious proportions is restricted to this area and a bleed air supply or ground air source of supply is not immediately available. Engine motoring should be maintained to extinguish the fire in preference to the use of CO_2. However, if the application of CO_2 is necessary, allow the engine to be shut down, if possible, in order to minimize engine damage.



5 Electrical Equipment and Hydraulic Packs on Rear Spar – Access with Wing Flaps Down (2)

6 Control Cabin Emergency Entry through Pilot's, Copilot's, and EW Officer's Escape Hatches

7 Control Cabin Normal Entry and Radar Navigator's Escape Hatch

8 (Deleted)

9 Electrical Equipment in Alternator Compartment – Access through Front Wheel Well

10 Electrical Equipment and Air Bleed Turbines in Front Wheel Well

11 Wing Flap Motors in Center Wing Equipment Bay – Access through Bomb Bay

12 Electrical Equipment and Air Bleed Turbines in Rear Wheel Well

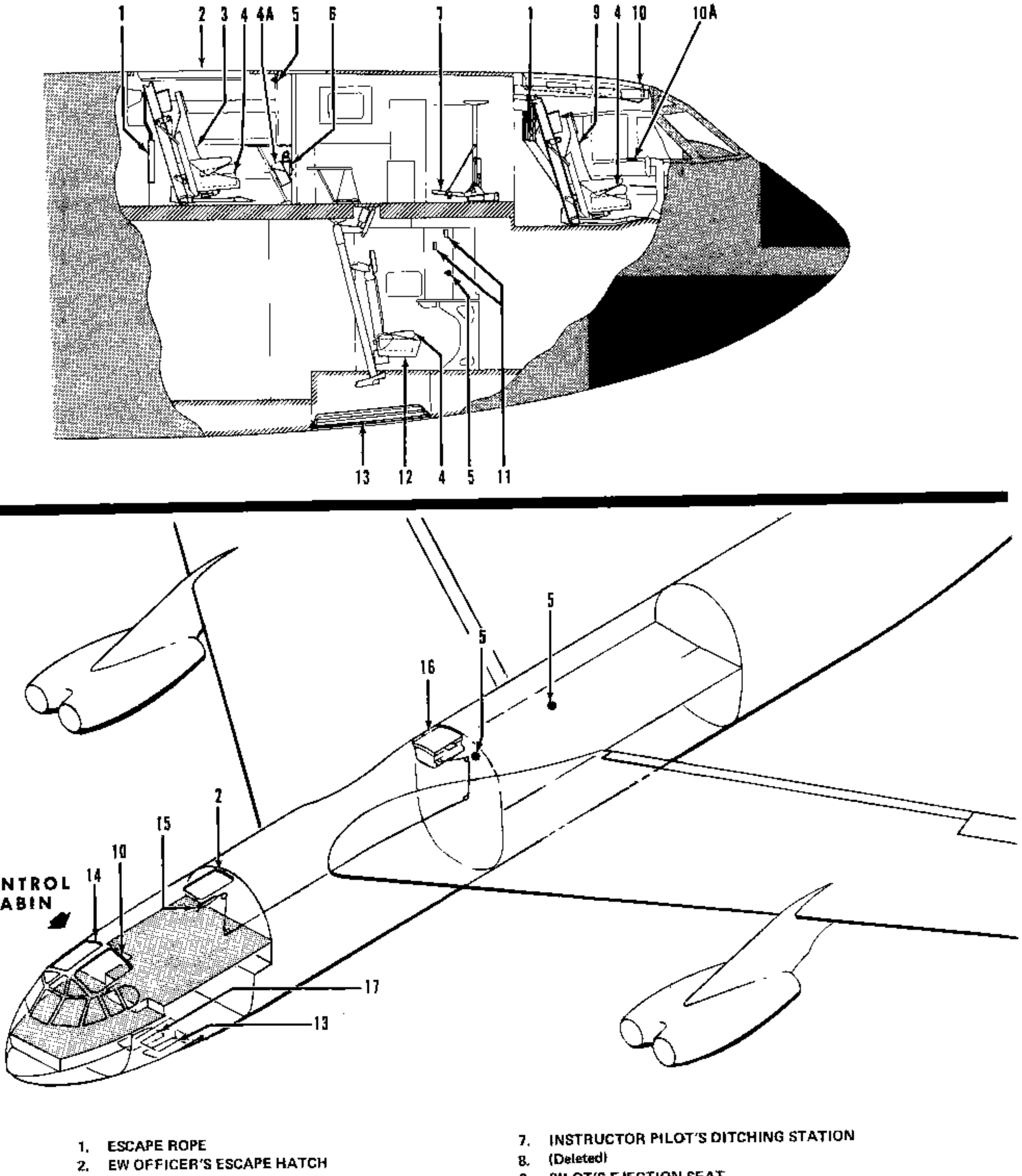
13 Electrical Equipment, Liquid Oxygen Converters, and Air Bleed Turbines in Aft Equipment Compartment – Access through Rear Wheel Well Aft Equipment Compartment Entrance Door or Aft Entry Door

14 Tail Compartment – Access through Aft Entry Door or by Use of Turret Jettison Handle (**ZR** , Handle Also Releases Canopy)

15 Gunner's Seat Integrated Harness Release Handle – Pull to Release Seat Occupant

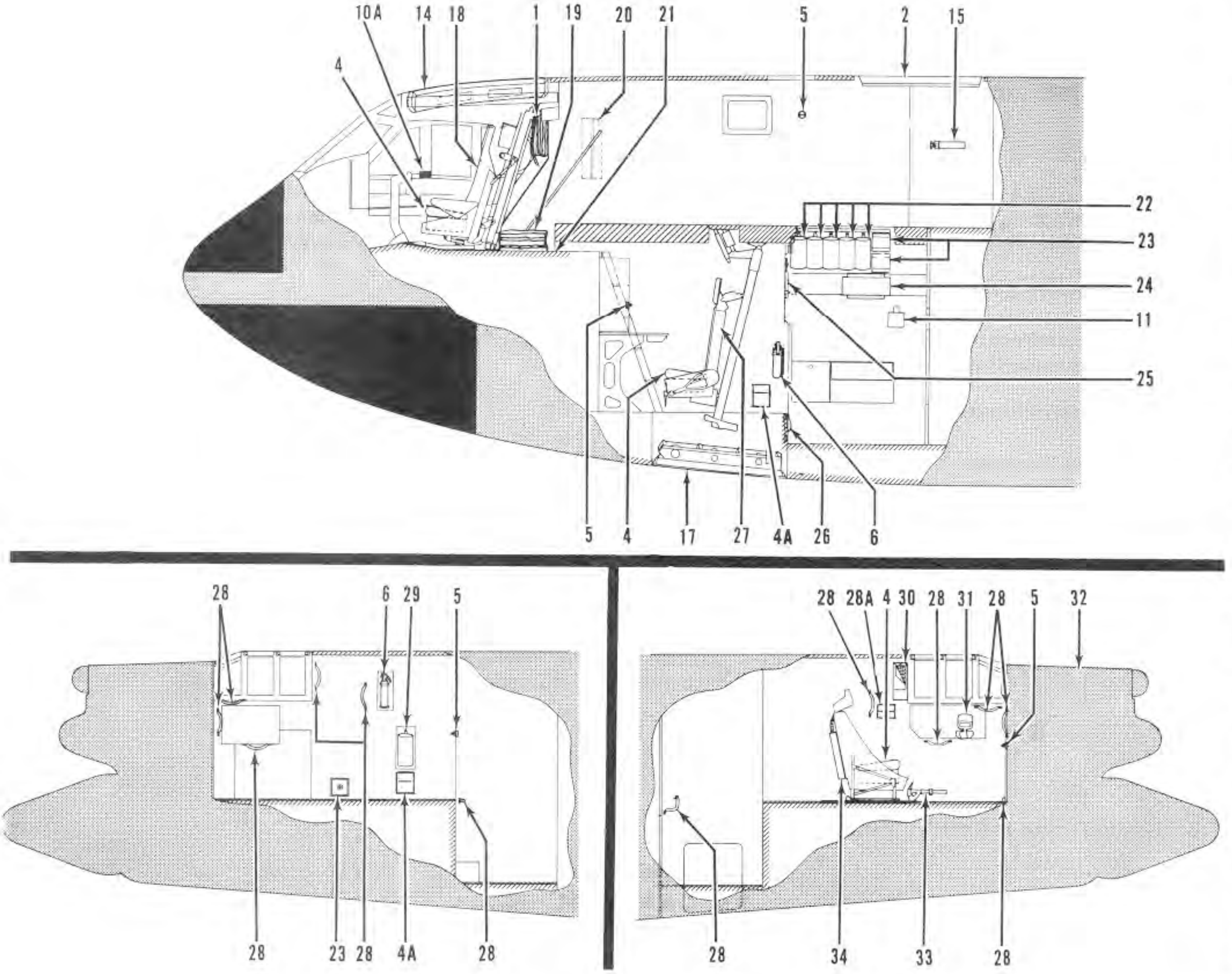
EMERGENCY ENTRANCE AND GROUND FIRE WATCH AREAS

Figure 3-1 (Sheet 2 of 2).



1. ESCAPE ROPE
2. EW OFFICER'S ESCAPE HATCH
3. EW OFFICER'S EJECTION SEAT
4. SURVIVAL KIT
4A. FIREFIGHTING CONTAINER
5. EMERGENCY ALARM LIGHT
6. FIRE EXTINGUISHER
7. INSTRUCTOR PILOT'S DITCHING STATION
8. (Deleted)
9. PILOT'S EJECTION SEAT
10. PILOT'S ESCAPE HATCH
10A. LIFERAFT DEFLATION TOOL
11. ALTERNATOR DECK INSPECTION MIRRORS
12. RADAR NAVIGATOR'S EJECTION SEAT

Figure 3-2 (Sheet 1 of 2).



13. RADAR NAVIGATOR'S ESCAPE HATCH
14. COPILOT'S ESCAPE HATCH
15. LIFERAFT EMERGENCY RELEASE HANDLE (INOPERATIVE)
16. LIFERAFT COMPARTMENT
17. NAVIGATOR'S ESCAPE HATCH
18. COPILOT'S EJECTION SEAT
19. RADAR NAVIGATOR'S DITCHING STATION
20. DITCHING HAMMOCK
21. INSTRUCTOR NAVIGATOR'S DITCHING STATION
22. ANTI-EXPOSURE SUITS (PROVISIONS FOR)
23. FIRST AID KITS
24. BATTLE DRESSING KIT (PROVISIONS FOR)
25. AXE
26. PARACHUTE STATIC LINE
27. NAVIGATOR'S EJECTION SEAT
28. GUNNER'S EMERGENCY ASSIST HANDLES
28A. CANOPY RELEASE HANDLE **ZR**
29. ANTI–EXPOSURE SUIT (PROVISIONS FOR)
30. ESCAPE ROPE **120** ▶ **W23** ▶
31. TURRET JETTISON HANDLE
32. TURRET
33. AXE
34. ESCAPE ROPE **54** ▶ **119** **W1** ▶ **W22**

EMERGENCY EQUIPMENT (Typical)

Figure 3-2 (Sheet 2 of 2).

GROUND EMERGENCIES

ENGINE FIRE ON THE GROUND

1. THROTTLE(S) — CLOSED (P)

An engine fire on the ground may be originated and supported by fuel, oil, or hydraulic fluid. When an indication of engine fire is evidenced, the affected engine throttle will be closed. If practicable, the throttle for the adjacent engine should be closed to aid personnel in putting out the fire.

2. FIRE SHUTOFF SWITCH(ES) — PULL (P/CP)

The affected engine fire shutoff switch will be pulled out to assure closing of the firewall fuel shutoff valves in case the throttle fails to do so.

3. Starter Switch(es) - ON (if air available) (CP)

The most effective means of extinguishing an engine fire is to motor the engine; therefore, it is necessary to have air available to the starter and the starter switch on. Continue motoring the engine until all evidence of the fire has disappeared.

CAUTION

- If engine fire occurs after starter dropout, it will be necessary to turn the starter switch to OFF and back to START in order to motor the engine.
- If engine fire occurs after closing the air bleed manifold valves, they must be reopened to supply bleed air for engine motoring in a nacelle in which the engines have been shut down.

4. Ground Crew & Control Tower - Notified (P/CP)

CAUTION

CO_2 should not be directed into the engine air inlet or tailpipe unless fire is restricted to those areas and is of serious proportions. Allow the engine to be shut down, if possible, in order to minimize engine damage if CO_2 is to be applied.

5. Starter Switch(es) - OFF (CP)

When fire is out or becomes uncontrollable by the crew, turn starter switches OFF.

6. Uncontrollable Fire - Abandon aircraft on pilot's order (ALL)

If fire becomes uncontrollable, shut down the remaining engines. The pilot will activate the abandon light and crewmembers will immediately evacuate the aircraft. An indication of engine fire without air available for motoring will result in a fire which is uncontrollable by the flight crew. Before leaving his position, the copilot will turn all fuel controls off or closed and will turn off the starter switches, battery switch, and external power switch. The pilot will direct the ground fire crew to extinguish the fire.

NOTE

If external power is connected, the pilot will notify the control tower of the fire prior to his evacuation.

WHEEL BRAKE SYSTEM FAILURE

1. ANTISKID SWITCH — OFF (P)

NOTE

When the antiskid switch is OFF, braking action depends entirely on the pressure applied to the brake pedals.

2. CHECK LANDING GEAR STANDBY PUMP SWITCH — ON (P)

3. HYDRAULIC PACKS 1 & 2 — RESTART (IF APPLICABLE) (P)

If hydraulic pressure is low on packs 1 and 2, momentarily place both 1 and 2 hydraulic pack switches to OFF & RESET, then back to ON. If adequate braking is not available, continue with the following steps.

4. THROTTLES 1, 2, 7 & 8 — CLOSED (P-CP)

NOTE

- Electrical power and hydraulic pressure source is provided by leaving the remaining engines operating. Steer aircraft to avoid collision. If a collision is imminent and the above procedures fail to slow or stop the aircraft, steer toward the selected ground course prior to shutting down remaining engines. Consider steering off prepared surface onto the adjacent sod to slow the aircraft.
- The above procedure is based on a minimum reaction time after brake failure occurs. Provided sufficient time is available and there are no requirements for electrical power (lighting, communications, etc), the total idle thrust may be further reduced by shutting down engines 3 and 6 after reducing bleed air requirements. In this instance, the procedure above could be modified beginning with step "5" as follows.

5. Hydraulic Packs 5 thru 10 - OFF (P)

6. Air Conditioning Master Switch - OFF (CP-G)

7. Anti-Icing Control Switch - OFF (P)

8. All Alternator Switches - OFF (CP)

9. Throttles 3 & 6 - CLOSED (P-CP)

NOTE

If it is necessary to taxi off prepared surfaces to avoid collision or if collision is imminent, engines 4 and 5 should not be shut down until the best ground course is selected because engine bleed air is required to provide steering.

TAKEOFF EMERGENCIES

ABORTED TAKEOFF

In event a takeoff emergency arises as a result of engine fire, tire failure, fire during ground roll, or other aircraft malfunction necessitating an aborted takeoff, the procedure to be followed for aborting shall always be the same. Refer to the following checklist for a standard step-by-step procedure for aborting takeoff.

WARNING

Takeoff will not be aborted after S_1 unless, in the opinion of the pilot, the emergency renders the aircraft definitely unsafe to attain emergency bailout altitude. In those cases where the pilot attempts to abort after S_1, he must accept the fact that he will probably fail to stop within the confines of the runway.

ABORT

1. THROTTLES — IDLE (P)

2. AIRBRAKES — SIX (P)

3. DRAG CHUTE — DEPLOY (CP)

The drag chute will be deployed at airspeeds above 70 knots. The maximum drag chute deployment speed is 135 knots.

4. BRAKES — APPLY (P)

Full brakes should be applied with the antiskid switch ON.

CAUTION

A ground loop should not be attempted at heavy gross weights since structural failure may occur at speeds above 30 knots. A turn of any kind should not be attempted unless conditions straight ahead appear more hazardous.

5. AGM-28 Engine Control Knobs - GRD START (CP)

WARNING

In the event of complete loss of ac power, no power is available to shut down AGM-28's with the engine control knobs. By using the emergency shutoff switches, switched battery power is available to shut down AGM -28's.

6. Control Tower - Notified (P/CP)

7. Brake Energy Limits - Checked (P/CP)

Refer to instructions provided in Section V to determine the heat energy absorbed during the abort.

TAKEOFF WITH ONE OR MORE ENGINES INOPERATIVE

Takeoff with one or more engines inoperative is not recommended. However, if conditions are such that it becomes necessary or desirable to fly the aircraft to another location, such takeoffs are possible. It will be necessary to consider carefully the field altitude, ambient runway temperature, available runway length, wind velocity, and gross weight at takeoff. With low takeoff gross weight plus the added thrust which can be obtained by water injection to compensate for high ambient field temperatures or high field elevations, or both, a successful takeoff will be possible by use of the normal takeoff procedure. Charts are provided in Parts 2 and 3 of the Appendix giving takeoff distances required for seven- and six-engine takeoffs with water injection and for seven engines without water injection.

CAUTION

It is recommended that no takeoffs be made with more than two engines inoperative on the same side.

SIMULATED FAILURE OF ONE ENGINE DURING TAKEOFF

Simulated failure of an engine will not be practiced below decision speed. No more than one engine will be failed at one time.

ENGINE FIRE ON TAKEOFF

If a fire warning light comes on after takeoff is committed, the engine indicators should be checked for evidence of loss of power or a pneumatic air bleed leak and engine nacelles checked visually for evidence of fire. Do not retard the throttle for the engine on fire if its thrust is needed for takeoff unless the engine has completely lost thrust or is vibrating seriously. When the landing gear and wing flaps have been retracted and a safe altitude is reached, retard the throttle for the engine on fire to IDLE to see if the fire warning light will go out. If light remains on, retard throttle to CLOSED and use, "Emergency Shutdown" procedure, this section. If light goes out, the engine should be shut down when thrust requirements permit. The source of heat can cause unnecessary additional heat damage to the engine or its accessories even though the temperature has been reduced sufficiently for the light to go out.

ENGINE FAILURE DURING TAKEOFF

TAKEOFF RUN

The possibility of an engine failure during the takeoff run influences takeoff procedure and should always be considered and planned for prior to the time the takeoff run is started. When an engine failure occurs on takeoff, the pilot must be able to stop on the runway remaining or continue the takeoff safely. To aid the pilot in making a decision to stop or continue takeoff, charts are presented in Parts 2 and 3 of the Appendix from which may be determined the decision speed and time (S_1). A check of the airspeed at S_1 will indicate how the aircraft is accelerating. A failing engine may be detected in this manner and, if the decision speed has not been reached, the takeoff must be aborted.

WARNING

Takeoff will not be aborted after S_1 unless, in the opinion of the pilot, the emergency renders the aircraft definitely unsafe to attain emergency bailout altitude. In those cases where the pilot attempts to abort after S_1, he must accept the fact that he will probably fail to stop within the confines of the runway.

TAKEOFF CONTINUED

NOTE

If for some reason a crash landing must be made, the touchdown should be accomplished in a wings-level attitude.

Landing Gear

If an engine fails during or immediately after the takeoff, climb performance is considerably reduced until the landing gear is retracted. Gear drag lowers the rate of climb approximately 450 feet per minute at takeoff with flaps down on a 400, 000-pound aircraft. Therefore, the landing gear should be retracted as soon as possible after the aircraft is airborne. An engine failure decreases the rate of climb about 420 feet per minute under the same conditions.

Wing Flaps

Wing flap drag increases as the flaps are retracted to the 37.5% position, an increase about equal to the drag that would occur if the landing gear were extended again. After this point in retraction, drag decreases rapidly. It is therefore recommended that with an engine failure on a high weight takeoff, the flaps be left down until a safe altitude is reached and flap retraction can be accomplished in level flight or in a slight dive. Full flap retraction should be accomplished as soon as feasible after reaching 1000 feet above terrain because the resulting acceleration to the proper climb speed will increase the rate of climb about 700 feet per minute. Speeds for maximum rate of climb with flaps down while operating on eight or seven engines are presented in Part 4 of the Appendix.

Drop Tanks

The drag effect of drop tanks on takeoff is negligible because of the low airspeeds involved. The weight effect of full tanks, however, is important enough to warrant consideration. The rate of climb can be increased about 300 feet per minute if the full 3000 gallon tanks are dropped. This action needs to be accomplished only when climb is extremely marginal. See "Drop Tank Emergency Operation," this section.

WARNING

The aircraft has reduced strength capability when flown without drop tanks at gross weights above 370,000 pounds. At these weights, the drop tanks should be jettisoned as an emergency procedure only. The aircraft should then be flown in a wings-level attitude to keep the "g" loading to an absolute minimum. Turbulent air and severe maneuvers or sharp turns should be avoided.

ENGINE FAILURE/FIRE ON TAKEOFF — TAKEOFF CONTINUED

1. ENGINE(S) — SHUTDOWN (P-CP)

Use "Emergency Engine Shutdown" procedures when a safe altitude and airspeed are reached.

TAKEOFF WITH BADLY UNBALANCED TIRE

The landing gear can be seriously damaged under high speed ground run conditions (such as takeoff or landing ground run) with a badly unbalanced tire. A blowout and subsequent high speed wheel rotation may result in partial disintegration of the tire and cause such an unbalance. Therefore, prior to every takeoff following a braked landing (other than a taxi-back landing using normal braking) or refused takeoff, a visual inspection should be made to determine the safe condition of the tires. In addition, if a tire failure is suspected on takeoff before S_1 is reached, the takeoff should be discontinued. If a strong vibration is experienced or tire failure occurs after S_1 is reached, brakes should be applied immediately after the aircraft leaves the ground to minimize possible damage from resultant vibration. Assessment of damage by a crewmember or chase plane should be the first consideration after wheel rotation is stopped. The landing gear should not be retracted until assessment of damage has been accomplished. The condition of tires, structure, and adjacent system components should be ascertained before any decisions are made. An unbalanced tire condition will be impossible to determine visually unless obvious tire failure can be seen. Failed tire condition (blown out, flat, or chunk loss) can usually be determined by visual inspection. If assessment of damage reveals no degradation of airworthiness, the mission could be continued with either an unbalanced or failed tire condition. However, unless otherwise warranted, it is recommended that the mission be aborted. If necessary to continue the mission, the landing gear should be retracted only after wheel rotation has stopped and hydraulic system pressures have been checked for satisfactory indications.

CRASH LANDING OR DITCHING IMMEDIATELY AFTER TAKEOFF

NOTE

The crash landing and ditching alarm signals are as follows: For crash landing or ditching, the crew will be alerted over interphone, if possible, and by an alert (intermittent) signal. Automatic transmission of this signal is provided by use of ALERT position of the emergency alarm switch. This signal will remain on until all crewmembers have acknowledged over interphone. Just prior to touchdown, the emergency alarm switch will be placed in ALERT position and crewmembers will be notified over interphone to brace for impact. Use of the abandon signal after contact with the ground will be the signal to exit from the aircraft.

1. LANDING GEAR – DOWN (UP FOR DITCHING) (P)

Landing gear will only be lowered after it has definitely been determined that a crash landing will be made.

2. THROTTLES – CLOSED (AFTER IMPACT) (P)

WARNING

Do not cut engines prior to touchdown. This would result in an immediate loss of all primary electric power. Electrical control of stabilizer trim will be lost. The spoilers will operate for only a few seconds on accumulator pressure.

3. BATTERY SWITCH – OFF (CP)

4. Abandon Aircraft - (ALL)

Remain in positions until aircraft comes to complete stop. After complete stop is made, pilot places emergency alarm switch to ABANDON. All crewmembers, except gunner, exit through ejection hatches using escape ropes. Gunner exits through the turret opening or his entry door (or on aircraft **ZR**, the canopy opening), depending on circumstances, using escape rope.

WARNING

- To prevent personal injury ascertain that the escape ropes are fully extended before using them.
- Crewmembers must be aware of protruding objects on the sides of the aircraft fuselage such as pitot tubes, antennas, etc. Attempt to avoid these objects by pushing away from the fuselage with your feet.

LANDING GEAR FAILURE TO RETRACT

CAUTION

- If a ruptured main gear hydraulic system is known or suspected, unnecessary loss of hydraulic fluid may be prevented as follows:
  - Pull the normal gear control circuit breaker for the affected gear to deactivate the gear normal control valve before actuating the normal gear handle.
  - Do not operate the emergency landing gear switch for the affected gear as it may deplete the alternate gear hydraulic system and seriously decrease or eliminate crosswind crab, steering, braking, and air refueling capabilities.
- If wing flaps are retracted, reduce speed to a maximum of 220 knots IAS prior to the accomplishment of the retraction checklist.

Emergency Retraction (Main Gear Only)

1. Position Landing Gear Lever to GEAR UP - Accomplished (P)

   Leave lever in GEAR UP position.

2. Turn Battery Switch ON - ON (CP)

   If battery switch is OFF and no ac power is available when landing gear lever is placed in GEAR UP, utility hydraulic packs will not start even though battery switch is subsequently moved to ON position. It will be necessary to place battery switch ON and momentarily place hydraulic pack switches to OFF & RESET, then ON position, before packs can be started.

3. Check Crosswind Knob Centered - Centered (P)

   If landing gear appears to be centered and fails to retract, leave landing gear lever in GEAR UP position and use 5° crosswind crab control either left or right until gear retraction occurs.

4. Check Standby Pump Switch OFF - Accomplished (P)

5. Check Hydraulic System Pressure - Checked (P)

   NOTE

   Check hydraulic pressure on failed gear or gears. If pressure is low, use "Hydraulic System Failure Checklist." If pressure is normal, proceed with this checklist.

6. Pull Normal Gear Control Circuit Breakers for All Unaffected Gear - Pulled (P)

   By pulling the normal gear control circuit breakers for all unaffected gear, the unaffected gear will not be recycled unnecessarily.

7. Position Landing Gear Lever to GEAR DOWN - Accomplished (P)

   Check for gear down indication.

8. Position Landing Gear Lever to GEAR UP - Accomplished (P)

LANDING GEAR FAILURE TO RETRACT (Cont)

9. Reset All Normal Gear Control Circuit Breakers - Reset (P)

   If a gear up indication is not shown, proceed with step "10."

   NOTE

   If an extended gear cannot be retracted and it is decided to continue the mission (training only), pull the affected gear normal control circuit breaker. This will prevent inadvertent retraction of that gear while exceeding gear retraction airspeed limitations. Reset the normal control circuit breaker for the affected gear after landing gear extension for landing.

10. Actuate Emergency Landing Gear Switch(es) to RETRACT (EWO only) - Accomplished (P)

    CAUTION

    To reduce the possibility of system damage, do not place switch to OFF or EXTEND position while the gear is in motion.

    After checking hydraulic system, actuate emergency switch(es) for failed gear. The following indicates alternate pack operation by emergency landing gear switch:

GEAR	NORMAL PACK	ALTERNATE PACK
Left Front	1	2
Right Front	2	1
Left Rear	3	4
Right Rear	4	3

NOTE

- The tip gear cannot be retracted on the emergency system.
- Limit emergency landing gear switch actuation to 10 seconds maximum if gear has failed to retract after unlocking by use of the normal system.
- When retracting any main gear by the emergency system, if gear fails to operate, first turn landing gear standby pump and hydraulic pack switches OFF and bleed the gear normal system down by operating the brakes, then repeat actuation of the emergency switch.

11. Turn Emergency Landing Gear Switch(es) OFF - OFF (P)

    As soon as landing gear is locked in the up position, return emergency switch(es) to OFF.

12. Check Hydraulic System Pressure - Checked (P)

    Pilot checks pressure on packs 1 thru 4 to insure appropriate utility packs have shut down.

RUNAWAY OR UNSCHEDULED STABILIZER TRIM

NOTE

For complete information on nose high and dive recoveries, see "Recovery from Unusual Maneuvers," Section VI.

1. AUTOPILOT — DISENGAGE (P/CP)

As soon as an unscheduled trim indication is noted, the pilot flying the aircraft will immediately apply control column movement, actuate autopilot release button, reposition the trim button to neutral, and monitor the manual trim wheel to make sure the trim has stopped. Apply electrical trim so that the manual trim wheel moves in the desired direction to reduce control column force. At the same time, the pilot not flying the aircraft checks the servos engage switch to DISENGAGE.

2. STABILIZER TRIM CUTOUT SWITCH — CUTOUT (P/CP)

If electrical trim cannot be obtained in the desired direction or cannot be stopped, the stabilizer trim cutout switch will be actuated to CUTOUT.

WARNING

Do not use the stabilizer trim cutout switch until positive that the attitude change is due to runaway trim.

3. Airbrakes - As required (P)

The pilot may raise the airbrakes to help raise the nose or lower the airbrakes, if they were up, to lower the nose.

WARNING

Incorrect actuation of the airbrakes during recovery from a runaway or unscheduled trim condition will aggravate an already dangerous situation. Caution should be exercised not to retract extended airbrakes during a nose down trim condition and, conversely, airbrakes should not be extended during a nose up trim condition.

4. Trim - Manually (P/CP)

The pilot utilizes the manual trim wheel to reposition the stabilizer. If the application of opposing control column movement and the actuation of the cutout switch plus the autopilot disengagement fail to stop the trim runaway, the manual trim wheel must be held against rotation.

5. Extend Landing Gear for Nose Up - As required (P)

Pilot extends landing gear if additional trim compensation is required, but only if a performance penalty can be tolerated.

6. Transfer Fuel - As required (CP)

Copilot transfers fuel, if required, to accomplish a cg shift.

NOTE

The manual trim wheel should be used to make any additional trim adjustments required during the remainder of the flight. The stabilizer trim cutout switch should be retained in CUTOUT (guard open) during this period to insure that the electrical trim circuit remains interrupted. Leaving the switch in CUTOUT will also aid ground maintenance personnel in trouble shooting.

ALL FOUR ALTERNATOR CIRCUIT BREAKER LIGHTS ON (COMPLETE A-C FAILURE)

1. **ALL ALTERNATOR SWITCHES — ON (CP)**
2. **ALL BUS TIE BREAKERS — OPEN (CP)**
3. **ALL ALTERNATOR CIRCUIT BREAKERS — CLOSE (CP)**
4. Electrical Loads - Reduced (ALL)

   Pilot will notify crewmembers to reduce unnecessary loads (e.g., BNS, FCS, and ECM).

NOTE

Alternators will indicate little or no KWATT's and KVAR's when loads have been reduced.

5. Voltages & Frequencies - Check (CP)

   Check frequency and voltage of each generator using the voltage and frequency selector switch to detect malfunctioning alternators.

6. Malfunctioning Alternator(s) - Shutdown and respective bus tie breaker(s) closed (CP)
7. Bus Tie Breaker on One Operating Alternator - Closed (CP)

   Close bus tie breaker on one operating alternator with the least load to provide an electrical power source to the central bus tie.

NOTE

If no alternators can be started, see "Conservation of Battery Power" checklist, this section.

INFLIGHT EMERGENCIES

ENGINE FAILURE

ENGINE FAILURE INDICATIONS

The first and most positive indication of an engine failure affecting thrust will be a change in the engine pressure ratio gage reading. This method will determine the failure of any engine during takeoff, climb, cruise, or descent. In addition, rpm, exhaust temperature, oil pressure, and fuel flow may change, depending upon the type of failure. Severe engine vibration may indicate internal failure of an engine. Oil or fumes may enter the cabin through the air conditioning system or there may be visual evidence of smoke or fire at the engine. Aircraft yaw may give a good indication of failure if an outboard engins fails. The failure may be overlooked, however, if one of the inboard engines fails, especially if the aircraft is in a turn. Also see "Air Bleed System Emergency Operation," this section, for failure indications due to an air bleed manifold leak.

CAUTION

Serious engine damage can occur from bird ingestion without accompanying abnormal indications on engine instruments. If bird ingestion is known or suspected, shut the engine down unless its operation is necessary to maintain safe flight.

ENGINE FAILURE DURING CLIMB

Engine failure during a climb is not considered critical provided the recommended airspeed climb schedule is followed. If an engine failure is encountered during a climb, the airspeed or rate of climb or both will decrease. If the mission is to be continued, a new climb schedule will have to be flown. Directional control can be maintained easily by adding rudder trim and a slight amount of lateral trim.

ENGINE FAILURE DURING CRUISE

If an engine fails during a cruise condition, cut the engine by moving the throttle to CLOSED position. Compensate for the unbalanced thrust condition by adding appropriate directional and lateral trim. Failure of an engine during cruise will not appreciably affect directional control but will result in a decrease in the speed being flown. Normally, the cruise altitude will also be decreased depending upon the amount of fuel remaining, type of mission being flown, etc. Applicable charts covering eight-, seven-, and six-engine operation are included in Part 5 of the Appendix. If the engine which failed was not on fire and the malfunction can be corrected, restart the engine as outlined under "Engine Air Starting" this section.

ENGINE FIRE WARNING LIGHT(S) ILLUMINATED

Intermittent or continuous operation of the engine fire warning lights or erratic operation of the engine instruments may be an indication of burned or scorched electrical wire bundles as a result of an air bleed manifold pneumatic duct failure. If such indications are observed, shutdown of engine(s) in the applicable engine pod should be accomplished in accordance with the "Emergency Engine Shutdown" checklist, this section. After engine shutdown, be sure the air bleed manifold interconnect valve switches are closed to prevent the passing of bleed air from other engines through the damaged duct. See "Air Bleed System Emergency Operation," this section, for failure indications due to an air bleed manifold leak.

EMERGENCY ENGINE SHUTDOWN

1. THROTTLE(S) — CLOSED (P)

Place the affected engine throttle(s) to the CLOSED position.

2. FIRE SHUTOFF SWITCH (ES) — PULL (P/CP)

After closing throttle and pulling firewall switch, if fire warning light continues to illuminate and there is no visible indication of fire, reduce power on adjacent engine in nacelle. If fire warning light goes out, complete shutdown on adjacent engine.

CAUTION

On an engine windmilling above 25% rpm, have fuel available to the firewall fuel shutoff valve, push the firewall fuel shutoff switch in, and advance the throttle to IDLE for 3 minutes out of every hour to prevent overheating the fuel control unit.

2A. Starter Switch(es) - OFF (CP)

CAUTION

- Insure that the starter switches for engines which have been shut down are off and remain off for the remainder of flight unless intentional engine air starting is accomplished.
- When fuel is available to an engine, even with some failures of the fuel control unit, restart could occur if the starter switch is placed to start and the throttle is moved out of the closed position. Continuous ignition will occur regardless of throttle position if the firewall fuel shutoff valve circuit breaker is out and the starter switch is placed to start.

3. Bleed Selector Switch to ALTERNATE Position if Engines 3 & 4 Are Shut Down - Selected (CP)

4. Check for Pneumatic Leak if Only One Engine in Nacelle Is Shut Down - Checked (CP)

See "Air Bleed System Emergency Operation," this section.

EMERGENCY ENGINE SHUTDOWN (Cont)

5. Open Air Bleed Interconnect Valve - OPEN (as required if no pneumatic system leak is suspected) (CP)

Maintain the pneumatic system interconnect valves in CLOSED position at all times during flight unless extreme emergencies determine otherwise. Open body and wing air bleed manifold interconnect valves as required if more than one engine failure is experienced on the same side. See "Air Bleed System Emergency Operation, " this section.

CAUTION

An engine air start after an emergency shutdown should not be attempted unless it is ascertained that it is reasonably safe to do so. A recurrence of the emergency condition could be more serious than the first occurrence.

6. Reroute Fuel Away from Nacelle with Engine Fire - Rerouted (CP)

In case of engine fire, reroute fuel away from affected nacelle and allow adjacent engine to starve the lines of fuel.

7. Fuel System Management - Monitored (CP)

NOTE

At any time an engine is shut down or any unusual combination of engines is used, care should be taken to manage fuel so as to maintain proper center of gravity and fuel distribution. See Section V for further information about fuel loading and cg location. Also, see "Fuel Management for Lateral Trim" under "Climb," Section II.

8. Persistent Engine Fire in Flight:

NOTE

If fire persists, it may be possible to save the aircraft by allowing the fire to burn the nacelle off the strut.

a. Increase Airspeed to Maximum - Increased (as applicable to configuration (P)

Increase airspeed to maximum allowable for the configuration and initiate a shallow descent if conditions permit. Descent will increase acceleration to maximum speed and decrease the angle of attack. Both the increased airspeed and the resultant decreased angle of attack will help keep fire from the wing until the fire is extinguished or controlled.

b. Observe Cowling, Strut & Wing - Observing (if conditions permit) (P/CP-RN/EW-G)

If conditions permit, maintain visual surveillance of affected area. When blackened discoloration appears on the cowling, burn-through is probably only a few seconds away and fire will be exposed to airstream. If fire intensifies and spreads to the strut area, the upper strut surface and the wing should be closely observed. Discoloration of the upper strut indicates the fire will probably spread to the wing. Discoloration may be very difficult to detect with a camouflaged aircraft.

NOTE

Cowling burn-through should not be confused with fire burning into the wing.

9. If Fire Appears To Be Burning into Wing - Bail out on pilot's order (ALL)

ENGINE AIR STARTING

The air start envelope (figure 3-3) indicates the altitude and indicated airspeed envelope in which windmilling starts normally should be attempted. The rpm lines on the curve are approximate. Starts may be attempted up to the airspeed limits of the aircraft. Starts made at an rpm below 65% are termed air starts; starts made above 65% rpm are termed relights.

ENGINE FLAMEOUT AND RELIGHT

Immediate response by the pilots to an engine flameout can make a relight possible without the necessity of descending to the altitudes and rpm limits shown on figure 3-3. Relights may be made at as low as 65% rpm. To simplify relight procedure, the starter selector switch should always be positioned to FLIGHT START when the aircraft is in flight. See "Engine Air Starting" checklist below. For recommended procedures in the event of multiple engine flameout at higher altitudes, see "Engine Operation," Section VII, and "Turbulence and Thunderstorms," Section IX.

NOTE

If the adjacent engine in the same nacelle starts to surge or vibrate during the engine relight, retard the adjacent engine throttle to IDLE and advance both engine throttles to the desired setting after the relight has been accomplished.

ENGINE AIR STARTING

CAUTION

- Do not attempt a restart or relight of a flamed-out engine in a nacelle with a known or suspected fuel leak unless a critical need for power exists.
- Immediate response by the pilots to an engine flameout can make it unnecessary to follow the complete engine air starting procedure. This type of relight may be made as low as 65% rpm. To obtain a relight, retard the throttle to IDLE and place the starter switch to START. Do not place the starter switch to START at engine rpm below 65% without following the complete procedure because engine fire or damage can result from accumulation of fuel in the engine.

NOTE

This checklist applies to a normal windmilling airstart (rpm below 65%). See "Airstart Envelope" (figure 3-3) for speed and altitude required for normal windmilling starts.

1. Reset Firewall Switch - Reset (P-CP)
2. Route Fuel to Engine - Routed (CP)

   Have fuel boost pressure available to the firewall fuel shutoff valve.

3. Advance Throttle to IDLE, then CLOSED - Accomplished (P)

   If shutdown was caused by fuel starvation, open the throttle to IDLE until fuel flow is established and retard to CLOSED for 30 seconds. This will purge the fuel control unit of air and the engine of fuel.

ENGINE AIR STARTING (Cont)

4. Check Engine RPM - Checked (P)

   Establish an indicated airspeed which will give an engine speed within the "normal windmilling start" range of the air start envelope. If sufficient airspeed cannot be obtained, use engine starter to increase rpm above 12%. See figure 3-3 for recommended airspeed and altitude for engine air starting.

5. Check Oil Pressure - Checked (P)

6. Turn Starter Selector to FLIGHT START - FLIGHT START (CP)

   The starter selector switch should be placed in FLIGHT START unless the engine starter is to be used to aid in the start.

CAUTION

Use of the engine starters for air starts is restricted to emergencies only.

7. Turn Engine & Nacelle Anti-Icing Switch Off - OFF (P)

8. Turn Starter Switch to START - START (CP)

9. Move Throttle to IDLE - IDLE (P)

10. Check Flowmeter - Checked (P)

    Fuel flow should be between 575 and 1250 pph prior to combustion. Starts with less than 575 pph may be attempted. When flow is more than 1250 pph, retard the throttle below IDLE to reduce the flow below 1250 pph. During acceleration from combustion to idle rpm, the normal fuel flow is 1800 to 2000 pph. In both cases, the engine operation should be watched carefully for evidence of further malfunctioning of the fuel control unit.

11. Check Engine Indicators - Checked (P)

    Leave the throttle at IDLE until engine indicator readings have stabilized as follows:

    a. Tachometer - 65% to 85% rpm

    b. Exhaust Gas Temperature - Stabilized

    c. Oil Pressure - Within limits (Section V)

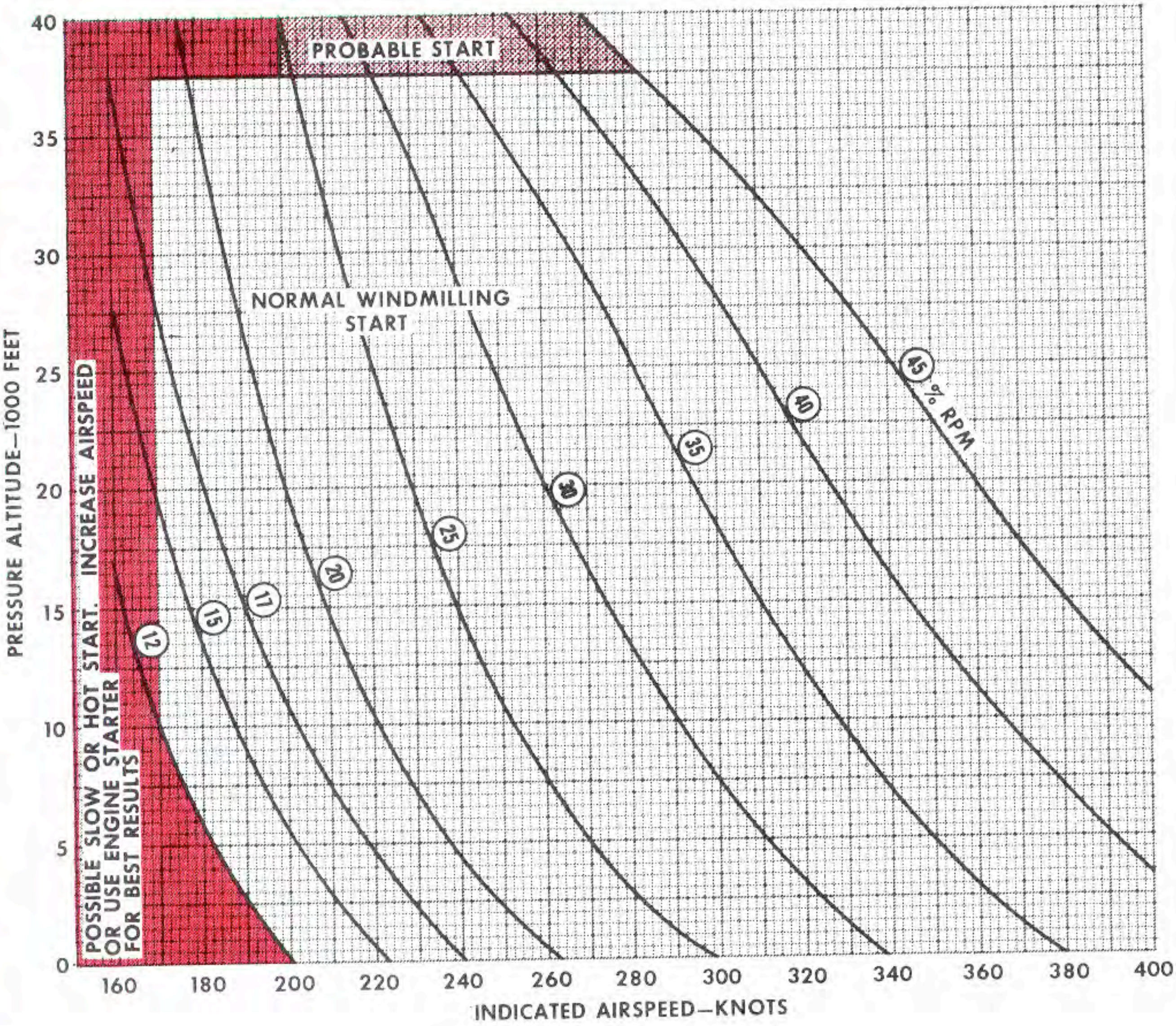
NOTE

Normally, combustion should occur within 20 seconds or less and will be evidenced by a rise in exhaust gas temperature. If the exhaust gas temperature exceeds limits, if the engine fails to accelerate to idle rpm, or if the oil pressure does not reach 35 psi, discontinue the restart by retarding the throttle to CLOSED and place the starter switch OFF. Allow the engine to windmill for 30 seconds before attempting another restart.

12. Advance Throttles - Desired setting (P)

13. Turn Starter Switch to OFF - OFF (CP)

14. Engine & Nacelle Anti-Icing Switch - Climatic (P)



AIR START ENVELOPE

Figure 3-3.

FLIGHT CHARACTERISTICS WITH ENGINE FAILURE

SINGLE ENGINE FAILURE

The loss of an engine at any time during takeoff or while in flight is considered an emergency, regardless of the amount of thrust still available, since some emergency procedure must be executed. The loss of an engine during takeoff can be controlled easily by correct application of rudder pedal force and a slight amount of lateral control force. The rudder pedal force required in the event of an outboard engine failure is about 40 pounds at speeds below takeoff speed with zero trim. The force increases to about 80 pounds at the recommended climbout speed. All of this rudder correction usually can be removed by application of rudder trim. The rudder trim limits should be observed. See "Airspeed Limitations," Section V.

MULTI-ENGINE FAILURE ON ONE SIDE

During inflight emergencies involving multi-engine failures on one side, applications of large amounts of rudder and lateral control are necessary in order to maintain control when extreme amounts of asymmetrical thrust exist or are applied. Application of this control creates severe loads on the aircraft structure. These loads vary in magnitude in accordance with the degree of thrust dissymmetry, degree of deflection of corrective rudder, rate of rudder application, amount of yaw/roll displacement that has taken place prior to rudder application, abruptness with which engine thrust is removed, indicated airspeed, gross weight, center of gravity, fuel distribution, amount of air turbulence present, aircraft configuration including flaps and landing gear positions, missile loading, external tank loading, etc. If these variables occur in certain combinations, critical structural loads can result. In view of the difficulty in controlling these variables, close observance of the following procedure will minimize the possibility of structural overload.

1. If asymmetrical thrust develops abruptly, the resulting yaw/roll tendency should be counteracted with lateral control followed by steady rudder application. Trim as required to balance control forces.
2. If thrust requirements permit, readjust the power on the remaining engines to minimize control surface deflections. Power adjustments should be applied slowly and simultaneously with control surface movement.
3. Avoid turbulent air and limit bank angle to 20° maximum.

PERFORMANCE

WARNING

> Nonzero lateral trim resulting from inoperative engines must not be compensated for by fuel manipulation because an uncontrollable roll may occur when power is reduced on approach for landing.

This aircraft is unique in its ability to handle asymmetrical thrust conditions provided the prescribed procedures are followed. See "Multi-Engine Failure on One Side," this section. The takeoff and climbout performance of the aircraft with inoperative engines is shown in Parts 2, 3, and 4 of the Appendix. In each case, the inoperative engines are assumed to be in the most outboard positions and all on the same side. This is the most adverse condition from the standpoint of trim drag which is associated with control surface deflections. Advancing the throttles to full travel in an emergency situation will give maximum thrust. This may exceed normal engine limits. Overthrusting the engines will accentuate the aircraft control problems and reduce engine life. All instances of overthrust as indicated by excessive EGT and/or rpm will be recorded on Form 781. See "Engine Limitations," Section V.

WING FIRE

NOTE

> If a fire occurs in the wing, it probably will be in the area aft of the rear spar. Trailing smoke probably will be the only indication of a wing fire. However, fuel and hydraulic fluid leaks will give an indication similar to trailing smoke.

1. FUEL TRANSFER SWITCHES — OFF (CP)

Stop fuel transfer and check fuel tank gage levels to assure that the fire indication is not caused by fuel spillage from overfilled tanks or a ruptured tank or transfer line.

2. AFFECTED HYDRAULIC PACK SWITCHES — OFF & RESET, GUARDS UP (P)

Shut down the two hydraulic packs in the affected wing. A malfunctioning pack may give an indication of the source of the smoke.

3. CHECK SPOILERS STANDBY PUMP SWITCH — OFF (P)

4. Wing Flaps - Lower (P CP)

Lower wing flaps allowing airflow to remove any accumulation of fluids supplementing the fire indication in the flap area.

CAUTION

> The maximum airspeed to start flap extension is 225 knots IAS. See Section V for wing flap airspeed limitations.

5. Air Bleed Leak - Checked (CP)

Conditions permitting, as airspeed is reduced to lower flaps, check for air bleed leak. (See "Air Bleed Manifold Leak," this section.)

6. Throttles for Side on Fire - CLOSED (P)

Shut down engines in vicinity of fire. If fire is not then extinguished, shut down other engines on side on fire.

7. Fuel Switches - OFF (as applicable) (CP)

Close fuel feed valves for engines which have been shut down.

8. Uncontrollable Fire - Bail out on pilot's order (ALL)

If it is apparent that the fire is being supplemented by fuel, immediately abandon the aircraft. See "Bailout," this section.

9. Wing Flaps - UP (P CP)

At the pilot's discretion, the wing flaps may be raised and the hydraulic packs turned back on after the fire is out.

10. Hydraulic Pack Switches - ON, guards closed (P)

FUSELAGE OVERHEAT WARNING

Illumination of a word warning light on the fuselage overheat warning panel calls for immediate action by all crewmembers. Illumination of a warning light should not cause undue alarm, but should be followed by an immediate investigation of the cause of the warning. Although the system is designed primarily to detect overheat conditions before fire has developed, the possibility of fire is always present. The master overheat warning light and a word warning panel will illuminate when the temperature rises to 300° F in the vicinity of the corresponding overheat warning detector. When this occurs, the copilot will alert the crew by interphone, announcing the number and the word warning. Upon being alerted by the copilot, the crew will accomplish the "Fuselage Overheat Warning Checklist." Each time the master overheat warning light illuminates, the copilot should reset it by pushing the master warning reset button. The light will then provide a warning should additional word warning panels illuminate. Following each alert, the gunner will check for signs of smoke trailing the fuselage, reporting only if smoke is observed. All operating equipment in the area of the fuselage overheat detector should be turned off as indicated in the "Fuselage Overheat Warning Checklist" and figure 3-4.

Followup action consists, in part, of the navigator observing the alternator deck. The navigator can also observe the right side of the forward wheel well by looking through the window in the pressure bulkhead door. Each crewmember should check all available instruments for indications of malfunctioning equipment. Certain members of the crew are designated in the chart as crew monitors to avoid confusion and unnecessary interphone conversation. The monitors have primary responsibility for reporting the progress of the overheat warning check. Any equipment suspected of malfunctioning should be shut off and reported. If shutting off the equipment in the affected area alleviates the overheat condition, the warning lights should go out as the area cools or as the supply of heated air from the pneumatic system is shut off. A second light coming on indicates a spreading overheat condition. The condition may be caused by a broken pneumatic manifold or, if shortly after takeoff, by an overheated landing gear wheel. If an overheated landing gear wheel is suspected, the affected gear should be lowered (figure 3-4). A series of lighted warning panels could be an indication of fire, particularly if shutting down the equipment does not put out all lights and if additional panels illuminate. If an overheat warning alert occurs on takeoff before S_1 is reached, the takeoff should be aborted. Depending on variable conditions, flight action taken will be at the pilot's discretion, as he closely monitors crew action following a fuselage overheat warning. Reports from the crew monitors, the number of word warning panels illuminated, the amount of equipment shut down, the gross weight of the aircraft, and weather conditions should be considered by the pilot. In all cases, prompt and careful completion of the "Fuselage Overheat Warning Checklist" shall be made to avoid possible loss of the aircraft or to facilitate a safe abandonment of the aircraft should it become necessary.

FUSELAGE OVERHEAT WARNING

NOTE

To be accomplished by applicable crewmembers each time fuselage overheat word warning panel is illuminated.

1. Alert Crew (CP)

   Copilot will alert crew over interphone by announcing the number of the word warning panel or panels illuminated. For example: "Attention crew, No. 2 fuselage overheat warning light which is for the right forward alternator deck is on, repeat, No. 2 overheat light which is for the right forward alternator deck is on. Execute checklist." Crew will check equipment and prepare to bail out.

2. Oxygen - 100% (ALL)

3. Turn Operating Equipment in Affected Area Off - Off (ALL)

   See figure 3-4.

FUSELAGE OVERHEAT WARNING (Cont)

4. Discontinue Fuel Transfer - Discontinued (CP)

   Shut off all transfer switches and transfer valves.

5. Reset Master Overheat Warning Light - Reset (CP)

6. Monitor Trailing Smoke - Monitored (G)

   Report only if smoke trailing from fuselage is observed.

7. Check for Pneumatic Leak - Checked (CP)

   If the applicable fuselage overheat warning light does not go out after the equipment in that area has been shut down, the cause may be a pneumatic leak.

WARNING

If an air bleed manifold leak is suspected or confirmed, the aircrew should consider all factors involved with the emergency and plan to land as soon as possible at the nearest suitable airbase. A failed pneumatic duct should be regarded as an impending disaster, and the pilot should not prolong the flight unnecessarily in the interest of reducing weight or establishing contact with his home base.

8. Follow-Up Action:

   a. If Fire or Trailing Smoke Is Observed, Notify Crew to Maintain Preparedness to Bail Out Until Further Instructions - Accomplished (P)

   b. If No Fire Is Observed, Resume Fuel Transfer as Required to Execute a Safe Landing - Accomplished (CP)

   c. Cabin Lights May Fail Due to Fire in the Wheel Well or Alternator Deck; if This Occurs, Refer to "Electrical System Emergency Operation," This Section - Accomplished (P)

NUMBERED WORD WARNING PANELS	IMMEDIATE ACTION		FOLLOWUP ACTION	
1. ALT. DECK FWD. L.H.	CP	Left Forward Alternator Switch – OFF	N	Monitor alternator deck using window in pressure bulkhead door
			N	Report to copilot
	CP	Air Conditioning Master Switch – OFF or RAM	CP	Oxygen Check – Completed (if applicable)
2. ALT. DECK FWD. R.H.	CP	Right Forward Alternator Switch – OFF	N	Monitor alternator deck using window pressure bulkhead door
			N	Report to copilot
	CP	Air Conditioning Master Switch – OFF or RAM	CP	Oxygen Check – Completed (if applicable)
3. FWD. L.H. ALT.	CP	Left Forward Alternator Switch – OFF	N	Monitor alternator deck using window in pressure bulkhead door
			N	Report to copilot
	CP	Air Conditioning Master Switch – OFF or RAM	CP	Oxygen Check – Completed (if applicable)
4. FWD. R.H. ALT.	CP	Right Forward Alternator Switch – OFF	N	Monitor alternator deck using window in pressure bulkhead door
			N	Report to copilot
	CP	Air Conditioning Master Switch – OFF or RAM	CP	Oxygen Check – Completed (if applicable)
5. FWD A/C PACK	CP	Forward Air Conditioning Pack – OFF	N	Monitor forward wheel well using window in pressure bulkhead door
	P	Descend to 42,000 Feet or Lower	N	Report to copilot
	P	Left Forward Landing Gear – Lower (If within 20 minutes of takeoff)	CP	Oxygen Check – Completed (if applicable)
6. ECM RADOME	EW	ECM System Switches 1, 2, and 3 – OFF	N	Monitor alternator deck using window in pressure bulkhead door
			N	Report to copilot

FUSELAGE OVERHEAT WARNING EMERGENCY PROCEDURES

Figure 3-4 (Sheet 1 of 3).

NUMBERED WORD WARNING PANELS	IMMEDIATE ACTION		FOLLOWUP ACTION	
7. HYD. PACK 1	P	Hydraulic Pack No. 1 – OFF, depressurize system	N	Monitor forward wheel well using window in pressure bulkhead door
	P	Left Forward Landing Gear (If second panel to light) – Lower	N	Report to copilot
8. FWD. W/W FWD. R.H.	P	Left Forward Landing Gear – Lower (If within 20 minutes of takeoff)	N	Monitor forward wheel well using window in pressure bulkhead door
			N	Report to copilot
9. FWD. W/W UPPER L.H.	CP	Forward Air Conditioning Pack – OFF	N	Monitor forward wheel well using window in pressure bulkhead door
10. FWD. W/W UPPER R.H.	P	Descend to 42,000 Feet or Lower	N	Report to copilot
	P	Both Forward Landing Gears – Lower (If within 20 minutes of takeoff)	CP	Oxygen Check – Completed (if applicable)
11. AFT L.H. ALT.	CP	Left Aft Alternator Switch – OFF	N	Monitor forward wheel well using window in pressure bulkhead door
			N	Report to copilot
12. AFT R.H. ALT. & HYD. 2	CP	Right Aft Alternator Switch – OFF	N	Monitor forward wheel well using window in pressure bulkhead door
	P	Hydraulic Pack No. 2 – OFF, depressurize system	N	Report to copilot
	P	Right Forward Landing Gear – Lower (If within 20 minutes of takeoff)		
13. AFT W/W FWD. L.H.	P	Left Aft Landing Gear – Lower (If within 20 minutes of takeoff)	G	Monitor – Look for trailing smoke from fuselage
			G	Report to copilot
14. WING R/S CTR. BODY	CP	Stop Flap Action	G	Monitor – Look for trailing smoke from fuselage
			G	Report to copilot
15. HYD. PACK 3	P	Hydraulic Pack No. 3 – OFF, depressurize system	G	Monitor – Look for trailing smoke from fuselage
	P	Right Aft Landing Gear – Lower (If within 20 minutes of takeoff)	G	Report to copilot

Figure 3-4 (Sheet 2 of 3).

NUMBERED WORD WARNING PANELS	IMMEDIATE ACTION		FOLLOWUP ACTION	
16. HYD. PACK 4	P	Hydraulic Pack No. 4 – OFF, depressurize system	G	Monitor – Look for trailing smoke from fuselage
	P	Left Aft Landing Gear – Lower (If within 20 minutes of takeoff)	G	Report to copilot
17. AFT A/C PACK	G	Aft Air Conditioning Pack – OFF	G	Monitor – Look for trailing smoke from fuselage
	G	FCS – OFF		
	G	Pull Air Compressor Circuit Breakers (if above 35,000 feet)		
	P	Descend to 42,000 Feet or Lower	G	Report to copilot upon reaching 42,000 feet altitude
18. AFT W/W AFT R.H.	P	Right Aft Landing Gear – Lower (If within 20 minutes of takeoff)	G	Monitor – Look for trailing smoke from fuselage
			G	Report to copilot
19. HYD. PACK 9	P	Hydraulic Pack No. 9 – OFF, depressurize system	G	Monitor – Look for trailing smoke from fuselage
	G	FCS – OFF	G	Report to copilot
	G	FEC – OFF, evaluator d-c circuit breaker pulled		
20. HYD. PACK 10	P	Hydraulic Pack No. 10 – OFF, depressurize system	G	Monitor – Look for trailing smoke from fuselage
			G	Report to copilot
	G	FCS – OFF		
	G	Pull Air Compressor Circuit Breakers		

FUSELAGE OVERHEAT WARNING EMERGENCY PROCEDURES

Figure 3-4 (Sheet 3 of 3).

ELECTRICAL FIRE

Since the aircraft electrical circuits have fault-clearance protection, it is not likely that short circuits will cause electrical fires. If an electrical fire does occur, however, the only practical means of stopping it is to deenergize the circuits in the affected area and cautiously put essential equipment back in operation, one circuit at a time.

PRESSURIZED COMPARTMENT FIRE

In the event that fire is discovered or suspected in any area of the forward or aft pressurized compartments, immediately notify the pilot or other crewmembers to go on 100% OXYGEN and proceed with proper fire control procedures. The following fire control procedures should be followed to minimize danger to personnel and equipment.

PRESSURIZED COMPARTMENT FIRE

1. OXYGEN — 100% (ALL)

All primary crewmembers and extra crewmember(s) will report to pilot when mask is on and OXYGEN 100%. If possible, extra crewmember oxygen outlets should be used when engaged in firefighting procedures. If portable oxygen bottles are used, the regulator must be set at 30M or higher, commensurate with aircraft altitude. The supply will last 3 to 4 minutes under adverse conditions.

2. AIR CONDITIONING MASTER SWITCH — OFF (CP) OR (G) (AS APPLICABLE)

The switch must be moved rapidly past RAM to the OFF position. This allows cabin leakage to depressurize the compartment and shut down incoming air.

WARNING

Do not depressurize until all crewmembers are on oxygen and the aircraft is below 42,000 feet.

3. UNNECESSARY ELECTRICAL EQUIPMENT — OFF (ALL)

Pilot will notify crew to reduce unnecessary loads (such as BNS, FCS, and ECM).

4. Fire - Combat (RN-N-EW-G-Extra crewmember)

Pilot will direct adjacent or extra crewmembers to institute firefighting procedures.

a. Locate the fire.

b. Remove objects that would spread the fire, or restrict firefighting procedures, from the vicinity of the fire area.

PRESSURIZED COMPARTMENT FIRE (Cont)

c. Apply extinguishing agent at base of fire.

WARNING

- When fighting a fire with the fire extinguisher, remember that the fumes from the CB fluid are toxic. Heavy, dense, black, suffocative, toxic smoke occurs when fire extinguishing agent is used on hot metal or open fire. The extinguisher must be held above the horizontal position (not upside down) to prevent the propellent charge from escaping.
- When using a portable oxygen bottle during fire fighting, the regulator setting will be 30M or higher, commensurate with aircraft altitude. This setting should be used where there is the possibility of heavy concentrations of fumes. The supply in the portable oxygen bottle will last 3 to 4 minutes.

NOTE

Supply of extinguishing agent is depleted in approximately 22 seconds during continuous operation.

d. Remove involved combustibles from fire source area.

5. Airspeed/Altitude - Reduce (P/CP)

Reduce airspeed to insure safe ejection and extra crewmember bailout, and then reduce altitude to 25,000 feet.

6. Controlled Fire - Repressurize (CP/G)

After fire is completely extinguished, the most effective way to eliminate smoke from the pressurized compartment is to position the air conditioning master switch to 7.45 PSI, move the cabin pressure release switch to DUMP, and open the sextant port. After smoke has dissipated, repressurize by placing the cabin pressure release switch to RESET and close the sextant port.

7. Uncontrollable Fire - Bail out on pilot's order (ALL)

If it is apparent the fire cannot be controlled, the pilot will order crewmembers to bail out.

WARNING

In the event of fire in the forward wheel well area, the jettisoning of an escape hatch will cause smoke and flames to be drawn into the crew compartment. In the event of fire in the crew compartment, the jettisoning of an escape hatch will rapidly intensify and spread the smoke and flames throughout the crew compartment. Therefore, the jettisoning of an upward escape hatch prior to the egress of all lower deck members and extra crewmembers could seriously hamper their escape. In this event, the revised order of bailout would be: G, N, Extra crewmembers, RN, EW, CP, and P.

SMOKE AND FUMES ELIMINATION

If smoke or fumes are evident in the pressurized compartment, locate the source immediately. If it can be determined that the smoke or fumes are coming from the cabin air outlets, refer to the following checklist.

WARNING

Under takeoff power conditions and with low temperature selection, fog or vapor resembling smoke can occur. Reporting this vapor as smoke or fire at a critical point of the takeoff could create a hazard.

SMOKE AND FUMES ELIMINATION

WARNING

If a fire is suspected or evidenced by visible flame and smoke in the pressurized compartment, see "Pressurized Compartment Fire Checklist" this section.

1. OXYGEN — 100% (ALL)

All primary crewmembers and extra crewmember(s) will report to pilot when on oxygen.

2. Air Bleed Selector - Opposite position (CP/G)

Place air bleed selector switch to its opposite position. Leave switch in selected position if incoming flow of smoke and/or fumes ceases. Additional ventilation may be obtained by placing the cabin pressure release switch to DUMP (below 42,000 feet only) and opening the sextant port. If smoke and/or fumes continue to enter the pressurized compartment, descend to below 42,000 feet and position air conditioning master switch to RAM. Additional ventilation may be obtained by opening the sextant port. After smoke and fumes have dissipated, repressurize by placing the cabin pressure release switch to RESET or air conditioning master switch to 7.45 PSI and closing the sextant port.

WARNING

When it is found necessary to depressurize the cabin in order to eliminate smoke and fumes, it will be necessary to descend to below 42,000 feet as this is the maximum altitude for effective use of the combination of the MBU-5/P mask and aircraft system regulator. Crewmembers should experience no difficulty below 42,000 feet if they switch their regulator diluter levers to 100% OXYGEN.

3. Monitor the Affected Nacelle Engines for Malfunction - Monitored (P/CP/G)

STRUCTURAL DAMAGE

Occasionally, structural damage may be incurred by an aircraft while in flight. Such damage may be caused by midair collision, overstressing the aircraft, and other causes. If the aircraft is still controllable following structural damage, certain procedures may be accomplished to assist in assuring a safe landing. One basic rule, generally applicable, is to make no gross change in aircraft configuration until the extent of the damage or adverse effect on flying characteristics can be determined. A chase plane may provide valuable assistance in determining the extent of damage. The reason for retaining the configuration existing at the time the damage occurs may be readily appreciated from the following: flight loads imparted to the wing structure with flaps full up will vary considerably from the loads that exist with flaps full down. A wing can conceivably contain structural damage or failure of a type and in a location permitting continued safe flight to a landing under certain prescribed operational conditions. To move the flaps to their opposite position, however, could effect a change in wing loading resulting in further progression of the existing damage. If structural damage has occurred to a flap or portions of its mechanism, an attempt to move the flaps could result in loss of the damaged flap. Structural damage to an aircraft sometimes results in tank rupture and leakage of fuel or other combustible materials. If this should occur, it is necessary under certain circumstances to take precautions in order to reduce to a minimum the possibility of inflight fire. Major sources of ignition are, of course, electrical arcs and high temperature surfaces or environment.

AIRCRAFT STRUCTURE

NOTE

> The following general description and definition of aircraft structure is intended to aid in flight crew comprehension of the B-52 structural makeup and is not intended to be all-inclusive. For additional information refer to applicable technical manuals.

Primary Structure

Primary structure is the major load carrying members or assemblies, the failure of which would materially decrease the safety of the aircraft as a whole. Each of the aircraft airfoil surfaces (wing, fin, and horizontal stabilizer) has a primary structural skeleton. This structure is generally described as follows: wing - box beam, encompassing structure between the forward and rear spars and extending from one tip through the center section to the other tip; fin - box section between the main and auxiliary spares extending from the base up to the fiberglas insulator; horizontal stabilizer - box section between the main and auxiliary spars extending through the center section to the middle of each surface then becoming a single spar to each tip. Certain ribs running aft to the control surfaces and flaps are also regarded as primary structure. The primary structure of the fuselage is generally the entire fuselage with the exception of the radomes, wheel well doors and covering, bomb bay doors, and the turret.

Secondary Structure

Secondary structure is all structure that is not part of the primary structure and is normally used to maintain the aerodynamic contour of aircraft components. Failure of a small portion of secondary structure will normally only affect aircraft control characteristics or performance efficiency, while a major loss of that structure could destroy flight capability completely. Wing trailing edge is an example of secondary structure which could be damaged to a small extent and affect controllability and performance slightly whereas its complete loss would preclude further flight.

PRELIMINARY PROCEDURES

1. If the aircraft is still controllable following inflight structural damage or failure, do not immediately make any major changes in existing configuration (retain flaps, gear, and airbrakes in the position existent at time damage was incurred).
2. Avoid turbulence or any maneuver that could apply unnecessary air loads to the aircraft.

NOTE

> Known bird strikes should be considered to have caused at least secondary structural damage. Airspeed should be reduced so as not to exceed 250 knots IAS or Mach .77, whichever is lower, for the remainder of the flight. "Damage Determination" procedures will be utilized and consideration given to early termination of the flight.

Damage Determination

If it is practical under the existing situation, request a chase plane to assist in determination of the extent of damage.

WARNING

- Pilot of the chase aircraft will be briefed on command chase aircraft procedures prior to engaging in chase operations.

- It is unsafe to fly two aircraft in close vertical proximity because of the magnitude of interrelated aerodynamic effects.

- If examination reveals that damage has occurred to secondary structure only and the damage does not include flaps or control surfaces, the flaps may be utilized as necessary.
- If damage has occurred to wing primary structure, the existing flap position should not be changed.
- If damage has occurred to elevator or horizontal stabilizer, flap position should not be changed until it is determined that sufficient longitudinal control is available to take care of the changing pitch trim requirements.
- If damage has occurred to one of the flaps, flap position should not be changed.

Controllability Check

If damage has occurred to any portion of the aircraft structure sufficient to affect the aircraft thrust, drag, lift, or in any other manner change the aircraft normal flight and control characteristics, a controllability check should be accomplished. This check should be conducted at an altitude at least 10,000 feet above the terrain or cloud cover. At these altitudes, the best flare speed will be increased by 1% for each 5,000 feet above 10,000 feet pressure altitude. The check should be accomplished in the intended landing configuration and immediately prior to descent for landing so that the gross weight and airspeed checked will be valid. The controllability check should be accomplished down to, but not below, best flare speed for the existing aircraft configuration and gross weight. Speed reduction for the last 30 knots above best flare speed should not exceed a rate of 1 knot per second. Following the controllability check, maintain aircraft loads and accelerations at a minimum by making all turns and maneuvers as shallow and gentle as possible and avoiding turbulence during the descent and approach to landing. For further information, see "Stall or Controllability Checks," Section VI.

WARNING

- When any controllability check is made due to doubtful control characteristics of the aircraft, the airspeed should not be reduced below the best flare speed for the aircraft configuration (approach speed for flaps up) in which the check is to be made. Under these conditions, the check should be discontinued immediately if any buffet or control problem is encountered.

- When the flaps are in a full-down or intermediate position and flap damage exists, such as a missing segment, the best flare speed given in the appendix may no longer apply. In this case, reduce speed slowly until the charted best flare speed is reached or until approximately one-half lateral control authority is required to maintain the wings level. Whichever of these speeds is higher should be used as the best flare speed.

NOTE

It is not always advantageous in modern aircraft to make large reductions of gross weight prior to landing after receiving structural damage. If the damage is a type that has reduced flight control capabilities, the reduced airspeed that would result from landing at low gross weights could result in control difficulties during the final portion of approach.

Fuel Leaks

If a fuel leak is known or suspected to exist, some of the following procedures may be required:

- Deenergize all electrical equipment not essential to continued safe flight and necessary communications.
- If the leak is such as to cause the emptying of a tank in a few minutes:

1. Close fuel feed valve for affected tank(s).
2. Stop transfer to affected tank(s).

NOTE

If the fuel leak is of a magnitude such as to deplete one or more tanks in a few minutes, the aircraft may have a tendency to become rapidly wing heavy, tail heavy, or nose heavy. Compensating fuel management for any of these conditions should be set up as soon as possible.

- If the rate of leakage is not excessively high, it is desirable to remove fuel from the leaking tank as rapidly as possible in order to keep any possible fuel contamination of the aircraft and its various compartments at a minimum. See "Fuel System Emergency Operation," this section, for tank emptying procedures.
- If the fuel leak exists in the area of any of the engine pods, the engines in the affected pod should be shut down.
- If the leak is in the bomb bay section, the aircraft should not be depressurized since strong fuel fumes may enter the crew compartment.

Electrical Circuit Damage

All electrical components of the flap and landing gear control circuits are hermetically sealed or explosion proof. Therefore, no special precautions will be required in the utilization of these circuits. If, however, structural damage has broken any wires or conduits, arcing could result from energizing these wires or conduits. If it is suspected that such damage may exist, explosion hazard may be minimized by utilizing the following procedure:

1. If damage to gear and flap circuitry is suspected, explosion possibility will be greatly reduced by energizing these circuits at altitudes above 30,000 feet. When gear and flaps are extended at high altitude, pull all circuit breakers to these control systems before descending.

NOTE

At altitudes above 30,000 feet, the possibility of accidentally igniting JP-4 fuel is reduced considerably. Altitudes between 15,000 and 25,000 feet may be more conducive to autoignition than either higher or lower altitudes.

2. Deenergize all circuitry suspected of being damaged by pulling the appropriate circuit breakers, to the extent that is possible, while still retaining the required functions.

ADDITIONAL PROCEDURES

It is seldom that two inflight emergencies are identical, therefore, the proper remedial measures will not necessarily be identical. When the necessary preliminary emergency procedures have been accomplished, contact the appropriate command within radio range for further assistance in determining additional emergency procedures.

EXPLOSIVE DECOMPRESSION

An explosive decompression occurs when the cabin pressure is reduced to the outside pressure in less than 1 second. Any explosive decompression affects all crew members and can be extremely dangerous if occurring at high altitudes. Following are some of the effects accompanying explosive decompression:

- Rush of air from lungs
- A momentary dazed sensation that passes immediately
- Possible gas pains
- Hypoxia if oxygen equipment is not immediately available

Following are precautions to observe in pressurized compartments:

1. Maintain a safe pressure differential.
2. Have oxygen equipment immediately available.

3. Have heavy flight clothing available.

If an explosive decompression occurs, ascertain, if possible, the cause of the trouble and, if it cannot be fixed in flight, the pilot should decide whether to continue the mission or to descend to a safe altitude immediately.

WARNING

If explosive decompression occurs above 42,000 feet, descend immediately to 42,000 feet or below.

NOTE

If decompression occurs, an apparent loss of interphone volume may occur due to increased cabin noise level. This situation may be alleviated by increasing interphone volume.

OXYGEN SYSTEM FAILURE

Descend to safe cabin altitude using emergency oxygen supply available.

BAILOUT/EJECTION PROCEDURES

At any time an emergency arises which may progress to a point where loss of aircraft control is possible, the pilot will alert all aboard over interphone to prepare to abandon. It is recognized that emergencies can arise where loss of aircraft control may be experienced without sufficient warning to allow the pilot to alert the crew before giving the command to bail out. Furthermore, in these cases time will not permit the pilot to receive an acknowledgement of his bailout command prior to initiating his own ejection sequence. Upon hearing this command, all personnel will initiate immediate action to bail out as expeditiously as possible. Before his own ejection, the pilot will determine insofar as possible that other crewmembers have left the aircraft.

NOTE

The interphone must be considered the primary means for crew warning.

The bailout alarm signals are as follows: For bailout, one long steady signal, obtained by placing the emergency alarm switch in ABANDON position. In addition, a steady signal is obtained when either the pilot's or copilot's control column is stowed during the ejection sequence.

WARNING

- Immediately following an alarm, crewmembers in ejection seats should ascertain that safety belts are fastened, ejection seat flight safety pins are removed, and emergency equipment is in readiness. Crewmembers not occupying ejection seats should check their equipment and proceed to the lower deck after depressurization.
- When the aircraft is below 2000 feet above the terrain or if aircraft control is lost at any altitude, crewmembers occupying ejection seats should eject immediately upon receiving the bailout command by either interphone or abandon signal.

The primary means provided for abandoning the aircraft in flight are the ejection seats for the forward crewmembers and a jettisonable turret for the gunner. Both upward and downward ejection seats will function at any speed; however, if time permits, a reduction in aircraft speed would be desirable since it will reduce the air blast on the seat occupants. During any low altitude ejection, the chances for successful ejection can be greatly increased by zooming the aircraft (if airspeed permits) to exchange airspeed for altitude. Ejection should be accomplished while the aircraft is in a positive climb and while the airspeed is above 120 knots IAS. This will result in a more nearly vertical trajectory for the seat and crewmember, thus providing more altitude and time for seat separation and parachute deployment. When the aircraft is descending and cannot be leveled out, ejection should not be delayed. Time required to get free of the aircraft may be the most important factor.

MINIMUM EJECTION ALTITUDES

No one minimum ejection altitude can be given to cover all types of ejections. Minimum altitude depends on aircraft speed and attitude, time required for human response and actuation of ejection controls, whether ejection is upward or downward, harness release time delay, type of parachute, and parachute deployment time delay. The minimum ejection altitudes presented in figure 3-5 are based on the use of a modified B-5 parachute with C-9 canopy, a 1-second harness release time delay and, on the upward ejection seats, a 0-second parachute deployment time delay (lanyard hooked to ripcord T-handle). These minimum ejection altitudes represent equipment capability only and do not include loss of aircraft altitude occurring during actuation of ejection controls or resulting from improper use of equipment.

In many instances, emergencies occur at "safe" altitudes but ejections are delayed to levels that make unsuccessful ejections inevitable. Also, improper or imperfect functioning of equipment or human response time may increase the minimum altitude required for escape. For increased safety, ejection should not be delayed to the minimum if higher ejection is possible. Ejection must be initiated at higher altitudes when in steep descent or dives. Therefore, to ensure the highest degree of survival, the following rules must be observed:

- **Under level flight conditions, eject at least 2000 feet above the terrain whenever possible.**
- **Under spin or dive conditions, eject at least 15,000 feet above the terrain whenever possible.**

WARNING

Do not delay ejection below 2000 feet above the terrain in futile attempts to start engines or for any other reason that may commit you to an unsafe ejection or a dangerous landing. Accident statistics emphatically show a progressive decrease in successful ejections as altitude decreases below 2000 feet above the terrain.

MINIMUM NON EJECTION ALTITUDES

Crewmembers not occupying ejection seats and the gunner should consider an altitude of 500 feet above the terrain as the minimum altitude for bailout.

LOW ALTITUDE EJECTION

In order to provide an improved low altitude escape capability, a system incorporating a 1-second safety belt delay and a 0-second parachute delay ("one and zero" system) is provided for the upward ejection seat escape systems. This system makes use of a detachable lanyard that connects the parachute arming knob to the parachute ripcord T-handle. At low altitudes, this zero delay lanyard must be connected, thus providing parachute actuation immediately after separation of the crewmember from the ejection seat. At other altitudes and airspeeds, the zero delay lanyard must be disconnected from the ripcord T-handle, thus allowing the parachute timer to actuate the parachute below the critical parachute opening speed and below the parachute timer altitude setting. The ring attached to the parachute harness is provided for stowage of the zero delay lanyard when it is not connected to the parachute ripcord T-handle. This "hookup" and "unhook" of the zero delay lanyard must be done manually by the crewmember.

WARNING

- When operating above terrain over 8000 feet high, the zero delay lanyard should remain connected until the aircraft is at least 2000 feet above the terrain during climb and should be reconnected at least 2000 feet above the terrain on descent.
- Manually pull the ripcord T-handle immediately following seat separation for all ejections below 14,000 feet. This is strictly a precautionary measure since the parachute should deploy automatically.

In order to provide for completely automatic separation of crewmember from seat, the downward ejection seats on these aircraft are equipped with a man-seat separator.

WARNING

Do not connect zero delay lanyard to parachute ripcord T-handle when using seat equipped with a man-seat separator.

The downward seats are one-control seats with two nylon straps installed in the seat under the survival kit and parachute. A reel-type ballistic actuator is connected to the automatic opening safety belt release initiator. The nylon straps are connected to a jackshaft driven by the reel-type actuator. During ejection immediately after safety belt release, the reel-type actuator pulls the straps tight to provide automatic-controlled separation of the seat occupant from the seat. Since this is completely automatic, the time delay incurred by a crewmember making a conscious physical effort to kick free of the seat is eliminated. Further, injured or unconscious crewmembers will be automatically separated from the seat and the parachute deployed following ejection.

EJECTION SPEEDS

Recent study and analysis of escape techniques from aircraft have revealed that ejection from B-52 aircraft may be successfully accomplished at airspeeds ranging from 120 knots to the limit speed of the aircraft. The zero second delay parachute configuration used for low altitude escape is restricted to velocities up to approximately 400 knots IAS because of excessive chute opening shock forces at higher speeds. Whenever circumstances permit, slow the aircraft down as much as possible prior to ejection. When

WARNING

These are emergency minimums above the terrain. Ejection should be started at or above 2000 feet, if possible.

1. All figures applicable to LEVEL FLIGHT only and are to be used only as guides. They are optimistic for diving attitudes and conservative for climbing attitudes.
2. All altitudes given are contingent upon separation from the seat without delay following ejection.
3. Zero second parachute figures, used during takeoff and landing, are applicable to airspeeds from 120 to 400 knots IAS.
4. All figures apply to modified B-5 parachute with a 1-second harness and lap belt release for upward ejection or a 0.3-second harness and lap belt release for downward ejection.

WARNING

Emergency minimum ejection altitudes quoted in this table were determined through extensive flight tests and are based on distance above terrain on initiation of seat ejection (i.e., time seat is fired). These figures do not provide any safety factor for such matters as equipment malfunction, delays in separating from the seat, etc. These figures are quoted only to show the minimum altitude you must go up to in the event of such low altitude emergencies as fire on takeoff. **They shall not be used as the basis for delaying ejection when above 2000 feet since accident statistics show a progressive decrease in successful ejections as altitude decreases below 2000 feet.** Therefore, whenever possible, eject above 2000 feet. To insure survival during extremely low altitude ejections, the automatic features of the equipment must be depended on.

UPWARD EJECTION/M-3 CATAPULT	
1 SECOND PARACHUTE	0 SECOND PARACHUTE
● F-1B Timer ● C-9 Canopy ● 125 Ft	● Lanyard Hooked To Ripcord T-Handle ● C-9 Canopy ● 0 Ft

DOWNWARD EJECTION/M-4 CATAPULT
1 SECOND PARACHUTE
● F-1B Timer ● C-9 Canopy ● 400 Ft

EMERGENCY MINIMUM EJECTION ALTITUDES — LEVEL FLIGHT

Figure 3-5

ejecting at low altitudes, pull the nose of the aircraft above the horizon if at all possible and use excess speed to gain altitude. Eject at the lowest practical airspeed above 120 knots IAS ("lowest practical" would be that speed below which level flight cannot be maintained). The need to be at the lowest possible airspeed down to 120 knots IAS prior to ejection is predicated on many factors such as avoiding bodily injury, precluding parachute or seat structural failure, and providing adequate tail clearance. Below 120 knots IAS, airflow is not sufficient to assure rapid parachute deployment. Therefore, it becomes extremely important during low altitude ejection to obtain at least 120 knots IAS, if possible, to assure complete parachute deployment at the greatest height above the terrain. During high altitude ejection, observing this minimum airspeed (120 knots IAS) becomes less important since there is adequate time (altitude) for parachute deployment. If the aircraft is not controllable, ejection must be accomplished at whatever speed exists, as this offers the only opportunity for survival.

PREPARATORY STEPS FOR EJECTION/BAILOUT

NOTE

If time permits during a controlled bailout, accomplish the following emergency steps.

1. Airspeed - Reduce (P)

Whenever circumstances permit, pilot will reduce airspeed, trim for level flight, and engage the autopilot prior to bailout.

WARNING

Maximum airspeeds for bailout from the navigator's escape hatch are 250 KIAS for gear down and 275 KIAS for gear up. Bailout from the escape hatch at higher airspeeds could result in fatal injury.

NOTE

- The gunner may have difficulty escaping from the tail if the aircraft is in an extreme nosedown attitude. It is recommended that the aircraft be trimmed for level flight, or a nose-high attitude if possible, to facilitate his bailout.
- At extremely low altitudes, it is recommended that the nose of the aircraft be pulled up in a "zoom up" maneuver during ejection to provide more time for parachute deployment. If an open hatch or bomb bay is being used for bailout, however, the aircraft should be trimmed for level flight.

2. Acknowledge Warning - Acknowledged (ALL)

Acknowledge the pilot's warning signal in the normal crew report sequence.

WARNING

The EW officer must insure that the ALR-20 rack is in the stowed and locked position before attempting ejection. Ejection with the rack extended would result in severe leg injuries.

3. SIF/IFF (if applicable) - Set (P)

Less ZV

If over friendly territory, place SIF/IFF in EMERGENCY, Mode 3 toggle switch "in," and set Mode 3 selector to 77.

ZV

If over friendly territory, place IFF master switch to EMER.

4. Safety Belt - Fasten (ALL)

Additional crewmembers should remain strapped in position until the aircraft is depressurized or after the navigator's hatch has left the aircraft in the ejection sequence.

WARNING

- Do not attempt downward ejection with safety belt unfastened under any circumstances.
- Do not manually open the safety belt prior to ejection at any altitude.

5. Equipment - Checked (ALL)

Crewmember will check parachute harness fastened, oxygen mask and chin strap fastened, helmet visor down, and beacon lanyard set as desired.

WARNING

On downward seat ejection, do not connect the zero delay lanyard to the parachute ripcord T-handle.

BAILOUT

1. ORDER CREWMEMBERS TO BAIL OUT (P)

Pilot gives command "Bail out" by interphone and by placing the emergency alarm switch in ABANDON. Bailout should be conducted in the order briefed. The navigator is ejected prior to the radar navigator in order to make this hatch available for bailout in case an ejection seat in the forward compartment fails or for use by extra personnel aboard. Extra crewmembers will commence bailout immediately following navigator in order briefed at crew inspection. The radar navigator waits to inform the pilot that all crewmembers using the navigator's escape hatch have left before ejecting himself. If time permits, each crewmember will inform pilot just before leaving the aircraft. In the event of loss of control of the aircraft, those crewmembers occupying ejection seats should eject immediately upon receiving the bailout order over the interphone or when the abandon light comes on. Extra crewmembers will bail out any opening available.

WARNING

In the event of fire in the forward wheel well area, the jettisoning of an escape hatch will cause smoke and flames to be drawn into the crew compartment. In the event of fire in the crew compartment, the jettisoning of an escape hatch will rapidly intensify and spread the smoke and flames throughout the crew compartment. Therefore, the jettisoning of an upward escape hatch prior to egress of all lower deck crewmembers and extra crewmembers could seriously hamper their escape. In this event, the revised order of bailout would be: G, N, extra crewmembers, RN, EW, CP, and P.

NOTE

- On receiving the pilot's order to bail out, pull bailout bottle release cord and assume position for bailout or ejection.
- If time permits, additional crewmembers should bail out prior to firing of upward escape hatch.
- Under flight conditions of high cabin pressure differential, the best indication of a hatch having been jettisoned will be a rapid decompression within the crew compartment.

UPWARD EJECTION

1. ARMING LEVERS — ROTATE (P-CP-EW)

Rotating the left arming lever out of its stowed position forward and upward to its full travel locks the shoulder harness inertia reel. The right handgrip may be rotated simultaneously with the left. Rotating the right arming lever forward and upward to its full travel positions the seat, stows the control column (on pilots' seats), jettisons the escape hatch, and arms the seat.

WARNING

- If the control column fails to stow automatically, it should be stowed manually to prevent possible leg injury during egress. If the control column fails to latch in the stowed position automatically, it can be latched by fully depressing the control column disconnect lever or by manually assisting the control column to the stowed position, whichever is most expeditious.
- Do not attempt manual release of the hatch. If the hatch fails to jettison, the ejection system has malfunctioned. There is no assurance that manual hatch release can be accomplished or that manual hatch release will correct the ejection system malfunction and make the seat safe for further use. Therefore, if hatch does not jettison, proceed with alternate bailout as this provides the greatest survival potential.

2. TRIGGER — SQUEEZE (P-CP-EW)

Squeeze the trigger against the right arming lever to fire the seat. The safety belt will open automatically 1 second after ejection, allowing the crewmember to kick free of the seat. If an automatic parachute is being used, the automatic timer will start to operate at preset altitude, then after the delay set on the timer expires, the parachute will open or, if bailout occurs below the preset altitude, the parachute will open 1 second after separating from the seat. If the automatic feature fails, manually unfasten the belt. Pulling the ripcord T-handle will override the automatic device and open the parachute immediately.

WARNING

- If the seat fails to eject:
    1. Manually unfasten safety belt
    2. Unfasten survival kit
    3. Proceed with manual bailout
- Immediately after ejection:
    1. Release arming lever
    2. Kick free of seat with positive action. (Experience has shown many casualties are caused by people freezing in the seat.)
- If the automatic opening safety belt fails to release after ejection:
    1. Manually open automatic opening safety belt.
    2. Kick free of the seat with positive action.
    3. Pull parachute arming lanyard knob or ripcord T-handle as applicable.
- If automatic parachute is being used and the safety belt is manually released or the parachute arming lanyard key is not inserted in the belt, then pull the arming lanyard knob immediately after separation from the seat.
- If parachute automatic opening device obviously has failed, pull the ripcord T-handle manually to open the parachute.
- Manually pull ripcord T-handle to open automatic parachute for all ejections below 14,000 feet.
- Pull survival kit release as soon as stable in parachute to lessen impact shock.

DOWNWARD EJECTION

1. TRIGGER RING — PULL (N-RN)

Grasp the trigger ring with both hands and pull. The safety belt will open automatically 0.3 second after ejection, allowing the crewmember to kick free of the seat. The man-seat separator separates seat occupant from the seat immediately after automatic safety belt release. If an automatic parachute is being used, the automatic timer will start to operate at preset altitude, then, after the delay set on the timer expires, the parachute will open or, if bailout occurs below the preset altitude, the parachute will open 1 second after separating from the seat. If the automatic feature fails, manually unfasten the belt. Pulling the ripcord T-handle will override the automatic device and open the parachute immediately.

WARNING

- When pulling the trigger ring:
  1. The ring must be held tightly during ejection to prevent flailing of the arms.
  2. To prevent injury, the elbows must be kept in against the body when pulling the trigger ring.

- If the trigger ring does not fire the catapult:
  1. Determine positively that the escape hatch has departed the aircraft.
  2. Pull upward on the manual catapult pin-pull handle on the left side of the seat.
  3. Reposition yourself for ejection.
  4. Pull trigger ring.

- If hatch fails to jettison:
  1. Do not attempt release of the hatch by use of the manual hatch release handle. There is no assurance that manual hatch release can be accomplished or that it would correct the ejection system malfunction and make the seat safe for future use.
  2. Proceed with nonejection (manual) bailout as this provides the greatest survival potential.

NOTE

- During controlled bailout, the radar navigator will report bailout of additional crewmembers.

- The failure of a hatch to jettison indicates a malfunction of the ejection system. If the radar navigator's hatch fails to jettison, pull the manual jettison handle on the floor at the right of the seat and attempt to reinitiate the ejection sequence. If this fails, proceed to the alternate exit and bail out. If the navigator's hatch fails to jettison, proceed immediately to the alternate exit and bail out.

WARNING

- If the automatic opening safety belt fails to release after ejection:
  1. Manually open automatic opening safety belt.
  2. Kick free of the seat with positive action.
  3. Pull parachute arming knob or ripcord T-handle as applicable.

- If parachute automatic opening device has obviously failed, pull ripcord T-handle manually to open the parachute.

- Manually pull ripcord T-handle to open automatic parachutes for all ejections below 14,000 feet. Pull survival kit release as soon as stable in parachute to lessen impact shock.

- If the seat fails to eject:
  1. Manually open automatic safety belt, detach survival kit, and proceed with nonejection manual bailout.

DOWNWARD EJECTION (Cont)

GUNNER'S BAILOUT

1. TURRET JETTISON HANDLE — PULL

Pull up on turret-drag chute interconnect control knob if pilot requests retention of drag chute. Jettison turret on the pilot's command. Upon jettisoning turret, if the drag chute is accidentally deployed, it may be possible to jettison the chute by pushing down on the drag chute control knob prior to bailout.

WARNING

When the turret is jettisoned, the aircraft has a tendency to pitch down. The gunner must be ready to abandon the aircraft immediately when the turret is jettisoned.

NOTE

If turret does not jettison in a controlled bailout, request pilot to lower right aft landing gear. Follow alternate bailout procedure.

WARNING

ZR

In an extreme emergency under an uncontrolled bailout situation (aircraft breakup and loss of aircraft control) and the turret fails to jettison, position the seat down and full forward (in relation to the aircraft), then pull canopy release handle. The canopy will have an unpredictable flight path after release; therefore, extreme caution should be used to ensure the gunner is clear of the canopy when pulling the canopy release handle.

2. INTEGRATED HARNESS RELEASE HANDLE — PULL

Pulling the integrated harness release handle will free the parachute harness and safety belt from the seat, permitting the gunner to leave the seat for bailout.

WARNING

- Lock inertia reel before actuating the integrated harness release handle to assure release of the integrated harness before leaving the seat.
- Pull integrated harness release handle only. Do not open safety belt when equipped with the modified parachute or integrated harness. Opening the safety belt will not release the occupant from the seat and may result in fatal delay.
- Hold up on the integrated harness release handle until safety belt and parachute are free of release fittings. It may be necessary to pull the belt from the release fittings.
- Do not pull the kit release handle while in the aircraft with the kit removed from the seat. Pulling the handle with kit suspended will cause the lid to open, leaving the crewmember attached to the survival kit. In an emergency, this could cause a fatal delay in escaping from the aircraft.

GUNNER'S BAILOUT

3. BAILOUT

Bail out of aircraft with arms and legs in close to the body. The static line will automatically pull the parachute arming lanyard after gunner has left the aircraft. If bailout is accomplished above preset altitude, the automatic timer will start to operate at preset altitude, then, after the delay set on the timer expires, the parachute will open. If bailout is accomplished below preset altitude, the parachute will open in 5 seconds. In either case, pulling the ripcord T-handle will override the automatic device and open the parachute immediately.

WARNING

- If parachute opening device has obviously failed, pull the ripcord T-handle manually to open the parachute.
- Pull survival kit release to lessen impact shock as soon as stable in the parachute.

ALTERNATE BAILOUT

WARNING

Detach the survival kit before leaving the seat to bail out an alternate exit. Detachment of the kit is necessary because the bulk of the kit would hamper or prevent egress.

Forward Crewmember's Alternate Bailout

If one of the forward crewmember's ejection seat fails to fire, it is possible to bail out from one of the downward ejection hatches from which the seat has already been ejected. Bailout may also be made from the bomb bay if time permits. See "Additional Crewmember Bailout Checklist" and "Bailout from Bomb Bay," this section.

The emergency parachute static line may be used for bailout of injured crewmembers through one of the downward opened hatches. For bailout of injured personnel above 14,000 feet, the static line should be connected to the automatic parachute arming lanyard. At lower altitudes, the static line should be connected directly to the ripcord T-handle of the parachute.

Gunner's Alternate Bailout

The right aft wheel well is designated as the first alternate bailout exit for the gunner if the turret fails to jettison during controlled bailout. Great effort is required to reach the wheel well with equipment and, therefore, the aircraft should be under control and a portable oxygen bottle should be used if at altitude. In case of uncontrolled bailout, the aft entry door should be used if unable to reach the aft wheel well.

BAILOUT FROM BOMB BAY

Bailout from the open bomb bay is a safe and easy method, provided the time to reach this position is available. The crewmember must traverse the walkway through the forward wheel well into the bomb bay. Due to the length of the bomb bay, no special technique is necessary for bailout from this position. The crewmember drops out from the walkway at the forward end of the bomb bay, making certain not to hit either side of the opening. This bailout may be made at any airspeed.

NOTE

The bomb bay doors should be opened at either the radar navigator's or pilot's position prior to proceeding to the bomb bay for bailout. However, the bomb bay doors can be opened by pushing down the gang switches at the aft actuator rod, provided alternator power and hydraulic pressure is available to perform the operation. This will allow the bomb doors to fully open and remain open. Unless the bomb bay doors have previously been opened by the pilot or radar navigator, availability of electrical power and hydraulic pressure must be ascertained before attempting to open the doors from the bomb bay for bailout.

GUNNER'S ALTERNATE BAILOUT

Gunner's Preparatory Steps

1. Report to Pilot "Turret Not Jettisoned. Lower Right Aft Gear."
2. Position Cabin Pressure Release Switch to Dump.

WARNING

If cabin pressure release switch will not dump cabin pressure electrically, pressure must be dumped manually with the emergency dump valve handle.

3. Disconnect Parachute Static Line from Parachute Arming Lanyard.

WARNING

It is necessary to manually unhook parachute arming lanyard from static line prior to vacating seat during alternate bailout to prevent premature actuation of parachute. The integrated release mechanism will not release the parachute from the static line.

GUNNER'S ALTERNATE BAILOUT (Cont)

4. Pull ML-2/CNU-68P Global Survival Kit Release Handle.

5. Pull Integrated Harness Release Handle.

WARNING

- Pulling the integrated harness release handle will free the parachute harness and safety belt from the seat, permitting the gunner to leave the seat for bailout.
- Lock inertia reel before actuating the integrated harness release handle to assure release of the integrated harness before leaving the seat.
- Hold up on the integrated harness release handle until safety belt and parachute are free of release fittings. It may be necessary to pull the belt from the release fittings.

6. Disconnect from Aircraft Oxygen System and Connect Portable Oxygen Bottle (if above 10,000 feet).

7. Disconnect Interphone.

8. Assume Position in Right Aft Wheel Well - Accomplished

   Proceed to right aft wheel well; stand on truss at rear of well holding walkway or other convenient structure for support.

9. Check Equipment - Checked

   Check helmet visor down, oxygen mask and chin strap fastened.

10. Pull Bailout Bottle Release Cord & Disconnect Portable Oxygen Bottle - Pull and disconnect

BAILOUT

1. BAIL OUT THEN PULL PARACHUTE ARMING KNOB (G)

From a crouched position, roll forward with arms and legs close to body. Hold parachute arming lanyard if using automatic parachute.

NOTE

Pull the parachute arming knob immediately after clearing the aircraft if using an automatic parachute. If bailout is accomplished above preset altitude, the automatic timer will start to operate at preset altitude then, after the delay set on the timer expires, the parachute will open. If bailout is accomplished below preset altitude, parachute will open in 5 seconds. In either case, pulling the ripcord T-handle will override the automatic device and open the parachute immediately. If conventional parachute is used, pull ripcord T-handle when altitude is reached where normal breathing is possible.

ADDITIONAL CREW MEMBER BAILOUT

NOTE

The open navigator's escape hatch is the primary exit for bailout. The open radar navigator's escape hatch may be used with equal success except for the slightly greater effort required to reach the proper bailout position. The seat will have been fired by this time and the ejection rails will be in the vertical position with the lower end at the aft end of the opening. If time permits, bailout may be made from the bomb bay. (See "Bailout from Bomb Bay," this section.) In the event of loss of control of the aircraft, extra crewmembers will bail out any opening available.

WARNING

- Unrestrained crewmembers are subject to injury during hatch jettison by air currents caused by the depressurization.
- Extra crewmembers will remain clear of the rear of the navigator's seat during the navigator's ejection sequence.

1. BAIL OUT THEN PULL PARACHUTE ARMING KNOB

Position is assumed by facing forward with feet placed on the diagonal rail braces on the outboard side of each rail. Crouch with hands placed on the compartment floor on each side of the hatch opening. Draw arms and legs in close to body. Exit head first, faced away from the slipstream, by rolling forward and downward through the opening. Be sure to duck head and crouch as much as possible to avoid hitting forward part of hatch. No serious turbulence exists in the area inside the open hatch. Altitude does not play a part in clearing the aircraft satisfactorily. Pull the arming knob immediately after clearing the aircraft. If bailout is accomplished above preset altitude, the automatic timer will start to operate at preset altitude, then after the delay set on the timer expires, the parachute will open. If bailout is accomplished below preset altitude, parachute will open in 5 seconds (1 second for ejection seat parachutes). In either case, pulling the ripcord T-handle will override the automatic device and open the parachute immediately.

WARNING

- Do not attempt to bail out from the side of the escape hatch as this type of bailout cannot be made in a crouched position. Bailout with the body in an extended or upright position would result in bodily injuries even at moderate airspeeds.
- If parachute opening device has obviously failed, pull the ripcord T-handle manually to open the parachute.
- Manually pull ripcord T-handle to open automatic parachutes for all bailouts below 14,000 feet.

UPWARD EJECTION

1 CHECK SAFETY BELT, OXYGEN MASK, CHIN STRAP FASTENED, HELMET VISOR DOWN, BAILOUT BOTTLE RELEASE KNOB PULLED

2 PLACE FEET IN FOOT RESTS

3 RAISE ARMRESTS

4 ROTATE LEFT ARMING LEVER UPWARD

5 HEAD AGAINST HEAD REST

6 ROTATE RIGHT ARMING LEVER UPWARD

7 SQUEEZE TRIGGER TO FIRE SEAT

NOTE

IF HATCH DOES NOT JETTISON, PROCEED TO ALTERNATE EXIT.

DOWNWARD EJECTION

1 CHECK SAFETY BELT, OXYGEN MASK, CHIN STRAP FASTENED, HELMET VISOR DOWN, BAILOUT BOTTLE RELEASE KNOB PULLED

2 PLACE LEGS IN POSITION AGAINST ANKLE RESTRAINT TRIGGERS

3 HEAD TIGHT AGAINST HEAD REST

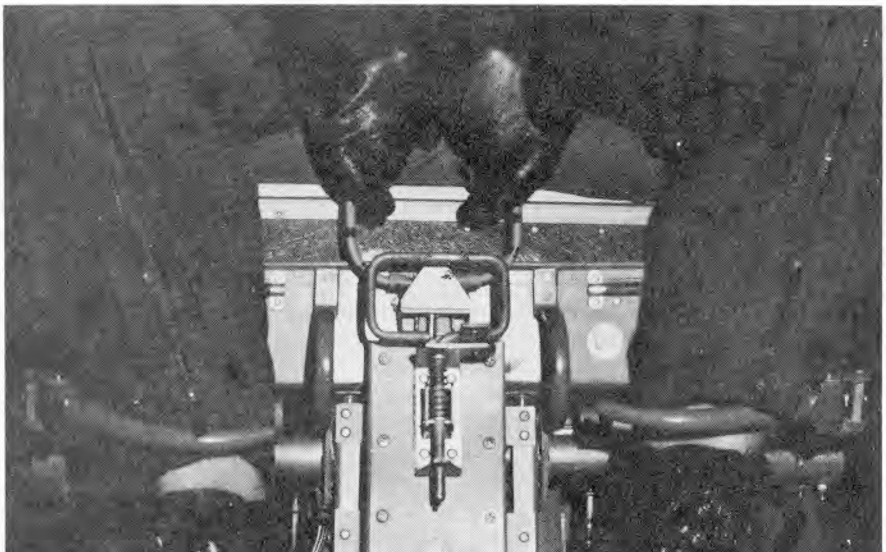
3-1-670

4 GRASP TRIGGER RING WITH BOTH HANDS, HOLD ELBOWS TIGHTLY AGAINST BODY AND PULL RING TO FIRE SEAT

5 IF HATCH DOES NOT JETTISON — RADAR NAVIGATOR PULL THE MANUAL JETTISON HANDLE. IF HATCH STILL DOES NOT JETTISON PROCEED TO ALTERNATE EXIT

NOTE

EQUIPMENT SHOWN MAY NOT BE TYPICAL.



3-752

Figure 3-6 (Sheet 1 of 2).

BAILOUT FROM NAVIGATOR'S ESCAPE HATCH

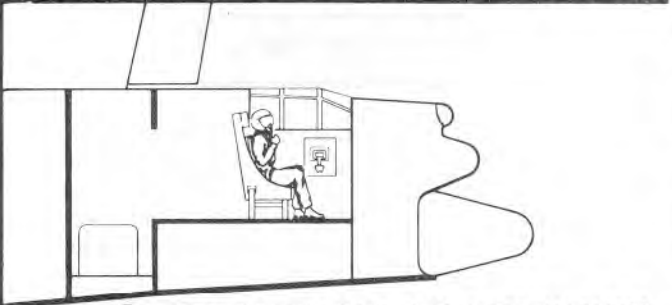
GEAR UP-275 KNOTS (IAS) OR LESS
GEAR DOWN-250 KNOTS (IAS) OR LESS

BAILOUT FROM RIGHT AFT WHEEL WELL

AIRSPEED-275 KNOTS (IAS) OR LESS

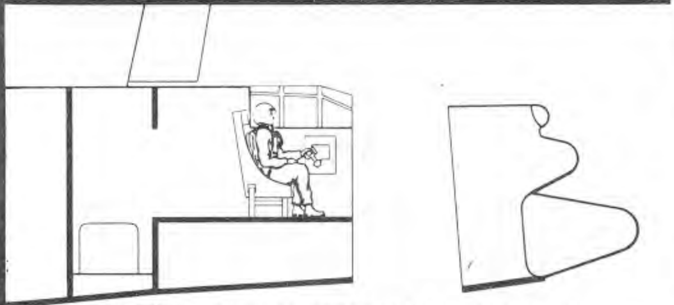
IF TURRET DOES NOT JETTISON REQUEST PILOT TO LOWER RIGHT AFT LANDING GEAR— FOLLOW ALTERNATE BAILOUT PROCEDURE

GUNNER'S BAILOUT PROCEDURE

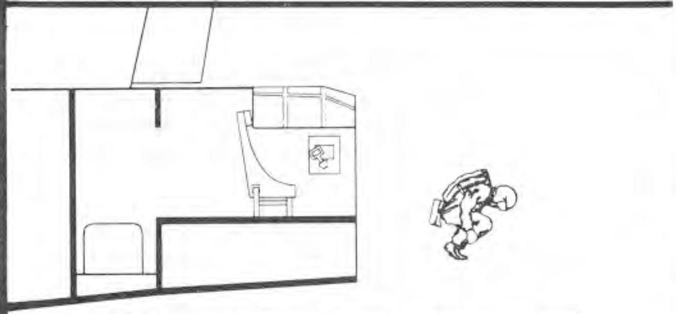


1 **FASTEN SAFETY BELT, SHOULDER HARNESS, OXYGEN MASK AND CHIN STRAP. HELMET VISOR DOWN**

2 **PULL UP TURRET-DRAG CHUTE INTERCONNECT CONTROL KNOB AT PILOT'S COMMAND ONLY**



3 **PULL TURRET JETTISON HANDLE ON PILOT'S COMMAND • NOTIFY PILOT — READY TO BAILOUT**



4 **PULL BAILOUT BOTTLE RELEASE KNOB**
5 **PULL INTEGRATED HARNESS RELEASE HANDLE**
6 **BAILOUT WITH ARMS AND LEGS TO BODY**

BAILOUT PROCEDURES

Figure 3-6 (Sheet 2 of 2).

EMERGENCY COMMUNICATION WITH GUNNER

WARNING

When the aircraft is at altitude and the gunner does not respond to an interphone call, the pilot will immediately check the pilot's tail compartment altimeter and the copilot's tail compartment low pressure warning light. If either or both of these devices indicates an abnormal condition in the tail compartment, an emergency descent will immediately be initiated. If both of these devices indicate that pressurization is normal, the crew will be notified and the CALL position of the interphone selector switch may be used to contact the gunner. In the event that all other methods of communication with the gunner fail, an emergency descent will be accomplished and a crewmember will initiate applicable portions of the "Emergency Inflight Movement Checklist" to investigate the condition of the gunner.

NOTE

- When communication with the gunner is lost, the following system will be used for transmitting signals by means of the call light for the following conditions:
- GUNNER CAN RECEIVE BUT CANNOT TRANSMIT BY INTERPHONE. Gunner transmits a series of dots using the call light. Pilot acknowledges over interphone.
- GUNNER CANNOT RECEIVE OR TRANSMIT BY INTERPHONE. Gunner transmits a series of dashes using the call light. Pilot acknowledges by sending a series of dashes using the call light.
- GUNNER CANNOT RECEIVE OR TRANSMIT BY INTERPHONE AND IS EXPERIENCING FLIGHT EMERGENCY. Gunner transmits a steady signal using the call light. Pilot immediately descends to 10,000 feet, terrain permitting, depressurizes the cabin, and sends a crewmember aft to the tail compartment to aid the gunner.

WARNING

Normal interphone (except Call) is inoperative while selector is in CALL position. Gunner will release selector switch as soon as descent is started.

NOTE

- When communication with the gunner is lost, the following method is available. The EW officer will place the ALR-18 to RADIATE in the sweep mode to cover the FCS frequency range. The gunner will take appropriate action by operating the ALR-18 deactivate switch using the same signals that would be used with the CALL light. The EW officer will then relay information to the pilot of the gunners status.
- When communication with the gunner is lost and abandonment of the aircraft is necessary: After the abandon light is activated and there is no indication the gunner has bailed out, time permitting, the EW officer will activate the APR-25 self test using button 1 so as to give a continuous visual signal. Upon receipt of this signal, gunner will abandon the aircraft.

EMERGENCY INFLIGHT MOVEMENT

NOTE

Loss of temperature control in the tail gunner's compartment will be considered as an emergency and emergency inflight movement to the forward compartment will be initiated.

WARNING

If an emergency inflight movement is made by other crewmembers to the tail compartment, the other crewmember should actuate the depressurization request light switch for entrance. However, if the gunner is unconscious, the compartment will be depressurized using the emergency cabin pressure dump handle.

An inflight emergency may make it necessary to bring the gunner forward during flight or to send a crewmember from the forward crew compartment to the tail compartment. On B-52D aircraft, crewmembers may encounter extreme difficulty when traversing the crawlway during an inflight emergency. At least one spare parachute in each compartment will preclude the necessity of taking a parachute along during this movement. Whenever possible, this movement should be made below 10,000 feet pressure altitude.

On training missions, if gunner's cabin altitude becomes greater than 20,000 feet, the pilot will initiate a descent to a pressure altitude of 10,000 feet and the gunner will go forward.

NOTE

- Prior to emergency movement of the gunner from the aft to forward compartment, it will be necessary for the pilot to raise the gear.
- A time delay (up to 2 minutes for forward compartment and 2 seconds for aft compartment) may be expected between the time cabin pressure is dumped and residual pressure depleted before the pressure door can be opened.

WARNING

- Complete loss of the aft TR units will result in an emergency situation for the gunner because of lack of control of the aft air conditioning pack and cabin temperature control.
- If an inflight emergency occurs requiring the gunner to come forward, the aircraft commander will instruct a crewmember to visually observe the gunner's progress through the bomb bay.

EMERGENCY INFLIGHT MOVEMENT

1. Stow Turret - Stowed (G)
    a. FCS Power Switch - WARMUP

       If system malfunction is cause for the movement of the gunner, the FCS will be turned to OFF.

    b. Track Emergency Off Switch - OFF (down)
    c. Search Emergency Off Switch - OFF (down)
2. Compressor Three-Phase & Heater Circuit Breakers - Pulled (G)
3. Turn Window Defog Switch Off - OFF (G)
4. Set Air Conditioning Master Switch to Off - OFF (G)
5. Set Air Conditioning Temperature Selector Switch to Manual - MANUAL (G)
6. Service & Carry Oxygen Bottle - Serviced and carried (G)

   If above 10,000 feet, a portable oxygen bottle will be carried. It will be recharged when necessary; possibly enroute. Recharging can only be accomplished at the bomb bay station while enroute (figure 4-19). Crewmember will carefully monitor oxygen pressure and regulator setting.

7. Turn Oxygen Supply Lever Off - OFF (G)

   Disconnect oxygen hose from regulator and hook up to portable oxygen bottle before turning oxygen supply lever off.

8. Carry Crewmember Equipment - Carried (G)

   Crewmember carries gloves, helmet, oxygen mask, and flashlight.

9. Compartment Lights - Off (as required)
10. Report to Pilot - Accomplished

    Request the aft crawlway lights to be turned on by radar navigator if applicable. The progress of the crewmember making the movement will be monitored by another crewmember both by timing and watching down the crawlway.

11. Operate Emergency Cabin Pressure Dump Handle - DUMP (G)
12. Open Aft Compartment Bulkhead Door, Close After Passage - Accomplished (G)

    Open and then close after entry into the 47 section. The gunner will close the bulkhead door behind him.

13. Close Emergency Cabin Pressure Dump Handle - CLOSED (G)
14. Turn Aft Compartment Section 47 Walkway Lights On - On (if applicable) (G)

EMERGENCY DESCENT

This procedure involves flying a descent speed schedule which is determined by the initial buffet limit and should not be used unless it is necessary to descend to a low altitude at the maximum rate of descent. If buffeting is encountered, it can be stopped by reducing the speed of the aircraft or by lowering the airbrakes to position 4. Do not subject the aircraft to negative "g" maneuvers or nosedown flight attitudes more severe than is necessary to maintain the emergency descent speed schedule. Trim to zero force on the control column during the descent.

EMERGENCY DESCENT

1. Throttles - IDLE (P/CP)

   Copilot will place AGM-28 engine control knobs in IDLE (if applicable). Leave throttles 4 and 5 advanced during landing gear extension to insure adequate pneumatic pressure for alternators and hydraulic packs.

2. Gear - DOWN (P)

3. Airbrakes - Six (P)

   Trim to zero force on the control column during the descent.

   NOTE

   Descend to safe altitude at .86 Mach until reaching 305 KIAS.

   CAUTION

   Severe pitchup will be encountered if nosedown stabilizer trim is not started prior to raising airbrakes to position 6.

4. SIF/IFF - Set (P)

   Less ZV

   If over friendly territory, place SIF/IFF in EMERGENCY, mode 3 toggle switch in, and set mode 3 code selector to 77.

   ZV

   If over friendly territory, place IFF master switch in EMER.

RADOME FAILURE/LOSS

Failure of the lower nose radome may begin as a collapse in the form of an inward bulge against the radar antenna. Such a collapse could result from a delaminated or soft spot in the radome caused by inflight collision with birds or hailstones or by ground damage. Failure will be audible as a loud thump accompanied by noise of the antenna bumping or scraping against the radome. If the antenna is completely jammed, the scope will so indicate. Therefore, in the event of a collapsed radome:

1. Immediately shut down radar.
2. Reduce airspeed to the lowest value that will leave a safe and reasonable margin above stall. (See "Airspeed Indication Failure," this section, in case of lost airspeed indication.)
3. Continue flight only as long as necessary.

WARNING

- Continued flight with radome collapsed may result in further structural failure with subsequent departure of the radome and loss of airspeed indications.
- Inflight loss of the lower nose radome will cause complete loss of airspeed and Mach indications during all flight conditions. An extreme increase in noise level and possible buffeting may occur.
- Inflight loss of the upper nose radome will cause the airspeed indicators to fluctuate 2 to 3 knots. Large instrument errors occur at airspeeds above 145 knots IAS with flaps down and above 270 knots IAS or .80 Mach with flaps up. Limit airspeeds to the above to avoid inadvertently exceeding flight limitations.

AIRSPEED INDICATION FAILURE

Loss of airspeed indication can result from pitot ice, leaks, loss of radome and other system malfunctions. There is no single best solution to deal with the loss of all airspeed indications under all conditions. However, there are a number of factors which must be considered in arriving at the best solution under a particular set of circumstances. If in cell, useful airspeed information can be obtained by maintaining a position relative to the other aircraft. All of the aircraft can aid in station keeping. In addition to the BNS radar, position indications can be obtained from the gunner's equipment. Setting the TA cursor on the aircraft ahead may help. The wind dials, which have a TAS input will be unreliable, but unless otherwise malfunctioning, the doppler ground speed will be reliable. It may also be possible to obtain ground speed from ground radar. To convert ground speed to airspeed requires accurate wind values which may be obtained from other aircraft in the vicinity of ground stations. If the aircraft is not in cell, consideration should be given to providing a chase airplane. A chase airplane should be used for airspeed and altitude if a landing is attempted with no airspeed indication.

The first consideration is to keep the aircraft under control and in a safe speed range; i.e., well away from the low speed or high speed buffet. As altitude and gross weight increase, the usable airspeed range between high speed buffet and low speed buffet is decreased. The B-52 aircraft in level flight is unlikely to encounter high speed buffet at high altitude and high gross weights because of engine thrust limitations. However, if the aircraft is descending under such a condition, the airspeed can rapidly increase and high speed buffet can be encountered. At low altitude, a descent maneuver can cause the aircraft to exceed the structural placard before the high speed buffet is encountered.

The stabilizer trim should be monitored. Progressive noseup trim requirements indicate the aircraft is decelerating and low speed buffet will be encountered. Nosedown trimming indicates that the aircraft is accelerating. Nosedown trimming followed by reverse or noseup trimming indicates that the high speed tuck region has been encountered and increasing speed will result in high speed buffet. If buffeting is accompanied by the nose of the aircraft dropping and a rapid decrease in altitude, the aircraft is either stalling or in a high speed dive. In a stall, elevator and rudder control pressures will be light, the aircraft will tend to wallow in the lateral axis, and lateral control/airbrakes will be ineffective. In high speed dives, the elevator and rudder pressures will be heavy and the lateral control/airbrakes will be effective. Lateral control pressures will increase with increasing speed. Recovery procedures for both conditions are described in Section VI of the flight manual. The aircraft can be successfully operated without airspeed indications as follows:

1. The pilot will alert all crewmembers over interphone to assume their positions and wear parachutes as directed under critical phases of flight.

8 ENGINE TOTAL FUEL FLOW — 1000 LBS/HR — LEVEL FLIGHT

	GROSS WEIGHT – 1000 POUNDS													
	200		240		280		320		360		400		440	
ALTITUDE -1000 FEET	KIAS	FUEL FLOW	KIAS	FUEL FLOW	KIAS	FUEL FLOW	KIAS	FUEL FLOW	KIAS	FUEL FLOW	KIAS	FUEL FLOW	KIAS	FUEL FLOW
SEA LEVEL	240	17.6	240	19.2	250	21.6	270	25.2	290	29.1	290	30.5	290	32.4
5	240	17.6	240	19.2	260	22.4	280	27.0	300	29.5	300	30.9	300	32.4
10	240	17.0	240	18.4	260	21.5	280	24.7	300	28.0	300	29.5	300	30.8
15	240	16.5	240	17.9	260	20.6	280	23.6	300	26.5	300	27.9	300	29.2
20	240	16.3	240	17.4	260	19.8	280	22.5	290	24.5	300	24.8	300	26.0
25	240	15.6	240	16.7	260	19.0	280	21.6	290	22.1	300	24.0	300	25.3
30	240	14.4	240	15.3	260	18.0	280	19.2	280	20.4	285	22.2	290	24.5
35	240	13.8	240	14.0	250	15.5	260	17.9	260	19.6	270	22.1	270	24.5
40	230	12.4	230	13.6	230	15.2	240	17.6	245	21.0	245	24.6	–	–
45	220	13.5	220	14.9	220	17.4	220	–	–	–	–	–	–	–

NOTE

- Increase fuel flow by 10% if loss of airspeed is caused by radome failure. In this case, these speeds may cause severe buffeting and a lower speed may be appropriate.
- Increase fuel flow by 2% for each 10°C over standard day temperature.
- Power setting in this chart will not necessarily prevent a stall if level off airspeed is less than that required for best endurance. If in doubt, use NRT and allow aircraft to accelerate to a safe airspeed.
- If protuberances or operational factors are present, apply the fuel flow correction factors in the "Range" section of the Appendix.

WARNING

Below 20,000 feet, NRT may accelerate aircraft past structural speed limits.

FUEL FLOW FOR AIR SPEED INDICATION FAILURE

Figure 3-7.

2. If practicable, request the immediate services of a chase aircraft for obtaining accurate airspeed checks and land as soon as conditions permit.

NOTE

A VFR landing with chase aircraft to monitor approach speed would be the most desirable procedure after due consideration of the following factors: gross weight, weather conditions at intended place of landing, length of time chase aircraft can remain in formation with B-52, and advisability of reducing gross weight prior to landing. If landing above 325,000 pounds gross weight becomes necessary, see "Heavy Weight Landing," Section II.

WARNING

- Pilot of the chase aircraft will be briefed on command chase aircraft procedures prior to engaging in chase operations.
- It is unsafe to fly two aircraft in close vertical proximity because of the magnitude of interrelated aerodynamic effects.

3. Depending on flight conditions when loss of airspeed occurred, accomplish the following appropriate procedure:

a. When airspeed is lost during level flight, see paragraph 4.

b. When airspeed is lost during climb, see paragraph 5.

c. When airspeed is lost during descent, see paragraph 6.

4. If all airspeed indications are lost in stable level flight, there should not be any immediate problem. If desired, engage autopilot; however, do not engage altitude hold if there is also a static system (altimeter or vertical velocity indicator) problem. Maintain power at the existing setting. Note and monitor stab trim setting especially when altitude hold is engaged. Rapid or continued changes of stab trim in one direction are danger signs. Avoid steep turns.

5. If all airspeed indications are lost in a climb, the problem is more complex. If altitude and conditions permit, the best solution is to level off. However, there may be factors favoring continuation of the climb such as; maintenance of cell integrity, adverse weather, terrain, and conflicting traffic. These must be balanced against dangers inherent in coping with the additional variables of attitude and vertical velocity, decreasing performance and increasing susceptibility to stall.

a. Level-off should present no problem if prescribed climb airspeed was being maintained. The existing NRT fuel flow would be safe for initial level-off. After the aircraft is in level flight, reduce fuel flow using the chart value from figure 3-7. At low weight and low altitude, do not delay this reduction as aircraft will accelerate rapidly. When level, follow procedures in paragraph 4. The chart values may not accelerate the aircraft to the charted speed, but will maintain it, once reached. The greatest danger is low speed and resultant stall.

b. Level flight fuel flow for charted airspeed can be immediately determined by entering figure 3-7 with altitude and gross weight. Adjusting the fuel flow to the values shown in the chart for a specific altitude and gross weight will not necessarily prevent a stall if level-off airspeed is less than that required for best endurance. If in doubt, use NRT and allow the aircraft to accelerate to a safe airspeed. Airspeeds that are less than best endurance will place the aircraft on the back side of the drag curve. For additional discussion of the drag curve, see "Thrust-Drag Speed Stability," Section VI. The data presented in the chart was extracted from the fuel flow charts in the "Range" part of the Appendix. Flight conditions are for a clean aircraft on a standard day. If protuberances or operational factors are present, apply the range correction factors given in the "Range" section of the Appendix.

c. If it is necessary to continue climb, concentration on aircraft attitude and performance is mandatory. Engage autopilot, if desired. Monitor vertical velocity and pitch attitude closely. Note and monitor stabilizer trim. Closely monitor EPR to insure that NRT is maintained. Avoid steep turns. If in cell, use every aid for station keeping and coordinate closely with other aircraft concerning relative position and performance. Cross-check doppler ground speed. At level-off, follow procedures in paragraph 5.a. above; however, it must be assumed that airspeed will have varied during continued climb. If at high weight and/or altitude, it would be safe to maintain NRT for several minutes to insure that a safe airspeed has been reached.

6. If all airspeed indications are lost during descent, a different set of problems ensue. Again, there may be factors which might suggest continued descent, but unless there are compelling reasons to the contrary, leveling off is probably the better decision. During descent, concentrate on aircraft attitude and performance. Use autopilot and monitor vertical velocity and attitude closely. Note and monitor stabilizer trim and cross-check doppler ground speed. An important consideration would be to level off at an altitude which would permit safe bailout if controlled flight becomes impossible.

a. When the decision is made to level off, break descent in the normal manner, lower air brakes, and apply power. Prior to level-off, time permitting, obtain fuel flow from the chart. If time does not permit, 7% of the aircraft gross weight (clean aircraft) will equal a safe initial fuel flow setting, e.g., for a 300,000-pound aircraft initially set 21,000 PPH fuel flow until the flight manual can be consulted.

7. If altitude changes become necessary because of weather or other reasons and no chase aircraft is available, a safe airspeed can be maintained by using the following procedure. Shut down engine 2 or 8. Enter chart in figure 3-3, "Air Start Envelope," with pressure altitude and desired indicated airspeed for letdown and obtain the desired windmill rpm for the engine that has been shut down. The following example lists desired windmill rpm for a 240 KIAS letdown:

PRESSURE ALTITUDE	DESIRED WINDMILL RPM
40,000	37%
35,000	33%
30,000	31%
25,000	28%
20,000	27%
15,000	25%
10,000	23%
5,000	21%
2,000	18%

WARNING

The actual airspeed could be from 10 to 70 knots low when using the engine windmill rpm to obtain desired indicated airspeed during letdown. Use this procedure as a last resort only and closely monitor for indications of low or high speed conditions as described in the above "Airspeed Indication Failure" text.

NOTE

During level flight on seven engines, the chart can be entered with pressure altitude and stable windmill rpm to obtain the resultant indicated airspeed.

Pitch corrections should not exceed 2° on the attitude gyro. Corrections in excess of 2° will cause overcontrol due to time lag to achieve stabilized windmill rpm. Traffic pattern should not be flown without chase aircraft; however, knowledge of wind velocity and direction coupled with doppler ground speed will provide the most reliable airspeed information. Subtract effective tailwind or add effective headwind from doppler ground speed to obtain approximate KIAS. Eight-engine operation should be resumed after arrival of chase aircraft.

FUEL FLOW FOR AIRSPEED INDICATION FAILURE

Level flight fuel flow for charted airspeed can be immediately determined from figure 3-7 by entering the chart with altitude and gross weight. This chart provides a minimum speed of 240 KIAS except for some low weight/high altitude conditions. All airspeeds shown are at least 15 knots above best endurance and generally approach best range speeds. Adjusting the fuel flow to the values shown in the chart for a specific altitude and gross weight will not necessarily prevent a stall if level-off airspeed is less than that required for best endurance. If in doubt, use NRT and allow the aircraft to accelerate to a safe airspeed. Airspeeds that are less than best endurance will place the aircraft on the back side of the drag curve. If the speed is less than the speed for minimum drag (best endurance) and thrust equals drag, altitude will be held. If a gust or control input occurs, it can cause a drag increase and deceleration will occur. If the pilot or autopilot is trying to hold altitude, this will not permit an accelerating force to develop and the deceleration will become more severe. In this situation, the aircraft will continue to decelerate further and stall will result unless power is applied or the nose is lowered enough to develop an accelerating force. The data presented in figure 3-7 was extracted from the fuel flow charts in the "Range" part of the Appendix. Flight conditions are for a clean aircraft on a standard day. If protuberances or operational factors are present, apply the fuel flow correction factors in the "Range" section of the Appendix.

EMERGENCY JETTISONING

ALE-20 INFLIGHT EMERGERGENCY JETTISON

During a planned crash landing or landing with both rear gears retracted, a possibility exists that loaded flares may be ignited from the ensuing heat and/or shock. For this reason, it is recommended that the flares be jettisoned if conditions permit. Time available, aircraft performance, fuel remaining, etc, are all considerations in electing to jettison the flares. The flares should be expended over an open water or isolated land area. If over land, the minimum altitude for jettisoning is 5000 feet. When flares are to be jettisoned, follow the procedures in the "ALE-20 Inflight Emergency Jettison" checklist.

ALE-20 INFLIGHT EMERGENCY JETTISON

NOTE

During flare dispensing, as each flare leaves the aircraft, crewmembers can expect a bright white flash visible within the crew compartments accompanied by a slight vibration of the aircraft similar to firing of guns. These flashes will be most noticeable at night, in the vicinity of cloud formations, or during IFR flight conditions; however, the flashes are discernible even during daytime VFR flight conditions.

1. Place Flare Circuit Breakers In - In (EW)
2. Turn Pilot's Flare Set Power Switch ON - ON (P)
3. Turn Power Switch ON - ON (EW)
4. Turn Transfer Switch OFF - OFF (EW)
5. Depress Fast Train Button - Depressed (EW)

   The "Program In Progress" light will illuminate when the fast train button is depressed. When the last flare has left the aircraft, the 'RH Empty" light will illuminate.

6. Turn Power Switch OFF - OFF (after "RH Empty" light illuminates) (EW)
7. Turn Pilot's Flare Set Power Switch OFF - OFF (P)

LANDING EMERGENCIES

LANDING GEAR FAILURE TO EXTEND

1. Position Landing Gear Lever to GEAR DOWN - Accomplished (P)

   Leave lever in GEAR DOWN position.

2. Turn Battery Switch ON - ON (CP)

   If battery switch is OFF and no ac power is available when landing gear lever is placed in GEAR DOWN, the utility hydraulic packs will not start even though the battery switch is subsequently moved to ON position. It will be necessary to place the battery switch ON and momentarily place hydraulic pack switches to OFF & RESET, then ON position, before packs can be started.

3. Check Hydraulic System Pressure - Checked (P)

   NOTE

   - Check hydraulic pressure on failed gear or gears. If pressure is low, use "Hydraulic System Failure Checklist." If pressure is normal proceed with this checklist.
   - With the landing gear lever down and the standby pump operating (hydraulic pack inoperative), the pressure indication will be near zero until the affected gear is down and locked (approximately 2 to 3 minutes).

4. Pull & Reset Normal Control Circuit Breaker(s) for Affected Gear - Pulled and reset (P)

   Should an intermediate gear position be indicated as a result of a malfunctioning position switch, pulling and resetting the normal control circuit breaker will break the holding circuit of the position switch relay, allowing the gear indication to become compatible with the physical location of the gear. The remainder of the checklist will be accomplished if the gear down indication is not obtained.

5. Pull Normal Gear Control Circuit Breakers for All Unaffected Gear - Pulled (P)

   By pulling the normal gear control circuit breakers for all unaffected gear, the unaffected gear will not be recycled unnecessarily.

6. Position Landing Gear Lever to GEAR UP - Accomplished (P)

   Check for gear up indication.

7. Position Landing Gear Lever to GEAR DOWN - Accomplished (P)

8. Reset All Normal Gear Control Circuit Breakers - Reset (P)

   If gear down indication is not shown, proceed with step "9."

LANDING GEAR FAILURE TO EXTEND (Cont)

9. Actuate Emergency Landing Gear Switch(es) to EXTEND - Accomplished (P)

CAUTION

> To reduce the possibility of system damage, do not place switch to OFF or RETRACT position while the gear is in motion.

Actuate emergency switch(es) to EXTEND for failed gear; however, limit operation to 10 seconds maximum if main gear has failed to extend after unlocking by use of normal system. (Time limit does not apply to tip gear since it is protected by a hydraulic fuse.) Actuation of the emergency switch(es) to EXTEND automatically turns on the alternate pack and its standby pump for main gear only. The spoiler standby pump switch must be on to provide standby pressure for emergency tip gear extension should hydraulic packs 6 or 7 fail. The following indicates alternate pack operation by emergency landing gear switch:

GEAR	NORMAL PACK	ALTERNATE PACK
Left Front	1	2
Right Front	2	1
Left Rear	3	4
Right Rear	4	3
Left Tip	5	6
Right Tip	8	7

If a tip gear fails to extend after using the normal system and if subsequent use of the emergency system fails to extend the tip gear, pull No. 5 or 8 standby pump circuit breaker, turn hydraulic pack switch 5 or 8 OFF, and bleed the normal system down by operating the spoilers. Repeat actuation of emergency switch and continue to bleed down the normal system as the gear extends. After the gear is down and locked, turn emergency tip gear switch to OFF. Restart pack 5 or 8. If tip gear retracts, shut down pack 5 or 8 and bleed down as before. After the gear is down and locked, leave emergency tip gear switch in EXTEND position and do not restart pack 5 or 8. This will result in loss of the use of the outboard spoilers and airbrakes on the side of the affected gear.

LANDING GEAR FAILURE TO EXTEND (Cont)

10. Turn Emergency Landing Gear Switch(es) Off - OFF (P)

As soon as landing gear is down and locked, return emergency switch(es) to OFF position. Return landing gear emergency switch(es) to EXTEND only if landing gear attempts to move to opposite position when emergency switch is returned to OFF position.

CAUTION

Continuous overload operation of the standby pumps will occur if the main landing gear emergency switch is left in EXTEND position.

NOTE

Since the standby pump switches are turned ON for all landings, standby pump pressure will be available as needed for braking regardless of the position of the landing gear emergency switches.

CAUTION

If the normal standby pump circuit breaker has been pulled because of low hydraulic pressure, pushing the normal standby pump circuit breaker back in could cause the standby pump to run in a dry hydraulic system which will damage the pump and possibly constitute a safety of flight hazard.

NOTE

If one main gear will not indicate down and locked after executing proper emergency procedures, leave the gear down and land using procedures outlined under "Landing With Partial Gear Checklist," this section.

WARNING

Due to the hazards involved, installation of downlocks in flight should not be attempted except in a serious emergency.

LANDING WITH BADLY UNBALANCED TIRE

If the decision is made to land with a failed tire condition (blown out, flat, or chunk loss), the following criteria are recommended in order to determine landing configuration.

1. If the specific unbalanced or failed tire cannot be identified, it is recommended that the landing be accomplished at minimum gross weight with all gear extended.
2. When the specific main landing gear tire failure can be determined, and the affected gear can be retracted with the normal system, subsequent landing on the affected gear will not be attempted. Since there is no way to determine certain minor damage to the landing gear strut or assembly, a landing on that gear may induce initial damage or aggravate already existing damage resulting in possible complete failure of the landing gear.

NOTE

The following procedures apply to main landing gear only. An affected outrigger gear should be down and locked for landing; however, the landing checklist for one or both tip gear retracted will be followed.

Before landing (if the landing gear has been retracted), pull the normal and emergency control circuit breakers for the affected gear to assure that it will remain up and locked when the landing gear lever is actuated to lower the landing gear. If the landing gear remained down and locked after takeoff, the affected gear should be retracted using the following procedures:

1. Pull the normal gear control circuit breakers for the nonaffected gear.
2. Place gear lever to the up position.
3. When the affected gear indicates up and locked, pull the normal and emergency control circuit breakers for the affected gear.

CAUTION

Do not attempt retraction of the affected gear by the emergency retraction system when main gear hydraulic system damage is suspected since alternate hydraulic system fluid may be depleted. If the affected gear remained fully extended, additional gear damage may be expected upon landing.

4. Place the gear lever to the down position. Reset the normal gear control circuit breakers for the nonaffected gear.
5. Check all nonaffected gear down and locked.

NOTE

See "Landing With Partial Gear Checklist," this section, when ready to land.

PARTIAL GEAR LANDINGS WITH AGM-28 MISSILES INSTALLED

When landing with both rear gears retracted, the AGM-28 engine(s) can be expected to contact the ground. With one main gear retracted, AGM-28 engine(s) will be in close proximity to the ground. If an AGM-28 engine contacts the ground, it will present no greater fire or structural hazard than an aircraft engine contacting the ground. For further information, see "Landing With Partial Gear Checklist."

LANDING WITH PARTIAL GEAR

One Main Gear or One Forward and One Rear Gear Retracted on Opposite Sides

1. Reduce Gross Weight - Accomplished (P)

Reduce gross weight to as low as possible but assure that 20,000 pounds of usable fuel remain when initiating the landing. If missiles and/or internal weapons are aboard, the landing gross weight may be above 200,000 pounds. Landing gear loading at 200,000 pounds with one gear retracted corresponds to a 400,000-pound landing with all gear extended. Weight reduction can be accomplished by flying at low altitude and high thrust settings (up to NRT) with airbrakes and landing gear extended.

NOTE

In the case of one main gear retracted, there is no requirement to establish a lateral fuel unbalance in order to reduce the tip gear load on the side with the retracted gear. A differential significant enough to reduce tip gear load would result in an increase in landing gross weight, lateral unbalance which could introduce controllability problems, and possible fuel starvation due to uncovered fuel pumps. The tip gear load imposed in this situation is relatively small when compared to ultimate design load.

2. Accomplish Normal Landing (P-CP)

Make normal approach with airbrakes in position 4. Touch down on main gears simultaneously at the minimum rate of descent. Keep braking at a minimum using all the runway available if one of the forward gears is retracted.

WARNING

Do not move steering ratio selector lever to TAXI position during ground roll. Even if the retracted gear is a forward gear, sufficient steering normally should be available. Stop the aircraft straight ahead on the runway. Do not attempt to taxi with a gear retracted.

One Forward and One Rear Gear Retracted on Same Side

1. Check Weight Distribution - Checked (CP)

Reduce gross weight to as low as possible but assure that 20,000 pounds of fuel remain when initiating the landing. Distribution of the fuel should be 7500 pounds in each main tank and 5000 pounds in the outboard wing tank on the side opposite the gear failure. Prior to initiating landing, fuel should be depleted from the main tanks on the side with gear failure and boost pumps turned off. Full lateral trim plus partial lateral control will be required at all flaps down speeds to compensate for asymmetrical fuel loading.

CAUTION

Fuel shall not be transferred directly between main tanks except through valve 46 and the refuel system. This is to prevent excessive surge pressures due to closure of transfer valve.

NOTE

If time is available, a controllability check should be made to determine the control characteristics which will be encountered on landing. This check is described under "Stall or Controllability Checks," Section VI.

LANDING WITH PARTIAL GEAR (cont)

2. Open Crossfeed Valves 9, 10, 11 & 12 - Opened (CP)

   The landing should be made by operating all engines on the fuel remaining in the main tanks on the side with gear extended.

3. Accomplish Normal Landing (P-CP)

   Make normal approach with airbrakes in position 4. Touch down with both main gear simultaneously at the lowest possible rate of descent. Hold the wings nearly level with the tip gear on the side with the extended main gear riding firmly on the runway. Apply minimum braking and steering. Use all of the runway if necessary to stop the aircraft on minimum braking.

WARNING

Do not move the steering ratio selector lever to TAXI during ground roll. Stop the aircraft straight ahead on the runway. Do not attempt to taxi the aircraft.

Both Forward Gears Retracted

It is not recommended that a gear down landing be made when the forward landing gear cannot be extended. In such a case, all extended landing gear should be retracted if a crash landing must be made.

Both Rear Gears Retracted

NOTE

When the rear main landing gears will not extend but the landing conditions are otherwise favorable, a landing on the runway with the forward and tip gears extended is recommended. This will probably result in less damage to the aircraft than crash landing off the runway. The fire hazard due to the location of the fuel vent in the bottom of the fuselage is a small additional risk in a rear gear up landing on concrete. The gunner will bail out if a landing with both rear gears retracted is to be accomplished.

1. Reduce Gross Weight - Accomplished (P)

   Reduce gross weight to an absolute minimum. Weight reduction can be accomplished by flying at low altitudes and high thrust settings (up to NRT) with airbrakes and landing gear extended.

2. Accomplish Crash Landing and Ditching Checklist.

LANDING WITH PARTIAL GEAR (cont)

One or Both Tip Gears Retracted

1. Check Weight Distribution - Checked (CP)

   a. Landing with one tip gear retracted

   Establish a 6000-pound differential between tanks No. 1 and 4 with the greater weight on the side of the extended tip gear.

   WARNING

   If both spoiler groups are inoperative on the wing with the retracted tip gear due to hydraulic pack failures, do not follow the above procedure. Maintain a balanced wing fuel loading as closely as possible. Follow the procedure under "Landing With Loss of All Spoilers on One Wing," this section.

   CAUTION

   Fuel shall not be transferred directly between main tanks except through valve 46 and the refuel system. This is to prevent excessive surge pressures due to closure of transfer valves.

   b. Landing with both tip gears retracted

   (1) Landing without crosswind

   Maintain symmetrical fuel load.

   (2) Landing with crosswind

   Establish a 3000-pound differential between tanks No. 1 and 4 with the greater weight on the upwind side.

   NOTE

   - If time is available, a controllability check should be made to determine the control characteristics which will be encountered on landing. This check is described under "Stall or Controllability Checks," Section VI.
   - Every effort will be made to land into the wind avoiding crosswinds.

LANDING WITH PARTIAL GEAR (cont)

2. Accomplish Normal Approach & Landing - Accomplished (P)

   a. With one tip gear retracted, make a normal approach and landing, touching down at the lowest possible rate of descent. Hold wings nearly level with the extended tip gear riding firmly on the runway. Apply minimum braking and steering.

   WARNING

   Stop the aircraft straight ahead on the runway. Do not attempt to taxi the aircraft except in an emergency which requires clearing the runway. If taxiing is required, make only large radius turns and make all turns away from the extended tip gear if possible.

   b. With both tip gears retracted, make a normal approach and landing, touching down at the lowest possible rate of descent. Hold wings as level as possible. If a wing starts to drop while at low speeds during landing roll, even though full lateral control is used, a sharp turn toward the dropping wing may assist in bringing it back up. If crosswind crab is used, brake application may tend to cause the aircraft to heel over toward the downwind wing. Therefore, brake application should not be heavy until crosswind crab has been centered during the roll. Apply only small forward gear steering corrections during the roll unless steering is used to bring up a wing.

   WARNING

   Stop the aircraft straight ahead on the runway. Do not attempt to taxi the aircraft with the tip gears retracted.

LANDING WITH ONE FORWARD GEAR STEERING FAILURE

In case steering is lost on one forward main landing gear, the aircraft may still be landed without undue concern. As the other main landing gear is turned, a sufficiently large turning moment is introduced to change the direction of the aircraft path down the runway. The main landing gear on which steering has failed will tend to caster and normally will follow the wheels which are turning unless some unusual failure has occurred. More rudder pedal travel along with more rudder pedal force will be required to obtain the same amount of effective steering as when both steering systems are operating. Maintain the aircraft in as near a level attitude as possible during the landing roll and, when the aircraft slows down to taxi speed, move steering ratio selector lever to TAXI position. Drag chute deployment during a strong crosswind is not desirable since this tends to turn the aircraft. If drag chute deployment is necessary, the chute should be jettisoned early.

NOTE

- If the standby pump is not used for emergency steering and the aircraft comes to a complete stop, effective steering will be greatly reduced as the gear that is trailing will be difficult to caster.
- The rudder pedals should be in neutral when the steering ratio selector lever is moved to TAXI position.

LANDING WITH COMPLETE STEERING FAILURE

WARNING

- Prior to landing, crosswind crab should never be set if steering has failed on both forward gears. Rotation of rear gears only will produce turning moments which may result in a high speed ground loop.
- If the forward gear steering fails because of complete loss of forward hydraulic pressure, normal brake pressure will not be available and braking will be limited to brake accumulator pressure. See "Landing With Brake System Failure," this section.

WITH FAILURE OF FORWARD CROSSWIND CRAB SYSTEM

It is quite unlikely that both of the forward gear steering systems will fail at the same time. This would require that two hydraulic packs as well as two hydraulic standby pumps must fail at the same time, or it would require some multiple failure of the steering or hydraulic mechanism. However, if such a combination of failures is encountered, the aircraft can be steered by use of the rear gear through actuation of the crosswind crab system. Corrections should be made by turning the crosswind crab control knob and pushing the rudder pedals in the direction in which it is desired that the aircraft go. For instance, if the aircraft is about to run off the right side of the runway, the knob should be turned to the left by a very small amount. This will cause the rear wheels to turn to the right which in turn will result in the aircraft turning to the left.

CAUTION

If the crosswind crab system is used on the rear gear in order to keep the aircraft on the runway, only a very small turning correction should be applied since a small turning angle introduces large turning components.

WITH COMPLETE FAILURE OF CROSSWIND CRAB SYSTEM

If it is known that both forward gear steering systems have failed while the aircraft is still in the air and the crosswind crab system is also inoperative, it is recommended that the landing be made at some field which has no crosswind. If no such field is located within the vicinity, the runway selected should be the one with the least amount of crosswind and the one that has the smoothest grading off the runway proper. Without use of the crosswind crab system on the rear gear, only small turns can be made by applying full rudder. Such action will cause the tires to corner slightly, but is only effective down to speeds of approximately 90% of touchdown speed. At speeds below 90% of touchdown speed, the rudder becomes ineffective in producing any change in direction. Some steering at lower speeds can be accomplished by banking the aircraft in the direction in which it is desired to turn. In this manner, a roller skate turning effect is introduced which may aid in keeping the aircraft on the runway. If the failure has occurred because of complete loss of hydraulic pressure, limited braking may be available from brake accumulator pressure. See "Landing With Brake System Failure," this section. If brakes are available, the drag chute should not be deployed unless the wind is straight down the runway since any wind at some angle off the runway will cause the chute to stream in a similar direction with the result that the aircraft will turn further into the wind. The chute should be jettisoned at any time an insufficient amount of directional control is available to keep the aircraft on the runway unless an overrun is probable.

LANDING WITH INSUFFICIENT STEERING ANGLE

Under certain emergency conditions on the ground, if a larger steering angle is necessary to control the aircraft, the steering ratio selector lever may be actuated toward TAXI position. Applying pressure to the steering ratio selector lever steers the aircraft further in the direction applied by the rudder pedals. Gaining this additional steering angle with the steering ratio selector lever may require the application of considerable force. The action must be smooth and firm.

CAUTION

Extreme caution must be exercised to avoid overcontrolling the aircraft and causing structural damage.

LANDING WITH CROSSWIND CRAB SYSTEM MALFUNCTION

ONE GEAR OPERATING WITH STANDBY PUMP PRESSURE ONLY (HYDRAULIC PACK SHUT DOWN)

When landing with one gear operating on standby pump pressure only, that particular gear will lag the gear being driven by the normal hydraulic packs. Braking and steering cannot be accomplished simultaneously on that gear.

CAUTION

When landing with the left aft crosswind crab operating on standby pump pressure only, accomplish crosswind centering manually as the centered signal for all gear originates from the centered position of the left aft gear. Since this gear is operating on standby pump pressure only, it will lag the other three gears. It will be necessary to monitor the position of the indicators while centering the gear.

ONE GEAR INOPERATIVE

If the crosswind crab control knob is turned and the indicator shows that one or more of the gears has not turned with the others, additional checks must be made to determine whether or not the crosswind crab system should be used for the landing. It cannot be established from observations made in the cockpit that crosswind crab system has failed on any one gear since the indicator is electrically connected only to one forward and one rear gear. Therefore, in order to determine if a single or multiple failure has occurred, a visual inspection of the wheels must be made by a member of the flight crew at the wheel well. The bombsight may be used to determine if the forward gears are at approximately the same angle. If it can be determined that crosswind crab has failed on only one gear, a normal crosswind landing can be accomplished if the crosswind encountered is of such magnitude to warrant such use. Such a landing should be accomplished using the minimum rate of sink at touchdown so as to minimize the side loads which will be imposed on the misaligned gear. Depending upon the type of malfunction, the misaligned gear normally will caster so that it will trail in approximately the same direction as the remaining wheels. If the crosswind component is of low magnitude, the crosswind gear should not be used and a normal landing made. The decision to accomplish the landing with or without use of the crosswind crab system will depend upon the experience the pilot has had in making crosswind landings without use of the crosswind crab system.

CAUTION

When landing with the left aft crosswind crab inoperative due to No. 3 hydraulic pack and No. 3 standby pump shut down, accomplish crosswind centering manually as the centered signal originates from the centered position of the left aft gear which will lag the powered gear.

NOTE

The crosswind crab centering button will not center the gear properly since the centered signal originates from the inoperative left aft gear. Depressing the centering button will drive the centering motor which would normally cause all gear to center. If the left aft gear hydraulic system is inoperative, the left aft gear will lag the other three gear during centering. Consequently, the other gear will drive on past center before the left aft gear reaches center and shuts off the centering motor. Therefore, it is necessary to monitor the position of the indicator in the crosswind crab control knob while centering the gear.

TWO OR MORE GEARS INOPERATIVE

WARNING

Prior to landing, crosswind crab should never be set if forward gear steering has failed on both the forward gears. Rotation of rear gears only will produce turning moments which may result in a high speed ground loop.

If the magnitude of the crosswind is large and the crosswind crab system has failed on only the rear gear, then a landing may be made using crosswind crab on the forward gear only. Under such a condition, the gross weight should be decreased as low as possible and the computed crab angle applied to the forward gear by rotation of the crosswind crab control knob. The crab angle setting must not exceed 9° since the misalignment between the front and rear wheels will tend to swing the aircraft in a circle which must be counteracted by the forward gear steering as the aircraft swings parallel with the runway. Twelve degrees of steering are available to counteract the 9° of misalignment leaving a 3° margin in case the aircraft starts heading off the downwind side of the runway. The approach should be made so as to remove most of the drift by crabbing. The landing should be accomplished using the minimum rate of sink at touchdown so as to minimize side loads imposed on the rear gear and, if possible, touch down all gears at the same time. The drag chute may be deployed but should be jettisoned if it starts to turn the aircraft off the runway. This action will be especially noticeable if the runway is icy. Again, the decision to accomplish the landing with or without use of partial crosswind crab will largely depend upon the experience the pilot has had in making crosswind landings without use of the crosswind crab system.

LANDING WITH PART OR ALL OF SPOILERS INOPERATIVE

In case any or all of the wing hydraulic packs and corresponding standby pumps fail or the electrical or mechanical control of the spoilers fail, sufficient lateral control will still be available so that the aircraft can be flown satisfactorily during normal flight operations. However, when a landing must be made with partial spoiler operation, the effect of reduced lateral control will be slower response and less maximum roll rate. Larger control wheel deflection will be required and its application should be anticipated and applied as early as possible. Any landing made in crosswind conditions with reduced lateral control should be made using the crosswind crab system as this will make the use of lateral control less necessary.

NOTE

- If either inboard or outboard airbrake control circuit breaker was pulled as suggested under "Asymmetrical Airbrake Control," this section, the circuit breaker must be reset after penetration has been completed and flaps extended for the following landing procedures.
- When landing with spoiler failures, use airbrake position 4 for gross weights of 325,000 pounds and below, and airbrake position 2 above 325, 000 pounds.

LANDING WITH PARTIAL SPOILER FAILURE ON ONE WING

Loss of either an inboard wing hydraulic pack (No. 6 or 7) and its standby pump or an outboard pack (No. 5 or 8) and its standby pump, or certain mechanical failures, will result in a loss of approximately half the lateral control power in the direction of the affected wing. A normal landing can be made using the following procedure: After the flaps are fully extended, extend the airbrakes to position 4. This will cause a roll toward the side with all spoilers operating. Trim the aircraft by applying rudder and aileron trim toward the wing with the failed pack. Approximately half rudder and aileron trim will be required. For example, if the pack failure is on the right wing (No. 7 or 8), extending the airbrakes will cause a roll to the left. Right rudder and aileron trim will be required to trim the aircraft and a small amount of left bank (less than 2°) will be required to maintain a straight flight path. By using this procedure, the available lateral control is more nearly equal in each direction. The sideslip angles which result are very small.

LANDING WITH LOSS OF ALL SPOILERS ON ONE WING

If both hydraulic packs on one wing or certain control cables have failed, the lateral control is marginal. However, lateral control effectiveness can be balanced to some extend by applying full rudder and aileron trim toward the dead spoilers. Extending the airbrakes to position 4 will return the aircraft approximately to trim and the available roll rate toward the dead spoilers will be approximately half that available in the opposite direction. Make a low speed control check. See "Stall or Controllability Checks," Section VI.

LANDING WITH THREE OR ALL SPOILER GROUPS INOPERATIVE

Lateral control effectiveness will be very low and a flaps-down landing should not be attempted. A flaps-up landing may be made under ideal conditions but should not be attempted in any sort of gusty conditions. See Part 9 of the Appendix for flaps-up landing and approach speeds and landing distances. With one pack operating, the lateral control effectiveness should be balanced by trimming with aileron and rudder away from the wing with the operating pack and extending airbrakes to position 4. Follow the procedure outlined under "Wing Flaps Up Landing Checklist," this section. Prior to landing, the airbrake control circuit breaker for two of the inoperative spoiler segments (inboard or outboard segments) may be pulled to preclude inadvertent operation during landing.

LANDING WITH STABILIZER TRIM FAILURE

If stabilizer trim should fail during flight, the aircraft can still be flown satisfactorily through proper application of the elevator control. Normally, at the time of failure, the aircraft would be trimmed to fly hands off for that particular weight and cg location. This cg location should be held at approximately the same value by shifting the fuel loading during the remainder of the flight. If such action is not possible or practicable, then the cg location may shift as required since the elevator is powerful enough to counteract for a shift within the limits of 18% and 34% MAC as long as the stabilizer fails within its normal operating range. Needless to say, the further the cg location moves from the location which existed at time of stabilizer trim failure, the greater the pilot control column forces will be at the original trim speed. The elevator is also sufficiently powerful to permit a safe landing if stabilizer trim fails within its normal operating range. If sufficient fuel remains to do so safely as the aircraft approaches the landing base, the cg should be shifted aft to approximately 30% MAC position by transferring fuel so as to compensate for the noseup trim which will be required as the speed is decreased. Between 3 and 5% of stabilizer nosedown trim normally is required when the wing flaps are moved rapidly from the flaps up to the fully extended position. The wing flaps therefore should be lowered in small increments. While lowering the wing flaps, the airspeed should be allowed to decrease. This will assist in compensating for the out-of-trim condition by keeping the control forces at a low level and will require less down elevator or forward control column travel. The change in trim due to wing flap extension will actually work to the advantage of the pilot and probably result in the requirement of down elevator and a push force on the control column during the final approach. For this reason, adequate up elevator travel will be available for producing the final flare. The airbrakes produce a noseup trim so that considerable trading is available between airbrake position and elevator position for obtaining a desirable trim and control situation for such an emergency. If the emergency is such that even with the aid of airbrakes little elevator can be made available for landing flare, a very flat approach should be made at normal approach speeds by carrying power. Under such conditions, it may not be possible to get the tail down far enough with the result that the forward landing gear will touch down first. Such a landing may cause the aircraft to porpoise between the forward and rear landing gear.

NOTE

If time is available, a controllability check should be made to determine the control characteristics which will be encountered on landing. This check is described under "Stall or Controllability Checks," Section VI.

LANDING WITH WING FLAPS INOPERATIVE

Normally, landings should not be made with wing flaps retracted since the touchdown speed is significantly higher than for a wing flaps-down landing. However, if the wing flaps malfunction or some other emergency exists, a safe landing can be made. Flaps-up landings at heavy gross weights are not recommended. To preclude exceeding tire and brake energy limits and to reduce landing ground run, the gross weight should be reduced to as low a value as practicable. The airspeed schedule for flaps-up traffic pattern is as follows:

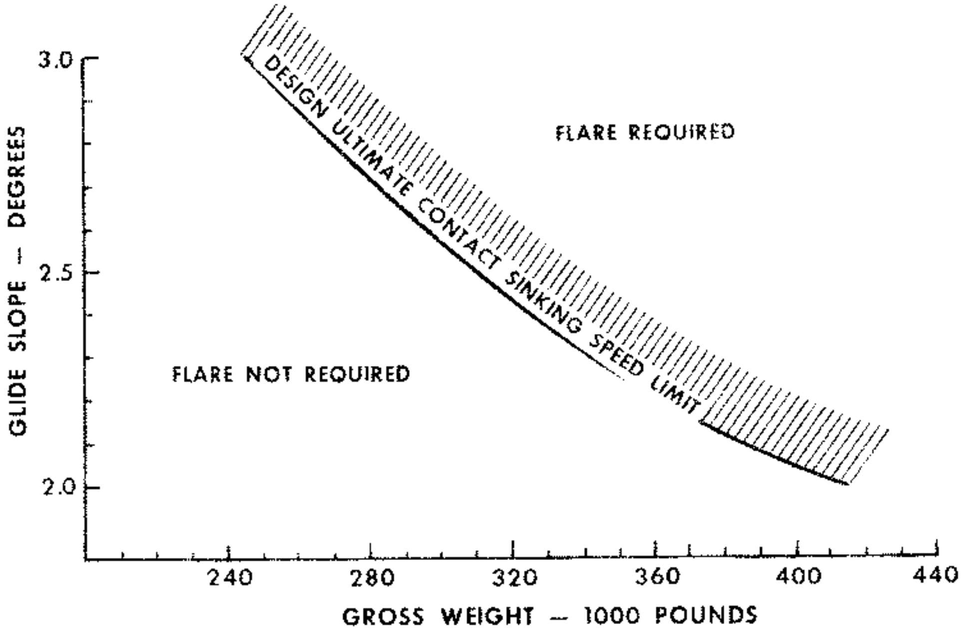
- Downwind Leg - Approach speed plus 30 knots
- Base Leg - Approach speed plus 20 knots
- Turn to Final (until established on final) - Approach speed plus 10 knots
- Final Approach - Approach speed

The higher speeds require additional maneuvering space and an extended final approach is desirable. Control response during the entire traffic pattern will be more positive than that experienced during a flaps-down pattern. The use of airbrakes provides excellent engine response and airspeed control throughout the final approach. A precision instrument approach should normally be flown. Under emergency landing conditions, glide slope angles of 3° or less may be utilized; however, an angle of approximately 2.5° is most desirable. If facilities or equipment are inoperative, the VASI approach lights may be used or if necessary a visual final approach may be flown.

NOTE

- For lower gross weights, flare is not required since the flare resulting from ground effect alone will reduce the rate of descent to a value that is less than the design ultimate contact sinking speed. See figure 3-8.
- For gross weights above 250,000 pounds, some flare may be required to prevent possible structural damage depending upon the glide slope angle. See figure 3-8. Since flare will increase the touchdown distance, a touchdown decision point will be required. Subtracting the charted ground roll distance from the available runway length results in a touchdown decision point. If this touchdown decision point is exceeded, a go-around will be necessary. The flare required for aircraft gross weights above 250,000 pounds but below 310,000 pounds is minimal and only required to reduce vertical velocity to an acceptable value.

The latter stage of the final approach is the critical phase of a flaps-up landing. The aircraft should be flown onto the runway at approach speed and attitude. At aft gear touchdown, the power should be reduced to idle and the control column should be positioned aft to cushion forward gear touchdown. Power should not be reduced to idle prior to aft gear touchdown. If power is reduced to idle prior to aft gear touchdown, airspeed may decrease below minimum touchdown speed resulting in a hard landing.



EFFECT OF GLIDE SLOPE ANGLE ON FLARE TECHNIQUE WITH GROUND EFFECT

Figure 3-8.

FLAPS-UP LANDING DATA

Landing data for flaps-up landings are given in figure 3-9. These charts have been designed to provide the required landing data in a minimum amount of time. The charts are: "Landing Ground Run - Flaps Up With Airbrakes Only, SL to 1000 Feet" and "Landing Ground Run - Flaps Up With Airbrakes and Drag Chute, SL to 1000 Feet." Normally, the airbrakes only chart is used for planning purposes. The landing data supplied by the charts includes the flaps-up approach speed, minimum touchdown speed, landing ground run, and wheel brake application speed. When the field pressure altitude is above 1000 feet, the altitude correction rules shown with the charts must be used to adjust the ground run and wheel brake application speed values given in the chart. For example, with airbrakes only and with a gross weight of 315, 000 pounds, temperature of 60° F and field pressure altitude of 1000 feet, the ground run and brake application speed with airbrakes only is found to be 9050 feet and 148 knots. If, however, the field pressure altitude were 3000 feet, it would be necessary to increase the ground run by 1240 feet (to 10, 290 feet) and to reduce the wheel brake application speed by 6 knots (to 142 knots). When making a flaps-up landing, the brake energy limits chart (figure 5-12, sheet 2) should also be used to determine if the brake energy limits will be exceeded. With this chart, the total heat energy absorbed by the brakes, with or without the drag chute, may be readily determined. The 12, 000-foot landing ground run lines on the chart are provided for a quick reference only of the stopping distances involved at particular gross weights and brake application speeds. Any point lying above these lines indicates a ground run of more than 12, 000 feet at sea level, standard day conditions.

WING FLAPS-UP LANDING (COPILOT READS)

Flaps Up Before Landing

Accomplish after completion of "Descent Checklist" or "Flaps-Up Go-Around Checklist" as applicable.

NOTE

If a flaps-up landing is due to electrical failure, see "Conservation of Battery Power Checklist," this section, for fuel system, landing gear, airbrakes, etc, operation.

1. Compute Landing Data - Computed and checked (CP-N)

   The following information will be extracted and/or computed from data presented on charts located in the "Emergency Procedures" parts of the pilot's and navigator's abbreviated checklists.

   a. Flaps-Up Approach Speed ______.

      For gust conditions, increase approach speed by full gust factor. Example: Winds 230 at 30 knots gusting to 40, add 10 knots to approach speed.

   b. Go-Around Speed (approach speed plus 30 knots)__________.

   c. Maximum Brake Application Speed__________.

   d. Landing Ground Run (flaps up with airbrakes and no drag chute)______.

   NOTE

   - Landing ground run is the amount of runway that must be available after touchdown for a complete stop on the remaining runway. If the runway remaining after touchdown is less than this distance, a go-around is mandatory.
   - The landing ground run distances on these tabular charts are based on dry surfaces. When other than dry conditions exist, obtain the RCR and use the appropriate flaps-up chart in Part 9 of the Appendix.

2. Nav Mode Select Switch - As required (P/CP)

3. Fuel Panel - Checked (CP)

   Crossfeed valve switches 9 and 12 will be positioned to OPEN when any main tank indicates 5000 pounds or less.

4. Landing Gear Lever - GEAR DOWN (P); Six down and checked (P-CP)

   Pilot checks gear lever in detent. Both pilots check that the gear warning light is out and that all six gear indicate down and locked.

5. Flap Lever - UP and OFF (lever UP **54**▶ **138** **W1**▶ **W34**) (CP)

6. AGM-28 Engine Control Knob(s) - As required (CP)

WING FLAPS-UP LANDING (COPILOT READS) (Cont)

7. Crosswind Crab - Checked/Set, knob down (CP)

   Obtain wind direction and velocity from the control tower. Compute and set crosswind crab as required using 70% of the flaps-down crosswind crab setting. If crosswind crab is not to be used, knob and position indicator must be checked for zero setting and gear position.

   CAUTION

   If wheel brakes are applied immediately before and held during touchdown when main gear is turned more than 14° (by any combination of crosswind crab setting and steering), the aircraft will land with wheels locked because the antiskid system is inoperative in this condition. Releasing the brakes will activate the antiskid system.

8. Approach Speed ______Knots - Rechecked (CP-N)

   Recheck approach speed (plus gust factor) and cross-check airspeed indicators. On downwind leg, maintain approach speed plus 30 knots; on base leg, maintain approach speed plus 20 knots; and on turn to final, maintain approach speed plus 10 knots. After established on final and during remainder of approach, maintain approach speed.

   NOTE

   Flaps up approach speeds do not change if airbrakes are inoperative.

9. Airbrake Lever - Position 4 (P)

10. Landing Light & Crosswind Landing Light Switches - As required (P/CP)

    Landing lights and crosswind landing lights will be turned on during both daytime and nighttime conditions for base leg and final approach unless reflection from these lights reduces pilot visibility.

11. Target Trim - Noted (P/CP)

    When aircraft is on final approach in landing configuration at approach speed, pilot not flying will note the stabilizer trim setting for zero stick force and call out this value as target trim.

Flaps-Up Landing

Accomplish after flaps-up touchdown (need not be read).

1. Airbrakes - Position 6 (P)

   Full airbrakes should be extended as soon as all wheels are on the ground.

2. Apply Wheel Brakes & Deploy Drag Chute - Accomplished (P/CP)

   Normally pilot applies brakes at touchdown and copilot deploys drag chute at 135 knots IAS. However, brake application will be delayed until below charted maximum brake application speed.

   CAUTION

   Application of brakes above the maximum brake application speed will exceed the brake energy limit and may result in complete loss of brakes, rupture of hydraulic lines, and subsequent fire.

WING FLAPS-UP LANDING (COPILOT READS) (Cont)

3. Hydraulic System - Checked (P)
4. Crosswind Crab Control Knob - Centered (P)
5. Starters - OFF (CP)
6. Steering Ratio Selector Lever - TAXI (P)

CAUTION

Center the rudder pedals before repositioning the steering ratio selector lever. Actuation of the lever is very difficult when the rudder pedals are deflected and could result in a dangerously abrupt change in steering angle.

Flaps-Up Go Around

1. Throttles - Set (as required) (P)
2. AGM-28 Engine Control Knob(s) - Set (as required) (CP)
3. Airbrake Lever - OFF (P)

   Pilot will retract airbrakes, level off, and check for a positive increase of airspeed.

4. Trim - As required (P)

   At all times during go-around, pilot will make a conscious effort to keep the aircraft trimmed to zero stick forces.

5. Thrust - Adjusted (P)

   Pilot accelerates to approach speed plus 30 knots and adjusts thrust to establish approximately 1000 feet per minute rate of climb.

6. Landing Gear Lever - As required (P-CP)

   Pilot may retract the gear when it is established that aircraft will not contact the runway.

7. Landing Light & Crosswind Landing Light Switches - OFF (P/CP)

NOTE

If climbing back to altitude, perform "After Takeoff-Climb Checklist." If remaining at traffic pattern altitude for closed traffic, GCA, ILS approaches, etc, perform "Before Landing Checklist" or "Flaps-Up Before Landing Checklist" as applicable.

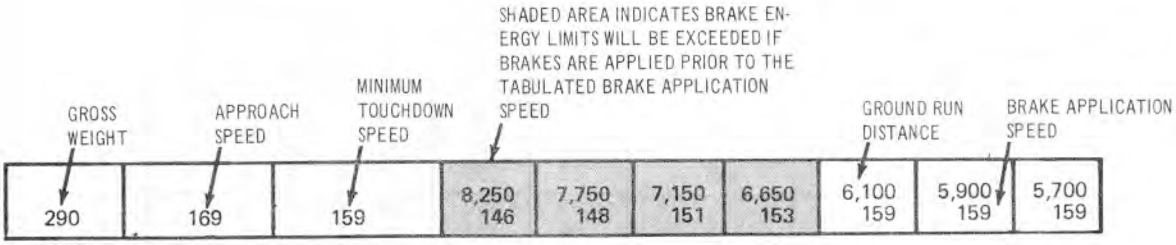
LANDING GROUND RUN — FLAPS UP, WITH AIRBRAKES ONLY, SL TO 1000 FEET
(Chart 1 of 2)

GROSS WEIGHT 1000 LB	APPROACH SPEED KIAS	MINIMUM TOUCHDOWN SPEED KIAS	120° F	100° F	80° F	60° F	40° F	20° F	0° F
200	140	132	4,050 132	3,900 132	3,750 132	3,600 132	3,500 132	3,400 132	3,300 132
205	142	134	4,200 134	4,100 134	3,900 134	3,800 134	3,650 134	3,500 134	3,400 134
210	143	136	4,350 136	4,200 136	4,000 136	3,900 136	3,750 136	3,600 136	3,500 136
215	145	137	4,500 137	4,350 137	4,150 137	3,950 137	3,850 137	3,750 137	3,600 137
220	147	139	4,650 139	4,500 139	4,350 139	4,150 139	4,050 139	3,900 139	3,800 139
225	149	140	4,800 140	4,600 140	4,400 140	4,250 140	4,150 140	4,000 140	3,900 140
230	150	142	4,900 142	4,800 142	4,600 142	4,350 142	4,250 142	4,100 142	4,000 142
235	152	143	5,100 143	4,900 143	4,700 143	4,500 143	4,350 143	4,200 143	4,100 143
240	154	145	5,250 145	5,100 145	4,900 145	4,700 145	4,550 145	4,400 145	4,250 145
245	155	146	5,400 146	5,250 146	5,100 146	4,900 146	4,700 146	4,550 146	4,400 146
250	156	148	5,600 148	5,400 148	5,250 148	5,000 148	4,800 148	4,650 148	4,500 148
255	158	149	5,750 149	5,600 149	5,400 149	5,150 149	5,000 149	4,850 149	4,650 149
260	160	151	6,000 151	5,750 151	5,550 151	5,300 151	5,150 151	5,000 151	4,800 151
265	161	152	6,150 152	5,550 152	5,700 152	5,500 152	5,300 152	5,100 152	4,900 152
270	163	154	6,300 154	6,100 154	5,900 154	5,650 154	5,450 154	5,300 154	5,100 154
275	164	155	6,750 149	6,300 155	6,050 155	5,800 155	5,600 155	5,400 155	5,200 155
280	166	156	7,250 148	6,800 150	6,250 156	6,050 156	5,800 156	5,650 156	5,400 156
285	167	158	7,750 147	7,200 149	6,750 152	6,250 158	6,050 158	5,850 158	5,600 158
290	169	159	8,250 146	7,750 148	7,150 151	6,650 153	6,100 159	5,900 159	5,700 159
295	170	161	8,750 145	8,150 147	7,650 150	7,050 152	6,550 155	6,100 161	5,900 161
300	172	162	9,200 144	8,650 146	8,100 149	7,550 151	7,000 154	6,450 156	6,050 162

Figure 3-9 Sheet(1 of 4).

LANDING GROUND RUN — FLAPS UP, WITH AIRBRAKES ONLY, SL TO 1000 FEET
(Chart 2 of 2)

GROSS WEIGHT 1000 LB	APPROACH SPEED KIAS	MINIMUM TOUCHDOWN SPEED KIAS	120° F	100° F	80° F	60° F	40° F	20° F	0° F
305	173	163	9,750 142	9,250 145	8,650 147	8,100 150	7,500 152	6,900 155	6,350 158
310	175	165	10,250 141	9,750 144	9,150 146	8,550 149	7,950 151	7,350 154	6,800 157
315	176	166	10,750 140	10,200 143	9,600 145	9,050 148	8,450 150	7,750 153	7,250 156
320	178	168	11,250 139	10,700 142	10,150 144	9,550 147	8,950 149	8,250 152	7,700 155
325	179	169	11,800 138	11,200 141	10,600 143	9,950 146	9,400 148	8,750 151	8,200 154
330	180	170	12,300 137	11,750 139	11,150 141	10,500 144	9,900 147	9,300 150	8,700 153
335	182	171		12,300 138	11,700 140	11,050 143	10,450 145	9,800 148	9,150 151
340	183	173			12,150 139	11,500 142	10,900 144	10,300 147	9,600 150
345	184	174				12,050 141	11,450 143	10,800 146	10,100 149
350	186	175					11,950 142	11,300 145	10,600 148
355	187	177					12,450 141	11,800 144	11,100 147
360	188	178						12,300 143	11,600 146
365	190	179							12,100 145



REMARKS:

FIELD PRESSURE ALTITUDE CORRECTION:

- For gross weights less than the altitude correction line (▨), increase ground run by 250 feet for each 1000 feet altitude above 1000 feet.
- For gross weights greater than the altitude correction line (▨), increase ground run by 620 feet for each 1000 feet altitude above 1000 feet.
- For gross weights in the shaded area, delay brake application 3 knots for each 1000 feet of altitude above 1000 feet.

FLAPS-UP LANDING DATA

Figure 3-9 (Sheet 2 of 4).

LANDING GROUND RUN — FLAPS UP, WITH AIRBRAKES AND DRAG CHUTE, SL TO 1000 FEET (Chart 1 of 2)

GROSS WEIGHT 1000 LB	APPROACH SPEED KIAS	MINIMUM TOUCHDOWN SPEED KIAS	120° F	100° F	80° F	60° F	40° F	20° F	0° F
200	140	132	3,400 132	3,250 132	3,150 132	3,050 132	2,950 132	2,850 132	2,750 132
205	142	134	3,500 134	3,400 134	3,300 134	3,200 134	3,100 134	3,000 134	2,900 134
210	143	136	3,600 136	3,500 136	3,400 136	3,300 136	3,200 136	3,100 136	2,950 136
215	145	137	3,800 137	3,650 137	3,500 137	3,400 137	3,300 137	3,200 137	3,050 137
220	147	139	3,950 139	3,750 139	3,600 139	3,500 139	3,400 139	3,300 139	3,150 139
225	149	140	4,050 140	3,850 140	3,750 140	3,600 140	3,500 140	3,400 140	3,250 140
230	150	142	4.100 142	3,950 142	3,800 142	3,650 142	3,600 142	3,450 142	3,300 142
235	152	143	4,200 143	4,100 143	3,950 143	3,750 143	3,650 143	3,550 143	3,400 143
240	154	145	4,350 145	4,200 145	4,050 145	3,900 145	3,750 145	3,650 145	3,500 145
245	155	146	4,450 146	4,300 146	4,100 146	4,000 146	3,850 146	3,750 146	3,600 146
250	156	148	4,550 148	4,400 148	4,250 148	4,100 148	3,950 148	3,800 148	3,700 148
255	158	149	4,700 149	4,550 149	4,400 149	4,300 149	4,150 149	4,000 149	3,850 149
260	160	151	4,950 151	4,700 151	4,550 151	4,400 151	4,250 151	4,100 151	3,900 151
265	161	152	5,050 152	4,850 152	4,650 152	4,500 152	4,400 152	4,200 152	4,050 152
270	163	154	5,200 154	5,000 154	4,850 154	4,700 154	4,500 154	4,350 154	4,200 154
275	164	155	5,350 155	5,150 155	5,000 155	4,850 155	4,650 155	4,500 155	4,300 155
280	166	156	5,550 156	5,350 156	5,150 156	4,950 156	4,800 156	4,650 156	4,450 156
285	167	158	5,700 158	5,500 158	5,350 158	5,150 158	4,950 158	4,750 158	4,600 158
290	169	159	5,900 159	5,700 159	5,500 159	5,300 159	5,100 159	4,900 159	4,750 159
295	170	161	6,050 161	5,850 161	5,700 161	5,500 161	5,300 161	5,100 161	4,900 161
300	172	162	6,250 162	6,050 162	5,850 162	5,650 162	5,400 162	5,200 162	5,000 162
305	173	163	6,700 160	6,250 163	6,000 163	5,800 163	5,600 163	5,400 163	5,200 163
310	175	165	7,150 159	6,700 162	6,250 165	6,000 165	5,800 165	5,600 165	5,400 165
315	176	166	7,600 158	7,150 161	6,650 163	6,150 166	5,900 166	5,700 166	5,500 166
320	178	168	8,050 157	7,600 160	7,100 162	6,600 165	6,100 168	5,900 168	5,650 168
325	179	169	8,500 156	8,050 159	7,550 161	7,100 164	6,550 167	6,050 169	5,800 169
330	180	170	8,950 154	8,500 157	7,950 159	7,500 162	6,950 165	6,400 168	5,950 170

Figure 3-9 (Sheet 3 of 4).

LANDING GROUND RUN — FLAPS UP, WITH AIRBRAKES AND DRAG CHUTE, SL TO 1000 FEET (Chart 2 of 2)

GROSS WEIGHT 1000 LB	APPROACH SPEED KIAS	MINIMUM TOUCHDOWN SPEED KIAS	120° F	100° F	80° F	60° F	40° F	20° F	0° F
335	182	171	9,400 153	8,950 156	8,450 158	7,900 161	7,350 164	6,800 167	6,250 170
340	183	173	9,900 152	9,400 155	8,900 157	8,400 160	7,800 163	7,250 166	6,650 169
345	184	174	10,350 151	9,800 154	9,300 156	8,850 159	8,300 162	7,700 165	7,050 168
350	186	175	10,850 150	10,200 152	9,750 155	9,250 157	8,700 160	8,100 163	7,450 167
355	187	177	11,300 149	10,750 151	10,200 154	9,700 156	9,100 159	8,550 162	7,900 166
360	188	178	11,800 148	11,200 150	10,650 153	10,200 155	9,600 158	9,000 161	8,350 165
365	190	179	12,250 146	11,700 148	11,150 151	10,600 154	10,000 157	9,450 160	8,750 163
370	191	180	12,700 145	12,200 147	11,600 150	11,100 152	10,400 155	9,850 158	9,200 162
375	192	182		12,650 146	12,150 149	11,550 151	10,900 154	10,300 157	9,650 161
380	193	183			12,600 148	12,050 150	11,450 153	10,900 156	10,100 160
385	194	184				12,550 149	11,900 152	11,250 155	10,600 158
390	196	185					12,350 150	11,700 153	11,000 157
395	197	187						12,250 152	11,400 156
400	198	188							11,850 155
405	200	189							12,350 153

SHADED AREA INDICATES BRAKE ENERGY LIMITS WILL BE EXCEEDED IF BRAKES ARE APPLIED PRIOR TO THE TABULATED BRAKE APPLICATION SPEED

GROSS WEIGHT	APPROACH SPEED	MINIMUM TOUCHDOWN SPEED					GROUND RUN DISTANCE	BRAKE APPLICATIO SPEED	
315	176	166	7,600 158	7,150 161	6,650 163	6,150 166	5,900 166	5,700 166	5,500 166

REMARKS:

FIELD PRESSURE ALTITUDE CORRECTION:

- For gross weights less than the altitude correction line (▨), increase ground run by 210 feet for each 1000 feet altitude above 1000 feet.
- For gross weights greater than the altitude correction line (▨), increase ground run by 580 feet for each 1000 feet altitude above 1000 feet.
- For gross weights in the shaded area, delay brake application 3 knots for each 1000 feet of altitude above 1000 feet.

Figure 3-9 (Sheet 4 of 4).

LANDING WITH BRAKE SYSTEM HYDRAULIC FAILURE

It is probable that the only indication of reduced braking capabilities that will be known in advance by the pilot will be the loss of one or more hydraulic packs. If the loss of a hydraulic pack is experienced, pressure will be supplied to the respective systems by the standby pumps. If the loss of a pack is due to lack of hydraulic fluid, pressure will still be supplied by the standby pumps as each pump has a reserve supply of 3 quarts of hydraulic fluid. Further reduction of brake capabilities will result from the loss of the respective standby pumps. Charts and correction factors for stopping distances when brakes are applied at touchdown and for partial braking are included in Part 9 of the Appendix.

HYDRAULIC PACKS NO. 1 AND NO. 2 INOPERATIVE

When landing with standby pumps 1 and 2 as the only source of forward gear hydraulic pressure, the following procedure should be used: If pack failure is due to loss of hydraulic fluid, turn the antiskid switch to OFF position. If it can be determined that pack failure is not due to loss of fluid, it is recommended the antiskid switch be left in ON position. Normal approach and landing procedure should be followed, except if crosswind crab is to be used, the gear should be positioned to the selected crab angle far enough in advance of touchdown to allow time for system pressure to rebuild. Deployment of the drag chute and raising of full airbrakes should take place as soon after touchdown as possible. Initial braking should be light to moderate after the weight of the aircraft is on the wheels, followed by heavier braking as more aircraft weight is transferred to the wheels. This is necessary to reduce the antiskid cycles to within the capacity of the standby pumps and accumulators.

HYDRAULIC PACKS NO. 1 AND 2 AND STANDBY PUMPS NO. 1 AND 2 INOPERATIVE

When landing with both forward hydraulic packs and their respective standby pumps inoperative, the only source of hydraulic pressure for the forward brakes, and slave control pressure for the rear brakes will be from the forward brake accumulators; therefore, the following landing procedure should be used: Reduce the aircraft gross weight as low as practicable in order to keep touchdown speed low. Turn antiskid switch to OFF position.

WARNING

Prior to landing, the crosswind crab system should never be set since forward gear steering will be inoperative. Rotation of rear gears only will produce turning moments which may result in a high speed ground loop.

Deployment of the drag chute and raising of full airbrakes should take place as soon after touchdown as possible. Brake application should take place as soon as the weight of the aircraft is firmly on the wheels. One smooth and gradually increasing brake application should be made.

WARNING

Do not pump the brakes. Pumping will deplete brake accumulator pressure causing complete loss of all braking action.

NOTE

The number of brake applications available is dependent on the amount of preload in the brake accumulators and the amount of wear on the brake linings. If the parking brake pressure gage on the pilot's side panel reads 3000 psi, there will be approximately two to seven brake applications available depending on the condition of the brake linings.

If parking brake pressure is less than 3000 psi, the parking brake hydraulic hand pump located in the forward wheel well may be used to build up the brake pressure for the left forward main gear.

WARNING

This action should be considered as a last resort due to the location of the hand pump handle.

LANDING WITH DRAG CHUTE INOPERATIVE

If the drag chute fails to deploy when the drag chute deployment lever is actuated, there is nothing else that the pilot can do to get the drag chute out of the compartment. The effect of the drag chute on ground roll distance is shown by the landing charts in Part 9 of the Appendix.

LANDING WITH DROP TANK UNBALANCE

If one drop tank fails to feed fuel or one full drop tank fails to jettison, the pilot is faced with lateral and directional control problems during approach and landing. Fuel transfer should be accomplished initially in an attempt to decrease the amount of lateral unbalance. In the normal landing configuration (flaps and gear down, airbrakes position 4) with one full 3000-gallon tank and other fuel tanks symmetrical, approximately 50% of the lateral control and full rudder control will be required to maintain wings level at touchdown on a 350,000-pound aircraft. For a lighter weight aircraft, the lateral control required will be greater. For the same conditions as above, 100% of the lateral control will be required to hold the wings level on a 225,000-pound aircraft. Before landing with a large lateral unbalance, a controllability check should be accomplished as described in Section VI. Depending on the aircraft gross weight and the amount of lateral unbalance, a flaps-up landing may be required. A last resort method of reducing the amount of lateral control required would be to increase the thrust of the outboard engine on the heavy wing. This technique should be practiced during the controllability check before attempting to use it on an actual landing. Refer to Part 9 of the Appendix for minimum landing weights, flaps up and down, with various amounts of unbalance.

LANDING WITH TAIL TURRET IN LOWER ELEVATION LIMIT

If it becomes necessary to make a landing with the tail turret in the lower elevation limit, use the following procedures:

1. Make a no-brake-chute landing provided the aircraft gross weight does not exceed 250,000 pounds on a dry runway and all criteria are complied with as outlined under "Taxi-Back Landing," Section II.
2. If not possible, use normal procedures (drag chute deployed); however, the pilot must be prepared for possible drag chute entanglement with the turret. Turret damage may ensue when the drag chute is jettisoned with the turret in the lower limit.

If wind conditions permit, allow the drag chute to collapse when turning off the runway. If this is not feasible, the engines should be shut down after turning off the runway to facilitate collapsing the chute. After coordination with ground crew personnel, the drag chute will be manually disconnected and the aircraft towed or taxied to the parking area. During extreme wind conditions, the chute may be jettisoned (normally) as a last resort action. This will preclude the possibility of additional damage to the tail surfaces by an uncontrollable drag chute.

CRASH LANDING

A crash landing is defined as a controlled landing under conditions such that damage to the aircraft is to be expected. A crash landing should not be considered unless the resultant risk to crew survival is considered to be less than would result from bailout. Even when conditions are ideal, serious consideration should be given to bailout or ejection of those crewmembers not essential for landing.

MINIMUM RUNWAY FOAMING REQUIREMENTS FOR LANDING WITH GEAR FAILURE

In the event the decision is made to land with all gear retracted or with the rear gear retracted, the following runway foaming instructions should be considered as minimum requirements.

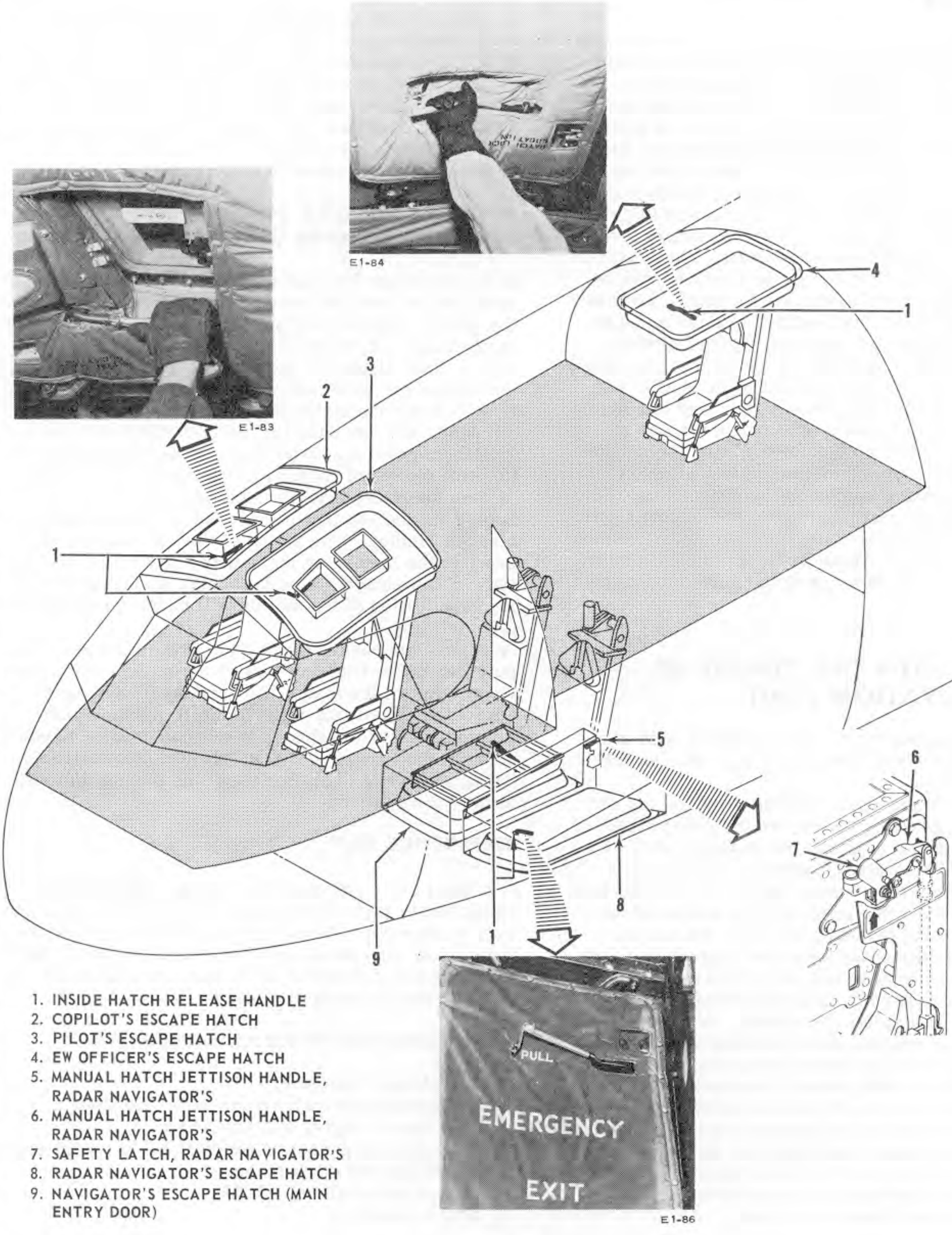
- The foaming should begin at the 2000-foot mark and extend for 8000 feet. The minimum requirement is a 50-foot wide strip, but ideally the foam should fan out to 150 feet wide for the last 4000 feet to provide foam coverage under the outboard engines and to allow for slight changes in the direction of slide.
- It is desirable that the depth of the foam be at least 2 inches and that it be cured 15 minutes prior to aircraft landing. The laying of the foam should not precede the landing by more than 2 1/2 hours on a hot day. Foam should not be laid if the normal firefighting capabilities of the station will be compromised by the operation.
- A possible hazard involved in foaming is that temperature below freezing may cause ice to form in the water beneath the foam. This ice layer may cause unpredictable sliding of the aircraft and may also present a hazard to the crash-rescue crews. Landing short of the foam and sliding into it is not desirable, but is preferred to sliding out of the foam at the end of the landing runout.

EMERGENCY EXIT

A manual hatch release handle (figure 3-10) is provided inside each escape hatch in order that the hatch may be manually opened from inside the aircraft during ground emergency or after crash landing or ditching. If manual removal of the hatch is necessary, observe the following procedure:

UPPER DECK CREWMEMBERS (P-CP-EW)

1. Install armrest pins.
2. Unfasten safety belt and shoulder harness.
3. Disconnect oxygen and interphone.
4. Remove parachute and survival kit by unfastening parachute leg and chest straps.
5. Stow control column (P-CP).
6. Stand facing aft.



1. INSIDE HATCH RELEASE HANDLE
2. COPILOT'S ESCAPE HATCH
3. PILOT'S ESCAPE HATCH
4. EW OFFICER'S ESCAPE HATCH
5. MANUAL HATCH JETTISON HANDLE, RADAR NAVIGATOR'S
6. MANUAL HATCH JETTISON HANDLE, RADAR NAVIGATOR'S
7. SAFETY LATCH, RADAR NAVIGATOR'S
8. RADAR NAVIGATOR'S ESCAPE HATCH
9. NAVIGATOR'S ESCAPE HATCH (MAIN ENTRY DOOR)

EJECTION HATCH MANUAL RELEASE

Figure 3-10.

7. Pull hatch release handle down and rotate full length of travel (approximately 80°).
8. Release hatch release handle.

NOTE

It is not necessary to hold the hatch release handle when removing the hatch. Although the hatch settles somewhat when the handle is released (because of hatch weight), the locking cam will not travel back past overcenter.

9. Push hatch upward and aft, stepping into seat while doing so. Continue pushing until hatch has rotated approximately 95° and falls free of aircraft.

NOTE

As the hatch is rotated, the mechanical link connecting the hatch to the catapult safety pin-pull initiator will fire the initiator. Do not be alarmed; although the seat catapult is now armed, it will not fire unless the firing trigger on the armrest is squeezed.

LOWER DECK CREWMEMBERS (N-RN)

1. Stow ejection control trigger ring.
2. Unfasten safety belt and shoulder harness.
3. Disconnect oxygen and interphone.
4. Remove parachute and survival kit by unfastening parachute leg and chest straps.
5. Reach down and aft of right side of seat approximately 15 inches and pull manual hatch jettison handle (except navigator) (5, figure 3-10). Navigator pulls manual hatch release handle (1, figure 3-10).

NOTE

As the hatch falls, the mechanical link connecting the hatch to the catapult safety pin-pull initiator will fire the initiator. Do not be alarmed; although the seat catapult is now armed, it will not fire unless the firing trigger ring is pulled.

Emergency Exit — Gunner

In the event that the turret cannot be jettisoned, a ballistic means has been provided to release the tail compartment canopy. Pulling the canopy release handle releases the canopy from the aircraft structure and the gunner can complete the operation by pushing up on the canopy and jettisioning it over the side. For further information, see "Canopy Release System," Section IV and "Escape Systems Operation," Section VII.

CRASH LANDING AND DITCHING

WARNING

- If an emergency arises necessitating immediate abandonment of the aircraft under unplanned circumstances, all crewmembers free themselves of parachute and survival kit in the quickest possible manner to evacuate the aircraft.
- If a crash landing or ditching becomes imminent and time and conditions permit, bailout or ejection of all crewmembers not essential for landing or ditching is recommended. However, if conditions dictate (survival or other reasons), other crewmembers may stay with the aircraft, provided there are sufficient approved crash landing and ditching stations available and at the discretion of the pilot. See "Crash Landing and Ditching Stations," Section I.

NOTE

For crash landing or ditching, the crew will be alerted over interphone, if possible, and by an alert (intermittent) signal. Automatic transmission of this signal is provided by use of ALERT position of the emergency alarm switch. This signal will remain on until all crewmembers have acknowledged over interphone. Just prior to touchdown, the emergency alarm switch will be placed in ALERT position and crewmembers will be notified over interphone to brace for impact. Use of the abandon signal after contact with the ground will be the signal to exit from the aircraft.

WARNING

After the alert signal has been given to warn crew to stand by for ditching or crash landing, it must be realized that the situation which dictated the pilot's decision to crash land or ditch may become so critical that the pilot decides a bailout is mandatory. Therefore, if the bailout (steady) signal is given, the crew should bail out immediately.

CRASH LANDING AND DITCHING (Cont)

1. Lower Landing Gear (Up for Ditching) - DOWN (or UP) (P)

   Landing gear will be lowered after it has definitely been determined that a crash landing will be made (except when both forward gears will not extend, in which case all gears will be retracted).

2. Lower Wing Flaps - DN (CP)

3. Jettison Flares as Directed - Jettisoned (P-EW)

   At the pilot's discretion, the flares will be jettisoned as directed.

NOTE

> During flare dispensing, as each flare leaves the aircraft, crew members can expect a bright white flash visible within the crew compartments accompanied by a slight vibration of the aircraft similar to firing of guns. These flashes will be most noticeable at night, in the vicinity of cloud formations, or during IFR flight conditions; however, the flashes are discernible even during daytime VFR flight conditions.

4. Jettison Drop Tanks - Jettisoned (P)

WARNING

- Do not jettison drop tanks above 300 or below 150 knots IAS.
- After jettisoning the drop tanks at gross weights above 370,000 pounds, the aircraft should be flown in a wings-level attitude to keep the "g" loading to an absolute minimum. Severe maneuvers or sharp turns should be avoided.
- Since the aircraft cg will move forward considerably when full 3000-gallon drop tanks are jettisoned, it is essential that the change in trim be anticipated by application of 2 to 3 units of noseup stabilizer trim in combination with nosedown elevator prior to release.

5. Jettison Stores as Directed - Jettisoned (P-RN)

   At the pilot's discretion, the stores may be jettisoned as directed.

6. Close Bomb Doors - Closed (RN)

   The radar navigator will close the bomb doors immediately after completing jettison operation.

7. Complete Emergency Radio Transmission - Accomplished (P-CP)

   Less ZV

   The SIF/IFF will be set to EMERGENCY, Mode 3 toggle switch "in," and Mode 3 code selector to 77. The pilot/copilot will call "Mayday" over UHF.

   ZV

   Place IFF master switch in EMER. Pilot/copilot will call "Mayday" over UHF.

NOTE

> Pull pins from escape rope containers if time permits.

CRASH LANDING AND DITCHING (Cont)

8. Loose Equipment - Stowed in lower deck compartment (RN-N)

   All loose equipment from the upper deck should be passed to the lower deck.

9. Jettison Turret & Aft Upper Escape Hatch - Jettisoned (G-EW)

NOTE

Gunner pulls up on turret-drag chute interconnect control knob if pilot requests retention of drag chute. If the drag chute is accidentally deployed when turret is jettisoned, jettison the chute by pushing down on the drag chute control knob.

WARNING

- The turret should be jettisoned as soon as possible to allow time for the gunner to come forward in the event the turret jettison system malfunctions. The turret will not be jettisoned below 1000 feet unless so directed by pilot.
- If the cg is forward of 27% MAC at the time the turret is jettisoned, airbrake position 2 will be required to supplement elevator control in order to accomplish the landing flare. Turret will be jettisoned immediately after impact if not previously accomplished. On aircraft **ZR** , if turret does not jettison after impact, pull the canopy release handle.

ZR

- Do not pull canopy release handle during flight except under an uncontrolled bailout situation when the turret does not jettison, since a loose canopy could be hazardous to the gunner.
- Because of high noise level, air buffeting, and the circulation of foreign particles by turbulent air, the EW officer's hatch should be jettisoned below 250 knots IAS and at a low altitude, preferably not lower than 1000 feet. If the hatch does not jettison, do not attempt manual release until the aircraft has come to a complete stop. The forward upper escape hatches will not be removed until the aircraft comes to a complete stop.

NOTE

Although jettison of the upper escape hatches arms the upward ejection seats, inertia forces due to crash landing or ditching normally are not great enough to fire these seats. To prevent accidental firing of the seat during egress, lower the armrests to the fully stowed position.

WARNING

Installation of the safety pin with the arming lever rotated to the up position will not prevent the seat from firing if the firing trigger is squeezed.

10. Airbrake Lever - Position 4 or as required (P)

    For gross weights between 290, 000 and 325, 000 pounds, use airbrake position 2. At gross weights above 325, 000 pounds, use airbrake position 0 except as required to maintain pitch control.

CRASH LANDING AND DITCHING (Cont)

11. Accomplish Final Crew Warning - Accomplished (P)

Warn crewmembers of impending impact over interphone and again actuate emergency alarm switch to ALERT. Crewmembers except gunner will unbuckle parachutes; gunner will unbuckle parachute leg straps only. All crewmembers will lock inertia reels, disconnect the male bayonet connector on the end of the oxygen mask hose, disconnect seat oxygen hose from CRU-8 P connector, and raise helmet visor. All personnel brace for impact.

CAUTION

The crewmember is prevented from bending forward when the shoulder harness inertia reel is locked; therefore, all switches not readily accessible should be properly positioned prior to locking the shoulder harness.

WARNING

Touch down at lowest possible rate of descent. Do not stall the aircraft; such action will probably result in complete destruction of the underside of the fuselage and may cause the fuselage to break completely apart.

12. AGM-28 Emerg Shutoff Switches - EMERG SHUTOFF (CP)

NOTE

If additional thrust is needed for landing or ditching, delay this action until after touchdown.

13. Throttles - CLOSED (after impact) (P)

WARNING

Do not cut engines prior to touchdown. This would result in loss, after a few seconds, of all primary electrical power and all hydraulic pressure except that still remaining in the accumulators. Electrical control of the stabilizer trim will be lost and manual trim will exist only as long as accumulator pressure lasts. The spoilers will operate for only a few seconds on accumulator pressure. Do not stall the aircraft; such action will probably result in complete destruction of the underside of the fuselage and may cause the fuselage to break completely apart.

14. Drag Chute Lever - DEPLOY (CP)

15. Drag Chute Lever - JETTISON (CP)

The drag chute will be jettisoned when it is evident that the aircraft cannot be stopped on the available runway and the airspeed is below 70 KIAS.

16. Battery Switches - OFF (CP)

CRASH LANDING AND DITCHING (Cont)

17. Abandon Aircraft (ALL)

Remain in positions until aircraft comes to a complete stop. After complete stop is made, pilot places emergency alarm switch to ABANDON and pilot and copilot remove the two forward escape hatches.

NOTE

If time permits, safety pins should re reinserted in the arming levers to prevent accidental firing of the seats during egress.

Remove available survival kits and pass them to crewmembers who have already abandoned the aircraft. All crewmembers, except gunner, exit through ejection hatches using escape ropes. Gunner exits through the turret opening or his entry door (or on aircraft ZR, the canopy opening), depending on circumstances, using escape rope.

WARNING

- To prevent personal injury, ascertain that the escape ropes are fully extended before using them.
- Crewmembers must be aware of protruding objects on the sides of the aircraft fuselage such as pitot tubes, antennas, etc. Attempt to avoid these objects by pushing away from the fuselage with your feet.

POSITION	PRIMARY EXIT
PILOT'S EJECTION SEAT	PILOT'ESCAPE HATCH
COPILOT'S EJECTION SEAT	COPILOT'S ESCAPE HATCH
RADAR NAVIGATOR'S EJECTION SEAT	EW OFFICER'S ESCAPE HATCH
NAVIGATOR'S EJECTION SEAT	EW OFFICER'S ESCAPE HATCH
EW OFFICER'S EJECTION SEAT	EW OFFICER'S ESCAPE HATCH
INSTRUCTOR PILOT'S SEAT	PILOT'S/COPILOT'S ESCAPE HATCH
BUNK POSITION	PILOT'S/COPILOT'S ESCAPE HATCH
INSTRUCTOR NAVIGATOR'S SEAT	PILOT'S/COPILOT'S ESCAPE HATCH
GUNNER'S SEAT	THROUGH OPENING LEFT BY JETTISONED TAIL TURRET OR ON AIRCRAFT **ZR**, THE CANOPY

NOTE

- Utilize escape ropes where applicable.
- If primary exit is blocked, proceed to nearest available exit.
- Any additional passengers will exit as instructed at crew briefing.

TAKEOFF AND LANDING EMERGENCIES EXIT CHART

Figure 3-11.

EMERGENCY ENTRANCE

Entrance into the aircraft during any emergency such as a fire or crash can best be accomplished by using the various hinged or latched access doors and escape hatches (figure 3-11) located throughout the aircraft. The escape hatches in the top and bottom of the aircraft and the opening left by jettisoning the turret (and on aircraft **ZR**, the canopy) are the primary entrances for use in crew rescue work. Each hatch, except the radar navigator's, has a push and pop-up type of flush surface latching handle for easy removal of the hatch from the outside. Secondary access for crew rescue and primary access to fuselage fires is gained through use of the bomb bay, the wheel wells, and the aft equipment entry door. Access to wing fires is accomplished through use of hinged flush latching doors in the wing surface and by placing the wing flaps down. The knock-in panels in the engine nacelles are hinged and spring loaded. A chop-in area is marked on the gunner's compartment in case his escape hatch is jammed and access is completely blocked.

DITCHING

WARNING

Bailout of all crewmembers is recommended in a ditching situation. The aircraft should be ditched only as a last resort.

If an emergency condition arises when over water which indicates that continued flight is impossible, it is not recommended that the crew ditch the aircraft. The aircraft is not structurally designed to withstand ditching, and no information is available to indicate the resultant structural condition of the aircraft if ditched. Further, crewmembers with survival kits attached would find escape from the aircraft difficult after ditching even though the aircraft was not badly damaged. Therefore, it is recommended that the aircraft commander bail out all crewmembers in any ditching situation where time and conditions will permit. This procedure will ensure that each crewmember is equipped with liferaft and survival kit upon abandoning the aircraft.

NOTE

For procedure to be followed when there is no alternative to ditching, see "Crash Landing and Ditching Checklist," this section.

DITCHING STATIONS

Unless the turret will not jettison, the gunner should remain at his station during ditching procedure even though there is time available to traverse the entire length of the fuselage to the control cabin.

DITCHING TECHNIQUE

The aircraft should be prepared for ditching by transferring fuel to move the cg aft of 27% MAC. The gunner should jettison the tail turret above 1000 feet altitude so that the aircraft can be safely retrimmed. After the alert signal has been given, the direction of the ditching operation should be chosen carefully. The recommended procedure is to ditch into the wind unless very high swells are running, accompanied with very light wind conditions. Try to touch down on the crest of the swell if landing across the swells. Under light wind conditions accompanied with uniform wave or swell patterns, best results will be achieved by ditching parallel to the waves or swells. Under such a condition, try to touch down on the crest of the swell or just after the crest passes. Touch down at a speed of approximately 5 knots above initial stall warning, if possible. Airbrakes do not provide a lower stalling speed but may be used as desired to vary the approach path and determine the point of touchdown. In a properly executed ditching, the control cabin and the body and wing fuel tanks should keep the aircraft afloat long enough to allow the crewmembers to abandon the aircraft. If the aircraft remains afloat after ditching, stay with the aircraft. However, if the aircraft appears as though it will sink, get clear of the aircraft prior to the time it sinks.

MINIMUM SPEED FOR DIRECTIONAL CONTROL

WARNING

The use of full rudder is mandatory to realize the charted minimum directional control speeds. Failure to use full rudder to counteract an engine out condition can increase the minimum control speed for one inoperative outboard engine by approximately 25 knots.

Minimum speed for directional control is defined as the speed at which a constant heading can be maintained with full rudder and one-half lateral control authority with all of the operative engines at a given amount of thrust. Only one-half lateral control authority is used in order to allow some reserve for maneuvering, gust loads, and dynamic conditions.

NOTE

With full control wheel positions, the pilots' view of some instruments, including the airspeed and attitude director indicators, may be obstructed.

The minimum speeds for directional control are shown in figure 3-12. It should be recognized that any attempt to fly below these speeds will result in a further reduction of the maneuvering margin to the point of absolute control limits. Two alternatives are available to the pilot. The pilot must either reduce the thrust on the remaining engines to balance the turning force or allow the aircraft to turn slowly while the speed increases to a point where the directional control margin is regained. In some cases, it may be necessary to use a combination of these two alternatives. Figure 3-12 may be used for takeoff planning by entering with the takeoff EPR and the field altitude. Knowing the takeoff speed, the criticality of the loss of various engines can be estimated. For a go-around, the charts may be used to estimate the maximum thrust (EPR) which can be applied to the engines opposite the inoperative engines at any speed and still maintain directional control. When using the charts to determine the maximum thrust (EPR) which can be applied for a go-around at any given approach speed, it is not intended to restrict the EPR on engines which are not opposite to inoperative engines. As an example, engines No. 4 and 5 may be set up to MRT with three outboard engines inoperative; engines No. 3, 4, 5, and 6 may be set to MRT with two outboard engines inoperative. For approach planning, both the minimum control speed with all operating engines at MRT and the maximum allowable EPR setting (engines opposite to inoperative engines) for a go-around from best flare speed plus 10 knots should be computed. Flaps up charts provide for an emergency wherein the flaps cannot be extended.

NOTE

When entering figure 3-12 with an airspeed to determine a maximum allowable EPR, the line brought up from the bottom of the chart should be taken first to the proper pressure altitude line. This determines the maximum allowable EPR on engines opposite inoperative engines for purposes of directional control. The EPR for MRT should then be determined by following the pressure altitude line to the reported field temperature line. Use the lesser of the two EPR's as maximum allowable asymmetrical thrust EPR for go-around.

PRACTICE MANEUVERS WITH ONE OR MORE ENGINES INOPERATIVE

WARNING

Simulation of engine-out conditions is limited to a maximum of any two engines at idle on one side.

For practice of any partial power operation, observe the following:

1. Avoid turbulent air and limit maneuvering bank angle to 20° to reduce the "g's" encountered and the resulting fuselage loads (two or more engines inoperative).
2. Simulated inoperative engines should be idled and not shut down.
3. Trim followup should be made with power changes.
4. Power should be applied smoothly when simulating a go-around.

During practice maneuvers simulating failure of one or two engines on one side, the airspeed should not be reduced below minimum directional control speed or best flare speed plus 30 knots, whichever is higher, until on final. The final approach phase should be flown at best flare speed plus 10 knots. The maximum thrust (EPR) should be computed from figure 3-12 for the particular indicated airspeed being used on the final approach. Use of asymmetrical thrust up to this value is desired in order to simulate thrust requirements encountered during heavy weight, multi-engine out operation. This EPR value does not prohibit using a higher EPR value up to MRT on opposite engines for balanced thrust if necessary to maintain thrust requirements. These minimum directional control airspeeds are based on the use of not more than 50% of the lateral control available. When practicing simulated failure of one or two engines on one side, the aircraft gross weight should not be greater than 250, 000 pounds nor less than 200, 000 pounds. In addition, descents should not be made below the minimum altitude established by current command directives. Under these conditions, minimum control speeds will be lower than those shown in figure 3-12, however, as a safety factor, the minimum airspeeds shown in the chart should be adhered to. Within these limitations, maneuvers such as simulated approach and landing and go-around with reduced thrust may be practiced safely. When practicing these maneuvers, it is recommended that the engine or engines be retarded to idle rather than shut down completely. An engine at idle thrust will provide control and maneuverability problems essentially equivalent to those encountered with the engine shut down.

CAUTION

When simulating failure of more than one engine on one side, it is important that the engines not be retarded or accelerated suddenly. This will induce over-yaw and then any sudden application of rudder could exceed structural limits of the aircraft. Rudder alone must not be used to oppose the initial yaw/roll tendency.

When simulating failure of engines, figure 3-12 can be used in two ways. One is to determine the minimum speed for directional control associated with a specific EPR such as MRT and the other is to determine the maximum EPR which can safely be applied at a given airspeed. The following are examples on the use of figure 3-12:

1. Determine the EPR for MRT and the minimum speed for directional control under the following conditions:
   - Pressure altitude 2000 feet
   - Temperature 45° F
   - Flaps down, gear down
   - Two outboard engines out on one side

Enter the flaps down, gear down chart (figure 3-12) on the pressure altitude 2000-foot line and follow to the point intersected by the ambient temperature for MRT (45° F). The EPR (2. 50) is read to the left of this point. Dropping down from the same point to the line representing the number of engines out (two), read right to the minimum speed for directional control (141 knots IAS). Above this speed, MRT may be safely applied but below this speed, the use of MRT would impose a critical control situation.

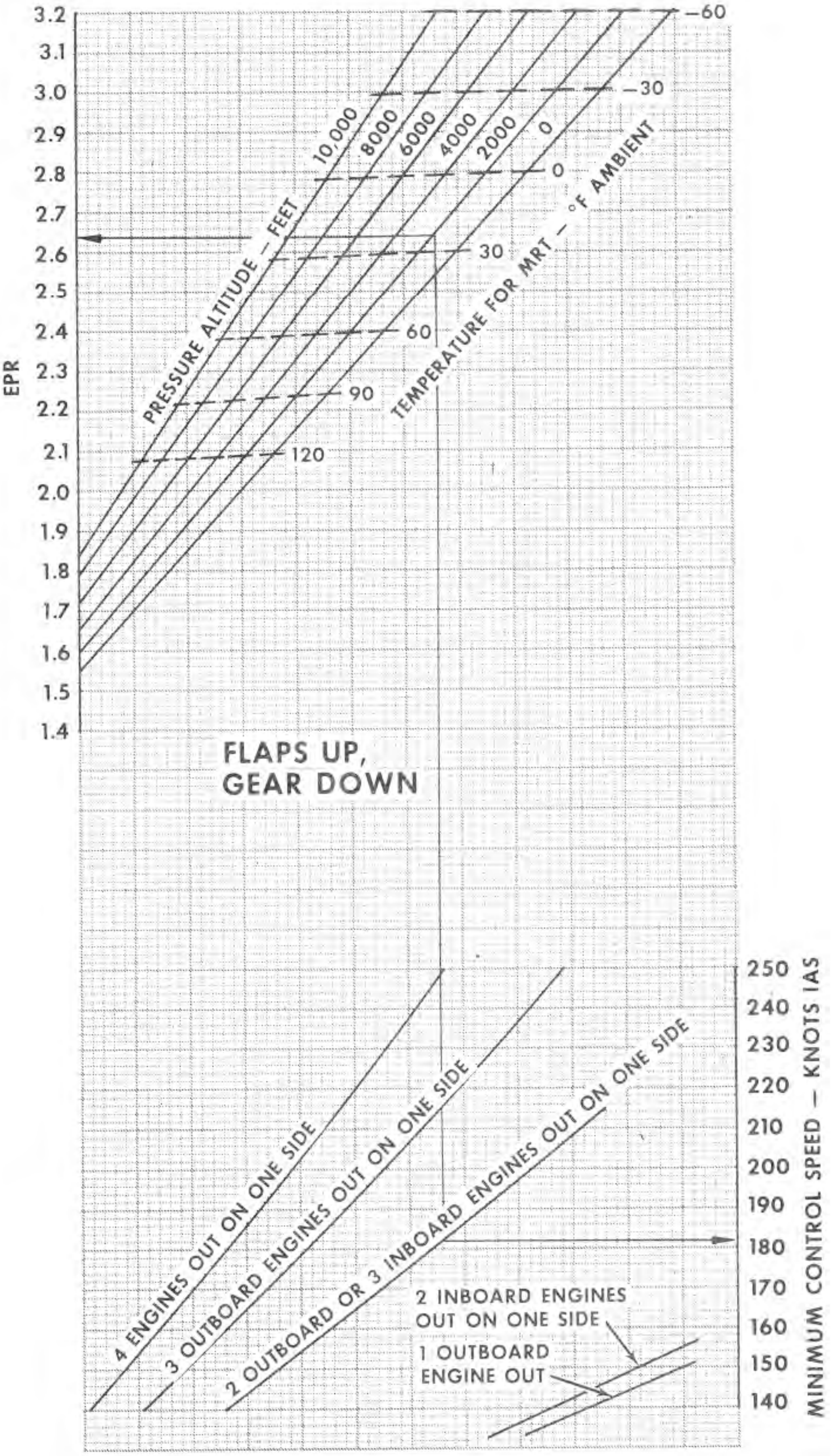
2. Determine the maximum thrust (EPR) which can be safely applied at a specific speed for a go-around from final approach under the following conditions:
   - 132 knots IAS final approach speed (best flare speed plus 10 knots)
   - Pressure altitude 2000 feet
   - Temperature 45° F
   - Flaps down, gear down
   - Two outboard engines out on one side

Enter the flaps down, gear down chart (figure 3-12) on the 132-knot IAS line. Read up from the point of intersection with the two-engine-out line to the pressure altitude line or to the ambient temperature for MRT, whichever comes first, then left to find maximum EPR. Since 2000 feet is reached before 45° F, the maximum EPR of 2. 35 is less than MRT. Note that if the given temperature had been 75° F, the temperature for MRT line would be reached before the pressure altitude line, resulting in a lower EPR reading.

DATA BASIS:
FLIGHT TEST
DATE: JUNE 1968

CONDITIONS:

- STANDARD DAY
- FULL RUDDER AND ONE-HALF LATERAL CONTROL AUTHORITY



REMARKS:

The MRT temperature lines are for quick reference only and were calculated for an average pattern speed. Refer to T.O. 1B-52B-1-2 for precise settings. MRT should not be applied for a go around unless necessary. See text for amplification.

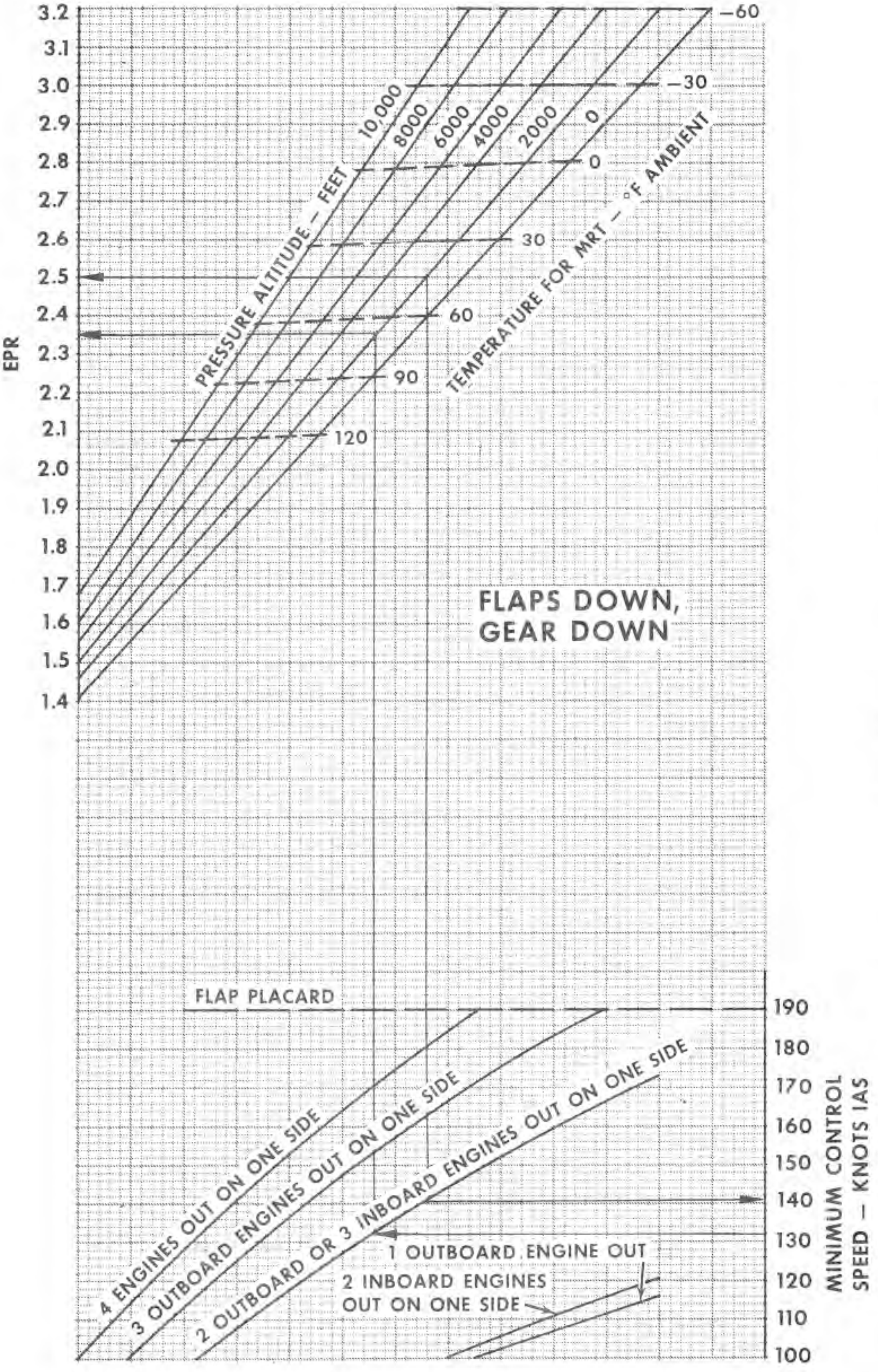
EXAMPLE:

GIVEN:
Pressure altitude = 2000 feet
Temperature = 25° F
Flaps up
2 outboard engines out on one side

FIND:
EPR for MRT
Minimum speed for directional control

SOLUTION:
MRT = 2.64 EPR
Minimum speed for directional control = 182 KIAS

Figure 3-12 (Sheet 1 of 2)



DATA BASIS:
FLIGHT TEST
DATE: JUNE 1968

CONDITIONS:

- STANDARD DAY
- FULL RUDDER AND ONE-HALF LATERAL CONTROL AUTHORITY

REMARKS:

The MRT temperature lines are for quick reference only and were calculated for an average pattern speed. Refer to T.O. 1B-52B-1-2 for precise settings. MRT should not be applied for a go around unless necessary. See text for amplification.

EXAMPLE 1:

GIVEN:
Best flare + 10 knots = 132 KIAS
Pressure altitude = 2000 feet
Temperature = 45° F
Flaps down
2 outboard engines out one one side
FIND:
Maximum EPR
SOLUTION:
2.35 EPR

EXAMPLE 2:

GIVEN:
Pressure altitude = 2000 feet
Temperature = 45° F
Flaps down
2 outboard engines out one one side
FIND:
EPR for MRT
Minimum speed for directional control
SOLUTION:
MRT = 2.50 EPR
Minimum speed for directional control = 141 KIAS

MINIMUM SPEED FOR DIRECTIONAL CONTROL

Figure 3-12 (Sheet 2 of 2).

LANDING WITH ONE OR MORE ENGINES INOPERATIVE

Landing with an engine failure can be accomplished by following the normal landing procedure with the addition that, as thrust is decreased, trim will have to be decreased to compensate for reduction of the unequal thrust. Engine failure will not materially affect the landing gear extension time. The gear is fully extended in 10 to 12 seconds. Consideration must be given to planning for a go-around. Refer to "Go-Around With One or More Engines Inoperative," this section.

NOTE

Under any approach conditions involving reduced power, the necessity of early anticipation of additional power requirements cannot be overemphasized. Most landing experience has been obtained at gross weights less than 270,000 pounds; therefore, it is strongly emphasized that weight be reduced to this value or less to allow landing in a familiar configuration and provide better performance capability.

THREE OR FOUR ENGINE FAILURE ON ONE SIDE WITH FLAPS DOWN

NOTE

With three or four engines inoperative on one side, a flaps-up landing is recommended rather than a flaps-down landing. The flaps-up approach will provide more positive control of the aircraft, is less hazardous, and results in a lower altitude go-around capability.

WARNING

- With three or four engines inoperative on one side, altitude cannot be maintained with gear and flaps extended except at very light gross weights of approximately 230,000 pounds or less.

- It is recommended that a landing under this condition should not be attempted at gross weights in excess of 270,000 pounds.

Flight tests have demonstrated that landings can be successfully accomplished with three or four engines inoperative on one side provided proper techniques and procedures are followed. Figure 3-13 illustrates two landing patterns from which landing may be accomplished with three or four engines inoperative on one side. From an operational standpoint, it is desirable to make the emergency patterns as near normal as possible. With three or four engines inoperative on one side for any given speed, there is a thrust level which will make that speed the minimum directional control speed. In order to keep the landing pattern speeds normal, the only way to reduce the thrust level is to increase the rate of descent. For example, an approach slope of 10 to 1 is required on the final approach leg to keep the thrust below the critical value as contrasted to the normal approach slope of approximately 20 to 1.

There are several factors to be considered because of possible system failures and multiple emergencies associated with engine failures. Consideration must be given to the reduced bleed air supply with engines shut down or failed.

CAUTION

Do not open the body or wing manifold interconnect valves if an air bleed system leak is suspected.

A failed air duct could render inoperative all hydraulic packs in a wing, one of the stabilizer trim packs, two of the four utility packs, and two of the four alternators. Standby pumps may or may not be available. These conditions will affect the brakes, steering, crosswind crab setting, stabilizer trim operation, and landing gear extension and retraction time as well as having a possible effect on the pilots' ability to control the aircraft due to reduced pitch trim and roll rates available or lack of spoiler operation.

WARNING

Loss of engines will require close attention to fuel panel settings to control lateral balance and desirable cg locations. Required deviations from the aircraft configuration fuel sequence must be planned to maintain the proper differential/balance between paired main/auxiliary tanks whenever possible.

NOTE

- The master bomb control power switch should be placed ON to ascertain operation of hydraulic packs.

- It is recommended that, prior to approach for landing, crossfeed valve switches No. 9, 10, 11, and 12 be opened. This will prevent possible fuel starvation of the operative engines in event any pumps become uncovered due to the bank angle and sideslip created by the asymmetrical thrust condition.

The downwind entry pattern landing is accomplished as follows:

1. The downwind entry pattern shown in figure 3-13 may be flown making turns into or away from the inoperative engines with no appreciable difference in aircraft flight handling characteristics. The downwind leg, which is the same distance out from the runway as for a normal landing, should be intercepted with the aircraft in clean configuration (flaps up, gear up, airbrakes down) at 220 knots IAS, 4000 feet above the runway elevation.

2. Maintain 4000 feet and 220 knots IAS until opposite the landing end of the runway. At this point, start the flaps down. Continue downwind 1 minute, maintaining 4000 feet altitude by accepting a decrease in airspeed to approximately 170 knots IAS.

NOTE

- Slight thrust adjustment may be required during flap extension if 220 knots IAS is maintained prior to initiating flap extension. Thrust reduction is required after full flap extension is accomplished in order to descend properly throughout the remainder of the landing pattern.

- It is recommended that directional control be maintained using lateral control with rudder control as necessary, without use of lateral or rudder trim. This eliminates the requirement for trim changes throughout final approach, flare, and touchdown. Sideslip may be decreased slightly by use of the rudder.

3. After 1 minute on downwind from a point opposite the landing end of the runway, commence turn on base leg from 4000 feet altitude at 170 knots IAS. Extend the landing gear on base leg and plan to roll out on final approach 3 miles from end of runway at 150 knots IAS, 2000 feet above the runway, with landing gear and flaps down. If a go-around is to be made, it must be initiated prior to descending below 2000 feet above the terrain. MRT may be required in order to arrest the rate of descent and accelerate the aircraft to climb speed within the 2000-foot altitude and still retain a satisfactory safety margin.

WARNING

A successful go-around with three or four engines inoperative on one side cannot be assured any time the aircraft descends below 2000 feet above the terrain. Flight tests have indicated that a minimum of 1000 feet altitude must be sacrificed in order to arrest the descent and accelerate the aircraft to minimum directional control speed if flaps and landing gear are retracted simultaneously with thrust increase. Thrust increase must be commensurate with the pilot's ability to control the sideslip and maintain the heading. The use of rudder will assist in keeping sideslip to a minimum during a go-around. Any hesitation on the part of the pilot in performing any of the above steps will result in a loss of altitude in excess of 1000 feet. It is recommended that a climb back to pattern altitude be accomplished at 220 knots IAS.

4. Commence turn to final approach leg, planning to roll out on final approach at 2000 feet, 150 knots IAS.

WARNING

- If a landing is necessary at gross weights above 270,000 pounds, final approach leg should be flown at best flare speed plus 10 knots or 150 knots, whichever is higher. However, landing above 270,000 pounds should not be attempted unless no other alternative exists.

- For weights above 270,000 pounds, do not attempt a go-around since the thrust required to arrest the loss of altitude may exceed the thrust permitted to maintain directional control.

5. After rollout from base leg, commence final approach at 150 knots IAS, 2000 feet above the runway altitude, with landing gear and flaps down. This altitude initially appears high for landing; however, since a rate of descent of approximately 1500 feet per minute can be expected, it is necessary to be at this altitude in order to accomplish a normal touchdown with minimum thrust.

WARNING

This is the final point in the landing pattern from which a successful go-around can be initiated. In addition, 150 knots IAS is below minimum directional control speed for four engines inoperative on one side and the operating engines at MRT. A go-around from such a speed is potentially hazardous. Flight tests conducted from this speed and configuration demonstrated that this maneuver required loss of altitude but could be made within the control capability of the pilot.

6. Continue the approach, maintaining 150 knots IAS, until assured the runway can be reached. From this point, thrust may be gradually further reduced, sideslip and bank angle further decreased, and a normal landing accomplished. Airbrake response may be limited as dictated by engine-out configurations. Airbrakes should be used if available to decrease altitude and airspeed to compensate for wind effect and/or pilot technique. Avoid abrupt lateral control movements by raising airbrakes in increments of two. If airbrake position 6 is to be used to decrease speed on the runway, raising airbrakes in increments of two will prevent an abrupt wing dip should an unbalanced airbrake condition exist.

The straight-in approach landing is accomplished as follows:

1. The straight-in approach is shown in figure 3-13 and is basically an extended downwind entry pattern which has been straightened out and aligned with the

centerline of the landing runway. It should be planned to intercept a point 20 miles downwind from and lined up with the runway, 4000 feet above runway elevation, in level flight at 220 knots IAS, with the aircraft in clean configuration (flaps up, landing gear up, airbrakes down).

2. Continue approach to the runway, maintaining 4000 feet altitude and 220 knots IAS in clean configuration to a point 12 miles from the runway. At this point, start the flaps down, maintaining 4000 feet altitude by accepting a decrease in airspeed to approximately 170 knots IAS.

NOTE

- Slight thrust adjustment may be required during flap extension if 220 knots IAS is maintained prior to initiating flap extension. Thrust reduction is required after full flap extension is accomplished in order to maintain proper rate of descent throughout the remainder of the landing approach.
- It is recommended that directional control be maintained using lateral control with rudder control as necessary, without use of lateral or rudder trim. This eliminates the requirement for trim changes throughout final approach, flare, and touchdown. Sideslip may be decreased slightly by use of rudder.

3. Flaps should be fully extended at a point approximately 9 miles from the runway at an altitude of 4000 feet and an indicated airspeed of 170 knots.

4. Maintain 170 knots IAS, planning to reach a point 6 miles from the runway, at 3000 feet and 170 knots IAS. At this point, extend landing gear. Plan to arrive at a point 3 miles from the landing end of the runway at 2000 feet altitude and 150 knots IAS with landing gear and flaps down. If a go-around is to be made, it must be initiated prior to descending below 2000 feet above the terrain. MRT may be required to arrest the rate of descent and accelerate the aircraft to climb speed within the 2000-foot altitude and still retain a satisfactory safety margin.

WARNING

A successful go-around with three or four engines inoperative on one side cannot be assured any time the aircraft descends below 2000 feet above the terrain. Flight tests have indicated that a minimum of 1000 feet altitude must be sacrificed in order to arrest the descent and accelerate the aircraft to minimum directional control speed if flaps and landing gear are retracted simultaneously with thrust increase. Thrust increase must be commensurate with the pilot's ability to control the sideslip and maintain the heading. The use of rudder will assist in keeping sideslip to a minimum during a go-around. Any hesitation on the part of the pilot in performing any of the above steps will result in a loss of altitude in excess of 1000 feet. It is recommended that a climb back to pattern altitude be accomplished at 220 knots IAS.

5. Start down final leg of approach from a point 3 miles from the runway, 2000 feet altitude, 150 knots IAS. This altitude initially appears high for landing; however, since a rate of descent of approximately 1500 feet per minute can be expected, it is necessary to be at this altitude to accomplish a normal touchdown with minimum thrust.

WARNING

- If a landing is necessary at gross weights above 270,000 pounds, final approach leg should be flown at best flare speed plus 10 knots or 150 knots, whichever is higher. However, landing above 270,000 pounds should not be attempted unless no other alternative exists.
- For weights above 270,000 pounds, do not attempt a go-around since the thrust required to arrest the loss of altitude may exceed the thrust permitted to maintain minimum directional control.
- This is the final point in the landing pattern from which a successful go-around can be initiated. In addition, 150 knots IAS is below minimum directional control speed for four engines inoperative on one side and the operating engines at MRT. A go-around from such a speed is potentially hazardous. Flight tests conducted from this speed and configuration demonstrated that this maneuver required loss of altitude but could be made within the control capability of the pilot.

6. Continue the approach, maintaining 150 knots IAS, until assured the runway can be reached. From this point, thrust may be further gradually reduced, sideslip and bank angle further decreased, and a normal landing accomplished. Airbrake response may be limited as dictated by engine-out configuration. Airbrakes should be used if available to decrease altitude and airspeed as required to compensate for wind effect and pilot technique. Avoid abrupt lateral control movements by raising airbrakes in increments of two. If airbrake position 6 is to be used to decrease speed on runway, raising airbrakes in increments of two will prevent an abrupt wing dip should an unbalanced airbrake condition exist.

THREE OR FOUR ENGINE FAILURE ON ONE SIDE WITH FLAPS UP

Flight tests have demonstrated that, with three or four engines inoperative on one side, a flaps-up landing provides more positive control of the aircraft during the approach as well as a lower altitude go-around capability than a flaps-down landing. In general, the multiple engine-out approach, landing, and go-around, should be flown using the "Landing with Wing Flaps Inoperative" procedures and checklists, and the particular techniques applicable to three or four engines inoperative on one wing. Airbrake position 2 will be used on final approach for all gross weights. The roll response of the aircraft is significantly increased with airbrake position 2 over airbrake position zero or 1. For airbrake position zero, a half-wheel deflection represents 50 percent lateral control authority; the same lateral control authority for airbrake position 2 is obtained at approximately one-third wheel deflection. This characteristic allows the pilot to obtain a large portion of the spoiler authority with small wheel inputs, thus reducing pilot effort. There are several factors to be considered because of possible system failures and multiple emergencies associated with engine failures. Consideration must be given to the reduced bleed air supply with engines shut down or failed.

CAUTION

Do not open the body or wing manifold interconnect valves if an air bleed system leak is suspected.

A failed air duct could render inoperative all hydraulic packs in a wing, one of the stabilizer trim packs, two of the four utility packs, and two of the four alternators. Standby pumps may or may not be available. These conditions will affect the brakes, steering, crosswind crab setting, stabilizer trim operation, and landing gear extension and retraction time as well as having a possible effect on the pilots' ability to control the aircraft due to reduced pitch trim and roll rate available or lack of spoiler operation.

WARNING

Loss of engines will require close attention to fuel panel settings to control lateral balance and desirable cg locations. Required deviations from the aircraft configuration fuel sequence must be planned to maintain the proper differential/balance between paired main/auxiliary tanks whenever possible.

Observe the "Landing with Wing Flaps Inoperative" procedures and checklist provided for flaps-up landing with all engines operating as applicable. The optimum procedures for the approach, landing and go-around, modified by particular techniques applicable to three or four engines inoperative on one wing are as follows:

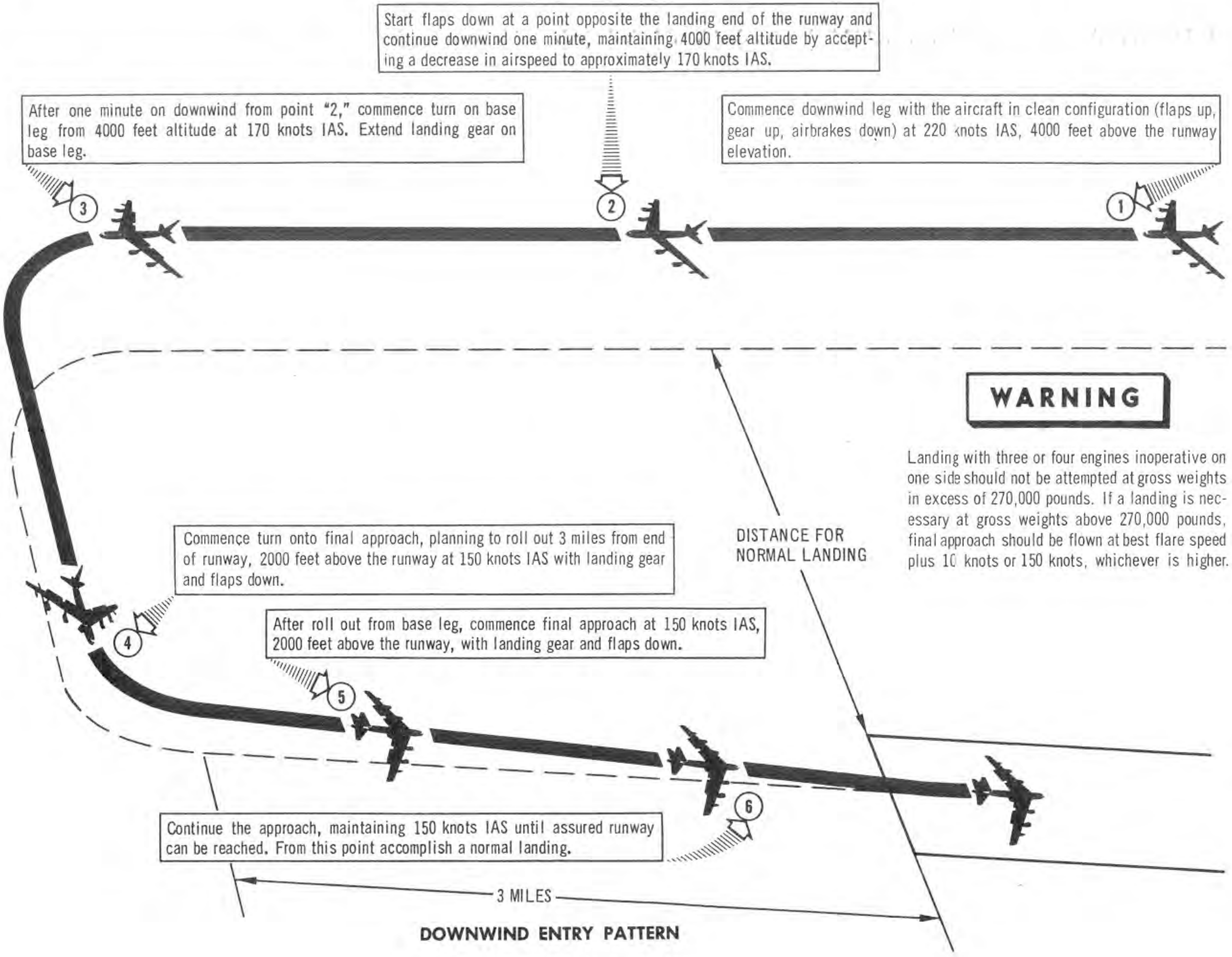
1. The higher speeds, larger turning radius, and difficulty in establishing speeds in an unfamiliar configuration require additional maneuvering space and make a long extended final approach desirable. A long straight-in pattern or an extended rectangular pattern should be flown at least 2000 feet above ground level, in the clean configuration, and airbrakes zero. At approach speed plus 30 knots IAS, up to 30 degrees of bank in either direction may be used with no adverse effects on handling qualities or performance. However, it is recommended that bank angle be limited, normally to 20 degrees. The speed schedule in the pattern will depend on the availability of hydraulic pack pressure to the landing gear. If hydraulic pack pressure is available, fly the normal no-flaps speed schedule. When approaching the glideslope, extend the landing gear, place airbrakes to position 2, and reduce to final approach speed just before glideslope interception.
2. Flight tests have shown that when the landing gear is extended using standby pump pressure, extension time is approximately 1 3/4 minutes. If only standby pump pressure is available for the landing gear, maintain approach speed plus 30 knots IAS (either straight-in or rectangular) until 2 minutes from glideslope interception. Extend the landing gear and allow airspeed to decrease so as to intercept the glideslope at approach speed with airbrake position 2. Systems failure may require the use of some emergency gear extension switches.
3. The final approach should be flown with landing gear down, airbrakes position 2, and at approach speed using a precision instrument (PAR/ILS) glideslope with a transition to VASI when appropriate. If facilities or equipment are inoperative, the VASI approach lights may be used or if necessary a visual final approach may be flown while attempting to maintain a 2.5 degree glideslope angle. Intercept the glideslope at 2000 feet or more above the runway elevation. Maintain the flaps-up approach speed on the glideslope by using all operating engine throttles together in a staggered setting with the inboard throttles further forward. Full rudder trim should be used throughout the pattern, approach, and go-around. With full rudder trim and some rudder input by the pilot, zero bank angle can be maintained during the pattern and approach.

NOTE

Full rudder trim should be used on the approach and should be zeroed when the decision to land is made. Caution must be exercised not to zero the rudder trim too quickly and to carefully compensate with rudder pedal force while doing so.

WARNING

If a decision to go around is made, the go-around must be initiated prior to descending below 500 feet above the terrain.



Commence downwind leg with the aircraft in clean configuration (flaps up, gear up, airbrakes down) at 220 knots IAS, 4000 feet above the runway elevation.

Start flaps down at a point opposite the landing end of the runway and continue downwind one minute, maintaining 4000 feet altitude by accepting a decrease in airspeed to approximately 170 knots IAS.

After one minute on downwind from point "2," commence turn on base leg from 4000 feet altitude at 170 knots IAS. Extend landing gear on base leg.

Commence turn onto final approach, planning to roll out 3 miles from end of runway, 2000 feet above the runway at 150 knots IAS with landing gear and flaps down.

After roll out from base leg, commence final approach at 150 knots IAS, 2000 feet above the runway, with landing gear and flaps down.

Continue the approach, maintaining 150 knots IAS until assured runway can be reached. From this point accomplish a normal landing.

WARNING

Landing with three or four engines inoperative on one side should not be attempted at gross weights in excess of 270,000 pounds. If a landing is necessary at gross weights above 270,000 pounds, final approach should be flown at best flare speed plus 10 knots or 150 knots, whichever is higher.

DOWNWIND ENTRY PATTERN

Figure 3-13 (Sheet 1 of 2)

WARNING

Landing with three or four engines inoperative on one side should not be attempted at gross weight in excess of 270,000 pounds. If a landing is necessary at gross weights above 270,000 pounds, final approach should be flown at best flare speed plus 10 knots or 150 knots, whichever is higher.

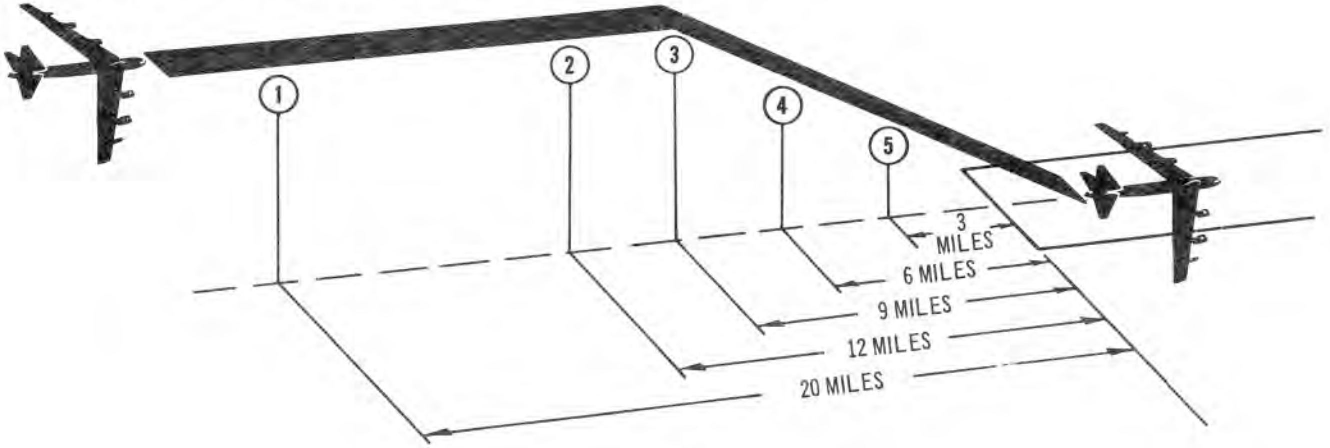
① Commence approach 20 miles downwind from the landing end of the runway with the airplane in clean configuration (flaps up, gear up, airbrakes down), 4000 feet above runway elevation in level flight at 220 knots IAS.

② After maintaining 4000 feet altitude and 220 knots IAS in clean configuration to a point 12 miles from the runway, start the flaps down maintaining 4000 feet altitude by accepting a decrease in airspeed to approximately 170 knots IAS.

③ Flaps should be fully extended approximately 9 miles from the runway at an altitude of 4000 feet and an airspeed of 170 knots IAS.

④ After maintaining 170 knots IAS to a point 6 miles from the runway at 3000 feet, extend landing gear and plan to arrive at a point 3 miles from the landing end of the runway at 2000 feet altitude and 150 knots IAS, with landing gear and flaps down.

⑤ From a point 3 miles from the landing end of the runway at 2000 feet altitude and 150 knots IAS, continue the approach maintaining 150 knots IAS until assured the runway can be reached. Then accomplish a normal landing.



STRAIGHT IN APPROACH PATTERN

LANDING WITH THREE OR FOUR ENGINES INOPERATIVE ON ONE SIDE WITH FLAPS DOWN

Figure 3-13 (Sheet 2 of 2)

4. Normally the landing should be made with airbrake position 2. Airbrake position 2 should be used from glideslope interception until after touchdown or until completion of the go-around. However, once a decision to land has been made, airbrake position 4 may be used to reduce excessive speed. The aircraft should be flown onto the runway at approach speed and attitude in accordance with published flaps-up procedures.

NOTE

With increasing speed above approach speed, there is an increasing tendency to float when in ground effect with a consequent "long" landing. During flight tests it was found that at approach speed plus 15 knots IAS it was necessary to apply a positive forward movement of the control column to achieve touchdown at the glideslope runway intersect point.

At touchdown, move throttles to IDLE. After forward gear touchdown, select airbrake position 6 with a pause at position 4 to prevent an abrupt wing dip should an unbalanced airbrake condition exist.

GO-AROUND WITH ONE OR MORE ENGINES INOPERATIVE

WARNING

- The decision to go around should be made as early as possible. This is of extreme importance when one or more engines are inoperative since the reduced thrust available and limited directional control under such circumstances may make a go-around impossible near the ground.
- A go-around can be extremely hazardous when one or more engines are inoperative and existing conditions (i.e., gross weight, ambient temperature, pressure altitude, center of gravity, and asymmetrical thrust) make controllability or performance of the aircraft marginal.
- It may not be possible to maintain directional control if all throttles are advanced to MRT. MRT may be set on all symmetric engines. See "Minimum Speed for Directional Control," this section. Thrust must not be applied faster than any generated roll-yaw problem can be controlled. Maintain directional control and accelerate to climb speed. (It may be safer to descend and trade altitude for airspeed.)
- If two outboard engines on the same side are inoperative and go-around is required, it is imperative that full rudder be applied as thrust is applied. If full rudder is not used to oppose the yaw, the spoiler deflection required to maintain control can reduce the climb or acceleration capability at heavy weights to almost zero. The rudder pedal force required to achieve full rudder deflection is approximately 250 to 300 pounds during a go-around when rudder trim is not used.

NOTE

- Pilot height, seat position, rudder pedal adjustment and foot position on the rudder pedal will determine the pilot's ability to counteract the high rudder pedal force and obtain full rudder. The copilot should assist in holding full rudder during the go-around.
- When one or more engines have been shut down and fuel usage and management have been modified, compute the center of gravity for the landing condition or refer to the "Approximate CG Location Landing Configuration" chart in the "Approach and Landing" section of the Appendix. A determination of the cg is necessary to assess the handling characteristics for landing.
- For effect of control displacement on performance during go-around, see "Go-Around Characteristics With Asymmetric Thrust," Section VI.

GO-AROUND WITH ASYMMETRICAL THRUST

Aircraft climb performance with seven, six, and five engines operating at MRT at best climb speed is shown in Part 4 of the Appendix. These charts, along with the minimum speed for directional control charts (figure 3-12), can be used as a guide to the feasibility of making a go-around with less than eight engines under specific circumstances. When landing with engines out, the minimum speed for directional control should be regarded as the minimum speed from which a go-around can be safely accomplished. However, it may be possible to perform a go-around from lower speeds using a combination of engines which will result in symmetrical thrust. In this case, directional control would not be a problem. Under extreme circumstances, it may be possible to make a go-around from a speed at which full control deflections are not sufficient to maintain a heading. This will cause the aircraft to make a gradual turn and, as speed is increased, directional control will be regained. The point to remember is that a safe go-around is not assured from a speed lower than the minimum directional control speed even though it may be possible to do so in some cases. See "Loss of Engines," this section. Therefore, in planning an approach with engines out, the minimum speed for directional control should be used to determine whether the landing is committed or a go-around can be safely executed. The use of nose-down trim due to thrust application will still be required in case of a go-around with less than eight engines; therefore, care should be taken to keep the aircraft trimmed for zero stick force as in a normal go-around. This is particularly important since other distractions will be present during this time.

ONE ENGINE FAILURE

When attempting a landing with one engine inoperative and a go-around becomes necessary, adequate control can be maintained quite easily by applying proper rudder pedal force and a slight amount of lateral control force. All corrective control power required can be trimmed out to fly hands off, even though military rated thrust is applied on the remaining good engines and the engine which failed is located at the outboard position. However, at landing weights below approximately 290,000 pounds, a small amount of sideslip will result.

TWO ENGINE FAILURE

If two outboard engines located on the same side become inoperative and a go-around becomes necessary, there will be an insufficient amount of rudder trim available to completely balance out the yawing moment encountered at the low go-around speeds with no sideslip. However, by applying appropriate lateral control as well as full rudder, straight ahead directional control can be maintained by sideslipping. See figure 3-12 for minimum speeds for directional control with asymmetrical thrust. If full rudder trim is used at speeds above 180 knots IAS, rapid rudder manipulations must be avoided because of the structural limits of the vertical tail and rudder. Steady flight conditions can be established only with the thrust deficient wing a few degrees high.

THREE OR FOUR-ENGINE FAILURE

Five-engine climb curves are presented in Part 4 of the Appendix. Any go-around which must be made with more than two outboard engines inoperative on the same side should be accomplished with utmost caution. Pilot application of directional and lateral control must be simultaneous with throttle movement. It is recommended that the throttles be moved to some position less than full forward until the pilot has determined his capabilities for handling such an emergency. Many different combinations of engine failures are possible and go-around techniques will vary slightly with each. The most critical conditions are those go-arounds which occur when the outboard engines have failed, since directional control is the limiting condition. Engine failure will not materially affect the landing gear retraction time. The gear is fully retracted in 8 to 10 seconds. For additional information, see "Landing With Three- or Four-Engine Failure On One Side," this section.

THREE OR FOUR ENGINE FAILURE ON ONE SIDE

NOTE

With three or four engines inoperative on one side, a flaps-up approach is recommended. If conditions permit, at least one practice approach and go-around should be made at an altitude of 5000 feet above ground level except that the landing gear should not be lowered until the actual landing approach.

WARNING

A go-around should not be attempted unless a gear down climb capability of 300 feet per minute exists. If the "Outboard Engines EPR for Go-Around" charts indicate that a climb potential of less than 300 fpm exists, gross weight should be decreased prior to the approach.

The decision to go around or land must remain with the pilot and be based on all factors involved. The decision should be made as early as possible and not later than 500 feet above ground level. Should the decision to go around be made, the go-around should be accomplished as follows:

1. The pilot should smoothly advance inboard throttles to MRT.

NOTE

It may not be possible to maintain directional control if all throttles are advanced to MRT.

2. As the pilot sets MRT on the inboard engines, the copilot should simultaneously advance the outboard throttles to the computed EPR for go-around. This is a target EPR which will result in approximately one-half lateral control. This EPR may be varied after initial setting depending on conditions and requirements.

WARNING

It is imperative that full rudder be applied as thrust is applied; the pilot should anticipate the bank angle requirement by rolling 10° toward the operative engines. If full rudder is not used to combat yaw, controllability and climb or acceleration is significantly degraded. The rudder pedal force required to achieve full rudder deflection is approximately 250 to 300 pounds during a go-around when rudder trim is not used.

NOTE

Pilot size, seat position, rudder pedal adjustment, and foot position on the rudder pedal will determine the pilot's ability to counter the high rudder pedal force and obtain full rudder. The copilot should assist in holding full rudder during the go-around.

3. Leave airbrakes in position 2. Airbrake position 2 will give more spoiler authority with less wheel deflection than position 1 or zero and require less pilot effort with no significant increase in drag.
4. Place landing gear lever in UP position.

NOTE

Raising the landing gear will increase rate of climb approximately 500 fpm.

Accelerate to approach speed plus 10 knots IAS. (Descend along the glideslope to trade altitude for airspeed if necessary.) Climb at approach speed plus 10 knots IAS with airbrakes 2. If the computed thrust for one-half lateral control authority is applied and speed is less than approach speed plus 10 knots, then more roll control will be required to maintain heading. This will result in an increase in drag and a decrease in remaining roll control. Do not attempt a turn until at least 1000 feet above the terrain.

WARNING

The effects of spoiler deflection, gear down, and fuel unbalance can become critical if go-around speed is not quickly attained and maintained.

DATE: MAY 1971

DATA BASIS:
FLIGHT TEST

CONDITIONS:
- FLAPS UP
- GEAR DOWN
- AIRBRAKES POSITION 2
- INBOARD ENGINES AT MRT
- FULL RUDDER
- ONE-HALF LATERAL CONTROL AUTHORITY
- APPROACH SPEED PLUS 10 KNOTS
- WITH DROP TANKS

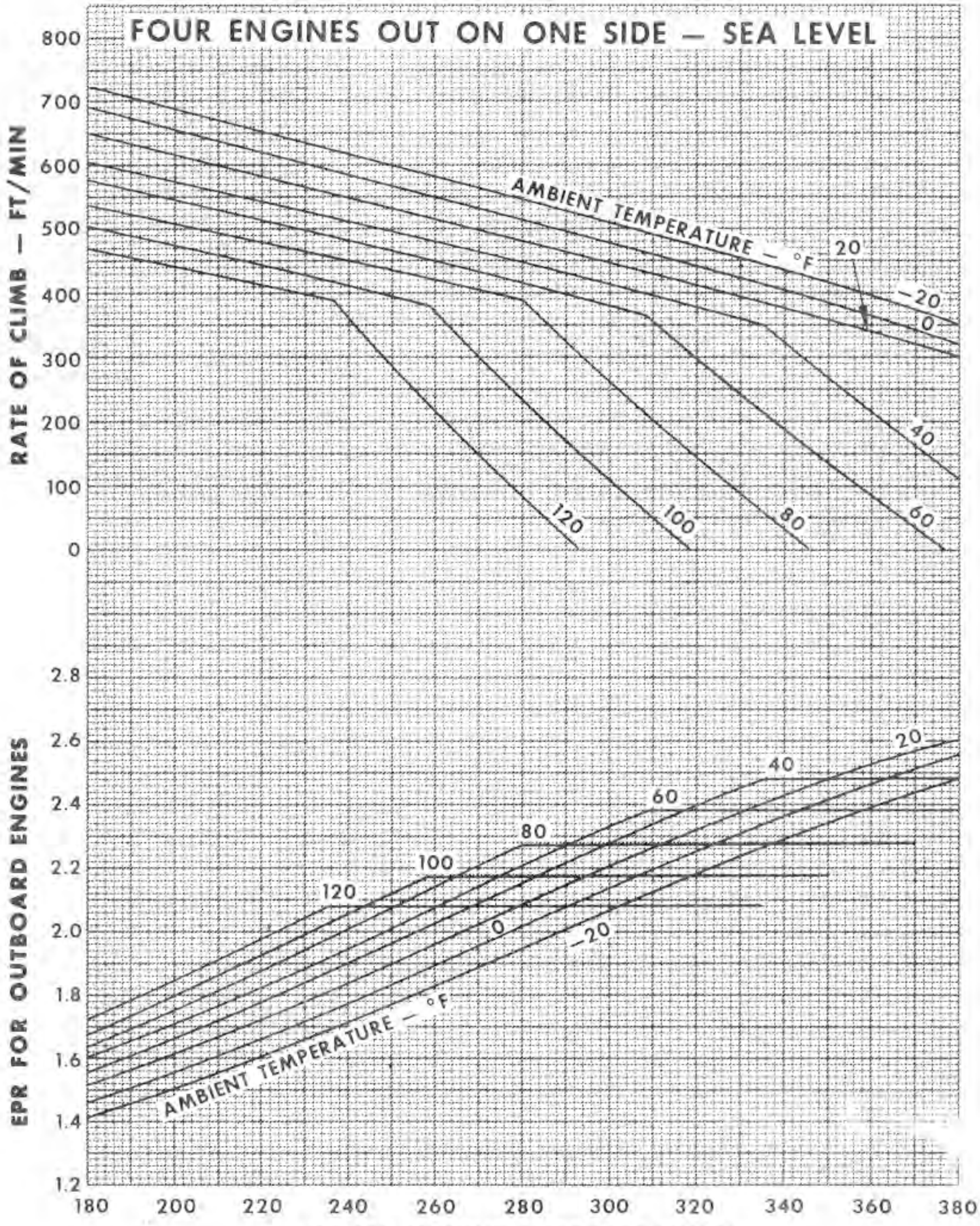


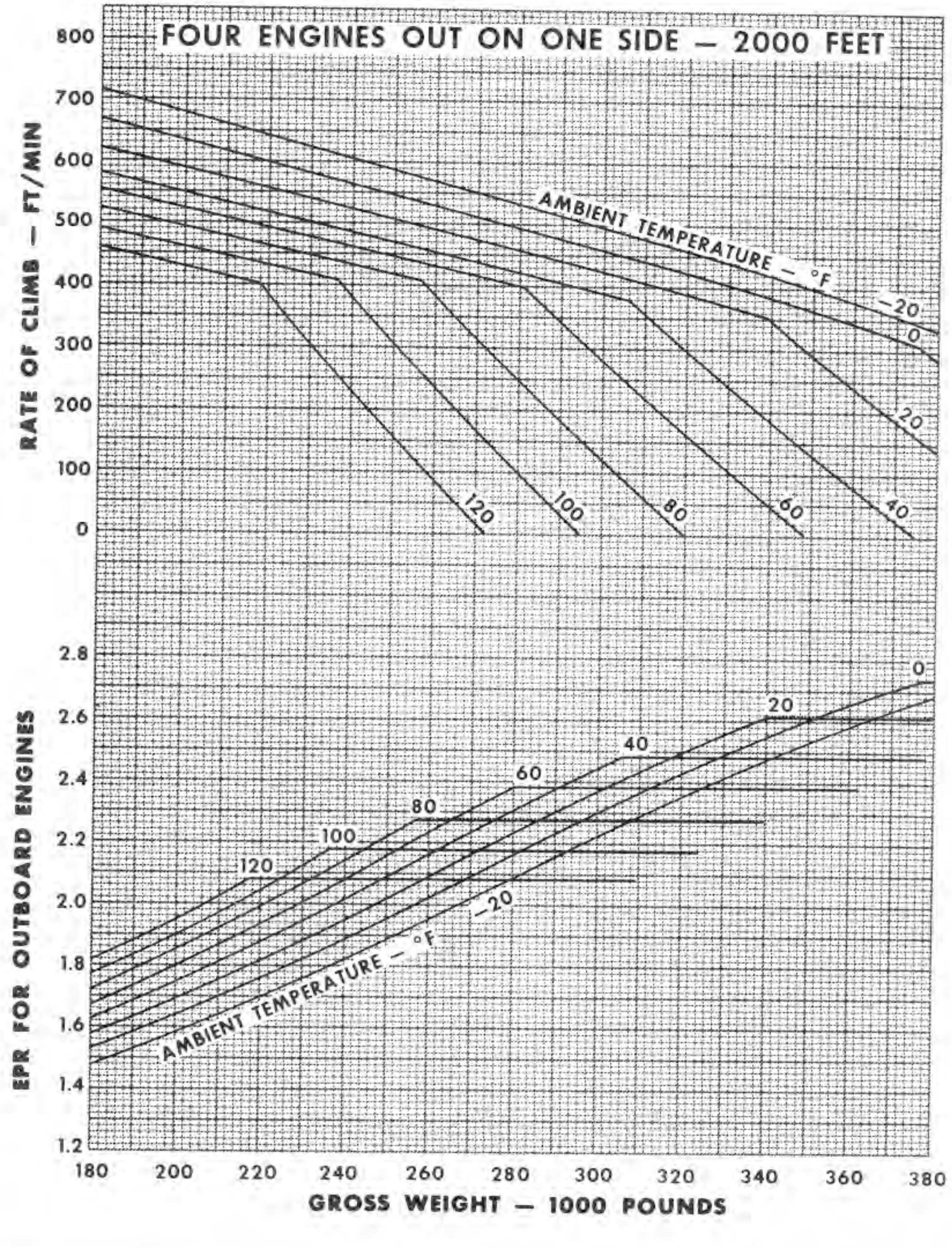
Figure 3-13A (Sheet 1 of 4)

DATE: MAY 1971

DATA BASIS:
FLIGHT TEST

CONDITIONS:

- FLAPS UP
- GEAR DOWN
- AIRBRAKES POSITION 2
- INBOARD ENGINES AT MRT
- FULL RUDDER
- ONE-HALF LATERAL CONTROL AUTHORITY
- APPROACH SPEED PLUS 10 KNOTS
- WITH DROP TANKS



OUTBOARD ENGINES EPR FOR GO-AROUND

Figure 3-13A (Sheet 2 of 4)

DATE: MAY 1971

DATA BASIS: FLIGHT TEST

CONDITIONS:

- FLAPS UP
- GEAR DOWN
- AIRBRAKES POSITION 2
- INBOARD ENGINES AT MRT
- FULL RUDDER
- ONE-HALF LATERAL CONTROL AUTHORITY
- APPROACH SPEED PLUS 10 KNOTS
- WITH DROP TANKS

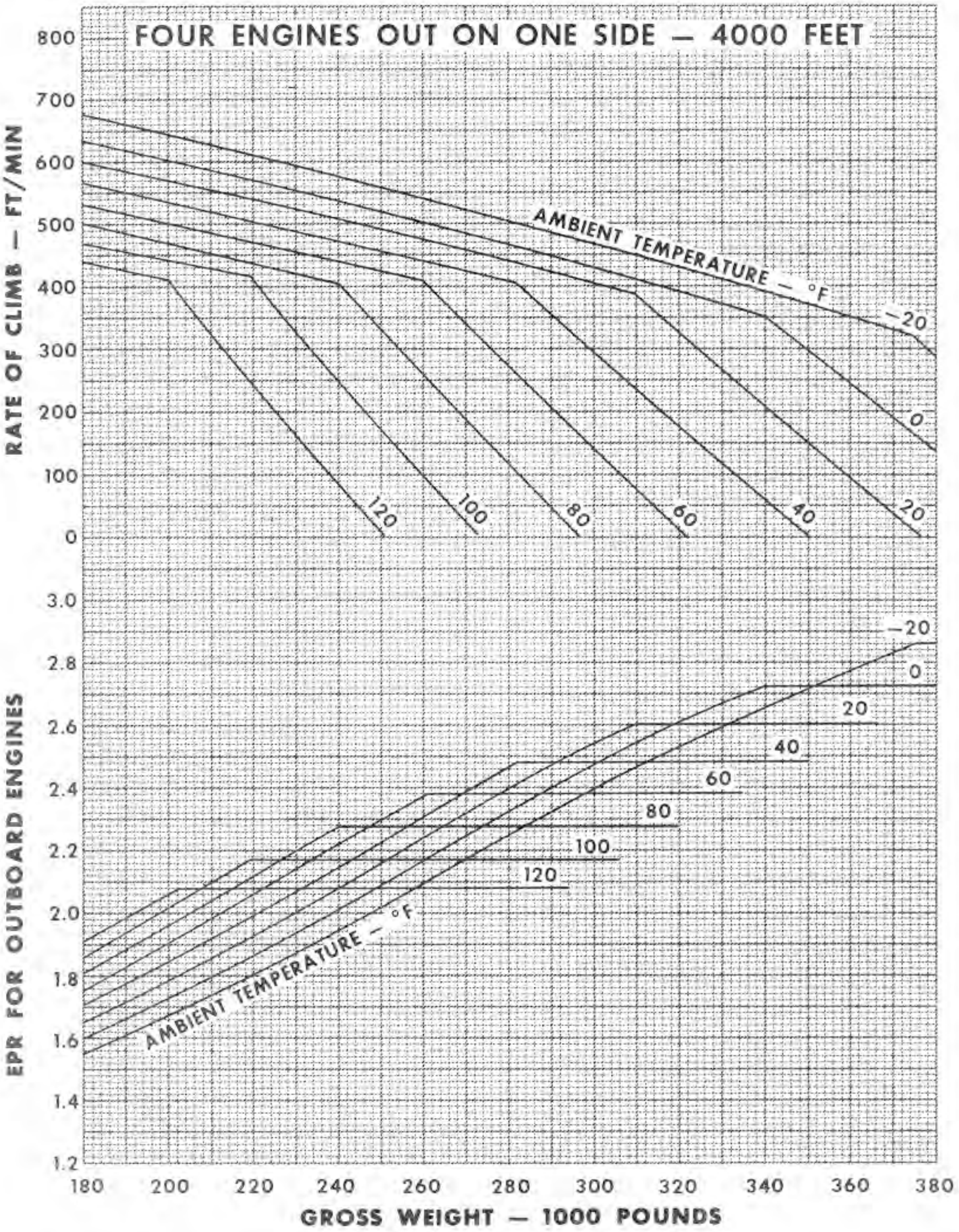
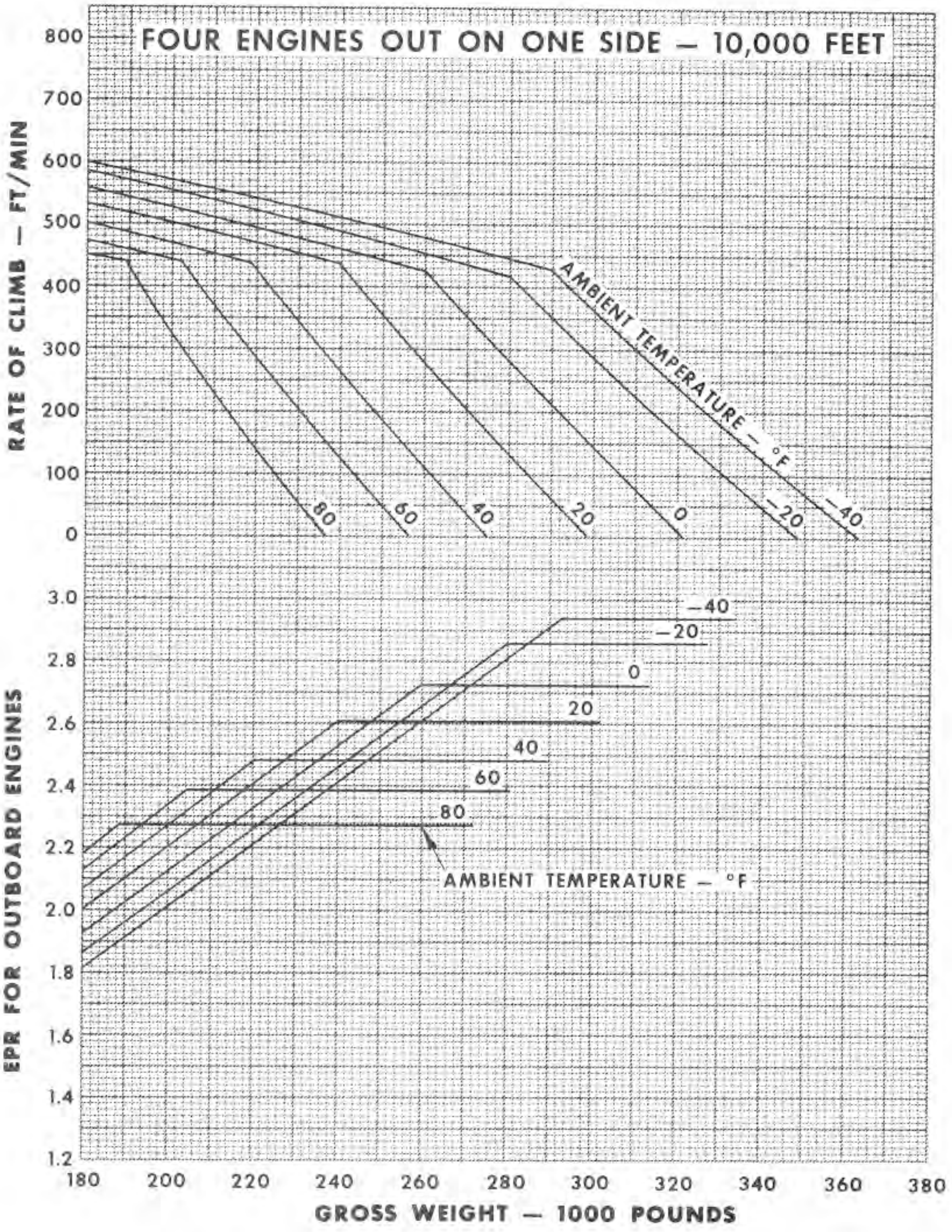


Figure 3-13A (Sheet 3 of 4)



DATE: MAY 1971

DATA BASIS:
FLIGHT TEST

CONDITIONS:

- FLAPS UP
- GEAR DOWN
- AIRBRAKES POSITION 2
- INBOARD ENGINES AT MRT
- FULL RUDDER
- ONE-HALF LATERAL CONTROL AUTHORITY
- APPROACH SPEED PLUS 10 KNOTS
- WITH DROP TANKS

OUTBOARD ENGINES EPR FOR GO-AROUND

Figure 3-13A (Sheet 4 of 4)

SYSTEMS EMERGENCY OPERATION

FLIGHT CONTROL SYSTEM EMERGENCY OPERATION

NOTE

> The following correctional procedures apply to recovery from unusual pitch attitudes (Section VI).

AILERON TRIM MALFUNCTION

Unscheduled operation of the aileron trim system due to an electrical control circuit malfunction can be stopped by actuation of the guarded aileron trim cutout switch on the forward end of the aisle stand. If at any time it is observed that both aileron trim tabs are traveling in the same direction, trim actuation must be stopped immediately and not be attempted for the remainder of the flight. Continued operation of the system will cause the actuator on the malfunctioning side to drive into its limit and become completely inoperable in that position. Under this condition of extreme tab travel, the amount of spoiler deflection required to maintain lateral trim will result in some range loss due to the added drag. An aileron trim malfunction of this type can be detected by observing both left and right aileron trim position indicators when actuating the aileron trim switch.

WARNING

> Vertical oscillations on the order of 2 to 3 cycles per second may result from excessive play in aileron control or trim tabs. To the pilot these oscillations appear as a rapid porpoising motion, with no vibration or movement of the control column. Acceleration forces may approach structural limits. If this condition is encountered, airspeed should be reduced until the oscillation ceases, and the mission terminated as soon as possible.

STABILIZER TRIM MALFUNCTION

Unscheduled stabilizer trim operation in flight can cause severe attitude changes if immediate corrective action is not taken. The time required for the stabilizer to travel beyond the limit of elevator control capability is approximately 5 seconds under most conditions. However, at maximum indicated airspeeds, the time may be as short as 2 seconds; therefore, it is essential that immediate corrective action be taken by the pilots when an unscheduled or runaway trim condition arises in flight. In most cases of runaway stabilizer trim, one of the following has occurred to give the pilots the idea that the stabilizer trim was running away:

1. A malfunction which allows the autopilot to remain on when the pilot is flying manually and believes the autopilot is off.
2. One of the pilots' trim buttons stuck in NOSE UP or NOSE DOWN position.
3. The aircraft has been thrown out of trim by the use of flaps and/or airbrakes. For complete information on flaps and airbrakes, see "Flight Controls," Section VI.
4. One of the pilots actuating the trim button, causing the other pilot to believe that the trim was malfunctioning.
5. Stabilizer trim response in the opposite direction to that commanded (caused by stabilizer trim motor reversal).

Any of the above situations can cause the pilots to take emergency actions resulting in a dangerous flight condition; therefore, the "Runaway or Unscheduled Stabilizer Trim Checklist" should be used whenever stabilizer trim malfunction is suspected.

Stabilizer Trim System Force Switches

To provide the pilots with a means of instantly terminating unscheduled stabilizer trim, a pitch attitude control force switch assembly is installed in the control column linkage. The pilot's trained reaction with the control column in counteracting undesired aircraft pitch attitude variation operates to cut out any opposing electrical stabilizer trim (figure 1-33).

NOTE

> Stabilizer trim reversal will not be interrupted by actuation of the force switches for the reasons noted in the following paragraph.

FORCE SWITCH OPERATION. Application of a forward load of more than the preset value (24 to 36 pounds) on a spring in the force switch assembly compresses the spring to interrupt the stabilizer noseup trim circuit. When this same preset value is exceeded in the aft direction, the spring is also compressed and the nosedown trim circuit is interrupted. The autopilot, if engaged, will disengage upon actuation of the force switches in either direction. Since the electrical circuit opposite the fault side continues to be operative, unless deactivated by the trim circuit cutout switch or circuit breakers, electrically controlled trim opposing the unscheduled trim movement is available through actuation of the trim button. Normally, trim cutout switch actuation should be delayed until the opposing force on the control column is reduced to the preset value by corrective trimming because an out of trim condition can be corrected more rapidly by using electrical trim. It should be noted that as soon as the control column force is reduced to this point, the force switches will close and allow an unscheduled trim to be reactivated. To prevent continuation of the unscheduled stabilizer trim operation and to permit manual trimming for the remainder of the flight, the trim cutout switch should then be placed in the CUTOUT position in sequence with the other corrective action measures noted in the following "Runaway or Unscheduled Stabilizer Trim Checklist."

NOTE

> Certain malfunctions with the aircraft electrical system can create a condition wherein the stabilizer trim motor may drive in the opposite direction to the input signal commanded by the stabilizer trim button. In the event of such stabilizer trim motor reversal, the pilot's natural reaction in responding to an aircraft pitch movement with an opposing control column force will not interrupt driving of the reversed trim motor. The force switches interrupt the power of the trim motor clutch on the side opposite that required for proper trim direction. In the reversed motor situation, the correct clutch is engaged but the direction of rotation is reversed. Stabilizer trim reversal can be interrupted by repositioning the trim button to neutral or by actuating the stabilizer trim cutout switch to the CUTOUT position.

ELEVATOR AND RUDDER CONTROL MALFUNCTION

Loss of Artificial Feel

If at any time loss of artificial feel is encountered, check the flight instruments for aircraft response to control movement. Loss of feel may be interpreted as loss of control response especially in the yaw axis. The start of yaw with rudder deflection is slow and close observance of flight instruments is necessary to detect aircraft response to control movement. If abnormally light elevator or rudder control forces are encountered, abrupt maneuvers should be avoided to prevent overstressing the aircraft. Loss of artificial feel can occur as a result of Q-spring ram air inlet ice or loss of ram air pressure from other causes. An additional tension spring provides partial feel in the elevator axis in the event Q-spring pressure is lost. The most significant indication of loss of Q-spring pressure is loss of rudder feel. The loss of elevator feel is masked for small control column displacements by the centering spring. Therefore, in event of loss of rudder feel, it should always be suspected that the elevator feel has also been lost and caution should be exercised when applying large control column inputs.

Control Stiffness

Stiffness of elevator and rudder control may be encountered when Q-spring ram air duct blockage from ice or other foreign material has occurred, or when mechanical jamming or failure has taken place. Blockage of this duct may result in pneumatic locking of the feel system. If such a condition occurs, descend to a warmer altitude. If a landing must be made with stiff controls, accomplish the following:

1. Check aircraft center of gravity location. Forward center of gravity loadings should be avoided and a more aft cg utilized since elevator requirements to maneuver during flare diminish as cg moves aft. In no case should a landing be made with cg outside the normal flight and ground handling limits.
2. Trim aircraft carefully during approach. During approach, the flare may require judicious use of stabilizer trim and airbrakes for a safe landing.
3. If steering control is inadequate after touchdown, place steering ratio selector lever to TAXI. Steering in TAXI position requires cautious use of rudder pedals, especially if steering control returns to normal during the landing roll.

CAUTION

> Steering in TAXI during high speeds produces excessive steering when small amounts of rudder displacement are induced which can produce critical side loads on aircraft structure.

If the above procedure does not provide sufficient steering, application of spoiler control in the desired direction may produce enough landing gear bicycling effect to maintain the desired heading.

ASYMMETRICAL AIRBRAKE CONTROL

When a hydraulic or mechanical malfunction occurs to a spoiler group, pulling the respective (inboard or outboard) airbrake control circuit breaker will assure symmetrical airbrake position during subsequent airbrake operation. Airbrake effect will be reduced for a selected airbrake position, but the desired results can be obtained by using a higher airbrake position, if available. If airbrakes are used after a hydraulic failure has occurred and the applicable circuit breaker is not pulled, a sudden roll to the side of the operating airbrakes will occur. The character of the roll will depend upon the spoiler group or groups inoperative and the position of the airbrakes used. Although the aircraft is less maneuverable, it can be flown without assistance of one or two spoiler groups. With one or more spoiler groups inoperative, see "Landing With Spoiler Control Failure" under "Landing Emergencies," this section.

WING FLAP SYSTEM EMERGENCY OPERATION

WING FLAP EMERGENCY OPERATION

1. Wing Flap Lever - OFF (CP)

NOTE

The wing flap lever must be OFF when operating by the emergency system to prevent subsequent actuation of the flaps by the normal system when the wing flap emergency switch is returned to OFF.

2. Retract or Extend Wing Flap Emergency Switch, then OFF - OFF (P)

Hold the selected wing flap emergency switch in the desired position. Release switch when the proper flap setting is attained.

CAUTION

- Use extreme caution when operating the wing flap emergency system switches during the last 10% of a cycle. Since no limit switches are provided, operation of the flap switches after flap contact with the mechanical stops can result in damage to the motor from overheating.
- If use of the emergency switches is unsuccessful during emergency flap retraction, do not attempt further movement of the flaps unless a flight control problem exists. The only exception would be during EWO.

WING FLAP DRIVE UNIT MALFUNCTION

Repeated failures to extend the wing flaps after prolonged flight at high altitude can be caused by frozen moisture in the flap drive overspeed brake. At low altitudes, pneumatic ducts should warm the flap drive power unit area to approximately 20° C above the OAT. Therefore, if wing flaps fail to respond to actuation by either the normal or emergency method, the following procedure should be employed:

1. If conditions permit, conduct flight at low altitude long enough for the system to warm up.
2. Repeat efforts to extend the flaps at 15-minute intervals during the warmup period.

CAUTION

Wing flap operation, either normal or emergency, shall be discontinued within 10 seconds if flaps fail to start moving. Do not use either flap motor for more than eight attempted starts in any 30-minute period.

3. If extension is not successful within 45 minutes, plan a flaps-up landing.

ASYMMETRICAL WING FLAP CONDITIONS

An asymmetrical wing flap condition may or may not be evidenced to the pilot by an unusual rolling and yawing moment. The asymmetrical wing flap yawing effect arises from the increased drag of the flaps-down wing as compared to that of the wing with flaps up. When the rolling moment is counteracted by spoiler action, the resulting yawing moment adds to that of the flaps. If only ailerons were available for roll correction, the resulting yawing moment would oppose that due to the flaps, but in most cases would not equal it. Effective countermeasures for asymmetrical wing flap conditions which result in unusual rolling and yawing moments will then include the application of opposite rudder in addition to lateral control. Flap damage which could result in an asymmetrical condition is most likely to occur during extension or retraction. To successfully counteract any adverse rolling moment due to asymmetrical flaps, it is essential that corrective action be taken immediately. The possible conditions which could cause asymmetrical flaps and the results expected are as follows:

1. An outboard section could leave the aircraft instantaneously with the other three sections either full or partially down. This condition can be adequately counteracted at all speeds above unstick speed by the application of full lateral control and rudder.

2. An inboard section could leave the aircraft instantaneously with the other three sections either full or partially down. Experience shows that this condition can be counteracted by application of one-half to two-thirds of the lateral control.

3. If a torque tube fails between the two sections on one side, the outboard section could go to full up while the others went to full down (corrective capabilities are the same as for the first condition above) or could go to full down when the other three sections went to full up. In the latter case, full lateral control and rudder can counteract the rolling moment at speeds over 20% above unstick speed.

4. If a torque tube breaks between an inboard flap section and the power unit, both sections on one side could go up or down while the two sections on the other side went in the opposite direction. This condition will be uncontrollable unless immediate action is taken to "chase" the free flap sections with the driven sections. Full lateral control and rudder can control a maximum of 25% asymmetry in the up position (flaps up on one side and 25% extended on the other side) and a maximum of 60% asymmetry in the down position (flaps down on one side and 40% down on the other side).

Wing Flap Movement Following Torque Tube Failure

If the flaps are less than 20% extended and a section becomes disconnected from the torque tube drive, airloads will probably carry the section to the full-up position. If the break occurs when the flaps are 30% or more extended, the airloads will probably move the section to the full-down position. In the range between 20% and 30% extended, airloads could move the section either up or down with the probable crossover point at 25%. An overspeed brake is provided on each section which limits its free travel to 5% per second. The flap drive moves the flap at a rate of 2.5% per second. Therefore, if a torque tube broke when the flaps were 30% extended and the flap lever was immediately moved to DN, the free section would reach full down in 14 seconds. The maximum asymmetry would occur at that time with the free section full down and the driven section 65% down.

Action To Be Taken With Asymmetrical Wing Flaps

When an asymmetrical flap condition exists, a landing in that configuration will be necessary. A check of aircraft controllability and initial buffet speed should be made. See "Stall or Controllability Checks," Section VI. Use normal flaps down "Landing Checklist." Determine the best flare speed from Part 9 of the Appendix for intermediate flap settings.

WARNING

When the flaps are in a full down or intermediate position and flap damage exists, such as a missing segment, the best flare speed given in the applicable Appendix may no longer apply. In this case, reduce speed slowly until the charted best flare speed is reached or until approximately one-half lateral control authority is required to maintain the wings level. Whichever of these speeds is higher should be used as the best flare speed.

NOTE

Visual observation of the wing flap condition may be made by a crew member or, if time is available, by a chase plane pilot, to aid in assessing the damage.

WARNING

Pilot of the chase aircraft will be briefed on command chase aircraft procedures prior to engaging in chase operation. It is unsafe to fly two aircraft in close vertical proximity because of the magnitude of interrelated aerodynamic effects.

1. When any unusual rolling moment is encountered during wing flap operation and the flap indicator needles remain synchronized, immediately place the flap lever to OFF. The synchronized indicator needles usually mean that the torque tubes are intact and therefore a flap section has either ceased to move or has fallen from the aircraft. The pilot must maintain the flap placard speed that is commensurate with the indicated flap position until a controllability check can be made.

CAUTION

- If visual observation reveals that one of the flap sections is damaged or cocked, or if visual observation cannot be made and the condition of the flaps is unknown, further operation of the flaps must be discontinued and a landing made with the flaps remaining in the position in which they stopped.

- Additional attempt to operate damaged flaps can result in further damage to the aircraft and could cause an increase in rolling moment. A cocked flap is subject to buffeting and vibration and may fall from the aircraft. To reduce this hazard, consideration should be given to landing the aircraft when practical.

2. When any unusual rolling moment is encountered during wing flap operation or the flap indicator needles become unsynchronized, immediately place the flap lever to OFF. Since the flap position indicator

transmitters are on the outer extremities of the torque tubes, an unsynchronized indicator needle movement accompanied by a rolling moment can usually be associated with failed torque tube. If the rolling moment continues to increase, the copilot must "chase" the free flap section with the flap lever.

a. If the flaps were more than 25% down, move the flap lever to DN. Monitor the needles to insure that both are moving in the down direction. If one needle has stopped or is going in the up direction, reposition the flap lever to OFF or UP as required to synchronize the needles.

b. If the flaps are less than 25% down, move the flap lever to UP. Monitor the needles to insure that both are moving in the up direction. If one needle has stopped or is going in the down direction, reposition the flap lever to OFF or DN as required to synchronize the needles.

WING FLAP STOPPAGE

If both needles stop during extension or retraction and no rolling moment is experienced, immediately move the flap lever to OFF. Flap stoppage can usually be associated with electrical problems or excessive friction in the system. The landing should be made with the wing flaps remaining in the position where they stopped.

CAUTION

If a partial flap landing is inadvisable due to critical landing factors, only flap extension may be attempted, and then only if visual observation reveals that no unusual position or alignment of flaps exist. Flap extension may be continued while under visual observation. Use caution in reactivating the flaps or in using the emergency switches, and be prepared to counteract any unusual rolling moment that may be encountered. Discontinue extension of flaps if the flap indicator needle motion becomes jerky or if the needles stop or become unsynchronized.

UNSCHEDULED FLAP MOVEMENT

All four flap sections are simultaneously driven by a common drive shaft operated by the wing flap power unit. Certain failures within the power unit could cause loss of flap response to the flap motors and flap lever. Such a failure would allow airloads to position all four flap sections, depending on flap position when failure occurs, as described under "Wing Flap Movement Following Torque Tube Failure," this section. During flap operation if the flaps stop and reverse direction, reposition the flap lever to agree with flap movement. When flap movement stops, place flap lever OFF to prevent extended flap motor operation should limit switches not be deenergized.

OIL SYSTEM EMERGENCY OPERATION

NOTE

When a malfunction occurs in the oil system which could cause damage to the engine bearings or when an engine has windmilled in flight with low or zero oil pressure, an entry will be made on Form 781. This information will aid maintenance personnel in determining the extent of damage and/or maintenance inspections required. Entries should provide information on elapsed time the engine(s) windmilled, what percent windmilled, and the oil pressure indicated.

OIL PRESSURE LOW

When engine oil pressure drops below 40 psi, the engine should be monitored closely; if engine oil pressure drops below 35 psi, oil pressure is considered low and the engine should be shut down as soon as possible to prevent extensive engine damage unless its thrust is necessary to maintain flight. If the thrust of an engine with low oil pressure is required to maintain flight, the pilot should be aware of the results of operating an engine during oil starvation. If an engine oil system malfunction has caused prolonged oil starvation of engine bearings, the result will be a progressive bearing failure and subsequent engine seizure. This progression of bearing failure starts slowly and will normally continue at a slow rate up to a certain point at which the progression of failure accelerates rapidly to complete bearing failure. The time interval from the moment of oil starvation to complete failure depends on such factors as condition of bearings prior to oil starvation, operating temperature of bearings, and bearing loads. A good possibility exists for up to 30 minutes of operation after experiencing oil starvation. Bearing failure due to oil starvation is generally characterized by a rapidly increasing vibration; when vibration becomes moderate to heavy, complete failure is only seconds away and may be avoided only by immediate engine shutdown. Since the end result of oil starvation is engine seizure, at the first indication of oil system malfunction the procedure outlined below should be followed to forestall engine seizure as long as possible.

1. Immediately shut the engine down unless its thrust is necessary to maintain flight.
2. If thrust is required from the affected engine, reduce thrust to minimum required to maintain flight. Avoid rapid and large variations in thrust settings on affected engine.
3. Jettison, if necessary, external stores not required.
4. Avoid all abrupt maneuvers causing high "g" forces. This prevents unnecessary bearing loads.
5. After critical thrust conditions are past, immediately shut the affected engine down. Reduction in IAS and altitude will reduce the engine windmilling rpm and delay engine seizure after the engine is shut down.
6. Reset oil pressure circuit breaker if applicable.
7. After engine shutdown, if the oil pressure gage does not indicate a positive value, land the aircraft as soon as practicable to prevent possible engine damage or seizure. Consideration should be given to gross weight for landing (325,000 pounds or less) and availability of a suitable landing base.

NOTE

> If the oil pressure circuit breaker has popped, oil pressure indications are unreliable.

OIL PRESSURE ERRATIC

If the engine oil pressure gage shows erratically lowering oil pressure below 40 psi when operating above idle rpm, or rises to approximately 50 psi, monitor the engine and continue normal operation until pressure drops to 35 psi or rises to 50 psi. Oil pressure fluctuations up to 5 psi total are allowable; however, the mean should not be lower than 35 psi. It may not be possible to distinguish between an oil pressure transmitting system malfunction and an engine oil pressure system malfunction. Therefore, if engine oil pressure drops below 35 psi, or exceeds the maximum limit, shut the engine down unless its thrust is necessary to maintain flight.

DROP TANK EMERGENCY OPERATION

EMERGENCY TRANSFER FROM DROP TANKS THROUGH REFUEL SYSTEM

If a drop tank transfer system fails, drop tank fuel can be routed through the refuel system provided 1) the drop tank pressurization system is functioning properly (engine bleed air is available to pressurize the drop tank(s)) and 2) the drop tank is not full by volume (full by volume float switch has not closed the refuel valve). If the drop tank fuel quantity gage pointer is near the full line so that it cannot be determined if the drop tank is full by weight or full by volume, turn the master refuel control switch to ON and the drop tank refuel secondary valve switch to valve OPEN position. If the corresponding refuel secondary valve light does not go out, depress the corresponding fuel quantity gage push-to-test button. This rotates the gage pointer counterclockwise. If the refuel secondary valve light goes out as the gage pointer approaches a less than full condition, the tank is full by weight and fuel can be transferred from the drop tank through the refuel system. If the valve light does not go out, the tank is full by volume. It may then be possible, by placing the aircraft in a normal climb attitude, to shift the drop tank fuel sufficiently to release the refuel secondary valve float control switch allowing the refuel secondary valve to open, as evidenced by the light going out. In a remote circumstance, the drop tank may be full by weight and by volume. In this case, it would be necessary to place the aircraft in a normal climb attitude and depress the corresponding fuel quantity gage push-to-test button in an attempt to open the refuel secondary valve. If these measures do not cause the valve light to go out, fuel cannot be transferred through the refuel system. Drop tank fuel transfer through the refuel system may be accomplished per the following checklist.

EMERGENCY TRANSFER FROM DROP TANKS THROUGH REFUEL SYSTEM

NOTE

Engine bleed air must be available to pressurize the drop tank(s) for fuel transfer.

1. Turn Off Drop Tank Transfer Valve Switch (17 or 21) - OFF (CP)

   This closes drop tank transfer valve 17 or 21.

2. Pull Fuel Feed Valve Control Circuit Breaker (as applicable; left drop 17, or right drop 21) - Pulled (CP)

   On copilot's circuit breaker panel, pull fuel feed valve control circuit breaker for the malfunctioned tank.

3. Turn On Drop Tank Transfer Valve Switch (17 or 21) - ON (CP)

   Transfer valve 17 or 21 will remain closed and pressurization of the drop tank routes fuel into the refuel system.

4. Turn On Master Refuel Control Switch - ON (CP)

5. Close Refuel Valve Switch - CLOSED, light out (CP)

6. Open Refuel Secondary Valve Switch (33 or 41) - Valve OPEN (CP)

7. Open Refuel Secondary Valve Switches (as required) - Valve OPEN (CP)

   Open refuel secondary valves to tanks to which transfer is desired.

NOTE

If drop tank refuel secondary valve light does not go out, perform each of the following actions in their listed order until the light does go out: (a) depress the fuel quantity gage push-to-test button, (b) place aircraft in a normal climb attitude, (c) perform both (a) and (b) simultaneously. With light out, turn master refuel control switch to OFF to prevent valve from closing when push-to-test button is released, or aircraft attitude is returned to level flight. Copilot will monitor fuel transfer and upon completion of transfer will place all refuel secondary valve switches in valve CLOSED position. (If master refuel switch is in OFF position as outlined above, it must be turned ON to provide a power source for closing refuel secondary valves.)

WARNING

Monitor the fuel quantity gages for those tanks being replenished by the refuel system. A failure of a primary refuel valve would result in overfilling of the tanks since the secondary refuel valves will not close automatically if the master refuel control switch is in the OFF position.

8. Close Refuel Secondary Valve Switches - Valve CLOSED (CP)

   Upon completion of fuel transfer, close refuel secondary valves.

9. Turn Off Master Refuel Control Switch - OFF (CP)

FUEL MANAGEMENT WITH ONE DROP TANK INOPERATIVE PROCEDURES

If one drop tank fails to transfer fuel in the normal manner and transfer through the refuel system cannot be accomplished ("Emergency Transfer from Drop Tanks through Refuel System"), land as soon as possible. The fuel management procedure required to maintain an acceptable cg location will depend on when the failure is noted, the planned mission fuel sequence, and the amount of fuel required for flight to a suitable landing base. Table I (figure 3-14) shows the maximum quantity of main tank available fuel which may be used in the various fuel usage sequences and still maintain the aircraft cg within the 35% MAC aft limit. Table I assumes use of main tank fuel in lieu of the normal step which would first require use of drop tank fuel. Table II (figure 3-14) shows the center wing ballast fuel requirements to maintain cg within the aft limit with the various aircraft missile and drop tank configurations. The quantities shown may be adjusted as required to compensate for differences in loading from the assumed conditions noted on the table. Tables I and II are designed to be used with the normal fuel sequence (no missiles) and fuel sequences when carrying two AGM-28 missiles. When carrying a conventional external munitions load of less than 20,000 pounds, the applicable quantities of Tables I and II must be adjusted to compensate for the lighter load. Use the chart (figure 3-14) to determine the reduction in main tank usable fuel or the increase in center wing ballast fuel required. Refer to "Minimum Landing Gross Weight with Lateral Unbalance" in Part 9 of the Appendix to determine the minimum landing weight for the applicable unbalance condition. Following is the recommended fuel management procedure for use with one drop tank inoperable:

FUEL MANAGEMENT WITH ONE DROP TANK INOPERATIVE

WARNING

- If fuel from an inoperable drop tank cannot be transferred through the refuel system, land as soon as possible. Follow the procedure of step "2. b." below only if available fuel including applicable quantity in Table I (figure 3-14) is not sufficient to reach a suitable base and accomplish a safe landing.
- The applicable airspeed limitations should be adhered to during these operations.

NOTE

Before making the decision to jettison an inoperable drop tank, check that the drop tank refuel valve is CLOSED and momentarily turn the master refuel control switch to ON. If the valve light does not illuminate, tank jettison circuitry may not be complete and tank jettison may be impossible.

1. Use the Following Applicable Fuel Usage Sequence:

    a. Normal Fuel Sequence (No Missiles) through Step "6"

    b. Two Missile Fuel Sequence Without Missile Launch through Step "6"

    c. Two Missile Fuel Sequence With Missile Launch through Step "7"

FUEL MANAGEMENT WITH ONE DROP TANK INOPERATIVE (cont)

2. Continue with Step "a" or "b" as Required:

   a. Use Main Tank Fuel as Applicable

   Use this procedure only if main tank fuel as shown in Table I is adequate to reach a suitable base and accomplish a safe landing.

   NOTE

   If conventional external munitions are being carried and the loading is less than 20,000 pounds, the quantity of main tank usable fuel from Table I, column 4, must be reduced to maintain the aircraft cg within the aft structural limit. Use the chart (figure 3-14) to determine the quantity correction to be subtracted.

   b. Determine Center Wing Ballast Fuel Requirement from Table II

   Use this procedure if main tank fuel as shown in Table I is not adequate to reach a suitable base and accomplish a safe landing.

   NOTE

   If conventional external munitions are being carried and the loading is less than 20,000 pounds, the quantity of center wing ballast fuel from Table II, column 3, must be increased to maintain the aircraft cg within the aft structural limit. Use the chart (figure 3-14) to determine the quantity correction to be added.

   (1) If Center Wing Ballast Fuel Requirement is Greater than the Quantity in Center Wing, use:

      (a) From Operable Drop Tank to Center Wing until Center Wing is up to Ballast Requirement

      (b) From Operable Drop Tank to Mains 1, 2, 3, and 4 (down to 9600 pounds less than inoperable drop tank)

      (c) Mains 1, 2, 3, and 4

   (2) If Center Wing Ballast Fuel Requirement is Less than the Quantity in Center Wing, use:

      (a) Operable Drop Tank to Main 1 (or 4); Center Wing to Mains 2, 3, and 4 (or 1, 2, and 3)

      This step is used until the operable drop tank is down to 9600 pounds less than the inoperable drop tank or the center wing tank is down to the ballast requirement, whichever comes first.

FUEL MANAGEMENT WITH ONE DROP TANK INOPERATIVE (cont)

(b) Operable Drop Tank to Mains 1, 2, 3, and 4 (down to 9600 pounds less than inoperable drop tank)

Use if center wing tank first reaches the ballast requirement in step "(2) (a)"

OR

Center Wing to Mains 1, 2, 3, and 4 (down to ballast requirement)

Use if operable drop tank first reaches 9600 pounds less than inoperable drop tank in step "(2) (a)"

(c) Mains 1, 2, 3, and 4

(3) Jettison Inoperative Drop Tank

If the ballast fuel from the center wing tank or the operable drop tank is required to reach landing base, descend to 10,000 feet and depressurize. Send a man to unpressurized compartment to pull drop tank power circuit breaker for the operable drop tank. The power circuit breakers for the drop tanks are located in the J-54 right forward a-c power load box. Jettison inoperative drop tank, repressurize, and climb back to altitude. Transfer fuel from drop tank or center wing tank to the main tanks.

WARNING

Use extreme caution when removing cover from right forward a-c power load box and when pulling drop tank power circuit breaker. Serious fires and injury may result.

CAUTION

If AGM-28 missiles or conventional external munitions are retained, drop tank ballast fuel may be necessary to maintain cg within forward limits for landing. Check ballast requirements before making decision to jettison drop tank(s).

TABLE I

MAIN TANK USABLE FUEL — POUNDS				
OPERATING WEIGHT* CG % MAC	FUEL USAGE SEQUENCE			
	NORMAL (NO MISSILES)	TWO MISSILE WITHOUT LAUNCH	TWO MISSILES WITH LAUNCH	
			MISSILES DROPPED	MISSILES RETAINED
35	23,000	—	—	—
34	27,000	25,000	11,000	47,000
33	31,000	29,000	15,000	51,000
32	35,500	33,000	19,000	55,000
31	40,000	37,500	23,000	59,000
30	44,500	42,000	27,500	60,000
29	49,000	46,000	32,000	60,000
28	53,000	50,000	36,000	60,000
27	57,000	54,000	40,000	60,000
26	60,000	58,000	44,500	60,000
25	60,000	60,000	49,000	60,000
24	60,000	60,000	53,000	60,000

*Basic weight plus crew and oil

NOTE

- The quantities are based on the use of main tank fuel in lieu of the sequence step which first uses drop tank fuel.
- After use of the quantities (less than 60,000 pounds) shown, the aircraft cg will be at 35% MAC.
- The quantity of 60,000 pounds is the total of all main tank fuel. Tanks are empty after use of this quantity.
- Quantities shown may be increased by 10,000 pounds (to a maximum of 60,000 pounds) if chaff, ammo, and flares have been expended.

TABLE II

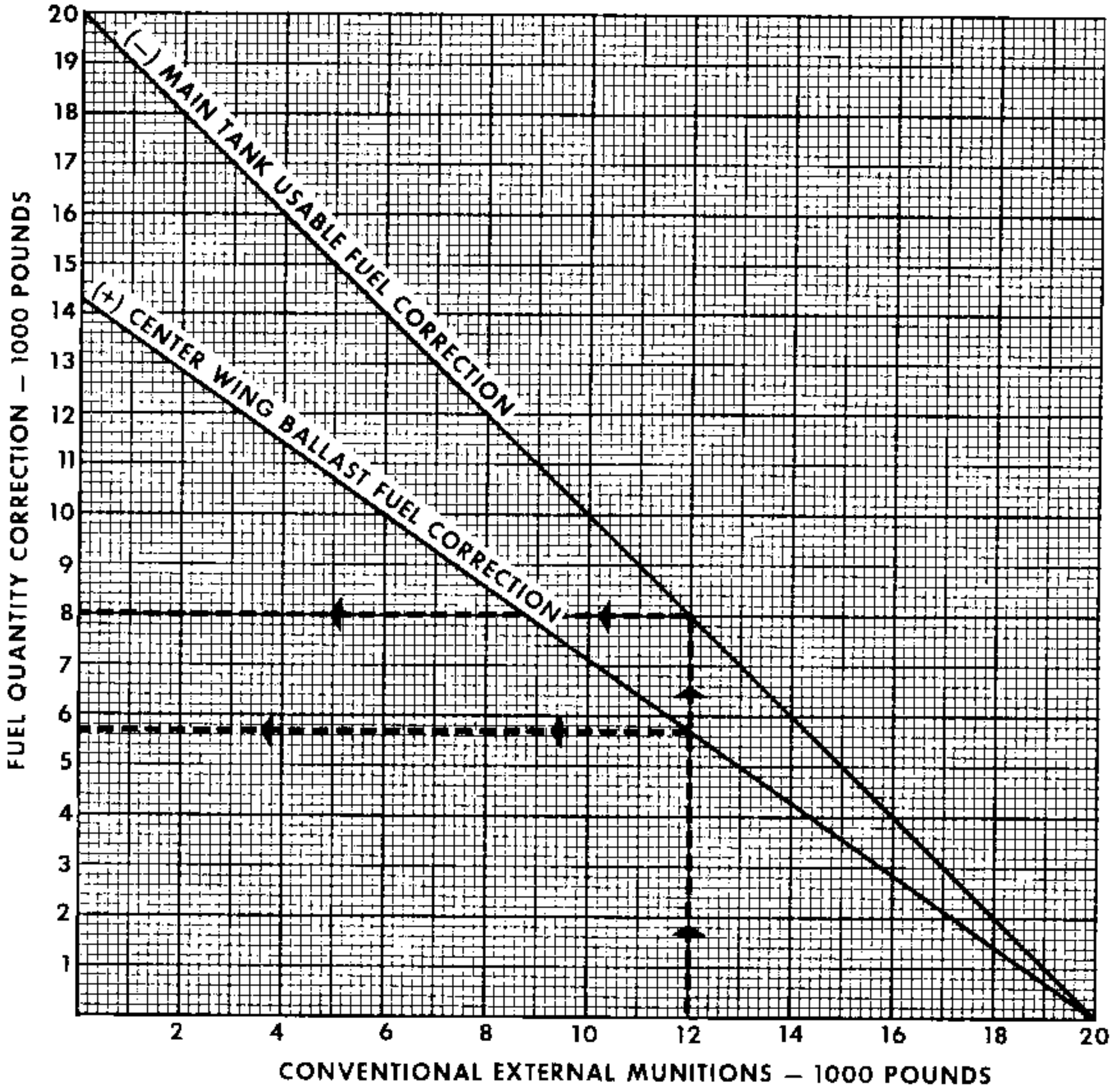
CENTER WING BALLAST — POUNDS				
OPERATING WEIGHT* CG % MAC	NORMAL FUEL SEQUENCE (NO MISSILES)		TWO MISSILE FUEL SEQUENCE (MISSILES RETAINED)	
	DROP TANKS RETAINED	INOPERABLE DROP TANK JETTISONED	DROP TANKS RETAINED	INOPERABLE DROP TANK JETTISONED
35	34,600	6,600	—	—
34	32,600	4,400	15,000	0
33	30,500	2,200	13,000	0
32	28,500	0	10,900	0
31	26,400	0	8,900	0
30	24,400	0	6,800	0
29	22,300	0	4,700	0
28	20,300	0	2,600	0
27	18,200	0	500	0
26	16,200	0	0	0
25	14,100	0	0	0
24	12,100	0	0	0

* Basic weight plus crew and oil.

NOTE

- The quantities shown for "Drop Tanks Retained" are based on a full inoperable tank and 9600 pounds in the operable tank.
- The quantities shown for "Inoperable Drop Tank Jettisoned" assume that the operable tank fuel is used.
- The quantities may be reduced by 4500 pounds if chaff, ammo, and flares are expended.
- If missiles are launched, use normal fuel sequence (no missiles) ballast requirements.

Figure 3-14. (Sheet 1 of 2).



EXAMPLE SHOWN: 12,000 POUND CONVENTIONAL EXTERNAL MUNITION LOAD.

- FOR USE WITH EXTERNAL MUNITIONS LOADS OF LESS THAN 20,000 POUNDS.
- SUBTRACT MAIN TANK USABLE FUEL CORRECTION FROM QUANTITY SHOWN IN TABLE I, COLUMN 4.
- ADD CENTER WING BALLAST CORRECTION TO QUANTITY SHOWN IN TABLE II, COLUMN 3.

FUEL COMPUTATIONS — DROP TANK INOPERATIVE

Figure 3-14. (Sheet 2 of 2).

JETTISONING OF DROP TANKS

Conditions for Jettison

The dropping of full external fuel tanks should not be considered unless one of the following emergency conditions exist:

1. Climb performance is marginal due to aircraft or engine malfunctions or a condition exists where an increased rate of climb is required. (Rate of climb can be increased approximately 300 feet per minute if full 3000-gallon drop tanks are jettisoned.)
2. Crash landing is imminent.
3. Fuel system malfunctions make maintenance of the cg forward of 35% MAC impossible.
4. Range is critical and can be improved by the elimination of unusable fuel weight and drop tank drag. A range increase up to 500 nautical air miles can be obtained by jettisoning one full 3000-gallon drop tank versus carrying it when it will not feed.
5. If fuel cannot be transferred from the drop tanks or is unusable and an emergency landing is required on a runway less than 200 feet in width, the pilot after proper considerations may jettison the drop tanks to insure safe recovery or prevent aircraft damage.

DROP TANK JETTISON

After the decision to jettison full drop tanks has been made, the following criteria should be considered:

1. Maintain Reasonable Altitude

   The possibility exists that only one tank may jettison in which case altitude might be lost during retrimming.

2. Aircraft Weight is not a Factor

   From a control as well as a range standpoint, it is more advantageous to jettison tanks at a high gross weight.

3. Shift Aircraft CG Aft

   Avoid exceeding forward cg limit after tank drop if time permits (figure 5-13).

4. Maintain 1 "g" Flight

   If possible, drop the tanks in 1 "g" flight, especially when the maximum allowable "tanks off" gross weight of 370,000 pounds will be exceeded.

5. Move Stabilizer Trim 2° to 3° Noseup

   Trim noseup prior to tank drop so that the elevator trim changes can be handled with reasonable stick forces.

6. Airspeed - Established

   a. Flaps Down - Maintain 180 knots IAS

   b. Flaps Up - Maintain 250 knots IAS (or Mach .75, whichever is less)

      At airspeeds higher than indicated in steps "6.a." and "6.b.," control forces become greater and the larger response of the wing to the sudden loss of the tanks is undesirable.

7. Jettison Tanks

WARNING

Do not jettison drop tanks above 300 knots IAS or below 150 knots IAS.

FUEL SYSTEM EMERGENCY OPERATION

NOTE

With electrical system normal and with minimum fuel aboard (any main tank below 5000 pounds), the necessary crossfeed valves should be opened to insure a continued supply of fuel to the affected engines. If the fuel level drops to the minimum value in both tanks in either wing, valves 10 and 11 will be opened. See Section V for flutter limits for other than normal fuel sequences.

MAIN TANK FUEL LEAK

Upon detecting evidence of a main tank fuel leak (visual evidence reported by gunner, excessive consumption, or inability to maintain 92% of tank spill-over-full during transfer), the following procedure should be used:

1. Stop all fuel transfer.
2. Open crossfeed valve on affected wing (9 or 12).
3. Close main tank feed valve from affected tank (13, 14, 15, or 16). Observe tank gage for lowering fuel quantity.
    a. If gage indicates continued lowering of fuel, a leak exists in the tank and emergency emptying procedures should be continued.
    b. If the gage for that particular tank holds steady after completing the above procedure but increased fuel consumption is indicated for the tank now feeding the crossfeed manifold, the following procedure must be taken because of a fuel line leak.
4. If an outboard pod is affected, open the pneumatic air bleed wing manifold interconnect; if an inboard pod is affected, open the pneumatic air bleed body interconnect.
5. Close applicable crossfeed valve (9 or 12) to starve the engines in the affected pod.
6. When engines flame out, close throttles and pull firewall fuel shutoff switches.

CAUTION

- Do not attempt a restart of either engine unless a critical need for power exists.
- Do not attempt cooling of the fuel control unit as specified in the "Emergency Shutdown Checklist," this section.

7. Follow six-engine flight procedures.

NOTE

- Fuel which cannot be transferred because of a leaking fuel line will be trapped in a main tank and, in order to maintain cg and lateral balance, this fuel must be taken into consideration for subsequent routing of fuel.
- For a further discussion of fuel tank leaks, refer to "Structural Damage," this section.

EMERGENCY EMPTYING OF A MAIN TANK

Severe fuel leaks or combat damage could make it necessary to empty a main tank to prevent loss of fuel. In this event, the following procedure should be used:

1. Shut off replenishing fuel to main tank affected.
    a. If main 2 or 3, close valve 48 or 49.

NOTE

The master refuel control switch must be OFF to permit manual closing of valve 48 or 49.

b. If main 1 or 4, close corresponding auxiliary tank valve switch and valve switch 26 or 28.

NOTE

If transfer from auxiliary tanks is needed, close valve 47 or 50. (See "Fuel Transfer Bypassing Outboard Main Tanks Checklist, this section.)

2. Route fuel from the affected main tank through the cross feed and refuel manifolds to body tanks as required for cg control. See figure 3-15, "Emergency Emptying of a Main Tank."
    a. If main 2 or 3 affected, check main tank valve switch ON, open adjacent crossfeed valve 10 or 11 and follow steps "d" thru "f."
    b. If main 1 affected, check main tank valve switch 13 ON, open crossfeed valves 9 and 10, pull main tank valve 14 circuit breaker, turn main tank valve switch 14 to CLOSED position, then follow steps "d" thru "f."
    c. If main 4 affected, check main tank valve switch 16 ON, open crossfeed valves 11 and 12, pull main tank valve 15 circuit breaker, turn main tank valve switch 15 to CLOSED position, then follow steps "d" thru "f."
    d. Place master refuel switch to ON.
    e. Place valve 46 switch to OPEN.
    f. Place refuel valve switch(es) for body tank(s) to OPEN.

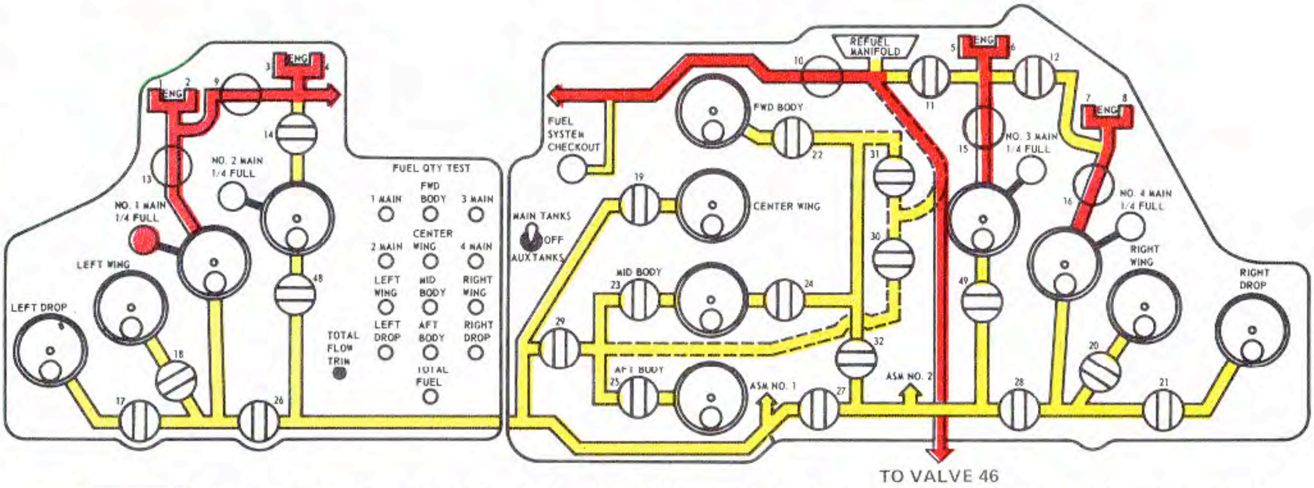
NOTE

In order to provide a minimum change in aircraft cg as a result of this fuel transfer, the following is recommended:

- Transfer main tank 1 or 4 fuel to the mid body tank.
- Transfer main tank 2 or 3 fuel to the center wing tank.

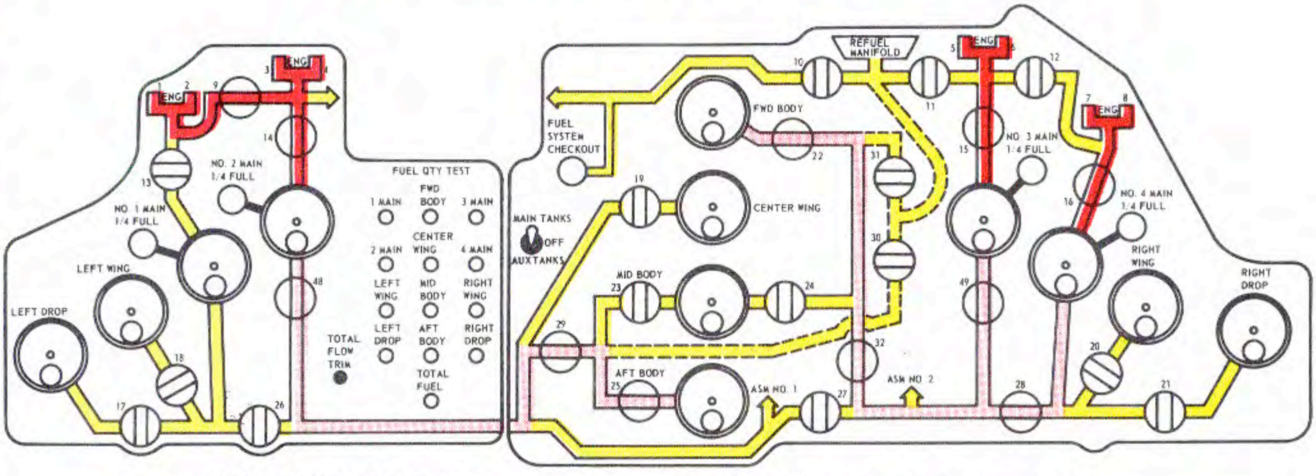
WARNING

Do not close main tank valves 13, 14, 15, and 16 except as necessary. Pull the fuel feed valve control circuit breaker for the affected tank and then close the main tank valve switch. (This will turn off the boost pumps in the desired tank with the valve failed in the open position.) When restarting boost pumps, open the main tank valve switch, then reset the fuel feed valve circuit breaker.

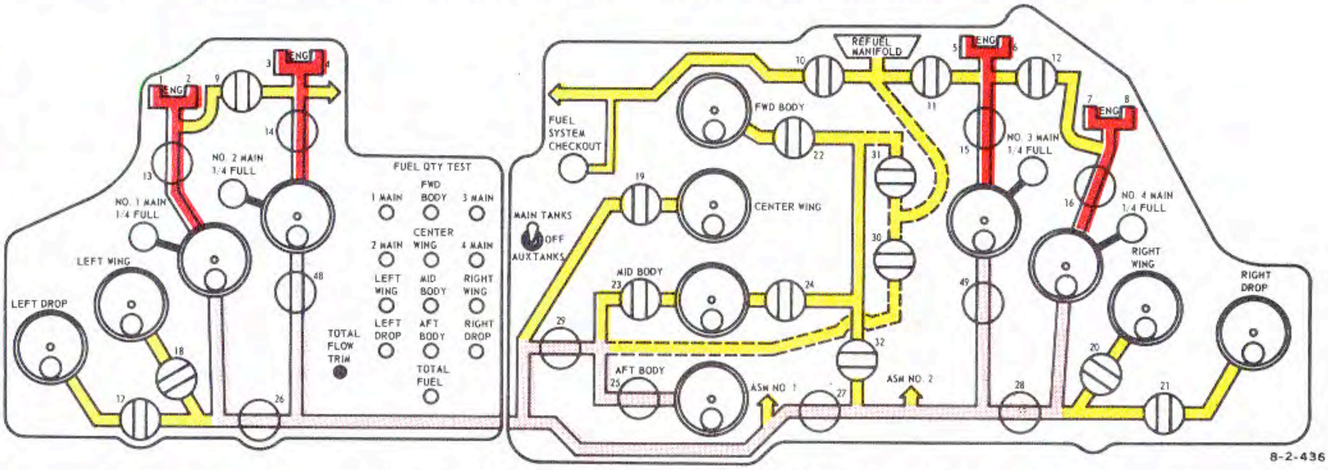


WARNING Do not close main tank valves 13, 14, 15, and 16 except as necessary. Pull the fuel feed valve control circuit breaker for the affected tank and then close the main tank valve switch. (This will turn off the boost pumps in the desired tank with the valve failed in the open position.) When restarting boost pumps, open the main tank valve switch, then reset the fuel feed valve circuit breaker.

EMERGENCY EMPTYING OF A MAIN TANK — Main Number 1

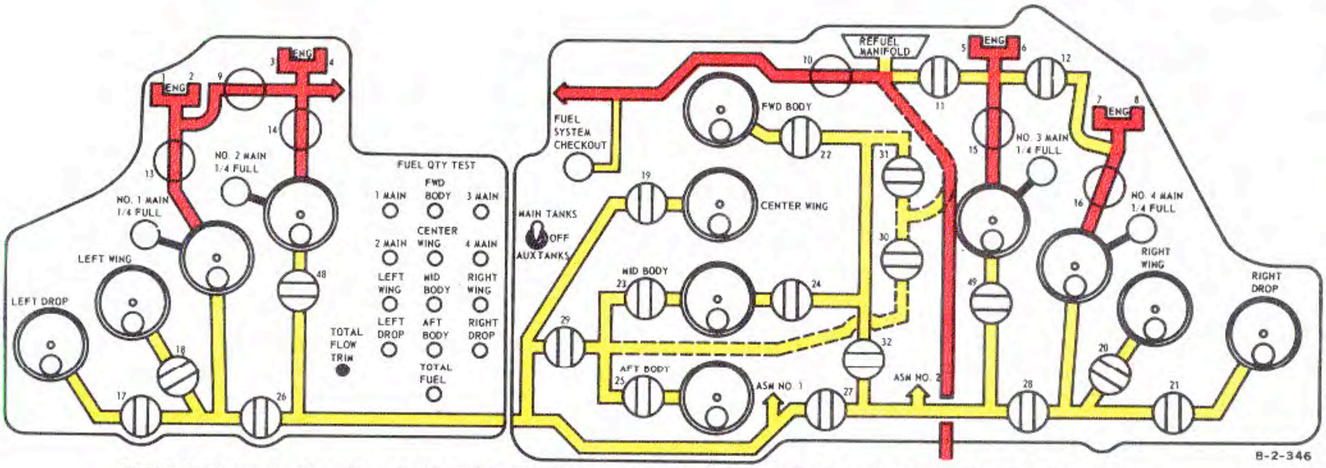


MAIN TANK VALVE OR COMPLETE BOOST PUMP FAILURE — Main Number 1

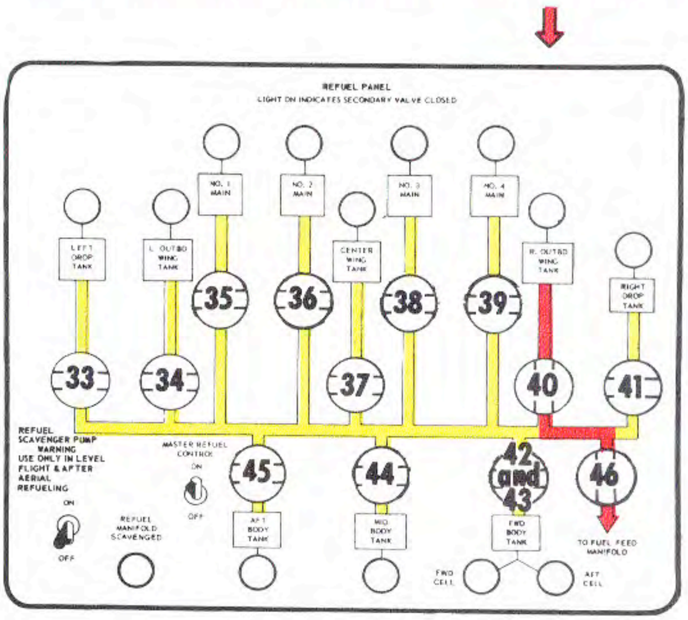


EMERGENCY EMPTYING OF AN AUXILIARY—Aft Body

Figure 3-15.(Sheet 1 of 2).



EMERGENCY FUEL TRANSFER FOR WEIGHT REDISTRIBUTION—To Right Outboard Wing Tank

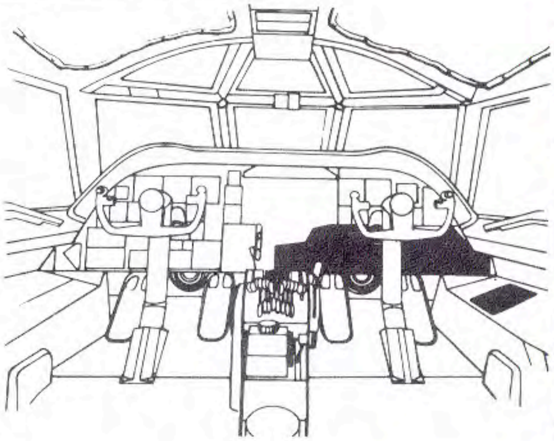


🟥 PRIMARY FLOW

▨ SECONDARY FLOW

🟨 STATIC

● LIGHT ON



FUEL SYSTEM EMERGENCY OPERATION

Figure 3-15 (Sheet 2 of 2).

CAUTION

Fuel shall not be transferred directly between main tanks except through valve 46 and the refuel system. This is to prevent excessive surge pressures due to closure of transfer valve.

3. Provide standby source of fuel. When the affected main tank is depleted to 1/4 full and the tank fuel low warning light illuminates, place valve 46 to the CLOSED position. If main 2 or 3 is affected, the corresponding crossfeed valve 9 or 12 should be placed to OPEN. If main tank 1 or 4 is affected, reposition the applicable main tank valve switch 14 or 15 to OPEN and reset the applicable fuel feed valve circuit breaker to restart idle boost pumps. Close crossfeed valve 10 or 11 if open. When affected main tank becomes empty, turn the main tank feed valve to CLOSED. See "Main Tank Valve or Complete Boost Pump Failure," figure 3-15.
4. If a landing is required, see "Minimum Landing Gross Weight with Lateral Unbalance" in Part 9 of the Appendix.

EMERGENCY EMPTYING OF AN AUXILIARY TANK

An auxiliary tank may be emptied quickly by routing fuel to all main tanks simultaneously. An example of this procedure is shown in figure 3-15. The boost pumps of one auxiliary tank may not provide sufficient fuel to keep all main tanks full; however, when the auxiliary tank is empty and fuel is supplied from other auxiliary tanks, the main tank fuel can be easily maintained again at the maximum level.

MAIN TANK VALVE OR COMPLETE BOOST PUMP FAILURE

The main tank valves are normally open in flight and failure of the valve in this condition would not cause an emergency situation as fuel flow would not be interrupted. However, if a main tank valve is closed for some reason and fails to open, engines normally supplied by that tank can be supplied fuel from an adjacent tank by using the crossfeed manifold. Failure of a main tank valve in the closed position makes it impossible to use the fuel in the tank. An example of fuel routing recommended in the event of a main tank valve or complete boost pump failure is shown in figure 3-15.

NOTE

The engines may be operated at substantial power with the boost pumps inoperative. The engine-driven fuel pumps can supply sufficient fuel pressure to sustain power but fuel available will vary with altitude and temperature. See "Complete A-C Power Failure," this section.

EMERGENCY FUEL TRANSFER FOR WEIGHT REDISTRIBUTION

Emergency conditions may make it necessary to reroute fuel to correct aircraft cg location. Aircraft cg may be moved aft by transferring fuel to the rearward body tanks as discussed in "Landing with Stabilizer Trim Failure." Transfer of fuel to an outboard wing tank could be required when landing with one forward and one rear main gear on the same side of the aircraft retracted. An example of fuel routing for this emergency situation is illustrated in figure 3-15. The emergency fuel transfer rate from the main tanks to any auxiliary tank may be as low as 300 pounds per minute. This rate is applicable with one or more main tanks transferring and with three boost pumps operating in each tank. The emergencies requiring weight redistribution by transfer of fuel are discussed under "Landing Emergencies," this section.

FUEL TRANSFER BYPASSING OUTBOARD MAIN TANKS

NOTE

If battle damage or a known leak occurs in main tanks 1 or 4, the following procedure will be used to avoid transferring fuel from the dropor outboard wing tanks to the damaged main tanks.

1. Turn Fuel Level Valve Switches 48 & 49 Off - OFF (CP)

These are the secondary transfer valves on main tanks 2 and 3.

2. Pull Fuel Level Control Circuit Breakers - Pulled (CP)

Pull the fuel level control circuit breaker for the affected main tank depending on whether valve 47 or 50 is to be closed:
Valve 47 - RIGHT OUTBD CTR WG & 1
Valve 50 - LEFT DROP MID BDY & 4

FUEL TRANSFER BYPASSING OUTBOARD MAIN TANKS (Cont)

3. Route Fuel, as Desired, from any Body Tanks - Routed (CP)

   Route fuel from any body tank as desired to valve 46.

4. Turn Master Refuel Control Switch On - ON (CP)

5. Open Fuel Manifold Interconnect Valve Switch (46) - OPENED (CP)

6. Actuate Refuel Ground Checkout Switch - Actuated (CP)

   Actuate the refuel ground checkout switch for the main tank to be isolated. Hold for a minimum of 1 minute before proceeding to next step.

7. Pull Main Tanks Level Circuit Breaker - Pulled (CP)

   Pull the circuit breaker on the copilot's circuit breaker panel while actuating the checkout switch.

8. Reset Appropriate Circuit Breaker - Reset (CP)

   Depending on whether valve 47 or 50 was closed, reset the following circuit breaker:
   Valve 47 - RIGHT OUTBD CTR WG & 1
   Valve 50 - LEFT DROP MID BDY & 4

9. Route Fuel to any Tank, as Desired - Routed (CP)

   Route fuel to any tank desired through the refuel manifold.

NOTE

> When the main tanks level circuit breaker is pulled, the secondary transfer valves in the main tanks will not operate. Since the fuel transfer is to be accomplished through the refuel manifold, all tanks will have both primary and secondary fuel level control.

HYDRAULIC SYSTEM EMERGENCY OPERATION

HYDRAULIC SYSTEM FAILURE

If any hydraulic system fails to operate, the cause may be hydraulic fluid loss, electrical fault, an inadequate air supply to drive the turbine, or mechanical failure. All important and necessary hydraulically operated systems have an alternate source of hydraulic pressure available as described in "Hydraulic Power Supply Systems," Section I. Also see "Air Bleed System Emergency Operation," this section, for hydraulic pack failure due to an air bleed manifold leak.

FAILURE OF A UTILITY PACK TO SHUT DOWN

In the event that a utility pack fails to shut down after retraction of the main landing gear, provide adequate pack cooling by lowering a single main gear as follows:

1. Turn the faulty hydraulic pack switch to OFF & RESET.

2. Turn the alternate hydraulic pack switch to OFF & RESET.
3. Check that standby pump control circuit breakers are pulled.
4. Lower the opposite landing gear by using the faulty pack and emergency extend system and leave switch in EXTEND position.

CAUTION

To reduce the possibility of system damage, do not place switch to OFF or RETRACT position while the gear is in motion.

NOTE

Emergency switch must be left in EXTEND position to prevent the normal system from retracting the gear.

HYDRAULIC SYSTEM FAILURE

NOTE

Failure of a hydraulic system normally will be indicated by illumination of the respective hydraulic pack pressure low light on the hydraulic control panel. The hydraulic pack pressure low master light on the forward instrument panel will also illuminate.

1. Check Hydraulic Pressure - Checked (P)
   a. If Pressure Low - OFF & RESET (P)
   b. If Pressure Normal - Bleed down (standby pumps OFF) (P)

   If hydraulic pressure builds up rapidly, warning system has malfunctioned.

2. Check Hydraulic Pack & Standby Pump Circuit Breakers - Set (P)

   Hydraulic package control circuit breakers supply power to the hydraulic pack switches.

CAUTION

A restart may be attempted as outlined in the following steps. If no indication of proper pressure output is obtained within 20 seconds, the switch for that pack will immediately be moved to OFF & RESET. Additional starts will not be attempted unless a critical need for hydraulic power exists. In no case will the switch be left in ON for longer than 20 seconds if the pack is not producing pressure.

3. Turn Hydraulic Pack Switch On - ON (P)

   Packs 5 through 10 require selection of ST position momentarily, not to exceed 6 seconds, before placing in ON position.

4. Check Hydraulic Pressure & Light - Checked for buildup (P)
   a. If Hydraulic Pressure Stays Down, Turn Hydraulic Pack Switch Off - OFF & RESET (P)

5. Check Hydraulic System - Check for air bleed leak if hydraulic pack 5, 6, 7, or 8 fails (P-CP)

   See "Hydraulic Pack Failure Due to Air Bleed Manifold Leak" under "Air Bleed System Emergency Operation," this section.

HYDRAULIC SYSTEM FAILURE (cont)

6. Turn Standby Pump Switch On - ON (P)

Move the respective group standby pump switch to ON; the pressure will rise slowly (30 seconds approximately). To operate the standby pumps for systems 1, 2, 3, or 4 with the gear handle in the up position and the gear up and locked, pull the landing gear normal control circuit breaker for the respective standby pump.

CAUTION

After once using a standby pump, no more than one effort should be made to restart the pack since damage to the pack will result if fluid level is below pump inlet.

NOTE

The standby pumps are capable of operating continuously at pressures up to 3000 psi. Therefore, there is no time limit on operation of the standby pumps except when the landing gear is extended with the emergency switches and the switches are left in EXTEND. In this case, the system pressure is determined by the setting of the relief valve and the standby pump pressure switch control is bypassed, causing the standby pump to operate in an overload condition. See "Landing With Partial Gear" this section.

a. If Hydraulic Pressure Still Down, Pull Standby Pump Control Circuit Breaker - Pulled (P)

If the pressure is not increased by the standby pump, it is possible that a tubing break exists and the fluid is depleted. Check that the respective standby pump circuit breaker is pulled out.

CAUTION

Do not actuate the emergency switch for the affected gear if standby pressure for that gear does not build up. With a ruptured main hydraulic system, actuation of the emergency switch may deplete the alternate hydraulic system, seriously decreasing or eliminating crosswind crab, steering, braking, and air refueling capabilities. (This caution does not apply to the tip gear since the emergency operation is protected by a fuse. See "Landing With Partial Gear" checklist, this section, for extension of tip gear.)

b. If Hydraulic Pressure Rises, Turn Standby Pump Off - OFF (until needed for approach and landing) (P)

NOTE

Since the fluid level supply for the standby pump is below that which the main pump can use, the standby pump switches are normally left off until needed in order to utilize this protective feature of a reserve supply. If hydraulic failure occurs during flight, save this reserve supply for the approach and landing.

7. Turn Standby Pump Off - OFF (P)

NOTE

For malfunctions involving lateral control, see "Asymmetrical Airbrake Control," this section.

ELECTRICAL SYSTEM EMERGENCY OPERATION

NOTE

For a list of possible electrical system failures, probable causes, and the corrective action to be taken, see figure 3-16.

AC POWER SYSTEM FAILURE

The ac electrical power system has been designed to automatically clear system faults and shut down malfunctioning alternators. If an alternator fails to trip off automatically when an abnormal operating condition is indicated by the lights and instruments on the ac control panel, its bus tie breaker should be opened manually, the alternator circuit breaker should be opened manually, or the alternator should be turned off, depending on the situation. When an alternator circuit breaker is open, its bus load can receive power from the remaining alternators through the central bus tie if the respective bus tie circuit breakers are closed. The bus tie circuit breaker of the affected alternator will close automatically in most cases when the alternator circuit breaker opens. Alternators which are operating normally should not be shut down in flight except when air bleed is insufficient to operate all four drives. This low air bleed condition will be indicated by consistent illumination of the alternator overload lights on the pilots' instrument panel. Three alternators will supply the total aircraft load requirements; therefore, if air bleed supply is marginal and cannot be increased by increasing power, one alternator may be turned off.

NOTE

In the event of an alternator failure and/or alternator shutdown that would require reducing loads from the buses, a bus-by-bus listing of the ac loads is shown in figure 3-18 and in the emergency portion of the pilots' abbreviated checklist.

When an alternator fails while operating isolated, it will be necessary to close the bus tie breaker for the failed alternator if it does not close automatically.

CAUTION

Should it become necessary to operate any combination of alternators isolated and/or shut down, the bus tie circuit breaker for one good operating alternator must be closed. Under no circumstances should a bus tie circuit breaker be left open after alternator failure or alternator shutdown. Check alternator circuit breaker open on any alternator that has failed or has been shut down.

NOTE

If any alternator control circuit breaker on the copilot's circuit breaker panel pops and cannot be reset, hold the alternator switch in OFF position and push the control circuit breaker in. Check that all bus tie breakers are closed. If the alternator will not shut down, consideration should be given to landing at the nearest suitable base.

WARNING

- When the alternator system exhibits abnormal frequency, voltage, or load fluctuations, turn off alternator switch for the offending alternator and check that the bus tie breaker is closed. Do not attempt to use the alternator unless additional alternators fail. Should additional failures occur, attempt to restart one or more of the failed alternators and to operate them isolated (not paralleled).
- Closely monitor voltage and frequency on restart. Shut down the alternator manually if abnormal readings are observed.

NOTE

Consideration should be given to the termination of the flight if one alternator has become inoperative. The loss of two alternators will result in a shortage of power and the mission should be terminated as soon as practicable.

A minimum waiting period of 1 minute should be observed before attempting a restart. This period is necessary to permit the alternator drive to slow down enough for all relays to relax so that a normal start sequence may be accomplished. In restarting alternators above 10, 000 feet, engines on the same side as alternators being restarted should be retarded to IDLE and the body manifold interconnect valve should be kept closed. If below 10, 000 feet, the body manifold interconnect should be closed during restart but the engines should be retarded only to the point where the pneumatic manifold pressure gage indicates 25 psi to avoid possible air starvation of other pneumatic packs supplied by the air bleed system.

A-C Transformer Failure

If the forward or aft 28-volt ac transformer fails, there is no emergency spare and power cannot be regained to that equipment powered by the lost transformer. Failure of the forward 28-volt transformer will result in loss of forward cabin lighting except the pilots' essential flight instrument lights.

AUTOMATIC PARALLELING UNIT FAILURE

A defective automatic paralleling unit short circuiting to ground can cause the alternator to shut down and the alternator circuit breaker light to come on. Rotating the VOLTS-CYCLES (voltage and frequency) selector switch on the copilot's panel to monitor the operation of remaining serviceable alternators, connects the faulted component to serviceable alternators, in turn, causing them to trip. The resulting trip of all four alternators can result in the complete loss of all ac power on the aircraft. The following symptoms may be indications of a failed automatic paralleling unit:

1. No frequency on frequency meter and abnormally low voltage on the voltmeter with the central bus tie selected and alternators in parallel. The capability to adjust KWATT and KVAR load division between parallel alternators with the KVARS DIV (voltage rheostat) and the KWATTS DIV (frequency rheostat) adjustment knobs indicates the aircraft power is of normal frequency and voltage. If the above conditions exist, the incorrect frequency and voltmeter indication is a result of a defective automatic paralleling unit.
2. Tripping of the alternator as the VOLTS-CYCLES selector switch is rotated to each alternator position.
3. Failure of either the alternator circuit breaker or bus tie circuit breaker to close when the automatic paralleling switch is actuated with the synchronizing lights blinking slowly.
4. Smoke or acrid fumes being emitted from the automatic paralleling unit located on the aft side of the copilot's seat.

The VOLTS-CYCLES selector switch should be placed to a central bus tie position at all times except when specifically required to monitor the operation of a particular alternator. Should a short circuit occur while the VOLTS-CYCLES selector switch is in a central bus tie position, the tripping of alternators will not result. If a defective automatic paralleling unit is indicated, the electrical connector to the unit should be disconnected by removing the connector. The unit is mounted on the vertical BNS rack immediately aft of the copilot's seat 8 inches above the aft floor with the connector pointed down. Flight may be continued with the unit disconnected. If the failure resulted in isolated operation, do not attempt to manually parallel the alternators unless load requirements dictate. If all functioning alternators are operating isolated, close the bus tie circuit breaker for the alternator with the least load.

AUTOMATIC PARALLELING SYSTEM FAILURE

In the event automatic paralleling fails and electrical power is required to operate essential and critical systems of the aircraft, manual paralleling of alternators is permissible under certain conditions. For information on manual paralleling conditions and procedure, see "Alternator Manual Paralleling Procedure, " this section.

A-C CIRCUIT FAULTS

Current Limiters (Fuses)

One basic type of fuse is used in two sizes throughout the aircraft to provide main circuit protection. Six ratings are used: ratings 10A, 20A, and 30A come in the small size and ratings 40A, 50A, and 60A come in the large size. Each fuse has a red indicator element which discolors if the fuse has blown. These fuses will carry eight times the rated load for 1 second and three times the rated load for 10 seconds before they will blow. In this manner, short time electrical faults will burn themselves out (with the multiwire feeder system) without interruption of electrical power. The current limiters will blow for faults of longer duration. If possible, all electrical power including battery power should be shut off before changing fuses. All discolored fuses should be replaced with spare fuses from the rack on the inside of the load box cover. Care should be exercised to use fuses of the correct ratings. An attempt should be made to correct the cause of the electrical fault.

WARNING

Changing fuses located in power distribution boxes, load boxes, shields, and panels (excluding neon light indicating fuses on panels at crew stations) inflight is extremely dangerous and should not be attempted unless a serious emergency exists.

NOTE

- Fuses which are in series with a blown fuse should be replaced since several fuses in series may blow, yet only one element may discolor. A fuse which has been directly exposed to a fault condition but has not blown should also be replaced since exposure to a fault can alter the normal rating of a fuse.
- It is possible that fuses, even though of higher amperage rating, may be blown instead of circuit breakers within a circuit due to a high current surge.

Circuit Breakers

A circuit breaker which has opened because of an existing fault condition (short circuit or overload) should be reset only when absolutely necessary. Two resets can be attempted. If, however, the circuit breaker continues to open, one additional reset may be attempted after a 5-minute time interval. If this procedure fails to close the circuit, the fault will not clear by itself and unless the trouble can be located and corrected, the unit should be shut down.

NOTE

Checking for opened circuit breakers is necessary during the execution of most emergency checklists in this section; however, an item for specific circuit breakers appears on the checklists only where special emphasis or action is required.

COMPLETE A-C POWER FAILURE

NOTE

The most positive indication of complete a-c power loss (other than the a-c control panel indication) is the illumination of the essential flight instrument lights and battery not charging lights.

If all four alternators fail and the procedures outlined in figure 3-16 do not result in restarting any alternator, the only power source remaining will be the batteries. The units receiving battery power are also shown in figure 3-16. The battery system is designed to provide 4 hours of battery power to the loads connected to the emergency battery switch. This time is based on fully charged relatively new batteries. The procedures outlined under "Conservation of Battery Power Checklist" should be followed.

Fuel Management

After complete electrical failure occurs, the only fuel available for the engines will be that which remains in the main tanks. Fuel will still be available from the drop tanks if transfer from the drop tanks is being accomplished at the time of complete a-c power failure. The transfer of fuel will not be possible because the boost pumps are powered by alternating current and the engine-driven fuel pumps are capable of drawing fuel from the main tanks only. The fuel valves that serve the main tank system, valves 1 thru 9 and 12 thru 16, are the only ones which can be operated by battery power. The engine driven fuel pumps tend to cavitate without boost pump operation. This may cause some or all engines to flame out. A restart should be attempted since engine ignition will be available from battery power. See "Engine Flameout and Relight" and "Engine Air Starting," this section.

WARNING

When the fuel in the main tanks lowers to approximately one-fourth full, the boost pumps will become uncovered and cause air to be drawn into the fuel lines, resulting in fuel starvation. If the aircraft is maintained in a level attitude, this condition will occur at a somewhat lower fuel level. The fuel management procedure should be such that each main tank is supplying its own nacelle with crossfeed manifold valves in CLOSED position. Fuel quantity gages will be inoperative.

Instrument Operation

The only instruments operating after complete a-c electrical failure will be:

- Airspeed indicators and mach indicator
- Altimeters
- Pilot's and copilot's turn-and-slip indicators
- Vertical velocity indicators
- Magnetic standby compass
- Clock
- EGT Gages
- Tachometers

In addition, the essential flight (emergency) instrument lights for the pilot's flight instruments, emergency alarm system, and interphone power for all stations will be available. The EPR gages and fuel quantity gages will be inoperative.

INSTRUMENT LIGHTING FAILURE

Forward Cabin Lights Failure (except essential flight instrument and side panel lights)

The loss of forward cabin lighting will be from one of the following malfunctions:

- By shutdown of the right forward alternator if the respective bus tie circuit breaker is OPEN.
- Failure of the 28-volt a-c transformer or failure of the 28-volt a-c transformer circuit breaker located in the section 41 power distribution box.

Essential (Emergency) Flight Instrument Lights

The essential flight instrument lights are those lights that are normally operated on a-c power but, in case of a complete a-c power failure, these lights will be operated by 24-volt battery power.

NOTE

> If the essential flight instrument lights are not automatically restored after complete a-c power failure, place the emergency battery switch to the EMERG position. This switches the lights to aft battery power and lighting should be restored immediately.

Less

In case of partial a-c power failure, the essential flight instrument lights will not automatically operate on battery power. With forward TR power on the bus, the emergency flight instrument lights switch battery relay will remain energized. This relay must be deenergized before battery power can be applied to the essential flight instrument lights. To restore the lights, pull the "Pilot Sw Batt Fwd Bus" circuit breaker on the "TR Power" portion of the pilot's circuit breaker panel. This will also switch battery power to several switched battery loads.

NOTE

Less

> If partial ac power failure occurs, and the essential flight instrument lights are not restored after the "Pilot Sw Batt Fwd Bus" circuit breaker is pulled, place the emergency battery switch to EMERG position. This switches aft battery power to the lights.

Less

The loss of essential flight instrument lights will be from one of the following a-c malfunctions:

- By shutdown of the right aft alternator if the bus tie circuit breaker is OPEN.
- Failure of the "Phase A" circuit breaker on the ECM circuit breaker panel or failure of the Phase A ECM circuit breaker in the auxiliary section 41 power distribution box.

D-C POWER SYSTEM FAILURE

Transformer-Rectifier Unit Failure

The forward and aft TR buses are not interconnected. Four of the forward TR units and two of the aft TR units are sufficient to carry the respective TR bus loads. If a TR unit fails, proceed as follows:

1. Monitor the remaining TR units on the affected bus. The unit with the highest load should be selected and monitored closely.
2. If the loadmeter indicates a load over .8 for any TR unit, reduce TR load on the affected bus until all TR units indicate a load of .8 or less.

WARNING

> If two of the forward TR units fail, wing flaps should be extended as soon as a suitable landing field can be reached with the increased drag. Failure to monitor and adjust the TR loads may result in a progressive overload and failure of the remaining TR units on the affected bus. If TR failure continues after loads are reduced to essential equipment only, a system fault exists and loss of systems which are powered by the affected bus should be anticipated. Complete failure of the forward TR bus is a serious aircraft emergency.

Complete Failure of Forward TR Units

Complete failure of the forward TR bus will result in an emergency condition which will require conservation of battery power. The procedures outlined under "Conservation of Battery Power Checklist" should be followed. Inasmuch as there are no means to positively measure the amount of battery capacity remaining, it is essential that capacity be conserved to the maximum degree possible. Battery power should not be used for any equipment item unless use of that item is necessary to maintain flight. Systems which utilize TR power or are controlled by TR power will cease to function. As a result, even some systems which are a-c powered will be unusable. Among such systems which will be unusable are flaps, fuel boost pumps, fuel transfer pumps, electrical stabilizer trim, N-1 compass, and radar.

Complete Failure of Aft TR Units

WARNING

> Complete loss of the aft TR units will result in an emergency situation for the gunner because of lack of control of the aft air conditioning pack and cabin temperature control. The gunner will notify the pilot of the emergency and emergency inflight movement to the forward compartment will be initiated. (Cabin pressure will have to be released by means of the emergency cabin pressure release handle since there is no d-c control power available.)

ALTERNATOR RESTART AND REPARALLELING

1. Check Alternator Circuit Breaker Light On - On (CP)

   Alternator circuit breaker must be open (light on).

2. Check Alternator Bus Tie Breaker Light Out - Out (CP)

   Alternator bus tie breaker should be closed (light out).

3. Check Alternator Indicators - Checked (CP)

   Check voltage, frequency, and indicator lights for any unusual indications.

4. Close Body Manifold Interconnect Valve Switch - CLOSED (CP)

5. Retard Throttles for Engines on the Same Side as Alternator Being Restarted - Retarded (P)

   Retard throttles on same side as alternator being restarted to IDLE if above 10,000 feet; retard to point where pneumatic manifold pressure gage indicates 25 psi if below 10,000 feet. This reduces pneumatic pressure to the drive being started but avoids possible air starvation of other pneumatic packs supplied by the system.

6. Turn Alternator Switch On Momentarily - ON (CP)

7. Monitor Voltage & Frequency - Monitored (CP)

   During restart of an alternator, its voltage and frequency should be watched closely.

WARNING

If voltage cannot be held within limits, is fluctuating, or if frequency is out of limits, shut down the alternator and do not attempt a restart.

8. Reparallel Alternator - Reparalleled (CP)

   Use normal procedure to reparallel alternator.

9. Monitor Alternator Loads (kwatts and kvars) - Monitored (CP)

   Check the loads as the alternator is put on the line. If load is excessive, shut down alternator.

ALTERNATOR MANUAL PARALLELING PROCEDURE

This manual paralleling procedure may be used only under the following conditions:

- Automatic paralleling system inoperative and automatic paralleling unit disabled. (See procedures in "Automatic Paralleling Unit Failure," this section.)
- Two operable alternators; one on the central bus tie operating at greater than 25 KVARS or 45 KWATTS, the other properly functioning but operating isolated.
- Flight conditions prohibit further reduction of loads.

WARNING

Manual paralleling alternators to the central bus tie when not properly in phase can result in damage to the alternator system components and opening of current limiters in the a-c distribution system to the extent that critical systems and functions are lost. Improper manual paralleling can cause permanent electrical system failure that could affect safe aircraft operation.

1. Place the VOLTS-CYCLES (voltage and frequency) selector switch to the alternator on the central bus tie.
2. If the voltmeter and frequency meter are operating normally adjust the voltage of the alternator on the central bus tie to 205 volts with the appropriate KVARS DIV knob (voltage rheostat). Adjust the frequency to 400 cps with the KWATTS DIV knob (frequency rheostat). If the voltmeter and frequency meter are not operating normally (no frequency and abnormally low voltage), adjust to the middle (12 o'clock) of the KVARS DIV and KWATTS DIV knobs.

NOTE

It is essential that all loads be reduced to the absolute minimum necessary for safe flight when attempting to manually parallel.

3. Select the other operable alternator to be paralleled with the VOLTS-CYCLES selector switch. Assure that the alternator circuit breaker is closed (light is out) and the bus tie circuit breaker is open (light is on). The bus tie circuit breaker must be left open until the selected alternator is in proper synchronization with the central bus tie.
4. If the voltmeter is operating normally, adjust voltage of the selected alternator to the same value as the alternator on the central bus tie with the appropriate KVARS DIV knob. If the voltmeter reads abnormally low, adjust the voltage to the middle (12 o'clock) of the KVARS DIV knob.

NOTE

In some cases only one synchronizing light may be operable after an automatic paralleling unit failure. This is due to the defective unit tripping an inaccessible thermal circuit breaker. The procedures outlined below can be used with one or two synchronizing lights operable.

5. Observe the synchronizing light(s). Adjust the frequency for the selected alternator with the appropriate KWATTS DIV knob until the light(s) blink at a slow rate (two or less blinks per second). When the light(s) are out, the alternator is synchronized with the central bus tie.

CAUTION

When the synchronizing light(s) are on, the selected alternator is out of phase with the alternator on the central bus tie and severe damage can occur if the selected alternator bus tie circuit breaker is closed. The synchronizing light(s) will function only for the selected alternator and do not indicate electrical phasing for other alternators.

6. When the synchronizing light(s) are blinking slowly (two or less per second), manually close the selected alternator bus tie circuit breaker by momentarily actuating the switch to CLOSE. Do not hold the switch in the CLOSE position.

NOTE

If paralleling of the alternators cannot be accomplished, the a-c control panel should be set to a configuration that would supply power to the most essential and critical loads required for safe aircraft operation.

NOTE

The primary purpose of this chart is to maintain electrical power to the aircraft equipment while defining the characteristics of the electrical malfunction.

CAUTION

- Under no circumstances should the respective bus tie breaker be left open after failure and/or shutdown of an alternator.
- Manually paralleling alternators to the central bus tie when not properly in phase can result in damage to alternator system components and opening of current limiters in the AC distribution system to the extent that critical systems and functions are lost.
- Multiple malfunctions can occur which are combinations of items listed in "Indications of Trouble" column. Careful analysis of indications should be made prior to initiation of corrective action.

NOTE

- All forward cabin lights will go out when the right forward alternator and right aft alternator bus is not receiving power from the alternator or through the respective bus tie circuit breaker.
- Check air bleed manifold pressure gages for sufficient bleed air before taking action.

INDICATION OF TROUBLE	POSSIBLE CAUSE	ACTION TAKEN BY CREW
Bus tie circuit breaker light on	Abnormally high or fluctuating voltage	Check voltage and frequency and adjust by use of the voltage and frequency rheostats. If voltage and frequency can be adjusted within limits and are not fluctuating, continue to operate isolated. If voltage and frequency cannot be adjusted within limits or are fluctuating, shut down alternator and check the bus tie breaker closed.
Alternator circuit breaker light on	Alternator drive trip or protective circuit trip	Check bus tie breakers closed. If other three alternators are operating properly, shut down alternator and do not attempt a restart.
Alternator overload light(s) on	Bleed air insufficient or alternator drive faulty	Increase engine power. Check air bleed manifold pressure gage. If light does not go out, shut down alternator and check bus tie breaker closed.
Fluctuating KVAR's	Malfunctioning regulator or reactive load loop	Open alternator circuit breakers one at a time and check voltage. The voltage should not oscillate more than 4 volts total spread. If voltage is within limits, reparallel. If outside limits, shut down alternator and check bus tie breaker closed.
Fluctuating KW's (9 KW or more total spread)	Malfunctioning alternator drive	Open alternator circuit breakers one at a time and adjust frequency. If frequency can be adjusted within limits and is stable, reparallel. If outside limits or unstable, shut down alternator and check bus tie breaker closed.
Alternator failure light on	Low reactive current output due to underexcitation or low voltage	Adjust KVAR's by use of voltage rheostats. If alternator will not adjust within limits and turn the light out, open alternator circuit breakers one at a time and check voltage. Shut down malfunctioning alternator and check bus tie breaker closed.

ALTERNATOR EMERGENCY OPERATION

Figure 3-16. (Sheet 1 of 4).

INDICATION OF TROUBLE	POSSIBLE CAUSE	ACTION TAKEN BY CREW
Abnormally unbalanced KW and/or KVAR readings	Malfunctioning voltage regulator or drive control	Adjust KVAR'S by use of the voltage rheostats. Adjust KWATT's by use of the frequency rheostats. If load division cannot be adjusted within limits, open alternator circuit breakers one at a time to determine which alternator will not adjust within limits. Shut down malfunctioning alternator and check bus tie breaker closed.
Multiple bus tie circuit breaker lights on	Multiple malfunctions	Do not attempt to reparallel. If all four bus tie circuit breaker lights are on, close the bus tie circuit breaker for one operating alternator. Check voltage and frequency for each alternator. Be alert for additional malfunctions.
Alternator control circuit breaker pops	Control circuit fault	Reset circuit breaker. If circuit breaker will not reset, hold the alternator switch in OFF position and push in the control circuit breaker. Check bus tie breakers closed. If alternator will not shut down, consideration should be given to landing at the nearest suitable base.
Two alternator overload lights on for alternators on the same side	Bleed air insufficient	If a pneumatic leak is not suspected, open body manifold interconnect valve switch to supply additional bleed air.
Two or three alternator circuit breaker lights on **NOTE** Alternators will indicate little or no KWATT's and KVAR's when loads have been reduced.	Multiple malfunctions	1. Reduce unnecessary loads (e.g. BNS, FCS, and ECM) to avoid overload on remaining alternator(s). 2. Check all bus tie breakers closed. 3. Turn failed alternator switches on. Check voltage and frequency. 4. Place VOLTS-CYCLES selector switch to the central bus tie position. Open bus tie breaker of one failed alternator and quickly close alternator circuit breaker. This minimizes time that bus is not receiving power. Run alternator isolated. If alternator circuit breaker does not close or steady voltage and frequency are not maintained, shut down alternator and check bus tie breaker closed. 5. Repeat for other failed alternators until three or more alternators are operating. 6. Turn equipment on cautiously and monitor load meters.

ALTERNATOR EMERGENCY OPERATION

Figure 3-16. (Sheet 2 of 4).

1. D-C loads available with battery switch ON and emergency battery switch NORMAL

FORWARD BATTERY	AFT BATTERY
FORWARD SWITCHED BATTERY BUS	AFT SWITCHED BATTERY BUS
Alternator circuit breaker indicator lights	Alternator circuit breaker indicator lights
Forward alternators 54▶ 75 W1▶ W6	Forward alternators 76▶ W7▶
Aft alternators 76▶ W7▶	Aft alternators 54▶ 75 W1▶ W6
Alternator control: left and right aft; alternator switches, circuit breakers, turbine controls, and bus tie breakers	Alternator control: left and right forward: alternator switches, circuit breakers, turbine controls, and bus tie breakers
Altimeter vibrators 7V	Automatic paralleling
Anti-skid: left and right forward main landing gear	Anti-skid: left and right aft-main landing gear
Battery not charging lights	Bomb door forward and aft normal control valves and relays
Bus tie breaker indicator lights 76▶ W7▶	
Bomb door forward and aft alternate control valves	
Cartridge start, engine 2	Cartridge start, engine 8
Depressurization warning	
Engine fire detection	
Engine starter selector switch	
Engine starter valve, engines 1 & 2	Engine starter valve, engines 7 & 8
	External power trip
Firewall fuel shutoff valves 1, 2, 3, & 4	Firewall fuel shutoff valves 5, 6, 7 & 8
Fuel crossfeed valve No. 12	Fuel crossfeed valve No. 9
Fuel feed valves 13 & 15	Fuel feed valves 14 & 16
Fuel level control, main tanks	
Hydraulic pack control for packs 1, 4, 5, 6 & 10	Hydraulic pack control for packs 2, 3, 7, 8 & 9
IFF Mode 4 light 7V	
Ignition for engines 2, 4, 6 & 8	Ignition for engines 1, 3, 5 & 7
Landing gear normal control, left forward and right aft main	Landing gear normal control, right forward and left aft main
Landing gear safety switch relay No. 1	Landing gear safety switch relay No. 2
Tip gears normal control	Tip gears emergency control
MISSILE SYSTEM (AGM-28)	MISSILE SYSTEM (AGM-28)
Armament control No. 1	Armament control No. 2
Emergency shutoff No. 1	Emergency shutoff No. 2
Fuel control No. 1	Fuel control No. 2
Lock control "A"	Lock control "B"
Missile jettison "A"	Missile jettison "B"
Separation "A"	Separation "B"
Temperature control No. 1	Temperature control No. 2
FORWARD BATTERY BUS	AFT BATTERY BUS
Bomb jettison control	Right aft and left forward main landing gear emergency control
Entry lights	● IFC power
Left aft and right forward main landing gear emergency control	
EMERGENCY BUSES	EMERGENCY BUSES
Airbrake control	(No aft battery loads. Emergency instrument bus and emergency battery bus are energized by foward battery)
Emergency alarm system	
Fuselage fire warning system	
Interphone power	
Landing gear position indicators	
Pilot's emergency flight instrument lights	● With IFC power select switch in BAT position
Pilot's and copilot's turn-and-slip indicators	

BATTERY SYSTEM LOADS

Figure 3-16. (Sheet 3 of 4).

2. D-C loads available with battery switch ON and emergency battery switch EMERGENCY

FORWARD BATTERY	AFT BATTERY
FORWARD SWITCHED BATTERY BUS (Same loads as with emergency battery switch NORMAL)	AFT SWITCHED BATTERY BUS (Same loads as with emergency battery switch NORMAL)
FORWARD BATTERY BUS (Same loads as with emergency battery switch NORMAL)	AFT BATTERY BUSES (Same loads as with emergency battery switch NORMAL)
EMERGENCY BUSES (No forward battery loads. Emergency instrument bus and emergency battery bus are energized by aft battery)	EMERGENCY BUSES Air brake control Emergency alarm system Fuselage fire warning system Interphone power Landing gear position indicators Pilot's emergency flight instrument lights Pilot's and copilot's turn-and-slip indicators

3. D-C loads available with battery switch OFF and emergency battery switch NORMAL

FORWARD BATTERY	AFT BATTERY
FORWARD BATTERY BUS Airbrake control Aft emergency alarm lights Entry lights Forward battery voltmeter Fuselage fire warning Interphone	AFT BATTERY BUS Aft emergency alarm lights Aft battery voltmeter

BATTERY SYSTEM LOADS

ELECTRICAL SYSTEM EMERGENCY OPERATION

Figure 3-16. (Sheet 4 of 4).

D-C SYSTEMS/INDICATORS INOPERATIVE WITH LOSS OF FORWARD/AFT TR POWER

TR BUS NO. 1

- AIR CONDITIONING
  - Aft cabin pressure warning
- ANTI-ICE CONTROL
  - Surface control overheat warning and indicator
  - Nacelles 3 & 4
  - Nacelle shutdown valves 3 & 4
- ELECTRONICS
  - Autopilot
  - Beacon transponder SST-181X **B-52D**
  - ECM transmitter 3 (AN/ALT-6B)
  - IFF (AN/APX-25) **Less ZV** ; IFF (AN/APX-64) **ZV**
  - Monitoring Set (AN/AJM-14)
  - Radar warning 1 (AN/APS-54)
  - TACAN (AN/ARN-21)
  - UHF Command 2 (AN/ARC-34) **B-52C**
  - UHF Command AN/ARC-34 or AN/ARC-133(V) **B-52D**
  - ECM receiver (AN/ALR-20/ALR-20A) **B-52D**
- ELECTRICAL, MISCELLANEOUS
  - Forward battery charging
  - Faceplate defog
  - Flare ejectors
  - Left chaff dispenser
- ENGINE
  - Water injection nacelles 2 & 3
- FUEL
  - Level control
  - Main tank warning lights
  - Scavenge
  - Tank purge
  - Boost pump control
    - Left outboard tank pump 2
    - Tank 1 pumps 4 & 5
    - Tank 2 pumps 7 & 8
    - Tank 3 pumps 10 & 11
    - Tank 4 pumps 13 & 14
    - Forward body pumps 21 & 22
    - Mid body pumps 25 & 26
    - Aft body pump 28
    - Right outboard pump 16
    - Center wing pump 32

FUSE

TR BUS NO. 2

- AIR CONDITIONING
  - Forward cabin control
  - Free air temperature indication
  - Water separator bypass
- ANTI-ICE CONTROL
  - Nacelles 1 & 2
  - Nacelle shutdown valves 1 & 2
  - Wing
  - Q-spring
  - Windshield and window anti ice
- ELECTRONICS
  - Interphone call
  - Radar warning 2 (AN/APS-54)
  - ECM Receiver (AN/APR-9) **B-52C**
  - ECM Receiver (AN/APR-14) **B-52C**
  - ECM transmitters 1, 2, & 16
  - N-1 compass
  - BNS
  - Glide path
  - Doppler radar
- ELECTRICAL, MISCELLANEOUS
  - Aft battery charging
  - Indicator lights dimming contol
  - Right chaff dispenser
  - Strike camera
  - Windshield wiper
- ENGINE
  - Water injection indicator lights
  - Water injection nacelles 1 & 4
  - Starter valves, engines 3, 4, 5 & 6
- FUEL
  - Inflight refueling
  - Boost pump control
    - Left outboard pump 1
    - Tank 1 pump 3
    - Tank 2 pump 6
    - Tank 3 pump 9
    - Tank 4 pump 12
    - Forward body pumps 19 & 20
    - Mid body pumps 23 & 24
    - Aft body pump 27
    - Center wing pumps 29, 30 & 31
    - Right outboard pump 15

Figure 3-17. (Sheet 1 of 3).

D-C SYSTEMS/INDICATORS INOPERATIVE WITH LOSS OF FORWARD/AFT TR POWER (cont)

FUSE

TR BUS NO. 1

Feed valve control
  Forward body 22 & 51
  Mid body 24
  Aft body 25
  Right drop 21
  Right outboard 20

Transfer valve control
  Left wing 26
  Body 27, 29, 32 & 46
  Right wing 28

LANDING GEAR
  Hydraulic standby pumps left forward, right forward

LIGHTS
  Essential (emergency) flight instrument **X**

SURFACE CONTROLS
  Aileron trim indicator
  Normal wing flap control
  Flap position indicator
  Yaw damper
  Hydraulic pressure warning lights
  Hydraulic pressure warning control
  Hydraulic standby pumps 5, 6 & 7

WEAPONS SYSTEMS
  Bomb door indicator lights
  Bomb door valve check
  Bomb door hydraulic pressure indicator
  Bomb door position indicator
  Normal bomb release
  Aft weapon IFI power
  Alternate weapon rack select
● Forward alternator weapon, IFC power (DCU-9A)
  Forward alternator weapon, IFM
  Forward alternator weapon, release heater power
  Forward parachute static line control
  External weapons arm and release
  External jettison
  Hi-density bomb release 3
  Emergency door open and release
  Fire detection, test, reset, power 1, AGM-28

TR BUS NO. 2

Feed valve control
  Left drop 17
  Left outboard 18
  Mid body 23
  Aft body 25a
  Center wing 19

Transfer valve control
  Left wing 10
  Body 30 & 31
  Right wing 11

Air pressure
  Left drop 17
  Right drop 21

Drop tank jettison

LANDING GEAR
  Crosswind crab indicator
  Landing gear and flap warning
  Centering
  Hydraulic standby pumps left aft and right aft

LIGHTS
  Ejection hatch warning
  Navigation
  Press to test
  Walkway light

SURFACE CONTROLS
  Emergency wing flap control
  Electrical aileron and stabilizer trim
  Hydraulic standby pumps 8, 9 & 10

WEAPONS SYTEMS
  Aft alternate weapon
    Bomb release heater
  ● IFC power (DCU-9A)
    IFM
  Aft parachute static line control
  Bomb door hold open
  Hi-density bomb releases 1 & 2
  Forward weapon, IFI power
  SWESS battery heater **Less A**
  Fire detection power 2, AGM-28
  Weapons sequence control

● With IFC power select switch in TR position

TR POWERED EQUIPMENT

Figure 3-17. (Sheet 2 of 3).

D-C SYSTEMS/INDICATORS INOPERATIVE WITH LOSS OF FORWARD/AFT TR POWER (cont)

AFT TR BUS

AFT CABIN AIR CONDITIONING – GUNNER
- Cabin
- Depress request light
- Pressure warning light
- Water separator bypass

ELECTRONICS
- Direction finder (AN/ARA-25)
- Radio navigation (AN/ARN-14)
- Radar beacon (AN/APN-69) **B-52D**
- Liaison radio (AN/ARC-65)
- Interphone call
- Fire control
- UHF command (AN/ARC-34) **B-52C**
- UHF command AN/ARC-34 or AN/ARC-133(V) **B-52D**
- ECM transmitters 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 & 15

ELECTRICAL, MISCELLANEOUS
- Flare ejector
- Chaff dispenser
- Faceplate defog – gunners

TR POWERED EQUIPMENT

Figure 3-17 (Sheet 3 of 3).

NOTE

The equipment shown in this chart is a bus-by-bus listing of the a-c operated equipment. This will give the crew an idea of a system or portion of a system that would be lost, if a bus was not receiving power.

LEFT AFT ALTERNATOR
- Cabin temperature and pressure, gunner's
- Chaff dispensers No. 1, 2, 3, and 4
- ECM systems No. 5 and 6
- Fire control system
- Fuel boost pump
  - Main wing tank No. 1, pump No. 5
- Fuel transfer pumps
  - Forward body tank pump No. 22
  - Mid body tank pumps No. 23 and 25
  - Aft body tank pump No. 28
- Hot cup, gunner's
- Hyd pack reservoir oil heaters No. 9 and 10
- Hydraulic standby pumps No. 3, 4, 9, and 10
- Liasion radio
- Lights, gunner's
  - Dome
  - Instrument
  - Panel
  - Signal light receptacle
  - Spot
- Q-spring scoop anti-ice
- Radar altimeter
- Radar beacon (APN-69) **B-52D**
- Stabilizer trim
- Stabilizer trim heat
- TR units, aft
- TR unit, forward No. 3
- Window defog, gunner's

Figure 3-18 (Sheet 1 of 2).

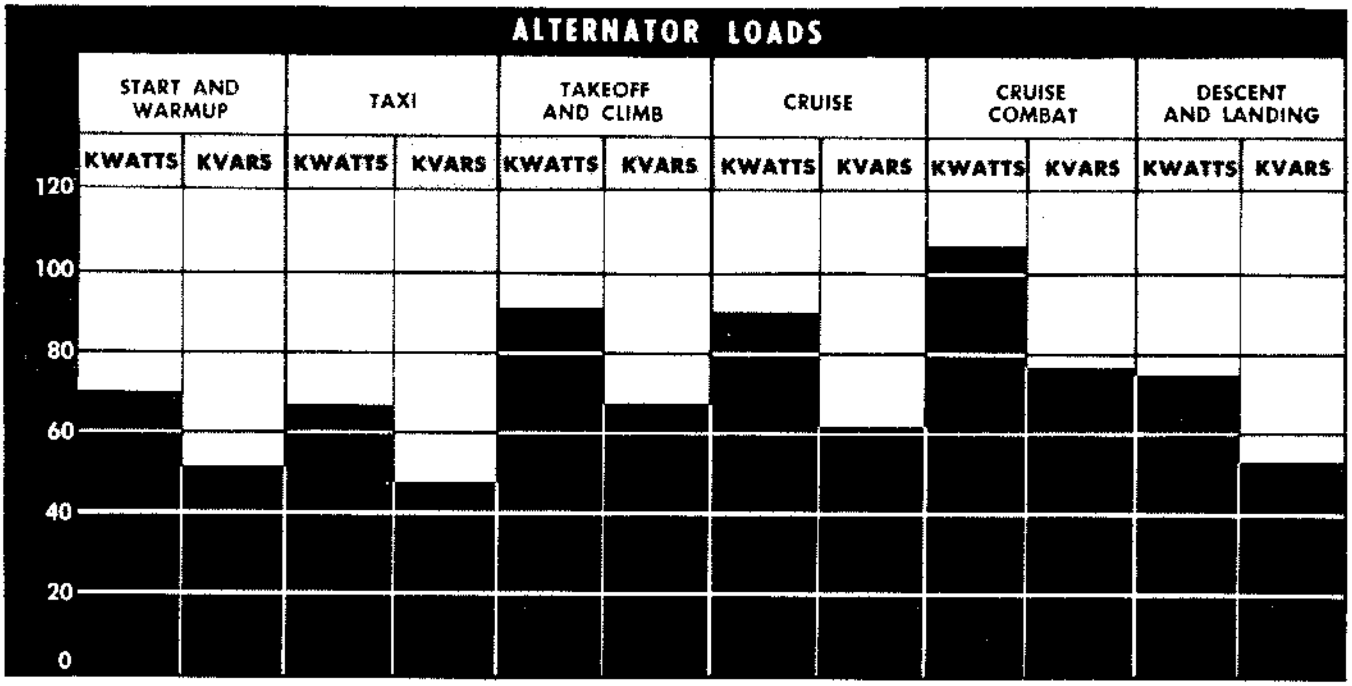
LEFT FORWARD ALTERNATOR
Chaff dispensers No. 5, 6, 7, and 8
Direction finder heater, ARA-25
ECM systems No. 7, 8, 9, 10, 11, 12, 13, 14, and 15
Fuel boost pumps
● Main wing tank No. 3, pump No. 11
● Main wing tank No. 4, pump No. 14
Fuel transfer pump
● Right outboard wing tank pump No. 16
Hydraulic pack reservoir oil heaters No. 7 and 8
Hydraulic standby pumps No. 7 and 8
Nacelles anti-ice No. 3 and 4
TR unit, forward No. 2
R wing anti-ice 54 ▶ 169 W1 ▶ W51

RIGHT FORWARD ALTERNATOR
Aileron trim
Air manifold bleed valves, wing and body
Airspeed computer
Alternator ground blowers, fwd
Armt provisions, AGM-28
Astrocompass
Automatic pilot
Bomb-nav system
BNS ground cooling
Cabin air conditioning, forward
Camera doors
Doppler radar, AN/APN-108
Doppler radar ground cooling
Drop tank release
Engine pressure ratio
Flap motor, left
Flight gyros, copilot's
Food warming oven
Fuel boost pumps
● Main wing tank No. 1, pump No. 3
● Main wing tank No. 2, pumps No. 6 and 8
● Main wing tank No. 3, pump 10
● Main wing tank No. 4, pump 13
Fuel flow indicators
Fuel transfer pumps
● Center wing tank pump No. 29
● Center wing tank pump No. 30
● Forward body tank pump No. 19
● Forward body tank pump No. 21
● R outbd wing tank pump No. 15
● L outbd wing tank pump No. 1
● Center wing tank pump No. 32 54 ▶ 88 W1 ▶ W11
Fuel quantity indicators
Fuel quantity totalizer
Fuel scavenge pump
Glide slope
Hydraulic pressure indicator
Hydraulic standby pumps No. 2, 5, and 6
Hydraulic pack reservoir oil heaters No. 1, 2, 5, and 6
Hot cups, fwd cabin
SIF/IFF
Lights, exterior
● Air refueling
● Crosswind landing
● Landing
● Navigation (wing)
● Taxi
● Terrain clearance
Lights, interior
● Aisle and ladder
● Thunderstorm
● Dome
● Flood
● Instrument, except pilot's flight and side panel
● Panel
● Periscopic sextant
● Scan receptacle
● Spot
● Table
● Work
● Walkway
Madrec, AN/AJM 14(V)
Manifold pressure indicator
N-1 compass
Nacelles anti-ice No. 1 and 2
Oil cooler flaps
Oil pressure indicator
Pitot heat (altitude computer) ZY
Pitot tube heater, pilot's
Radio nav indicator (radio nav receiver)
Section 49 pressure indicator, pilots
Seat position, P-CP-N-RN
TACAN
TR units, forward No. 1
Yaw damper
L wing anti-ice mod valve 54 ▶ 169 W1 ▶ W51
Anti-ice control 54 ▶ 169 W1 ▶ W51
IFC lighting transformer (fwd and aft)

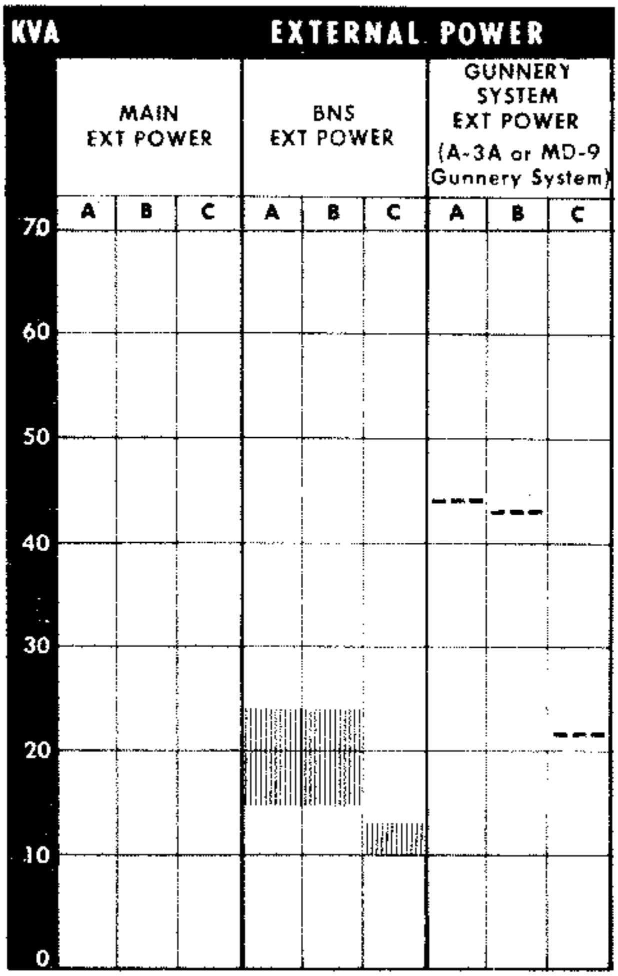
RIGHT AFT ALTERNATOR
AGM-28 battery heater
Alternator ground blowers, aft
Copilot's pitot tube heater
Countermeasures receivers, APR-9 and APR-14
AN/ALR-20/ALR-20A B-52D
AN/APR-25 B-52D
ECM systems No. 1, 2, 3, and 16
Flap motor, right
Flare ejector
Flight gyros, pilot
Fuel transfer pumps
● Aft body tank, pump No. 27
● Center wing tank, pump No. 31
● Forward body tank, pump No. 20
● L outbd wing tank, pump No. 2
● Mid body tank, pumps No. 24 and 26
Fuel boost pumps
● Main wing tank No. 1, pump No. 4
● Main wing tank No. 2, pump No. 7
● Main wing tank No. 3, pump No. 9
● Main wing tank No. 4, pump No. 12
Hydraulic pack reservoir oil heaters No. 3 and 4
Hydraulic standby pump No. 1
Lights, Anticollision
Lights, EWO panel
Lights, pilot's flight and side panel instrument
Radar warning receiver, AN/APS-54 B-52C
Seat position, EW
TR units, forward No. 4 and 5
Window anti-ice and defog, fwd cabin
Pitot tube heat (copilot)

A-C POWERED EQUIPMENT

Figure 3-18 (Sheet 2 of 2).



NOTE: THESE ARE THE MAXIMUM LOADS OF SIGNIFICANT DURATION LIKELY TO BE ENCOUNTERED



BASIC AIRCRAFT

▩ **HEAT AND ANTI-ICING**

---- **TURRET GROUND CHECK**

|||||||| **COLD WEATHER OPERATION**

COLUMN CODE

A **TOTAL POWER OF ALL UNITS USED DURING THIS PERIOD**

B **MAXIMUM POWER ATTAINED USING NORMAL PROCEDURES**

C **AVERAGE POWER FOR PERIOD**

NOTE: *THIS CHART ASSUMES SIMULTANEOUS USE OF ALL THREE EXTERNAL POWER CARTS. THE LOADS ON EXTERNAL POWER CHART ARE GIVEN IN KVA TO AID IN MAINTAINING THE LOADS WITHIN THE LOAD RATINGS OF THE EXTERNAL POWER CARTS.*

Figure 3-19 (Sheet 1 of 9).

A-C LOADS

EQUIPMENT	NO. OF UNITS	REQUIREMENTS PER UNIT								ALTERNATOR BUS			
		KWATTS			KVARS			TOTAL					
		ØA	ØB	ØC	ØA	ØB	ØC	KWATTS	KVARS	L. AFT	L. FWD	R. FWD	R. AFT
ARMAMENT													
Fire Control	1	2.71	2.71	2.71	2.04	2.04	2.04	8.14	6.13	X			
Momentary		6.70	6.70	6.70	4.88	4.88	4.88	20.01	14.65	X			
AIR CONDITIONING SYSTEM (FWD)													
Bleed and Shutoff Valves	4			0.03			0.02	0.03	0.02			X	
Modulation Valve	1	0.03	0.03	0.03	0.02	0.02	0.02	0.09	0.06			X	
AIR CONDITIONING SYSTEM (AFT)													
Bleed and Shutoff VAlves	4			0.03			0.02	0.03	0.02	X			
Modulation Valve	1	0.03	0.03	0.03	0.02	0.02	0.02	0.09	0.06	X			
ECM													
AN/APR-9 B-52C	1		0.42			0.20		0.42	0.20				X
AN/APR-14 B-52C	1		0.21			0.10		0.21	0.10				X
AN/ALR-20/ALR-20A B-52D	1		0.32	0.32		0.15	0.15	0.64	0.30				X
AN/ALT-15 or ALT-32, Sys 1	1	0.76	0.76	0.76	0.25	0.25	0.25	2.28	0.75				X
AN/ALT-6B or ALT-22, Sys 2	1		1.58			0.77		1.58	0.77				X
AN/ALT-6B or ALT-22, Sys 3	1			1.58			0.77	1.58	0.77				X
AN/ALT 13 or ALT-28, Sys 5 & 6	2	1.77	1.77	1.77	0.57	0.57	0.57	5.31	1.71	X			
AN/ALT 13 or ALT-28, Sys 7 & 8	2	1.77	1.77	1.77	0.57	0.57	0.57	5.31	1.71		X		
AN/ALT-13 or ALT-28, Sys 9 & 10	2	1.77	1.77	1.77	0.57	0.57	0.57	5.31	1.71		X		
AN/ALT-16, Sys 11	1	0.98	0.98	0.98	0.32	0.32	0.32	2.94	0.96		X		
AN/ALT-6B or ALT-22, Sys 12	1	0.98	0.98	0.98	0.32	0.32	0.32	2.94	0.96		X		
AN/ALT-15 or ALT-32, Sys 13 & 14	2	1.64	1.64	1.64	0.54	0.54	0.54	4.92	1.62		X		
AN/ALT-6B (AN/ALR-18) Sys 15	1	1.06	1.06	1.06	0.68	0.68	0.68	3.18	2.04		X		
AN/ALT-6B (AN/ALR-18) Sys 16	1	1.06	1.06	1.06	0.68	0.68	0.68	3.18	2.04				X
AN/ALE-27 (Chaff Dispensers No. 1, 2, 3, and 4)	4	0.09	0.09	0.09	0.20	0.20	0.20	0.27	0.60	X			
AN/ALE-27 (Chaff Dispensers No. 5, 6, 7, and 8)	4	0.09	0.09	0.09	0.20	0.20	0.20	0.27	0.60		X		
AN/APR-25 B-52D	1		1.44			0.70		1.44	0.70				X
Flare Ejector	1			0.23			0.11	0.23	0.11				X
ENGINE INSTRUMENTS													
Engine Pressure Ratio	8	0.7			0.6			0.7	0.6			X	
Fuel Flow Indicators	8			★								X	
Fuel Flow Totalizer	1			0.02				0.02	0.01			X	
Oil Pressure Indicator	8	★					0.01					X	
FLIGHT CONTROLS													
Aileron Trim	2			0.32				0.32	0.16			X	
Autopilot	1	0.51				0.27	0.16	0.51	0.27			X	
Flaps (L and R)	1	5.23	5.23	5.23	1.70	1.70		15.69	5.10			L	R
Stabilizer Trim	1	0.05	0.95	0.95	0.84	0.84	1.70	2.85	2.52	X			
Yaw Damper	1		0.14			0.07	0.84	0.14	0.07			X	

NOTE: Total alternator loads cannot be determined from the chart since the loads are single and three-phase loads. In the event an alternator becomes overloaded, the chart will help the crew to determine the loads to drop for completion of the mission.

★ Insignificant Load

ELECTRICAL LOADS CHART

Figure 3-19 (Sheet 2 of 9).

A-C LOADS

EQUIPMENT		NO. OF UNITS	REQUIREMENTS PER UNIT								ALTERNATOR BUS			
			KWATTS			KVARS			TOTAL					
			ØA	ØB	ØC	ØA	ØB	ØC	KWATTS	KVARS	L. AFT	L. FWD	R. FWD	R. AFT
FLIGHT INSTRUMENTS														
Flight Gyro (Pilot)		1	0.21	0.16	0.20	0.15	0.12	0.15	0.57	0.42				X
Flight Gyro (Copilot)		1	0.31	0.24	0.30	0.23	0.18	0.22	0.85	0.63			X	
N-1 Compass		1	0.48	0.23	0.32	0.34	0.29	0.65	1.03	1.28			X	
True Airspeed		1			0.81			0.39	0.81	0.39			X	
FUEL														
Fuel Boost Pumps (Main)		12	0.36	0.36	0.36	0.54	0.54	0.54	1.09	1.63				
Tank No.	Pump No.													
1	3												X	
1	4		EACH INDIVIDUAL BOOST PUMP HAS THREE-PHASE POWER AND LOAD REQUIREMENT											X
1	5										X			
2	6 & 8												X	
2	7													X
3	9													X
3	10												X	
3	11											X		
4	12													X
4	13												X	
4	14											X		
Fuel Transfer Pumps		17	0.18	0.18	0.18	0.21	0.21	0.21	0.55	0.64				
Tank	Pump No.													
Aft Body	27													X
Aft Body	28		EACH INDIVIDUAL TRANSFER PUMP HAS THREE-PHASE POWER AND LOAD REQUIREMENT								X			
Center Wing	29 & 30												X	
Center Wing	31													X
Center Wing	32 54▶ 88 W1▶ W11												X	
Forward Body	19 & 21												X	
Forward Body	20													X
Forward Body	22										X			
Left Outboard	1												X	
Left Outboard	2													X
Mid Body	23 & 25										X			
Mid Body	24 & 26													X
Right Outboard	15												X	
Right Outboard	16											X		
Fuel Flow			★										X	
Fuel Drop Tank Release				★									X	
Fuel Quantity Indicators		13			0.09			0.08	0.09	0.08			X	
Fuel Scavenge Pump		1			0.14			0.12	0.14	0.12			X	

★ Insignificant Loads

Figure 3-19 (Sheet 3 of 9).

A-C LOADS

EQUIPMENT	NO. OF UNITS	REQUIREMENTS PER UNIT								ALTERNATOR BUS			
		KWATTS			KVARS			TOTAL					
		ØA	ØB	ØC	ØA	ØB	ØC	KWATTS	KVARS	L. AFT	L. FWD	R. FWD	R. AFT
HEAT AND ANTI-ICE													
Anti-Ice (R Wing) 55 ▶ 170 W1 ▶ W51											X		
Anti-Ice (L Wing) 55 ▶ 170 W1 ▶ W51												X	
Anti-Ice Control 55 ▶ 170 W1 ▶ W51												X	
Anti-Ice (Nacelles No. 1 and 2)												X	
Anti-Ice (Nacelles No. 3 and 4)											X		
Airscoop Anti-Ice			1.49					1.49					X
Anti-Ice Mod Valves	8	0.03	0.03	0.03	0.03	0.03	0.03	0.09	0.09				X
Battery Heat (AGM-28)	1	0.26			0.12			0.26	0.12				X
Escape Hatch (Aft)	2			0.14			0.03	0.14	0.03				X
Escape Hatch (Fwd)	2			0.13			0.33	0.13	0.33				X
Forward Window Heat Control	5			0.02			0.01	0.02	0.01				X
Forward Window Heat													
No. 1	1			2.51			0.64	2.51	0.64				X
No. 2	2		2.74			0.68		2.74	0.68				X
No. 3	2	0.57			0.14			0.57	0.14				X
No. 4	2		1.35			0.33		1.35	0.33				X
No. 5	2		0.27			0.07		0.27	0.07				X
No. 7	1		0.23			0.06		0.23	0.06				X
Hydraulic Pack Heat													
No. 1, and 2	4	No. 1	No. 2 & 5	No. 6				0.25				X	
No. 3 and 4	2		No. 3	No. 4									X
No. 9 and 10	2	No. 10		No. 9						X			
Observer Heat	3	0.10						0.10					X
Pitot Heat	2	(CP) 0.29		(P) 0.29				0.58				P	CP
Pitot Heat (Altitude Computer)	2			0.29				0.58				X	
Q-Spring Scoop, Anti-Ice	1		0.27					0.27		X			
Stabilizer Trim Heat	2		0.20					0.40		X			
Tail Window Defog	1	1.0			0.29			1.0	0.29	X			

ELECTRICAL LOADS CHART

Figure 3-19 (Sheet 4 of 9).

A-C LOADS

EQUIPMENT	NO. OF UNITS	REQUIREMENTS PER UNIT								ALTERNATOR BUS			
		KWATTS			KVARS			TOTAL					
		ØA	ØB	ØC	ØA	ØB	ØC	KWATTS	KVARS	L. AFT	L. FWD	R. FWD	R. AFT
HYDRAULIC SYSTEM													
Pressure Gages	2		★									X	
Pumps	10	0.64	0.64	0.64	0.48	0.48	0.48	1.94	1.45				
No. 1													X
No. 2, 5, and 6		EACH INDIVIDUAL PUMP HAS THREE-PHASE										X	
No. 3, 4, 9, and 10		POWER AND LOAD REQUIREMENT								X			
No. 7 and 8											X		
LIGHTING (EXTERIOR)													
Air Refueling	3	★										X	
Anticollision	3	0.09						0.09					X
Crosswind Landing	1	0.70						0.70				X	
Landing	2	(LH) 0.70	(RH) 0.70					1.40				X	
Navigational (Wing) **B-52C**	4			0.17				0.17				X	
Taxi (Crosswind)	1			0.29				0.29				X	
Taxi (Wing)	2			0.17				0.17				X	
Terrain Clearance	1		0.66			0.18		0.66	0.18			X	
LIGHTING (INTERIOR)		3.87			1.89			3.87	1.89				
Cabin												X	
												X	
Aisle and Ladder		EACH INDIVIDUAL LIGHT HAS SINGLE-PHASE										X	
Dome		POWER AND LOAD REQUIREMENT (INCLUDES										X	
Flood		28-VOLT AC)										X	
Instrument (Except Pilots' Flight and Side Panel)												X	
Instrument (Essential Emergency, (Pilots)													X
Panel												X	
Panel (EWO)													X
Perisopic Sextant												X	
Scan Receptacle												X	

★ Insignificant Load

Figure 3-19 (Sheet 5 of 9).

A-C LOADS

EQUIPMENT	NO. OF UNITS	REQUIREMENTS PER UNIT								ALTERNATOR BUS			
		KWATTS			KVARS			TOTAL					
		ØA	ØB	ØC	ØA	ØB	ØC	KWATTS	KVARS	L. AFT	L. FWD	R. FWD	R. AFT
LIGHTING (INTERIOR) (Cont)													
Spot												X	
Table												X	
Thunderstorm												X	
Walkway												X	
Work												X	
Gunner's Lights													
Dome										X			
Instrument										X			
Panel										X			
Signal Light Receptacle										X			
Spot										X			
MISCELLANEOUS													
Air Manifold Bleed Valves, Wing and Body			*									X	
Alternator Ground Blowers	4	0.69	0.69	0.69	0.61	0.61	0.61	2.07	1.83			FWD	AFT
BNS Ground Blowers	2	0.52	0.47	0.47	0.33	0.29	0.29	1.47	0.91			X	
Food Warming Oven			0.59					0.59				X	
Hot Cup	2	0.68						0.68		AFT		FWD	
IFC Lighting Transformer (Fwd and Aft)	2	*										X	
Manifold Pressure Indicator		*										X	
Oil Cooler Flaps		0.17			0.15			0.17	0.15			X	
Seat Position (P-CP-N-RN)				*								X	
Seat Position (EW)				*									X
Section 49 Pressure Indicator (Pilots)				*								X	
MISSILE SYSTEMS													
AGM-28	2	1.01	1.01	1.01	0.37	0.37	0.37	3.04	1.11			X	

*Insignificant Load

ELECTRICAL LOADS CHART

Figure 3-19 (Sheet 6 of 9).

A-C LOADS

EQUIPMENT	NO. OF UNITS	REQUIREMENTS PER UNIT								ALTERNATOR BUS			
		KWATTS			KVARS			TOTAL					
		ØA	ØB	ØC	ØA	ØB	ØC	KWATTS	KVARS	L. AFT	L. FWD	R. FWD	R. AFT
PHOTOGRAPHIC													
Camera Door			0.13			0.11		0.13	0.11			X	
POWER (DC)													
TR Units (Aft)	3												
Expected Max		0.77	0.77	0.77	0.27	0.27	0.27	2.31	0.81	X			
With Full Load		1.0	1.0	1.0	0.33	0.33	0.33	3.0	0.99				
TR Units (Fwd)	5												
Expected Max		0.56	0.56	0.56	0.27	0.27	0.27	1.68	0.81	No. 3	No. 2	No. 1	No. 4 & 5
With Full Load		1.0	1.0	1.0	0.33	0.33	0.33	3.0	0.99				
RADIO													
Direction Finder Heater (AN/ARA-25)	1	0.25						0.25			X		
Glide Slope (AN/ARN-18)	1			0.13			0.06	0.13	0.06			X	
Liaison Radio (AN/ARC-65)	1			0.92			0.44	0.92	0.44	X			
Tacan (AN/ARN-21)	1		0.41			0.20		0.41	0.20			X	
RADAR													
Astrocompass	1	0.20	0.16	0.14	0.13	0.12	0.08	0.48	0.33			X	
BNS System (AN/ASB-15A)	1	3.08	3.58	3.49	1.91	2.22	2.16	10.15	6.29			X	
BNS Heaters (equipment)		2.49	2.94	2.02				7.58				X	
BNS Pressure Kit	1			0.35			0.38	0.35	0.38			X	
Doppler (AN/APN-108)	1	0.79	0.37	0.31	0.36	0.16	0.15	1.48	0.68			X	
Doppler Ground Cooling		0.47	0.47	0.47	0.29	0.29	0.29	1.41	0.87			X	
IFF (AN/APX-64) **ZV**			0.27			0.13		0.27	0.13			X	
SIF IFF (KY-95A/APX-25) **Less** **ZV**	1		0.27			0.13		0.27	0.13			X	
Monitoring Set (AN/AJM-14(V))	1			0.65				0.65				X	
Radar Altimeter (AN/APN-150)	1	0.76			0.38			0.76	0.38	X			
Rendezvous Radar (AN/APN-69) **B-52D**	1	0.60			0.28			0.60	0.28	X			
Radar Warning (AN/APS-54) No. 1 **B-52C**	1		0.72			0.35		0.72	0.35				X
Radar Warning (AN/APS-54) No. 2 **B-52C**	1			0.72			0.35	0.72	0.35				X

Figure 3-19 (Sheet 7 of 9).

FORWARD D-C LOADS

EQUIPMENT	NO. OF UNITS	AMPERES PER UNIT
AIR CONDITIONING		3.8
ARMAMENT AND BOMBING		
Battery Heater (SWESS) **Less A**	1	2.5
IFC (DCU-9A)		2.5
Weapon Door	1	5.7
Weapon Release		2.5
ECM		
AN/ALR-20/ALR-20A Receiver **B-52D**	1	4.5
AN/ALT-6B or ALT-22 (Systems 2 and 3)	2	13.6
AN/ALT-6B and AN/ALR-18 (System No. 16)	1	15.3
AN/ALT-15 (Lo) or ALT-32 (System No. 1)	1	1.1
AN/APR-9 Receiver **B-52C**	1	2.5
AN/APR-14 Receiver **B-52C**	1	2.5
ENGINE CONTROL		
Ignition	8	7.5
Start Relays	8	0.2
Start Valves	8	3.0
FLIGHT CONTROLS		
Airbrake Valves	4	2.2
Autopilot (Steady)		24.1
Autopilot (Turn)		46.5
Flap Brake	2	11.2
Yaw Damper	1	3.0
FLIGHT INSTRUMENTS		
Flight Gyro	2	1.0
N-1 Compass	1	1.0
Turn and Slip Indicator	2	0.2
FUEL		
Air Refueling Control		5.0
Fuel Relays	29	0.3
Fuel Valves (Momentary)	42	.02
Water Injection (Momentary)		12.5
HEAT AND ANTI-ICE		
Window Heat Relays	9	0.5

EQUIPMENT	NO. OF UNITS	AMPERES PER UNIT
LANDING GEAR		
Anti-Skid Valves	4	1.5
Safety Switch Relays	13	0.5
LIGHTING		
Dimming Control		1.0
Emergency Instruments		0.8
Navigation		2.0
Spot and Entrance	10	0.2
Walkway Dome Control	1	0.2
MISCELLANEOUS		
Astrocompass (MD-1)	1	2.4
Flare Ejector	1	3.0
Monitor Set (AJM-14)	1	2.5
Miniature Chaff	1	7.2
Standby Pump Control	10	0.2
Window Wiper		5.3
MISSILE SYSTEM		
AGM-28	2	2.9
PHOTOGRAPHIC		
Camera Control	1	10.0
POWER		
Battery Charge	2	1.0
(Momentary)		24.0
D-C Relays	10	0.2
RADAR		
BNS (AN/ASB-15A)	1	45.8
BNS Pressure Kit	1	2.0
Doppler (AN/APN-108A)	1	2.5
IFF (AN/APX-64) **ZV**	1	1.8
Rendexvous Radar (AN/APN-69)	1	1.0
SIF/IFF (AN/APX-25) **Less ZV**	1	1.8
RADIO		
AN/AIC-10A (Interphone)	13	0.3
AN/ARC-34 (Command Radio)	1	15.0
AN/ARN-18 (Receiver)	1	1.3
AN/ARN-21 (TACAN)	1	0.7

NOTE: The forward TR units are rated at 100 amperes each. A reading of 1.0 on the loadmeter corresponds to a load of 100 amperes on the respective TR unit.

ELECTRICAL LOADS CHART

Figure 3-19 (Sheet 8 of 9).

AFT D-C LOADS

EQUIPMENT	NO. OF UNITS	AMPERES PER UNIT
AIR CONDITIONING		
Cabin	1	2.0
Water Separator Bypass	1	1.8
ARMAMENT AND BOMBING		
Emergency Manual Bomb Release **A**	1	3.1
Fire Control System (MD-9)	1	40.3
(Momentary)		73.2
ECM		
AN/ALT-6B and AN/ALR-18 (System No. 15)	1	15.3
AN/ALT-13 or ALT-28 (Systems No. 5, 6, 7, 8, 9, and 10	6	1.8
AN/ALT-15 (Hi) or ALT-32 (Systems No. 13 and 14)	2	1.1
AN/ALT-16 (System No. 11)	1	
AN/ALT-6B or ALT-22 (System No. 12)	1	13.6
INSTRUMENTS		
Cabin Depressure Request	1	0.2
Cabin Pressure Warning	1	1.3
MISCELLANEOUS		
Flare Ejector	1	3.7
Miniature Chaff	8	0.5
RADAR		
Radar Altimeter (AN/APN-150)	1	2.5
Rendezvous Radar (AN/APN-69)	1	1.0
RADIO		
AN/ARA-25 (Direction Finder)	1	3.1
AN/ARC-34 (Command Radio)	1	20.0
AN/ARC-65 (Liaison Radio)	1	37.0
AN/ARC-65 (Antenna Decoupler)	1	8.0
AN/AIC-10A (Interphone)	1	0.2
AN/ARN-12 (Marker Beacon)	1	1.5
AN/ARN-14 (Omni-Range)	1	5.2
AN/ARN-32 (Marker Beacon)	1	0.6

NOTE: The aft TR units are rated at 100 amperes each. A reading of 1.0 on the loadmeter corresponds to a load of 100 amperes on the respective TR unit.

ELECTRICAL LOADS CHART

Figure 3-19 (Sheet 9 of 9).

CONSERVATION OF BATTERY POWER

NOTE

If the battery not charging lights come on or the autopilot or BNS systems fail during flight, check the forward TR bus for normal voltage on the TR units. If no voltage is indicated, proceed with the following steps:

1. Place Battery Switch OFF - OFF (CP)

   Turn battery switch to OFF to conserve as much battery power as possible for later use.

2. Emergency Battery Switch - As required (CP)

   a. Leave switch in NORMAL if conditions do not require power for emergency instrument lights and turn-and-slip indicator.

   b. Place switch to EMERG if conditions require power for emergency instrument lights and turn-and-slip indicator. Monitor battery voltage. If aft battery voltage decreases to 21 (±1/2) volts, place emergency battery switch to NORMAL. If power for emergency instrument lights and turn-and-slip indicator is still needed, place battery switch to ON.

3. Reduce Battery Loads - Reduced (P-CP)

CAUTION

It is essential that battery power be conserved to allow operation of airbrakes during final approach and antiskid after touchdown.

NOTE

The flaps will be inoperative. Therefore, if the flaps are up, a flaps up landing must be made. See "Wing Flaps Up Landing" checklist, this section.

   a. Do not use airbrakes for descent and approach.

   b. Do not use engine ignition for descent.

   c. Pull battery charge circuit breakers on copilot's circuit breaker panel.

   d. If flight instruments are not required, pull the "Direct Ind," "Rate of Turn," and "Radio Nav Ind" circuit breakers on pilot's circuit breaker panel.

   e. If emergency flight instrument lights are not required, pull circuit breaker on pilot's circuit breaker panel.

   f. Turn interphone power switch to OFF during any period when communications are not necessary.

NOTE

With loss of all alternators, there are no means to monitor the tail compartment pressure altitude from the forward compartment. With loss of the forward TR units, only the pilot's tail compartment altimeter is still operative. As dictated by the emergency situation, consideration should be given to moving the gunner forward prior to turning the interphone switch to OFF.

CONSERVATION OF BATTERY POWER (Cont)

g. If alternators are inoperative, pull all "Alternator Control" circuit breakers on the copilot's circuit breaker panel.

NOTE

> If battery switch is required to be ON for extended time periods, pull "Safety Switch Relay" circuit breakers numbers 1 and 2 on pilot's circuit breaker panel. This will eliminate load drawn by landing gear safety switch relays (and antiskid equipment if gear is down). Locked wheel protection and gear retraction capability will not be available. (Do not apply brakes before wheels start to rotate.) However, antiskid operation will be normal after touchdown.

4. When ready to lower landing gear, proceed as follows:

NOTE

> If fuel, gross weight, and other conditions permit, the landing gear should be lowered as soon as it is determined that TR power will not be available for the remainder of the flight. Landing gear extension may be delayed if a landing cannot be made immediately and fuel quantity is such that a suitable landing field could not be reached due to the increased drag. When battery voltage decreases below 21 volts, the battery is almost depleted and gear extension may not be possible.

   a. Place Battery Switch ON (CP)

   b. Place Landing Gear Lever to GEAR DOWN Until All Gear Indicate Down (P)

   c. Place Battery Switch OFF (CP)

   d. Pull "Pos Ind" Circuit Breaker (P)

5. If crossfeed valves are open:

   a. Place Switches to CLOSED (CP)

   b. Place Battery Switch ON for 15 Seconds, Then OFF (CP)

6. System configuration change:

   If hydraulic packs, alternators, or other systems on the switched battery bus require changes, proceed as follows:

   a. Place System Switches As Required (P-CP)

   b. Place Battery Switch ON Until Changes Are Accomplished (CP)

   c. Place Battery Switch OFF (CP)

7. Prior to Final Approach, Place Battery Switch ON to Provide Antiskid (CP)

8. Use Airbrakes As Required During Final Approach and After Touchdown (P)

AIR BLEED SYSTEM EMERGENCY OPERATION

ONE ENGINE INOPERATIVE

With any one engine inoperative in a nacelle on either side of the aircraft, systems that normally receive bleed air from this engine are supplied by the other engine in that nacelle.

TWO INBOARD ENGINES INOPERATIVE

With two inboard engines on the same nacelle inoperative on either side of the aircraft, systems that are normally supplied bleed air from these engines can best be supplied by opening the body manifold valve.

TWO OUTBOARD ENGINES INOPERATIVE

With two outboard engines in one nacelle inoperative on either side of the aircraft, systems that are normally supplied bleed air from these engines can be supplied by opening the wing manifold interconnect valve on the side of the failed engines. This is accomplished by placing the wing air bleed manifold interconnect switch on the failed side in OPEN position.

FOUR ENGINES INOPERATIVE ON ONE SIDE

With four engines on either side of the aircraft inoperative, systems that are normally supplied bleed air from these engines can be supplied by opening interconnect valves. This is accomplished by placing both the body manifold interconnect switch and the two wing manifold interconnect switches in OPEN position.

CAUTION

Do not open the body and wing manifold interconnect valves if an air bleed system leak is suspected.

AIR BLEED MANIFOLD LEAK

Past experience shows a pneumatic leak may cause many varied and seemingly unrelated symptoms. Therefore, with any abnormal or unusual instrument indications, unexplained system losses, or intermittent warning or failure lights, suspect a pneumatic duct failure.

WARNING

- Scorching or burning of electric wire bundles in the wing as the result of an air bleed leak can cause inadvertent loss of a drop tank, wing hydraulic pack failure, complete loss of hydraulic failure warning circuits for that wing, and similar malfunctions. If any of these symptoms are evidenced, an expeditious check of the air bleed system should be conducted.
- When an air bleed manifold leak is suspected or confirmed, the aircrew should consider all factors involved with the emergency and plan to land as soon as possible at the nearest suitable airbase. A failed pneumatic duct should be regarded as critical impending disaster and the pilot should not prolong the flight unnecessarily in the interest of reducing weight or establishing contact with his home base.
- Do not perform an air bleed manifold leak check when both engines in a nacelle have been shut down following engine fire warning light illumination.
- When an engine has been shut down due to fire warning light illumination yet no other indications of an engine fire are observed, the heat source which caused light illumination may be an air bleed manifold leak resulting in scorching or burning of electric wire bundles. When an air bleed manifold leak is suspected, an air bleed manifold leak check is recommended, since extensive aircraft damage may occur as a result of the operating engine in the nacelle feeding hot air to the failed air bleed manifold. To check for an air bleed manifold leak, the following procedure is recommended:

CAUTION

Do not open the body and wing manifold interconnect valves if an air bleed system leak is suspected or confirmed.

1. Retard throttles of the engines in the adjacent wing nacelle toward IDLE (e.g. No. 7 engine shutdown, retard throttles of engines 5 and 6) while observing appropriate body manifold pressure gage. If pressure gage drops steadily along with retardation of throttles, an air bleed leak definitely exists in the manifold supplied by the nacelle containing the shut down engine.
2. If pressure drop appears excessive (for the existing conditions) use shutdown procedure on operating engine in nacelle (assuming six-engine operation is feasible), and land as soon as possible. See "Emergency Shutdown" checklist, this section.

Air Conditioning Failure Due to Air Bleed Manifold Leak

If a bleed air manifold leak is suspected as the cause of loss or reduction of cabin air conditioning airflow, place the bleed air selector switch to the opposite position (ALTERNATE or NORMAL). If the opposite position does not result in restored cabin airflow, place the air conditioning master switch to RAM.

RAM position closes the air bleed body manifold interconnect valves when the body manifold interconnect valve switch is in the guarded CLOSED position, closes the air conditioning system shutoff valve, and opens the ram air valve. Ram air will then be available for electronic equipment cooling when use of that equipment is necessary to arrive at the nearest suitable air base and to effect a safe landing.

Hydraulic Pack Failure Due to Air Bleed Manifold Leak

NOTE

> If the loss of hydraulic failure warning circuits for a wing is suspected, confirmation of a wing hydraulic pack failure can be accomplished by having the gunner monitor movement of the spoiler segments with the spoiler standby pump switch OFF. No movement of a spoiler segment when the pilot actuates the airbrakes indicates failure of the respective pack.

A pneumatic leak of sufficient size in any one of the wing manifolds will cause failure of the corresponding hydraulic pack. When either 5, 6, 7, or 8 pack is lost, the following procedure is recommended:

1. Complete the "Hydraulic System Failure" checklist through item "5," and then continue as follows:
2. Check for slight loss in EPR on appropriate pod relative to other engines.
3. Move throttles of adjacent wing pod; i.e., 7 pack failed - engines 7 and 8 toward IDLE while observing appropriate body manifold pressure gage. If pressure gage drops steadily along with retardation of throttles, an air bleed leak definitely exists in the manifold of the failed hydraulic pack.
4. If pressure continues to drop, use shutdown procedure on both engines of affected pod (assuming six-engine operation is feasible).

CAUTION

> Do not open air bleed interconnect valves to affected manifold as this will cause additional loss of air bleed pressure.

5. Route fuel as desired.

NOTE

> Maintain the pneumatic system interconnect valves in the CLOSED position at all times during flight, unless extreme emergencies determine otherwise.

6. If no air bleed leak is evident, complete remainder of "Hydraulic System Failure" checklist.

Engine Instrument Failure Due to Air Bleed Manifold Leak

WARNING

> Intermittent or continuous operation of the engine fire warning lights or erratic operation and loss of engine instruments may be an indication of an air bleed system leak resulting in scorching or burning of electric wire bundles. Upon such an indication, shut down the engines in the affected pod. After engine shutdown, check that air bleed manifold valves to the affected pod are turned off to prevent bleed air from other engines entering the damaged duct.

CAUTION

> Do not open the body and wing manifold interconnect valves if an air bleed system leak is suspected.

Body Air Bleed Manifold Leak

WARNING

Scorching or burning of electric wire bundles in the fuselage may result in failure of one or more hydraulic systems (1, 2, 3, 4, 9, and 10), runaway stabilizer trim, loss of communications, loss of affected alternators, abnormal TR unit readings, many abnormal BNS indications and failures, landing gear abnormal indications when the throttles are retarded, and other associated failures.

A body air manifold duct failure is most likely to occur during or immediately after takeoff and/or during high power operations. If an air bleed manifold leak occurs in the bomb bay, as confirmed by visual inspection, or is suspected due to associated failures, accomplish the following:

1. While considering all factors involved with the emergency, if conditions permit, reduce power on the affected side to decrease the high temperature bleed airflow.

CAUTION

Reducing power could result in additional losses of hydraulic systems and alternators on the affected side.

2. Open bomb bay doors to cool the bomb bay areas.

WARNING

The urgency of this step is increased if the high pressure, high temperature bleed air is striking bomb bay munitions.

3. Leave bomb bay doors open for the remainder of the flight. Disregard bomb bay doors open time vs airspeed limitations.

CAUTION

Observe hydraulic pack limitations. If flight is continued in excess of 30 minutes, turn off hydraulic packs 1 thru 4. Bomb doors will remain partially open. Packs may be turned on periodically to reposition doors fully open.

4. Release conventional bomb bay munitions in accordance with flight manual and command directives.
5. If any munitions remain in the bomb bay and doors are operable, have RN close doors during final phase of landing approach.

ACCIDENTAL DRAG CHUTE DEPLOYMENT

The drag chute is designed to operate without failure at indicated airspeeds of 135 knots or less. If the chute is fully inflated at higher speeds, it will seriously weaken the risers and failure may result; also a shear pin may fail, thus releasing the chute. Such accidental deployment will exert only minor effect upon the aircraft handling characteristics but deployment at lower airspeeds would be critical in that it would induce considerable drag causing a pitchdown tendency with wing flaps up or a slight pitchup with the wing flaps extended. This pitching would be controllable but the sudden decrease in airspeed could result in a stall condition. It is necessary therefore to increase thrust and to jettison the drag chute immediately under these conditions. If the drag chute is jettisoned or deployed over 135 knots IAS, the pilot shall so note on Form 781.

WARNING

Jettison the drag chute at once if accidental deployment occurs after attaining S_1 speed during takeoff or any time accidental deployment occurs in the air at an airspeed too low for the shear pin to fail and release the chute. Move the drag chute lever directly from LOCKED to JETTISON position.

NOTE

Normal jettisoning of the drag chute is accomplished by the drag chute lever on the pilots' aisle stand. If this unit fails, the gunner may jettison the deployed drag chute by checking the gunner's drag chute control knob in the down position at pilot's command and jettisoning the turret.

NUCLEAR BOMB EMERGENCY PROCEDURES

Amplified checklists for nuclear bomb emergency procedures are published in T.O. 1B-52C-25-2. The abbreviated checklist for Emergency Manual Bomb Release is published in T.O.'s 1B-52C-1CL-2(N) and 1B-52C-1CL-3(RN). Safe Jettison Procedures, Armed Jettison Procedures, and DCU-9/A Malfunction Correction Procedures are published in T. O. 1B -52C-25-2CL-1.

CONVENTIONAL MUNITIONS EMERGENCY PROCEDURES

Amplified checklists for conventional emergency procedures are published in T. O. 1B-52C-34-2-1. The corresponding abbreviated checklists are published in T. O.'s 1B-52C-1CL-2(N) and 1B-52C-1CL-3(RN).

AGM-28 EMERGENCY OPERATION

Amplified checklists for AGM-28 Emergency Operation are published in T. O. 1B-52C-30-1 and T. O. 1B -52C-30-1A. The corresponding abbreviated checklists are published in T. O.'s 1B-52C-1CL-1(P); 1B -52C-1CL-2(N); and 1B-52C-1CL-3(RN).

section IV

AUXILIARY EQUIPMENT

TABLE OF CONTENTS

AIR CONDITIONING SYSTEMS

An air conditioning system (figure 4-2) for each compartment (2 and 3, figure 1-2) provides independent air conditioning and pressurizing. Air conditioning packs located outside each compartment condition air obtained from the air bleed system. This conditioned air is directed to cool electronic equipment and to heat, cool, ventilate, and pressurize the occupied compartments.

AIR CONDITIONING PACK

An air conditioning pack supplies each pressurized compartment with conditioned engine bleed air for heating and pressurizing. Alternate and normal sources of bleed air to the aft pack are controlled by two shutoff valves in the aft air conditioning system. Bleed air delivered to the forward air conditioning pack is controlled by a single shutoff valve which operates in conjunction with the body air bleed manifold interconnect valves. See "Air Bleed System," Section I, for further information about the body manifold interconnect valves. From the shutoff valve for each pack, bleed air flows through a filter, a flow limiter, two air-to-air heat exchangers and a cooling turbine. The turbine cools and reduces the pressure of the engine bleed air delivered from the heat exchangers. Protection against turbine and blower wheel fragmentation is incorporated in the air cycle machine. An electronic anti-icing controller receives signals from the temperature sensor and operates the anti-icing valve electrically to keep air discharged from the cooling turbine above freezing temperature. The cooled air flows from the turbine anti-icing system through a water separator or bypass, with a portion of the cooled air being diverted to cool electronic equipment. The remaining flow of cooled air is brought up to cabin heating temperature by mixing it with hot engine bleed air which bypasses the pack. This air flows into the cabin through the air outlets.

Water Separator

The centrifugal-type water separator removes part of the moisture precipitated by refrigeration of engine bleed air to minimize fogging and snow conditions in the cabin. The separator is installed with an automatically controlled bypass just downstream of the air cycle machine. Water collected is drained overboard. The water separator bypass valve is opened automatically at altitudes above 25,000 feet and opens at any other altitude as a fail-safe feature if a malfunction or a freezeup restricts the airflow.

CABIN PRESSURIZING

Cabin pressurizing is achieved by regulating the outflow of conditioned air from the pressurized compartments. An automatic cabin pressure regulator governs this outflow of air which escapes overboard through cabin pressure safety and outflow valves. The cabin pressure regulator maintains a preselected maximum pressure differential (figure 4-1) between outside and cabin pressures above 8000 feet altitude. A high differential (7.45 psi) and a low differential (4.50 psi) pressure bellows is provided in the regulator. When energized by 24-volt d-c TR power, a solenoid valve in the regulator switches operation from high to low differential operation.

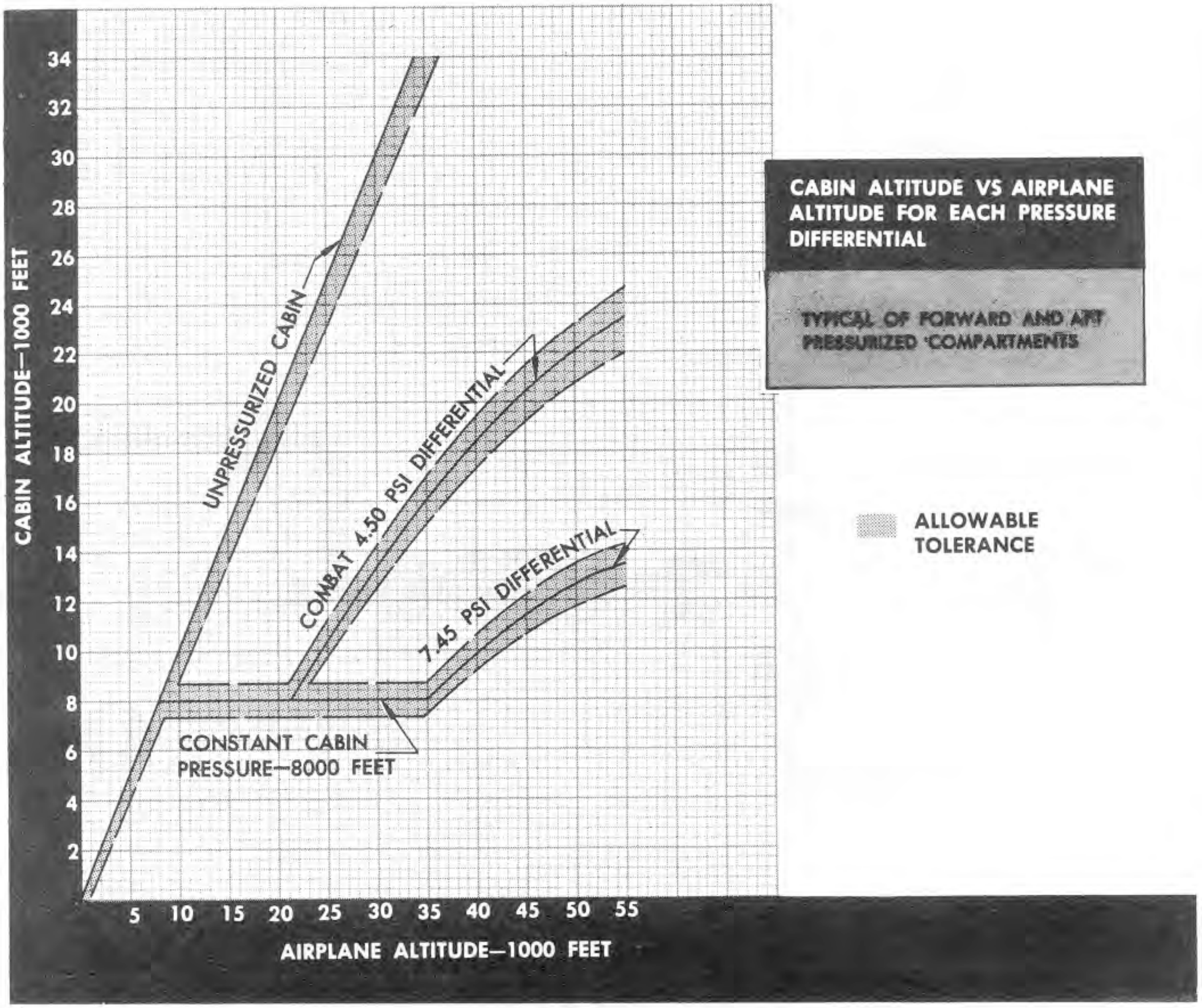
NOTE

> When changing the cabin pressure differential from 7.45 PSI to COMBAT 4.50 PSI, a maximum initial cabin altitude overshoot of 3000 feet above that selected may occur and should be considered normal. See figure 4-1 for cabin altitude versus aircraft altitude for the two pressurization schedules.

The rate at which the compartments may be pressurized is automatically controlled by the pressure regulator to a maximum change of 1 psi per minute. In unpressurized operation the regulator will maintain the cabin at outside air pressure. In pressurized operation, a cabin altitude of 8000 feet will be maintained up to the altitude where a differential pressure exists equal to the pressure setting selected. Above this altitude (where the differential pressure is equal to the setting selected) a constant differential pressure between cabin and outside air pressure is maintained. Cabin pressure safety and outflow valves are provided for each compartment. These valves provide a means of normal pressure outflow and are also used to dump cabin pressure. Relief of both positive and negative cabin pressures is provided by these valves. The control chambers of each group of safety valves are vented to the atmosphere through a cabin pressure dump control valve which is operated either manually or electrically. When open, this valve vents the safety valve control chamber to the atmosphere allowing it to open and dump cabin pressure. An additional dump control valve is provided for the gunner which is operated by the turret jettison handle when the turret is jettisoned.

CAUTION

> When the main landing gear is extended and crabbed in flight to an angle equal to or exceeding 14 degrees through any combination of crosswind crab setting and rudder motion, the landing gear squat switch will be actuated causing forward cabin pressure to be dumped. Up to 8000 feet this is not critical, since cabin pressure is regulated to approximately 1/2 inch Hg differential.



CABIN PRESSURE SCHEDULE

Figure 4-1.

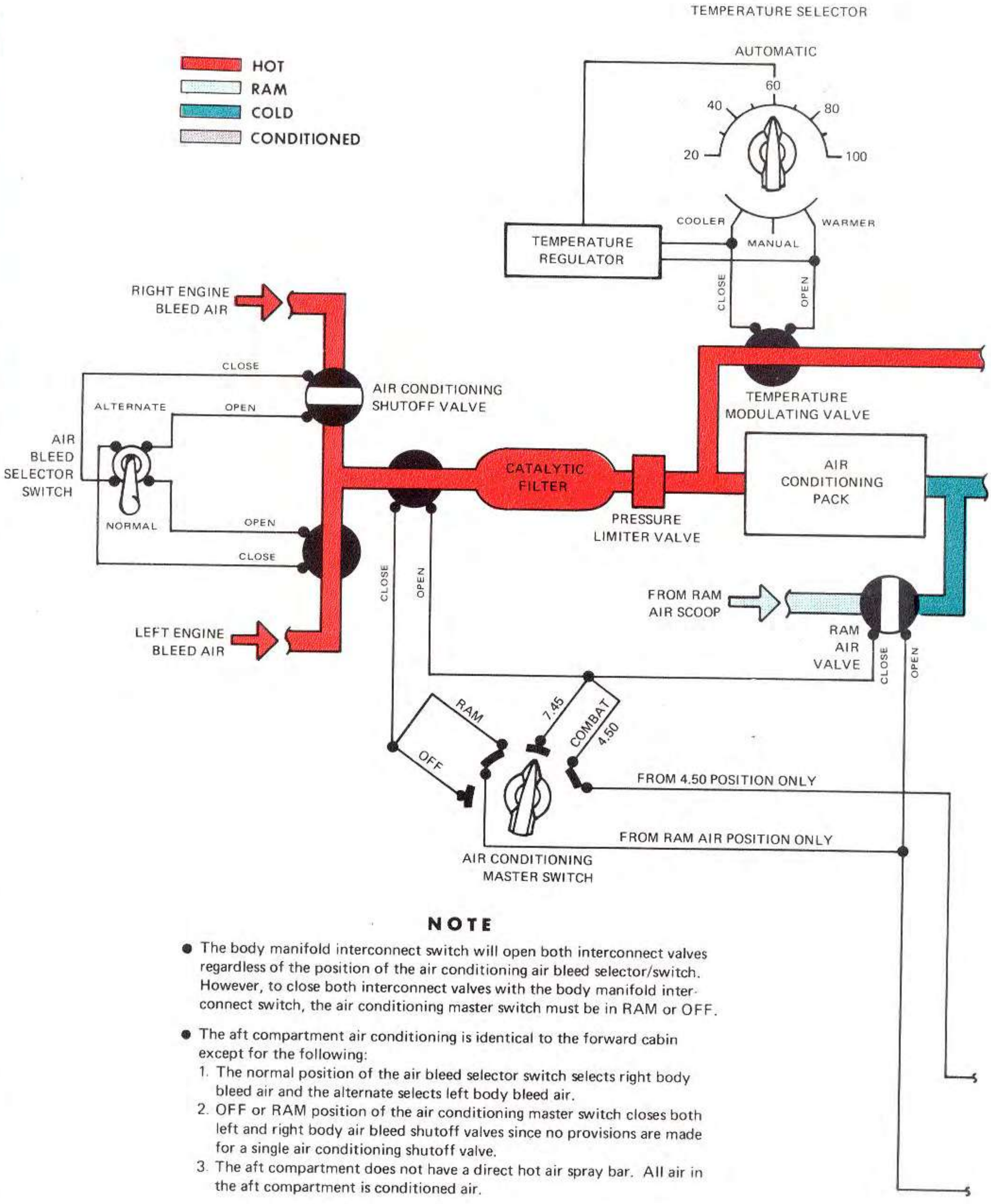
CABIN HEATING AND VENTILATING

Pressurized Compartments

Air used for pressurizing is also used to cool electronic equipment and to heat and ventilate the crew compartments. During pressurized flight, this air is obtained from the air bleed system (figure 1-30). It passes through the air conditioning pack and the distribution ducts to the air outlets at each crew member's station.

WARNING

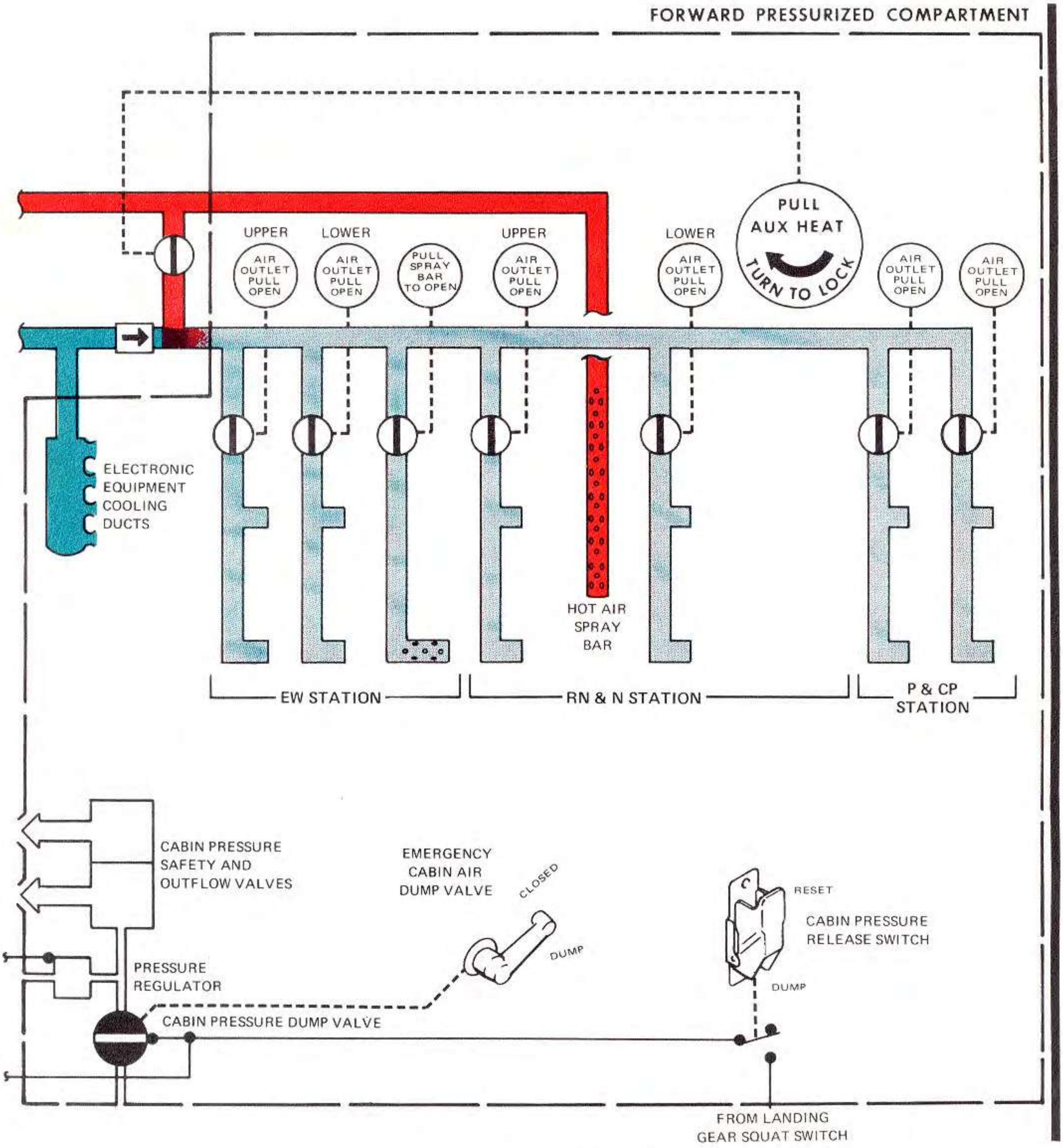
Extreme caution must be exercised by all crew members when stowing and securing gear aboard the aircraft. Care must be taken to assure that gear is safely secured and is not stowed on or near heating ducts, outlets, electrical wiring, and electronic equipment. Periodically during flight, each crew member should check ducts, outlets, electrical wiring, and electronic equipment in his immediate area to see that they are free of combustible materials. See figure 4-2A for hot air duct locations and outlets.



NOTE

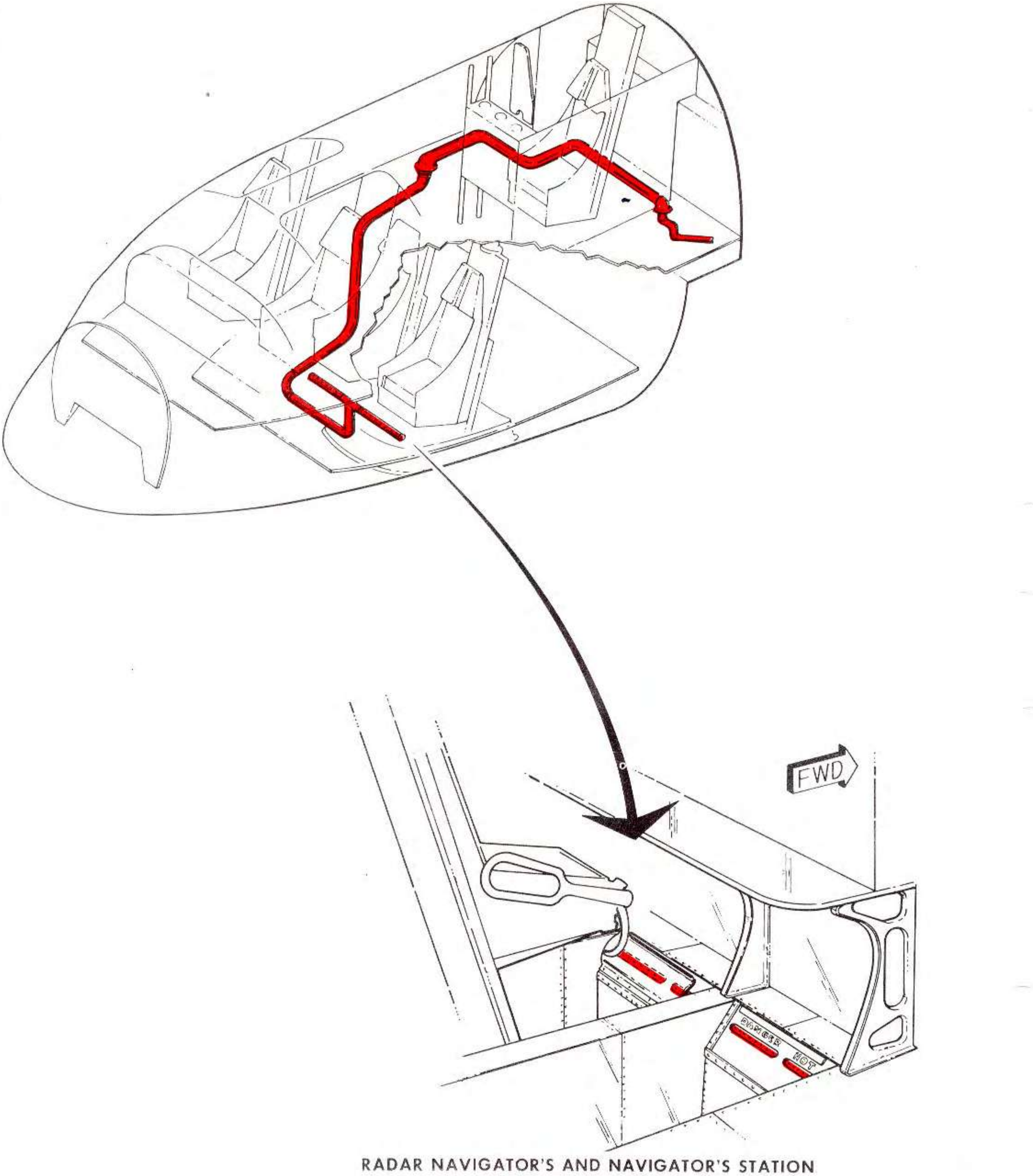
- The body manifold interconnect switch will open both interconnect valves regardless of the position of the air conditioning air bleed selector/switch. However, to close both interconnect valves with the body manifold interconnect switch, the air conditioning master switch must be in RAM or OFF.
- The aft compartment air conditioning is identical to the forward cabin except for the following:
  1. The normal position of the air bleed selector switch selects right body bleed air and the alternate selects left body bleed air.
  2. OFF or RAM position of the air conditioning master switch closes both left and right body air bleed shutoff valves since no provisions are made for a single air conditioning shutoff valve.
  3. The aft compartment does not have a direct hot air spray bar. All air in the aft compartment is conditioned air.

Figure 4-2 (Sheet 1 of 2).



AIR CONDITIONING SYSTEMS (Typical)

Figure 4-2 (Sheet 2 of 2).



RADAR NAVIGATOR'S AND NAVIGATOR'S STATION

HOT AIR DUCT LOCATIONS

Figure 4-2A.

During unpressurized operation, air for cooling electronic equipment and for ventilating the compartments is obtained from the ram air scoops. An electrically operated ram air valve, provided for each compartment, is closed during pressurized operation and may be opened during unpressurized operation. For ram airscoops anti-icing, see "Anti-Icing Systems," this section. Heating of the pressurized compartments is provided only during operation with the air conditioning master switch in 7.45 PSI or COMBAT 4.50 PSI. Cooled and depressurized engine bleed air discharged from the air conditioning pack is mixed with hot engine bleed air which bypasses the pack. In each compartment, a 205-volt three-phase a-c motor-operated temperature modulating valve controls the flow of this hot bypassed bleed air. These valves are controlled by TR-powered open and close relays. An electronic cabin temperature regulator automatically governs operation of the temperature modulating valve through the relays. The temperature regulator is supplied with both duct and cabin temperature sensing elements which control the action of the regulator. A cabin temperature selector switch is provided to permit automatic or manual control of cabin temperature.

Camera Compartment

The camera compartment in the aft equipment compartment (5, figure 1-2) is heated by air obtained from the air bleed system. For additional information on the source of bleed air, see "Air Bleed System," Section I. Airflow for heating the camera compartment is controlled by a 24-volt d-c TR-powered solenoid-operated shutoff valve. This valve is controlled by an overheat switch and is supplied power through the ON position of the camera master switch.

BNS Radar Antenna Anti-icing

Conditioned cabin air is extracted from the vicinity of the pilots' lower air outlets and routed into the radome compartment. The flow is controlled by a fixed-diameter orifice prior to entering an inlet adapter installed between the BNS radar antenna base and the access cover. Cabin differential pressure insures a positive flow of heated dry air into the antenna base to inhibit moisture condensation on the sliding electrical contacts and slip rings. Electrical contact between input and output antenna control signals is maintained by prevention of frost or ice formation when subfreezing flight conditions are encountered. Anti-icing air is exhausted through a screened outlet adapter, located on the underside of the antenna base, into the radome compartment.

AIR CONDITIONING SYSTEM CONTROLS

Body Manifold Interconnect Switch

An OPEN--CLOSED body manifold interconnect switch (2, figure 1-31), guarded in the CLOSED position, is on the copilot's auxiliary side panel. This switch electrically controls the positioning of the two body air bleed manifold interconnect valves. Moving this switch to the CLOSED position, with the air conditioning master switch in either the 7.45 PSI or COMBAT 4.50 PSI position, supplies 118-volt single-phase a-c power through a circuit breaker marked "Air Conditioning Air Bld Body" on the "Miscellaneous" portion of the pilot's circuit breaker panel to close one interconnect valve. The interconnect valve that remains open to supply air conditioning for the forward compartment is determined by the position of the air bleed selector switch for the forward compartment. With the air conditioning master switch in either OFF or RAM, the CLOSED position of this switch supplies power to close both body interconnect valves. Lifting the guard and moving this switch to the OPEN position supplies power to open both body manifold interconnect valves regardless of the position of the air conditioning master switch or air bleed selector switch. This permits crossfeeding of bleed air between inboard pods. For additional information on this switch, see "Air Bleed System," Section I.

Air Conditioning Master Switches

A four-position OFF--RAM--7.45 PSI--COMBAT 4.50 PSI air conditioning master switch (3, figure 4-3) is on the air conditioning panel in each pressurized compartment. The aft compartment switch is guarded to prevent inadvertent depressurizing of the gunner's compartment. This multi-purpose switch controls electrical power for cabin pressurizing as well as for heating and ventilating. When this switch is in the OFF or RAM position, 118-volt single-phase a-c power is supplied to close the air conditioning shutoff valves and the air conditioning pack does not operate. In RAM position, TR power is supplied to open the cabin pressure dump control valve and 118-volt single-phase a-c power is supplied to open the ram air valve. In OFF or RAM position, it is impossible to obtain cabin heat and no power reaches the cabin temperature selector switch. Positioning the switch to OFF closes the ram air valve and shuts down the air conditioning pack without depressurizing the aircraft, provided the switch is turned quickly past RAM position. Pressure will bleed down gradually due to normal leakage of the aircraft. In 7.45 PSI or COMBAT 4.50 PSI position, TR power is supplied to the cabin temperature selector switch for either manual or automatic control of the temperature modulating valve and 118-volt single-phase a-c power is supplied to close the ram air valve and to open the air conditioning shutoff valve. The position of the air bleed selector switch then determines which source of bleed air will be used to operate the air conditioning packs. COMBAT 4.50 PSI position, in addition to the power supplied in 7.45 PSI position, supplies TR power to energize a solenoid valve in the pressure regulator shifting the regulator from high to low pressure differential operation. The forward air conditioning master switch is supplied TR power through a circuit breaker marked "Cabin Cont" and 118-volt a-c power through circuit breakers marked "Air Conditioning Eng Bld Ram Air" and "Air Conditioning Air Bld Body." The circuit breakers are on the "Miscellaneous" portion of the pilot's circuit breaker panel. The aft air conditioning master switch

is supplied TR power through a circuit breaker marked "Cab" and 118-volt a-c power through circuit breakers marked "Body Bleed" and "Aft Ram Air Bleed." The circuit breakers are on the "Air Conditioning" portion of the gunner's circuit breaker panel.

Air Bleed Selector Switch (Forward Compartment)

A NORMAL--ALTERNATE air bleed selector switch (4, figure 4-3) is provided on the air conditioning panel for the forward compartment at the copilot's station. This switch is used to supply power to reverse the positions of the body manifold interconnect valves provided the body manifold interconnect valve switch is in the CLOSED position and the air conditioning master switch is in either pressurized setting. With the conditions as above, NORMAL position provides 118-volt single-phase a-c power through a circuit breaker marked "Air Conditioning Air Bld Body" on the "Miscellaneous" portion of the pilot's circuit breaker panel to open the left and close the right body manifold interconnect valve. This condition supplies bleed air for air conditioning from No. 2 nacelle when the left wing manifold interconnect valve is closed. In ALTERNATE position, the valve positions are reversed and bleed air is supplied from No. 3 nacelle. See "Air Bleed System," Section I, for further information on the body manifold interconnect switch.

Air Bleed Selector Switch (Aft Compartment)

A NORMAL--ALTERNATE air bleed selector switch (4, figure 4-3) is provided on the air conditioning panel in the aft compartment. The body manifold interconnect switch is not involved in the operation of the air bleed selector switch for the aft compartment. When the air conditioning master switch is in either pressurized setting, NORMAL position of this switch provides 118-volt single-phase a-c power through a circuit breaker marked "Body Bleed" on the "Air Conditioning" portion of the gunner's circuit breaker panel to open the right and close the left air conditioning shutoff valve supplying bleed air from the right body air bleed manifold. With the air conditioning master switch for the aft compartment in OFF or RAM position, both air conditioning shutoff valves are closed regardless of the position of the air bleed selector switch.

Cabin Pressure Release Switches

A two-position DUMP--RESET cabin pressure release switch (2, figure 4-3), guarded to RESET position, is located on each air conditioning panel. When the guard is lifted and the switch is moved to DUMP position, cabin pressure is released by supplying TR power to the cabin pressure dump control valve. A TR-operated safety valve dump relay is provided which opens the forward dump control valve when the weight of the aircraft is on the wheels. TR power is supplied to the aft pressure dump control valve through a circuit breaker marked "Cab" on the "Air Conditioning" portion of the gunner's circuit breaker panel. TR power is supplied to the forward pressure dump control valve through a circuit breaker marked "Air Conditioning Cabin Cont" on the "Miscellaneous" portion of the pilot's circuit breaker panel.

Cabin Depressure Request Switches

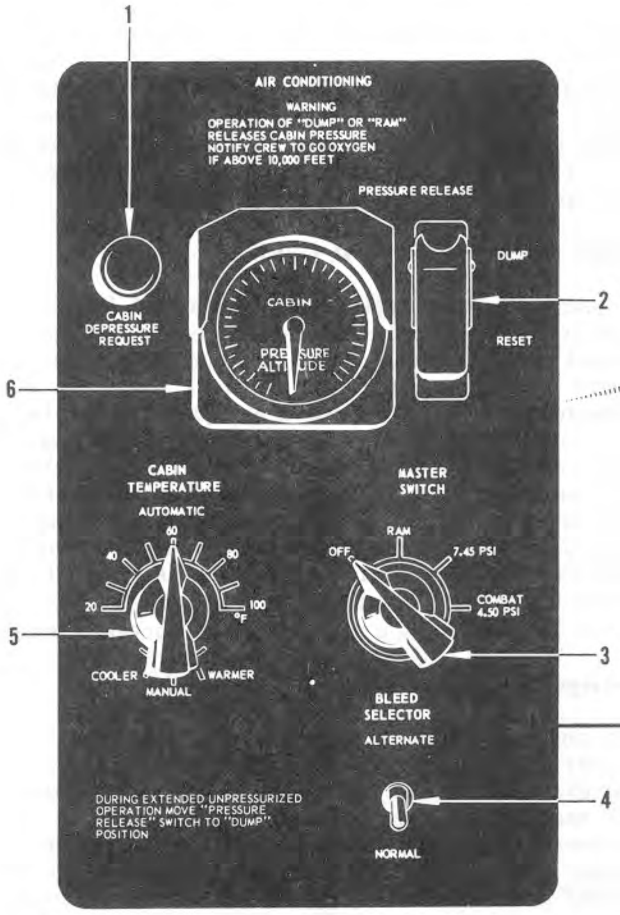
A guarded cabin depressure request switch (figure 4-4) is provided on the nonpressurized side and adjacent to each pressure bulkhead door. When the guard is lifted and the switch actuated, d-c power is supplied to the cabin depressure request light on the air conditioning panel of the corresponding compartment. Switched battery power for the forward cabin depressure request light is supplied through a circuit breaker marked "Depress Warn" on the "Miscellaneous" portion of the pilot's circuit breaker panel. The aft cabin depressure request light is supplied TR power through a circuit breaker marked "Cab Depress Request" on the gunner's circuit breaker panel.

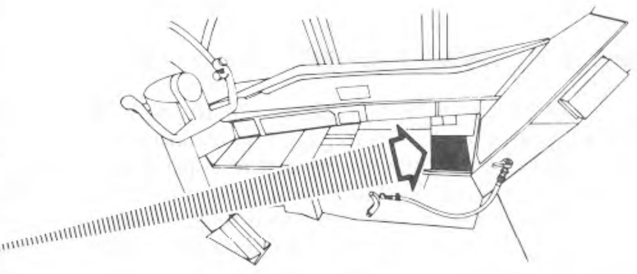
Emergency Cabin Pressure Dump Handles

An emergency cabin pressure dump handle with DUMP--CLOSED positions, (figure 4-4) is provided for each pressurized compartment. A dump handle for each compartment is located adjacent to each pressure bulkhead door and may be operated from either side of the bulkhead. Moving the handle to the DUMP position manually opens the dump control valve allowing cabin pressure to be released through the cabin pressure safety and outflow valves. In the CLOSED position, the cabin pressure dump control valve is closed and the cabin pressure safety and outflow valves operate normally.

Cabin Temperature Selector Switches

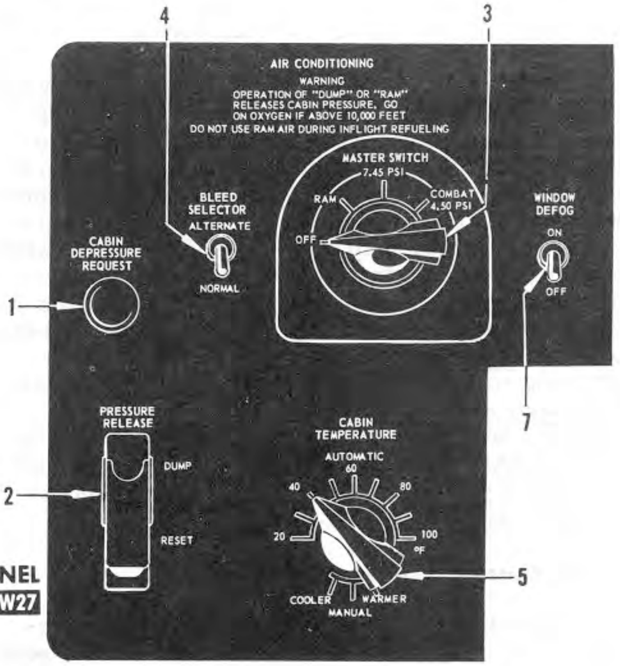
A cabin temperature selector switch (5, figure 4-3) is located on each air conditioning panel. This switch is marked AUTOMATIC--MANUAL--COOLER--WARMER and is used in conjunction with the temperature regulator to operate the cabin temperature modulating valve. When the switch is in the AUTOMATIC range, cabin temperature is maintained by positioning the switch to the desired temperature between 20° and 100° F. When in this automatic range, a power relay supplies 118-volt single-phase a-c and TR power to the temperature regulator. In MANUAL position, the cabin temperature regulator is inoperative. When the switch is held in COOLER or WARMER position, TR power is supplied to the temperature modulating valve relay which repositions the modulating valve. An overheat switch is provided which closes the temperature modulating





FORWARD AIR CONDITIONING PANEL

1. CABIN DEPRESSURE REQUEST LIGHT
2. CABIN PRESSURE RELEASE SWITCH
3. AIR CONDITIONING MASTER SWITCH
4. AIR BLEED SELECTOR SWITCH
5. CABIN TEMPERATURE SELECTOR SWITCH
6. CABIN ALTIMETER
7. WINDOW DEFOG SWITCH



AFT AIR CONDITIONING PANEL
54▶ 138 W1▶ W27

Figure 4-3 (Sheet 1 of 2).

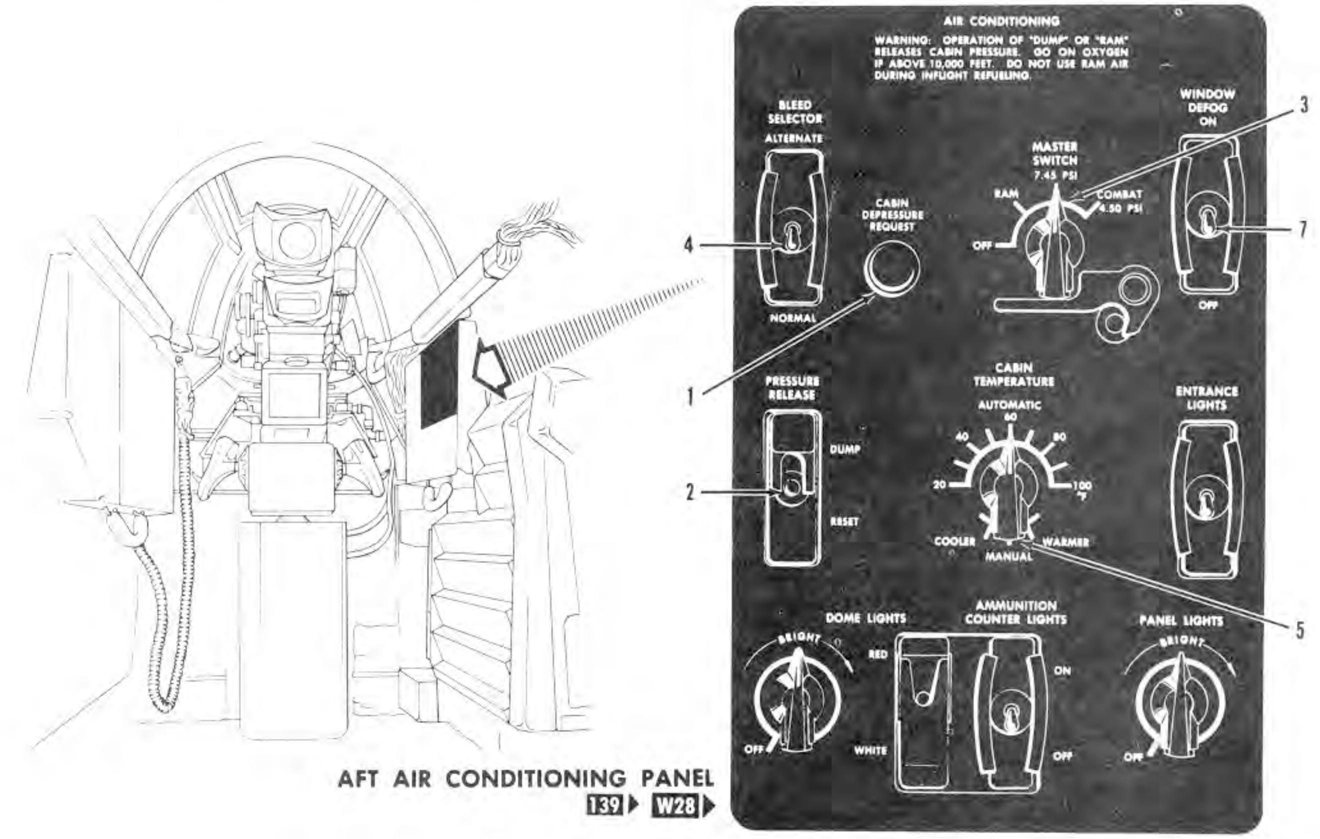
valve when duct air temperature exceeds 300° F. The forward cabin temperature selector switch is supplied TR power through a circuit breaker marked "Air Conditioning Cabin Cont" and 118-volt a-c power through a circuit breaker marked "Air Conditioning Temp Reg." Both circuit breakers are on the "Miscellaneous" portion of the pilot's circuit breaker panel. The aft cabin temperature selector switch is supplied TR power through a circuit breaker marked "Cab" and 118-volt a-c power through a circuit breaker marked "Cab Temp." Both circuit breakers are on the "Air Conditioning" portion of the gunner's circuit breaker panel. The modulating valves operate on 205-volt a-c power through circuit breakers marked "Cabin Temp Air Cond Valves" in the aft and right forward a-c power shields.

Air Outlet Knobs

Air outlet knobs control the flow of heating and pressurizing air delivered to each compartment. No controls are provided for the electronic equipment cooling ducts. In the forward pressurized compartment, these knobs are mounted near the air outlets and are pulled out to increase airflow and pushed in to decrease the flow of air. The pilots' air outlet knobs are located below the pilots' instrument panel. The two radar navigator-navigator air outlet knobs are just above the sighting angle indicator on the radar navigator's side panel. The EW officer's two air outlet knobs and one spray bar knob are to his left below his circuit breaker panel. The gunner's air outlets are controlled by pointer-type knobs which decrease airflow when rotated toward OFF. The gunner's air outlet knobs are located below both the left and right panels.

Auxiliary Heat Knob

An auxiliary heat knob (43, figure 4-35) is located at the radar navigator's station to provide more heat for the radar navigator and the navigator. To operate the knob, turn it counterclockwise to unlock, pull or push it to the desired position, then turn



AFT AIR CONDITIONING PANEL

139▶ W28▶

AIR CONDITIONING PANELS

Figure 4-3 (Sheet 2 of 2).

clockwise to relock. Pulling out the knob increases the flow of hot air through perforated dispersal tubes near the feet of both the radar navigator and navigator by restricting the hot airflow to the pilots' compartment.

WARNING

> Operation with the auxiliary heat knob near the full out position should be avoided. Air flowing from the spray bar near the navigator's and radar navigator's feet can reach 600 °F which may cause injury to these crew members at high airflow rates.

Spray Bar Knob

A spray bar knob (3A, figure 4-15) is located under the EW officer's air outlet knobs and is used to reduce the air pressure at the pilot's and copilot's air outlets and to reduce the air conditioning noise level in the forward crew compartment.

AIR CONDITIONING SYSTEM INDICATORS

Cabin Altimeters

Each pressurized compartment is equipped with a 0 to 80,000-foot cabin pressure altimeter. The cabin altimeter for the forward compartment (6, figure 4-3) is located on the forward air conditioning panel. The tail compartment cabin altimeter (13, figure 4-75) is located aft of the gunner's right panel. As the rate of cabin pressurizing is automatically controlled by the pressure regulators, no cabin pressure rate of change indicator is provided.

PILOT'S TAIL COMPARTMENT ALTIMETER. A remote indicating cabin pressure altimeter (33, figure 1-15), energized by 118-volt a-c power from the right forward a-c power load box, is on the pilots' instrument panel. This altimeter indicates the cabin altitude of the gunner's compartment. The dial face is graduated clockwise from 0 to 80,000 feet, with numbered major graduations every 10,000 feet and minor graduations every 2,000 feet.

Cabin Depressure Request Lights

A cabin depressure request light (1, figure 4-3) is located on the air conditioning panel of each pressurized compartment. The forward light receives switched battery power through a circuit breaker marked "Depress Warn" on the "Miscellaneous" portion of the pilot's circuit breaker panel and the aft light receives TR power through a circuit breaker marked "Cab Depress Request" on the gunner's circuit breaker panel when the corresponding cabin depressure switch is actuated.

Gunner's Cabin Pressure Warning Light

A press-to-test cabin pressure warning light (15, figure 4-76) located on the gunner's right side panel illuminates when cabin altitude is between 13,980 and 16,020 feet mean sea level. The warning light is energized by TR power through a circuit breaker marked "Cab Press Warning" on the gunner's circuit breaker panel. The initial low pressure signal consists of a bright flashing of the light. A three-position STEADY--NEUTRAL--DIM switch is provided. STEADY position changes the light from a flashing to a steady light and DIM position decreases the light by the same amount provided by the forward cabin automatic night light dimmers, while allowing the light to continue flashing. In NEUTRAL position, it provides the bright flashing signal. After the low pressure condition is corrected, the indicating circuit is automatically reset so that a subsequent low pressure condition in the gunner's cabin again provides a bright flashing light for an initial signal.

Copilot's Tail Compartment Pressure Low Warning Light

A copilot's tail compartment pressure low warning red light (24, figure 1-15) located on the copilot's instrument panel illuminates when the cabin pressure altitude in the gunner's compartment is between 21,750 and 24,100 feet mean sea level. The light is supplied TR power through a circuit breaker marked "Sect 49 Press Warn" on the "Misc" portion of the copilot's circuit breaker panel.

NOTE

> There is a time lag between the illumination of the gunner's and copilot's tail compartment low pressure warning lights. Duration of this time lag depends upon the rate of loss of gunner's cabin pressure differential.

AIR CONDITIONING SYSTEM NORMAL OPERATION

CAUTION

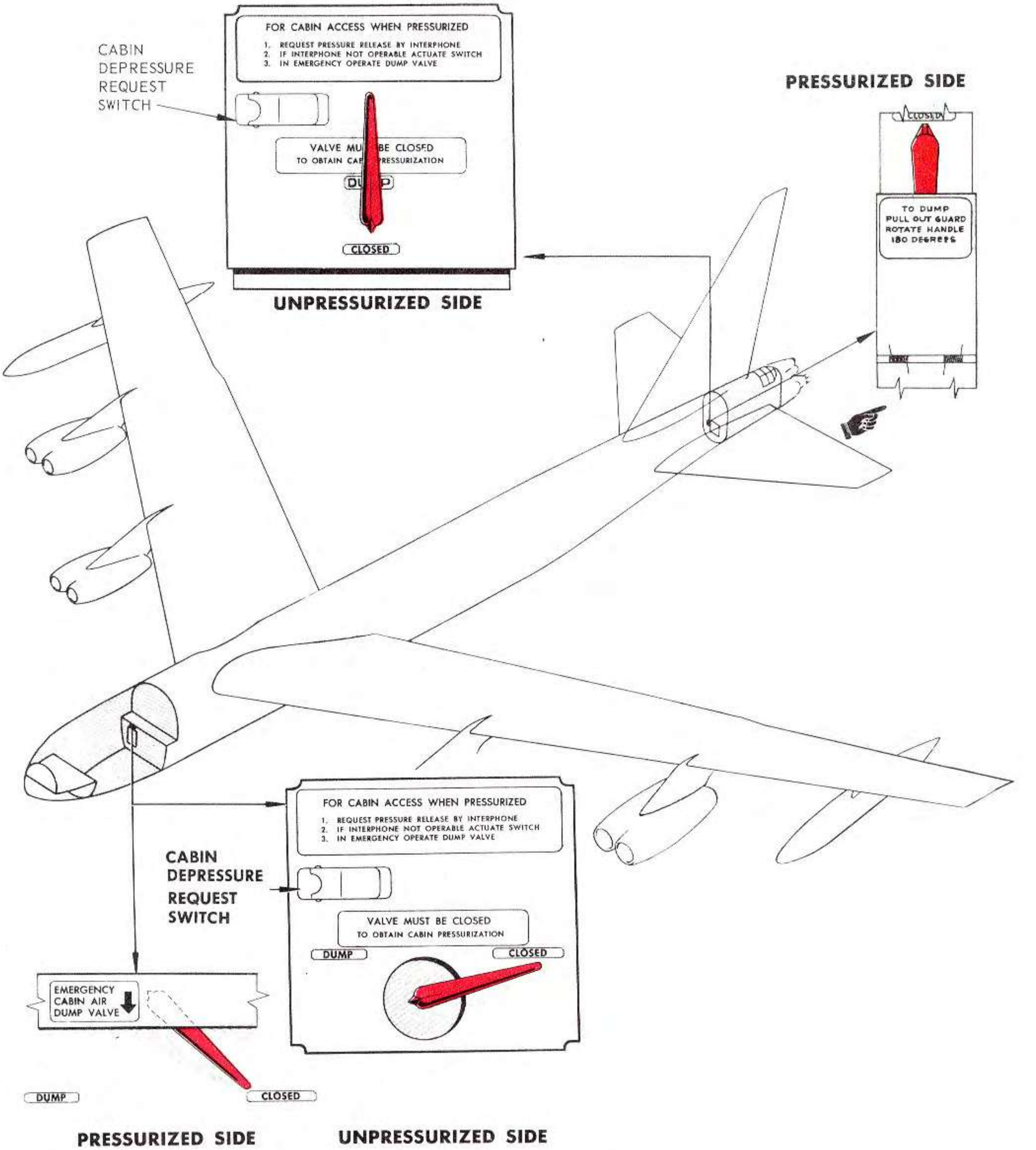
> Do not run an air conditioning unit with the wing duct plugs in place as the cooling (expansion) turbine-driven blower will overspeed resulting in the destruction of the unit and possible damage to the aircraft.

For normal pressurized operation, the air conditioning system is placed in operation as follows:

1. Emergency cabin pressure dump handle - CLOSED

CAUTION

> The emergency cabin pressure dump handle must be set positively in CLOSED position for cabin pressurizing. If the dump handle is cocked slightly from CLOSED position because the handle detent is difficult to detect, it may allow cabin pressure to be dumped overboard.



EMERGENCY CABIN PRESSURE DUMP HANDLES

Figure 4-4.

2. Cabin pressure release switch - RESET
3. Body manifold interconnect valve switch - CLOSED (forward compartment only)
4. Air bleed selector switch - NORMAL
5. Air conditioning master switch - 7.45 PSI

NOTE

- Heating or cooling, according to cabin temperature selector switch settings and availability of pneumatic system hot air, is provided with the air conditioning master switch in 7.45 PSI (or COMBAT 4.50 PSI) position whether the cabin is pressurized or not.
- During extended periods of unpressurized operation, move cabin pressure release switch to DUMP position in order to provide additional airflow for cooling of electronic equipment.
- Continuous ground operation of the air conditioning packs is permissible at manifold pressures of 100 psi or less. At manifold pressures above 100 psi, limit continuous operation to 15 minutes.
- At low power settings, it may be necessary to increase power on the engine supplying the air conditioning pack to maintain full (7.45 psi) cabin pressure differential.
- If excessive noise tends to blank out interphone and radio communication, the air conditioning master switch may be positioned to RAM during low altitude operation at power settings which cause difficulty in communications. On climbout, return master switch to 7.45 PSI before reaching 10,000 feet.
- To preclude nuisance tripoff of air conditioning pack, retard throttles on engines supplying air to 80% rpm before switching from RAM to 7.45 PSI.
- Do not turn the air conditioning ON or OFF when engines supplying air are above 80% rpm. To do so could cause shutdown of the system on aircraft which have an early unimproved automatic pressure limiter valve installed at the air conditioning pack. It is necessary to enter the forward wheel well to reset a tripped valve.

6. Cabin temperature selector switch - AUTOMATIC (set at desired cabin temperature)

An initial setting between 60° and 70° will provide for maximum crew comfort with the least additional attention.

NOTE

Moving the temperature selector switch through an increment greater than 5° F causes the modulating valve to move to its extreme travel, either fully open or fully closed. This will result in extreme fluctuations in cabin temperatures. Since the cabin temperature will automatically stabilize at the selected temperature within 3 to 10 minutes, the temperature selector switch should be moved in the desired direction in increments not to exceed 5° F until the stabilized desired cabin temperature is obtained.

7. Air outlet knobs (aft compartment) - As desired
8. Air outlet and auxiliary heat knobs (forward compartment) - As follows:

- Upper outlet knobs - 1/2 to full out
- Lower outlet knobs - Full out
- Auxiliary heat knobs - Full in

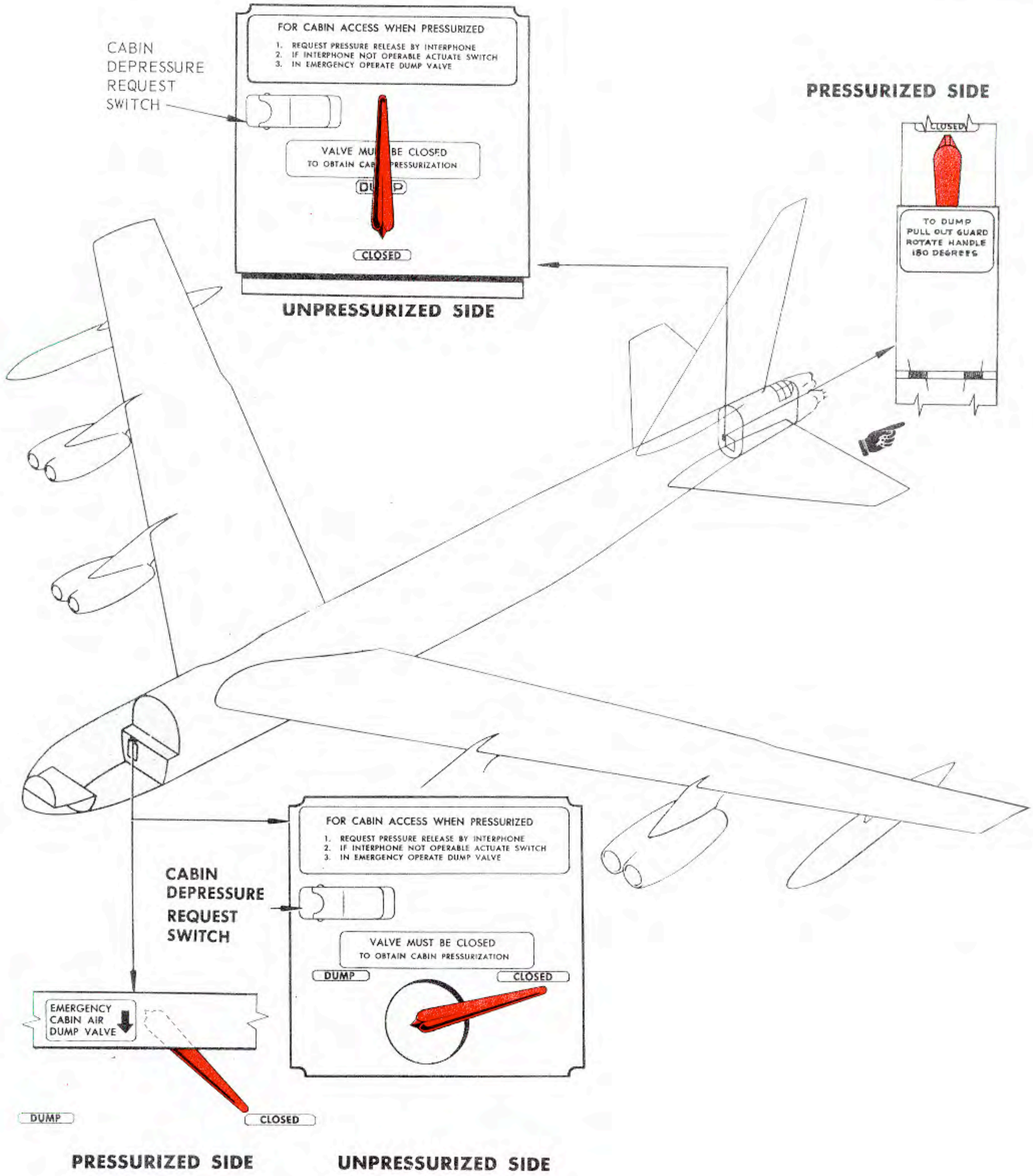
These initial settings are for maximum crew comfort until cabin temperature has stabilized. Thereafter, knob adjustment may be varied slightly for crew comfort. When more heat is needed in the lower compartment than on the upper deck, pull the radar navigator's auxiliary heat knob partially out before requesting a higher setting on the temperature selector switch. With the knob completely out, hot airflow to the pilots' compartment will be shut off and redirected to the navigators' compartment, causing possible overheating in that area.

System Shutdown

The system is normally shut down by opening a pilot's side window approximately 2 inches and placing cabin pressure master switch in RAM position to relieve the small residual cabin pressure buildup during ground operation of the air conditioning system. The residual pressure is due to the need to maintain the outflow valve preloaded to the closed position by a slight spring pressure when the cabin is depressurized. With the crew compartment closed and the air conditioning system operating, a residual cabin pressure must build up to balance the spring pressure before the outflow valve will open to permit the necessary airflow for ventilation. An unusually high residual cabin pressure, as noted by means of the cabin altimeter, can be relieved by turning the air conditioning master switch to RAM and then opening the side window. The air conditioning master switch should then be returned to the 7.45 PSI position to insure cooling of electronic equipment, if operating. Prior to ground operations, opening a pilots' side window before closing the entry door will prevent buildup of residual pressure.

WARNING

- To prevent injury to ground crewmen, one of the pilots' side windows will be opened approximately 2 inches before the main entry door is opened. Otherwise, a small residual cabin pressure will build up during ground operation of the air conditioning system. This pressure may impose sufficent load on the door to cause injury to anyone in its path when it is unlatched.
- To prevent injury to ground crewmen, the tail compartment will be depressurized by turning the air conditioning master switch to RAM prior to opening the aft entry door.



EMERGENCY CABIN PRESSURE DUMP HANDLES

Figure 4-4.

2. Cabin pressure release switch - RESET
3. Body manifold interconnect valve switch - CLOSED (forward compartment only)
4. Air bleed selector switch - NORMAL
5. Air conditioning master switch - 7.45 PSI

NOTE

- Heating or cooling, according to cabin temperature selector switch settings and availability of pneumatic system hot air, is provided with the air conditioning master switch in 7.45 PSI (or COMBAT 4.50 PSI) position whether the cabin is pressurized or not.
- During extended periods of unpressurized operation, move cabin pressure release switch to DUMP position in order to provide additional airflow for cooling of electronic equipment.
- Continuous ground operation of the air conditioning packs is permissible at manifold pressures of 100 psi or less. At manifold pressures above 100 psi, limit continuous operation to 15 minutes.
- At low power settings, it may be necessary to increase power on the engine supplying the air conditioning pack to maintain full (7.45 psi) cabin pressure differential.
- If excessive noise tends to blank out interphone and radio communication, the air conditioning master switch may be positioned to RAM during low altitude operation at power settings which cause difficulty in communications. On climbout, return master switch to 7.45 PSI before reaching 10,000 feet.
- To preclude nuisance tripoff of air conditioning pack, retard throttles on engines supplying air to 80% rpm before switching from RAM to 7.45 PSI.
- Do not turn the air conditioning ON or OFF when engines supplying air are above 80% rpm. To do so could cause shutdown of the system on aircraft which have an early unimproved automatic pressure limiter valve installed at the air conditioning pack. It is necessary to enter the forward wheel well to reset a tripped valve.

6. Cabin temperature selector switch - AUTOMATIC (set at desired cabin temperature)
An initial setting between 60° and 70° will provide for maximum crew comfort with the least additional attention.

NOTE

Moving the temperature selector switch through an increment greater than 5° F causes the modulating valve to move to its extreme travel, either fully open or fully closed. This will result in extreme fluctuations in cabin temperatures. Since the cabin temperature will automatically stabilize at the selected temperature within 3 to 10 minutes, the temperature selector switch should be moved in the desired direction in increments not to exceed 5° F until the stabilized desired cabin temperature is obtained.

7. Air outlet knobs (aft compartment) - As desired
8. Air outlet and auxiliary heat knobs (forward compartment) - As follows:

- Upper outlet knobs - 1/2 to full out
- Lower outlet knobs - Full out
- Auxiliary heat knobs - Full in

These initial settings are for maximum crew comfort until cabin temperature has stabilized. Thereafter, knob adjustment may be varied slightly for crew comfort. When more heat is needed in the lower compartment than on the upper deck, pull the radar navigator's auxiliary heat knob partially out before requesting a higher setting on the temperature selector switch. With the knob completely out, hot airflow to the pilots' compartment will be shut off and redirected to the navigators' compartment, causing possible overheating in that area.

WARNING

- To prevent injury to ground crewmen, one of the pilots' side windows will be opened approximately 2 inches before the main entry door is opened. Otherwise, a small residual cabin pressure will build up during ground operation of the air conditioning system. This pressure may impose sufficent load on the door to cause injury to anyone in its path when it is unlatched. The residual pressure is due to the need to maintain the outflow valve preloaded to the closed position by a slight spring pressure when the cabin is depressurized. With the crew compartment closed and the air conditioning system operating, a residual cabin pressure must build up to balance the spring pressure before the outflow valve will open to permit the necessary airflow for ventilation. An unusually high residual cabin pressure, as noted by means of the cabin altimeter, can be relieved by turning the air conditioning master switch to RAM and then opening the side window. The air conditioning master switch should then be returned to the 7.45 PSI position to insure cooling of electronic equipment, if operating. Prior to ground operations, opening a pilots' side window before closing the entry door will prevent buildup of residual pressure.
- To prevent injury to ground crewmen, the tail compartment will be depressurized by turning the air conditioning master switch to RAM prior to opening the aft entry door.

AIR CONDITIONING SYSTEM EMERGENCY OPERATION

Failure of Water Separator

Under this condition, system operation will differ from the normal procedure and the following operational procedures should be followed:

1. During takeoff, increase the cabin temperature setting if fog streamers form and tend to reduce visibility.
2. During descent and at approximately 10, 000 feet altitude, fog streamers in excess of 15 inches may issue from air outlets. Increase the temperature setting until fog streamers are reduced to approximately 6 inches in length.
3. During descent at approximately 5000 feet altitude, if fog streamers exceed 6 inches in length, move the air conditioning master switch to RAM and continue descent and landing.

Failure of Normal Bleed Air Source

In the event of failure of the normal source of bleed air for air conditioning, move the air bleed selector switch to ALTERNATE position. If alternate procedure does not provide adequate cabin airflow, place the air conditioning master switch in RAM position and see "Air Bleed System Emergency Operation," Section III.

WARNING

- An engine or system failure in a nacelle supplying air for an air conditioning system may cause oil or fumes to enter the pressurized compartment(s). If this should occur, go on 100% OXYGEN with the emergency toggle lever in OFF (NORMAL, pilot and copilot), and place the air bleed selector switch to its other position, ALTERNATE or NORMAL. If the condition persists, place the air conditioning master switch to RAM and maintain all manifold interconnect switches in the CLOSED position. Monitor engines 3, 4, 5, and 6 for signs of malfunction. See "Smoke and Fumes Elimination," Section III.
- If an air bleed manifold leak is suspected or confirmed, land as soon as possible. See "Air Bleed System Emergency Operation," Section III.

Failure To Regulate Cabin Temperature

If difficulty is encountered in controlling cabin temperature, proceed as follows:

1. If the automatic control system fails to provide the proper temperature regulation, place the cabin temperature selector switch in MANUAL. Move the switch to COOLER or WARMER as necessary to provide proper cabin temperature.

NOTE

Allow sufficient time for the manual control to change the cabin temperature before attempting additional readjustment. It is very easy to overcontrol using this system.

2. If only hot air is available from the air outlets and a check of the electronic equipment cooling ducts shows that relatively cool air (in the order of 80° F) is still available to these units, the decision to continue the mission pressurized or to go on ram air is at the discretion of the pilot.
3. If a puff of smoke is observed from the air outlets accompanied by vibration from the air conditioning pack and followed by hot air from the air outlets, it is probable that the air cycle machine (expansion turbine) in the air conditioning pack has stopped. If this occurs on a hot day at low altitudes or at high power settings, the air from the air conditioning system will be quite hot (in the order of 125° to 160° F) and the air conditioning pack should be shut down until cruising altitude is reached. If it occurs at cruising altitudes and cruising power settings, the air conditioning air will be fairly cool (the failure may not be apparent until descent is made) and the flight can be continued pressurized until a descent is made. On descent, the air will become hot and the pack should be shut down. Operation of the electronic equipment during cruise can be continued if the panels are removed from the BNS equipment rack aft of the navigator and from the compartment to the right of the EW officer. A small reduction in power will assist in reducing the air temperature.
4. If extremely hot air (over 150° F) comes out of the air outlets and the electronic equipment cooling ducts very soon after the air conditioning pack is turned on or after the engines are advanced to high power, it is possible that the cooling air to the air conditioning pack is partially or completely blocked. Continued operation of the pack would result in a fire hazard and the pack must be shut down.
5. If the navigators' compartment becomes overheated while normal cold air is being delivered from

the pilots' air outlets, the navigators' auxiliary hot air supply should be shut off. Push the navigators' auxiliary heat knob all the way in.

WARNING

- In event an uncontrollable supply of hot air is experienced in all modes of operation of the air conditioning system during flight, the air conditioning system should be shut down by placing the air conditioning master switch in OFF or RAM position.
- Do not use ram air for tail compartment ventilation during air refueling. This is to prevent possibility of fuel vapors entering tail compartment through the air conditioning ducts.
- Positioning the air conditioning master switch to RAM during pressurized flight will dump cabin pressure and provide ram air to the cabin. Switching to OFF position will not open the ram air valve or the cabin pressure dump valve, and the cabin will depressurize slowly through normal leakage if the switch is turned quickly past RAM position. OFF position will shut down the air conditioning pack. Crew members should go on oxygen if above 10,000 feet altitude.

Filter Failure

Failure of the air conditioning system catalytic filter will cause a finely divided black powder to issue from the cabin air outlets. In some cases, crew visibility will be totally obscured, and manual control of the aircraft will be marginal. Therefore, consideration should be given to engaging the autopilot as soon as filter failure is detected, to assist in maintaining a stabilized flight condition. All crew members should go on 100% OXYGEN and the air conditioning master switch should be turned to OFF. After the powder has settled, the air conditioning master switch should be turned to RAM and left in this position for the remainder of the mission.

WARNING

To avoid possible harmful effects of breathing the powder when failure of the filter occurs during flight, each crew member must place the oxygen regulator diluter lever in 100% OXYGEN.

Releasing Cabin Pressure

If, for any reason, immediate release of cabin pressure is desired, place the cabin pressure release switch in DUMP position. The air conditioning master switch in RAM position will also release cabin pressure. If these electrical means of dumping cabin pressure are not operable, turn the emergency cabin pressure dump handle to DUMP position.

Shutdown of Air Conditioning System Without Dumping Cabin Pressure

To shut down the air conditioning system in flight without dumping cabin pressure, turn the cabin pressure master switch to OFF position. However, the cabin will depressurize in a few minutes due to normal leakage and no ram air will be provided.

Repressurizing

To repressurize, check:

1. Cabin Pressure Release Switch - RESET
2. Air Conditioning Master Switch - 7.45 PSI (or COMBAT 4.50 PSI)
3. Emergency Cabin Pressure Dump Handles - CLOSED.

ANTI-ICING SYSTEMS

Several different methods are used to accomplish anti-icing of various parts of the aircraft. The engines and nacelles and certain airscoops (figure 4-5) are anti-iced by engine bleed air. The pilots' windshield and other aircraft windows are anti-iced by electrical means. Pitot heads and, on some aircraft, certain airscoops are also electrically heated. Anti-icing is provided for missile (AGM-28) engine nacelles and pitot-static probes. For further information on AGM-28 anti-icing, refer to T.O. 1B-52C-30-1.

SURFACE ANTI-ICING SYSTEM

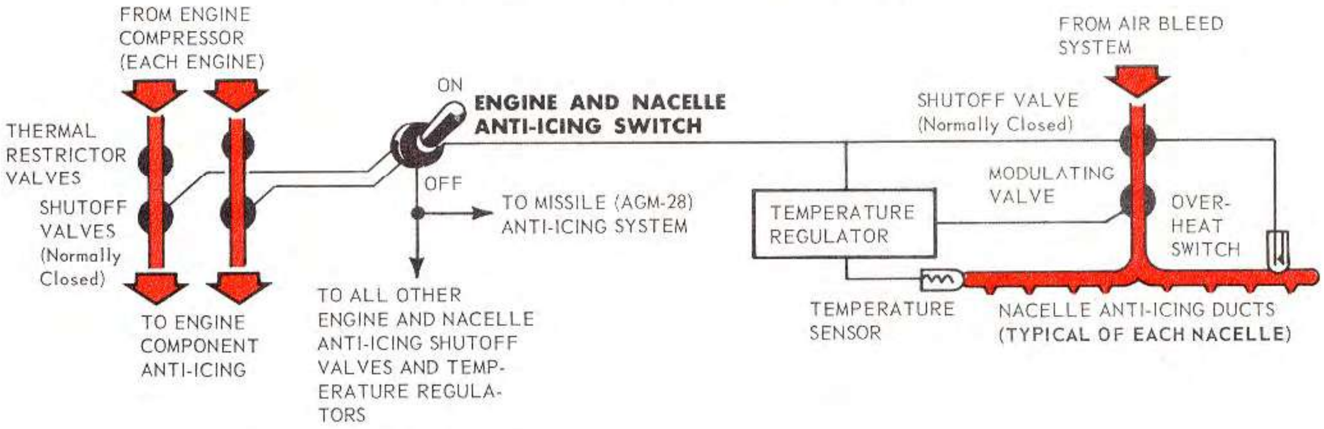
54▶ 169 W1▶ W51

Anti-icing of the inboard portion of the wings and the leading edge ram airscoops is accomplished by directing hot air obtained from the air bleed system into perforated ducts in the leading edge of each surface. Anti-icing air released from the perforated ducts flows between the inner and outer skins into the leading edge cavity and then is exhausted overboard. The inboard nacelles normally supply bleed air for anti-icing the corresponding wings and airscoops. The flow of heated air to each surface is controlled by electrically operated shutoff and modulating valves. The normally closed shutoff valve is solenoid-operated and is controlled through relays which are provided with TR power normally controlled by the surface anti-icing switch and throttle switches, but also controlled for overheat by an overheat switch. Even though wing surface anti-icing is not ordinarily required, operation of the surface anti-icing system is necessary in order to anti-ice the wing ram air inlet scoops during penetration or operation in icing conditions.

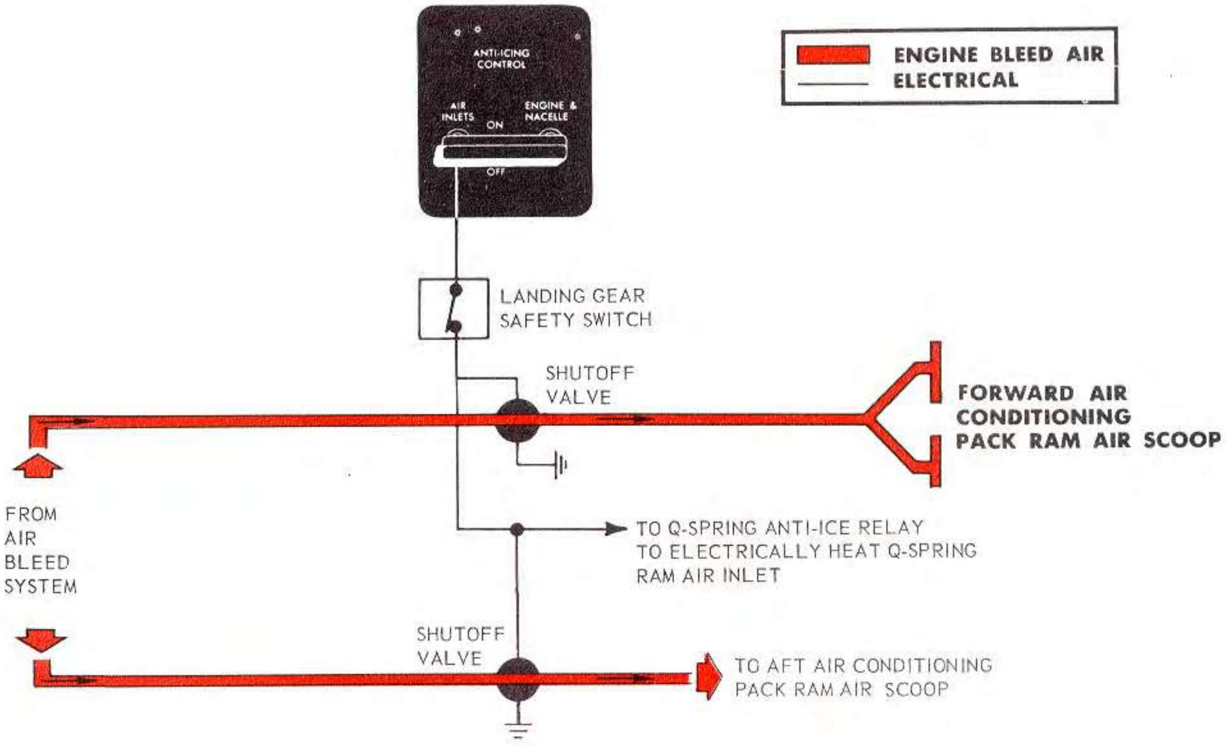
NOTE **54▶ 169 W1▶ W51**

At least one throttle for each inboard nacelle must be positioned approximately three-fourths open or more in order to actuate the throttle mounted anti-ice switch for providing electrical power to open the anti-icing valves.

ENGINE AND NACELLE ANTI-ICING



SCOOPS ANTI-ICING 170▶ W52▶



ENGINE, NACELLE, AND SCOOPS ANTI-ICING

Figure 4-5.

Circuit breaker control is provided through "Anti-Ice Surface Control" circuit breakers marked "Wing," "Tail," and "Overht Warn" located on the pilot's circuit breaker panel. The motor-driven modulating valve is controlled electrically through relays by a temperature regulator and sensor. Temperature indications picked up by the sensor are amplified by the regulator which completes circuits to supply power through relays to position the modulating valve. The modulating valves serves to limit the amount of bleed air allowed to enter the anti-icing ducts and thus regulates surface temperature. Surface overheating is prevented by deenergizing a corresponding shutoff valve relay through an overheat control to allow closing of the shutoff valve. Operation of the surface anti-icing system is controlled automatically; however, the temperature of each surface is regulated independently of the others and no temperature balance control between the left and right wings is provided.

NOTE

54▶169 W1▶W51

> Even though wing and tail surface anti-icing is not ordinarily required for the B-52, the surface anti-icing system must be operated in order to anti-ice the wing and fin ram air inlet scoops during penetration or operation in icing conditions. See "Airscoop Anti-Icing," this section.

Surface Temperature Gage and Selector Switch

54▶169 W1▶W51

An anti-icing temperature gage (1, figure 4-6) is located on the anti-icing control panel. This gage is calibrated in degrees centrigrade and is operated by TR power when the surface anti-icing switch is in ON position. The gage indicates the temperature of anti-icing air in the anti-icing surface air distribution duct. When the system is operating, the gage will show a gradual rise in temperature indication until stabilization is reached but it cannot be used as an accurate measure of anti-icing system performance. If a malfunction prevents system operation, the gage will stabilize at approximately the indicated OAT. A four-position rotary selector switch with L WING--FIN--STAB--R WING) positions is also located on the anti-icing control panel (the FIN and STAB positions are inoperative.) This switch is used to select the surface for which temperature indication is desired. If the temperature gage pointer passes beyond 150° C, the temperatures of all surfaces should be checked by means of the selector switch. If all four positions of the selector switch show readings above 150° C, the anti-icing system should be turned off. If one of the positions of the selector switch indicates a malfunction of the system, the appropriate circuit breaker on the pilot's circuit breaker panel should be pulled.

Surface Overheat Light

54▶169 W1▶W51

An amber surface overheat light (37, figure 1-15) is located on the pilots' instrument panel. This light is illuminated when any surface has overheated and has deenergized the shutoff valve relay, causing the shutoff valve to close. When the shutoff valve relay is deenergized and the shutoff valve has closed, TR power is supplied to the surface overheat light. The overheated surface may be located by use of the anti-icing temperature gage and selector switch.

NOTE

54▶169 W1▶W51

> The surface anti-icing system may be used continuously during operation in icing conditions even though the overheat warning light is illuminated. Illumination of the warning light indicates that one of the surface anti-icing systems has shut down temporarily to allow the surface to cool; however, continued anti-icing of the faulty system is accomplished by the overheat controller opening and closing the shutoff valve. The surface temperature selector may be rotated to determine which surface system is malfunctioning.

Surface Anti-Icing System Normal Operation 54▶169 W1▶W51

To provide surface anti-icing, turn surface anti-icing switch ON with at least one throttle for each inboard nacelle positioned approximately three-fourths open or more to provide electrical power to open the anti-icing shutoff valves. After the system is turned on, monitor the temperature gage to detect a rise in temperature for each surface. The surface temperature gage does not indicate the actual anti-icing surface temperature but does indicate that the surface anti-icing system is operating for the selected surface. The indicated temperature will be higher than the actual anti-icing surface temperature.

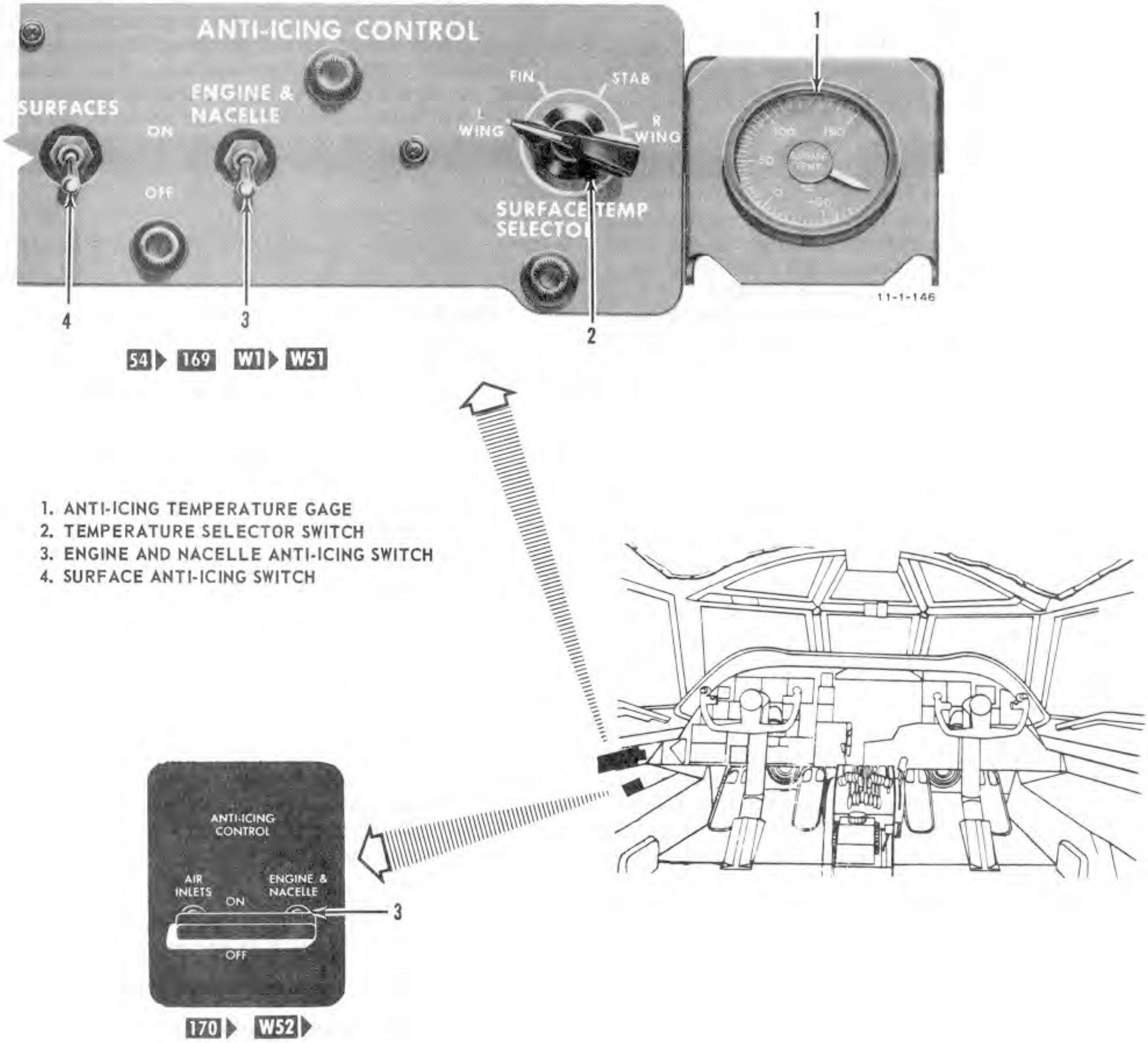
WARNING

54▶169 W1▶W51

> Aircraft takeoff ground roll will be increased by 1% when using surface anti-icing, and increased by 2.5% when using engine and nacelle anti-icing. Therefore, if both systems are on during takeoff, a 3.5% increase in takeoff ground roll should be expected.

ENGINE AND NACELLE ANTI-ICING SYSTEM

Anti-icing of nacelles is accomplished thermally by directing hot engine bleed air from both engines of each nacelle to perforated ducts which encircle the



1. ANTI-ICING TEMPERATURE GAGE
2. TEMPERATURE SELECTOR SWITCH
3. ENGINE AND NACELLE ANTI-ICING SWITCH
4. SURFACE ANTI-ICING SWITCH

ANTI-ICING CONTROL PANEL (Typical)

Figure 4-6.

leading edge of each nose cowl. Engine anti-icing air is bled directly from the engine compressor and passes through the oil cooler cowl and engine inlet struts. Spent air is then exhausted overboard. Each system has a shutoff valve to close off the flow of bleed air to the distribution ducts. The engine anti-icing shutoff valve is motor operated and the nacelle anti-icing shutoff valve is solenoid operated and relay controlled. Engine anti-icing airflow is regulated by a thermally operated restrictor valve which automatically governs the volume of bleed air through the engine anti-icing system. Nacelle temperature is regulated by a modulating valve controlled through relays by a temperature regulator and temperature sensor. An overheat switch is provided for each nacelle which opens when overheating occurs, deenergizing the shutoff valve relay and allowing the nacelle anti-icing shutoff valve to close. No overheat light is provided for the engine and nacelle system.

Engine and Nacelle Anti-Icing Switch

54▶169 W1▶W51

A single ON--OFF engine and nacelle anti-icing switch (3, figure 4-6) on the anti-icing control panel controls engine and nacelle anti-icing. In ON position, connections are made for TR power through circuit breakers marked "Nacelle Control" - "1," "2," "3," and "4" on the "Anti-Ice" portion of the pilot's circuit breaker panel to cause all engine and nacelle anti-icing shutoff valves to open. ON position also supplies TR power and 118-volt a-c power to the four nacelle temperature regulators. The temperature regulator in each nacelle uses TR control power to connect 205-volt three-phase a-c power to the modulating valve motor as required to maintain proper anti-icing temperature. In OFF position, the nacelle temperature modulating valves and the engine anti-icing shutoff valves are energized to close. OFF position deenergizes the nacelle anti-icing shutoff valve solenoids, allowing duct pressures to close the valves. The anti-icing control switch also provides missile (AGM-28) anti-icing.

Anti-Icing Control Switch

170▶ W52▶

This ganged ON--OFF anti-icing control switch (figure 4-6) performs identically the same functions described under the "Engine and Nacelle Anti-Icing Switch" and, in addition, controls ram airscoop anti-icing. See "Airscoop Anti-Icing" for description of that function.

Engine and Nacelle Anti-Icing System Normal Operation

WARNING

Actuating the engine and nacelle anti-icing above NRT settings may cause engine surge and flameout. Before turning on anti-icing, ascertain that engine starter switches are in START. Do not turn starter switches OFF until rpm and EPR have stabilized.

The engine and nacelle anti-icing system was designed to prevent the accumulation of ice in the inlet section of the engine, not to remove it. Thus, it is essential that icing conditions be anticipated. Therefore, the engine and nacelle anti-icing control switch will be turned on below 20,000 feet when the OAT gage reading is below 10° C during night flights or in areas of forecasted or suspected icing conditions. If ice should form, the engines must be above a minimum EPR to maintain adequate anti-icing. Flying at a speed of 340 knots IAS or above will insure that the minimum EPR required to anti-ice is available. When flying below 340 knots IAS, the EPR must be kept above the minimum values noted in the table below by extension of drag items as necessary.

ALTITUDE (FEET)	MINIMUM EPR BELOW 280 KNOTS IAS	MINIMUM EPR 280 KNOTS IAS AND ABOVE
Sea Level	1.60	1.50
5,000	1.60	1.50
10,000	1.70	1.60
15,000	1.82	1.72
20,000 & up	1.95	1.85

NOTE

If ice is inadventently allowed to build up on the engine inlet, throttle setting should be reduced (if flight conditions permit) before anti-ice is activated to prevent or reduce engine damage. Throttle settings should be consistent with minimum EPR's for use of anti-ice heat and ignition should be turned on until engine stabilizes.

Proper operation of the anti-icing system is indicated when a noticeable EPR drop on all engines is noted upon actuating the anti-icing control switch to ON. Engine and nacelle anti-icing should remain ON at all times during icing conditions. This includes static ground operation, taxiing, and the takeoff ground run.

WARNING

Using engine and nacelle anti-icing during takeoff results in a 2.5% increase in the takeoff ground roll.

CAUTION

Indiscriminate or prolonged use of engine and nacelle anti-icing may cause cracking of inlet guide vanes. Anti-icing should be used only as necessary in prevention of icing and not for prolonged periods in dry air. When the possibility of encountering icing conditions no longer exists, engine and nacelle anti-icing should be turned off.

Engine and Nacelle Anti-Icing System Emergency Operation

No provisions are made for emergency operation of the engine and nacelle anti-icing system.

AIRSCOOP ANTI-ICING

54▶169 W1▶W51

The two forward alternator airscoops and the cabin ram airscoops on the fuselage are anti-iced by an electrically heated conductive coating. This coating is sprayed on the scoop surfaces between two coats of an insulating varnish. The Q-spring ram air inlet has an electrically operated heating element.

170▶ W52▶

Airscoop anti-icing is accomplished by directing hot air from the air bleed system to the forward air conditioning pack ram airscoop. The Q-spring ram air inlet has an electrically operated heating element.

Airscoop Anti-Icing Controls

54▶169 W1▶W51

Airscoop anti-icing is controlled by the surface anti-icing switch and the landing gear safety switch relay. With the surface anti-icing switch in ON position and the weight of the aircraft off the landing gear, TR power energizes an airscoop anti-icing relay which supplies 118-volt single-phase a-c power to the electrically anti-iced fuselage scoop elements and the Q-spring ram air inlet. To anti-ice the cabin airscoop, it is also necessary to have the air conditioning master switch in RAM position. TR power is supplied to the airscoop anti-icing system through a circuit breaker marked "Air Scoop Anti-Ice" while a-c power is supplied through a circuit breaker marked "Q-Spring Scoop Anti-Ice." All circuit breakers are on the "Anti-Ice" portion of the pilot's circuit breaker panel, except Q-spring scoop anti-ice which is on the aft a-c power shield.

170▶ W52▶

Airscoop anti-icing is controlled by two shutoff valves, one located in the left wing and the other in the fin leading edge. The fail-safe air-actuated solenoid-controlled valves are operated by TR power through the anti-icing control switch and landing gear safety switch relay supplied through a circuit breaker marked "Air Scoop Anti-Ice Control" on the "Anti-Ice" portion of the pilot's circuit breaker panel. The anti-icing control switch is a ganged ON--OFF switch (figure 4-6) located on the pilot's forward instrument panel. The switch also controls engine and nacelle anti-icing. With the switch in ON position and the weight off the landing gear, the two shutoff valve solenoids are energized and permit hot air to flow from the air bleed system to the anti-iced airscoop areas, except the Q-spring which is operated electrically by 118-volt a-c power through a circuit breaker "Q-Spring Scoop Anti-Ice" in the aft a-c power shield. In OFF position, the shutoff valve solenoids are deenergized and pneumatic pressure closes the valves.

PITOT ANTI-ICING

Right pitot tube and fairing heat is supplied 28-volt a-c power through a circuit breaker marked "Pilot Pitot Tube Ht" **Less ZV** ; "Pilot Airspeed Pitot Htr" **ZV** on the "Flight Indicators" portion of the pilot's circuit breaker panel. Left pitot and fairing heat is supplied 28-volt a-c power through a circuit breaker marked "Copilot Pitot Tube Ht" **Less ZV** ; "Copilot Airspeed Pitot Htr" **ZV** on the right aft a-c power box. On aircraft **ZV** , altitude computer pitot heaters are supplied 118 volt a-c power from two circuit breakers marked "Alt Cmptr LH and RH" on the "Flight Indicators" portion of the pilot's circuit breaker panel. There is no emergency provision for pitot anti-icing.

Pitot Anti-Icing Controls

PITOT HEAT SWITCHES. Left and right ON--OFF pitot heat switches (54, figure 1-15) are located on the left side of the pilots' instrument panel. ON position of each switch energizes the pitot tube and fairing heaters on the respective (left or right) side of the aircraft to prevent pitot tube stoppage by icing. OFF position removes power from the heaters.

Pitot Anti-Icing Normal Operation

Pitot heat switches should be in ON position prior to takeoff or in flight whenever icing conditions are anticipated to prevent ice formation and loss of airspeed indication. The switches should be turned to OFF position after landing.

CAUTION

To reduce overheating of the elements, do not leave pitot heat switches ON for extended periods while the aircraft is on the ground.

WINDSHIELD ANTI-ICING AND WINDOW DEFOGGING

The aircraft is equipped with electrically heated windows which include the pilots' windshield, auxiliary windows above and behind the windshield, and auxiliary windows in the upper escape hatches and at the EW officer's and gunner's stations. The pilots' windshield windows are numbered 1 thru 4L and 4R; auxiliary windows at the pilots' station are numbered 5L, 5R, and 7 as shown in figure 1-9. Heating of all the windows is accomplished by a transparent electrically conductive film between the glass laminations. There are two types of windows, anti-ice and defog. The anti-ice windows have the conductive film next to the outer pane which serves to prevent the formation of ice on the outside of the window in addition to preventing fog formation on the inside of the window. The defog windows have the conductive film next to the inner pane to prevent fog formation on the inside of the window. Windows of the pilots' windshield, 1 thru 4L and 4R, are the anti-ice windows; the remainder of the heated windows in the aircraft are defog windows. A-C power passed across the conductive films is supplied by 118-volt single-phase a-c powered autotransformers for all windows except the EW officer's, which use 118-volt single-phase a-c power from the aircraft bus. The temperatures of the pilots' windshield windows 1 thru 4L and 4R (anti-iced) are regulated by a-c powered electronic temperature control units signaled by sensing elements in the conductive films. Temperatures of all the auxiliary (defog) windows are controlled by individual thermal switches mounted on the surface of each window glass. The anti-ice windows may be operated at two different heating rates while the defog windows have only a single heating rate. All windows in the forward cabin are controlled by a single windshield anti-ice and defogging switch on the pilots' instrument panel. All windows in the tail compartment are controlled by a single defog switch on the aft air conditioning panel. When either of the pilots' sliding windows (3L and 3R) is opened, limit switches are actuated to discontinue anti-icing of all three windows 3L, 3R, and 4L. All control relays in the forward compartment utilize TR power for operation.

Windshield Anti-Icing and Window Defogging Controls

WINDSHIELD ANTI-ICE AND DEFOGGING SWITCH. A three-position rotary selector switch (52, figure 1-15) located on the pilots' instrument panel electrically controls the operation of all heated windows in the forward cabin. The switch has OFF--NORMAL--HIGH positions. OFF position deenergizes all equipment. In NORMAL position, a-c power is passed across the conductive films of all the windows and gives a normal heating rate. In HIGH position, increased a-c power is made available to pilots' anti-iced windshield windows 1 thru 4L and 4R and gives a high heating rate to those windows in order to prevent icing under the most severe conditions; all other windows continue to operate at the normal rate. In both NORMAL and HIGH positions, 118-volt a-c power is supplied to the electronic temperature regulator and TR power controls the overheat and power relays. TR power is supplied to the switch through circuit breakers marked "Left Windshield Relays," "Right Windshield Relays," and "Aux Windows Relays." A-C power is supplied through circuit breakers marked "Left Windshield Cont Units," "Right Windshield Cont Units," "Windshield" - "1," "2" - "Left" and "Right," "3," "4" - "Left" and "Right," "5 & 7," "Obsvr," and "Escape Hatch." All circuit breakers are on the "Anti-Ice" portion of the pilot's circuit breaker panel.

GUNNER'S WINDOW DEFOG SWITCH. An ON--OFF toggle switch (7, figure 4-3) located on the aft air conditioning panel controls operation of all heated windows in the tail compartment. ON position of the switch directly connect 118-volt single-phase a-c power from a circuit breaker marked "Window Defog" on the gunner's circuit breaker panel to the autotransformer to heat the windows. A thermal snap switch protects each window from overtemperature. OFF position disconnects a-c power from the autotransformer.

Windshield Anti-Icing and Window Defogging Normal Operation

PILOTS' WINDSHIELD AND WINDOWS. Use the lowest power settings that will provide adequate anti-icing in order to prolong windshield life.

1. Place windshield anti-ice and defogging switch in NORMAL prior to takeoff. Leave the switch in this

position as long as satisfactory defogging is obtained. The low power setting will give the longest windshield service life and will provide satisfactory defogging under normal flight conditions.

CAUTION

To prevent damage to the heated windows, operate on NORMAL 15 minutes before turning switch to a higher heat position.

2. The switch should be set to HIGH at any time the NORMAL setting does not provide satisfactory defogging.
3. Turn the switch to OFF after landing.

GUNNER'S HEATED WINDOWS. Turn the window defog switch to ON position prior to takeoff. No further manual control is provided. Turn the switch to OFF position after landing.

Windshield Anti-Icing and Window Defogging Emergency Operation

If arcing at the heating power terminals, arcing at the sensing element, or discoloration or bubbles in the windows occurs, pull the individual circuit breakers for the affected window. These circuit breakers are marked "1," "2 Left," "2 Right," "3," "4 Left," "4 Right," "5," "7," "Obsvr," and "Escape Hatch." They are grouped under "Anti-Ice Windshield" on the pilot's circuit breaker panel. The numbered circuit breakers apply to the various parts of the pilots' windshield respectively numbered as shown on figure 1-9.

NOTE

- The anti-ice control circuit breakers marked "Windshield Relays," "Windshield Cont Units," and "Aux Windows Relay" should not be pulled since these circuit breakers provide power for the control of heat to more than one window.
- The structural integrity of a cracked window may be checked by sliding a hand across the inner surface to feel for the crack. Since the inner pane of a heated window is the primary structure, a crack in only the outer pane will not impair the strength. (Unheated windows, 6L and 6R, are made of laminated acrylic plastic and carry the load on the outer surface.)

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

The communication and associated electronic equipment (figure 4-7) includes an interphone system, UHF command radios, liaison radio, UHF DF, TACAN radio, omni-range receiver, glide slope equipment, marker beacon receiver, radar altimeter, rendezvous radar, SIF-IFF radar, N-1 compass system, doppler radar, DNS radar, automatic astrocompass, fire control system, and beacon transponder. For antenna locations, see figure 4-9.

INTERPHONE SYSTEM AN/AIC-10A

A transistorized interphone system provides intercommunication between the crew stations, transmission and reception on UHF command and liaison radio sets, and reception of audio signals from specialized receivers. Control panels (figure 4-8) vary according to station requirements. Most stations have an interphone control panel containing a selector switch for selecting transmitting and receiving channels and mixer switches which permit simultaneous monitoring of several channels. The interphone control panels at all stations have a call button and a volume control knob. The celestial navigation station has selector switch capabilities but no mixer switches for monitoring. Stations of limited use (stabilizer jackscrew, forward wheel well, bunk, and bomb bay) utilize interphone and call functions only. For the interphone capability of a given station, see figure 4-8. Only 24-volt d-c direct battery power is used to power the system, all stations being in parallel. All interphone power is supplied through circuit breakers on the pilot's overhead circuit breaker panel. Normal battery power is supplied through a circuit breaker marked "Fwd Bat Pwr" on the "Inph & Inbd Air Brake" portion of the panel. Emergency battery power is supplied through a circuit breaker marked "Aft Bat Pwr" on the same portion of the panel when the emergency battery switch is in EMERG position. D-C control power is provided through a circuit breaker marked "Inph" on the center portion of the panel.

EQUIPMENT — AIRCRAFT

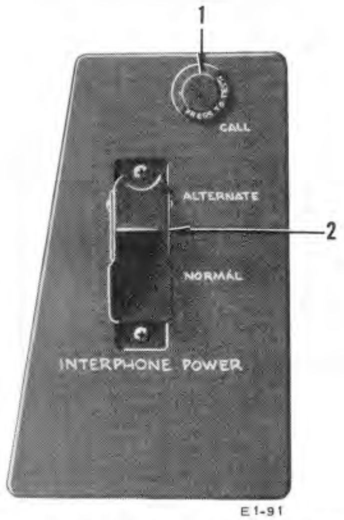
TYPE	DESIGNATION	FUNCTION	OPERATOR	HORIZONTAL RANGE	LOCATION OF CONTROLS
INTERPHONE	AN AIC-10	Intercrew Communication	Any crew member		Each crew station
UHF COMMAND	AN ARC-34 **B-52C** AN ARC-34 or AN ARC-133(V) **B-52D**	Short range, two-way, voice, and code communication	Pilot, copilot, and EW officer	75-270 miles	Pilot's overhead panel, EW officer's radio panel
UHF COMMAND NO. 2	AN ARC-34 **B-52C** AN ARC-34 or AN ARC-133(V) **B-52D**				
LIAISON RADIO	AN ARC-65	Long range, two-way, voice and code communication	Pilot and EW officer	800-1500 miles	Pilot's side panel, EW officer's radio panel
UHF DIRECTION FINDER	AN ARA-25	Determines direction of incoming UHF signals to the command radio	Pilot and Copilot	75-150 miles	Operates through UHF command radio
TACAN RADIO	AN ARN-21	UHF navigation	Pilot	195 miles	Pilot's side panel
OMNI-RANGE RADIO	AN ARN-14	Indicates lateral alignment with runway and used for VHF navigation	Pilot and Copilot	Line of Sight	Pilot's overhead panel
GLIDE SLOPE	AN ARN-18	Indicates glide angle for landing	Pilot and Copilot	15 miles	Operates through omni-range radio

Figure 4-7 (Sheet 1 of 2).

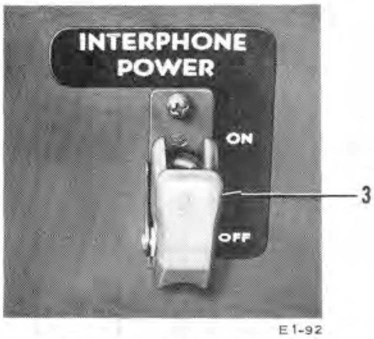
MARKER BEACON	AN/ARN-12 **54**▶ **138** **W1**▶ **W27** AN/ARN-32 **139**▶ **W28**▶	Receives location marker signals on navigation beam	Pilot and Copilot	Low altitude	Operates through omnirange radio
RADAR ALTIMETER	AN/APN-150	Measures terrain clearance	Pilot		Pilots' instrument panel
RENDEZVOUS RADAR	AN/APN-69 **B-52D**	Aerial rendezvous	Navigator	150-200 mi.	Navigator's side panel
SIF/IFF RADAR ☛	KY-95A, APX-25 **Less ZV** AN/APX-64 **ZV**	Aircraft recognition IFF Mode 4	Pilot Pilot	Line of Sight	Pilot's side panel Pilot's side panel
N-1 COMPASS SYSTEM		Provides heading reference	Navigator		Navigator's station
DOPPLER RADAR (Component of ASQ-48)	AN/APN-108	Ground speed and drift angle	Navigator		Navigator's forward panel
BOMBING NAVIGATIONAL SYSTEM	ASQ-48	Bombing and navigation	Radar Navigator		Radar Navigator's station
AUTOMATIC ASTRO-COMPASS (Component of ASQ-48)	MD-1	Provides heading reference	Navigator		Navigator's station
BNS RADAR SYSTEM (Component of ASQ-48)	AN/APS-108	Provides bombing, navigation, and low level flight assist	Pilot, Copilot, and Radar Navigator		Pilots' and Navigators' stations
FIRE CONTROL SYSTEM	A-3A **54**▶ **87** **W1**▶ **W8** MD-9 **88**▶ **W9**▶	Fire Control	Gunner		Gunner's station
BEACON TRANSPONDER	SST-181X **B-52D**	Bombing reference	Navigator		Navigator's station

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

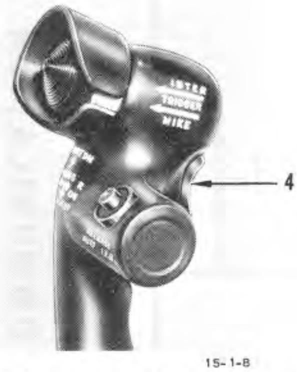
Figure 4-7 (Sheet 2 of 2).



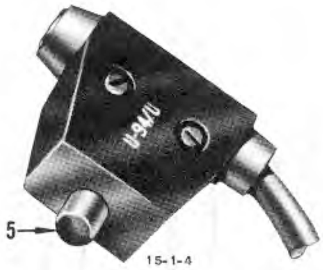
TYPICAL INTERPHONE (ALTERNATE) POWER SWITCH PANEL (PILOT, COPILOT, NAVIGATOR)



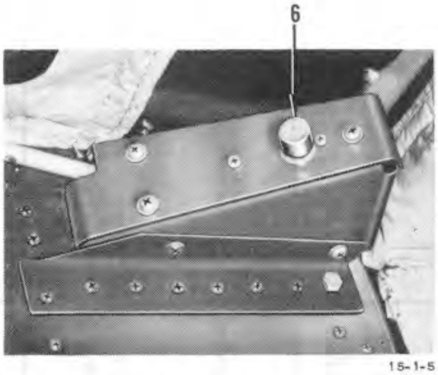
INTERPHONE (SYSTEM) POWER SWITCH (PILOT)



TRIGGER SWITCH (PILOT AND COPILOT)



HAND SWITCH (BOMB BAY, FORWARD WHEEL WELL, STABILIZER JACK SCREW, BUNK, INSTRUCTOR PILOT, INSTRUCTOR NAVIGATOR, GUNNER 114▶ W22▶ AND CELESTIAL NAVIGATION STATIONS)



FOOT SWITCH (RADAR NAVIGATOR, NAVIGATOR, EW OFFICER AND GUNNER)

1. CALL LIGHT
2. INTERPHONE (ALTERNATE) POWER SWITCH
3. INTERPHONE (SYSTEM) POWER SWITCH
4. TRIGGER SWITCH
5. HAND SWITCH
6. FOOT SWITCH
7. MIXER SWITCH
8. AUXILIARY LISTEN SWITCH
9. INTERPHONE SELECTOR SWITCH
10. INTERPHONE VOLUME CONTROL KNOB
11. CALL BUTTON

Figure 4-8 (Sheet 1 of 2).

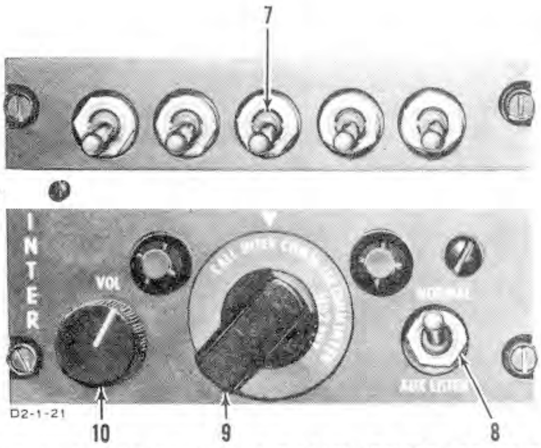
PILOT, COPILOT, RADAR NAVIGATOR, INSTRUCTOR PILOT AND INSTRUCTOR NAVIGATOR

EW OFFICER B-52C

EW OFFICER, GUNNER, AND CELESTIAL NAVIGATION STATION B-52D

NAVIGATOR

GUNNER B-52C



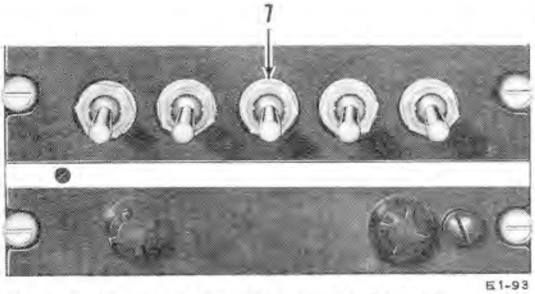
INTERPHONE CONTROL PANEL (PILOT, COPILOT, NAVIGATOR, RADAR NAVIGATOR, EW OFFICER, INSTRUCTOR PILOT, INSTRUCTOR NAVIGATOR, CELESTIAL NAVIGATION STATION AND GUNNER)

EW OFFICER (155▶ W37▶) B-52D

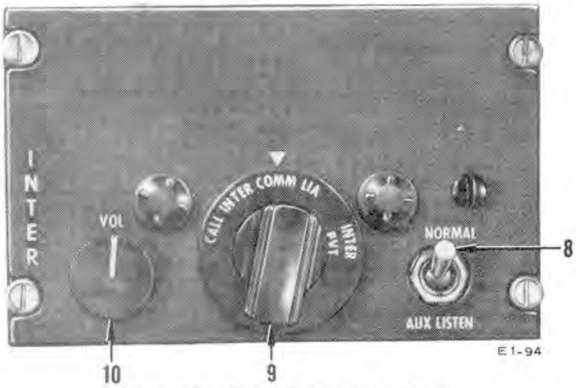
EW OFFICER (89▶ 154 W1▶ W36) B-52D

CELESTIAL NAVIGATION STATION B-52D

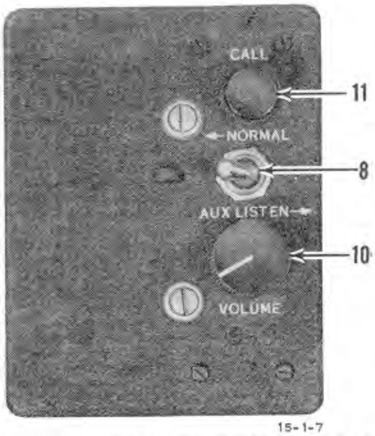
EW OFFICER B-52C



INTERPHONE MIXER CONTROL PANEL (EW OFFICER, CELESTIAL NAVIGATION STATION)



INTERPHONE CONTROL PANEL (CELESTIAL NAVIGATION STATION B-52C)



INTERPHONE CONTROL PANEL (BOMB BAY, FORWARD WHEEL WELL, STABILIZER JACK SCREW, AND BUNK STATIONS)

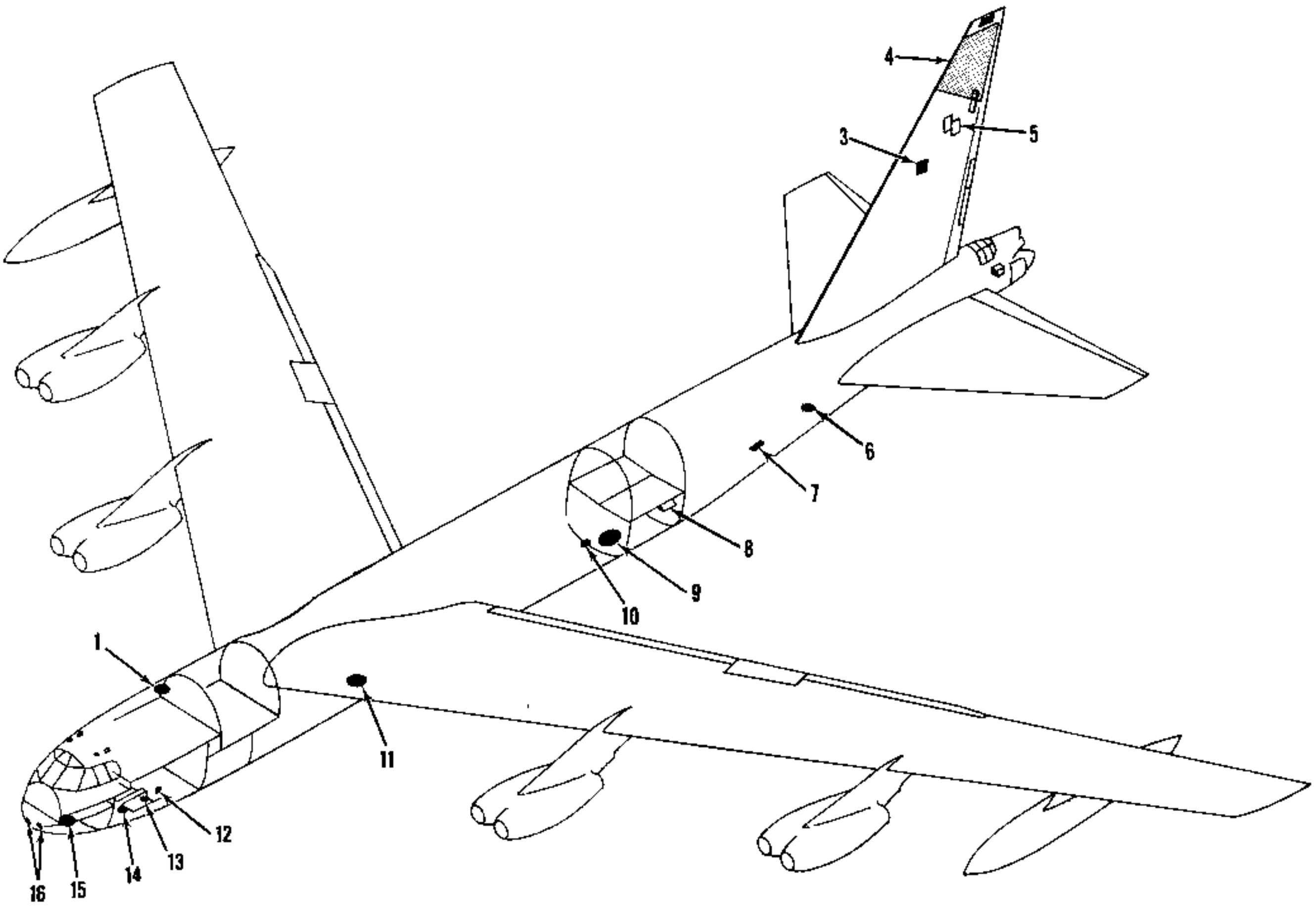
INTERPHONE SYSTEM CONTROLS

Figure 4-8 (Sheet 2 of 2).

1. IFF ANTENNA (UPPER) **ZV**
2. (Deleted)
3. RENDEZVOUS RADAR ANTENNA **155**▶ **W37**▶
4. LIAISON RADIO ANTENNA
5. OMNI-RANGE RADIO ANTENNA
6. UHF COMMAND NO. 1 RADIO ANTENNA
7. RADAR ALTIMETER ANTENNA APN-150
8. MARKER BEACON ANTENNA
9. RENDEZVOUS RADAR ANTENNA **B-52D**
10. DIRECTION FINDER ANTENNA
11. DOPPLER RADAR ANTENNA APN-108
12. TACAN ANTENNA
13. SIF/IFF ANTENNA Less **ZV** ; IFF ANTENNA (LOWER) **ZV**
14. UHF COMMAND NO. 2 RADIO ANTENNA
15. BNS RADAR ANTENNA
16. GLIDE SLOPE ANTENNA

NOTE

FOR ECM ANTENNA LOCATIONS REFER TO T.O. 1B-52D-1-2



ANTENNA LOCATIONS (EXCEPT ECM)

Figure 4-9.

Interphone System Controls

INTERPHONE SELECTOR SWITCH. A selector switch (9, figure 4-8) on each crew member's interphone panel has CALL--INTER--COMM--LIA--COMM No. 2--PVT INTER positions. When any selector switch is held in CALL position, as the switch is spring loaded away from this position, all stations are contacted simultaneously regardless of their selector switch positions. INTER position provides normal interphone communication between crew members. COMM, LIA, and COMM NO. 2 positions permit corresponding transmission and reception via UHF command, liaison, and No. 2 UHF command radios. Both command radios may be used interchangeably and simultaneously in most aircraft. PVT INTER position provides another interphone channel identical in function to the normal channel and can be used at the same time for private or extended communication between two or more crew members.

NOTE

- When the call channel is energized, it is not necessary to depress any mike switch to talk on this channel, as the mike switches are bypassed. Use the call channel only in emergencies or to direct someone to another facility.
- If the selector switch is placed in an unmarked position, reception is possible only through the selected mixer switches and the call channel. Transmission is not possible.

INTERPHONE VOLUME CONTROL KNOB. A volume control knob (10, figure 4-8) on each interphone panel regulates the volume level received at that station. Normally the volume control knob should be set at or less than the midposition (approximately 9 to 12 o'clock position). When the volume control knob is rotated beyond the midposition, distortion becomes excessive. When the auxiliary listen switch is in AUX LISTEN, the volume control knob is ineffective. It is also ineffective at all stations except the bomb bay, forward wheel well, and stabilizer jackscrew stations when the auxiliary listen switch is on NORMAL and the call channel is energized.

AUXILIARY LISTEN SWITCH. An auxiliary listen switch (8, figure 4-8) on each interphone panel is used to provide listening facilities at that station if the amplifier in that panel fails. This switch has NORMAL--AUX LISTEN positions, and is lockwired in the NORMAL position. If the amplifier in the panel should fail, breaking the lockwire and positioning the switch to AUX LISTEN will permit a crew member to listen to one facility at a time at that panel. If the panel has mixer switches and they are OFF, or if the panel does not have mixer switches, then the facility heard will be selected by the selector switch. If the panel has mixer switches and any of them are ON, then the facility heard will be the one associated with the farthest left mixer switch that is ON.

NOTE

The mixer switches on the interphone control panel take precedence over the auxiliary mixer switches on the auxiliary interphone panel.

MIXER SWITCHES. The mixer switches (7, figure 4-8) allow monitoring of channels essential to individual crew positions. Placing one or more mixer switches to the ON (up) position provides listening to the corresponding channel(s) simultaneously with transmission or reception on any other channel selected on the interphone selector dial. The mixer switches allow listening to the interphone system, UHF command radio, liaison radio, ECM receiver (EW officer), No. 2 UHF command (pilot, copilot, radar navigator, EW officer, instructor pilot, and instructor navigator). TACAN or omni-range radio and marker beacon (pilot, copilot, navigator, radar navigator, instructor pilot, and instructor navigator), radar warning receiver (EW officer), and rendezvous radar beacon (EW officer). The gunner has mixer switch facilities as above.

INTERPHONE (SYSTEM) POWER SWITCH. This switch (3, figure 1-10) located on the pilot's auxiliary side panel has ON--OFF positions. Operating independently of battery switches, it provides a direct connection between the batteries and interphone system. ON position provides direct battery power to the pilot's, copilot's, instructor pilot's, radar navigator's, navigator's, instructor navigator's, EW officer's, bunk, gunner's, and defense instructor's interphone facilities. In addition, when positioned to ON, direct battery power is supplied to the interphone facilities in the bomb bay, forward wheel well, and stabilizer jackscrew provided the battery switch is ON.

NOTE

This switch provides a direct connection of a portion of the interphone system to the batteries independent of the battery switch. To conserve batteries, this switch should be placed in OFF position whenever a-c power is lost or removed from the aircraft and the interphone system is not to be operated.

INTERPHONE (ALTERNATE) POWER SWITCH. A toggle switch (2, figure 4-8) having NORMAL--ALTERNATE position is located on the power switch panels at each of the following stations: pilot's, copilot's, navigator's, and gunner's. Both ALTERNATE and NORMAL positions are connected to the same 24-volt d-c power source and no alternate power is available through operation of this switch.

CALL BUTTON. A call button (11, figure 4-8) on the interphone panels at the bunk station, bomb bay, forward wheel well, and stabilizer jackscrew stations, when pressed down, is used to call all other stations on the call channel.

NOTE

> The call button cover must be removed before the button can be depressed.

TRIGGER SWITCH. A trigger switch (4, figure 4-8) on the pilot's and copilot's control wheels has three positions, INTER--OFF--MIKE, and is spring loaded to the OFF position. When the switch is held in the MIKE position, the crew member may speak through the facility selected on the interphone selector switch. When the switch is held in the INTER position, the crew member can speak on the interphone channel only. The purpose of the trigger switches is to provide the pilots with a microphone switch and a quick method for speaking on the interphone without changing the selector switch. When the interphone selector switch is in the CALL position, the trigger switch need not be actuated to speak to the crew.

FOOT SWITCH. A foot switch (6, figure 4-8) on the floor at the EW officer's, radar navigator's, navigator's, and gunner's stations is the microphone switch for the respective crew members. When the switch is depressed, the crew member may speak through the facility selected on the interphone selector switch. When the interphone selector switch is in CALL position, the foot switch need not be depressed in order to speak to the crew.

HAND SWITCH. The instructor pilot's, instructor navigator's, celestial navigation, and on aircraft 114▶ W22▶, the gunner's stations are equipped with a microphone hand switch (5, figure 4-8). When the switch is depressed, the crew member may speak through the facility selected with the interphone selector switch. Microphone hand switches are also installed in the bomb bay, forward wheel well, at the stabilizer jackscrew, and at the bunk.

Interphone System Indicators

CALL LIGHT. An amber call light (1, figure 4-8) on the power switch panel at the pilot's, copilot's and navigator's stations and also on the cabin altimeter bracket (14, figure 4-75) at the gunner's station, indicates when the call channel is energized.

Interphone System Normal Operation

WARNING

> Except when specifically cleared by the aircraft commander, all crew members must be on interphone at all times as the interphone is considered the primary means for crew warning.

To transmit or receive over any interphone facility, observe the following procedure:

1. Turn volume knob to or slightly less than its midpoint (approximately 9 to 12 o'clock position). Reception will become distorted if volume is turned too high.
2. Turn interphone selector switch to desired facility (e.g., COMM, LIA). It is necessary to hold CALL switches or buttons in position.

NOTE

> As only the pilots or EW officer can turn on or select channels on the UHF command, liaison, and omni-radios, it will be necessary for other crew members to contact these stations on interphone and request the respective set be turned to the desired channel.

3. Close mike switch to talk. The speaker will hear only his own voice unless someone else is speaking on CALL.
4. Place mixer switch(es) in ON (up) position for any channel(s) to be monitored except the channel to which the interphone selector (wafer) switch is set. Adjust radio volume for balanced reception with either the respective mixer switch ON or the interphone selector switch set to that radio, but not both. Placing both the mixer switch and the interphone selector switch to a particular channel doubles the effective volume of that channel at that interphone panel; adjusting the radio volume control with such a setting effectively cuts the volume in half at other stations, making monitoring of the radios and interphone very difficult.

Interphone System Emergency Operation

Emergency (aft) battery power is available to all interphone facilities for normal operation when the emergency battery switch is placed in EMERG position.

UHF COMMAND RADIO
AN/ARC-34 B-52C
AN/ARC-34 OR AN/ARC-133(V) B-52D

The UHF command radio provides voice and modulated code communication from aircraft to aircraft and aircraft to ground. On B-52D aircraft, the system also has secure speech communication capability. There are 1750 frequencies available in steps of one-tenth of a megacycle within the frequency range of 225.0 to 399.9 megacycles. Any 20 frequencies may be preset in any order at the control panel (figure 4-10) located on the pilots' overhead panel. If it is desired to tune a frequency other than one which has been preset, that frequency may be set manually without disturbing any of the preset channels. Receiver and transmitter tuning is automatically completed after a channel or frequency change. Both a main receiver and a preset guard receiver are provided to permit a selected frequency and the guard frequency to be received simultaneously. A No. 2 UHF command radio is installed with the control panel located on the pilots' overhead panel. The No. 2 set, however, is not connected to the UHF direction finder.

NOTE

- No transmission will be made on emergency (distress) frequency channels except for emergency purposes. For test, demonstration, or drill purposes, this radio equipment will be operated in a shielded room to prevent transmission of messages that could be construed as actual emergency messages.
- When the aircraft is equipped with ice-tread tires, radio noise is generated in the No. 1 UHF command radio during the takeoff roll and the landing roll.

Each UHF command radio has its own antenna as shown in figure 4-9. When both No. 1 and 2 radios are operated simultaneously, more efficient operation may result if the radios are tuned at least one-half megacycle apart. The No. 1 UHF command radio receives TR power through a circuit breaker marked "UHF Command" located on the aft d-c power shield. The No. 2 UHF command radio operates on TR power provided through a circuit breaker marked "UHF" Com No. 2" located on the section 41 power distribution panel. The following values of range for various aircraft altitudes are typical for the UHF command radio:

ALTITUDE (1000 FEET)	AVERAGE RANGE (NAUTICAL MILES)
50	270
40	240
30	210
20	170
10	120

KY-28 Keyer

B-52D

The KY-28 keyer is used with either AN/ARC-133(V) command radio to provide secure speech communications. Controls and indicators for the KY-28 keyer are provided on the ciphony control panel. The KY-28 keyer receives TR power through a circuit breaker marked "KY-28 Keyer" located on the pilot's circuit breaker panel.

NOTE

B-52D

- The supply of KY-28 keyers is limited; therefore, KY-28 keyers may not be installed on all aircraft.

B-52D

- The KY-28 keyer can only be used with AN/ARC-133(V) UHF command radios.

UHF Command Radio Controls

MANUAL FREQUENCY SELECTOR KNOBS. Manual frequency selector knobs (2, figure 4-10) on the UHF command radio control panel are used to set up any of the operating frequencies other than those already available on the preset channels. This does not disturb any of the preset channels. The manual-preset-guard switch must be in MANUAL position before the dial numbers above the control knobs will become visible. Each knob is turned until the proper digit appears in the window.

TONE BUTTON. The tone button (3, figure 4-10) located on the UHF command radio control panel energizes an oscillator and turns on the transmitter when depressed and held. A continuous tone is transmitted until the button is released.

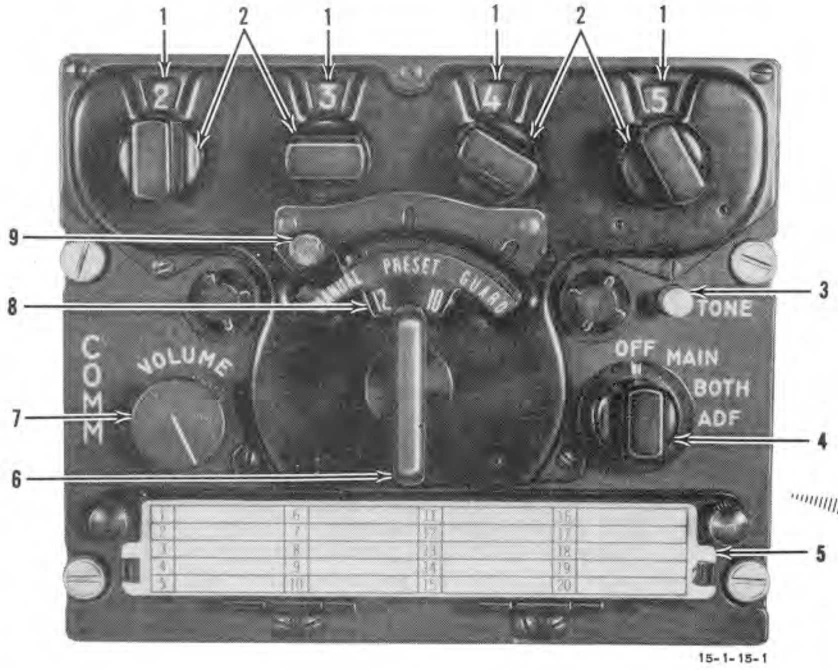
OFF-MAIN-BOTH-ADF SWITCH. A four-position rotary switch (4, figure 4-10) on the UHF radio control panel has OFF-MAIN--BOTH--ADF positions. The set is inoperative in OFF position. In MAIN position, the transmitter and main receiver are operative at the same frequency. The guard receiver is inoperative and the guard frequency can be received only if it is one of the preset channels or if it is manually set up using the manual frequency control knobs. In BOTH position, it is possible to transmit on a selected frequency and simultaneously receive the main receiver frequency and the fixed guard receiver frequency. The UHF direction finder is installed to provide bearing information on incoming UHF signals. ADF position will place the bearing indication on the pilots' radio magnetic indicator (figure 4-10).

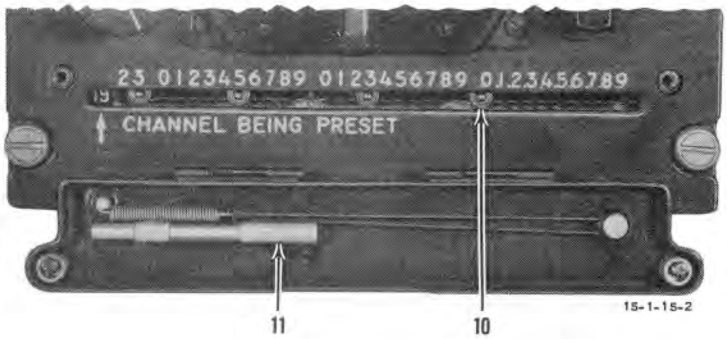
PRESET CHANNEL SELECTOR SWITCH. A rotary-type preset channel selector switch (6, figure 4-10) on the UHF radio control panel is used to select any one of 20 preset frequencies.

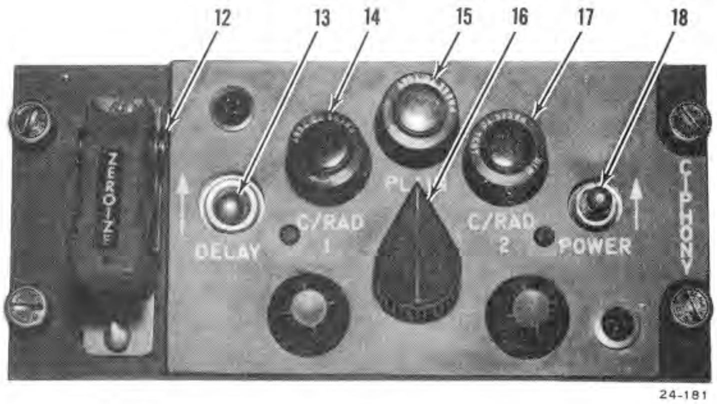
VOLUME CONTROL KNOB. A volume control knob (7, figure 4-10) on the UHF radio control panel is used to adjust the volume of both main and guard receivers. However, receiver output cannot be reduced below a fixed audible level.

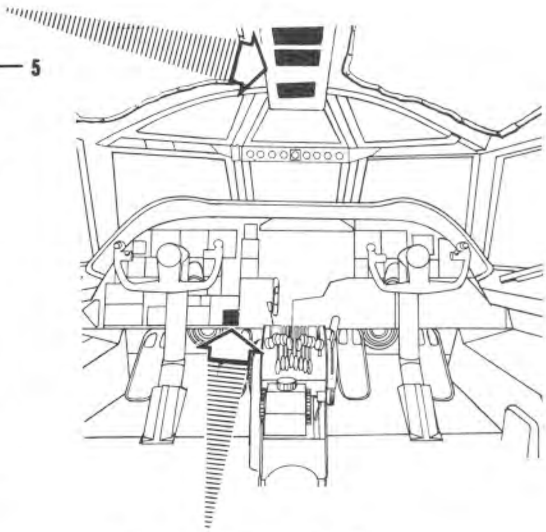
MANUAL-PRESET-GUARD SWITCH. A manual-preset-guard switch (9, figure 4-10) on the UHF radio control panel selects the method of frequency selection. In MANUAL position, the covers over the digit windows are retracted exposing the frequency numbers. The frequency can then be set using the manual frequency selector knobs. Preset channels can be checked or changed without disturbing the MANUAL operating frequency. The preset channel number is covered in this switch position and PRESET and GUARD are seen through a green window. PRESET position allows the preset channel selector to be used to select any one of 20 preset frequencies. MANUAL and GUARD are covered by a green window. In GUARD position, only the main receiver and

1. MANUAL FREQUENCY INDICATORS
2. MANUAL FREQUENCY SELECTOR KNOBS
3. TONE BUTTON
4. OFF-MAIN-BOTH-ADF SWITCH
5. PRESETTING DRUM COVER
6. PRESET CHANNEL SELECTOR SWITCH
7. VOLUME CONTROL KNOB
8. PRESET CHANNEL INDICATOR DIAL
9. MANUAL-PRESET-GUARD SWITCH
10. CHANNEL PRESETTING BUTTONS
11. FREQUENCY PRESETTING TOOL
12. ZEROIZE SWITCH
13. DELAY SWITCH
14. C/RAD 1 INDICATOR LIGHT
15. PLAIN INDICATOR LIGHT
16. MODE SELECTOR SWITCH
17. C/RAD 2 INDICATOR LIGHT
18. POWER SWITCH









RADIO MAGNETIC INDICATOR

UHF COMMAND RADIO CONTROLS AND INDICATOR

Figure 4-10.

transmitter are operative even though the off-main-both-ADF switch is set to BOTH. The guard frequency is set up prior to installing the equipment in the aircraft and can be changed only by removal of the control panel. MANUAL and PRESET can be seen through a green window.

CHANNEL PRESETTING BUTTONS. The channel presetting buttons (10, figure 4-10) on the presetting drum behind the drum cover are used for presetting channel frequencies. Each channel has four buttons and only one channel is accessible at a time. With the drum cover open, the preset channel selector is turned to rotate the presetting drum until the desired channel appears in the opening. The presetting tool then can be used to position the preset buttons under the digits corresponding to the frequency. Only the channel number appearing on the left end of the drum is used for reference when presetting.

FREQUENCY PRESETTING TOOL. A small tool (11, figure 4-10) on the back of the drum cover (5, figure 4-10) is used to position the frequency preset buttons on the preset drum. Access to the tool and preset drum is gained by opening the drum cover.

CAUTION

Do not set the preset buttons or select a frequency on MANUAL that is below 225.0 megacycles (the lowest operating frequency) as the automatic tuning mechanism cannot set up on that frequency and will hunt. If the set does not channel within 2 minutes or is shut down by a protective relay, reset to a frequency within the operating range. Turn the off-main-both-ADF switch to OFF then to BOTH and allow approximately 1 minute for the set to resume operation.

B-52D

POWER SWITCH. A two-position toggle switch (18, figure 4-10) on the ciphony control panel has ON-OFF positions. ON position provides power to the KY-28 keyer and, when selected, permits operation of the secure speech facility. OFF position removes all power from the KY-28 keyer and permits only normal operation of the UHF command radio.

B-52D

MODE SELECTOR SWITCH. A three-position rotary switch (16, figure 4-10) on the ciphony control panel has C/RAD 1--PLAIN--C/RAD 2 positions. With the KY-28 keyer installed, C/RAD 1 position provides secure speech operation with the No. 1 command radio. PLAIN position provides normal UHF command radio communications. C/RAD 2 position provides secure speech operations with the No. 2 command radio.

B-52D

DELAY SWITCH. A two-position toggle switch (13, figure 4-10) on the ciphony control panel has DELAY--OFF positions. DELAY position provides a short delay for use during secure speech operations with a relay radio. OFF position disables the delay function.

B-52D

ZEROIZE SWITCH. A two-position toggle switch (12, figure 4-10) on the ciphony control panel has ON--OFF positions. The switch is guarded and spring loaded to OFF position. ON position returns certain circuits in the KY-28 keyer to a zero condition. OFF position disables the zeroize circuits.

UHF Command Radio Indicators

MANUAL FREQUENCY INDICATORS. The manual frequency indicators (1, figure 4-10) on the UHF radio control panel consist of four windows which indicate the manual operating frequency set by the manual frequency selector knobs. The manual-preset-guard switch must be on MANUAL before the frequency numbers will appear in the windows indicating that manual selection is possible.

PRESET CHANNEL INDICATOR DIAL. An indicator dial (8, figure 4-10) indicates the channel to which the preset channel selector switch is set. The dial numbers are visible only when the manual-preset-guard switch is on PRESET.

B-52D

C/RAD 1 INDICATOR LIGHT. A green press-to-test C/RAD 1 indicator light (14, figure 4-10) is located on the ciphony control panel. When illuminated, this light indicates that the mode selector switch is positioned to C/RAD 1.

B-52D

PLAIN INDICATOR LIGHT. An amber press-to-test plain indicator light (15, figure 4-10) is located on the ciphony control panel. When illuminated, this light indicates that the mode selector switch is positioned to PLAIN position.

B-52D

C/RAD 2 INDICATOR LIGHT. A green press-to-test indicator light (17, figure 4-10) is located on the ciphony control panel. When illuminated, this light indicates that the mode selector switch is positioned to C/RAD 2.

Normal Operation

To put the set in operation on a preset command frequency and the fixed guard frequency, proceed as follows:

1. Off-Main-Both-ADF Switch - BOTH

WARNING

B-52D

Simultaneous keying of an unsecure HF or UHF transmitter is prohibited when No. 1 or 2 UHF command radio is being used for classified conversation in the same aircraft compartment or area.

NOTE

- A minimum warmup time of 1 minute that includes a 4-second tuning cycle is required before operating the command radio.
- When switching from ground power to aircraft power, the command radio off-main-both-ADF switch may have to be turned OFF then back to MAIN or BOTH to obtain proper system operation. This procedure is necessary since the master voltage oscillator circuit in the power supply may be unable to recover itself and start oscillation after momentary interruption of power.

2. Manual-Preset-Guard Switch - PRESET
3. Preset Channel Selector Switch - Set to desired channel
4. Power Switch B-52D - As desired

Position the power switch to ON when secure speech operations are desired on either UHF command radio.

5. Mode Selector Switch B-52D - As desired

Position the switch to C/RAD 1 to select secure speech communication with No. 1 UHF command radio or to C/RAD 2 to select secure speech communication with No. 2 UHF command radio. Position the switch to PLAIN to select normal UHF command radio operation.

6. Volume Control Knob - Turn clockwise to approximately the one o'clock position.

To turn the set off:

7. Off-Main-Both-ADF Switch - OFF

To select frequencies manually:

1. Off-Main-Both-ADF Switch - MAIN or BOTH
2. Manual-Preset-Guard Switch - MANUAL

Ascertain that the tabs in the frequency indicator windows have retracted, exposing the numbers.

3. Manual Frequency Selector Knobs - Set to desired frequency

NOTE

Operator should wait approximately 4 seconds for tuneup and the set will be ready for operation.

To transmit and receive on the guard frequency:

1. Off-Main-Both-ADF Switch - MAIN or BOTH
2. Manual-Preset-Guard Switch - GUARD

Emergency Operation

If the set fails to tune properly, the difficulty often can be corrected by switching to a different channel or trying either of the two remaining positions on the manual-preset-guard switch. If this fails, turn the set off for a few minutes and try again.

UHF Direction Finder AN/ARA-25

The UHF direction finder is used with the UHF command set to determine the bearing of incoming UHF signals as a navigational aid. It is operated from the UHF command control panel (figure 4-10) on the pilots' overhead panel. Incoming UHF signals will be relayed to the pilot's radio magnetic indicator when the control knob on the UHF control panel is on ADF.

RADIO MAGNETIC INDICATOR. The radio magnetic indicator (figure 4-10) has a rotating dial and two indicator needles numbered 1 and 2. The dial is slaved to the N-1 compass system and the heading read under the index mark at the top of the dial is the same as that shown by the heading pointer on the N-1 compass master indicator. Needle No. 1 indicates the bearing of the station to which the ARC-34 command receiver is tuned, as determined by the ARA-25 direction finder. Needle No. 2 is slaved to needle No. 1.

NOTE

Bearings indicated by needle No. 1 and aircraft headings indicated by the dial will be related to magnetic north or gyro north depending on whether the N-1 compass system is in magnetic or gyro operation.

LIAISON RADIO AN/ARC-65

This radio provides long range voice communication from plane-to-plane and plane-to-ground in the high frequency range. The radio operates over a frequency range of from 2 to 23.995 megacycles in 500-cycle steps, giving a total of 44,000 available frequencies. The set includes control panels (figure 4-11) for both the pilot and EW officer and uses both

TR power and 118-volt single-phase a-c power for operation. Power and control circuit breakers are marked "AC" and "DC" on the "AN/ARC21X" portion of the gunner's circuit breaker panel. To turn the radio on, position the control switch on either panel to ON. To turn the set off, reposition the control switch to OFF.

NOTE

- No transmission will be made on emergency (distress) frequency channels except for emergency purposes. For test, demonstration, or drill purposes, this radio equipment will be operated in a shielded room to prevent transmission of messages that could be construed as actual emergency messages.
- Either the pilot or EW officer can interrupt the other's transmission simply by placing the respective control switch to ON position.

Liaison Radio Controls (ARC-65)

LIAISON RADIO CONTROL KNOB. A two-position ON--OFF rotary switch (2, figure 4-11) on both liaison radio control panels is used to turn the equipment on and also to secure control of the equipment.

VOLUME CONTROL KNOB. A volume control knob (1, figure 4-11) on both liaison radio control panels provides a means of adjusting the audio output during voice operation and signal sensitivity during CW operation from the liaison radio to the interphone system.

CHANNEL SELECTOR SWITCH. A channel selector switch (5, figure 4-11) on both liaison radio control panels has channel positions numbered from 1 to 20, providing selection of any of the preset channel frequencies.

POWER SWITCH. A power switch (6, figure 4-11) on the EW officer's liaison radio control panel has HI--LOW positions to provide a means for selecting the power output in a 10 to 1 ratio. HI position is provided for use in making maximum range transmissions and LOW position for short range transmissions.

NOISE CONTROL KNOB. A control knob (7, figure 4-11) marked "Noise" located on both liaison radio control panels allows adjustment of the background noise level of the receiver for best voice reception.

PRESETTING DRUMS. Two drums (4, figure 4-11) on the EW officer's liaison radio control panel provide means for manually presetting the frequency of each channel to be selected by the channel selector switch. Each drum is protected by a hinged cover. A special presetting tool is stowed inside the top drum cover which also contains a card for recording the preset frequencies.

CW TUNING KNOB. A CW tuning knob (3, figure 4-11) on the EW officer's liaison radio control panel is used to adjust the CW beat frequency.

EW OFFICER'S LIAISON OPERATION SELECTOR SWITCH. An operation selector switch (8, figure 4-11) on the EW officer's liaison radio control panel has AME--CW--SSB--FSK positions. AME position places the liaison radio in equivalent amplitude modulation operation for voice communication with stations not equipped for single sideband operation. CW position provides for continuous wave communication with a 7-kilocycle band width. SSB position places the liaison radio in single sideband voice operation. The FSK position is provided for teletypewriter operation; this equipment, however, is not installed in the aircraft.

PILOT'S LIAISON OPERATION SELECTOR SWITCH. A pilot's operation selector switch (9, figure 4-11) located on the pilot's liaison radio control panel has SSB--AME positions. SSB position places the liaison radio in a single sideband voice operation. AME position places the liaison radio in equivalent amplitude modulation operation for voice communication with stations not equipped for single sideband operation.

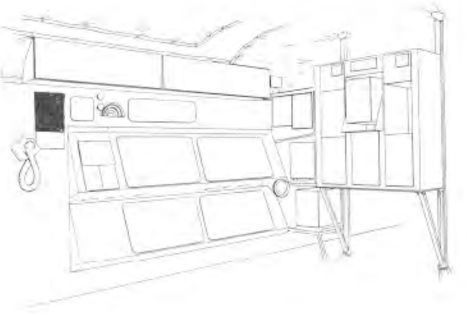
Normal Operation of ARC-65 Liaison Radio

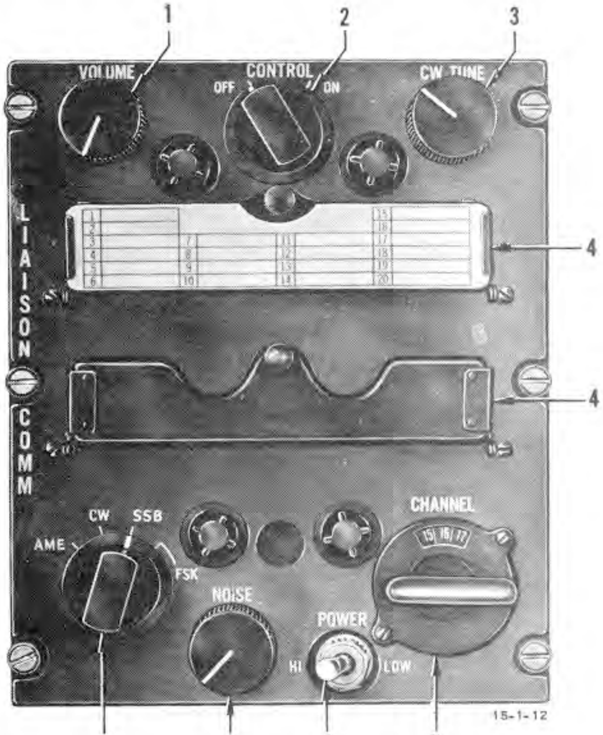
CAUTION

Operating the ARC-65 during periods of abnormally high voltage or fluctuating power will decrease the operational life of the equipment and can cause material failure.

FREQUENCY PRESETTING. The frequency presetting operation is accomplished on the master control panel with the equipment turned off. Presetting is normally done before flight but may be done in flight if necessary and is accomplished as follows:

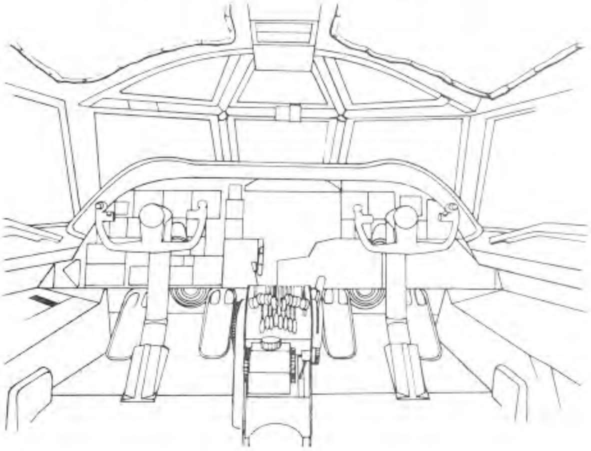
1. Loosen two screws holding drum covers in position and open covers.
2. Remove presetting tool from clip inside top drum cover.
3. Rotate channel selector switch until number of channel to be preset appears at left end of selector drum.
4. Using the presetting tool, move four buttons, one at a time, to a position under the respective numbers sliding socket end of tool over buttons and moving them along the drum to coincide with the desired numbers.

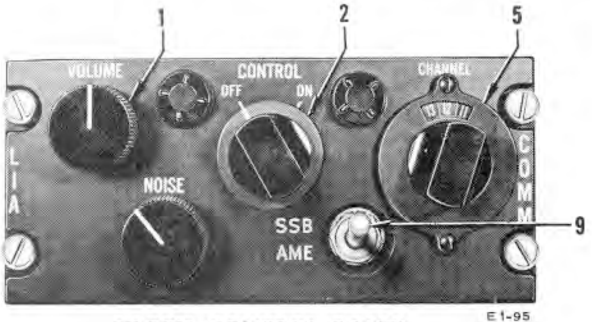




EW OFFICER'S CONTROL PANEL

1. VOLUME CONTROL KNOB
2. LIAISON RADIO CONTROL KNOB
3. CW TUNING KNOB
4. PRESETTING DRUMS
5. CHANNEL SELECTOR SWITCH
6. POWER SWITCH
7. NOISE CONTROL KNOB
8. LIAISON OPERATION SELECTOR SWITCH
9. PILOT'S LIAISON OPERATION SELECTOR SWITCH





PILOT'S CONTROL PANEL

(AN/ARC-65)

LIAISON RADIO CONTROLS

Figure 4-11.

5. Move top drum left button to coincide with the figure representing thousands of kilocycles.
6. Move top drum right button to coincide with the figure representing hundreds of kilocycles.
7. Move bottom drum left button to coincide with the figure representing tens of kilocycles.
8. Move bottom drum right button to coincide with the figure representing units and halves of kilocycles.
9. Record the frequency adjacent to the applicable channel number on the card mounted on the top drum cover.
10. Turn channel selector switch to next channel number to be preset and repeat steps "4" thru "9." Preset remaining channels in the same manner.
11. Close drum covers and tighten screws.

NOTE

If the drum cover doors on the master control panel are not securely closed, a door interlock switch will remain open and prevent operation of the liaison radio.

VOICE COMMUNICATION. Liaison radio voice communication can be accomplished as follows:

1. Place interphone selector switch in LIA to receive and transmit liaison radio signals.
2. Place liaison radio control knob to ON.

NOTE

A 40-second warmup period is required. The first 30 seconds allow for tube warmup and the remaining 10 seconds allow for automatic tuning. If automatic tuning is not accomplished in the normal 40-second period, the control switch will go to OFF and must be returned to the ON position.

CAUTION

Do not hold liaison radio control knob to ON position.

3. Turn channel selector switch to desired frequency and rock the knob slightly to feel the switch click into its seat. The channel in use will be shown in the center of the selector window.
4. Rotate liaison operation selector switch to the desired position.
5. Place power switch in HI or LOW. Operate transmitter in LOW power except when necessary to use HIGH power to insure communications.

NOTE

Should the air pressure within the equipment be reduced by leakage, an aneroid switch will automatically shift the set to low power to reduce the possibility of electrical arcing within the equipment. No indication is given when this occurs.

6. Momentarily depress mike switch to initiate the transmit tune cycle. Completion of the transmit tune cycle is indicated by the return of the receiver background noise. The transmitter is now ready for transmission. Adjust volume control for proper audio level and noise control for a slight background noise in absence of signals. A sidetone will be heard in the headset when talking if the transmitter is on the air.
7. Turn set off by rotating the liaison radio control knob on the panel to OFF.

Emergency Operation of ARC-65 Liaison Radio

When a frequency selection cycle is not completed in the normal time interval causing the liaison radio control knob to return to OFF position, a second try on another channel is recommended. If tuning is normal, return to the initially selected channel. Malfunction within the equipment is indicated by the control knob moving to OFF position. If damage to the equipment is less important than getting the message through, transmission or reception can be resumed by holding the knob in ON position. If no sidetone is heard when attempting to transmit, the transmitter is not on the air.

TACAN RADIO AN/ARN-21

The AN/ARN-21 TACAN (Tactical Air Navigation) radio is provided to operate in conjunction with the AN/URN-3 surface navigation beacons. The TACAN radio and beacons form a radio navigation system which enables the aircraft to obtain continuous indications of its range and bearing to any selected surface beacon located within a line-of-sight distance from the aircraft up to 195 nautical miles. Bearing and range information is displayed on the horizontal situation indicator (HSI) located on the pilots' instrument panel (figure 4-27). The receiver-transmitter of the TACAN radio initiates the interrogation process by radiating pulse signals. These signals, known as distance interrogation pulses, are detected at the particular beacon installation to which the TACAN radio is tuned, causing the beacon to respond with its own transmitted pulses. These response pulses are received by the receiver portion of the TACAN radio and are converted into a range indication which is displayed on the range indicator of the HSI. In addition, the beacon transmits a continuous reference signal which can be received by the TACAN radio any time the receiver portion is in operation. This reference signal is displayed as a bearing indication on the HSI. Bearing information may be received even though interrogation pulses are not being transmitted by the TACAN radio. Each beacon may be identified by a tone identification signal in International Morse Code. Placing the TACAN

-ODR (VHF Omnidirectional Range) marker mixer switch to ON position provides the tone identification signal in the crew member's headset. The TACAN control panel is located on the pilot's side panel. The system is supplied 118-volt single-phase a-c power through a circuit breaker marked "AN/ARN-21 AC" located on the pilots' circuit breaker panel. A circuit breaker marked "AN/ARN-21 DC" located next to the a-c circuit breaker provides d-c power for the system.

TACAN Radio Controls

NAV MODE SELECT SWITCH. A nav mode select switch (20, figure 4-27) is located on the navigation system select panel. The rotary switch has TACAN--VOR--ILS--ILS APP positions. In TACAN position the TACAN system may be placed in operation in the normal manner as outlined under "Normal Operation of TACAN Radio." For VOR-ILS-ILS APP positions see "Flight Director System Controls," this section.

TACAN CHANNEL SELECTOR SWITCH. A TACAN channel selector switch marked "Channel" located on the TACAN radio control panel (1, figure 4-26) provides a means by which the desired navigation beacon channel may be selected. Combinations of dial settings can be made from 00 to 129; however, the equipment only operates on channels 01 to 126, a total of 126 channels.

CAUTION

No attempt should be made at any time to set the channel selector switch below channel 01 or above channel 126.

OFF-REC-T/R SWITCH. A three-position rotary switch located on the TACAN radio control panel (2, figure 4-26) has OFF--REC--T/R positions. In OFF position, the system is inoperative. In REC position, only the receiver portion of the receiver-transmitter is placed in operation. When in this position, only bearing information is furnished by the TACAN system. In T/R position, the TACAN radio interrogates the ground beacon and receives a reply signal which incorporates both range and bearing information.

VOLUME CONTROL KNOB. A volume control knob (3, figure 4-26) marked "Vol" located on the TACAN control panel is used to adjust the volume of the audio identification signal received from the beacon through the headset.

TACAN Radio Indicators

HORIZONTAL SITUATION INDICATOR (HSI). The horizontal situation indicators (figure 4-27) located on the pilots' instrument panel provide range, bearing, and selected course deviation indications of the AN/URN-3 beacon to which the system is tuned. Distance in nautical miles is provided by the range indicator (1, figure 4-27). Magnetic bearing is provided by the bearing pointer (3, figure 4-27). Deviation from a selected course is provided by the course deviation indicator (12, figure 4-27).

Normal Operation of TACAN Radio

The following procedure is used to place the TACAN system in operation:

1. Place nav mode select switch to TACAN position.
2. Select desired beacon channel by setting the channel selector switch.
3. Place OFF-REC-T/R switch to REC or T/R position as desired. After closure of the thermal delay relay allowing warmup, equipment should be operational.

CAUTION

When outside the effective range of the station, as indicated by the DME range indicators rotating continuously, the OFF-REC-T/R switch will be placed in REC or OFF position to prevent damage to the DME.

4. Identification of the selected beacon is accomplished by listening to the call letters of the beacon in International Morse Code over the interphone system by placing the TACAN-ODR (VHF Omnidirectional Range) marker mixer switch to ON position. Adjust volume of audio signal with the TACAN volume control.

NOTE

Occasionally, TACAN equipment will "lock-on" a false bearing which will be 40° or a multiple of 40° in error. These errors can be on either side of the correct bearing. The possibility of this error is inherent in the TACAN system and can only be avoided by use of other navigation equipment in addition to the TACAN. This false lock-on does not affect the DME display.

5. When the TACAN is first turned on or channels have been switched, check for proper lock-on as follows:

   a. Cross-check for false lock-on with ground radar, airborne radar, VOR, dead reckoning, or other available means.

b. If a false lock-on is suspected, switch to another channel, check it for correct bearing, and then switch back to the desired channel.

c. Check for correct lock-on.

d. If false lock-on is still suspected, turn the set off, then back on.

e. Recheck for correct lock-on.

f. If false lock-on persists, turn the set off and utilize other available navigation equipment.

6. To turn the TACAN system off, place the OFF-REC-T/R switch to OFF position.

Integrated TACAN Omni-Range Operation

1. Nav mode select switch in TACAN position:

a. With TACAN OFF-REC-T/R switch in T/R and omni-range power switch in OFF position, bearing and range to the selected TACAN beacon will be indicated on the HSI, and the course deviation indicator (CDI) on the HSI will indicate deviation from the selected course to the TACAN beacon. (If the TACAN system goes into search, the CDI will go to the null or zero position and remain until TACAN once again locks onto the station.)

b. With TACAN OFF-REC-T/R switch in T/R, the omni-range power switch in ON position, and the set tuned to an ILS frequency, the HSI will indicate bearing and range to the TACAN beacon and deviation from the selected course to the TACAN beacon (except for zero position during TACAN search).

NOTE

In TACAN mode of operation, the TACAN radio AN/ARN-21 28-volt d-c circuit breaker also provides power for relay switching the course deviation indicator warning flag and course warning flag functions. Should this circuit breaker pop out, control of the warning flags reverts to VOR regardless of the position of the nav mode select switch. In TACAN mode, when the TACAN radio is inoperative due to this circuit breaker being out, the warning flags will remain out of sight if the VOR is receiving a reliable signal. However, the appearance of the TACAN range indicator warning flag and loss of TACAN aural signal are available indications of loss of TACAN.

WARNING

- In TACAN mode, loss of TACAN radio will not always be indicated by the course deviation indicator warning flag and course warning flag. Cross-checking of all available indicators is essential.
- If TACAN is being used for an approach and the range indicator warning flag comes into view, the approach should be abandoned and changed to a reliable instrument approach system.

2. Nav mode select switch in VOR position:

a. With TACAN OFF-REC-T/R switch in T/R and omni-range power switch in OFF position, the HSI will provide range to the TACAN beacon only.

b. With TACAN OFF-REC-T/R switch in T/R and omni-range power switch in ON position, the HSI will indicate omni bearing and TACAN range. The CDI of the HSI will respond to the omni station except when an ILS station is selected, then the CDI will provide localizer information.

NOTE

With autopilot energized and engaged, the localizer switch cannot be engaged as long as the nav mode select switch is in TACAN or VOR position.

Emergency Operation of TACAN Radio

If the transmitter or range unit of the TACAN system becomes faulty, satisfactory beacon bearing information may be obtained by placing the OFF-REC-T/R switch to REC position. If satisfactory range and bearing indications are not available on a particular channel, switch to another channel known to be on the air within the 195-mile range (if such a channel is available). If satisfactory range and bearing indications are received for the alternate channel and the proper code signals are heard, it may be assumed the TACAN radio is operating properly. Once the equipment has been checked on an alternate channel, the operator should return to his original channel to assure himself that the faulty indication was not the result of a temporary pause in beacon transmission or a temporary obstruction between the aircraft and beacon which prevented proper reception. If a second attempt fails to provide bearing and range information on the original channel, either select an alternate channel for navigation purposes or employ other navigational means.

OMNI RANGE RADIO AN/ARN-14

The omni-range radio provides a very high frequency receiver for navigation over land and for runway localizer instrument approaches. The omni-range radio includes a receiver, a control panel on the pilots' overhead panel, and shares an HSI (figure 4-27) with the TACAN system. The above instruments are all on the pilots' instrument panel. The omni-range radio uses TR power for both control and operation of a dynamotor through a circuit breaker marked "Dynamotor" on the "AN/ARN-14" portion of the gunner's circuit breaker panel. To start the omni-range radio, position the power switch to ON. To turn off the omni-range radio, position the switch to OFF. For additional information on the indicators, see "Instrument Landing System Indicators," this section.

GLIDE SLOPE EQUIPMENT AN/ARN-18

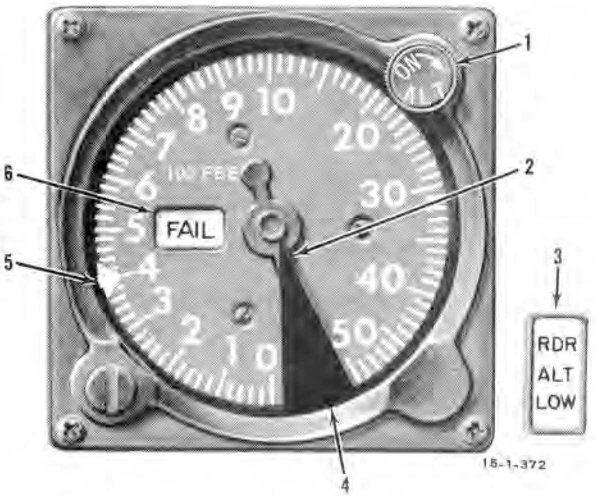
This equipment indicates glide angle of the aircraft with relation to the runway for instrument approach. The controls and indicators are common to the omni-range radio. A glide slope indicator on the attitude-director indicator (1, figure 1-48) indicates aircraft position relative to a glide slope beam. A warning flag on the left side of the indicator moves out of sight when a glide slope signal is being received. The equipment operates on TR power through a circuit breaker marked "Glide Path DC" and 118-volt single-phase a-c power through a circuit breaker marked "Glide Path AC." Both circuit breakers are on the "Flight Indicators" portion of the pilot's circuit breaker panel. To start the glide slope equipment, position the omni-range radio power switch to ON and, to cease operation, position the switch OFF.

MARKER BEACON RECEIVER AN/ARN-12 54▶138 W1▶W27 AN/ARN-32 139▶ W28▶

This receiver, located in the gunner's compartment, is used both as a navigational and as a landing aid. When flying over a beacon, a signal is heard on the interphone and observed as a light illumination just above each HSI (7, figure 1-15). Power is received through the omni-range radio dynamotor. For circuit breaker information, see "Omni-Range AN/ARN-14," this section.

RADAR ALTIMETER AN/APN-150

A Type AN/APN-150 radar altimeter (figure 4-12) is located on both sides of the pilots' forward instrument panel (14, figure 1-15). The instrument provides for measuring absolute altitude from 0 to 5000 feet. An altitude indicator needle (2, figure 4-12) indicates altitude from 0 to 1000 feet in 20-foot increments and from 1000 to 5000 feet in 100-foot increments. When power is not being supplied to the radar altimeter system, the altitude indicator needle disappears behind a black mask (4, figure 4-12) painted on the indicator cover glass. When the altitude indicator needle is in this position, an internal mechanical linkage positions a red function flag (6, figure 4-12) on the indicator face to FAIL. This action is also prevalent when system power is on and the aircraft absolute altitude is above 5000 feet. When the aircraft absolute altitude is below 5000 feet and power is on, the indicator needle will point to the respective altitude and the function flag will show ON. An adjustable index or cursor (5, figure 4-12) is provided on the circumference of the indicator dial. This index can be manually set between indicator altitudes of 0 and 5000 feet and serves as a reference point to the altitude indicator needle when the system is in operation. The radar altimeter has a single operating control knob (1, figure 4-12) located on the upper right corner of the instrument and marked ON-ALT. The ON-ALT control knob turns the system on and off and also provides a means of setting the cursor at any desired altitude. A barometric pressure switch is incorporated to control the on-off function of the radar altimeter at 30,000 feet pressure altitude. Above 30,000 feet, power is removed from the system except for warmup power supplied to the klystron filament. Below 30,000 feet, power is supplied to the system and the radar altimeter will indicate accurate altitude (between 0 and 5000 feet absolute) within 45 seconds. The radar altimeter system is provided aft TR power through a circuit breaker marked "Radar Altimeter" in the aft d-c power box and 118-volt a-c power through a circuit breaker marked "Radar Altimeter" in the aft a-c power box.



1. ON-ALT CONTROL KNOB
2. ALTITUDE INDICATOR NEEDLE (BEHIND MASK)
3. RADAR ALTIMETER CAUTION LIGHT (TYPICAL)
4. MASK
5. CURSOR
6. FAIL/ON FUNCTION FLAG

RADAR ALTIMETER

Figure 4-12.

An amber press-to-test radar altimeter caution light (3, figure 4-12) is located adjacent to each pilot's radar altimeter. Each caution light illuminates when its associated radar altimeter indicated altitude is below the altitude at which its cursor is set. The radar altimeter caution light receives aft TR power through a circuit breaker marked "Radar Altimeter" in the aft d-c power box.

WARNING

- The radar altimeter FAIL/ON function (warning) flag does not indicate all failures of this system.
- Over rough terrain, the radar altimeter has been observed to indicate the crossing clearance as much as 30% higher than actual clearance.

NOTE

- At terrain clearance altitudes above 5000 feet, the altimeter may accomplish lock-on. In this event, the function flag will indicate ON and the indicator needle will move from behind the mask to a false altitude. Movement of the indicator needle may be opposite to movement of the aircraft as it changes altitude. Ignore all altimeter readings when the aircraft is more than 5000 feet above terrain. The radar altimeter should remain on during the entire flight even though fluctuation of the FAIL/ON function flag and intermittent reappearance of the altitude indicator needle above 5000 feet may prove distracting to the pilot. This is due to the fact that if the system is turned off for a period of time and then turned on just prior to a rapid descent, an insufficient warmup period could seriously impair the accuracy of the system.
- When the radar altimeter is operated on the ground and the aircraft is parked or during taxiing, takeoffs, and landings, the altimeter may not maintain a continuous ground lock-on. This results from the multiple bounce paths between the system transmitting and receiving antennas during operation in close proximity to the ground. After takeoff, the radar altimeter should regain lock-on within 1 minute and will then indicate the proper altitude. Also, when on the ground and in the vicinity of reflective objects, the altimeter may lock on returns from these objects and indicate an erroneous altitude. This condition is a normal function of the altimeter.

Normal Operation of Radar Altimeter

The radar altimeter is to be used in conjunction with the terrain avoidance system and will be included in the pilot's normal instrument scanning pattern for a continuous cross-check with other terrain clearance information. The following procedure is used to place the radar altimeter in operation and may be accomplished in one continuous action.

NOTE

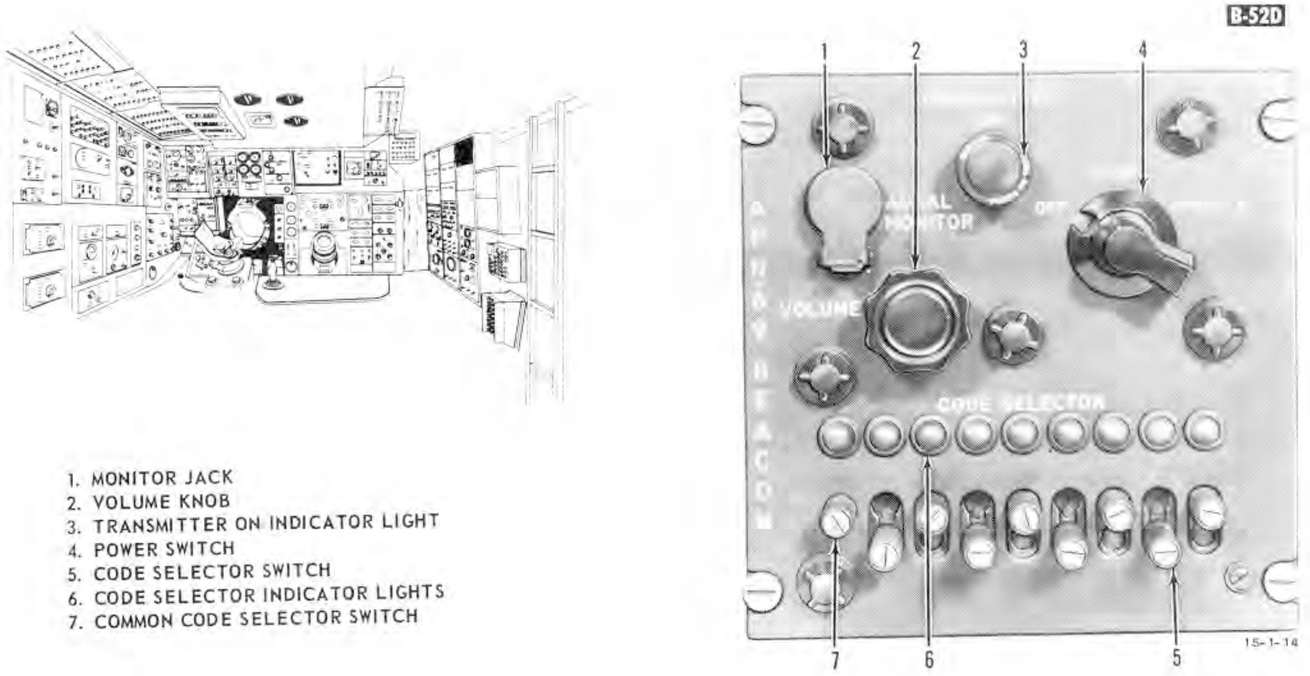
The copilot has no control of system turn-on. However, by rotating the ON-ALT knob, he may set the cursor on his indicator to any desired altitude.

1. Rotate ON-ALT knob to its limit stop in the counterclockwise direction.
2. Rotate ON-ALT knob approximately 8° in the clockwise direction or enough to move the curson to an indication between 0 and 5000 feet. This will supply power to the system.
3. Allow approximately 2 minutes for warmup and for the system to search for and lock on a return signal from the ground. At the end of this period, the following will occur:
    a. The altitude indicator needle will appear from under the mask and rotate in a counterclockwise direction toward 0 feet altitude. Full tracking from 5000 to 0 feet will take approximately 12 seconds.
    b. With the appearance of the altitude indicator needle, the red FAIL flag will be removed from view on the instrument face and be replaced by the system ON flag.
4. Check caution light operation by adjusting the pilot's cursor to an altitude greater than indicated by pointer. Pilot's caution light should illuminate. Repeat for copilot's instrument.
5. To turn system off, rotate ON-ALT knob counterclockwise to its limit stop.

RENDEZVOUS RADAR AN/APN-69

B-52D

The APN-69 radar is used for air refueling rendezvous. The set includes a receiver, transmitter, and a control panel (figure 4-13) which is located at the navigator's station. The beacon responds automatically when interrogated by the APN-59 (KC-135), or APS-108, ASB-4A, ASB-16, or ASB-9A (B-52) search radars, providing range and bearing information for the interrogating aircraft to "home" on the beacon signal. Transmissions are coded to permit positive identification between aircraft. The set operates on TR and 118-volt single-phase a-c power through circuit breakers marked "Rendezvous Beacon" on the ECM circuit breaker panel.



RENDEZVOUS RADAR CONTROL PANEL

Figure 4-13.

Rendezvous Radar Controls

B-52D

POWER SWITCH. A rotary-type power switch (4, figure 4-13) on the rendezvous radar control panel has OFF--STDBY--OPERATE positions. STDBY position supplies power to all system circuit except the high voltage circuits. OPERATE position completely energizes the system provided a 3-minute warmup period is observed after turning to STDBY. OFF position removes all power from the set.

B-52D

CODE SELECTOR SWITCH. Eight code selector slide switches (5, figure 4-13) on the rendezvous radar control panel are used to set up the code combinations in the response transmission. The code element corresponding to an individual switch can be included in the reply by pulling out on the spring-loaded knob and sliding the switch to ON (up) position.

B-52D

COMMON CODE SELECTOR SWITCH. A common code selector switch (7, figure 4-13) on the rendezvous radar control panel which corresponds to the first code element is stationary. This code element is common to all code combinations.

B-52D

VOLUME KNOB. A volume knob (2, figure 4-13) on the rendezvous radar control panel is used to adjust the audio signal level when monitoring the set over the interphone. See figure 4-8 for proper mixer toggle switch selection.

B-52D

MONITOR JACK. A jack (1, figure 4-13) on the rendezvous radar control panel is used for test purposes. When a headset is connected to the jack, random noises (or periodic triggering of the system) may be heard and is indicative of set operation.

Rendezvous Radar Indicators

B-52D

TRANSMITTER ON INDICATOR LIGHT. A green indicator light (3, figure 4-13) on the rendezvous radar control panel illuminates when high voltage has been applied to the transmitter and indicates that the set is ready for operation.

B-52D

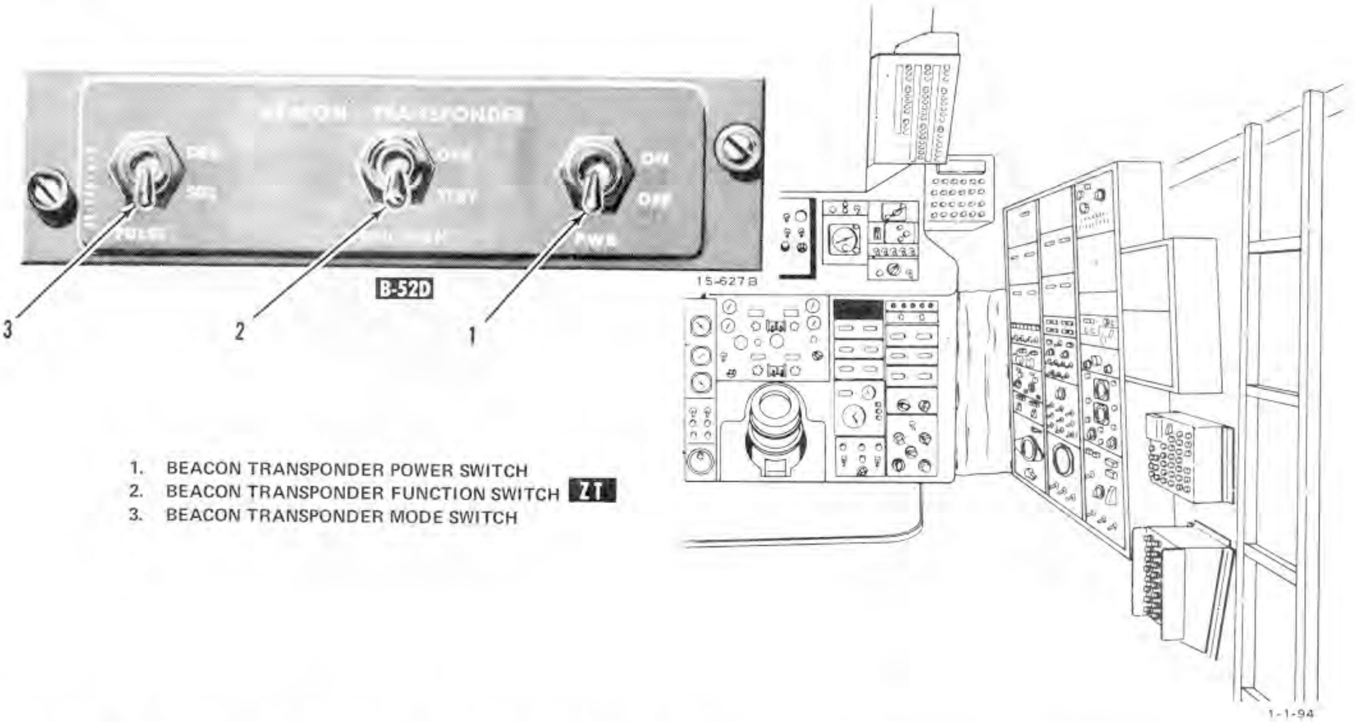
CODE SELECTOR INDICATOR LIGHTS. Nine indicator lights (6, figure 4-13) on the rendezvous radar control panel indicate when the respective code element is included in the radar response.

Normal Operation of Rendezvous Radar

B-52D

The following procedure is used to place the rendezvous radar in operation:

1. Place power switch to STDBY.
2. Allow approximately 3 minutes for warmup and place power switch to OPERATE. After the warmup period, the transmitter-on light will come on indicating that the set is ready for automatic operation and will reply to interrogating pulses of the proper characteristics.



BEACON TRANSPONDER CONTROL PANEL B-52D

Figure 4-13A.

3. Select code. As an example of a 3-2 code, the first (which is stationary and common to all code combinations), second, third, fifth, and sixth code selector switches would be in up (ON) position; all other code selector switches would be in down (OFF) position. Do not insert more than six code elements, including the stationary element, at one time.
4. Operation of the rendezvous radar may be monitored over the interphone by placing the proper interphone mixer switch to ON position.
5. If it is desired to discontinue operation temporarily, place power switch to STDBY. In this manner, the equipment is kept ready for immediate use.
6. To deenergize the equipment, reset code selector switches to down position and place power switch to OFF.

BEACON TRANSPONDER SST-181X

B-52D

The beacon transponder installation consists of the SST-181X transponder, an antenna (AS21A/APN-69), and a control panel. The transponder and antenna are located on the fuselage bottom centerline aft of the rear MLG well. Upon application of power, the transponder will respond automatically to any compatible X-band trigger. The SST-181X beacon transponder operates on the same TR frequencies as the APN-69 rendezvous radar transponder. The APN-69 power switch should be in STDBY position, the optional bombing switch in AN/ASQ-48 NORMAL position, and ECM/BNS transmissions avoided on beacon frequencies whenever SST-181X operation is required. The SST-181X beacon transponder is supplied TR power through a circuit breaker marked "Beacon Transponder" located on the "Miscellaneous" portion of the radar navigator's circuit breaker panel. The transponder triggering mode may be manually selected from a control panel toggle switch to respond to either a single-pulse or double-pulse interrogation.

Beacon Transponder Controls

B-52D

BEACON TRANSPONDER POWER SWITCH. An unmarked two-position switch located on the right side of the beacon transponder control panel (1, figure 4-13A) at the navigator's station has ON--OFF positions. ON position provides transponder operating power and 28-volt d-c control power to the beacon transponder mode (pulse) switch. A 2-minute warm-up period is required for stable operation. OFF position removes all system power.

B-52D

BEACON TRANSPONDER MODE (PULSE) SWITCH. An unmarked two-position switch located on the left side of the beacon transponder control panel (3, figure 4-13A) at the navigator's station has DOUBLE PULSE--SINGLE PULSE positions. DOUBLE PULSE position selects a transponder operating mode which responds to double-pulse interrogation only. SINGLE PULSE position furnishes 28-volt dc from the ON position of the power switch for operation of a relay. Transponder response is limited to a single-pulse interrogation when the relay is closed.

BEACON TRANSPONDER FUNCTION SWITCH. This switch (2, figure 4-13A) is located in the center of the beacon transponder control panel, has OPR-STBY positions, and provides standby function for the transponder. With the power switch ON, the function switch permits selection of either standby or operate function of the beacon transponder. STBY position places the transponder in standby, which prevents reception of interrogating pulses while providing power to maintain the magnetron at operating temperature. OPR position provides normal transponder operation.

NOTE

B-52D

The code name "Sky Spot" has been established to refer to the SST-181X beacon transponder employment tactic for use in lieu of "beacon transponder" in the checklist procedures. The beacon transponder power switch is identified as the "Sky Spot Power Switch," the beacon transponder mode (pulse) switch is identified as the "Sky Spot Mode Switch," and the beacon transponder function switch is identified as the "Sky Spot Function Switch" in the "Sky Spot Tactic (Conventional Munitions)" procedures checklist.

SIF/IFF TRANSPONDER SET KY-95A/APX-25 Less ZV

The transponder set KY-95A/APX-25 installed on the aircraft consists of basic Mark X IFF system equipment with additional components which enable it to operate as a selective identification feature (SIF) system. This transponder set, with controls on the pilot's side panel (11 and 12, figure 1-10), is an airborne transponder-interrogator set which forms a two-way link between the aircraft and ground IFF recognition installations. The ground interrogator station sends a special signal which is received by the aircraft; the aircraft transponder (replay system) then replies by sending a signal which is received on the ground and displayed as a unique signal on the scope. The ground controller may use any of three special interrogations which are known as mode 1, 2, and 3. The aircraft transponder can reply to any of the modes of interrogation received from the ground station as well as transmit a special emergency reply consisting of either a mode 1 reply with a single pulse, a mode 2 reply represented by a pair of pulses spaced 16 microseconds apart, or a mode 3 reply appearing as a single pulse which is identical to the mode 1 reply. The fourth reply capability of the airborne transponder is transmitted in place of the normal mode 1, 2, and 3 reply and is known as the emergency reply. This signal appears on ground interrogation as four pulses spaced 16 microseconds apart and has the capability of appearing in any or all of the three modes. The transponder set also has an "identification of position" feature by the use of I/P-OUT-MIC switch. The principal units of the transponder set are a pulse-type receiver-transmitter, with a separately housed coder, connected to a common omni-directional receiving and transmitting antenna. The transponder set control (figure 4-14) permits turning the equipment on and selecting the various modes of operation. The coder group control (figure 4-14) permits selection of reply codes (generated in the coder) to two modes of operation. Switches on the coder permit selection of the reply code to the third mode. The IFF radio receiver-transmitter contains circuits which enable it to receive and properly decode coded interrogation pulse-pairs, depending upon the mode of operation selected, and to transmit various coded replies modulated either from its own reply-pulse generator or from the coder unit. The transponder set coder, triggered by the decoded pulse from the receiver-transmitter, generates a train of pulses with a variable interval and number depending upon the reply code selected. The reply code is returned to modulate the transmitter of the receiver-transmitter. The power requirements are as follows: The transponder set control and the coder group control require TR power; the operating units, receiver-transmitter, and coder require 118-volt single-phase a-c power. Power is supplied through circuit breakers marked "AC" and "DC" on the "IFF" portion of the section 41 power distribution circuit breaker panel. The antenna (9, figure 4-9) is installed on the centerline on the underside of the aircraft just forward of the entrance hatch.

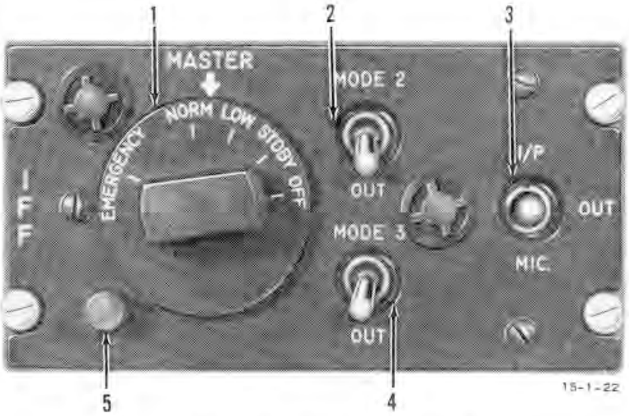
SIF/IFF Transponder Set Controls Less ZV

MASTER SELECTOR SWITCH. The master selector switch on the transponder set control (1, figure 4--14) is a dial-type selector having OFF--STDBY--LOW--NORM--EMERGENCY positions. In OFF position, all power is removed from the set. In STDBY position, power is applied to the tubes for warmup. The warmup period should be at least 1 minute. In LOW position, the set is operating at a partially sensitive performance. In NORM position, the set is operating at maximum sensitive performance. In EMERGENCY position, the set is operating at full sensitivity for responses to mode 1 interrogations with four successive groups of mode 1 reply code trains. Due to FAA requirements and SAGE equipment limitations, emergency aircraft transmissions will not normally be seen in the SAGE environment. In order to insure emergency recognition by these agencies, the following actions must be taken: the master switch on the transponder set control must be in EMERGENCY position, the Mode 3 toggle switch "In," and Mode 3 code selector to 77. The master control switch must be in LOW, NORM, or EMERGENCY position for operation in mode 1. The master control switch must also be in one of the operating positions before activating the mode 2 or mode 3 switches. A detent button (5, figure 4-14) must be pressed before the dial can be turned to the EMERGENCY position.

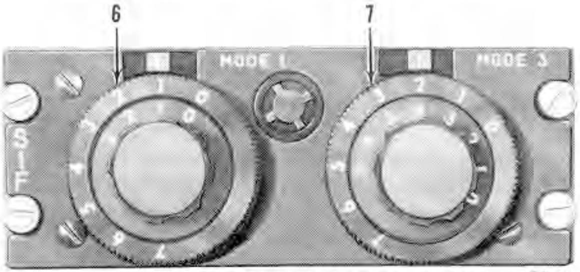
I/P-OUT-MIC SWITCH. The I/P-OUT-MIC switch on the transponder set control (3, figure 4-14) provides for special indentification features which are of use to the air traffic controller. The reply is transmitted by holding the switch in the spring-load loaded I/P position or by switching to the MIC position and depressing the pilot's microphone button. The response will continue for 30 seconds after the I/P switch or the pilot's microphone button has been released and consists of a double train response in both mode 1 and mode 3. This operation does not affect emergency operation.

Normal Operation of Transponder Set Less ZV

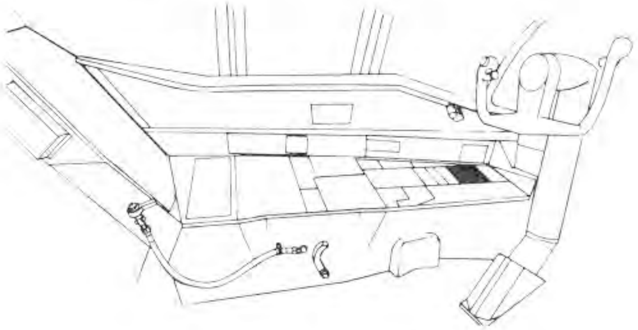
Normal operation consists of three modes of operation in which the transponder responds to challenging signals. These signals are 1-microsecond wide pulse-pairs on an assigned carrier frequency. The spacing between the pulse-pairs differs with the mode of operation selected. Pulse intervals (leading edge to leading edge) of 3, 5, and 8 microseconds are used for modes 1, 2, and 3 respectively. The receiver, a superheterodyne receiver, detects the signal, converts it to a 59.5 mc IF frequency, amplifies it, and delivers the pulse-pairs (video) to the decoder circuits. The decoder examines the pulse-pair spacings. The pulse from the decoders is then used to trigger the reply pulse generation circuit. If the emergency code is on, the gating time is extended to permit a total of four pulses to be developed. The pulse widths are shaped to 1 microsecond by a cutoff timing line and applied to the modulator. The modulator circuit uses these developed reply pulses to energize the transmitter on the carrier frequency. The coded responses are transmitted and are shown as a reply on the interrogator's PPI scope. The I/P-OUT-MIC switch and the master selector switch in EMERGENCY position have effect in the coder but not the receiver-transmitter. The SIF system allows for a selection from a large number of coded replies to interrogation. There are 32 possible coded responses in mode 1, 400 possible coded responses in mode 2, and 64 possible coded responses in mode 3. Additional responses in mode 1 and mode 3 are selected by the code selector switches on the coder group control. When setting a desired response code, the first digit of the code must be selected on the outer ring of the selector switch. The second digit of the code must be selected on the inner ring of the selector switch; i.e., if mode 3 normal code 02 is desired, the master switch on the transponder set control must be in the NORM position. The MODE 3-OUT switch must be in the MODE 3 position and the number 0 on the outer ring of the selector switch on the coder group control must be positioned beneath the white arrow above the dial. The number 2 on the inner ring of the selector switch must also be beneath the white arrow above the dial. The switches for presetting mode 2 are not accessible as operating controls in flight since the code will be assigned according to aircraft type and use or will be based on some characteristics which will not change over a lengthy period of time. To operate in this mode, it is necessary to turn on the mode 2 toggle switch on the IFF transponder control panel.



TRANSPONDER SET CONTROL PANEL



CODER GROUP CONTROL PANEL



1. MASTER SELECTOR SWITCH
2. MODE 2-OUT SWITCH
3. I/P-OUT-MIC SWITCH
4. MODE 3-OUT SWITCH
5. DETENT BUTTON
6. MODE 1 CODE SELECTOR
7. MODE 3 CODE SELECTOR

SIF/IFF RADAR CONTROL PANELS Less ZV

Figure 4-14.

SIF/IFF TRANSPONDER SET AN/APX-64 (AIMS) **ZV**

NOTE

- AIMS includes the features of and is derived from:
  - Air traffic control radar beacon system (ATCRBS)
  - IFF (SIF)
  - MK 12 IFF
  - System

The transponder set AN/APX-64 (AIMS) provides for Mark X IFF with selective identification feature (SIF), automatic altitude reporting, and Mark XII (Mode 4) encrypted IFF. The transponder set is the airborne portion of a two-way link between the aircraft and ground radar installations. The ground radar station sends an interrogation signal which is received by the aircraft; the aircraft transponder (reply system) then replies with coded signals which are received on the ground and displayed on the radar scope as unique identification and altitude signals. The ground station may interrogate in more than one mode. However, the transponder will only reply in those modes that are enabled. In addition to the normal replies listed below, the transponder contains provisions for a special emergency mode of operation (EMER position of the master switch), and for transmission of an "identification of position" (IDENT) signal. The transponder receives coded altitude information from the CPU-66 altitude computer (see Instruments, Section I). Modes 1, 2, 3/A, and C have a self-test capability with either internally generated test interrogations or ground station interrogations. Mode 4 operation requires that the mode 4 transponder computer be physically installed in the aircraft and, when installed, operation is continuously monitored by a caution light. The interrogation and reply modes are as follows:

INTERROGATION	REPLY
MODE 1	Any one of 32 possible codes, as set on IFF panel
MODE 2	Any one of 4096 possible codes, as set on APX-64 transponder
MODE 3/A	Any one of 4096 possible codes, as set on IFF panel
MODE C	Standard ATC code for altitude reporting
MODE 4	As determined by mode 4 transponder computer

The transponder receives TR power and 118-volt a-c power from circuit breakers located on the pilot's circuit breaker panel, marked "IFF DC" and "IFF AC" respectively. The IFF test set is provided TR power by a circuit breaker marked "IFF Test Set" on the pilot's circuit breaker panel. The mode 4 computer is provided a-c power by the transponder and emergency battery power by a circuit breaker marked "EMER FLT INST" on the pilot's circuit breaker panel.

AN/APX-64 IFF Transponder Set Controls **ZV**

MASTER SWITCH. The master switch (4, figure 4-14A) is a rotary switch with OFF--STBY--LOW--NORM--EMER positions. In OFF position, all power is removed from the set. STBY position places the transponder in warmup condition. Warmup requires approximately 3 minutes. LOW position places the transponder in operation with reduced receiver sensitivity. NORM position results in operation with normal receiver sensitivity. EMER position causes automatic transmission of emergency reply signals when interrogated by mode 1, mode 2, or mode 3/A. The switch must be pulled out to turn to OFF or EMER.

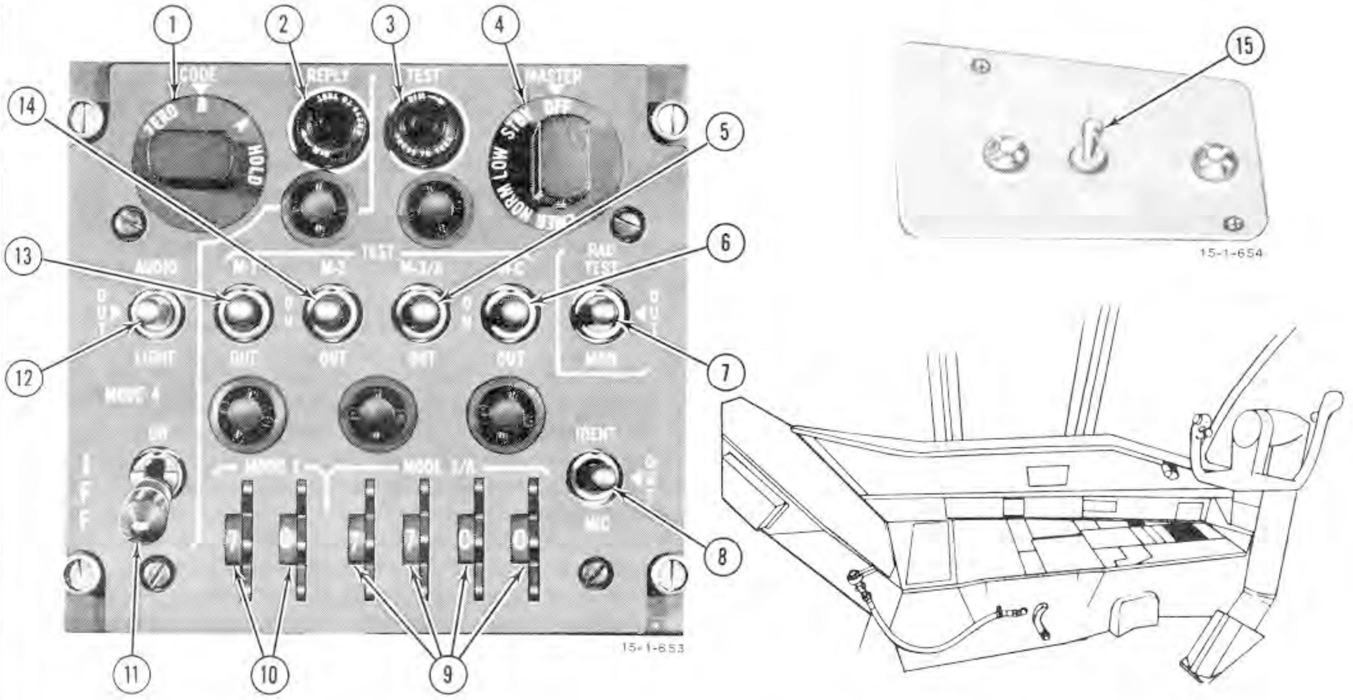
NOTE

- The master switch must be in the NORM position for self-test with mode enabling switches.
- OFF position will zeroize mode 4 code settings.
- The mode 4 computer door must be closed firmly in one continuous motion or zeroize will result.

MODE ENABLING SWITCHES. Four mode enabling switches (13, 14, 5, and 6, figure 4-14A) are marked "M-1," "M-2," "M-3/A," and "M-C" and have positions of OUT--ON--TEST with momentary TEST position. The OUT position prevents the transponder from replying to interrogation signals in that mode. The ON position enables operation in the selected mode. The momentary TEST position provides for a self-test of the selected mode. When the switch is held to the TEST position, test interrogations are generated, the transponder response is analyzed, and results are indicated by the test light.

TEST LIGHT. A green press-to-test test light (3, figure 4-14A) illuminates when the transponder is responding correctly to mode 1, 2, 3/A, or C interrogations. Source of interrogations is controlled by the mode enabling switch TEST positions or by the RAD TEST/MON switch.

RAD TEST/MON SWITCH. The RAD TEST/MON switch (7, figure 4-14A) has three positions marked RAD TEST--OUT--MON and is spring loaded from RAD TEST to OUT. RAD TEST position is not used by the flight crew. MON position enables the test light to monitor modes 1, 2, 3/A, and C replies generated by the transponder to ground interrogations.



1. MODE 4 CODE SWITCH
2. MODE 4 REPLY LIGHT
3. TEST LIGHT
4. MASTER SWITCH
5. MODE 3/A ENABLING SWITCH
6. MODE C ENABLING SWITCH
7. RAD TEST/MON SWITCH
8. IDENT/MIC SWITCH
9. MODE 3/A CODE SELECTORS
10. MODE 1 CODE SELECTORS
11. MODE 4 ON/OUT SWITCH
12. MODE 4 AUDIO/LIGHT SWITCH
13. MODE 1 ENABLING SWITCH
14. MODE 2 ENABLING SWITCH
15. IFF ANTENNA SWITCH

AN/APX-64 IFF RADAR CONTROL PANELS ZV

Figure 4-14A.

This switch must be positioned to OUT when using the mode enabling switch TEST positions.

IDENT/MIC SWITCH. The IDENT/MIC switch (8, figure 4-14A) provides for special identification features which are of use to the air traffic controller. The switch has three positions marked IDENT--OUT --MIC and is spring loaded from IDENT to OUT position. Momentarily actuating the switch to the IDENT position initiates the identification response. When the switch is placed in the MIC position, identification response is initiated whenever the pilot's or copilot's microphone trigger switch is depressed provided the command radio is on and the interphone select switch is in the respective COMM position. The response will continue for 30 seconds after the IDENT/MIC switch or the trigger switch is actuated and consists of a double reply, depending upon which modes are enabled.

NOTE

> The proper mode enabling switch must be turned on (to match the interrogation mode) to allow identification operation.

CODE SELECTORS. Mode 1 code selectors (10, figure 4-14A) are eight-position thumbwheel type selectors with integral indicators. The first digit selector is numbered from 0 thru 7, and the second digit selector is numbered from 0 thru 3. A total of 32 mode 1 code combinations is available. Mode 3/A code selectors (9, figure 4-14A) are eight-position thumbhweel type selectors with integral indicators numbered from 0 thru 7. The mode 3/A selectors allow selection of any base eight code from 0000 to 7777, for a total of 4096 different codes. Mode 2 and 4 codes are preset.

MODE 4 ON/OUT SWITCH. The mode 4 on/out switch (11, figure 4-14A) has two positions marked ON--OUT. With the transponder functioning, mode 4 operation is selected by placing the switch to ON. Transponder functioning is controlled by the master switch for mode 4 as for other modes. Placing the mode 4 on/out switch to OUT disables mode 4 operation. Accidental selection of OUT is prevented by the switch design, which requires the operator to pull out on the toggle lever before it can be moved to the OUT position.

MODE 4 CODE SWITCH. The mode 4 code switch (1, figure 4-14A) has four positions marked HOLD--A--B--ZERO. Positions A and B select the preset code for the present and succeeding code period, respectively. ZERO position will zeroize both code settings at any time aircraft power is on and the master switch is in any position other than OFF. Inadvertent selection of ZERO is prevented by switch design which requires that the knob be pulled out before it can be turned to ZERO. Both code settings normally will be zeroized when power is turned off after the aircraft has landed. The code settings can be retained by momentarily placing the mode 4 code switch in the spring-loaded HOLD position while the aircraft is on the ground. The HOLD function is controlled by the landing gear safety switches and requires transponder power to remain on for at least 15 seconds to mechanically latch the code settings.

MODE 4 AUDIO/LIGHT SWITCH. The mode 4 audio/light switch (12, figure 4-14A) has three positions marked AUDIO--OUT--LIGHT. In the LIGHT position, the mode 4 reply light will illuminate when mode 4 replies are transmitted. In the AUDIO position, an audio signal in the pilot's headset indicates interrogations are being received and illumination of the mode 4 reply light indicates when replies are transmitted. The audio signal is controlled by a separate mixer switch channel on the pilot's interphone panel. In the OUT position, both light and audio indications are inoperative.

MODE 4 REPLY LIGHT. The mode 4 reply light (2, figure 4-14A) is a green press-to-test light controlled by the mode 4 audio/light switch.

IFF MODE 4 CAUTION LIGHT. The amber IFF mode 4 press-to-test caution light (4A, figure 1-15) is located on the pilots' instrument panel. The caution light illuminates whenever an inoperative mode 4 capability is detected, provided that (1) the mode 4 transponder computer is installed, (2) aircraft power is on, and (3) the master switch is not OFF. Specific discrepancies monitored by the caution light are:

- Mode 4 codes zeroized.
- Transponder failure to reply to proper interrogation.
- Automatic self-test function of the computer reveals a faulty computer.

To attempt correction when the caution light is illuminated, reposition the master switch to NORM (if in STBY or LOW), check that the mode 4 on/out switch is ON, and check that the proper A or B code has been selected.

NOTE

> Since power for the caution light is routed through the mode 4 transponder computer, this unit must be physically installed in the aircraft to render the caution light operative.

IFF ANTENNA SWITCH. A three-position IFF antenna switch (15, figure 4-14A) on the pilot's side panel allows selection of UPPER, BOTH, or LOWER IFF antennas. When the IFF antenna switch is positioned to BOTH, the transponder alternates between antennas.

Normal Operation ZV

Normal operation is as follows:

1. Position master switch to STBY for warmup. Warmup requires about 3 minutes.
2. Set mode 1 and mode 3/A code selectors as briefed.
3. Position IFF antenna switch to BOTH.
4. Position IDENT/MIC switch to OUT.
5. For system self-test:
   a. Position master switch to NORM.
   b. Position RAD TEST/MON switch to OUT.
   c. Momentarily hold each mode enabling switch to TEST, then return to OUT. Illumination of test light for each mode indicates satisfactory operation.
6. Position master switch to LOW or NORM as desired.
7. Position mode enabling switches to ON as briefed.
8. Position RAD TEST/MON switch to OUT or MON as desired.
9. Perform mode 4 operations as briefed. Place the mode 4 code switch to the HOLD position after the mode 4 computer has been encoded if transponder power will be interrupted or lost prior to flight.

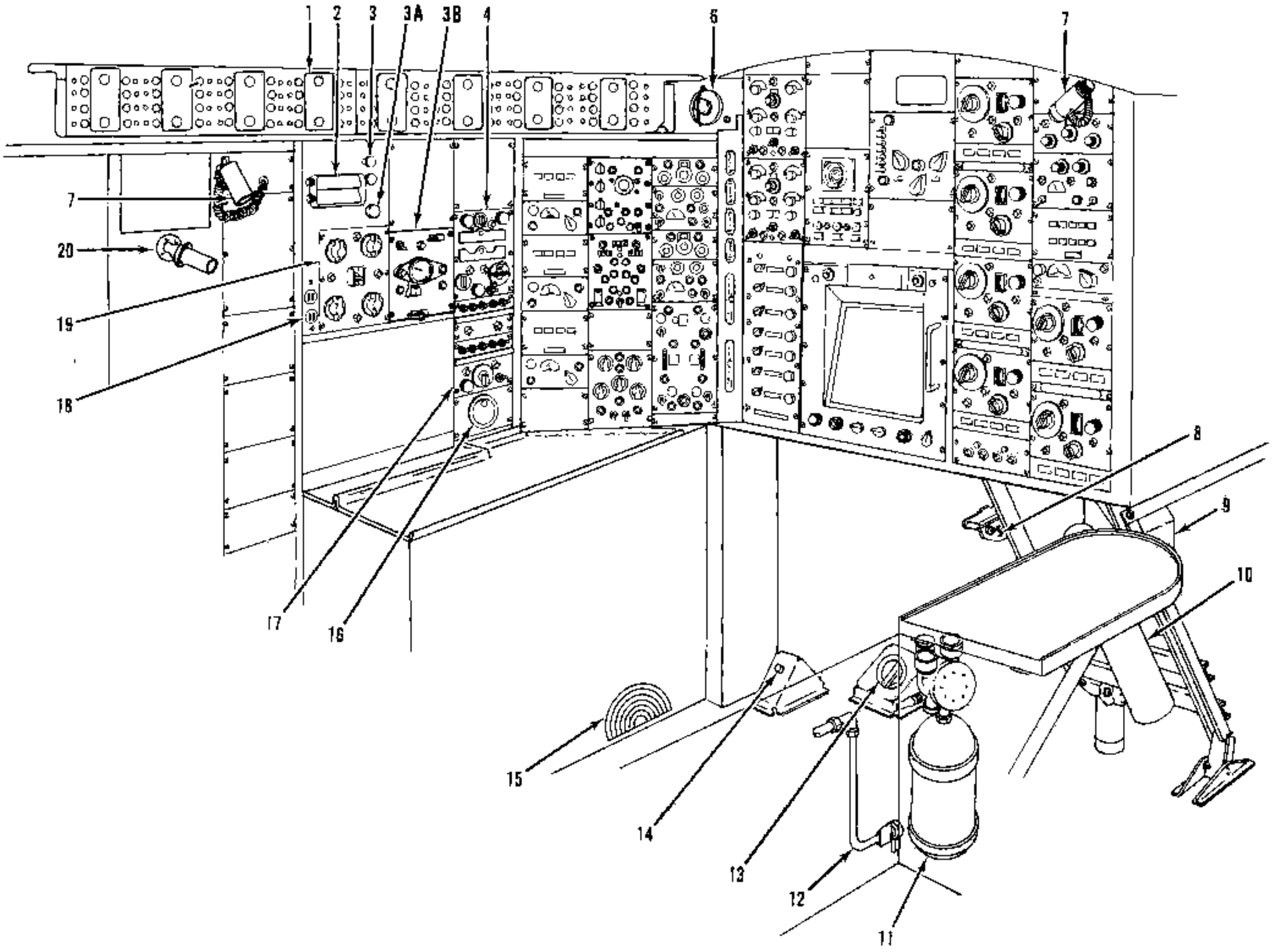
NOTE

> Place the mode 4 code switch to the HOLD position a minimum of 15 seconds prior to removal of electrical power from the aircraft.

10. To turn off equipment, position master switch to OFF.

Emergency Operation ZV

For emergency operation, pull outward on the master switch and rotate to the EMER position. Modes 1, 2, and 3/A are automatically enabled. The set will respond to modes 1 or 2 interrogations with the reply code determined by the mode 1 and mode 2 code selectors followed by three sets of pulse pairs. Mode 3/A reply code will be 7700, regardless of the position of the mode 3/A code selectors, and will be followed by three sets of pulse pairs.



1. ECM CIRCUIT BREAKER PANEL
2. UPPER AIR OUTLET
3. AIR OUTLET KNOBS
3A. SPRAY BAR KNOB
3B. OXYGEN REGULATOR
4. AN/ARC-65 LIAISON RADIO CONTROL PANEL
5. (Deleted)
6. EMERGENCY ALARM LIGHT
7. SPOTLIGHT
8. SPECIAL WEAPON MANUAL LOCK HANDLE STOWAGE BRACKET
9. SAFETY PIN STREAMER STOWAGE BOX
10. FIRE EXTINGUISHER
11. PORTABLE OXYGEN BOTTLE
12. PORTABLE OXYGEN BOTTLE RECHARGER HOSE
13. SPECIAL WEAPON MANUAL LOCK HANDLE
14. INTERPHONE FOOT SWITCH
15. LOWER AIR OUTLET
16. ASH TRAY
17. INTERPHONE CONTROL PANELS
18. 115 VOLT A-C RECEPTACLES
19. LIGHT CONTROL PANEL
20. FLOOD LIGHT

NOTE

FOR ECM EQUIPMENT REFER TO T.O. 1B-52D-1-2

EW OFFICER'S STATION

Figure 4-15.

FIRE CONTROL RADAR

For further information, see "Gunnery Systems" this section. Also refer to T.O. 1B-52B-1-5.

BNS RADAR

For description of this equipment, see "Bombing Navigational System (BNS)," this section. Also refer to T.O. 1B-52C-1-1-1.

ECM EQUIPMENT

Refer to T. O. 1B-52D-1-2.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

Exterior lighting consists of navigation lights on the wings, tail, and midbody; anticollision lights on the upper and lower fuselage; taxi lights on the right forward landing gear and left and right tip gear doors; landing lights in the forward landing gear doors; crosswind landing light on the right forward landing gear; air refueling lights on the slipway doors and in the refueling receptacle; and a retractable terrain clearance light on the forward bottom fuselage. The center taxi light and crosswind landing light turn with the right forward gear for lighting the turning or landing area. The air refueling lights illuminate the wings and can aid the tanker boom operator in checking the receiver aircraft engines, nacelles, wing flaps, and spoilers. These lights also illuminate the refueling slipway and receptacle. No passing or formation lights are provided.

Landing Lights

A fixed landing light is installed in each forward landing gear door for use during approach and landing. The landing lights are controlled by an ON--OFF switch (figure 4-16) on the aisle stand and will not illuminate when the landing gear is up and locked. D-C control power for these lights is provided through circuit breaker marked "RH Landing" and "LH Landing" on the "Exterior Lights" portion of the pilots' overhead circuit breaker panel.

NOTE

> The landing lights will not be available for night ditching as the landing gear doors will be kept closed. A retractable terrain clearance light located on the forward bottom fuselage will provide illumination during a night ditching or crash landing.

Navigational Lights

The navigation lights consist of a yellow and white light on the rudder trailing edge, a red light on the left wing tip, a green light on the right wing tip, and three midbody (nonflashing) lights. The lights are controlled by a STEADY--OFF--FLASH toggle switch and a BRIGHT--DIM toggle switch on the pilot's auxiliary side panel. STEADY position selects steady illumination of all lights. FLASH position selects a flashing of the wing and tail lights with steady illumination of the fuselage lights, while OFF position turns the lights out. The other switch has BRIGHT--DIM positions and selects bright or dim illumination of all navigation lights. Light power is provided through circuit breakers marked "NAV A-C" and "NAV D-C" **B-52C** and "NAV D-C" **B-52D** on the "Exterior Lights" portion of the pilots' overhead circuit breaker panel.

Anticollision Lights

Three rotating anticollision lights, one on each side of the fuselage and one on the bottom of the fuselage, are used to safeguard against midair collision. The lights are controlled by an ON--OFF switch (figure 4-16) on the pilot's auxiliary side panel. Light power is provided through circuit breakers marked "Anti-Collision Upper" and "Anti-Collision Lower" on the "External Lights" portion of the pilots' overhead circuit breaker panel.

Crosswind Landing Light

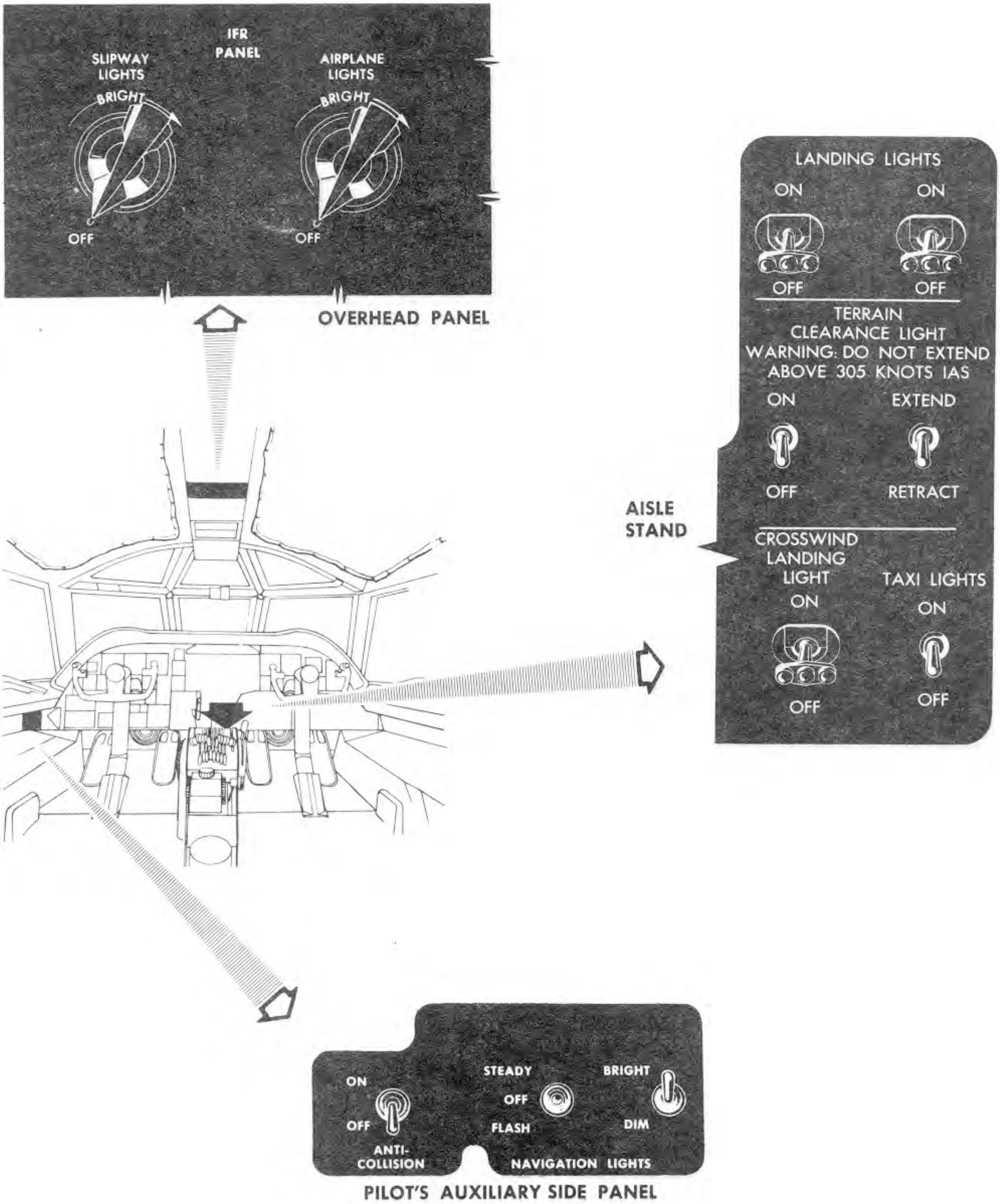
A crosswind landing light is installed on the right forward landing gear to provide lighting on the landing area during crosswind landings. The light is controlled by an ON--OFF switch (figure 4-16) marked "Crosswind" on the aisle stand. Also, the light may be controlled by a switch marked "Taxi" on the aisle stand on aircraft **89**▶ **W13**▶. D-C control power is provided through a circuit breaker marked "Crosswind Ldg" on the "Exterior Lights" portion of the pilots' overhead circuit breaker panel.

Terrain Clearance Light

A retractable terrain clearance light installed on the forward bottom fuselage will provide illumination during a night crash landing. In addition, the light may be used on night takeoffs since the landing lights will not illuminate after the landing gear has been retracted. See "Emergency Equipment," Section I.

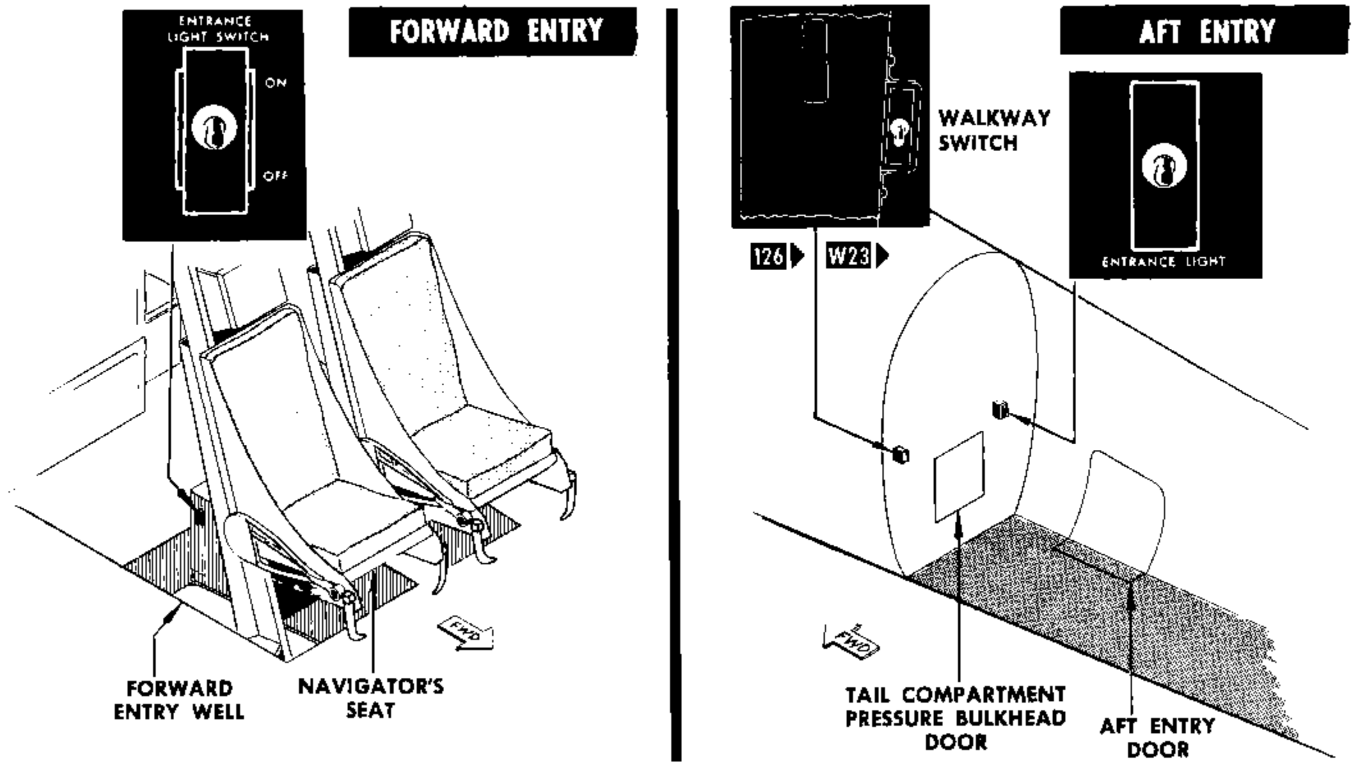
Taxi Lights

Three taxi lights and the crosswind landing light provide lighting for taxi operation. One light is installed on the right and left tip gear doors. A crosswind taxi light and a crosswind landing light are installed on the right forward landing gear door and will not



EXTERIOR LIGHTING CONTROLS (Typical)

Figure 4-16.



ENTRY AND WALKWAY LIGHT SWITCHES

Figure 4-17.

illuminate unless the landing gear lever is in DOWN position. The lights are controlled by an ON--OFF switch on the aisle control stand. D-C control power is provided through circuit breakers marked "Wing Taxi" and "Main Taxi" on the "Exterior Lights" portion of the pilots' overhead circuit breaker panel.

Air Refueling Lights

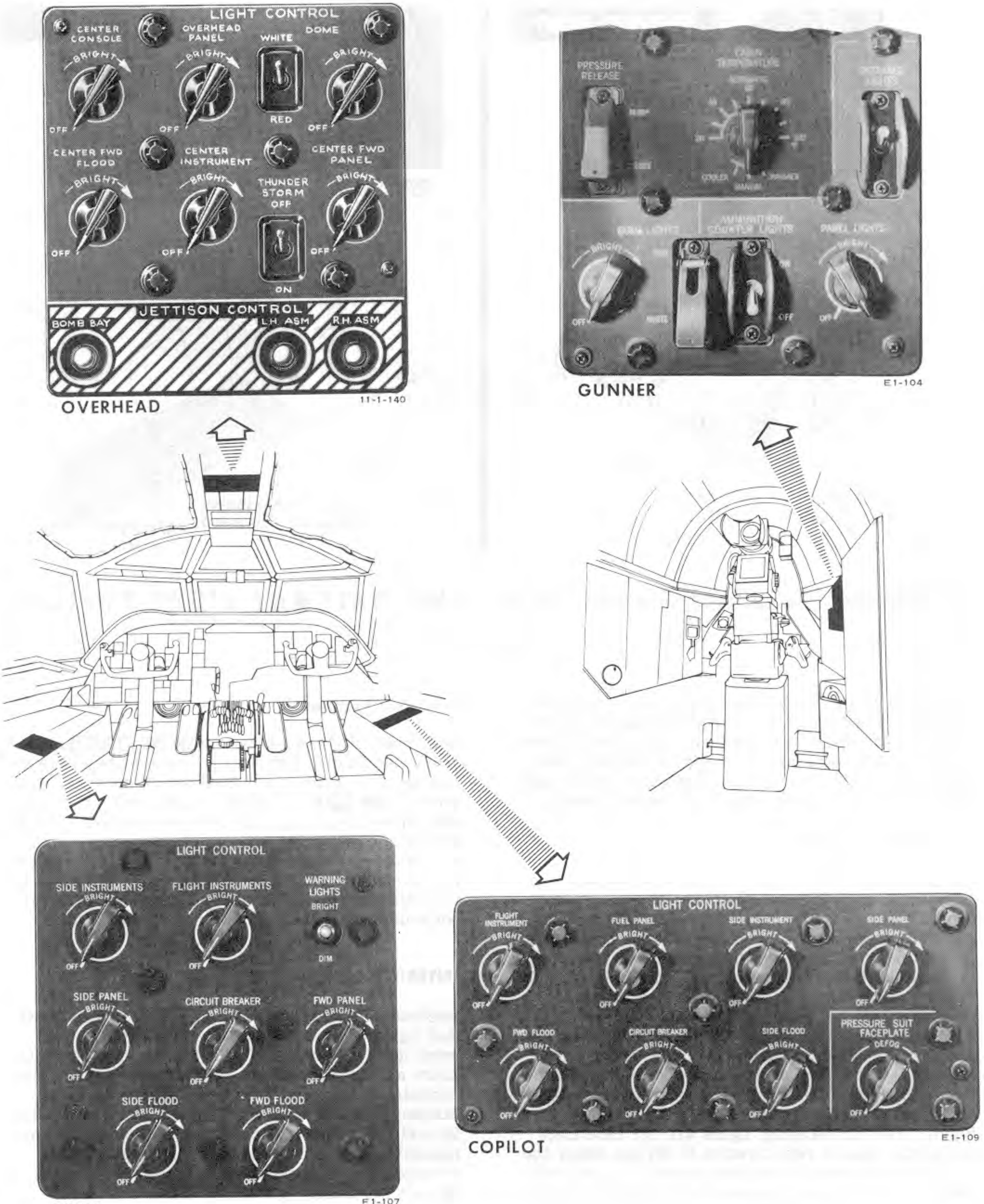
Air refueling lights consist of five white lights, one installed in the receptacle and two in each slipway door. The lights illuminate the receptacle, slipway, and wing areas during night air refueling operations. In addition, the lights aid the tanker boom operator in checking the receiver aircraft. The lights in the slipway doors may be used for scanning the wing leading edges, nacelles, struts, and spoilers. The lights are controlled by two OFF--BRIGHT rotary switches (figure 4-16) on the overhead panel. The slipway lights rotary switch controls the receptacle light and slipway lights. The aircraft lights rotary switch controls the left and right wing illuminating lights. The air refueling lights will not illuminate unless the master refuel switch is ON and either the slipway door normal or alternate switch is in OPEN position. Light power is provided through a circuit breaker marked "Ext Lights" on the "IFR" portion of the pilots' overhead circuit breaker panel.

Protective Features

The landing lights on aircraft 54▶ 63 W1▶ W3 and crosswind landing light will not illuminate unless the landing gear lever is in GEAR DOWN position. On aircraft 64▶ W4▶, the landing lights will not illuminate when the landing gear is up and locked. The air refueling (IFR) lights will not illuminate unless the air refueling system master switch is in ON and either the slipway door normal or alternate switch is in OPEN position. The terrain clearance light will not illuminate within 10° of the retracted position.

INTERIOR LIGHTING

Interior lighting is provided by red and white lights. Red lights are used during night flights since red color does not adversely affect night vision. White lights are used for daytime flights during dull light conditions and during thunderstorms to lessen the blinding effect of lightning flashes. All lights utilize 28-volt a-c power reduced from 118-volt ac by autotransformers, except the entry lights and, in an emergency, the essential instrument lights which use 24-volt d-c battery power.



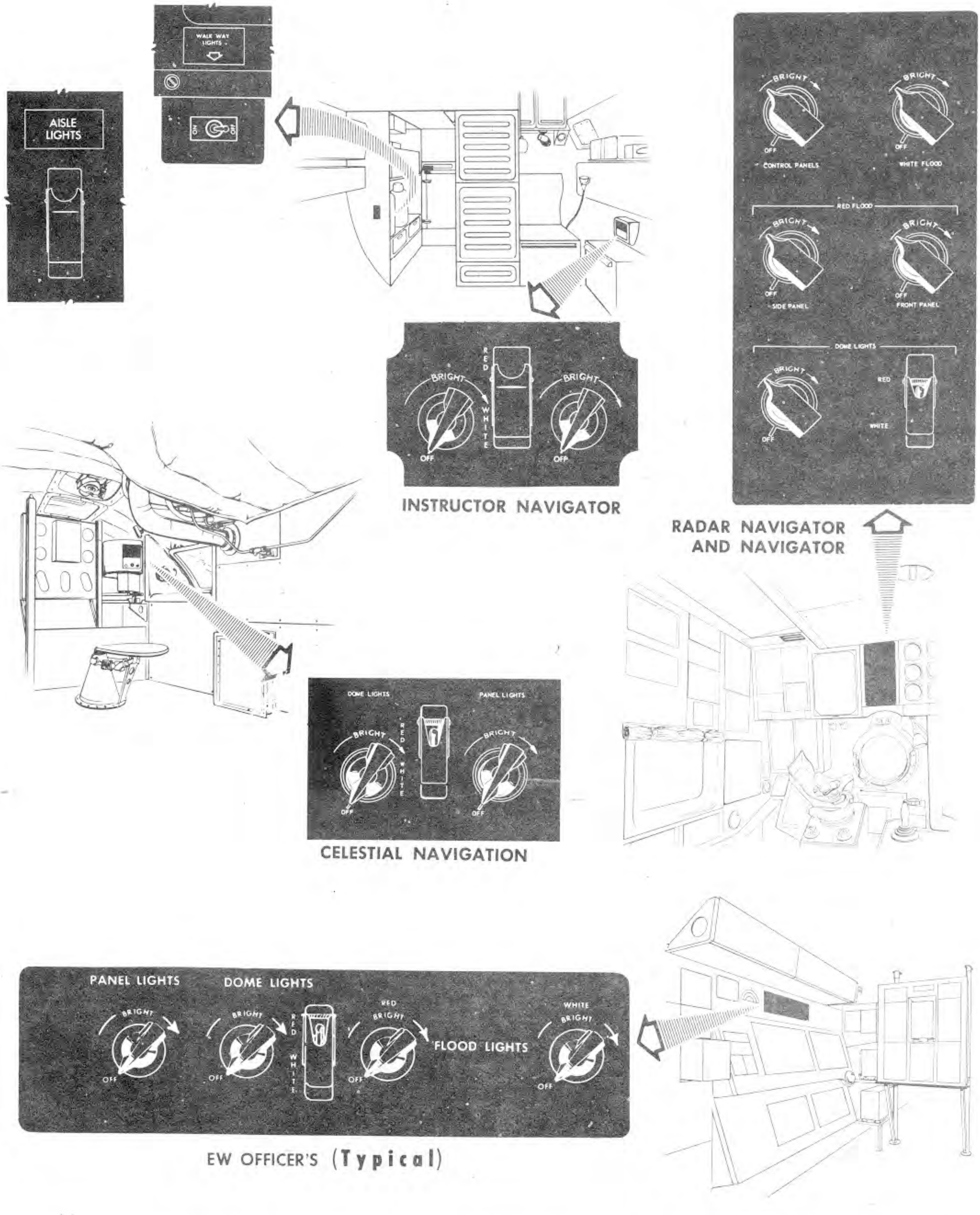
OVERHEAD

GUNNER

PILOT

COPILOT

Figure 4-18 (Sheet 1 of 2).



INSTRUCTOR NAVIGATOR

RADAR NAVIGATOR AND NAVIGATOR

CELESTIAL NAVIGATION

EW OFFICER'S (Typical)

INTERIOR LIGHTING PANELS (Typical)

Figure 4-18 (Sheet 2 of 2)

Pilot's and Copilot's Station Lighting

PANEL LIGHTS. Lights within edge-lighted panels, which illuminate indirectly from the underside, are red. The lights are the primary source of instrument lighting and are controlled by OFF--BRIGHT rotary switches (figure 4-18) on the pilot's side panel and overhead lighting panel. Light power is supplied through circuit breakers marked "Pilot Panel," "Center Panel," and "Copilot Panel" on the "Interior Lighting" portion of the pilot's circuit breaker panel.

INSTRUMENT LIGHTS. Red lights in the instrument hoods provide illumination for individual instruments. The lights are controlled by OFF--BRIGHT rotary switches (figure 4-18) on the pilot's side panel and overhead lighting panel. Light power is received through circuit breakers marked "Pilot Inst," "Copilot Inst," and "Center Instr" on the "Interior Lighting" portion of the pilot's circuit breaker panel.

ESSENTIAL FLIGHT INSTRUMENT LIGHTS. The essential flight instrument lights provide lighting for the pilot's altimeter, clock, vertical velocity indicator, turn-and-slip indicator, airspeed indicator, standby compass, and machmeter. The lights normally receive 118-volt ac through a circuit breaker marked "Pilot's Inst" on the ECM circuit breaker panel, On aircraft **Less** **X**, in the event partial ac power to the lights is lost, they will receive dc emergency power through a circuit breaker marked "Emer Flt Inst" on the pilot's circuit breaker panel provided the "Pilot Sw Batt Fwd Bus" circuit breaker is pulled. In the event complete ac power is list, the lights will automatically receive emergency dc power. See "Instrument Lighting Failure," Section III.

FLOODLIGHTS. Floodlights are a secondary source of instrument lighting and are mounted in a manner so as to provide illumination on a group of instruments located in the same area. The lights are controlled by OFF--BRIGHT rotary switches (figure 4-18) on the pilot's lighting panel and the overhead lighting panel. The lights are provided power through circuit breakers marked "Pilot Flood," "Center Flood," and "Copilot Flood" on the "Interior Lighting" portion of the pilot's circuit breaker panel.

SPOTLIGHTS. Two adjustable spotlights, one on the pilot's escape hatch and one on the copilot's escape hatch, provide a means of supplying light on any object desired by the pilot or copilot. The lights are controlled by a rheostat switch on the individual light. Light power is provided through a circuit breaker marked "Aisle, Ladder & Spot" on the "Interior Lighting" portion of the pilot's circuit breaker panel.

DOMELIGHTS. One red and one white domelight are located on the pilot's and copilot's escape hatches and one in the ceiling aft of the pilot's seat. The lights are controlled by an OFF--BRIGHT rotary switch and the color is selected by a RED--WHITE toggle switch on the overhead lighting panel. Light power is provided through a circuit breaker marked "Dome" on the "Interior Lighting" portion of the pilot's circuit breaker panel.

THUNDERSTORM LIGHTS. Two white thunderstorm lights located above and behind the pilot's and copilot's seats provide illumination during thunderstorms to lessen the blinding effect of lightning flashes. The lights are controlled by an ON--OFF toggle switch on the overhead lighting panel marked "Thunderstorm." Light power is provided through a circuit breaker marked "Thunderstorm" on the "Interior Lighting" portion of the pilot's circuit breaker panel.

STANDBY COMPASS LIGHT. The standby compass and light are located above the pilots' instrument panel. The light is controlled by an OFF--BRIGHT rotary switch on the overhead lighting panel. The switch is marked "Center Instrument." The light normally operates on 28-volt a-c power through a circuit breaker marked "Center Instr" on the "Lighting" portion of the pilot's circuit breaker panel. In the event a-c power is lost, the light will operate on battery power. With the emergency battery switch in NORMAL position, forward battery power is supplied through a circuit breaker marked "Emer Flt Instr" on the "Lighting" portion of the pilot's circuit breaker panel. With the emergency battery switch in EMERG position, aft battery power is supplied through a circuit breaker marked "Power" on the "Emer Flt Inst" portion of the pilots' overhead circuit breaker panel.

INDICATOR (WARNING) LIGHT DIMMING CONTROL SWITCH. An indicator light dimming control switch on the pilot's lighting panel controls the brightness of all indicator and warning lights at the pilot's and copilot's stations with the exception of the fire warning lights, landing gear warning light, pilot's call light, autopilot disengaged light, and copilot's tail compartment pressure low warning light. The switch has momentary BRIGHT--DIM positions and is springloaded to neutral. When the switch is momentarily placed to BRIGHT position, all indicator lights are at their brightest illumination. Momentarily moving the switch to DIM position will dim all indicator lights with the exception of those named above to reduce glare. The dimming circuit is mechanically linked to the flight instrument lights rheostat on the pilots' lighting panel so that when the flight instrument lights have been reduced to a specified low intensity, the warning lights will be automatically reset to BRIGHT.

Radar Navigator's and Navigator's Station Lighting

PANEL LIGHTS. Lights within all of the edge-lighted panels are controlled by an OFF--BRIGHT rotary switch on the radar navigator's and navigator's lighting panel. Light power is provided through a circuit breaker marked "Panel" on the "Lighting" portion of the radar navigator's circuit breaker panel.

FLOODLIGHTS. Floodlights for the entire compartment are controlled by an OFF--BRIGHT rotary switch on the radar navigator's and navigator's lighting panel. The lights are provided power through circuit breakers marked "Flood Red" and "Flood White" on the "Lighting" portion of the radar navigator's circuit breaker panel.

SPOTLIGHTS. Spotlights for the entire compartment are controlled by a rheostat switch on the individual lights. The lights are provided power through a circuit breaker marked "Spot" on the "Lighting" portion of the radar navigator's circuit breaker panel.

DOMELIGHTS. Two domelights, one red and one white, are located above the radar navigator's and navigator's seats. In addition, one light is located in the ceiling over the celestial navigation station. The lights are controlled by an OFF--BRIGHT rotary switch and the light color is selected by a RED--WHITE toggle switch. Both switches are on the radar navigator's and navigator's lighting panel. Light power is provided through circuit breakers marked "Dome BMDR & NAV" and "Dome Misc" on the "Lighting" portion of the radar navigator's circuit breaker panel.

TABLE LIGHT. A white table light is located on the right side of the navigator's forward control panel and is controlled by an OFF--BRIGHT rotary switch on the table light panel. Light power is provided through a circuit breaker marked "Table" on the "Lighting" portion of the radar navigator's circuit breaker panel.

ECM and Celestial Navigation Station Lighting

PANEL LIGHTS. Lights within all edge-lighted panels at the EW officer's and celestial navigation stations are controlled by an OFF--BRIGHT rotary switch on the EW officer's lighting panel. Light power is provided through a circuit breaker marked "Panel" on the "Lights" portion of the ECM circuit breaker panel.

FLOODLIGHTS. Red floodlights at the EW officer's station are controlled by an OFF--BRIGHT rotary switch on the EW officer's lighting panel. Light power is provided through a circuit breaker marked "Red Flood" on the "Lights" portion of the ECM circuit breaker panel.

SPOTLIGHTS. Three adjustable spotlights, one at the aft end of the EW officer's panel, one to the left of the instructor pilot's position, and one at the celestial station, provide a means of supplying light upon any object desired by the operator. The lights are controlled by a rheostat switch on the individual light. Light power for the lights at the instructor pilot's and EW officer's station is provided through a circuit breaker marked "Spot" on the radar navigator's circuit breaker panel. Light power for the light at the celestial station is provided through a circuit breaker marked "Dome & Spot" on the "Lights" portion of the ECM circuit breaker panel.

DOMELIGHTS. One red and one white domelight are located in the ceiling over the EW officer's station. The lights are controlled by an OFF--BRIGHT rotary switch and the light color is selected by a RED--WHITE toggle switch on the EW officer's lighting panel. Light power is provided through a circuit breaker marked "Dome & Spot" on the "Lights" portion of the ECM circuit breaker panel.

Gunner's Station Lighting

PANEL LIGHTS. Lights within all edge-lighted panels at the gunner's station are controlled by a rotary switch on the gunner's lighting panel. Light power is provided through a circuit breaker marked "Panel & Instr" on the "Lights" portion of the gunner's circuit breaker panel.

INSTRUMENT LIGHTS. Red lights in the instrument hoods provide illumination for individual instruments. The lights are controlled by an OFF--BRIGHT rotary switch on the gunner's lighting panel. Light power is provided through a circuit breaker marked "Panel & Instr" on the "Lights" portion of the gunner's circuit breaker panel.

DOMELIGHTS. One white domelight located in the ammunition bay and one red-white domelight in the ceiling over the gunner's seat provide a means of supplying light upon any object desired by the operator. The white lights are controlled by an ON--OFF toggle switch on the right side of the ammunition bay while the red-white light is controlled by an OFF--BRIGHT rotary switch and a RED--WHITE toggle switch on the gunner's lighting panel. Light power is provided through a circuit breaker marked "Dome & Spot" on the "Lights" portion of the gunner's circuit breaker panel.

SPOTLIGHTS. Two adjustable white spotlights, one to the right of the gunner's seat and one to the right of the entry door, provide a means of supplying light upon any object desired by the operator. The lights are controlled by a rheostat switch on the individual light. Light power is provided through a circuit breaker marked "Dome & Spot" on the "Lights" portion of the gunner's circuit breaker panel.

Passageway Lights

ENTRY LIGHTS. White entry lights are located in the ceiling above the forward door and on the bulkhead forward of the aft entry door. The forward entry light is controlled by an ON--OFF toggle switch right and aft of the entry door. The aft entry light is controlled by dual toggle switches, one to the right of the aft entry door and one on the gunner's lighting panel. Light power is provided through a circuit breaker marked "Entr" on the "Lighting" portion of the radar navigator's circuit breaker panel.

AISLE LIGHTS. One red aisle light is located in the upper deck floor at the top of the deck ladder and two white aisle lights are located one above the bunk and one in the ceiling to the right of the navigator's station. The red light has no switch for control. The white lights are controlled by an ON--OFF toggle switch on the aft side of the galley wall and one aft of the copilot's escape hatch. Light power is provided through a circuit breaker marked "Aisle Ladder & Spot" on the "Interior Lighting" portion of the pilot's circuit breaker panel.

Electronic Rack Lighting

UPPER ELECTRONIC COMPARTMENT. A white spotlight located on the upper equipment rack is controlled by a rheostat switch on the light. Light power is provided through a circuit breaker marked "Work" on the "Lights" portion of the ECM circuit breaker panel.

GALLEY AND LOWER ELECTRONIC ENCLOSURE. One red-white domelight located in the corner of the ceiling over the galley and one white spotlight on the lower equipment rack are controlled by a RED--OFF--WHITE toggle switch adjacent to the light and a rheostat switch on the light. Light power is provided through circuit breakers marked "Spot" and "Red and White Flood" on the "Lighting" portion of the radar navigator's panel.

Miscellaneous Lights

Three white spotlights and three red-white domelights are located forward of the navigator's and radar navigator's instrument panel and on the aft wall at the relief station. The spotlights are controlled by a rheostat switch on the individual light. The domelights forward of the instrument are controlled by a RED--OFF--WHITE toggle switch adjacent to the right light while the domelights at the relief station are controlled by an OFF--BRIGHT rheostat and a RED--WHITE toggle switch on the relief station lighting panel. Light power is provided through circuit breakers marked "Red and White Flood" and "Dome Misc" on the "Lighting" portion of the radar navigator's circuit breaker panel.

Bomb Bay Lights

Six white floodlights located on the forward end and on each side of the bomb bay are controlled by an ON--OFF toggle switch on the right side of the forward bomb bay below the crawlway. In addition, two white service lights are installed in the top of the bomb bay and are controlled by individual toggle switches on the equipment panel near the lights. Light power for the lights is provided through a circuit breaker marked "Bomb Bay Flood" on the "Lighting" portion of the radar navigator's circuit breaker panel.

Walkway and Crawlway Lights

Twelve domelights are located along the walkway, crawlway, wheel well, and aft equipment bay. On aircraft 54▶125 W1▶W22, the lights are controlled by an ON--OFF toggle switch in the control cabin above the crawlway entrance door and, on aircraft 126▶ W23▶, on the right side (facing aft) of the aft pressure bulkhead. Light power is provided through a circuit breaker marked "Walkway Lts Cont" on the "Lighting" portion of the radar navigator's circuit breaker panel.

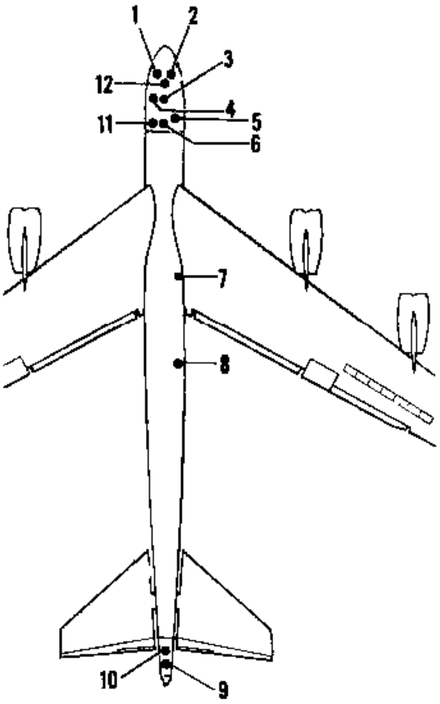
OXYGEN SYSTEMS

The aircraft is provided with a 300 psi liquid oxygen system only. This system supplies all crew station regulators and the portable oxygen bottle rechargers. See figure 4-19 for location of portable oxygen bottle recharger stations.

An automatic pressure breathing diluter demand oxygen regulator (figure 4-21) is provided at all crew stations and the bomb bay stations. A Type D-2 regulator is used at all stations except the pilot's and copilot's stations which utilize a Type CRU-68/A, CRU-69/A, or CRU-73/A regulator. An additional regulator is installed in the gunner's compartment for use when the gunner is not in his normal operating position.

LIQUID OXYGEN SYSTEM

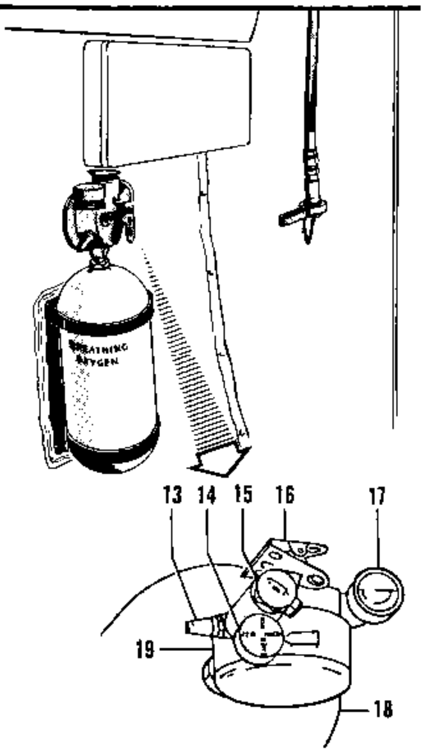
The liquid oxygen system is supplied by three 20-liter 300 psi liquid oxygen converters (10, figure 1-57). Converter No. 1 is located on the forward left



OXYGEN BOTTLES AND RECHARGER POINTS

Station	Bottle	Recharger
1 PILOT	ONE	ONE
2 COPILOT	ONE	ONE
3 NAVIGATOR	ONE	ONE
4 RADAR NAVIGATOR	ONE	ONE
5 UPPER BUNK	NONE	NONE
6 EW OFFICER	ONE	ONE
7 FWD BOMB BAY*	ONE	ONE
8 AFT BOMB BAY*	ONE	ONE
9 GUNNER	ONE	ONE
10 GUNNER'S AUXILIARY	NONE	NONE
11 INSTRUCTOR NAVIGATOR	NONE	ONE
12 INSTRUCTOR PILOT	NONE	NONE

*Optional installation



13 OXYGEN BOTTLE FILLER PORT
14 ALTITUDE SELECTOR KNOB
15 OXYGEN MASK HOSE CONNECTION
16 CLIP
17 OXYGEN PRESSURE GAGE
18 A-6 OXYGEN BOTTLE
19 PRESSURE DEMAND REGULATOR

TYPICAL OXYGEN BOTTLE AND RECHARGER

OXYGEN BOTTLES AND RECHARGER POINTS

Figure 4-19.

side of the aft equipment compartment; converter No. 2 is located aft, and converter No. 3 is located forward on the right side of the aft equipment compartment. A supply line from each converter connects with all oxygen regulators. Check valves at each regulator isolate the lines from each converter making three separate oxygen supply systems. An additional flow equalizer check valve is in the line from either converter No. 1 or No. 2 because one converter generally will supply oxygen at a slightly different pressure than the others. The additional flow equalizer check valve will open at a differential pressure of 10 to 14 psi so that the No. 1 and No. 2 converters will each supply roughly half the stations; oxygen from these two converters will be consumed at about the same rate. Converter No. 3, which has no such additional flow equalizer check valves in its lines, will usually be depleted first.

NOTE

- Pressure indications as high as 420 psi may be attained due to pressure buildup in the heat exchanger line downstream of the liquid oxygen converter and check valve prior to use of oxygen. A relief valve having a high pressure setting of 395 (±25) psi governs system pressure.

- Frost buildup above the lower three or four coils is an indication of a possible deterioration of converter vacuum. During service or buildup period, icing above the lower three or four coils should dissipate within 1 hour after buildup if ground temperature is above 32° F. Icing on the lower three or four coils must be considered a normal condition during service or buildup period.

OXYGEN SYSTEM CONTROLS

Regulator Diluter Lever

A regulator diluter lever (3, figure 4-21) located on each oxygen regulator has NORMAL OXYGEN--100% OXYGEN positions. In NORMAL OXYGEN position, the regulator automatically supplies the proper mixture of oxygen and air at all altitudes. In 100% OXYGEN position, the air intake port is closed and pure

OXYGEN DURATION—HOURS
BASED ON CREW OF SIX

CABIN ALTITUDE (feet)	REGULATOR DILUTER POSITION	GAGE QUANTITY—SUM TOTAL OF THREE GAGES												
		60 LITERS	55 LITERS	50 LITERS	45 LITERS	40 LITERS	35 LITERS	30 LITERS	25 LITERS	20 LITERS	15 LITERS	10 LITERS	5 LITERS	BELOW 5 LITERS
40,000	100%	62.9	57.6	52.4	47.1	41.9	36.8	31.4	26.2	21.0	15.7	10.5	5.2	EMERGENCY
	NORMAL	62.9	57.6	52.4	47.1	41.9	36.8	31.4	26.2	21.0	15.7	10.5	5.2	
35,000	100%	62.9	57.6	52.4	47.1	41.9	36.8	31.4	26.2	21.0	15.7	10.5	5.2	DESCEND TO ALTITUDE NOT REQUIRING OXYGEN
	NORMAL	62.9	57.6	52.4	47.1	41.9	36.8	31.4	26.2	21.0	15.7	10.5	5.2	
30,000	100%	45.4	41.6	37.8	34.0	30.2	26.4	22.7	18.9	15.1	11.3	7.5	3.8	
	NORMAL	46.6	42.7	38.8	35.0	31.0	27.2	23.3	19.4	15.5	11.6	7.7	3.9	
25,000	100%	35.0	32.2	29.2	26.2	23.3	20.4	17.5	14.6	11.6	8.7	5.8	2.9	
	NORMAL	44.1	40.5	36.8	33.0	29.4	25.7	22.0	18.4	14.7	10.5	7.3	3.7	
20,000	100%	26.6	24.4	22.4	19.9	17.7	15.5	13.3	11.1	8.9	6.6	4.4	2.2	
	NORMAL	48.6	44.4	40.5	36.4	32.4	28.3	24.3	20.2	16.2	12.1	8.1	4.0	
15,000	100%	21.3	19.5	17.7	16.0	14.2	12.4	11.6	8.9	7.1	5.3	3.5	1.8	
	NORMAL	60.5	55.5	50.4	45.4	40.4	35.2	30.2	25.2	20.2	15.1	10.1	5.0	
10,000	100%	17.1	15.6	14.2	12.8	11.4	10.0	8.5	7.1	5.7	4.3	2.8	1.4	
	NORMAL	60.5	55.5	50.4	45.4	40.4	35.2	30.2	25.2	20.2	15.1	10.1	5.0	

OXYGEN DURATION

Figure 4-20.

oxygen is supplied for emergencies regardless of the altitude. At cabin altitudes above 30,000 feet, the lever should be placed in 100% OXYGEN position as a safety precaution. The lever should be left in 100% OXYGEN position at the end of a flight to prevent dust and lint from entering the regulator.

Oxygen Supply Shutoff Lever

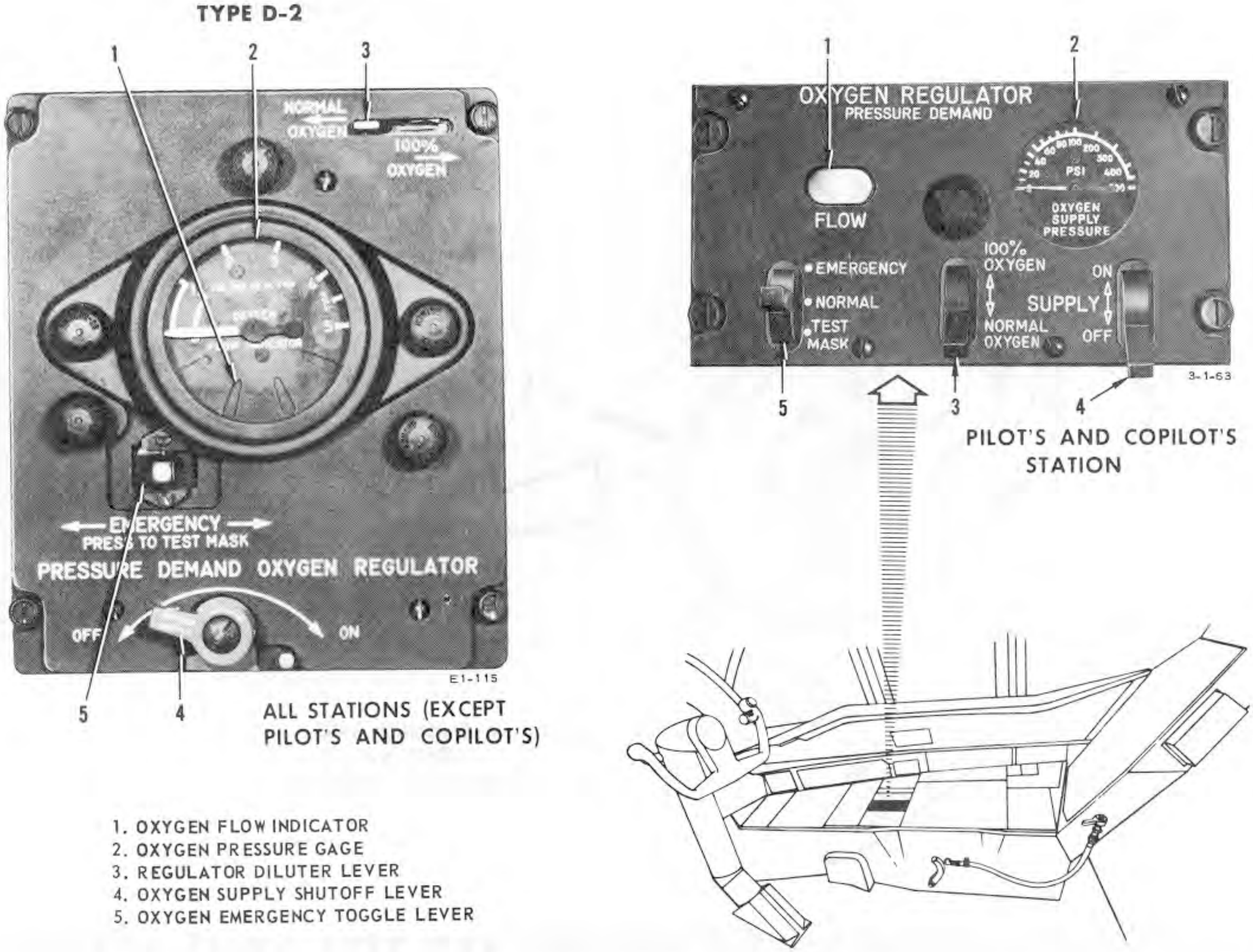
An ON--OFF oxygen supply shutoff lever (4, figure 4-21) is provided on each oxygen regulator. On the gunner's side panel on aircraft **139**▶ **W28**▶, the lever is protected by a clear plastic guard to prevent inadvertent movement to OFF position. In ON position, the oxygen supply to the regulator is shut off to prevent any flow of oxygen from the regulator when not in use.

NOTE

> Due to the automatic pressure breathing feature of the oxygen regulator, a continuous flow of oxygen will result if the oxygen regulator is not being used and the oxygen supply shutoff lever is left in ON position above 30,000 feet cabin altitude. This condition will cause a rapid loss of oxygen.

Oxygen Emergency Toggle Lever

An emergency toggle lever (5, figure 4-21) is provided on each regulator for manually supplying a positive oxygen pressure to the mask for emergency use. On the Type D-2 regulator, the lever has EMERGENCY--OFF--EMERGENCY positions and may be depressed in OFF position to supply positive oxygen pressure for checking the oxygen mask. On the Type CRU-68/A, CRU-69/A, or CRU-73/A regulator, the lever has EMERGENCY--NORMAL --TEST MASK positions. TEST MASK position supplies positive oxygen pressure for checking the oxygen mask. EMERGENCY position on both regulators supplies oxygen at a continuous positive pressure for emergency use. In OFF or NORMAL position, oxygen flow is controlled automatically by the regulator.



ALL STATIONS (EXCEPT PILOT'S AND COPILOT'S)

PILOT'S AND COPILOT'S STATION

1. OXYGEN FLOW INDICATOR
2. OXYGEN PRESSURE GAGE
3. REGULATOR DILUTER LEVER
4. OXYGEN SUPPLY SHUTOFF LEVER
5. OXYGEN EMERGENCY TOGGLE LEVER

OXYGEN REGULATORS (Typical)

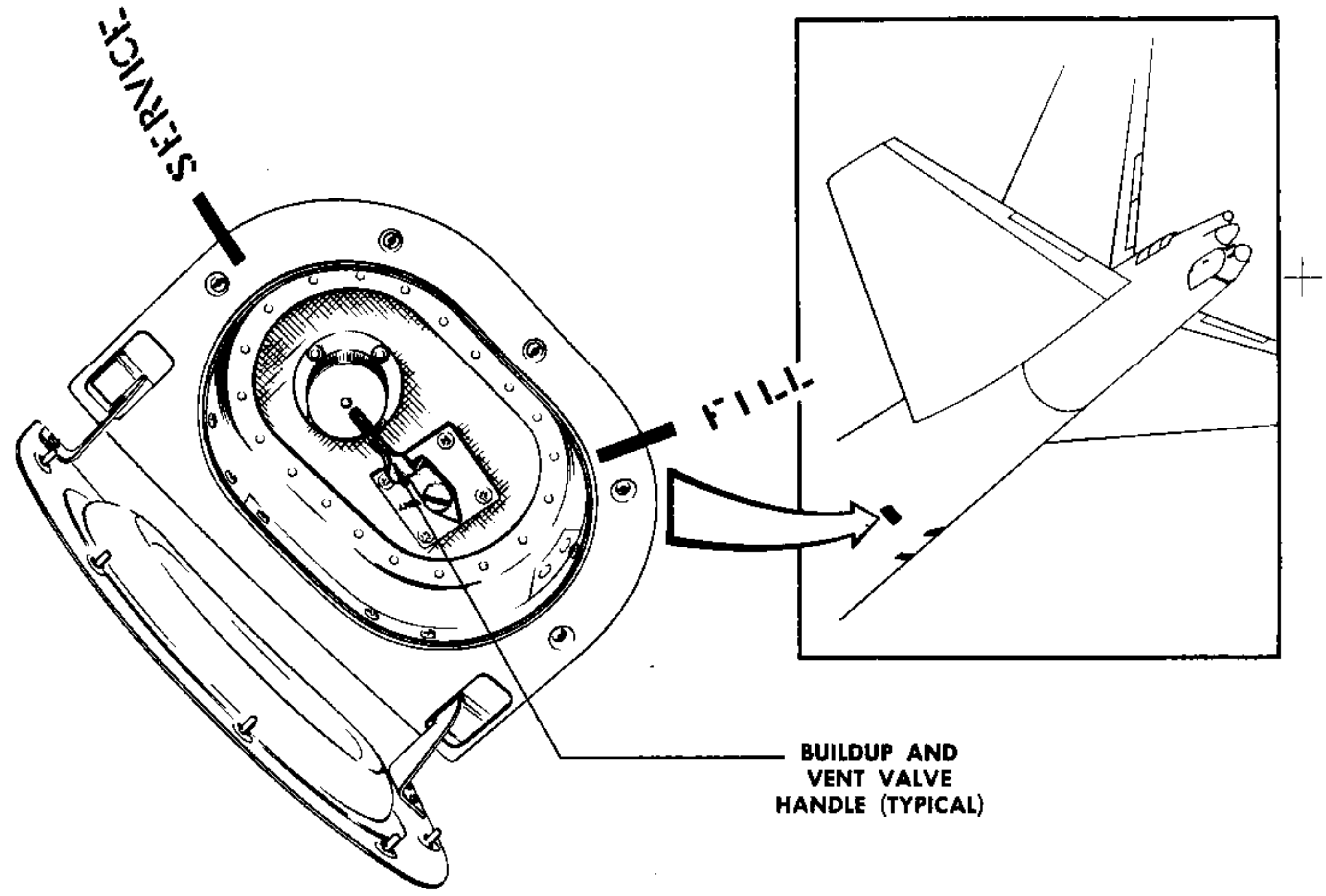
Figure 4-21.

Buildup and Vent Valve Handle

Three buildup and vent valve handles (figure 4-22) located on the underside of the aft equipment compartment, control a dual-purpose two-position three-port valve which is actuated to either a FILL or a SERVICE position. In FILL position, the converter is vented to the atmosphere when being filled from the oxygen service cart. Any excess liquid oxygen introduced during filling or excess oxygen pressure will escape through the vent. In SERVICE position, the vent line is blocked, the converter gas and liquid lines are connected, and system pressure builds up. The handle rotates through a 120° arc from one decaled position to the other. It is spring loaded in such a manner that, as the midpoint of travel is approached, the handle will travel to the stop in the direction of travel.

NOTE

Oxygen system buildup requires approximately 30 minutes for system stabilization. Servicing should be accomplished at least 30 minutes prior to engine start.



BUILDUP AND VENT VALVE HANDLES

Figure 4-22.

OXYGEN SYSTEM INDICATORS

Oxygen Converter Quantity Gages

Three oxygen converter quantity gages (figure 4-23) located on the forward end of the pilot's side panel are graduated from 0 to 20 liters in increments of 1 liter. The gages are operated by pressure caused from the head of liquid in the converter.

Oxygen Pressure Gage

An oxygen pressure gage (2, figure 4-21) on each Type D-2 regulator unit indicates oxygen system pressure in pounds per square inch when the oxygen supply shutoff lever is in ON position. The Type CRU-68/A, CRU-69/A, or CRU-73/A regulator will indicate system pressure regardless of supply lever position.

Oxygen Flow Indicator

A blinker-type oxygen flow indicator (1, figure 4-21) is provided on each regulator unit to show the crew member he is receiving oxygen. Luminescent segments indicate that oxygen is being dispensed.

PORTABLE OXYGEN BOTTLES

A portable oxygen bottle and recharger are located near each of the regular crew stations (figure 4-19). The portable oxygen bottle assembly consists of a low pressure cylinder (18, figure 4-19) and a pressure demand regulator (19, figure 4-19). The regulator consists of an oxygen pressure gage (17, figure 4-19), altitude selector knob (14, figure 4-19), and a clip (16, figure 4-19) to attach the portable oxygen bottle to the crew members flight clothing. The pressure gage is calibrated from 0 to 500 psi and is red-lined at 450 psi. The altitude selector knob (15, figure 4-19) has NORM--30M--42M--EMER positions. The pressure demand regulator delivers 100% oxygen on all positions. The NORM position is used on all cabin altitudes up to 30,000 feet and delivers oxygen only on demand. The 30M position is used at cabin altitudes from 30,000 to 40,000 feet. This position delivers oxygen under a slight positive pressure which is intended to combat mask leaks and possible altimeter lag. From 40,000 to 42,000 feet, the 42M position is used. This position delivers oxygen under the higher pressure required to sustain life at the altitudes. The EMER position further increases the pressure of the oxygen and should be used any time the cabin altitude exceeds 42,000 feet. Duration of the oxygen supply will vary with the altitude setting of the regulator, therefore the pressure gage should be monitored continuously when the bottle is in use.

OXYGEN SYSTEM NORMAL OPERATION

In Flight

The following procedure should be followed when oxygen is used during flight:

NOTE

> Requirements for use of oxygen while performing various activities will be in accordance with current directives. Use of 100% oxygen will be as outlined in Sections II, III, IV, and VIII. Pilot will insure that oxygen is used as required.

1. Check connection of oxygen mask hose to oxygen supply hose.
2. Place oxygen supply shutoff lever in ON.
3. Place oxygen regulator diluter lever in NORMAL or 100% (as required).

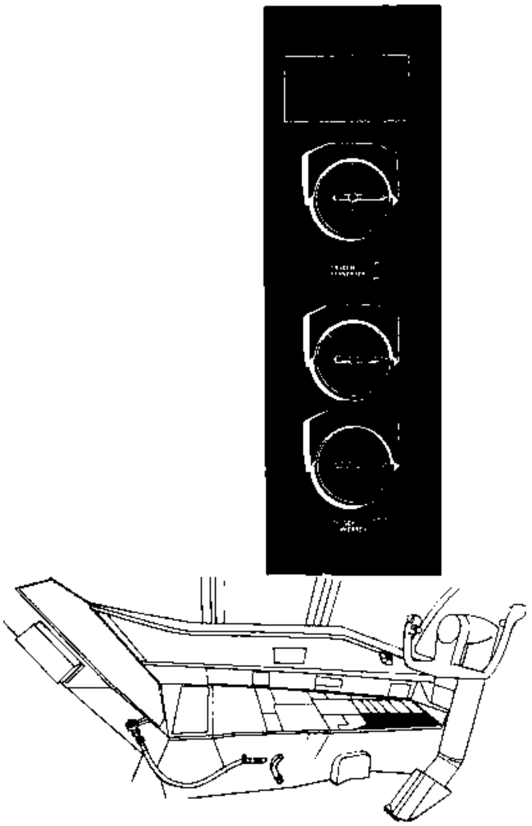
NOTE

> At cabin altitudes above 30,000 feet, the lever should be placed in 100% OXYGEN position as a safety precaution.

4. Frequently check the oxygen flow indicator.

NOTE

- During turbulent flight conditions, liquid oxygen sloshes inside the converter. This cools the gas and allows part of it to return to the liquid state, resulting in a lowered gas pressure. Lowering of the gas pressure is not detrimental to crew consumption as long as pressure remains above 150 psi.



OXYGEN GAGES

Figure 4-23.

- Negative "g" loading during turbulence could cause temporary loss of quantity indication. Stabilization of flight conditions should result in reasonably rapid stabilization of the oxygen pressure and quantity indications.

WARNING

> Before smoking, the crewmember will turn the oxygen supply shutoff lever OFF, deplete the oxygen remaining in the line, and push the regulator diluter lever to the 100% OXYGEN position. This will eliminate the possibility of accelerated combustion and will also prevent forgetting to turn the supply lever back ON when resuming use of the system.

5. When flight is completed, turn oxygen supply shutoff lever OFF and push the regulator diluter lever to the 100% OXYGEN position.

All data on pages 4-55 and 4-56, including figure 4-24 (Deleted)

AUTOPILOT

WARNING

- The autopilot will be used with caution during any critical phase of flight (i.e., instrument approach, low level, air refueling, or combat breakaway maneuvers). All disengagements of the autopilot by means of the pilot's or copilot's release button on the control wheel will be followed immediately by checking that the servos engage switch has disengaged.
- The trim condition of the aircraft should be closely monitored at all times when using the autopilot, but particularly so in the critical phases mentioned above. In the event of automatic trim system failure, large amounts of stabilizer trim can be compensated for by the autopilot. This can result in severe pitch down (up) when either a change in attitude or power setting causes an automatic disconnect or when a manual disconnect is accomplished. To minimize the effect of an automatic trim system failure, the trim meters and fore and aft position of the control column should be monitored closely. Disengaging the autopilot, retrimming and reengaging at frequent intervals is recommended.

AUTOMATIC FLIGHT CONTROL SYSTEM

The word "autopilot," as used in this manual, consists of the entire A/A42G-11 automatic flight control system which includes autopilot nonsteering modes, pitch and roll steering modes, and the electromechanical yaw damper.

AUTOPILOT — NONSTEERING MODES

The aircraft is provided with an autopilot which is used to maintain a reference attitude, heading, and altitude; to provide a stable bombing platform; and to provide an accurate flight path control when used with the instrument landing system (ILS). During normal flight, the autopilot holds the aircraft in a straight and level attitude at a constant heading provided by the N-1 compass system unless otherwise commanded by a crew member using the autopilot flight controller, the bombing navigational system, or the automatic approach system. Altitude control is also provided to maintain constant barometric pressure altitude. Servo motors operate the rudder tab, elevator tab, aileron tab-spoiler control valves, and stabilizer jackscrew, which in turn control the rudder, elevator, ailerons-spoilers, and stabilizer, respectively. The autopilot incorporates a protective system through the use of limit switches on the aileron and rudder axes and a safety monitor system on the pitch axis which automatically disengage the autopilot when the limit conditions for an axis have been exceeded. Force switches are installed in control column and control wheel linkage to disengage the autopilot if a certain control column or control wheel force is exceeded by either pilot. When the autopilot is ON but disengaged, the followup system continually aligns with the flight attitude and heading of the aircraft so that smooth engagement may be made at any time. Pitch control is such that the aircraft pitch attitude at the time the autopilot is engaged will be maintained. An interlock system is provided as protection against improper operation of the autopilot and to insure the pilot of primary control at all times. The autopilot operates on TR power supplied through circuit breakers marked "Interlock," "Filament," "Field & Engage," "Servo Cont," and "Pilot Off Lt," and 118-volt single-phase a-c power supplied through a circuit breaker marked "AC Pwr." The circuit breakers are on the "Auto Pilot" portion of the pilots' overhead circuit breaker panel. The systems have separate circuit breakers.

NOTE

If d-c or all a-c power to the N-1 compass is lost, the autopilot will disengage immediately. Loss of a single a-c phase will not degrade the heading information from the N-1 compass; therefore, the autopilot will not disengage. Loss of a single phase will not indicate on the protective fuses. The loss of a single phase may be detected only be removing and testing the fuses. If a fault occurs in the N-1 compass circuitry, two or all of the protective fuses will blow and may be detected by the blown fuse indicators lighting on the fuse holders. In the case of such a fault, the autopilot will disengage.

AUTOPILOT PITCH AND ROLL STEERING MODES

Aerial refueling and low level modes of the autopilot are designed to substantially reduce the loads imposed during aerial refueling and to reduce pilot fatigue during low level mode of flight. When using the aerial refueling and low level modes, the pilot flies the aircraft through the autopilot by control column and control wheel inputs in the same manner that he flies without the autopilot except that control column and wheel forces are considerably reduced. Inputs of the pilot through the column and wheel generate electrical signals proportional to the force applied through force transducers in and below the control columns. These signals to the autopilot are used to command the aircraft in pitch and roll in lieu of signals from the autopilot pitch, turn, and roll trim knobs. Turn and roll trim knobs are disabled and the pitch trim knob is mechanically stiffened to provide higher rotational forces than required when aerial refuel, low level, or altitude hold modes are not engaged. (Do not attempt to overpower the pitch trim knob.) The maximum bank angle in both modes is 33°. Lateral control force stiffens when this bank angle is approached. Attempts to increase the bank angle beyond 33° will result in an autopilot disconnect. Aerial refueling and low level modes differ in that during aerial refueling mode, the autopilot will maintain a constant attitude and will resist attempts to change that attitude. The autopilot will return the aircraft to its original attitude unless the pilot holds a particular change to pitch or bank angle for a sufficient period of time to allow the autopilot to adjust. Once the autopilot adjusts, it will aid the pilot in maintaining the new attitude. During low level mode, any bank angle up to 8° initiated by the pilot, by turbulence, etc, will result in a "roll-to-level" action by the autopilot. The pilot will feel very little resistance in the lateral controls for bank angles up to 8°. Any bank angle between 8° and 33° established by the pilot will be held by the autopilot regardless of changes to power or airspeed. Changes in pitch attitude will also be maintained by the autopilot in low level mode regardless of changes in thrust or airspeed. The rudder axis of the autopilot is automatically disengaged when selecting the aerial refueling or low level mode of operation but manual rudder requirements are greatly reduced when the electromechanical yaw damper is engaged. The pilot trims the aircraft laterally but need not apply any stabilizer trim. The autopilot will automatically trim the aircraft to assist the pilot in maintaining a pitch attitude and will trim to compensate for any gross weight or cg change. See "Pitch and Roll Steering Flight Characteristics," this section.

ELECTROMECHANICAL YAW DAMPER

The electromechanical yaw damper provides increased positive damping to lateral-direction (Dutch roll) oscillations for all flight conditions. It operates in parallel with the existing magnetic yaw damper and senses the yaw rate of the aircraft through a rate gyro. The signal from the rate gyro drives a servo motor which in turn drives the bob-weight. The bob-weight is connected to the rudder stability tab in the normal manner. With the electromechanical yaw damper engaged, the autopilot on, and in either aerial refueling or low level mode of operation, the rudder axis of the autopilot is disengaged, allowing the pilot to fly the aircraft by use of rudder pedals. When the electromechanical yaw damper is disengaged, the magnetic yaw damper provides Dutch roll damping in its normal manner. The electromechanical yaw damper is designed to operate from unstick to touchdown and is automatically disengaged through a squat switch when the aircraft is on the ground. The yaw damper receives power continuously through circuit breakers marked "Yaw Damper AC" and "Yaw Damper Cont DC" on the "Control Surface" portion of the pilot's circuit breaker panel. An ON--OFF yaw damper switch (12, figure 4-25) on the aisle stand can be placed to ON position at any time after unstick.

AUTOPILOT CONTROLS

Autopilot Flight Controller

The autopilot flight controller (3, figure 4-25) is located on the aisle stand. When the autopilot is engaged, the flight controller provides a means for maneuvering the aircraft from the pilot's or copilot's position through the turn knob, pitch knob, and roll trim knob.

TURN KNOB. A turn knob (2, figure 4-25) on top of the flight controller provides coordinated turns in autopilot nonsteering modes. Rotating the turn knob results in an aircraft turn in the same direction as the knob is rotated. The rate of turn is proportional to the speed of the aircraft and amount of bank commanded with the turn knob. Moving the turn knob out of center detent puts turn control back to the pilot regardless of the setting of the autopilot turn control selector switch or the automatic approach localizer switch. Additional detents are located at points in the turn knob rotation corresponding with approximately 10° less than the maximum bank capability of 50°. The turn knob is disabled during aerial refuel and low level modes of operation.

NOTE

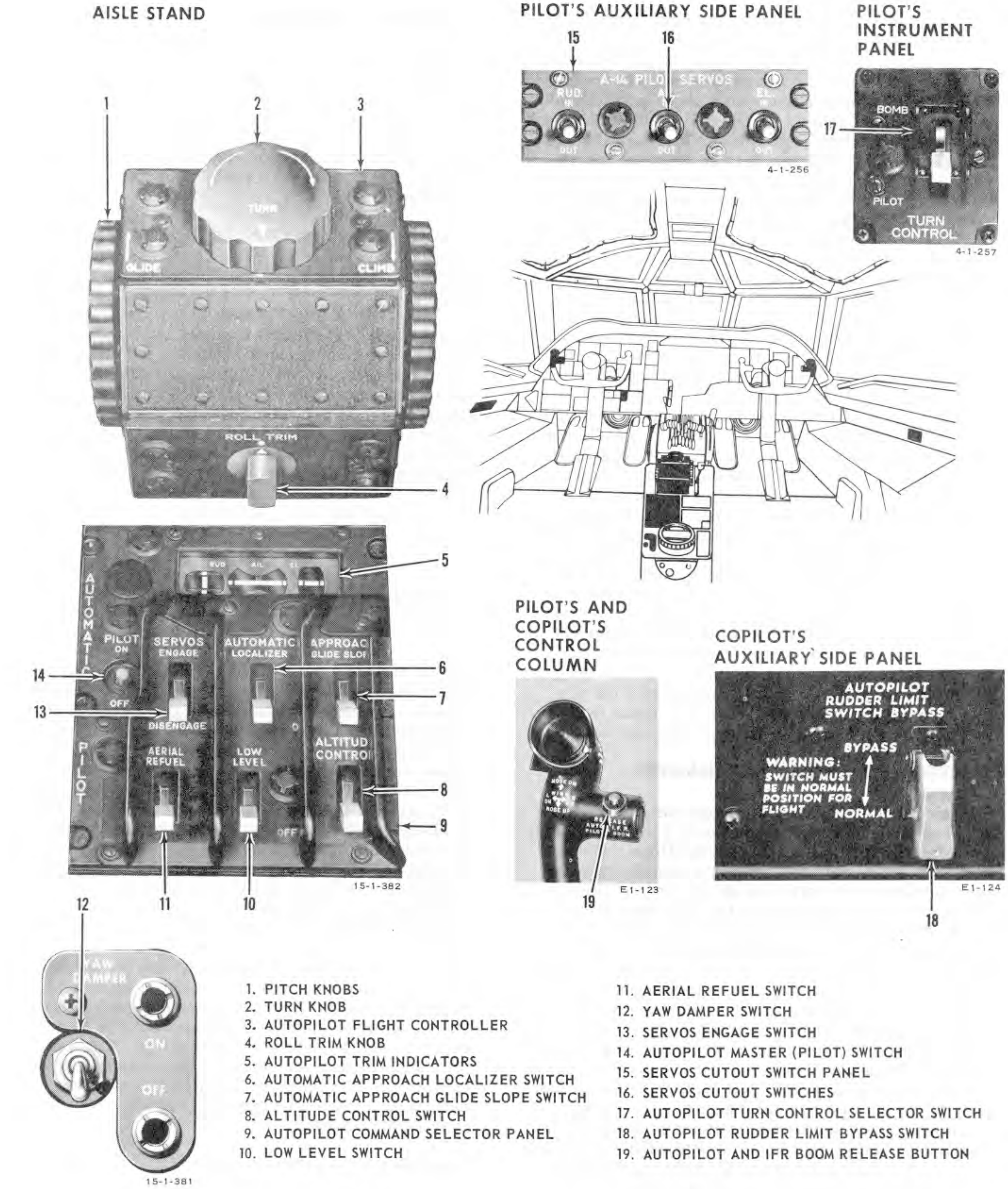
> When the turn knob is not in use, it should be in the detent at center position of total knob rotation.

PITCH KNOBS. Interconnected pitch knobs (1, figure 4-25) are located on each side of the flight controller. The pitch knobs control the elevators for climb or glide in autopilot nonsteering configurations. Forward rotation of the pitch knobs results in descent; aft rotation results in climb. The degree of aircraft climb or dive is proportional to the amount of rotation of the pitch knobs. The pitch knob signal is always aligned to the existing aircraft pitch attitude when the autopilot is engaged. With the altitude control or automatic approach glide slope switch in ON position, rotating the pitch knob will cause either of the above switches to drop to OFF position, disengaging either of these functions.

ROLL TRIM KNOB. A roll trim knob (4, figure 4-25) located on the front of the flight controller, is used principally to correct localizer standoff error when making an automatic ILS approach or to correct PDI standoff error in bomb mode. The roll trim knob is disabled during aerial refuel mode of operation. It is disabled during low level mode except when the autopilot turn control selector switch is in BOMB position.

Autopilot Command Selector Panel

The autopilot command selector panel (9, figure 4-25) is located on the aisle stand. It contains the autopilot trim indicators, autopilot master switch, servos engage switch, altitude control switch, and automatic approach switches. The autopilot command selector panel also contains an aerial refuel switch and a low level switch.



AISLE STAND

PILOT'S AUXILIARY SIDE PANEL

PILOT'S INSTRUMENT PANEL

PILOT'S AND COPILOT'S CONTROL COLUMN

COPILOT'S AUXILIARY SIDE PANEL

1. PITCH KNOBS
2. TURN KNOB
3. AUTOPILOT FLIGHT CONTROLLER
4. ROLL TRIM KNOB
5. AUTOPILOT TRIM INDICATORS
6. AUTOMATIC APPROACH LOCALIZER SWITCH
7. AUTOMATIC APPROACH GLIDE SLOPE SWITCH
8. ALTITUDE CONTROL SWITCH
9. AUTOPILOT COMMAND SELECTOR PANEL
10. LOW LEVEL SWITCH
11. AERIAL REFUEL SWITCH
12. YAW DAMPER SWITCH
13. SERVOS ENGAGE SWITCH
14. AUTOPILOT MASTER (PILOT) SWITCH
15. SERVOS CUTOUT SWITCH PANEL
16. SERVOS CUTOUT SWITCHES
17. AUTOPILOT TURN CONTROL SELECTOR SWITCH
18. AUTOPILOT RUDDER LIMIT BYPASS SWITCH
19. AUTOPILOT AND IFR BOOM RELEASE BUTTON

AUTOPILOT CONTROLS (Typical)

Figure 4-25.

AUTOPILOT MASTER (PILOT) SWITCH. An autopilot master (pilot) switch (14, figure 4-25) on the autopilot selector panel has ON--OFF positions. ON position puts power to the servo control drive motor and permits ready engagement of the servos. OFF position cuts off power to the servo control drive motor and also disengages the autopilot.

NOTE

- Power is applied to the autopilot system regardless of the position of the autopilot master (pilot) switch. Autopilot operation is prevented during the automatic warmup period of 3 to 5 minutes after power is on the aircraft. After this initial warmup period, placing the autopilot master (pilot) switch to ON and waiting 5 seconds will permit autopilot operation.
- Prior to placing the autopilot master switch to ON, the servos engage switch will be checked to the DISENGAGE position and all mode switches will be checked to OFF.
- In the event of any indication of malfunction in the autopilot disengagement by autopilot release button, place the autopilot master switch to OFF position, thus assuring positive disengagement.

SERVOS ENGAGE SWITCH. A solenoid-locking type servos engage switch (13, figure 4-25) on the autopilot command selector panel has ENGAGE--DISENGAGE positions. ENGAGE position engages all servos simultaneously. However, any axis whose servos cutout switch is in OUT position will not be engaged. DISENGAGE position will disengage all servos. The servos engage switch cannot be moved to ENGAGE if the autopilot master (pilot) switch is OFF or the roll trim knob or turn knob is out of detent. If engaged, interlocks will return this switch to DISENGAGE when 1) autopilot release buttons are pressed; 2) autopilot master switch is turned OFF; 3) a-c power, filament, fields engage, interlock, or servo control circuit breakers are tripped; or 4) one of the protective systems is tripped.

NOTE

- If servos engage switch fails to return to DISENGAGE when disengaging with autopilot release buttons, place autopilot master switch to OFF position, thus assuring positive disengagement.
- A minimum of 5 seconds waiting period will be allowed after autopilot master switch turn-on before the servos engage switch is placed to ENGAGE.

ALTITUDE CONTROL SWITCH. An altitude control switch (8, figure 4-25) located on the autopilot selector panel has ON--OFF positions. In ON position, the elevator servo is controlled by a barometric pressure control unit. Rotating the pitch knob drops the altitude control switch to OFF and deactivates altitude control operation. Moving the glide slope switch to ON will drop the altitude control switch to OFF position. The altitude control switch will remain locked in OFF as long as the glide slope switch is in ON position. The altitude control switch will drop to OFF position when the aerial refueling switch or the low level switch is engaged. The altitude control switch cannot be turned to ON with the elevator servo cutout switch in OUT position. In OFF position, the constant altitude control is made inoperative.

AUTOMATIC APPROACH LOCALIZER SWITCH. An automatic approach localizer switch (6, figure 4-25) on the autopilot selector panel has ON--OFF positions. The localizer switch is locked OFF unless the radio receivers are on and tuned to a localizer frequency. ON position allows the lateral controls of the autopilot to be controlled by the localizer beam after it has been intercepted. In OFF position, no signal from the beam is received by the autopilot. The localizer switch will go to OFF if the turn knob is moved out of detent.

NOTE

The localizer switch is locked OFF when the nav mode select switch is positioned to TACAN or to VOR.

AUTOMATIC APPROACH GLIDE SLOPE SWITCH. An automatic approach glide slope switch (7, figure 4-25) on the autopilot selector panel has ON--OFF positions. ON position allows the pitch controls of the autopilot to be controlled by the glide slope beam after it has been intercepted. In OFF position, no signal from the glide slope is received by the autopilot. The automatic approach glide slope switch cannot be turned ON unless the automatic approach localizer switch is in ON position and will go to OFF position if the pitch knobs are rotated or when the localizer switch is turned OFF.

NOTE

Placing the automatic approach glide slope switch to ON position modifies the system response to localizer signals to compensate for the narrow localizer beam near the station. Attempting to continue the approach with the automatic approach localizer switch in ON and the automatic approach glide slope switch in OFF position after the glide slope has been intercepted will probably result in the aircraft bracketing the localizer beam.

AERIAL REFUEL SWITCH. A solenoid-locking aerial refuel switch (11, figure 4-25) has AERIAL REFUEL--OFF positions. In AERIAL REFUEL position, signals are supplied from the force transducers which allow the pilot to control the aircraft through the autopilot. Turn and roll trim knobs are disabled and the pitch trim knob is mechanically stiffened to provide higher rotational forces than required when aerial refuel, low level, or altitude hold modes are not engaged. (Do not attempt to overpower the pitch trim knob.) In OFF position, power is removed from the aerial refuel portion of the autopilot. The aerial refuel switch will automatically return to OFF position when the autopilot is disengaged for any reason.

LOW LEVEL SWITCH. A solenoid-locking low level switch (10, figure 4-25) has LOW LEVEL--OFF positions. In LOW LEVEL position, signals are supplied from the force transducers which allow the pilot to control the aircraft through the autopilot. The turn knob is disabled and the pitch trim knob is mechanically stiffened to provide higher rotational forces than required when aerial refuel, low level, or altitude hold modes are not engaged. (Do not attempt to overpower the pitch trim knob.) In OFF position, power is removed from the low level portion of the autopilot. The low level switch will automatically return to OFF position when the autopilot is disengaged for any reason.

Servos Cutout Switches

A servos cutout switch (16, figure 4-25) is provided for each of the three control axes. Each switch located on the servos cutout switch panel has IN--OUT positions. This switch must be in IN position before the individual servo can be engaged by the servos engage switch. OUT position is used to cut the servo out of operation.

NOTE

- The servos engage switch may move to DISENGAGE, disengaging the autopilot whenever any one of the servos cutout switches is placed in OUT position. The servos engage switch will move to DISENGAGE disengaging the autopilot whenever any one of the servos cutout switches is placed from OUT to IN position. In either case, the servos engage switch may be returned to the the ENGAGE position.
- Either the aerial refuel or low level switch, if engaged, will drop to OFF if any of the servos cutout switches are placed in OUT position. The elevator cutout switch must be IN before the servos engage switch and aerial refuel or low level switches are reengaged. The aerial refuel and low level modes may be operated with the aileron cutout switch in OUT, but for full utilization of the system, the aileron cutout switch should also be placed to IN position.
- Engaging the aerial refuel or low level switches will automatically disengage the rudder axis of the autopilot although the servo cutout switch will remain IN.

Autopilot and Air Refueling (IFR) Boom Release Buttons

Autopilot release buttons (19, figure 4-25) are provided on both control wheels. Pressing either one of these pushbutton switches disengages all autopilot servo motors, thereby eliminating autopilot control. The autopilot will be disengaged at all times when either autopilot release button is depressed. If the servos engage switch does not drop to DISENGAGE position because of a malfunction, the autopilot will be reengaged upon release of the button. For further use of these release buttons, see "Air Refueling System," this section.

WARNING

All disengagements of the autopilot by means of the pilot's or copilot's autopilot release button will be followed immediately by checking the servos engage switch to DISENGAGE.

Autopilot Rudder Limit Bypass Switch

A two-position rudder limit bypass switch (18, figure 4-25), located on the copilot's auxiliary side panel, has BYPASS--NORMAL positions and is guarded in NORMAL position. When switch is held in BYPASS position, the low speed rudder limit switch is bypassed, permitting engagement of autopilot during the pilot's preflight check in the event of disengagement caused by a hard-over rudder from wind gusts. In NORMAL position, the low speed rudder limit switch will function normally.

Autopilot Turn Control Selector Switch

A two-position autopilot turn control selector switch (17, figure 4-25) is located on the pilots' instrument panel. This switch has BOMB--PILOT positions and is used to transfer turn command from the autopilot flight controller to the autopilot remote turn controller. Interlocks will return the turn control selector switch from BOMB to the PILOT position without disengaging the autopilot when the pilots' turn knob is rotated out of detent, or if any of the following changes occur during BNS operation of the autopilot:

1. When changing from BOMB mode to any other mode.
2. Moving bomb select switch from SYN to L/S.
3. In BOMB mode when bomb bay doors close.
4. Changing from AUTO STEER to any other mode.

See "Pitch and Roll Steering Flight Characteristics," this section, for use of the autopilot turn control selector switch in low level mode of operation.

Force Switches

The control rods, between the pilot's and copilot's control columns and the forward elevator cable quadrants, each include a force switch assembly which is actuated by a predetermined control column force initiated by either pilot in opposition to autopilot or unscheduled stabilizer trim movement. See "Force Switches," Section I. Actuation of either force switch will completely disengage the autopilot and electrically interrupt stabilizer trim circuit in the pitch direction opposing control column force. In addition, a roll force switch will disengage autopilot if either pilot exerts a predetermined control wheel force in opposition to autopilot.

AUTOPILOT INDICATORS

Autopilot Disengaged Light

A red autopilot disengaged warning light (6, figure 1-15) on the pilots' instrument panel flashes whenever the servos engage switch is disengaged after having once been engaged. The flashing may be stopped by reengaging the servos engage switch or by momentarily shutting off autopilot master switch. The disengage light is provided TR power through a circuit breaker marked "Pilot Off Lt" on "Auto Pilot" portion of pilots' overhead circuit breaker panel.

Autopilot Trim Indicators

Three autopilot trim indicators (5, figure 4-25) are located on the autopilot selector panel and are marked "Rud," "Ail," and "El" according to the autopilot servo with which each is used. The trim indicators provide a visual indication of the electrical power input to the autopilot servos. The indicator bar will be displaced when the servo is exerting force on the control surface actuator and the bar will be displaced in proportion to the amount of force exerted. During flight, the indicators will fluctuate constantly and their actual indication must be determined by interpreting their average displacement. The centered indicator bars indicate no electrical power input to the autopilot servos. Before autopilot engagement, a displaced trim indicator bar indicates incorrect power input to the autopilot servo and, upon autopilot engagement, the autopilot servos will deflect the aircraft control surfaces to change aircraft attitude in the direction of indicator bar displacement. After autopilot engagement, a displaced trim indicator bar indicates that the autopilot servo is exerting force on the control surface to compensate for an out-of-trim condition and, upon autopilot disengagement, the servo will release the force, allowing the control surface to return to the manual trimmed position and the aircraft attitude will change in the opposite direction of indicator bar displacement.

CAUTION

> An abrupt control surface displacement will occur if the autopilot is engaged or disengaged with a trim indicator steadily displaced more than one bar width.

Remote Turn Control Indicator Light

A green remote turn control indicator light on the radar navigator's panel will illuminate when the autopilot turn control selector switch is placed in BOMB position.

AUTOPILOT SAFETY FEATURES

Pitch Protection

A safety monitor system provides protection on the pitch axis against excessive angular accelerations. When such accelerations are encountered, this system disengages the autopilot. Protection against possible servo or accelerometer malfunctions is also provided by this system. As an additional safety feature, the pilot can overpower the stabilizer trim servo manually with the stabilizer trim wheels. A force switch will disengage the autopilot if the pilots apply a force to the control column opposing autopilot-induced stabilizer trim actuation.

NOTE

> The stabilizer trim function of the aileron and stabilizer trim buttons will be inoperative when the elevator servo cutout switch is positioned to IN and the servos engage switch is positioned to ENGAGE.

Roll Protection

BNS controlled turns are limited to 39° in the bomb mode and to 15° in AUTO STEER or NAV mode. When the bomb mode and low level mode are selected together, the bank angle is limited to 15°. Turns commanded by the pilot's turn knob, when rotated to the detent, are limited in bank angle to approximately 39°. However, rotation of the turn knob past this detent will allow up to 50° of bank angle to facilitate a breakaway maneuver.

WARNING

> See "Combat Breakaway Maneuvers," Section VI, for maximum recommended bank angles applicable to existing gross weight, altitude, and Mach number.

In both aerial refuel and low level modes, turns commanded by the pilot's control wheel are limited in bank angle to 33°. Attempts to increase the bank angle beyond 33° will result in an autopilot disconnect. Roll trim knobs are effective only in BOMB and ILS modes. Diode limiters in the automatic approach amplifier limit the bank angle to 25° when the localizer switch is in ON position or 10° when the glide slope switch is in ON position. Aileron limit switches provide roll axis protection in case of an autopilot failure resulting in hard-over signals. These switches are effective in all flight conditions except when a bank angle in excess of approximately 4 1/2° is commanded by bombing computer, ILS coupler, or crew member. In addition, a force switch will disengage the autopilot if either pilot exerts a control wheel force of approximately 40 pounds.

Rudder Protection

Rudder limit switches provide protection in yaw movements when in nonsteering configuration. Three sets of limit switches provide protection by disengaging the autopilot within various airspeed ranges. The settings of the limit switches are based upon the structural limits of the vertical stabilizer.

"G" Limiter

When using the low level steering function, control column force requirements are considerably reduced by servo assistance from the autopilot. Consequently, it would be possible for the pilot to inadvertently exceed the normal acceleration (load) limits of the aircraft in a pull-up, pushover, turn, or combination of pull-up and turn. To prevent this, a "g" limiter function has been incorporated in the system to limit the normal acceleration obtainable with pitch and roll steering. The "g" limiter function is set to limit "g" loads from a minimum of 0.2 to a maximum of 1.8. As the pilot maneuvers the aircraft through any longitudinal attitude change, an accelerometer senses the variation in acceleration and causes the autopilot servo torque assistance to reduce, with a corresponding increase in pilot required force. If the pilot or copilot continues to increase the applied force, the autopilot will finally disengage. However, the disconnect will be smooth and the first indication to the pilot will be an illumination of the autopilot disengaged light. The smooth disconnect results from the logic that is built in the system. The logic requires that the following two conditions exist before the autopilot is disengaged: 1) The applied column force is greater than 30 (±6) pounds of push or pull force, and 2) the elevator servo is opposing the applied column force by approximately 3 pounds. This requirement means that the pilot will be applying approximately 3 pounds more force than is required to hold the same column displacement manually. Since these two conditions must be satisfied for all flight conditions, the transition from autopilot operation to manual operation is smooth.

NOTE

The "g" limiter does not affect the disconnect logic but is merely a method of increasing the pilot's applied force up to the manual force level.

An operational ground check of the disconnect logic circuit is made by applying a sharp push or pull force to the column and then rapidly reversing the direction of the applied force. Since the servo cannot reverse its direction of rotation as rapidly as the force is changed, both disconnect requirements will be met, assuming that the force applied exceeds 30 pounds.

PITCH AND ROLL STEERING FLIGHT CHARACTERISTICS

Aerial Refueling Mode

The aerial refueling mode of the autopilot was designed primarily to substantially reduce the loads imposed on the aircraft during air refueling and will be utilized for all air refueling operations with KC -135 tanker aircraft, when the equipment is operative, unless specific directives dictate otherwise.

NOTE

The aerial refueling mode is not recommended for formation flying other than that required for air refueling operations.

The pilot will find that using the aerial refueling mode will improve manual proficiency. This mode provides stability in pitch and roll which will resist attitude changes due to tanker downwash or turbulence. The aircraft responses in the aerial refueling mode differ from the low level mode in that more rapid aircraft responses are obtained when wheel or column force is applied. This characteristic allows smoother control inputs to maneuver the aircraft in the small envelope behind the tanker and also allows use of more of the envelope, thus reducing aircraft loads. When the pilot relaxes wheel or column force following momentary corrections, the autopilot will restore the aircraft to the attitude existing prior to the correction.

NOTE

The characteristics of the following pitch and roll maneuvers while in aerial refueling mode may be observed by the pilot without the aid of a tanker.

PITCH MANEUVERS. The attitude hold and pitch attitude reference change features of the autopilot while in aerial refueling mode may be demonstrated by the following maneuvers. Momentarily pitch the aircraft up or down approximately 2° and relax force on the control column. When force is relaxed, the aircraft will return to the original flight attitude. A change to the pitch attitude reference may be accomplished by maintaining column force for some period of time. As an example, with the servos engage switch engaged, establish an approximate 2° noseup pitch attitude by rotating the pitch knob. Place aerial refuel switch to AERIAL REFUEL and push the column forward until the aircraft rotates to level flight. Relax column force and observe that the aircraft starts recovery to the original 2° noseup attitude. Maintain level flight and observe that the restraining force necessary to maintain level flight gradually decreases until column force is zero. When column force reaches zero, the aircraft attitude reference will have changed from 2° noseup to level flight. Thus, a change in pitch attitude reference is accomplished automatically by the autopilot when column force is maintained for a specific period of time. The amount of reference change is dependent on the length of time column force is maintained. Automatic stabilizer trimming occurs during autopilot aerial refueling operation whenever a column force is applied.

ROLL MANEUVERS. The attitude hold and roll attitude reference change features of the autopilot when in aerial refueling mode may be demonstrated by the following maneuvers. Momentarily roll the aircraft left or right, establishing a shallow bank angle and relax force on the control wheel. When force is relaxed, the aircraft will return to the original flight attitude. Reestablish the bank angle, restrain the wheel, and note that the wheel force will gradually decrease until the aircraft roll attitude is maintained at the new reference with zero wheel force. Turns are accomplished by changing the roll attitude reference but the roll characteristics of the aerial refueling mode require a special technique. The change in roll reference from wings level to a 30° bank angle, for example, may require maintaining a wheel force as long as 1 1/2 minutes. However, the time required to change the roll reference may be shortened by slight overcontrolling. That is, after the desired bank angle is established, a slight increase in wheel force (through the use of cross-control) will increase the roll reference rate of change. Returning to wings level after turning requires a similar procedure.

RECEIVER-TANKER CONTACT TECHNIQUES. The aerial refueling mode of the autopilot is designed to be compatible with refueling altitude, airspeeds, and downwash characteristics of the KC-135 tanker. Generally, each pilot must perform several contacts with the tanker before the optimum air refueling technique is developed and full confidence in this mode of the autopilot is realized. The autopilot master switch should be ON, all other mode switches OFF or DISENGAGED, and the servos cutout switches IN.

NOTE

> The pilot should be prepared to initiate a switch or force disconnect prior to engaging the servos engage switch or the aerial refueling switch since some autopilot failures (e.g., a vertical gyro failure) are not detectable by the trim indicators and may result in a hard-over pitch and/or roll servo action. Force disconnects during this condition are easily initiated by resisting column or wheel movement until force builds up to the force switch disconnect value.

The air refueling system should be ready for contact. At approximately 10 knots above refueling airspeed, engage the servos switch and, in turn, the aerial refuel switch. Engaging the servos engage and aerial refuel switches in sequence should be accomplished as rapidly as possible to minimize the time when the autopilot is in a nonsteering mode. The autopilot is now ready for contact.

NOTE

> When engaging the aerial refuel switch, if the signal amplifier cycles from ready to disconnect, push the reset button and return air refueling system to ready condition.

Low Level Mode

The low level mode of the autopilot was designed to aid the pilot in flying the aircraft at low altitudes and to reduce pilot fatigue during this type of flying.

NOTE

> The low level mode is not recommended for penetrations, takeoffs, formation flying, holding patterns, instrument approach procedures, landing, or flight at any altitude other than that required for low level or low altitude missions.

The low level mode should be engaged after stabilizing at an altitude consistent with the start of a low level flight phase. The aircraft should be trimmed properly and the trim indicators should be centered prior to engaging the servos engage switch. The low level switch should be placed to LOW LEVEL immediately after engaging the servos engage switch to avoid low level flight in a nonsteering mode.

NOTE

> The pilot should be prepared to initiate a switch or force disconnect prior to engaging either the servos engage switch or the low level switch since some autopilot failures (e.g., a vertical gyro failure) are not detectable by the trim indicators and may result in a hard-over pitch and/or roll servo action. Force disconnects during this condition are easily initiated by resisting the column or wheel until force builds up to the force switch disconnect value.

PITCH MANEUVERS. After engaging the low level mode, pitch maneuvers are commanded through the autopilot by applying force to the control column. Pitch characteristics may be observed by gradually increasing control column force. As force is increased, the column starts to move with a corresponding change in aircraft pitch attitude. Allow the aircraft attitude to change a few degrees by applying column force. The column will return approximately to neutral as stabilizer trim occurs and the aircraft will be maintained in the new attitude. This attitude will be maintained by the autopilot. Automatic trimming may be observed during changes in aircraft speed due to climbing or descending flight or by advancing or retarding the throttles. Apply a column force and observe that trimming occurs whenever such a force is applied.

ROLL MANEUVERS. Bank the aircraft left or right to a bank angle of 8° or less. When wheel force is relaxed, the autopilot will return the aircraft to wings level and the heading will be maintained. Bank the aircraft left or right to a bank angle greater than 8°. When wheel force is relaxed, the autopilot will maintain the aircraft in the new bank angle. Continue the bank angle to approximately 30° and note that wheel force must be increased in order to keep the wheel displaced at this bank angle. The increase in wheel force is called wheel stiffening and autopilot disconnect will occur at approximately 33° of bank angle or when approximately 40 pounds of wheel force is reached. This roll force disconnect feature is available in all modes.

OUT-OF-TRIM EFFECTS. Effects of an out-of-trim aircraft may be noted by disengaging the autopilot, slightly reducing power on engines 7 and 8, and reengaging the autopilot low level mode. The control wheel will be displaced to the left. This exaggerated out-of-trim condition illustrates the necessity of trimming the aircraft before engaging the low level mode. Wheel displacement may be decreased by advancing throttles for engines 7 and 8. Note that the aircraft also remains on heading. Heading hold in the low level mode is accomplished by lateral control surface displacement since the rudder is disengaged. If the heading is drifting at the time the low level mode is selected, the lateral control surfaces will displace to compensate for drift, resulting in wheel displacement.

BNS TIE-IN. The BNS tie-in (second station) mode may be selected while in low level mode by positioning the autopilot turn control selector switch to BOMB. The pilot retains pitch and rudder control but roll and heading control responds to BNS commands. Bank angle is limited to 15° in the NAV mode of the BNS. The autopilot will disconnect if the pilot restrains the wheel movement that accompanies second station roll control. Pilot-initiated pitch control through the control column simultaneously with second station roll control may appear awkward at first and will necessitate coordination between the pilot and radar navigator. Manual control of the aircraft may be regained by overpowering the autopilot in roll or pitch or by pressing the disengage button. Second station control may be disengaged and autopilot roll steering control returned to the pilot by rotating the flight controller turn knob out of detent or returning the autopilot turn control selector switch to PILOT.

AUTOPILOT NORMAL OPERATION

Preflight of the Autopilot

NOTE

> This check may be performed after a reported malfunction has occurred, time and conditions permitting, and at the discretion of the flight crew.

CAUTION

> Hydraulic power is necessary at the stabilizer jackscrew to allow the mechanism to operate without slipping of the autopilot stabilizer trim servo override clutch.

1. (Deleted)
2. Place hydraulic pack switches 9 and 10 to ON.
3. Place turn knob and roll trim knob in detent and synchronize the N-1 compass.
4. Check all servos cutout switches to IN.
5. Place autopilot master switch ON.

6. Note that autopilot trim indicators are centered and place servos engage switch in ENGAGE.

NOTE

If the autopilot cannot be initially engaged or if disengagement of the autopilot occurs during the checkout due to the rudder contacting the rudder limit switch, hold the autopilot rudder limit bypass switch in BYPASS position throughout the remainder of the checkout.

7. Check autopilot disengage functions:

a. Disengage autopilot by pressing pilot's release button; reengage autopilot and check by pressing copilot's release button.

b. Apply approximately 40 pounds lateral force on the pilot's control wheel to the right; autopilot should disengage. Reengage autopilot and repeat to the left. Reengage autopilot and repeat lateral force disconnect both right and left for copilot's control wheel.

NOTE

It may be necessary to move the control wheel to the stops to apply sufficient force to disconnect the autopilot.

c. Push forward on the pilot's control column until the servos engage switch moves to DISENGAGE, reengage the autopilot and pull back on the control column until the servos engage switch moves to DISENGAGE, and again reengage the autopilot. Repeat control column force disconnect both fore and aft for the copilot's control column.

d. Place the aileron servo cutout switch to OUT. Place servos engage switch to ENGAGE. Rotate control wheel clockwise. Autopilot should disengage at approximately 75° of control wheel rotation.

e. Place servos engage switch to ENGAGE. Rotate control wheel counterclockwise. Autopilot should disengage at approximately 75° of control wheel rotation.

8. Place elevator servo cutout switch to OUT. Return servos engage switch to ENGAGE if it moved to DISENGAGE. Operate the pilot's or copilot's stabilizer trim button to NOSE UP and NOSE DN; the manual trim wheels should rotate in the direction of the commanded trim.

9. Place elevator servo cutout switch to IN. Return the servos engage switch to ENGAGE if it moved to DISENGAGE. Operate the pilot's or copilot's stabilizer trim button to NOSE UP and NOSE DN; the manual trim wheels should not rotate.

10. With the autopilot master switch ON, servos engage switch in ENGAGE, and ILS receiver inoperative, the automatic approach localizer switch should be locked OFF. Turn nav mode select switch to ILS. With the ILS receiver on and tuned to an approach localizer frequency, turn the automatic approach localizer switch and altitude control switch to ON.

11. With the automatic approach localizer switch ON, place nav mode select switch to ILS APP and turn the automatic approach glide slope switch to ON. Altitude control switch should drop to OFF.

12. Rotate the roll trim knob clockwise; the pilots' control wheels should rotate clockwise. Repeat for the counterclockwise direction, then return the roll trim knob to detent.

13. Rotate the pitch knob; the automatic approach glide slope switch should drop to OFF.

14. Rotate the turn knob out of detent; the automatic approach localizer switch should drop to OFF. Return the turn knob to detent.

15. Place the altitude control switch in ON. Rotate pitch knob; altitude control switch should drop to OFF.

NOTE

It should be considered normal, when engaging the altitude control on the ground, for the "engage error" of the altitude control to originate a signal to which the aircraft at rest on the ground cannot respond, causing the elevator and stabilizer trim to be driven to their limits.

16. Rotate the turn knob clockwise; the pilots' control wheels should rotate clockwise. Repeat for the counterclockwise direction, then return the turn knob to detent.

NOTE

Rotating the turn knob rapidly may result in disengagement of the autopilot. This occurs because the servo will drive the control surface to the limit (opening the limit switch) before the roll followup amplifier can make the circuit that bypasses the limit switch.

17. Rotate the pitch knobs in the climb direction; the control columns should move aft and the manual trim wheel should rotate for noseup trim. Rotate the pitch knobs in the dive direction; the control columns should move forward and the manual trim wheel should rotate for nosedown trim.

18. Place the autopilot turn control selector switch in BOMB; the remote turn control indicator light should come on.

19. Command a right turn with the bombing navigational system; the pilots' control wheels should rotate clockwise. Command a left turn with the bombing navigational system; the pilots' control wheels should move counterclockwise.
20. Return the autopilot turn control selector switch to PILOT.
21. Place low level mode switch to LOW LEVEL.

NOTE

The rudder axis of the autopilot will automatically disengage although the servo cutout switch will remain in.

a. Disengage autopilot by pressing pilot's release button; reengage autopilot and check by pressing copilot's release button.

b. Apply approximately 40 pounds lateral force on the pilot's control wheel to the right; autopilot should disengage. Reengage autopilot and repeat to the left. Reengage autopilot and repeat lateral force disconnect both right and left for copilot's control wheel.

NOTE

It may be necessary to move the control wheel to the stops to apply sufficient force to disconnect the autopilot.

c. Apply a sharp push-pull force to pilot's control column; autopilot should disconnect. Reengage and repeat using a sharp pull-push force. Repeat using copilot's control column.

d. Move control column forward. Control column should move easily and remain where displaced by the pilot. The stabilizer trim should move while force is being applied to the control column and should drive in the nosedown direction, possibly driving to the limit. Limit stabilizer trim movement to 1/2 unit of displacement. While stabilizer trim is moving, apply a 5-pound force to control column in the opposite direction of trim movement and note that the stabilizer trim follows the force change.

e. Repeat step "d" using an aft control column displacement.

f. Displace control wheel right using varying amounts of displacement up to full travel. Note that control wheel returns approximately to neutral when force is released. (The aileron limits are bypassed in low level mode.) Repeat using left control wheel displacement.

g. Place autopilot turn control selector switch to BOMB.

h. Command a right turn with the BNS; pilots' control wheels should rotate clockwise. Command a left turn with the BNS; pilots' control wheels should rotate counterclockwise. During bomb mode of operation, the pilot will have the overpower feature on lateral control to disconnect the autopilot. The pilot will have pitch control through the control column. Switching between pilot and bomb modes of operation should not disconnect the autopilot.

NOTE

The roll trim knob may be used to reduce standoff error as observed on the PDI when the autopilot turn control selector switch is in BOMB position.

i. Return autopilot turn control selector switch to PILOT. Return low level switch to OFF.
22. Place air refueling system master switch ON.
23. Place normal slipway door switch to OPEN.
24. Place aerial refuel mode switch to AERIAL REFUEL.

NOTE

The rudder axis of the autopilot will automatically disengage when placing aerial refuel switch to AERIAL REFUEL, although the servo cutout switch will remain in.

a. Disengage autopilot by pressing pilot's release button; reengage autopilot and check by pressing copilot's release button.

b. Apply approximately 40 pounds lateral force on the pilot's control wheel to the right; autopilot should disengage. Reengage autopilot and repeat to the left. Reengage autopilot and repeat lateral force disconnect both right and left for copilot's control wheel.

NOTE

It may be necessary to move the control wheel to the stops to apply sufficient force to disconnect the autopilot.

c. Apply a sharp push-pull force to pilot's control column; autopilot should disconnect. Reengage and repeat using a sharp pull-push force. Repeat using copilot's control column.

d. Move pilot's control column forward and release; column should return to neutral. Move control column aft and release; column should return to neutral. Repeat using copilot's control column.

e. Move pilot's control column forward and hold in displaced position for 20 to 30 seconds. The control column should remain in displaced position. Repeat procedure by moving control column aft. Repeat using copilot's control column.

NOTE

- If stabilizer trim drives, limit movement to 1/2 unit by using approximately 5 pounds of force in the opposite direction of trim movement.
- Control column forces may appear higher when using aerial refueling mode than when using low level mode.

f. Rotate pilot's control wheel right and release; wheel should return to neutral. Rotate wheel left; wheel should return to neutral. Rotate control wheel right and hold in displaced position for 20 to 30 seconds; wheel should remain in displaced position when released by pilot. Rotate control wheel left and hold in displaced position for 20 to 30 seconds; wheel should remain in displaced position when released. Repeat using copilot's wheel.

25. Return the autopilot master switch to OFF.
26. Check all servos cutout switches to IN.

Pilot's Operation of the Autopilot

Pilot's inflight operation of the autopilot may be accomplished by the following procedure:

1. Place yaw damper switch in ON position after takeoff.
2. Check autopilot master switch ON.
3. Trim aircraft wings level and ball centered.

a. The aircraft should be trimmed by fuel management and thrust adjustments as much as possible since manual trim will create drag. See "Fuel Management for Lateral Trim" under "Climb," Section II.

b. Use rudder trim as required to obtain straight and level flight. However, the autopilot should not be engaged if the rudder trim exceeds the following:

KNOTS IAS	TRIM UNITS
Up to 155	12
155 to 235	6
Above 235	3

Nuisance autopilot disengagements may be encountered in mild turbulent air and during turn transient conditions when rudder trim is near or at the above values. Such disengagements are caused by the rudder actuating the autopilot rudder limit switches.

NOTE

Rudder trim should not be applied while the autopilot is engaged in nonsteering modes.

4. Check all servos cutout switches to IN.

NOTE

- With aileron servo cutout switch in OUT position, aircraft will not hold heading; however, rudder servo will continue to provide Dutch roll damping.
- If the N-1 compass fails completely, the rudder servo cutout switch should be positioned to OUT to prevent erratic heading signals. All modes except heading hold are still available.
- With only the rudder servo cutout switch in OUT position:
  a. The aircraft will not hold heading unless coupled to BNS or automatic approach equipment.
  b. Turns can be made with the turn knob.
  c. A slight decrease in Dutch roll damping may be noted.

5. Check autopilot flight controller for:

a. Turn knob in detent.
b. Roll trim knob in detent.

6. Check that autopilot trim indicator bars are in center reference positions.

NOTE

Steady displacement of one or more of the autopilot trim indicator bars on the autopilot selector panel indicates a lack of autopilot-aircraft synchronization. The autopilot should not be engaged unless the malfunctioning axis is cut out, using the applicable servo cutout switch.

7. Place servos engage switch to ENGAGE.

WARNING

The pilot should be prepared to immediately disengage the autopilot in the event of a hardover signal following engagement.

NOTE

- Upon engagement, there should be no engage transient in the control axes exceeding 1/2° of pitch or yaw and 1° of roll.
- Servos may be engaged in a normal climb or descent and the aircraft will continue to fly that attitude until the pilot moves his pitch knob.
- If the autopilot is engaged when the aircraft is banked for a turn, it will automatically roll the aircraft to a near wings-level attitude.
- The autopilot will not completely compensate for all lateral mistrim. If the aircraft is not properly trimmed before autopilot engagement or becomes out of trim after engagement, the aircraft may fly slightly wing low until the aircraft is retrimmed by fuel management and thrust adjustments.

8. Place altitude control switch to ON if constant altitude control is desired. The aircraft is now under autopilot control on all three axes.

NOTE

- The aircraft should, with no more than two overshoots, stabilize out on a "reference" altitude within the following stated tolerances from "engage" altitude:

Bombing condition	±300 feet
Hi-speed condition	±175 feet
Approach condition	±100 feet

Then variation from "reference" altitude should not exceed ±50 feet during any 15-minute interval with no continuous oscillation after the engage transient has damped out. Long term wander (slow, steady change in altitude) may occur but shall not exceed 200 feet maximum altitude change. Gust response shall not exceed one overshoot in smoothly returning the aircraft to controlled altitude. Recovery from a turn should be within ±70 feet of the altitude indicated before the turn.

- Pitch oscillations or erratic operation may occur while in altitude control near maximum level flight airspeeds above 20,000 feet altitude. In such cases, disengage the altitude control until airspeed is reduced.

9. Standard maneuvers may be executed with the pitch and turn knobs. Climb and descent are accomplished with the pitch knob; turns are made with the turn knob. A climbing or descending turn is made with a combination of the two knobs.

10. During flight, check that the autopilot trim indicator bars remain in the near centered position. Steady displacement of the "Ail" and/or "Rud" trim indicator bars and the control wheel indicate asymmetrical fuel load or engine thrust requiring appropriate fuel management and/or thrust adjustment to center the control wheel and return the "Ail" and "Rud" trim indicator bars to near center. See "Fuel Management for Lateral Trim" under "Climb," Section II. Steady displacement of the "El" trim indicator bar appreciably more than a bar width indicates a malfunction. The elevator axis must be disengaged using the procedure under "Individual Servo Disengagement." Rudder and aileron axes normally will not require retrimming while on autopilot.

NOTE

- During operation on autopilot, airbrake operation should be performed with caution to avoid an excessive longitudinal out-of-trim condition and to prevent possible automatic pilot disengagement.
- During autopilot control with altitude control engaged, operation of the wing flaps is permissible. While operating flaps, a large but not dangerous indicated altitude change will result due to a change in airflow across the static source. Lowering flaps results in a gain in altitude; raising flaps will result in a loss of altitude.

11. The low level mode may be engaged under the following conditions:

- Autopilot master switch is ON
- Elevator servo cutout switch is IN
- Aileron servo cutout switch is IN
- Servos engage switch is in ENGAGE
- No other autopilot mode is engaged (if altitude hold is engaged, it will drop out)

- Normal and alternate slipway door switches are CLOSED
- Roll trim and turn knob in detent

NOTE

- In the event of a malfunction of the slipway door system, the low level switch may be engaged if the air refueling system master switch is OFF or is cycled from ON to OFF after the slipway door switches are in CLOSED position.
- When engaging either the low level or aerial refuel mode switches, the pilot and copilot should not be exerting any force on the control column or wheel. If either pilot is exerting a force on his respective controls when the low level or aerial refuel mode switch is engaged, an engage transient will occur. The action will be observed as a short pulse action on the wheels or columns but will not drive the control to the limit.

12. The aerial refueling mode is placed in operation while approaching the precontact position and will be engaged under the following conditions:
    - Autopilot master switch is ON
    - Elevator cutout switch is IN
    - Aileron cutout switch is IN
    - Servos engage switch is in ENGAGE
    - Slipway doors are open
    - No other autopilot mode is engaged (if altitude hold is engaged, it will drop out)

NOTE

During aerial refueling, boom disconnects caused by excessive pressure (exceeding the boom envelope limits) or boom operator-initiated disconnects will not disengage the autopilot.

Radar Navigator's Operation of the Autopilot

The bombing navigational system has no pitch control over the aircraft. Turn control of the autopilot is transferred to the BNS when the autopilot turn control selector switch is placed in the BOMB position. The radar navigator can then command autopilot turns manually with the tracking handle or set up the BNS for automatic operation of the autopilot.

Autopilot Disengagement

CAUTION

- Check elevator and rudder systems for artificial feel after autopilot disengagement if flying in or leaving an icing condition. Icing of the Q-spring ram air duct may result in loss of artificial feel. If abnormally light rudder or elevator control forces are encountered, abrupt control displacements should be avoided to prevent overstressing the aircraft. See "Elevator and Rudder Control Malfunction," Section III.
- If a constant large displacement of the elevator trim indicator bar indicates failure of the automatic stabilizer trim system during flight on autopilot, maintain column position manually after autopilot disengagement and retrim.

INDIVIDUAL SERVO DISENGAGEMENT. Individual servo disengagement is accomplished by the following procedure:

1. Disengage autopilot by means of the autopilot release button on the pilot's or copilot's control wheel.
2. Disengage desired individual servo by placing the proper servo cutout switch in OUT.
3. Reengage remaining servos by placing the servos engage switch in ENGAGE.

NOTE

The aerial refueling and low level modes cannot be used unless the elevator cutout switch is IN.

COMPLETE DISENGAGEMENT. Complete disengagement may be accomplished at any time by pressing the pilot's or copilot's autopilot release button on the respective control wheel, placing the servos engage switch in DISENGAGE, or placing the autopilot master switch in OFF position. The pilot or copilot may apply sufficient force on the control column or control wheel to actuate the force switches and completely disengage the autopilot.

WARNING

One or more of the switches on the autopilot command selector panel (servos engage, automatic localizer, approach glide slope, altitude control, aerial refuel, and low level) can fail to trip off when the autopilot is disengaged by the pilot's or copilot's autopilot release button. To preclude automatic reengagement of the autopilot upon release of the button, button should be held in continuously until servos engage switch is observed to be disengaged.

AUTOPILOT EMERGENCY OPERATION

There are no special operating procedures to be used during an emergency. However, if the autopilot is engaged and manual flight control is desired, press the pilot's or copilot's autopilot release buttons for immediate autopilot disconnect. If the methods outlined under "Autopilot Disengagement" fail, pull the six autopilot circuit breakers located on the pilots' overhead circuit breaker panel.

WARNING

If a malfunction or erratic behavior is experienced in any mode of the autopilot, the air refueling, low level, and automatic approach modes will be disengaged and will not be used for the remainder of the flight. If a malfunction or erratic behavior is experienced in the normal mode (other than air refueling, low level, or automatic approach), the pilot will disengage the autopilot and investigate the cause of the malfunction. In this instance, the pilot will determine whether the malfunction in the normal mode precludes further use of this mode of the autopilot. Normal autopilot disengagements as discussed in this section, such as those occurring due to turbulence, improper pilot technique, or electrical system malfunctioning should not be considered an autopilot malfunction.

INSTRUMENT LANDING SYSTEM (ILS) EQUIPMENT

The instrument landing system (ILS) provides the pilots with a straight line glide slope and a localizer or on-course guidance. The ILS system is used both as a means of navigation and as an aid to assist the pilots when landing in inclement weather. The ILS consists of the glide slope equipment (AN/ARN-18), omni-range radio (AN/ARN-14), pilots' control panel, and marker beacon receiver (AN/ARN-12 or AN/ARN-32). For further information on this equipment, see "Communication and Associated Electronic Equipment," this section.

INSTRUMENT LANDING SYSTEM CONTROLS

Omni-Range Selector Switch

A selector switch (4, figure 4-26) on the pilots' control panel provides manual selection of the desired frequency. Tuning the receiver to the proper localizer channel will automatically tune the glide slope receiver to the proper glide slope channel frequency. The selector is calibrated from 108.0 to 135.9 megacycles.

Omni-Range Power Switch

The receiver is turned on and off by a power switch (5, figure 4-26) on the pilots' control panel which has OFF--ON TONE positions. ON TONE position provides operation of the tone comparison glide slope and omni-range operation. OFF position turns off the equipment.

Omni-Range Volume Knob

A volume knob (6, figure 4-26) on the pilots' control panel is used to adjust the receiver audio to the interphone system.

Course Set Knob

A course set knob (13, figure 4-27) located on the horizontal situation indicator is used to set the course arrow and the course display to the desired course on three tab indicators in the course selector window. See "Flight Director System," this section.

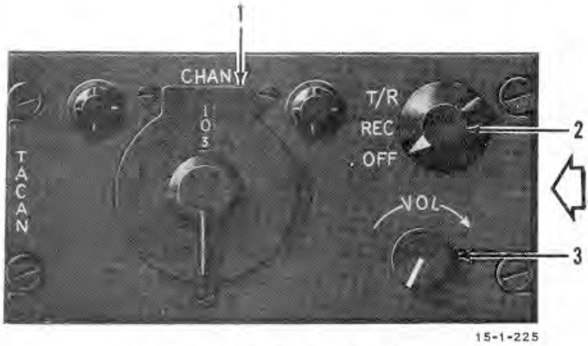
INSTRUMENT LANDING SYSTEM INDICATORS

CAUTION

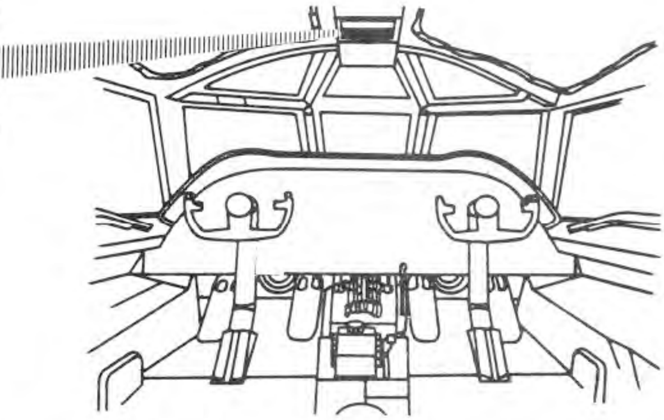
Some of these instruments have red warning flags which may be difficult to see at night.

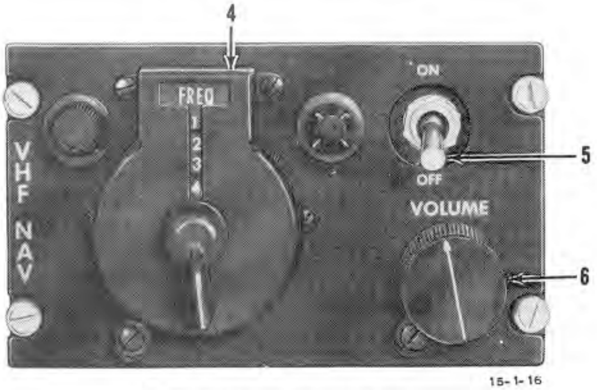
NOTE

Course, bearing, and range indicators are integrated in the AQU-4/A horizontal situation indicator. See "Flight Director System," this section.



TACAN CONTROL PANEL





VOR CONTROL PANEL

1. TACAN CHANNEL SELECTOR SWITCH
2. OFF-REC-T/R SWITCH
3. TACAN VOLUME KNOB
4. OMNI-RANGE SELECTOR SWITCH
5. OMNI-RANGE POWER SWITCH
6. OMNI-RANGE VOLUME KNOB

TACAN AND OMNI RANGE RADIO CONTROLS (Typical)

Figure 4-26.

Marker Beacon Indicator Light

The marker beacon indicator light is used as a navigational and landing aid. The light (7, figure 1-15) is green with translucent colored lettering "Marker Beacon" on a black background and is located just above the respective pilot's horizontal situation indicator. Both lights are tested by pushing the press-to-test button located adjacent to the pilot's marker beacon light.

FLIGHT DIRECTOR SYSTEM

ATTITUDE-DIRECTOR INDICATOR

See "Instruments," Section I.

HORIZONTAL SITUATION INDICATOR (HSI)

A Type AQU-4/A horizontal situation indicator (HSI) (figure 4-27), is located on both the pilot's and copilot's instrument panel (5, figure 1-15). It is an electrically operated instrument and replaces the bearing distance indicator, the radio course indicator, and the directional indicator (heading system). The HSI receives 115-volt a-c power through a circuit breaker marked "Radio Nav Ind AC" and 24-volt d-c power through a circuit breaker marked "Radio Nav Ind DC." Both circuit breakers are located on the "Flight Indicators" portion of the pilot's circuit breaker panel. In the event of loss of all a-c power, no information will be available from either the pilot's or copilot's HSI. A power off flag (9, figure 4-27) on the right side of the HSI has black letters on a red background and will indicate OFF when power is not being supplied to the instrument. A description of the various components of the AQU-4/A is as follows:

- A rotating compass card (6, figure 4-27) and a lubber line (5, figure 4-27) that provide an indication of aircraft heading.
- A bearing pointer (3, figure 4-27) that indicates the bearing heading to a URN-3 surface beacon or to an omni-range station. The bearing pointer indicates bearing to a URN-3 surface beacon when the nav mode select switch (20, figure 4-27) is in TACAN position. (The TACAN radio system must be tuned to the surface beacon and the surface beacon must be within 195 nautical miles of the aircraft.) The bearing pointer indicates bearing to an omni-range station when the nav mode select switch is in VOR position and then only if the omni-range radio (ARN-14) is tuned to that station. The bearing pointer is inoperative when the omni-range receiver (ARN-14) is tuned to an ILS station.

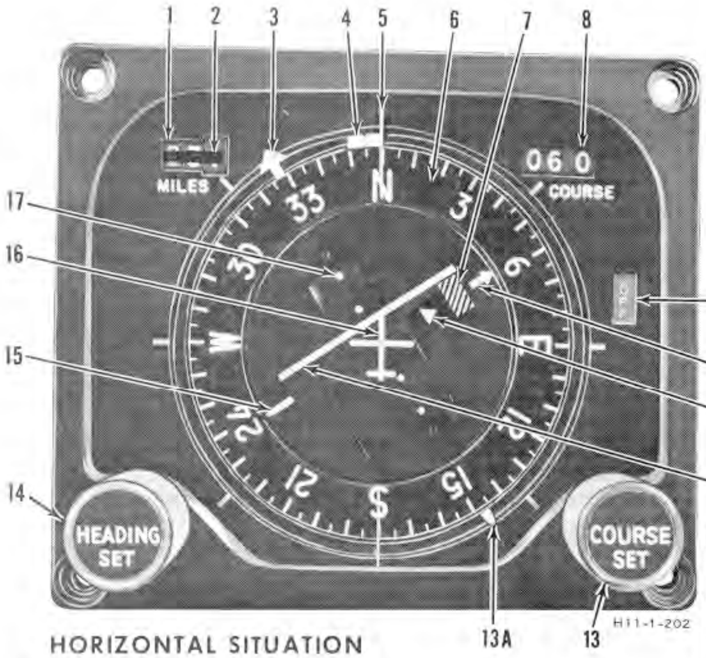
NOTE

> When in TACAN, VOR, ILS or ILS APP mode of operation, a course warning flag (3, figure 1-48) will appear when the ARN-21 or ARN-14 fails or signals from the URN-3 beacon or the VOR station are lost or become unreliable.

- A range indicator (1, figure 4-27) will give a digital display of the line-of-sight distance (up to 195 nautical miles) to an URN-3 surface beacon. The display will be covered by a range indicator warning flag (2, figure 4-27) if the TACAN radio system is not tuned to a surface beacon that is within 195 nautical miles of the aircraft and will also be covered if the TACAN station is not transmitting a signal of dependable strength.
- A course arrow (10, figure 4-27) that indicates the desired course selected by the course set knob during TACAN, VOR, ILS or ILS APP modes. The course arrow will rotate (in step) with the compass card.
- A course selector window (8, figure 4-27) that gives a digital display of the desired course selected by the course set knob.

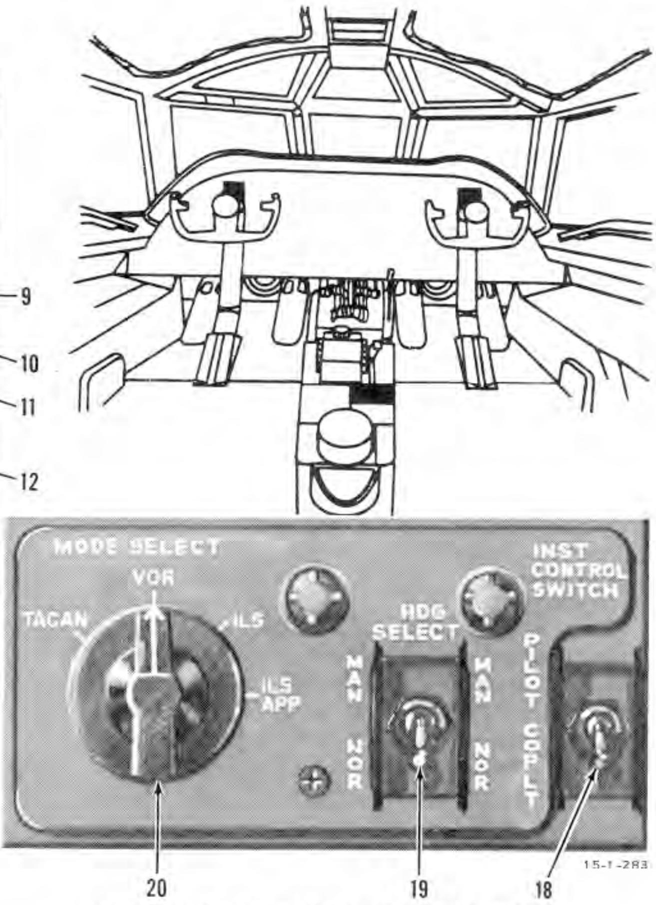
NOTE

> The digital display in the course selector window should be checked and, if necessary, reset with the course set knob when changing the instrument control switch position from the pilot's or copilot's setting.



HORIZONTAL SITUATION INDICATOR

1. RANGE INDICATOR
2. RANGE INDICATOR WARNING FLAG
3. BEARING POINTER (HEAD)
4. HEADING MARKER
5. LUBBER LINE
6. COMPASS CARD
7. COURSE DEVIATION INDICATOR WARNING FLAG
8. COURSE SELECTOR WINDOW
9. POWER OFF FLAG
10. COURSE ARROW (HEAD)
11. TO-FROM INDICATOR (TO SHOWN)
12. COURSE DEVIATION INDICATOR
13. COURSE SET KNOB
13A. BEARING POINTER (TAIL)
14. HEADING SET KNOB



NAVIGATION SYSTEM SELECT PANEL

15. COURSE ARROW (TAIL)
16. AIRCRAFT SYMBOL
17. COURSE DEVIATION SCALE
18. INSTRUMENT CONTROL SWITCH
19. HEADING SELECT SWITCH
20. NAV MODE SELECT SWITCH

HORIZONTAL SITUATION INDICATOR AND CONTROLS (Typical)

Figure 4-27.

- A course set knob (13, figure 4-27) used to set the course arrow and the digital display in the course selector window to the desired course. When the nav mode select switch is in VOR position and the ARN-14 is tuned to an ILS frequency, the course set knob will have no functional effect on the course deviation indicator; however, the course deviation indicator will rotate in conjunction with the course set knob.

NOTE

To prevent course counter malfunctions, the course set knob should not be moved or spun in a rapid, jerky motion.

- A course deviation indicator (12, figure 4-27) referenced to the course arrow that indicates whether the aircraft is left or right of the desired course or localizer beam. The equally spaced dots that are perpendicular to the course arrow represent 5° of course deviation and 1 1/4° of localizer deviation. The deviation indicator provides information relative to the localizer beam when the nav mode select switch is in ILS or ILS APP and the ARN-14 is on and tuned to an ILS frequency. For all other conditions, the course deviation indicator provides information relative to the desired course, provided TACAN radio or ARN-14 is tuned to the respective surface beacon or omni-range station.
- A red course deviation indicator warning flag (7, figure 4-27) will come into view during TACAN, VOR, ILS or ILS APP mode of operation when the ARN-21 or ARN-14 fails or signals from the URN-3 beacon or the VOR or ILS stations are lost or become unreliable.

- A to-from indicator (11, figure 4-27) that indicates whether the selected course, if intercepted and flown, will take the aircraft to the selected facility, and vice versa. The pointer references the URN-3 surface beacon if the nav mode select switch is in TACAN. For all other positions of the nav mode select switch, the pointer references the omni-range station; however, if the ARN-14 is tuned to an ILS frequency, the pointer is not visible.
- A heading marker (4, figure 4-27) that indicates a desired heading. The heading marker will rotate with the compass card after the desired heading has been selected by the heading set knob.
- A heading set knob (14, figure 4-27) that is used to set the heading marker to the desired heading.

NOTE

- The course set knob and the heading set knob will be quite warm to the touch when the system is operated for extended periods of time in moderately high ambient temperatures.
- Aircraft headings indicated by the compass will be related to magnetic north or gyro north depending on whether the N-1 compass system is in magnetic or gyro operation. Bearings indicated by the bearing pointer will always be magnetic.

FLIGHT DIRECTOR SYSTEM CONTROLS

Nav Mode Select Switch

A nav mode select switch (20, figure 4-27) marked "Mode Select" is located on the navigation system select panel. The rotary switch has TACAN--VOR--ILS--ILS APP positions. In TACAN position, the TACAN system may be placed in operation in the normal manner as outlined under "Normal Operation of TACAN Radio." In VOR position, the omni-range radio navigation system is selected and may be placed in operation as noted under "Omni-Range Radio AN/ARN-14," this section. In ILS position, the instrument landing system mode of navigation is selected; for further information, see "Instrument Landing System (ILS) Equipment," this section. In ILS APP position, the instrument landing system-approach mode of navigation is selected; for further information, see "Automatic Approach Equipment," this section. The autopilot localizer and glide slope can be energized only when the nav mode select switch is in ILS or ILS APP position respectively and the omni-range radio system is on and tuned to an ILS frequency.

Heading Selector Switch

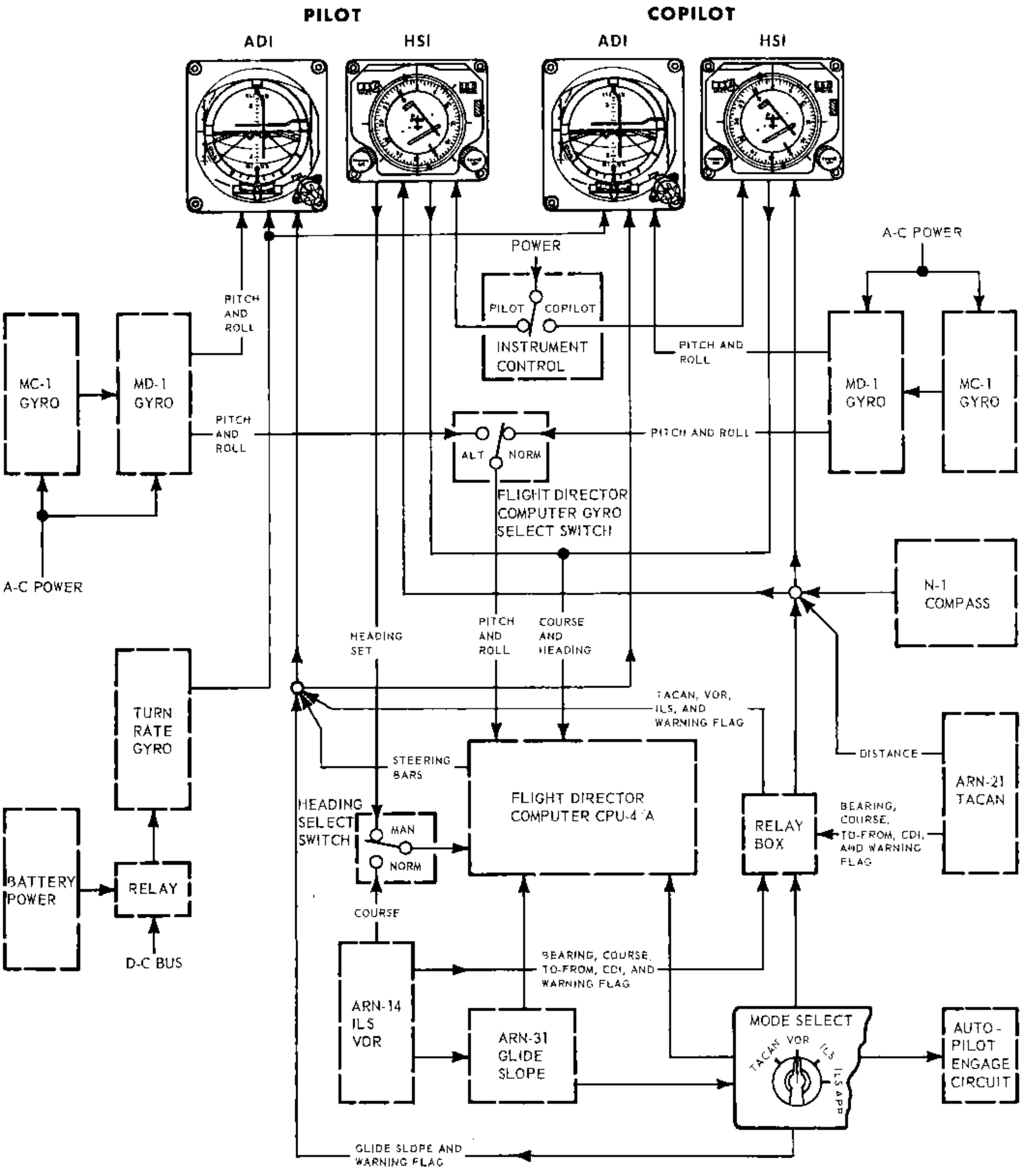
A heading selector switch (19, figure 4-27) located on the navigation system select panel is marked "Hdg Select." The switch has MAN--NOR positions and controls the input source for signals to the bank steering bar on the attitude-director indicator. In NOR (normal) position, the information displayed on the flight director indicator will be determined by the position of the mode select switch. In MAN (manual) position, the flight director instruments will operate the same as when the switch is in NOR position with the exception of the bank steering bar. The bank steering bar will come into view and will respond to the heading set by the heading set knob on the horizontal situation indicator. The bar will indicate zero deflection when the aircraft has the correct bank angle to arrive at the selected heading. The heading can be maintained by keeping the bank steering bar at zero deflection.

NOTE

- When in TACAN, VOR, ILS, or ILS APP mode of operation, the course warning flag will appear when the ARN-21 or ARN-14 fails or signals from the URN-3 beacon or the VOR or ILS stations are lost or become unreliable. Continued display of this warning flag after the heading select switch has been positioned to MAN does not indicate faulty operation of the bank steering bar.
- If the heading select switch is in MAN position the selected heading rather than the selected course will be commanded by the bank steering bar. When it is desired to fly a specific course rather than heading, check that the heading select switch is in NOR position.

Instrument Control Switch

An instrument control switch (18, figure 4-27) located on the nav system select panel has PILOT--COPLT positions and selects whether the pilot or copilot has control of the course and heading set knobs on the AQU-4/A indicator. When the switch is in PILOT position and the pilot rotates his course and heading set knobs, the corresponding information will be displayed on the copilot's AQU-4/A indicator and the copilot will not be able to change these settings. The reverse of the above condition will be true when the instrument control switch is in COPLT position. Both pilot's and copilot's horizontal situation indicators and attitude indicators are fully operative regardless of the position of the instrument control switch.



FLIGHT DIRECTOR SYSTEM DATA FLOW

Figure 4-28.

NORMAL OPERATION OF FLIGHT DIRECTOR SYSTEM

Turns to, and Maintaining Heading

To select and fly a particular magnetic heading using the bank steering bar or heading marker, proceed as follows:

1. Place nav mode select switch to VOR or TACAN.
2. Place heading selector switch to NOR or MAN as desired.
3. Rotate heading set knob to align heading marker with desired magnetic heading on compass card.
4. Turn aircraft to desired heading.
    a. If heading selector switch is in NOR, turn aircraft to center heading marker under lubber line, rolling out of turn as heading marker centers under lubber line.
    b. If heading selector switch is in MAN, bank aircraft to center bank steering bar. Reduce bank angle as necessary to keep bank steering bar centered. Rollout will be complete when desired heading is reached. Maintain heading by keeping bank steering bar centered.

NOTE

In this submode of operation, the indications given in step "4.a." also will occur.

TACAN or VOR Navigation

To fly a selected TACAN or VOR course, proceed as follows:

1. Select desired frequency on TACAN or VOR receiver.
2. Place nav mode select switch to TACAN or VOR.
3. Place heading selector switch to NOR.
4. Set course set knob. Rotate course set knob until head of course arrow is aligned with desired course on compass card. The course window should indicate the same course, and the CDI should show the aircraft deviation from the selected course.
5. Establish intercept heading. The intercept heading to be flown should be determined on the basis of prescribed instrument flying techniques.
6. Monitor course deviation indicator. Check movement toward aircraft symbol. As CDI approaches aircraft symbol, turn aircraft to heading of selected course.
7. Check position of course deviation indicator. If CDI is offset, indicating overshoot or undershoot, steer aircraft toward CDI to center it.

NOTE

If desired, the bank steering bar may be used to maintain aircraft heading after wind drift correction has been established.

ILS Approach

The following operating procedure shows the normal method of using the flight director system to intercept a localizer course and glide slope in conjunction with an ILS approach. Specific instrument flight procedures, which vary from base to base, are not considered.

1. Select localizer frequency on VOR/ILS receiver and identify station.
2. Place heading selector switch to NOR.

NOTE

Failure to place the heading selector switch to NOR will cause the bank steering bar to command headings toward the selected heading rather than the ILS approach course.

3. Set course set knob. Rotate the course set knob to set localizer front approach course in the course selector window. The head of the course arrow should point to the same course on the compass card.

NOTE

The published front approach course must be set in the course selector window for all ILS approaches to obtain accurate directional indications on the HSI course deviation indicator.

4. Place nav mode select switch to ILS to obtain steering information from bank steering bar.
5. Center bank steering bar. When the aircraft heading is within 90° of the published front approach course, steer aircraft as necessary to keep bank steering bar centered. The steering bar should provide an intercept angle to the localizer course of up to 45° and, when the course is approached, command a turn inbound to place the aircraft on the localizer course.

NOTE

- If the published front course has not been set in the course selector window, the bank steering bar will be unreliable.
- In the ILS mode of operation the flight director computer does not compensate for wind which may cause localizer standoff. Therefore, it might be necessary to complete the intercept without using the bank steering bar in strong crosswinds.

WARNING

The flight director will command up to a 45° angle of intercept to the localizer course without regard to the location of the outer marker. Therefore, the pilot is responsible for properly positioning the aircraft by use of the other nav aids or radar before following the bank steering bar commands to the localizer course.

6. Check course deviation indicator. When rollout on localizer front approach course is complete, check that CDI is centered under aircraft symbol, indicating aircraft is on localizer course.

7. Place nav mode select switch to ILS APP. When the nav mode select switch is moved from ILS to ILS APP, the maximum bank angle required to center the bank steering bar is reduced from 30° to 15°. This bank angle limit will automatically restrict corrective maneuvering which may be required to keep the aircraft on the localizer approach course. The aircraft should be on course and nearly aligned with the inbound heading before using the bank steering bar in the ILS APP mode. This should prevent bracketing and apparently large intercept angles during the ILS approach. If bracketing occurs, disregard the bank steering bar and use the CDI as reference to align the aircraft on the localizer. Then use the bank steering bar to complete the approach.

NOTE

- In ILS APP mode, wind drift corrections will be accomplished automatically. Consequently, centering the bank steering bar will result in an aircraft flight path along the centerline of the localizer approach course.
- The pitch steering bar will come into view when switching to ILS APP. However, pitch steering corrections should not be made at this time.

8. When flying aircraft on localizer approach course, monitor glide slope indicator. When indicator approaches center, proceed to step "9." (The position of the glide slope indicator when pitch steering is initiated will depend primarily on pilot technique.)

9. Adjust aircraft pitch attitude to center pitch steering bar.

10. Keep pitch and bank steering bars centered. The pitch and bank steering bars command attitude corrections directly proportional to glide slope and localizer deviations to correct to or maintain the ILS flight patch.

NOTE

The pitch and bank steering bars do not indicate direct ILS localizer nor glide slope information. Crosscheck as necessary the glide slope indicator and CDI to ensure the aircraft is on course and glide slope.

AUTOMATIC APPROACH EQUIPMENT

The automatic approach equipment includes the instrument landing system equipment and the autopilot. The automatic approach equipment is the same as the ILS equipment except that the flight path of the aircraft is controlled automatically rather than manually as in ILS. The localizer switch controls the on-course path, and the glide slope switch controls the angle of approach. For more information on this equipment, see "Communication and Associated Electronic Equipment" and "Autopilot," this section, and "Instrument Flight Procedures, "Section IX.

NAVIGATION EQUIPMENT

Although the bombing navigational system of the aircraft provides complete electronic navigation equipment, other equipment, which is used separately or can be used separately, is provided to aid in navigating. These items are the periscopic sextant, N-1 compass system, true airspeed computer, altimeter, outside air temperature gage, clock, automatic astrocompass, and doppler radar. A celestial navigation station (figure 4-30) is located on the upper deck of the control cabin forward of the EW officer's station.

PERISCOPIC SEXTANT

A periscopic sextant (figure 4-31) and periscopic sextant carrying case are located to the right of the celestial navigation seat and just aft of the entrance hatch (25, figure 1-2). This bubble-type periscopic sextant operates through a full 360° in azimuth and -10° to +92° in elevation. This sextant is provided with an automatic averager assembly which plots minor variations in altitude readings versus length of observations. Lighting is provided to read the counters and dials and illuminate the bubble during sightings. The 28-volt a-c power is provided through the "Peri Sextant" circuit breaker on the radar navigator's circuit breaker panel.

Periscope Sextant Mount

A periscopic sextant mount (figure 4-32) is provided to hold the periscopic sextant for celestial observations and to indicate the azimuth of the sighting. When the sextant is not in use, the mount may be sealed by a shutter which is flush with the aircraft skin. When the sextant is to be used, the sealing shutter is drawn aside and the sextant extended so that the tip of the tube is exposed 1 1/2 inches. The shutter chamber drain plug permits the draining of water from the chamber to prevent the formation of ice at altitude. If lack of time prevents draining the chamber before takeoff, it is advisable to leave the drain plug open as it may be difficult or impossible to open the shutter after passing through freezing level. Provisions must be exercised to insure that excessive moisture does not enter cabin area if drain plug is left out.

CAUTION

- When the aircraft is pressurized, do NOT open the shutter of mount until AFTER the sextant has been inserted to its "retracted" position.
- The provision of stops in the retracted position of the sextant is intended only to prevent its being dropped during insertion or removal. It is NOT advisable to leave the sextant in the retracted position for any extended period, particularly during rough weather, since damage may occur. When the sextant is removed from the mount, it should be returned to the carrying case.

An independently rotatable compass rose, engraved in increments of 1/2°, is provided. A lubber's line which may be aligned with the aircraft longitudinal axis to establish a reference point provides indications to azimuth on the scale. For manual setting of true azimuth to a tenth of a degree, a counter is synchronized with the lubber's line indication. The direction of numbering the gradations is so arranged that relative bearing is subtracted. Thus, when the azimuth of an observed body is set against the lubber's line and the sighting mechanism is aligned on that body, the true heading of the aircraft is indicated by the sextant vertical line of the reticle as read against the azimuth scale.

Optics

The optical system of the sextant is a two-power telescope with a true field of 15°. This wide field facilitates the location and identification of celestial bodies. Coating of optical elements serves to minimize light losses caused by reflections, although "ghost" images of the sun are inherent in the design of the optical system. These images usually occur when the sextant altitude is set several degrees above the true altitude of the sun. The image may be identified by tilting the sextant forward and back. If the body and the artificial horizon (bubble) move in opposite directions, it is an image. Images of the moon may be observed, but they will not be visible for stars. The eyepiece is adjustable for focusing. Filters of varying densities are provided for selective use in the optical system so that the intensity of the sun's light may be adequately reduced.

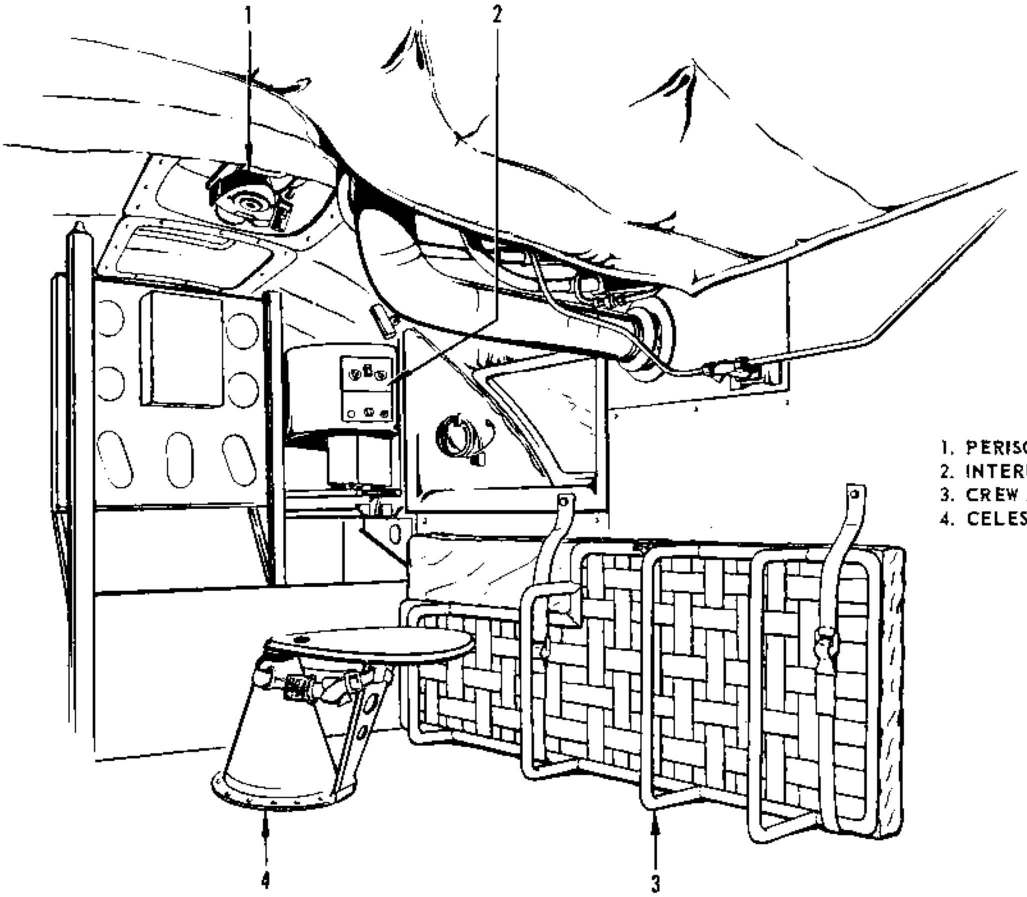
Bubble Horizon

The air bubble artificial horizon is formed from an air chamber located at the top of the body of the sextant. The bubble may be formed and adjusted in size, while in the field of view, by means of the "Increase Bubble" knob on the left side of the chamber. If a bubble is not present in the sextant, the knob must be rotated to the minimum position, the sextant tilted to the right, and the knob rotated toward maximum until the proper size bubble is formed. Bubble size is maintained by moving the sextant to the vertical position and positioning the "Increase Bubble" knob to the maximum position. If a bubble is already present, it may be adjusted by moving the knob in the desired direction while holding the sextant tilted to the right, keeping the bubble centered in the notch in the air chamber.

NOTE

Except when adjusting the bubble, the "Increase Bubble" knob is to be kept at full increase at all times.

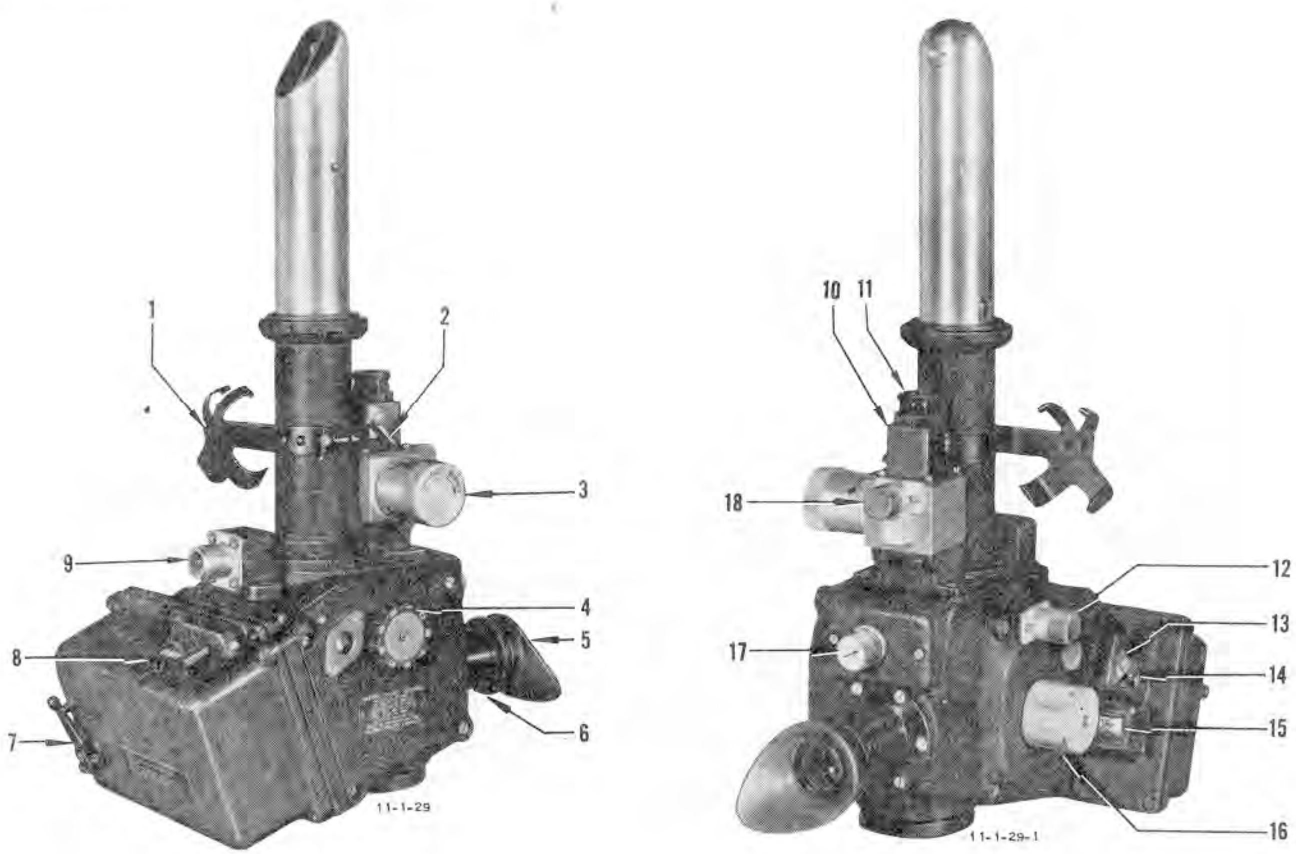
Figure 4-29 (Deleted)



1. PERISCOPIC SEXTANT MOUNT
2. INTERPHONE AND LIGHT PANELS
3. CREW BUNK
4. CELESTIAL NAVIGATION SEAT

CELESTIAL NAVIGATION STATION (Typical)

Figure 4-30.



1. WATCH CLIP
2. HEADING SCALE SHUTTER LEVER
3. BUBBLE ADJUSTMENT KNOB
4. FILTER CONTROL KNOB
5. EYEPIECE
6. EYEPIECE FOCUS ADJUSTMENT RING
7. AVERAGER REWIND LEVER
8. AVERAGER ACTUATING BUTTON (LEVER)
9. ELECTRICAL CONNECTOR
10. PROJECTION LENS LOCK RING
11. PROJECTION LENS ADJUSTMENT RING
12. DIAL LAMP
13. HALF TIME DIAL
14. AVERAGER INDICES
15. ALTITUDE COUNTER
16. ALTITUDE KNOB
17. RHEOSTAT KNOB
18. BUBBLE LIGHT

PERISCOPIC SEXTANT

Figure 4-31.

The lens mounted above the bubble chamber may prevent the entrance of sufficient daylight for direct illumination; therefore, artificial illumination provided by a 28-volt lamp with controllable intensity is usually required.

Projection Lens

Supported on the bubble chamber is a small optical system which superimposes the relevant portion of the true heading scale on the same plane as that of the bubble. The magnified scale is therefore visible in the eyepiece together with the bubble, celestial objective, and reticle. When the objective and bubble are collimated near the center of the field, the vertical line of the reticle acts as an index against the scale, so that when the true azimuth has been correctly set and the sextant aligned, true heading is immediately indicated. A diffuser may be inserted in the system to obstruct the image of the scale when true heading readings are not required. This, however, does not detract from the effective illumination of the mount scale. Provision is also made for adjusting the projection lens to remove parallax and allow for alignment of the sextant and mount. The lens is held stationary by a locking ring which may be loosened to allow the lens to be turned in order to position the lubber's line, vertical line of the reticle, and the alignment objective in coincidence.

NOTE

> Rotation of the projection lens will cause the image of the azimuth scale and the lubber's line to appear to move in an elliptical path, giving two settings (high and low) where coincidence will occur. The higher of the settings should be selected.

Averager

In the periscopic sextant, the averaging is performed by a ball integrator which effects a continuous moving average over any observation period up to 2 minutes. A single lever sets and winds the averager. No other presetting of sextant, timing mechanism, or averager is necessary.

NOTE

> At least 4 seconds should be allowed for the averager to "run" to its starting position after being wound.

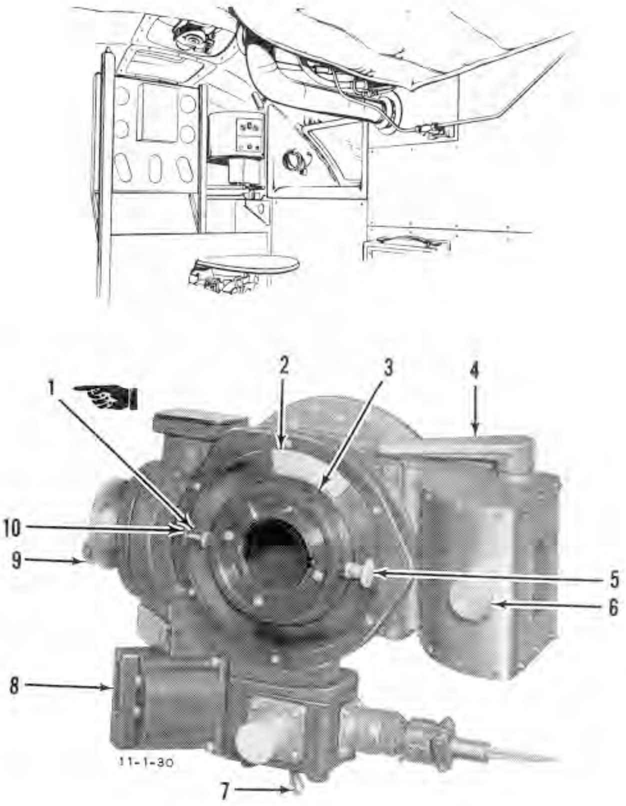
Because it is continuously integrating altitude against elapsed time, after at least 30 seconds it may be stopped at any time up to 2 minutes as circumstances dictate. The average altitude angle is obtained at the end of an observation by recentering the averager indices by the means of the altitude knob. The averager altitude may then be read directly from the counter. A time dial graduated in seconds indicates the half-time of the observation, thus the maximum dial reading of 60 indicates 120 seconds of time. At the end of 2 minutes of observation, the averager actuates a lever which drops a shutter across the field of view, indicating that the observation has been concluded. The shutter (and filter assembly) is mounted on the left side plate which is removable in flight. The shutter is raised, clearing the field of view when the averager rewind lever is pressed.

CAUTION

> The averager actuating lever (button) should always be depressed to allow the averager to run down when the sextant is not being used for an observation.

Lighting

An on-off switch on the mount controls illumination. The illumination of the bubble and azimuth scale of the mount is adjustable by a rheostat. No adjustment is provided to control the illumination of the mount counter, sextant counter, averager indices, or the navigator's watch. Electrical connection is made from the aircraft power supply (28-volt ac) to an AN receptacle on the mount.



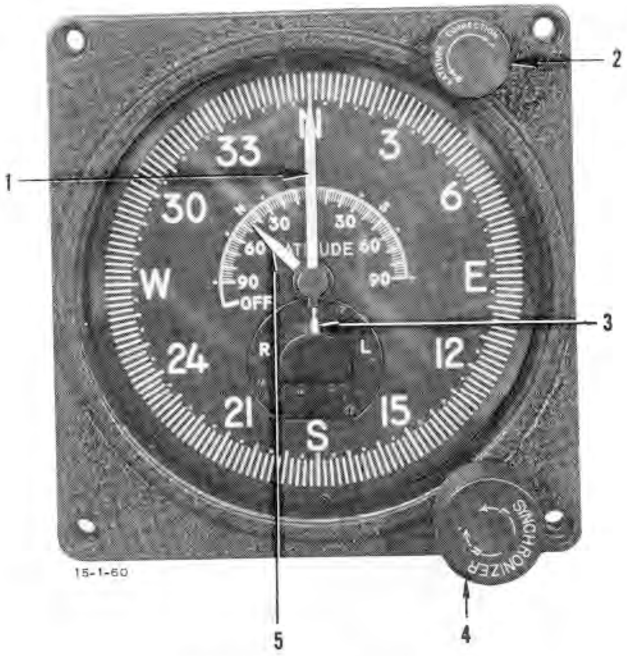
1. AZIMUTH INDEX (LUBBER'S LINE)
2. HEADING SCALE
3. LINE OF SIGHT LOCKING LEVER
4. SEXTANT PORT SHUTTER LEVER
5. RETRACT SEXTANT PULL KNOB
6. SHUTTER CHAMBER DRAIN PLUG
7. ILLUMINATION SWITCH
8. AZIMUTH COUNTER
9. AZIMUTH KNOB
10. INSERT REMOVE SEXTANT PULL KNOB

PERISCOPIC SEXTANT MOUNT

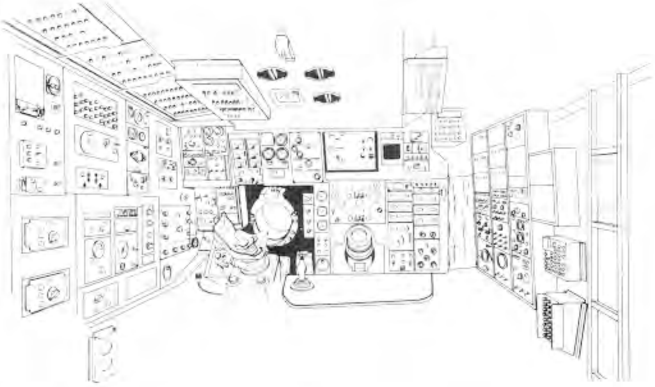
Figure 4-32.

N-1 COMPASS SYSTEM

The N-1 compass system is a remote indicating gyro stabilized compass system designed for use in all latitudes. It may be operated to provide gyro stabilized magnetic reference headings (magnetic mode) or latitude corrected directional gyro reference

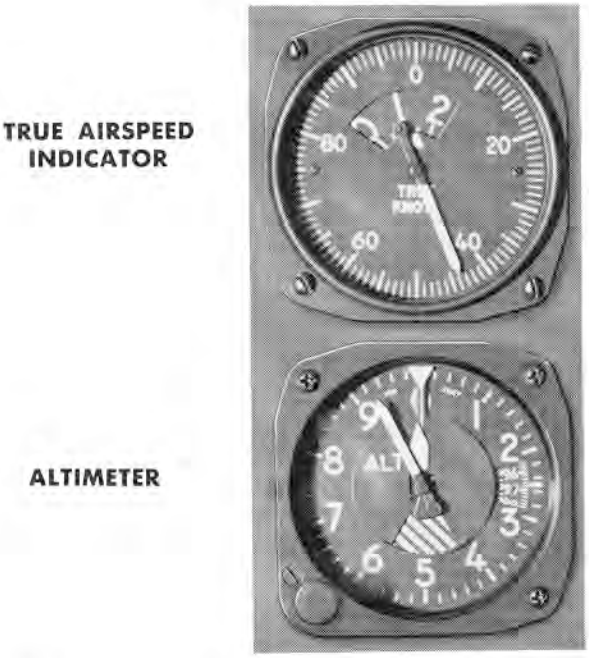


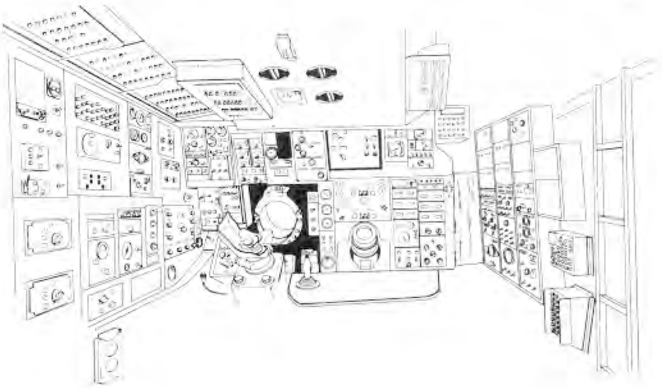
1. HEADING POINTER
2. LATITUDE CORRECTION KNOB
3. ANNUNCIATOR POINTER
4. SYNCHRONIZER KNOB
5. LATITUDE CORRECTION POINTER



N-1 COMPASS MASTER INDICATOR

Figure 4-33.





NAVIGATOR'S INSTRUMENTS

Figure 4-34.

headings (gyro mode). Operation as a magnetic (slaved) compass may be used in any locality except near the poles or in areas where severe magnetic distortion occurs. Operation as a directional gyro (unslaved) may be used in any latitude but is especially useful where the magnetic field is weak or distorted or when used for grid navigation in the polar regions. The N-1 compass master indicator (figure 4-33) located on the navigator's front panel contains the controls and indicators for the system. The N-1 compass system provides gyro or magnetic reference signals for directional control directly to the autopilot. The direction displayed by the heading pointer on the N-1 compass master indicator is the heading supplied the pilot's radio magnetic indicator, whether operating the system in magnetic or gyro mode. A latitude correction knob (2, figure 4-33) on the N-1 compass system panel allows selection of magnetic slaved or directional gyro operation. The latitude correction knob is mechanically connected to the latitude correction pointer (5, figure 4-33). When operating the system in the magnetic mode, the N-1 compass latitude correction pointer is positioned to OFF. When operating in the gyro mode, the N-1 compass latitude correction pointer is positioned to the local latitude. The latitude indicated by the correction pointer is the latitude for which correction is applied to the heading pointer. A synchronizer knob (4, figure 4-33), located on the lower right side of the N-1 compass system panel, provides a manual means to rapidly synchronize the heading pointer to the correct magnetic heading when the system is in magnetic slaved operation or to set the heading pointer to a desired gyro heading when in directional gyro operation. The heading pointer (1, figure 4-33) and scale indicate the correct magnetic heading of the aircraft when the system is in slaved magnetic operation and gives the aircraft heading reference to the preselected gyro heading datum when the system is in directional gyro operation. An annunciator scale and pointer (3, figure 4-33) indicate the direction in which to rotate the heading pointer to synchronize it while in magnetic slaved operation. The heading is synchronized when the annunciator is on the center of index mark. A compass cutoff switch (18, figure 4-35) with a guarded to ON position is installed in the overhead panel at the radar navigator's station to facilitate removing power from the N-1 during ground operations. Whenever power is on the aircraft, the N-1 compass transformer receives 205-volt three-phase a-c power through three fuses marked "N1 Compass" - "ØA," "ØB," and "ØC"; 118-volt single-phase a-c power through a circuit breaker marked "N-1 Comp Amp AC"; and TR power through a circuit breaker marked "N1 Compass Amp DC" on the "Bombing-Navigation System" portion of the radar navigator's circuit breaker panel.

NOTE

> The N-1 compass system becomes inoperative immediately upon failure of d-c power or all a-c power and the autopilot will disengage. See "Autopilot," this section.

TRUE AIRSPEED COMPUTER

The aircraft is equipped with a true airspeed computer which uses static pressure, pitot pressure, and temperature to compute true airspeed. True airspeed information is supplied to the following: BNS, true airspeed indicators on the radar navigator's front panel, and gunnery system. True airspeed information is also supplied to the true airspeed indicator on the pilots' instrument panel (44, figure 1-15). Single-phase 118-volt a-c power is supplied through the "Air Speed Computer" circuit breaker on the pilot's circuit breaker panel.

True Airspeed Indicator

The true airspeed indicator located on the radar navigator's front panel (figure 4-34) is a remote indicating unit. A main dial and subdial in the true airspeed indicator repeat airspeed information transmitted from the true airspeed computer. A cutout and reference mark on the main dial permit reading of the subdial. The power to operate this indicator is supplied by the true airspeed computer.

NAVIGATION INSTRUMENTS

Altimeter

The altimeter is located on radar navigator's front instrument panel (figure 4-34) and, on aircraft **Less ZV**, is identical with the pilots' instruments. For further information, see "Instruments," Section I.

ZV ALTIMETER CORRECTION CARD. Altimeter correction cards and holder (43A, figure 4-35) are located on the radar navigator's side panel. Two altimeter correction cards are necessary, one for clean configuration and one for AGM-28 configuration. These cards reflect position error only and are based on an average gross weight and a standard day temperature. For further information concerning the use of the altimeter correction card, refer to Part I of the Appendix.

WARNING

> The altimeter correction card for the current aircraft configuration must be used to fly corrected altitude for traffic separation.

Outside Air Temperature Gage

The outside air temperature gage (7, figure 4-35) is located on the radar navigator's side panel. For further information, see "Instruments," Section I.

Clock

A clock (6, figure 4-35) is located on the radar navigator's side panel. For further information, see "Instruments," Section I.

Watch Holders

Two watch holders are provided at the navigators' station, one on the radar navigator's left side panel (44A, figure 4-35) and one on the navigator's front panel (35A, figure 4-36).

Pilot's Data Indicator (PDI)

The pilots' data indicator(s) (PDI) (figure 4-37) located on the pilots' instrument panel displays the time in seconds remaining before the bomb release pulse is initiated by the BNS and the turn angle required to stay on the desired bomb release course, when operating in NORMAL NAV mode and BOMB function. A red light on the instrument (1, figure 4-37) illuminates when the BNS is operated in BOMB

1. PHASE SEQUENCE INDICATOR
2. RADAR NAVIGATOR'S CIRCUIT BREAKER PANEL
3. BOMB INDICATOR LIGHTS
4. INTERNAL BRIC (BOMB RELEASE INTERVAL CONTROL UNIT)
5. RADAR PRESSURE CONTROL PANEL
6. CLOCK
7. OUTSIDE AIR TEMPERATURE GAGE
8. OXYGEN REGULATOR
9. RADAR RECORDING CAMERA CONTROL PANEL
10. LINE-OF-SIGHT CONTROL PANEL

10A. TERRAIN COMPUTER POWER PANEL

11. INTERPHONE PANEL
12. VERTICAL CAMERA INTERVALOMETER
13. VERTICAL CAMERA CONTROL PANEL
14. RADAR TRANSMITTER CONTROL PANEL
15. AUXILIARY BNS CIRCUIT BREAKER PANEL
16. BALLISTICS CONTROL PANEL (OFFSET 1 – 2)
17. EXTERNAL MISSILE MANUAL RELEASE HANDLE
18. COMPASS CUTOFF SWITCH
19. RELEASE CIRCUITS DISCONNECT
20. REAR SPECIAL WEAPON MANUAL RELEASE HANDLE
21. FORWARD SPECIAL WEAPON MANUAL RELEASE HANDLE

21A. TRUE AIRSPEED INDICATOR

22. BNS TRUE HEADING TRANSMITTER

22A. BNS TRUE AIRSPEED INDICATOR

23. PRESSURE ALTIMETER
24. RADAR LOW PRESSURE AND CABIN LOW AIRFLOW LIGHTS PANEL
25. REMOTE TURN CONTROL INDICATOR LIGHT
26. TIME-TO-GO INDICATOR
27. EMERGENCY ALARM LIGHT
28. GROUND SPEED INDICATOR
29. DRIFT ANGLE INDICATOR
30. WORK TABLE LIGHT CONTROL PANEL
31. HEADING SELECT CONTROL PANEL

31A. OFFSET 1 – 2 OR 3 – 4 SELECTOR SWITCH

32. ASHTRAY
33. TRACKING CONTROL HANDLE

33A. VARIAC CONTROL UNIT

34. RADAR INDICATOR (10-INCH)
35. PERISCOPIC BOMBSIGHT

35A. OPTIONAL BOMBING SWITCH CONTROL PANEL

36. SPECIAL WEAPON CONTROL PANEL
37. PRIMARY CONTROL PANEL
38. ALTITUDE DISABLE PANEL
39. BOMB TONE SCORING PANEL
40. DOOR AND BOMB CONTROL PANEL
41. D-2 BOMB RELEASE SWITCH
42. BNS SIGHTING ANGLE INDICATOR
43. AIR OUTLET KNOBS AND AUXILIARY HEAT KNOBS

43A. ALTIMETER CORRECTION CARD HOLDER

44. WALKWAY LIGHT SWITCH **126**▶ **W28**▶

44A. WATCH HOLDER

45. RADAR CONTROL UNIT
46. ASHTRAY
47. STC UNIT

47A. CODED SWITCH SET CONTROL PANEL

48. TERRAIN RADAR CONTROL PANEL
49. SWK-2/A24T-1 SWITCH BOX (SWK BOX)
50. TERRAIN TEST PANEL

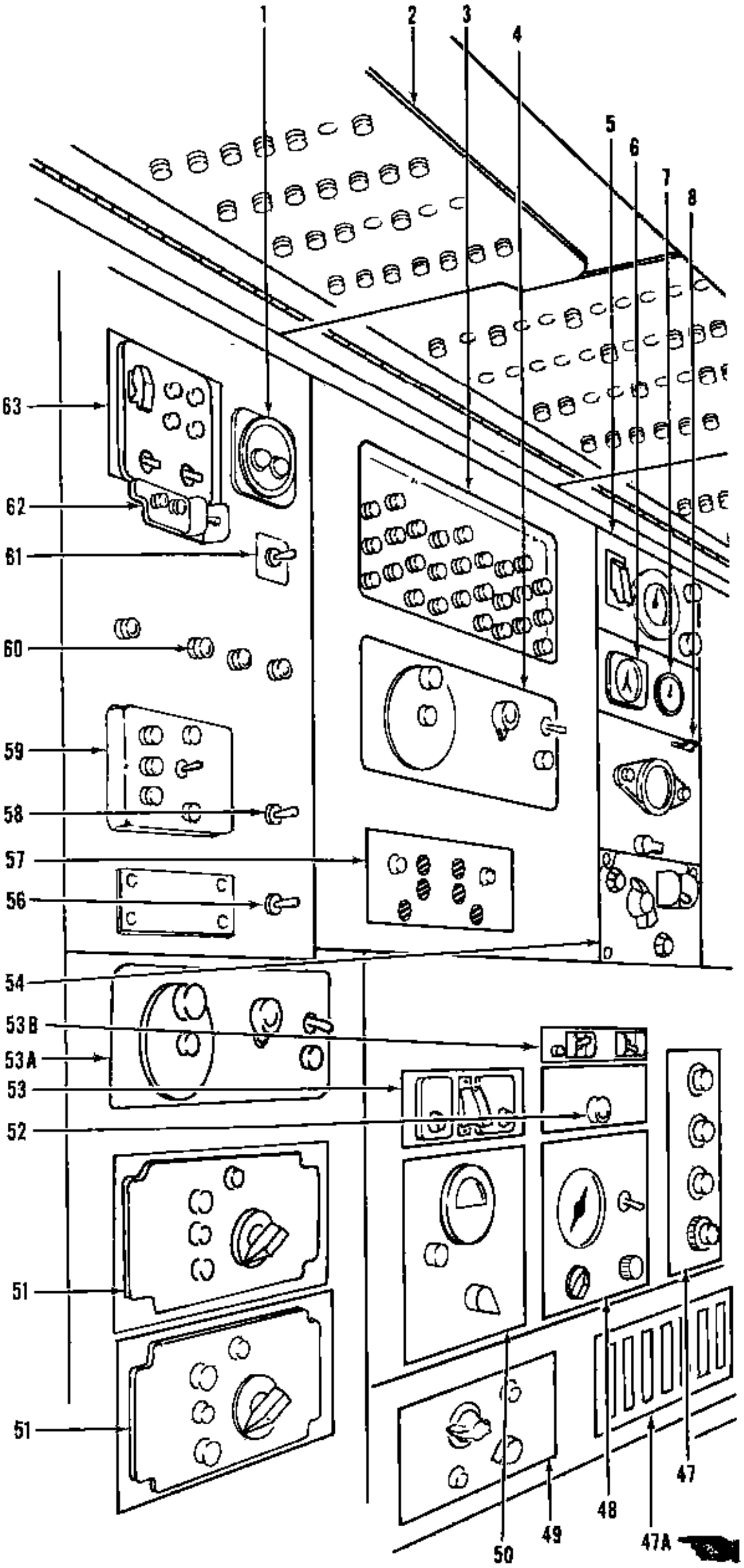
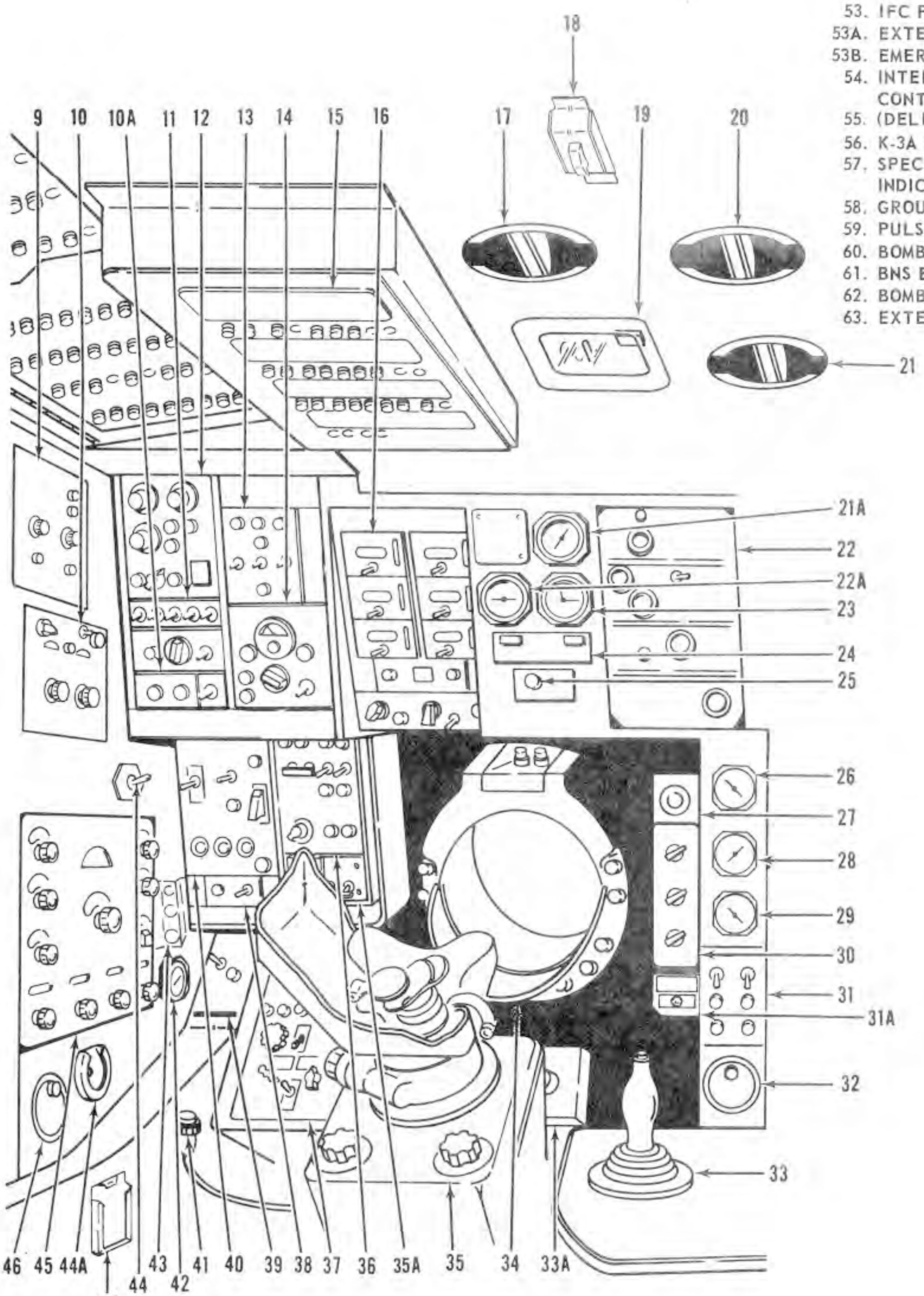


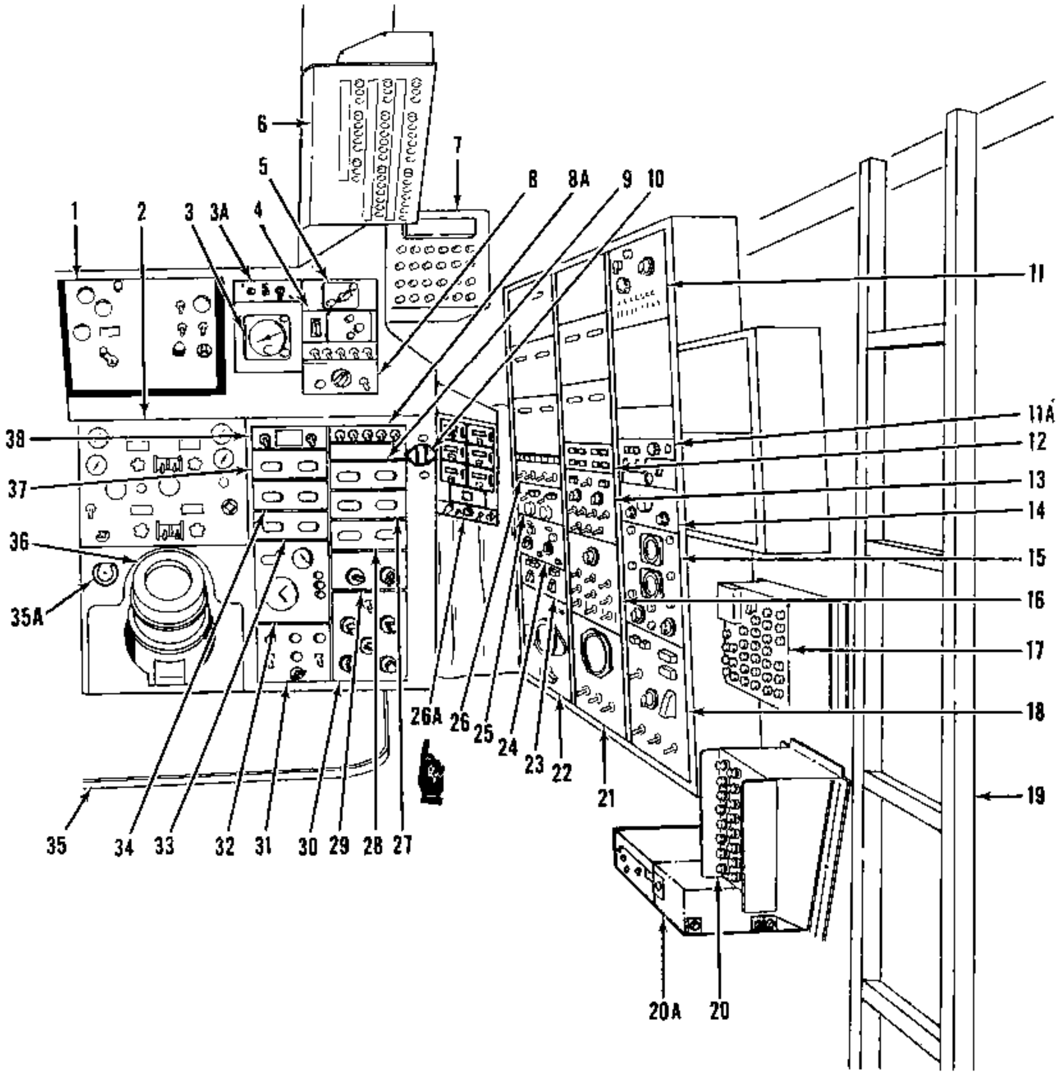
Figure 4-35 (Sheet 1 of 2).

51. DCU-9A CONTROL MONITORING UNITS
52. DTO (DOUBLE TARGET OFFSET) SWITCH
53. IFC POWER SELECT PANEL
53A. EXTERNAL BRIC
53B. EMERGENCY BOMB CONTROL PANEL
54. INTERNAL BOMB INDICATOR LIGHTS CONTROL PANEL
55. (DELETED)
56. K-3A HEAT SWITCH
57. SPECIAL WEAPONS AND ASM LOCK INDICATOR PANEL
58. GROUND BLOWERS SWITCH
59. PULSE MARK GENERATOR SWITCH BOX
60. BOMB DOOR CONTROL VALVE LIGHTS
61. BNS EXTERNAL POWER SWITCH
62. BOMB RELEASE MODE CONTROL PANEL
63. EXTERNAL BOMB RACK CONTROL PANEL



RADAR NAVIGATOR'S STATION (Typical)

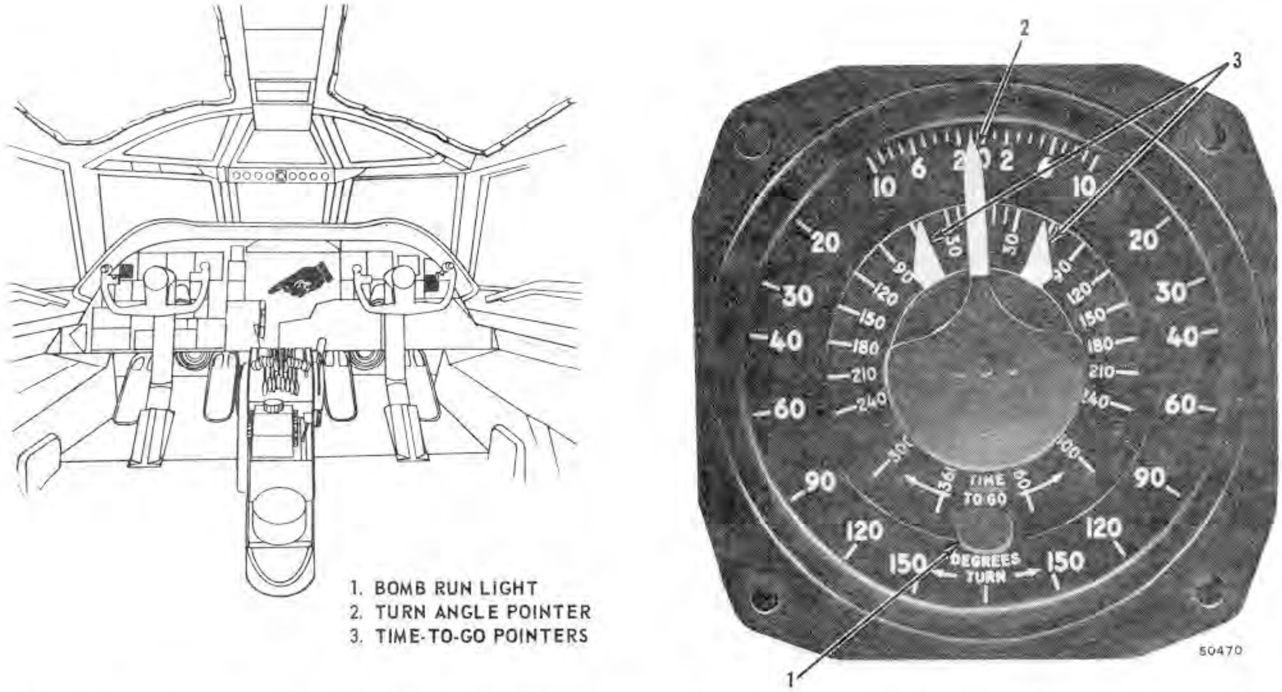
Figure 4-35 (Sheet 2 of 2).



1. HEADING REFERENCE CONTROL PANEL
2. NAVIGATION CONTROL PANEL
3. N-1 COMPASS SYSTEM PANEL
3A. PILOTS' DISPLAY GROUP AZIMUTH CONTROL PANEL
4. INTERPHONE POWER PANEL
5. FACEPLATE SWITCH
6. ASM CIRCUIT BREAKER PANEL
7. TERRAIN RADAR J-BOX
8. INTERPHONE PANEL
8A. INTERPHONE MIXER CONTROL PANEL
9. ASTROCOMPASS STAR DATA 1 PANEL
10. RADAR WARNING RECEIVER (AN/APS-54) INDICATOR B-52C
11. RENDEZVOUS RADAR CONTROL PANEL
11A. ATTITUDE REFERENCE CONTROL PANEL
12. AGM-28 INDICATOR LIGHTS PANEL
13. AGM-28 GUIDANCE PANEL
14. MONITORING SET CONTROL PANEL
15. AGM-28B RADAR ALTIMETER CHECK PANEL
16. AGM-28 GUIDANCE DATA PANEL
17. DOPPLER INTERCONNECTING BOX (FUSE PANEL)
18. AGM-28 NONTACTICAL INSTRUMENTATION PANEL
19. LADDER
20. BNS FUSE PANEL
20A. SIGNAL DATA RECORDER UNIT
21. AGM-28 LAUNCH SIMULATION PANEL
22. OXYGEN REGULATOR
23. AGM-28 LAUNCH PANEL
24. AGM-28 ARMAMENT PANEL
25. AGM-28 FLIGHT CONTROL PANEL
26. AGM-28 ELECTRICAL POWER PANEL
26A. BALLISTICS CONTROL PANEL (OFFSET 3-4)
27. ASTROCOMPASS STAR DATA 2 PANEL
28. ASTROCOMPASS STAR DATA 3 PANEL
29. ASTROCOMPASS MANUAL SET PANEL
30. ASTROCOMPASS MASTER CONTROL PANEL
31. AUTO-NAV RADAR PANEL
32. ASTROCOMPASS INDICATOR DISPLAY PANEL
33. ASTROCOMPASS LINE OF POSITION DISPLAY PANEL
34. MANUAL PRESET POSITION DISPLAY PANEL
35. WORK TABLE
35A. WATCH HOLDER
36. RADAR INDICATOR (5-INCH)
37. ASTROCOMPASS HEADING DISPLAY PANEL
38. BEACON TRANSPONDER CONTROL PANEL

NAVIGATOR'S STATION (Typical)

Figure 4-36.



PILOTS' DATA INDICATOR (PDI)

Figure 4-37.

function. In AUTO STEER mode, the turn angle pointer (2, figure 4-37) provides steering correction information to the destination coordinates inserted in the navigation control panel. In this mode, the time-to-go pointers (3, figure 4-37) are used to read time-to-destination in minutes if the numerical reading is increased 30 times and converted to minutes. (Reading in minutes equals pointer reading in seconds divided by two.) The turn angle pointer movement and scale are logarithmic to increase pointer sensitivity and scale readability near the zero null point. Zero degrees represents the current aircraft heading such that pointer displacements indicate both the magnitude and direction of heading change required to attain the desired track. The time-to-go (time-to-destination) pointers move toward zero from both the clockwise and counterclockwise directions. These pointers are useful for judging right or left turn rate corrections to remove the heading error prior to time-to-go reading 0 second. The turn angle pointer should be maintained between the time pointers during PDI following to avoid excessive turn rates as the time value approaches zero. Automatic steering is available when the autopilot turn control selector switch is placed to BOMB. The turn angle is supplied to the autopilot as well as to the PDI in NORM NAV mode with BOMB function selected or in AUTO STEER mode with NAV function selected. The autopilot removes turn angle errors thus maintaining the PDI turn angle pointer at 0°. During NORM NAV mode, the turn angle indicator and time-to-go indicators are activated when track or bomb functions are selected. The pointers continuously display turn angle in degrees and time-to-go in seconds to the relative location of the BNS crosshairs (offset out), but adjusted for ballistics setting in bomb. Data accuracy may be degraded in track function due to an incomplete time-distance solution in the BNS computers. Accurate heading and timing information may be obtained through direct or offset crosshair placement or destination counter settings. These techniques are useful for homing on a point not otherwise identifiable, directing airborne radar approaches, and for accurate space-time control in holding or special flight patterns in the absence of other reference aids. Time and direction computations are made continuously and conveniently displayed on the PDI instrument pointers.

AUTOMATIC ASTROCOMPASS

For description of this equipment, refer to T.O. 1B-52C-1-1-1.

DOPPLER RADAR

For description of this equipment, refer to T.O. 1B-52C-1-1-1.

AIRCRAFT WEAPONS CONTROL SYSTEM MONITORING SET (AN/AJM-14(V)) (MADREC)

The monitoring set (AN/AJM-14(V)) provides a means for inflight recording of malfunctions which cannot be duplicated on the ground, detecting marginal circuits which do not present symptoms severe enough for operator or flight line personnel to discover, revealing the location of a malfunction thus decreasing maintenance manhours for trouble shooting, and for ground checkout for proper system operation. The monitoring set samples 200 voltages of the components of the bombing navigational and autopilot systems and records this information on a light-sensitive continuously moving paper tape. The 200 test voltages sampled include 50 test voltages of each BNS function (bomb, navigation, heading, and radar). Two modes of operation are available, manual and automatic. Manual mode provides manual selection of the BNS function to be monitored. Automatic mode provides continuous cycling of the monitoring system through all four functions of the BNS. Automatic mode provides a complete cycle every 12 minutes allowing a 3-minute monitoring period for each BNS function. On **B-52D** aircraft, in addition to the 200 BNS voltages sampled, approximately 50 test voltages of the AGM-28 can also be sampled. Only manual mode of operation is provided for monitoring the AGM-28 voltages. The monitoring set is composed of three basic components: the signal isolator which adjusts the sample voltages to the proper level for recording, the signal data recorder containing the recording paper, and the monitoring set control panel marked "Recorder Control" (figure 4-39) located at the navigator's station. The system is supplied 118-volt single-phase a-c power through a circuit breaker marked "AN/AJM-14( )" located on the section 41 power distribution panel. Eleven of the BNS recording channels are assigned for monitoring critical alternator, AN/APN-150 radar altimeter, and autopilot signal voltages. Two of the BNS recording channels are assigned for monitoring bomb release circuits. On aircraft **I**, one of the BNS recording channels is assigned for monitoring the special weapons select switch.

NOTE

The supply of signal data recorders is limited; therefore, recorders may not be installed on all aircraft. Prior to each mission, when monitoring set operation is planned, it will be necessary to ascertain that a signal data recorder is installed on the aircraft.

SIGNAL ISOLATOR

The signal isolator contains the circuits which process the sampled signals to a form usable by the recorder. The switching circuits which connect the recorder to the selected BNS function group are also contained in this unit.

SIGNAL DATA RECORDER

The signal data recorder unit (figure 4-38) contains the signal recording equipment, a blower for cooling, a power supply, and a 24-hour clock. The recorder provides a means of recording the signals being monitored. The record is made on a 12-inch wide photosensitive recording paper, exposed at a speed of 0.22 inch per second. The paper is exposed by high intensity light reflected from the mirrors of 50 galvanometers which are operated by the sampled signals. Timing lines occur every 10 seconds (2.2 inches on the paper) and extend the entire width of the paper. These lines, when used with galvanometer zeroing and clock image indications, enable the time of a trace indication to be determined to the nearest second. The galvanometers are "zeroed" (shorted out) every 60 seconds in coincidence with every sixth timing line for a period of 0.4 second. In addition, the galvanometers are zeroed for 1.5 seconds every 3 minutes when operating in automatic mode. Each roll of recording paper (475 feet thin-base paper) provides approximately 7 hours and 12 minutes of recorder operation. The 24-hour clock image is impressed on the recording paper automatically every 60 seconds. The record identification clock is accessible for resetting and winding prior to or during flight to insure an accurate time correlation of systems monitoring data. The lamp and clock access door (1, figure 4-38) may be removed by loosening the two captive dzus fasteners (2, figure 4-38). Two panels are located on the chassis beneath the access door. The lower panel (3, figure 4-38), to which the identification clock is attached, is secured to the recorder chassis by a knurled thumbscrew (4, figure 4-38).

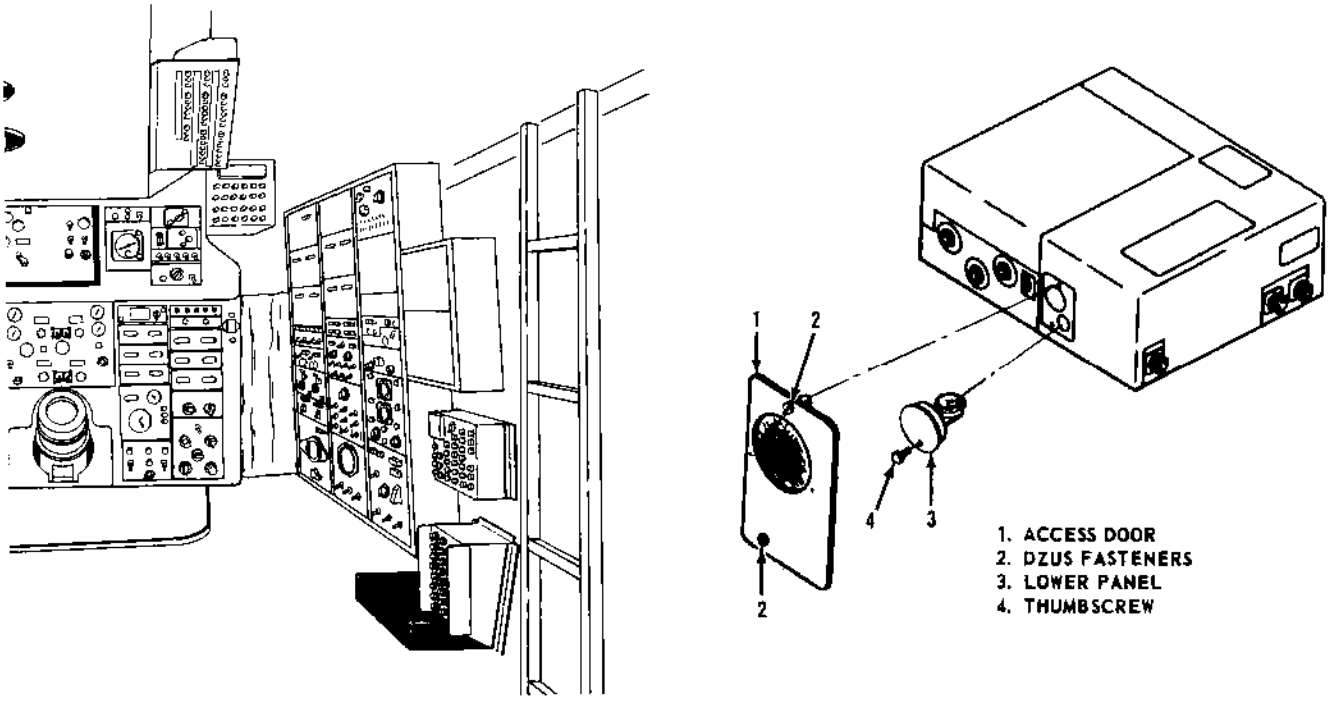
MONITORING SET CONTROL PANEL

This unit contains all controls and indicators necessary for operation of the monitoring set.

MONITORING SET CONTROLS

System Select Switch (MADREC)

A system select switch (2, figure 4-39) located on the monitoring set control panel has OFF--STDBY--AUTO--BOMB--NAV--HDG--RADAR positions on **B-52C** aircraft and OFF--STDBY--AUTO--BOMB--NAV--HDG--RADAR--AGM-28 positions on **B-52D** aircraft. This switch is identified as MADREC in the checklist. STDBY position energizes the monitoring set warmup circuits. AUTO position energizes the timing and recording circuits which provide automatic mode of operation. BOMB, NAV, HDG, or RADAR position will select their respective BNS function for manual mode of operation. AGM-28 position selects the AGM-28 manual monitoring function. During the automatic mode of operation, the monitoring set cycles through the BOMB, NAV, HDG,



SIGNAL DATA RECORDER UNIT

Figure 4-38.

and RADAR functions with each function being monitored for 3 minutes during each cycle. With the system select switch positioned to AUTO and BOMB mode of the BNS selected, the monitoring set will cycle to bomb function and remain in this function until the BNS changes modes.

Selection of BOMB position provides eight channels for recording the A+ excitation voltage and the field current (voltage) from the regulator to each of the four alternators. RADAR position activates two channels used to record AN/APN-150 radar altimeter absolute altitude signal level and the failure/low-level warning signals. HDG position provides a single channel which records operation of the aerial refueling and low level relays of the autopilot.

B-52D

Selection of BOMB position provides two channels for recording certain bomb release system circuits. One channel monitors the internal BRIC output circuit and the other channel monitors the emergency armed release input (initiation circuit) to the emergency armed release pulser.

J

Selection of BOMB position provides an additional capability which permits monitoring the special weapons select switch.

Code Button

A code button (5, figure 4-39) located on the monitoring set control panel is provided so that the recording tape may be coded at any time that a special event is observed. Depressing the code button prints a picture of the recorder clock on the tape and zeroes the galvanometer (removes the signal from the tape for a short period of time).

Press-To-Test Button

A press-to-test button (4, figure 4-39) located on the monitoring set control panel provides a means of testing the recorder failure and ready indicator lamps. Pressing the press-to-test button, when the system select switch is in STDBY, should cause the recorder failure and ready indicator lamps to illuminate.

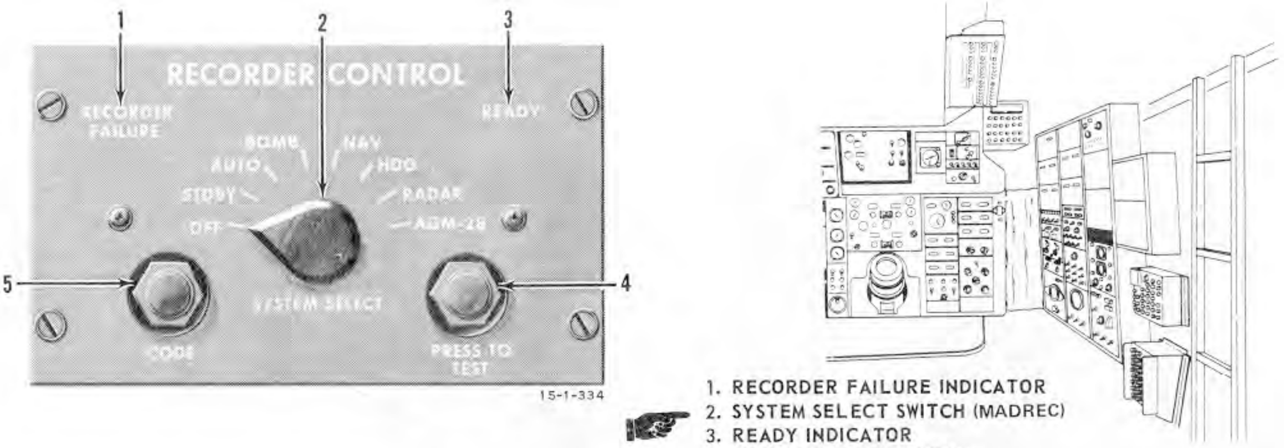
MONITORING SET INDICATORS

Ready Indicator

A ready indicator (3, figure 4-39) is located on the monitoring set control panel. The word "Ready" will illuminate when the system has completed its warmup period and is ready for operation.

Recorder Failure Indicator

A recorder failure indicator (1, figure 4-39) is located on the monitoring set control panel. The words "Recorder Failure" will illuminate whenever the tape magazine runs out of recording tape, the system blower motor is operating below normal speed, the automatic timing circuit malfunctions, or the recording light goes off.



1. RECORDER FAILURE INDICATOR
2. SYSTEM SELECT SWITCH (MADREC)
3. READY INDICATOR
4. PRESS-TO-TEST BUTTON
5. CODE BUTTON

MONITORING SET CONTROL PANEL

Figure 4-39.

Index Indicators

Index indicators are provided with each position of the system select switch (2, figure 4-39). The STDBY, AUTO, BOMB, NAV, HDG, RADAR, or AGM-28 index indicator will illuminate when the monitoring set is operating in that particular function.

MONITORING SET NORMAL OPERATION

NOTE

The MADREC should be turned off when not in use for an extended period of time.

1. Position system select switch to OFF.
2. Position system select switch to STDBY.
3. Test the ready and recorder failure indicator lamps by pressing the press-to-test button.

NOTE

- The recorder failure indicator will normally illuminate momentarily, immediately after applying power. It should extinguish when the blower is up to speed.
- A 90-second warmup period is required before selecting an operating mode. The ready indicator should illuminate at completion of warmup period.

4. Position system select switch to the desired operating mode or function.

CAUTION

If the recorder failure indicator illuminates (other than momentarily) during system operation, the system select switch should be positioned to OFF.

NOTE

- If the recorder failure indicator illumination is caused by a timing circuit malfunction, operation of the system may be continued using monitoring set emergency operation procedures.
- Should an event of special importance occur during operation, pressing the code button will cause the recorder clock image to be impressed on the tape, thereby providing later identification of the event.
- During automatic mode operation (AUTO index indicator illuminated continuously), the index indicators should illuminate in the following sequence: BOMB, NAV, HDG, and RADAR with each indicator remaining illuminated for 3 minutes.

5. The system is turned off by placing the system select switch to OFF. All indicator lamps should extinguish.

MONITORING SET EMERGENCY OPERATION

During automatic mode if the automatic system switching circuits fail (indicated by a BNS function index indicator remaining illuminated longer than 3 minutes and/or the recorder failure indicator illumination), the system should be operated in manual mode or turned off for 1 minute, then recycled to AUTO. If the automatic mode is still not functioning properly, all operation should be limited to manual mode until the malfunction is found and corrected.

ASQ-48 BOMBING NAVIGATIONAL SYSTEM (BNS)

This system is composed of the following auxiliary systems:
- Bombing Navigational System
- BNS Radar System
- Doppler Radar
- Automatic Astrocompass
- Radar Recording Camera

The BNS is designed to be highly automatic in operation by interconnection of the various auxiliary systems. The doppler radar feeds ground speed and drift data to the bombing navigational system. The bombing navigational system in turn supplies data to the other systems. Latitude and longitude data is supplied to the automatic astrocompass and triggering impulses are supplied to the radar recording camera. For all except the terrain avoidance system, which is a part of the BNS radar system, refer to T.O. 1B-52C-1-1-1.

TERRAIN AVOIDANCE SYSTEM

DESCRIPTION

The terrain avoidance (TA) system comprises a special mode of the BNS radar, an electronic terrain computer, and the pilot's and copilot's display indicators and their associated electronic components. The TA system provides a radar display of the terrain along the flight path of the aircraft. By interpreting the display and maneuvering the aircraft accordingly, the pilot is able to fly the aircraft at low absolute altitudes (aircraft to terrain separation distance).

Power Source

Power is supplied to the TA system through circuit breakers located on the "BNS Radar" portion of the auxiliary BNS circuit breaker panel.

Pilots' Controls and Indicators

TERRAIN DISPLAY INDICATOR INTENSITY SWITCH. A terrain display indicator intensity switch (1, figure 4-40) is located on the pilot's and copilot's terrain display control panel. Low indicator intensity is provided when the switch is in the extreme counterclockwise position. Intensity or brightness is increased as the switch is moved clockwise toward MAX position.

TERRAIN DISPLAY MODE SELECTOR SWITCH. A terrain display mode selector switch (2, figure 4-40) located on the pilot's and copilot's terrain display control panel has OFF--PROFILE CAL--PROFILE 3--PROFILE 6--PROFILE 10--PLAN positions. The TA system is placed in operation when the selector switch is moved out of OFF position. PROFILE CAL is a test position used to determine if the profile mode circuitry in the terrain computer and pilot's display group has been properly calibrated. PROFILE 3 position provides a silhouette outline display on the pilots' terrain display indicators of the highest terrain between minimum range and 3 nautical miles. PROFILE 6 position provides a silhouette outline display on the pilots' terrain display indicators of the highest terrain between minimum range and 6 nautical miles. PROFILE 10 position may or may not provide a silhouette outline display on the pilots' terrain display indicators of the highest terrain between minimum range and 10 nautical miles. PLAN position provides a plan display (azimuth and range) of the terrain protruding above a variable clearance plane between minimum range and 10 nautical miles.

NOTE

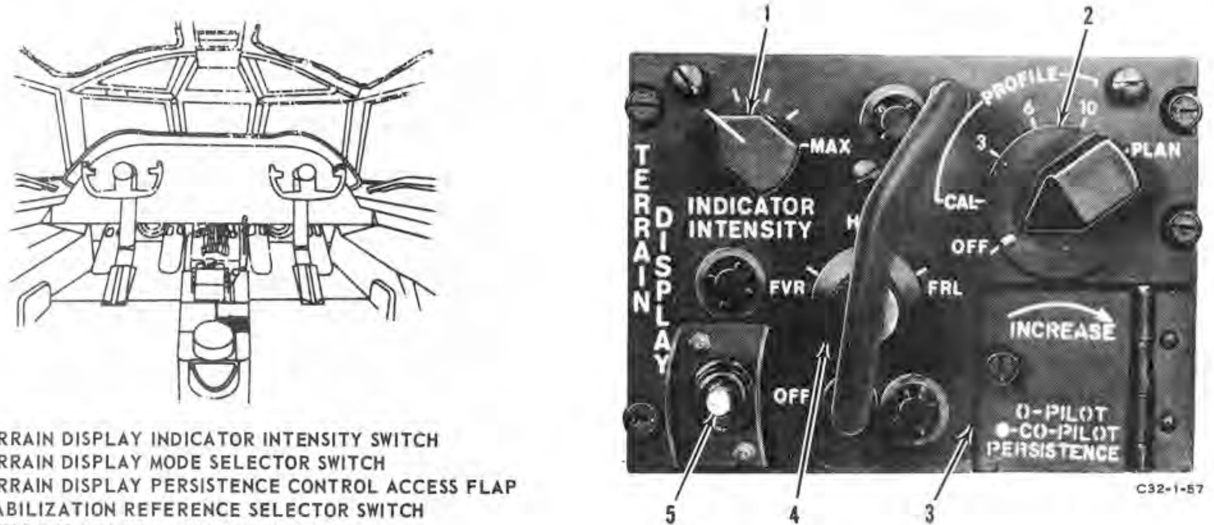
> When the terrain display mode selector switch is placed to a profile mode position and a plan mode display appears on the terrain display indicators, one of the TA display select switches must be depressed to obtain the selected profile mode display.

TERRAIN DISPLAY PERSISTENCE CONTROL. A terrain display persistence control is located under a flap (3, figure 4-40) on the pilot's and copilot's terrain display control panel. The screwdriver controls are used to increase or decrease the persistence of the pilot's or copilot's terrain display indicator.

NOTE

> The larger outer shaft of the persistence control adjusts the pilot's display and the smaller inner shaft adjusts the copilot's display.

STABILIZATION REFERENCE SELECTOR SWITCH. A stabilization reference selector switch (4, figure 4-40) located on the pilot's and copilot's terrain display control panel has FVR--HOR--FRL positions. The clearance plane is oriented to the selected stabilization reference. FVR (flight vector



1. TERRAIN DISPLAY INDICATOR INTENSITY SWITCH
2. TERRAIN DISPLAY MODE SELECTOR SWITCH
3. TERRAIN DISPLAY PERSISTENCE CONTROL ACCESS FLAP
4. STABILIZATION REFERENCE SELECTOR SWITCH
5. CLEARANCE PLANE CONTROL SWITCH

PILOT'S AND COPILOT'S TERRAIN DISPLAY CONTROL PANEL

Figure 4-40.

reference) position is not used in this installation; however, FVR position is tied to the FRL mode circuits and placing the switch to FVR will select FRL mode. In HOR (horizontal) position, the clearance plane is maintained horizontal within the pitch and roll limits of the vertical gyro. In FRL (fuselage reference line) position, the clearance plane is maintained at a preset angle which is nearly parallel to the longitudinal axis of the aircraft.

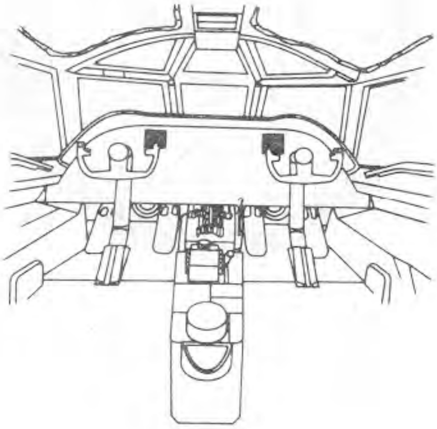
CLEARANCE PLANE CONTROL SWITCH. A clearance plane control switch (5, figure 4-40) is located on the pilot's and copilot's terrain display control panel. An open-type guard discourages inadvertent actuation of this switch. The switch has RAISE--OFF--LOWER positions, is spring loaded to OFF position, and is independent of the radar navigator's clearance plane. Holding the switch to LOWER position lowers the clearance plane with respect to the aircraft and will be reflected on the clearance plane indicator. Holding the switch to RAISE position raises the clearance plane and will be reflected on the clearance plane indicator. The clearance plane can be set from 0 to 3000 feet below the aircraft.

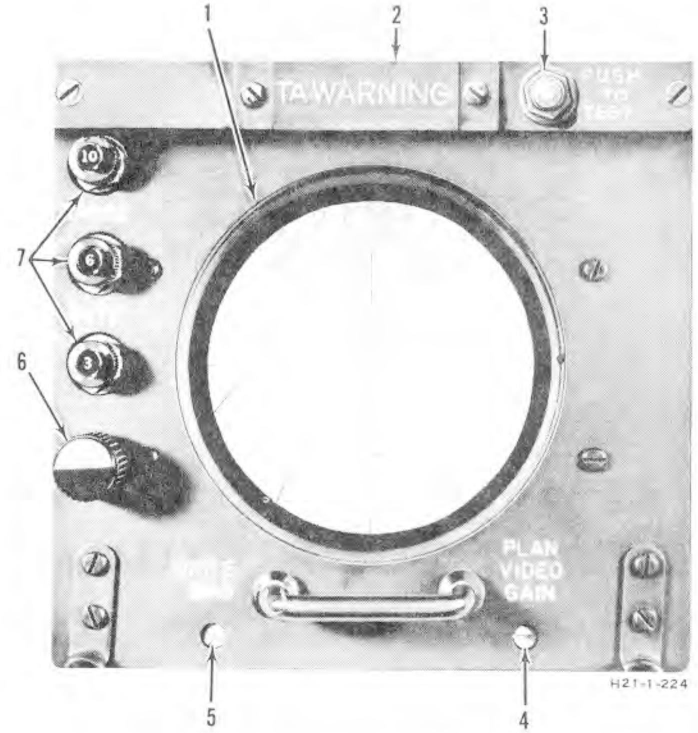
WARNING

Under no circumstances will TA flight be conducted with clearance plane settings between 0 and 200 feet.

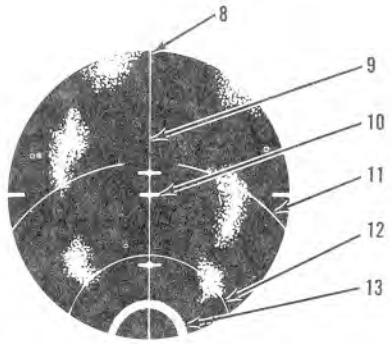
TA DISPLAY SELECT SWITCH. A button-type TA display select switch (4A, figure 1-32) is located on the inboard grip of the pilot's and copilot's control wheels. This switch is operational only when the terrain display mode selector switch is positioned to a profile mode and allows either pilot to change the TA display mode from profile to plan, or vice versa, without removing his hands from the aircraft control wheel. The TA display mode (plan or profile) is changed by depressing and releasing either TA display select switch.

TERRAIN DISPLAY INDICATORS. The pilot and copilot each has a terrain display indicator (1, figure 4-41) located on the forward instrument panel. The terrain display indicators present the pilot and copilot a "profile display" or a "plan display" of the approaching terrain. There are six etched marks on the terrain display indicators. The etched marks are a ground track line (9, figure 4-41), a display center etch mark (10, figure 4-41), an aircraft mark (14, figure 4-41), a profile calibration etch mark (17, figure 4-41), a 6-mile range mark (11, figure 4-41), and a 3-mile range mark (12, figure 4-41). The upper edge of the terrain display indicator at the ground track line represents 10-mile range (8, figure 4-41). In addition, there are four electronically generated marks. During plan mode, the electronically generated mark is a failure warning cursor (13, figure 4-41). During profile mode, the electronically generated marks are a horizontal reference line (15, figure 4-41) and a terrain trace (16, figure 4-41). In addition, when PROFILE CAL

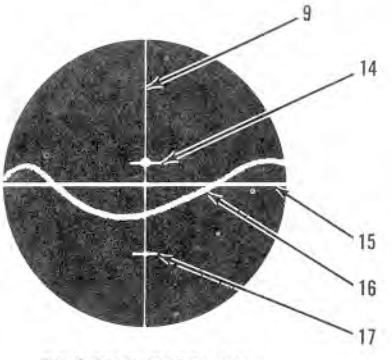




1. TERRAIN DISPLAY INDICATOR
2. TA WARNING LIGHT
3. PUSH-TO-TEST BUTTON
4. PLAN VIDEO GAIN CONTROL
5. WRITE BIAS CONTROL
6. RANGE GATE INDICATOR LIGHTS INTENSITY CONTROL
7. RANGE GATE INDICATOR LIGHTS
8. 10-MILE RANGE
9. GROUND TRACK LINE
10. DISPLAY CENTER ETCH MARK
11. 6-MILE RANGE MARK
12. 3-MILE RANGE MARK
13. FAILURE WARNING CURSOR
14. AIRCRAFT MARK
15. HORIZONTAL REFERENCE LINE
16. TERRAIN TRACE
17. PROFILE CALIBRATION ETCH MARK
18. TERRAIN DISPLAY INDICATOR POLARIZING FILTER



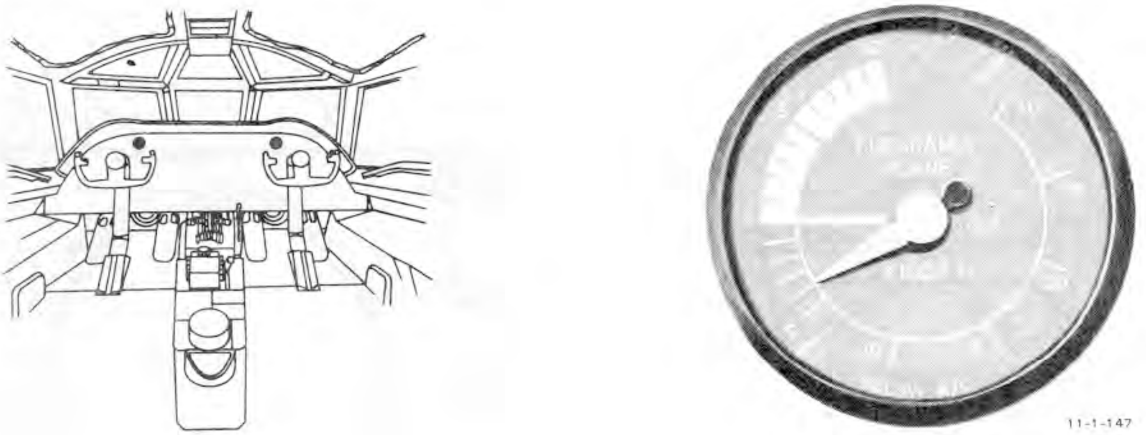
PLAN DISPLAY



PROFILE DISPLAY

PILOT'S AND COPILOT'S TERRAIN DISPLAY INDICATORS

Figure 4-41.



PILOT'S AND COPILOT'S CLEARANCE PLANE POSITION INDICATORS

Figure 4-42.

is selected, an electronically generated profile calibration cursor (figure 4-52) is displayed. In profile mode, the sector displayed is ±45° about the ground track line and the vertical limits of the pilots' terrain display indicators are ±1500 feet with respect to the horizontal reference line. In plan mode, the sector scanned is ±85° about the ground track line which is all the area in an arc of 170° ahead of the aircraft; however, the display presented on the terrain display indicators is approximately ±80° about the ground track line. The plan mode display shows only those terrain features which project above a variable clearance plane as set by the clearance plane control switch.

NOTE

The aircraft mark is correctly positioned relative to the horizontal reference line for a 200-foot profile clearance plane only.

WARNING

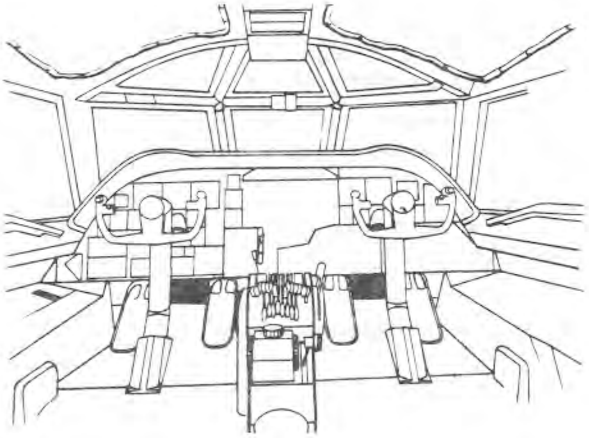
If the horizontal reference line is not present while using profile mode or if the failure warning cursor is not present while using plan mode, the TA system should be used with caution and only when visual contact with the ground can be maintained. When using profile mode and the horizontal reference line is not present, the display center etch marks must be used in lieu of the horizontal reference line.

NOTE

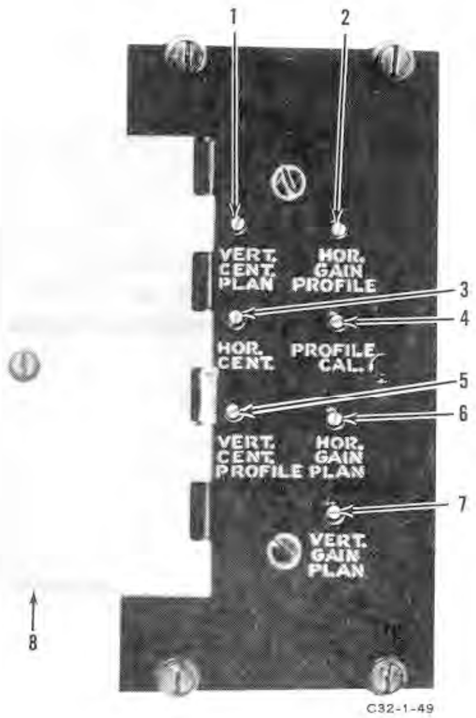
The pilot's and copilot's terrain display indicators require filters for night operation.

TERRAIN DISPLAY INDICATOR POLARIZING FILTERS. Each terrain display indicator is provided with a polaroid filter (18, figure 4-41) which fits over the indicator face. The filter consists of two pieces of polarized glass mounted so that one piece of glass can be rotated with respect to the other. The filler prevents glare by controlling the brightness of the indicator display and is required for night operation. When not in use, the filters are stowed at the pilots' stations.

TA WARNING LIGHT. A red TA warning light (2, figure 4-41) located on each terrain display indicator provides a means of indicating a failure of some but not all critical circuits in the TA system. The brightness of the TA warning light is controlled by the warning light dimming control switch on the



1. PLAN DISPLAY VERTICAL CENTERING CONTROL
2. PROFILE DISPLAY HORIZONTAL GAIN CONTROL
3. HORIZONTAL CENTERING CONTROL
4. PROFILE CALIBRATION CONTROL
5. PROFILE DISPLAY VERTICAL CENTERING CONTROL
6. PLAN DISPLAY HORIZONTAL GAIN CONTROL
7. VERTICAL GAIN CONTROL
8. PREFLIGHT ADJUSTMENTS PROTECTIVE COVER



PREFLIGHT ADJUST CONTROL UNITS

Figure 4-43.

pilot's light panel. The light may not be visible under some conditions with the warning light dimming control switch in the DIM position.

NOTE

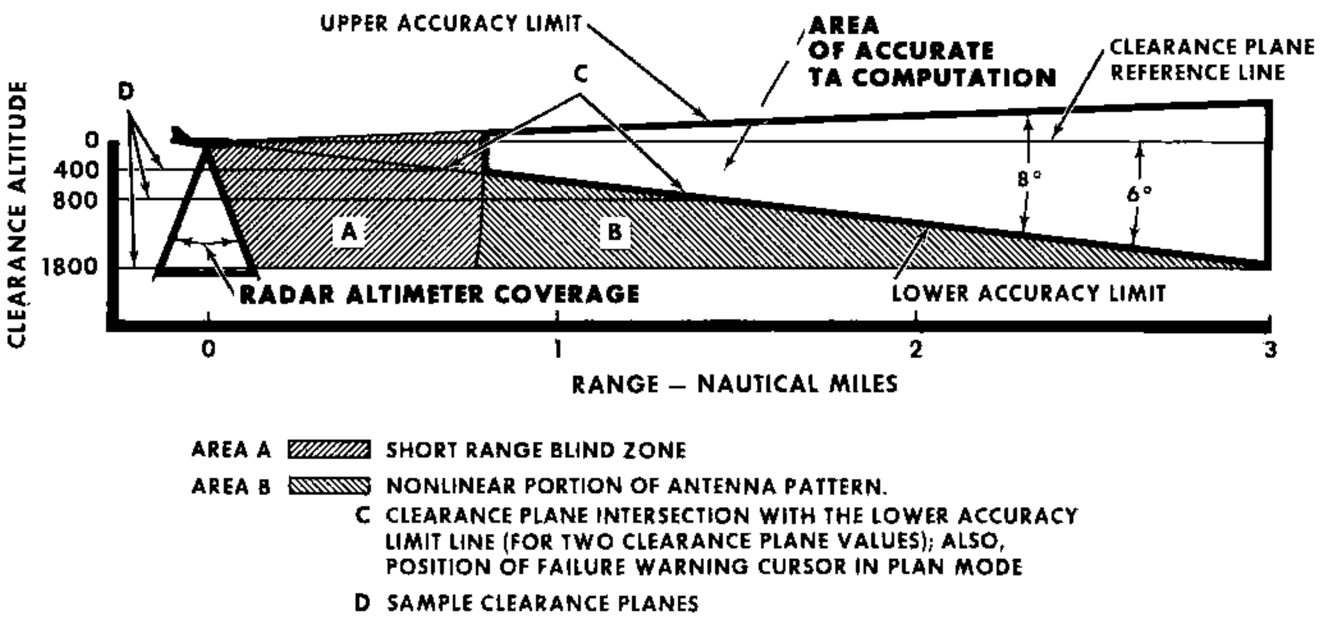
Either bright sunlight or instrument panel floodlighting may cause the TA warning light to appear illuminated, erroneously indicating a TA system failure. An actual failure warning indication can be masked by this abnormal condition. In the event such a condition occurs, disregard the TA warning light and observe the failure warning cursor in plan mode and/or the horizontal reference line in profile mode for failure warning information.

WARNING

- If this light illuminates except for bank angles greater than 25°, the TA system should be used with caution and only when visual contact with the ground can be maintained.
- For proper operation during the high altitude "Inflight Functional TA System Check," the BNS radar must be in MAN LOAD.

TA WARNING PUSH-TO-TEST BUTTON. A TA warning push-to-test button (3, figure 4-41) located on each terrain display indicator provides a means of testing the TA warning light lamp and the TA failure warning circuits. Pressing the button while operating in plan mode should cause the failure warning cursor to disappear and the TA warning light to illuminate. Pressing the button while in a profile mode should cause the horizontal reference line to disappear and the TA warning light to illuminate.

WRITE BIAS AND PLAN VIDEO GAIN CONTROLS. Write bias and plan video gain controls (5 and 4, figure 4-41) are located on the pilot's and copilot's terrain display indicators. The write bias control provides a means of controlling the brightness of both plan and profile displays. The plan video gain control provides a means of controlling the plan video signals.



TERRAIN AVOIDANCE SYSTEM GEOMETRY

Figure 4-44.

RANGE GATE INDICATOR LIGHTS. Three green range gate indicator lights (7, figure 4-41) are located on the left side of the pilot's and copilot's terrain display indicators. The indicators are marked "3," "6," and "10" and are provided to indicate the particular range selected. The "10" indicator light remains illuminated during plan mode and when PROFILE CAL is selected.

RANGE GATE INDICATOR LIGHTS INTENSITY CONTROL. A range gate indicator lights intensity control (6, figure 4-41) located on the pilot's and copilot's terrain display indicators provides a means by which the intensity of the range gate indicator lights may be adjusted.

CLEARANCE PLANE POSITION INDICATORS. The pilot and copilot each has a clearance plane position indicator (figure 4-42) located on the forward instrument panel. The indicators show the position of the clearance plane in feet below the aircraft.

NOTE

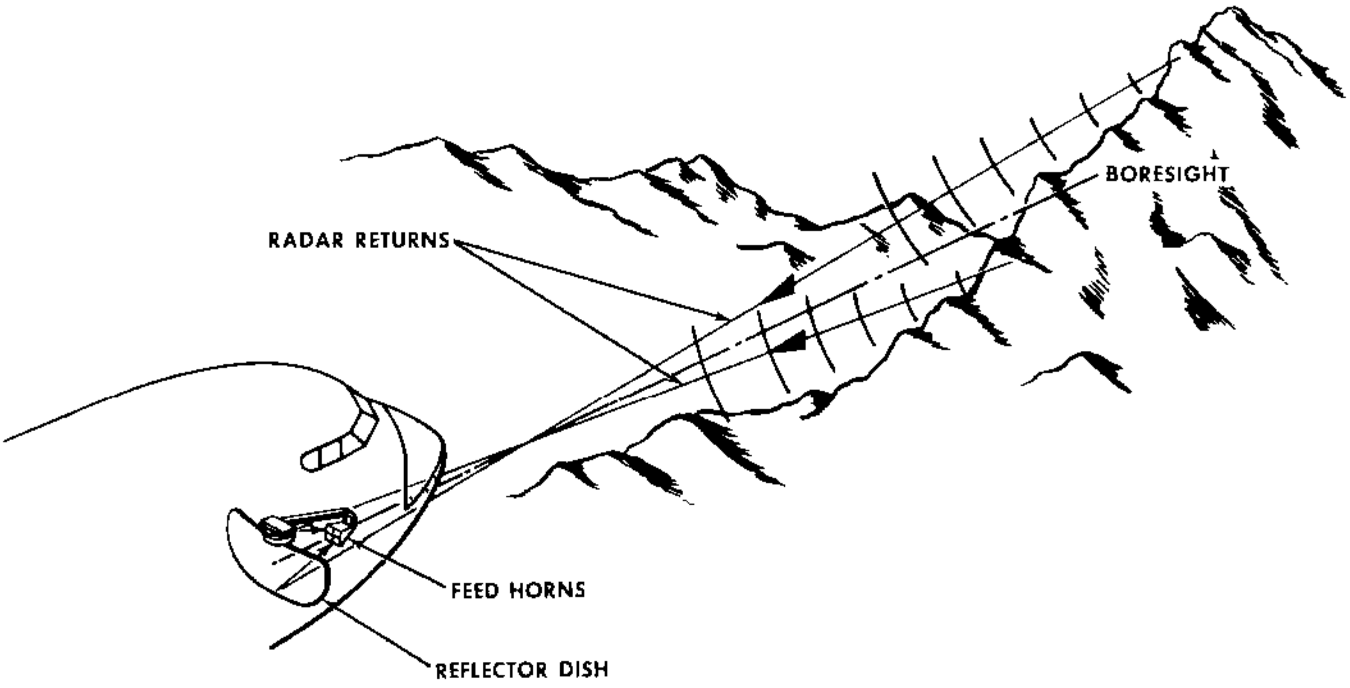
> The clearance plane indicator dial is graduated from 1000 feet above to 3000 feet below the aircraft; however, the clearance plane cannot be set above the aircraft as the setting limits are 0 to 3000 feet below the aircraft.

VERTICAL CENTERING CONTROLS. Vertical centering controls (1 and 5, figure 4-43) located on the pilot's and copilot's preflight adjust control units provide a means of vertically centering the display. The plan display vertical centering control (1, figure 4-43) is used to position the vertex of the plan display to the bottom of the scope. The profile display vertical centering control (5, figure 4-43) is used to center the profile display.

HORIZONTAL CENTERING CONTROL. A horizontal centering control (3, figure 4-43) located on the pilot's and copilot's preflight adjust control units provides a means of horizontal centering both the plan and profile displays. This control is used to place the vertex of the plan display precisely on the ground track line at the bottom of the scope.

HORIZONTAL GAIN CONTROLS. Horizontal gain controls (2 and 6, figure 4-43) located on the pilot's and copilot's preflight adjust control units provide a means of adjusting the horizontal gain of the display. The profile horizontal gain control is for ground crew use only. The plan horizontal gain control is for use by both ground crew and pilots.

VERTICAL GAIN CONTROL. A vertical gain control (7, figure 4-43) located on the pilot's and copilot's preflight adjust control units provides a means of adjusting the vertical gain of the plan display.



DUAL ANTENNA

Figure 4-45.

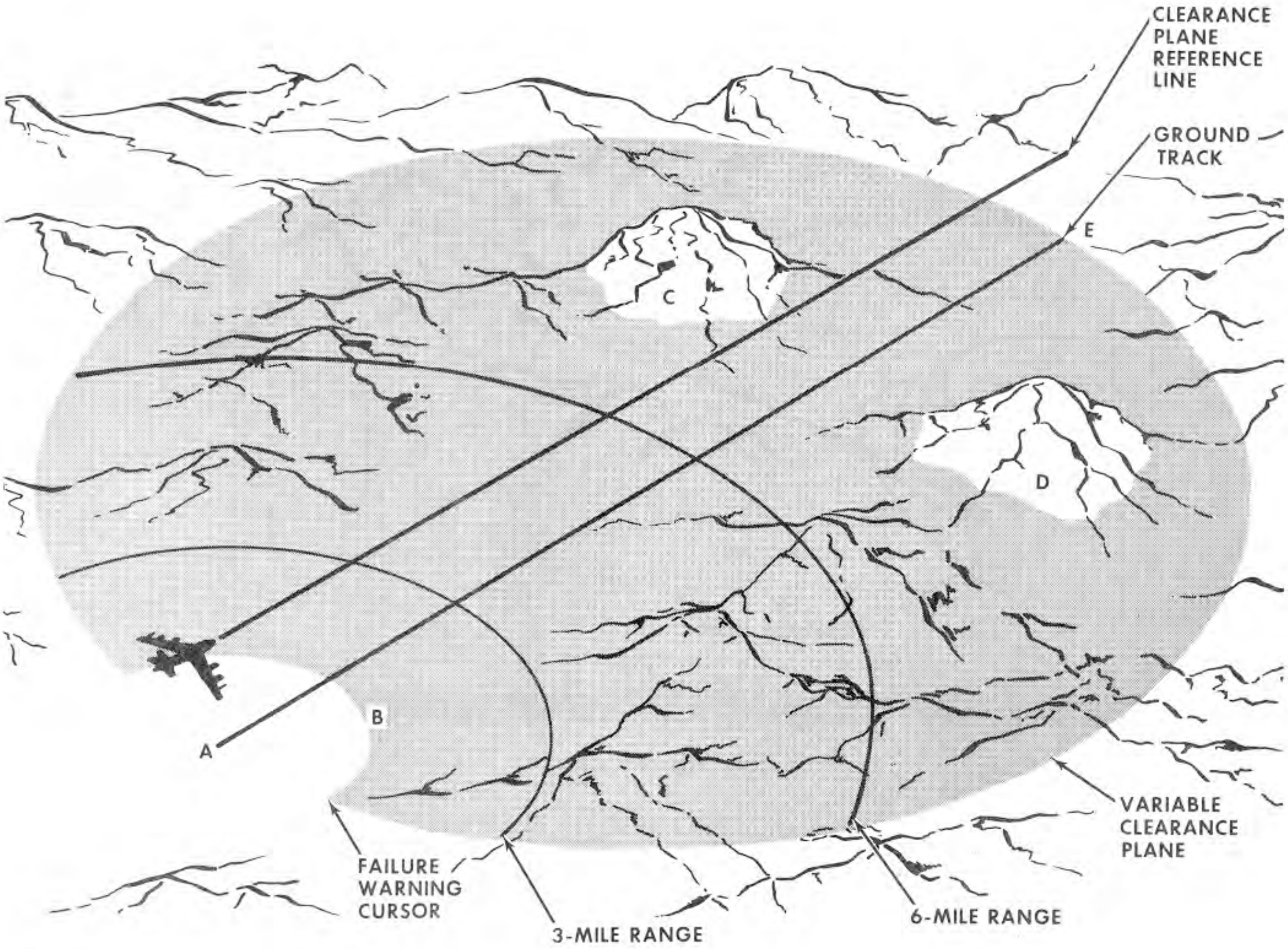
PROFILE CALIBRATION CONTROL. A profile calibration control (4, figure 4-43) located on the pilot's and copilot's preflight adjust control units is used to adjust the vertical scale factor of the profile display so that, if the profile video output signal from the terrain computer is correct, the profile calibration cursor will appear at the correct position on the PROFILE CAL display.

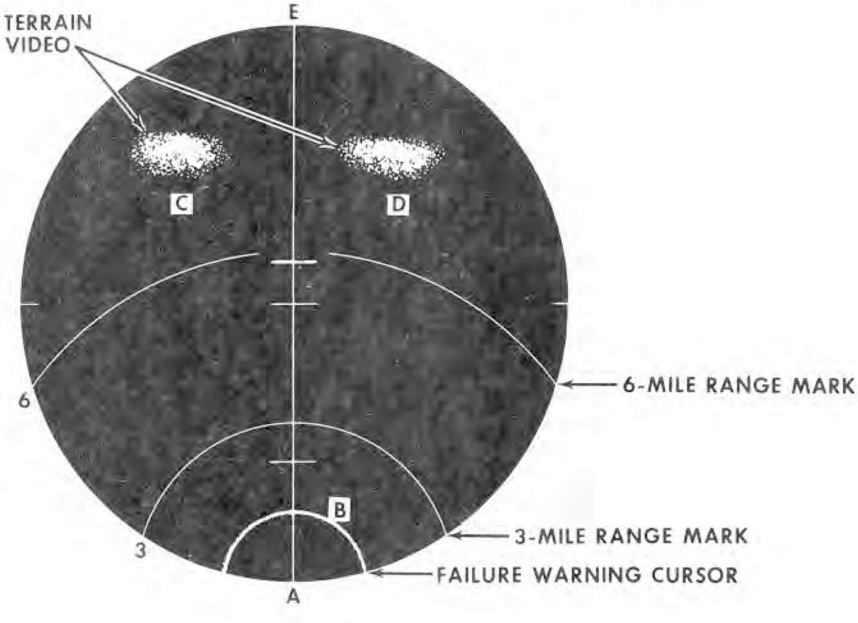
Navigators' Controls and Indicators

For information on the navigators' equipment, refer to T.O. 1B-52C-1-1-1.

THEORY OF OPERATION

The TA system utilizing the BNS radar operates on the monopulse radar concept. The system provides range, azimuth, and height data on each target from a single transmitted pulse, hence the term "monopulse." A terrain computer, two radar receivers, a conventional transmitter, and a dual antenna are used to provide the TA system data. The transmitter is connected to the antenna and generates a short high energy pulse which illuminates the terrain ahead of the aircraft. The antenna is then switched from the transmitter to the receivers. This switching cycle is repeated for each transmitter pulse. The dual antenna contains the usual reflector dish and is equipped with two pairs of feed horns (radiators), one located directly above the other (figure 4-45). For simplicity, each horizontal pair can be considered as a single feed horn. Returns from high obstacles tend to focus more energy into the lower feed horn while returns from low obstacles tend to focus more energy into the upper feed horn. An obstacle located midway will reflect equal energy into each horn and is said to be located on boresight; that is, on the principal axis of the antenna electric field. The antenna design enables accurate height computation of obstacles within the 8° primary area shown in figure 4-44. If radar returns were received in area A of figure 4-44 while operating in profile mode, gross inaccuracies in the terrain trace would result. To mask this area of major inaccuracy, a minimum range gate (MRG) is used in profile mode to remove returns within this area resulting in a short range blind zone. The range of this blind zone (or MRG) is preset in the system during ground alignment to a distance of 0.85 mile from the aircraft. This setting of the short range blind zone prevents display of profile mode returns within the 0.85-mile range. In plan mode, the receiver switching cycle prevents display of returns from obstacles within approximately 1/2 mile of the aircraft. A failure warning cursor is provided on the plan mode display and





PLAN MODE DISPLAY

Figure 4-46.

indicates the intersection of the lower accuracy limit with the clearance plane ("two shown" C, figure 4-44). The range variation of this intersection with the clearance plane setting is apparent. Obstacles which protrude into the primary area are accurately computed and displayed. When radar echoes are received in area B, invalid returns are produced and will result in a blooming vertex. The blooming will normally occur within the failure warning cursor. When range and azimuth obtained by conventional means are added to height information, a good description of the obstacle position is available to the pilot. The computation cycle is repeated continuously with the net output of the terrain compuer being a chain of longitudinal terrain profiles spaced about 1/7° in azimuth. Since the width of each profile is about 1°, complete overlapping coverage of the terrain is provided within the line-of-sight limitation. Terrain obstacles are displayed in azimuth with respect to aircraft ground track using a drift angle correction signal provided by the doppler radar. The terrain computer generates a clearance plane (figures 4-46 and 4-47) which can be thought of as a surface positioned at the desired clearance altitude below the aircraft. All terrain obstacles are displayed relative to the clearance plane. Noting the displayed position of an obstacle on the flight path, the pilot maneuvers the aircraft in pitch to maintain the clearance plane coincident with the top of the obstacle. He will then pass over the object at the desired clearance altitude. The clearance plane remains parallel with the reference plane which is oriented with respect to the horizon or flight path, depending on the stabilization mode chosen.

Stabilization Modes

Two stabilization modes are provided, fuselage reference line (FRL) and horizontal. In both modes of stabilization, a roll correction is applied to the antenna to compensate for bank angles. This correction maintains the system accuracy up to 12° of bank, beyond which the antenna strikes the stops on the down wing side. The distorted display thus produced is restored as soon as the bank angle is reduced. Bank angles above approximately 25° may cause the TA warning lights to illuminate but do not damage the system physically or electrically.

NOTE

The presentation on the terrain display indicators may be affected during abnormal ECO light indications; therefore, during TA system operation, the radar navigator should notify the pilots if the ECO light remains illuminated during straight and level flight or does not illuminate during bank angles exceeding 4°.

FRL MODE. In FRL stabilization, the clearance plane is established approximately parallel to the flight path of the aircraft. The accuracy of FRL stabilization is dependent on a correct FRL angle of attack setting. The FRL angle of attack is set by the navigator for the given conditions, using the attitude reference control panel and the angle of attack chart (figure 4-51). In the FRL mode of stabilization as the aircraft pitch altitude is changed, the clearance plane also pitches to remain approximately parallel with the flight path. This enables the pilot to cause obstacles to appear or disappear by merely pulling the nose of the aircraft up or pushing it down. Using this technique with an obstacle displayed, the pilot can change the aircraft attitude and determine how much performance is necessary to clear the obstacle.

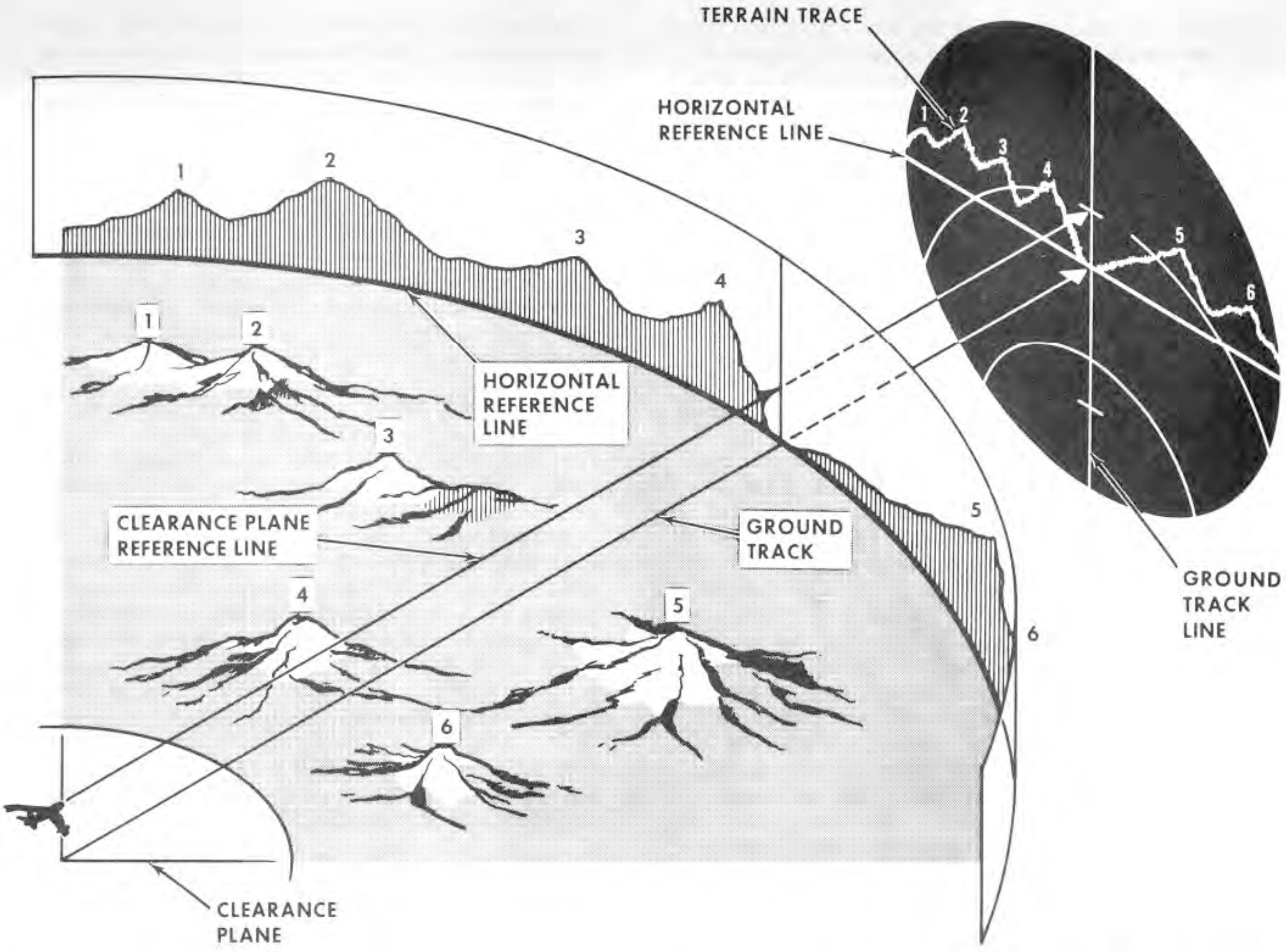
HORIZONTAL MODE. In horizontal stabilization, the clearance plane is established parallel with the horizon, using a correcting signal obtained from the BNS stabilization reference. This mode is used principally to check the TA system accuracy and is of limited use in contour following. A change in aircraft altitude is the only way to change the presentation in horizontal stabilization. This characteristic causes excessive clearance altitude when approaching obstacles in a climb and insufficient clearance when approaching or crossing obstacles in a descent.

Pilots' Display Modes

The TA system is equipped with two display modes, plan and profile, which can be used with either of the two modes of stabilization.

PLAN MODE. The plan mode display (figure 4-46) is a 10-mile PPI (plan position indicator) which displays range and azimuth of obstacles protruding through (above) the clearance plane. The bottom of the ground track line represents the position of the aircraft. The display resembles a contour map having 10 miles range. Valleys, river beds, ridge lines, etc may be discernible on the display. The radar shadow effect causes a large blank space to appear behind the display of a prominent obstacle. The position of the plan failure warning cursor (C, figure 4-44) varies with the clearance plane setting and indicates the range at which the lower limit of the primary area of the antenna intersects the clearance plane as explained above.

PROFILE MODE. The profile mode displays azimuth and height (figure 4-47). In contrast to the forward and down view of plan mode, the profile mode display presents a view looking forward. The height of obstacles is displayed relative to the clearance plane which is represented by an electronically generated cursor known as the horizontal reference line. The term "horizontal" refers only to the cursor position of the line relative to the tube face. The profile mode is equipped with three selectable range gates: 3, 6, and 10 miles. Only radar echoes from targets



PROFILE MODE DISPLAY

Figure 4-47.

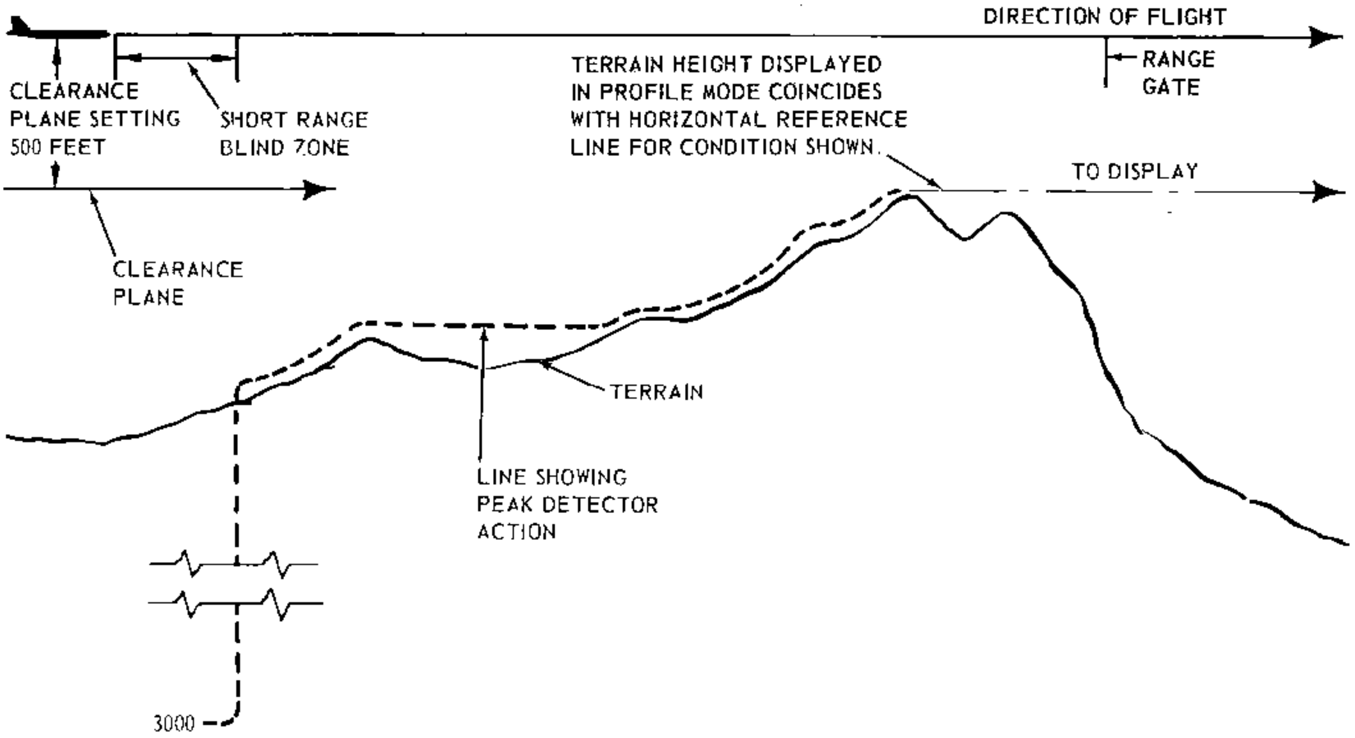
within the range selected are accepted for processing or display. The highest visible terrain obstacle between minimum range and the selected range gate (3, 6, or 10 miles) is sensed and retained in a peak detector module in the following manner: The profile mode peak detector senses the highest terrain computation within the range gate selected at each degree of azimuth and causes this terrain height to be displayed as illustrated in figure 4-48. Notice that the peak detector value is -3000 feet within the short range blind zone and that the peak detector senses and retains the highest terrain within the range gate, represented by the dashed line in figure 4-48. (The peak detector is recycled to -3000 feet between radar cycles.) The peak detector output is smoothed and reproduced on the profile display; thus, only a silhouette of the highest obstacles is seen. Sweep circuits slaved to the antenna generate the left-right scan of the trace.

NOTE

> Based on past experience with the TA system and because all errors and distortions are greatest at the longer ranges, profile 10 will usually cause the aircraft to fly too high.

Navigators' Displays

For information on the navigators' displays, refer to T.O. 1B-52C-1-1-1.



PROFILE PEAK DETECTOR

Figure 4-48.

Failure Warning

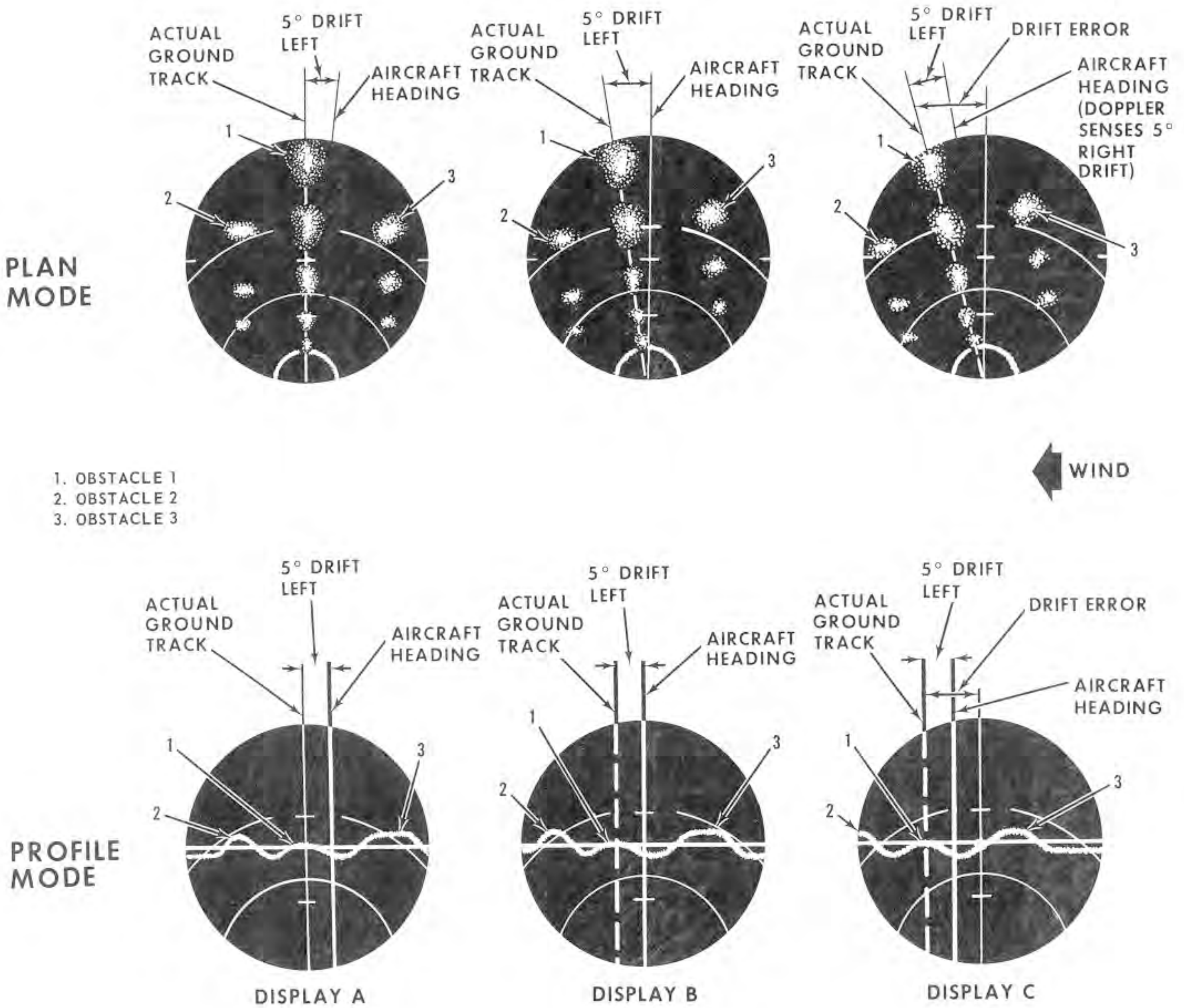
The TA system is equipped with a self-test feature called "failure warning." A synthetic terrain obstacle is generated electronically and supplied to the radar receivers. This signal is processed through the computer and fed to a comparing circuit. The comparing circuit senses the accuracy of the computation. The failure warning circuits detect errors in either the positive or negative direction and errors of 300 feet or more will cause the failure warning cursor or horizontal reference line to disappear and the TA warning light to illuminate. Although the failure warning circuit does not include every system component from the input to the output, it does check the accuracy of a majority of electronics involved. The items not checked include the antenna, a portion of the receiver-transmitter unit, and a portion of the terrain computer. Furthermore, errors or malfunctions can exist in the components checked which may produce abnormal or erroneous displays but not cause a failure warning indication.

NORMAL OPERATION

System Characteristics

The following terrain display indicator characteristics are occasionally visible but do not degrade TA system performance significantly.

- A variation in persistence may exist between the pilot's and copilot's terrain display indicators.
- A dim halo may occur around the periphery of the terrain display indicators.
- There may be a range error on either of the pilots' displays of ±0.75 mile at 6-mile range and decreasing to ±0.4 mile at 3-mile range.
- It may be that a return will be seen on the pilots' display but will not be seen on the navigators' display or vice versa; however, the two displays will not differ (in elevation) more than 250 feet plus 0.5% of the range. (In any event, the pilots' display is the reference for TA flying.)
- Dead and bright spots are permissible on the terrain display indicator from 1/2 inch either side of the ground track line to the edge of the indicator.



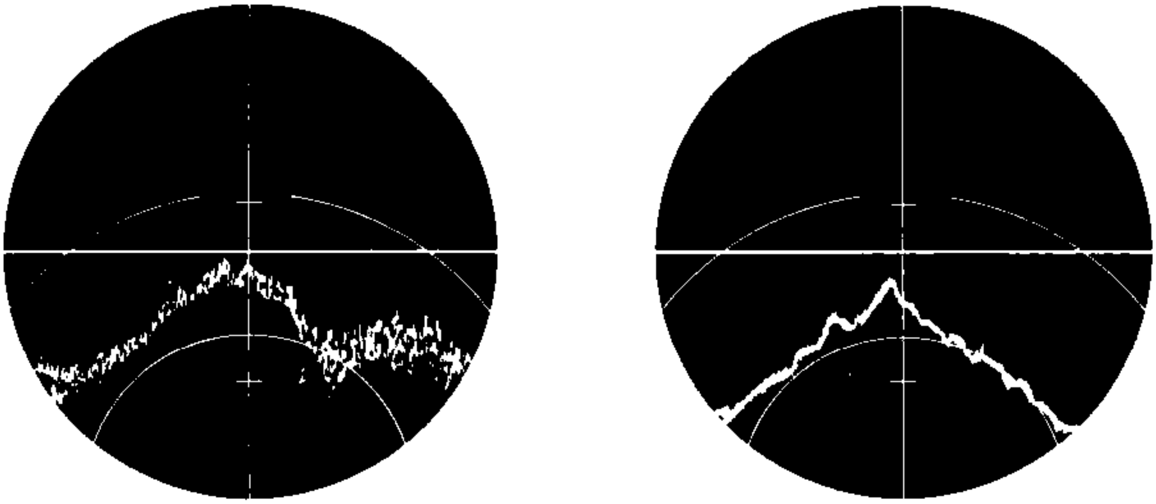
NOTE

DRIFT REPRESENTATIONS NOT TO SCALE

GROUND TRACK ERROR

Figure 4-49.

GROUND TRACK ERROR DUE TO DOPPLER. Drift angle signals are supplied to the TA system to orient the actual ground track under the ground track line (A, figure 4-49). With the doppler drift switch positioned to ZERO DRIFT, the ground track line will represent the projected longitudinal axis of the aircraft and will not represent the actual ground track (B, figure 4-49). If the doppler radar system is providing erroneous drift information, the actual ground track line will be displaced from the etched ground track line an amount equal to the drift error (C, figure 4-49). This error may also shift back


BETA ANOMALIES PRESENT

BETA ANOMALIES ABSENT

EFFECTS OF BETA ANOMALIES (PROFILE MODE DISPLAY)

Figure 4-50.

and forth in respect to the ground track line. The doppler radar is more likely to be unreliable in a descent.

TERRAIN VIDEO TRACE BREAKUP. The solidity or continuity of the terrain video trace is affected to some extent by antenna scan speed, PRF, drastic terrain profile slope changes (i. e., canyon walls, steep hills, etc), and the rate of TA solution and display. Abrupt changes in transverse slope of the terrain profile is the greatest cause of normal profile video trace breakup. Basically the magnitude of profile video trace breakup depends on the magnitude and duration of the terrain profile transverse slope changes. This condition will not prevent operational use of profile mode since it is possible to distinguish between normal trace breakup due to the above combination of factors and abnormal breakup due to system malfunction.

EFFECTS OF BETA ANOMALIES. Due to nonlinearities in the antenna radiation pattern, anomalous (false) terrain indications may be observed in both plan and profile modes, when the aircraft altitude above the surrounding terrain exceeds 800 feet. In plan mode, these anomalies appear as noise or clutter near the indicator vertex which may obscure the minimum range mark. In profile mode, the anomalous returns may cause the terrain to be computed higher than it actually is, giving an erroneous indication of terrain height on the display. Figure 4-50 presents two profile displays, one with beta anomalies present and one with beta anomalies absent. The anomalies may cause random spikes, a widening of the terrain trace, and a ragged or broken trace. In profile 10, the combined effect of these anomalies, azimuth compression and system inaccuracies may be such that a peak ahead of the aircraft may not be recognizable on the display until it is within 6 miles range. As the range to the peak decreases, the peak will be more readily discernible.

OBSCURED FAILURE WARNING CURSOR. At clearance plane settings most often used for operational flights, the failure warning cursor is very close to the vertex of the display and may not be seen because it is lost in the clutter.

SCAN TO SCAN DISPARITY. Two types of TA presentation disparity may exist in the BNS:

1. Vertical disparity may occur when either plan or profile mode is being used. Plan mode video may appear on one scan and disappear on the reverse and/or successive scans if the "aircraft-to-terrain" height is close to the clearance plane setting. Profile mode video may appear higher on one scan than on the reverse and/or successive scans.
2. Azimuth disparity may occur when profile mode is being used. Profile mode video may appear at a slightly different azimuth on one scan than on the reverse scan.

TERRAIN DISPLAY INDICATOR STORAGE. Video which is displayed with the indicator intensity setting at a maximum may remain on the display for a short time after the intensity is reduced to minimum. At high levels of intensity, some video smearing may appear; this can be reduced by proper adjustment of the intensity controls.

FADE-IN FADEOUT DIFFERENCE. In TA plan mode and horizontal stabilization, there may be as much as 200 feet difference between the fade-in and fadeout points of an obstacle. The fade-in of the obstacle must be taken at a range within 1/4 mile of that at which the fadeout was taken.

SHORT RANGE BLIND ZONE. The radar utilized in the TA system is blind at ranges closer than 0.85 nautical mile of the aircraft (area A, figure 4-44) while in profile mode due to the minimum range gate (MRG). Targets within the short range blind zone (MRG) will not be observed on the profile mode display. There is no observable short range blind zone (MRG) while in plan mode; however, video returns within the failure warning cursor are inaccurate and should be disregarded.

RADAR SHADOWS. Radar energy travels in line of sight. Only targets "visible" to the antenna are displayed; other targets which are hidden are located in the area known as the "radar shadow." As the aircraft progresses over the ground, the shadow areas are progressively illuminated provided the aircraft is above the terrain causing the shadow. The changing illumination and shadows can be observed on the plan mode displays.

POOR DISPLAY OF SHEER TARGETS. The system is not capable of consistently displaying or accurately computing the height of TV or radio antenna towers, power transmission lines, suspension bridges, very tall office buildings, straight-sided cliffs or peaks, etc. These obstacles may be displayed at partial height with improving accuracy as range decreases, producing a rapidly rising terrain trace on succeeding scans of the display. If the target is displayed close to ground track, the pilot should consider such a sequence as an emergency and immediately initiate a climbing steep turn.

POOR DISPLAY OF SMALL TARGETS. The returns from small objects (small buildings, boats, etc) are very weak and are not computed or displayed accurately, even though they may be discernible to the radar navigator.

WEATHER SENSITIVITY. The TA system will display returns from dense clouds, moderate rain or snow, etc. The total contrast feature of this display prevents the pilot from differentiating between weather returns and valid obstacles. Weather has been observed to make the profile terrain trace appear jagged (having an irregular sawtooth shape). Areas of precipitation should be avoided because these returns mask the ground returns and will cause the pilot to climb above the desired clearance altitude. The climb command in this case can exceed the climb performance of the aircraft. The radar navigator can often provide guidance through areas of scattered precipitation. When TA capability is degraded by weather effects, the pilot should climb to IFR altitude.

BANK ANGLE. The terrain display indicators will present a distorted display on the wing down side when the bank angle exceeds 12°. The short range blind zone affects the display of targets at close range off the wing tip as well as in front of the aircraft. These combined effects will prevent display of important targets during turns if the bank angle exceeds 12°.

DISPLAY IRREGULARITIES. Invalid spiking in profile 6 or profile 10 mode may appear. Evasive action should be initiated unless visual observation determines otherwise.

AZIMUTH DISTORTION OF PROFILE MODE DISPLAY. There are two general causes of azimuth distortion in the profile display, one due to the sine function deflection voltage and the other to the large difference between the vertical and horizontal scale factors. In all TA modes, the antenna sector is +85° about the aircraft ground track. The full 170° sector is not needed and is not displayed on the pilots' indicators in profile mode because the information on the edges of the display would be compressed and unusable. The profile display near ground track (at the center of the tube) will be essentially linear (uncompressed). This condition occurs because the profile horizontal deflection voltage for the tube is a sine function of antenna azimuth angle. The compression effect is partially eliminated by displaying only ±45° about ground track. However, there is still some compression at the edges of the display. The effect of this is that a peak near the ground track line will appear wider than it will when near the edge of the display. In profile mode, the terrain within a 90° sector is displayed across the width of the indicator tube. The actual distance displayed on the tube varies with range so that at 10-mile range, the distance displayed is approximately 16 miles. At 6-mile range, the distance displayed is approximately 9.5 miles and, at 3-mile range, the distance displayed is approximately 5 miles. The apparent width of a target therefore becomes larger as the range to that target decreases since the azimuth scale factor (distance per inch) necessarily becomes larger. The elevation scale factor does not change with range. The limits of the profile display are 3000 feet in elevation and 90° in azimuth. As a result of the elevation and azimuth scale factors, distortion is inherent in the profile mode display. A peak at the longer ranges will appear as a narrow spike and the displayed contours will not be a pictorial representation of the actual terrain contours.

Planning Considerations

All B-52 low altitude training flights are planned and flown in accordance with command directives. Careful planning is essential for safety and effectiveness. The following TA characteristic should be considered:

1. Plan all turns for 12° bank. (Turn short to make good the planned track.) If the bank angle must be increased beyond 15°, do not depend on the TA display for terrain clearance. Maintain visual clearance or climb to a safe altitude.
2. The system is not capable of consistently displaying radio and TV towers. An increased clearance plane setting can be used if circumnavigation is not feasible.
3. The TA system will display returns from dense clouds and precipitation. When TA capability is degraded by weather effects, the pilot should climb to IFR altitude. Do not rely on TA system displays for weather penetration.
4. Radar returns from water depend on sea state and are usually of such low value that erroneously high clearance indications are displayed. Use of the radar altimeter is recommended when over water.

WARNING

Do not depend on the TA display for letdown or low absolute altitude operation over water.

5. Airspeeds will normally be as dictated by the needs of the mission and may be adjusted in flight for control time purposes.
6. Preparations during mission planning includes review of clearance plane setting for each low level route.
7. FRL stabilization. Determine the gross weight, indicated airspeed, and airbrake positions. Using this information, determine the FRL angle of attack value from the angle of attack chart (figure 4-51) and set the FRL angle of attack into the system using the attitude reference control panel at the navigator's station.

EXAMPLE: At 280,000 pounds gross weight and 260 knots IAS, the computed FRL angle of attack is -1.4° without airbrakes, -1.1° with airbrake position 2 (or position 4 with inboard airbrake circuit breakers pulled), and -0.8° with airbrake position 4.

NOTE

The FRL setting should be up-dated as necessary to maintain the set-in value accurate within 0.2°.

WARNING

Positive procedures must be established to insure that the FRL angle is reset when airspeed is changed during terrain avoidance operations. Failure to do so will result in serious clearance plane errors.

Operating Techniques

NOTE

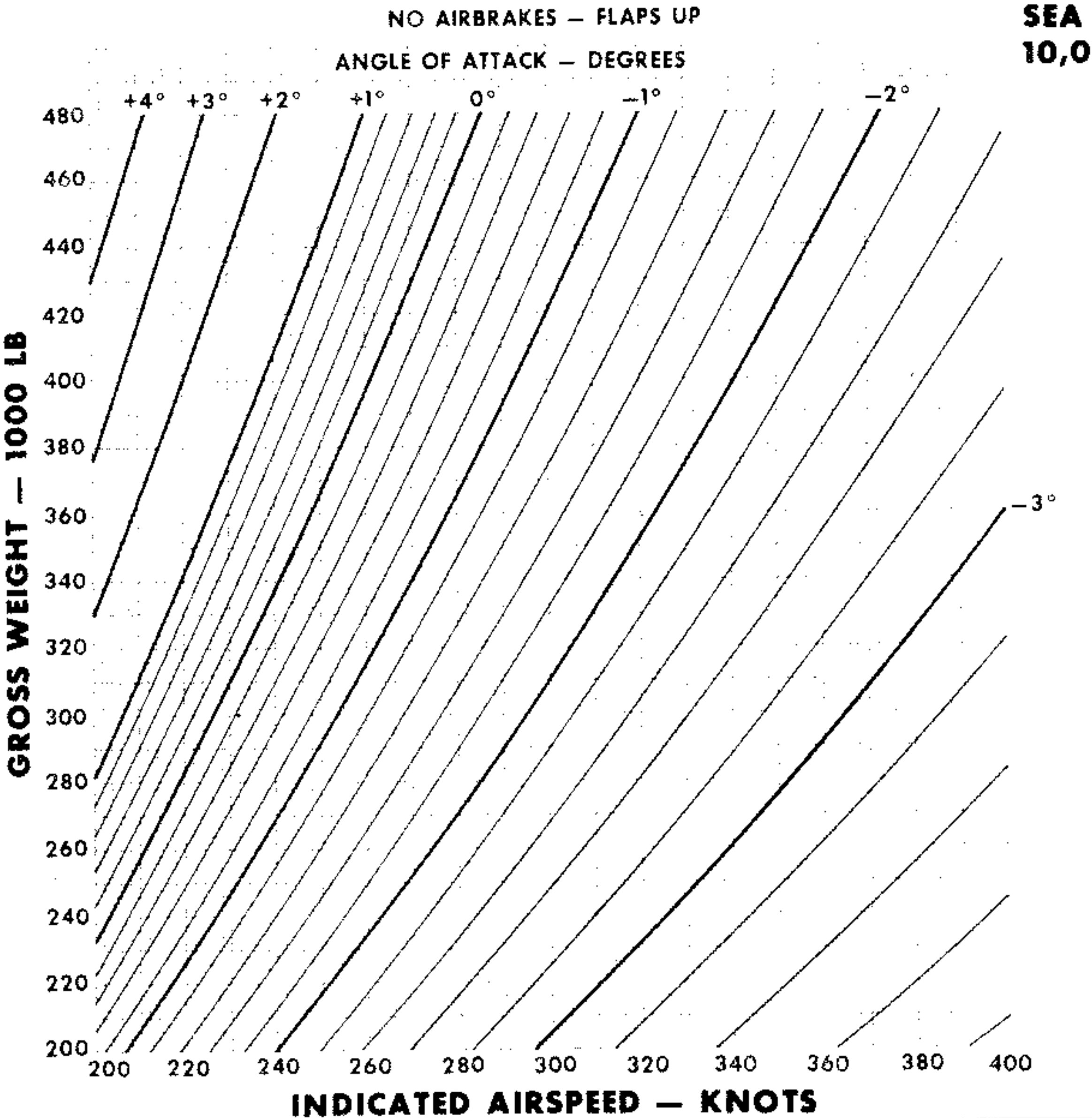
The radar altimeter is to be used in conjunction with the TA system. It will be included in the pilot's normal instrument scanning pattern for continuous cross-check with other terrain clearance information and for observing peak passage before following a fly-down command.

WARNING

TA operation without a properly operating radar altimeter is extremely hazardous if visual terrain clearance cannot be maintained.

In flight, TA operation is essentially an extension of instrument flying with the TA system displays included in the cross-check. Neither TA display mode (plan or profile) provides any direct indication of pitch or roll, although an approximate indication of pitch changes can be obtained by noting the scan-to-scan changes in position of the profile terrain trace. It has been found helpful to assign airspeed (throttles) control to the safety pilot, who then maintains the desired airspeed without further direction. Frequent use of airbrakes for deceleration is not recommended. The climbing portions of TA operation require close monitoring of airspeed in rough terrain. Pilots should overshoot throttle settings by early advancement to higher settings than required, then retard throttles as required to maintain desired airspeed. It is especially important to maintain correct airspeed when in the FRL stabilization mode because airspeed reduction causes lower than desired crossing altitudes. Turns are possible during terrain following, provided good judgment is applied. The radar navigator must verbally clear the proposed flight path prior to all turns greater than 10 . Blank, missing, or ragged (saw-toothed) areas of the terrain trace in profile mode or blank areas of the display in plan mode may be present. This blank may be caused by radar shadow from a large obstacle at very close range. Plan turns so that no

SEA LEVEL TO 10,000 FEET



NOTE

- Use airbrake corrections in airbrake position 2 column when the inboard airbrake circuit breaker is pulled out and airbrake position 4 is selected per low altitude tactic in Section II.
- When flying with constant airspeed and a gross weight less than that used to compute the FRL potentiometer settings, the use of airbrakes will tend to improve the accuracy of the TA system display by providing a more nose-up angle of attack. At heavier gross weights, the use of airbrakes will tend to degrade the accuracy of the TA system display.
- One or two AGM-28 missiles installed on the aircraft changes the angle of attack 0.1° and 0.2° respectively in the positive direction due to aircraft loss of lift when missiles are installed.

  EXAMPLE:

  If the aircraft gross weight (including two missiles) is 300,000 pounds, the angle of attack value at 260 knots indicated airspeed from the chart is −1.2° then add +0.2° correction for the missiles which results in an angle of attack setting of −1.0°.

INDICATED AIRSPEED KNOTS	AIRBRAKE CORRECTION	
	ADD THIS CORRECTION TO THE ANGLE OF ATTACK FROM THE CHART	
	AIRBRAKE POSITION 2	AIRBRAKE POSITION 4
200	+0.4°	+0.8°
250	+0.3°	+0.6°
300	+0.3°	+0.6°
350	+0.3°	+0.5°
400	+0.3°	+0.3°

AIRCRAFT (BODY) ANGLE OF ATTACK — LEVEL FLIGHT

Figure 4-51.

more than 15° bank angle is used. Use slow rate of roll-in, not to exceed 3° per second. The copilot must monitor all the instruments and provide visual clearance of the aircraft. The radar navigator provides terrain assessments beyond the pilot's range. When hazardous terrain is observed the radar navigator will continue to advise pilot until pilot is tracking obstacle on his indicator. The radar navigator using GM can normally see out as far as 35 NM ahead of the aircraft and provides information on large obstacles and weather beyond the range selected by the pilot. Using ranges greater than 75 miles may result in retraces and other interference effects. The radar navigator may recommend small course changes to utilize terrain cover or for weather. The navigator sets the destination indicators to the turn point coordinates which enable the pilot to use the pilots' data indicator (PDI) as the primary heading instrument. The pilot may use the bank steering bar as primary heading instrument during TA operation. When this procedure is used, the copilot must reset the heading marker, as required, during heading correction or when azimuth deviations are noted on the pilot's data indicator (PDI). BNS steering may be used to maintain correct aircraft heading while the pilot maintains pitch control. The navigator must also monitor the doppler radar and, in the event of a doppler malfunction, notify the pilot and place the doppler drift switch to ZERO DRIFT. If the doppler radar will not return to normal operation, the navigator will place the doppler radar silence switch to SILENT. After the radar navigator has accomplished a memory point wind run, the doppler drift switch should be positioned back to NORMAL. This will align the TA presentation about ground track derived from the BNS memory point winds. All subsequent wind runs will be made with the doppler drift switch in ZERO DRIFT position. Inform the pilot before making any changes in the doppler drift switch position. The navigator will monitor minimum safe altitudes for the low altitude leg.

WARNING

Failure of the BNS radar tilt circuitry will create an inaccurate TA displays

HORIZONTAL STABILIZATION. In the horizontal stabilization mode, the terrain is displayed relative to its vertical distance below the aircraft. Horizontal stabilization mode is considered only a backup in TA operations and should only be used when FRL stabilization mode is inoperative or unreliable and then only for calibration checks or for combat TA altitude operations.

WARNING

Use of horizontal stabilization will result in inconsistent peak crossings at very low clearance altitudes when peaks are crossed in a descending attitude. Confine descent rates to less than 1000 feet per minute. Insure active safety pilot monitoring. When horizontal stabilization is used with plan mode, do not use compensated clearance plane settings that result in less than 800 feet actual terrain clearance. A rapidly rising profile mode terrain trace, even though the trace may be well below the horizontal reference line, provides a visible indication of an impending low crossing or collision.

TA System Failure Detection

Timely recognition of TA system failures is essential to safe contour following operations. A failed condition may be detected using any of the following methods:

- The TA failure warning lights (actuated by the TA failure warning circuits) illuminate.

WARNING

The failure warning circuits do not detect every failure of the TA system but do check the accuracy of the majority of the electronics involved.

- The radar altimeter indicates unsatisfactory terrain clearance.
- Comparison with pressure altitude and known terrain elevation indicates unsafe or abnormal terrain clearance.
- Safety pilot detects impending collision.
- When, in the radar navigator's judgment, the radar system appears abnormal or the display indicates impending ground collision (based on the shadow characteristics of terrain along the ground track).

Upon suspicion or recognition of TA system failure, the pilot should initiate immediate pull-up to safe altitude. Since the TA failure warning does not detect every type of TA failure, the radar altimeter must be monitored for indication of TA failures and so must be included in the pilot's normal cross-check. In the event of failure of the radar altimeter, the safety pilot must be ready and able to recognize a TA failure and be prepared to take necessary action to assure safety.

Failure Verification

WARNING

> If the horizontal reference line is not present while using profile mode or if the failure warning cursor is not present while using plan mode, the TA system should be used with caution and only when visual contact with the ground can be maintained.

NOTE

> Either bright sunlight or instrument panel floodlighting may cause the TA warning light to appear illuminated, erroneously indicating a TA system failure. An actual failure warning indication can be masked by this abnormal condition. In the event such a condition occurs, disregard the TA warning light and observe the failure warning cursor in plan mode and/or the horizontal reference line in profile mode for failure warning information.

The general rule when observing a failure warning indication is to climb to a safe altitude and investigate. Switch to the other TA mode of display and, if failure warning indications disappear, TA flight may be continued in this mode of display after confirmation of TA system accuracy. A rough estimate of the TA system accuracy can be obtained by switching to PROFILE CAL. The failure warning problem is then displayed as a profile calibration cursor below the horizontal reference line. With an accurate system, the line will be coincident with the profile calibration etch mark. Failures of monitored components which influence short range accuracy may cause the profile calibration cursor (figure 4-52) to shift above or below the etch mark providing a visual indication of the error. When the shift exceeds 300 feet downward (negative error), the failure warning cursor or horizontal reference line disappears and the TA warning light comes on. Upward shifts (positive error) will also cause failure warning indication. The failure warning circuits may also be actuated by excessive bank angle which is inconsequential unless it remains after reducing the bank angle.

TA System Calibration

A TA system calibration check provides a means of determining TA system errors. A calibration check should be accomplished prior to flying at TA low level altitudes and also, when low level tactics are not scheduled, to evaluate the TA system for maintenance purposes. The data recorded during the check may be used to determine the existing error in the system and make any necessary compensations prior to the final descent to TA altitude. The data will also be used by maintenance personnel to evaluate the system performance and make any necessary alignment corrections or maintenance actions required to correct TA system errors/malfunctions documented by Form 781 writeups. There are four methods which can be used to evaluate TA system accuracy. The method used will depend on particular circumstances and conditions prevailing. Two methods require the use of a peak; the peak fly-by, and the peak fly-over. The other two methods require flat or rolling terrain, one using a ground return (prominent terrain feature) which can be tracked down the scope during the run and the other using just the terrain returns.

PEAK FLY-BY. This method will give the most accurate results and is the preferred method for functional checks, equipment acceptance, calibration, etc, where an approved test area has been established. The "TA System Calibration Checklist" in Section II is not designed to be used for this method of evaluation. The pilot will perform a fly-by at peak elevation and note the pressure altimeter reading. This establishes a base altitude. The calibration check is then made at base altitude plus 500 feet. Allow at least 10 miles of straight and level flight during the approach to the peak. When within 10 miles of the peak, lower the clearance plane if necessary until the peak is displayed. As soon as the peak can be identified on the plan display, fade the peak by raising the clearance plane. As an actual fadeout is approached, actuate the clearance plane control switch in short spurts until just prior to complete fadeout. Note the clearance plane setting and range then immediately lower the clearance plane and begin the fade procedure for the next fade point. Record as many clearance plane settings as possible between 10 miles and minimum range. The difference between each noted clearance plane setting and the 500-foot peak clearance altitude is the system error at the respective range. If the clearance plane setting is less than 500 feet, a positive error is present and if the clearance plane setting is greater than 500 feet, a negative error is present. If profile mode is operational, the run should be made in profile mode (for this type check) instead of plan mode. For profile mode, the technique is the same except the clearance plane is adjusted to place the top of the peak trace on the horizontal reference line, noting and recording the clearance plane setting. For this procedure, with profile mode selected, range information at each data point must be furnished by the radar navigator. Select the applicable profile range gate (10, 6, or 3) as the peak is approached. FRL stabilization should be used.

PEAK OR PROMINENT FEATURE FLY-OVER. The "TA System Calibration Checklist" in Section II will be used for this method of evaluation. The altitude of the peak or prominent feature must be known from a map or other means. The calibration run is made at 800 feet above the selected feature, maintaining straight and level flight starting at least 10 miles from the feature until cross-over. The run is normally started in PROFILE 10 with FRL stabilization. Between 9- and 6-mile range, compare stabilization modes as follows: Note the position of the top of the trace along ground track line, and estimate the trace deviation in feet from the horizontal reference line (if profile mode capability is not available, use plan mode with fade techniques and note clearance plane settings for each stabilization mode). Switch to the other stabilization mode and repeat the check. When using profile mode, the clearance plane is not adjusted during the stabilization check. The purpose of the stabilization cross-check is to determine the difference in tilt error of the two stabilization modes. After completing the stabilization check, return to the primary calibration stabilization mode, select plan mode and obtain 6-, 5-, 4-, and 3-mile fade points. Prior to reaching 6-mile range, lower the clearance plane if necessary until the feature is displayed then fade the return by raising the clearance plane. As an actual fadeout is approached, actuate the clearance plane control switch in short spurts until just prior to complete fadeout. Note the clearance plane setting and range then immediately lower the clearance plane and begin the fade procedure for the next fade point. After completing the 3-mile fade point, switch to PROFILE 3. Adjust clearance plane so terrain trace becomes coincident with the horizontal reference line and note clearance plane setting. At the crossover point note the minimum reading on the radar altimeter.

NOTE

- Care must be taken to fly the aircraft directly over the feature being tracked in order to obtain a valid radar altimeter reading.
- Calibration over sloping terrain is not desirable; however, if necessary, calibration can be accomplished over upsloping terrain using the above procedures. Calibration over downsloping terrain with gradient in excess of 200 feet in 10 miles should not be attempted.

FLAT OR ROLLING TERRAIN WITH A PROMINENT TERRAIN FEATURE. The "TA System Calibration Checklist" in Section II will be used for this method of evaluation. The technique is the same as for the peak fly-over method. The difference is in the amount of video on the display. When obtaining the fade points, depending on the type of tilt error existing, the scope may be flooded with video beyond the return being tracked or at the shorter ranges.

FLAT OR ROLLING TERRAIN WITHOUT A PROMINENT TERRAIN FEATURE. The "TA System Calibration Checklist" in Section II will be used for this method of calibration. The technique is the same as the two preceding methods except the aircraft is flown at 800 feet constant pressure altitude above the average terrain elevation along the ground track during the check. Since no feature is being tracked, the clearance plane is raised or lowered to place the edge of the ground returns (along ground track) at the range required for each data point. Depending on the direction of the tilt in the system, the returns may appear first at short range or at long range. If returns appear first at short range, the clearance plane must first be lowered to show returns at long range and then raised to obtain the readings per the checklist. The average radar altimeter reading during this check should be recorded as the zero range absolute altitude. Flat or rolling terrain calibration procedures should not be attempted over sloping terrain with gradient in excess of 200 feet per 10 miles. Refer to "Peak or Prominent Feature Fly-Over" procedures to accomplish calibration over sloping terrain with gradient in excess of 200 feet in 10 miles.

NOTE

Regardless of which method is used, a minimum of three plan mode fade points are necessary to obtain valid data for error determination. Additional fade points will improve the accuracy of the evaluation.

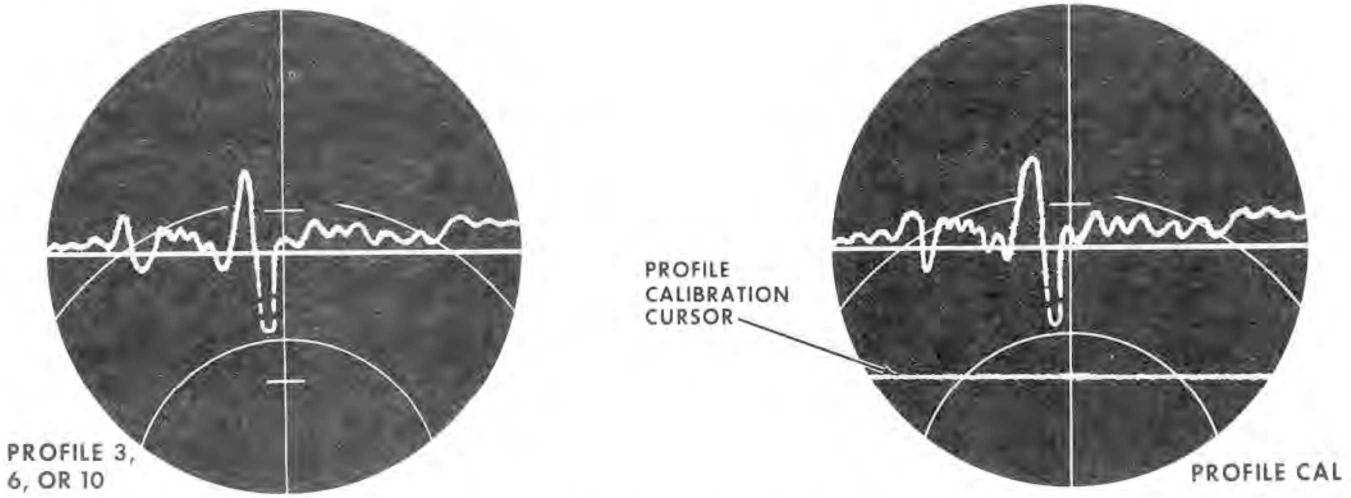
Pilot's Inflight Procedures (FRL Stabilization)

PLAN MODE OPERATION

With absolute altitude above approximately 500 feet, the pilot will occasionally observe a blooming vertex due to receipt of spurious returns from the nonlinear area of the antenna (area B, figure 4-44). The blooming increases directly with absolute altitude but the computational inaccuracy is most severe at short ranges. To fly TA satisfactorily, the pilot must recognize and ignore the spurious returns displayed inside the failure warning cursor.

FLAT TERRAIN (terrain which does not vary more than 200 feet in elevation in 10 miles). Over flat terrain, many parts of the terrain display indicator may be flooded with video. The pilot should maintain the area between the vertex and the 3-mile range mark free of terrain returns within a corridor 1/8 inch each side of the ground track line. Slight pressures on the control column are usually sufficient to cause video to either appear or disappear.

ROLLING TERRAIN (terrain which does not vary more than 1000 feet in elevation in 10 miles). Over rolling terrain, a minimum of pitch maneuvering is required. When approaching an obstacle, the final maneuver is not performed until the obstacle is at the 3-mile range. The pitch attitude should be adjusted to maintain the obstacle display as a small dot, alternately appearing and disappearing until it enters the failure warning cursor. As a prominent obstacle presentation enters the area inside the failure warning cursor, the aircraft pitch attitude should be maintained until the obstacle is crossed. A strong target displayed within the 3-mile range and within 1/8 inch left or right of ground track should never be permitted to remain longer than two consecutive scans. When flying over rolling terrain, it is good practice to check the long range area of the plan display frequently to ascertain the magnitude of approaching obstacles.



TYPICAL PROFILE DISPLAY ON THE GROUND

Figure 4-52.

MOUNTAINOUS TERRAIN (terrain which varies more than 1000 feet in elevation in 10 miles). The display provides a ground map of terrain which is useful in determining the best flight course through the mountains. Azimuth maneuvering is recommended to avoid the highest obstacles. The size of radar shadow areas can be used to estimate the height of terrain obstacles. When approaching prominent terrain, the pitch change required to fade the obstacle enables early estimate of the climb performance necessary to clear the obstacle. When the obstacle within 1/8 inch of ground track appears inside the 3-mile range, it should be maintained as a small dot, alternately appearing and disappearing until it enters the failure warning cursor. As prominent obstacle presentation enters the area inside the failure warning cursor, the aircraft pitch attitude should be maintained until the obstacle is crossed. Crossover can be determined by the radar altimeter (APN-150) when the aircraft has crossed over the highest terrain. When the radar altimeter is inoperative, crossover can be estimated from the display or measured by timing. For example, a peak reaching the 3-mile range mark will have passed under the aircraft in approximately 33 seconds when flying at 325 knots ground speed.

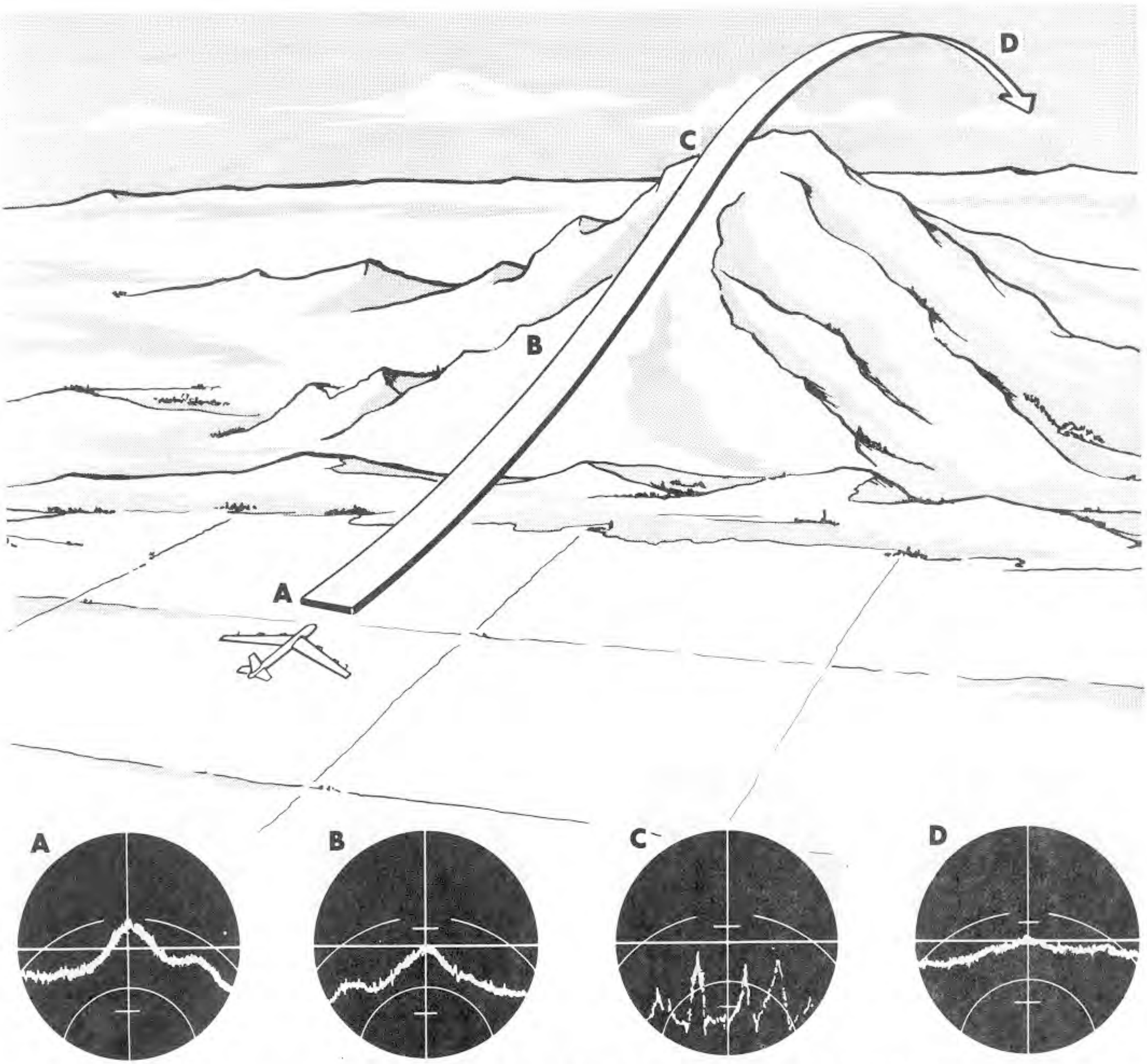
PROFILE MODE OPERATION

Three selectable range gates are provided for profile mode operation for different flight conditions and for pilot training. The longer range gates permit the pilot more time to adjust power and attitude during TA operations. Profile 3 mode is recommended for all normal conditions. When in extremely rough terrain at high gross weights and low airspeeds or partial power, the profile 6 mode may be more desirable. Flight operations in the profile mode are straight forward. If an obstacle is displayed above the horizontal reference line within 1/2 inch each side of ground track line, a climb is initiated. The climb attitude is then adjusted to maintain the terrain trace coincident with the horizontal reference line. This attitude is maintained until the obstacle is passed by utilizing the radar altimeter or dropout techniques. Profile mode is considered a command display using the rule "terrain up, fly up; terrain down, fly down." The technique is similar to that used in following ILS glide slope.

NOTE

- During profile mode operation, it will be desirable to use the TA display select switches to select plan mode for a quick assessment of terrain conditions out to 10 miles range (especially with profile 3 selected). By proper selection of display modes (using the TA display select switches), it may be possible to plan the flight path to take maximum advantage of terrain cover. In some cases, by having longer range information available from the plan mode display, turns may be made to go around rather than up and over peaks and ridges.
- Recheck system accuracy by switching momentarily to plan mode before proceeding from flat to mountainous terrain.

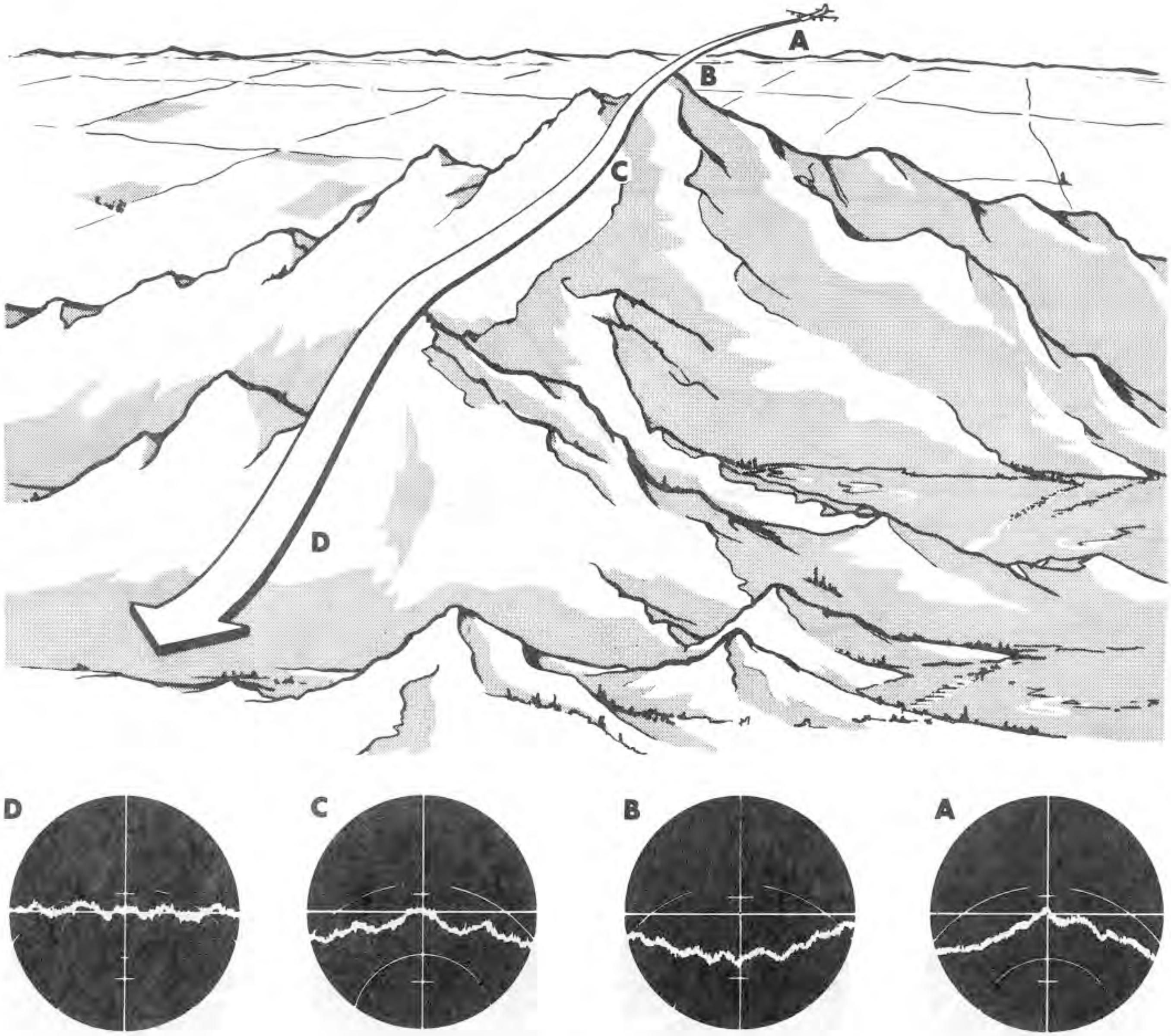
PREFLIGHT DISPLAYS. Two typical profile displays on the ground are shown in figure 4-52. The terrain trace is noisy (ragged sawtooth shaped) and may be positioned above or below the horizontal reference line. The profile calibration cursor is shown aligned with the profile calibration etch mark. The profile calibration cursor should not exceed 1/8 inch in width and should coincide ±1/4 inch with the profile calibration etch mark. The profile calibration cursor may be ragged but not broken.



PROFILE DISPLAY COMPLETE DROPOUT

Figure 4-53.

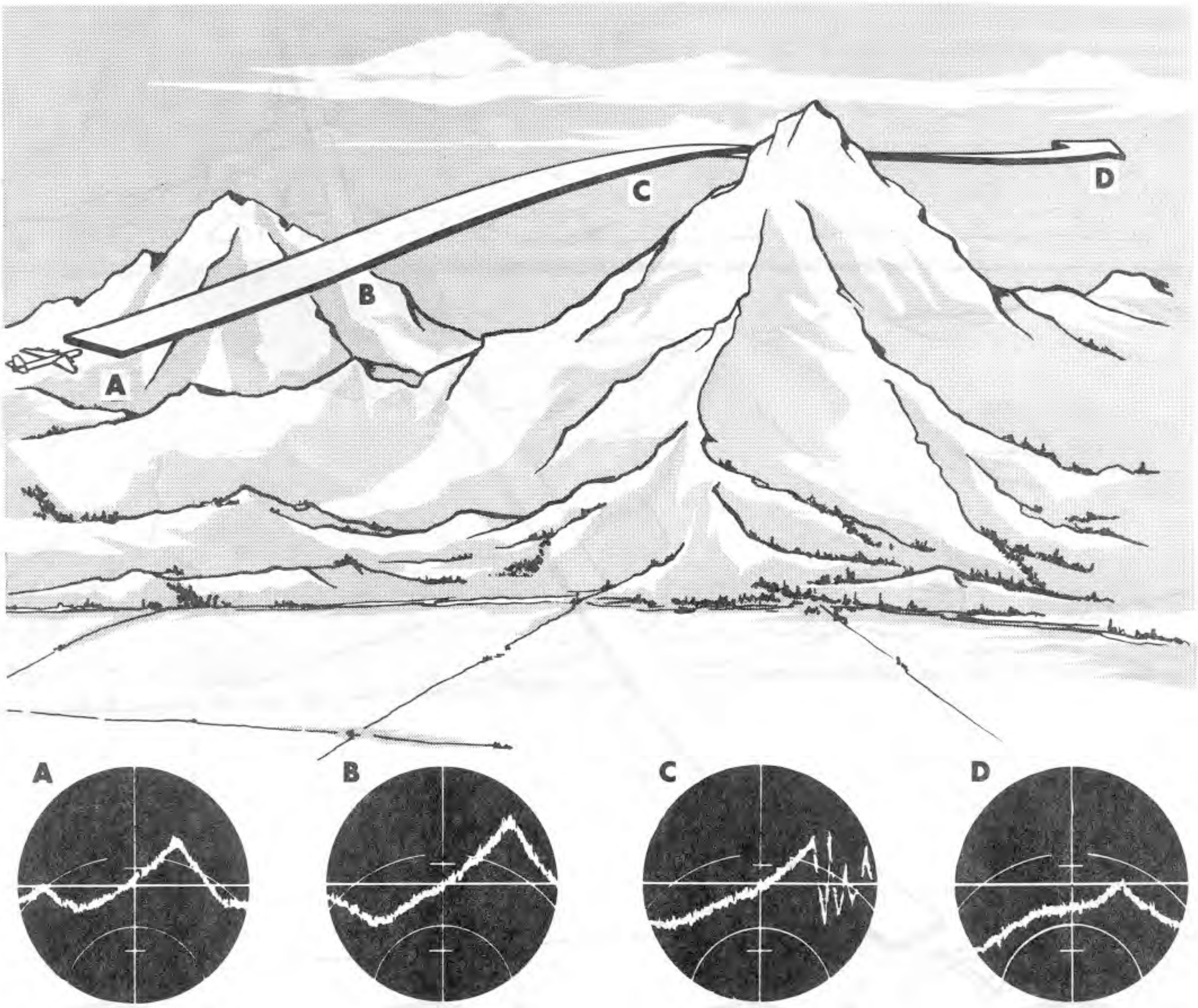
COMPLETE DROPOUT SEQUENCE. The TA system contains a short range blind zone. This is the area immediately adjacent to the aircraft extending in a horizontal arc of 3/4-mile radius across the nose. Obstacles within the short range blind zone are not displayed. This characteristic is very noticeable in profile mode as shown in the picture sequence of figure 4-53. Note that the peak is displayed as solid video in displays A and B, drops down and becomes ragged and dotted (dropout) in display C, and returns to correct position after passing the peak in display D. If the pilot should fail to recognize this complete dropout, he would initiate descent in accordance with the display producing a low crossing. The proper technique is to note and maintain the aircraft pitch attitude until, about 10 seconds later, the peak passage is observed on the radar altimeter (the altitude indicator needle indicates a decrease in altitude, then stops and indicates an increase in altitude) and then resume following the profile terrain trace.



PROFILE DISPLAY PARTIAL DROPOUT

Figure 4-54.

PARTIAL DROPOUT SEQUENCE. Frequently a situation occurs in which the profile video drops an inch or so on the display without the ragged and dotted symptoms of a complete dropout. This characteristic is shown in figure 4-54 and indicates a minor ridge (mesa, peak behind peak, small peak, or ridge) is about to be crossed. The same peak crossing technique, as described under the complete dropout sequence, should be applied if the dropout is recognized, but if the pilot continues to follow the trace and uses gradual and gentle forward wheel pressure to ease into the descent, a satisfactory, although lower than planned, crossing will be observed in about 10 seconds.



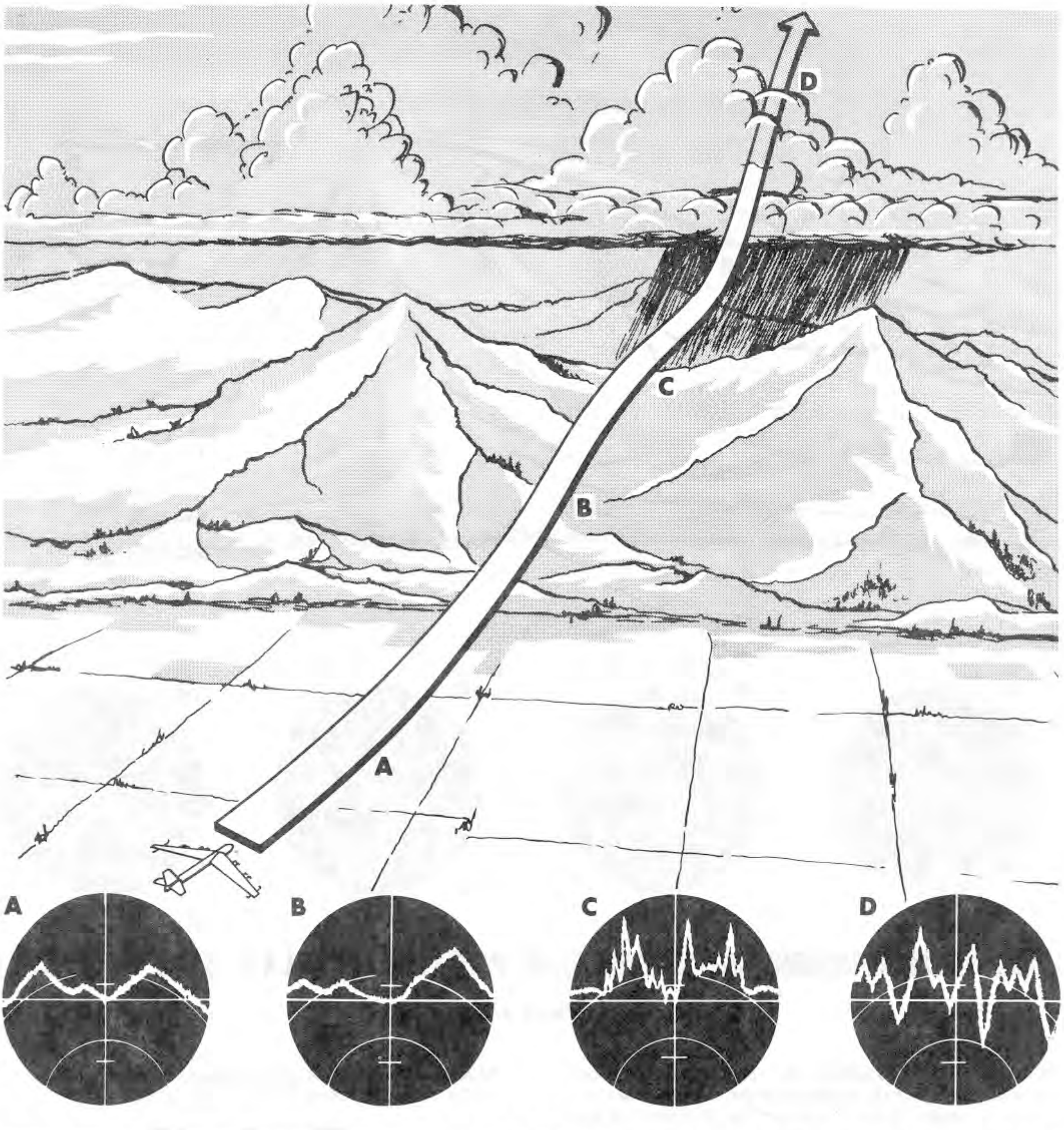
PROFILE DISPLAY SIDE DROPOUT

Figure 4-55.

SIDE DROPOUT SEQUENCE. The side dropout occurs as the aircraft passes across the shoulder of a ridge or peak. This characteristic is shown in figure 4-55. The dropout symptoms appear at the side because high terrain, right or left of ground track, is within the short range blind zone and the shadowing effect prevents reception of returns outside the blind zone. Therefore, the video on the peak side drops down or "out" until the aircraft passes beyond the obstacle. When the shadowing effect no longer blocks returns from other obstacles, the profile mode displays these obstacles as usual.

WARNING

Dropouts are important because they represent a circumstance in which the terrain display is inaccurate displaying obstacle height much lower than actual height.



PROFILE DISPLAY WEATHER EFFECTS

Figure 4-56.

WEATHER EFFECTS SEQUENCE. The TA system may react unfavorably to certain types of clouds or rain in the flight path. This characteristic is shown in figure 4-56. The profile terrain trace may provide some symptom indications if the trace becomes very ragged and gives a fly-up command. The only safe procedure is to climb to safe altitude and prepare for weather penetration. Weather effects not seen by the radar navigator have been observed to affect the pilots' terrain display.

System Error Analysis and Compensation

TA system errors are caused by malfunctions, poor ground alignment, alignment drift due to aging or temperature, etc. The two basic types of errors are bias error and tilt error which may occur singly or in combination. A bias error is one of essentially the same magnitude at all ranges. A tilt error is one which increases in magnitude with range. These errors may be either negative or positive. A positive error will cause the flight path to be higher above the terrain than desired because the terrain is computed erroneously high. A negative error will cause the flight path to be closer to the terrain than desired because the terrain is computed erroneously low. Situations may arise when the TA system must be used even though the system exhibits errors. The "TA System Calibration Checklist" in Section II is provided to help the flight crews obtain the necessary data to evaluate the system error. It will be possible in most cases to continue TA operations if the TA system errors are determined and appropriate compensation is applied.

BIAS ERRORS. Figure 4-57 detail B illustrates SAC Form 449 plots that would be obtained with negative bias error in the TA system. The terrain is computed too low by a constant amount at all ranges as shown in figure 4-57 detail A. If the calibration check is made over flat terrain, the plan display will remain blank until the clearance plane setting is greater than the absolute altitude and, when the returns appear, they will appear at all ranges simultaneously. With profile mode selected and over flat terrain, the terrain trace would appear below the horizontal reference line when the clearance plane setting is equal to absolute altitude. This error will cause the flight path to be nearer to the terrain than desired. Compensation for a negative bias error is easily applied by increasing the clearance plane setting by the amount of error.

NOTE

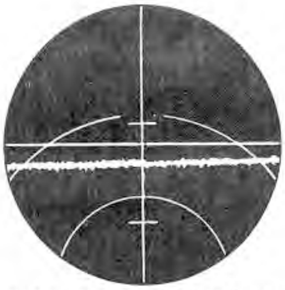
Bias errors in excess of 100 feet require compensation to obtain satisfactory TA operation.

A positive bias error (illustrated by detail D of figure 4-57) exists if the plot on SAC Form 449 appears below the zero range absolute altitude value and would cause the flight path to be higher than desired because the terrain is computed erroneously high as shown in detail C of figure 4-57. If the calibration check is made over flat terrain, the plan display would be filled with returns at all ranges until the clearance plane setting is decreased to a value less than absolute altitude. With profile mode selected and over flat terrain, the terrain trace would appear above the horizontal reference line when the clearance plane setting is equal to absolute altitude. A positive bias error is compensated by decreasing the clearance plane setting; however, for flight safety reasons, the clearance plane setting is decreased by only one-half of the error. The plan mode bias error may differ from the profile mode bias error. For example, a system could have a plan mode positive error and a profile mode negative error simultaneously. The bias error for each mode must be computed and the appropriate compensation applied for the display mode (plan or profile) selected. If profile mode is selected as the primary display mode, the clearance plane setting need not be changed when plan mode is momentarily selected with the TA display select switch to obtain long range information.

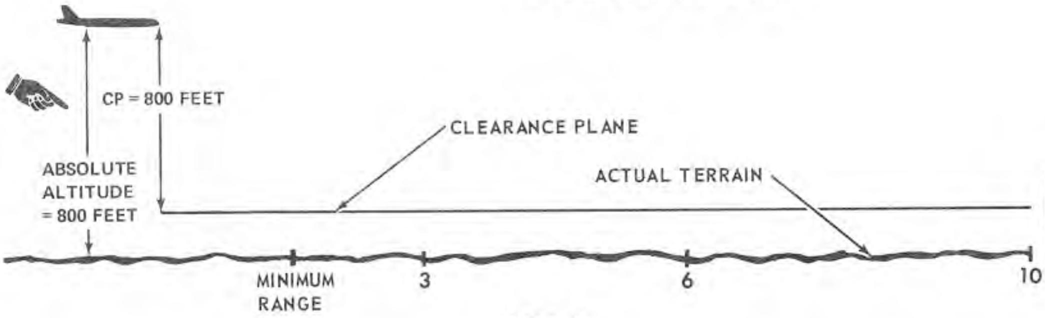
NEGATIVE BIAS ERROR

NOTE

This illustration is based on aircraft being over flat terrain.



PROFILE 3, 6, OR 10 DISPLAY

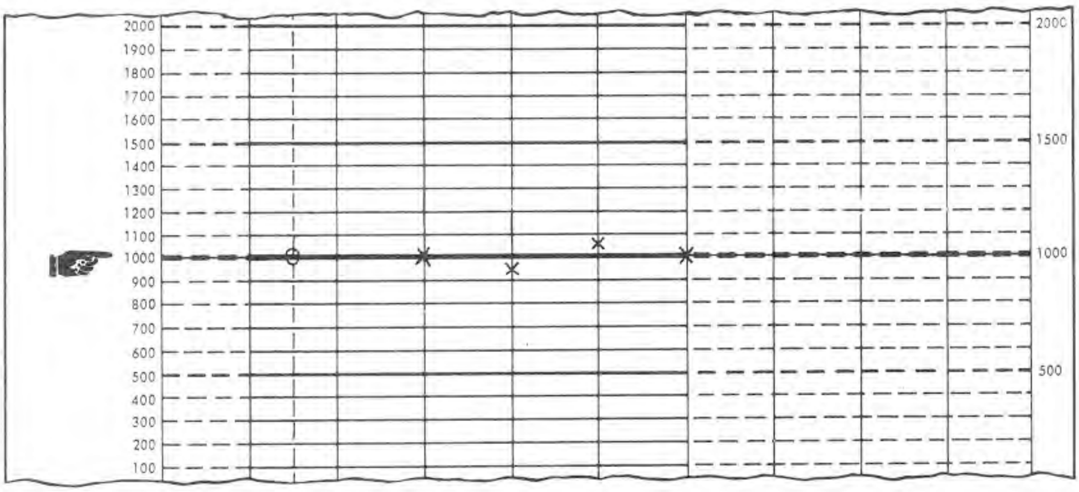


PLAN DISPLAY

NOTE

This detail illustrates a negative bias error. With this type of error, increasing clearance plane setting or decreasing absolute altitude will cause the plan mode returns to start filling in, at all ranges, and will cause the profile trace to rise.

DETAIL A



NOTE

This detail illustrates a SAC 449 plot obtained from calibration data collected with a TA system containing a negative bias error similar to detail A.

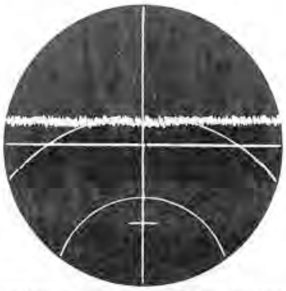
DETAIL B

Figure 4-57 (Sheet 1 of 8).

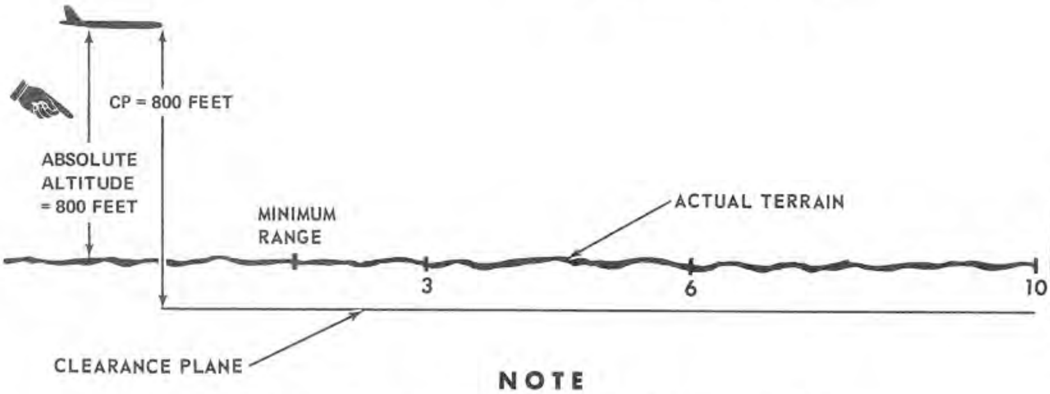
POSITIVE BIAS ERROR

NOTE

This illustration is based on aircraft being over flat terrain.



PROFILE 3, 6, OR 10 DISPLAY

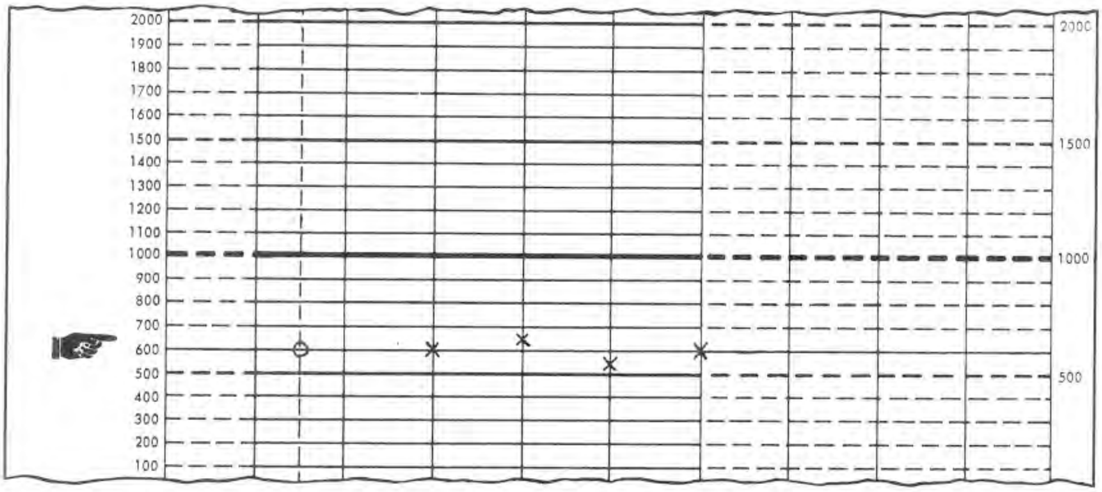


PLAN DISPLAY

NOTE

This detail illustrates a positive bias error. With this type of error, the scope would be flooded until true clearance plane is reduced to less than absolute altitude.

DETAIL C



NOTE

This detail illustrates a SAC 449 plot obtained from calibration data collected with a TA system containing a positive bias error similar to detail C.

DETAIL D

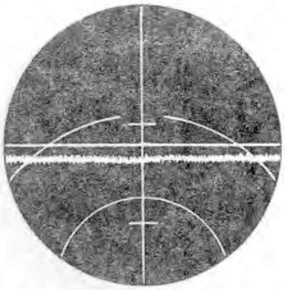
TA SYSTEM ERRORS

Figure 4-57 (Sheet 2 of 8).

NEGATIVE TILT ERROR

NOTE

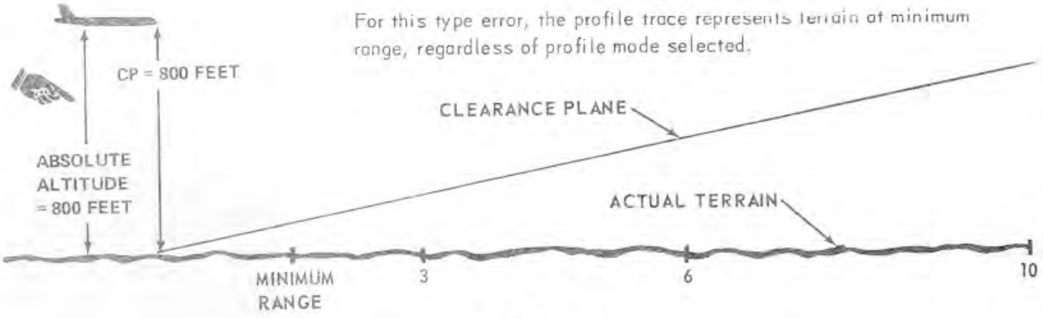
This illustration is based on aircraft being over flat terrain.

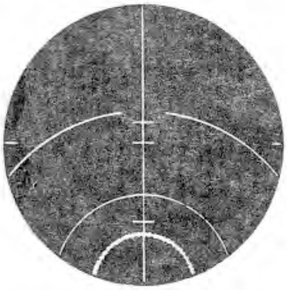


PROFILE 3, 6, OR 10 DISPLAY

NOTE

For this type error, the profile trace represents terrain at minimum range, regardless of profile mode selected.



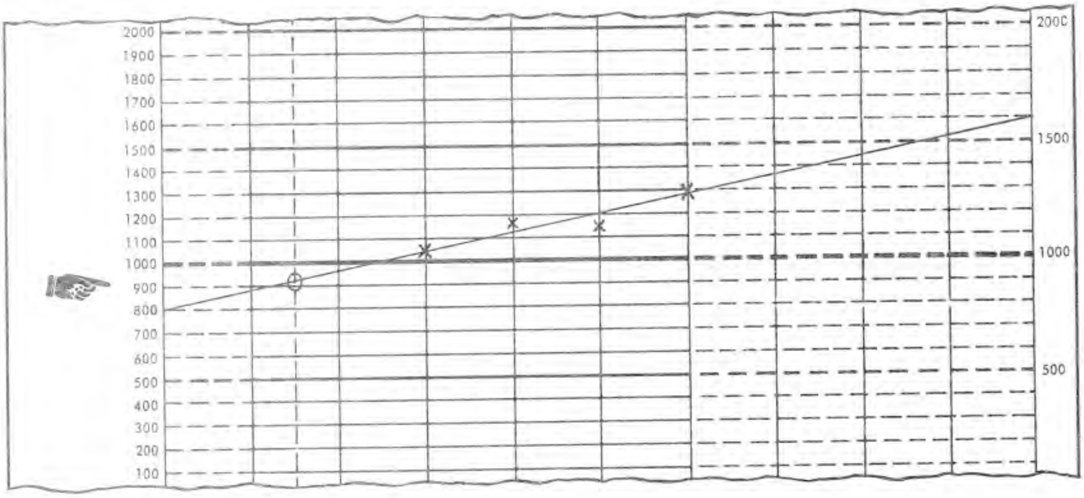


PLAN DISPLAY

NOTE

This detail illustrates a negative tilt error. With this type of error, increasing clearance plane setting or decreasing absolute altitude will cause the plan mode returns to start filling in, beginning at minimum range, and will cause the profile trace to rise.

DETAIL E



NOTE

This detail illustrates a SAC 449 plot obtained from calibration data collected with a TA system containing a negative tilt error similar to detail E.

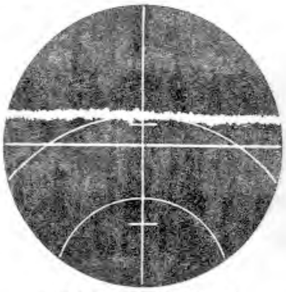
DETAIL F

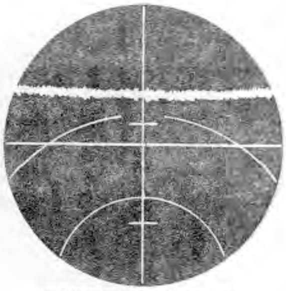
Figure 4-57 (Sheet 3 of 8).

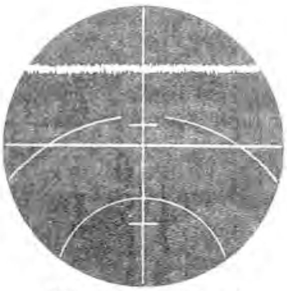
POSITIVE TILT ERROR

NOTE

This illustration is based on aircraft being over flat terrain

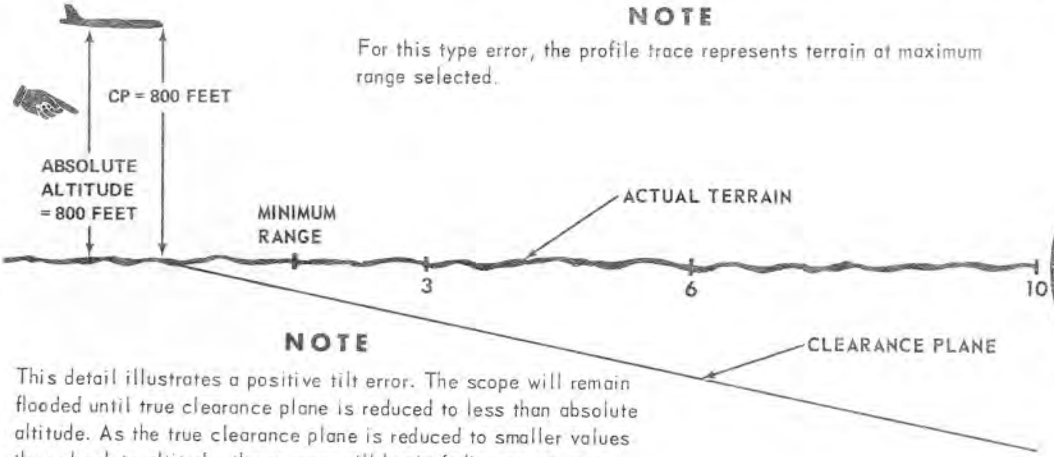

PROFILE 3 DISPLAY

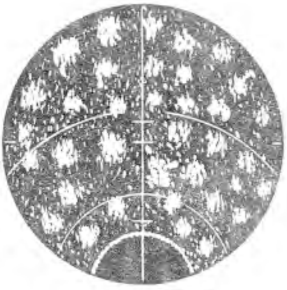

PROFILE 6 DISPLAY


PROFILE 10 DISPLAY

NOTE

For this type error, the profile trace represents terrain at maximum range selected.

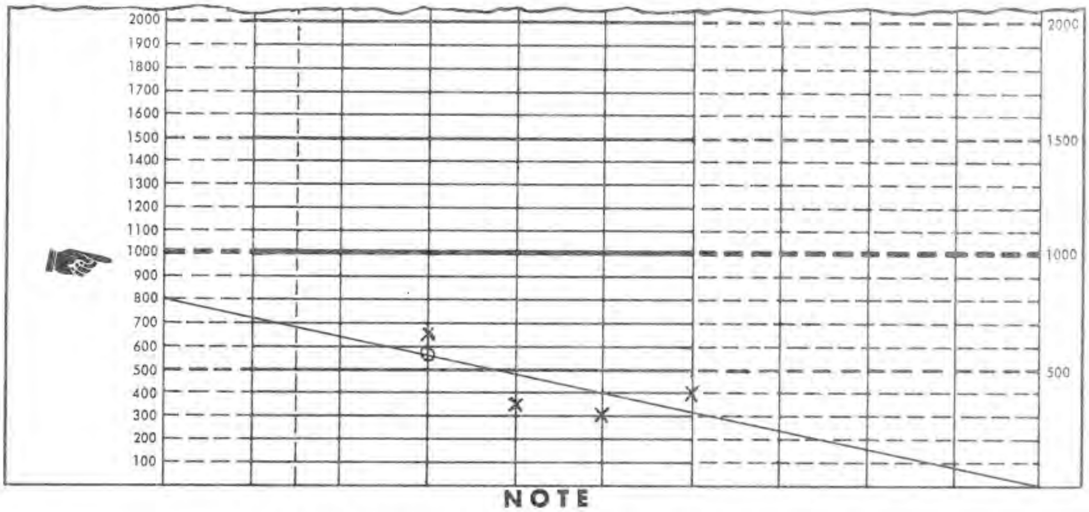



PLAN DISPLAY

NOTE

This detail illustrates a positive tilt error. The scope will remain flooded until true clearance plane is reduced to less than absolute altitude. As the true clearance plane is reduced to smaller values than absolute altitude, the returns will begin fading at minimum range and as the clearance plane is furthur reduced, the longer range returns will begin fading.

DETAIL G



NOTE

This detail illustrates a SAC 449 plot obtained from calibration data collected with a TA system containing a positive tilt error similar to detail G.

DETAIL H

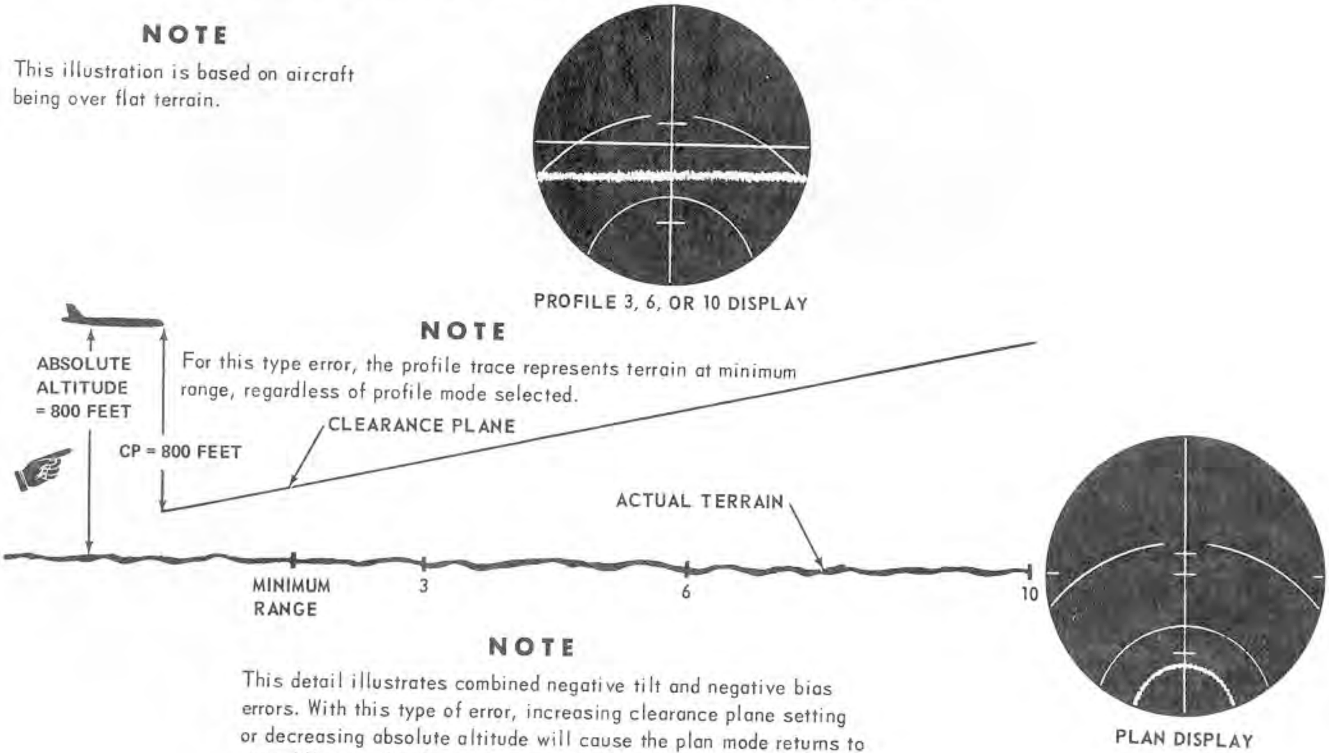
TA SYSTEM ERRORS

Figure 4-57 (Sheet 4 of 8).

COMBINED NEGATIVE TILT AND NEGATIVE BIAS ERRORS

NOTE

This illustration is based on aircraft being over flat terrain.



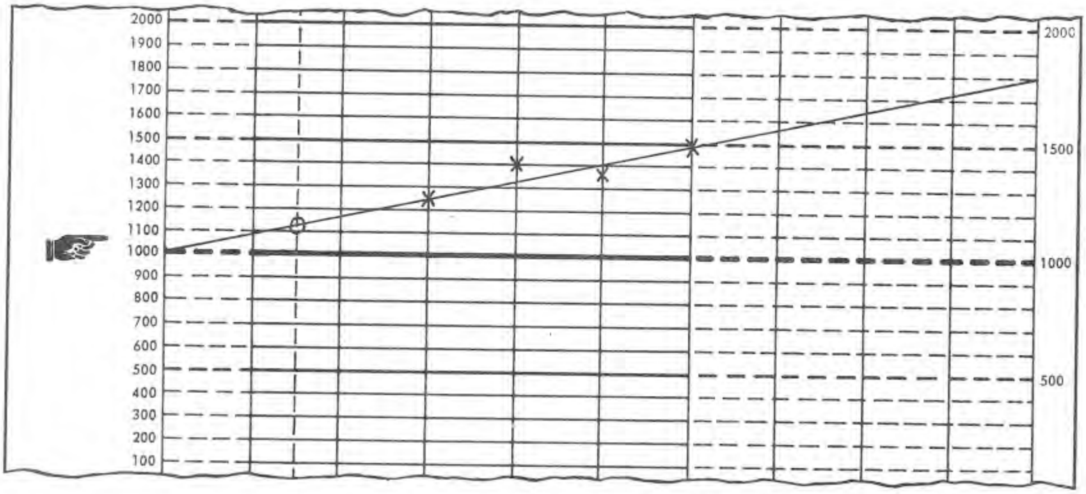
NOTE

For this type error, the profile trace represents terrain at minimum range, regardless of profile mode selected.

NOTE

This detail illustrates combined negative tilt and negative bias errors. With this type of error, increasing clearance plane setting or decreasing absolute altitude will cause the plan mode returns to start filling in, beginning at minimum range, and will cause the profile trace to rise.

DETAIL J



NOTE

This detail illustrates a SAC 449 plot obtained from calibration data collected with a TA system containing combined negative tilt and negative bias errors similar to detail J.

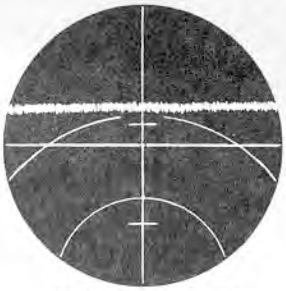
DETAIL K

Figure 4-57 (Sheet 5 of 8).

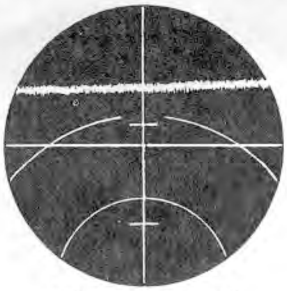
COMBINED POSITIVE TILT AND POSITIVE BIAS ERRORS

NOTE

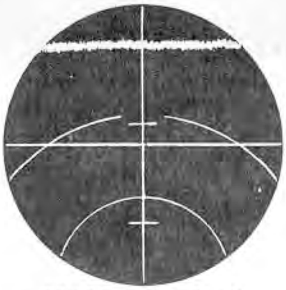
This illustration is based on aircraft being over flat terrain.



PROFILE 3 DISPLAY



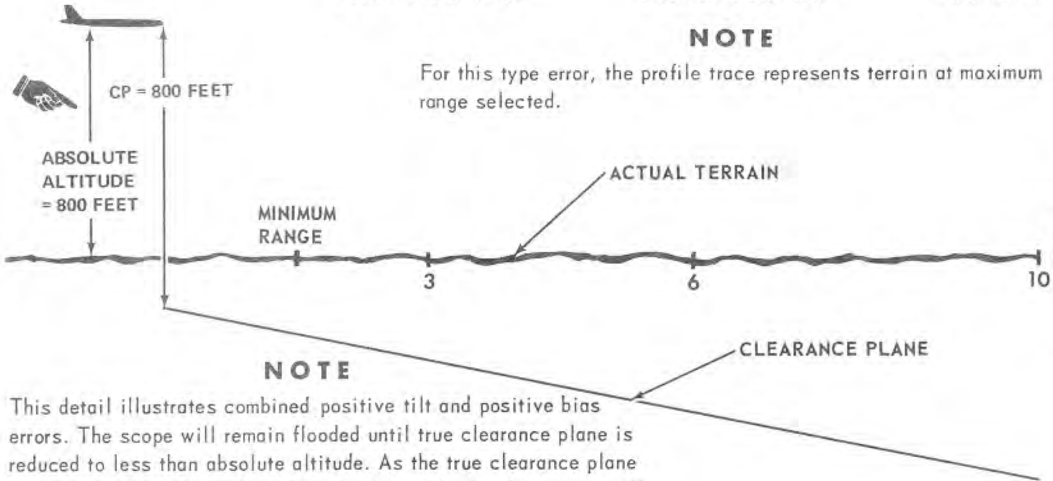
PROFILE 6 DISPLAY

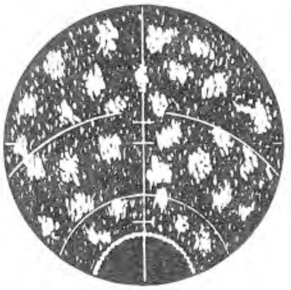


PROFILE 10 DISPLAY

NOTE

For this type error, the profile trace represents terrain at maximum range selected.



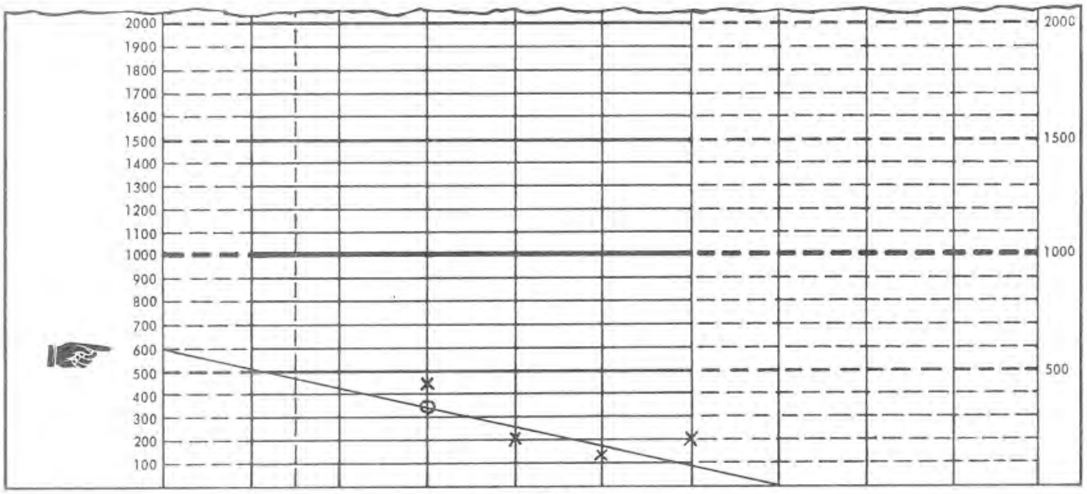


PLAN DISPLAY

NOTE

This detail illustrates combined positive tilt and positive bias errors. The scope will remain flooded until true clearance plane is reduced to less than absolute altitude. As the true clearance plane is reduced to smaller values than absolute altitude, the returns will begin fading at minimum range and as the clearance plane is further reduced, the longer range returns will begin fading.

DETAIL L



NOTE

This detail illustrates a SAC 449 plot obtained from calibration data collected with a TA system containing combined positive tilt and positive bias errors similar to detail L.

DETAIL M

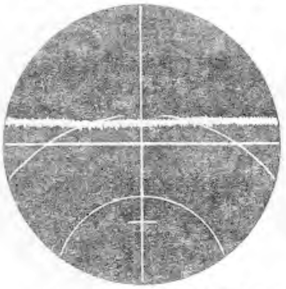
TA SYSTEM ERRORS

Figure 4-57 (Sheet 6 of 8).

COMBINED NEGATIVE TILT AND POSITIVE BIAS ERRORS

NOTE

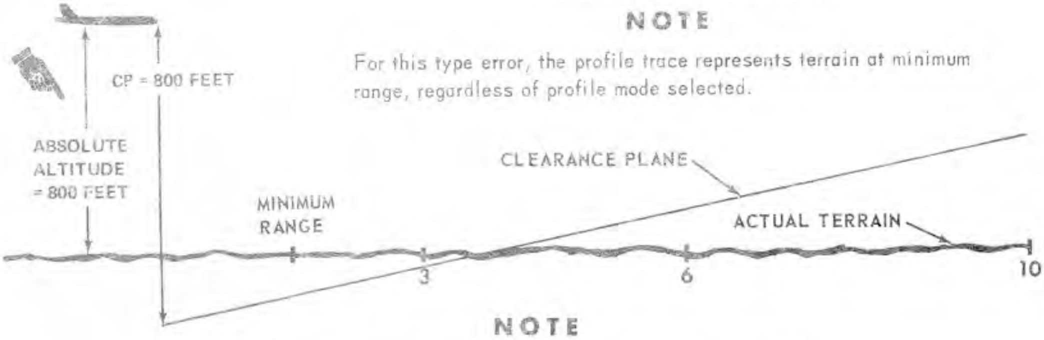
This illustration is based on aircraft being over flat terrain.

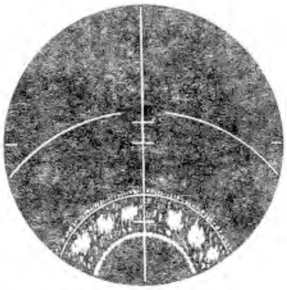


PROFILE 3, 6, OR 10 DISPLAY

NOTE

For this type error, the profile trace represents terrain at minimum range, regardless of profile mode selected.



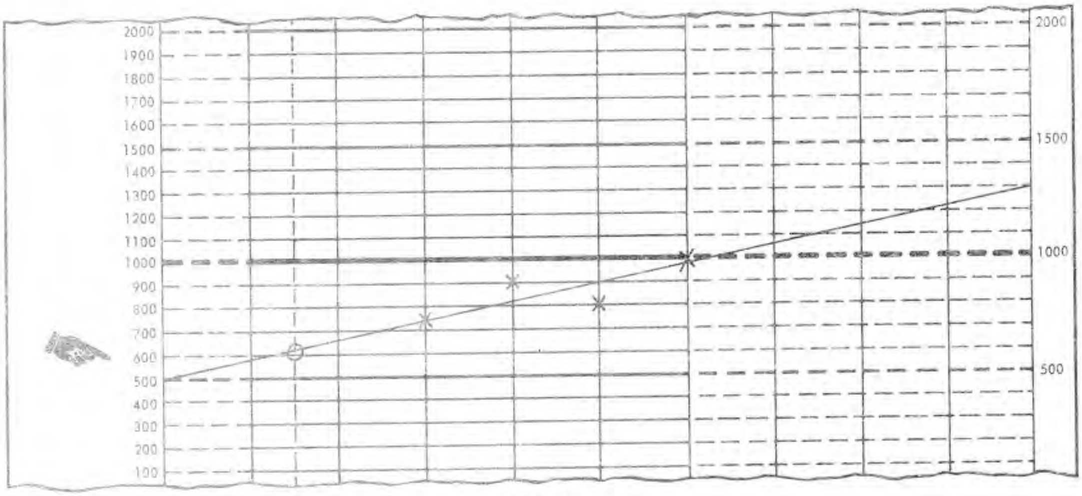


PLAN DISPLAY

NOTE

This detail illustrates combined negative tilt and positive bias errors. With this type of error, increasing clearance plane setting or decreasing absolute altitude will cause the plan mode returns to fill in at longer ranges and will cause the profile trace to rise.

DETAIL N



NOTE

This detail illustrates a SAC 449 plot obtained from calibration data collected with a TA system containing combined negative tilt and positive bias errors similar to detail N.

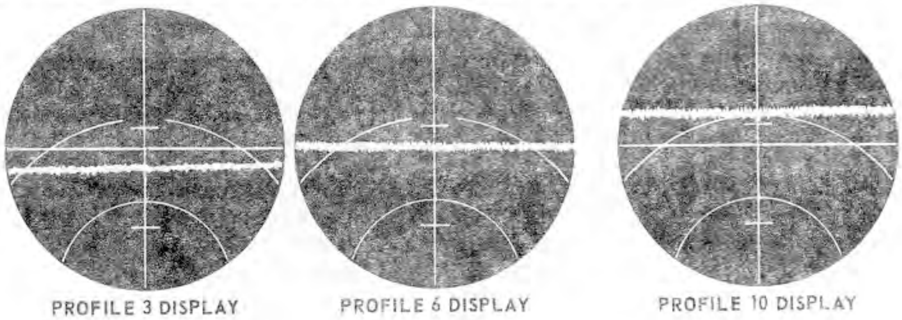
DETAIL P

Figure 4-57 (Sheet 7 of 8).

COMBINED POSITIVE TILT AND NEGATIVE BIAS ERRORS

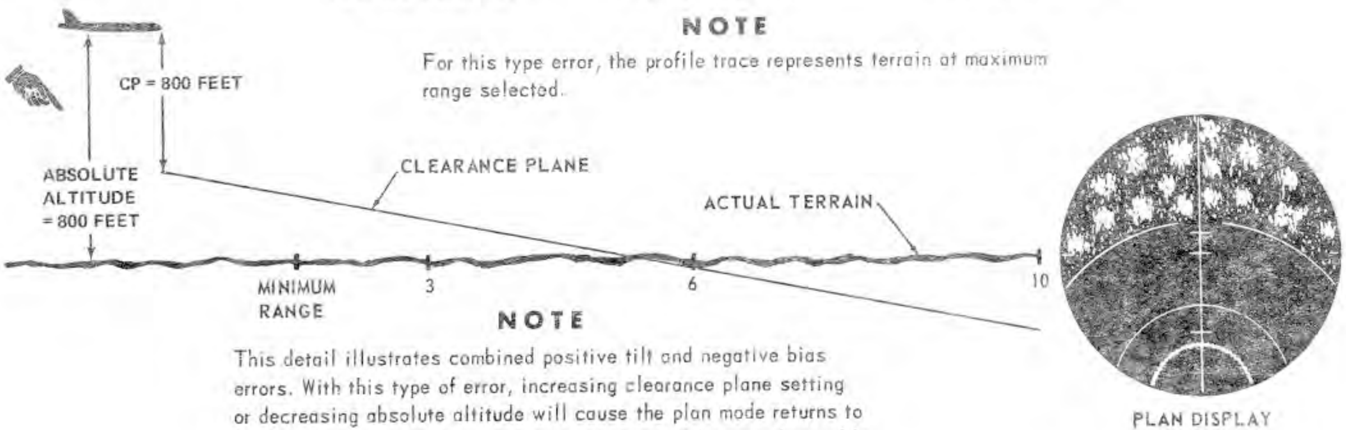
NOTE

This illustration is based on aircraft being over flat terrain.



NOTE

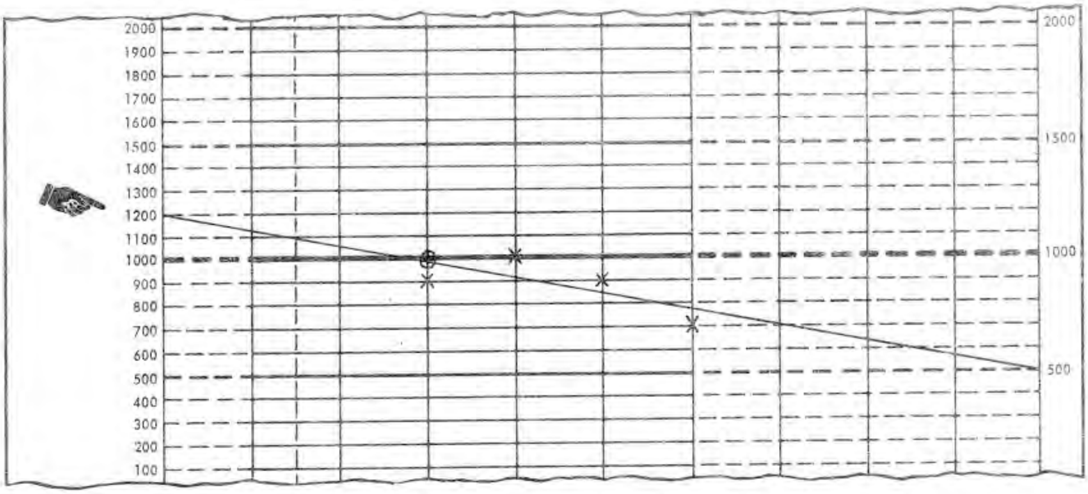
For this type error, the profile trace represents terrain at maximum range selected.



NOTE

This detail illustrates combined positive tilt and negative bias errors. With this type of error, increasing clearance plane setting or decreasing absolute altitude will cause the plan mode returns to continue filling in toward minimum range, and will cause the profile trace to rise.

DETAIL Q



NOTE

This detail illustrates a SAC 449 plot obtained from calibration data collected with a TA system containing combined positive tilt and negative bias errors similar to detail Q.

DETAIL R

Figure 4-57 (Sheet 8 of 8).

TILT ERRORS. A negative tilt error exists when terrain is computed low at long range but the error decreases as the peak is approached or as range decreases until almost no error exists at minimum range as shown in figure 4-57 detail E. Figure 4-57 detail F illustrates SAC Form 449 plot obtained from data taken with a system having negative tilt error. Since the error at short range is small, the clearance altitudes over peaks or flat terrain will be near the desired altitude. The large error at long range, however, will prevent timely warning of approaching obstacles; therefore, increased aircraft power is required to clear high obstacles at the desired altitude. If the calibration check is made over flat terrain, the returns would appear first only at the bottom of the plan display and would fill in toward the top of the display as the clearance plane is lowered. The terrain trace in profile mode displays the highest computed terrain between minimum range and the range gate selected (PROFILE 3, 6, or 10). Over flat terrain with a negative tilt error, the profile terrain trace will display the terrain which is at minimum range, since it would be the highest terrain computed within the range gate. This error cannot be detected in profile mode since the trace position would not change when switching from PROFILE 3 to PROFILE 6 or PROFILE 10. For this type of error, the profile point on SAC Form 449 is plotted at minimum range. A positive tilt error exists when terrain is computed erroneously high at long range but the error diminishes as range decreases as shown in figure 4-57 detail G. Figure 4-57 detail H illustrates a SAC Form 449 plot obtained from data taken with a system having positive tilt error. Again, the error is small at short range and clearance altitudes will be essentially as desired; however, the long range error will cause excessive clearance altitudes over valleys due to erroneous long range fly-up commands. If the calibration check in this case is made over flat terrain, the returns would appear first only at the top of the plan display. The returns would then fill in toward the bottom of the plan display as the clearance plane is lowered. With profile mode selected, over flat terrain, and a positive tilt error exists, the terrain trace displays the terrain which is at maximum range for the range gate selected (PROFILE 3, 6, or 10) since this would be the highest terrain computed within the range gate. This error could be detected by selecting a different profile mode, since the trace would rise as the range gate was changed from 3 to 6 to 10 miles. For this type error, the TA calibration profile point (made in profile 3) is plotted on SAC Form 449 at 3 miles. The tilt correction required to compensate the system tilt error can be determined from the data plotted on SAC Form 449. The system tilt correction is equal and of opposite polarity to system tilt error. For example, a positive tilt correction will be required when a negative tilt error exists. Tilt errors are compensated by adjusting the FRL angle of attack indicator on the attitude reference control panel. Although tilt errors in excess of 500 feet (up to 1000 feet) could provide satisfactory TA operation, tilt compensation is required for errors of more than 500 feet to provide improved TA system performance. Tilt errors will be the same in both plan and profile modes; therefore, the tilt correction applied will compensate the error for both display modes of operation.

COMBINED TILT AND BIAS ERRORS. Combinations of tilt and bias error will exhibit symptoms of both types of errors. The different combinations are illustrated in details J thru R of figure 4-57. The data recorded on SAC Form 449 can be used to determine compensation for any combination of these errors. Detailed procedures for determining the required tilt and bias corrections and for accomplishing the error compensation are included in the "TA System Error Compensation Procedures," this section.

WARNING

Positive or negative errors of 300 feet or more will cause the failure warning cursor or horizontal reference line to disappear and the TA warning light to illuminate. Under these conditions, accurate TA system error compensation can be accomplished; however, the failure warning indication will remain. Therefore, continued TA operations must be conducted with caution and only when visual contact with the ground can be maintained.

TA SYSTEM ERROR COMPENSATION PROCEDURES

These procedures should be used in conjunction with SAC Form 449 to determine TA system errors from data obtained during the TA system calibration check. Actual plotting and computation should be accomplished on SAC Form 449.

1. Tilt Correction:

Plot the plan fade points on the chart and draw the best fit straight line for the points.

NOTE

- Do not plot fade points obtained during the plan mode stabilization check.
- The best fit straight line should be plotted in accordance with detail B of figure 4-58.

Extend the best fit straight line to the 0 (zero) and 10-mile range lines. Determine the 10-mile (CP_{10}) and the zero range (CP_0) clearance plane values from the intersection of the best fit straight line with the respective ranges. Algebraically subtract CP_0 from CP_{10} to compute tilt correction.

NOTE

If the best fit straight line is off the scale at 10 miles, then algebrically subtract CP_0 from CP_5 (clearance plane value at 5 miles range) and multiply the remainder by 2 to compute tilt correction.

WARNING

If tilt correction is more than 2000 feet, tilt compensation will not be accomplished and the TA system will not be used for the TA tactic.

2. Tilt Compensation:

Multiply tilt correction by 0.001 to obtain FRL correction in degrees. FRL correction will have same sign (plus or minus) as tilt correction. Algebraically add the FRL correction to the current chart value to obtain the required FRL compensated angle to be set into the attitude reference control panel.

NOTE

Maintain the same FRL correction each time the FRL angle is changed.

WARNING

Tilt error compensation can only be accomplished using data collected in FRL stabilization mode. Tilt error compensation only compensates the tilt error for FRL stabilization mode.

TA SYSTEM ERROR COMPENSATION PROCEDURES (Cont)

3. Plan Bias Compensation:

Algebraically subtract plan CP_0 from the zero range absolute altitude (APN-150 reading or computed absolute altitude) to compute the plan bias error. If bias error is positive, decrease briefed clearance plane setting by one-half of bias error value. If bias error is negative, increase briefed clearance plane setting by amount of bias error.

WARNING

- The clearance plane will never be set to less than 200 feet in the presence of a failure warning indication.
- When horizontal stabilization is used with plan mode, do not use compensated clearance plane settings that result in less than 800 feet actual terrain clearance.

4. Profile Bias Compensation:

a. Plot the profile 3 mode point as follows:

(1) If the calibration check was made against a peak or prominent feature, plot this point at 2-mile range.

(2) If the calibration check was made over flat or rolling terrain and tilt is negative (⟋), plot this point at 1 mile.

(3) If the calibration check was made over flat or rolling terrain and tilt is positive (~), plot this point at 3 miles.

b. Draw a line from this profile mode point to range zero parallel to the best fit straight line to determine CP_0 (PROFILE).

c. Profile bias error may now be computed and applied in the same manner as plan bias error.

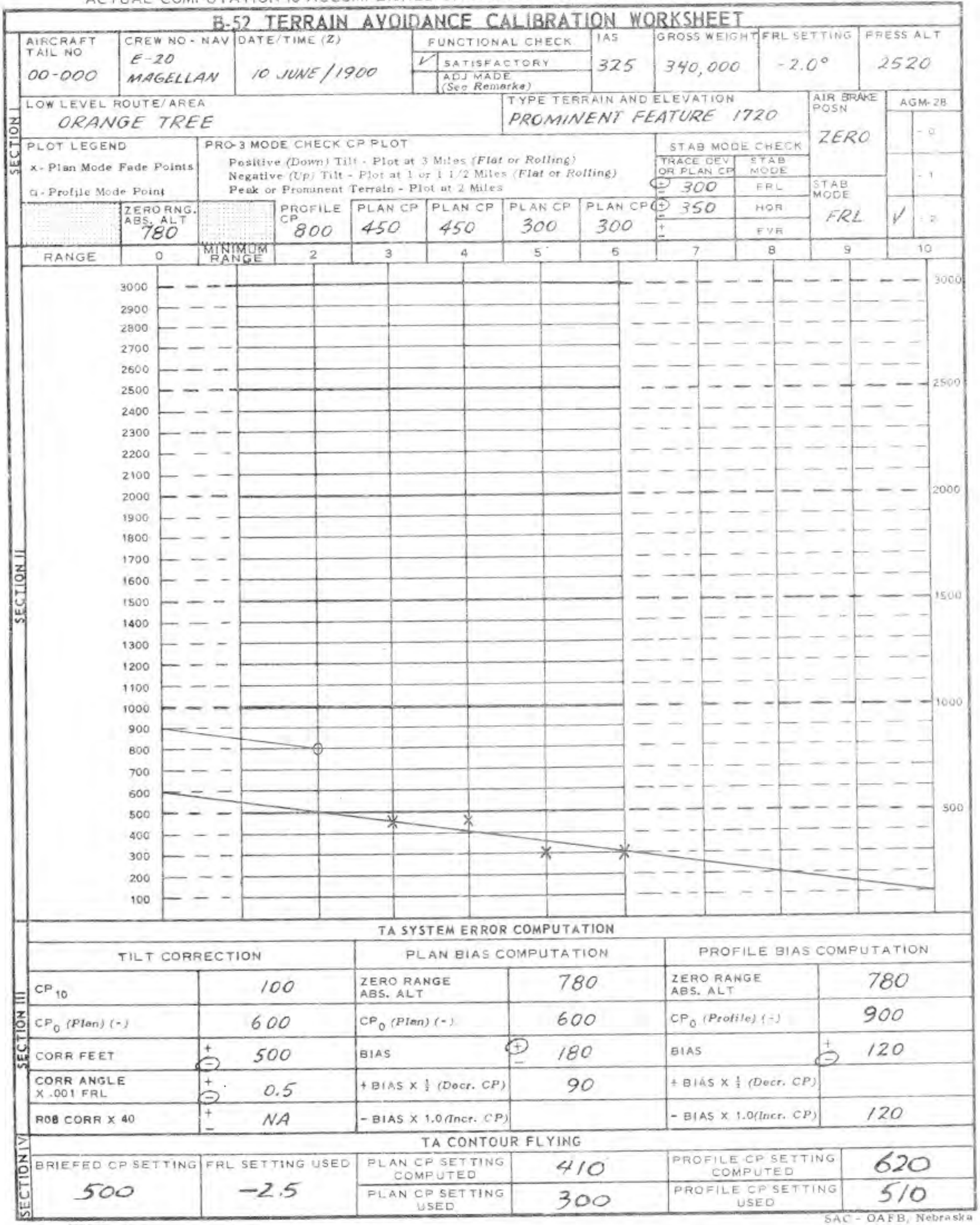
NOTE

No compensation is required for profile bias errors of less than 100 feet.

WARNING

- The clearance plane will never be set to less than 200 feet.
- Due to nonlinearities in the antenna radiation pattern (beta anomalies), the short range profile check at 800 feet altitude over flat terrain may indicate the profile mode bias error is approximately 200 feet more positive than the actual system profile mode bias error.

ACTUAL COMPUTATION IS ACCOMPLISHED ON SAC FORM 449 AND IS INCLUDED AS DETAIL A.



B-52 TERRAIN AVOIDANCE CALIBRATION WORKSHEET

SECTION I

AIRCRAFT TAIL NO 00-000	CREW NO - NAV E-20 MAGELLAN	DATE/TIME (Z) 10 JUNE / 1900	FUNCTIONAL CHECK ✓ SATISFACTORY ADJ MADE (See Remarks)	IAS 325	GROSS WEIGHT 340,000	FRL SETTING -2.0°	PRESS ALT 2520

LOW LEVEL ROUTE/AREA ORANGE TREE	TYPE TERRAIN AND ELEVATION PROMINENT FEATURE 1720	AIR BRAKE POSN ZERO	AGM-28 - 0 - 1 ✓ - 2

PLOT LEGEND
x - Plan Mode Fade Points
⊡ - Profile Mode Point

PRO-3 MODE CHECK CP PLOT
Positive (Down) Tilt - Plot at 3 Miles (Flat or Rolling)
Negative (Up) Tilt - Plot at 1 or 1 1/2 Miles (Flat or Rolling)
Peak or Prominent Terrain - Plot at 2 Miles

STAB MODE CHECK

TRACE DEV OR PLAN CP	STAB MODE
[✓ +] − 300	FRL
[✓ +] − 350	HOR
+ −	FVR

STAB MODE: FRL

	ZERO RNG. ABS. ALT		PROFILE CP	PLAN CP	PLAN CP	PLAN CP	PLAN CP
	780		800	450	450	300	300
RANGE	0	MINIMUM RANGE	2	3	4	5	6	7	8	9	10

SECTION II

SECTION III

TA SYSTEM ERROR COMPUTATION

TILT CORRECTION		PLAN BIAS COMPUTATION		PROFILE BIAS COMPUTATION	
CP_{10}	100	ZERO RANGE ABS. ALT	780	ZERO RANGE ABS. ALT	780
CP_0 (Plan) (-)	600	CP_0 (Plan) (-)	600	CP_0 (Profile) (-)	900
CORR FEET	+ [✓ −] 500	BIAS	[✓ +] − 180	BIAS	+ [✓ −] 120
CORR ANGLE X .001 FRL	+ [✓ −] 0.5	+ BIAS X ½ (Decr. CP)	90	+ BIAS X ½ (Decr. CP)	
R08 CORR X 40	+ − NA	- BIAS X 1.0 (Incr. CP)		- BIAS X 1.0 (Incr. CP)	120

SECTION IV

TA CONTOUR FLYING

BRIEFED CP SETTING	FRL SETTING USED	PLAN CP SETTING COMPUTED	410	PROFILE CP SETTING COMPUTED	620
500	-2.5	PLAN CP SETTING USED	300	PROFILE CP SETTING USED	510

SAC - OAFB, Nebraska

SAC FORM 449 PREVIOUS EDITIONS ARE OBSOLETE.

DETAIL A

TA SYSTEM ERROR COMPUTATION AND COMPENSATION EXAMPLE

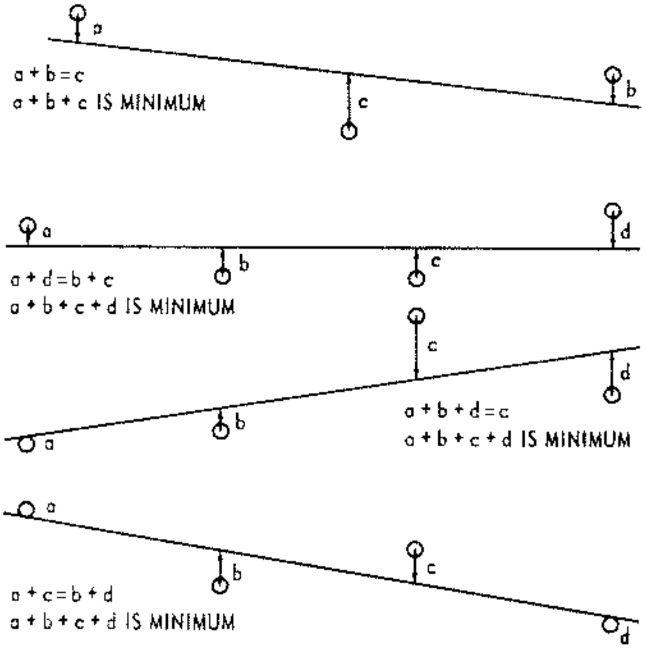
Figure 4-58 (Sheet 1 of 3).

An example of methods to use when filling out the form is included in the following procedure:

1. Record Initial Conditions:
   Aircraft Tail No. =00-000
   Crew No. – Navigator = E-20, Magellan
   Date Time 10 June 1900
   Functional Check = Satisfactory
   IAS = 325 knots
   Gross Weight =340,000 pounds
   AGM-28 = 2
   Airbrake Position Zero
   FRL Setting = −2.0°
   Low Level Route ORANGE TREE
   Type Terrain and Elevation Prominent Feature and 1720 feet
   Pressure Altitude 2520 feet
   Stab Mode FRL (Stabilization mode used when obtaining plan mode fade points)
2. Record TA System Calibration Data:
   a. Stabilization Cross-Check:
      Profile Trace Deviation in FRL Stab Mode = +300 feet
      Profile Trace Deviation in Horizontal Stab Mode = +350 feet
   b. Plan Mode Fade Points:

RANGE (MILES)	CLEARANCE PLANE SETTING (FEET)
6	300
5	300
4	450
3	450

   c. Profile Mode Plot Point:
      Clearance Plane Setting = 800 feet
      Plot Range 2 miles
   d. Zero Range Absolute Altitude = 780 feet
3. Computation and Compensation:
   a. Determine Tilt Correction:
      (1) Draw the best fit straight line on Detail A in accordance with method presented in Detail B.



BEST FIT STRAIGHT LINE

NOTE

A "best fit" straight line is the straight line which has the least total deviation from all of the plotted points. This condition will be approximated if the deviations of the plotted points above the line equal the deviations of the points below the line and the sum of all the deviations of the points from the line is a minimum as shown above. (It is not necessary to compute the line; it can be established with acceptable accuracy by estimation.)

DETAIL B

Figure 4-58 (Sheet 2 of 3).

(2) Determine and Record CP_{10} and CP_0:

CP_{10} is the clearance plane value read at the intersection of the 10-mile range line and the best fit straight line.

$CP_{10} = 100$ feet

CP_0 is the clearance plane value read at the intersection of the 0 (zero) range line and the best fit straight line.

$CP_0 = 600$ feet

(3) Compute and Record Tilt Correction:

Clearance plane tilt correction (amount of correction required to compensate the tilt at 10 miles) is computed by algebraically subtracting CP_0 from CP_{10}.

Tilt correction $= CP_{10} - CP_0 = 100 - (600) = -500$ feet

(4) Compute and Record FRL Correction:

FRL correction is the number of feet of tilt correction converted to degrees.

FRL Correction = Tilt Correction X 0.001 = −500 X 0.001 = −0.5°

(5) Compute and Record Corrected FRL Angle:

Corrected FRL Angle = FRL Angle Chart Value plus FRL Correction = −2.0° + (−0.5°) = −2.5°

The FRL correction must be algebraically added to the current FRL angle of attack chart value with the result set into the TA system. All subsequent FRL angle settings must include the FRL correction.

b. Determine Plan Mode Bias Error:

Plan mode bias error is obtained by algebraically subtracting CP_0 from zero range absolute altitude.

Absolute Altitude = 780 feet

$CP_0 = 600$ feet

(1) Compute and Record Plan Mode Bias Error:

Plan Mode Bias Error = Absolute Altitude $- CP_0 = 780 - (600) = 180$ feet

This value must be used to compensate for plan mode bias error.

(2) Compensate for Plan Mode Bias Error:

Plan mode bias error compensation, in this case, is accomplished by decreasing the clearance plane by 1/2 of bias error (1/2 of 180 feet) equals 90 feet.

c. Determine Profile Mode Bias Error:

(1) Plot Profile Mode Clearance Plane Point:

Clearance Plane Setting = 800 feet

Since the calibration check was made against a prominent feature, the point will be plotted at 2 miles.

(2) Draw Profile Straight Line:

This line is constructed by drawing a line parallel to the best fit straight line from the profile clearance plane point to the zero range line.

(3) Determine and Record CP_0 (Profile):

CP_0 (Profile) is determined by reading the clearance plane value where the profile straight line intersects the 0 (zero) range line.

CP_0 (Profile) = 900 feet

(4) Compute and Record Profile Mode Bias Error:

Profile mode bias error is obtained by algebraically subtracting CP_0 (Profile) from zero range absolute altitude.

Zero Range Absolute Altitude = 780 feet

CP_0 (Profile) = 900 feet

Profile Mode Bias Error = Absolute Altitude $- CP_0$ (Profile)

$780 - (900) = -120$ feet

(5) Compensate for Profile Mode Bias Error:

Profile mode bias error compensation, in this case, is accomplished by increasing clearance plane 120 feet.

4. Record TA Low Level Data:

Briefed Clearance Plane Setting = 500 feet
Computed Plan Mode Clearance Plane Setting = 410 feet
Computed Profile Mode Clearance Plane Setting = 620 feet
Final Plan Mode Clearance Plane Setting Used = 300 feet
Final Profile Mode Clearance Plane Setting Used = 510 feet
FRL Setting Used = −2.5°

TA SYSTEM ERROR COMPUTATION AND COMPENSATION EXAMPLE

Figure 4-58 (Sheet 3 of 3).

NOTE

The primary purpose of this chart is to provide a means of correcting pilots' terrain display indicators when found to be out of tolerance. However, abnormal indications need not be corrected unless pilot feels that the urgency of the mission or the magnitude of the malfunction warrants adjustment. Abnormal indications should be documented in Form 781.

WARNING

Due to the location of the preflight adjust control units, the pilot/copilot must lean forward in close proximity to the engaged control column while making adjustments. Adjustments will not be attempted during low level operation at TA altitude or during turbulence at any altitude.

NORMAL INDICATION	REMEDY FOR ABNORMAL INDICATION
Display Centering: Select plan mode and observe that the bright spot at the start of the sweep is centered ±1/16 inch under the intersection of the ground track line and the bottom of the indicator. If bright spot is not visible, note position of spot on the write bias control and then adjust write bias clockwise to make spot visible. If centering is in tolerance, return write bias control to the initial setting. **CAUTION** ● To prevent damage to indicator tube, do not turn write bias beyond the minimum clockwise position that will permit viewing the spot. ● The position of the spot may shift from one system turn-on to the next. The centering adjustments must be reset if the shift exceeds ±1/16 inch.	Adjust plan vertical centering and horizontal centering controls until bright spot is centered at intersection of ground track line and bottom of indicator, then return write bias control to initial setting. (P/CP)
Display Persistence: In plan mode, the persistence should be such that the failure warning cursor is completely faded at the ground track line just prior to new information being painted at the ground track line. **NOTE** Small adjustments to persistence may be accomplished by adjustment of the pilot's and/or copilot's persistence control. When persistence adjustments are made, a momentary check of both profile and plan display modes is required. If the persistence adjustment adversely affects either display mode, then the "Remedy for Abnormal Indication" steps listed in the right column must be accomplished.	1. Radar navigator's radar indicator must be sectoring 170° (+0°, −10°) before adjusting persistence. (P-RN) 2. Position plan video gain control fully CCW. (P/CP) 3. Position indicator intensity switch to MAX. (P/CP) 4. Adjust write bias control counterclockwise until sweep trace disappears. (P/CP) 5. Place terrain display mode selector switch to PROFILE 10. (P/CP) 6. Depress and hold TA warning light push-to-test button. Horizontal reference line should disappear. (P/CP) 7. If horizontal reference line is still visible and the TA warning light is illuminated, readjust write bias control counterclockwise until horizontal reference line just disappears, then release push-to-test button. 8. Place terrain display mode selector switch to PLAN. (P/CP) 9. Position plan video gain control fully CW. (P/CP) 10. Place failure warning cursor coincident with 3-mile range mark using clearance plan control switch. (P/CP) 11. Position indicator intensity switch to next to highest setting. (P/CP) 12. Adjust persistence control so that the failure warning cursor is completely faded at the ground track line just before it reaches the ground track line again on the return sweep. (P/CP) 13. Position terrain display mode selector switch to PROFILE 10. (P/CP)

Figure 4-59 (Sheet 1 of 2).

NORMAL INDICATION	REMEDY FOR ABNORMAL INDICATION
	14. Repeat adjustment as necessary to find the best setting for both modes. (P/CP) **NOTE** ● The larger outer shaft of the persistence control controls the pilot's display and the smaller inner shaft controls the copilot's display. ● No video flutter should be apparent as video fades out. If flutter is noticeable, indicator must be replaced. 15. Position plan video gain control fully CCW. (P/CP) 16. Position terrain display mode selector switch to PLAN. (P/CP) 17. Slowly adjust plan video gain control clockwise and note that a saturation point is reached where further clockwise adjustment does not increase brightness of the failure warning cursor but only degrades sharpness or focus of the failure warning cursor. (P/CP) 18. Set plan video gain control to saturation point observed in step "17." (P/CP) 19. Readjust persistence control as necessary per step "12" and then repeat steps "17" and "18." (P/CP)
Failure Warning Cursor: In plan mode, set failure warning cursor at 3-mile range mark and check that clearance plane is at 2200 (±200) feet.	Set clearance plane to 2200 feet and adjust both the plan display vertical and horizontal gain controls until the failure warning cursor is coincident with the 3-mile range mark. (P/CP)
Horizontal Reference Line and Profile Calibration Cursor: In PRO CAL mode the horizontal reference line should be centered with the horizontal etch mark at center of indicator (±1/32 inch). The profile calibration cursor should coincide (±1/4 inch) with the profile calibration etch mark.	**NOTE** These adjustments provide a means of correcting an out of tolerance condition for either or both the horizontal reference line and the profile calibration cursor. 1. Position terrain display mode selector switch to PROFILE 3. (P/CP) 2. Remove coaxial cable from J26 on terrain relay frame and connect a coaxial jumper from J22 to J26 on terrain relay frame. (P-N) 3. Adjust profile display vertical centering control until horizontal reference line coincides with the horizontal etch mark at center of indicator. (P/CP) 4. Adjust profile calibration control to place the profile calibration cursor coincident with the profile calibration etch mark. (P/CP) 5. Repeat steps "3" and "4" until both the horizontal reference line and the profile calibration cursor are coincident with their respective etch marks. (P/CP) 6. Switch to PROFILE 6, then PROFILE 10 and check that both the horizontal reference line and profile calibration cursor coincide with their respective etch marks within ±1/32 inch. (P/CP) 7. Remove coaxial jumper from J22 and J26 on terrain relay frame and reconnect coaxial cable to J26. (P-N)

TA ADJUSTMENT PROCEDURES

Figure 4-59 (Sheet 2 of 2).

BOMBING SYSTEM

The bombing system provides the aircraft with a means of carrying, pre-arming and releasing nuclear and conventional munitions. The bomb bay has provisions for carrying clip-in, cluster, SUU-24/A dispenser, and, on B-52D aircraft, hi-density suspension systems. In addition, B-52D aircraft have the capability of carrying munitions externally on multiple ejector racks (MER) suspended under the wings. Single carriage clip-in racks are used exclusively for nuclear bombs while multiple carriage clip-in racks may be used for either nuclear bombs or the larger type conventional munitions. Release methods associated with the suspension systems are BNS, D-2, jettison, emergency armed release B-52D , special weapons manual release, single string, and SWESS. BNS, D-2, jettison, and emergency armed release (EAR) systems are applicable to all suspension systems; however, EAR will never be used when nuclear weapons are loaded. The special weapons manual release will effect a release from the clip-in system only. Single string is used exclusively with external conventional munitions, providing a method of triggering external release by an internal release pulse. SWESS, originally used with clip-in, nuclear carriage, has been disabled as an effective release system by sealing the bomb bay SWESS AUTO--OFF switch in OFF. Information on the bombing system is contained in T.O. 1B-52C-25-1, "Nuclear Bomb Delivery Technical Manual" and T.O. 1B-52C-34-2-1, "Aircrew Conventional Munitions Delivery Manual." The aircrew must be familiar with these manuals to insure an adequate knowledge of the requirements, limitations, and restrictions of the system.

BOMB RELEASE PULSE INDICATING SYSTEM

The bomb release pulse indicating system may be installed as a training device to provide a means of indicating bomb release when bombs are not loaded on the aircraft. The system consists of A-5 release units installed in the bomb bay and connected to the bomb release circuits. When a release circuit is energized the release pulse actuates the A-5 which in turn energizes the applicable weapon released light (single carriage) or bomb indicator light (multiple carriage). The special weapon manual lock handle must be unlocked to provide power for the system.

AUTHORIZED MUNITIONS

Only those conventional munitions listed in figure 4-60 are authorized for carriage and delivery in the configuration and quantity shown. Authorized nuclear weapons are those contained in T.O. 1B-52C-25-1.

MUNITION TYPE	NO. LOADED	RACK CONFIGURATION	WEIGHT CLASS/ACTUAL
		CLUSTER RACKS	
CBU-24A/B	24		750/810 pounds
CBU-24B/B Cluster	27		750/830 pounds
CBU-49B/B Cluster	27		750/830 pounds
CBU-49C/B	24		750/810 pounds
CBU-58/B	27		750/820 pounds
CBU-71/B	27		750/820 pounds
M36 Cluster	27		750/900 pounds
MK82 GP	27		500/531 pounds
M117 GP [5]	27		750/823 pounds
M124 Practice	27		250/264 pounds
M129/M129E1 Leaflet	18		750/[1] pounds
MJU1/B	18		750/[1] pounds
MK52 Mine [2][4]	18		1,000/1,190 pounds
MK53 Mine [4]	27		500/378 pounds
		EXTERNAL MER B-52D	
CBU-24B/B Cluster	24		750/830 pounds
CBU-49B/B Cluster	24		750/830 pounds
CBU-58/B	24		750/820 pounds
CBU-71/B	24		750/820 pounds
MK36 Destructor (high drag) [4]	24		500/560 pounds
MK81	24		250/260 pounds
MK82 GP	24		500/531 pounds
MK82 Snakeye (high drag) GP [4]		**NOTE** Mild buffeting may occur when high drag munitions are released.	500/560 pounds
MK83 GP [8]	12		1000/985 pounds
M117 GP [5]	24		750/823 pounds
M117D Destructor (high drag) [4][10]	16		750/880 pounds
M117R (high drag) GP [4][10]	16		750/880 pounds
M129E1 Leaflet [9]	24		750/[1] pounds
MJU1/B [9]	24		750/[1] pounds
		HEAVY STORES BEAM B-52D	
MK84 GP Bomb	10		2,000/1,970 pounds
MK55 Mine [6]	12		2,000/2,198 pounds
MK56 Mine [7]	12		2,000/2,055 (unfinned) pounds 2,000/2,133 (finned) pounds

[1] Weights will depend on filler material used. (Minimum weight is 250 pounds)
[2] With MK-10 fin the maximum release altitude is 3,000 feet.
[4] Rapid release not authorized.
[5] M131 or MAU-103A/B fin.
[6] All mines must have nose fairings and fins installed.
The mines on forward stations must have nose fairings and fins installed.
[8] Emergency armed release (EAR) and rapid release are not authorized for fuze arming settings of less than 10 seconds.
[9] Ejector pistons required at all stations.
[10] Carriage prohibited on MER centerline (lower) stations.

AUTHORIZED CONVENTIONAL MUNITIONS

Figure 4-60 (Sheet 1 of 2).

MUNITION TYPE	NO. LOADED	RACK CONFIGURATION	WEIGHT CLASS/ACTUAL
CLIP-IN (TWO)			
MK84 GP Bomb	8	All Stations	2,000/1,970 pounds
MK55 Mine	8	All Stations	2,000/2,120 pounds
MK56 Mine	8	All Stations	2,000/2,055 pounds
HI-DENSITY B-52D			
CBU-24A/B	42	3A-1	750/810 pounds
CBU-24B/B	42	3A-1	750/830 pounds
CBU-49B/B Cluster	42	3A-1	750/830 pounds
CBU-49C/B	42	3A-1	750/810 pounds
CBU-58/B	42	3A-1	750/820 pounds
CBU-71/B	42	3A-1	750/820 pounds
M36 Cluster	42	3A-1	750/900 pounds
MK36 Destructor (high drag) [4]	60	3BB-1	500/560 pounds
MK81 GP [6]	74	3B-1	250/260 pounds
MK82 GP	42	3A-1	500/531 pounds
MK82 GP	84	3B-1	500/531 pounds
MK82 Snakeye (high drag) GP [4]	60	3BB-1	500/560 pounds
MK83 GP	28	2A-1	1,000/985 pounds
M117 GP [5]	42	3A-1	750/823 pounds
M117D Destructor (high drag) [4]	36	3A-1	750/880 pounds
M117R (high drag) [4]	36	3A-1	750/880 pounds
M124 Practice	42	3A-1	250/264 pounds
M129/M129E1 Leaflet	28	3A-1	750/ [1] pounds
MJU1/B	28	3A-1	750/ [1] pounds
MK52 Mine [4] [7]	18	3BC-1	1,000/1,190 pounds
MK53 Mine [2] [3]	56	4A-1	500/378 pounds
MK53 Mine [4]	48	4A-1	500/378 pounds

[1] Weights will depend on filler material used. (Minimum weight is 250 pounds).

[2] Low altitude only (400 – 3,000 feet above surface).

[3] The two upper inboard mines in each bay (total 8 mines) are unfinned.

[4] Rapid release not authorized.

[5] M131 or MAU-103A/B fin.

[6] The top two bombs in each of the five vertical sticks in the aft bay (bay 4) shall not be loaded.

[7] With MK-10 fin the maximum release altitude is 3,000 feet.

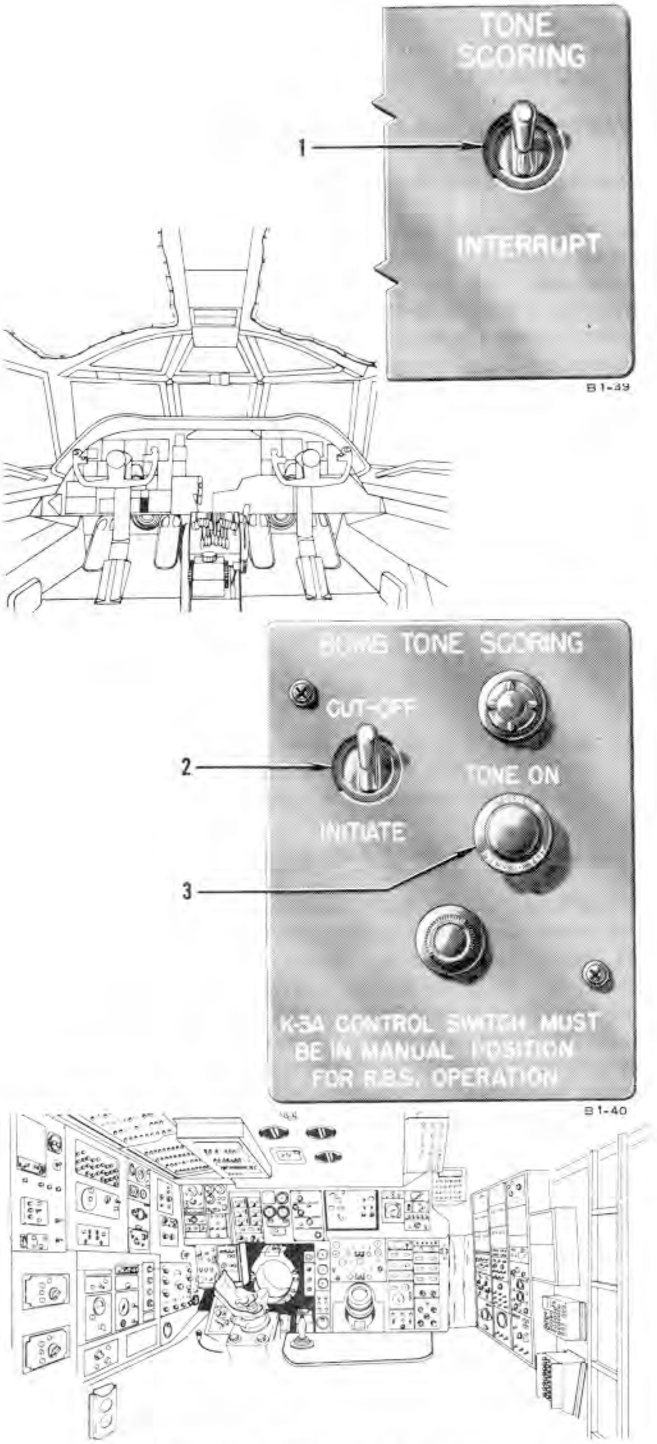
NOTE

Mild buffeting may occur when high drag munitions are released.

AUTHORIZED CONVENTIONAL MUNITIONS

Figure 4-60 (Sheet 2 of 2).

Figures 4-61 thru 4-69 (Deleted)



1. BOMB TONE SCORING INTERRUPT SWITCH
2. BOMB TONE SCORING SYSTEM SWITCH
3. TONE-ON INDICATOR LIGHT

BOMB TONE SCORING SYSTEM CONTROLS

Figure 4-70.

BOMB TONE SCORING SYSTEM

A bomb tone scoring system is installed in this aircraft to provide a means of simulated bomb drops whereby the accuracy of the bomb run can be determined using a radio signal. When initiated, the bomb tone scoring system causes a continuous tone to be transmitted by the UHF radio set(s) on the selected frequency(ies). A bomb release pulse from either the BNS or the bomb release switch (but not the salvo system) stops the tone, simulating bomb release. The bomb tone scoring system must be reinitiated in order to simulate another bomb run. Voice communications cannot be transmitted by means of either UHF radio set when the bomb tone scoring system is energized. A bomb tone scoring panel (39, figure 4-35) is provided at the radar navigator's station.

Bomb Tone Scoring System Controls

BOMB TONE SCORING SWITCH. A bomb tone scoring switch (2, figure 4-70) on the bomb tone scoring panel at the radar navigator's station provides a means of energizing the bomb tone scoring system. The switch has INITIATE--NORMAL--CUTOFF positions and is spring loaded to the unmarked NORMAL position. Actuating this switch momentarily to INITIATE will energize the circuit, causing the tone-on indicator light to illuminate and both UHF radio sets to transmit a steady tone provided both UHF radio sets are turned on. Actuating this switch momentarily to CUTOFF position will deenergize the circuit, causing the bomb tone indicator light to go out and the tone transmission to stop.

BOMB TONE SCORING INTERRUPT SWITCH. A bomb tone scoring interrupt switch (1, figure 4-70) on the pilots' instrument panel provides the pilot with a means of deenergizing the bomb tone scoring system. The switch has NORMAL--INTERRUPT positions, spring loaded to the unmarked NORMAL position. Actuating this switch momentarily to INTERRUPT will deenergize the bomb tone scoring system causing the bomb tone indicator light to go out and the tone transmission to stop.

Bomb Tone Scoring System Indicators

TONE-ON INDICATOR LIGHT. A tone-on indicator light (3, figure 4-70) on the bomb tone scoring panel is illuminated when the bomb tone scoring system has been energized. This light is supplied TR power through the bomb tone scoring switch and the bomb tone scoring interrupt switch from a circuit breaker marked "Norm Rel" on the "Bomb System" portion of the radar navigator's circuit breaker panel.

Bomb Tone Scoring System Normal Operation

The bomb tone scoring system operates whenever the command (or No. 2) UHF transmitter is on and the bomb tone scoring master switch has been positioned momentarily to INITIATE. The tone is stopped by a bomb release pulse from the BNS or bomb release switch, through the bomb intervalometer, or by momentary actuation of the pilot's bomb tone scoring interrupt switch to INTERRUPT or the bomb tone scoring switch to CUTOFF position.

NOTE

The bomb tone scoring system will cause the No. 1 and No. 2 UHF radios to transmit a tone if both are turned on. A garbled transmission will result if both UHF radios are tuned to the same frequency; therefore, it is recommended that one UHF radio be tuned to an unused frequency during tone operation.

VERTICAL (STRIKE) CAMERA SYSTEM

The vertical camera photographic system provides a photographic record of the bombing run. A compartment at the forward end of the aft unpressurized section houses the strike and orientation camera. An automatic vacuum system supplies vacuum for camera operation made by venting air from the air bleed system to the atmosphere through an ejector; a line connects the low pressure side of the throat of the ejector to a spring-balanced vacuum regulator which is connected to the camera magazine. An automatic camera heating system heats the camera compartment. For further information on camera compartment heating, see "Air Conditioning Systems," this section. The camera can be operated by manual operation of the switches or automatically by means of the bomb intervalometer or camera intervalometer. The camera door can be operated by manually positioning the camera door switch, by means of a handcrank, or opened automatically when the bomb doors open. Controls for the photographic system are located on the front panel of the radar navigator's station. Salvo release of the bombs causes the camera door to open and the camera to operate in accordance with intervalometer settings provided the camera master switch is ON and the camera intervalometer power switch is in ON or BOMB SPOTTING position.

VERTICAL CAMERA SYSTEM CONTROLS

Vertical Camera Master Switch

A vertical camera master switch (15, figure 4-71) on the vertical camera control panel has ON--OFF positions. ON position supplies 118-volt single-phase a-c power to operate the camera doors and TR power to the camera door indicating lights, camera operating light, camera intervalometer, and camera compartment heat system. Turning this switch OFF then ON will allow the camera intervalometer to reset itself. Single-phase 118-volt a-c power is supplied to the vertical camera master switch through a circuit breaker marked "Camera" - "Doors." TR power is supplied to the switch through circuit breakers marked "Camera" - "Master," "Ind," "Auto," and "Htr." All circuit breakers are on the "Miscellaneous" portion of the radar navigator's circuit breaker panel.

NOTE

No camera or camera door operation is possible or camera heat available when the camera master switch is in OFF position.

Vertical Camera Door Switch

A vertical camera door switch (13, figure 4-71) on the vertical camera control panel has OPEN--AUTO--CLOSE(D) positions and is spring loaded to AUTO position. With the camera master switch ON, placing the camera door switch in OPEN position will open the camera doors. Placing the camera door switch in CLOSE(D) position will close the camera doors provided the bomb doors are fully closed and in AUTO position. The camera doors will open automatically when the bomb doors are opened. The camera doors will not close automatically when the bomb doors are closed but may be closed by placing the camera door switch to CLOSE(D) position. This switch supplies 118-volt single-phase a-c power to the camera door actuator through a circuit breaker marked "Camera Doors" on the "Miscellaneous" portion of the radar navigator's circuit breaker panel.

Vertical Camera Door Handcrank

A handcrank stowed on the forward side of the vertical camera compartment cover is provided for emergency operation of the camera door. The socket for the camera door is located on the door motor mechanism on the left side of the walkway forward of the camera.

WARNING

To prevent injury to personnel resulting from the handcrank being driven by the motor, remove electrical power from the circuit while the crank is in the mechanism.

Vertical Camera Intervalometer Switch

A vertical camera intervalometer switch (14, figure 4-71) on the vertical camera control panel has MANUAL--AUTO positions and is spring loaded to AUTO position. This switch provides TR power from the camera master switch to operate the camera intervalometer. In AUTO position, the camera intervalometer controls operation of the camera. In MANUAL position, the camera intervalometer is inoperative, the camera takes pictures at the maximum rate, and the camera operating light will flash for each exposure. Turning this switch to MANUAL then AUTO will allow the camera intervalometer to reset itself. TR power is supplied to the vertical camera intervalometer switch through a circuit breaker marked "Camera Auto" on the "Miscellaneous" portion of the radar navigator's circuit breaker panel.

Vertical Camera Intervalometer

A vertical camera intervalometer (12, figure 4-35) located on the radar navigator's front panel controls the initial delay, exposure interval, and number of exposures which may be taken automatically. Automatic operation of the camera by the camera intervalometer can be initiated by means of a bomb release pulse from the bomb intervalometer, the camera intervalometer manual initiation switch, or the bomb salvo switches. Initiation of the camera intervalometer will cause it to operate as preset if the camera master switch is ON, the camera intervalometer switch is in AUTO, and the camera intervalometer power switch is in ON or BOMB SPOTTING position. The initiation pulse will cause the camera to take one exposure which will not affect the camera exposure limiter; the pulse will register on the camera exposure counter. At the completion of a set sequence, the intervalometer will reset itself and the camera intervalometer ready light will illuminate. When the camera intervalometer has reset, it must be initiated before it will transmit camera trip pulses. The camera intervalometer will also reset itself whenever power is removed from the intervalometer as when the camera master switch is positioned to OFF or the camera intervalometer switch is positioned to MANUAL, or the camera intervalometer power switch is positioned to OFF.

Vertical Camera Intervalometer Power Switch

A vertical camera intervalometer power switch (7, figure 4-71) on the camera intervalometer has ON--OFF or RUNAWAY--OFF-BOMB--SPOTTING positions. In ON or BOMB SPOTTING position, the camera intervalometer will, when initiated, operate the camera as set. In RUNAWAY position, the camera intervalometer will, when initiated, cause the camera to make exposures at the maximum rate for the length of time set on the camera exposure interval control knob. In OFF position, the camera can be operated only with the camera intervalometer switch or the camera trip switch. The camera intervalometer will reset at the conclusion of each automatic operation; it can also be reset by turning the camera intervalometer power switch to OFF, then to ON or BOMB SPOTTING or RUNAWAY.

NOTE

> With the intervalometer power switch in either RUNAWAY or BOMB SPOTTING position, the initiation pulse accomplished either manually or by remote signal may not be of sufficient length to actuate the camera trip.

Vertical Camera Trip Switch

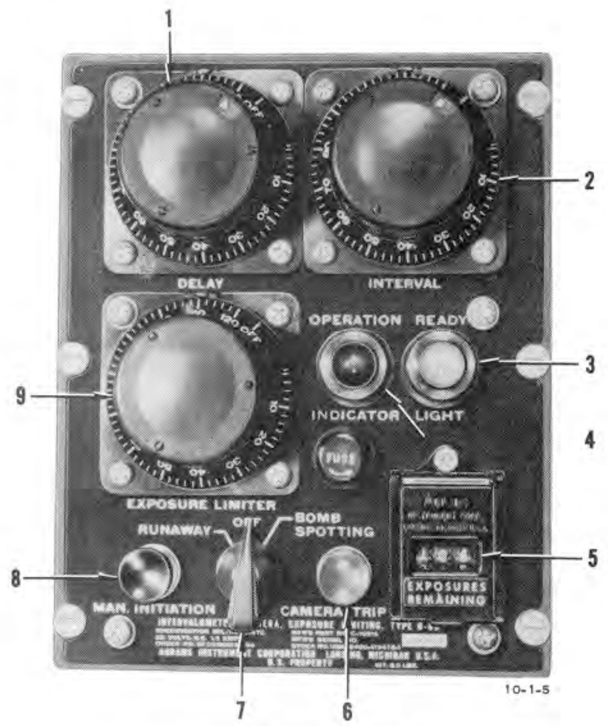
The vertical camera trip switch (6, figure 4-71) on the vertical camera intervalometer is a spring loaded push-to-actuate type switch. While this switch is depressed, power to operate the camera bypasses the intervalometer circuits, the camera operates at maximum rate, and the camera operating lights will flash at each exposure. The camera exposures remaining counter will also operate but will have no effect on the exposure limiter control. When this switch is released, the camera intervalometer resumes operation as it was set or initiated prior to actuation of the camera trip switch. This switch supplies TR power from the camera master switch and the camera intervalometer switch to the camera. TR power is supplied to the switch through a circuit breaker marked "Camera Master" on the "Miscellaneous" portion of the radar navigator's circuit breaker panel.

Vertical Camera Intervalometer Manual Initiation Switch

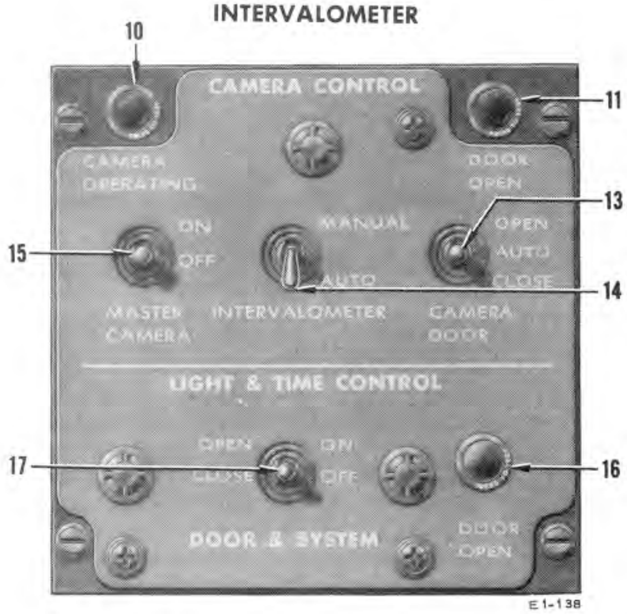
The vertical camera intervalometer manual initiation switch (8, figure 4-71) on the vertical camera intervalometer is a spring loaded push-to-actuate type switch. Depressing and releasing this switch will initiate camera operation by the camera intervalometer just as a bomb release pulse would.

Vertical Camera Exposure Delay Control Knob

A vertical camera exposure delay control knob (1, figure 4-71) on the vertical camera intervalometer has OFF and 1- thru 120-second interval positions marked in 2-second intervals but with 1-second interval detents. The position selected by this knob controls the amount of delay between the camera intervalometer initiation pulse and operation of the camera by the camera exposure interval control. Once the camera intervalometer has been initiated, the only effective repositioning of this control is to decrease the amount of delay set. If this control knob is positioned to OFF, automatic camera operation is not possible even though the camera intervalometer ready light is illuminated.

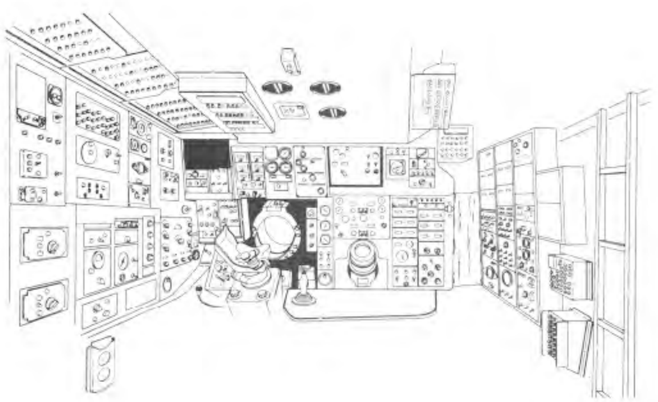


INTERVALOMETER



170 ▶ W52 ▶

CAMERA AND LIGHT & TIME CONTROL PANEL



54 ▶ 169 W1 ▶ W51

CAMERA CONTROL PANEL

1. CAMERA EXPOSURE DELAY CONTROL KNOB
2. CAMERA EXPOSURE INTERVAL CONTROL KNOB
3. CAMERA INTERVALOMETER READY LIGHT
4. CAMERA OPERATION INDICATOR LIGHT
5. CAMERA EXPOSURES REMAINING COUNTER
6. CAMERA TRIP SWITCH
7. CAMERA INTERVALOMETER POWER SWITCH
8. CAMERA INTERVALOMETER MANUAL INITIATION SWITCH
9. CAMERA EXPOSURE LIMITER CONTROL KNOB
10. CAMERA OPERATING LIGHT
11. CAMERA DOOR OPEN LIGHT
12. CAMERA DOOR CLOSED LIGHT 54 ▶ 169 W1 ▶ W51
13. CAMERA DOOR SWITCH
14. CAMERA INTERVALOMETER SWITCH
15. CAMERA MASTER SWITCH
16. LIGHT AND TIME RECORDER DOOR OPEN LIGHT 170 ▶ W52 ▶ (INOPERATIVE)
17. LIGHT AND TIME RECORDER DOOR AND SYSTEM CONTROL SWITCH 170 ▶ W52 ▶ (INOPERATIVE)

VERTICAL CAMERA SYSTEM CONTROLS

Figure 4-71.

Vertical Camera Exposure Interval Control Knob

A vertical camera exposure interval control knob (2, figure 4-71) on the vertical camera intervalometer panel has OFF and 1- thru 120-second interval positions marked in 2-second intervals but with 1-second interval detents. The camera exposure control spaces the impulses to operate the camera as selected on the dial when the intervalometer power switch is positioned to ON or BOMB SPOTTING. When the intervalometer power switch is positioned to RUNAWAY, this control limits the length of time the camera will make exposures. The setting can be changed at any time. In OFF position, no impulses will be sent to the camera thus preventing normal automatic operation, and the camera intervalometer ready light will not illuminate.

Vertical Camera Exposure Limiter Control Knob

A vertical camera exposure limiter control knob (9, figure 4-71) on the vertical camera intervalometer panel has OFF and 1- thru 120- exposure positions marked in 2-exposure intervals but with 1-exposure detents. The desired number of camera exposures to be taken is selected with this knob. Once the camera intervalometer has been initiated, the only effective repositioning of this control is to decrease the number of exposures set. The camera exposure limiter counts the number of camera trip impulses from the camera trip mechanism. When the preset number of exposures have been taken, this control will allow the intervalometer to reset itself. When the camera exposure limiter control knob is in OFF position, the number of exposures is not limited by this control.

VERTICAL CAMERA INDICATORS

Vertical Camera Door Open Light

An amber vertical camera door open light (11, figure 4-71) on the vertical camera control panel will illuminate while the camera door is fully open. The light is supplied TR power through the camera master switch. TR power is supplied to the light through circuit breakers marked "Camera" - "Master" and "Ind" on the "Miscellaneous" portion of the radar navigator's circuit breaker panel.

Vertical Camera Door Closed Light 54 ▶ 169 W1 ▶ W51

A red vertical camera door closed light (12, figure 4-71) on the vertical camera control panel will illuminate while the camera door is fully closed and the camera master switch is ON. The light is supplied TR power through the camera master switch. TR power is supplied to the light through circuit breakers marked "Camera" - "Master" and "Ind" on the "Miscellaneous" portion of the radar navigator's circuit breaker panel.

Vertical Camera Operating Light

A green vertical camera operating light (10, figure 4-71) on the vertical camera control panel will flash each time the camera mechanism is actuated to take an exposure. The light is supplied TR power through the camera master switch. TR power is supplied to the light through circuit breakers marked "Camera" - "Master" and "Ind" on the "Miscellaneous" portion of the radar navigator's circuit breaker panel.

Vertical Camera Intervalometer Ready Light

An amber vertical camera intervalometer ready light (3, figure 4-71) on the vertical camera intervalometer will be illuminated when the camera intervalometer is receiving power and is ready to be initiated. This light will be out when the camera intervalometer is not receiving power or has been initiated.

NOTE

> If the camera exposure delay control knob is positioned to OFF, the camera intervalometer is not ready to be initiated even though the camera intervalometer ready light is illuminated.

Vertical Camera Operation Indicator Light

A green vertical camera operation indicator light (4, figure 4-71) on the vertical camera intervalometer panel will flash each time the camera mechanism is actuated to take an exposure provided the camera intervalometer is receiving power; that is, camera master switch in ON and camera intervalometer switch in AUTO position.

Vertical Camera Exposures Remaining Counter

The vertical camera exposures remaining counter (5, figure 4-71) on the vertical camera intervalometer panel will indicate one less exposure remaining each time a picture is taken provided the camera intervalometer switch is in AUTO position.

NOTE

> When the camera is operated by holding the intervalometer switch in the MANUAL position, the camera exposures remaining counter will count only a single, final exposure as the switch is released.

VERTICAL CAMERA SYSTEM NORMAL OPERATION

The following steps are recommended for the normal operation of the vertical camera system:

1. Vertical Camera Master Switch - ON

No camera or camera door operation is possible unless this switch is ON. It is recommended that this switch be turned ON prior to takeoff as it turns on the camera compartment heat. When this switch is ON, the camera door will open when the bomb doors open.

2. Vertical Camera Intervalometer Power Switch - Set
3. Vertical Camera Intervalometer - Set

    a. Vertical Camera Exposure Delay Control Knob - Set at any desired position but OFF

    If this knob is set at OFF, automatic camera operation is not possible even though the camera intervalometer ready light is illuminated.

    b. Vertical Camera Exposure Interval Control Knob - Set at any desired position but OFF

    If this knob is set at OFF, automatic camera operation is not possible.

    c. Vertical Camera Exposure Limiter Control Knob - Set as desired

4. Vertical Camera Door Open Light - Illuminated

If camera door open light is not illuminated, open the camera door by means of the camera door switch. Hold the camera door switch in OPEN position until the camera door open light illuminates.

NOTE

The camera will expose film whether the camera door is open or not.

The camera system is now ready to take pictures. The camera intervalometer can be initiated by a bomb release pulse from the bomb intervalometer or bomb salvo system or by the manual initiation switch on the camera intervalometer. The camera can be operated by depressing the camera trip switch on the camera intervalometer. The camera can also be operated by positioning the camera intervalometer switch to MANUAL, but this is inadvisable unless the camera intervalometer is inoperative because the exposures remaining counter will not register.

NOTE

If the camera operating light stops flashing, the camera exposures remaining counter stops working, and the camera intervalometer ready light does not illuminate, it is an indication that the camera is no longer taking pictures because 1) it has run out of film, 2) the film has broken, or 3) the camera is not receiving the impulses from the intervalometer. If it is desired to take more pictures, move the camera intervalometer switch to MANUAL position. If the camera operating light on the camera control panel does not flash, the camera probably is not making exposures. Shut down the photographic system.

To shut down the photographic system, proceed as follows:

5. Vertical Camera Door Switch - CLOSED

When the bomb doors are fully closed, the camera doors can be closed by holding the camera door switch in CLOSED position. On aircraft **54**▶ **169** **W1**▶ **W51** hold the switch in CLOSED position until the camera door closed light illuminates.

6. Vertical Camera Intervalometer Power Switch - OFF
7. Vertical Camera Master Switch - OFF

It is recommended that this switch remain ON until after landing to provide heat for the camera compartment.

BOMB DOOR SYSTEM

The bomb door system (figure 4-72) comprises doors, latches, and the systems which control them. Six double-panel doors cover the bomb bay opening. All actuation by the bomb door system affects the lower panels only. The upper panels are hinged to provide a larger opening for ground service. The doors are latched at the forward and aft bulkheads of the bomb bay. To secure simultaneous action of all doors, the center doors are mechanically linked to the forward and aft doors. The doors can be operated with the bomb door switch on either the pilot's or the radar navigator's control panel. The BNS can operate the doors automatically. The bomb jettison system will open the doors but will not close them. On **B-52D** aircraft, an emergency bomb door open switch provides an emergency means of opening the bomb doors. This switch opens the bomb doors by utilizing the present hydraulic configuration in conjunction with electrical actuating circuits which bypass many of the normal bomb door open relays. A completely mechanical means is provided to unlatch the bomb doors in an emergency, after which they will be positioned by the airstream loads to some position between closed and full open depending on indicated airspeed. During ground operation, with no power on the aircraft, the bomb doors may be unlatched by manually pulling the bomb door latch release cable in the aft wheel well. The bomb doors are held closed by means of mechanical latches and held open by hydraulic pressure. Hydraulic system No. 2 provides normal pressure and No. 1 provides alternate pressure to operate the forward bomb doors actuator. On **B-52C** aircraft, hydraulic system No. 4 provides normal pressure and No. 3 provides alternate pressure to operate the aft bomb door actuator. In the event the normal hydraulic system does not supply enough pressure, the alternate hydraulic system operates the actuator. On **B-52D** aircraft, only hydraulic system No. 4 provides pressure to operate the aft bomb door actuator. The control circuits operate on 24-volt dc switched battery power.

BOMB DOOR SYSTEM CONTROLS

CAUTION

To avoid bomb door damage in the event of a hydraulic system malfunction, see "Bombing System Switch in the Manual Position," this section.

Bomb Door Switches

PILOT'S BOMB DOOR SWITCH. A pilot's bomb door switch (2, figure 1-15) on the pilots' instrument panel provides a means of controlling the bomb doors. The switch has OPEN--OFF--CLOSED positions and is spring loaded to OFF position. Actuation of this switch to OPEN will turn on hydraulic packs 1, 2, 3 B-52C , and 4 (if hydraulic pack switches 1, 2, 3 B-52C , and 4 are positioned to on) and energize the bomb doors open circuit. Hydraulic packs 1, 2, 3 B-52C , and 4 will remain running until the bomb doors are closed and the pilot's bomb door switch is returned to OFF. Actuating this switch to CLOSED will deenergize the salvo circuits if the salvo circuit is energized and will close the bomb doors. This switch provides the bomb door circuits with switched battery power through a circuit breaker marked "Bomb Door Control Relays" on the "Miscellaneous" portion of the pilot's circuit breaker panel.

RADAR NAVIGATOR'S BOMB DOOR SWITCH. A radar navigator's bomb door switch (1, figure 4-73) on the radar navigator's door and bomb control panel provides a means of controlling the bomb doors. This switch has OPEN--OFF--CLOSE positions and is spring loaded to the unmarked OFF position. Actuating this switch to OPEN, if the bombing system switch is in MANUAL and the master bomb control switch in ON, will energize the bomb doors open circuit. Actuating this switch to CLOSE, if the bombing system switch is in MANUAL, will deenergize the salvo circuits if the salvo circuits are energized and may B-52C cause the bomb doors to be closed even though the master bomb control switch is OFF. Power is supplied to this switch through relay contacts when the bomb doors are open and the bombing system switch is in MANUAL. This switch provides the bomb door circuits with switched battery power through a circuit breaker marked "Bomb Door Control Relays" on the "Miscellaneous" portion of the pilot's circuit breaker panel.

Emergency Bomb Door Open Switch B-52D

An open-guarded emergency bomb door open switch (2, figure 4-74) located on the emergency bomb door control panel at the radar navigator's station has OPEN--OFF positions and provides a means of emergency opening the bomb doors. When positioned to OPEN, hydraulic packs 1, 2, and 4 are energized and the aft main bomb door valve, forward main bomb door valve, and emergency bomb door valves are all actuated to open position opening the bomb doors. In addition, if the landing gear standby pumps switch is ON, the No. 1 and 2 hydraulic standby pump pressure switches are energized and power is supplied to the emergency armed release switch. OFF position deenergizes the emergency bomb door open and armed release functions. This switch is provided TR power through the "Emer Door Open & Rel" circuit breaker located on the "Bomb System" portion of the radar navigator's circuit breaker panel.

WARNING

B-52D

- Do not place emergency bomb door open switch to OPEN position when carrying high drag bombs internally. Rapid release sequence will result in bomb drafting and collision between bombs. The emergency bomb door open switch may be used to open the bomb doors for jettison if the jettison system fails to open the doors.
- Do not place the emergency bomb door open switch to the OPEN position when configured with a clip-in (nuclear) system. The possibility exists of an early release pulse being supplied at the time of bomb door opening.

CAUTION

B-52D

- Do not attempt to close the bomb doors by any means while the emergency bomb door open switch is positioned to OPEN as damage to the bomb doors could result.

B-52D

- The bombing system switch should always be positioned to MANUAL during use of the emergency bomb door open function.

B-52D

- To prevent overheating and possible failure of hydraulic packs, do not leave this switch in OPEN position for periods to exceed 30 minutes out of each hour.

NOTE

B-52D

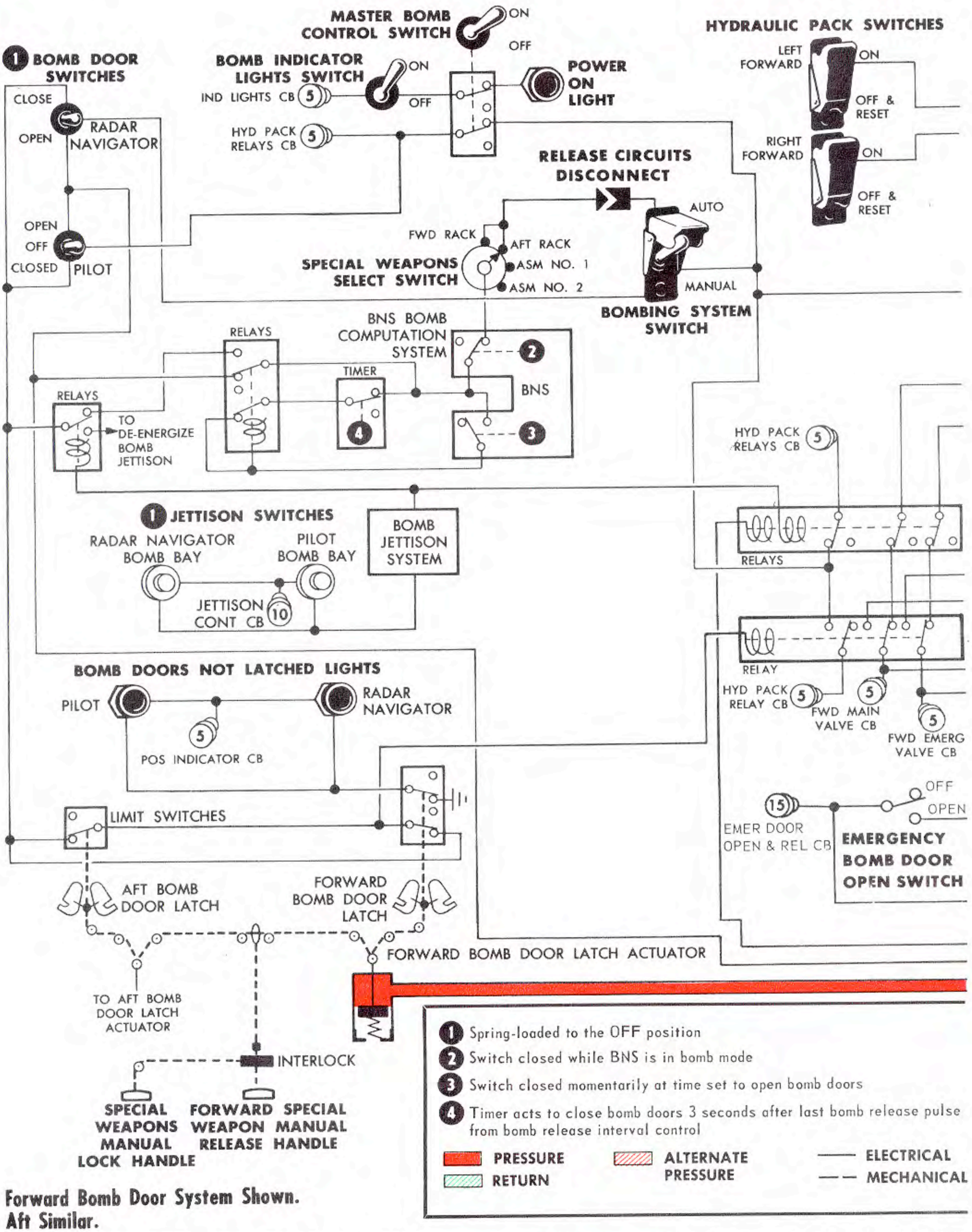
Opening the bomb doors with the emergency bomb door open switch will result in a "Rapid" release sequence regardless of the position of the bomb release mode selector switch.

Bombing System Switch

A bombing system switch (5, figure 4-73) located on the radar navigator's door and bomb control panel provides a means of transferring control of the bomb doors from the BNS to the radar navigator's bomb door switch. The switch has AUTO--MANUAL positions. Actuating the switch to AUTO allows the BNS control of the bomb doors. Actuating the switch to MANUAL transfers control of the bomb doors to the radar navigator's bomb door switch. The switch is shielded with an open-type guard. The bombing system switch is supplied switched battery power through a circuit breaker marked "Bomb Door Control Relays" on the "Miscellaneous" portion of the pilot's circuit breaker panel.

NOTE

The bomb doors cannot be opened with the BNS (bombing system switch in AUTO) when the special weapons select switch is positioned to ASM NO. 1 or ASM NO. 2.



① Spring-loaded to the OFF position

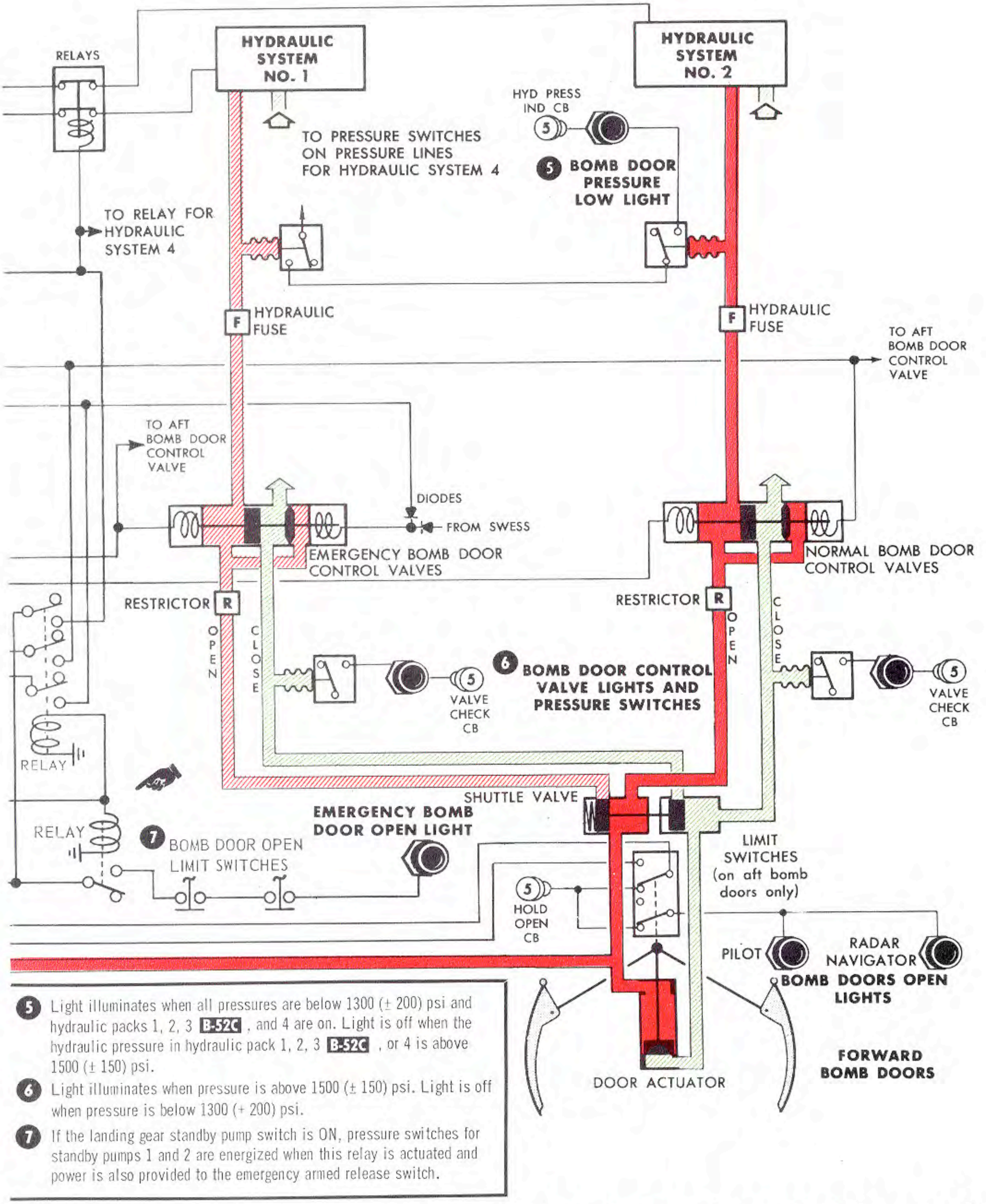
② Switch closed while BNS is in bomb mode

③ Switch closed momentarily at time set to open bomb doors

④ Timer acts to close bomb doors 3 seconds after last bomb release pulse from bomb release interval control

Forward Bomb Door System Shown. Aft Similar.

Figure 4-72 (Sheet 1 of 2).



⑤ Light illuminates when all pressures are below 1300 (± 200) psi and hydraulic packs 1, 2, 3 **B-52C**, and 4 are on. Light is off when the hydraulic pressure in hydraulic pack 1, 2, 3 **B-52C**, or 4 is above 1500 (± 150) psi.

⑥ Light illuminates when pressure is above 1500 (± 150) psi. Light is off when pressure is below 1300 (+ 200) psi.

⑦ If the landing gear standby pump switch is ON, pressure switches for standby pumps 1 and 2 are energized when this relay is actuated and power is also provided to the emergency armed release switch.

BOMB DOOR SYSTEM (Typical)

Figure 4-72 (Sheet 2 of 2).

Bomb Door Actuator Locks B-52D

Bomb door actuator locks are provided for use under emergency airborne conditions to lock the bomb doors in the closed position. The bomb door actuator lock is a split cylindrical collar, hinged so that it can be opened and held in the closed position by removable pins. When used, an actuator lock is placed around each bomb door actuator rod, thus preventing the bomb door actuators from opening the bomb doors. When not in use, the actuator locks are stowed on brackets mounted forward and aft within the bomb bay. Actuator locks are called for in SUU-24/A dispenser hung munitions checklist in the emergency procedures section of this manual.

BOMB DOOR SYSTEM INDICATORS

Bomb Doors Open Lights

An amber bomb doors open light is located on the pilots' instrument panel (40, figure 1-15). An amber bomb doors open light is located on the radar navigator's door and bomb control panel (2, figure 4-73). When illuminated, the bomb doors open lights indicate the bomb doors are fully open, the bomb doors will be held open until the bomb doors close circuit is energized, and the bomb door safety switches are positioned so that bomb release may be made by either the normal or the jettison systems. The lights will remain illuminated as long as the bomb doors are fully open. The bomb doors open lights receive TR power through the bomb door indicator and valve open limit switch actuated by the aft bomb door radius rod. The bomb doors open lights are supplied TR power through a circuit breaker marked "Bomb Door Control Hold Open" on the "Miscellaneous" portion of the pilot's circuit breaker panel.

Emergency Bomb Door Open Light B-52D

An amber bomb door open press-to-test light (1, figure 4-74) is located on the emergency bomb door control panel at the radar navigator's station. This light will illuminate when the emergency bomb door open switch is positioned to OPEN and at least one bomb door open limit switch is closed. This will permit an emergency armed release. The emergency bomb door open light receives TR power through the bomb door open limit switches, the emergency bomb door open switch, and the "Emer Bomb Door Open & Rel" circuit breaker located on the "Bomb System" portion of the radar navigator's circuit breaker panel.

NOTE

> B-52D
>
> Open bomb doors will be indicated by this light only when the emergency bomb door open switch is positioned to OPEN.

Bomb Doors Not Latched Lights

An amber bomb doors not latched light is located on the pilots' instrument panel (39, figure 1-15). An amber bomb doors not latched light is located on the radar navigator's door and bomb control panel (4, figure 4-73). When illuminated, the bomb doors not latched lights indicate the forward bomb door latch is unlatched. The lights will remain illuminated until the bomb doors are closed and the forward bomb door latch is latched. The bomb doors not latched lights are supplied TR power through a limit switch actuated by the forward bomb doors latch. The bomb doors not latched lights are supplied TR power through circuit breakers marked "Bomb Door Control Pos Ind" on the "Miscellaneous" portion of the "Bomb Door" portion of the radar navigator's circuit breaker panel.

Bomb Door Pressure Low Light

An amber bomb door pressure low light (3, figure 4-73) on the door and bomb control panel, when illuminated, indicates that hydraulic pressure from hydraulic packs 1, 2, 3 B-52C , and 4 are all below 1300 (±200) psi and the landing gear is not up and locked or the master bomb control switch is ON. The light goes out when the hydraulic pressure from any of these hydraulic packs is above 1500 (±150) psi. The light is supplied TR power through a series circuit with the pressure switches on the hydraulic pressure lines from these hydraulic packs. The bomb door pressure low light is supplied TR power through a circuit breaker marked "Hyd Press Ind" on the "Bomb Door" portion of the radar navigator's circuit breaker panel.

Bomb Door Control Valve Lights

Four B-52C or three B-52D amber bomb door control valve lights (60, figure 4-35) are on the radar navigator's side panel. Each light receives TR power through a pressure switch on the bomb door close line located between the control valve and the shuttle valve B-52C. Each light receives TR power through a pressure switch on the bomb door close line located between the respective control valve and the shuttle valve (packs 1 and 2) or the hydraulic actuator (pack 4) B-52D. The bomb door control valve lights are supplied TR power through a circuit breaker marked "Valve Check" on the "Bomb Door" portion of the radar navigator's circuit breaker panel. Each light, when illuminated, indicates the corresponding bomb door control (four-way) valve is directing hydraulic pressure to the respective bomb door close line. If opening is attempted with a bomb door control valve light illuminated, trapped door closing pressure may be indicated and bomb door damage may occur. If a bomb door control valve light is illuminated when there is no pressure on the corresponding hydraulic system, it indicates the corresponding bomb door control valve light pressure switch is malfunctioning. This, of course, does not indicate whether or not the bomb door control valve (four-way) is operating properly. Each light will illuminate when the hydraulic pressure in the close line is approximately 1500 psi and go off when the hydraulic pressure in the close line is approximately 1300 psi. Operation of the lights is as follows:

1. During Opening - All lights off
2. During Closing - Emergency light(s) on, main lights off

It is possible that one or both of the main lights may momentarily blink and/or remain on during closing.

3. Doors Closed and Properly Latched - All lights off

B-52C

4. If the forward main hydraulic pack (pack 2) fails, all lights will be off during closing except the aft emergency (blinking or steady illumination of the operating lights may still occur).

B-52D

5. If the forward main hydraulic pack (pack 2) fails, all lights will be off during closing except the forward emergency (blinking or steady illumination of the operating lights may still occur).

B-52C

6. If the aft main hydraulic pack (pack 4) fails, all lights will be off during closing except the forward emergency (blinking or steady illumination of the operating lights may still occur).

B-52C

7. If both main packs fail (packs 2 and 4) all lights will be off during door closing (blinking or steady illumination of the operating lights may still occur).

CAUTION

> If a bomb control valve light remains illuminated after the doors are closed and properly latched, door damage may occur if the doors are opened. See "Bomb Door Control Valve Lights Illuminated with Bombing System Switch in the MANUAL Position," this section.

BOMB DOOR SYSTEM NORMAL OPERATION

The BNS and bomb door switches at the pilot's and radar navigator's stations are used for normal operation of the bomb doors. For normal operation of the bomb doors, hydraulic pack switches 1, 2, 3, B-52C, and 4 should be positioned to ON, even though it is possible for one hydraulic pack to open the bomb doors. On B-52C aircraft, the standby pumps are not available to open the bomb doors when the landing gear is retracted. On B-52D aircraft, hydraulic standby pumps 1 and 2 are available for opening the bomb doors regardless of the landing gear position with the emergency bomb door open switch positioned to OPEN and the landing gear standby pump switch ON. The bomb door pressure low light at the radar navigator's station will illuminate only if the pressures from the applicable hydraulic packs are all low, when the landing gear is not up and locked, or the master bomb control switch is in ON position. The bomb door control valve lights on the radar navigator's side panel will illuminate if there is pressure in the bomb door close lines. The bomb doors not latched lights will illuminate when the forward bomb door latch is unlatched and they remain illuminated until the forward bomb door latch is latched again. When illuminated, the bomb doors open lights indicate the bomb doors are fully open and the bomb door system will now hold the bomb doors open until closing action is initiated.

CAUTION

> Do not operate the bomb doors with either the standby pumps or the accumulators as equipment may be damaged. The hydraulic packs must be used to operate the bomb doors. On B-52D aircraft, use of standby pumps for bomb door opening is reserved for combat only.

Bomb Door Operation With BNS

The BNS will automatically open and close the bomb doors at the proper time according to a predetermined setting. When the BNS function switch is in NAV, TRACK, or BOMB and the bombing system switch is in AUTO position, the BNS sends a continual door close signal to the bomb door system. This door close signal is interrupted only when the BNS sends a door open signal (possible only when function switch is in BOMB) or the jettison circuits are energized. When the BNS does not receive a bomb release pulse from the bomb intervalometer for 2.5 to 3 seconds, the BNS changes to a continuous door close signal, closing the bomb doors. To operate the bomb doors and obtain a release with the BNS:

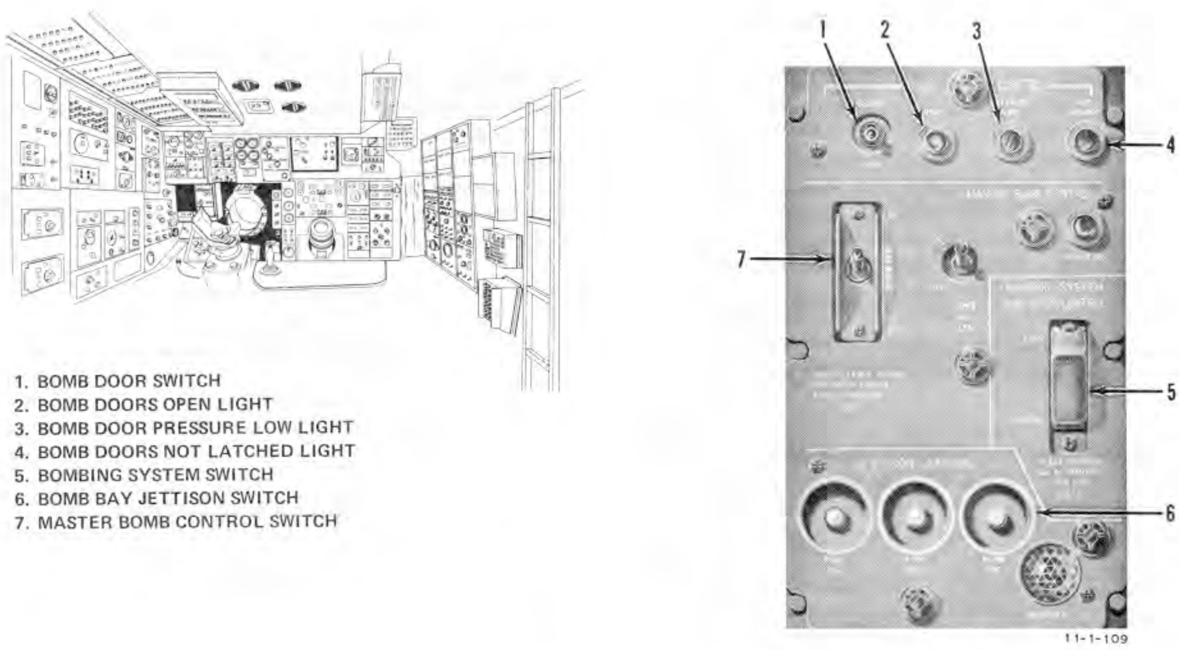
1. BNS Function Switch - BOMB
2. Hydraulic Pack Switches 1, 2, 3 B-52C, and 4 - ON
3. Master Bomb Control Switch - ON
4. Bomb Indicator Lights Switch - ON
5. Bombing System Switch - AUTO
6. Special Weapons Select Switch - FWD or AFT RACK
7. Release Circuits Disconnect - Connected
8. BRIC - On

Bomb Door Operation With Radar Navigator's Bomb Door Switch

To open the bomb doors with the radar navigator's bomb door switch:

1. Hydraulic Pack Switches 1, 2, 3 B-52C, and 4 - ON
2. Master Bomb Control Switch - ON
3. Bombing System Switch - MANUAL
4. Radar Navigator's Bomb Door Switch - OPEN

Hold the switch in OPEN until the bomb doors open lights are illuminated, then release the switch. The bomb doors will remain open and the hydraulic packs will remain in operation. Loss of hydraulic pressure will allow the bomb doors to be positioned by the airstream loads to some position between closed and full open depending on indicated airspeed.



1. BOMB DOOR SWITCH
2. BOMB DOORS OPEN LIGHT
3. BOMB DOOR PRESSURE LOW LIGHT
4. BOMB DOORS NOT LATCHED LIGHT
5. BOMBING SYSTEM SWITCH
6. BOMB BAY JETTISON SWITCH
7. MASTER BOMB CONTROL SWITCH

DOOR AND BOMB CONTROL PANEL

Figure 4-73.

To close the bomb doors with the radar navigator's bomb door switch:

1. Hydraulic Pack Switches 1, 2, 3 **B-52C**, and 4 - ON
2. Master Bomb Control Switch - ON

NOTE

> When the bomb doors are fully open, it is not (always **B-52C**) necessary to have the master bomb control switch ON in order to close the bomb doors with the radar navigator's bomb door switch.

3. Bombing System Switch - MANUAL
4. Radar Navigator's Bomb Door Switch - CLOSE

Hold the switch in CLOSE until the bomb doors not latched lights are out, then release the switch. The bomb doors will remain closed. The hydraulic packs will remain in operation until the master bomb control switch is positioned to OFF or the hydraulic pack switches are positioned to OFF & RESET.

Bomb Door Operation With Pilot's Bomb Door Switch

To open the bomb doors with the pilot's bomb door switch:

1. Hydraulic Pack Switches 1, 2, 3 **B-52C**, and 4 - ON
2. Pilot's Bomb Door Switch - OPEN

Hold the switch in OPEN until the bomb doors open lights illuminate, then release the switch. The bomb doors will remain open and the hydraulic packs will remain in operation. Loss of hydraulic pressure will allow the bomb doors to be positioned by the airstream loads to some position between closed and full open depending on indicated airspeed.

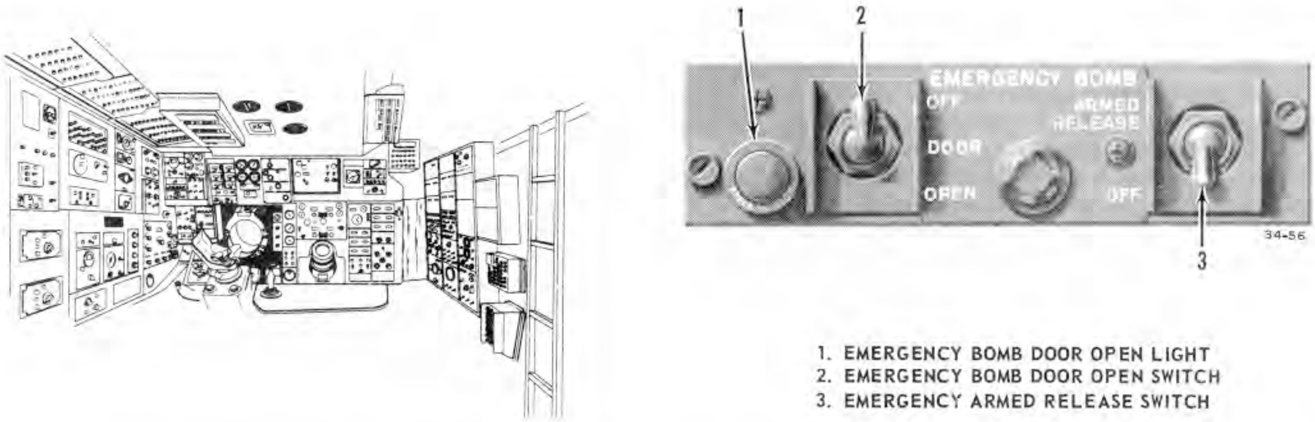
CAUTION

> Do not attempt to open the bomb doors with the pilot's bomb door switch when the bombing system switch is in AUTO position and the BNS is operating in the bomb mode as the bomb doors will keep cycling (opening partly and then slamming closed) until either the pilot's bomb door switch is positioned OFF or the bombing system switch is positioned to MANUAL.

To close the bomb doors with the pilot's bomb door switch:

1. Hydraulic Pack Switches 1, 2, 3 **B-52C**, and 4 - ON
2. Pilot's Bomb Door Switch - CLOSED

Hold the switch in CLOSED until the bomb doors not latched lights are out, then release the switch. The bomb doors will remain closed and the hydraulic packs will be shut down provided the master bomb control switch is OFF.



1. EMERGENCY BOMB DOOR OPEN LIGHT
2. EMERGENCY BOMB DOOR OPEN SWITCH
3. EMERGENCY ARMED RELEASE SWITCH

EMERGENCY BOMB CONTROL PANEL B-52D

Figure 4-74.

BOMB DOOR SYSTEM EMERGENCY OPERATION

Bomb Door Emergency Operation With Jettison Switches

When the jettison circuits are energized, hydraulic packs 1, 2, 3 B-52C, and 4 are energized, the bomb doors close signal from the BNS is interrupted, and the bomb doors are opened. The jettison circuits can be deenergized by actuation of the pilot's bomb door switch to CLOSED position. The pilot's bomb door switch not only deenergizes the jettison circuits but also closes the doors. The radar navigator's bomb door switch performs the same function as the pilot's bomb door switch when the bombing system switch is in MANUAL position.

Bomb Door Emergency Operation with Emergency Bomb Door Open Switch

B-52D

To open the bomb doors with the emergency bomb door open switch, proceed as follows:

1. Landing Gear Standby Pumps Switch - ON (combat only)
2. Bombing System Switch - MANUAL
3. Emergency Bomb Door Open Switch - OPEN

Placing the switch to OPEN will cause the bomb doors to open and the emergency bomb door open light will illuminate. The switch must remain in OPEN position to keep the doors open. Loss of hydraulic pressure will allow the bomb doors to be positioned by airstream loads.

WARNING

Do not place the emergency bomb door open switch to the OPEN position when configured with a clip-in (nuclear) system. The possibility exists of an early release pulse being supplied at the time of bomb door opening.

CAUTION

B-52D
- Do not attempt to close the bomb doors by any means while the emergency bomb door open switch is in OPEN position as damage to bomb door system could result.

B-52D
- Do not attempt to open the bomb doors with the emergency bomb door open switch when the bombing system switch is in AUTO position and the BNS is operating in bomb mode as a door close signal may be applied to the normal door close circuits and damage to the bomb door system could result.

To close the bomb doors, place the emergency bomb door open switch OFF then use the pilot's or radar navigator's bomb door switch to close the doors.

Bomb Door Emergency Operation with Forward Special Weapon Manual Release Handle

Pulling the forward special weapon manual release handle through the first 9 inches of travel will manually unlatch the bomb doors. After they are unlatched, airloads will position the bomb doors to some intermediate position between closed and full open, depending on indicated airspeed, provided hydraulic systems 1, 2, 3 **B-52C**, and 4 are not pressurized and the bomb door system is not receiving a door close signal from the bomb door switches or the BNS. When the bomb doors are unlatched, the bomb doors not latched lights will illuminate provided TR power is available. To close the bomb doors, use the procedure described under "Bomb Door System Normal Operation," this section.

NOTE

> Due to a mechanical interlock incorporated in the forward special weapon manual release system, the bomb doors cannot be unlatched with this system without first pulling the special weapons manual lock handle. All special weapon racks and AGM-28 missile separation systems are unlocked when the special weapons manual lock handle is actuated.

Manual opening of bomb bay door latches may be accomplished using the bomb door latch release cable in the aft wheel well. The cable is the same cable actuated by the aft hydraulic latch actuator and is directly linked to the aft latches and through the coordinating unit to the forward latches.

CAUTION

> Unlatching the bomb doors using the aft bomb door latch release cable will not be attempted with power on the aircraft.

Bomb Door Control Valve Lights Illuminated With Bombing System Switch In The AUTO Position

If all the bomb door control valve lights are illuminated when the bomb doors are closed and latched and the bombing system switch is in AUTO, the BNS (when operating in the bomb function) may be sending a door close signal through a defective door close limit switch which is actuating the door close system. The following steps are recommended to check this condition:

1. Place the bombing system switch to MANUAL.

Positioning the bombing system switch to MANUAL stops BNS control of the doors.

2. Check that the master bomb control switch is ON.

Check the master bomb control switch ON so the hydraulic system will remain pressurized when the door close signal is stopped.

3. If the bomb door control valve light(s) goes off after accomplishing steps "1" and "2," the bomb door system is safe for operation provided the respective hydraulic systems are pressurized.
4. If the bomb door control valve light(s) remains illuminated after accomplishing steps "1" and "2," refer to the procedure under "Bomb Door Control Valve Lights Illuminated with Bombing System Switch in the MANUAL position," this section.

Bomb Door Control Valve Lights Illuminated With Bombing System Switch In The MANUAL Position

If the bomb door switches are both out of the CLOSE(D) position and the bombing system switch is in MANUAL with the respective hydraulic system pressurized, an illuminated bomb door control valve light may indicate the corresponding bomb door control (four-way) valve is stuck in a position to direct hydraulic pressure to the corresponding bomb door close line. Opening the bomb doors in this condition may cause them to be damaged. The following steps are recommended to check the system:

1. Master Bomb Control Switch - ON

NOTE

> Hydraulic pack 1 or 2 must be in operation in order to bleed hydraulic pressure from hydraulic pack 3 or 4.

2. Affected Hydraulic Pack Switch - OFF

CAUTION

> Do not attempt to free a bomb door control (four-way) valve or bleed hydraulic pressure by means of the bomb door switches as this procedure may damage the bomb door system.

3. Brake Pedals - Actuate

Pump brake pedals to deplete the system hydraulic pressure to zero.

a. Bomb Door Control Valve Light Remains Illuminated:

(1) A malfunctioning bomb door control valve light pressure switch is indicated if the light remains

All data on pages 4-151 thru 4-166 (Deleted)

illuminated when the affected hydraulic system pressure is zero. This, of course, does not indicate whether or not the control valve (four-way) is operating properly.

(2) If hydraulic pack 1 or 2 is affected, the system is safe for bomb door operation since an alternate system is available; however, the affected hydraulic pack switch will remain positioned in OFF & RESET for subsequent bomb door operation only.

(3) **B-52D** If hydraulic pack 4 is affected, there is no alternate source of pressure. Further, the position of the control valve (four-way) is unknown. If the control valve is stuck in the CLOSE position, the bomb doors would be damaged if opened. In this instance, it is not safe to open the bomb doors.

CAUTION

B-52D

Do not operate the bomb doors with the aft main bomb door control valve light illuminated unless imperative to do so since this may result in damage to the bomb doors.

(3) **B-52C** If hydraulic pack 3 or 4 is affected, the system is safe for bomb door operation since an alternate system is available; however, the affected hydraulic pack switch will remain positioned in OFF & RESET for subsequent bomb door operation only.

b. Bomb Door Control Valve Light Not Illuminated:

(1) A bomb door control (four-way) valve stuck in the CLOSE position is indicated.

(2) If hydraulic pack 1 or 2 is affected, the system is safe for bomb door operation since an alternate system is available; however, the affected hydraulic pack switch will remain positioned in OFF & RESET for subsequent bomb door operation only.

(3) **B-52C** If hydraulic pack 3 or 4 is affected, the system is safe for bomb door operation since an alternate system is available; however, the affected hydraulic pack switch will remain positioned in OFF & RESET for subsequent bomb door operation only.

(3) **B-52D** If hydraulic pack 4 is affected, it is not safe to open the doors. Since there is no alternate source of hydraulic pressure for this pack (bomb door operation) and the control valve (four-way) is stuck in the CLOSE position, the bomb doors would be damaged if opened because of a hydraulic lock in the aft actuator.

CAUTION

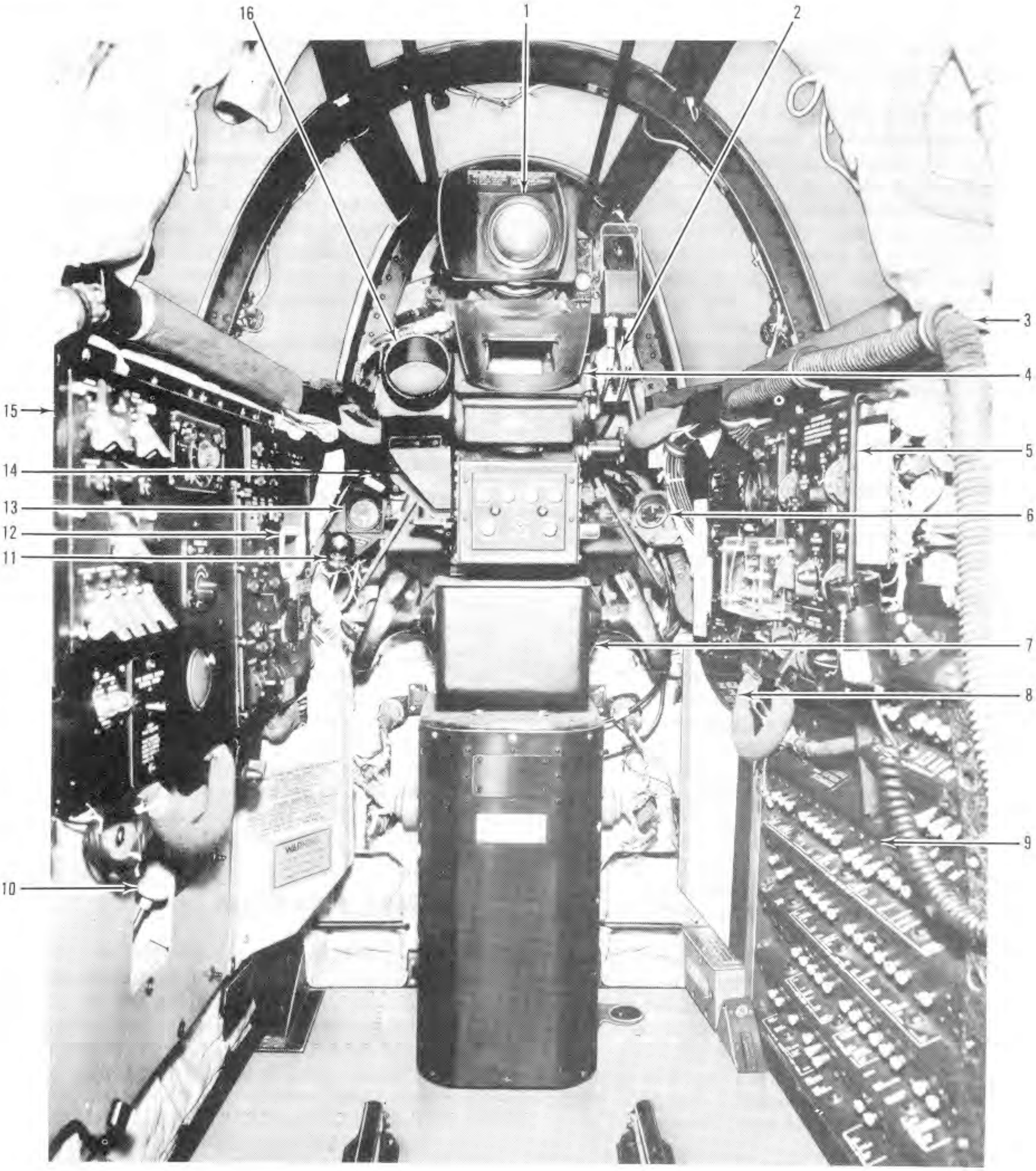
- When the bomb doors are operated with power to only the forward bomb door actuator, aircraft speed should not exceed 325 knots IAS, if practical, as a precaution against buffeting and structural damage to the doors.
- Do not operate bomb doors in flight with power to only the rear bomb door actuator except when imperative to do so since this may result in loss of portions of the bomb doors and possible damage to the aft body structure and empennage.

MISSILE SYSTEM (AGM-28)

The aircraft has provisions for mounting and controlling two AGM-28 (Hound Dog) missiles. The missiles are mounted on pylons attached to the left and right wings between the fuselage and the inboard engine nacelles. The copilot has controls and indicators for missile engine operation and the missile fire detection system switches and indicators. The navigator has the controls and indicators for missile guidance, arming, and launch. The pilots and radar navigator have jettison switches. The radar navigator can also release the missile by means of the BNS. For further information, refer to T.O. 1B -52C-30-1.

GUNNERY SYSTEM (MD-9)

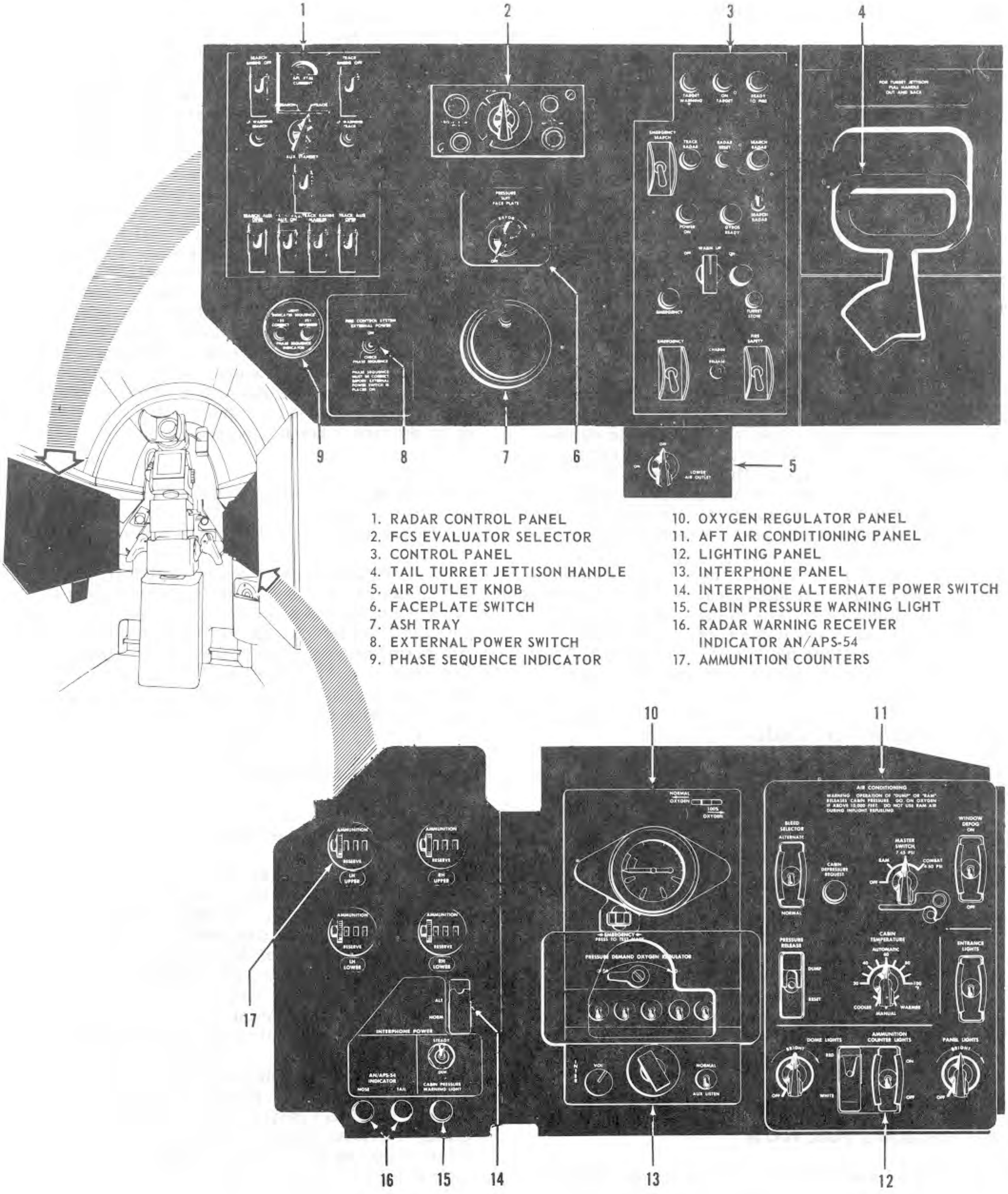
The MD-9 fire control system has the ability to search, detect, acquire, track, and compute correct lead angle for attacking enemy aircraft. At the same time, the system automatically and continuously positions the turret and then provides accurate gunfire against the targets. A hemispheric sight is provided to permit visual search and manual tracking if the radar mode is inoperative. The gunner has the controls and indicators for operation of the system. For inflight operating procedures and general overall technical information, refer to T.O. 1B-52B-1-5.



1. HEMISPHERIC SIGHT
2. HEMISPHERIC SIGHT COVER HANDLE
3. OXYGEN SUPPLY HOSE
4. RADAR INDICATOR
5. GUNNER'S SIDE PANEL
6. GUN CHARGER AIR PRESSURE GAGE **139**▶ **W28**▶
7. CONTROL COLUMN
8. HEATED AIR OUTLET
9. GUNNER'S CIRCUIT BREAKER PANEL
10. TURRET DRAG CHUTE INTERCONNECT CONTROL KNOB
11. EMERGENCY ALARM LIGHT
12. TURRET JETTISON HANDLE
13. CABIN ALTIMETER
14. INTERPHONE CALL LIGHT
15. GUNNER'S SIDE PANEL
16. GUNNER'S APR-25 INDICATOR **B-52D** ☞

GUNNER'S STATION (MD-9)

Figure 4-75.



1. RADAR CONTROL PANEL
2. FCS EVALUATOR SELECTOR
3. CONTROL PANEL
4. TAIL TURRET JETTISON HANDLE
5. AIR OUTLET KNOB
6. FACEPLATE SWITCH
7. ASH TRAY
8. EXTERNAL POWER SWITCH
9. PHASE SEQUENCE INDICATOR
10. OXYGEN REGULATOR PANEL
11. AFT AIR CONDITIONING PANEL
12. LIGHTING PANEL
13. INTERPHONE PANEL
14. INTERPHONE ALTERNATE POWER SWITCH
15. CABIN PRESSURE WARNING LIGHT
16. RADAR WARNING RECEIVER INDICATOR AN/APS-54
17. AMMUNITION COUNTERS

GUNNER'S SIDE PANELS (Typical) (MD-9)

Figure 4-76.

AIR REFUELING SYSTEM

An air refueling (IFR, aerial refueling) system makes it possible to refuel the aircraft in flight from a boom-type tanker aircraft. An air refueling slipway and receptacle, which can be covered by hydraulically operated slipway doors when not in use, is located on top of the fuselage slightly aft of the pilots' stations. A refuel system (figure 4-77) makes it possible to fill all the aircraft fuel tanks from the air refueling receptacle or a single point ground refueling receptacle. The refuel system is normally independent of either the fuel feed system or fuel transfer system ("Fuel Supply System," Section I). A refuel shutoff valve, downstream from the receptacle, connects the receptacle to the refuel manifold and is designed to keep fuel during ground refueling. The refuel manifold distributes fuel to each tank through refuel secondary valves which are controlled from the refuel panel on the copilot's side panel. The refuel manifold has thermal relief provisions around the refuel shutoff valve to eliminate trapped fuel between the air refueling receptacle and the refuel valve. This provision decreases pressure in the manifold and prevents fuel leakage into the control cabin. An air refueling panel (figure 4-79) on the pilots' overhead panel contains the controls necessary to operate the air refueling hydraulic system and refuel shutoff valve, and to control an electronic signal amplifier system. The signal amplifier serves to indicate when the air refueling system is ready for contact, to control power supplied to lock the hydraulic latching toggles when contact is made, and to indicate when a disconnect occurs.

AIR REFUELING HYDRAULIC PRESSURE

Hydraulic pressure used to operate the slipway door system (figure 4-78) is normally supplied by hydraulic system No. 1. Hydraulic system No. 2 serves as an alternate source of pressure for this purpose. This pressure is controlled by normal and alternate slipway door control valves which are electrically controlled by slipway door switches. A shuttle valve, positioned by the pressure source, allows hydraulic pressure to operate the slipway doors actuator and to position the toggle actuator to unlock the toggles. Pressure is also supplied to an electrically operated toggle actuator valve which is controlled automatically by the signal amplifier or manually by a manual toggle latching switch. Opening the toggle actuator valve allows hydraulic pressure to lock the latching toggles which hold the air refueling boom in the receptacle.

AIR REFUELING FUEL FLOW

When the air refueling boom nozzle is seated in the air receptacle and held by hydraulically operated latching toggles, fuel is pumped from the tanker to the receiver refuel manifold. Rate of flow is controlled by the tanker crew and number of receiver tanks open. In the receiver, fuel flows from the refuel manifold into fuel tanks as directed by refuel secondary valves which are operated by switches located on the refuel panel. When a fuel tank is full by weight, the full by weight switches connected to the fuel quantity indicating system will close the secondary valves. When a fuel tank is full by volume, a float valve hydraulically closes a refuel primary valve. A float switch is also provided which will close the refuel secondary valve when the fuel tank is full if the primary valve should fail. When refuel shutoff valves for all tanks are closed, pressure builds up in the refuel manifold and a disconnect is effected if the fuel pressure in the refuel manifold exceeds a disconnect pressure switch setting of 69 (±3) psi. A disconnect is also caused by the boom exceeding its envelope limits. A voluntary disconnect may be initiated by either pilot of the receiver or by the tanker boom operator.

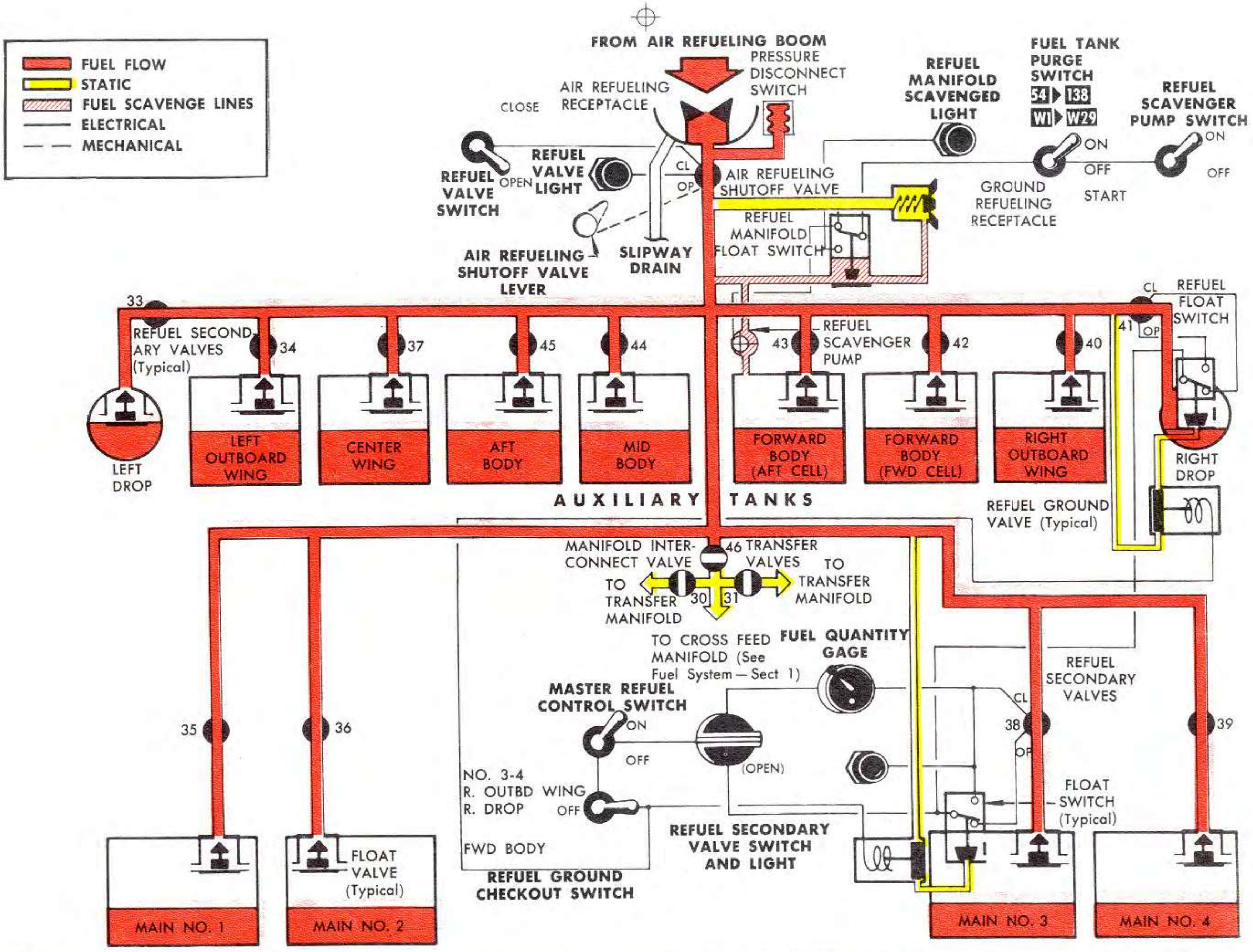
AIR REFUELING SYSTEM CONTROLS

Air Refueling (IFR or Refuel) System Master Switch

An air refueling system master switch (1, figure 4-79), guarded on some aircraft, is located on the air refueling panel and has ON--OFF positions. In ON position, this switch supplies TR power through circuit breakers marked "Slipway Doors" - "Normal" and "Alternate" to the slipway doors switches and to the signal amplifier power switch through a circuit breaker marked "Sig Ampl." All circuit breakers are on the "IFR" portion of the pilots' overhead circuit breaker panel. In OFF position, no power is supplied to these units.

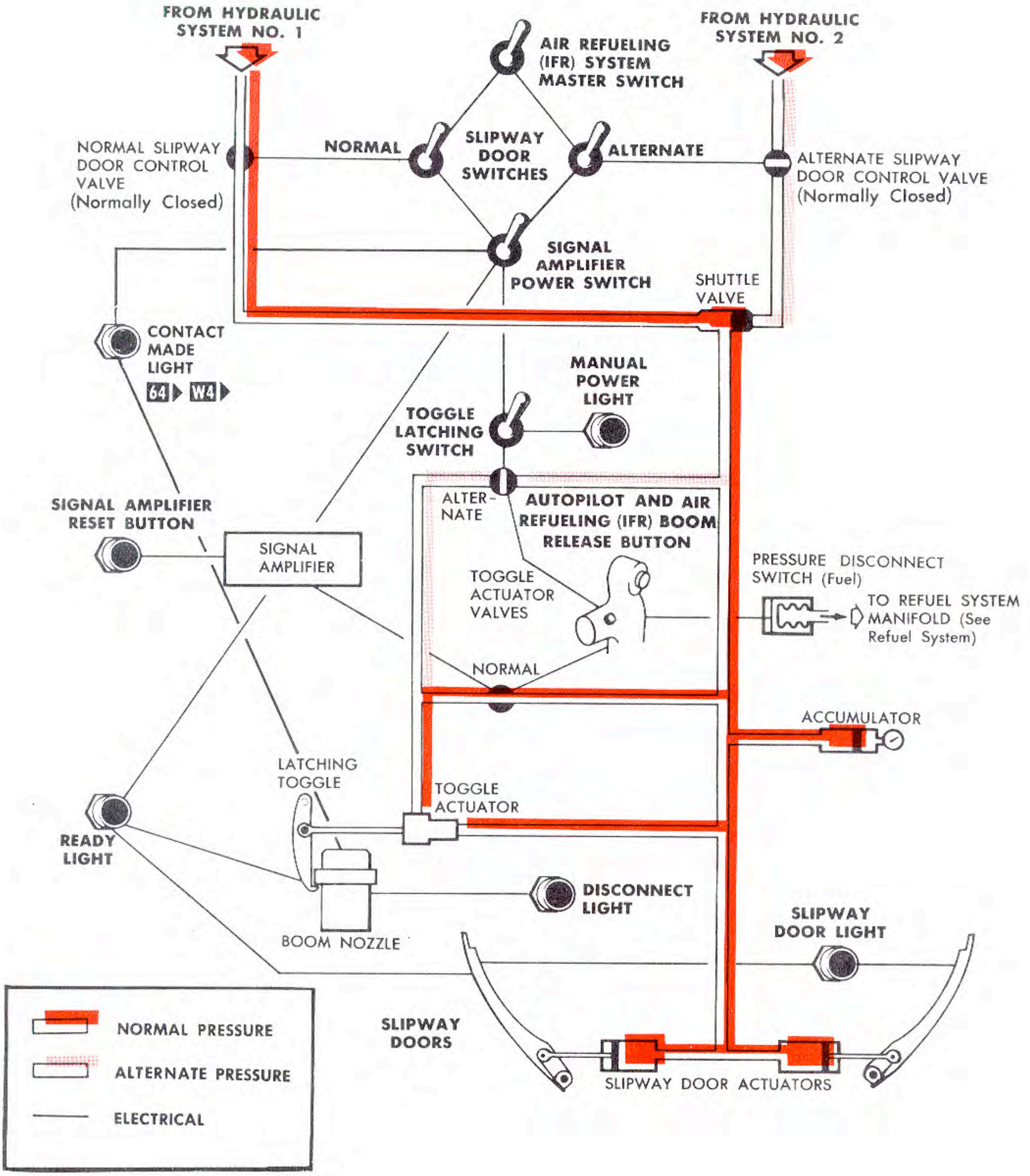
Signal Amplifier Power Switch

A signal amplifier power switch (6, figure 4-79), guarded on some aircraft, located on the air refueling panel has MANUAL--NORMAL positions. This switch controls power supplied to the signal amplifier and the actuation of the latching toggles which hold the boom in the air refueling receptacle. NORMAL position supplies TR power from a circuit breaker marked "Sig Ampl" through the master refuel switch to the signal amplifier which automatically controls operation of the latching toggles. MANUAL position deenergizes the signal amplifier and supplies TR power from a circuit breaker marked "Manual Control" on the "IFR" portion of the pilots' overhead circuit breaker panel to the manual power light and the toggle latching switch for manual operation of the latching toggles.



REFUEL SYSTEM (Typical)

Figure 4-77.



SLIPWAY DOOR SYSTEM

Figure 4-78.

Toggle Latching Switch

A toggle latching switch (5, figure 4-79), guarded on some aircraft, is located on the air refueling panel and has RELEASE--HOLD positions. This switch is supplied with TR power only when the signal amplifier power switch is in MANUAL position, and controls the latching toggles (normally controlled by the signal amplifier). In HOLD position, power is supplied to the manual toggle latching valve allowing the latching toggles to hold the boom in the air refueling receptacle. In RELEASE position, the toggles are released and allow the air refueling boom nozzle to be withdrawn from the receptacle. The latching toggles may also be released by pressing the air refueling disconnect button on the pilot's control wheel, copilot's control wheel, by high fuel pressure, or by brute force pull-outs. TR power is supplied to the toggle latching switch through a circuit breaker marked "Manual Control" on the "IFR" portion of the pilots' overhead circuit breaker panel.

Refuel Valve Switch

A refuel valve switch (8, figure 4-79), guarded on some aircraft, is located on the air refueling panel and has OPEN--CLOSE positions. This switch controls an air refueling shutoff valve located immediately downstream from the air refueling receptacle. In the CLOSE position, TR power is supplied to close the air refueling shutoff valve. In OPEN position, power is supplied to open the air refueling shutoff valve and to illuminate the refuel valve light. Power is supplied to the refuel valve switch at all times regardless of the position of the air refueling system master switch. TR power is supplied to the refuel valve switch through a circuit breaker marked "Fuel Valve & Hyd Pks Shutoff" on the "IFR" portion of the pilots' overhead circuit breaker panel.

Air Refueling Shutoff Valve Lever

An air refueling shutoff valve lever (2, figure 4-82), having OPEN--CLOSE positions, is provided for manual operation of the air refueling shutoff valve which is normally operated by the refuel valve switch. The lever is mounted directly on the valve which is located aft of a removable panel in the left side of the aft pressure bulkhead of the forward pressurized compartment. It is accessible from the lower deck of the control cabin. If the lever is operated manually to either the OPEN (inboard movement of handle) or CLOSED (outboard movement of handle) position, electrical operation may be resumed by running the valve motor to the position corresponding to the valve position using the refuel valve switch.

Slipway Doors Switches

Alternate and normal slipway doors switches (4, figure 4-79), guarded on some aircraft, with OPEN--CLOSE positions are provided on the air refueling panel. Power is supplied to these switches when the air refueling system master switch is in ON position. When the normal slipway door switch is in OPEN position, hydraulic pack No. 1 is started and TR power is supplied to the normal slipway door control valve which allows hydraulic pressure from system No. 1 to open the doors. When the normal slipway door switch is placed in CLOSE position, power is supplied to the normal slipway door control valve to close the doors. When the normal slipway door switch remains in CLOSE position, the hydraulic pack is shut down, no power is supplied to the valve, and the valve closes. The alternate slipway door switch functions similarly except that hydraulic system No. 2 and the alternate slipway door control valve are utilized. TR power is supplied to the slipway door switches through circuit breakers marked "Slipway Door" - "Normal" and "Alternate" on the "IFR" portion of the pilots' overhead circuit breaker panel.

CAUTION

To prevent overheating and possible failure of the hydraulic packs, do not fly with either slipway door switch in OPEN position for periods in excess of 30 minutes out of each hour unless the landing gear is extended. Adequate cooling for continuous operation of the packs is available only when the landing gear is extended.

NOTE

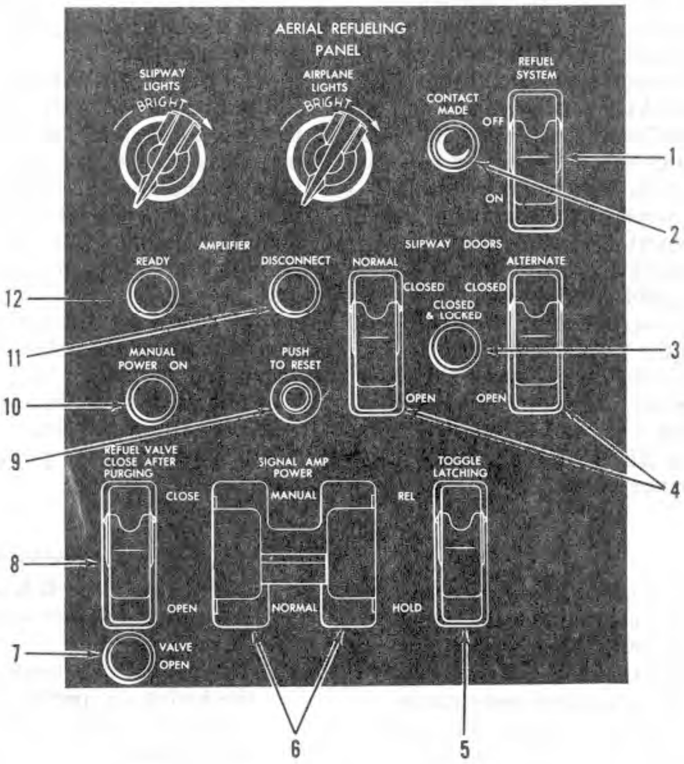
The alternate slipway door switch must be in CLOSE position for the normal slipway door switch to operate the doors properly.

Signal Amplifier Reset Button

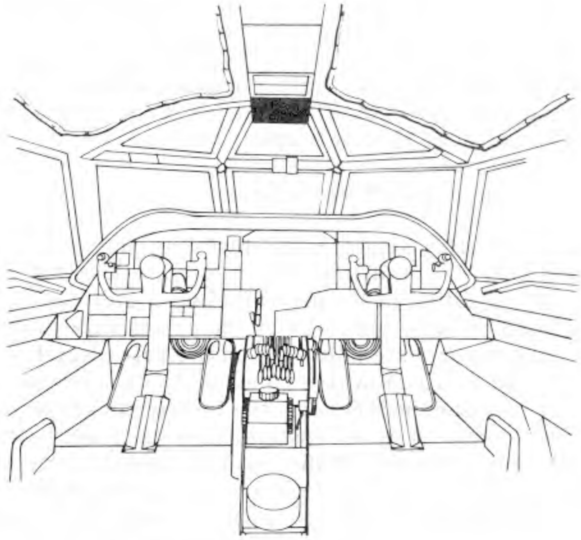
A push-to-reset signal amplifier reset button (9, figure 4-79) is located on the air refueling panel. When depressed after a disconnect has been accomplished, this button resets the automatic control circuit of the signal amplifier. After resetting, the air refueling system is ready for another contact.

NOTE

Upon occasion, the signal amplifier reset button will either fall out of or be pushed inside the air refueling panel when attempting to reset after a disconnect has occurred. Placing the air refueling system master switch to OFF, then back to ON will accomplish the same thing as pressing the reset button and the signal power amplifier will be in the "ready for contact" position.

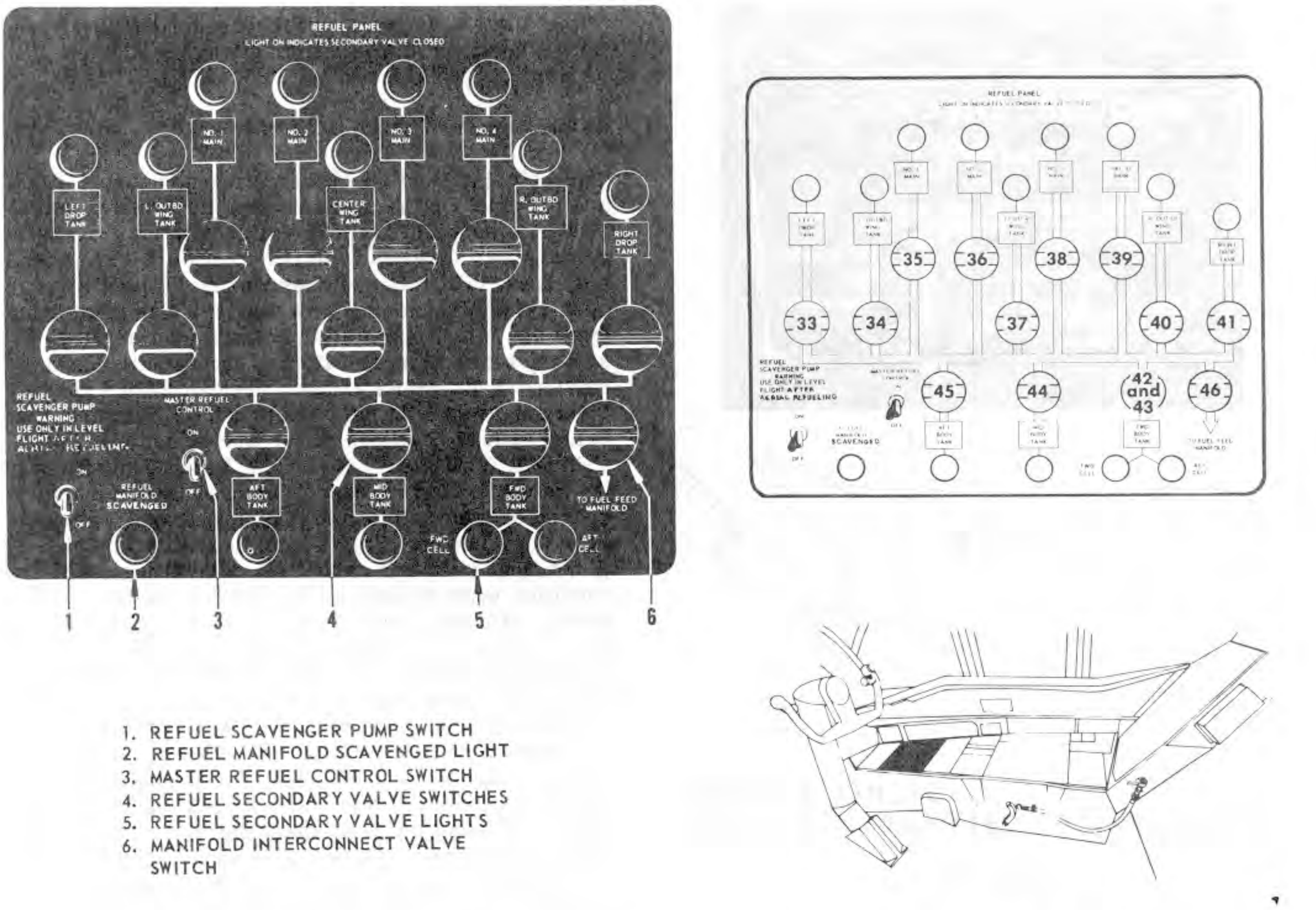


1. AIR REFUELING SYSTEM MASTER SWITCH
2. CONTACT MADE LIGHT 64 ▶ W4 ▶
3. SLIPWAY DOORS LOCKED LIGHT
4. SLIPWAY DOORS SWITCHES
5. TOGGLE LATCHING SWITCH
6. SIGNAL AMPLIFIER POWER SWITCH
7. REFUEL VALVE OPEN LIGHT
8. REFUEL VALVE SWITCH
9. SIGNAL AMPLIFIER RESET BUTTON
10. MANUAL POWER LIGHT
11. DISCONNECT LIGHT
12. READY LIGHT



AIR REFUELING PANEL (Typical)

Figure 4-79.



1. REFUEL SCAVENGER PUMP SWITCH
2. REFUEL MANIFOLD SCAVENGED LIGHT
3. MASTER REFUEL CONTROL SWITCH
4. REFUEL SECONDARY VALVE SWITCHES
5. REFUEL SECONDARY VALVE LIGHTS
6. MANIFOLD INTERCONNECT VALVE SWITCH

REFUEL PANEL (Typical)

Figure 4-80.

Master Refuel (Fuel) Control Switch

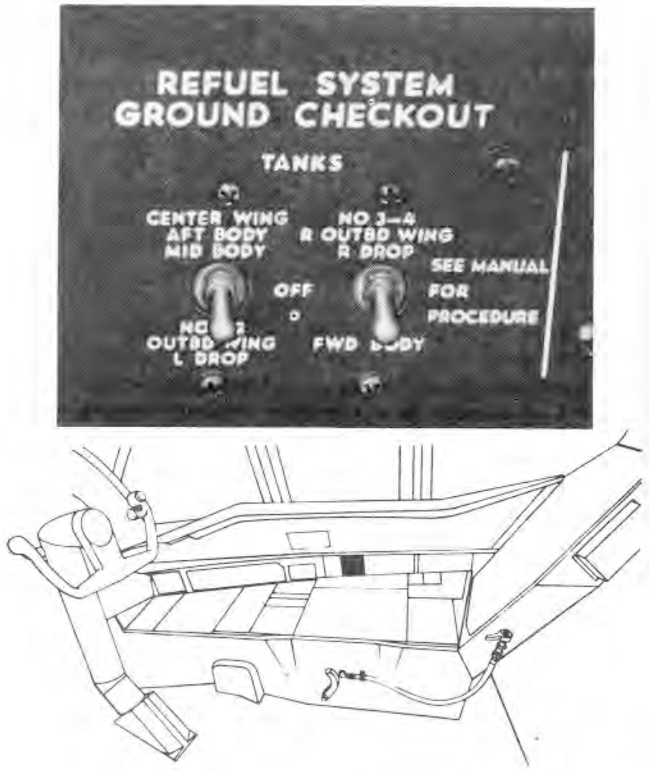
A master refuel control switch (3, figure 4-80) on the refuel panel has ON--OFF positions. In ON position, switched battery power is supplied to the refuel secondary valve switches, the fuel weight control relay, the fuel gage full by weight switch, and the refuel ground checkout switches. In OFF position, switched battery power is supplied through float switches to the main tank fuel level valves. Switched battery power is supplied to the master refuel control switch through circuit breakers marked "Master" - "Left" and "Right" on the "Fuel Level Control" portion of the copilot's circuit breaker panel. See "Fuel Supply System, " Section I, for additional information about this switch.

NOTE

Turning the master refuel control switch to ON position transfers float switch control of main tank fuel level to the refuel secondary valves in the refuel system. This will cause the main tank fuel level valves to remain in their last position. If these valves are closed at the time, no replenishing of the main tanks from the fuel transfer system will occur until the master refuel control switch is returned to OFF position.

Refuel Secondary Valve Switches

Twelve refuel secondary valve switches (4, figure 4-80) are on the refuel panel. The refuel secondary valve switch is in the VALVE OPEN position when



REFUEL GROUND CHECKOUT SWITCHES

Figure 4-81.

the white line on the refuel secondary valve switch is aligned with the flow lines on the refuel panel. When turned 90° to the line of flow, the switch is in VALVE CLOSED position and supplies TR power to close the refuel secondary valve which illuminates the corresponding refuel secondary valve light. Power is supplied to these switches only when the master refuel control switch is in ON position. TR power is supplied to the refuel secondary valve switches through circuit breakers marked "Master" - "Left" and "Right" on the "Fuel Level Control" portion of the copilot's circuit breaker panel.

Autopilot and Air Refueling (IFR) Boom Release Buttons

An autopilot and air refueling (IFR) boom release button (2, figure 1-32) is located on the pilots' control wheels. Depressing this button during air refueling operations will supply TR power to the signal amplifier which in turn deenergizes the toggle latching valve thus releasing the latching toggles. TR power is supplied to the release buttons through a circuit breaker marked "Disc" on the "IFR" portion of the pilots' overhead circuit breaker panel. Additional functions of this switch are covered under "Autopilot, " this section.

Refuel Ground Checkout Switches

Two refuel ground checkout switches (figure 4-81) are provided on the copilot's auxiliary side panel. Power is supplied to these switches when the master refuel control switch is in ON position. When operated, these checkout switches supply TR power to open refuel ground checkout valves which permit fuel from the refuel manifold to actuate the tank float switch, testing the operation of the refuel secondary valves. Each refuel ground checkout switch has three positions. In the center or OFF position, the refuel ground checkout valves are closed. In the CENTER WING, AFT BODY, MID BODY position, the refuel ground checkout valves of these tanks are opened provided the master refuel control switch is in ON position. This action floods the chamber of the float switch in each tank, simulating a full tank condition when refueling. In CENTER WING, AFT BODY, MID BODY position, the center wing, aft body, and mid body fuel tanks are checked. In No. 1-2, OUTBD WING, L DROP position, the No. 1 and 2 main fuel tanks, the outboard wing fuel tank, and left drop tank are checked. In FWD BODY position, the forward and aft cells of the forward body fuel tank are checked. In No. 3-4, R OUTBD WING, R DROP position, the No. 3 and 4 main fuel tanks, the right outboard wing fuel tanks, and the right drop tank are checked. TR power is supplied to the refuel ground checkout switches through circuit breakers marked "Ground Checkout" - "Fuel System" and "Refuel System" on the pilot's auxiliary circuit breaker panel.

NOTE

> The refuel ground checkout switches can be used during air refueling to check operation of the refuel secondary valves if absolutely necessary; however, their use in flight is not recommended. Use of these switches at such a time might cause a pressure disconnect or might, as a remote possibility, result in a refuel secondary valve failing closed. It is recommended therefore that refuel secondary valve operation be checked before flight while fueling through the single point ground refueling receptacle.

Refuel Scavenger Pump Switch

A refuel scavenger pump switch (1, figure 4-80) on the refuel panel has ON--OFF positions. In ON position, 118-volt single-phase a-c power is supplied to the refuel scavenger pump motor through the float switch in the refuel manifold and the fuel scavenge control relay. The refuel scavenger pump will automatically shut off when fuel has been exhausted from the refuel manifold; however, residual fuel may actuate the refuel manifold float switch and turn off the refuel manifold scavenged light during brief intermittent (5 to 10 seconds) intervals if the refuel scavenger pump switch is left in ON position. TR power is supplied to the refuel scavenger pump switch through a circuit breaker marked "Scavenge" on the "Fuel Level Control" portion of the copilot's circuit breaker panel.

NOTE

- If installed, the tank purge switch must be ON before placing the refuel scavenger pump switch in the ON position. When manifold scavenge is completed, turn tank purge switch to OFF.
- The refuel scavenger pump switch should be turned to OFF position after the amber refuel manifold scavenged light is illuminated.
- To ensure optimum scavenging after air refueling and when the aircraft is in level flight, fuel should be removed from the refuel manifold by the refuel scavenger pump.

Manifold Interconnect Valve Switch

A rotary manifold interconnect valve switch (6, figure 4-80) on the refuel panel controls switched battery power to the fuel manifold interconnect valve (No. 46). The switch is in VALVE OPEN position when the white line on the switch is aligned with flow lines on the refuel panel. In VALVE OPEN position, power is supplied to open the manifold interconnect valve which connects the refuel manifold with the crossfeed manifold and fuel feed system. When turned 90° to the line of flow, the switch is in VALVE CLOSED position and the valve prevents flow of fuel from the refuel manifold to the fuel feed system. TR power is supplied to the manifold interconnect valve switch through a circuit breaker marked "Body 46" on the "Fuel Transfer Valve Control" portion of the copilot's circuit breaker panel. For further information on the fuel feed system, see "Fuel Supply System," Section I.

Slipway Drain Valve and Handle

A manually operated slipway drain valve is installed in the drain line tee connection just forward of the celestial navigation station. The handle (3, figure 4-82) has OPEN--CLOSED positions and is lockwired in the OPEN position to provide continuous drainage of the receptacle cavity.

AIR REFUELING SYSTEM INDICATORS

Slipway Doors Locked Light

An amber slipway doors locked light (3, figure 4-79) on the air refueling panel is supplied TR power when the slipway doors are closed and locked and is off when the doors are either open or not locked. TR power is supplied to the slipway doors locked light through a circuit breaker marked "Fuel Valve & Hyd Pks Shutoff" on the "IFR" portion of the pilots' overhead circuit breaker panel.

Refuel Valve Light

A green refuel valve light (7, figure 4-79) is on the air refueling panel. When the air refueling shutoff valve is open, TR power is supplied to illuminate the refuel valve light. When the air refueling shutoff valve is closed, the light is out. TR power is supplied to the refuel valve open light through a circuit breaker marked "Fuel Valve & Hyd Pks Shutoff" on the "IFR" portion of the pilots' overhead circuit breaker panel.

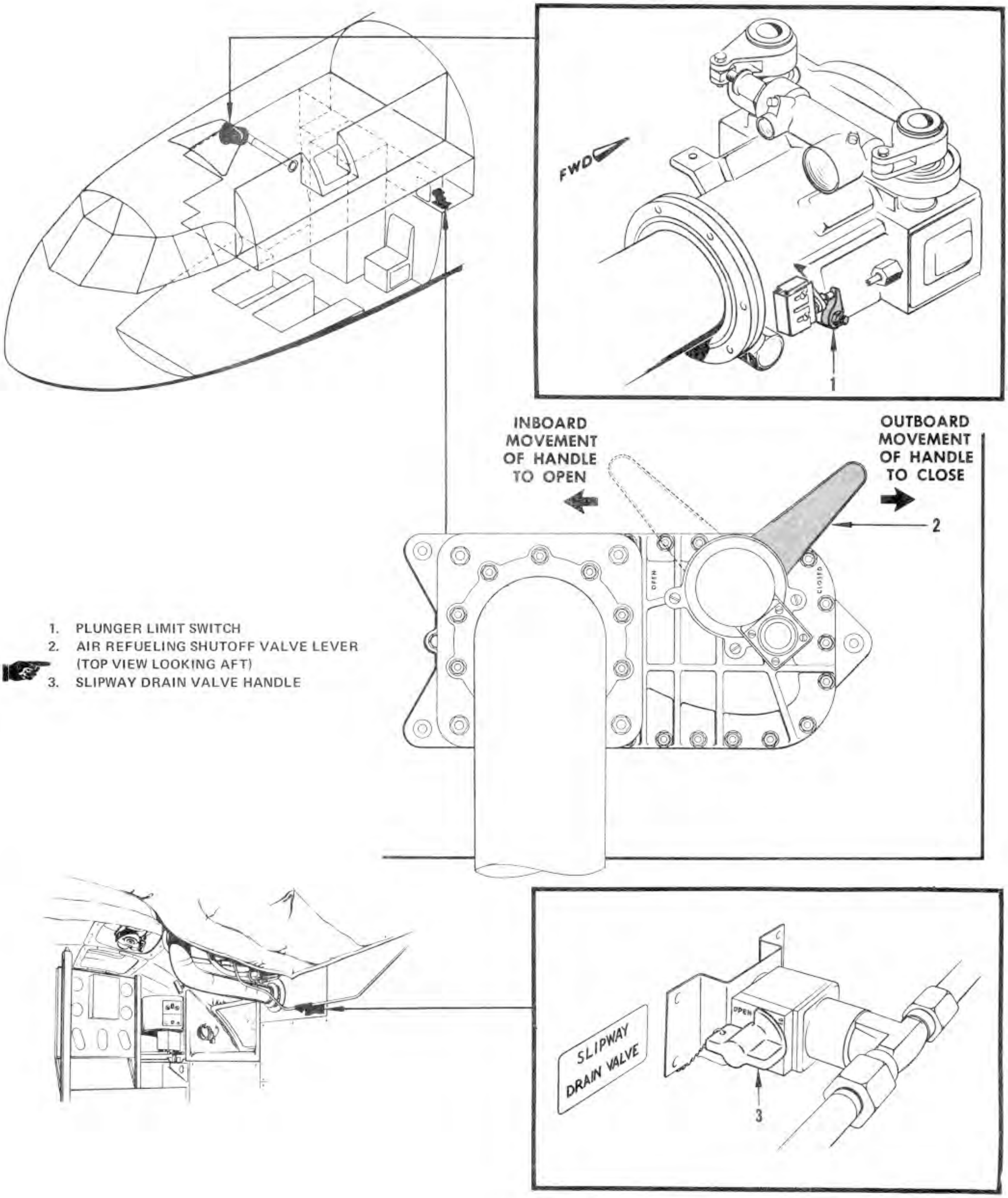
Ready Light

A blue ready light (12, figure 4-79) on the air refueling panel is supplied TR power when the air refueling system is ready for contact. The air refueling system master switch must be in ON, the slipway doors open, the signal amplifier power switch in ON, and the toggle latching switch in RELEASE position (if manual toggle latching is used) for power to be supplied to this light. Pressing the signal amplifier reset button or closing the slipway doors will cause the light to go out. TR power is supplied to the ready light through a circuit breaker marked "Sig Ampl" on the "IFR" portion of the pilots' overhead circuit breaker panel.

Contact Made Light

64▶ W4▶

A green contact made light (2, figure 4-79) on the air refueling panel indicates when the boom is locked into the receptacle. It is supplied TR power from the signal amplifier power switch during a normal contact, and from the IFR circuit breaker during a manual contact. When the air refueling boom nozzle is seated in the receptacle and the signal amplifier power switch is in MANUAL position, as the toggles are locked in place over the nozzle the ready light will go out and the contact made light will illuminate. TR power is supplied to the contact made light through a circuit breaker marked "Sig Ampl" on the "IFR" portion of the pilots' overhead circuit breaker panel.



1. PLUNGER LIMIT SWITCH
2. AIR REFUELING SHUTOFF VALVE LEVER (TOP VIEW LOOKING AFT)
3. SLIPWAY DRAIN VALVE HANDLE

AIR REFUELING SYSTEM MISCELLANEOUS CONTROLS

Disconnect Light

An amber disconnect light (11, figure 4-79) on the air refueling panel is supplied TR power when the air refueling boom has been disconnected from the receptacle after a contact has been made. TR power is supplied to the disconnect light through a circuit breaker marked "Disc" on the "IFR" portion of the pilots' overhead circuit breaker panel.

Manual Power Light

An amber TR powered manual power light (10, figure 4-79) on the air refueling panel is illuminated when the signal amplifier power switch is in MANUAL position, provided the air refueling system master switch is ON. The manual power light is out when the signal amplifier power switch is in NORMAL position. TR power is supplied to the manual power light through a circuit breaker marked "Manual Control" on the "IFR" portion of the pilots' overhead circuit breaker panel.

Refuel Secondary Valve Lights

Thirteen amber refuel secondary valve lights (5, figure 4-80) are on the refuel panel. These switched battery powered lights are illuminated when the corresponding refuel secondary valve is closed. The refuel secondary valve light is out when the refuel secondary valve is open. Switched battery power is supplied to the refuel secondary valve lights through circuit breakers marked "Master" - "Left" and "Right" on the "Fuel Level Control" portion of the copilot's circuit breaker panel.

Refuel Manifold Scavenged Light

An amber refuel manifold scavenged light (2, figure 4-80) on the refuel panel is supplied TR power when the float switch in the refuel scavenger line indicates the refuel manifold is free of fuel. TR power is supplied to the light through a circuit breaker marked "Scavenge" on the "Fuel Level Control" portion of the copilot's circuit breaker panel.

AIR REFUELING SYSTEM NORMAL OPERATION

CAUTION

Do not open the manifold interconnect valve switch (valve 46) on the refuel panel while refueling.

NOTE

Aviation gasoline and JP-4 fuel mixed in any proportion are suitable for continuous operation from an engine performance standpoint. However, the use of aviation gasoline must be restricted to air refueling operations and to emergency evacuation ferry-type missions to minimize undesirable lead depositis in the engines. "Rate of Climb Limitations with Emergency Fuel (Aviation Gasoline)" under "Fuel Grade Properties and Limits," Section V, must be observed when applicable.

Air Refueling System Check (Pilot Reads)

INTERIOR CHECK. The following preflight will be accomplished after external power is connected to the aircraft, the landing gear standby pumps are on, and the bypass keys are removed. This check may be performed after maintenance or a reported malfunction has occurred, time and conditions permitting, and at the discretion of the flight crew.

1. Air Refueling System Master Switch - ON (CP)
2. Refuel Valve Switch - OPEN, light on (CP)

Check that refuel valve green indicator light illuminates.

3. Signal Amplifier Power Switch - NORMAL (CP)
4. Normal Slipway Door Switch - OPEN, Ready light on (CP)

When slipway doors are open, the amber slipway door locked light will be out and the blue ready light will illuminate when the slipway doors are fully open.

NOTE

The pilot must wait 30 seconds after the blue ready light is illuminated to allow sufficient warmup time for the signal amplifier before proceeding with the next steps.

5. Plunger Limit Switch - Depressed, toggles engaged (EW)

The EW officer depresses the plunger limit switch on pilot's request and observes toggle actuator operation. Blue ready light will go out and the green contact made light will illuminate (if installed), indicating contact made and toggles engaged.

NOTE

When operating the plunger limit switch, the EW officer should check the actuator and spring for operation by pulling down on the actuator arm. For the remaining checks, the EW officer need only push the limit switch.

6. Plunger Limit Switch - Released, toggles disengaged (EW)
EW officer releases signal switch plunger and toggle actuator will return to the release position. Amber disconnect light will illuminate and the green contact made light will go out (if installed).
7. Signal Amplifier Reset Button - Depressed (CP)
Push and release signal amplifier reset button and check ready light illuminated.
8. Plunger Limit Switch - Depressed, toggles engaged (EW)
EW officer holds plunger limit switch in depressed position and observes toggle actuator operation. Blue ready light will go out and the green contact made light will illuminate (if installed), indicating contact made and toggles engaged.
9. Pilot's Boom Release Button - Depressed (P); Toggles disengaged (EW)
Pilot depresses boom release button on control wheel. The amber disconnect light will illuminate and the green contact made light will go out (if installed), indicating the toggles are in the released position. EW officer checks toggle release action and continues to hold the plunger limit switch depressed.
10. Signal Amplifier Reset Button - Depressed (CP); Toggles engaged (EW)
Copilot depresses and then releases the amplifier reset button. The blue ready light will blink on then will go out and the green contact made light will illuminate (if installed), indicating contact made and toggles engaged. EW officer observes toggle actuator operation.

NOTE

The toggles will engage as soon as the copilot releases the signal amplifier reset button because the EW officer is still holding the plunger limit switch depressed.

11. Copilot's Boom Release Button - Depressed (CP); Toggles disengaged (EW)
Copilot depresses boom release button on control wheel. The amber disconnect light will illuminate and the green contact made light will go out (if installed), indicating the toggles are in the released position. EW officer checks toggle release action.
12. Plunger Limit Switch - Released (EW)
13. Normal Slipway Door Switch - CLOSE(D), slipway door locked light on (CP)
Amber slipway door locked light will illuminate when doors are fully closed.
14. Alternate Slipway Door Switch - OPEN, ready light on (CP)
Amber slipway door locked light will go out and blue ready light will illuminate when the doors are fully open.
15. Signal Amplifier Power Switch - MANUAL (CP)
The amber manual power light will illuminate and the blue ready light will illuminate when the toggle latching switch is in the release position.
16. Toggle Latching Switch - HOLD (CP); Toggles engaged (EW)
The blue ready light will go out. EW officer checks toggle engage action.
17. Pilot's Boom Release Button - Depressed (P); Toggles disengaged (EW)
Pilot depresses boom release button on control wheel; amber disconnect light will illuminate. EW officer checks toggle release action.

NOTE

If the pilot's and copilot's boom release buttons function properly when the signal amplifier switch is in NORMAL position, it is unnecessary to check the copilot's boom release button with the signal amplifier switch in MANUAL.

18. Toggle Latching Switch - RELEASE (CP)
19. Signal Amplifier Power Switch - NORMAL (CP)
20. Refuel Valve Switch - CLOSE (CP)
When the switch is in CLOSE position, green refuel valve light will go out.
21. Alternate Slipway Door Switch - CLOSED, slipway door locked light on (CP)
The amber slipway door locked light will illuminate when the doors are fully closed.
22. Air Refueling System Master Switch - OFF (CP)

CAUTION

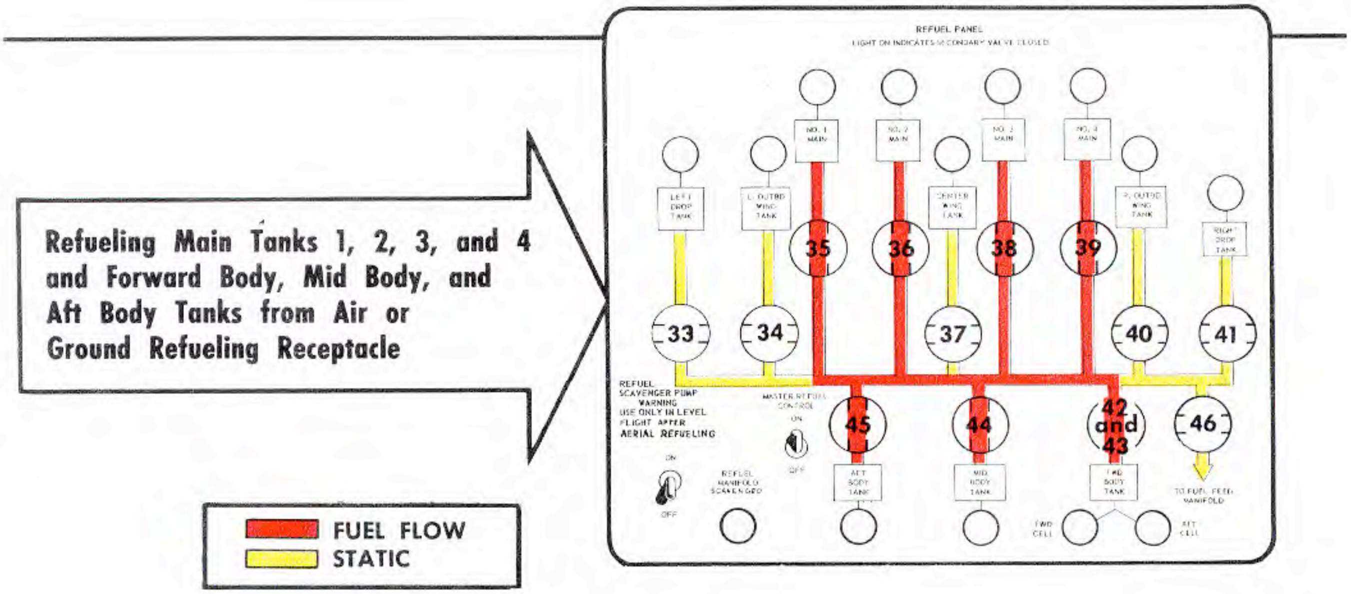
If the air refueling system master switch is turned OFF before the slipway doors locked light illuminates, the doors will remain in an unlocked or intermediate position.

23. Air Refueling Accumulator Preload - Checked (EW) EW officer checks air refueling accumulator located on sidewall of upper deck above ladder.
24. Hydraulic Leaks - Checked (EW)

AIR REFUELING FUEL MANAGEMENT

Fuel Distribution Prior to Air Refueling

The distribution of fuel prior to air refueling will affect the wing structural life and also affect the time required for contact. The primary consideration for improved wing fatigue life is to maintain or fill the wing tanks prior to refueling the body and center wing tanks. The recommended procedure provides for refueling the main wing and body tanks prior to using fuel from the slower filling outboard wing or drop tanks. Seven tanks will be open to admit fuel during most of the refueling period, providing a capacity of up to 140,000 pounds. In general, the body



AIR REFUELING FUEL MANAGEMENT

Figure 4-83.

tank refueling should be made in the reverse order of use so that the applicable steps of the normal fuel usage sequence can be followed after refueling.

WARNING

> To avoid flutter, all outboard wing tank fuel must be used prior to using fuel from full drop tanks in accordance with normal fuel usage sequence. If normal fuel sequence cannot be followed, do not exceed the lower airspeed and Mach number flutter limitation given in Section V. If the EWO fuel sequence is used, the lower airspeed flutter limitation must be observed until all drop tank fuel is used.

Recommended Air Refueling Procedure

A. The following procedure is recommended for refueling prior to use of outboard and center wing fuel in the normal fuel sequence (no missiles or external conventional munitions):

1. Prior to refueling contact, determination of fuel quantity distribution should be based on the following:

a. Determine the net transfer by subtracting fuel to be used during contact from the gross tanker off-load.

b. Approximately 5000 pounds of fuel will be required to refuel the main tanks from the transfer level to the 100% full level. In addition, fuel burned during refueling will be used from the main wing tanks and automatically replenished.

c. The maximum body tank capacity available for refueling may be determined by subtracting the aircraft gross weight with forward, mid, and aft body tanks empty and all other tanks full from the desired gross weight after refueling. The fuel distribution in the body tanks during refueling must be planned to maintain the aircraft cg within structural limits.

d. In the event net transfer is in excess of 5,000 pounds plus the body tank capacity determined above, additional capacity of up to 16,000 pounds may be attained by using main tank fuel equally until main tanks 1 and 4 are at the 10,000-pound level. This fuel is used after step 4 and just prior to contact.

NOTE

> Main tanks 1 and 4 should not be used to less than 10,000 pounds in each tank. At this time, main tanks 2 and 3 will be at approximately 12,500 pounds each.

2. Fuel use prior to refueling:

a. Use normal fuel sequence through step 4.

b. Main tanks equally to no less than 10,000 pounds in each of main tanks 1 and 4. At this time, mains 2 and 3 will be at approximately 12,500 pounds each.

NOTE

> If fuel available using this procedure is insufficient to reach planned ARCP, use procedures outlined in "B." below.

3. The following procedure should be observed during refueling:

a. Refuel the mains and body tanks simultaneously maintaining cg within acceptable structural limits. Leave the main tank refuel valve switches open until refueling is completed to replenish fuel used during contact.

NOTE

Due to armament load or deactivated tanks, it may be necessary to maintain a specific fuel quantity differential between the forward and aft body tanks.

During refueling, do not transfer fuel to the main tanks through the fuel transfer system. Monitor all fuel quantities on tanks which are not to be completely filled. Turn the secondary valve switch to VALVE CLOSED position when the required fuel quantity is reached. The engines will receive fuel directly from the main tanks during refueling.

CAUTION

The copilot must monitor the fuel quantity indicators during air refueling to insure lateral and cg control. The forward or aft body tank refuel valves should be opened or closed as necessary to avoid exceeding the cg limits during refueling. The fuel loading and structural limits are found in Section V.

B. The following procedure is recommended for refueling after use of any center wing, outboard, or drop tank fuel through step 7 in the normal fuel sequence (no missiles or external conventional munitions):

1. Fuel use prior to refueling:

a. Normal sequence through steps 5, 6, or 7.

b. Main tanks equally to no less than 8000 pounds in each of main tanks 1 and 4. At this time, mains 2 and 3 will be at approximately 10,500 pounds each.

2. The following sequence should be observed for refueling:

a. Refuel simultaneously the mains, outboards, and drop tanks. If the planned on-load is not sufficient to fill the mains and drop tanks, do not refuel the outboard wing tanks because of flutter speed restrictions incurred with partial outboard and drop tank fuel.

b. When mains 2 and 3 are near full, open the center wing and body tanks and continue simultaneous refueling to desired on-load.

c. If the outboards and drop tanks are not full when contact has been completed, complete filling of these tanks by transfer of fuel from the body tanks through valve 46. Adjust body and center wing fuel during transfer so that the normal fuel sequence can be followed. Use main tank fuel to the engines. Do not use main tank fuel to less than 10,000 pounds in each of mains 1 and 4 during this transfer.

NOTE

If the gross weight after refueling will exceed 395,000 pounds with mains and drop tanks full, the outboard wing tank fuel quantity should be in accord with the structural limitations outlined in Section V.

3. After refueling, return to the normal fuel usage sequence or to the EWO fuel usage sequence if drop tanks are to be jettisoned. See "Fuel System Management," Section VII.

C. The air refueling of aircraft carrying two AGM-28 missiles or external conventional munitions should be accomplished using the same general procedures outlined in the preceding paragraphs. However, there are some additional restrictions on body tank fuel quantities and tank filling combinations which must be observed in order to preclude the possibility of exceeding the forward structural cg limits during fuel usage after refueling.

1. The following should be accomplished when refueling prior to using outboard and center wing fuel:

a. When all body fuel has been consumed, use main tank fuel equally to no less than 6000 pounds in each of mains 1 and 4.

b. Refuel the mains, mid, and aft body tanks simultaneously until the aft body fuel level is at 5000 pounds, then open the forward body tank valve.

c. When the mains are full, continue refuel of the forward, mid, and aft body tanks to desired gross weight. Maintain the aft body tank at a minimum of 5000 pounds more than the forward body tank.

CAUTION

The aft body tank must be refueled to 5000 pounds prior to refueling the empty forward body tank.

2. The following should be accomplished when refueling after use of center wing, outboard, or drop tank fuel.

a. Prior to refueling, use main tank fuel equally to no less than 6000 pounds in each of mains 1 and 4 with the sequence for missile launch (figure 7-5). Use main tank fuel equally to no less than 8000 pounds in each of mains 1 and 4 for the sequence without missile launch (figure 7-4).

b. Refuel simultaneously the mains, outboards, and drop tanks. When mains 2 and 3 are near full, open the center wing tank and continue simultaneous refuel of center wing, outboard, and drop tanks, or center wing and drops as applicable, with mains 1 and 4.

c. When mains 1 and 4 are near full, open the mid and aft body tanks. When the aft body is at 5000 pounds, open the forward body tank and continue refuel to desired gross weight. Maintain the aft body tank at a minimum of 5000 pounds more than the forward body tank.

d. If the outboard wing and drop tanks are not full when refueling has been completed, fill these tanks by transfer of fuel from the body tanks through valve 46. Adjust body and center wing fuel during this transfer so that the applicable fuel sequence can be followed when transfer has been completed.

WARNING

With partial outboard and drop tank fuel, do not exceed the lower airspeed and Mach number flutter limitations given in Section V.

NOTE

If the gross weight after refueling will exceed 395,000 pounds with mains and drop tanks full, the outboard wing tank fuel quantity should be in accord with the structural limitations outlined in Section V.

D. Air refueling procedures with drop tanks off or on and empty.

NOTE

The distribution of fuel prior to air refueling will affect the wing structural life and also affect the time required for contact. The primary consideration for wing fatigue life is to maintain or fill the wing tanks prior to refueling the body and center wing tanks. The recommended procedures provide for refueling the main wing and body tanks prior to using fuel from the slower filling outboard wing tanks. In general, the body tanks are refueled simultaneously so that the drop tanks off or on and empty fuel usage sequences can be followed after refueling.

WARNING

The maximum allowable in-flight gross weight with drop tanks off is 370,000 pounds and with drop tanks on and empty is 375,000 pounds.

1. Recommended air refueling procedure (no missiles or external conventional munitions):

a. In order to accomplish air refueling with a minimum reduction in wing fatigue life, the following procedure is recommended for refueling prior to use of outboard wing fuel:

(1) Prior to refueling contact, determination of fuel quantity distribution should be based on the following:

(a) Determine the net transfer by subtracting fuel to be used during contact from the gross tanker offload.

(b) Approximately 5,000 pounds of fuel will be required to refuel the main tanks from the transfer level to the 100% full level. In addition, fuel burned during refueling will be used from the main wing tanks and automatically replenished.

(c) The maximum body tank capacity available for refueling may be determined by subtracting the aircraft gross weight with mains and outboard wing tanks full and the maximum required center wing ballast fuel from the desired gross weight after refueling or the maximum allowable gross weight, whichever is less. The fuel distribution in the body tanks during refueling must be planned to maintain the aircraft cg within structural limits.

(d) In the event net transfer is in excess of 10,600 pounds plus the body tank capacity determined above, additional capacity of up to 32,000 pounds may be attained by using main tank fuel equally until main tanks 1 and 4 are at the 6,000 pound level. This fuel is used after step 4 (step 5 if operating weight cg is forward of 31% MAC) and just prior to contact.

NOTE

Main tanks 1 and 4 should not be used to less than 6,000 pounds in each tank. At this time, main tanks 2 and 3 will be approximately 8,500 pounds each.

(2) Use fuel prior to refueling in the following order:

(a) 8% main tanks.

(b) Aft body (until equal to forward body) to main tanks 1, 2, 3, and 4.

(c) Aft body to main tanks 1 and 2; forward body to main tanks 3 and 4.

(d) Mid body to main tanks 1, 2, 3, and 4.

(e) Center wing to main tanks 1, 2, 3, and

NOTE

For aircraft with operating weight (basic weight plus crew and oil) cg aft of 31% MAC, retain center wing ballast fuel (figure 7-10).

(f) Main tanks equally to no less than 6,000 pounds in each of main tanks 1 and 4.

(3) The following sequence should be observed during refueling:

(a) Refuel the main wing tanks simultaneously until near full. To avoid a pressure disconnect, the necessary body tank valves should be opened for refueling when any main tank is full and the other main tanks are still receiving fuel. Leave the main tanks open until refueling is completed to replenish fuel used during contact.

(b) Simultaneously refuel the aft and mid body tanks. Refuel as required, maintaining cg within acceptable structural limits. When the aft body fuel quantity has reached 5,000 pounds, open the forward body tank and continue simultaneous refuel of forward, mid, and aft body tanks. If the forward body tank is filled before fuel transfer is completed, continue refueling the mid and aft body tanks. Refuel these tanks as required, maintaining cg within acceptable structural limits.

NOTE

Due to armament load, it may be necessary to maintain a specific fuel quantity differential between the forward and aft body tanks.

b. During refueling, do not transfer fuel to the main tanks through the fuel transfer system. Monitor all fuel quantities on tanks which are not to be completely filled. Turn the secondary valve switch to VALVE CLOSED position when the required fuel quantity is reached. The engines will receive fuel directly from the main tanks during refueling.

CAUTION

The copilot must monitor the fuel quantity indicators during air refueling to insure lateral and cg control. The filling rate and location of the forward body tanks makes it possible to exceed the forward cg limits if the copilot fails to open and close valves as necessary to control rate of transfer. The fuel loading and structural limits are found in Section V.

2. Recommended air refueling procedure (two AGM-28 missiles or with external conventional munitions):

a. The air refueling of aircraft carrying two AGM-28 missiles or external conventional munitions should be accomplished using the same general procedures outlined in the preceding paragraphs. However, there are some additional restrictions on body tank fuel quantities and tank filling combinations which must be observed in order to preclude the possibility of exceeding the forward structural cg limits during refueling.

(1) Use fuel prior to refueling in the following order:

(a) 8% mains

(b) Aft body (until equal to forward body plus ballast) to mains 1, 2, 3, and 4.

(c) Aft body to mains 1 and 2; forward body to mains 3 and 4.

(d) Mid body to mains 1, 2, 3, and 4.

(e) Aft body to mains 1, 2, 3, and 4 (use ballast fuel retained in steps 2 and 3).

(f) Main tanks equally to no less than 6,000 pounds in each of mains 1 and 4.

(2) The following sequence should be observed during refueling:

(a) Refuel the main tanks simultaneously until near full, then open body tanks as specified below. Leave main tank refuel valves open until refueling is completed to replenish fuel used during contact.

(b) Open the mid and aft body tank valves and continue refuel until the aft body tank fuel level is at 10,000 pounds, then open the forward body tank valve.

(c) Refuel the forward, mid, and aft body tanks until the forward body is at 20,000 pounds. Close forward body tank valve and continue refuel of mid and aft body tanks to desired gross weight.

CAUTION

- The aft body tank must be refueled to 10,000 pounds prior to refueling the empty forward body tank.
- The aft body tank fuel quantity must be a minimum of 10,000 pounds greater than the forward body quantity when refueling has been completed.
- The forward body tank fuel quantity must be limited to 20,000 pounds.

AIR REFUELING SYSTEM EMERGENCY OPERATION

Emergency Operation of Slipway Doors

Failure of hydraulic system No. 1 will prevent actution of the slipway doors from the normal system. In such an emergency, place the alternate slipway door switch in OPEN position to operate the slipway doors. Hydraulic pressure is supplied from hydraulic system No. 2 with the alternate slipway door switch in OPEN position. If both hydraulic packs No. 1 and 2 fail and the landing gear is up and locked, hydraulic pressure for the air refueling system can be obtained from either No. 1 or 2 standby pump. With the standby pumps switch for the landing gear in ON position, pressure is supplied from the No. 1 standby pump by pulling the left forward landing gear normal control circuit breaker on the pilot's circuit breaker panel and placing the normal slipway door switch to OPEN position. Pressure from the No. 2 standby pump, if needed, can be obtained by pulling the right forward landing gear normal control circuit breaker and placing the alternate slipway door switch to OPEN position.

NOTE

Upon completion of the air refueling operation, reset the landing gear normal control circuit breaker and return the landing gear standby pumps switch to OFF position.

Emergency Operation of Air Refueling Shutoff Valve

The air refueling shutoff valve (figure 4-82) on the pressure bulkhead aft of the radar navigator's station is operated by a 24-volt d-c motor. If this motor should fail in the closed position, it would be impossible to receive fuel from a tanker until the valve was manually placed in OPEN position. If the air refueling shutoff valve is to be manually operated, pull the "Fuel Valve & Hyd Pks Shutoff" circuit breaker located on the "IFR" portion of the pilots' overhead circuit breaker panel since the valve motor may tend to resist valve movement when the air refueling shutoff valve lever is actuated. To manually place the valve in OPEN, the control lever must be moved in a counterclockwise position (inboard). To close the valve, move the control lever in a clockwise direction (outboard).

AIR REFUELING OPERATION

For further air refueling information and checklists, refer to T.O. 1-1C-1 and T.O. 1-1C-1-5.

SINGLE POINT GROUND REFUELING SYSTEM

A single point ground refueling receptacle (20, figure 1-57) is provided to allow filling of all aircraft fuel tanks from a single point. Single point servicing of the fuel system reduces the time and amount of equipment required during fuel servicing of the aircraft. The receptacle in the right forward wheel well baffle is accessible through a filler cap. The nozzle adapter of the receptacle contains a spring-loaded poppet which is opened by the fuel nozzle and seals the filler opening when the nozzle is withdrawn. The single point refueling receptacle is connected directly to the refuel manifold and fuel flows in the same manner as in air refueling (figure 4-77). The refuel panel (figure 4-80) on the copilot's side panel includes the controls necessary for operation of the refuel system valves. See "Air Refueling System," this section, for information on these controls.

EW OFFICER'S EJECTION SEAT

The EW officer is provided with an upward ejection seat the same as the pilot's upward ejection seat (figure 1-53). The controls are operated in the same manner as the pilot's seat controls and the sequence of operation of the seat ejection system is the same as the pilot's with the exception of not having a control column stowage thruster. For a detailed description of the upward ejection seats, see "Upward Ejection Seats," Section I.

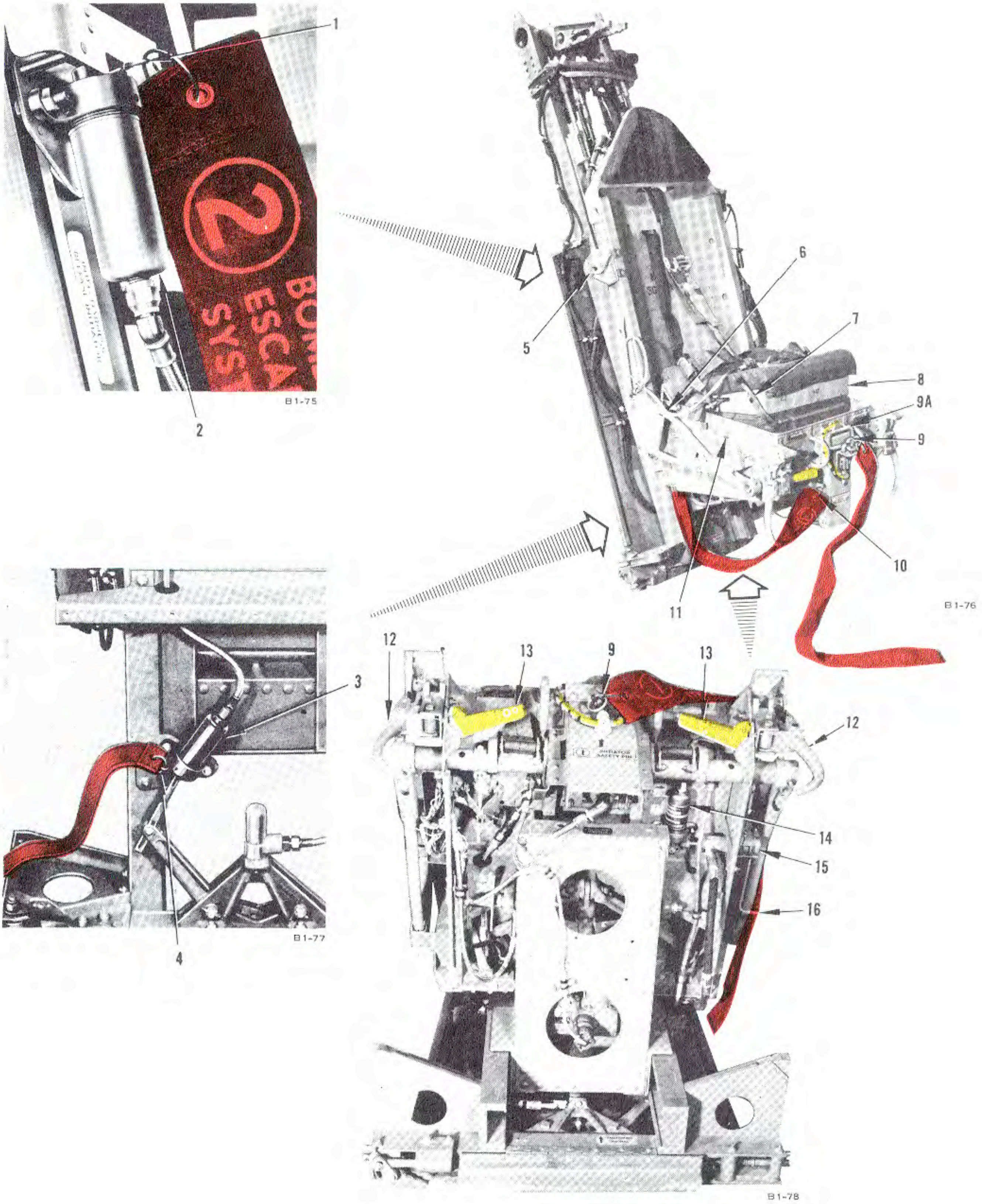
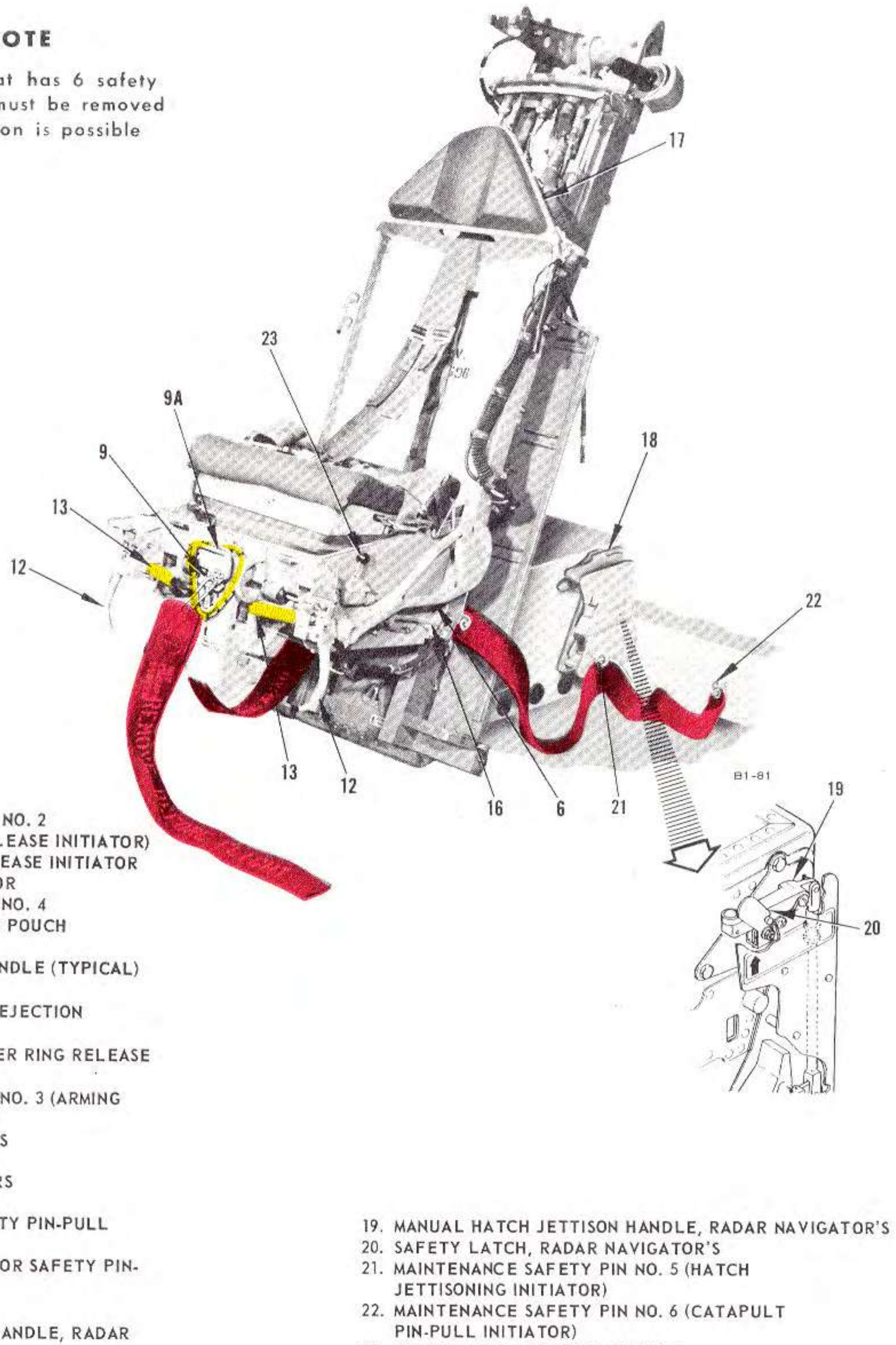


Figure 4-84 (Sheet 1 of 2).

NOTE

This type seat has 6 safety pins which must be removed before ejection is possible



1. MAINTENANCE SAFETY PIN NO. 2 (AUTOMATIC LAP BELT RELEASE INITIATOR)
2. AUTOMATIC LAP BELT RELEASE INITIATOR
3. SEAT POSITIONING INITIATOR
4. MAINTENANCE SAFETY PIN NO. 4
5. NO. 1 SAFETY PIN STOWAGE POUCH
6. LEG GUARD
7. SURVIVAL KIT RELEASE HANDLE (TYPICAL)
8. MD-1 SURVIVAL KIT
9. FLIGHT SAFETY PIN NO. 1 (EJECTION CONTROL RING)
9A. EJECTION CONTROL TRIGGER RING RELEASE MECHANISM PIN
10. MAINTENANCE SAFETY PIN NO. 3 (ARMING INITIATOR)
11. SEAT POSITIONING SWITCHES
12. ANKLE RESTRAINTS
13. ANKLE RESTRAINT TRIGGERS
14. CATAPULT INITIATOR
15. CATAPULT INITIATOR SAFETY PIN-PULL CYLINDER
16. MANUAL CATAPULT INITIATOR SAFETY PIN-PULL HANDLE
17. HEADREST
18. MANUAL HATCH JETTISON HANDLE, RADAR NAVIGATOR'S
19. MANUAL HATCH JETTISON HANDLE, RADAR NAVIGATOR'S
20. SAFETY LATCH, RADAR NAVIGATOR'S
21. MAINTENANCE SAFETY PIN NO. 5 (HATCH JETTISONING INITIATOR)
22. MAINTENANCE SAFETY PIN NO. 6 (CATAPULT PIN-PULL INITIATOR)
23. INERTIA REEL CONTROL HANDLE

DOWNWARD EJECTION SEAT (Typical)

Figure 4-84 (Sheet 2 of 2).

DOWNWARD EJECTION SEATS

The navigator and radar navigator are provided with downward ejection seats (figure 4-84). The radar navigator's seat is positioned over an escape hatch and the navigator's seat is positioned over the main entry hatch. Both seats position automatically for ejection. The ejection control trigger ring located on the front of the seat initiates the ejection cycle. One continuous pull on the ejection control ring will sequence a series of ballistic devices and mechanical linkages incorporated in the seat to rotate the leg guards, lock the inertia reel, position the seat, jettison the hatch, and fire the catapult to eject the seat from the aircraft. Ankle restraints are provided to keep the legs in position during ejection. The ankle restraints are spring loaded and may be kicked free any time after they are closed. In event they are accidentally triggered, they may be reset by pushing downward and outward on either restraint until pivot arms and restraints are locked.

Each seat can be positioned electrically up and down, fore and aft, and tilted by seat positioning switches during normal use. The fore and aft adjustment is accomplished by two electric actuators, one at the top and one at the bottom of the seat. The back is tilted by operation of the upper actuator only. Electrical, oxygen, and ballistics lines are provided with disconnects to permit separation of the lines when the seat is ejected. The seat is equipped with a headrest and an inertia reel which assist the occupant in maintaining position during ejection. The downward ejection seat accommodates a survival kit and a back-type parachute and is equipped with an automatic opening safety belt. Utilizing the wrong seat cushions and/or survival kit or too much cushioning material does not provide comfort, but actually creates a definite injury hazard and may position the seat occupant where it is difficult to reach the controls. Chance of vertebral injury upon impact of crash landing or ditching is increased considerably by sitting on too thick a compressible mass. The added cushioning may also permit the seat occupant to sink far enough down to loosen the shoulder straps, allowing the seat occupant to slump forward, possibly incurring severe back injury. It may raise the seat occupant to such a height that the leg restraints will not restrain his legs, thus exposing them to possible injury from flailing in the windblast following ejection. See "Automatic Opening Safety Belts and Automatic Parachute," this section, for additional information. For a detailed discussion of seat ejection sequences, see "Escape Systems Operation," Section VII.

WARNING

- Should a downward ejection hatch be inadvertently dropped, the ejection seat at that station will be armed and can be fired.
- Do not use any form of shock absorbing device other than the survival kit and/or seat cushion designated as standard equipment for the ejection seat. To do so would create a definite possibility of serious injury during ejection and/or crash landing/ditching.

MAN-SEAT SEPARATOR

The seats are equipped with a man-seat separator that insures positive controlled separation of crew members occupying downward seats during ejection. Two nylon straps are installed in the seat under the survival kit and parachute. A reel-type ballistic actuator and jackshaft are installed on the back of the seat. The nylon straps are attached to the jackshaft driven by the reel-type ballistic actuator. The actuator is connected by ballistic hose to the automatic opening safety belt ballistic actuation system. After the automatic opening safety belt is released, the straps are pulled tight, forming one side of a triangle, the other two sides of which form the seat back and bottom. As the straps are pulled tight, they throw the man clear of the seat automatically. The man-seat separator separates the man from the seat 0.3 second after ejection. More time than this is needed to decelerate the man to an acceptable parachute deployment velocity and is provided by the parachute timer when the zero delay lanyard is not used.

WARNING

Do not connect zero delay lanyard to parachute ripcord T-handle when using seat equipped with a man-seat separator.

DOWNWARD EJECTION SEAT CONTROLS

Leg Guards

The leg guards (6, figure 4-84) are positioned automatically during the ejection cycle. Pulling the ejection control trigger ring triggers the arming initiator which in turn fires the leg guard thruster which turns the leg guard torque tube and rotates the leg guards into position to protect the legs during ejection.

CAUTION

Do not apply pressure to the leg guards during ground or air operations. A loss of dampening fluid could result, causing rapid movement of the leg guards during ejection sequence. Upward pressure on the leg guards may break the shear pin on the leg guard thruster and render it unserviceable.

Safety Pins and Streamers

Each downward ejection seat is provided with a safety pin (9, figure 4-84) (numbered 1) to be used by the flight crew member to prevent inadvertent initiation of the seat ejection sequence. This pin (lockpin) safeties the ejection control firing trigger located at the front of the seat. The pin should be in place in the firing trigger ring at all times on the ground including preflight and postflight inspections. The ejection control firing trigger safety pin is stowed in a pouch on the right side of the seat when the pin is removed. In addition, each downward ejection seat is provided with five maintenance pins (numbered 2, 3, 4, 5, and 6) to be used for maintenance operations only (figure 4-84). Three of the pins are attached to a single red streamer and the remaining two pins attached to another red streamer. When the seat is in flight status, these pins are stowed in the box provided on the back of the seat.

Ejection Control Trigger Ring

An ejection control trigger ring (9, figure 4-84) is stowed on the front center of the seat. Prior to flight, the trigger ring is safetied by the ejection control trigger ring release mechanism pin (9A, figure 4-84), which in turn is safetied by the No. 1

"Remove Before Flight" safety pin. In order to unstow the ejection control trigger ring, remove the No. 1 "Remove Before Flight" safety pin from the stowage clip on the ejection control trigger ring release mechanism pin; then, pull upward on the spring-loaded release mechanism pin. When the release mechanism pin is lifted, the spring-loaded trigger ring will rotate 180° upward, thus providing the seat occupant ready access to grasp the ring. A pull of approximately 35 pounds is required to remove the trigger ring from its retaining detent. After release from the detent, a pull of approximately 40 pounds and a cable travel of approximately 1 inch fires the arming initiator, which locks the inertia reel, positions the seat, rotates the leg guards, and jettisons the escape hatch. Continued pull on the ejection trigger ring (exerting approximately the same 40 pounds for approximately 4 more inches of cable travel) fires the catapult initiator which fires the catapult to eject the seat.

Ejection Control Trigger Ring Release Mechanism Pin

An ejection control trigger ring release mechanism pin (9A, figure 4-84) is installed on the front center of the seat. The release mechanism pin provides a means of stowing and unstowing the ejection control trigger ring with the parachute and safety belt fastened. In addition, the release mechanism pin provides a stowage clip for the No. 1 "Remove Before Flight" safety pin. The release mechanism pin cannot be operated until the No. 1 safety pin is removed. After removal of pin No. 1, pull upward on the spring-loaded release mechanism pin to release the ejection control trigger ring from the stowed position. To restow the trigger ring, reverse the sequence.

Ankle Restraint Triggers

A trigger (13, figure 4-84) is located on each side of the seat front. Pressing the triggers causes the ankle restraints to rotate upward and inward to clasp the ankles securely. Normally, the legs should be pressed against the triggers prior to grasping the ejection trigger ring. The ankle restraints will then hold the legs in position during ejection. The ankle restraint triggers are cocked until triggered. If accidentally triggered, they may be reset by pushing downward and outward on either ankle restraint until the pivot arms and restraints are restowed and locked.

Seat Positioning Switches

Three seat positioning switches (11, figure 4-84) are located on the right side of the seat. The up and down switch is mounted vertically, the fore and aft switch is mounted horizontally, and the tilt switch is mounted on a 45° slant. The appropriate switch is pushed in the direction movement is desired to electrically position the seat.

CAUTION

Excessive operation of the positioning motors will shorten their normal duty cycle. A full actuation in one direction should be followed by at least a 30-second rest. If another full actuation is required after the 30-second delay, a 5-minute rest must follow before another actuation of any degree.

Inertia Reel Control Handle

A handle (23, figure 4-84) with LOCKED--RELEASED positions is located on the left side of each ejection seat. A detent is provided for retaining the handle at either position of the quadrant. In RELEASED position, the shoulder harness will extend to allow the crew member to lean forward; however, the inertia reel will automatically lock when an impact force of 2 to 3 "g's" is encountered. When the reel has been locked in this manner or has been locked by rotation of the arming levers, it will remain locked until released by moving the control handle to LOCKED and then returning the handle to RELEASED position. In LOCKED position, the inertia reel is manually locked so the crew member is prevented from bending forward. LOCKED position is used for ditching and crash landing. The arming levers used for seat ejection also lock the shoulder harness inertia reel. LOCKED position may be used as an additional safety feature over the automatic operation of the inertia reel system.

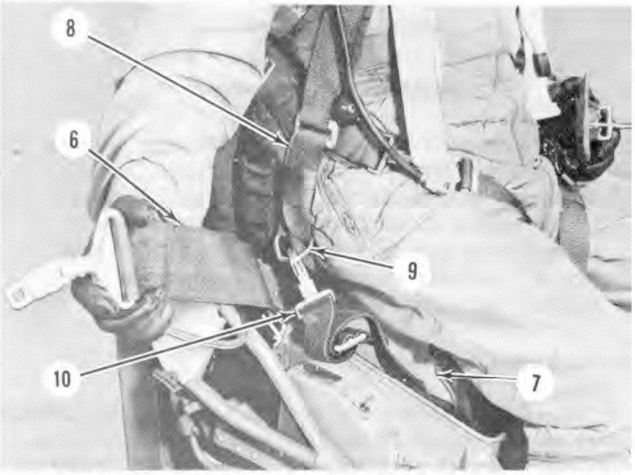
Manual Catapult Initiator Safety Pin-Pull Handle

A handle (16, figure 4-84) on the left side of the seat is provided to manually disengage the catapult pin-pull cylinder and thus pull the safety pin from the catapult initiator. The pin-pull handle should be straight and properly seated parallel to and in close proximity below the left leg guard. No movement of the straight handle up past the stowed leg guard should be possible. If the seat will not fire after pulling the trigger ring, pulling upward on the manual pin-pull handle will allow a spring to force the pin-pull cylinder outward, withdrawing the safety pin from the initiator.

AUTOMATIC OPENING SAFETY BELTS AND AUTOMATIC PARACHUTES

AUTOMATIC OPENING SAFETY BELTS

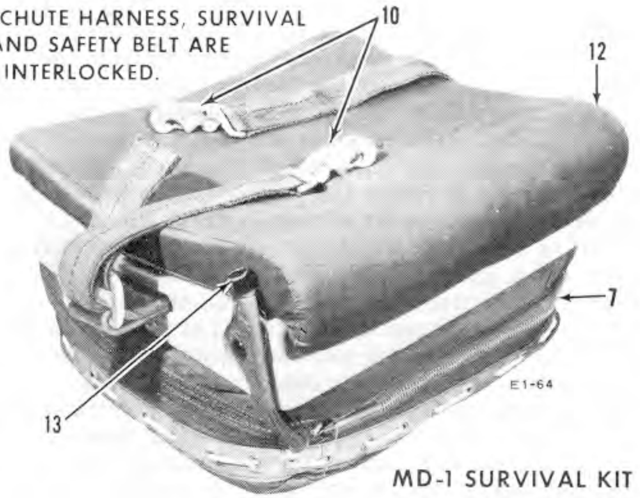
In order to provide a quick, sure, and dependable separation from the seat after ejection, an automatic safety belt release mechanism is incorporated in each ejection seat. The system consists of a trigger,



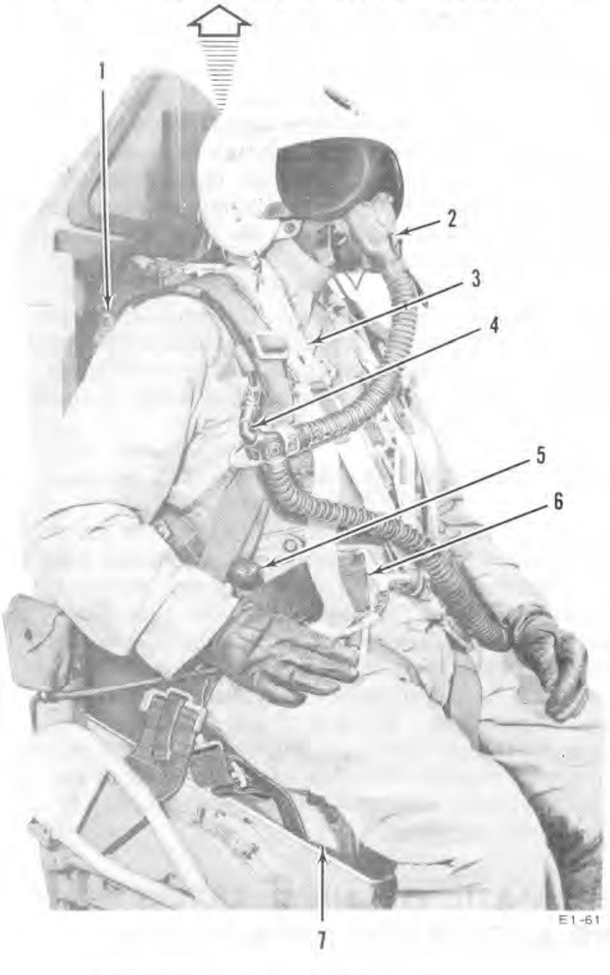
ATTACHING SURVIVAL KIT TO PARACHUTE

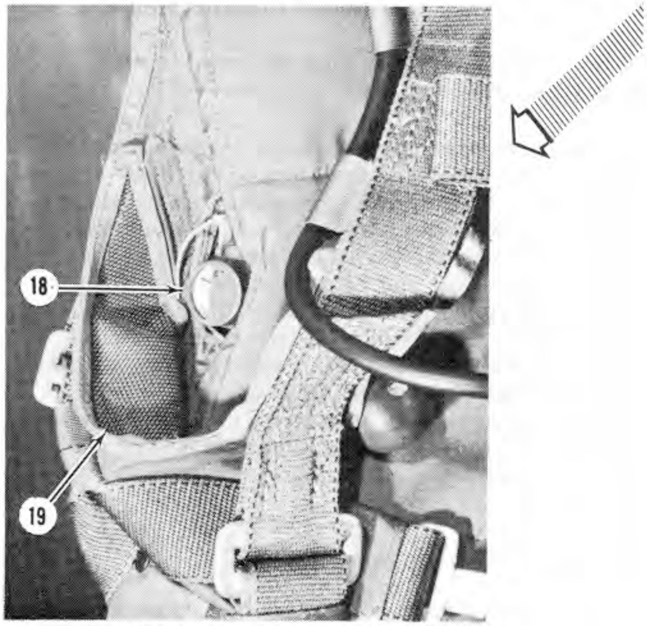
NOTE

PARACHUTE HARNESS, SURVIVAL KIT, AND SAFETY BELT ARE NOT INTERLOCKED.



MD-1 SURVIVAL KIT





BAILOUT OXYGEN BOTTLE

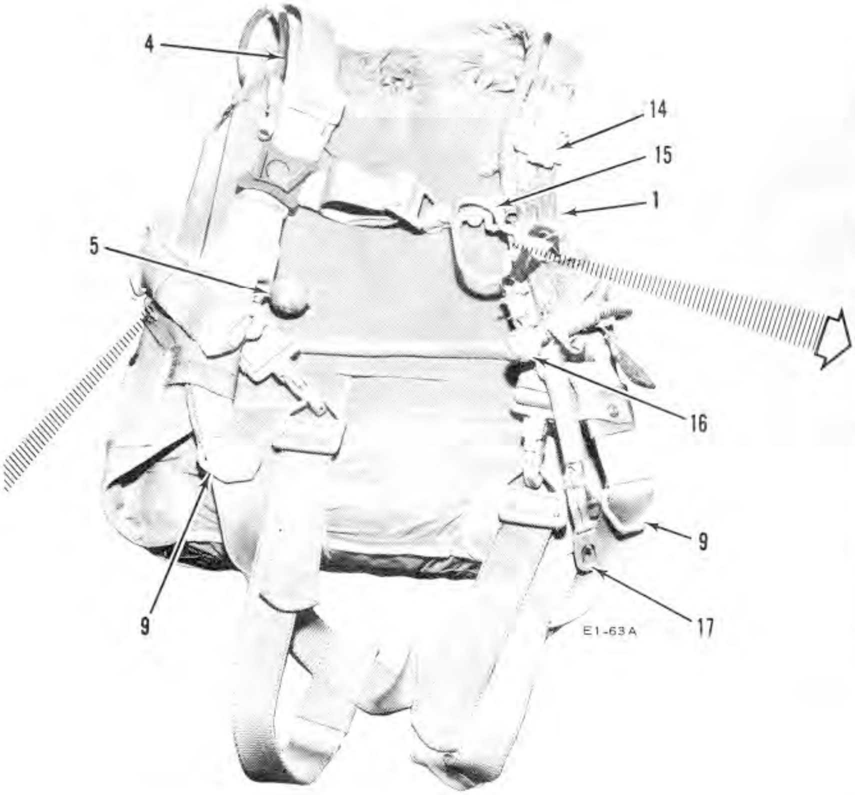
1. PARACHUTE, AUTOMATIC OPENING
2. OXYGEN MASK
3. SHOULDER HARNESS

3A. PERSONAL LOCATOR BEACON LANYARD SNAPPED (AUTOMATIC BEACON ACTUATION)

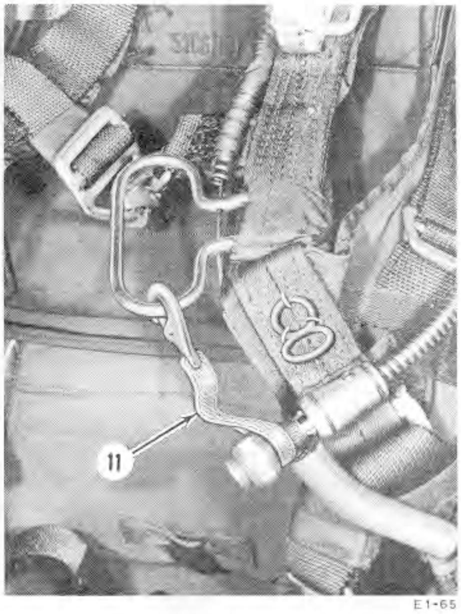
3B. PERSONAL LOCATOR BEACON LANYARD UNSNAPPED (NONAUTOMATIC BEACON ACTUATION)

4. BAILOUT OXYGEN HOSE
5. BAILOUT OXYGEN BOTTLE RELEASE KNOB
6. AUTOMATIC OPENING SAFETY BELT
7. SURVIVAL KIT
8. PARACHUTE HARNESS
9. SURVIVAL KIT ATTACHMENT RING
10. SURVIVAL KIT ATTACHMENT FITTING
11. ZERO DELAY LANYARD
12. SEAT CUSHION
13. SURVIVAL KIT RELEASE KNOB
14. PARACHUTE CANOPY RELEASE
15. PARACHUTE RIPCORD MANUAL "D" RING (RIPCORD T-HANDLE) ☞
16. PARACHUTE AUTOMATIC RELEASE MANUAL ARMING KNOB
17. PARACHUTE ARMING LANYARD ANCHORS
18. BAILOUT OXYGEN BOTTLE PRESSURE GAGE
19. BAILOUT BOTTLE INSPECTION FLAP

Figure 4-85 (Sheet 1 of 4).



B-5 AUTOMATIC
OPENING PARACHUTE

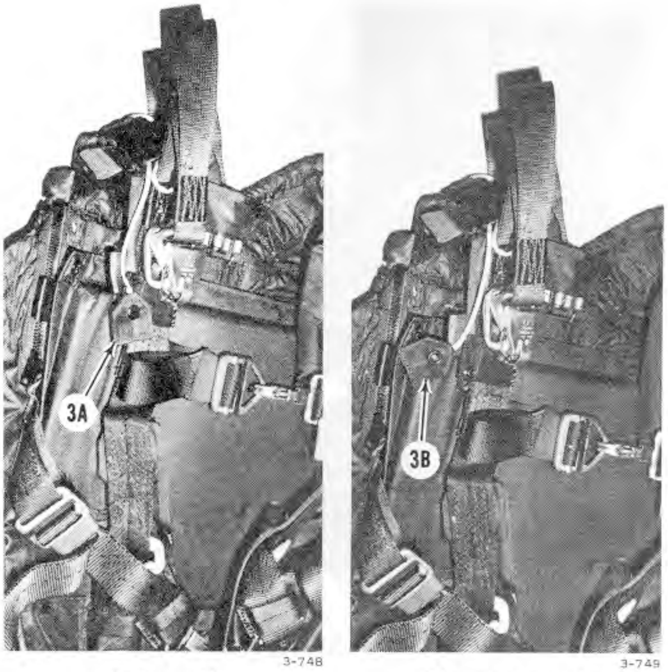


ZERO DELAY LANYARD
ATTACHED TO D-RING

20. COMPRESSIBLE SPACER
21. SURVIVAL KIT QUICK-DISCONNECT FITTING AND STRAP
22. SEAT CUSHION
23. KIT RELEASE HANDLE
24. ARMING PLUNGER
25. MAIN COMPARTMENT
26. DROP LINE
27. AFT COMPARTMENT
28. SURVIVAL KIT STRAP ADJUSTER
29. COMPARTMENT LID MANUAL RELEASE KNOB
30. ZIPPER
31. COMPARTMENT LID
32. REFLECTIVE SURFACE
33. (Deleted)
34. WATERPROOF CONTAINER
35. (Deleted)
36. WATERPROOF CONTAINER TIE-DOWN STRAPS

NOTE

EQUIPMENT SHOWN MAY NOT
BE TYPICAL.



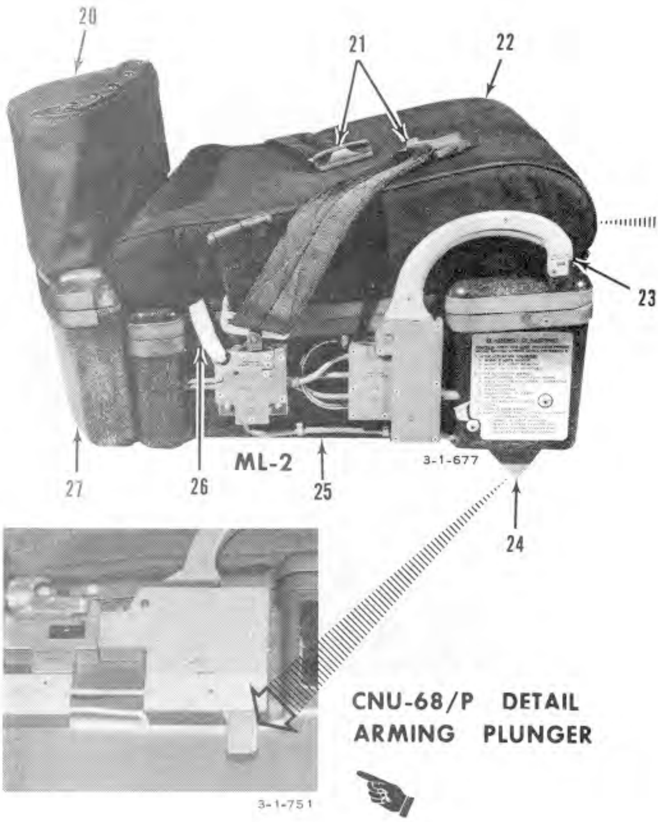
Automatic

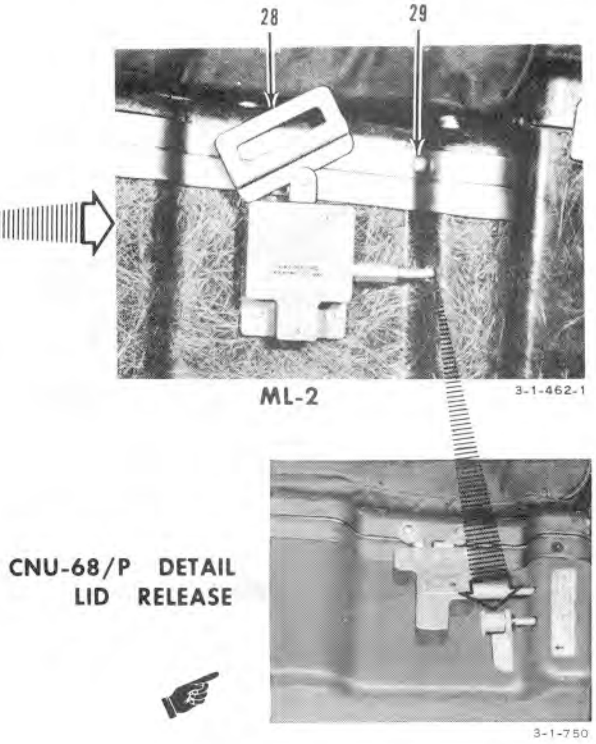
Nonautomatic

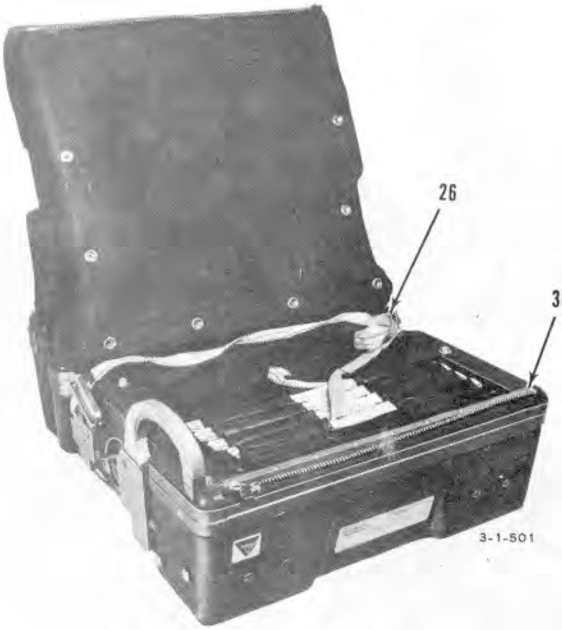
PERSONAL LOCATOR BEACON LANYARD

BAILOUT EQUIPMENT

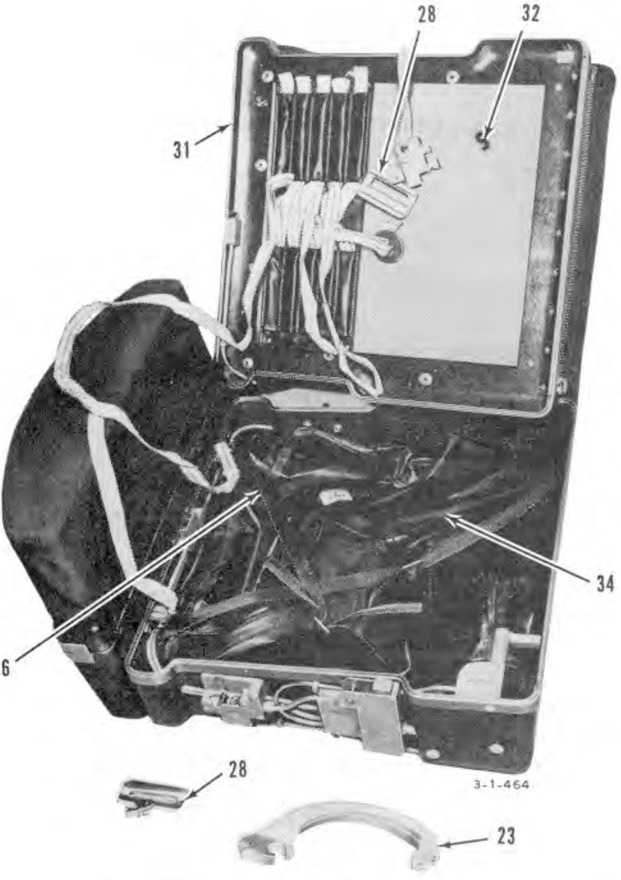
Figure 4-85 (Sheet 2 of 4).







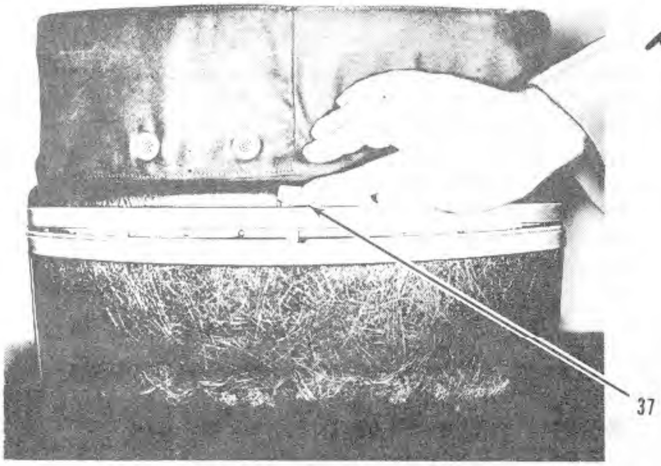
SEAT CUSHION REMOVED



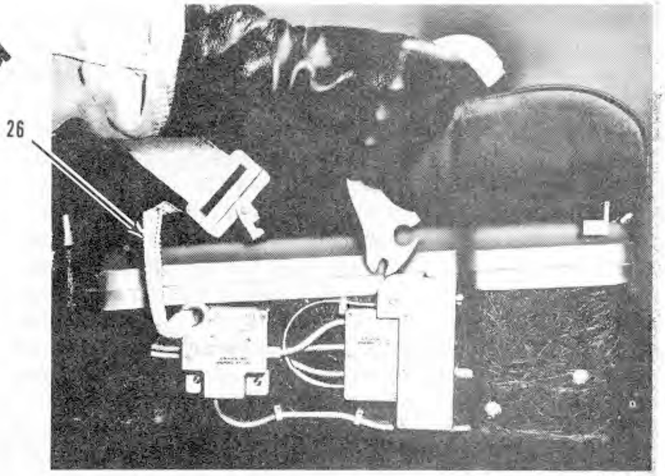
MAIN COMPARTMENT LID OPEN

GLOBAL SURVIVAL KIT
(Gunner's Seat Only)

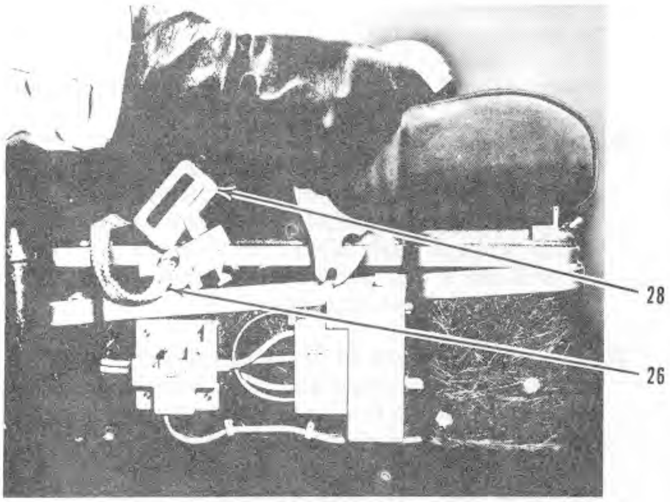
Figure 4-85 (Sheet 3 of 4).



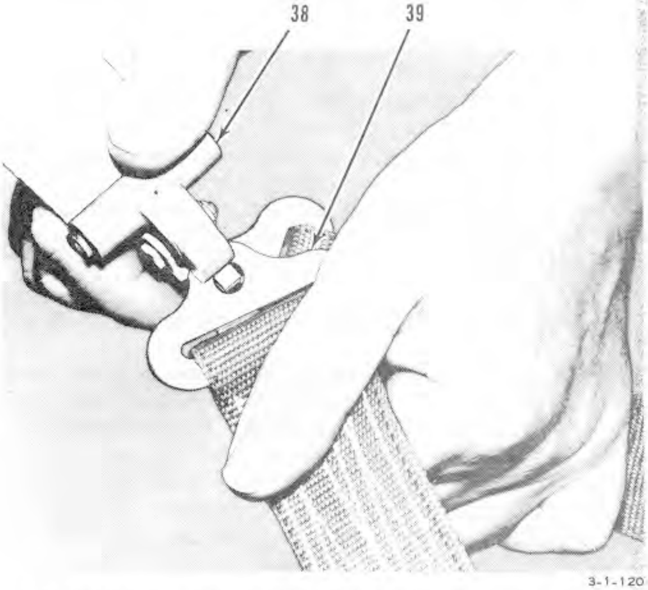
OPENING AFT COMPARTMENT



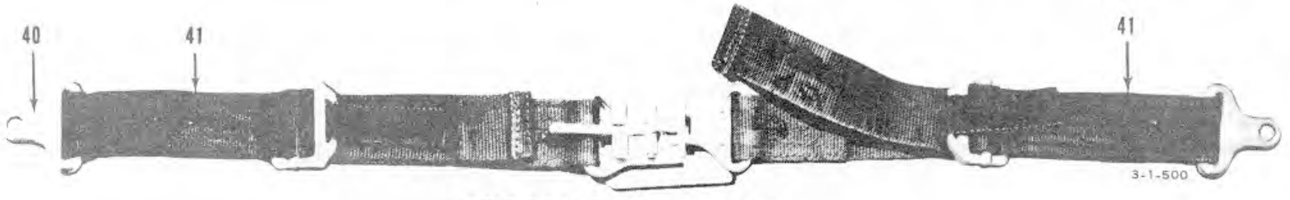
KIT IN SEAT — PLUNGER DEPRESSED



KIT SUSPENDED — PLUNGER EXTENDED



ATTACHING PARACHUTE SHOULDER HARNESS TO INTEGRATED HARNESS RELEASE FITTING



BELT FOR GUNNER'S SEAT

37. AFT COMPARTMENT LID MANUAL RELEASE LATCH
38. INTEGRATED HARNESS RELEASE FITTING
39. SHOULDER STRAPS
40. SAFETY BELT ATTACHMENT FITTING
41. GLOBAL SURVIVAL KIT THREADING LOOPS

GLOBAL SURVIVAL KIT OPERATION
(Gunner's Seat Only)

BAILOUT EQUIPMENT

Figure 4-85 (Sheet 4 of 4).

a safety belt release initiator, necessary ballistics tubing, and an automatic opening safety belt (figures 4-86 and 4-86A). The safety belt initiator is triggered by the seat as it leaves the aircraft; after a 0.3-second delay, the initiator fires and the expanding gas operates the seat belt automatic opening mechanism. The safety belt is designed to allow the shoulder harness and the parachute arming lanyard anchor to be installed by manual operation of the belt. Upon automatic operation of the belt, only the shoulder harness will be released; the arming lanyard will be securely attached to the belt and thus to the seat. The opening of the belt and release of the shoulder harness leaves the occupant free to separate from the seat, and since the arming lanyard is attached to the belt, the automatic opening feature of the parachute is activated by the occupant's separation from the seat. Figures 4-86 and 4-86A show the automatic release safety belt in the locked, manually opened, and automatically opened conditions. The belt is designed to be used with the automatic opening parachute and is provided with a means of retaining the parachute arming lanyard when the crewmember is separated from the seat. A metal retaining ring is fastened to the end of the parachute arming lanyard as an anchor. Note that the anchor, either key or metal ring, is retained and the lanyard pulled only if the belt is opened automatically. If the belt is opened manually, the anchor will not be retained to pull the lanyard and the parachute will not open automatically unless the parachute arming lanyard knob is pulled by hand.

Type HBU-2B/A Automatic Opening Safety Belts

The HBU-2B/A belt (figure 4-86) consists of two seat belt halves, one side having a link assembly and the opposite side the buckle assembly. It is provided with a manual latching and release mechanism for normal operation and a gas-operated automatic release mechanism for emergency operation during seat ejection. Gas for actuating the automatic release is supplied from a ballistic initiator through a flexible hose. The link side of the belt engages the two harness loops. The buckle mechanism incorporates an interlock device which prohibits fastening the lap belt without first inserting the parachute automatic ripcord lanyard anchor (gold key) into the lanyard latch located at the top of the buckle. The automatic seat belt halves cannot be connected until this key has been inserted into the buckle assembly. Once inserted, the key remains locked in the buckle throughout the automatic release phase and can only be released manually.

In the operation of the HBU-2B/A belt, a parachute arming lanyard anchor (gold key) on the parachute lanyard is inserted into the lanyard latch located at the top of the lap belt mechanism assembly housing (belt buckle). To close the belt, insert the lanyard anchor into the lanyard latch first. This enables the lap belt link to be latched within the buckle assembly. The right shoulder harness loop is then placed on the link, followed by the left loop. Pushing the seat belt link into the side of the buckle assembly allows the lap belt halves to be connected. To open the belt manually, rotate the manual release lever on the buckle assembly. This allows the lap belt halves to separate and the parachute arming lanyard anchor to be released.

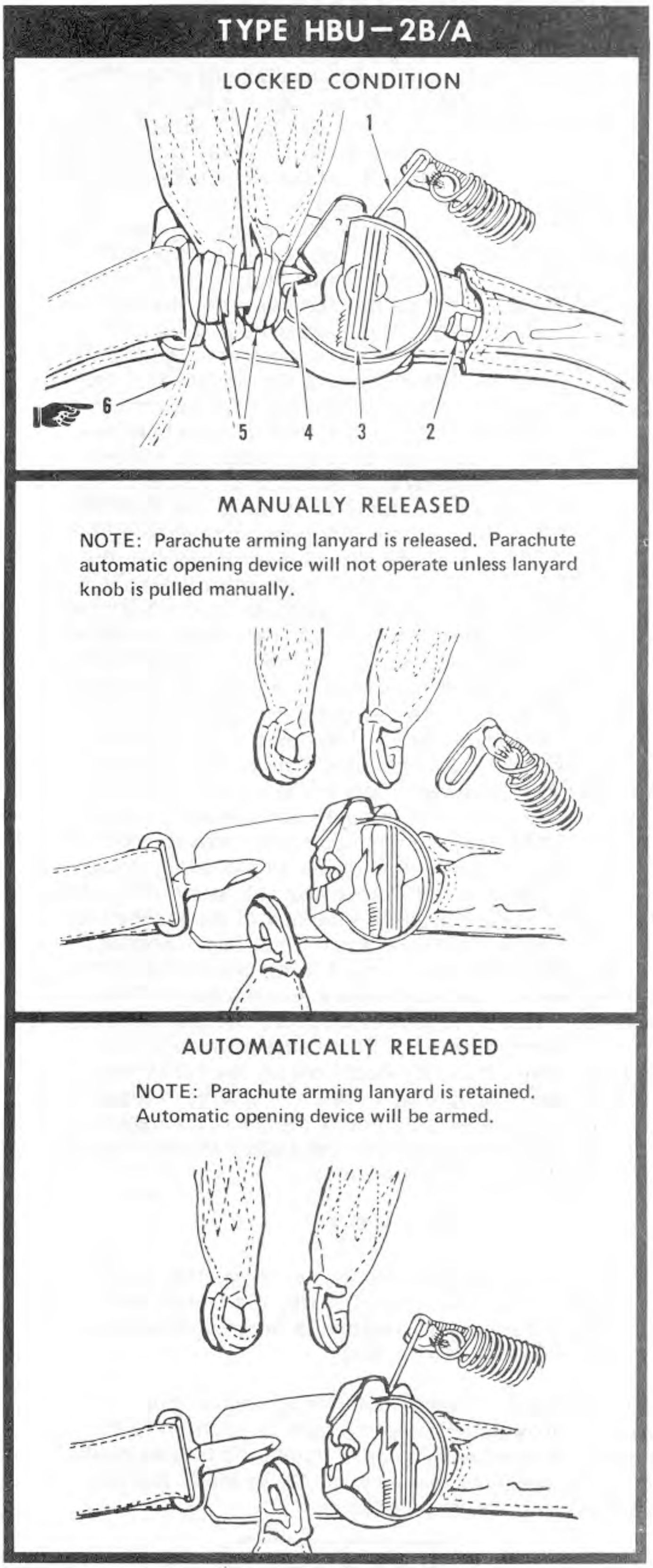
WARNING

- Do not open the automatic release safety belt prior to ejection, regardless of altitude. Since the deceleration of a crewmember alone is considerably greater than that of the crewmember and seat together, immediate separation would result if the belt were manually opened prior to ejection. This could result in the parachute pack being blown open and injuries caused by a high opening shock of the parachute.
- Parachute arming lanyard anchor must be installed as shown (figure 4-86) or the parachute will not open automatically if ejection is necessary. An audible click may be heard as the lanyard latch locks. Pull on the lanyard to check that the lanyard anchor (gold key) is locked and secured.
- Care must be taken to preclude inadvertent release of the parachute arming lanyard anchor. The manual release lever can be rotated slightly, resulting in the lanyard anchor being released without opening the lap belt attaching link. Periodically during flight, check that the lanyard anchor is locked.
- Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.
- If the belt is manually opened during ejection, the parachute will not open automatically upon separation from seat.

NOTE

Manual release lever may be used to unlock belt at any time, even if automatic opening sequence has been initiated.

All data on pages 4-192A and 4-192B (Deleted)



TYPE HBU—2B/A

LOCKED CONDITION

MANUALLY RELEASED

NOTE: Parachute arming lanyard is released. Parachute automatic opening device will not operate unless lanyard knob is pulled manually.

AUTOMATICALLY RELEASED

NOTE: Parachute arming lanyard is retained. Automatic opening device will be armed.

1. PARACHUTE ARMING LANYARD ANCHOR (GOLD KEY)
2. BALLISTICS HOSE FITTING
3. MANUAL RELEASE LEVER
4. LAP BELT ATTACHING LINK
5. SHOULDER HARNESS LOOPS
6. CROTCH STRAP

AUTOMATIC OPENING SAFETY BELTS

Figure 4-86.

Figure 4-86A (Deleted)

AUTOMATIC OPENING PARACHUTES

The ejection seats and gunner's seat are designed to utilize a back-type automatic opening parachute (figure 4-85) attached to a survival kit. A bailout oxygen bottle and gage are contained in the parachute and may be inspected by opening the flap (19, figure 4-85) located under the right side of the parachute lining. Normal bailout bottle pressure is 1800 psi based on 80° F. A reduction in temperature causes reduction in cylinder pressure of 3.5 psi for each degree F. The bailout bottle is operated by pulling the green knob (5, figure 4-85) on the right front of the harness. The gunner's modified B-5 parachute is equipped with shoulder straps which are sewn onto the parachute harness for attachment to the inertia reel fittings. Automatic release from the seat following ejection and automatic opening of the parachute results in safer and, especially adventageous at low altitudes, quicker deployment of the parachute. In order to accomplish automatic opening, the parachute is equipped with an automatic ripcord release mechanism. An aneroid device is incorporated in the release mechanism to enable the mechanism to pull the ripcord when the desired altitude is reached. A timer is also included which causes a delay in opening the parachute. When the parachute is used in an ejection seat, the F-1B timer is set for the number of seconds delay recorded in the parachute log book. When the parachute is used in other than ejection seats, as in the gunner's seat, the timer is set for 5 seconds. The aneroid device is set according to instructions contained in applicable technical publications. The release mechanism is activated by a lanyard which is attached to the automatic opening safety belt by a metal anchor for automatic operation. An orange striped knob is attached to the lanyard for manual operation. Upon separation from the seat, the lanyard remains attached to the safety belt, thus activating the ripcord release mechanism. When activated above the preset altitude, the parachute will remain closed until the preset altitude is reached; then after the delay set on the timer expires, the parachute will open. When the release mechanism is activated below the predetermined altitude, the parachute will open after the number of seconds delay set on the timer.

NOTE

When bailout from the gunner's position is attempted at minimum altitude, the use of the automatic opening feature is not recommended due to the 5-second delay.

The parachute is equipped with a manual ripcord T-handle for opening the parachute in addition to the automatic opening feature. Provision is also made for attachment of the survival kit to the parachute-survival kit attachment fitting.

WARNING

- For automatic parachute deployment:
  1. The automatic release safety belt initiator safety pin must be removed.
  2. The parachute arming lanyard anchor (metal ring) must be fastened to the belt.
  3. The safety belt must be allowed to open automatically.

  If any one of the above conditions is not met:
  4. The parachute arming lanyard knob must then be pulled for automatic deployment.
- When attaching the survival kit to the parachute harness, care must be taken to insure the straps are not entangled in the safety belt. The survival kit should always be fastened to the parachute before fastening the safety belt.

NOTE

- The automatic opening parachute can be opened manually at any time by pulling the ripcord T-handle.
- If it is necessary that either the ripcord or the arming lanyard be pulled to open the parachute, it is desirable to use the ripcord T-handle if below 14,000 feet and the arming lanyard knob if above.

ZERO DELAY LANYARD

WARNING

Do not hook the zero delay lanyard to parachute ripcord T-handle when using a downward seat since it is equipped with man-seat separator.

A detachable zero delay lanyard (11, figure 4-85) provides for improved low altitude escape capability when using an upward ejection seat. The lanyard is attached to the automatic release device arming knob. When the hook on the other end of the lanyard is hooked to the ripcord T-handle, the automatic release device is bypassed and the manual ripcord release is pulled simultaneously as separation from the seat occurs. (In effect, this is zero second delay in deployment of the automatic parachute following separation from the seat.) The zero delay lanyard should never be hooked to the ripcord T-handle at the downward ejection seat stations. During all flight above minimum altitudes, the hook must be detached from the T-handle and stowed on the stowage ring provided on the parachute harness. "Hooking" and "stowing" are manually accomplished by each crew member.

WARNING

Zero second delay parachute configuration should never be used at speeds in excess of approximately 400 knots IAS since the opening shock will be excessive.

PERSONAL LOCATOR BEACONS

Most parachutes are equipped with personal locator beacons. The beacon equipped parachutes may have an AN URT-21, AN URT-27, or AN URT-33 installed. Except for size and range, all three beacons are almost identical. Each beacon is designed to begin transmitting automatically when a plastic plug is pulled from the radio by a lanyard during chute deployment. The beacons are accessible to the crew member after a parachute landing and have complete metalcal instructions for manual operation attached to the unit.

Personal Locator Beacon Lanyard

Parachutes equipped with a personal locator beacon, have a nylon cord lanyard with a tab and a female snap fastener. The lanyard can accommodate all three personal locator beacons. For automatic actuation of the beacon with this type of lanyard, the tab fastener is snapped to a male snap fastener located below the right canopy release. For nonautomatic (manual) operation, the tab is left unsnapped (3A and 3B, figure 4-85). For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation.

NOTE

- The sole purpose of the beacon lanyard is to assure automatic operation (if desired) after bailout in case the crew member is injured or incapacitated during the egress cycle. For this reason, the beacon lanyard must be configured to the desired operation (automatic or nonautomatic) during the interior preflight and rechecked just prior to bailout.
- Recent experience has indicated that some beacons are unreliable when configured for automatic actuation due to lanyard rigging defects. Operation (transmitting) can be readily confirmed after parachute landing by checking that the plastic plug has been pulled from the radio.

TURRET JETTISON SYSTEM

The aft portion of the tail compartment can be jettisoned for emergency escape or rescue of the gunner. The tail turret can be jettisoned from the inside of the aircraft by pulling the jettison handle (figure 4-87) out of its recess and back (forward in the aircraft) toward the operator. The tail turret may be jettisoned from outside the aircraft by opening the door (figure 4-87) and pulling the jettison handle out and away from its recess. (On aircraft **ZR** , this action also releases the canopy.) Power for the jettison system is self-contained pneumatic pressure, and the turret is pushed away through the action of the initiators and the two thrusters. For an illustration of the system mechanism and schematic diagram, see "Escape Systems Operation," Section VII.

WARNING

The possibility exists that shipping pins may be inadvertently left in the initiators on initial delivery of the aircraft and following major inspections and depot overhaul. In such instances, the gunner must take every precaution possible to assure that these shipping pins have been removed.

TURRET JETTISON SAFETY PINS

There are three turret jettison safety pins, one for the inside turret jettison handle initiator, one for the outside turret jettison handle initiator, and one for the pushoff thruster initiator (figure 4-87). The safety pins in the pushoff thruster initiator and the outside turret jettison handle initiator must be removed before the ground crew can jettison the tail turret. All safety pins are removed immediately prior to flight and the inside turret jettison handle initiator safety pin is reinstalled immediately after parking.

TURRET DRAG CHUTE INTERCONNECT CONTROL KNOB

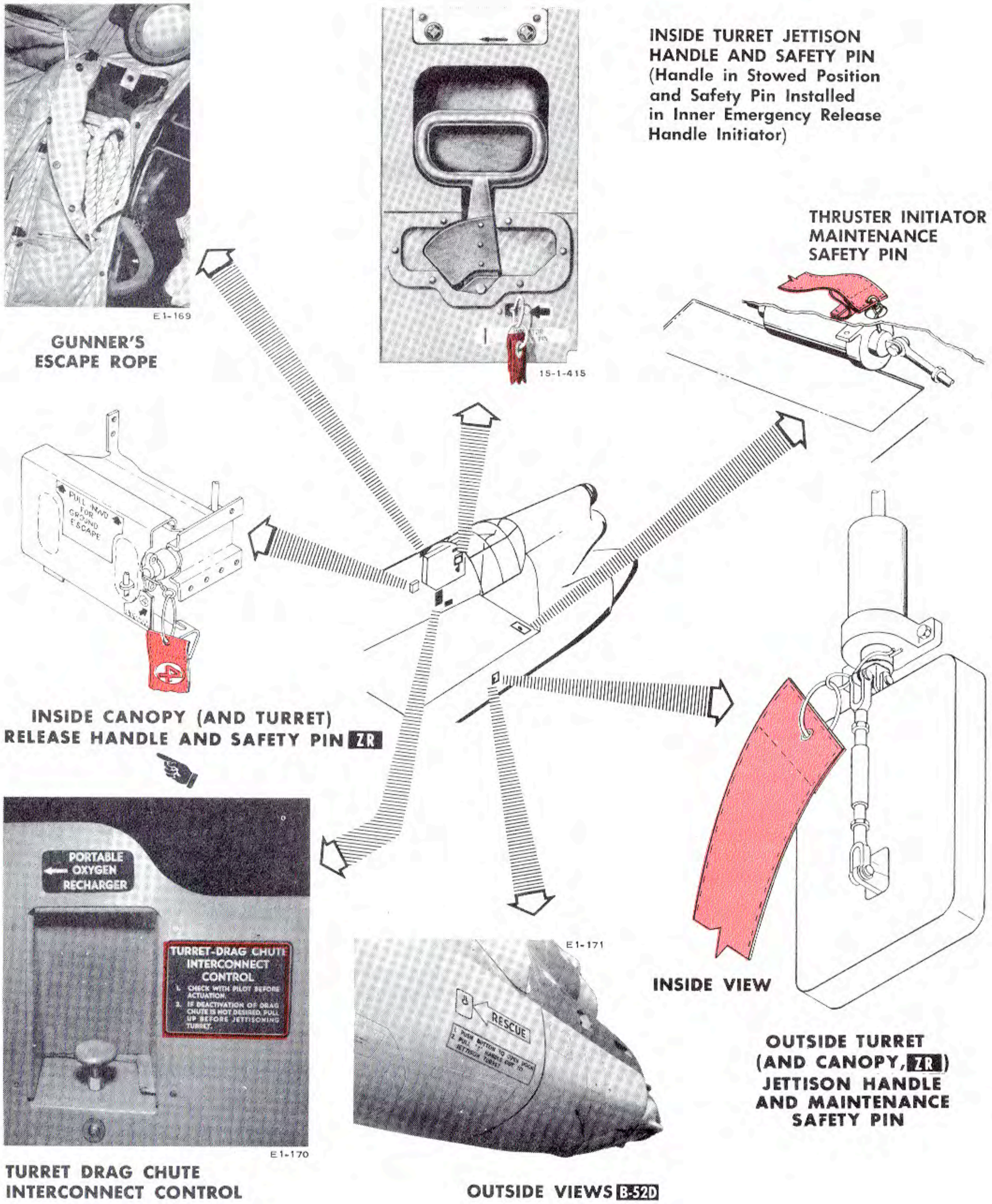
A turret drag chute interconnect control knob (figure 4-87) below the turret jettison handle provides a means by which the gunner may deactivate or retain activation of the drag chute prior to jettisoning the turret. If the turret is jettisoned with the knob in the up position, the drag chute remains active. If the knob is in the down (normal) position and the turret is jettisoned, the drag chute is deactivated.

NOTE

If the turret is jettisoned with the drag chute interconnect control knob up, it will be possible to position the knob down and deactivate the drag chute or jettison a deployed drag chute.

GUNNER'S ESCAPE ASSIST HANDLES

Canvas-covered escape assist handles are located throughout the tail compartment from the aft entry door to the escape opening primarily to aid the gunner in abandoning the aircraft after the turret has been jettisoned. They also assist him in moving about the compartment.



GUNNER'S EMERGENCY ESCAPE CONTROLS

Figure 4-87.

CANOPY RELEASE SYSTEM 2R

The tail compartment canopy can be released for emergency escape or rescue of the gunner. The canopy can be released from inside the aircraft by pulling the canopy release handle (figure 4-87). Pulling the canopy release handle fires the inner canopy release initiator. Gas expansion from the initiator activates two pin pullers which, through a series of linkages, release four locking pins from each side of the canopy sill. Simultaneously, gas expansion from the initiator activates two power cartridges and they in turn release their respective separation nuts and push the locking bolts, located on the rear (forward in the aircraft) portion of the canopy, free of the aircraft structure. Pulling the handle also actuates the turret jettison system. The canopy may be released from outside the aircraft by opening the exterior door (figure 4-87) and pulling the jettison handle out and away from its recess. For further information, see "Escape Systems Operation," Section VII.

MISCELLANEOUS EQUIPMENT

GUNNER'S SEAT

The gunner's seat (figure 4-88) in the tail compartment is a bucket-type seat, facing aft. The seat may be adjusted in height using the (gunner's) forward handle on the right side of the seat. Actuation of the forward handle on the left side of the seat allows the seat to be moved forward or aft. The seat back can be tilted by actuating the (gunner's) aft handle on the right side of the seat from the full-up position through seven detents to the 45° position. The next detent holds the back in a horizontal position. The seat back is spring loaded to the full-up position. The headrest can be adjusted fore and aft by actuating the lever on the left side of the headrest. The headrest is spring loaded to the (gunner's) full forward position. The seat is also equipped with an inertia reel and integrated harness release mechanism to which a shoulder harness and manual safety belt are attached. See "Gunner's Integrated Harness System," this section, for detailed information.

A parachute static line (8, figure 4-88) and a parachute static line reel assembly (9, figure 4-88) is provided for the gunner. The static line should be attached to the gunner's parachute arming lanyard prior to flight for bailout above 2000 feet. During low altitude flights up to 2000 feet, the zero delay lanyard should be attached to the ripcord T-handle. The reel assembly contains 6 feet of cable which will allow the gunner to move freely about the seat without arming the parachute, yet will automatically arm the parachute following bailout.

Gunner's Seat Controls

SEAT POSITIONING HANDLES. A handle (5, figure 4-88) on the left forward side of the seat near the floor is provided to release the seat for fore and aft movement. A handle (3, figure 4-88) on the right front corner of the seat controls up and down movement of the seat. To control the tilting back, a handle (2, figure 4-88) is installed on the center of the right side of the seat. Pulling the reclining handle to the first detent allows the seat back to be tilted to seven different positions through 45°. Pulling the reclining handle past the detent will permit the seat back to fold flat, permitting greater accessibility to the forward end of the compartment. A handle (4, figure 4-88) on the left side of the headrest permits positioning of the headrest.

INTEGRATED HARNESS SYSTEM

The gunner's seat is equipped with an integrated harness system. The integrated harness system consists of the integrated harness release mechanism located on the seat, safety belt, modified B-5 automatic parachute (figure 4-85), and an inertia reel. Pulling the integrated harness release handle on the seat provides separation of man, parachute (with survival kit), and safety belt from the seat. See "Automatic Opening Safety Belts and Automatic Parachutes," this section, for information concerning the gunner's parachute.

WARNING

Lock the inertia reel before actuating the integrated harness release handle to assure complete release of the integrated harness before leaving the seat for gunner's bailout.

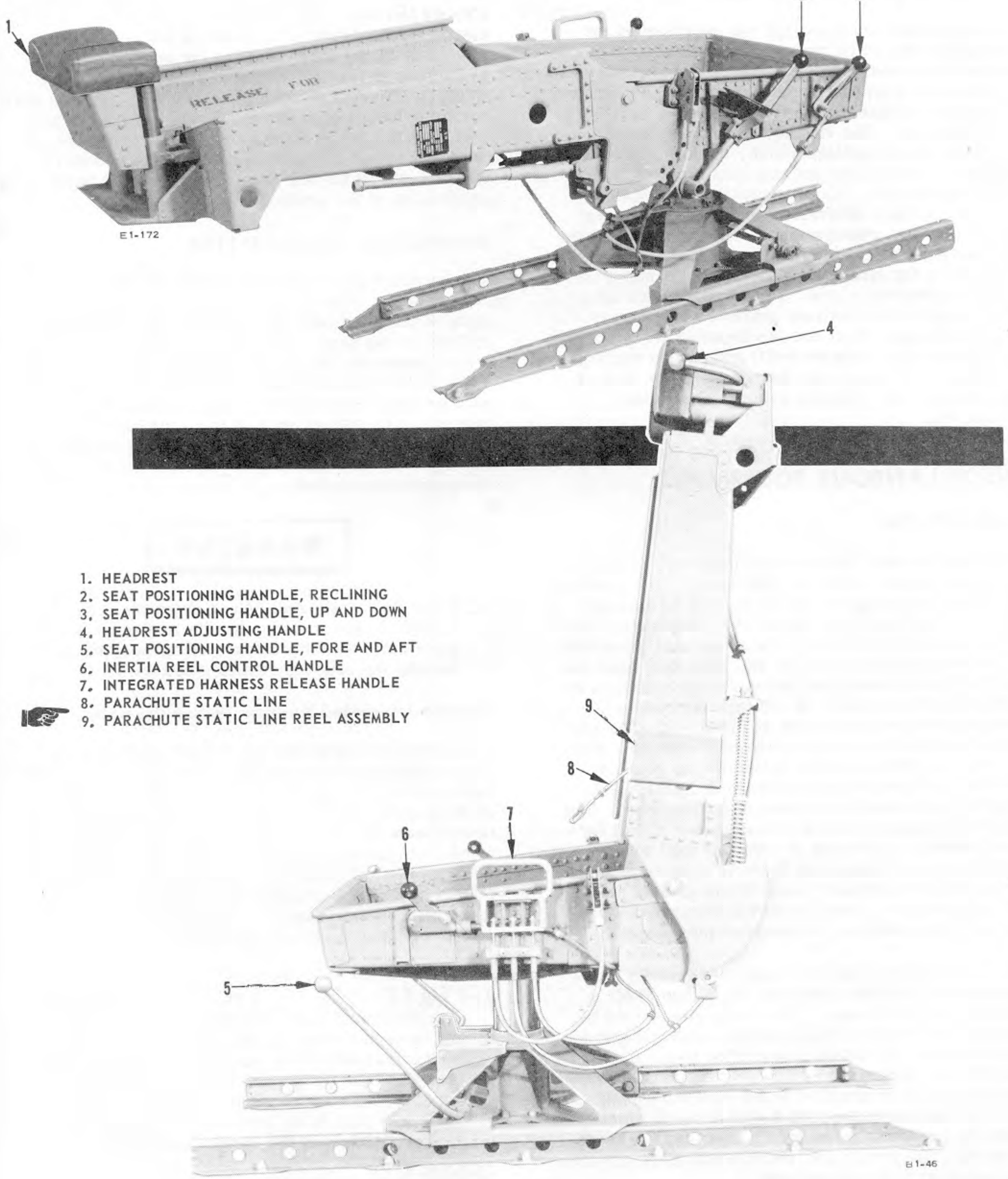
Gunners Integrated Harness System Controls

INTEGRATED HARNESS RELEASE HANDLE. A yellow integrated harness release handle (7, figure 4-88) on the left side of the seat enables the parachute harness and the safety belt to be manually detached from the seat. Pulling the release handle upward disengages the two safety belt fittings and the parachute harness shoulder strap fittings, thus completely freeing the occupant from the seat. The release mechanism resets automatically when the handle is returned to the down position.

NOTE

The integrated harness release handle should not be used to free the occupant from the seat for normal inflight or postflight movement. If the release is pulled and the parachute and survival kit worn during such movement, the parachute will have to be removed to reinstall the shoulder straps in the inertia reel fitting without assistance.

INERTIA REEL CONTROL HANDLE. A handle (6, figure 4-88) with LOCKED--RELEASED positions is on the left side of the gunner's seat. A detent is provided for retaining the handle at either position of the quadrant. In RELEASED position, the shoulder harness will extend to allow the crew member to lean forward; however, the inertia reel will automatically



1. HEADREST
2. SEAT POSITIONING HANDLE, RECLINING
3. SEAT POSITIONING HANDLE, UP AND DOWN
4. HEADREST ADJUSTING HANDLE
5. SEAT POSITIONING HANDLE, FORE AND AFT
6. INERTIA REEL CONTROL HANDLE
7. INTEGRATED HARNESS RELEASE HANDLE
8. PARACHUTE STATIC LINE
9. ☞ PARACHUTE STATIC LINE REEL ASSEMBLY

GUNNER'S SEAT

Figure 4-88.

lock when an impact force of 2 to 3 "g's" is encountered. When the reel is locked in this manner, it will remain locked until the handle is moved to LOCKED and then returned to RELEASED position. In LOCKED position, the inertia reel is manually locked so the crew member is prevented from bending forward. LOCKED position is used for ditching and crash landing.

Safety Belt

A safety belt with standard manual release and lock lever fittings is provided with each seat. The belt is installed by inserting the attachment fittings in the integrated harness fittings on each side of the seat.

The global survival kit (ML-2 or CNU-68/P) is then secured to the parachute by threading the parachute-survival kit attachment fittings through the straps on the safety belt and fastening them to the kit. Thus, seat occupant, parachute, safety belt, and survival kit are released from the seat as an integral unit whenever the integrated harness release fittings are opened.

The MD-1 survival kit is secured to the parachute by attaching the parachute-survival kit attachment fittings to the parachute harness accessory rings. Do not thread the parachute-survival kit attachment fittings through the loops in the safety belt.

WARNING

When attaching the MD-1 survival kit to the parachute harness, care must be taken to insure the straps are not entangled in the safety belt. The survival kit should always be fastened to the parachute before fastening the safety belt.

For routine movement about in the aircraft, it is recommended that the crew member unlock and open the safety belt, then disconnect the parachute chest and leg straps, leaving the parachute with survival kit attached to the seat.

GLOBAL SURVIVAL KITS (GUNNERS SEAT ONLY)

A global survival kit (figure 4-85), provided for the gunner's seat, is located in the bottom of the seat and includes a seat cushion. Provisions for an inflatable raft, sleeping bag, rations, battery radio, M-4 rifle and ammunition, and assorted items of survival equipment are contained in the kit. The kit is made up of two compartments, a small compartment to the rear of the kit and the main compartment containing the liferaft and survival equipment. A waterproof container, equipped with straps for carrying as a backpack, serves as an inner compartment containing various items of survival equipment. The inner compartment is secured with straps in the bottom of the main compartment. A coating of international orange reflective material is applied to the inner surface of the main compartment lid and may be used in signaling or as a marker. A nylon drop line, connected by a yoke to the aft end of the main compartment, is bypassed through a slot in the center of the main compartment lid; the other end is attached to a detachable fitting which is part of the right parachute attachment fitting. The liferaft is fastened to a loop located on the drop line about 10 feet from the survival kit. A kit release handle is provided to release the kit from the parachute harness and open the container lid: the dropline automatically triggers liferaft inflation when extended, permitting the liferaft and kit to hang below the crew member during the parachute descent. The survival kit is designed to be used with the modified B-5 parachute and the modified safety belt. Special hardware is provided with some kits to permit the use of the kits with other types of parachutes. The kit is attached to the parachute by means of a linkage assembly strap connected by quick-disconnect fittings to the parachute harness accessory ring. When attached to the modified B-5 parachute, the straps with quick-disconnects are passed through loops in the safety belt. This interconnects parachute, safety belt, and survival kit. The kit is installed in the aircraft merely by placing it in the seat bucket. The straps are then passed through the safety belt loops and connected to the parachute accessory rings with the quick-disconnects. The safety belt and parachute are then installed in the integrated harness fittings on the seat. Normally the survival kit is not detached from the parachute except for emergency reasons such as a crash landing or when accomplishing an alternate bailout. After bailout from the aircraft and opening of the parachute, the survival kit release handle is pulled. Operation of the handle releases the parachute attachment fittings, allowing the kit to drop, the lid to open, and the liferaft to inflate. The dropline remains attached to the parachute harness and is attached to the compartment lid, liferaft, and survival kit. The liferaft will hang about 15 feet below the descending airman and the kit about 25 feet below.

NOTE

The contents of the kit are designed to serve a useful purpose for survival and should be utilized in the most advantageous manner.

Global Survival Kit Controls (ML-2 or CNU-68/P) (Gunner's seat only)

The survival kit release handle (23, figure 4-85) located on the right side of the survival kit is operated by pulling up against the handle latch until the handle pulls free from the container. When the survival kit is in the seat, a plunger (24, figure 4-85) located on the bottom of the kit is depressed. If the kit release handle is pulled with the plunger depressed, the parachute strap adjuster (28, figure 4-85) will be disconnected, thus severing the survival kit from the parachute harness. The lid, (31, figure 4-85) will not open and the drop line (26, figure 4-85) will remain attached to the kit. The kit release handle may then be reset by replacing the handle in the socket and pushing down, locking the handle latch.

When the release handle has been reset, the parachute strap adjuster may be reinstalled in the kit by inserting in the sockets and pushing down.

NOTE

- Do not allow the arming plunger to drop down before the release handle and parachute strap adjuster have been reset.
- Do not use the survival kit release handle to carry the kit. To do so may cause the kit to open.
- It is possible to install the survival kit in the seat with the arming plunger extended. Insure that the plunger is fully depressed into the kit before occupying the seat.

When the survival kit is removed from the seat, the arming plunger will be extended, arming the forward compartment lid opening mechanism. If the kit release handle is pulled with the plunger extended, the lid will open, the drop line will be attached to the parachute harness, the parachute attachment fittings will be disconnected, and the raft will inflate as the dropline is extended.

WARNING

Do not pull the kit release handle while in the aircraft with the kit removed from the seat. Pulling the handle with the kit suspended will cause the lid to open, leaving the crew member attached to the survival kit. In an emergency, this could cause a fatal delay in escaping from the aircraft.

A compartment lid manual release knob (29, figure 4-85) is located on the left side of the kit aft of the parachute attachment fitting. Pulling the knob will release the main compartment lid, giving access to the uninflated liferaft and equipment. A separate latch is provided on the aft compartment (37, figure 4-85) to open the lid and gain access to the additional survival equipment. A compressible spacer (20, figure 4-85) is installed on the lid of the aft compartment. A foam rubber seat cushion (22, figure 4-85) is fastened with dot fasteners and a zipper to the lid of the main compartment.

CELESTIAL NAVIGATION SEAT

The celestial navigation seat (4, figure 4-29) is located in the center of the control cabin upper deck. When actuated, a release lever near the forward end of the seat permits the seat to be turned through 360°. The seat is equipped with a standard safety belt and is used with the periscopic sextant.

NOTE

The ALR-20 rack located at the EW officer's station, must be moved aft to the extended position to permit freedom of movement when occupying the celestial navigation seat. For a description of the rack, see "ALR-20 Rack," this section.

INSTRUCTOR PILOT'S SEAT

The instructor pilot's seat (33, figure 1-2) behind and between the pilot's and copilot's seats is not adjustable. The seat is equipped with a standard safety belt but no shoulder harness is provided. When not in use, the seat may be folded to the stowed position. The seat may be converted to a ditching seat and consists essentially of a seat back and two seat bottoms. The back is suspended from overhead structure and is locked in either the normal or ditching position at the floor. The two seat bottoms, one on the forward side and one on the aft side of the seat back, are hinged so they may be folded up against the back when not in use. A release cord under the forward seat bottom will unlock the back so it may be swung aft for ditching or forward for normal use. The aft seat bottom is designed for ditching and should be used since the floor is not adequately stressed. The safety belt is fastened on swivels at the bottom of the seat back so it may be used on either the forward or aft side.

INSTRUCTOR NAVIGATOR'S SEAT

An instructor navigator's seat (5, figure 4-89; and 60, figure 1-2) is located behind the radar navigator's seat in the control cabin lower deck. Through the use of a hinged lid, this seat also serves as a toilet. The seat is equipped with a standard safety belt and a shoulder harness without the inertia reel. The seat is not stressed for high "g" loads.

INSTRUCTOR EW OFFICER'S SEAT

An instructor EW officer's seat is located adjacent to the right side of the EW officer's seat. The seat is not stressed for takeoff and landings or use in turbulent air. No safety belt is provided.

WARNING

Do not occupy seat for takeoff and landing or in turbulent air.

RELIEF EQUIPMENT

Two chemical toilets (59, figure 1-2) are provided, one forward of the gunner's seat in the tail compartment and one under a hinged cover on the instructor navigator's seat in the control cabin lower deck. A toilet paper bracket (73, figure 1-2) is provided near each chemical toilet. Relief tanks and tubes are also provided in the aircraft. One relief tank (7, figure 4-89) is located to the right and aft of the navigator's seat. One relief tank and tube (76, figure 1-2) is located at the side of the gunner's seat.

NOTE

> Liquid spillage in the gunner's compartment has caused corrosion of the tail turret thruster initiator. The gunner's relief tank will be stowed at all times while not in use.

WINDSHIELD WIPERS

Windshield wipers, driven by a 24-volt d-c TR powered motor, clear the pilot's front windows. They are controlled by a six-position PARK--OFF--FULL--3/4--1/2--LOW rotary-type switch (53, figure 1-15) on the pilots' instrument panel. The switch is spring loaded from PARK to OFF position. The wiper blades may be stopped in any position by placing the switch in OFF position. When the switch is turned through OFF and held in PARK position, the wiper blades will move to the stowed position.

CAUTION

> Do not operate windshield wipers on dry or dirty glass as this can scratch or damage the windshield glass.

NOTE

> If rain repellent has been applied to the windshield, hold windshield wiper operation to an absolute minimum as approximately 30 minutes of wiper operation will remove the rain repellent.

CREW BUNK

A crew bunk (3, figure 4-30) is located in the control cabin upper deck along the bulkhead left of the celestial navigation seat. When not in use, the bunk may be stowed against the bulkhead and held by retaining straps.

STOWAGE HAMMOCKS

The aircraft is equipped with fishnet-type stowage hammocks (69, figure 1-2). Two stowage hammocks are located in the control cabin lower deck and one in the tail compartment.

MATTRESS STOWAGE

Provisions for mattress stowage are installed aft of the entrance hatch on the upper deck. When the mattress is not in use, it may be rolled up and stowed by means of straps.

EW OFFICER'S TABLE

An EW officer's table (53, figure 1-2) is on the right side of the seat and hinged at the aft edge. The table can be raised to a stowed position and fastened by a strap when not in use.

ALR-20 RACK

A sliding rack, which houses the APR-14 receiver **B-52C** , or the ALR-20 receiver **B-52D** , is located on the EW officer's console. The rack is normally stowed and locked in the full forward position. When unrestricted use of the celestial navigation seat and equipment is desired, the rack can be unlocked and moved aft to the extended position. The rack will latch in the extended position and will latch and lock in the stowed position.

Locking Lever

A locking lever located on the aft side of the ALR-20 rack has three detent positions. Holding the lever full down unlocks the rack allowing it to slide aft. When the lever is released, it will automatically reposition itself to an intermediate position. In this position, the rack will latch when moved to the stowed position. Placing the lever to the full-up position (stowed) will lock the rack in the stowed position.

CAUTION

> - To prevent damage to the latching mechanism, the locking lever should be in the intermediate position when the rack is moved into the stowed position.
> - After stowing and locking the rack, it can be checked for security by applying a pull force on the rack (not on the APR-14 handles) of not over 100 pounds.

Latch Release Button and T-Handle

A latch release button on the aft face of the ALR-20 rack and a T-handle on the forward end of the rack unlatches the rack when in the extended position. The release button must be pressed or the T-handle pulled before the rack can be moved forward from extended position.

PERISCOPIC SEXTANT CARRYING CASE

Removable periscopic sextant carrying cases are located in the control cabin upper deck. Tie-downs are provided either beneath the window on the left side of the aircraft at the celestial station or on the forward end of the equipment rack to the right of the celestial station (25A, figure 1-2).

LADDER

A five-step ladder (64, figure 1-2) is installed against the fuselage on the right side of the control cabin lower deck to provide access between the upper and lower decks of the control cabin. In addition, two handrails are installed against the fuselage on the right side of the upper deck control cabin directly above the ladder.

ALTIMETER CORRECTION CARD

An altimeter correction card and holder (16, figure 1-9) is located on the pilot's left glare shield. For information concerning the use of the altimeter correction card, refer to Part 1 of the Appendix.

FLIGHT REPORT HOLDERS

54 ▶ **88** **W1** ▶ **W12**

An aircraft flight report holder (34, figure 1-2) is mounted on the back of both the pilot's and copilot's seats.

CLIPBOARD

A clipboard (45, figure 1-2) is provided at the copilot's station for his use in flight.

NIGHT FLYING CURTAIN

A night flying curtain (49, figure 1-2) is provided to shut out light between the EW officer's and pilot's stations. When not in use, it is rolled up and stowed aft of the pilot's seat.

ALTERNATOR DECK INSPECTION MIRRORS AND WINDOW

Two mirrors are mounted on the radar navigator's front panel. The outboard mirror is aligned to reflect back through the window in the pressure bulkhead. The inboard mirror is aligned to reflect back to a third mirror mounted forward and outboard of the pressure bulkhead door and then through the window (10, figure 4-89) in the door. The purpose is to permit the radar navigator to monitor the alternator deck area without turning around.

GALLEY EQUIPMENT

The aircraft is equipped with a galley located forward of the pressure bulkhead in the control cabin lower deck. The galley equipment consists of hot cups, paper cup dispensers, trash containers, water containers, and shelf and food stowage provisions.

Shelf and Food Stowage

The aircraft has a shelf and food stowage (6, figure 4-89) space in the lower right side of the galley. The top of the shelf provides the framework for the trash container. The aft section of the shelf is provided with a hinged door and is used for food stowage.

Trash Container

A trash container (62, figure 1-2) is provided in the galley in the forward end of the shelf and food stowage unit.

Hot Cups

Hot cups (63, figure 1-2) are provided in the aircraft, one on the left side of the forward end of the tail compartment with an alternate location immediately aft at the left window and one in the forward end of the shelf and food stowage unit in the galley.

WARNING

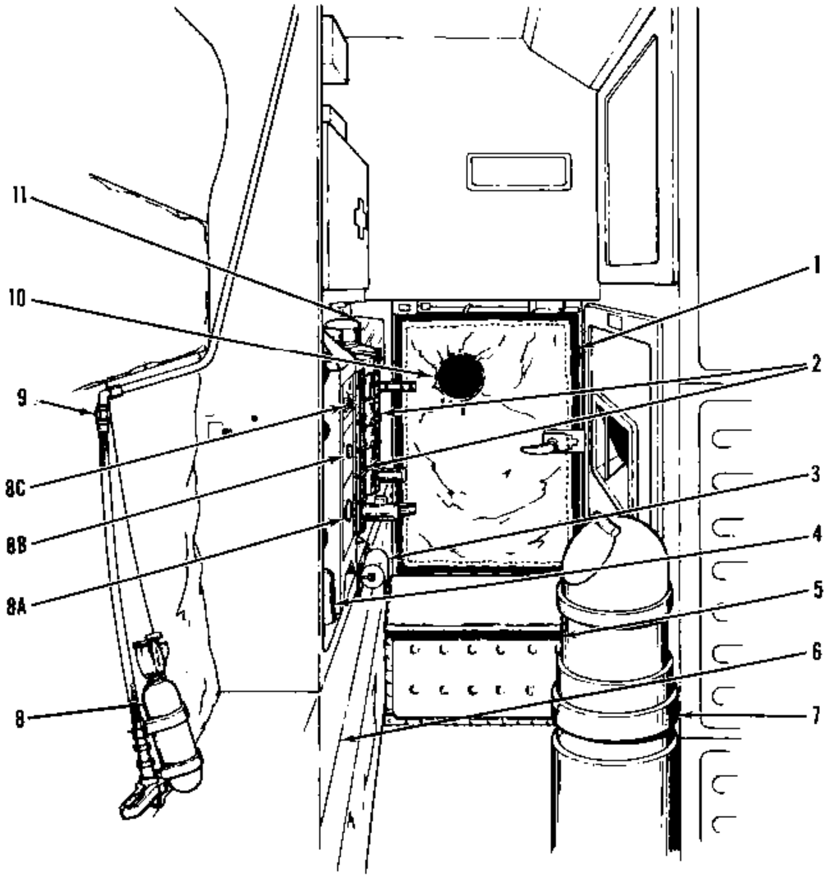
Type B-1 hot cups can explode when operated dry. To avoid injury to personnel, do not allow the hot cups to operate without liquid or semi-solid food.

Food Warming Oven

A food warming oven (32, figure 1-2) is located forward and left of the celestial navigator's station. The oven is mounted by the use of two hooks and a strap. A-C power is supplied for the oven through a circuit breaker marked "Food Oven" in the section 41 power distribution panel.

Drinking Water Containers

The aircraft is equipped with drinking water containers. Two 2-gallon drinking water containers (2, figure 4-89) are mounted on the top of the shelf and



1. FORWARD COMPARTMENT PRESSURE BULKHEAD DOOR
2. DRINKING WATER CONTAINERS
3. PAPER DISPENSER
4. HOT CUP
5. INSTRUCTOR NAVIGATOR'S SEAT (CREW TOILET)
6. SHELF AND FOOD STOWAGE
7. RELIEF TANK
8. PORTABLE OXYGEN BOTTLE
8A. OXYGEN REGULATOR
8B. INTERPHONE PANEL
8C. FACE PLATE SWITCH
9. PORTABLE OXYGEN BOTTLE RECHARGER
10. ALTERNATOR DECK INSPECTION WINDOW
11. ALTERNATOR DECK INSPECTION MIRROR

GALLEY (Typical)

Figure 4-89.

food stowage unit in the galley. A 2-quart thermos bottle (72, figure 1-2) is mounted on the right side of the tail compartment.

WARNING

Only black coffee or water may be used in this container because of bacteria and contamination. Rinse thoroughly with boiling water before filling.

Cup Dispensers

Cup dispensers (54, figure 1-2) are provided in the aircraft, one on the wall in the middle of the galley and one at the gunner's left on the wall of the tail compartment.

ASHTRAYS

An ashtray is conveniently located at each crew member's position.

SCANNING LAMP AND FILTER

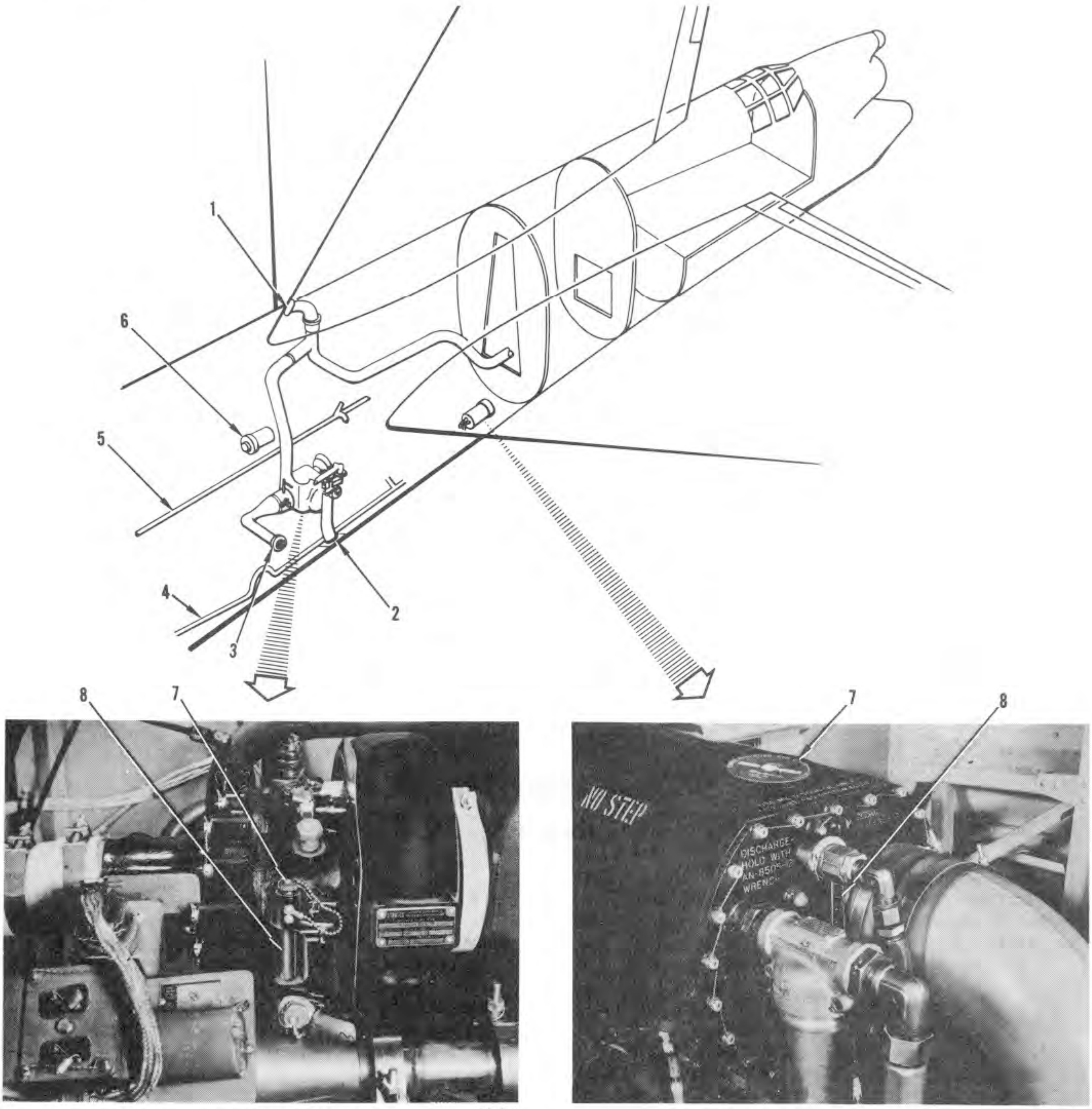
A scanning lamp (29, figure 1-2) is provided on the window shelf to the left of the celestial navigation seat. A 28-volt a-c power receptacle is located near the light and is supplied power through a circuit breaker marked "Scan Light Recp" on the section 41 power distribution panel.

SIGNAL LIGHT

A signal light (74, figure 1-2) is provided on the bulkhead forward of the gunner's seat on the left side of the aircraft. A 28-volt a-c power receptacle is located near the light. Another receptacle is located near the aft end of the left side of the compartment. A 28-volt a-c circuit breaker marked "Signal" on the gunner's circuit breaker panel supplies power to the signal light receptacles.

SPARE LAMPS

Spare lamps are located on the bulkhead of the AGM-28 equipment rack.



AFT AIR CONDITIONING PACK

HYDRAULIC PACK NO. 9 (Typical)

1. RAM AIRSCOOP
2. RAM COOLING AIR EXHAUST
3. GROUND COOLING AIR INTAKE
4. AIR BLEED SYSTEM LEFT BODY MANIFOLD
5. AIR BLEED SYSTEM RIGHT BODY MANIFOLD
6. HYDRAULIC PACK NO. 10
7. FILLER CAP
8. SIGHT GAGE

AFT AIR CONDITIONING AND HYDRAULIC PACKS

Figure 4-90.

ACCESSORY EQUIPMENT

Each aircraft is provided with stowage facilities for the following accessory equipment for ground use: pitot tube covers, landing gear ground locks, engine tailpipe shields, air intake shields, bomb bay door lock struts, body jacking fittings, wing jacking pads, tail closure cover, and miscellaneous external opening plugs.

STARTER CARTRIDGE STOWAGE

A stowage rack (18, figure 1-2) with clamps for eight MXU/4A starter cartridges is located in the aft wheel well.

VGH RECORDER

The VGH recorder has been removed and the system is inoperative.

ACCESSORY RADAR EQUIPMENT

Each aircraft is provided with stowage facilities for the following radar accessory equipment.

BNS Spare Tubes

A spare tube compartment is located on the forward pressurized compartment bulkhead behind the radar navigator.

BNS Spare Amplifiers

Provisions for carrying BNS system spare amplifiers are provided above the forward compartment pressure bulkhead door.

THERMAL CURTAINS

Aluminized thermal curtains are provided for each aircraft window to increase the weapons delivery capability. The curtains are provided to cover the windows by using slides, rollers, or snaps attached to the structure surrounding the window. The aluminized surface must be placed facing the window. Care must be taken to prevent scuffing, scratching, or otherwise marring the reflective surface of the curtains. The curtains must fit closely enough to prevent direct outside light rays (straight line) from hitting a crewmember in his normal sitting position. Window glass must not be visible to any crewmember while seated in his normal position. If either of these cases exist, the thermal curtain(s) must be readjusted. Translucent light (bright contrasts of indirect light due to scuffing, etc.) is acceptable. However, pin holes, cuts, tears, or curtains that cannot be adjusted to prevent direct light rays will be cause for rejection or AFTO Form 781 entry. Pin holes can be located by closing all curtains and visually inspecting for light penetration into cockpit when the sun is shining (clear day) on the aircraft windows. If the aircraft is in the hangar, the sun is obscured by clouds, or at night, use 300-to-500 watt floodlight approximately 18 to 30 inches from aircraft window to simulate sunlight. Light ray penetration through curtain stitching holes is not acceptable.

The radar navigator's window is covered with an aluminum plate attached to the window frame. The navigator's window has been painted on the inner surface. No thermal curtain is required on the navigator's window so long as the paint is in good condition. The gunner's sunshades must be removed before his thermal curtain can be used. Two 5-inch square peepholes, one for each pilot, are provided for forward visibility with thermal curtains in place. Covers are provided to cover the peepholes when not in use and are held in place by the use of nap pile tape and hook tape.

WARNING

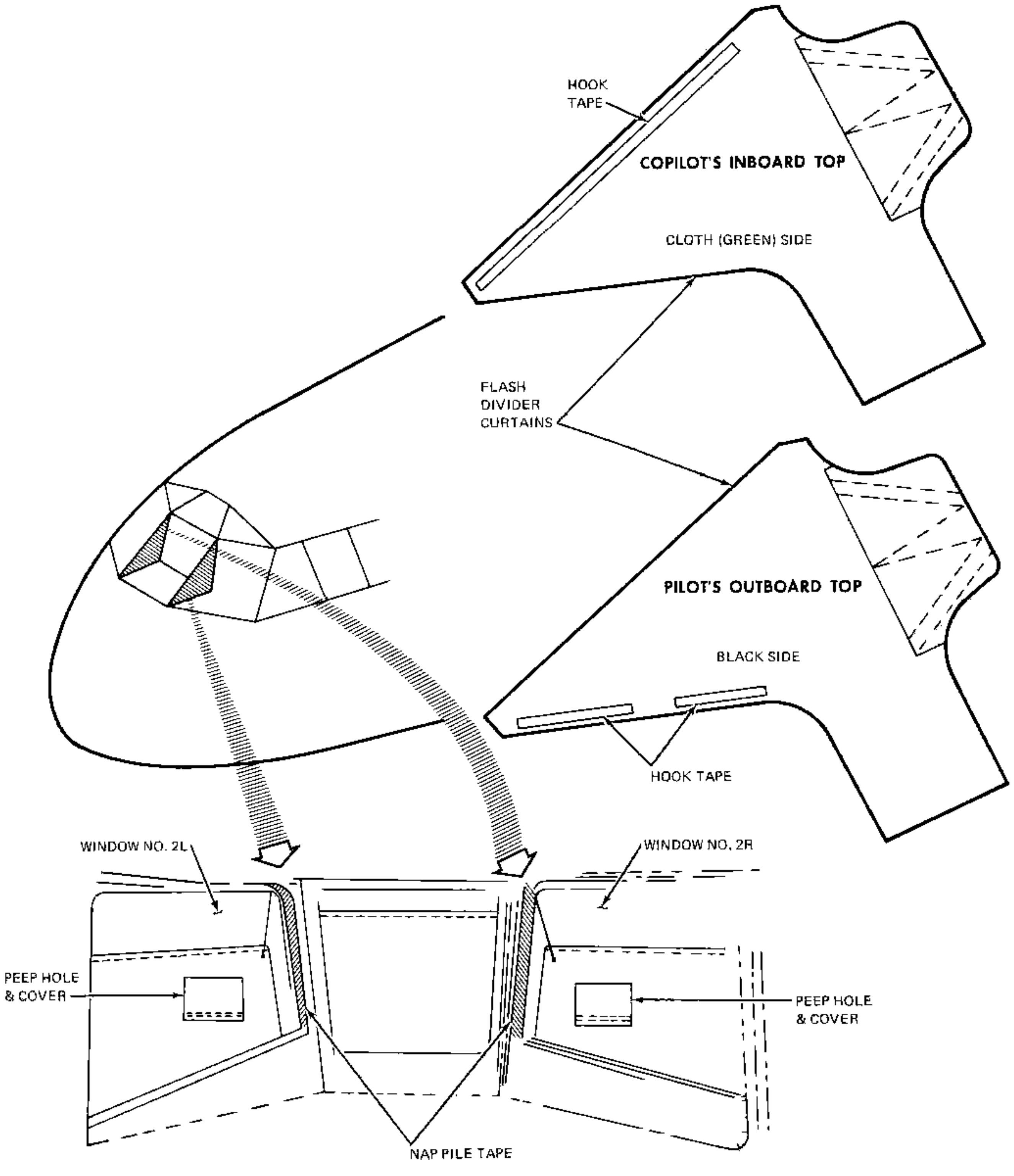
- Thermal curtains will not be used as a sunshade on crew training missions. Use of the curtains for this purpose subjects the curtains to abnormal wear which will eventually cause deterioration to the point that their effectiveness as a heat shield is materially decreased.
- The thermal curtains must be kept free from grease, oil, and mold as any discoloration will seriously impair the value of the curtains. Oil or grease base materials will ignite upon exposure to thermal radiation. Dirty or cracked thermal curtains must be replaced.
- Failure to close thermal curtains (during EWO) may result in flash blindness from nuclear detonation.

NOTE

Thermal curtains must be replaced after each flight on which they are exposed to radiation.

FLASH DIVIDER CURTAINS

Two flash divider curtains, one for each pilot, are provided to shield the pilot or copilot when the opposite thermal curtain peephole is being used. The divider curtains are installed with the green cloth side toward the centerline of the aircraft which exposes the black side to the pilot and copilot (figure 4-91). The dividers are held in place by the use of nap pile tape and hook tape. Pressing the hook tape, which is sewed to the sides of the curtains into the nap pile tap attached to the top of the instrument panel cover and to each inboard side of the No. 2 windshield curtain frames will secure the curtains (figure 4-91). To remove, grasp the curtains at the top and pull down and toward the centerline of the aircraft. The divider curtains, when not in use, are stowed in the data case behind the pilot's seat.



THERMAL CURTAINS

Figure 4-91.

INSTRUMENT FLYING HOODS

Instrument flying hoods are installed for instrument and low altitude training flights. They consist of roller-type curtains which can be extended by pulling inboard. To hold in extended position, insert lower end of curtain rod into hole in top of instrument panel, then place upper end of curtain rod into wire retainer located on lower surface of the eyebrow panel. To stow the curtain, reverse the steps.

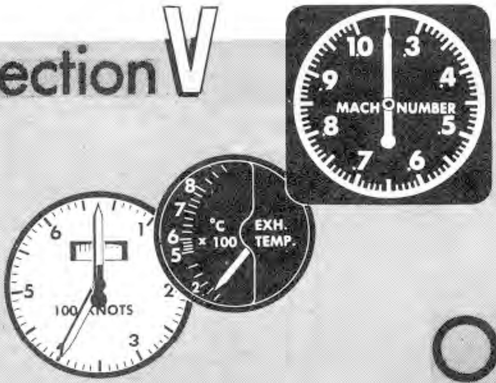
BLACKOUT CURTAIN

A blackout curtain (50, figure 1-2) is provided to enclose the opening and ladder area between the radar navigator-navigator station and the pilots' and EW officer's stations. This curtain serves the double function of a blackout curtain and a heat retainer to help keep heat in the lower compartment. The curtain has a zippered opening to allow passage between the upper and lower compartments. The section of the curtain forward of the ladder is attached with buttons to provide access to the area forward of the radar navigator-navigator panel. Straps are provided to stow the aft and/or the forward parts of the curtain in the open position.

SUNSHADES

Sunshades (28, figure 1-2) are installed on the overhead windows. The roller-type sunshades are closed by pulling the tab and snapping it to the structure. The sliding-type sunshade at the gunner's station uses the same fasteners and tracks as the crew hood and may be removed easily by the gunner during flight so that it will not interfere with operation of the crew hood. Sunshades are provided for the windows at the radar navigator, midcompartment window, and celestial position and may be installed as desired on the same snaps provided for installing the crew hoods. Crew hoods need not be unstowed or removed to permit installation of sunshades at these positions.

section V



OPERATING LIMITATIONS

TABLE OF CONTENTS

This section covers the operating limitations of the aircraft that must be observed during normal conditions. Special attention should be given to the instrument markings (figure 5-1) since these limitations are not necessarily repeated under their respective sections. When necessary, an additional explanation of instrument markings is covered under appropriate headings in this section.

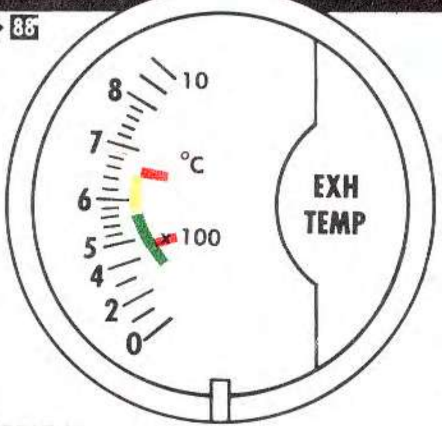
NOTE

- The term "within limits," as used herein, pertains to the operating range between the minimum and maximum red line markings on the applicable gage.
- All aircraft instruments will be marked in accordance with the limitations reflected in figure 5-1.

EXHAUST GAS TEMPERATURE

89▶ W1▶

54▶ 88



🟩	300° to 560°C	CONTINUOUS OPERATION 0-30,000 ft *(580°C at 55,000 ft)
🟨	560° to 650°C	RANGE OF LIMITED OPERATION Military Rated Thrust (30 Minutes) 620°C from 0-30,000 ft *650°C at 55,000 ft Normal Rated Thrust and Below (continuous) 560°C from 0-30,000 ft *580° C at 55,000 ft.
🟥	450° C	MAXIMUM FOR STARTING (450° C applies up to the time engine reaches idle rpm. From idle rpm on up, the acceleration EGT limit applies)
🟥	660° C	MAXIMUM DURING ENGINE ACCELERATION ☞ (2 Minutes Maximum Duration)

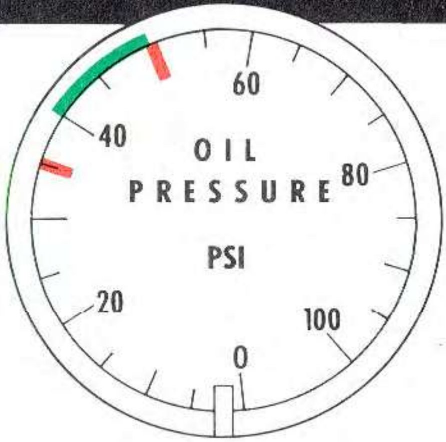
* Temperature limit increases directly between 30,000 and 55,000 feet altitude

CAUTION

Prolonged engine operation at the maximum operating limits will shorten engine life.

Figure 5-1 (Sheet 1 of 6).

OIL PRESSURE

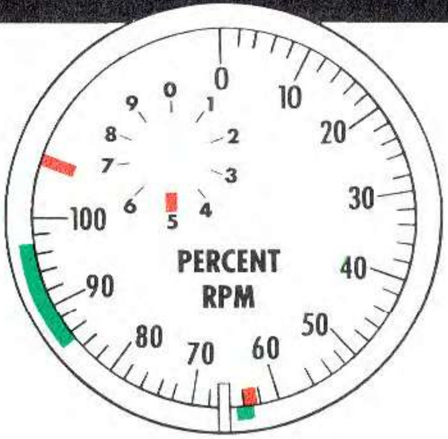


🟥	35 PSI	MINIMUM (FOR IDLE)
🟩	40-50 PSI	NORMAL
🟥	50 PSI	MAXIMUM

NOTE

See "Oil System Limitations" this section, for additional information.

TACHOMETER

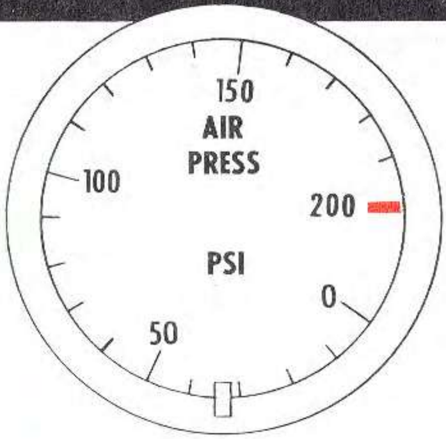


🟥	63% RPM	MINIMUM IDLE
🟩	63-65% RPM	IDLE RANGE
🟩	85-97% RPM	RANGE FOR NORMAL CRUISE
🟥	105% RPM	MAXIMUM ALLOWABLE

CAUTION

Prolonged engine operation at the maximum operating limits will shorten engine life.

AIR BLEED MANIFOLD PRESSURE



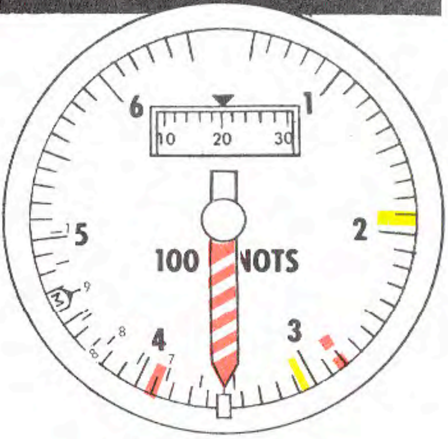
🟥	200 PSI	MAXIMUM

INSTRUMENT MARKINGS

Figure 5-1 (Sheet 2 of 6).

AIRSPEED

- 🟨 190 KNOTS IAS FULL FLAPS
- 🟥⬜🟥 280 KNOTS IAS MAXIMUM UNDER CERTAIN FUEL USAGE AND DISTRIBUTION CONDITIONS. SEE FIGURE 5-3.
- 🟨 305 KNOTS IAS MAXIMUM WITH LANDING GEAR EXTENDED
- 🟥 390 KNOTS IAS (400 KNOTS CAS) MAXIMUM WITHOUT DROP TANKS



NOTE

The instrument setting is such that the striped pointer will move to indicate the limiting structural airspeed with drop tanks of 350 knots IAS or the airspeed representing a Mach of .90, whichever is less.

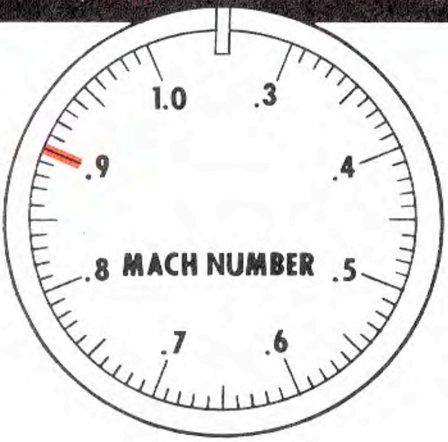
WARNING

For additional airspeed limitations see AIRSPEED LIMITATIONS and figure 5-6, this Section.

NOTE

Maximum airspeed without drop tanks is 390 knots IAS (400 knots CAS). At altitudes above 20,000 feet, speed is generally restricted by tolerable buffeting. At Mach .87, a "tuck under" tendency develops and increases with Mach; however, it is easily controllable with stabilizer or elevator.

MACH INDICATOR

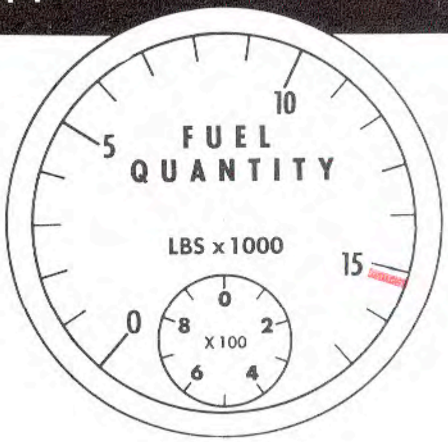


🟥 MACH .90 INDICATED MAXIMUM. SEE FIGURE 5-6.

Figure 5-1 (Sheet 3 of 6).

FUEL QUANTITY

TANK	WEIGHT IN POUNDS
No. 1 and No. 4 MAIN	15,300 ± 150
No. 2 and No. 3 MAIN	17,900 $^{+100}_{-300}$
MID BODY	33,100 ± 400
FORWARD BODY	28,450 ± 400
AFT BODY	38,450 ± 400
OUTBOARD WING	14,550 ± 150
CENTER WING	35,600 ± 400
DROP	19,500 $^{+100}_{-300}$



🟥 FULL BY WEIGHT SWITCH SETTING
(Value for No. 1 and No. 4 main tanks shown. For other tanks see table)

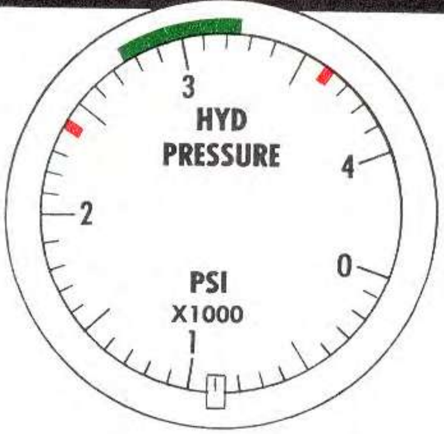
NOTE

- The tank fuel weights shown above may be exceeded up to the fully serviced quantities as given in the fuel quantity data chart, figure 1-16.
- The above figures are based on a fuel weight of 6.5 pounds per gallon.

INSTRUMENT MARKINGS

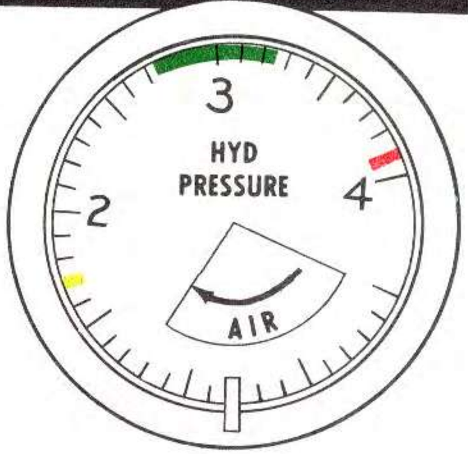
Figure 5-1 (Sheet 4 of 6).

HYDRAULIC SYSTEMS PRESSURE



🟥	2400 PSI	MINIMUM	
🟩	2750-3250 PSI	NORMAL	☛
🟥	3600 PSI	MAXIMUM	

PARKING BRAKE HYDRAULIC PRESSURE



🟨	1700 PSI	ONE BRAKE APPLICATION REMAINING	
🟩	2750-3250 PSI	NORMAL	☛
🟥	3900 PSI	MAXIMUM	

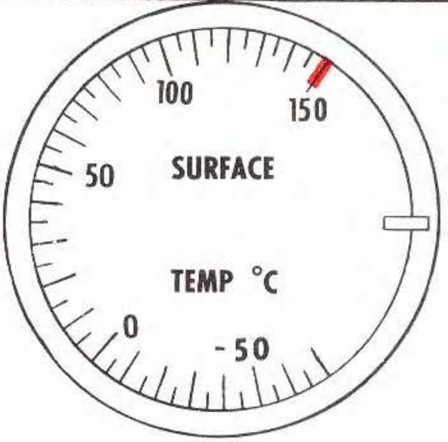
ACCELEROMETER

+1.5 MAX G OVER 300,000 #

🟥	+ 2g	MAXIMUM POSITIVE VERTICAL ACCELERATION AT DESIGN GROSS WEIGHT under 300,000#
🟥	−.67g	MAXIMUM NEGATIVE VERTICAL ACCELERATION

See 5-92 31 MAR 72

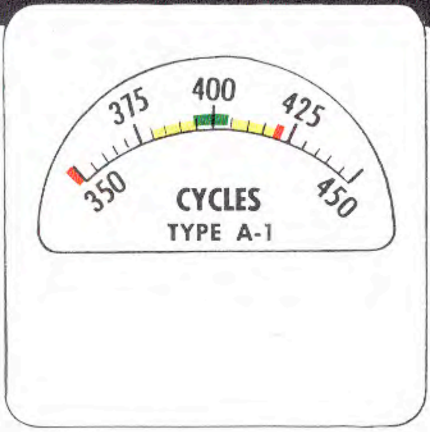
ANTI-ICING SURFACE TEMPERATURE INDICATOR 54▶ 169 W1▶ W51



🟥	150°C MAXIMUM

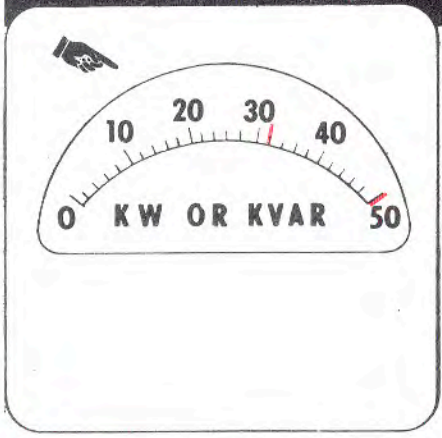
Figure 5-1 (Sheet 5 of 6).

A-C FREQUENCY



🟥	300 CPS	MINIMUM FREQUENCY AT WHICH CIRCUIT BREAKERS MAY BE EXPECTED TO REMAIN UNTRIPPED
🟨	380-420 CPS	ALLOWABLE OPERATING RANGE
🟩	395-405 CPS	NORMAL OPERATING RANGE
🟥	420 CPS	MAXIMUM ALLOWABLE FREQUENCY

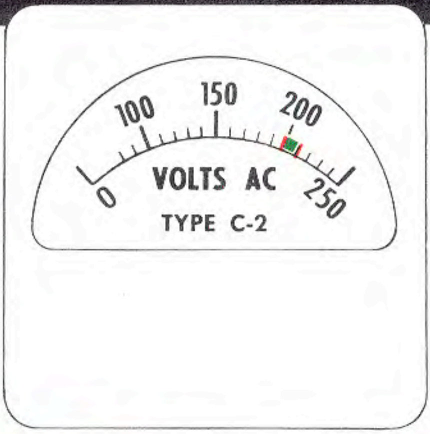
KWATTS — KVARS



🟥	31.6 KVAR, MAXIMUM
🟥	51 KW MAXIMUM

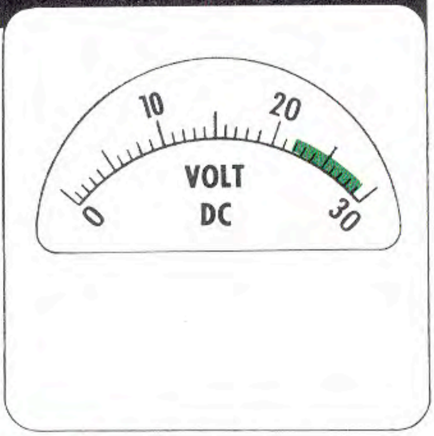
NOTE: These figures are based on an altitude below 30,000 feet and a power factor of .85. See figure 7-12, ALTERNATOR LOAD LIMITS for more complete information.

A-C VOLTS



🟥	200 VOLTS	MINIMUM
🟩	200-210 VOLTS	NORMAL RANGE
🟥	210 VOLTS	MAXIMUM

D-C VOLTS



🟩	22-29.5 VOLTS	NORMAL RANGE

INSTRUMENT MARKINGS

Figure 5-1. (Sheet 6 of 6).

ENGINE OPERATING LIMITS

Operating Condition	Exhaust Gas Temperature Limit*			Time Limit
	SL to 30,000 Ft	45,000 Ft	55,000 Ft	
Takeoff Rated Thrust (TRT - Wet)	640° C	– –	--	5 minutes
Military Rated Thrust (MRT - Dry)	620° C	640° C	650° C	30 minutes ***
Normal Rated Thrust (NRT)	580° C	570° C	570° C	Continuous
90% NRT **	[illegible] C	515° C	550° C	Continuous
80% NRT **	490° C	500° C	510° C	Continuous
70% NRT **	460° C	470° C	480° C	Continuous
Idle	400° C		–	--
Ground Starting	450° C	-		[illegible]
Air Starting	400° C	450° C	450° C	[illegible]
Transient Overtemperature	660° C	660° C	660° C	2 minutes

[illegible] Operating Limit Speed is 10[illegible] [illegible] Engine Takeoff Speed nominal spread is 99 to 102% rpm.

[illegible] tendency to overtemperature is observed, the throttle should be retarded in an attempt to maintain the EGT within limits.

NOTE

[illegible] RPM cannot be controlled, the engine should be shut down as soon as [illegible] exceeds [illegible]° C for any length of time or the RPM exceeds 10[illegible].

[illegible] vary between the [illegible] limits [illegible] straight line relation with altitude. The [illegible] feet altitude table is [illegible].

[illegible] limits, but are indicative of expected temperatures. At thrust settings less than NRT, the NRT temperature limit applies.

[illegible]

- [illegible] is defined as the period between advancing the throttle and the time that the EGT is first observed to [illegible].
- [illegible] engine acceleration for the EGT to decrease to a stabilized temperature at or below the [illegible].
- [illegible] NRT [illegible] temperature limit applies.
- [illegible] settings below NRT [illegible] intermediate thrust settings to NRT, use the temperature limit for the desired [illegible].

[illegible] MRT [illegible] minutes [illegible] for the EGT to stabilize.

[illegible] Anytime 450° C is exceeded prior to reaching idle rpm during start, the engine must be shut down and the ground crew notified.

[illegible] Anytime 450° C is exceeded prior to reaching idle rpm during start, the engine must be shut down.

NOTE

- [illegible] thrust settings (EPR) above NRT, the MRT limitations will apply.
- [illegible] exceeded it must be recorded accurately on Form 781 [illegible] temperature or rpm observed and the length of time the temperature limit was exceeded.

ENGINE OPERATING LIMITATIONS

Figure 5-2.

MINIMUM CREW REQUIREMENTS

A pilot, copilot, and a radar navigator/navigator constitute the minimum crew required for a normal nontactical flight in this aircraft. Additional crew members as required will be added at the discretion of the commanding officer.

ENGINE LIMITATIONS

ENGINE RATING DEFINITIONS

The following terms are used to define engine thrust ratings and limitations associated with the ratings:

NOTE

EPR is the only parameter that indicates thrust, therefore the charted EPR value as given in the Appendix should not be exceeded. Thrust ratings as defined are subject to the applicable EGT limitations specified in figure 5-2.

CAUTION

Thrust ratings are not established by setting EGT.

1. Takeoff Rated Thrust (TRT) is the highest value of thrust which the engine will consistently deliver at specific ground or flight conditions with water injection. This rating is restricted to 5 minutes of operation on takeoff and is obtained by positioning the throttle in the full forward position and actuating the water injection system.
2. Military Rated Thrust (MRT) is the highest value of thrust which the engine will deliver consistently at specific ground or flight conditions without water injection. This rating is restricted to 30 minutes of operation. MRT is obtained by placing the throttle in the full forward position, but may be limited by EGT.
3. Normal Rated Thrust (NRT) is the highest value of thrust at which the engine may be operated continuously with the prevailing ground or flight conditions. Throttle position is selected with reference to a predetermined EPR which is obtained from the "Thrust Setting" chart in Part 4 of the Appendix.
4. Idle Thrust is not an engine rating, but rather a throttle position suitable for minimum thrust operation on the ground or in flight; it is obtained by placing the throttle in IDLE detent on the throttle quadrant. See figure 1-3 for thrust ratings.

ENGINE AND STARTER LIMITATIONS

Engine

Each engine is trimmed when it is installed to assure that it will develop takeoff thrust. As takeoff thrust is set by EPR, the rpm at takeoff may be expected to vary for each engine due to the differences in tolerances between engines. Engine rpm at takeoff will also increase as ambient temperature increases and will decrease as temperature decreases. Takeoff rpm at any temperature should never exceed the operating limit of 105% (10,200 rpm) which can damage an engine. In the event of overspeed, the engine should be shut down as soon as possible. All instances of overspeed or overtemperature will be recorded on Form 781 in order that the engine may be inspected for possible damage before being released for further operation.

NOTE

- Aviation gasoline and JP-4 fuel mixed in any proportion are suitable for continuous operation from an engine performance standpoint. However, the use of aviation gasoline must be restricted to air refueling operations and to emergency evacuation ferry-type missions to minimize undesirable lead deposits in the engines. Furthermore, "Rate of Climb Limitations with Emergency Fuel (Aviation Gasoline)" under "Fuel Grade Properties and Limits," this section, must be observed when applicable.

- The engine operating limits are the same for all fuel grades; however, with the use of aviation gasoline, the charted EPR values may not be obtained at takeoff rated thrust.

- The engine pressure ratio should not exceed the minimum EPR by more than .10 for wet and dry power checks prior to takeoff. If this value is exceeded, a Form 781 entry must be made and the engine retrimmed.

Starter

The pneumatic starters have the following limitations:

1. Maximum continuous operation	2 minutes
2. Minimum rest after 2-minute continuous operation	3 minutes
3. Minimum rest after two 2-minute cycles	10 minutes

The cartridge-pneumatic starters installed on engines 2 and 8 have the following limitations:

1. Not more than two cartridge starts shall be made in any period of 60 minutes.
2. After normal cartridge firing, at least 5 minutes shall elapse before removing the breech cap, inserting another cartridge, and initiating another cartridge start. If the cartridge malfunctioned (misfired or hangfired), wait at least 5 minutes before attempting to remove the cartridge, except as noted below. The time intervals, based on experience and consideration of safety, have been established to minimize the danger associated with misfire or hangfire. Cartridge malfunctions are defined as:

   a. Hangfire. A delay in the functioning of a propelling charge at the time of firing. The amount of delay is unpredictable, but in most cases will fall within the range of a split second to several minutes. There will be evidence of smoke at the starter exhaust duct. The engine rpm will increase rapidly and the cartridge will give evidence of nearly normal operation. In this type malfunction the energy is expended and presents no hazard to engine operation.

b. Misfire. A cartridge that fails to ignite. There is no physical evidence of smoke at the starter exhaust duct and no engine rotation. This type malfunction presents a potential fire and explosive hazard to engine operation until removed.

WARNING

Do not remove a cartridge that has fired normally, hangfired, or misfired until there is no evidence of exhaust smoke at the starter exhaust duct and minimum time intervals have elapsed since start of initiation. Wear asbestos gloves when removing cartridge. Do not point screened end of cartridge at personnel or equipment.

NOTE

For actual EWO or if an impending disaster makes moving the aircraft necessary and both cartridges malfunction, the waiting period after a misfire or hangfire may be reduced to not less than 1 minute after initiation of engine start provided the following conditions are met:

- No smoke can be observed from starter exhaust.
- Starter breech cover is not hot to the bare hand.
- There is no evidence of pressure inside breech chamber (breech cover offers no undue resistance to removal).
- Cartridge screen end is pointed away from aircraft, equipment, or personnel.
- Cartridge is treated as a potential hangfire (fire hazard) for a period of 10 minutes after removal from breech.

3. Not more than three pneumatic starts shall be made in any period of 15 minutes.
4. If cartridge starts and pneumatic starts are interspersed, no more than three starts shall be made within a 15-minute period. Two of these starts may be cartridge starts provided the limitations noted previously are not exceeded.

WARNING

Except in an emergency, engine operation is prohibited when a live or misfired cartridge is installed in the starter. Abnormal cartridge conditions of an explosive nature could be generated due to the combination of vibration and high temperatures that can exist in the engine nacelle.

In the event an unfired cartridge has remained in the breech during engine operation, the cartridge will not be used for a subsequent start.

IGNITION SYSTEM LIMITATIONS

For the purpose of engine starting on the ground, operation of the engine ignition system is limited to 2 minutes followed by a 3-minute cooling period. The system may be energized for another 2 minutes following the 3-minute cooling period. To assist in prevention of multiple engine flameout, this limit may be exceeded when flying through cumulus clouds or areas of severe turbulence at altitudes of 40,000 feet or above. (See "Engine Operation," Section VII, and "Turbulence and Thunderstorms," Section IX.) Under such circumstances, continuous use of the ignition system for a period of time not in excess of 10 minutes is permissible. After 10 minutes of continuous operation, the ignition system must be turned off for a cooling period of at least 10 minutes.

CAUTION

Continuous use of the ignition system for a period in excess of 10 minutes or continuous use without 10-minute interim cooling periods may damage the ignition system and render it inoperable for subsequent engine restarts.

WATER LIMITATIONS

Normally, water with less than 10 parts solid per million parts will be used in the water injection system. Tap water rarely meets these specifications. Use of water with impurities greater than specified must be restricted to EMERGENCY USE ONLY. Water with impurities exceeding specified limits will coat the compressor blades with deposits which can result in lowering thrust and stall margins of the engine to a dangerous point. This is especially true if the engine is subsequently operated under dry takeoff conditions. When impure water is used, this fact will be entered in the Form 781.

OIL SYSTEM LIMITATIONS

Oil pressure fluctuations up to 5 psi total are allowable; however, the mean should not be lower than 35 psi. These fluctuations are generally in the pressure indicating system and do not indicate abnormal engine operation. Although the minimum oil pressure required for idle is 35 psi, actual pressure may be greater than 50 psi immediately following engine start when the oil is cold. Normal oil pressure for engine operation above idle is 40 to 50 psi. However, oil pressure at idle of 35 to 40 psi is acceptable after ground start, during flight, and after landing.

NOTE

ZE

Oil pressure will have a tendency to follow the throttle due to the type of oil pressure relief valve installed. This condition is normal provided the oil pressure stabilizes between the minimum and maximum limits.

FUEL GRADE PROPERTIES AND LIMITS

RECOMMENDED FUEL

Recommended fuel is a fuel which has been proven to operate satisfactorily under all conditions. The recommended fuel for the B-52 type aircraft shall conform to Specification MIL-T-5624 Grade JP-4.

ALTERNATE FUEL

Alternate fuel is a fuel which can be used continuously with a possible loss of efficiency and may result in increased maintenance or overhaul costs. The alternate fuel for this aircraft shall conform to Specification MIL-T-5624 Grade JP-5. Use of alternate fuels may require engine retrimming if takeoff is critical. To determine if trim is required, use the EPR to check rated thrust; i.e., if rated EPR cannot be obtained, retrim the engines. It is recommended that if a landing is made at a base having only alternate grade fuels and no facilities for engine retrimming, only enough fuel should be loaded to accomplish a one-time flight to a base where JP-4 is available. Engine thrust settings below takeoff thrust will not be limited. Engines operating on alternate fuels can be trimmed to produce the same thrust as obtained with JP-4. The engine operating limits discussed under "Engine Limitations," this section, also apply to alternate fuels.

USE	FUEL TYPE	GRADE (In order of preference)	NATO SYMBOL	U.S. MILITARY SPECIFICATION	SPECIFIC GRAVITY (Max-Min at 60°F)	FREEZE POINT °F	LIMITS
RECOMMENDED FUEL	WIDE CUT GASOLINE	JP-4 5▷	F-40★	MIL-T-5624	.802-.751	-72	
ALTERNATE FUEL	WIDE CUT GASOLINE	COMMERCIAL JET B 5▷	NONE	NONE	.802-.751	-56	2▷ 3▷
	KEROSENE	JP-5	F-44	MIL-T-5624	.845-.788	-51	2▷
		COMMERCIAL JET A-1 5▷	F-34★	NONE	.829-.775	-54	2▷ 3▷
		COMMERCIAL JET A 5▷	NONE	NONE	.829-.775	-36	2▷ 3▷
EMERGENCY FUEL	AVIATION GASOLINE (AVGAS) PLUS 3% MIL-L-22851 TYPE II	80-87	F-12	MIL-G-5572	.706 4▷	-76	1▷
		91-96	NONE	NONE	.709 4▷	-76	1▷
		100-130	F-18	MIL-G-5572	.702 4▷	-76	1▷
		108-135	NONE	NONE	.707 4▷	-76	1▷
		115-145	F-22	MIL-G-5572	.706 4▷	-76	1▷

★ Fuel identified by NATO symbols F-34 and F-40 contain a fuel system icing inhibitor.

1▷ Follow climb restrictions.

2▷ Avoid flying at altitudes where indicated OAT is below the freeze point of the fuel.

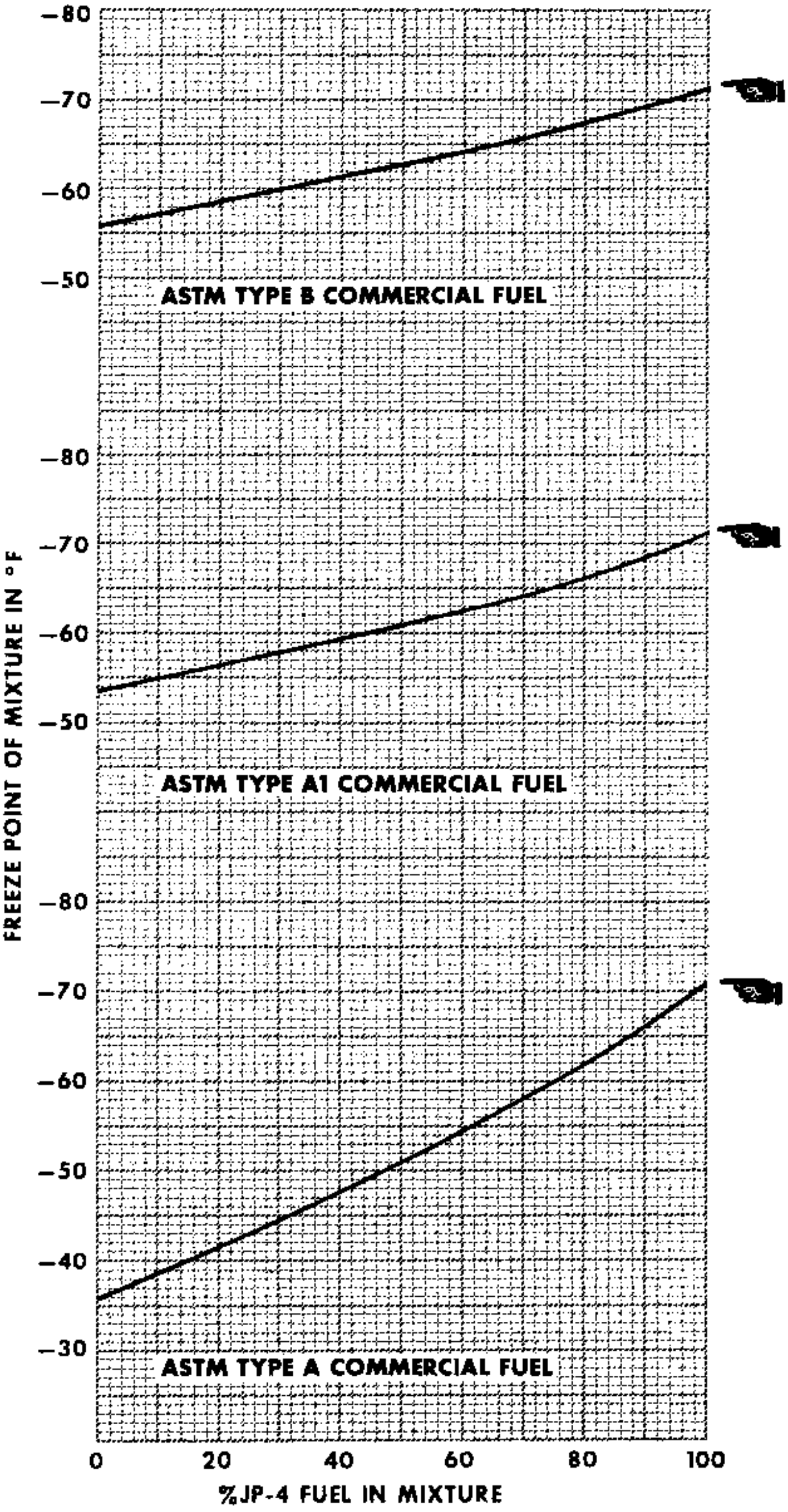
3▷ Prior to using commercial fuel, obtain freeze point from vendor or airline supplying the fuel, then follow limit 2 above. The pilot should exercise caution if he suspects or observes improper fuel handling procedures. If there is any indication that cleanliness is not up to standard, a fuel sample should be taken in a glass container and observed for fogginess, presence of water or rust.

4▷ Average value-limits are not controlled by specification.

5▷ See figure 5-4, "Jet Fuel Mixture Freeze Point Charts."

FUEL GRADE PROPERTIES AND LIMITS

Figure 5-3.



JET FUEL MIXTURE FREEZE POINT CHARTS

Figure 5-4.

EMERGENCY FUEL

CAUTION

Alternate or emergency fuels may or may not contain icing inhibitor additives. Precautions should be taken to avoid flight conditions which are conducive to fuel icing.

Emergency fuel is a fuel which may cause significant damage to the engines or other systems. Emergency fuel for this aircraft must conform to Specification MIL-G-5572, the lowest grade aviation gasoline available. This fuel is limited to a one-time flight and should be used only if recommended or alternate fuels are unavailable. When using aviation gasoline, the engine-driven fuel pump life becomes critical because of the poor lubricating properties of the gasoline. In addition, the use of aviation gasoline will leave lead deposits in the burners, turbine section, and the tailpipe. For these reasons, the use of aviation gasoline is to be avoided.

NOTE

Aviation gasoline and JP-4 fuel mixed in any proportion are suitable for continuous operation from an engine performance standpoint. However, the use of aviation gasoline must be restricted to emergency evacuation or ferry-type missions to minimize undesirable lead deposits in the engines.

RATE OF CLIMB LIMITATION WITH EMERGENCY FUEL (AVIATION GASOLINE)

The fuel tank vent system is designed for JP-4 fuel which has a Reid vapor pressure of 3 psi. Aviation gasoline has a Reid vapor pressure of 7 psi. If any tanks are refueled with aviation gasoline and a rapid rate of climb is established at altitudes above the boiling altitude of the fuel, the flow of vapor will exceed the capacity of the tank vent system. This will result in hazardous excess pressures in the tanks and vent system. When aviation gasoline is used, the rate of climb at altitudes above the boiling altitude of the fuel must be reduced. This is required as approximately 0.5% of the tank fuel quantity will be evaporated overboard per 1000 feet of tank altitude above the boiling point altitude of the fuel. The kerosene-type fuels will not limit aircraft climb rate.

NOTE

Gasoline and JP-4 fuel mixtures that contain less than 10% gasoline in all fueled tanks have no climb rate limitations.

GROUND REFUELING

When the aircraft is serviced on the ground with aviation gasoline and subsequently is flown above the limiting altitudes for the initial fuel temperatures shown in the table below, the rate of climb shall be restricted to not more than 200 feet per minute. Initial fuel temperature is the temperature of the aviation gasoline in the tanks shortly before takeoff time.

INITIAL FUEL TEMPERATURE	LIMITING ALTITUDE (FEET)
60° F	53,000
70° F	44,000
80° F	36,000
90° F	30,000
100° F	25,000
110° F	20,000

AIR REFUELING

If the fuel received from the tanker includes a portion of aviation gasoline, no accurate fuel temperature data will be available. The rate of climb restrictions will be determined by altitude and by the percent of aviation gasoline in any of the receiver tanks after refueling. If the aircraft is flown above the limiting altitudes for the percent of aviation gasoline shown in the table below, the rate of climb shall be restricted to not more than 200 feet per minute.

% AVIATION GASOLINE	LIMITING ALTITUDE (FEET)
50	45,000
75	35,000
100	Transfer Altitude

AIRSPEED LIMITATIONS

Mach number limitations shown in this section are indicated unless otherwise noted. The airspeed limitations, other than those shown in figure 5-1, are listed herein and are summarized in figure 5-8.

NOTE

If proper calibration is made, the aircraft may be flown to 400 knots calibrated airspeed and .93 Mach true under conditions allowing 390 knots IAS and .90 Mach indicated.

WING FLUTTER

To avoid flutter when equipped with the 3000-gallon external drop tanks, the maximum speed to be observed is 350 knots IAS or Mach .90 indicated, whichever is less. To avoid flutter, all outboard wing tank fuel must be used prior to using fuel from full drop tanks in accordance with normal fuel usage sequence. If normal fuel sequence is initiated with drop tanks less than 2000 pounds of full or if the normal fuel sequence cannot be followed, do not exceed 280 knots IAS. If the EWO fuel sequence is used, do not exceed 280 knots IAS until all drop tank fuel is used. For tabular presentation of wing flutter airspeed limitations, see figure 5-6.

EWO Fuel Usage Sequence

A serious flutter problem is approached at speeds above 530 KTAS between 22,000 and 29,000 feet during the low gross weight portion of the EWO fuel usage sequence. When using the EWO fuel usage sequence, do not exceed 530 KTAS between 22,000 and 29,000 feet pressure altitude when the following configuration is reached:

1. External tanks off or jettisoned, and
2. Mains 2 and 3 at 13,000 pounds each or less, and
3. Outboard wing tanks less than full.

ECM EQUIPMENT

The aircraft should not exceed 300 knots IAS unless one of the following is accomplished:

1. ECM transmitters and heat exchangers are installed in systems 5 thru 8, ALT-16 transmitters and amplifiers are installed in systems 11 and 12 or ALT-6B transmitter only in system 12, ALT-15, ALT-32 transmitters and power supplies in systems 13 and 14, and transmitter in system 16.
2. Dummy boxes or blank adapter plates are installed in lieu of any of the above equipment. Possible ram air duct, radome, or ECM shroud failures may occur if the aircraft exceeds 300 knots IAS without one of the above installations due to the flow of the unrestricted ram air.

Systems 1, 2, 3, 4, 9, 10, and 15 are not included in the above since systems 1, 2, 3, 4, and 15 are not ram-air cooled and systems 9 and 10 have blank adapter plates permanently installed.

DROP TANK JETTISONING

The following speed limitation must be observed when jettisoning the 3000-gallon drop tanks:

1. Maximum: 300 knots IAS or Mach .83 indicated, whichever is less
2. Minimum:
   - Flaps Up - 150 knots IAS or minimum recommended speed from figure 2-15, whichever is greater
   - Flaps Down - 150 knots IAS

CAUTION

Since the aircraft cg will move forward considerably when full 3000-gallon drop tanks are jettisoned, it is essential that the change in trim be anticipated by application of 2 to 3 units of noseup stabilizer trim in combination with nosedown elevator prior to release.

NOTE

Jettisoning at airspeeds above 300 knots IAS may result in a partially opened drop tank parachute having a streamlined configuration.

WING FLAPS

Wing flap airspeed limits for extension and retraction are illustrated in figure 5-5. It should be noted that the maximum airspeed to start flap extension is 225 knots IAS, maximum speed for 50% flaps is 225 knots IAS, and maximum speed for flaps full down is 190 knots IAS.

LANDING GEAR

The landing gear airspeed limitations are as follows:

1. Maximum speed for retraction - 220 knots IAS
2. Maximum speed for extension - 305 knots IAS at 30,000 feet and below; Mach .82 indicated at 35,000 feet; Mach .83 indicated at 40,000 feet; Mach .85 indicated at 45,000 feet; Mach .88 indicated at 50,000 feet.

NOTE

Maximum speed at which all gears will lock down is 305 knots IAS.

3. Maximum speed while extended - 305 knots IAS or aircraft strong buffet

AIRBRAKES

At speeds above 305 KIAS, do not select an airbrake position greater than position 4. See "Flight Characteristics," Section VI.

AIR REFUELING SLIPWAY DOORS

Maximum speed while slipway doors are open is 300 knots IAS.

MUNITION	MAXIMUM RELEASE KIAS			
	CLUSTER B-52 ■	HI-DENSITY B-52D	CLIP-IN	EXTERNAL B-52D
CBU-24A/B	–	350	–	350
CBU-24B/B	350	350	–	350
CBU-49B/B	350	350	–	350
CBU-49C/B	–	350	–	350
CBU-58/B	350	350	–	350
CBU-71/B	350	350	–	350
M36	370	350	–	–
MK36 Destructor	–	350	–	350
MK81	–	350	–	350
MK82	350	390 ◁5	–	350
MK82 Snakeye	–	350	–	350
MK83	–	350	–	350 ◁3
MK84	–	–	350	350
M117 ◁2	370	350	–	350
M117D Destructor	–	350	–	350
M117R	–	350	–	350
M124	350	350	–	–
M129/M129E1	325	325	–	350
MJU1/B	325	325	–	350
MK25	–	–	350 ◁1	–
MK36	350 ◁1	350 ◁1	–	–
MK52	350	350	–	–
MK53	350 ◁1	350 ◁1	–	–
MK55	–	–	350 ◁3	350
MK56	–	–	350 ◁1	350 ◁4

1▷ Or Mach .81, whichever is less.
2▷ M131 or MAU-103A/B fin.
3▷ Or Mach .86, whichever is less.
4▷ Or Mach .77, whichever is less. Or Mach .81, whichever is less with fins installed on mines at release stations 9, 10, 11, and 12.
5▷ 350 when using 3A-1 configuration.

CONVENTIONAL MUNITIONS RELEASE AIRSPEED LIMITATIONS

Figure 5-7A.

External Racks B-52D

For release airspeed limitations see figure 5-7A. For flutter airspeed limitations see figure 5-6.

NOTE

> Due to possibility of failure, the M-131 fins used on the M-117 GP bombs are normally restricted to one external flight. Fin failure can result in damage to the aircraft and bomb fuzes. Under emergency conditions the M-131 fin can be used on a maximum of two external flights provided total flight time above 300 KIAS does not exceed 1 hour.

TERRAIN CLEARANCE LIGHT

Maximum speed for terrain clearance light extended is 305 knots IAS.

AIRSPEED UNRESTRICTED

- Camera door operation

INDICATED AIRSPEED		CONDITIONS
KNOTS	MACH	
135	–	Drag chute deployed
190	–	Full flaps
220	–	Gear retraction
225	–	Half flaps
280	.90	Wing flutter (Abnormal fuel sequence)
300	.83	Drop tank jettison
300	–	Air refueling slipway doors open
300	–	ECM transmitters and heat exchangers, dummy boxes, or blank adapter plates not installed
305	–	Airbrakes greater than position 4
305	–	Terrain clearance light extended
305	–	Gear extension 30,000 feet and below
–	.82	Gear extension at 35,000 feet
–	.83	Gear extension at 40,000 feet
–	.85	Gear extension at 45,000 feet
–	.88	Gear extension at 50,000 feet
305	–	Landing gear extended
350	.90	When equipped with drop tanks
390	.86	AGM-28 installed
390	.90	Maximum airspeed (clean aircraft)

AIRSPEED LIMITATIONS

Figure 5-8.

RUDDER TRIM LIMITATIONS

In order to stay within the structural limits of the fin, the rudder trim limits tabulated below should be observed. These limits will protect the aircraft structure during normal maneuvering with pedal forces up to 200 pounds and will also allow trimming of single outboard engine failures throughout the normal speed range in the clean configuration. Double outboard engine failures can be trimmed in cruising flight.

KNOTS IAS	TRIM SETTING
Under 320	12 units (full trim)
Over 320	8 units

NOTE

It should be observed that these limits are not identical to those listed on the rudder trim placard. The placard limits, being more conservative, should be adhered to operationally whenever possible. In any event, the above listed structural limits shall not be exceeded.

ENGINES:
J57-P-19W & -29WA

CONDITIONS:

- CLEAN CONFIGURATION
- NACA STANDARD DAY
- WITH DROP TANKS

EXAMPLE:

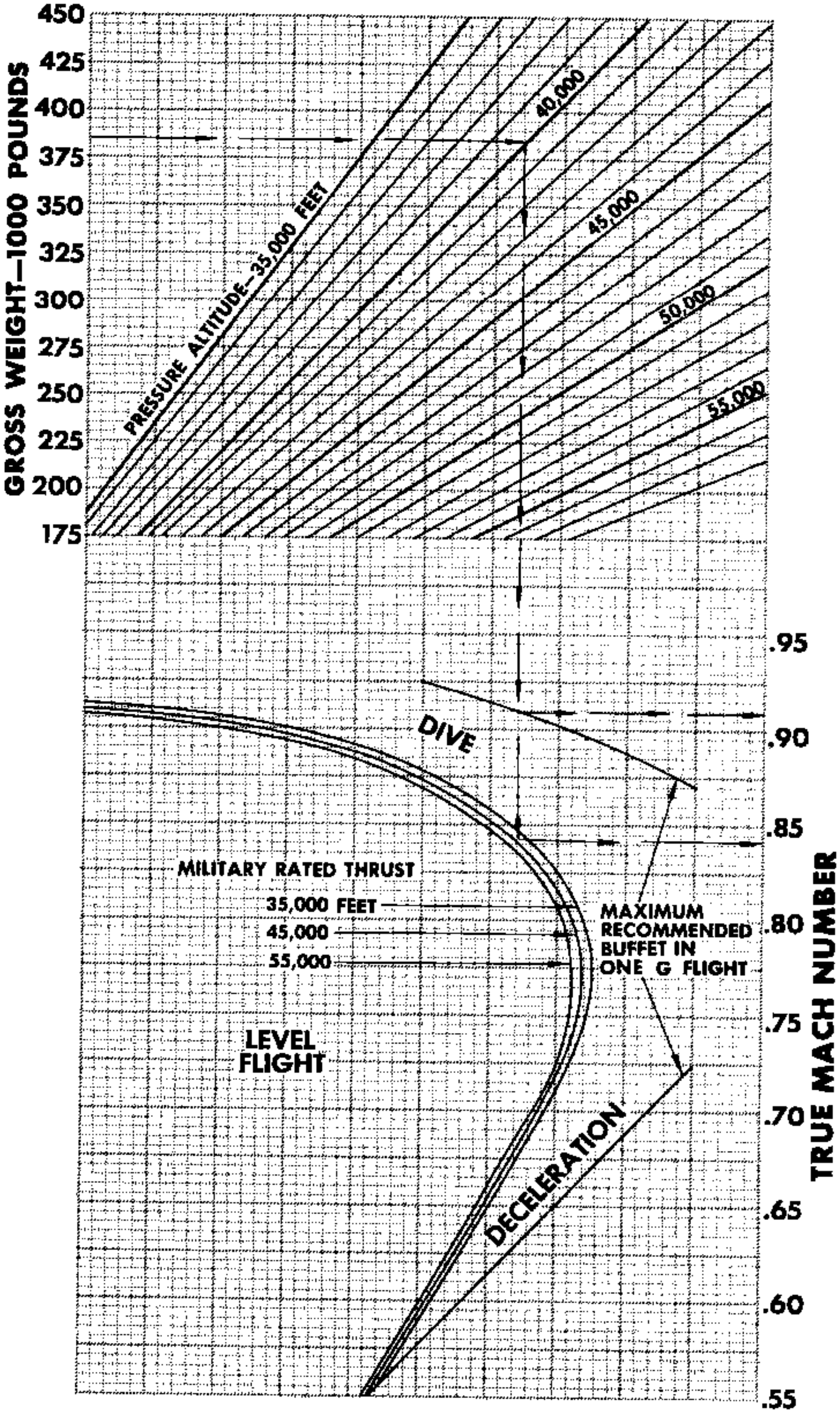
GIVEN:
Gross weight = 385,000 lb
Altitude = 40,000 ft

FIND:
Maximum speed in level flight and maximum permissible dive speed

SOLUTION:
Max level flight
Mach No. = .842

Max dive speed
Mach No. = .909

DATA BASIS: FLIGHT TEST
DATE: JULY 1956



FLIGHT SPEED ENVELOPE

Figure 5-9.

DRAG CHUTE LIMITATIONS

During the deceleration of a landing or refused takeoff, the drag chute may be deployed at 135 knots IAS. Deployment at higher speeds may result in failure of the chute or the shear pin.

BUFFET BOUNDARY LIMITATIONS

Flight Speed Envelope

Figure 5-9 represents the flight speed envelope of the aircraft at high altitude. It is possible to fly fast enough to cause a progressive airflow separation over the wing which results in aircraft buffet. Buffet is also encountered at low speeds prior to stalling. The aircraft can be flown safely through the first indication of buffet to the speed for maximum recommended buffet (maximum recommended buffet is defined as a buffet or vibration amplitude of ±0.1 "g" at the pilots' stations). The MRT lines on figure 5-9 define the level flight speed range at high altitude. See "Wing Buffeting," Section VI.

PROHIBITED MANEUVERS

Acrobatics of any kind are strictly prohibited. This includes intentional spins, vertical stalls, and steep dives, as well as any other maneuver resulting in abrupt accelerations. Normal stalls, accidental spins, and shallow dives are discussed in Section VI.

ACCELERATION LIMITATIONS

LIMIT LOAD FACTOR

On figure 5-10, a plot is shown which illustrates the limitations imposed on the manuevering "g's" by the structural design of the aircraft. Maximum flight weight versus fuel weight in the wing tanks (figure 5-16) must be observed in order to avoid exceeding the inflight maximum allowable wing bending moment.

NOTE

When using either the normal or alternate EWO fuel sequence (Section VII), intentional maneuvers to local factors in excess of 1.8 "g's" are prohibited at speeds less than 300 knots IAS for gross weights greater than 312,000 pounds once the use of outboard wing fuel has begun (since information in figure 5-16 is violated over this weight range).

ALTITUDE AND TEMPERATURE LIMITATIONS

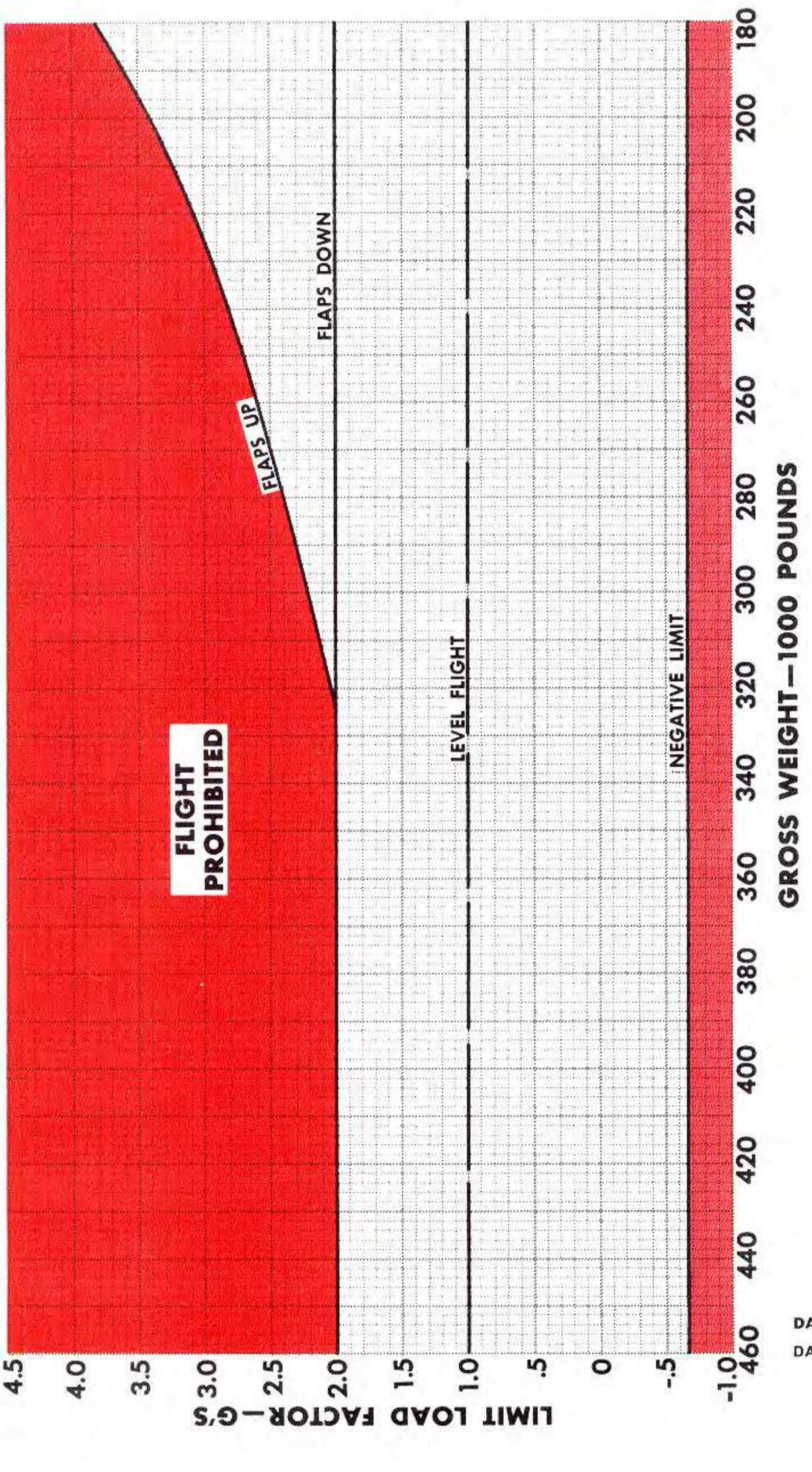
Although there is no unqualified altitude restriction on the aircraft, the table below lists limitations on equipment which is not designed for operation above the noted altitude or which must be shut down under specific conditions.

Water Injection System	40° F OAT or 8000 feet
Oxygen Regulator and MBU-5/P Oxygen Mask Combination	42,000 feet (cabin altitude)
IP-135A/APA-82 Auxiliary Scope (marginal)	35,000 to 40,000 feet, (cabin altitude)
Gunnery System	50,000 feet (aircraft altitude)

If ECM equipment is to be operated on the ground without ground cooling equipment, specific time and temperature limitations must be complied with to prevent overheating. APR-25 equipment has no time or temperature limitations. Other ECM equipment time and temperature limitations are listed in Section VIII, ECM Operational Check.

CAUTION

Due to probable equipment damage, operation of ECM equipment without complying with proper cooling, time, and/or temperature indications is prohibited.



DATA BASIS: ESTIMATED
DATE: JANUARY 1956

STRUCTURAL LIMITATIONS — LIMIT LOAD FACTOR

Figure 5-10.

RATE OF DESCENT LIMITATIONS

The maximum rate of descent is 25,000 feet per minute.

MANEUVER LIMITS — FLAPS DOWN

Figure 5-11 provides curves which may be used to determine the allowable flaps-down maneuver limits to avoid stall buffeting, stalls, or exceeding the structural placard limits. This chart is useful in planning the approach.

MANEUVER LIMITS — FLAPS UP

Figure 5-11A depicts the flaps-up maneuvering limits above 10,000 feet. Three reference curves are plotted on the chart to compute minimum recommended speed, initial buffet speed, and strong buffet speed. Strong buffet and maximum recommended buffet are synonymous. The chart may be used to compute high speed initial buffet at a given bank angle by using the top portion of the buffet curve, or the low speed initial buffet at a given bank angle by using the lower portion of the buffet curve. See examples on figure 5-11A. Maximum bank angle for initial buffet may be computed by establishing the point of convergence of the high speed and low speed buffet curves (note asterisk on figure 5-11A) and following vertically to the intersection of the bank angle curve developed from the gross weight and altitude conditions. The same process would be used for computing strong buffet-maximum recommended. Acceleration "g's" may also be computed for any selected condition from the scale on the left side of the bank angle chart.

SYSTEMS LIMITATIONS

STABILIZER TRIM MECHANISM LIMITATIONS

There are no restrictions on the use of the manual stabilizer trim system; however, when using the electrical portion of the system, observe the following limitations:

1. Do not operate the electrical trim mechanism on the ground more than 5 seconds after either pack 9 or 10 hydraulic low pressure warning light illuminates. At this time, hydraulic pack 9 or 10 accumulator pressure will have become depleted and clutch slippage will occur.
2. Do not operate the electrical trim mechanism on standby hydraulic pressure except during inflight emergencies.
3. Do not actuate one trim switch in NOSE UP position while applying nosedown trim with the other trim switch (an exception to this is a runaway trim condition). This operation causes the electric actuator to stall, since one electric actuator clutch cancels the effect of the other. Overheating and eventual failure will result if this condition is maintained for long periods of time (in excess of 2 minutes) due to a stalled actuator rotor.
4. Electrical actuation of the followup screws into either the noseup or nosedown limit stops should be avoided to prevent stalling the output shaft of the actuator motor and overheating the clutch, as this shortens clutch service life. Extreme noseup or nosedown positions may be obtained manually after approaching the extremes electrically.
5. During flight, the stabilizer trim should be operated only in short bursts. This will serve as an aid in recognizing a malfunctioning electrical trim system before an extreme out-of-trim condition is reached.

HYDRAULIC PACK LIMITATIONS

To prevent overheating and possible failure of hydraulic packs 1, 2, or 4, do not fly with any one of the following conditions existing for a period in excess of 30 minutes out of each hour unless the landing gear is extended:

1. Either slipway door switch in OPEN position.
2. Master bomb control switch in ON position.
3. Bomb doors open.

In case a utility pack fails to shut down, see "Hydraulic System Emergency Operation" in Section III.

WING FLAP LIMITATIONS

Actuation of the wing flaps is limited as follows:

1. Three complete duty cycles (extension and retraction) allowed in a 30-minute period.
2. Eight starts allowed in a 30-minute period.

Wing flap operation, either normal or emergency, shall be discontinued within 10 seconds if the flaps fail to start moving. Slippage of the power unit clutch or malfunction of the wing flap system can be detected by monitoring the wing flap indicator while using the system. Any additional attempt to start the flaps shall be limited to 10-second intervals of actuation. Do not use either flap motor for more than eight attempted starts in any 30-minute period.

NOTE

> If slippage of the wing flap power unit clutch is known or suspected to have occurred, an entry must be made in Form 781 stating the circumstances and the approximate duration of the malfunction.

ELECTRICAL LOAD LIMITATIONS

For electrical load limitations other than those indicated in figure 5-1, see "Electrical Loads" under "Electrical System Operation," Section VII.

CONDITIONS:

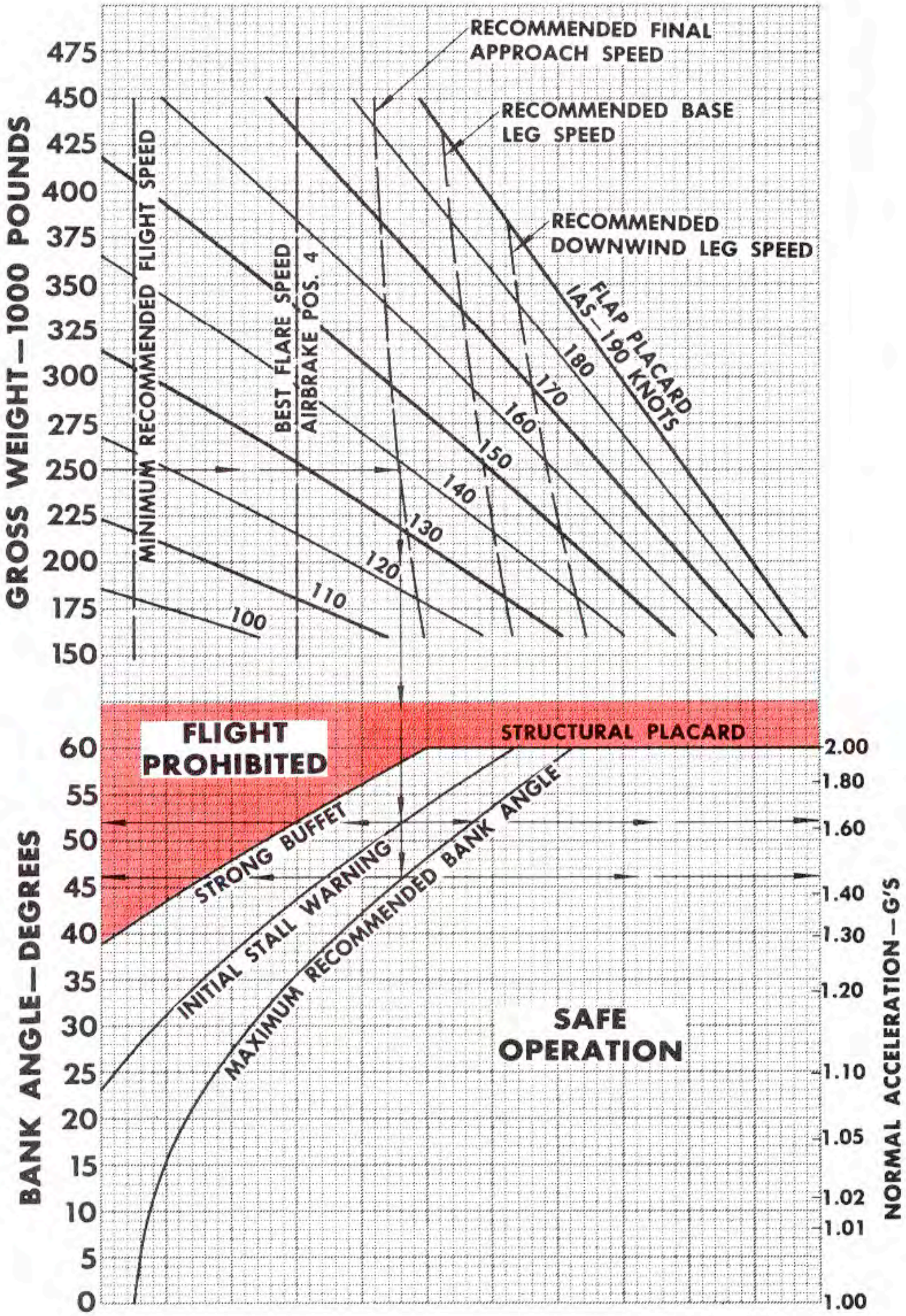
- ● FLAPS DOWN
- ● SEA LEVEL TO 10,000 FEET

EXAMPLE:

GIVEN:
Gross weight = 250,000 lb

FIND:
Maneuver limit at recommended final approach speed

SOLUTION:
46° bank angle or 1.45 g = Maximum recommended
52° bank angle or 1.62 g = Initial stall warning



DATA BASIS: FLIGHT TEST
DATE: JANUARY 1956

MANEUVER LIMITS—FLAPS DOWN

Figure 5-11.

DATE: AUGUST 1968

DATA BASIS: ESTIMATED

REMARKS:

This chart may be used to compute the maximum allowable bank angle for the existing gross weight and altitude.

EXAMPLE 1:

GIVEN:
Gross weight = 375,000 pounds
Altitude = 37,000 feet
Bank angle - 30°

FIND:
Maximum and minimum airspeed for initial buffet

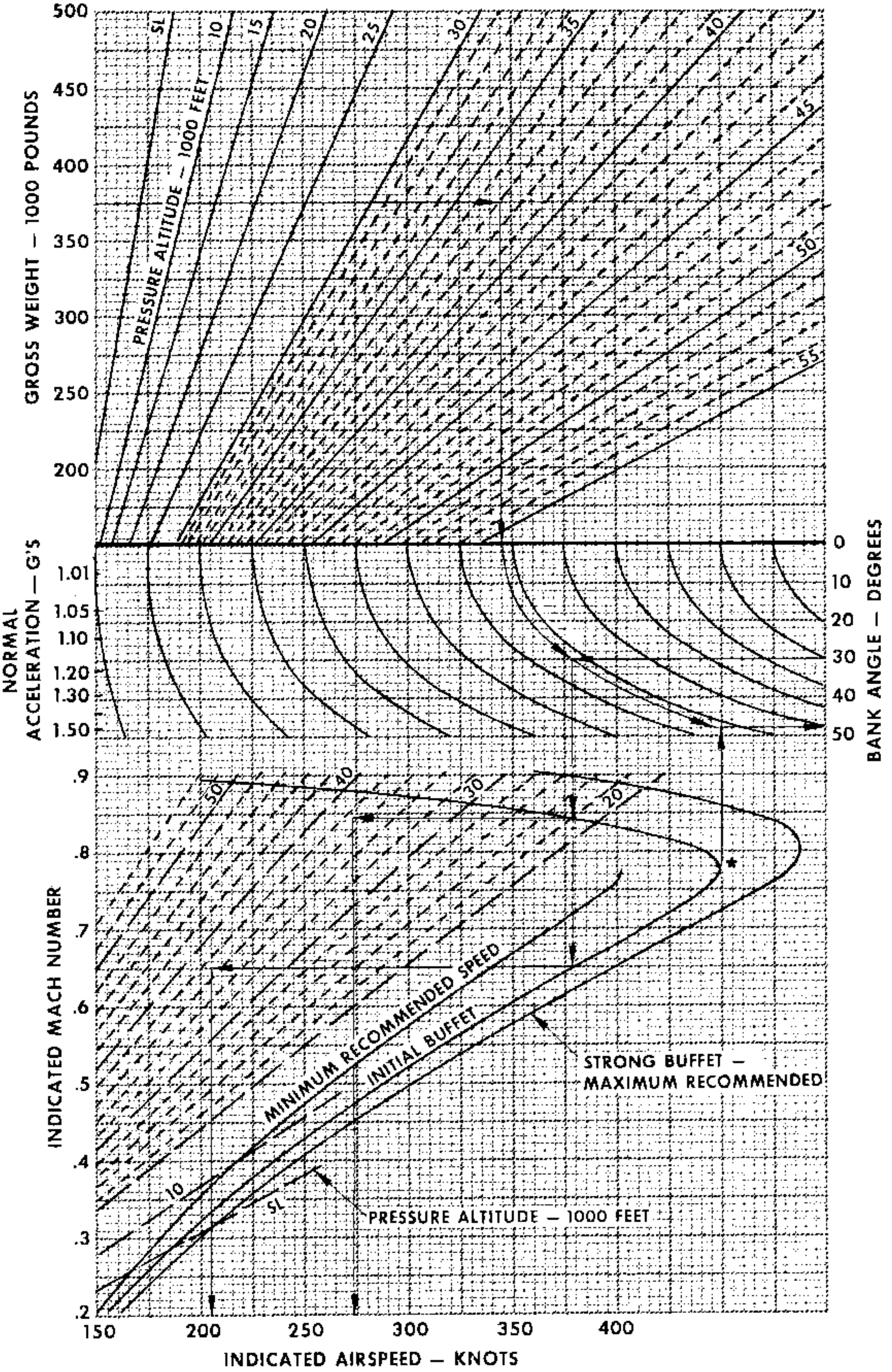
SOLUTION:
Initial buffet low speed = 205 KIAS
Initial buffet high speed = 274 KIAS

EXAMPLE 2:

GIVEN:
Gross weight = 375,000 pounds
Altitude = 37,000 feet

FIND:
Maximum bank angle limit

SOLUTION:
*Initial buffet curve convergence = .775 Mach
Maximum bank angle = 48°



MANEUVER LIMITS — FLAPS UP

Figure 5-11A.

BOMBING SYSTEM LIMITATIONS

Cluster Bomb Racks

WARNING

Do not land with 1000-pound class munitions in any of the nine bottom stations of the cluster racks. Loads imposed during landing stresses may result in failure of the racks.

Conventional Munitions Jettison

In an emergency, jettison of internal munitions with the aft gear down may be attempted; however, consideration must be given to possible gear damage. A planned release in this configuration is not authorized.

CAUTION

Jettison of internal munitions with the aft landing gear in the down position may result in landing gear damage.

B-52D

Jettison of external munitions with the wing flaps extended can be safely effected. A nose low attitude at release is desired; therefore, jettison airspeed should be 180 KIAS or above, not to exceed flap placard speed. In all cases, 180 KIAS will exceed the minimum release TAS of 180 knots given in T.O. 1B-52C-34-2-1.

BOMB DOOR OPERATION LIMITATIONS

Maximum bomb door open speed is 390 KIAS. Noticeable bomb door fatigue damage (loose rivets, cracked skin and ribs, etc.) can be expected after the doors have been open for 5 minutes at 390 KIAS. Fatigue damage can also be expected at lesser airspeeds if the doors are open for longer periods. If the doors remain open for extended periods due to system malfunction or any limit is exceeded, make a Form 781 entry.

CAUTION

- When bomb doors are operated with power to only the forward bomb door actuator, aircraft speed should not exceed 325 knots IAS, if practical, as a precaution against buffeting and structural damage to the doors.
- Do not operate bomb doors in flight with power to only the rear bomb door actuator except when imperative to do so, since this may result in loss of portions of the bomb doors and possible damage to the aft body structure and empennage.

AILERON TRIM MECHANISM LIMITATIONS

Continuous actuation of the aileron trim mechanism shall be limited to two complete duty cycles followed by a 10-minute cooling period. One duty cycle includes actuation from the neutral, or 0° position, to either the extreme left wing-down or right wing-down position, back through neutral to the opposite extreme position, then finally returned to neutral.

TERRAIN CLEARANCE LIGHT LIMITATIONS

CAUTION

- Ground operation of the terrain clearance light should not exceed 5 continuous minutes without allowing a 5-minute cooling period before a subsequent operating period. The light should be extended beyond a 30° position (beam from vertical) to allow maximum heat dissipation.
- Inflight operation of the terrain clearance light should not exceed 15 continuous minutes without allowing a 4-minute cooling period before subsequent operating periods.

GROUND OPERATION LIMITATIONS

GROUND TURNING LIMITATIONS

Maximum ground turning speeds with full rudder travel are 5 knots with steering ratio selector lever in TAXI or 27 knots with the lever in TAKEOFF LAND.

WHEEL BRAKE LIMITATIONS

Brake Energy Limits

The brakes are limited in the amount of work they can perform and still function properly because this work must be dissipated in the form of heat. A measure of the amount of heat absorbed or work performed by the brakes is the kinetic energy expended, measured in millions of foot-pounds. The heat generated from the brakes can cause the tire pressure to increase to dangerous values. The combination of increased tire pressure and deterioration of the tire strength, due to the heat, could cause the tire to explode. In some extreme cases, the brake and wheel assembly may get hot enough to ignite the hydraulic fluid and start a fire before the tire explodes. The amount of heat added to the brakes for each braking effort during a landing rollout, taxiing, or ground maneuver is cumulative and is determined by the speed of the aircraft and its gross weight at the time the brakes are applied. To preclude the possibility of injury to personnel and damage to equipment from an overheated brake and wheel assembly and tire due to the brake energy limit being exceeded, separate charts for flaps down and flaps up are provided in figure 5-12.

NOTE

- The effect of aerodynamic braking has been considered in the "Brake Energy Limits" charts. This aerodynamic braking will slow the aircraft the same amount whether the brakes are applied steadily or in short applications.
- The same amount of heat is generated by the brakes in stopping the aircraft within a given stopping distance or in deceleration of the aircraft during taxiing or ground maneuvers, regardless of whether the brakes are applied in one steady application or in a series of short applications. The internal heat generated by the brakes does not reach the outer surface of the wheel-brake assembly for several minutes whereas the ground roll requires only a few seconds; therefore, all but an insignificant amount of the heat generated by the brakes will remain in the brake assembly for the duration of the ground roll.

The brake energy limits charts should be used whenever a takeoff is aborted, for all flaps up landings, and for flaps down landings at gross weights over 300,000 pounds, for planned lengthy ground maneuvers, and when the pilot suspects that the combination of gross weight, runway altitude, temperature, runway grade, IAS, and the number of stops and decelerations will result in exceeding the brake energy limits. To determine the heat energy absorbed during landings and aborted takeoffs, enter the appropriate chart with gross weight, brake application speed, runway pressure altitude, runway temperature, and drag chute configuration. Correct for runway gradient using chart on sheet 2. For stops and decelerations, determine the heat energy absorbed during each brake application by entering the table on sheet 2 with the taxi speed at brake application and the final taxi speed. The total heat absorbed is found by summing the heat energy absorbed from each maneuver per example on the brake energy limits charts. The following operating procedures and restrictions are necessary to preclude the possibility of injury to personnel and damage to equipment from overheated brakes and tires in accordance with the applicable brake energy limit zones on the brake energy limits charts.

DANGER ZONE - OVER 230 MILLION FOOT-POUNDS.

1. Taxi aircraft clear of runway, other aircraft, and personnel. Taxi distance and braking shall be an absolute minimum. Stop aircraft and release brakes as soon as possible.
2. Approach from front or rear only for fire fighting. Crew evacuation shall be in same direction. Tire explosion and hydraulic fluid fires are imminent.
3. Extinguisher agents shall be applied as fog or foam on tires. Do not spray liquid directly on wheels.
4. After wheels and brakes have cooled, remove and replace per T.O. 1B-52B-2-10.
5. Remove and replace tires per T.O. 4T-1-3.

DATA BASIS: FLIGHT TEST

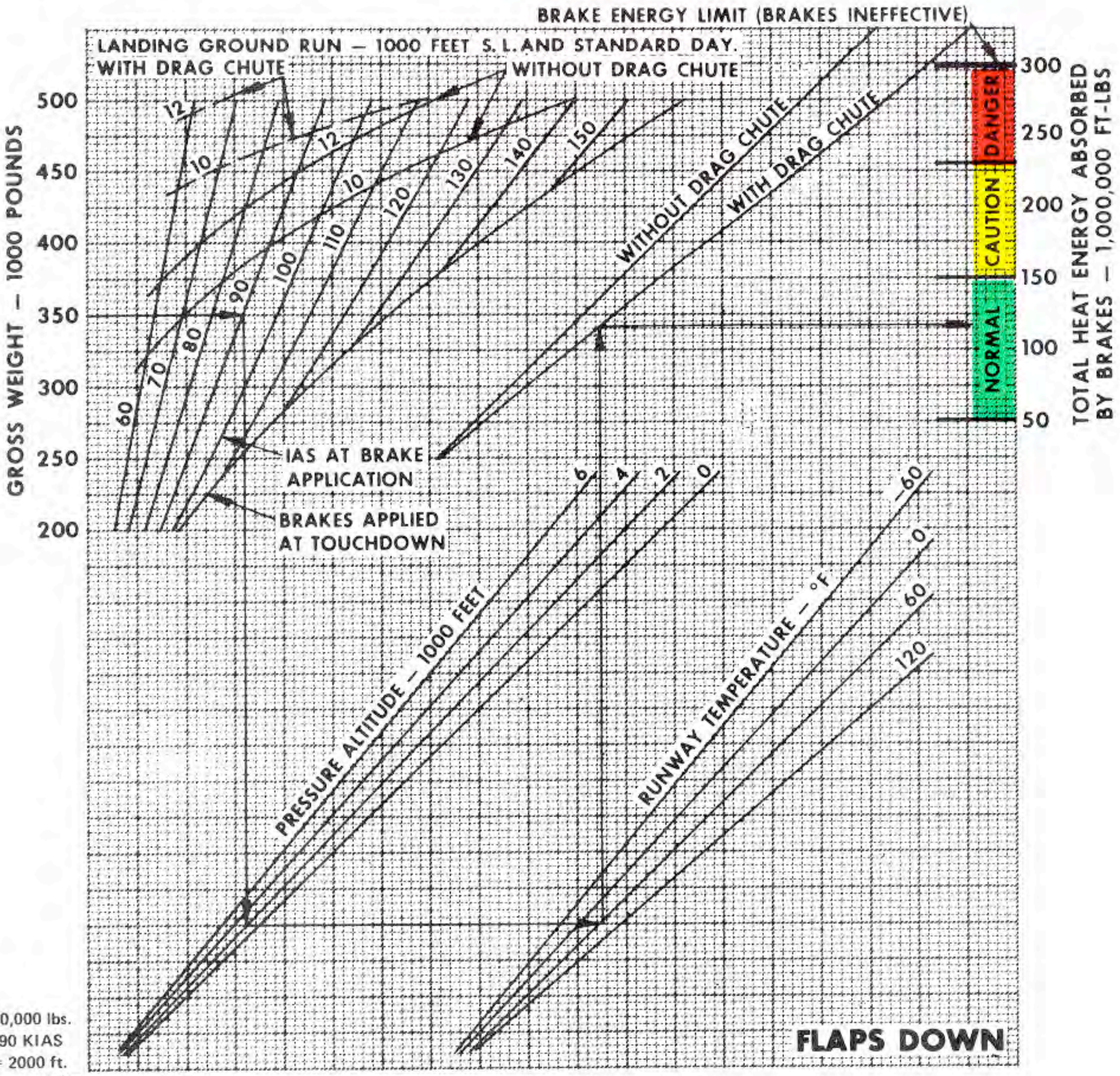
DATE: JANUARY 1968

CONDITIONS:

- **EIGHT ENGINES AT IDLE**
- **RCR 23**
- **NO WIND. NO GRADIENT**
- **EQUAL BRAKING**
- **DRAG CHUTE FULLY EFFECTIVE AT 130 KIAS**

REMARKS:

- One-half the HEADWIND component measured by the tower should be subtracted from the IAS at brake application.
- A TAILWIND component must be added to the IAS.
- If aircraft is allowed to creep during engine run up, add 10,000,000 foot pounds for each 100 feet of travel.
- To determine total heat energy absorbed gradient correction and ground maneuvering increments from sheet 2 must be applied.



EXAMPLE:

GIVEN:
Gross weight = 350,000 lbs.
Brakes applied at 90 KIAS
Pressure altitude = 2000 ft.
Runway temperature = 60°F
With drag chute
Gradient = 1% downhill

FIND:
Heat energy absorbed by brakes for a complete stop after landing and taxi to parking area.
Four brake applications during taxi to parking area, decelerating from 20 to 5 knots.
One brake application from 5 knots to 0.

SOLUTION:
From the chart:
Initial heat energy absorbed to stop after landing = 118,000,000 foot-pounds.
From the gradient correction chart (sheet 2)
Heat energy absorbed to stop after landing = 125,000,000 foot-pounds.

From the ground maneuvering table (sheet 2):
Four brake applications at 7,000,000 foot-pounds each upon each application = 28,000,000 foot-pounds.
One brake application at 1,000,000 foot-pounds.
Total heat energy absorbed = 154,000,000 foot-pounds (caution zone).

Figure 5-12 (Sheet 1 of 3).

REMARKS:

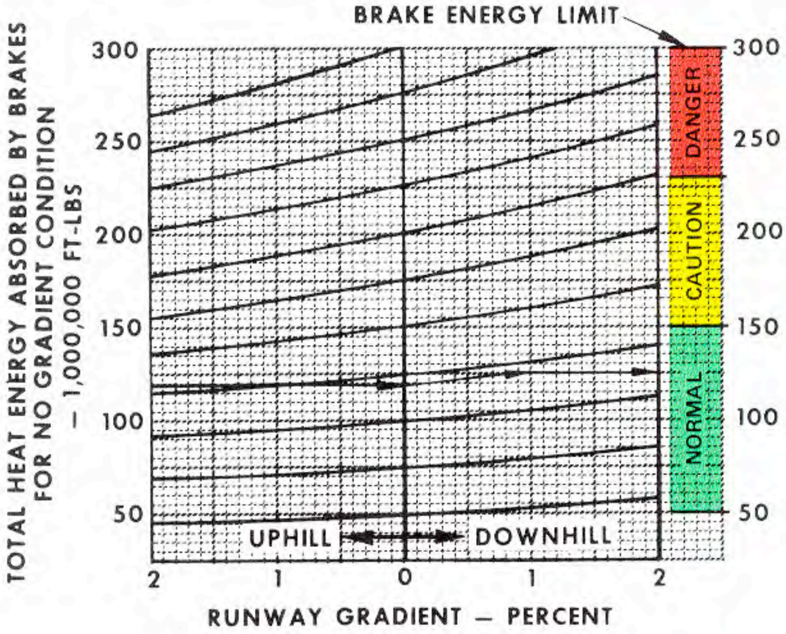
The table is based on maximum ground handling of the aircraft and will be conservative for lesser weights.

CONDITIONS:

- ANY LANDING CONFIGURATION
- RCR = 23
- NO WIND

DATE: SEPTEMBER 1973

DATA BASIS: ESTIMATED



BRAKE ENERGY CORRECTIONS DUE TO RUNWAY GRADIENT

TAXI SPEED AT BRAKE APPLICATION — KNOTS	FINAL TAXI SPEED — KNOTS						
–	50	40	30	20	10	5	0
60	23	41	55	66	71	73	74
50	–	18	32	43	48	50	51
40	–	–	14	25	30	32	33
30	–	–	–	10	16	18	19
20	–	–	–	–	6	7	8
10	–	–	–	–	–	2	3
5	–	–	–	–	–	–	1

HEAT ENERGY ABSORBED
1,000,000 FT-LBS

GROUND MANEUVERING BRAKE ENERGY INCREMENT

BRAKE ENERGY LIMITS

Figure 5-12 (Sheet 2 of 3).

CONDITIONS:

- 8 ENGINES AT IDLE
- RCR 23
- WITH AIRBRAKES
- NO WIND NO GRADIENT
- EQUAL BRAKING
- DRAG CHUTE FULLY EFFECTIVE AT 130 KIAS

EXAMPLE:

GIVEN:

Gross weight = 315,000 pounds
Brakes applied at 142 KIAS
Pressure altitude = 3000 feet
Runway temperature = 60° F
Without drag chute

FIND:

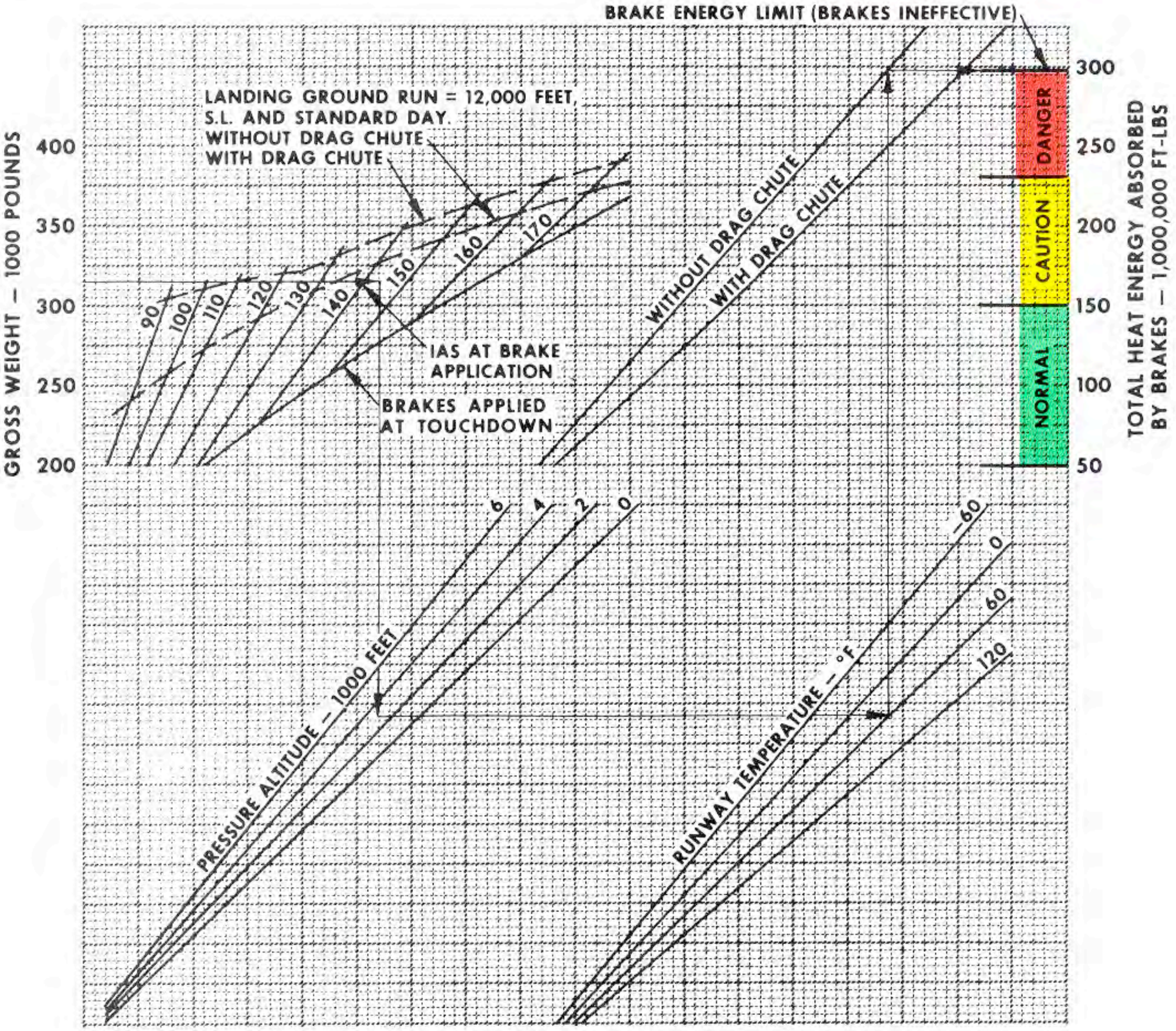
Heat energy absorbed by brakes for a complete stop

SOLUTION:

Total heat energy absorbed = 298,000,000 foot-pounds (danger zone)

DATA BASIS: FLIGHT TEST

DATE: AUGUST 1968



FLAPS UP

BRAKE ENERGY LIMITS

Figure 5-12 (Sheet 3 of 3).

CAUTION ZONE - 150 TO 230 MILLION FOOT-POUNDS.

1. Park aircraft.
2. Inspect tires per T.O. 4T-1-3.
3. Inspect brakes per T.O. 1B-52B-2-10 for brake wear and hydraulic fluid leaks.
4. Delay subsequent takeoff until hand can be held on brake assembly (approximately 135° F).

NORMAL ZONE - UP TO 150 MILLION FOOT-POUNDS.

1. No special inspection is required.
2. If gross weight is not above 300,000 pounds, no brake cooling is required prior to takeoff. If gross weight is above 300,000 pounds, delay subsequent takeoff until hand can be held on brake assembly.
3. If stop exceeds 100 million foot-pounds and an immediate takeoff is made:
    a. Make a normal takeoff.
    b. After cleanup altitude is reached, extend gear and leave down 2 minutes for each 8 million foot-pounds in excess of 100 million foot-pounds.
    c. Some loss in rate of climb can be expected.

Landing Gear Oscillation

If landing gear oscillation is experienced, brakes shall be fully released immediately. Brakes may be reapplied as soon as body and landing gear oscillations have ceased.

TIRE LIMITATIONS

Maximum Ground Speed

To prevent main landing gear tire casing failures, all takeoffs and landings will be limited to a maximum ground speed of 217 knots. Refer to Part 9 of the Appendix for tire limit speed chart used to correct IAS to ground speed.

ARC-65 LIAISON RADIO LIMITATIONS

WARNING

Ground operation of the AN/ARC-65 transmitter (interphone selector switch positioned to LIA and mike switch actuated) is prohibited on any tactical aircraft with nuclear weapons loaded and bomb bay doors open.

NOTE

This restriction applies only to AN/ARC-65 installed on the tactical aircraft having nuclear weapons aboard and does not apply to adjacent aircraft regardless of separation distance. This does not prohibit AN/ARC-65 receiver operation on the ground.

CENTER OF GRAVITY LIMITATIONS

The allowable cg limits are shown in the chart on figure 5-13. Maintaining the center of gravity within these limits is required by structural rather than aerodynamic considerations. The cg may easily be maintained within these limits by following the prescribed normal fuel scheduling. A considerable margin is also available for other than normal scheduling to allow for battle damage.

WEIGHT LIMITATIONS

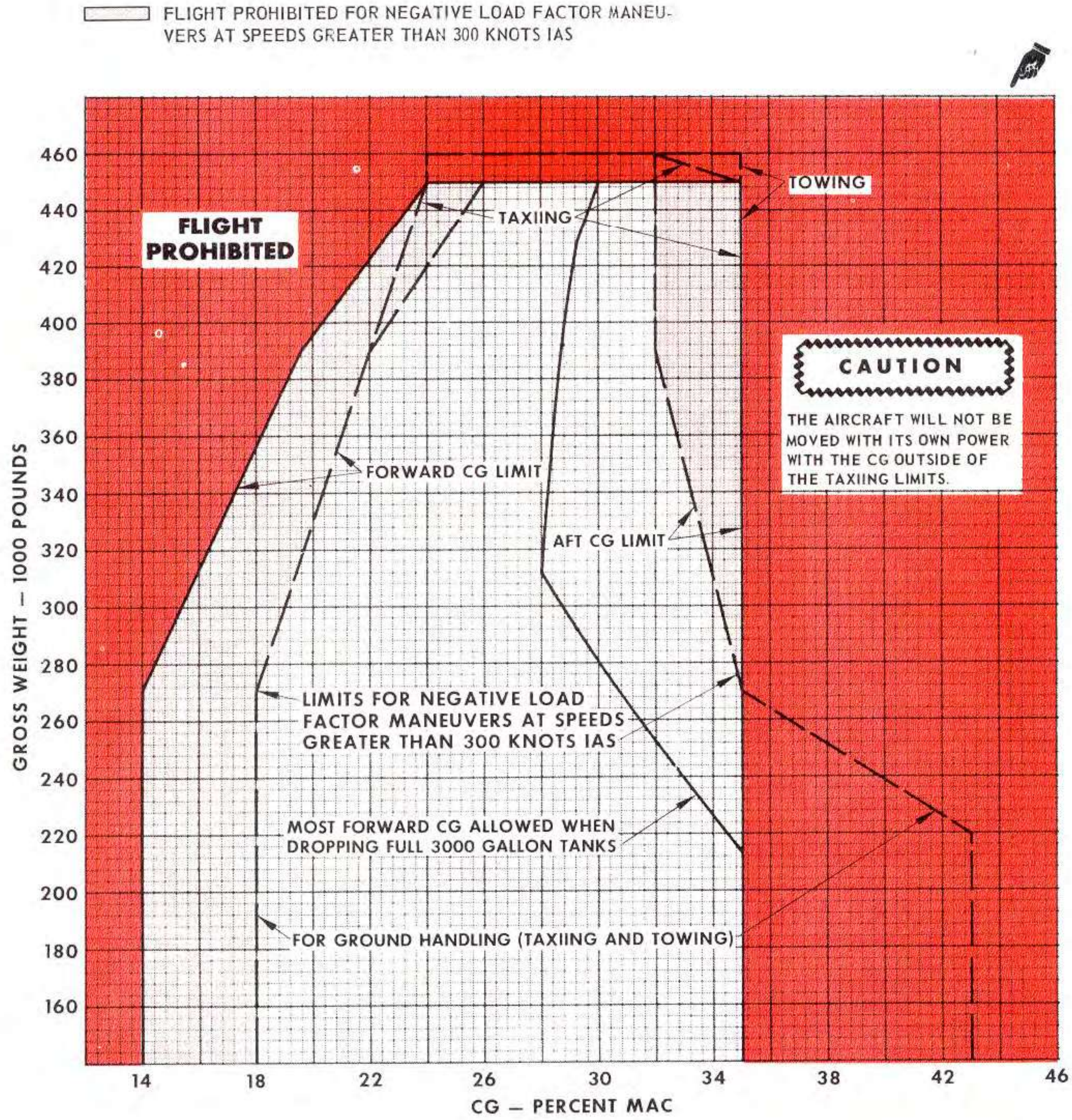
MAXIMUM GROSS WEIGHT

The aircraft may be loaded to a maximum gross weight under certain conditions as follows:

CONDITION	MAXIMUM GROUND HANDLING WEIGHT INCLUDING WATER	MAXIMUM INFLIGHT WEIGHT
WITH EXTERNAL TANKS ON AND FULL	460,000 POUNDS	450,000 POUNDS
NO EXTERNAL TANKS	376,500 POUNDS	370,000 POUNDS
EXTERNAL TANKS ON BUT EMPTY	379,100 POUNDS	375,000 POUNDS
MAXIMUM WEIGHT TO DROP EMPTY EXTERNAL TANKS		372,600 POUNDS

LANDING GEAR LIMITATIONS

The main landing gear is basically critical for braked-roll condition. The drag strength is sufficient to allow application of the brakes for aircraft gross weights up to the maximum flight gross weight. The hydraulic pressure of the brake system has been limited to preclude gear failures up to the maximum flight gross weight. The normal landing gross weight at 470 feet per minute limit contact sinking speed is 270,000 pounds. However, it is possible to land the aircraft up to the maximum flight weight limit if the sinking speed is limited as shown in figure 5-15. Landings above 400,000 pounds would be quite difficult because of the shallow approach angles necessary, and also because there would be little power margin for maneuvering or go-around. These sinking speeds are dictated by a combination of vertical and spin-up loads. The strength of the body bulkheads supporting the landing gear permits ground turns which produce a maneuver side load of 0.27 "g" limit at the maximum ground handling gross weight.



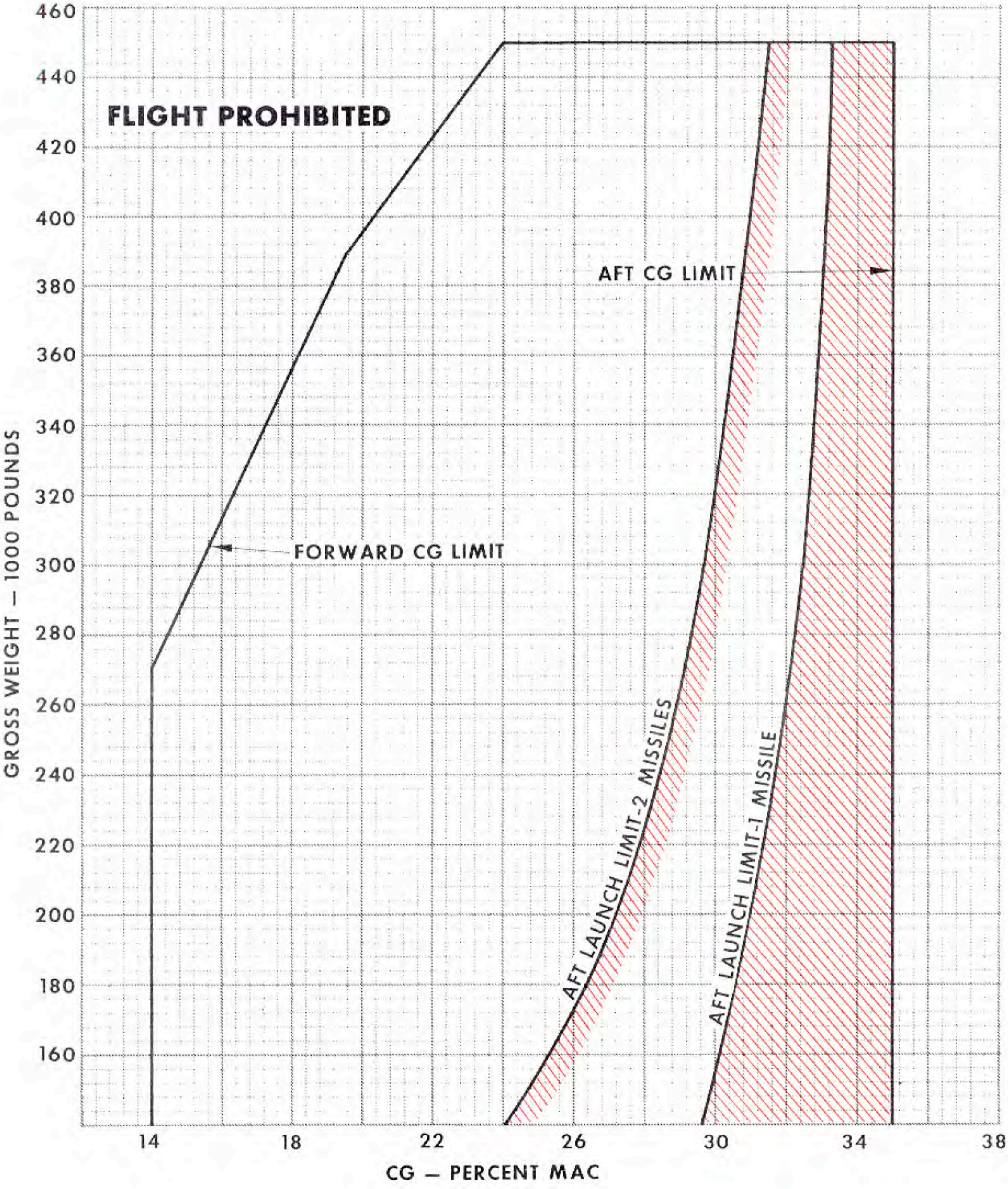
CAUTION

THE AIRCRAFT WILL NOT BE MOVED WITH ITS OWN POWER WITH THE CG OUTSIDE OF THE TAXIING LIMITS.

DATA BASIS: ESTIMATED
DATE: AUGUST 1965

STRUCTURAL CG LIMITS

Figure 5-13.

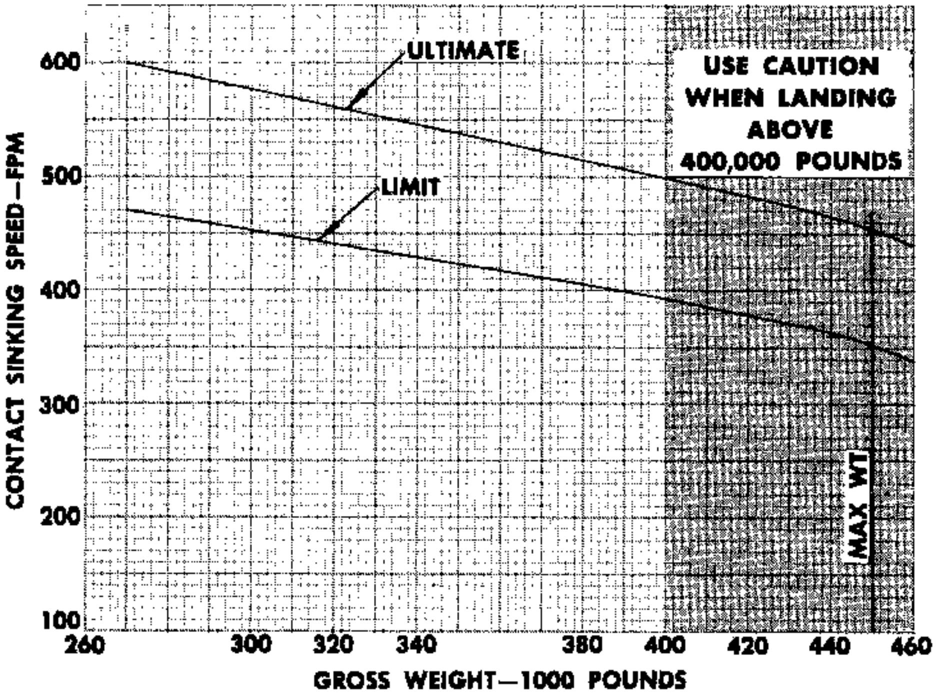


NOTE

THE FUEL SEQUENCES (FIGURES 7-4 THRU 7-7) ARE DESIGNED TO KEEP THE AIRCRAFT FORWARD OF THE AGM-28 LAUNCH CG LIMITS.

AGM-28 LAUNCH CG LIMITS

Figure 5-14.



CONTACT SINKING SPEED LIMITATIONS

Figure 5-15.

FUEL LOADING

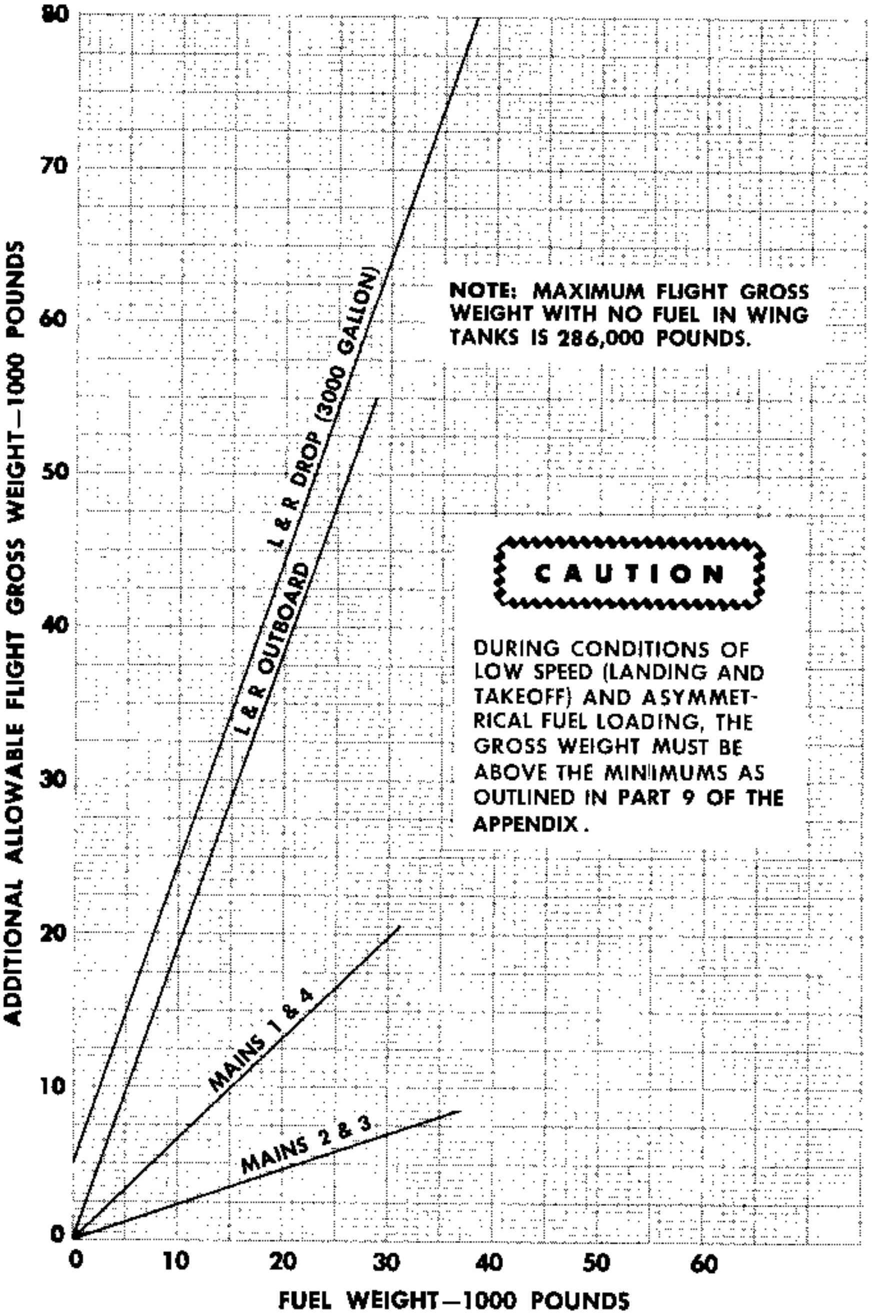
NOTE

> Do not use fuel sequencing as placarded on aircraft. See "Fuel System Management," Section VII.

The fuel feed system is designed so that the engines receive fuel from the nearest main tank only. For emergencies, fuel can be routed from any tank to any or all of the engines through the fuel transfer and crossfeed manifolds. Fuel from the auxiliary tanks is normally routed through the main tanks to the engines. Auxiliary tank fuel then maintains the main tanks at or near 92% full until auxiliary tank fuel is used. At various gross weights, wing strength is based upon the fuel loading in the wing tanks. The maximum allowable gross weights for different fuel loadings are shown in figure 5-16. The "Maximum Flight Weight vs Fuel Weight in Wing Tanks" chart (figure 5-16) is presented in a form that is independent of fuel usage sequence in order to provide information that is applicable to unusual fuel loading conditions. This chart shows, in incremental form, the maximum flight gross weight corresponding to any given combination of wing fuel loading. This chart may be used for symmetrical or asymmetrical fuel loading and for any fuel usage sequence, provided the flutter placards are not exceeded. As the aircraft weight is supported by the airload on the wings, the more load that is carried in the fuselage the greater will be the bending movment in the wings. To prevent overloading the wings as the gross weight increases, it is necessary to provide relieving dead weight in the wings to relieve the effects of increased airloads. Since the center wing tank fuel does not provide relieving dead weight, it is considered to be the same as body fuel.

Example of Chart Usage

PROBLEM 1: An aircraft is to be loaded with the following quantities of wing fuel: Full fuel (39,000 pounds) in the two drop tanks, 25,000 pounds total in the two outboard tanks, 20,000 pounds in main tanks 1 and 4, and 30,000 pounds in main tanks 2 and 3. What is the maximum flight gross weight allowable under this wing fuel loading condition?



NOTE: MAXIMUM FLIGHT GROSS WEIGHT WITH NO FUEL IN WING TANKS IS 286,000 POUNDS.

CAUTION

DURING CONDITIONS OF LOW SPEED (LANDING AND TAKEOFF) AND ASYMMETRICAL FUEL LOADING, THE GROSS WEIGHT MUST BE ABOVE THE MINIMUMS AS OUTLINED IN PART 9 OF THE APPENDIX.

INSTRUCTIONS: TO OBTAIN MAXIMUM FLIGHT GROSS WEIGHT, READ THE ADDITIONAL ALLOWABLE WEIGHT CORRESPONDING TO THE ACTUAL FUEL WEIGHT IN EACH WING TANK AND ADD THESE ADDITIONAL WEIGHTS TO THE BASIC 286,000 POUNDS.

MAXIMUM FLIGHT WEIGHT vs FUEL WEIGHT IN WING TANKS

Figure 5-16.

SOLUTION: Referring to figure 5-16, proceed along the fuel line to 39,000 pounds and project a vertical line to the drop tank line. From this intersection, draw a horizontal line and read 80,000 pounds additional flight gross weight. Similarly, read 48,000 pounds additional flight gross weight corresponding to 25,000 pounds in the outboard tanks, 13,500 pounds additional flight gross weight for a combined fuel weight of 20,000 pounds in main tanks 1 and 4, and 7,000 pounds additional flight gross weight corresponding to a combined fuel weight of 30,000 pounds in main tanks 2 and 3. The maximum allowable flight gross weight is equal to the 286,000-pound basic aircraft weight plus the combined sum of the individual additional allowable gross weights corresponding to the fuel weights in each wing tank. In this example the maximum allowable flight gross weight is 286,000 + 80,000 + 48,000 + 13,500 + 7,000 = 434,500 pounds.

NOTE

Flutter placards and cg limitations must be observed at all times.

FUEL USAGE

The aircraft is designed primarily as a 2.0 "g" load factor aircraft. A lighter gross weight with the noted wing fuel limits will increase the margin of safety for critical wing bending. The advantages of carrying more wing fuel than necessary are counteracted by consideration of protecting over-target fuel and jettisoning the drop tanks as early as possible for maximum range. The EWO fuel sequence (Section VII) is designed to utilize the fuel so as to allow jettisoning of the empty drop tanks at the maximum permissible gross weight. The aircraft is designed for tanks full of 6.5 pounds-per-gallon fuel, but standard fuel variations may be from 6.0 to 6.8 pounds per gallon. Weight switches prevent overfilling the tanks with the heavier fuels. Volume switches prevent overfilling of tanks with lightweight fuel; however, the aircraft will be underweight. The underweight condition in the wing will reduce the relieving dead weight and lower the allowable gross weight (figure 5-16).

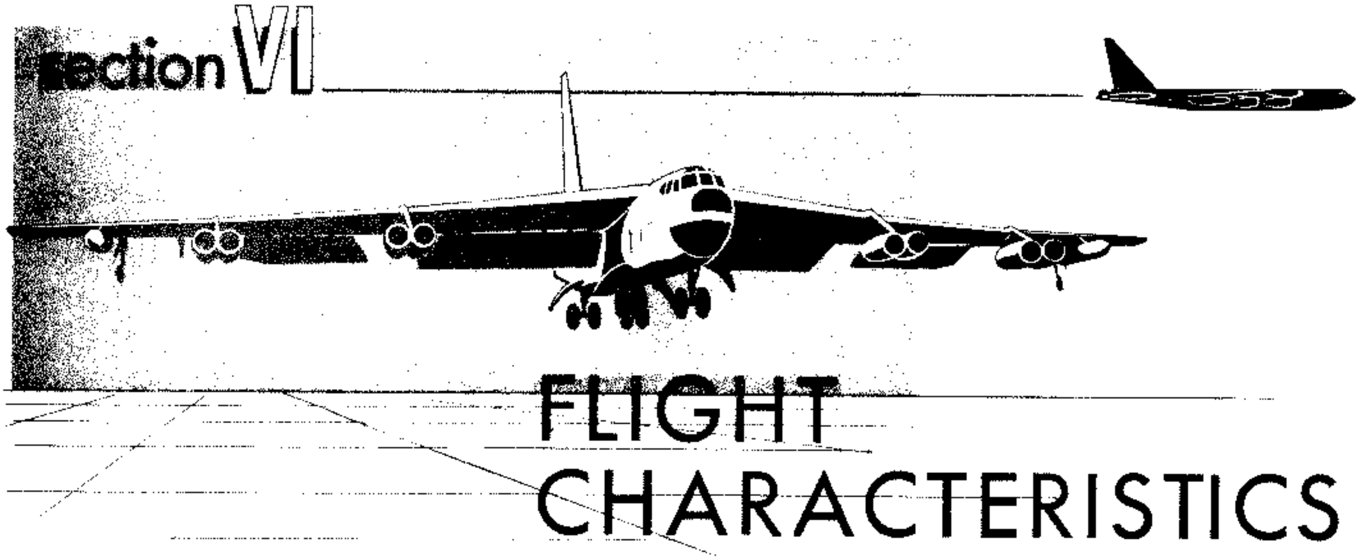
NOTE

To avoid overweight and center of gravity complications, the tanks should be filled by the fuel quantity gages and not to the filler neck or vent limits.

REFUELING OPERATIONS

To prevent exceeding the structural limits during refueling operations, any wing tank fuel that has been used should be replaced first. In using fuel prior to air refueling, it is advantageous to use body fuel first. This method shortens air transfer time by keeping the slow filling wing tanks full. After using body fuel prior to air refueling, the recommended refueling sequence is to fill main tanks first, then distribute the remaining fuel required between the forward body, mid body, and aft body tanks as necessary to stay within the structural limits of the aircraft. The normal fuel usage sequence should be followed after air refueling is completed. Any deviations from the standard fuel sequence procedures set forth in Section VII must be thoroughly investigated to determine their effect on the aircraft center of gravity.

section VI



FLIGHT CHARACTERISTICS

TABLE OF CONTENTS

DESIGN CONSIDERATIONS

AERODYNAMIC DESIGN

The following discussions are intended to give some of the aerodynamic design background of the aircraft in order to aid in understanding the aircraft flight characteristics.

Wing Selection

The effects of compressibility are the primary limiting factors on the performance of high speed aircraft. In order that a wing may produce lift, the air must pass over the top surfaces of the wing at a higher speed than that over the lower surfaces. As the aircraft speed is increased, the air velocity over the top surface of the wing reaches the speed of sound much sooner than that over the lower surfaces. When the air over the top surface of the wing exceeds the speed of sound, a shock wave is produced resulting in a sharp pressure rise. This in turn causes an increase in drag and a decrease in lift because of the airflow separation induced behind the shock wave. Since the air velocity over the top of the wing is greater than the aircraft speed, this condition always occurs at aircraft speeds less than the speed of sound (Mach 1.0). The speed where this effect becomes great enough to be noticeable is termed the critical Mach number.

Elevator and Stabilizer Selection

Because of the large spread between stalling speed and top speed and the overall aircraft aerodynamic characteristics, the longitudinal trim requirements of this aircraft are much greater than would be required for a comparable aircraft of lower performance. An adjustable horizontal stabilizer is utilized for longitudinal trim rather than elevator surfaces for the following reasons:

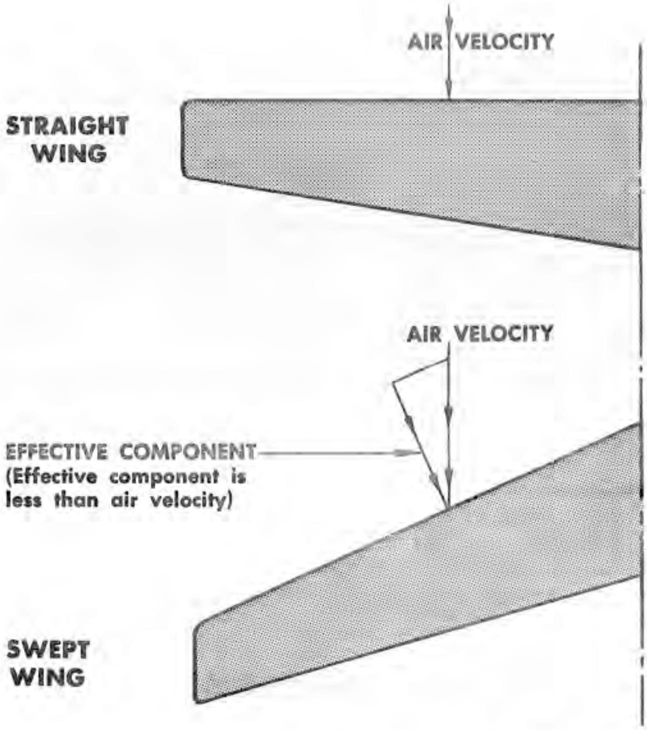
1. An elevator surface to be used both for primary longitudinal control and for longitudinal trim would be so large that its aerodynamic balancing would present extreme difficulties.
2. The drag of such a control surface held in a displaced position for trim purposes would adversely affect performance.

HIGH SPEED DESIGN FEATURES

Every presently known means for increasing the critical Mach number of this aircraft has been employed in the design. The more important features employed to attain a high critical Mach number are wing and tail surface sweepback, choice of thin high speed airfoil sections, careful selection of wing loading, and smooth and clean surfaces with a minimum of protuberances.

Sweepback

Sweeping back the wing and tail surfaces is one of the most effective methods of increasing the critical Mach number. The lift of a wing is produced from the component of air velocity traveling at right angles to the leading edge of the wing. A swept wing has a smaller effective component as shown in figure 6-1. Since the velocity of the effective air passing over the top of the wing is less on a swept wing than on a straight wing, the aircraft can fly at a higher speed before reaching the critical Mach number. Swept-forward wings would be just as effective as swept-back wings in producing high critical Mach numbers; however, swept-forward wings are seldom used because of stability, control, and structural problems which are more severe than those for swept-back wings. The maximum lift of a swept wing is also less than a comparable straight wing. The decreased lift is not detrimental at high speed but it must be offset by the use of efficient flaps in order to have moderate takeoff and landing speeds. This is one of the main reasons why the aircraft is equipped with large area fowler-type flaps. The swept wing, in conjunction with its flexibility, also helps to reduce the loads imposed on the wing and body structure at high speeds and gusty conditions. Swept-back wings, however, have the disadvantage that sweepback tends to cause a stall progression from the wing tips to the root. This disadvantage was overcome by changing the wing airfoil section at different spanwise locations and providing spoilers in addition to ailerons for improved lateral control.



COMPARISON OF AIR VELOCITY EFFECTIVE COMPONENTS

Figure 6-1.

Airfoil Section

The thickness ratio of a wing has an important bearing on its critical Mach number. When the thickness ratio of an airfoil section is decreased, the critical Mach number increases since the air flowing over the top of the wing travels relatively slower, thereby permitting higher aircraft speeds before the wing critical speed is reached. Wind tunnel tests conducted on models show that the airfoil section at the root of the wing could be quite thick without reducing the critical Mach number. The aircraft has a relatively thick airfoil section near the root of the wing and tapers down to a very thin section at the tips. The outstanding disadvantages of a thin airfoil section as compared to one with more thickness are that there is less space in the wing to house fuel and equipment, a heavier structure is required because of the decreased beam depth of the spars, and the maximum lift is lower.

Wing Loading

The design wing loading (weight per square foot of wing area) is an important parameter in the aerodynamic and performance characteristics of the aircraft. The critical Mach number of the wing is strongly dependent on the magnitude of the wing loading. A decrease in the wing loading of the aircraft (increase in the aircraft's wing area) will generally increase the critical Mach number. This effect can be explained from the fact that for a given speed, altitude, and weight, the wing angle of attack is proportionally reduced with a decrease in wing loading. Since the velocity of the airflow over the wing is proportionally less at low angles of attack than at high angles of attack, the aircraft speed corresponding to where the airflow reaches a sonic velocity is increased. This increase in aircraft speed is the change in the critical Mach number of the wing. The increased wing area associated with a reduction in wing loading will improve the takeoff performance but may reduce the range performance of the aircraft due to the additional frictional drag and the heavier structural weight required. A compromised wing loading was necessary in order to achieve an optimum configuration from all design considerations.

STALLS

The stall characteristics of the aircraft will vary with wing flap extension and drop tank installation. The following stall characteristics can be expected:

1. With flaps extended and no drop tanks installed, there is little or no stall warning speed margin. Buffet of the flaps when the stall is approached will mask aircraft buffet. At stall, the aircraft will tend to fall off on one wing. This fall-off can be stopped by applying forward pressure on the control column and by using whatever lateral control and rudder is required. As lateral control degrades rapidly at speeds below initial buffet, the use of rudder may be necessary to correct for bank angle.
2. With flaps extended and drop tanks installed, a fair amount of stall warning will exist. The stall is preceded by a mild buffet approximately 5 to 10 knots above the stall, increasing to strong buffeting at the stall.
3. With flaps retracted and with or without drop tanks installed, the initial buffet occurs at approximately 10 to 15 knots above the stall.
4. There is approximately a 20- to 35-knot difference in the stalling airspeed depending upon whether the flaps are extended or retracted. The use of airbrakes has a negligible effect on the stalling speed but full airbrakes will cause the initial buffet to occur at an airspeed approximately 2 to 4 knots higher than if no airbrakes are used.

PRACTICE STALLS

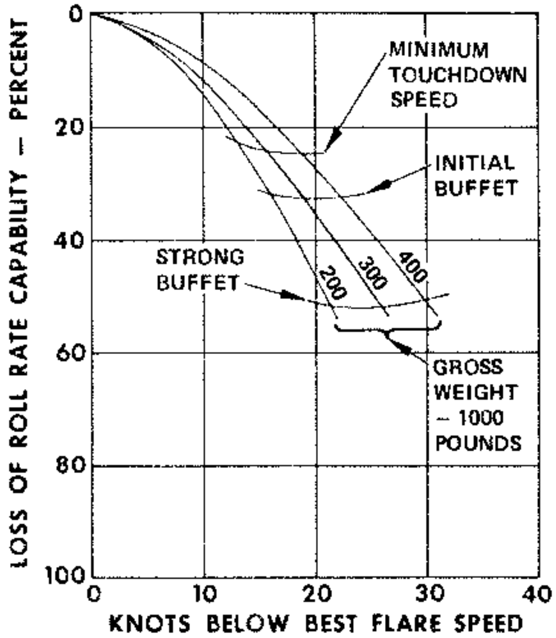
Practice stalls may be executed without difficulty provided the following procedures are observed:

1. Gross weight does not exceed 300,000 pounds.
2. A minimum altitude of 20,000 feet above terrain.
3. Extend flaps and adjust thrust to allow the aircraft to decelerate while holding a constant altitude. Engine thrust has a negligible effect on the stall characteristics or stall speed; however, high thrust settings in the stall approach will result initially in a fairly large rate of climb.

NOTE

> As the aircraft is decelerated in the stall approach, it is essential that it not be trimmed to speeds below best flare speed (approach speed flaps up). The stall recovery should be made using forward elevator control only. If the aircraft has been trimmed below the best flare speed trim setting, stabilizer trim may be used to augment the elevator as required. The use of stabilizer trim in a normal practice stall recovery may result in overcontrolling the aircraft with a resultant potentially dangerous nosedown attitude developing.

4. Continue to decelerate the aircraft using back pressure on the wheel. The amount of force and column movement needed to stall the aircraft will vary with cg position. Maintain wings level attitude with lateral control as the stall is approached. Fairly large lateral corrections may be necessary. Caution should be used because lateral control capability decreases rapidly as the stalling speed is approached. Shown in figure 6-1A is the deterioration of the lateral control effectiveness as the speed is reduced below best flare speed. Rudder may be used to maintain heading; however, during low speed flight, a delay in aircraft response after control input of up to 3 seconds may exist before a roll correction develops.



- FLAPS DOWN
- AIRBRAKES 4

DECAY OF LATERAL CONTROL EFFECTIVENESS FROM BEST FLARE SPEED

Figure 6-1A.

5. With flaps down, there will be a 5- to 10-knot stall warning buffet which increases as speed is reduced. At the stall, there will be fairly heavy buffeting.
6. The stall should be terminated by sufficient forward control column movement to lower the nose below the horizon and simultaneously advancing the throttles to MRT until safe and proper airspeed is attained. Trim the aircraft as required.
7. If practice stalls are performed in the flaps-up configuration, procedures are the same as flaps-down. There will be a 10- to 15-knot stall warning buffet which increases as the speed is reduced. Generally, there is a reduced tendency for the wing to drop in the flaps-up configuration than in the flaps-down configuration.

The stall should be terminated if a wing drops or before heavy buffet is reached.

CAUTION

Under no circumstances should an attempt be made to carry a stall to completion by holding the column back until the nose falls through the horizon. Any such attempt will result in severe buffeting. Severe buffeting has resulted in damage to secondary structure and aircraft equipment.

8. Accelerated stalls can occur at any speed as a result of pulling excessive "g's" in turns or pull-ups. Generally they are similar to unaccelerated stalls except that speed and altitude changes occur much faster. An accelerated stall will occur if the aircraft is placed in a stalling angle of attack during a pull-up or turn at any speed higher than 1 "g" stalling speed. As a rule at normal cg's, if the aircraft is trimmed for 1 "g" flight, sufficient elevator control is available at high altitudes to produce an accelerated stall at any speed. At low altitudes, the elevators must be augmented by stabilizer trim and, in some cases, the wing structural limits are exceeded to obtain an accelerated stall. Approaches to accelerated stalls requiring flight in the strong buffet region can be safely executed and may be necessary in escape maneuvers at high altitudes. Complete stalls while pulling "g's" are not recommended for the following reasons:
   a. The drag associated with accelerated stalls will result in rapid speed and altitude changes.
   b. Loss of accurate orientation due to the extreme attitudes which can occur during and following an accelerated stall may delay recovery or jeopardize control of the aircraft so that considerable altitude will be lost in the maneuver.
   c. The strong buffeting encountered will have adverse effects on the aircraft structure and equipment.
   d. If the accelerated stall occurs at Mach numbers well above the low speed stall, the aircraft can accelerate beyond the flight placards during recovery. Close monitoring of aircraft attitudes in turns should be observed to avoid pitchup into inadvertent accelerated stalls.

RECOVERY FROM INADVERTENT STALLS

Recovery procedures from any stalled condition are standard: stick forward, add thrust, maintain heading with rudder, level wings, recover to level flight with adequate airspeed. Most common of the inadvertent stalled conditions is maneuvering stall or stall during a turn. Turning flight increases stall speed similar to the effect of increased weight. Both require increased lift for level flight. Any steady level turn requires that the vertical component of lift be equal to the weight, and the horizontal component be equal to the centrifugal force. Stall speeds increase with bank angles and this increase becomes significantly more rapid at bank angles over 30°. See "Maneuver Limits" charts, Section V. This fact emphasizes the need to avoid steep bank angles at low airspeeds. Approach and entry into a stall is accompanied by mild, moderate, then severe buffeting. Stabilizer trim can be an important factor both in stall entry and stall recovery. An aircraft trimmed into a stall can be difficult or sometimes impossible to recover unless the mistrimmed condition is corrected. The autopilot can cause a mistrimmed condition if a turn is established on autopilot and thrust is not increased to maintain airspeed. An aircraft trimmed to the best flare speed trim setting can be recovered with elevator only and does not require stabilizer trim until the stall recovery has been completed. An aircraft that has been trimmed into stall will require proper stabilizer trim application to recover from the stall. With flaps down and no drop tanks installed, there is only a one or two knot stall warning and this can easily be masked by flap buffeting if the engines are above idle thrust. The stall is characterized by a strong but not violent rolloff. Recovery is accomplished by using the normal stall recovery procedures.

STALL OR CONTROLLABILITY CHECKS

Under some unusual aircraft configurations or conditions, it may be desirable to conduct a stall check or controllability check of the aircraft prior to landing. A check of the stalling speed should be made if the accuracy of the pitot-static system is seriously in doubt or if the fuel quantity indicating system becomes inoperative resulting in an unknown landing gross weight. If the aircraft sustains damage or has a control system malfunction which makes controllability doubtful, control characteristics should be determined at a safe altitude prior to descent for landing. It is recommended that a minimum altitude of 10,000 feet above the terrain or cloud cover be used for these checks. At these altitudes, the initial buffet speed will be increased, compared with those shown in figure 2-15, by a factor of 1% per 5,000 feet for altitudes above 10,000 feet pressure altitude.

WARNING

- When any controllability check is made due to doubtful control characteristics of the aircraft, the airspeed should not be reduced below the best flare speed for the aircraft configuration (approach speed for flaps up) in which the check is to be made. Under these conditions, the check should be discontinued immediately if any buffet or control problem is encountered.

- When the flaps are in a full-down or intermediate position and flap damage exists, such as a missing segment, the best flare speed given in the appendix may no longer apply. In this case, reduce speed slowly until the charted best flare speed is reached or until approximately one-half lateral control authority is required to maintain the wings level. Whichever of these speeds is higher should be used as the best flare speed.

Determination of Stalling Speed

If the airspeed indicators are suspected of giving inaccurate readings or if the fuel quantity gages are inoperative, a check of the initial buffet speed should be made at an altitude of 10,000 feet above the terrain or cloud cover and the resulting speed compared with the appropriate (flaps up or down; drop tanks on or off) initial buffet curve on figure 2-15. The percentage change in stalling speed can be determined and applied to the chart landing speeds. If the gross weight is unknown, comparing the initial buffet speed found with that shown on the charts will give the approximate gross weight directly. If the landing is to be made in a short period of time, this weight should be used to compute the landing data; otherwise, the anticipated fuel consumption between the stall check time and the landing time can be subtracted from the weight found by the check.

NOTE

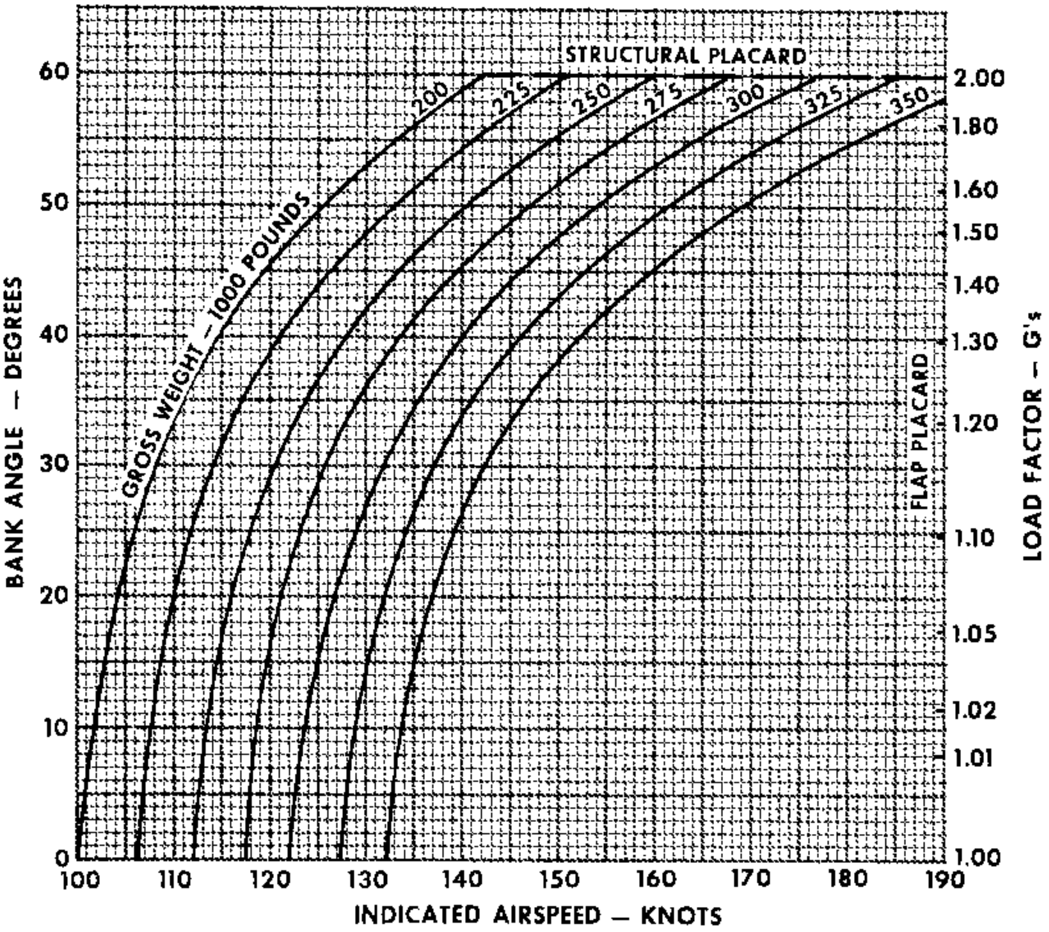
Figure 6-2 shows the increase in stall speed with increased bank angle and also shows the load factor in "g's" for various bank angles.

Determination of Aircraft Controllability

REDUCED LATERAL CONTROL OR LATERAL UNBALANCE. In case of reduced lateral control or of lateral unbalance, a control check may be made at an altitude of 10,000 feet above the terrain or cloud cover by putting the aircraft in the landing configuration and slowing it to the best flare speed (approach speed for flaps up configuration) shown on the "Landing Speeds" charts in Part 9 of the Appendix. As the best flare speed (approach speed for flaps up) is approached, care must be taken to avoid slowing the aircraft to a speed at which full lateral control is required to keep the wings level. If control problems are encountered at a speed higher than best flare speed (approach speed for flaps up), the speed at which control is considered adequate should be noted. The landing approach should be made at 20 knots higher than the noted speed. This speed will allow the same maneuvering capabilities as the speed for a normal approach provides under normal conditions.

REDUCED LONGITUDINAL CONTROL OR LONGITUDINAL UNBALANCE. In cases of reduced elevator and/or stabilizer trim control or of longitudinal unbalance, a control check may be made at 10,000 feet by putting the aircraft in the landing configuration including airbrakes in planned landing position and cautiously slowing the aircraft to best flare speed (approach speed for flaps up). If the lowest speed at which the available stabilizer trim will hold the aircraft level without aid of the elevators is above best flare speed (approach speed for flaps up), the trim speed should be noted. The landing approach should be made at 10 knots above this noted speed. The margin will allow sufficient elevator control for the flare but the landing approach should be made as shallow as possible in order to minimize the amount of flare required for landing. Power should not be reduced until after completion of the flare.

AIRCRAFT DAMAGE. In cases where the aircraft has been damaged (such as damage to the wing leading edge, to the control surfaces, or with asymmetrical wing flaps) so that both controllability and stalling speed could be affected, a controllability check



NOTE

Chart is valid from sea level to 10,000 feet with flaps down.

AIRSPEED AT INITIAL BUFFET VS BANK ANGLE

Figure 6-2.

should be made prior to landing. The altitude for this check will depend on the extent of damage sustained. In any case, an altitude below 10,000 feet above the terrain or cloud cover is not recommended. The aircraft should be slowed to the minimum speed at which the pilot feels he has adequate control (controllability speed). This speed should not be lower than the speed at which the first indications of buffet are felt. If a pressure altitude above 10,000 feet is used, the airspeeds (for landing) found during the check may be reduced by 1% for each 5,000 feet above 10,000 feet that the check is made. If the controllability speed is above the charted minimum touchdown speed, the final approach should be made at 20 knots above the controllability speed. If the controllability speed is below minimum touchdown speed, fly the normal final approach speed. For the case where initial buffet speed is reached before a controllability speed and the initial buffet speed checks the charted value, fly the normal final approach speed. If the initial buffet speed is above the charted value, the percentage change should be determined and applied to the normal final approach speed.

SPINS

WARNING

- Intentional spins are prohibited.
- The B-52 is critical in body side loading at high sideslip angles and the possibility of aft fuselage and empennage failure is almost certain for the fully developed spin condition. In the event of structural failure, emergency egress must be accomplished immediately.

The ability of an aircraft to spin is dependent upon cg location, distribution of mass, basic aerodynamic configuration, and control deflections. Forward cg's tend to make spinning more difficult while aft cg's promote spinning. Extended gear and/or flaps have no appreciable effect on spin recovery; however, extended gear will reduce speed buildup during dive recovery after spin rotation stops. In a developed spin, an indicated airspeed of approximately 200 to 220 knots can be expected. The pilot should not interpret this as sufficient flying speed but should make certain that angle of attack is reduced to less than stall angle during recovery.

STANDARD SPINS

In case an inadvertent yaw or roll is encountered at low indicated speed, corrective rudder and lateral control plus nosedown elevator should be immediately applied. In case a spin is entered accidentally, apply full opposite rudder immediately followed by forward stick to reduce angle of attack with neutral lateral control. Apply nosedown trim and close the airbrakes if they are extended. Reduce throttles to idle. Extend the gear. To augment the rudder, apply throttles asymmetrically to develop thrust against the spin. As spin rotation stops, set all throttles in idle and neutralize rudder. Recover from dive attitude by retrimming. If excessive nosedown trim was introduced during the spin recovery, airbrakes may be extended as required to effect recovery from the dive attitude.

NOTE

> The airbrakes will give the fastest pitch control possible but should be used judiciously and in conjunction with the elevators and stabilizer trim so that design limit "g" forces are not exceeded and buffeting is not reencountered. The airbrakes in position 6 produce the maximum drag to reduce speed buildup during the steep nosedown attitude required to recover. Recommended dive recovery procedures apply following spin stop.

INVERTED SPINS

Recovery from an inverted spin must be accomplished by the least structurally hazardous method. Full rudder and lateral control against the spin must be applied and held until rotation stops and a zero "g" roll made to "right side up." Airbrake throttle and gear utilization should be accomplished as noted above. A dive recovery then must be made following recommended procedures.

FLIGHT CONTROLS

FLIGHT CONTROL SYSTEM COMPONENTS

The flight controls on this aircraft have been designed to provide a system that will give the aircraft good flying qualities at all speeds, altitudes, and aircraft weights, as well as small control forces for these same conditions. Weight has been saved and safety of operation has been increased by the elimination of power boost on all of the primary controls, except the lateral control spoilers. The flight controls are quite unique in that the rudder and elevator are only 10% chord surfaces. (In other words, the chord of the control surface from hinge line to trailing edge is 10% of the chord of the horizontal or vertical stabilizer.) On high speed aircraft, weights must be added to properly balance the control surfaces. By using short chord empennage control surfaces, less weight is required for balancing purposes. It is possible to use a short chord elevator because an adjustable stabilizer is used to provide longitudinal trim. The yawing moment produced by the short chord rudder plus less than one-half lateral control will adequately control the yawing moment due to asymmetrical thrust which results from the failure of an outboard engine. The inboard location for the ailerons was dictated by the wing flexibility. With the aileron located out near the wing tip on a flexible wing, the controls reverse at the higher speeds.

Tab Characteristics

The elevator, ailerons, and rudder are positioned by tabs rather than by direct push-pull rods or cable systems. Tabs have been used primarily because they make it possible to obtain good control force characteristics at all speeds. The tab system also results in a weight saving for such a large aircraft as compared to other systems involving power boost. Basically, the tab is a small control surface attached to the main control surface and is used to vary the pressure distribution on the main control surface so the aerodynamic force developed by the control tab will deflect the larger surface. For a particular flight condition (altitude and airspeed), one unique tab deflection setting will balance the control surface hinge moments and command a particular control surface position.

Tab Followup Ratio

Tab followup ratio is used on the elevators and rudder. The elevators have a followup ratio of 1:1, while the followup ratio between the rudder stability tab and the rudder is 1/2:1. Followup ratio is defined as the ratio of the tab deflection angle to the control surface deflection angle where the tab deflection is caused by the surface deflection with the pilot's controls held fixed. Using the elevators as an example, by holding the control column in a fixed position, movement of the elevator trailing edge upward 10° will also cause the elevator tab to move upward 10° relative to the elevator. Or, if the elevator is moved upward 15°, the tab will also move 15° upward relative to the elevator. If the followup ratio were 2:1, then a 5° movement of the elevator would result in a 10° movement of the tab relative to the elevator. During flight, the pilot moves the control column which causes the tab to deflect. This results in a corresponding movement of the control surface until the tab deflection and control surface deflection balance out aerodynamically. Again considering the elevator with a 1:1 followup ratio, assume the pilot pulls back on the control column to one fixed position such that the elevator tab is deflected downward to an angle of 10°. (This actually would not occur since the elevator would start to move before the tab would get to the 10° position.) This tab movement would cause the elevator to start moving upward. When the elevator reaches 2°, the tab would back off to an angle of 8° relative to the elevator. At a 4° elevator deflection, the tab relative angle would be 6°. At increasing elevator deflections, the tab relative angle decreases to a point where the hinge moments balance out and no further deflection of either surface will occur for one set of conditions. This control surface deflection is variable and dependent upon the altitude, airspeed, and gross weight of the aircraft.

Tab Systems and Functions

ELEVATOR AND RUDDER CONTROL TABS. The control tab used on the elevator and rudder is positioned relative to the control surface by a direct cable system from the pilot's controls. Normally the pilot can only move the control surface through the hinge moments developed by the tab. On the elevator, however, the pilot can move the control surface directly if the tab reaches its limit of travel before the elevator reaches its limit. This will occur, for example, on the ground when the tab has no aerodynamic effect.

AILERON TABS. The type of control tab used on the ailerons is similar to the one described above except that no followup ratio is used. Aileron centering is accomplished by a torsion rod which is connected to the control cable system in the pilot's compartment. The purpose of this torsion rod is to center the pilot's control wheel which in turn centers the aileron control surfaces. Additional control forces over and above those produced by aerodynamic forces on the control tab result from deflection of the torsion spring as the control wheel is turned to deflect the control tab. The aileron trim and balance tab is connected by a link between the tab and the aircraft structure. The tab deflection relative to the aileron is thus determined by the aileron deflection relative to the wing structure. The linkage is so adjusted that the tab aids the aileron deflection.

RUDDER STABILITY TAB. The rudder stability tab is basically a control tab which is primarily controlled by a bob-weight for small deflections and by the pilot for large deflections. The purpose of this installation is to damp out aircraft lateral oscillations (Dutch roll) that might be caused by gusts or other disturbances. A damping device is required on this aircraft because low damping is encountered in the high altitude flight regime.

Yaw Damper

OPERATION OF YAW DAMPER. The yaw damper consists of a bob-weight that is free to rotate about a nearly vertical axis. A bob-weight is linked to the stability tab so that the tab will drive the trailing edge of the rudder in the opposite lateral direction from that of the bob-weight; that is, a left displacement of the bob-weight would cause a right rudder deflection. Thus, the mass of the bob-weight acts like additional mass overbalance on the rudder. Some centering of the stability tab is accomplished as a result of the bob-weight axis being canted 15° from vertical so that the bob-weight exhibits pendulum stability in coordinated flight. Damping is introduced into the bob-weight motion by an eddy current device consisting of magnets on the bob-weight which traverse a copper or aluminum plate attached to the aircraft structure. Damping is produced by this device because the moving magnetic flux lines induce electrical currents (eddy currents) in the copper or aluminum plate which in turn develop a magnetic field tending to oppose the motion of the magnetic field associated with the magnets on the bob-weight. The eddy currents and their magnetic fields are proportional to the velocity of the bob-weight magnets so that the device produces velocity or viscous damping. An electromechanical yaw damper has been installed to provide increased positive damping to lateral-directional (Dutch roll) oscillations for all flight conditions. It works in parallel with the magnetic yaw damper and senses the yaw rate of the aircraft through a rate gyro. A signal from the rate gyro drives a servo motor which in turn drives the bob-weight. The bob-weight is connected to the stability tab in the normal manner.

NOTE

With the electromechanical yaw damper engaged, aggravated Dutch roll may be encountered if the signal from this subsystem is lost. Loss of this signal locks both the electromechanical yaw damper and the magnetic bob-weight yaw damper, and the magnetic yaw damper will remain inoperative until the yaw damper switch is placed in OFF position. With the yaw damper switch in the OFF position, the existing magnetic yaw damper will function normally. When an electromechanical yaw damper malfunction is suspected, place yaw damper switch to OFF position and note results. If Dutch roll conditions improve, leave yaw damper switch OFF until the cause can be isolated and corrected. If Dutch roll conditions worsen, indicating that the system is functioning, turn yaw damper switch ON. If Dutch roll conditions do not change, indicating system servo power loss, leave yaw damper switch OFF. When yaw damper switch is left in OFF position, use of the autopilot (non-steering mode) will assist in controlling any Dutch roll or yaw tendencies.

For additional information, see "Electromechanical Yaw Damper" under "Autopilot," Section IV.

EFFECT OF YAW DAMPER. The effect of the yaw damper on the motion of the aircraft is most easily understood by considering a simplified installation that would produce the same results. The magnetic bob-weight damper could be replaced by a heavily massed overbalanced rudder (nose heavy). It should be pointed out that this type of rudder would not be practical for two reasons: 1) a great weight penalty would be incurred in order to obtain the required overbalance and 2) the damping would interfere with the normal use of the rudder. The damper is designed to be effective in coupled oscillations consisting of yaw, roll, and sideslip, all of which are present in the aircraft response to a disturbance but, for simplicity, only a yawing oscillation of the aircraft will be considered. The inertia force on the undamped rudder causes the rudder to be deflected in such a manner that it will force the yawing motion during one-half of a cycle and oppose the motion during the other half. The addition of damping causes the rudder motion to be out of phase with the aircraft motion so that the rudder will oppose the aircraft motion for more than one-half of each cycle. The damping and overbalance could be adjusted to an optimum so that this rudder action would effectively stop all aircraft oscillation in a very short time and also limit the peak amplitude. This is the same result that is actually produced by the bob-weight damper acting on the rudder through the stability tab.

Aerodynamic Balance

SIMPLE AND COMPOUND BALANCES. Sealed gap aerodynamic balances are used on the elevator, ailerons, and rudder. These balances are of two types: One consists of a simple nose overhang area and the other has a compound balance area consisting of hinged plates to augment the nose overhang. Aerodynamic balance is used to reduce the normal control surface hinge moments that result from a surface deflection and thereby, through this action, assist the pilot in making maneuvers with less control force. This action is accomplished by venting each side of the balance area to the free airstream on opposite sides of the control surface. The pressure differential on the balance area which exists when a control surface is deflected then causes a moment that reduces the normal control surface hinge moment.

HINGE MOMENT REGULATORS. A slight modification to the compound aerodynamic balance is used on part or all of the aerodynamic balance panels on the aircraft. Such additions, called hinge moment regulators, are used for varying the effectiveness of the compound aerodynamic balance at various deflections so that a near linear hinge moment curve can be obtained. This is done by controlling the airflow between the two sides of the balance area which controls the pressure differential and thus the load developed on the balance panel. Weights are added to the nose section of the balance panels and a slight amount of static overbalance is used on all of the control surfaces in order to avoid any surface instability such as flutter or buzzing.

FAILURE OF AERODYNAMIC BALANCE SYSTEM. All aerodynamic balance panels are sealed by a rubberized fabric. In case this sealing material becomes ruptured, wears out, or is damaged in such a way that a good seal is not maintained, the aerodynamic balance becomes ineffective. If such a condition occurs, it will be readily apparent to an experienced pilot in the form of increased control forces. A larger tab deflection angle will also be required to produce the same amount of response since a smaller boost will be obtained from the aerodynamic balance panel. Any change in control forces or control system operation which are noted should be reported on Form 781 so that a thorough inspection can be made of the balance panels and seals.

Gust Damper

Built-in gust dampers are used to protect the control surfaces rather than mechanical gust locks. The gust dampers are used because the controls cannot be inadvertently locked, damage cannot result from a failure to use gust locks, and the dampers are more practical because the surfaces are tab controlled with no direct link to the control cabin. The gust dampers are similar to automobile shock absorbers in their action. They are effective in gusts up to 65 knots and allow 10° of free control surface travel in both directions before acting so that there is no appreciable interference with a normal control operation.

Q-Springs

Any high speed aircraft which had very light control forces at high speeds would be very dangerous since it would be relatively easy for the pilot to make such large and rapid control surface deflections that the control surface mounting structure would be overstressed. The direct use of control surface and tab hinge moments as the only source of pilot's control feel is unsatisfactory because this requires that the control surfaces be very closely balanced at all speeds and control surface deflections to obtain reasonable control forces and gradients. Since this approach is not satisfactory from a design and weight consideration, an artificial feel system using a ram air pressure bellows (commonly called a Q-spring) has been added to the rudder and elevator control system to give the pilot the desired control forces for the specific conditions needed throughout the speed range. This Q-spring is essentially a bellows under pressure from the ram air taken from a pressure source at the leading edge of the fin. Use of ram air as the pressure source provides part of the increase in control forces required to aid the pilot in limiting flight maneuvers at high speeds and to stay within the structural limits of the aircraft. The desired feel characteristics (pilot force with respect to control deflection) have been obtained by proper design of the linkage between the Q-spring and the control system. As with any aircraft, there is a practical limit to the control force which can be added without causing excessive control forces for normal operations. For this reason, no violent reversal of control should be made at high indicated airspeeds since it is still possible under these conditions to overstress the aircraft structure even with the Q-spring installed. The rudder system makes use of two Q-springs while the elevator control system makes use of one Q-spring plus two tension springs. One tension spring was added to the elevator control system to assist in centering the elevator at low indicated airspeeds. An additional tension spring in the elevator control system provides supplemental artificial feel and a positive control column neutral position. Pilot effort required to maneuver the aircraft is increased at low airspeeds (providing trim stimulus) and decreased at high airspeeds (providing improved maneuvering capabilities) with positive centering at all airspeeds (increasing trim stability). No Q-spring is installed in the aileron control system since feel and centering characteristics are introduced by the tab hinge moments and by the installation of a torsion bar in the control system as explained under "Tab Systems and Functions," this section.

CAUTION

- Malfunction of the Q-spring system either due to the inlet being plugged by icing or loss of ram pressure for other reasons, can result in partial loss of control surface feel. If, at any time abnormally light control forces are encountered in the elevators or in the rudder, abrupt maneuvers should be avoided so as not to structurally overload the aircraft.
- After disengagement of the autopilot, either automatically or manually, while operating in or after leaving an icing condition, check the elevator and rudder systems for artificial feel.
- If at any time abnormally stiff controls are encountered and icing is suspected, descend to a warmer altitude. Icing or other blockage of the ram air duct can result in a pneumatic lock of the artificial feel system.
- If a landing must be made with stiff controls, see "Elevator Control Malfunction" under "Flight Control System Emergency Operation," Section III.

NOTE

The additional tension spring will provide partial elevator feel in the event Q-spring pressure is lost.

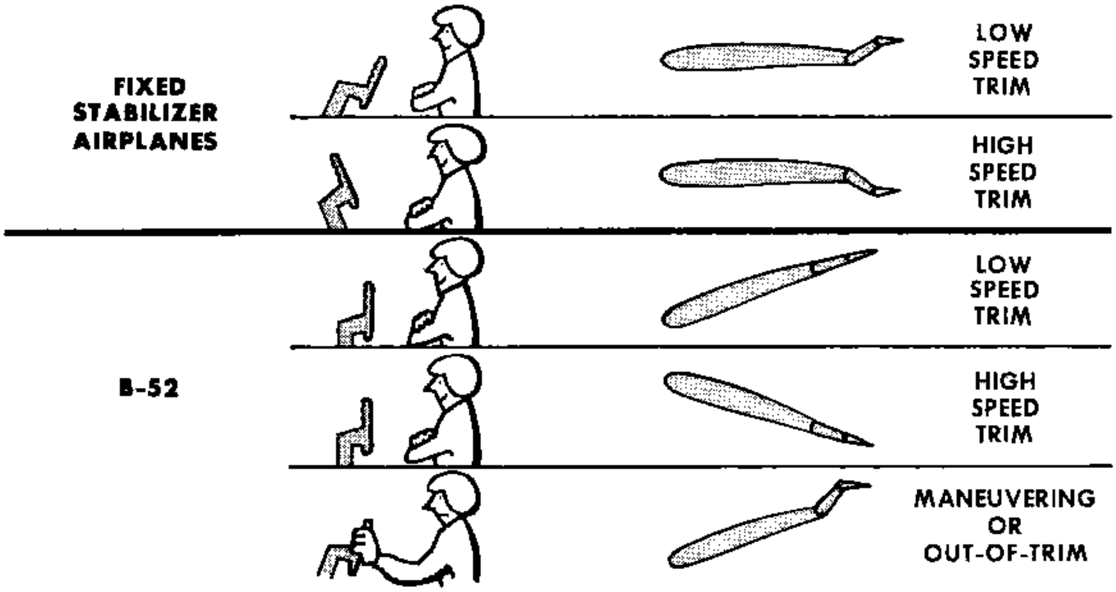
Control Column Balance

Balance weights are installed on each control column below the pivot point to automatically dampen unstable oscillations of the longitudinal (pitch) control system which can be induced under certain flight conditions. These oscillations are divergent and if allowed to continue could result in undue stress and/or loss of control of the aircraft. If such oscillations are encountered, they can be stopped by a slight pull force on the control column with a reduction in airspeed. The pendulum action of the balance weights aids in control centering.

FLIGHT CONTROL SYSTEM CHARACTERISTICS

Pitch Control

Longitudinal control is provided by a 10% chord elevator located on the trailing edge of the stabilizer. The elevator is positioned by a control tab which is manually controlled by the pilot. Longitudinal trim is provided by an adjustable stabilizer. Actuation of the trim switch causes the stabilizer to move at the rate of 0.60° per second. The stabilizer may also be actuated by a manual trim wheel which results in 1° or 1 unit of stabilizer deflection for each revolution of the trim wheel. In either case, operation of the stabilizer trim system is accompanied by rotation of the manual trim wheel. Basically, the stabilizer is intended as a trimming device while the elevators are intended for maneuvering at a given speed and control for small speed changes. The elevators are adequate for maneuvering purposes and should be used whenever possible. The stabilizer, in conjunction with the elevator, should be used to counteract all trim changes occurring, such as when using the landing gear, flaps, and airbrakes. In general, use of the stabilizer as the primary control



PITCH CONTROL SYSTEMS

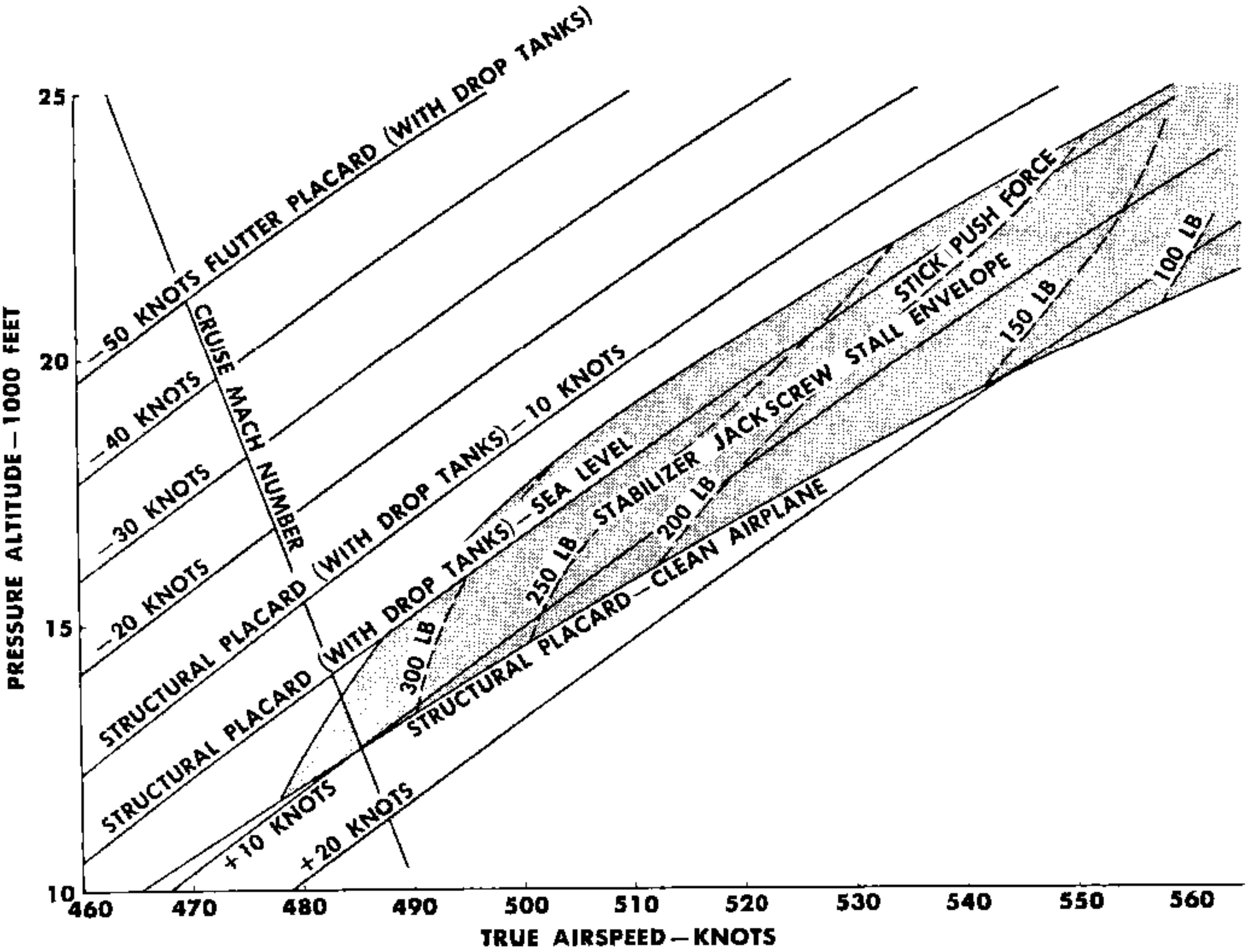
Figure 6-3.

is not considered desirable. More specifically, use of the stabilizer as the primary control in steep turns is undesirable because in turn recoveries, the elevators cannot counter the combined pitchup used to establish the turn and the pitchup moment produced from the lateral control spoilers.

Pitch Control Systems

To better understand the difference in trim technique between a fixed stabilizer aircraft and this aircraft, it is necessary to consider one fact; when any aircraft is flying in equilibrium, the pitching moment about the center of gravity is zero and no change in pitch rate can exist. An aircraft in equilibrium does not necessarily have to be trimmed to a "hands off" condition. It means only that a tail load is being developed by the stabilizer and elevator control system that is just sufficient to balance the aircraft and maintain a desired attitude or flight path. An aircraft having a fixed horizontal stabilizer is placed in trim by the pilot positioning the elevator with the control column to maintain the desired attitude as shown in figure 6-3. Any forces the pilot might be holding on the control column can be eliminated by means of the trim system but the control column and elevator remain in their original position. The pilot can detect the operation of the trim system by a lightening of forces as control column position is held constant. This aircraft is placed in trim by the pilot positioning the elevator through the control column and control tabs. When the stabilizer is moved to relieve the force being held, the pilot detects the movement by a change in attitude rather than a reduction of force and must allow the column to return to neutral to prevent an attitude change and realize a force reduction. This aircraft can only be in hands-off trimmed flight when the control columns are neutral and the elevators are faired with the horizontal stabilizer as shown in figure 6-3. To sum it up, holding a constant control column position while trimming results in a change in attitude with no change in force; but in a fixed horizontal stabilizer aircraft, this results in a change of force with no change in attitude. This difference in trimming must be thoroughly understood for safe operation of this aircraft.

STABILIZER JACKSCREW CAPABILITY. The structural limits of the horizontal tail and its components will not be exceeded when operating within the flight placards of the aircraft; however, it is possible to exceed the operating capability of the jackscrew hydraulic mechanism within the small area shown in figure 6-4 if abnormal trim procedures are used. The stabilizer jackscrew mechanism is stalled because of the high forces imposed on it due to abnormal trimming. This takes place only at speeds very near the structural placard speed when large push forces are held on the stick



STABILIZER JACKSCREW STALL LIMITS

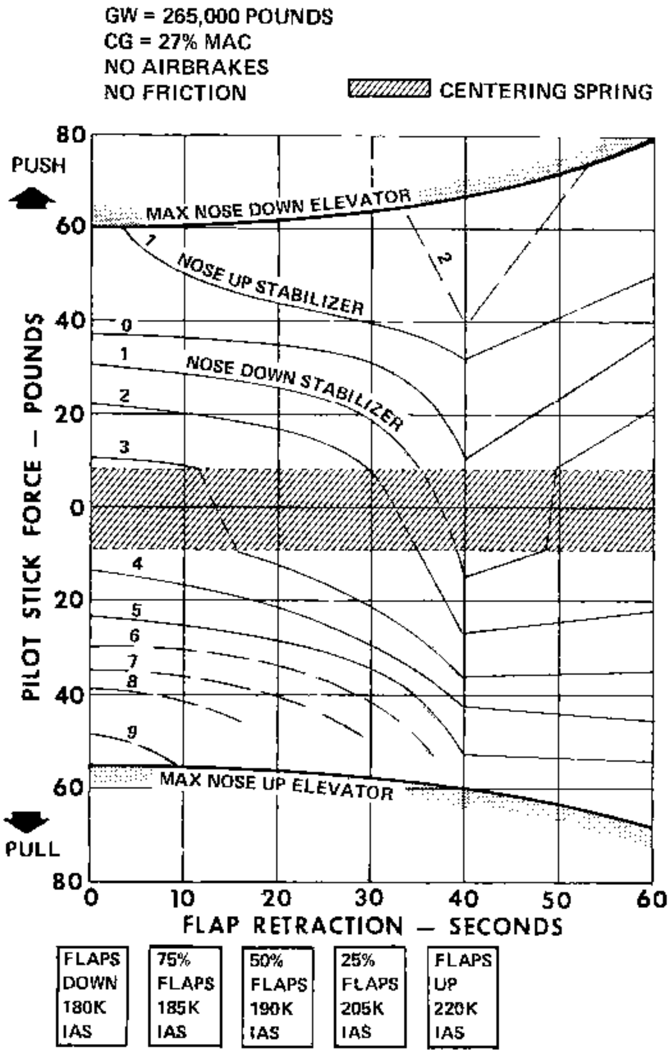
Figure 6-4.

by the pilot. The push forces that need to be held are abnormally large, from 100 to 300 pounds, as shown on figure 6-4. The jackscrew cannot be stalled by a pull force under any circumstances. In case the aircraft is in this very unusual condition (near the placard airspeed with large push stick forces), the pilot can do one of two things to free the stabilizer hydraulic trim mechanism. One is to momentarily reduce elevator deflection while operating the trim button which reduces the force on the jackscrew and allows the mechanism to start. The other is to momentarily reverse the trim mechanism by operating the button in the wrong direction before pushing it in the correct direction which relieves friction and allows starting against a higher load. If placard speeds are inadvertently exceeded, the aircraft must be kept trimmed as closely as possible with the stabilizer to prevent the stabilizer from being stalled.

ELEVATOR FEEL CHARACTERISTICS. The elevator feel force required to accomplish a maneuver varies with control column deflection and airspeed being flown. The major contribution to stick forces is produced by the Q-spring with secondary forces being contributed by a mechanical spring and tab hinge moments. Some centering force results from the pendulum action of balance weights on the control columns. The mechanical springs are installed to produce a more positive centering of the elevator controls at all airspeeds and to increase trim stimulus through higher stick forces. In the event Q-spring pressure is lost, the tension provided by the additional mechanical spring will provide partial feel. The outboard sections of elevators have a simple type of aerodynamic balance while the inboard sections have the compound type of balance. The compound balance area is equipped with hinge moment regulators. This type of regulator contains holes in the balance area that are open at low elevator angles and are closed off by plugs at large angles. The purpose of this balance system is to make certain that there is no reversal of elevator hinge moments throughout the elevator deflection range. The elevator control system provides control force gradients and feel characteristics that should prohibit inadvertent maneuvers. The elevator control force necessary to pull a maximum "g" loading, by performing some normally executed maneuver, is approximately 20 to 40 pounds. Elevator control forces as high as 80 to 100 pounds may be encountered at heavy weights with forward cg locations. At low airspeeds, the pilot can obtain full elevator without encountering excessive stick forces. Therefore, at low airspeeds, it is important to keep the aircraft in trim with stabilizer because high forces are not present to warn the pilot of a mistrim condition and the resulting loss of elevator authority.

ELEVATOR EFFECTIVENESS. The total elevator authority in the low speed flight regime is essentially independent of the flap configuration and is equivalent to 10.6 units of equivalent stabilizer trim or nearly 80% of the total stabilizer authority. If the aircraft is trimmed to zero control column stick force, the elevator authority is 6.6 equivalent stabilizer units in the noseup direction and 4.0 units in the nosedown direction. The maximum elevator authority significantly reduces as the aircraft speed is increased. The elevator authority, in terms of equivalent stabilizer travel, at the high speed structural placard may be reduced as much as 50% to 75% of the authority available in the low speed flight regime. A row of vortex generators on the upper and lower surface of the stabilizer increases the energy of the air in the boundary layer which passes over the elevators. The vortex generators improve the maximum elevator authority in the nosedown direction during low speed, flaps down flight. This improvement in elevator authority amounts to 25% in the nosedown direction and 3% in the noseup direction. The longitudinal control power is a function of center of gravity location for an aircraft flying at a constant altitude and airspeed. A lesser amount of elevator is required to maneuver the aircraft at an aft center of gravity than at a forward center of gravity. A noseup mistrim occuring with an aft center of gravity rather than a forward center of gravity will cause the aircraft to be trimmed into a higher load

Figure 6-5. (Deleted)



STICK FORCE REQUIRED DURING FLAP RETRACTION

Figure 6-6.

factor maneuver. In the low speed regime, a mistrim due to airbrake operation or failure to reset the stabilizer trim to the target setting could result in the aircraft being trimmed into a stall condition.

WARNING

> When holding full noseup elevator, the pilot must be certain that he is engaging the trim button in the noseup position. Due to the position of the control column, he may be pushing in on the trim button or down on the trim button guard.

The elevator effectiveness is sufficient to adequately maneuver the aircraft under all conditions for which trim is established by the stabilizer. The elevator is also sufficiently effective to permit the aircraft to be landed by means of the elevator system alone should the stabilizer actuating system become inoperative within its normal operating range. In case the stabilizer trim becomes inoperative while set at a large aircraft nosedown position, a full flare landing probably could not be made but adequate control could be maintained to accomplish a safe landing.

STABILIZER TRIM FAILURE. See "Flight Control System Emergency Operation," Section III, for detailed instructions pertaining to stabilizer trim failure.

NOTE

> A temporary failure may be experienced in the stabilizer trim system under certain conditions of temperature and humidity if the trim followup screw heater elements are inoperative. This condition would result from frost or ice buildup on the followup screws which could jam the followup screws and cause the stabilizer trim system to be inoperative both electrically and manually until the frost or ice has melted.

Lateral Control

Lateral control is provided by one aileron and seven spoiler segments on each wing. The maximum roll rates that can be generated at various true airspeeds and altitudes are given in figure 6-7. At normal operating speeds and altitudes, roll rates are quite high. Care should be exercised that roll corrections during instrument flying under these conditions are not excessively applied nor in the wrong direction. The highest roll rates at any altitude will occur at approximately 250 knots IAS. Beyond this speed, hydraulic pressure is insufficient to obtain full deflection of the spoilers so that roll rates will decrease. However, roll rates will not decrease to zero and aileron reversal will not occur at any speed.

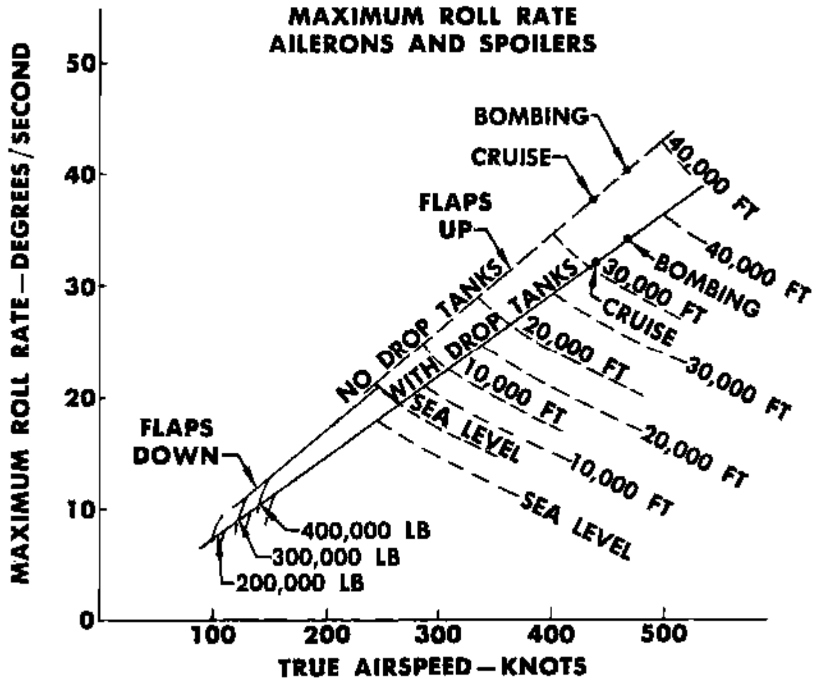
A loss of lateral control authority will occur in the low speed flight regime as the aircraft approaches a stall. The decay of lateral control, for the flaps down configuration as the speed is reduced below best flare speed, is shown in figure 6-1A. This loss in lateral control results from airflow separation on the wing ahead of the spoilers and aileron at the high angles of attack associated with wing stall. In the low speed flight regime where lateral control authority is severely reduced, control inputs in correcting bank angle should be made primarily with the rudder assisted by whatever lateral control is available.

The maximum roll rate capability of the flaps-down configuration is slightly higher than that for the flaps-up configuration for the same airspeed and altitude. However, when a landing must be made flaps up, the roll rate capability during the approach will be essentially the same as for a normal flaps-down approach due to the effect of the higher flaps-up airspeed.

LATERAL UNBALANCE. During the landing operation, roll control can be marginal in at least one direction when large amounts of lateral unbalance exist. Figure 6-8 shows percent lateral control required to trim out lateral unbalance due to an asymmetric external tank condition where one tank has been jettisoned and the remaining tank is full. There is a minimum speed at which roll control can be maintained. As speed decreases below the point where more than 50% lateral control is required, the lateral control is used up rapidly. Lateral control can be augmented during such conditions through use of the rudder which will provide a sizeable rolling moment from the sideslip induced. It is not desirable during normal operations to deliberately enter regions where more than 60% of lateral control is required for lateral balance. Part 9 of the Appendix shows minimum landing weight for various amounts of unbalance. This data is based on the use of not more than 50% lateral control and illustrates the advantage of higher touchdown speeds obtained by flaps-up landings. Additional advantage can be gained through the use of airbrakes which will allow simultaneous contact of the landing gear at higher than normal touchdown speeds. (See figure 6-9A.)

AILERON SYSTEM. The ailerons are positioned by control tabs which are manually actuated by the pilot. The ailerons are bused together by a cable system in order to prevent a symmetrical up-float in level flight. The hinge moments developed on the tab as a result of tab and aileron deflections through rotation of the pilot's control wheel provide most of the pilot's control force, with the remainder being supplied by the control wheel torsion bar. Simple aerodynamic balance with the addition of hinge moment regulators is used on each aileron.

SPOILER SYSTEM. Seven spoilers are provided on each wing, each having its own hydraulically operated actuator. The three inboard spoilers are interconnected and operate as one unit and the four outboard spoilers are interconnected and operate as one unit. The cable controls from the control wheels are so connected that approximately the first 4° of control wheel rotation will cause only the aileron

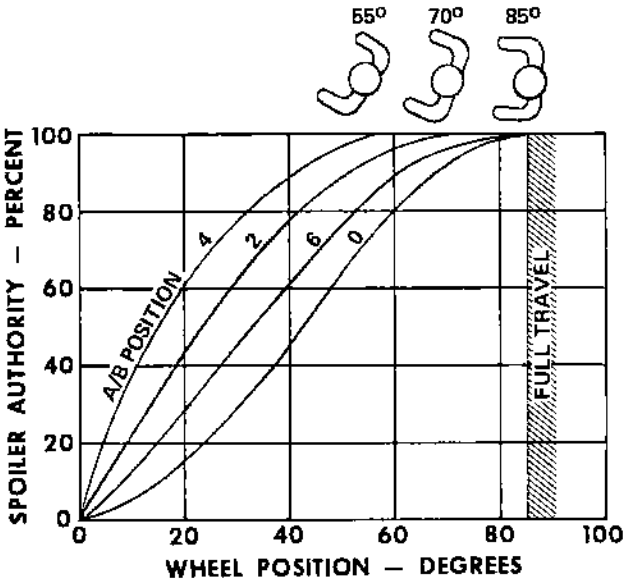


MAXIMUM ROLL RATES

Figure 6-7.

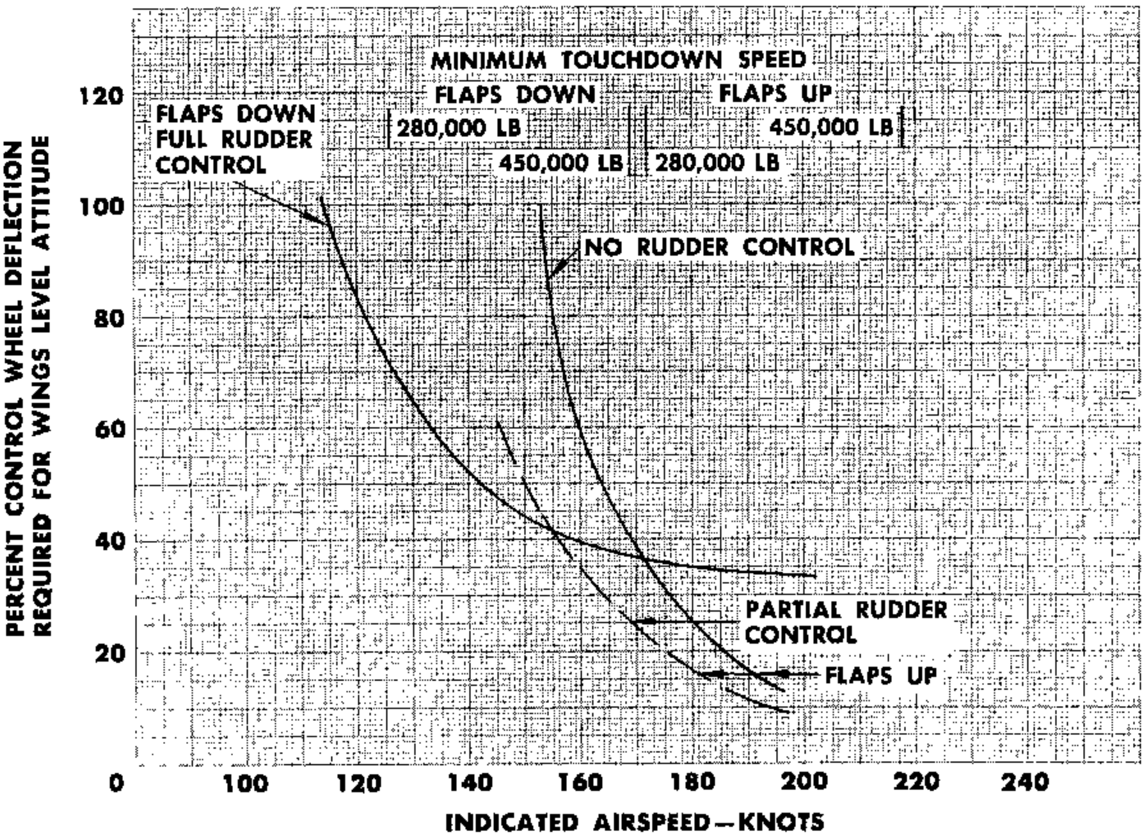
control tab to move. Additional rotation of the control wheel above approximately 4° will give spoiler travel proportional to the additional wheel travel. Wheel travel of 80° will give full extension of the spoilers.

SPOILERS AS A LATERAL CONTROL DEVICE. The extension of spoilers on one wing decreases the lift produced by that wing and also increases the drag. The loss of lift on the wing with the spoilers extended causes it to rotate downward. The addition of drag causes a slight yawing motion in the direction toward the wing with the spoilers extended which assists the pilot in bringing the wing down or in starting a turn. With application of roll control, a pitchup is induced directly proportional to the amount of spoiler deflection used. This pitchup is favorable during entry into a turn, but unfavorable in coming out of a turn. For large wheel deflections, the pilot will have to make small push corrections at the entry of a bank and large push corrections at the termination of a bank to prevent inadvertent nose-high attitudes and pulling excessive "g's." Spoiler authority for a fixed amount of wheel deflection is dependent on the airbrake position selected. The greatest spoiler authority for a given amount of wheel deflection occurs when the airbrakes are in position 4 (see figure 6-7A). The main reason for this characteristic is the pickup schedule of the spoilers which allows the spoilers on one wing to reach full deflection nearly simultaneously with spoilers on the opposite wing being fully retracted. This characteristic of the spoiler system is especially important since it allows the pilot to obtain a large portion of the spoiler authority with small wheel inputs thereby increasing the pilot's ability to make roll adjustments.



SPOILER AUTHORITY WITH WHEEL POSITION

Figure 6-7A.



LATERAL CONTROL REQUIRED WITH ONE FULL DROP TANK

Figure 6-8.

AIRBRAKES. All of the spoilers are also used as airbrakes. The extension of the airbrakes is controlled by an airbrake lever located at the pilot's station. In the case of simultaneous actuation of spoiler and airbrake controls, the spoiler groups on the wing requiring spoiler action will rise to the angle called for by the spoiler control input plus the angle called for by airbrake control input up to the maximum. At the same time, the spoiler groups on the opposite wing will rise to the angle called for by the airbrake control input minus the spoiler control input. With airbrakes in position 6, a subsequent application of spoiler control input will result in a proportional lowering of the spoilers on the wing which will rise and a proportionate raising of the outboard spoilers on the wing which will lower. A full application of spoiler control will override the airbrake input to the extent of completely lowering the spoilers on one wing. Such action causes a maximum lift differential between the two wings resulting in a roll in the direction toward the wing producing the smallest lift.

NOTE

> Application of airbrakes will tend to pitch the aircraft nose up. The pitching moment produced by airbrake extension can be used to augment elevator authority in counteracting an undesirable nosedown aircraft attitude.

SPOILER AND AIRBRAKE BUFFET. Flight testing with the spoilers and airbrakes in many different configurations and positions has been accomplished over the entire flight envelope of the aircraft and no appreciable buffet has been encountered. Mild buffet will occur at position 2 or 3 with flaps up, therefore, position 4 should be used for all normal descents. At high altitudes, an abrupt buffet may be noted just as the spoilers begin to extend if the control wheel is rotated very rapidly, but this opening shock has no damaging effects.

CAUTION

> As the airbrakes are extended, a noseup pitching moment is produced. This pitchup tendency is more pronounced when the aircraft is in the clean configuration than when the flaps and gear are down. An increased pitchup tendency will occur when changing from position 2 to position 3 or 4. Therefore, to compensate for this pitchup tendency as airbrakes are extended, nosedown elevator or stabilizer trim must be applied. The amount of corrective action necessary becomes larger with higher altitudes and higher indicated airspeeds. Full airbrake application at speeds up to 250 knots IAS requires approximately 3.5 units of nosedown stabilizer trim or nearly all of the available nosedown elevator authority when the aircraft is trimmed hands off prior to the application of full airbrakes. The airbrakes should not be moved rapidly through their full travel since a sufficient amount of elevator may not be available to counteract the spoiler pitching moment produced. The greatest trim change between airbrake positions is between positions 2 and 4. This trim change is equivalent to 2 units of stabilizer trim and is approximately three times that associated with changing the airbrakes from position 0 to 2 or from position 4 to 6. By moving the airbrake lever not more than two positions without retrimming the aircraft, sufficient elevator will be available to stop the pitching tendency.

SPOILER AND AIRBRAKE BLOWDOWN. At indicated airspeeds in excess of 250 knots, the air loads acting upon spoilers raised to the full-up position (position 6) are greater than the force available from the spoiler actuators. Obviously, under these conditions, the spoilers will be unable to maintain the normal extension of position 6. This reduction of the spoiler or airbrake angle by air loads is termed "blowdown." The greater the speed above 250 knots IAS, the farther the spoilers will blow down. For example, at the maximum airspeed without drop tanks (Section V), the maximum extension is reduced to approximately 20°. During blowdown, oil displaced from the hydraulic actuators exits through relief valves. Since it is difficult to adjust several relief valves to open at exactly the same pressure, blowdown may occur in one bank of spoilers sooner than in another. Such an occurrence will cause a rolling moment to be applied to the aircraft which requires compensating lateral control. During asymmetrical airbrake blowdown from the full airbrake position, the first portion of control wheel travel will have greatly reduced effect, and considerable movement will be required to produce roll. A lag between the control wheel position and the spoiler position resulting from blowdown causes this condition. However, ailerons are still effective for lateral control. The most extreme condition will require control wheel rotation of approximately 55° to obtain lateral control from the spoilers. Depending on aircraft speed, control forces required to reach the required wheel deflection may be greater than that obtainable with one hand operation of the control wheel. By using less airbrake at the higher speeds, this reduced effect will be less. Airbrake position 6 is satisfactory for speeds up to 305 knots IAS.

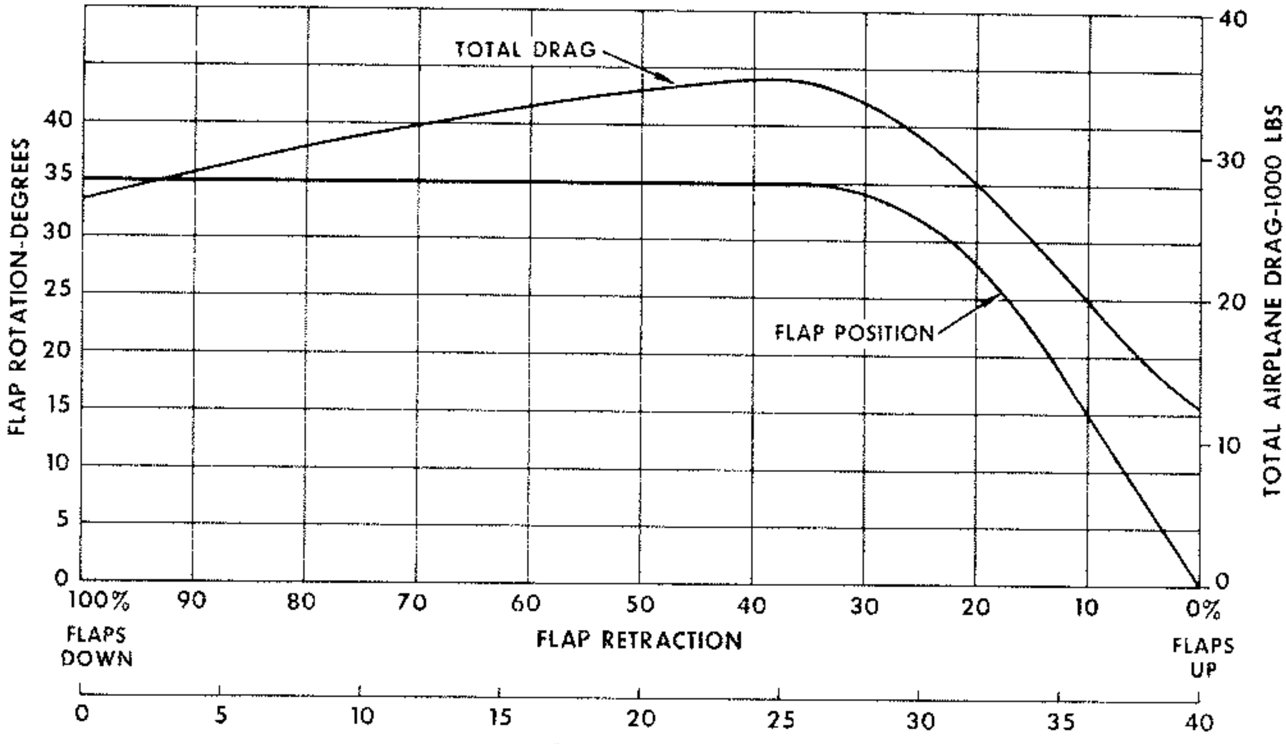
CAUTION

> At speeds above 305 knots IAS, do not select an airbrake position greater than position 4 since an excessive control wheel lag may occur.

MALFUNCTION OF SPOILERS OR AIRBRAKES. For instructions pertaining to malfunction of spoilers or airbrakes, see "Takeoff and Landing Emergencies," Section III.

Directional Control

Directional control is provided by a 10% chord rudder located on the trailing edge of the fin. Directional trim is provided by a manual adjustment to the rudder control tab through the Q-spring centering arm. The rudder is positioned by a manually actuated control tab which picks up and deflects the stability tab after about 10° of control tab motion so that both tabs reach full deflection at the same time. Damping is introduced into lateral aircraft oscillations by a stability tab in conjunction with a yaw damper. The rudder feel force and pedal centering are developed primarily by a Q-spring. Tab hinge moments also contribute to feel but are very small compared to Q-spring forces. Simple aerodynamic balance is used on the upper end of the rudder and the compound type of balance is used on the lower end. In this



CONDITIONS:
WEIGHT=250,000 LBS.
SEA LEVEL
NACA STANDARD DAY

WING FLAP CHARACTERISTICS

Figure 6-9.

compound balance are hinge moment regulators which are used to adjust the rudder hinge moments to obtain the proper control characteristics at all rudder deflection angles.

RUDDER EFFECTIVENESS. The rudder control forces during normal operations are moderate at all airspeeds and altitudes. For sea level operations, the rudder control is sufficiently powerful to counteract asymmetrical thrust from two inoperative outboard engines on the same side with zero sideslip at indicated airspeeds of approximately 200 knots and higher, even with the remaining good engines at military rated thrust. At indicated airspeeds below 200 knots and down to takeoff and approach speeds corresponding to 290,000 pounds gross weight, the rudder is adequate to maintain zero sideslip with the loss of one outboard engine with the remaining engines at military rated thrust. At lower weights under these conditions, some sideslip results and thus some lateral control is required to maintain the desired heading. Any time asymmetrical thrust is offset by a yawing moment from the vertical tail, the side thrust on this surface should be balanced by either sideslipping or banking the aircraft, if a constant heading is to be maintained. Thus, if a flight with zero sideslip is desired, the aircraft equilibrium attitude will include an angle of bank. Power may be reduced on the good side and flight continued with no sideslip or angle of bank. At speeds approaching minimum touchdown speed, the rudder becomes the primary flight control system to control an asymmetric thrust condition, especially since the lateral control effectiveness deteriorates as speed is reduced below best flare speed. See "Lateral Control" this section. The use of full rudder is mandatory to realize the charted Flight Manual minimum control speeds. Failure to use full rudder to counter an engine out condition can increase the minimum control speed for one outboard engine by approximately 25 knots.

RUDDER LIMITS. Structural strength of the fin is adequate to allow use of rudder trim to accomplish the trimming required for asymmetrical power operations; however, abrupt rudder manipulations must be avoided when using more rudder trim than indicated in "Rudder Trim Limitations" under "Airspeed Limitations," Section V. These limits were also provided to reduce the number of autopilot excursions into the autopilot rudder limit switches as well as to aid the pilot in staying within the structural limits of the vertical fin. The average thickness of the fin is 2% less than the average thickness of the wing. This was designed to insure that the fin would not reach its critical Mach number before the wing. Therefore, no buffet will be encountered resulting from the fin at speeds below that at which the wings start to buffet. Any tendencies for the aircraft to get into the steady combined roll and yaw oscillation commonly known as "Dutch roll" are adequately cancelled by the yaw damper. If conditions become such that very rough air is encountered, it will be the natural reaction for the pilot to attempt to assist the yaw damper in making the necessary corrections. This may be done by application of either aileron or rudder as required.

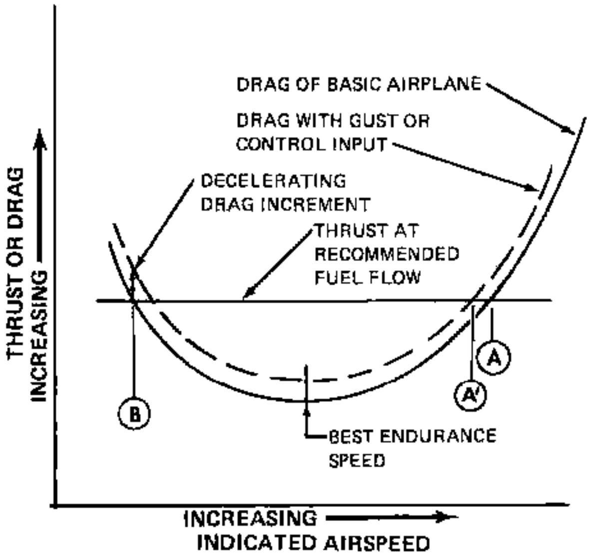
Wing Flap Characteristics

The wing flaps are designed so that the highest lift/drag ratio is achieved in the 100% down position. For this reason, full flaps are always used for both takeoff and landing. Extending the flaps causes an increase in lift which requires the pilot to lower the nose of the aircraft to hold altitude. The converse occurs when the flaps are retracted. During climbout while accelerating the aircraft to 180 knots IAS in preparation for flap retraction, a considerable amount of nosedown trim may be required to maintain zero stick force. During the period of flap retraction, trim requirements change in the opposite direction, necessitating noseup trim if zero stick forces are to be maintained. During flap retraction, most of the trim requirement will be noticed between the 37 1/2% extended position and the full-up position. Approximately 2 units of the trim change occurs during this portion of the flap retraction while about 1 unit of trim change occurs during the first 62 1/2% of the flap retraction. An out-of-trim condition may exist during the last portion of flap retraction if the pilot lags the rapid trim change rate occurring during this period. The elevator is the primary pitch control during flap operation; however, the stabilizer trim should be used to maintain the control column close to a zero stick force position. Figure 6-9 shows the rotational position of the flaps in relation to their percent of retraction. During flap retraction, drag builds up during the retraction to the 37 1/2% position and drops off as flaps are fully retracted. The effect of wing flaps on the stalling characteristics is discussed under "Stalls," this section.

FLIGHT CHARACTERISTICS UNDER VARIOUS SPEED CONDITIONS

THRUST-DRAG SPEED STABILITY

The B-52 has a thrust-drag type speed stability. If the flight condition is such that the aircraft is flying on the front side of the drag curve, i.e., faster than the speed for minimum drag (best endurance) at constant altitude, such as point A on figure 6-9A, then there will be a thrust-drag speed stability. That is, an increase in drag due to a gust or control input will cause a deceleration that will reduce the speed to a new stabilized speed shown as point A'. If the speed is less than the speed for minimum drag, then the additional drag due to gusts or control inputs will again cause a deceleration but a stabilized speed will not be reached because the excess drag gets greater as speed reduces causing the problem to be aggravated. Point B is an example of this case and it illustrates the fact that if flying below the minimum drag speed, the same fuel flow that existed at point A will result in a thrust-drag speed instability. In this situation, the aircraft will continue to decelerate further and stall will result unless power is applied or the nose is lowered enough to develop an accelerating force.



THRUST — DRAG SPEED STABILITY

Figure 6-9A.

LATERAL TRIM

When all engines are developing the same thrust and there is no lateral unbalance due to fuel load or other causes, the aircraft normally can be trimmed at cruising conditions within 1 unit of rudder and 2 units of aileron trim. When the landing gear is extended, however, the aircraft will yaw and fly slightly left wing heavy. This is caused by the asymmetrical location of the landing gear doors on the fuselage. Approximately 4 units of rudder trim may be required to retrim the aircraft. If desired, the aircraft may be trimmed by the use of a slight amount of asymmetrical thrust. In the flaps-down configuration, the control wheel forces required to balance the wing-heavy tendency are so small that the condition may not be noticed. The correction used may vary with pilot preference and flight conditions.

TAKEOFF

Stabilizer Trim

If the normal takeoff procedure is used, no unusual characteristics will be experienced. The stabilizer trim settings as given in Parts 2 and 3 of the Appendix have been calculated so that with the control column partially back, the aircraft will unstick at the proper speed at the planned ground run distance.

With these stabilizer settings, it is assumed that the pilot can use stabilizer trimming at the time when the trim changes are greatest; that is, to hold nosedown trim during landing gear retraction, during climbout of ground effect, and during acceleration to best flaps-down climb speed. The stabilizer should always be set to the position corresponding to the cg location and the aircraft gross weight. If too much nosedown trim is used, the aircraft will require a longer ground run and the rear gear will lift off the runway first. This can result in a difficult steering situation, particularly if any crosswind exists. A small amount of additional nosedown stabilizer trim provides a smoother takeoff transition between the ground run and airborne flight and also reduces the stabilizer trimming needed to obtain flaps-down climb speed. However, more nosedown stabilizer trim than the manual calls for will result in a ground run penalty of 10% for each additional unit of nosedown trim. It is imperative during flap retraction that the aircraft be kept trimmed to a zero stick force condition. This is especially important during the last 20% of flap retraction. If a nosedown mistrim of 2.5 units of stabilizer (approximately 30 pounds pull column force) is allowed to exist at the start of flap retraction and no retrimming of the stabilizer is made, the elevator authority is marginal until the airspeed is above approximately 250 knots (figure 6-6). During the latter portion of flap retraction, the pilot cannot keep up with the trim requirement changes using the manual trim system. However, the aircraft can quite easily be kept in trim with the stabilizer trim button.

Engine Failure

In case of an engine failure during takeoff (takeoff to be continued), rudder response is adequate to maintain zero sideslip with the remaining engines at takeoff rated thrust for takeoff gross weights above 300,000 pounds at unstick speeds. It should be noted, however, that zero sideslip cannot be maintained without a slight angle of bank. At lower weights, some sideslip results and lateral control as well as bank angle is required to maintain the desired heading. All of this correction may be trimmed out so that the aircraft will climb out from the field "feet off" the rudder pedals.

CLIMB

No unusual characteristics should be experienced during the climb. Adequate rudder control is available to handle the loss of one outboard engine with the remaining engines at military rated thrust. During initial climbout at altitudes near sea level, the rudder control in combination with bank angle is sufficiently powerful to maintain zero sideslip with two inoperative outboard engines on the same side as indicated airspeeds of approximately 200 knots and higher with the remaining good engines at military rated thrust. It should be noted, however, that zero sideslip cannot be maintained without a slight angle of bank. As much rudder and lateral trim as required may be used to trim out the asymmetrical thrust, but abrupt rudder manipulation must be avoided if the trim used is greater than recommended on the rudder trim placard.

CRUISE (LEVEL FLIGHT)

During a maximum range cruise operation, no unusual characteristics are to be expected if the recommended speeds and altitudes are maintained. However, if high airspeeds and/or high altitudes are to be flown, then buffeting or "tuck under" may be encountered.

DESCENT

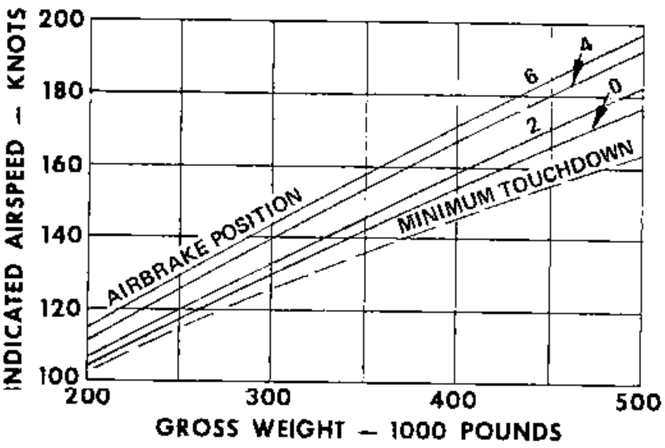
The normal descent procedure will be used for most descents and requires that the landing gear be extended and airbrakes be extended to position 4. During the transition period between cruise and descent, application of airbrakes will cause a pitchup and lowering of the landing gear will cause a slight pitchdown. If the airbrakes are extended to position 4 at a constant cruising speed, approximately 2.6 units of aircraft nosedown trim will be required to compensate for the noseup pitching moment produced. Lowering the landing gear at speeds near the gear extension placard limit requires approximately 1 unit aircraft noseup stabilizer trim to compensate for the nosedown pitching moment produced. Therefore, if the gear and airbrakes are extended at approximately the same time, less change in stabilizer trim will be required. Airbrakes normally should be extended slowly to allow sufficient time for the stabilizer trim to keep up with the trim requirements. In case the emergency descent procedure is used, the descent speed shown by the chart in Part 8 of the Appendix will take the aircraft down the edge of the buffet region. Caution should be observed not to make any sudden maneuvers which will place the aircraft within the buffet region. See "Buffet," this section, for additional information on this subject.

APPROACH

The main change in aircraft attitude during the approach will be encountered when the flaps are extended. The first 37 1/2% of flap extension causes the greatest trim change. Approximately 2 units of aircraft nosedown trim is required during this interval and an additional 1 unit nosedown trim is required during the remainder of the extension. When airbrakes are extended to position 4, an additional noseup pitching moment is produced requiring approximately 2.8 units of nosedown stabilizer trim.

FLARE

The aircraft should be trimmed during final approach so as to maintain near zero control forces on the elevator. Throttles are gradually retarded when flare point is approached and further reduced when over the overrun and flare is being completed. As back pressure is applied to the elevator during flare, stabilizer trim should be utilized to maintain near zero control forces until a landing attitude is attained.



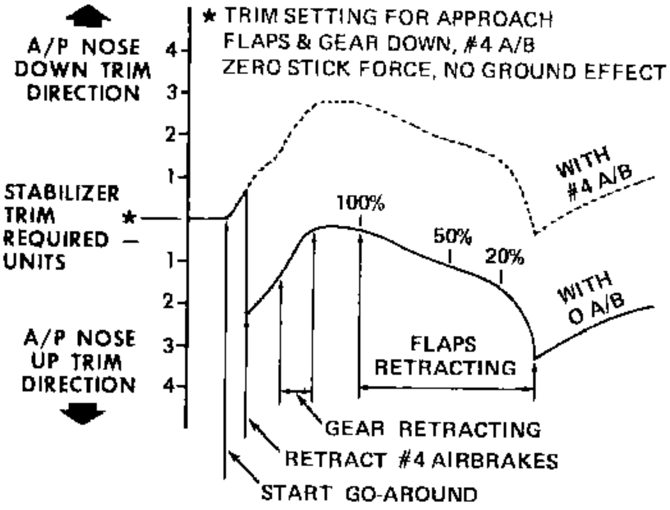
SIMULTANEOUS TOUCHDOWN SPEEDS

Figure 6-9B.

The elevator then becomes primary for attitude control to touchdown. Continued application of noseup trim after touchdown attitude has been established is not recommended since it will result in an excessive noseup trim condition when a go-around is required. In cases of forward cg's and/or heavy gross weights, gradual power reduction should be made as flare is entered and continued until touchdown.

LANDING

After touchdown, adequate directional control can be maintained by the rudder at the higher speeds and by forward wheel steering at the lower speeds. The effectiveness of lateral control for maintaining a wings-level attitude will decrease as the aircraft slows down but the tip gear will maintain adequate clearance for the nacelles and tip tanks. In case a strong crosswind exists, the landing can be accomplished quite easily using the steering and crosswind crab system. In order to obtain most effective braking, it is desirable to keep the wings as level as possible during the braking roll. Limit braking to no more than that required to stop on the available runway so that brake life can be increased. The speed corresponding to a simultaneous gear touchdown attitude, shown in figure 6-9B, is dependent on both the airbrake position and the aircraft gross weight. The speed for simultaneous gear touchdown increases with higher airbrake positions but is always above the minimum touchdown speed. The speed range between the simultaneous touchdown speed and the minimum touchdown speed can be thought of as a touchdown speed margin. For a typical landing gross weight of 250,000 pounds, this speed margin, with airbrakes n position 2, is only 5 knots. Selection of airbrake position 4 will increase this speed margin to 11 knots and significantly reduce the possibility of a poor landing due to a forward gear first ground contact. The desirability of having a large touchdown speed margin is one of the main reasons for selection of airbrake position 4 as the normal aircraft landing configuration. The stopping distance charts have been computed based on the minimum touchdown speeds and it should be noted that the actual ground roll will be longer if the touchdown is made at higher speeds.



TRIM CHANGE FOR GO-AROUND FROM BEST FLARE SPEED

Figure 6-10.

GO-AROUND

The go-around is similar to a takeoff provided airbrakes are retracted and the aircraft is kept in trim after the decision is made to go-around. Failure to retrim the aircraft to the target trim value noted during the landing approach, along with failure to retract the airbrakes, may result in a noseup mistrim condition of up to approximately 5 units of stabilizer trim during the go-around. Since this mistrim exceeds the total elevator push authority, it is imperative that the stabilizer be returned to the target trim value and the airbrakes be lowered during a go-around.

WARNING

- If the stabilizer trim is not restored to near the target trim value and the airbrakes are not lowered at the initiation of a go-around, the aircraft may pitch up into a stall attitude while in close proximity to the ground. Elevator authority will be severely reduced as a result of the mistrim condition and a recovery may not be successful from low altitude. An aircraft with an aft cg location will have a stronger tendency to pitch up than an aircraft with a mid to forward cg location.
- In cases where a go-around is initiated just prior to or during the landing flare and where adequate runway remains, it may be advisable to maintain a touchdown attitude, contact the runway, then retrim the aircraft during the ground run before initiating a large power application.

Stabilizer trim requirements change considerably when advancing thrust from idle to MRT. At light gross weight when MRT is rapidly applied, as in an emergency go-around situation, the rapid aircraft acceleration and high rate of climb will cause a pronounced aft center of gravity shift due to fuel shift in the tanks. This effect is most severe at low airspeeds, especially near or below minimum touchdown speed. Under certain fuel distributions, the aircraft center of gravity may shift as much as 5.5% MAC with application of MRT. The greatest tendency for fuel shift occurs when the gross weight is in the normal landing weight range, with partially full wing fuel tanks. The second most severe case is at high gross weights when the body tanks are only partially full; however; this case is considerably less severe. The trim change required to counteract a 5% MAC aft center of gravity shift at landing speeds is approximately 2.5 units of nosedown stabilizer trim. The trim change requirement due to an increase of thrust from idle to MRT is approximately 1 unit nosedown stabilizer trim. (This is due to the thrust moment arm alone and not to any fuel shift.) As the aircraft comes into ground effect, (about 150 feet above the runway), the downwash at the tail is reduced causing a trim change requirement of approximately 1.8 units noseup. Conversely, on climbing out of ground effect a change of about 1.8 units of nosedown stabilizer trim is required. Retracting the landing gear causes a noseup pitching moment which is equivalent to 1 unit of stabilizer trim. These trim changes, which may occur almost simultaneously during a go-around, account for the requirement of resetting the stabilizer trim and retracting the airbrakes during go-around.

NOTE

> Retracting the airbrakes from position 4 results in a nosedown pitching moment which is equivalent to approximately 3 units of stabilizer trim. See figure 6-10 for a profile of stabilizer trim requirements during a typical go-around.

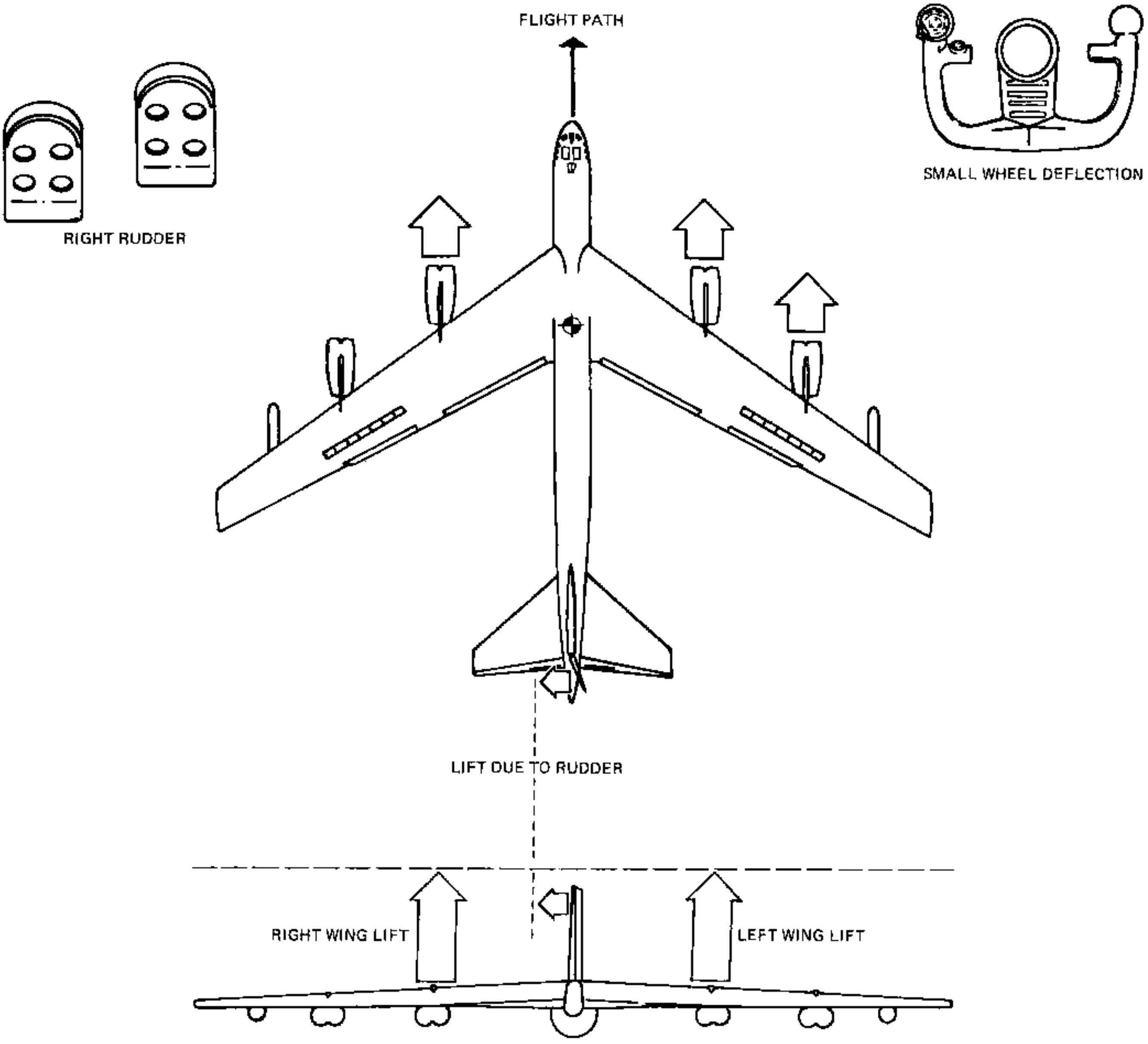
During a go-around at speeds near or below best flare, the aircraft control requirements will increase with a decrease in speed while the available control authority generally decreases. A go-around from a speed near or below best flare will require, under these conditions, prompt attention to the directional and roll control requirements in addition to the pitch trim requirements. This is especially important during asymmetric thrust conditions where a significant portion of the total control authority must be applied to control the aircraft. See "Lateral Control," "Rudder Effectiveness," and "Go-Around Characteristics With Asymmetrical Thrust," this section, for additional information about low speed control characteristics.

GO-AROUND CHARACTERISTICS WITH ASYMMETRIC THRUST

The proper control technique to achieve maximum performance during an engine out go-around is to use full rudder pedal deflection and wheel deflection only as required to control the rolling moment. The small 10% chord rudder on B-52 aircraft has a negligible drag penalty. The lateral control on B-52 aircraft includes a spoiler control device. The extension of spoilers on one wing decreases the lift produced by that wing and increases the drag. Increasing wheel deflection increases spoiler deflection and in turn increases the aircraft drag. Basically two cases of engine out control exist:

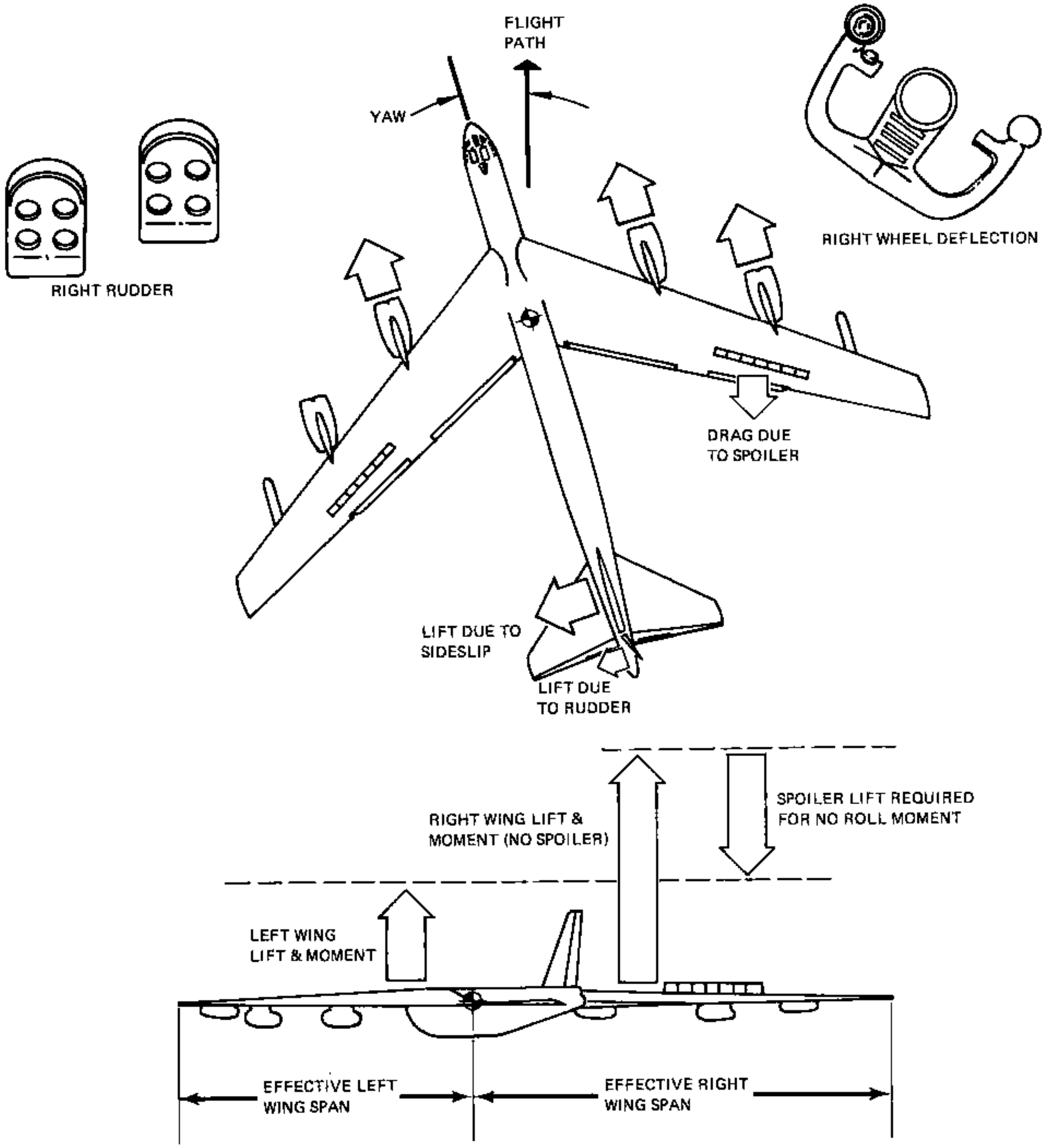
1. Rudder control sufficient to control the yaw asymmetry.
2. Rudder control insufficient to control the yaw asymmetry.

Figure 6-10A (Sheet 1 of 2) is a graphical illustration of Case 1 with the rudder control sufficient to overcome the yaw asymmetry without sideslipping the aircraft. The roll moment due to rudder deflection is small for the 10% chord rudder surface of B-52 aircraft. Small wheel deflections are required to control the roll moment. Figure 6-10A (Sheet 2 of 2) is a graphical illustration of Case 2 with the rudder control insufficient to overcome the yaw asymmetry. When the yaw asymmetry is greater than the rudder capability, the aircraft will sideslip so the yaw moment due to the engine out condition will be counteracted and balanced by the yaw moment due to the rudder plus the yaw moment due to the vertical tail sideslip. A swept wing in a sideslip condition will experience a large roll moment due to increased wing span effectiveness on the advancing wing and decreased wing span effectiveness on the retreating wing. This lift asymmetry must be counteracted by control wheel deflection. Since lateral control is achieved with the help of spoiler type controls, a spoiler must be raised on the advancing wing so that the lift on both wings is equal during the sideslip. Raising of a spoiler on one wing reduces the lift on that wing, but also creates a drag component. The spoiler drag component assists the rudder and vertical tail in controlling the yaw moment but reduces the aircraft climb performance. If the rudder control is now relaxed from the full control position, the aircraft sideslip will increase requiring an increase in wheel deflection to control the increase in rolling moment. The increased spoiler drag component will further reduce the aircraft climb performance. Figure 6-10B illustrates the reduction in rate of climb capability due to control wheel deflection. Retraction of the landing gear during a flaps down go-around will result in a climb performance improvement of approximately 250 fpm.



SUFFICIENT FOR CONTROL

Figure 6-10A(Sheet 1 of 2).



INSUFFICIENT FOR CONTROL

RUDDER CONTROL FOR YAW ASYMMETRY

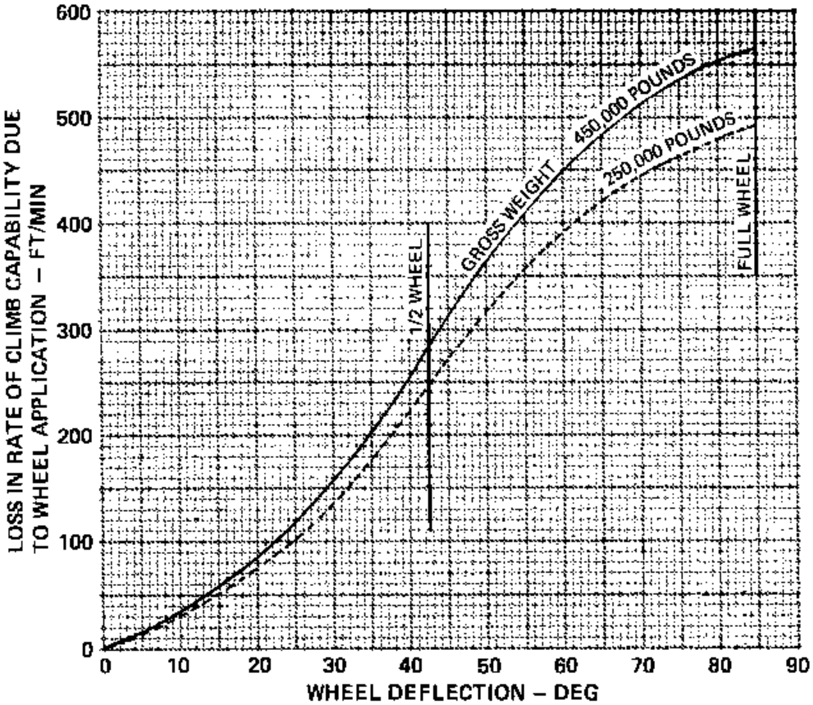
Figure 6-10A (Sheet 2 of 2).

CONDITIONS:

- ALTITUDE = 2,000 FT.
- TEMP. = 85°F
- FLAPS AND GEAR DOWN
- BEST FLARE SPEED + 10 KNOTS
- NO AIRBRAKES
- CONSTANT THRUST
- CONSTANT YAW ANGLE

NOTE

RATE OF CLIMB INCREASES 250 FT/MIN. WHEN LANDING GEAR IS RETRACTED



EFFECT OF WHEEL APPLICATION ON INCREMENTAL RATE OF CLIMB CAPABILITY

Figure 6-10B.

PRACTICE LANDING PATTERNS AT ALTITUDE

Thrust available decreases rather rapidly with increased altitude. At 7,000 feet altitude, eight engines at MRT produce approximately the same thrust as seven engines at sea level; at 13,000 feet, eight engines are equivalent to six engines at sea level; at 20,000 feet, eight engines are equivalent to five engines at sea level; at 27,000 feet, eight engines are equivalent to four engines at sea level. Aircraft acceleration and trim characteristics are affected by this decrease in thrust with increases in altitude and these characteristics are not directly comparable with those for sea level conditions. Because of altitude effects on initial buffet and aircraft thrust, it is recommended that practice landing patterns be performed at aircraft gross weights below 300,000 pounds and an altitude under 20,000 feet. If the best flare speed with No. 4 airbrake as presented in Part 9 of the Appendix is used, at least 10% cushion between initial buffet and the best flare speed will be available. It should be kept in mind that, as thrust available decreases with altitude, the change in pitch trim required as full power is applied at the best flare speed is less than would be encountered at sea level. Thus, when a go-around is accomplished at sea level, the change in nosedown trim required to maintain zero stick force is much more severe than that encountered for a go-around at altitude. The amount of asymmetrical thrust for a simulated engine-out condition decreases with increases in altitude because of thrust decreasing with altitude. Since the thrust of an idling engine increases with altitude, this also further decreases the amount of asymmetry. The loss of No. 1 engine wet during takeoff under standard sea level conditions can be demonstrated at 10,000 feet by retarding engines 3 and 4 to idle and placing all other engines to MRT. The effort to maintain directional control at a given IAS will be the same. Even though an aircraft can be easily controlled at altitude under a given asymmetrical thrust condition, sufficient control may not be available at sea level to maintain aircraft heading under similar engine-out conditions.

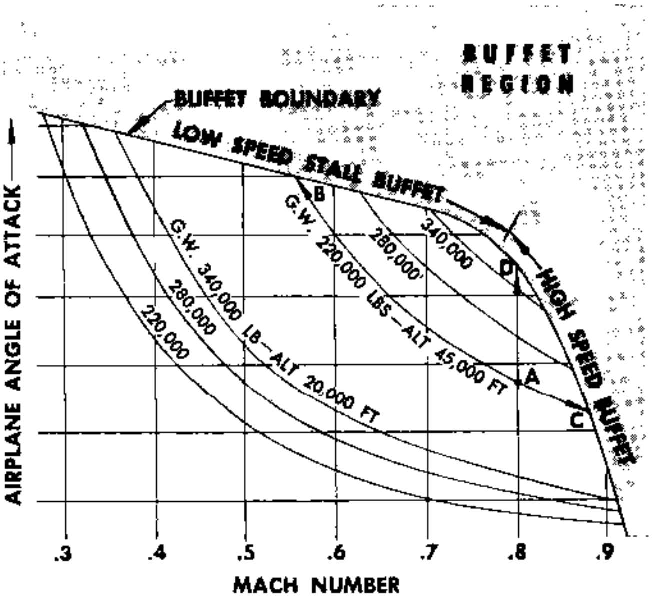
HIGH SPEED FLIGHT

Wing Buffeting

During high speed operations, a slight buffet begins when the aircraft critical Mach number is reached. This is caused by the turbulent airflow behind the shock wave which is established when the airflow over a portion of the top surface of the wing has reached sonic velocity. As the speed of the aircraft increases above this initial buffet speed, additional turbulence of the airflow over the upper surface of the wing is produced which causes a further increase in buffeting resulting in aircraft vibration. Unless some emergency exists, the aircraft should not be flown at speeds greater than that at which light buffeting is encountered. Increasing the altitude or the gross weight will cause buffeting to occur at a lower airspeed since the critical Mach number is reduced when the angle of attack of the aircraft is increased.

BUFFET BOUNDARY. The point where buffeting occurs is called the "buffet boundary" (figure 6-11). Buffet free flight can be conducted in the area below the curve but as the aircraft approaches the buffet boundary, a small gust, maneuver, or slight increase in the aircraft normal acceleration can cause the buffet region to be entered. Buffeting occurs during flight in any portion of the shaded region. The two types of buffeting encountered at high altitudes are low speed stall buffeting which occurs on the curve in the vicinity of point B and high speed buffeting which occurs in the vicinity of point C. For example, an aircraft weighing 220,000 pounds and cruising at .80 Mach at 45,000 feet altitude would be at point A on the curve. If speed is decreased far enough while maintaining the same altitude, buffeting will be encountered at point B. The buffeting encountered at point B is a low speed stall buffet and is essentially the same in nature as that described in "Stalls," this section. The only difference between high altitude low speed buffeting and that described under "Stalls" is that at high altitude, low speed buffeting occurs at higher indicated airspeeds. If the airspeed is increased from point A while maintaining the same altitude, buffeting will be encountered at point C. The aircraft can be flown past point C in level flight by increasing power to military rated thrust. Therefore, use caution when flying in level flight at MRT since the high speed buffet region might be entered.

RECOVERY FROM BUFFET. Level flight operation near the high speed buffet boundary or in the high speed buffet region is not dangerous provided the aircraft shaking is not great and the pilot understands that the quickest way to get out of the buffet region is to reduce speed or altitude or both. Since the aircraft drag in the buffet region is very high, the most effective method of getting out of this region is by reduction of power without change of trim which will result in reduction of speed and loss of altitude. A very slight climb produced by slight back pressure on the control column while momentarily increasing the buffeting will eventually aid in the loss of speed. While operating at low altitudes in level flight, the low speed buffet region can be entered but at lower airspeeds than that for higher altitudes. During normal flight operations, the buffet region will never be entered.



BUFFET BOUNDARY LIMITS

Figure 6-11.

Aileron Buffeting

As the aircraft approaches high speed buffet, an oscillation is experienced by the aileron and tab which reacts through the control system and results in movement of the control wheel. This shaking is mild to strong depending upon how far beyond the initial buffet speed the flight is carried. Vortex generators have been installed on the top of each wing in front of the ailerons in order to delay this aileron buffet until initial wing buffet occurs and to keep the aileron buffet within acceptable limits as speed is increased beyond initial buffet speed to limiting airspeeds. The vortex generators each have a 2-inch span and chord evenly spaced, about 6 inches apart, and are attached to the in-spar skin immediately aft of the rear spar. Being small airfoils, they are mounted vertically and aligned at a small angle to the local airflow direction. They are effective because the spiral airflow or tip vortex created by each of the generators transfers high energy air into the wing boundary layer delaying the boundary layer airflow separation. The pulsating flow caused by the separation is responsible for the aileron and tab oscillation.

LOSS OF VORTEX GENERATORS. If more than four vortex generators per wing are missing or more than one is missing in any 48-inch length, the aircraft speed should not exceed the maximum speed available in unaccelerated level flight.

Tuck Under

As the speed of any aircraft is increased, the normal requirement is more aircraft nosedown trim. However, with this aircraft, as with many other high speed aircraft, the trim requirement reverses as the buffet region is entered and noseup trim is required. Such a condition is called "tuck under" and is considered critical on those aircraft which do not provide sufficient longitudinal control or when the trim reversal is large. Since the aircraft is equipped with an adjustable stabilizer, sufficient longitudinal control is available to handle any condition within structural capabilities. The inboard portion of the wing approaches the critical Mach number first with the result that the center of lift of this area moves rearward with increasing speed. Because of this action, the resultant lift produced from the entire wing moves aft (center of pressure moves aft) which produces an aircraft nosedown pitching moment. The trim changes are small and gradual as speed is increased above the critical Mach number. They can be handled easily by use of the stabilizer trim or by use of elevator alone with not more than 50 to 60 pounds of pilot effort. Such a reversal of longitudinal trim is not unusual, but the amount of reversal and the speed at which reversal starts will vary depending upon the amount of sweepback used, flexibility of the wing, wing airfoil sections used, and wing taper ratio employed.

MANEUVERING FLIGHT

LOAD FACTOR

When the aircraft is being flown in level unaccelerated flight, the wings produce sufficient lift to counteract the weight of the aircraft such that a 1 "g" loading (a load factor of 1) is being produced. If the nose is pushed over, the loading decreases to less than 1 "g" during the maneuver, while if a pull-up is performed, a loading greater than 1 "g" is produced. If a turning maneuver is accomplished while maintaining the same speed, the wings produce less lift in a vertical direction and the angle of attack must be increased to compensate for this loss of lift if a constant altitude is to be maintained. This increase in angle of attack causes a loading increase greater than 1 "g."

EFFECT OF POSITIVE ACCELERATIONS

The effect of positive accelerations caused by coordinated turns or pull-ups is to increase the load factor on the aircraft. Performing any normal maneuver during maximum range cruise flight is generally not critical from buffet considerations. If level flight is being maintained in an area very close to the buffet region, even a small maneuver can cause the aircraft to enter the buffet region. Starting from level flight at point A (figure 6-11), a turn can be made at .80 Mach until buffeting is encountered at point D. A coordinated bank of approximately 53° is required to reach point D for this condition. Recovery from buffeting occurring during a turn or a pull-up is best made by rolling out of the turn or nosing over slightly or both.

COMBAT BREAKAWAY MANEUVERS

Techniques for combat breakaway maneuvers may vary depending upon the nature of the bomb run and status of equipment being utilized. This maneuver may be accomplished either by using automatic pilot or by manual controls but a combination of the two is not advised. Prior to the bomb run, consult figure 6-12 to determine the maximum recommended bank angle. It will be noted that the maximum recommended bank angle chart has reduced the bank angle 10° from the maximum recommended buffet and there is no need to further reduce the bank angle if best performance is desired. When making this maneuver on automatic pilot, rotation of the turn knob past the detent will allow up to 50° of bank. Entry into and recovery from the bank angle should be accomplished smoothly to prevent inadvertent disengagement of the autopilot.

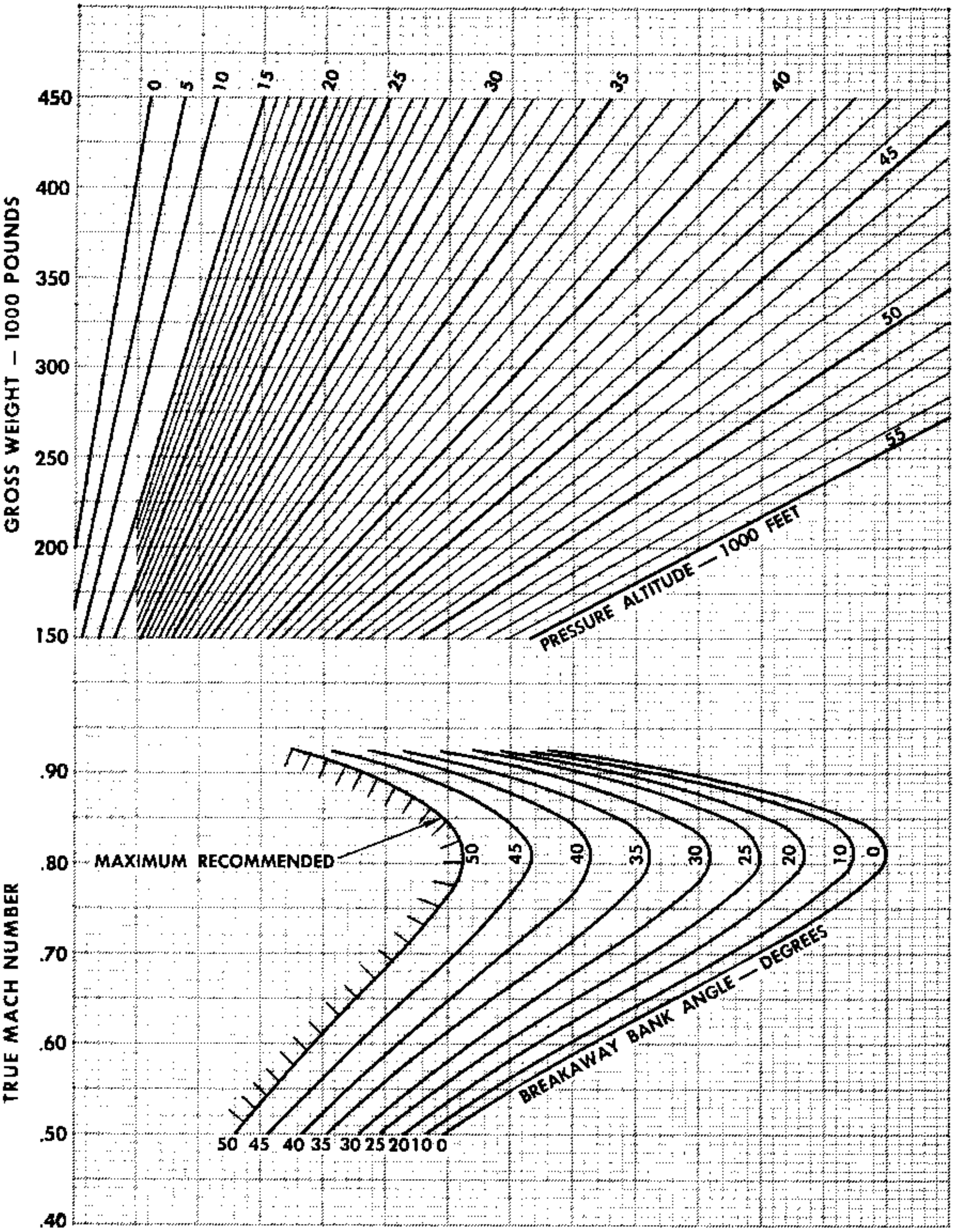
NOTE

> In the event of autopilot disengagement during breakaway maneuver, be prepared for a pitchup during manual recovery resulting from the trimming accomplished by the autopilot in the turn.

When performing this maneuver manually, the turn should be completed utilizing little or no stabilizer trim. Constant thrust and altitude should be maintained with a small resultant loss of airspeed during the breakaway maneuver; thrust should not be increased over that maintained during the bomb run.

RECOVERY FROM UNUSUAL POSITIONS

An unusual position is any abnormal bank attitude, pitch attitude, or speed which the aircraft has inadvertently assumed. The recovery from unusual positions may be safe or unsafe, depending on whether or not there is an easily understood and executed procedure assuring straight and level flight without damage to the aircraft. More specifically, an unusual position for this aircraft may be considered as



NOTE

BREAKAWAY BANK ANGLE IS 10 DEGREES LESS THAN THE BANK ANGLE FOR MAXIMUM RECOMMENDED BUFFET.

MAXIMUM RECOMMENDED BANK ANGLE (BREAKAWAY MANEUVERING)

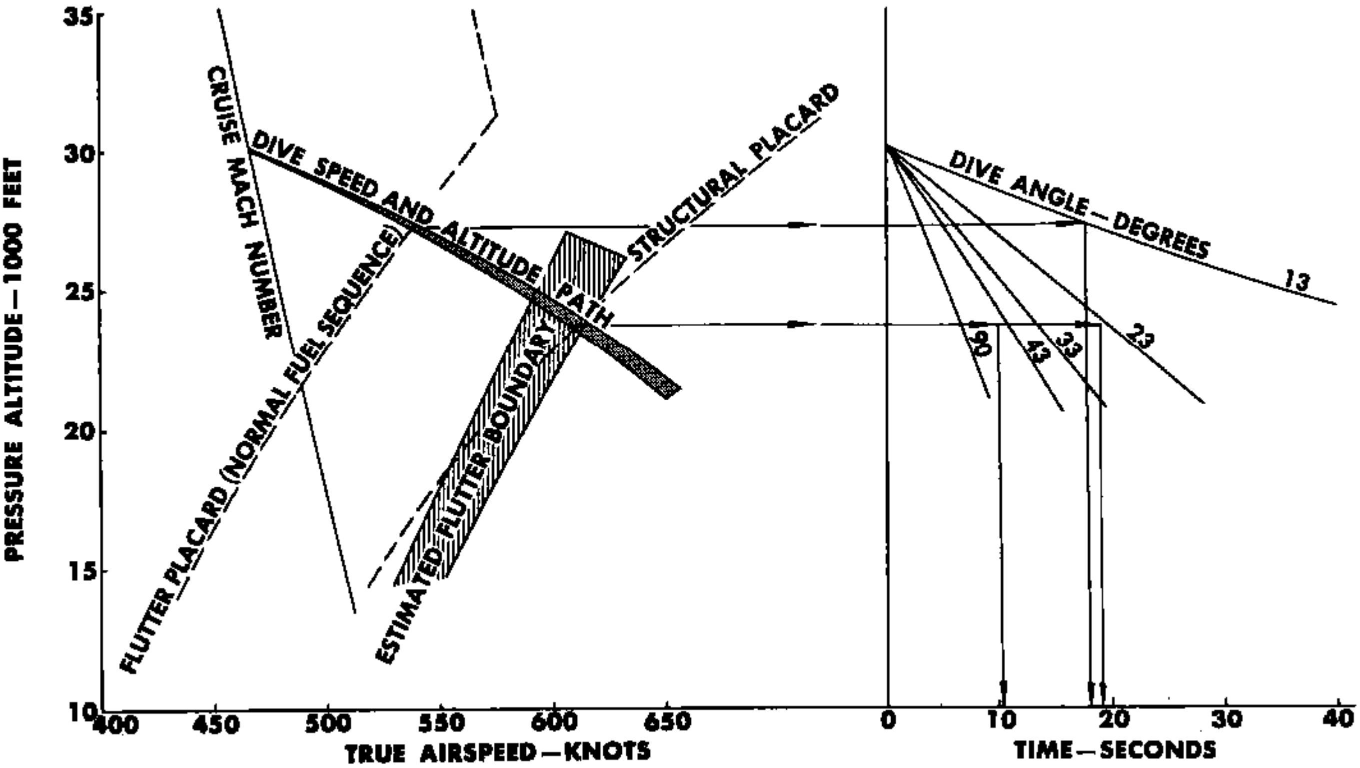
Figure 6-12.

any attitude or speed which results in inadvertent operation outside the following limitations:

1. An unintentional bank angle greater than 45°.
2. A nose-high attitude greater than that required for a maximum steady climb angle at aircraft gross weights with which the pilot has had flight experience.
3. A nosedown attitude greater than that required for the established descent procedures under conditions with which the pilot has had experience.
4. Maximum placard speed or structural load factor limitations for the particular aircraft configuration.
5. Minimum recommended speed.

Aircraft attitudes that exceed the abovelisted limits which the pilot has intentionally caused the aircraft to safely assume, such as a combat breakaway maneuver, are not considered unusual positions and the following procedures for recovery from unusual positions will not apply if the aircraft is operating safely after intentionally establishing the aircraft attitudes or speeds. If, after intentionally exceeding the above limits, the aircraft operation appears to become unsafe, then the recovery from unusual positions procedures will be used. Acrobatic maneuvers in this aircraft are prohibited; however, it is imperative that procedures for recovery from inadvertent unusual positions be understood. During action over a target, it may be necessary to recognize and recover from extreme maneuvers. Incorrect recovery from normal over-the-target maneuvers or incorrect procedures during instrument flight, especially descents, can lead to unusual positions. During recovery from unusual positions, the pilot must be aware of the aircraft limitations and be able to make a decision as to whether to attempt recovery or abandon the aircraft. Recovery from normal over-the-target maneuvers can be safely practiced if ordinary precautions are taken. Any procedure, however, which requires the pilot to recognize and recover from an unusual position with limits in excess of those established in this paragraph, which he has not observed being established, is not recommended. This is because operation cannot always be easily established unless the maneuver entry has been progressively observed and incorrect interpretation of attitude may lead to incorrect recovery. Any protracted delay in recovery from an unusual position will result in a dive. The time required to exceed placard speeds from cruise Mach number at 30,000 feet at various dive angles is shown in figure 6-13. In a 13° dive, the flutter placard can be exceeded in less than 20 seconds. In a 25° dive, the structural placard and the flutter boundary can be exceeded in less than 20 seconds. At 45° or more, all placards are exceeded in less than 10 seconds if recovery procedures are not initiated immediately. Basically, the techniques required for recovery from unusual positions are the same as for other aircraft of this class, except that a higher degree of proficiency may be required. The pilot should, however, be familiar with the following pilot technique and flight characteristics which are peculiar to this aircraft:

1. Although the electrical trim features make it easy to maintain elevator control forces at a minimum, little or no stabilizer trim should be used during fast rate roll-ins or pull-ups. This assures that release of the controls will return the aircraft toward the original trim condition if rapid recovery is required.
2. Rolling the wings level during a dive recovery can be accomplished at high indicated airspeeds since adequate control exists.
3. If lateral controls are used in the recovery, forward column movement is required to compensate for pitchup due to the lateral control spoilers unless the pitchup is required as part of the recovery procedure.
4. Application of stabilizer trim should very closely follow corrective control column movement. This is desirable in order to keep recovery effort to a minimum and to assure that the stabilizer screw is not loaded beyond operating capacity if aircraft placard speeds are unintentionally exceeded in the recovery. It is not considered good practice to move the stabilizer ahead of time in anticipation of a certain aircraft response unless it has been previously experienced that this response is certain to occur. This is especially true if placard speeds have inadvertently been exceeded. Control characteristics beyond placard speeds are covered in Section V.
5. Airbrakes can be used in emergencies, such as loss of stabilizer trim, for a pitch trimming device. When used at low airspeeds, incremental extension of the airbrake following application of full noseup elevator will assist in recovering from a nosedown attitude. In addition, they can be used as a drag device at high speeds; however, they should be applied gradually, keeping in mind their strong pitchup effects and blowdown characteristics at speeds above 250 knots IAS. Use of more than airbrake position 2 at higher indicated airspeeds will make full lateral control more difficult to attain (higher wheel deflections and forces) and results in unpredictable but controllable roll caused by asymmetrical spoiler blowdown.
6. Extension of landing gear as a drag device in recovery from steep nosedown attitudes is recommended but every effort should be made to extend the gear as soon as the attitude or the possibility of such an attitude is recognized. At high speeds, however, successful egress of personnel without ejection seats is virtually impossible after gear extension. In addition, if aircraft placard speeds are exceeded, it is likely that gear doors will be lost with possible collision damage to horizontal and vertical tail.
7. Since improper recovery from an unusual position may result in exceeding placard speeds, rudder trim should be returned to zero before initiating a deliberate unusual position in order to preclude



EXAMPLE OF SPEED CHANGES DURING A DIVE

Figure 6-13.

structural failure. With the electronic yaw damper off, steep dive angles or negative load factors will cause the bob-weight damper to become statically unstable. In this case, the stability tab will cause rudder deflections and consequent small yaw and rolling moments. These can be countered if necessary by appropriate rudder pedal application. The electronic yaw damper, when operating, will override and compensate for the instability.

WARNING

Rudder deflection can cause structural failure if speeds greater than aircraft placard speeds are inadvertently reached.

8. Aircraft buffet cannot be relied upon as an indication that structural limit load factors have been reached since in most cases buffet is not reached until after structural load factor limitations have been exceeded. This is shown on the "Normal Acceleration at Maximum Recommended Buffet" chart. (See Part 10 of the Appendix.) No reliable flight experience exists on the buffet characteristics at combined Mach numbers and indicated speeds above the structural and flutter placards.

WARNING

Instrument misinterpretation during the initial phase of the recovery would result in improper recovery action which could overstress the aircraft. Pilots must be alert to prevent improper recovery action. Caution must also be exercised during recoveries because the accelerometer is not a precise or easily read instrument.

Nose-High Attitudes

A nose-high condition can develop immediately after takeoff or touch and go because of the following conditions:

- Stabilizer trim not set properly for takeoff

- Stabilizer trim not reset properly for touch and go
- Airbrakes left extended
- Unscheduled and/or runaway noseup trim
- Misinterpretation of visual or artificial horizon.

WARNING

Do not use the stabilizer trim cutout switch until positive that the attitude change is due to runaway trim.

The use of a steep bank to control the aircraft can be fatal if at a low airspeed and close to the ground, and should not be attempted. The best opportunity for recovery exists when using full forward control column, retracting airbrakes if extended, continuous application of nosedown trim, and maintaining takeoff thrust and a wings-level attitude at all times. During touch and go, the trim must be reset prior to making the takeoff. If this action is not accomplished immediately following unstick, forward column will be required in order to prevent pitchup, and nosedown stabilizer trim will have to be initiated to obtain zero stick force. The forward control column required to maintain attitude will increase to the extent that at a speed of unstick plus 10 knots (approximately 4 seconds) all of the available forward control will have been used (approximately 30-pound push force is required). If nosedown trim is not applied and continued at this time, recovery from the ensuing pitchup and steep climb attitude may be questionable. Even with nosedown trim being applied and held continuously from the point at which full forward control column has been used, a time element of approximately 5 to 8 seconds will elapse before trim effectiveness becomes apparent to the pilot. To be sure that the trim action desired is being accomplished, note that the movement of the manual trim wheel is in the proper direction. If electrical trim appears inoperative, manual trim must be applied as rapidly as possible while holding wings level and the control column full forward. Recovery is still possible but will be slower. The airspeed will fall alarmingly low but lateral control will be good. The aircraft will perform an over-the-top maneuver and recovery can be made as the descent is begun by use of trim and power as required. Do not release forward pressure on the control column until the desired attitude is established and airspeed increases to a safe value. Because of the tendency to overtrim during the recovery from the nose-high condition, prompt opposite trim action will be required after the aircraft assumes a nosedown attitude. Caution must be exercised to avoid an accelerated stall. Even though a reduction of thrust will decrease the amount of mistrim in the noseup direction, there are definite advantages to be gained by maintaining thrust. When thrust is maintained, the minimum speed encountered in the recovery will be higher, altitude gained will be greater, and the possibility of a secondary stall in the recovery will be decreased. Do not use a steep turn maneuver for recovery from nose-high attitudes, one reason being that dangerous sideslip could occur causing structural failure. If nose-high attitude develops after takeoff, recover straight ahead. Maintain wings-level, full takeoff thrust, and full forward control column. Retract airbrakes, if extended, and apply continuous nosedown trim until recovery is made.

WARNING

Do not attempt to take off unless trim has been properly set for takeoff and airbrakes are down.

A steep turn as a last resort maneuver will compensate for a considerable amount of noseup mistrim; however, if the mistrim condition is undetected until a high noseup attitude and a low airspeed is reached, there is a danger, when entering a turn, of causing an uncontrollable maneuver which may result in structural failure. Two other factors should be considered: 1) While rolling the aircraft, the spoilers aggravate the mistrim and 2) the time taken establishing a turn would be better spent trimming manually. Therefore, a steep turn maneuver to compensate for an excess of noseup trim is not recommended even at high altitude except in the case when both electric and manual trim are inoperative. When starting a steep turn under these circumstances, alert the crew to "prepare to abandon the aircraft." If unscheduled noseup trim is encountered while in a turn, the best action will be to continue the turn and use the "Runaway or Unscheduled Stabilizer Trim Checklist," Section III. If nosedown trim is encountered in a turn, roll wings level while using the "Runaway or Unscheduled Trim Checklist," Section III.

Dive Recovery

Dives can result from stabilizer trim in the nosedown direction, autopilot malfunction, unscheduled loss of airbrakes, or instrument misinterpretation or malfunction. Because of its extremely low drag with landing gear and flaps retracted, this aircraft will increase in speed very rapidly any time the nose is dropped. Therefore, during dive recovery, the application of a positive load factor (back stick) should be made immediately up to the structural limit of 2.0 "g's" or to the point of buffeting, whichever occurs first. In cases where elevator authority alone is found to be insufficient to control the dive or when nosedown mistrim is suspected, airbrake extension should be used as a backup to the elevator for pitch authority. The application of load factor should have precedence over power reduction. See figure 6-13 for speed changes during a dive and figure 6-13A for altitude loss during a dive recovery.

CONDITIONS:

LOW ALTITUDE (10,000 FT OR LESS)
FLAPS UP
GROSS WEIGHT 300,000 LB

RECOVERY TECHNIQUE:

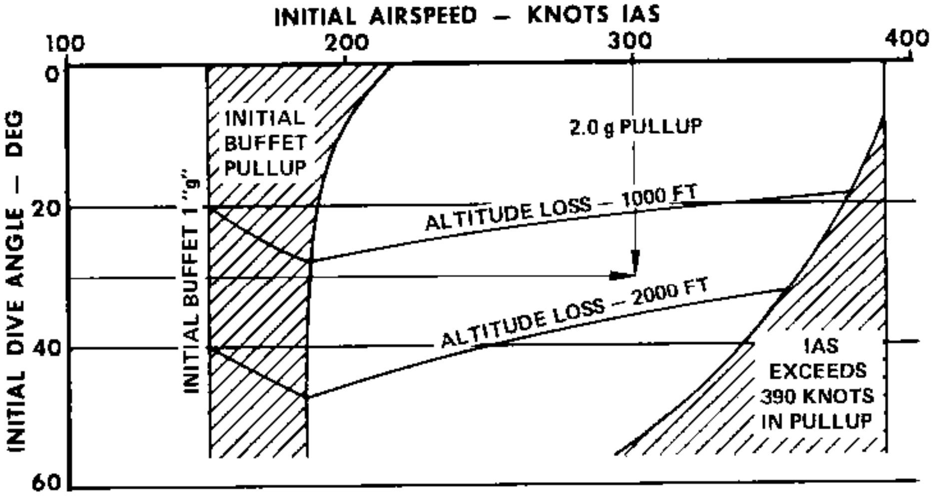
ELEVATOR IMMEDIATELY APPLIED TO 2.0 g OR INITIAL BUFFET

EXAMPLE:

GIVEN:
Initial dive angle 30°, airspeed 300 KIAS

FIND:
Altitude loss for recovery

SOLUTION:
Approximately 1600 feet



DIVE RECOVERY CAPABILITY

Figure 6-13A.

Spiral Dives

If an aircraft reaches too large a bank angle or falls off on one wing, a spiral dive can result. This maneuver is easily entered when visual orientation is not possible or if instrument orientation is momentarily lost because of distraction or vertigo. To recover from a spiral dive, roll out of the bank and hold wings level while holding a constant heading. At the same time, the recommended procedures for dive recovery should be initiated.

Vertigo

When the pilot becomes disoriented or experiences vertigo, the aircraft can be returned to wings level by engaging the autopilot. It is not necessary for the aircraft to be in trim. If a spoiler is up when the autopilot is engaged, the aircraft will only return to approximately wings level, with the autopilot holding some spoiler and rudder to compensate for an out-of-trim condition. After the pilot is reoriented, it is recommended that the autopilot be disengaged momentarily and then reengaged after trimming aircraft. Recovery from a climb or dive must be commanded through the pitch knob or the altitude control switch. If the autopilot disengages itself when engaged in such an emergency, continuous manual reengagements will introduce signals in a recovery direction.

Summary of Causes for Unusual Positions

The following conditions are the most prevalent causes for unusual positions in this aircraft:

1. Pilot disorientation or vertigo
2. Turbulence or weapons effects
3. Improper use or malfunction of airbrakes
4. Improper use or malfunction of stabilizer trim
5. Split flap operation.

Summary of Procedures for Recovery from Unusual Positions

The following procedures will be used for recovery from nose-high unusual positions when the bank is less than 45°:

1. Add thrust as required and later adjust as necessary to obtain the desired airspeed.
2. Lower nose of aircraft to slightly below the horizon (approximately 3°) and maintain the original bank angle when lowering the nose. If the wings are level when starting the recovery, maintain wings-level attitude and lower nose to slightly below the horizon. If applicable, use the "Runaway or Unscheduled Stabilizer Trim Checklist," Section III, to help correct the nose-high attitude.
3. After obtaining a slightly nose-low attitude, roll wings level and establish straight and level flight.

The following procedures will be used for recovery from nose-high unusual positions when the bank is more than 45°:

1. Add thrust as required and later adjust as necessary to obtain the desired airspeed.
2. Simultaneously lower nose of aircraft to slightly below the horizon (approximately 3°) and reduce the bank to 45° or less. If applicable, use the "Runaway or Unscheduled Stabilizer Trim Checklist," Section III, to help correct the nose-high attitude.
3. After obtaining a slightly nose-low attitude, roll wings level and establish straight and level flight.

The following procedures will be used for recovery from nose-low unusual positions:

NOTE

> A nose low unusual position can be entered as the result of a low speed stall. For recovery techniques from this low speed condition, see "Recovery from Inadvertent Stalls," this section.

1. Back stick, thrust reduced as required, and drag devices such as airbrakes and landing gear should be used as necessary to avoid exceeding airspeed limitations.
2. Simultaneously correct pitch and bank to establish level flight condition. Elevator control should be closely followed by stabilizer trimming in order to keep elevator control forces and jackscrew loads at a minimum. The structural or buffet limits should not be exceeded in an attempt to level off too rapidly. If the wings are level when starting the recovery, maintain wings-level attitude when correcting the pitch attitude so the maximum effectiveness of lift will be available for producing a recovery flight path.

Spins

For spin recovery, see "Spins," this section.

Inverted Attitudes

The best way to recover from an inverted attitude with a minimum loss of altitude is to roll out. Since this aircraft has spoilers and inboard ailerons, there is no problem of lateral control reversal.

FORMATION FLYING

AERODYNAMIC EFFECTS

Aircraft flying in close formation have an aerodynamic effect on each other due to the interaction of the airflow around the two aircraft. This effect, in general, tends to draw the two aircraft together and the strength of this effect is inversely proportional to the distance. The closer the two aircraft, the stronger the effect. The strength is also directly proportional to the size and weight of the aircraft. For example, a T-33 chase plane would not noticeably affect a B-52 but the T-33 would experience a strong disturbance from the B-52. Two B-52's would experience similar forces but the lighter of the two would be more disturbed. Also, the aerodynamic effect increases with decreasing airspeed since, for the same weight aircraft, the distortion in the airflow is greater at slower speed. The extension of wing flaps distorts the airflow in a manner to increase the disturbance so that it is more hazardous to fly formation at low speeds with the flaps extended on the lead aircraft. In addition, formation flying at high Mach numbers can introduce large unfavorable interactions between the two aircraft. The pilot feels all of these aerodynamic effects as changing control force requirements as the two aircraft maneuver near each other. If the relative position of the two aircraft is changing rapidly, the control force requirements will also change rapidly. For this reason, one of the basic rules for formation flying is to make all position changes slowly. The direction of the disturbing force is different for every relative position, but generally the force is in the direction to bring the two aircraft closer together. Consider a B-52 underrunning a KC-135 during an attempt to formate for refueling; if the center lines of the two aircraft coincide, they will tend to fly together and the B-52 pilot must push on the control column to maintain clearance. As the B-52 wing passes forward of the KC-135 wing, it passes from a region of downwash to a region of upwash and the lift is suddenly increased; therefore, the B-52 pilot must strongly increase the push force at this time to prevent pitching up into the tanker. If the B-52 were to underrun the tanker to one side so that their wings overlapped on one side only, the pitching tendency would not be quite as strong, but the aerodynamic interaction is such that less lift is generated on the top wing and more lift is generated on the bottom wing. This causes the two aircraft to bank in the same direction with the two wings tending to collide since one goes down and the other goes up.

LIMITATIONS

To prevent possible midair collision, intentional close formation flying is prohibited except during air refueling conducted in accordance with applicable air refueling flight manuals and authorized formation flying conducted in accordance with major air command directives. Prior to participating in air refueling operations or formation flight, all crews will be properly briefed on formation tactics and procedures that will be used and to 1) never fly over or under the other aircraft and 2) maintain safe separation in all directions as specified in the applicable air refueling flight manuals or the major air command formation flying directives. In the event an emergency requires a chase aircraft for airspeed reference or a visual inspection, the pilot of the chase aircraft will be briefed on command chase aircraft procedures prior to engaging chase operations.

DIVING

At cruising altitude, a considerable increase in speed above the maximum range cruise speed may be made before reaching the buffet boundary; therefore, a shallow dive may be made without entering the buffet region. However, because of the extremely low drag of the aircraft with the gear and flaps retracted, the speed increases very rapidly at any time the nose is dropped or a dive is started. If the buffet region is entered while in a dive, recovery may be made by immediately retarding the throttle to IDLE and leveling out very slowly. Leveling off too rapidly will cause the load factor to increase to a value considerably greater than 1 "g" with the result that buffeting will increase. In cases where a rapid descent is to be accomplished, the landing gear and airbrakes should be extended and the procedures followed as outlined under "Descent," Section II.

FLIGHT WITH ASYMMETRICAL LOADS

See "Fuel Management for Lateral Trim," Section II; "Drop Tank Emergency Operation," Section III; and Part 9 of the Appendix for information regarding flight with asymmetrical loads.

LOW ALTITUDE FLIGHT CHARACTERISTICS

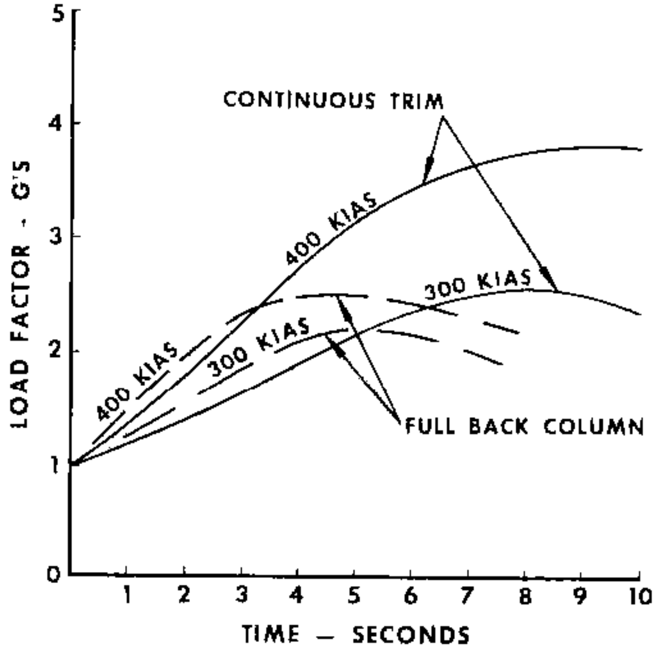
Considerable motion in the vertical and lateral planes from the effects of turbulence and strong or gusty surface winds is apparent while flying at low altitude, especially if the airspeed is above 325 knots IAS. When gusts move horizontally due to surface wind, there is motion in the lateral plane but motion in the vertical plane is most commonly encountered. When a vertical gust is encountered, the aircraft continues to bounce vertically after passing through the gust and, if no further gusts are flown into, the bounce damps out after 4 to 5 cycles. When gusts are close together, the aircraft never stabilizes but continues to bounce at a frequency of 2 to 3 cycles per second. Wing and nacelle motion as viewed from the cockpit is very extensive and rapid in frequency. The aircraft is stable in turbulent flight and no undesirable deviations from the desired altitude or flight path have been caused by gusts. The normal operating limitations contained in Section V apply to low altitude operation. See "Low Altitude Operation" and "Navigation at Low Altitude," Section II, and "Turbulence and Thunderstorms," Section IX.

NOTE

For operation of terrain avoidance system, see Section IV.

AIRCRAFT RESPONSE TO FLIGHT CONTROLS

The most significant problem with which the pilot must familiarize himself at high speed is the aircraft control characteristics while encountering severe turbulence at low altitudes. Gust feedback through control surfaces at design speed of 400 knots with turbulent conditions causes considerable and sometimes violent displacement of the pilot's controls. The control wheel can rotate as much as 30° to either side of center position. The control column and rudder pedals move back and forth several inches. At design speeds, the rudders are not used since gust forces overpower pilot effort. Even if the pilot does attempt to use rudder, a gust will probably move the rudder to a new position. Aircraft response to use of the elevators only is sluggish, while response to change in stabilizer trim is rapid and positive. However, any change in pitch should be made by leading with the elevators and using stabilizer trim to relieve the physical effort required by the pilot. Fine control is then maintained by use of the elevators. Use of the automatic flight control system will substantially reduce stick forces required and lateral forces will also be lighter than manual. With the electromechanical yaw damper engaged, lateral-directional oscillations of the aircraft are sensed and increased positive damping is provided for easier rudder control. The autopilot will also provide automatic stabilizer trim to compensate for any pitch or thrust changes. See "Autopilot," Section IV. Figure 6-14 compares load factors developed during low altitude pull-ups at high and low airspeeds. See "Acceleration Limitations," Section V, for inflight limit load factors. When using the low level mode of the autopilot, a "g" limiter will automatically disengage the autopilot before the pilot inadvertently exceeds the normal acceleration (load) limits. For additional information, see "G Limiter" under "Autopilot," Section IV. The use of airbrakes is not advisable except in maintaining the necessary EPR for anti-icing or under other



SEA LEVEL
STANDARD DAY

CG = 25% MAC
GW = 250,000 LB

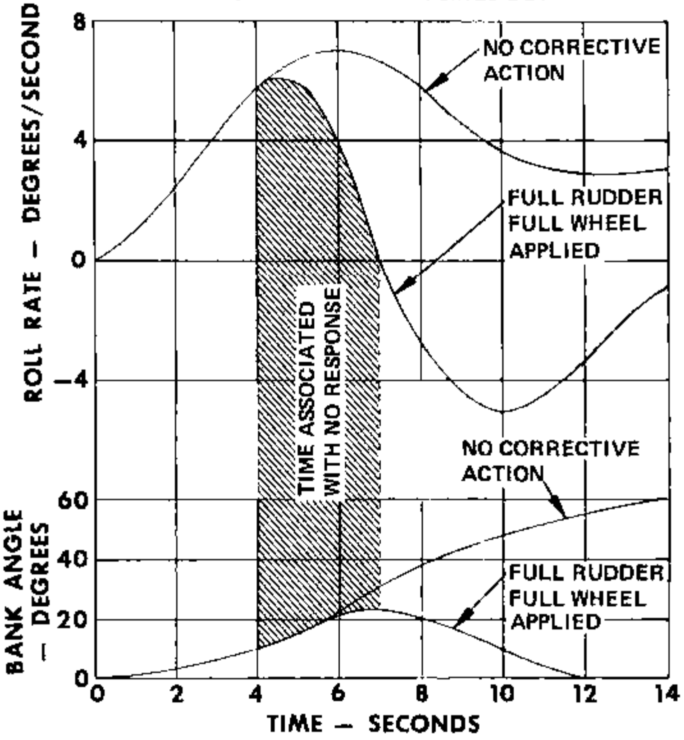
LOAD FACTORS DURING LOW ALTITUDE PULL-UPS

Figure 6-14.

controlled conditions. Pitchup or pitchdown characteristics associated with the extension or retraction of the airbrakes can cause high load factor maneuvers resulting in undesirable attitude changes, especially at low altitudes. Aircraft response to controls and control forces varies sharply with airspeed and it is only at high (near design) speeds that difficult control force problems are encountered.

The roll-yaw response of a B-52 resulting from a typical asymmetrical thrust condition is shown in figure 6-15. For a particular case where corrective action is applied 4 seconds after thrust loss, the roll rate does not reduce to zero until an additional 3 seconds have elapsed. During this period, the aircraft continues to bank even though full corrective control has been applied. A sensation that the controls are not effective will be felt since the bank angle continues to increase for several seconds when full controls are applied to oppose the roll. The aircraft is, however, in a process of responding by reducing the roll rate. Control inputs must be held in to speed the recovery.

- G.W. 250,000 POUNDS
- S.L. STANDARD DAY
- UNSTICK SPEED
- 2 OUTBOARD ENGINES OUT



ROLL-YAW RECOVERY (TYPICAL)

Figure 6-15.

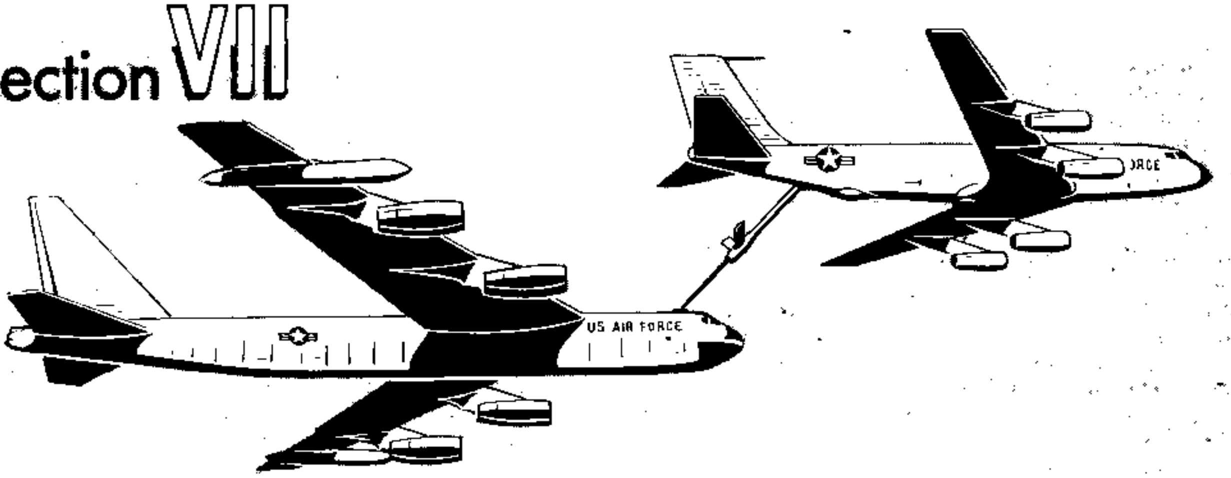
PILOT CONTROL TECHNIQUE

During low altitude operations, pilot technique is extremely important and proper coordination between pilot and copilot is essential. Prolonged low altitude operation may require assistance from the copilot, depending on turbulence level and character of the terrain. An effective method of controlling the aircraft while experiencing difficult control forces may be accomplished by the pilot using both hands on the control wheel while the copilot controls airspeed with the throttles.

Autopilot

Autopilot nonsteering modes are not suited to low altitude flying and cannot be relied upon to maintain control. Autopilot response, particularly in using the pitch control knob, is not rapid enough to perform low altitude maneuvers and is subject to disengagement due to turbulence. However, the autopilot low level mode may be used for low altitude operations. This mode reduces loads imposed on the aircraft and also reduces pilot fatigue during low altitude flying by allowing the pilot to command the aircraft through the autopilot. The pilot flies the aircraft through the autopilot by control column and control wheel inputs in the same manner that he flies without the autopilot. Control column and wheel forces are considerably reduced because the autopilot is sensing the pilot's force on the controls and provides the necessary action to move the control surfaces. For additional information, see "Autopilot," Section IV.

section VII



SYSTEMS OPERATION

TABLE OF CONTENTS

ENGINE OPERATION

ENGINE LIFE

Time-Temperature-RPM

The "Time-temperature-rpm" relationship within the engine is the main factor in engine life. The most important of these is temperature. The strength of the materials used in the engine decreases as high internal termperatures approach the melting points of the metals, even though the danger point may not be closely approached. There is a tendency for any material to take a permanent set, stretch, or bend; this tendency increases with both the load and the temperature. The amount of permanent set increases with the length of time that the load and/or temperature is applied. After a certain amount of permanent set is attained, the fibers or grains of the material begin to pull apart. Under inspection with a high powered microscope, the beginnings of fine cracks may be seen. With additional time, the material begins to elongate at faster rates as the cracks become bigger and deeper. Finally, the material breaks. This process is so slow that elongation is perceptible only with careful measurement. The term "creep" has been applied to the process because of the length of time required for elongation to become significant. In a turbine engine, high load and high temperature are usually experienced at the same time. The loading on the turbine and compressor blades is principally the combined result of the centrifugal force, associated with rpm, and some gas or air load, associated with engine internal pressure. When the turbine discharge pressure, which is indicative of other internal pressures, is high, the EGT is also high. This means that when the turbine blades are subjected to their heaviest load, the material of which they are constructed will be at its weakest. The compound effect of high rpm and high temperature results in an astounding increase in the rate of creep at very high thrust settings when the centrifugal load is the greatest. The ends of the compressor blades and the rims of the turbine wheels tend to travel outward. The rate of creep, which is measured in millionths of an inch per hour, increases tremendously as the rpm and EGT approach maximum.

Engine Thrust vs Time

The length of time that an engine may be operated at each of the various thrust ratings, such as takeoff or military, has been established in the interest of conserving the life of the engine and making the time between overhauls predictable. The periods of 5 minutes for takeoff and 30 minutes for military (full dry thrust) has, by universal acceptance of the definitions for the various engine ratings, been deemed adequate to take care of most situations. The real purpose of limiting the time for engine operation at takeoff or military rated thrust is not so much to permit a cooling period between intervals of operation at high thrust (although such a cooling period is very desirable) as it is to provide distribution of the rate of creep and deterioration of hot section parts throughout an engine's normal life. There is no hard and fast rule for reducing the throttle setting to normal rated when operating at military for any specific length of time before the higher thrust rating may be used again. Whenever the situation permits, it is good practice to operate an engine at reduced thrust between periods of operation at military thrust for the same amount of time that the engine has just operated at the higher thrust setting.

ENGINE COMPRESSOR STALL

Engine compressor stall is inherent in a jet engine due to the airfoil characteristics of the compressor blades. Compressor stall is an aerodynamic stall caused by the reduction of airflow through the engine. With reduced airflow through the engine, the compressor blades, which are in effect miniature airfoils, stall in a manner similar to an aircraft wing during slow flight, and as a result of variations in the pattern of reduced airflow across the compressors, complex differences in stalls are created. Compressor blade stalls vary in severity, depending on whether the stall involves only a portion of a stage, a complete stage, several stages, or an entire compressor. Reduced airflow can happen over the complete engine inlet area and can extend back into all of the compressor stages right up to the diffuser section, or it can happen to only one or two stages, or to any degree between these extremes. The usual causes of compressor blade stall are low temperatures, reduced air densities, engine inlet conditions, and the adjustment and operation of the engine fuel control unit and overboard air bleed valve. The propagation of a stall occurs so rapidly it appears to be instantaneous and results in a complete reversal or breaking down of airflow in the engine. This breaking down of airflow occurs as a result of an imposed pressure rise across a stage of compressor blades. An increased pressure rise across a compressor stage results in an increased angle of attack of incoming air with respect to the compressor blades. This also may be thought of as a reduction in the incoming air velocity component which results when pressure rise is increased. Stalling of a single blade or circumferential row of blades will reduce the pressure rise of that compressor stage. This in turn loads the remaining stages of compression by requiring them to increase the pressure by the amount lost at the stage which stalled. The stalling of one stage will in turn increase the pressure rise at the next stage and cause it to stall since it also is highly loaded. In addition to the compressor blade design contributing to stalls, the high thrust output and low specific fuel consumption of an axial flow compressor engine necessitates that the engine be operated as close as possible to the stall region of the compressors. Stall can be designed out of an engine operating schedule at the expense of efficiency. The loss in efficiency though would be so great that it is essential that the engine and fuel flow schedule be designed in such a manner that stall will normally be avoided during periods of acceleration, deceleration, and low thrust operation. The occasional stalls experienced during acceleration and deceleration are caused by blade stall. During acceleration, extra fuel is fed to the burners to provide the extra energy needed to accelerate the rotating masses. If engine inlet conditions cause operation to be near a stall, the process begins with a relatively high internal pressure being built up in the combustion chambers as a result of the extra fuel introduced. This slows down the air coming through the high pressure compressor to the point where the air velocity and the rpm in some part of the compressor no longer properly match and a stall occurs. When a throttle is retarded with conditions which will produce stall during deceleration, the high pressure compressor slows first because it has the lightest mass. Slowing of the high pressure compressor, in effect, blocks the airflow through the low pressure compressor and, following blade stall, a stall of the low pressure compressor results when the air velocity through it gets low enough. The reduction of airflow through the engine is induced by rapid engine throttle movements, high angle of attack, extreme altitude operation, and high altitude turns. The most common of these conditions is the rapid advancement or retardation of the throttles and high altitude turns. There is another type of compressor stall which appears to originate with ice crystals in the air at high altitudes and which usually is encountered in and around thunderheads. The crystals apparently go into the engine with the air and ingest the engine with water as they are melted during compression. At high altitudes, the actual weight of airflow into the engine is low, so the amount of water required to mix with the air to establish the necessary water/air ratio for water injection is relatively small. Ice crystal stalls appear to be due to operation of the high pressure compressor approaching a stall condition when water is injected at the time of low air density as encountered at high altitude. Compressor stall is usually associated with unstable engine operation and may in some instances be recognized by compressor pulsations which cause very loud explosive reports to be emitted. This may be startling to a flight crew when a severe engine stall is first experienced. Some stalls do not make themselves known by noise or surges, but simply result in the engine not being able to accelerate or in losing rpm with no change in the throttle position. Incipient stall may produce roughness in engine operation with or without any audible reaction. More pronounced stalls may produce audible pulsations of varying intensity. As a "feel" of the engines is acquired with experience, an instinctive sense of how to handle the aircraft attitude and the engines in order to avoid possible stall-producing conditions becomes almost second nature. With recognition of the operational symptoms, it is possible to take corrective action in time to minimize the possibility of engine damage or to correct an engine malfunction. Stall may be avoided or the intensity of a stall reduced by use of the following procedures:

- Avoid erratic or abrupt throttle movements. Rapid throttle advances during periods of high distortion of the air at the engine inlet are sometimes the cause of acceleration stalls.
- Carefully coordinated flying will increase the efficiency of the air inlet ducts and reduce the tendency of engine stall. Airspeeds should be maintained above the acceptable minimum.
- Operation at a higher airspeed and at a reduced angle of attack or rate of climb of the aircraft may help to eliminate a stall condition.
- When a stall occurs, slowly retard the throttle to IDLE or until the stall ceases, then slowly accelerate the engine until the desired thrust is obtained.
- During periods of compressor stall, observe the exhaust gas temperature closely. Reduce the throttle to avoid overtemperaturing, when necessary.
- If a stall occurs at high altitude, reduce the altitude, if necessary, to aid stall recovery. Dropping the nose of the aircraft slightly sometimes produces smoother airflow into the inlet duct, eliminating the stall.
- If the stall condition cannot be controlled, shut down the engine depending upon circumstances such as whether or not one or more engines have developed uncontrollable stall. Continued severe compressor stall could conceivably be detrimental to an engine. The conditions of engine choo-choo, acceleration hang-up, engine surge, and engine flameout are associated with respective characteristics of engine compressor stall and may be either reduced in intensity or avoided by use of applicable procedures.

ENGINE SPEED FLUCTUATIONS

Engine instability may occur because of some malfunction in the engine or fuel control and may be recognized if any of the following are noted:

1. Erratic increase of turbine exhaust gas temperature.
2. Rapid reduction or fluctuation of rpm at constant throttle setting or failure of rpm to continue to increase during acceleration.
3. Shock of compressor pulsations felt in the aircraft structure.
4. Loss of power reflected in aircraft instruments.
5. No response of pressure ratio to throttle movement.

Corrective Measures

ACCELERATION. If erratic engine performance is experienced during acceleration of the aircraft:

1. Retard throttle to IDLE position.
2. Obtain stable operation.
3. Slowly advance throttle to the desired power condition.

STEADY STATE OPERATION. While in a stabilized cruise condition, if erratic engine performance is experienced:

1. Slowly retard or advance throttle to a more stable power range.
2. Reduce altitude.

While in a stabilized climb condition, if erratic engine performance is experienced:

1. Slowly retard or advance throttle to a more stable power range.
2. Increase airspeed by reducing climb.

DECELERATION. During periods of deceleration of the aircraft, if erratic engine performance is experienced:

1. Continue to retard the throttle to IDLE position.
2. Obtain stable operation.
3. Slowly advance throttle to the desired power condition.

ENGINE CHOO-CHOO

Engine choo-choo is a mild form of engine compressor stall and sounds surprisingly like a steam locomotive under load. Choo-choo occurs on the ground only and is the result of accelerating the engine out of the idle position with rapid throttle movement. This unstable condition is of very short duration and ceases after a slight rpm increase above the idle position. Occasionally, choo-choo is inaudible, in which case it can be identified by erratic fuel flow fluctuations.

ACCELERATION HANG-UP

Acceleration hang-up is a type of malfunction in which the engine fails to accelerate past a specific rpm. This hang-up sometimes occurs after the throttle has been retarded and an attempt has been made to accelerate to a higher rpm. Acceleration hang-up can be attributed to a faulty fuel control unit or to continuous engine stall. In case of a faulty fuel control unit, engine shutdown may be necessary; in the case of continuous engine stall, it may be necessary to reduce power, increase airspeed, or decrease altitude.

ENGINE SURGE

Engine surge, which is an intermittent engine compressor stall, produces thrust variations which may be indicated by fuel flow fluctuations or a marked rise in EGT. Shock and pulsation frequently can be felt, and sometimes heard, in the cockpit during flight. Although there have been occasions when engine surge has occurred on the ground, it usually manifests itself above 40,000 feet. It generally occurs during rapid throttle movements or during slow speed high angle of attack flight at similar altitudes. Surging which occurs during engine acceleration usually ceases as the engine speed increases. If it does not, a power reduction, followed by a slower rate of throttle advance, will usually give satisfactory results. Surging which occurs during slow speed high angle of attack flight (usually with fixed throttles) may require throttling the affected engines and/or an increase in airspeed to furnish relief. Persistent or severe surge occasionally results in engine flameout unless very prompt corrective actions are taken.

ENGINE FLAMEOUT

Engine flameout is the complete loss of combustion. In most cases it occurs at altitudes above 40,000 feet as a result of a too rapid throttle movement. It can also be caused by a change in the inlet air pressure gradient of the engine at high angles of attack. Following a flameout, the rpm, EPR, and EGT will begin dropping at once. Generally, engine flameout can be remedied by merely restarting the engine. For additional information and proper inflight restarting procedures, see "Engine Flameout and Relight" and "Engine Air Starting" and "Engine Failure" in Section III.

PRACTICE ENGINE SHUTDOWN AND AIR STARTING

CAUTION

> It is recommended that engine shutdown and air starting be practiced at altitudes between 10,000 and 37,500 feet, one engine at a time. Practice starts should be made in the "normal windmilling start" area of the air start envelope (figure 3-3). Air starts may be demonstrated in the "probable start" range but the "possible slow or hot start" area should be avoided except in an actual emergency. Use of the engine starters for air starts is restricted to emergencies only.

1. Throttle - IDLE for 3 minutes

The throttle for the engine to be shut down should be retarded to IDLE for 3 minutes before the engine is shut down.

2. Throttle - CLOSED
3. Restart - See "Engine Air Starting Checklist," Section III.

After windmilling rpm has stabilized, the engine will be started using the procedure outlined under "Engine Air Starting," Section III.

MULTIPLE ENGINE FLAMEOUT

Flight through severe turbulence or icing conditions which are encountered with cumulus clouds at 40,000 feet or above may result in multiple engine flameout. Severe turbulence distorts the engine inlet airflow, causing compressor stalls, surging, and erratic fuel control unit operation. Icing of the engine inlet or flight at reduced airspeeds (high angles of attack) will further distort the inlet airflow. The possibility of multiple engine flameout under these conditions may be reduced by 1) turning on the engine and nacelle anti-icing system prior to penetration of high cumulus clouds and 2) energizing the engine ignition system for limited periods during flight through areas of turbulence. Energizing the ignition system will not prevent compressor surge or stall but will tend to prevent a stalled or surging engine from flaming out. See "Turbulence and Thunderstorms," Section IX, and "Engine Limitations," Section V.

ENGINE FLAMEOUT DUE TO ICING

Engine icing should not exist during a normal cruise power setting if anti-icing heat is used properly. Instances of engine flameout originally attributed to fuel icing may possibly have occurred due to ice formation within the engine compressor section resulting from lack of sufficient anti-icing heat. Engine flameout may be eliminated by use of ignition per the instructions under "Multiple Engine Flameout," this section. When EPR is reduced below the minimum required, the possibility of insufficient heat for anti-icing exists and, in the event of engine instability, the use of ignition is desirable. Instability will normally be expected to occur after sufficient power has been stabilized for adequate anti-ice heat. This is due to ice and water ingestion as inlet ice melts. The use of ignition during takeoff and landing phases of flight, when engine inlet icing exists, will provide additional protection against engine flameout due to instability or ice ingestion. The atmospheric conditions presently outlined in Section IV under "Engine and Nacelle Anti-icing" should be used to determine when anti-ice is required.

ENGINE OVERSPEED

Engine overspeed is indicated by excessive rpm. Immediate retarding of the throttle may be necessary to return engine readings to safe limits. The primary causes of engine overspeed are improper trimming of the engine during maintenance operations or failure of the fuel control unit.

NOTE

> Engine overspeed should not be confused with the increase in takeoff rpm which occurs when runway temperatures are high. On hot days, takeoff rpm will exceed the rpm for which the engine is trimmed. This is normal as long as EGT and EPR remain within limits. See "Engine Limitations," Section V.

VARYING EXHAUST GAS TEMPERATURE

Varying exhaust gas temperature will be accompanied by engine rpm fluctuations that follow the EGT. Depending on the magnitude of the fluctuations, the indications will be the same as an unstable engine speed fluctuation. The same corrective procedures will apply. Monitor the engine operation within operating limits of rpm and EGT.

MONITORING EGT DURING TAKEOFF

The EGT of a normally operating engine will usually peak considerably sooner than the 2-minute engine acceleration time limit. It therefore is important that the pilot not physically making the takeoff monitor EGT during the takeoff roll and as soon after unstick as possible. Throttles should be retarded to maintain the appropriate EGT limits. Normally, a very small reduction in throttle setting will return an EGT to within the limits.

ENGINE INSTRUMENT FLUCTUATIONS

Intermittent or continuous operation of the engine fire detector system lights or erratic operation the engine instruments may be an indication of burned or scorched electrical wire bundles as a result of an air bleed manifold pneumatic duct failure. If such indications are observed, shutdown of engine in the applicable engine pod should be accomplished in accordance with the "Emergency Shutdown Checklist," Section III. After engine shutdown, be sure the air bleed manifold pressure valves are turned off to prevent the passing of bleed air from other engines through the damaged duct. See "Air Bleed System Emergency Operation," Section III, for failure indications due to an air bleed manifold leak.

ENGINE IGNITION AND STARTING SYSTEM OPERATION

When the engine accelerates above starter cutout speed, the starter relay becomes deenergized. This prevents the starter from reengaging if the engine speed drops below starter cutout speed, even though the starter switch remains in ON position. If the starter switch is returned to OFF position, however, and the engine speed drops below starter cutout speed, the starter relay will become energized. Then if the starter switch is turned ON while the engine is still rotating, starter coupling shaft failure can result.

FUEL SYSTEM OPERATION

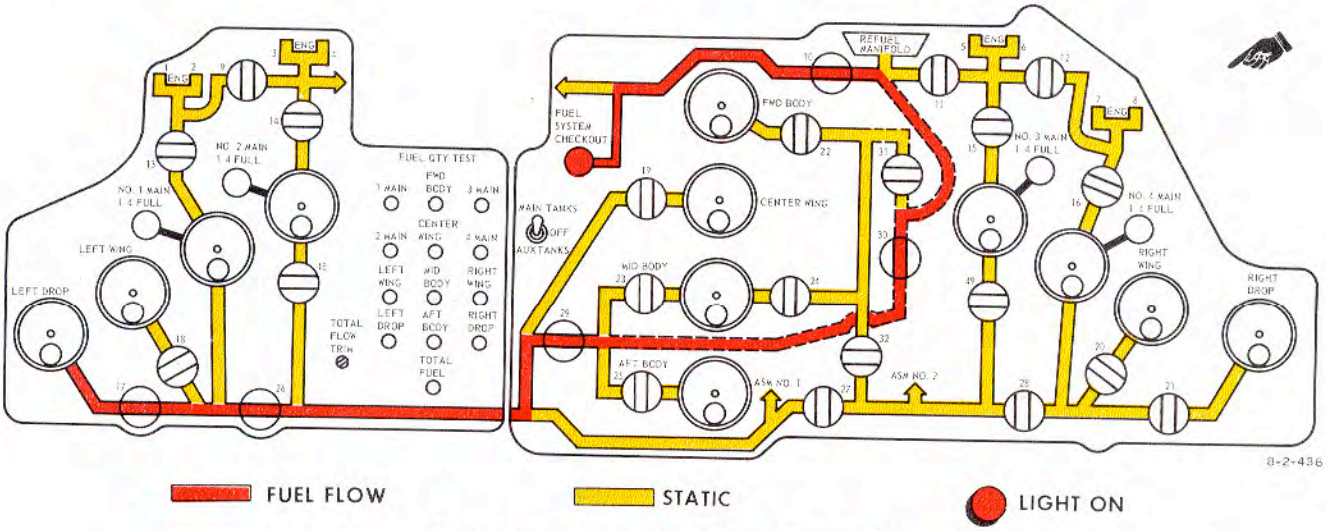
Operation of the fuel system is performed by the copilot.

FUEL SYSTEM CHECKOUT

Fuel Feed and Transfer System Checkout Procedures for All Tanks Except Drop Tanks

A complete checkout of the fuel feed and transfer systems for all tanks except drop tanks may be accomplished as follows:

1. All fuel valve switches - OFF; throttles - CLOSED
2. Ground and electrical sources - Connected, electrical power on aircraft buses
3. Fuel system checkout switch - AUX TANKS; fuel system checkout light remains out
4. Fuel valve switches No. 18, 26, 29, 30, and 10 - ON, light on
5. Fuel valve switch No. 26 - OFF, light out; after 10 seconds - ON, light on
6. Fuel valve switch No. 18 - OFF, light out
   Fuel valve switch No. 26 - OFF
   Fuel valve switch No. 19 - ON, light on
7. Fuel valve switch No. 29 - OFF, light out



CHECKOUT OF LEFT DROP TANK SHOWN

FUEL VALVE SWITCH POSITIONS FOR CHECKOUT OF FUEL FEED AND TRANSFER SYSTEMS

FUEL SYSTEM CHECKOUT SWITCH POSITION	AUXILIARY FUEL TANK TO BE CHECKED	FUEL VALVE SWITCHES—ON (All other fuel valve switches OFF)	FUEL SYSTEM CHECKOUT SWITCH POSITION	MAIN FUEL TANK TO BE CHECKED	FUEL VALVE SWITCHES—ON (All other fuel valve switches OFF)
MAIN TANKS OFF AUX. TANKS	LEFT OUTBOARD WING	18, 26, 29, 30 and 10	MAIN TANKS OFF AUX. TANKS	NO. 4	16, 12, 11 and 10
	CENTER WING	19, 29, 30 and 10			
	AFT BODY	25, 30 and 10		NO. 3	15, 11 and 10
	MID BODY (LEFT)	23, 30 and 10			
	FORWARD BODY	22, 31 and 10		NO. 1	13 and 9
	MID BODY (RIGHT)	24, 31 and 10			
	RIGHT OUTBOARD WING	20, 28, 32, 31 and 10		NO. 2	14
	LEFT DROP	17, 26, 29, 30 and 10			
	RIGHT DROP	21, 28, 32, 31 and 10			

FUEL SYSTEM CHECKOUT

Figure 7-1.

8. Fuel valve switches No. 27, 32, and 31 - ON, light on
9. Fuel valve switch No. 27 - OFF then ON, light out then on
10. Fuel valve switch No. 19 - OFF, light out
11. Fuel valve switches No. 27, 32, and 31 - OFF
    Fuel valve 25a circuit breaker - Pulled
    Fuel valve switch No. 25 - ON then OFF, light on then out
    Fuel valve 25a circuit breaker - Closed
    Fuel valve 25 circuit breaker - Pulled
    Fuel valve switch No. 25 - ON then OFF, light on then out
    Fuel valve 25 circuit breaker - Closed
12. Fuel valve switch No. 23 - ON, light on
13. Fuel valve switch No. 30 - OFF then ON, light out then on
14. Fuel valve switch No. 23 - OFF, light out
15. Fuel valve switch No. 30 - OFF
    Fuel valve switch No. 31 - ON
    Fuel valve 51 circuit breaker - Pulled
    Fuel valve switch No. 22 - ON then OFF, light on then out
    Fuel valve 51 circuit breaker - Closed
    Fuel valve 22 circuit breaker - Pulled
    Fuel valve switch No. 22 - ON then OFF, light on then out
    Fuel valve 22 circuit breaker - Closed
16. Fuel valve switch No. 24 - ON then OFF, light on then out
17. Fuel valve switches No. 20, 28, and 32 - ON, light on
18. Fuel valve switches No. 28, 32, and 31 - OFF then ON (one at a time, in order), light out then on (each time)
19. Fuel valve switch No. 20 - OFF, light out
20. Fuel valve switches No. 28, 32, and 31 - OFF
    Fuel system checkout switch - MAIN TANKS, light out
21. Fuel valve switches No. 16, 12, 11, and 10-ON, light on
22. Fuel valve switch No. 12 - OFF then ON, light out then on
23. Fuel valve switch No. 16 - OFF, light out
24. Fuel valve switch No. 12 - OFF
    Fuel valve switch No. 15 - ON, light on
25. Fuel valve switches No. 11 and 10 - OFF then ON (in order), light out then on (each time)
26. Fuel valve switch No. 15 - OFF, light out
27. Fuel valve switches No. 10 and 11 - OFF
    Fuel valve switches No. 13 and 9 - ON, light on
28. Fuel valve switch No. 9 - OFF then ON, light out then on
29. Fuel valve switch No. 13 - OFF, light out
30. Fuel valve switch No. 9 - OFF
    Fuel valve switch 14 - ON then OFF, light on then out
31. Fuel system checkout switch - OFF

Fuel Feed and Transfer System Ground Checkout Procedure for Drop Tanks

A ground checkout of the drop tank fuel feed and transfer system may be accomplished as follows:

NOTE

> Valve 46 may be momentarily opened to relieve residual pressure.

1. All fuel valve switches - OFF; throttles - CLOSED

2. Ground, electrical, and air bleed sources - connected, electrical power on aircraft buses
3. Air bleed manifold interconnect switches - OPEN
4. Fuel system checkout switch - AUX TANKS; fuel system checkout light remains out
5. Fuel valve switches No. 17, 26, 29, 30, and 10 - ON, light on
6. Fuel valve switch No. 17 - OFF, light out
7. All fuel valve switches - OFF
8. Fuel valve switches No. 21, 28, 32, 31, and 10 - ON, light on
9. Fuel valve switch No. 21 - OFF, light out
10. Fuel system checkout switch - OFF

Fuel Feed and Transfer System Inflight Checkout Procedure for Drop Tanks

CAUTION

> To avoid exceeding flight limitations, do not reduce drop tank fuel quantity below 17,500 pounds each tank during this check. See "Airspeed Limitations," Section V.

An inflight checkout of the drop tank fuel feed and transfer system may be accomplished as follows:
1. Fuel valve switches No. 13, 14, 15, and 16 - ON
Check all fuel valve switches except No. 13, 14, 15, and 16 - OFF
2. Fuel valve switches No. 17 and 21 - ON
3. Drop tank fuel quantity gage - Monitor
Monitor each drop tank fuel quantity gage for a decrease in fuel quantity of 500 to 800 pounds.

NOTE

> Monitoring may require up to 5 minutes because of time needed to pressurize drop tanks.

Manifold Interconnect Valve Check

A test of the manifold interconnect valve (No. 46) is not included in either the normal preflight check covered in Section II or in the check outlined in this section. If a test of this valve is desired, it may be accomplished following step "5" of the fuel feed and transfer system checkout procedure.

NOTE

- The refuel manifold must be scavenged following the check of the manifold interconnect valves to remove fuel from the refuel system lines.
- Operation of the fuel level valves (No. 47, 48, 49, and 50) for main tanks are not checked in the fuel system checkout procedure outlined in this manual.

FUEL SYSTEM MANAGEMENT

The aircraft fuel feed system is designed to provide all engine fuel flow requirements from the main tanks. Use of auxiliary fuel is normally accomplished by transfer to the mains after the main tank fuel has been used down to or below the 92% full level. Fuel panel switch settings for the normal fuel sequences are shown in figure 7-2. In an emergency, fuel may be supplied from any tank to the engines by use of the transfer or crossfeed manifold. See "Fuel System Emergency Operation," Section III. Fuel for the AGM-28A or AGM-28B missiles is supplied from the B-52 fuel transfer manifold. Missile tank refuel is controlled by a valve in the fuel line connecting the transfer manifold with the missile pylon. Fuel usage sequences for aircraft with missiles installed are shown in figures 7-4 thru 7-7. At any time an unusual combination of engines is used, care should be taken to manage fuel so as to maintain proper center of gravity and fuel distribution. See Section V for further information about fuel loading, cg location, and aircraft gross weight limitations. Also see "Fuel Management for Lateral Trim" under "Climb," Section II.

WARNING

> To avoid flutter, all outboard wing tank fuel must be used prior to using fuel from full drop tanks, in accordance with normal fuel usage sequence. If the normal fuel sequence cannot be followed, do not exceed the lower airspeed and Mach number flutter limitations given in Section V. If the EWO fuel sequence is used, the lower airspeed flutter limitation must be observed until all drop tanks fuel is used.

CAUTION

- Fuel shall not be transferred directly between main fuel tanks except through valve 46 and the refuel system. This is to prevent excessive surge pressures due to closure of transfer valves.
- Immediately turn off the auxiliary tank valve switches upon completion of fuel transfer. If fuel transfer from auxiliary tanks is required while the aircraft is on the ground, fuel quantity and pressure from main tanks 1 and 4 must be available through the thermal relief lines to cool and lubricate the auxiliary tank pumps. The transfer pump check valves are drilled to allow this backflow.

NOTE

- Icing of main fuel transfer valves may be indicated by inability to transfer or inability to stop transfer (resulting in tank overflow).
- To allow the fuel transfer system to replenish the main tanks, fuel level valve switches No. 48 and 49 must be in ON position and the master refuel control switch must be in OFF position.
- The main tanks cannot be replenished with fuel from the auxiliary tanks until the main tank fuel level is 8% below the full level allowed by the refuel system.
- When setting the fuel panel for sequence steps which specify the use of fuel from two auxiliary tanks, transfer valve No. 27 must be closed to minimize the possibility of unequal fuel use from these tanks.
- Fuel sequence placards have been removed from the aircraft.
- The aircraft shall be loaded in accordance with the "Fuel Loading Charts" and procedures outlined in T.O. 1B-52C-5 (T.O. 1-1B-40), "Handbook of Weight and Balance Data." All of the following fuel usage sequences have been designed for use in conjunction with the proper fuel loading in order to maintain the cg within allowable structural limits.
- The maximum aircraft service life will be attained by following the normal fuel usage sequence.

Normal Fuel Sequence (No Missiles) — Operating Weight (Basic Weight plus Crew and Oil) CG from 24% to 35% MAC

NOTE

For aircraft with operating weight (basic weight plus crew and oil) cg aft of 31% MAC, center wing ballast fuel as specified in figure 7-10 is required to stay within the aft cg flight limit during step 9.

The normal fuel sequence provides for maximum wing structural life by using all body fuel before using outboard, center wing, and drop tank fuel. After the first step of 8% mains, the 92% level in the four main tanks is maintained through step 7 by transfer from the auxiliary tanks. During step 8, main tanks 1 and 4 will be maintained at 92% until the drop tanks are empty. Main tanks 2 and 3 will be at approximately 9800 pounds each (approximately 5500 pounds each if maximum center wing ballast is retained) after completing step 8. Step 9 uses only main tank fuel with crossfeed valves 9 and 12 open when any main tank indicates 5000 pounds or less.

Step 1. 8% OF MAINS 1, 2, 3 & 4

Step 2. AFT BODY UNTIL EQUALIZED TO FORWARD BODY TO 1, 2, 3 & 4

Step 3. MID BODY TO 1, 2, 3 & 4

Step 4. AFT BODY TO 1 & 2
FORWARD BODY TO 3 & 4

Step 5. LEFT WING TO 1 & 2 (DOWN TO 5000 POUNDS)
RIGHT WING TO 3 & 4 (DOWN TO 5000 POUNDS)

Step 6. LEFT WING TO 1
CENTER WING TO 2 & 3
RIGHT WING TO 4

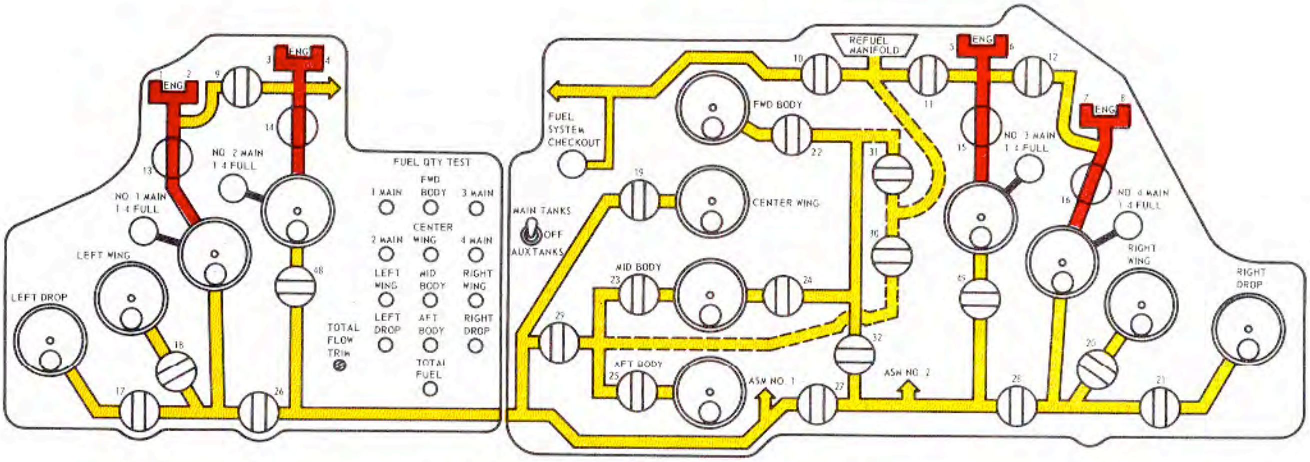
Step 7. LEFT DROP TO 1
CENTER WING TO 2 & 3 (DOWN TO BALLAST FUEL)
RIGHT DROP TO 4

NOTE

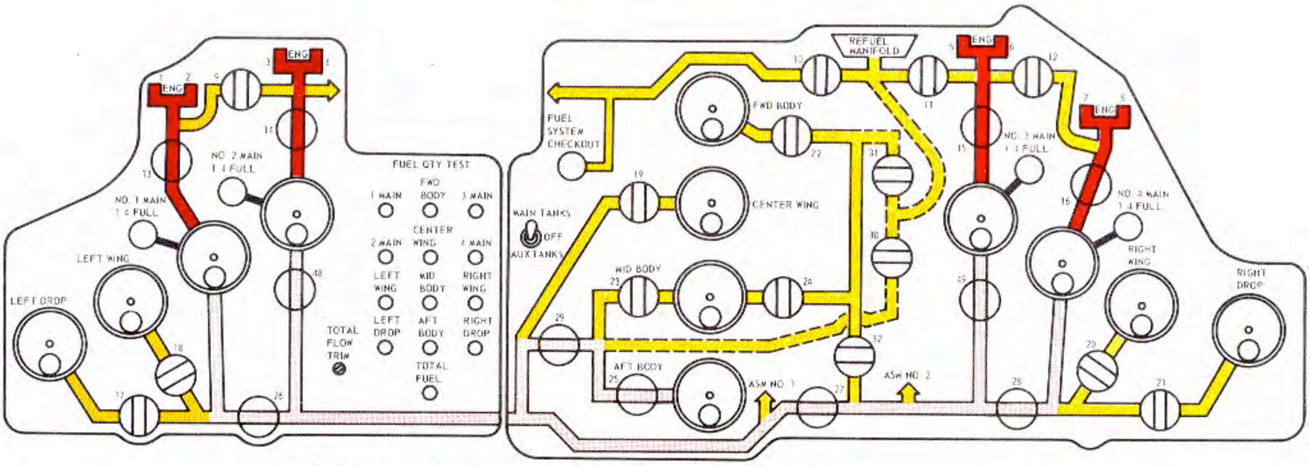
Determine from figure 7-10 the amount of center wing ballast fuel required to maintain cg within the aft flight limit.

Step 8. LEFT DROP TO 1
NO. 2 MAIN
NO. 3 MAIN
RIGHT DROP TO 4

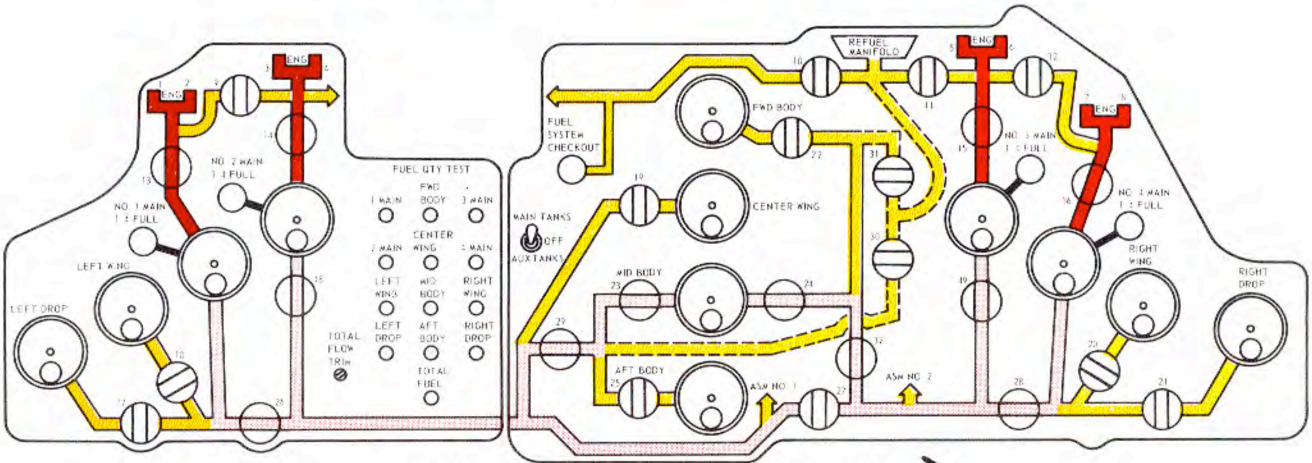
Step 9. MAINS 1, 2, 3 & 4



STEP NO. 1: Main Tanks 1, 2, 3 and 4



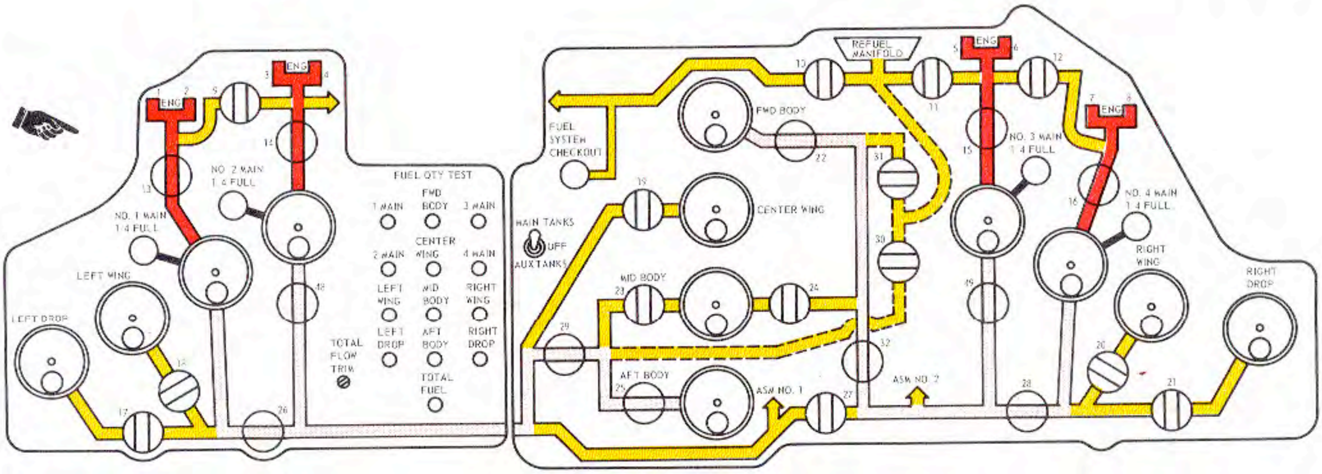
STEP NO. 2: Aft Body until equalized to Fwd Body to 1, 2, 3 and 4



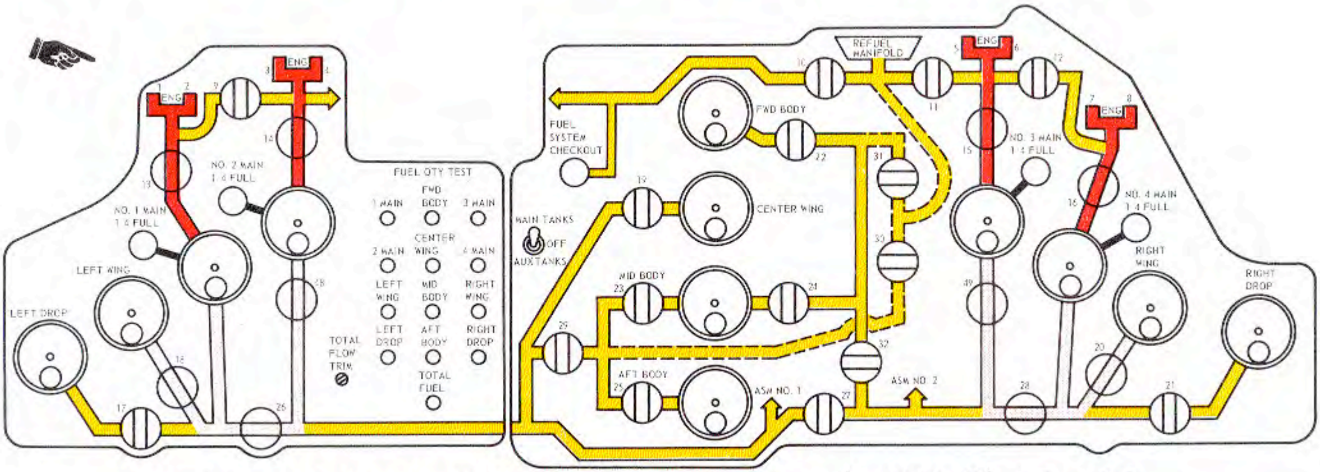
STEP NO. 3: Mid Body to 1, 2, 3 and 4 ☛

🟥 FUEL FEED FLOW ▨ FUEL TRANSFER FLOW 🟨 STATIC

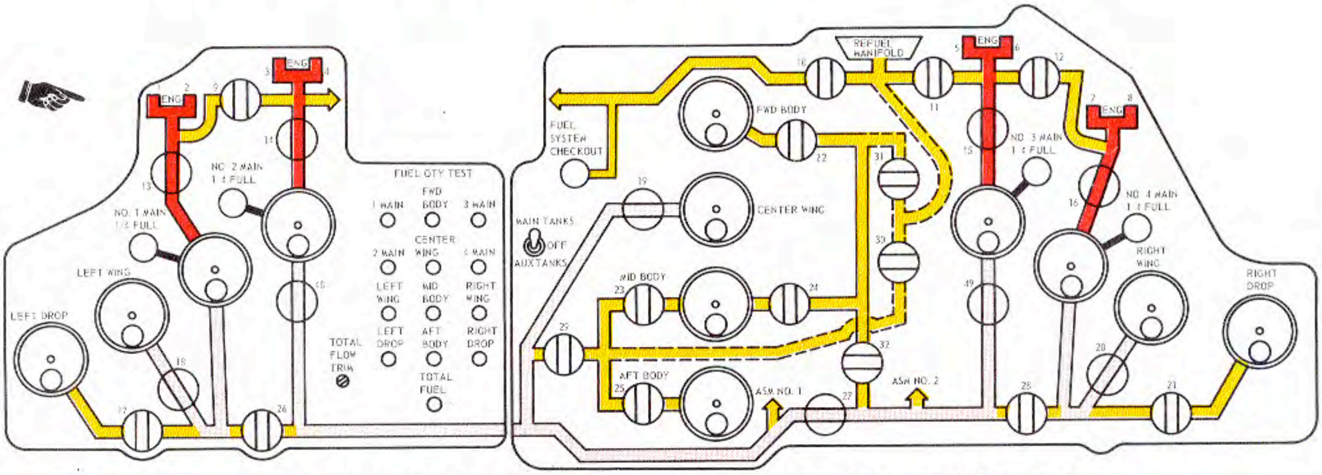
Figure 7-2(Sheet 1 of 3).



STEP NO. 4: Aft Body to 1 and 2 — Fwd Body to 3 and 4



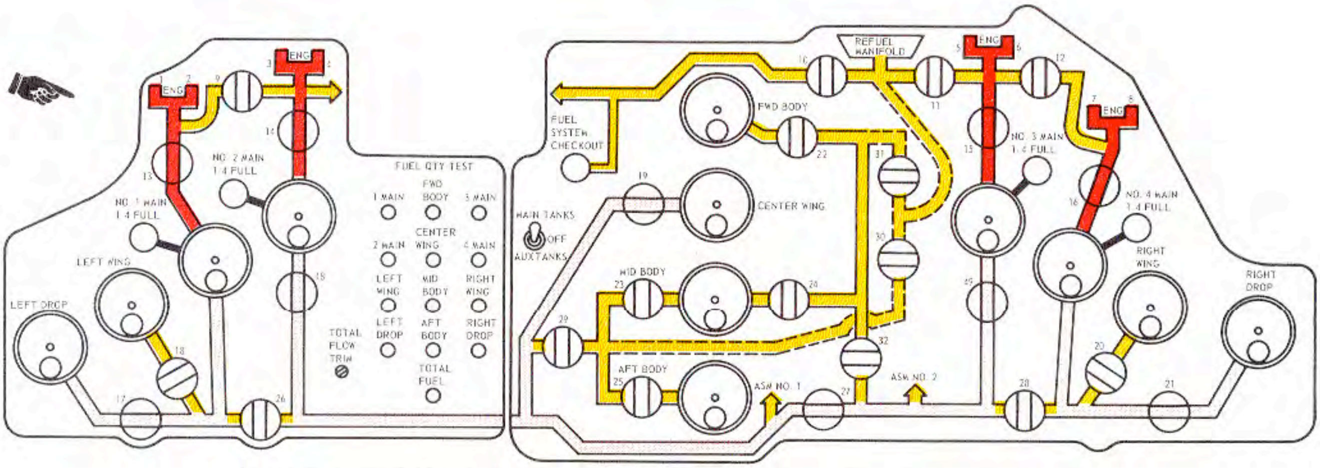
STEP NO. 5: L Wing (to 5000 lb) to 1 and 2 — R Wing (to 5000 lb) to 3 and 4



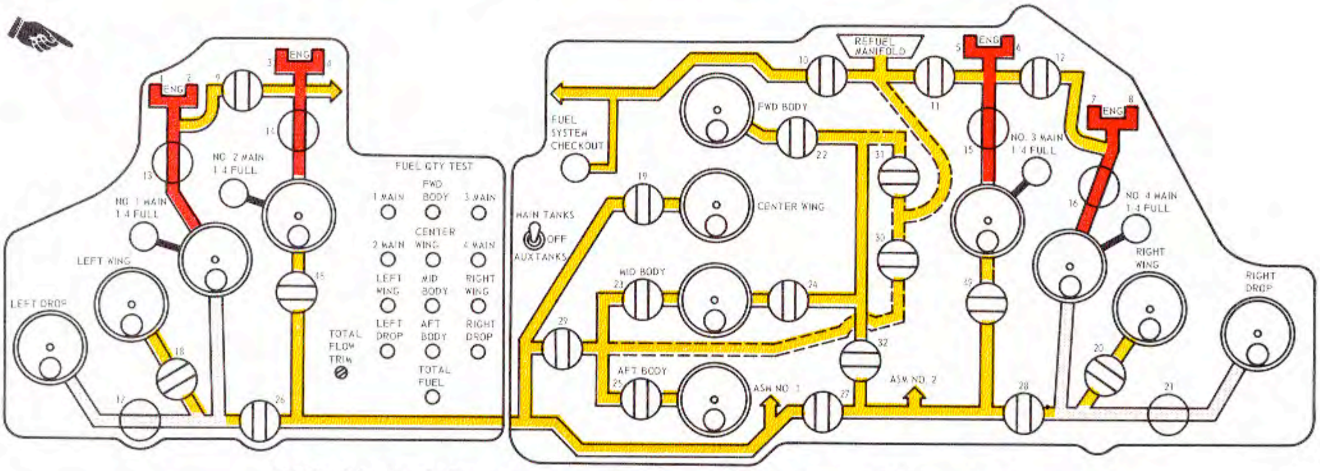
STEP NO. 6: L Wing to 1 — Center Wing to 2 and 3 — R Wing to 4

FUEL SYSTEM NORMAL OPERATION (Typical)

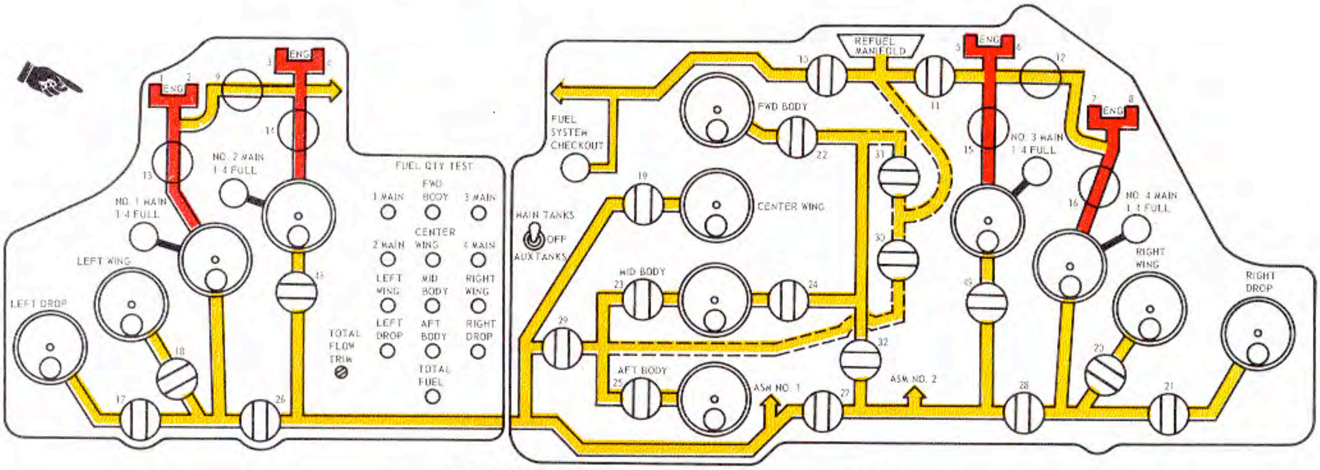
Figure 7-2 (Sheet 2 of 3).



STEP NO. 7: L Drop to 1 — Center Wing to 2 and 3 — R Drop to 4



STEP NO. 8: L Drop to 1 — No. 2 and 3 Mains — R Drop to 4



STEP NO. 9: Main Tanks 1, 2, 3 and 4

NOTE

- See figures 7-4 thru 7-7 for operation with AGM-28 missiles.
- If the operating weight (basic weight plus crew and oil) CG falls aft of 31% MAC, determine the amount of center wing ballast fuel to be retained in Step 7.

FUEL SYSTEM NORMAL OPERATION (Typical)

Figure 7-2 (Sheet 3 of 3).

EWO Fuel Sequence (No Missiles) — Operating Weight (Basic Weight Plus Crew and Oil) CG from 24% to 35% MAC

The EWO fuel usage sequence is designed to provide for use of external fuel early in the mission in preparation for jettison of drop tanks before reaching the target area. The sequences below provide for optional use of external fuel by the order in which the first four steps are accomplished. The normal EWO sequence provides for earlier jettison of the drop tanks but is speed restricted until all external fuel is used. The alternate EWO sequence provides for the greatest speed and range prior to drop tank jettison. See Section V for speed and load limit factors applicable to the EWO fuel sequences. Steps 5 thru 9 are the same for normal and alternate sequences. In step 5, 15,000 pounds of aft body fuel is retained to preclude exceeding the forward cg limits. This fuel is used in the sequence, during step 8, with mains 2 and 3 fuel. Mains 1 and 4 will be at 92% and mains 2 and 3 will be at approximately 8700 pounds each after completing step 8. Main tank fuel is used during step 9 with crossfeed valves 9 and 12 open when any main tank indicates 5000 pounds or less.

NOTE

Intentional maneuvers to load factors in excess of 1.8 "g's" are prohibited at speeds less than 300 knots IAS beginning with the use of outboard wing fuel and continuing through subsequent steps down to a gross weight of 312,000 pounds.

NORMAL EWO SEQUENCE

Step 1. 8% OF MAINS 1, 2, 3 & 4

Step 2. LEFT DROP TO 1
CENTER WING TO 2 & 3
RIGHT DROP TO 4

Step 3. LEFT DROP TO 1 & 2
RIGHT DROP TO 3 & 4

NOTE

- During steps 2 and 3, do not exceed 280 knots IAS or Mach .90 indicated until all drop tank fuel is used.
- Drop tanks may be jettisoned after completion of step 3. Do not exceed 300 knots IAS or Mach .83 indicated when jettisoning.

Step 4. LEFT WING TO 1 & 2
RIGHT WING TO 3 & 4

WARNING

During terrain avoidance operations, a reduction in airspeed will cause erroneous terrain clearance indications. Make necessary adjustments to the FRL setting prior to reducing airspeed.

Step 5. AFT BODY TO 1 & 2 (DOWN TO 15,000 POUNDS)
FORWARD BODY TO 3 & 4

Step 6. MID BODY TO 1 & 2
FORWARD BODY TO 3 & 4

Step 7. MID BODY TO 1, 2, 3 & 4

Step 8. AFT BODY TO 1 & 4
NO. 2 MAIN
NO. 3 MAIN

Step 9. MAINS 1, 2, 3 & 4

NOTE

Aircraft with operating weight (basic weight plus crew and oil) cg aft of 31% MAC may require center wing ballast fuel as specified in figure 7-10 to stay within the aft cg flight limit. Transfer the required ballast from mains 2 and 3 to the center wing tank during step 9.

ALTERNATE EWO SEQUENCE

Step 1. 8% OF MAINS 1, 2, 3 & 4

Step 2. LEFT WING TO 1 & 2
RIGHT WING TO 3 & 4

Step 3. LEFT DROP TO 1
CENTER WING TO 2 & 3
RIGHT DROP TO 4

Step 4. LEFT DROP TO 1 & 2
RIGHT DROP TO 3 & 4

NOTE

Drop tanks may be jettisoned after completion of step 4. Do not exceed 300 knots IAS or Mach .83 indicated when jettisoning.

WARNING

During terrain avoidance operations, a reduction in airspeed will cause erroneous terrain clearance indications. Make necessary adjustments to the FRL setting prior to reducing airspeed.

Step 5. AFT BODY TO 1 & 2 (DOWN TO 15,000
POUNDS) FORWARD BODY TO 3 & 4

Step 6. MID BODY TO 1 & 2
FORWARD BODY TO 3 & 4

Step 7. MID BODY TO 1, 2, 3 & 4

STEP 8. AFT BODY TO 1 & 4
NO. 2 MAIN
NO. 3 MAIN

Step 9. MAINS 1, 2, 3 & 4

NOTE

Aircraft with operating weight (basic weight plus crew and oil) cg aft of 31% MAC may require center wing ballast fuel as specified in figure 7-10 to stay within the aft cg flight limit. Transfer the required ballast from mains 2 and 3 to the center wing tank during step 9.

Two Missile Fuel Sequence Without Missile Launch

This sequence will be used for all missions not requiring missile launch. The aircraft cg will be maintained within the limits shown in figure 5-13 by using the sequence shown in figure 7-4. After the first step of 8% mains, the 92% level in the four main tanks is maintained through step 4 by transfer from the body tanks. During step 5, main tank fuel will be used until mains 1 and 4 are down to 6000 pounds each. Provide missile tank refuel from the center wing tank by opening transfer valves 19 and 27. At this time, mains 2 and 3 will be approximately 8500 pounds each. During steps 6 and 7, fuel transfer from the outboards, center wing, and drop tanks will refill the main tanks to 92%. Step 8 provides for fuel transfer from the drop tanks to all mains until each drop tank contains 7000 pounds plus ballast fuel required. Step 9 provides for transfer of drop tank fuel to mains 1 and 4 (maintaining 92%) while using main tanks 2 and 3 fuel below the 92% level. Open valves 26 and 28 for missile tank refuel. During this step, use 7000 pounds of fuel from each drop tank down to the ballast fuel requirement and 7000 pounds from each of mains 2 and 3. Step 10 supplies fuel from all mains with crossfeed valves 9 and 12 open when any main tank reaches 5000 pounds. Missile tank refuel during step 10 will be provided by opening valves 10, 11, 29, 30, 31, and 32. Unequal fuel feed from the main tanks with these valves open can be controlled by use of the crossfeed valve (10 or 11) on the wing with low fuel quantity.

NOTE

With missiles installed, determine the amount of drop tank ballast fuel to be retained from figure 7-8.

CAUTION

If emergency jettison of both missiles is required prior to using drop tank fuel, the aircraft cg will be aft of the 35% MAC limit during sequence steps 5 thru 7 on aircraft with operating weight (basic weight plus crew and oil) cg aft of 31% MAC. When missiles must be jettisoned prior to step 8, set fuel panel to transfer 6000 pounds (total) drop tank fuel to all mains. Return to the applicable sequence step after completing the drop tank fuel transfer.

NOTE

If missiles are jettisoned, center wing tank ballast fuel (figure 7-10) will be required for aircraft with an operating weight cg aft of 31% MAC. Transfer ballast fuel from mains 2 and 3 to center wing tank during step 10.

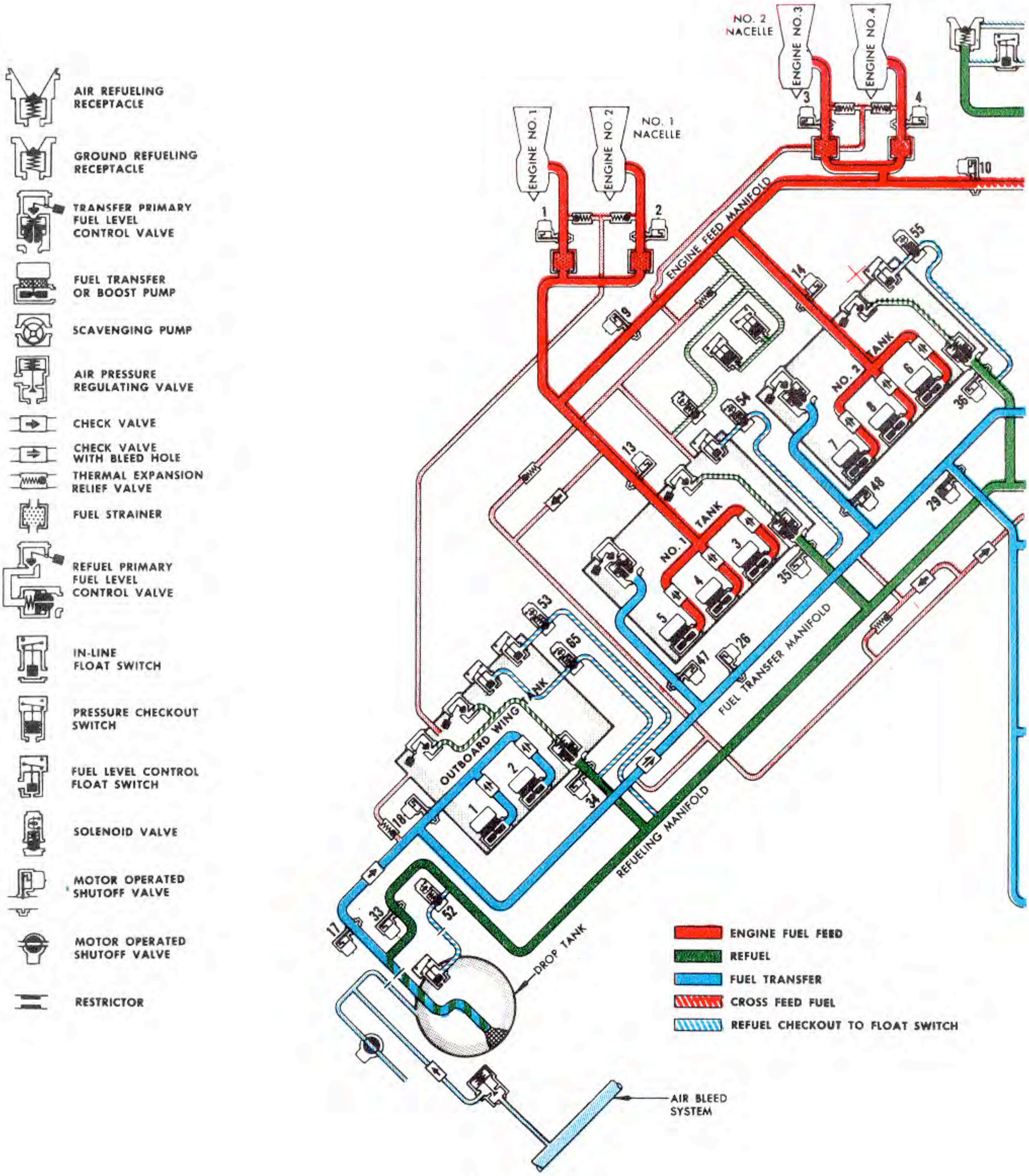
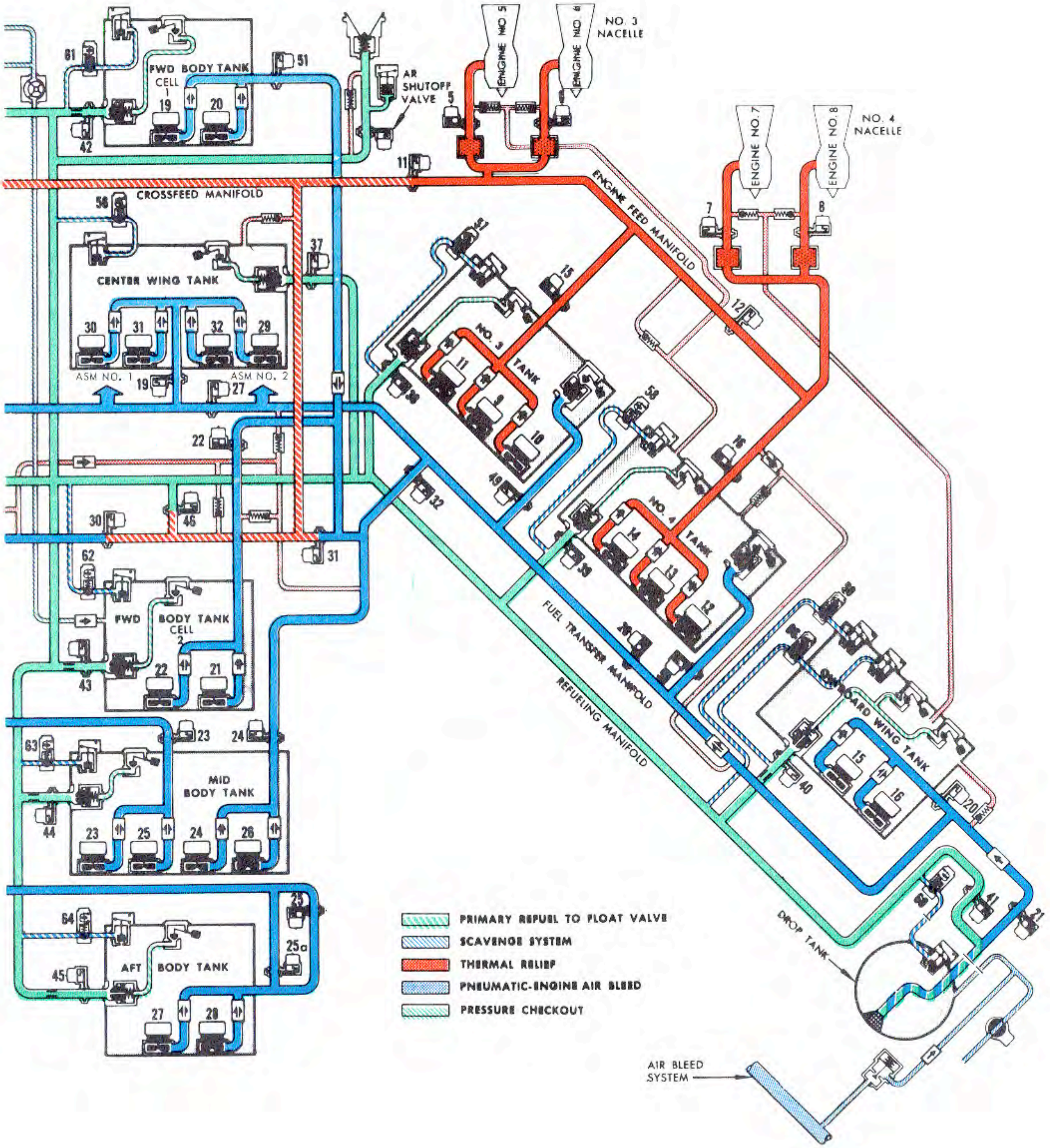


Figure 7-3 (Sheet 1 of 2).



FUEL SYSTEM COMPOSITE (Typical)

Figure 7-3 (Sheet 2 of 2).

TWO MISSILE FUEL SEQUENCE WITHOUT MISSILE LAUNCH

NOTE

- FOR OPERATING WEIGHT (BASIC WEIGHT PLUS CREW AND OIL), CG FROM 24% TO 34% MAC.
- THE FOLLOWING SEQUENCE WILL BE USED FOR ALL TRAINING MISSIONS NOT REQUIRING MISSILE LAUNCH.
- DETERMINE FROM FIGURE 7-8 THE AMOUNT OF DROP TANK BALLAST FUEL TO BE RETAINED WITH MISSILES INSTALLED.

CAUTION

IF EMERGENCY JETTISON OF BOTH MISSILES IS REQUIRED PRIOR TO USING DROP TANK FUEL, THE AIRCRAFT CG WILL BE AFT OF THE 35% MAC LIMIT DURING SEQUENCE STEPS 5 THRU 7 ON AIRCRAFT WITH OPERATING WEIGHT CG AFT OF 31% MAC. WHEN MISSILES MUST BE JETTISONED PRIOR TO STEP 8, SET FUEL PANEL TO TRANSFER 6000 POUNDS (TOTAL) DROP TANK FUEL TO ALL MAINS. RETURN TO APPLICABLE SEQUENCE STEP AFTER COMPLETING THE DROP TANK FUEL TRANSFER.

STEP 1	
Use 8% Mains	
STEP 2	
Aft Body (until equalized to Forward Body) to Mains 1, 2, 3, and 4	
STEP 3	
Aft Body to Mains 1 and 2 Forward Body to Mains 3 and 4	
STEP 4	
Mid Body to Mains 1, 2, 3, and 4	
STEP 5	
Mains 1, 2, 3, and 4	(DOWN TO 6000 POUNDS IN 1 AND 4) USE FUEL FROM CENTER WING FOR MISSILE TANK REFUEL. OPEN TRANSFER VALVES 19 AND 27
STEP 6	
Left Wing to Main 1 Center Wing to Mains 2 and 3 Right Wing to Main 4	
STEP 7	
Left Drop to Main 1 Center Wing to Mains 2 and 3 Right Drop to Main 4	
STEP 8	
Left Drop to Mains 1 and 2	(DOWN TO 7000 POUNDS PLUS BALLAST FUEL)
Right Drop to Mains 3 and 4	(DOWN TO 7000 POUNDS PLUS BALLAST FUEL)
STEP 9	
Left Drop to Main 1	(USE 7000 POUNDS—DOWN TO BALLAST FUEL)
No. 2 Main	(USE 7000 POUNDS)
No. 3 Main	(USE 7000 POUNDS)
Right Drop to Main 4	(USE 7000 POUNDS—DOWN TO BALLAST FUEL) ● DROP TANK BALLAST FUEL MUST BE RETAINED WITH MISSILES INSTALLED ● OPEN VALVES 26 AND 28 FOR MISSILE TANK REFUEL
STEP 10	
Mains 1, 2, 3, and 4	● IF MISSILES ARE JETTISONED, TRANSFER BALLAST FUEL FROM MAINS 2 AND 3 TO CENTER WING TANK (IF REQUIRED) ● OPEN VALVES 10, 11, 29, 30, 31, AND 32 FOR MISSILE TANK REFUEL ● OPEN CROSSFEED VALVES 9 AND 12 WHEN ANY MAIN TANK INDICATES 5000 POUNDS OR LESS

TWO MISSILE FUEL SEQUENCE WITHOUT MISSILE LAUNCH

Figure 7-4.

Two Missile Fuel Sequence with Missile Launch

This sequence will be used for all missions (except EWO) which are to accomplish a planned missile launch. The aircraft cg will be maintained within the limits shown in figure 5-14 by using the sequence shown in figure 7-5. After the first step of 8% mains, the 92% level in the four main tanks is maintained through step 4 by transfer from the body tanks. During step 5, main tank fuel will be used until mains 1 and 4 are down to 10,000 pounds each. (At this time, mains 2 and 3 will be at approximately 12,500 pounds each.) Provide missile tank refuel from the center wing tank by opening transfer valves 19 and 27. During steps 6 and 7, fuel transfer from the outboards and center wing tanks will refill the main tanks to 92%. Use outboard wing fuel down to 8000 pounds each in step 6. Step 8 maintains the 92% level in all mains and is used until center wing tank is empty. Step 9 provides for fuel transfer from the drop tanks to all mains until each drop tank contains 7000 pounds (plus ballast fuel if missiles are retained). Step 10 provides for transfer of drop tank fuel to mains 1 and 4 (maintaining 92%) while using main tanks 2 and 3 fuel below the 92% level. Open valves 26 and 28 for missile tank refuel. During this step, use 7000 pounds of fuel from each drop tank down to the ballast fuel requirement and 7000 pounds from each of mains 2 and 3. Step 11 supplies fuel from all mains with crossfeed valves 9 and 12 open when any main tank reaches 5000 pounds. Missile tank refuel during step 11 will be provided by opening valves 10, 11, 29, 30, 31, and 32. Unequal fuel feed from the main tanks with these valves open can be controlled by use of the crossfeed valve (10 or 11) on the wing with low fuel quantity.

NOTE

- When missiles are launched, determine the amount of center wing tank ballast fuel required for aircraft with an operating weight cg aft of 31% MAC from figure 7-10. Transfer the required ballast fuel from mains 2 and 3 to the center wing tank during step 11.
- If missiles cannot be launched, continue with this sequence and determine the amount of drop tank ballast fuel to be retained from figure 7-8.

External Conventional Munitions Fuel Sequence **B-52D**

For all bombing missions with external racks and conventional munitions installed, the "Two Missile Fuel Sequence with Missile Launch" (figure 7-5) will be used. If munitions are not dropped, continue with this sequence and determine the amount of drop tank ballast fuel to be retained from figure 7-8. If the munitions were released on one side only due to a malfunction, the "One Missile Fuel Sequence" will be used. Determine the amount of drop tank ballast fuel to be retained from figure 7-9.

NOTE

When munitions are dropped, determine the amount of center wing tank ballast fuel required for aircraft with an operating weight cg aft of 31% MAC from figure 7-10. Transfer the required ballast fuel from mains 2 and 3 to the center wing tank during step 11.

EWO Fuel Sequence with Two Missiles

With two AGM-28 missiles carried aboard the aircraft under EWO conditions, the fuel management sequence as shown in figure 7-6 will be used. The first four steps of the fuel management sequence provide the option for an early jettison of the drop tanks (normal sequence) or a greater speed and range prior to jettison of the drop tanks (alternate sequence). Steps 5 thru 8 are the same for either option. Step 5 uses forward and mid body fuel until forward body tank is empty. Step 6 uses mid body fuel until empty. Step 7 uses aft body fuel until empty or down to ballast requirements if missiles are retained (see figure 7-8). Main tank fuel is used during step 8 with crossfeed valves 9 and 12 open when any main tank indicates 5000 pounds or less. If missiles are retained, open valves 10, 11, 29, 30, 31, and 32 for missile tank refuel. If missiles were launched, transfer ballast fuel from mains 2 and 3 to center wing tank if required (see figure 7-10).

NOTE

- If missiles are not launched, determine the amount of aft body tank ballast fuel to be retained from figure 7-8.
- If missiles are launched, center wing tank ballast fuel (figure 7-10) will be required for aircraft with an operating weight cg aft of 31% MAC. Transfer the required fuel from mains 2 and 3 to the center wing tank during step 8.

TWO MISSILE FUEL SEQUENCE WITH MISSILE LAUNCH

NOTE

- FOR OPERATING WEIGHT (BASIC WEIGHT PLUS CREW AND OIL), CG FROM 24% TO 34% MAC.
- DETERMINE FROM FIGURE 7-8 THE AMOUNT OF DROP TANK BALLAST FUEL TO BE RETAINED IF MISSILES ARE NOT LAUNCHED.
- B-52D THE FOLLOWING FUEL SEQUENCE WILL ALSO BE USED FOR ALL CONVENTIONAL BOMBING MISSIONS WITH EXTERNAL RACKS AND CONVENTIONAL MUNITIONS INSTALLED. DETERMINE FROM FIGURE 7-8 THE AMOUNT OF DROP TANK BALLAST FUEL TO BE RETAINED IF CONVENTIONAL MUNITIONS ARE NOT DROPPED.
- DETERMINE FROM FIGURE 7-10 THE AMOUNT OF CENTER WING TANK BALLAST FUEL REQUIRED WHEN MISSILES (CONVENTIONAL MUNITIONS) HAVE BEEN LAUNCHED (DROPPED).

STEP 1	
Use 8% Mains	
STEP 2	
Aft Body (until equalized to Forward Body) to Mains 1, 2, 3, and 4	
STEP 3	
Aft Body to Mains 1 and 2 Forward Body to Mains 3 and 4	
STEP 4	
Mid Body to Mains 1, 2, 3, and 4	
STEP 5	
Mains 1, 2, 3, and 4	(DOWN TO 10,000 POUNDS IN 1 AND 4) USE FUEL FROM CENTER WING FOR MISSILE TANK REFUEL. OPEN TRANSFER VALVES 19 AND 27
STEP 6	
Left Wing to Mains 1 and 2	(DOWN TO 8000 POUNDS)
Right Wing to Mains 3 and 4	(DOWN TO 8000 POUNDS)
STEP 7	
Left Wing to Main 1 Center Wing to Mains 2 and 3 Right Wing to Main 4	
STEP 8	
Left Drop to Main 1 Center Wing to Mains 2 and 3 Right Drop to Main 4	
STEP 9	
Left Drop to Mains 1 and 2	(DOWN TO 7000 POUNDS, PLUS BALLAST FUEL IF MISSILES ARE RETAINED)
Right Drop to Mains 3 and 4	(DOWN TO 7000 POUNDS, PLUS BALLAST FUEL IF MISSILES ARE RETAINED)
STEP 10	
Left Drop to Main 1	(USE 7000 POUNDS – DOWN TO BALLAST FUEL)
No. 2 Main	(USE 7000 POUNDS)
No. 3 Main	(USE 7000 POUNDS)
Right Drop to Main 4	(USE 7000 POUNDS – DOWN TO BALLAST FUEL) ● DROP TANK BALLAST FUEL MUST BE RETAINED IF MISSILES ARE NOT LAUNCHED ● IF MISSILES ARE RETAINED, OPEN VALVES 26 AND 28 FOR MISSILE TANK REFUEL
STEP 11	
Mains 1, 2, 3, and 4	● IF MISSILES ARE LAUNCHED, TRANSFER BALLAST FUEL FROM MAINS 2 AND 3 TO CENTER WING TANK (IF REQUIRED) ● IF MISSILES ARE NOT LAUNCHED, OPEN VALVES 10, 11, 29, 30, 31, AND 32 FOR MISSILE TANK REFUEL ● OPEN CROSSFEED VALVES 9 AND 12 WHEN ANY MAIN TANK INDICATES 5000 POUNDS OR LESS

TWO MISSILE FUEL SEQUENCE WITH MISSILE LAUNCH

Figure 7-5.

EWO FUEL SEQUENCE WHEN CARRYING TWO MISSILES

NOTE

- For operating weight (basic weight plus crew and oil), cg from 24% to 34% MAC
- Determine from figure 7-8 the amount of aft body tank ballast fuel to be retained if missiles are not launched.
- Use ballast fuel immediately following missile launch. Use aft body to mains 1, 2, 3, and 4.
- Observe EWO fuel sequence load limit factor in Section V.
- For B-52C aircraft, the sequence below will also be used under EWO conditions for conventional bombing with external racks and conventional munitions installed. Determine from figure 7-8 the amount of aft body tank ballast fuel to be retained if conventional munitions are not dropped.
- The first four steps of the following sequence provide for optional EWO fuel usage. The normal EWO sequence offers earlier jettison of the drop tanks but is speed restricted until all external fuel is used. The alternate EWO sequence offers greater speed and range prior to drop tank jettison. Steps 5 through 8 are the same for either sequence.

NORMAL

STEP 1 Use of 8% Mains	
STEP 2 Left Drop to Main 1 Center Wing to Mains 2 and 3 Right Drop to Main 4	DO NOT EXCEED 280 KIAS OR MACH .86 INDICATED UNTIL ALL DROP TANK FUEL IS USED.
STEP 3 Left Drop to Mains 1 and 2 Right Drop to Mains 3 and 4	• DROP TANKS MAY BE JETTISONED AFTER COMPLETION OF THIS STEP. • DO NOT EXCEED 300 KIAS OR MACH .83 INDICATED WHEN JETTISONING TANKS. • DURING TA OPERATIONS, MAKE NECESSARY FRL ADJUSTMENTS PRIOR TO REDUCING AIRSPEED.
STEP 4 Left Wing to Mains 1 and 2 Right Wing to Mains 3 and 4	

ALTERNATE

STEP 1 Use 8% Mains	
STEP 2 Left Wing to Mains 1 and 2 Right Wing to Mains 3 and 4	
STEP 3 Left Drop to Main 1 Center Wing to Mains 2 and 3 Right Drop to Main 4	
STEP 4 Left Drop to Mains 1 and 2 Right Drop to Mains 3 and 4	• DROP TANKS MAY BE JETTISONED AFTER COMPLETION OF THIS STEP. • DO NOT EXCEED 300 KIAS OR MACH .83 INDICATED WHEN JETTISONING TANKS. • DURING TA OPERATIONS MAKE NECESSARY FRL ADJUSTMENTS PRIOR TO REDUCING AIRSPEED.

STEP 5 Mid Body to Mains 1 and 2 Forward Body to Mains 3 and 4	
STEP 6 Mid Body to Mains 1, 2, 3, and 4	
STEP 7 Aft Body to Mains 1, 2, 3, and 4	AFT BODY BALLAST FUEL MUST BE RETAINED IF MISSILES ARE NOT LAUNCHED. (SEE FIGURE 7-8.)
STEP 8 Mains to 1, 2, 3, and 4	• IF MISSILES ARE RETAINED, OPEN VALVES 10, 11, 29, 30, 31, AND 32 FOR MISSILE TANK REFUEL. • IF MISSILES WERE LAUNCHED, TRANSFER BALLAST FUEL FROM MAINS 2 AND 3 TO CENTER WING TANK (IF REQUIRED). (SEE FIGURE 7-10.) • OPEN CROSSFEED VALVES 9 AND 12 WHEN ANY MAIN TANK INDICATES 5000 POUNDS OR LESS.

EWO FUEL SEQUENCE WITH TWO MISSILES

Figure 7-6.

FUEL SEQUENCE WHEN CARRYING ONE MISSILE

NOTE

- FOR OPERATING WEIGHT (BASIC WEIGHT PLUS CREW AND OIL), CG FROM 24% TO 35% MAC.
- A MAXIMUM DIFFERENTIAL OF 2000 POUNDS MUST BE RETAINED IN DROP TANKS TO COUNTERBALANCE THE SINGLE MISSILE. QUANTITIES SHOWN ARE FOR MISSILE INSTALLED ON LEFT WING; REVERSE QUANTITIES FOR RIGHT WING INSTALLATION.
- DETERMINE FROM FIGURE 7-9 THE AMOUNT OF DROP TANK BALLAST FUEL TO BE RETAINED IF MISSILE IS NOT LAUNCHED.

STEP 1	Use 8% Mains	
STEP 2	Equalize Forward and Aft Body Tank to Mains 1, 2, 3, and 4	
STEP 3	Aft Body to Mains 1 and 2 Forward Body to Mains 3 and 4	
STEP 4	Mid Body to Mains 1, 2, 3, and 4	
STEP 5	Mains 1, 2, 3, and 4	(DOWN TO 10,000 POUNDS IN 1 AND 4) USE FUEL FROM CENTER WING FOR MISSILE TANK REFUEL. OPEN TRANSFER VALVES 19 AND 27
STEP 6	Left Wing to Mains 1 and 2 Right Wing to Mains 3 and 4	(DOWN TO 8000 POUNDS) (DOWN TO 8000 POUNDS)
STEP 7	Left Wing to Main 1 Center Wing to Mains 2 and 3 Right Wing to Main 4	
STEP 8	Left Drop to Main 1 Center Wing to Mains 2 and 3 Right Drop to Main 4	
STEP 9	Left Drop to Mains 1 and 2 Right Drop to Mains 3 and 4	(DOWN TO 7000 POUNDS PLUS BALLAST FUEL) (DOWN TO 9000 POUNDS PLUS BALLAST FUEL)
STEP 10	Left Drop to Main 1 No. 2 Main No. 3 Main Right Drop to Main 4	(USE 7000 POUNDS – DOWN TO BALLAST FUEL) (USE 7000 POUNDS) (USE 7000 POUNDS) (USE 7000 POUNDS – DOWN TO BALLAST FUEL) OPEN VALVE 26 (28) FOR MISSILE TANK REFUEL
STEP 11	Mains 1, 2, 3, and 4	● OPEN VALVES 10, 29, AND 30 (11, 31, AND 32) FOR MISSILE TANK REFUEL ● IF MISSILE WAS LAUNCHED, TRANSFER FUEL FROM MAINS 2 AND 3 TO CENTER WING TANK (IF REQUIRED) ● OPEN CROSSFEED VALVES 9 AND 12 WHEN ANY MAIN TANK INDICATES 5000 POUNDS OR LESS

FUEL SEQUENCE WITH ONE MISSILE AND ONE PYLON

Figure 7-7.

DROP TANK FUEL BALLAST REQUIREMENTS WHEN CARRYING TWO MISSILES

OPERATING WEIGHT* CG % MAC	WITH FULL CHAFF AND FULL AMMO		WITH FULL CHAFF		WITH FULL AMMO		WITHOUT CHAFF AND AMMO	
	LEFT DROP POUNDS	RIGHT DROP POUNDS	LEFT DROP POUNDS	RIGHT DROP POUNDS	LEFT DROP POUNDS	RIGHT DROP POUNDS	LEFT DROP POUNDS	RIGHT DROP POUNDS
24	4,000	4,000	5,500	5,500	5,500	5,500	7,000	7,000
25	3,000	3,000	4,500	4,500	4,500	4,500	6,000	6,000
26	2,000	2,000	3,500	3,500	3,500	3,500	5,000	5,000
27	1,000	1,000	2,500	2,500	2,500	2,500	4,000	4,000
28	0	0	1,500	1,500	1,500	1,500	3,000	3,000
29	0	0	500	500	500	500	2,000	2,000
30	0	0	0	0	0	0	1,000	1,000
31	0	0	0	0	0	0	0	0

EWO FUEL SEQUENCE

AFT BODY FUEL BALLAST REQUIREMENTS WHEN CARRYING TWO MISSILES

OPERATING WEIGHT* CG % MAC	WITH FULL CHAFF AND FULL AMMO	WITH FULL CHAFF	WITH FULL AMMO	WITHOUT CHAFF AND AMMO
	AFT BODY FUEL POUNDS	AFT BODY FUEL POUNDS	AFT BODY FUEL POUNDS	AFT BODY FUEL POUNDS
24	17,000	19,500	19,500	22,000
25	15,000	17,500	17,500	20,000
26	13,000	15,500	15,500	18,000
27	11,000	13,500	13,500	16,000
28	9,000	11,500	11,500	14,000
29	7,000	9,500	9,500	12,000
30	5,000	7,500	7,500	10,000
31	3,000	5,500	5,500	8,000
32	1,000	3,500	3,500	6,000
33	0	1,500	1,500	4,000
34	0	0	0	2,000

*BASIC WEIGHT PLUS CREW AND OIL

NOTE

- IF EXTERNAL TANKS ARE RETAINED, THE AFT BODY FUEL BALLAST FIGURES MAY BE REDUCED BY 2,000 POUNDS.
- THESE CHARTS INCLUDE BALLAST FOR BOMB BAY LOADS. BALLAST REQUIREMENTS WILL BE LESS WHEN NOT CARRYING BOMB BAY LOADS AND MAY BE ADJUSTED IF DESIRED.
- INTERPOLATE BALLAST REQUIREMENTS FOR CG'S FALLING BETWEEN THOSE SHOWN.
- DROP TANKS ARE NOT TO BE INCLUDED IN OPERATING WEIGHT.
- PYLONS, ECM EQUIPMENT, AND CY-2617/ALA-17 RACK ASSEMBLY (LESS FLARES) ARE TO BE INCLUDED IN BASIC WEIGHT WHEN INSTALLED.
- ALA-17 FLARES AFFECT CG BY ONLY THREE-TENTHS OF 1% MAC. SUFFICIENT CONSERVATISM IS INCLUDED IN BALLAST TABLES TO PROVIDE FOR FLARES.

BALLAST REQUIREMENTS WHEN CARRYING TWO MISSILES

Figure 7-8.

BALLAST REQUIREMENTS WHEN CARRYING ONE MISSILE AND ONE PYLON

OPERATING WEIGHT★ CG % MAC	WITH FULL CHAFF AND FULL AMMO		WITH FULL CHAFF		WITH FULL AMMO		WITHOUT CHAFF AND AMMO	
	LEFT DROP POUNDS	RIGHT DROP POUNDS	LEFT DROP POUNDS	RIGHT DROP POUNDS	LEFT DROP POUNDS	RIGHT DROP POUNDS	LEFT DROP POUNDS	RIGHT DROP POUNDS
24	0	0	1,000	1,000	1,000	1,000	2,000	2,000
25	0	0	0	0	0	0	1,000	1,000
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0

★BASIC WEIGHT PLUS CREW AND OIL

NOTE

- This chart includes ballast requirements for bomb bay loads. Ballast requirements will be less when not carrying bomb bay loads and may be adjusted if desired.
- Interpolate ballast requirements for CG's falling between those shown.
- Drop tanks are not to be included in operating weight.
- Pylons, ECM equipment, and CY-2617/ALA-17 rack assembly (less flares) are to be included in basic weight when installed.
- ALA-17 flares affect CG by only three-tenths of 1% MAC. Sufficient conservatism is included in ballast tables to provide for flares.

BALLAST REQUIREMENTS WHEN CARRYING ONE MISSILE AND ONE PYLON

Figure 7-9.

One Missile Fuel Sequence

When carrying only one missile, lateral unbalance and trim requirements can be minimized by using a differential fuel load in the drop tanks. The off-loaded tank should be on the same side of the aircraft as the missile. The maximum differential fuel quantity which can be used without exceeding flutter limits is 2000 pounds. Lateral trim will also be required to completely counterbalance the single missile. Figure 7-9 shows the drop tank ballast fuel required for maintaining the aircraft cg aft of the forward structural limit at low gross weight. The sequence shown (figure 7-7) assumes the missile to be installed on the left wing.

NOTE

- If missile is not launched, determine the amount of drop tank ballast fuel to be retained from figure 7-9.
- If missile is launched, center wing tank ballast fuel (figure 7-10) will be required for aircraft with an operating weight cg aft of 31% MAC. Transfer the required ballast fuel from mains 2 and 3 to the center wing tank during step 11.

Fuel Usage Sequence Drop Tanks Off or Empty. Operating Weight (Basic Weight Plus Crew and Oil) CG From 24% to 35% MAC.

The following fuel usage sequence is provided for use with the drop tanks off or on and empty. Since operations with the drop tanks off or empty increases the structural fatigue damage rate, frequent use of these procedures would significantly reduce aircraft service life. Therefore, this sequence is provided only for special purpose or EWO restrike missions.

NOTE

For aircraft with operating weight (basic weight plus crew and oil) cg aft of 31% MAC, center wing ballast fuel as specified in figure 7-10 is required to stay within the aft cg flight limit during step 8. If center wing fuel available is less than that required for ballast, transfer additional fuel from main tanks 2 and 3 to the center wing tank.

WARNING

The maximum allowable in-flight gross weight for this configuration is 370,000 pounds with drop tanks off or 375,000 pounds with drop tanks on and empty.

This sequence provides for use of body and center wing fuel prior to using the outboard wing fuel. After the first step of 8% mains, the 92% level in the 4 main tanks will be maintained through step 4 (step 5 on aircraft with operating weight cg forward of 31% MAC) by transfer from auxiliary tanks. During step 6, while using the outboard wing fuel down to 5,000 pounds each, mains 1 and 4 will be maintained at the 92% level and mains 2 and 3 will be used down to approximately 7,000 pounds each. The transfer of the remaining outboard wing fuel to all main tanks in step 7 will keep mains 1 and 4 at the 92% level and increase the quantity in mains 2 and 3. Use main tank fuel during step 8 with crossfeed valves 9 and 12 open when any main tank indicates 5,000 pounds or less.

Step 1. 8% OF MAINS 1, 2, 3, AND 4
Step 2. AFT BODY (UNTIL EQUAL TO FORWARD BODY) TO MAINS 1, 2, 3, AND 4
Step 3. AFT BODY TO MAINS 1 AND 2; FORWARD BODY TO MAINS 3 AND 4
Step 4. MID BODY TO MAINS 1, 2, 3, AND 4
Step 5. CENTER WING TO MAINS 1, 2, 3, AND 4

NOTE

For aircraft with operating weight (basic weight plus crew and oil) cg aft of 31% MAC, retain center wing ballast fuel for landing.

Step 6. LEFT OUTBOARD TO MAIN 1 (DOWN TO 5,000 POUNDS)
NO. 2 MAIN
NO. 3 MAIN
RIGHT OUTBOARD TO MAIN 4 (DOWN TO 5,000 POUNDS)
Step 7. LEFT OUTBOARD TO MAINS 1 AND 2
RIGHT OUTBOARD TO MAINS 3 AND 4
Step 8. MAINS 1, 2, 3, AND 4

Fuel Usage Sequence With Two Missiles or External Conventional Munitions, Drop Tanks Off or Empty. Operating Weight (Basic Weight Plus Crew and Oil) CG From 24% to 35% MAC.

The following fuel usage sequence is provided for use with the drop tanks off or on and empty. Since operations with the drop tanks off or empty increases the structural fatigue damage rate, frequent use of these procedures would significantly reduce aircraft service life. Therefore, this sequence is provided only for special purpose or EWO restrike missions.

NOTE

- For aircraft with operating weight (basic weight plus crew and oil) cg forward of 30% MAC, 10,000 pounds of aft body ballast fuel is retained to stay within the forward cg limit if missiles are not launched or external conventional munitions are not dropped.
- Use ballast fuel immediately following missile launch or external conventional munitions drop. Use aft body fuel to mains 1, 2, 3, and 4.
- If both missiles are launched or external conventional munitions dropped, center wing ballast fuel (figure 7-10) is required to stay within the aft cg flight limit during step 7 for aircraft with operating weight cg aft of 31% MAC. Transfer mains 2 and 3 fuel to the center wing tank.

WARNING

The maximum allowable in-flight gross weight for this configuration is 370,000 pounds with drop tanks off and 375,000 pounds with drop tanks on and empty.

This sequence provides for use of all body fuel down to the aft body ballast prior to using outboard wing fuel. After the first step of 8% mains, the 92% level in the 4 main tanks will be maintained through step 4 by transfer from body tanks. During step 5, while using the outboard wing fuel down to 5,000 pounds each, mains 1 and 4 will be maintained at the 92% level and mains 2 and 3 will be used down to approximately 7,000 pounds each. The transfer of the remaining (10,000 pounds) outboard wing fuel to all main tanks in step 6 will keep mains 1 and 4 at the 92% level and increase the quantity in mains 2 and 3. Use main tank fuel during step 7 with crossfeed valves 9 and 12 open when any main tank indicates 5,000 pounds or less.

Step 1. 8% MAINS

Step 2. AFT BODY (UNTIL EQUAL TO FORWARD BODY PLUS BALLAST) TO MAINS 1, 2, 3, AND 4

NOTE

For aircraft with operating weight cg forward of 30% MAC retain 10,000 pounds of aft body ballast fuel.

Step 3. AFT BODY TO MAINS 1 AND 2 (DOWN TO BALLAST FUEL)
FORWARD BODY TO MAINS 3 AND 4

Step 4. MID BODY TO MAINS 1, 2, 3, AND 4

Step 5. LEFT OUTBOARD TO MAIN 1
NO. 2 MAIN
NO. 3 MAIN
RIGHT OUTBOARD TO MAIN 4

Step 6. LEFT OUTBOARD TO MAINS 1 AND 2
RIGHT OUTBOARD TO MAINS 3 AND 4

Step 7. MAINS 1, 2, 3, AND 4

CENTER WING FUEL BALLAST REQUIREMENTS TABLE

OPERATING WEIGHT* CG % MAC	WITH FULL CHAFF AND AMMO	WITH FULL CHAFF	WITH FULL AMMO	WITHOUT CHAFF AND AMMO
	CENTER WING FUEL POUNDS	CENTER WING FUEL POUNDS	CENTER WING FUEL POUNDS	CENTER WING FUEL POUNDS
35	8500	5500	6000	3000
34	6500	3500	4000	1000
33	4500	1500	2000	0
32	2500	0	0	0
31	0	0	0	0
30	0	0	0	0

*BASIC WEIGHT PLUS CREW AND OIL

NOTE

- WITHOUT EXTERNAL TANKS THE ABOVE BALLAST FIGURES CAN BE REDUCED 3000 POUNDS.
- THIS CHART DOES NOT INCLUDE BOMB BAY LOADS. BALLAST REQUIREMENTS WILL BE LESS WHEN CARRYING BOMB BAY LOADS AND CAN BE ADJUSTED IF DESIRED.
- INTERPOLATE BALLAST REQUIREMENTS FOR CG'S FALLING BETWEEN THOSE SHOWN.
- DROP TANKS ARE NOT TO BE INCLUDED IN OPERATING WEIGHT.
- PYLONS, ECM EQUIPMENT, AND CY-2617/ALA-17 RACK ASSEMBLY (LESS FLARES) ARE TO BE INCLUDED IN BASIC WEIGHT WHEN INSTALLED
- ALA-17 FLARES AFFECT CG BY ONLY THREE-TENTHS OF 1% MAC. SUFFICIENT CONSERVATISM IS INCLUDED IN BALLAST TABLES TO PROVIDE FOR FLARES.

CENTER WING FUEL BALLAST REQUIREMENTS TABLE

Figure 7-10.

ELECTRICAL SYSTEM OPERATION

CONTROL CIRCUITS

A complete understanding of the d-c relays which control the primary electrical system is a valuable aid in the efficient operation of the electrical systems. All controls that effect the starting and routing of electrical power use 24-volt d-c switched-battery power with the exception of the voltage rheostats and frequency rheostats. This use of switched-battery power assures that with the battery switch in ON position, there will always be power available to start, control, and route power throughout the aircraft. Control power for the external power relays is furnished by the external power carts.

INSTRUMENT INDICATIONS

Information which can be obtained from the electrical system instruments can be correctly interpreted only if the significance of the readings is understood. A brief explanation of the meaning of the instrument readings is given in the following paragraphs.

Voltage

Voltage is the electrical potential supplied by the batteries, TR units, or alternators. It can be thought of as the force which is pushing current through the lines. In the case of the alternators, the a-c voltmeter measures the effective voltage rather than the voltage at the peak of the cycle. The d-c voltmeter indicates either battery or TR voltage. Although TR voltage readings are taken from the individual units, resistance to current flow between each unit and the TR bus it feeds is so small that there is very little difference between bus voltage and unit voltage. For this reason, a TR unit voltage reading gives, in effect, the bus voltage. This is true even if the unit has failed.

Load

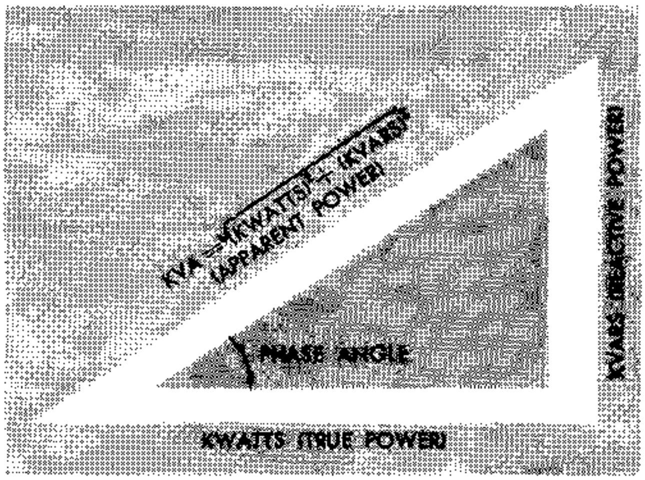
The d-c loadmeter measures current output of the TR units in decimal fractions of their rated loads. A negative reading on the loadmeter means that the unit is being fed power by the system.

Frequency

The a-c frequency meter tells the number of voltage (and current) cycles that occur in each second. One complete cycle is considered 360 electrical degrees and each phase reaches a voltage and a current peak in either direction once during each cycle. Since this is a balanced three-phase system, the voltage peaks of the three phases are separated by one-third of a cycle of 120°.

Power

If the current and voltage peaks occur simultaneously or are continuous as in a d-c system, the power (time rate of doing work) is the product of the current and the voltage. However, the reactive elements (inductance and capacitance) in an a-c system almost always cause the current to lead or lag behind the peak of the voltage and their product will give an apparent power. True power is a function of the apparent power and the amount of lead or lag. It can be read on the a-c power meter when the selector switch is in KWATTS position. Some of the power delivered to the circuit by the alternator during one part of the cycle is "kicked back" to the alternator during another part of the cycle by the reactive elements in the circuit. Such power is called reactive power and can be read on the power meters when the selector switch is in KVARS position. The apparent power, true power, and reactive power are related to each other in magnitude in the same way as the three sides of a right triangle (figure 7-11). The true power and reactive power can be represented by the legs of the triangle and the apparent power by the hypotenuse. The angle between the sides representing the true power and apparent power is equal in degrees to the cycle lead or lag of the current relative to the voltage and is called the phase angle. The power factor is used as a means of expressing the above relationships and can be most simply defined as the result of dividing the true power by the apparent power. In terms of KWATTS and KVARS, which can be read on the power meters, the power factor can be expressed as the result of dividing the KWATTS by the square root of the sum of the squares of the KWATTS and KVARS. Power limits established for the a-c system are based on a reasonable power factor of 0.75. See "Alternator Load Limits" (figure 7-12) and "Electrical Loads Chart" (figure 3-14) for more detailed information on power limits.



$$\text{POWER FACTOR} = \frac{\text{KWATTS}}{\sqrt{(\text{KWATTS})^2 + (\text{KVARS})^2}}$$

A-C POWER RELATIONSHIPS

Figure 7-11.

Synchronization

In order that two or more alternators may be used simultaneously to supply power to a central bus (parallel operation), their voltage cycles must coincide and the voltage of all the alternators must be approximately equal. If the peak voltage of an alternator should occur at a different time than that of the bus, then current that should have been used to power the consuming units will flow between the bus and the alternator. This current can be directed through the synchronizing lights by means of the voltage and frequency selector switch. The lights will blink as the voltages of the bus and alternator are alternately in and out of phase until the cycles are brought into synchronization by means of the frequency rheostat. The two lights provided on the a-c control panel indicate the degree of synchronization between two of the three phases on the bus and the two corresponding phases on the selected alternator.

Phase Sequence

With faulty wiring, it is possible to have the three phases of the external a-c power enter the aircraft system with their voltage peaks occurring in a reversed order in the cycle. As this situation can cause damage to some of the a-c units, the phase sequence indicator must be checked before routing external power into the central bus tie.

EXTERNAL POWER

To connect external power, several preliminary steps must first be accomplished. The battery switch should be turned on and a check made of the battery not charging lights. These lights should illuminate since TR power for charging is not available. The alternator circuit breakers should be open since the control circuit for external power is routed through the open side of these circuit breakers. A check that the four indicator lights are on would be sufficient to determine the correct position of the alternator circuit breakers since these lights use switched-battery power. If the lights are out, the circuit breaker switches should be pushed to OPEN. When external power is plugged in, the phase, voltage, and frequency can be checked with a single movement of the external power switch. After this, the switch is moved to ON position and external d-c power will close the external power circuit breaker bringing power into the central bus tie. It is then necessary that the bus tie breakers be closed in order to power all units on the aircraft. Closing any alternator switch, positioning the main external power switch to OFF, or removing the plug will isolate external power from the aircraft system if the "Ext Pwr CB Trip" circuit breaker on the copilot's panel is in. See "Before Starting Engines Checklist," Section II, for operation with external power.

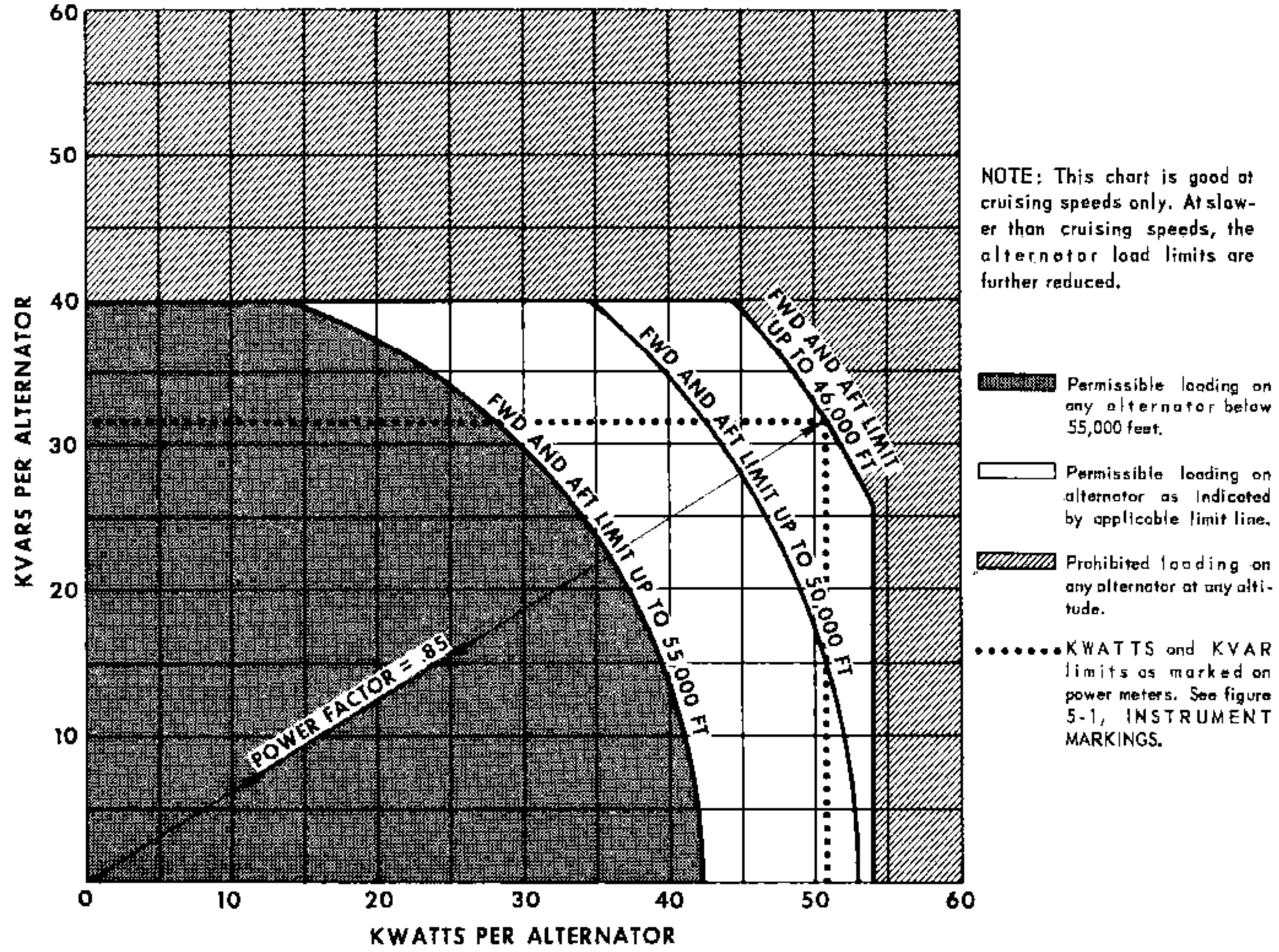
ALTERNATOR OPERATION

Starting

Before starting the alternators, the alternator circuit breakers should be open so that each machine will be separated from the a-c power system. Bus tie breakers are closed to prevent "dropout" of power to any one bus when external power is cut as the first alternator is put on the line. To start the alternators, each of the four alternator switches is momentarily held to ON position. Each switch will send power through a pressure switch (if sufficient pneumatic pressure exists) to open the pneumatic shutoff valve and close the exciter control relay for its corresponding alternator. This will cause bleed air to be routed to the drive and will enable the alternator field to be energized. When all four alternators are running, a check should be made with the ground crew to ascertain that alternator ground blowers are operating. Check valves are installed in the aft alternator drive cooling air ducts, resulting in a variance in the supply of cooling air. Voltages and frequencies should then be checked. The aircraft system is designed to operate on voltages from 200 to 210 volts. However, requirements of the BNS equipment make it necessary to adjust the voltage as close as possible to, but not above, 205 volts. At the time voltages are checked, attention should also be given to the frequencies. The frequency meter should read 400 (±5) cps. Alternators are placed on the line in the sequence and manner described in the "Starting Engines and Before Taxiing Checklist," Section II. When the first alternator circuit breaker is closed, the external power circuit breaker will trip and isolate external power from the aircraft. Power from the first alternator will be routed through the central bus tie to all of the distribution boxes. As each remaining alternator is put on the line, the automatic paralleling button will send closing pulses to both the bus tie and alternator circuit breakers provided the synchronizing lights are blinking very slowly. If the lights are blinking too fast or are on steady, it indicates that there is too much difference between the frequencies of the alternator and the central tie bus for paralleling. If the frequencies of the bus and the alternator being paralleled to it are exactly equal, as indicated by the light not blinking at all, the automatic paralleling system may not operate. In either case, the frequency of the alternator should be readjusted and the paralleling button again depressed. After paralleling, all alternator circuit breaker lights and all bus tie breaker lights should be out.

Shutdown

The alternators should not be shut down in flight except when air bleed is insufficient to operate all four alternators. This condition will be indicated by consistent (several seconds or longer) illumination of the alternator overload lights. Normally this can be corrected by increasing engine power. Any combination of alternators may be shut down without a loss of equipment if the bus tie breakers remain closed. In the extreme case when only one alternator is operating, unnecessary electrical loads should be turned off. The alternators should always be shut down before cutting engines since low frequencies from lack of engine bleed air will cause high voltage and blow circuit limiters throughout the aircraft. See "Electrical System Emergency Operation," Section III.



NOTE: This chart is good at cruising speeds only. At slower than cruising speeds, the alternator load limits are further reduced.

▩ Permissible loading on any alternator below 55,000 feet.

☐ Permissible loading on alternator as indicated by applicable limit line.

▨ Prohibited loading on any alternator at any altitude.

••••••• KWATTS and KVAR limits as marked on power meters. See figure 5-1, INSTRUMENT MARKINGS.

ALTERNATOR LOAD LIMITS

Figure 7-12.

ELECTRICAL LOADS

Alternators

The alternators are designed to carry 60KVA at a reasonable power factor; however, they are limited at altitudes above 46,000 feet due to lack of cooling air. For operation above 46,000 feet, the load limit lines shown on figure 7-6 must be used. Figure 7-12 shows the forward and aft alternators with the same capacity. If the alternators were operated isolated, the aft alternators could carry more load than indicated in figure 7-12. All alternators have an overload capacity that allows them to operate at 120KVA for 5 seconds or at 90KVA for 5 minutes.

TR Units

Maximum continuous load for the TR units is 100% of rated power (1.0 on the loadmeter). Individual TR loads can be controlled only by shutting down equipment that receives power from the affected bus. TR units which supply power to the same bus normally will not share the bus load equally. However, TR load unbalance is excessive if the lowest TR load is less than 50% of the highest TR load on that bus. Excessive unbalanced loads will be recorded in Form 781 with complete TR load for all TR units on the affected busses. See "DC Power System Failure," Section III.

Negative TR Loadmeter Indications

A negative load condition is caused by the d-c voltmeter being in a common circuit with the loadmeter. When little or no load is on the TR unit, current will flow through the TR shunt and the loadmeter to ground through the d-c voltmeter. This current flow is in a negative direction to the loadmeter and is so indicated. To prove that the TR unit is operating properly, press either battery voltage switch. This will break the common circuit, putting battery voltage on the voltmeter and leaving the selected TR unit connected to the loadmeter. The load indication will then be zero or positive. If, by pressing the battery voltage switch, the loadmeter should remain negative, there is a fault in the TR unit or current.

Alternator Speed-Load Characteristics

The alternator drives are designed to maintain equal load division (for parallel operation) and constant alternator output frequency regardless of alternator load. For a description of the drives, see "A-C Power System," Section I.

Parallel Operation

All electrical loads are divided among the four alternators during parallel operation. Should any alternator or drive unit fail, the load would be automatically redistributed among the remaining three. Two or more alternators operating in parallel must have the same frequency (speed) and voltage. The real power (kwatts), however, may vary to some degree between alternators operating in parallel because of the tolerance in the speed load curve of the drive units. The real load difference can be adjusted by use of the frequency rheostats. Normally the difference should be set to within 2 kwatts and need not be readjusted until it exceeds 4 kwatts. If this spread cannot be held, a maximum difference of 9 kwatts is allowable. The reactive power (kvars) division between parallel alternators is controlled by the voltage adjust rheostats on the a-c control panel. The reactive load should be so adjusted that the difference between any two alternators is not greater than 4 kvars. Constant fine adjustment is not required.

Isolated Operation

Under certain conditions, as outlined in Section III, "Electrical System Emergency Operation," it may be necessary to operate one or more alternators isolated from the rest of the system by opening their corresponding bus tie breakers. In this case, each alternator that is isolated operates to supply power to a separate independent system and each such system has a distribution box and one or more load boxes for the electrical units.

NOTE

Do not attempt to equalize alternator loads during isolated operation. Since each alternator carries the load on its own bus and the real and reactive loads (kwatts and kvars) cannot be divided, the load difference limits do not apply. Attempts to balance loads by adjusting the voltage and frequency rheostats may increase voltage on an alternator enough to trip the over-voltage relay.

CAUTION

Do not isolate an alternator which is known to have a permanent malfunction.

For a clear understanding of this operation, reference should be made to figures 1-19, 1-20, 1-25, and 3-14. After a general understanding of the layout of the system is gained from figure 1-19, the loadboxes, panels, and shields supplied power by any isolated alternator can be determined from figure 1-20. Following this, units operated through the above sources of distribution can be determined from figure 1-25. Further, the load effect of each unit can be found from figure 3-14. The possibility of failure of an isolated alternator, or even complete power failure on the central tie bus, must be kept in mind. The alternator which assumes the extra burden could become overloaded and trip off unless its output is monitored and kept within the protected limits.

WHEEL BRAKE SYSTEM OPERATION

WHEEL BRAKE OPERATION

Brakes, themselves, merely stop the wheels from turning, but stopping the aircraft is dependent on the friction of the tires on the runway. This frictional force, in turn, is dependent upon the load imposed on the wheel. Therefore, optimum braking action on landings cannot be expected until the tires are carrying heavy loads. Although the antiskid system allows for immediate braking after touchdown, lift should also be decreased as much as possible by extension of the airbrakes. The tendency for the tires to skid decreases considerably when the full weight of the aircraft is on the wheels. It has been found that optimum braking occurs with approximately a 15% to 20% rolling skid: that is, the wheel continues to rotate but has approximately 15% to 20% slippage on the surface so that the rotational speed is 80% to 85% of the speed which the wheel would have were it in a free roll. As the amount of skid increases beyond this amount, the coefficient of friction decreases rapidly so that with a 75% skid the friction is approximately 60% of the optimum and with a full skid becomes even lower. There are two reasons for this loss in braking effectiveness with skidding. First, the immediate action is to scuff the rubber, tearing off little pieces which act almost like rollers under the tire. Second, the heat generated starts to melt the rubber and the molten rubber acts as a lubricant between the tire and the ground surface.

BRAKE DESIGN

Aerodynamic braking should be utilized in an attempt to keep wheel brake usage to a minimum. To provide minimum brake weight, consistent with safe operation, the military specification to which the brakes are designed requires that they provide for only one maximum refused takeoff stop. Under such a condition, it is advisable to taxi clear of the runway before coming to a complete stop and not to apply the parking brake. It is possible that the overheated brakes may seize, resulting in considerable delay of runway operations. For brake energy limits, see figure 5-12. Cold brakes on this aircraft may result from landing in a moderate headwind at light weight, on a long runway when little or no braking was done, or when there is a definite malfunction or failure of a brake. Usually some heat will be felt when approaching the wheel brake rotor or housing with the hand. The amount of heat radiating from the brake depends upon these variables: the amount of braking needed to stop the aircraft, amount of hydraulic pressure delivered to the brakes, location of the wheel well doors affecting the airflow around the wheels, differential wheel loadings due to turns and crosswinds, and difference in rpm settings of the antiskid systems. Any heat at all radiating from a brake indicates that it has been operating satisfactorily, even though no two brakes will be at the same temperature.

WHEEL BRAKE LIMITATIONS

See "Wheel Brake Limitations" and "Tire Limitations," Section V.

ANTISKID OPERATION

The antiskid system is intended to prevent skids at high speed under light wheel loads and to provide optimum braking resulting in shorter stopping distances regardless of the surface conditions. Therefore, the antiskid switch should be ON during takeoff and landing. However, it should not be used to its maximum potential to purposely make all landing rolls as short as possible since this causes undue wear of the tires and brakes. If the antiskid is ON while taxiing and a skid or locked wheel condition is experienced on a wheel, all braking can be lost on that gear until such time as the antiskid system is turned off or the aircraft accelerates to a speed that will energize the locked wheel detectors. This condition could conceivably occur on all four gears at one time which would result in the loss of all braking.

NOTE

150▶ W40▶

The possibility of loss of all braking due to skid or locked wheel conditions has been eliminated by incorporation of a simplified antiskid system. However, in order to prevent serialization in descriptive text and operating procedures, the antiskid systems in all aircraft covered by this manual are to be operated in the same manner.

HYDRAULIC SYSTEM OPERATION

HYDRAULIC PACK LIMITATIONS

If an open circuit exists in the transmitting circuit between the hydraulic pressure transmitter and the hydraulic pressure gage, no signal will be generated to activate the gage autosyn. Thus, a loss of pressure on a failed pack will not be reflected. Consequently, the pilot reads the same pressure for both the malfunctioning system and the system to which the selector switch was positioned just prior to being placed to the malfunctioning system.

ESCAPE SYSTEMS OPERATION

The aircraft escape systems include the ejection seats and the jettisonable turret. Use of these systems will greatly increase the crew members' chances of safe escape from the aircraft in time of emergency. Detailed descriptions and the inspection and operating checklists for the escape systems are properly placed in other sections of this flight manual. However, this discussion is presented to enable the crew members to round out their knowledge and to consolidate references made to the systems in other parts of the manual. Every crew member who might possibly be in a position to use an automatic escape system should be familiar with the system and have confidence in it. Although operation is simple, if you do not know the system well enough to operate it quickly and correctly, or if distrust of the automatic features causes you to manually override them, you may lessen your chances in an already dangerous situation. For step-by-step procedures and minimum safe altitudes for operating the escape systems, see "Bailout," Section III. A detailed description of the automatic opening parachute, which should be considered a part of each escape system, can be found under "Automatic Opening Safety Belts and Automatic Parachutes," Sections I and IV. Information concerning the automatic release safety belts may also be found under the same title.

EJECTION SEAT SYSTEMS

Ejection seat systems, with their automatic features, increase the airspeed and the high and low extremes of altitude at which safe bailout can be accomplished. Automatic operation of a system includes stowing the control column, positioning the seat where applicable, jettisoning the hatch, ejecting the seat, releasing the occupant from the seat, and activating the automatic parachute opening device. Release from the seat and opening the parachute can be accomplished manually by overriding the automatic system. However, fully automatic operation can greatly reduce the time required for seat separation and chute deployment at low altitudes and make safe descent from high altitudes possible even if loss of consciousness occurs.

Upward Ejection Seats

For a detailed description of the upward ejection seats, see "Pilots' Upward Ejection Seats," Section I. Detailed preflight checks of the pilots' seats are found in the "Interior Inspection Checklists," Section II. A detailed preflight check of the EW officer's seat is found in the "Interior Inspection Checklist" in Section VIII for that crew member.

Downward Ejection Seats

For a detailed description of the downward ejection seats, see "Navigators' Downward Ejection Seats," Section IV. Detailed preflight checks are found in the "Interior Inspection Checklists" of Section VIII for the navigator and radar navigator.

Ejection Seat Illustrations

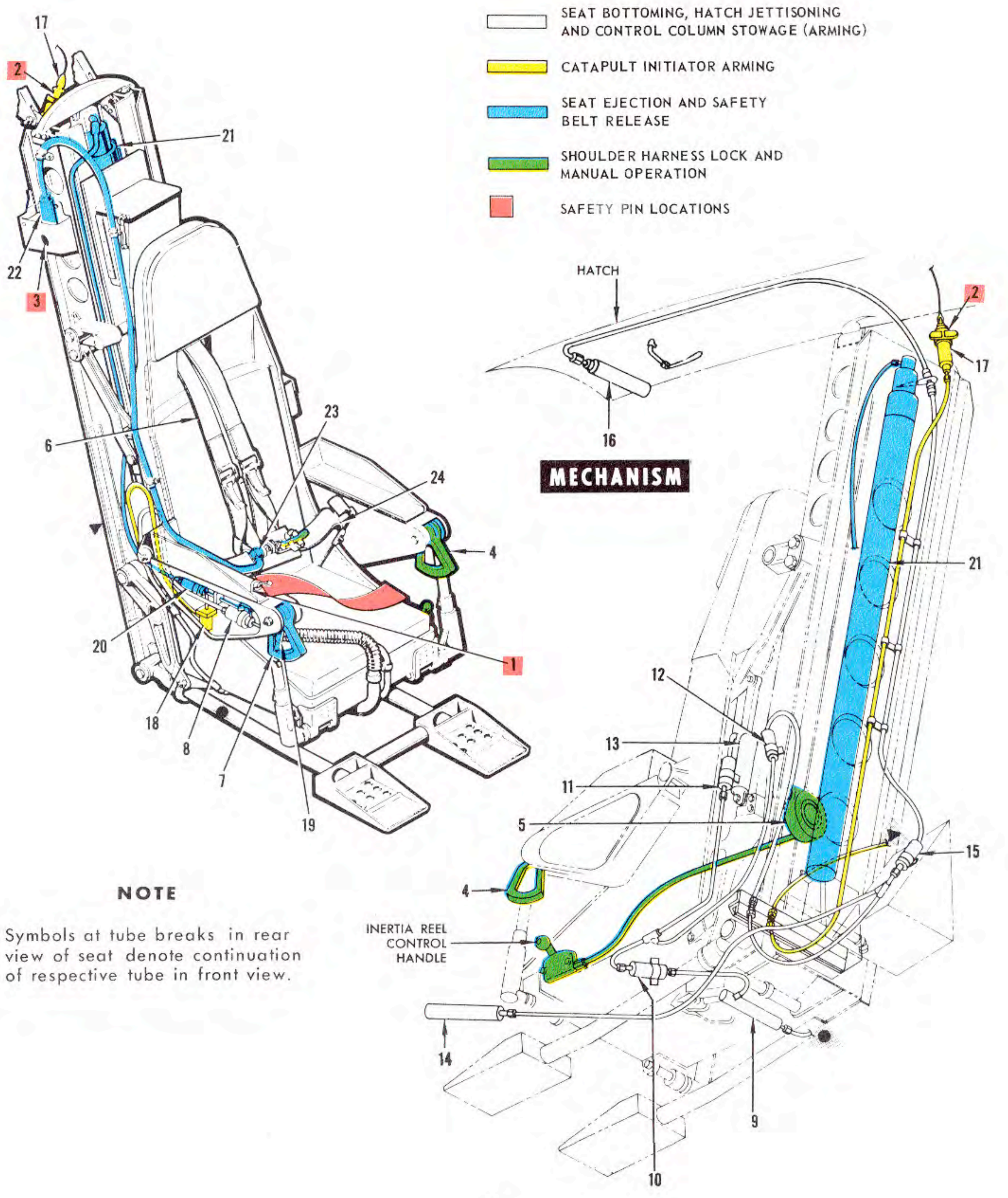
Illustrations of the upward and downward ejection seats accompany their respective descriptions in Sections I and IV. These pictures show the configuration of the seats and the component parts with which the crew member should be familiar in order to properly operate his seat. Figure 7-13 gives a schematic of the upward ejection seat system along with a sequence of events relative to the ejection operation. Color coding makes it possible to correlate the actuation of controls and mechanisms with the sequence of events. Figure 7-14 gives the sequence of events for the downward seats. One sheet of each illustration contains a detailed sequence of events and is numbered in sequence; the numbers correspond to the callouts on the other sheets of the illustration.

TURRET JETTISON SYSTEM

The jettisonable turret is described under "Turret Jettison System" in Section IV. An illustration showing the controls and safety pins accompanies the text. If the inside jettison handle is used, the system will release tail compartment pressure and, after a 2-second delay, detach and push away the turret section. The external handle accomplishes the same thing except that it does not actuate the pressure relief valve. (On aircraft 7R , the external handle also actuates the canopy release system, figure 7-16) Figure 7-15 shows the mechanism, including tubing runs, on sheet 3 and a schematic on sheet 2 so that the sequence of events can be studied along with the mechanical components which cause the actions. Some of these mechanisms can be checked from the ammunition compartment. Sheet 1 contains a detailed sequence of events and is numbered in sequence; the numbers correspond to the callouts on sheets 2 and 3.

TAIL COMPARTMENT CANOPY RELEASE SYSTEM 7R

The canopy release system is described under "Canopy Release System," Section IV. If the inside canopy release handle is used, the canopy will be released and the turret will be jettisoned. If the outer emergency release handle is used, the same result will occur; the canopy will be released and the turret will be jettisoned. Figure 7-16 shows the mechanism and action of the release system and also contains a sequence of events that are numbered in sequence; the numbers corresponding to the callouts on the mechanism.



NOTE

Symbols at tube breaks in rear view of seat denote continuation of respective tube in front view.

UPWARD EJECTION SYSTEM (Typical)

Figure 7-13 (Sheet 1 of 3).

NOTE

This is the key for sheets 1, 2, and 3.

EJECTION SEQUENCE

PRE-EJECTION PREPARATION

One **FLIGHT SAFETY PIN** (1) and two **MAINTENANCE SAFETY PINS** (2 and 3), must be removed prior to accomplishing ejection sequence.

ARMING SEQUENCE

Raise armrests to up position. Rotate **LEFT ARMING LEVER** (4). Action of left arming lever locks **INERTIA REEL** (5) thus locking **SHOULDER HARNESS** (6). Rotate **RIGHT ARMING LEVER** (7). Action of right arming lever positions firing trigger (19) in firing position, and fires **ARMING INITIATOR** (8). Gas expansion from arming initiator fires **SEAT ADJUSTING ACTUATOR DISCONNECT THRUSTER** (9), disconnecting actuator. Gas expansion from bypass in the disconnect thruster fires **SEAT BOTTOMING AND CONTROL COLUMN STOWAGE BOOSTER INITIATOR** (10). Gas expansion from booster initiator fires **SEAT BOTTOMING INITIATOR** (11) and also fires **HATCH JETTISONING INITIATOR** (12). Gas expansion from seat bottoming initiator fires **SEAT BOTTOMING THRUSTER** (13) thus bottoming the seat. Gas expansion from the hatch jettisoning initiator fires **CONTROL COLUMN STOWAGE THRUSTER** (14) and fires **HATCH JETTISONING BOOSTER INITIATOR** (15). Gas expansion from booster initiator fires **HATCH JETTISONING THRUSTER** (16). Action of the thruster unlocks and opens the hatch allowing the hatch to jettison. As the hatch is jettisoned, a lanyard attached to the hatch and connected to **CATAPULT SAFETY PIN-PULL INITIATOR** (17) fires the initiator. Gas expansion from the pin-pull initiator actuates the **CATAPULT SAFETY PIN-PULL CYLINDER** (18) causing the pin-pull cylinder to withdraw the pin from the **CATAPULT INITIATOR** (20), arming the seat.

NOTE

The control column stowage thruster (14) and the hatch jettisoning initiator (12) are not included in the EW officer's seat. Gas expansion from the **SEAT BOTTOMING AND HATCH JETTISONING INITIATOR** (10) fires the hatch jettisoning booster initiator (15) on the EW officer's seat.

FIRING SEQUENCE

Squeeze **FIRING TRIGGER** (19). Action of trigger linkage fires **CATAPULT INITIATOR** (20). Gas expansion from catapult initiator fires **CATAPULT** (21), ejecting the seat from the airplane. A lanyard attached to the fixed seats rails and connected to the **AUTOMATIC OPENING SAFETY BELT RELEASE INITIATOR** (22) activates the initiator as the seat ejects. After a 1-second delay the initiator fires. Gas expansion from the safety belt release initiator operates the **SAFETY BELT OPENING CYLINDER** (23), opening the **SAFETY BELT** (24) and allowing the occupant to separate from the seat.

MANUAL EMERGENCY OPERATION

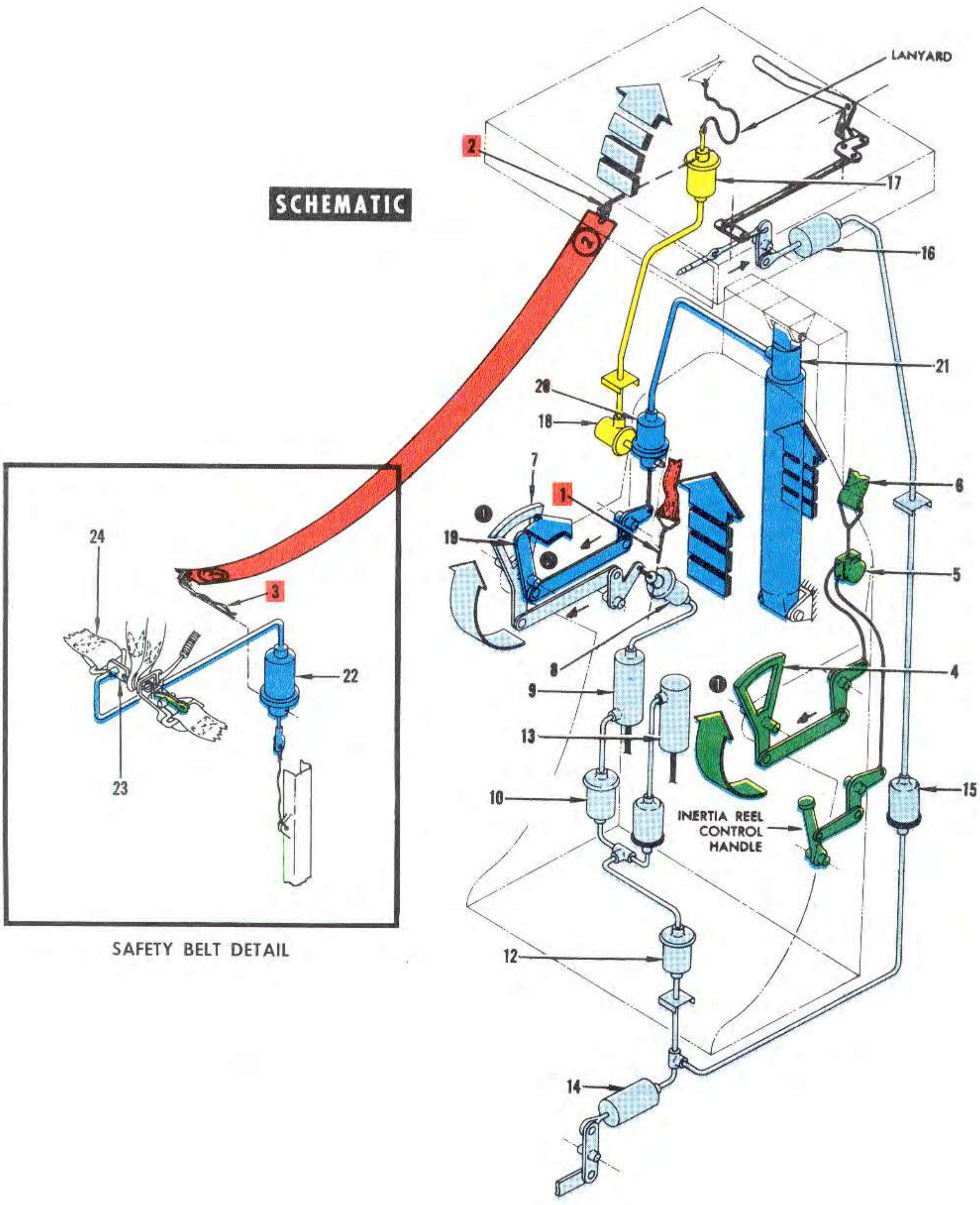
If the automatic opening safety belt release initiator fails to fire after a 1-second delay, manually open the safety belt to separate from the seat.

PREFLIGHT STATUS AND LOCATION OF SAFETY PINS

PIN NO.	LOCATION	REMOVED BY GROUND CREW	REMOVED BY FLIGHT CREW
No. 1	RH Armrest (Arming Initiator)		✓
No. 2	On Rail Support Bulkhead at Top of Rails (Catapult Safety Pin-Pull Initiator)	✓	
No. 3	RH Ejection Rail (Safety Belt Release Initiator)	✓	

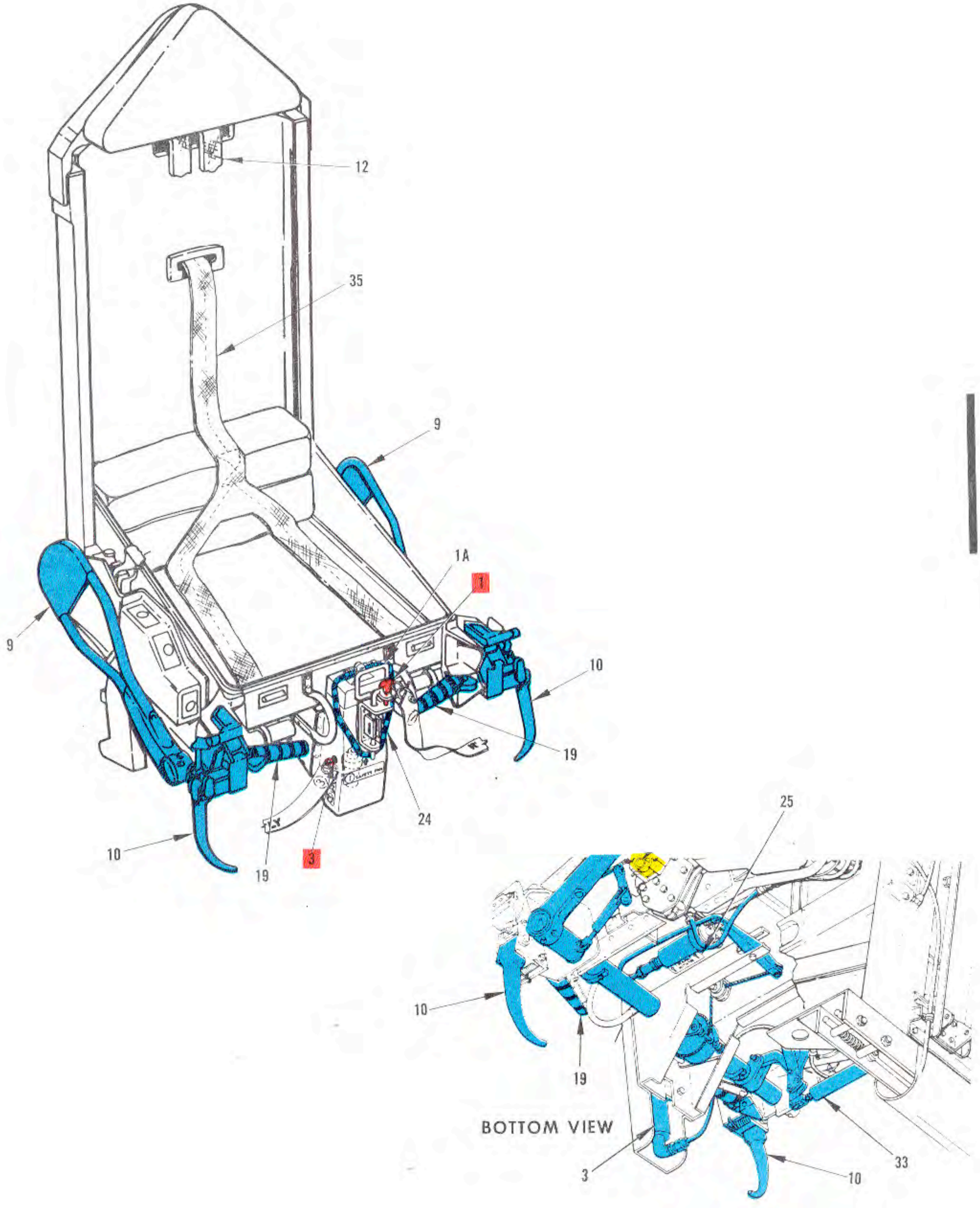
UPWARD EJECTION SYSTEM (Typical)

Figure 7-13 (Sheet 2 of 3).



UPWARD EJECTION SYSTEM (Typical)

Figure 7-13 (Sheet 3 of 3).



DOWNWARD EJECTION SYSTEM

Figure 7-14 (Sheet 1 of 4).

MECHANISM

NOTE

Symbols at tube breaks in rear view of seat denote continuation of respective tube in front view.

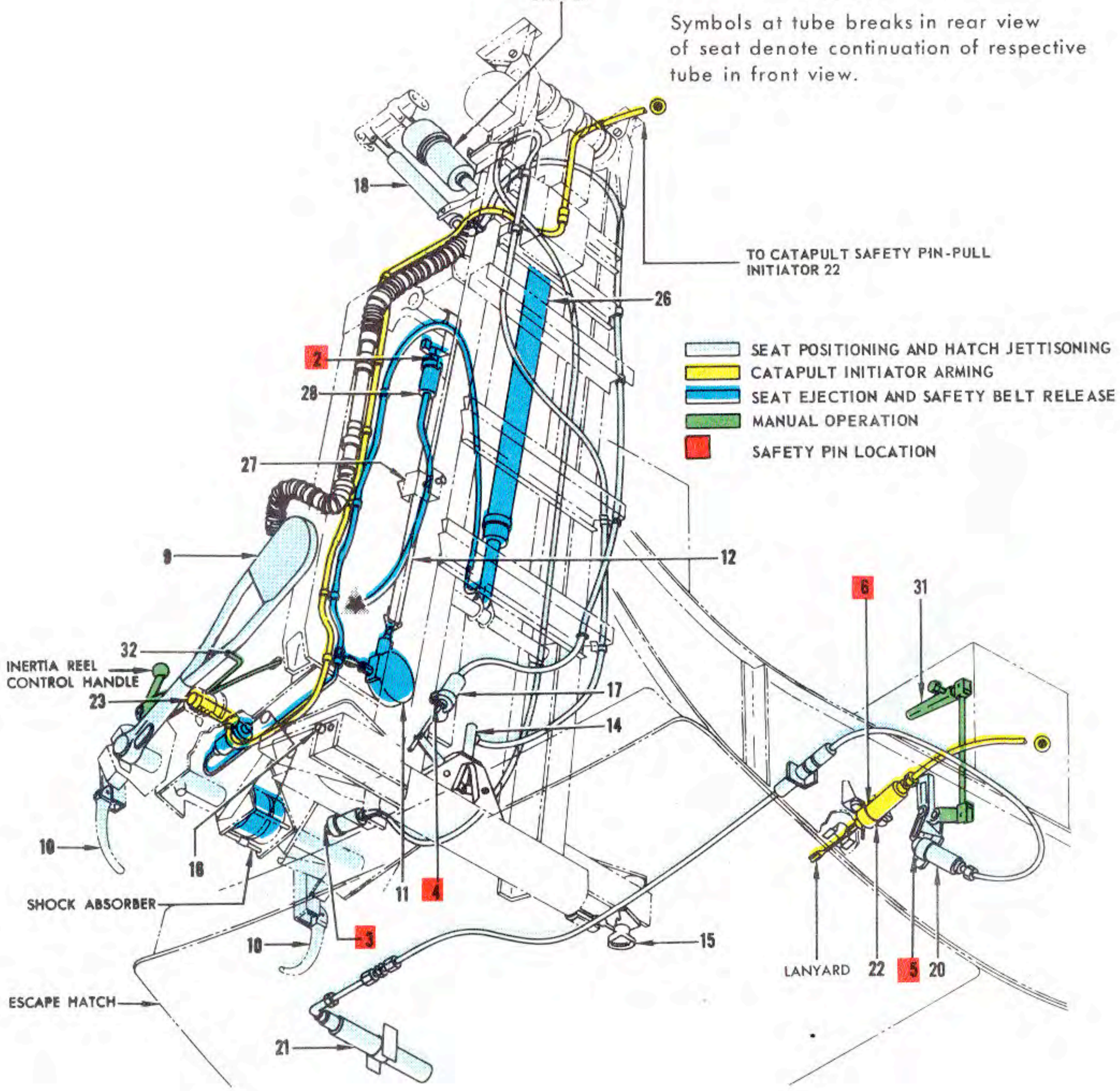


Figure 7-14 (Sheet 2 of 4).

NOTE

This is the key for sheets 1, 2, 3, and 4.

EJECTION SEQUENCE

PRE-EJECTION PREPARATION

ONE FLIGHT SAFETY PIN (1) and **FIVE MAINTENANCE SAFETY PINS** (2, 3, 4, 5, and 6) must be removed and the **EJECTION CONTROL TRIGGER RING RELEASE MECHANISM PIN** (1A) must be actuated to release the ejection control trigger ring from the stowed position prior to each flight operation.

ARMING AND FIRING SEQUENCE

Pull **EJECTION CONTROL TRIGGER RING** (24) upward. A cable attached through a cable linkage to the **ARMING INITIATOR** (13) fires the initiator. Gas expansion from the arming initiator fires the **LEG GUARD THRUSTER** (33) and operates the **POSITIONING PIN-PULL CYLINDER** (14). As the **LEG GUARDS** (9) move, the **INERTIA REEL** (11) and **SHOULDER HARNESS** (12) are mechanically locked. Simultaneously the positioning pin-pull cylinder (14) rotates the **HATCH JETTISONING INITIATOR FIRING LUG** (15) [illegible] and mechanically retracts the **FORWARD LOCKING PINS** (16) and fires the **SEAT POSITIONING INITIATOR** (17). Gas expansion from this initiator fires the **SEAT POSITIONING THRUSTER** (18), thus positioning the seat for ejection. Pressure of the legs against the **ANKLE RESTRAINT TRIGGERS** (19) releases the **ANKLE RESTRAINTS** (10) [illegible]. As the seat moves into the ejection position, the [illegible] through linkage fires the **HATCH JETTISONING INITIATOR** (20). Gas expansion from the initiator fires the **HATCH JETTISONING THRUSTER** (21) which unlocks and opens the hatch, allowing the hatch to be jettisoned. A lanyard attached to the hatch and connected to the **CATAPULT SAFETY PIN-PULL INITIATOR** (22) fires the initiator. Gas expansion from the initiator actuates the **CATAPULT PIN-PULL CYLINDER** (23) withdrawing the pin from the **CATAPULT INITIATOR** (25). Further travel of cable linkage to the catapult initiator from the **EJECTION CONTROL RING** (24) through the [illegible] fires the catapult initiator (25). Gas expansion from the initiator fires the **CATAPULT** (26) thus ejecting the seat from the aircraft. A **SAFETY BELT INITIATOR TRIP** (27) attached to the aircraft structure actuates the **AUTOMATIC OPENING SAFETY BELT RELEASE INITIATOR** (28). After a delay of approximately 0.5 second the safety belt release initiator is fired. Gas expansion from the release initiator actuates the **SAFETY BELT RELEASE CYLINDER** (29) opening the **SAFETY BELT** (30); it also fires the **INTEGRATED ROTARY ACTUATOR** (34) which operates to pull the nylon **MAN-SEAT SEPARATION STRAPS** (35) tight and provide automatic controlled separation of the seat occupant from the seat following ejection.

MANUAL EMERGENCY OPERATION

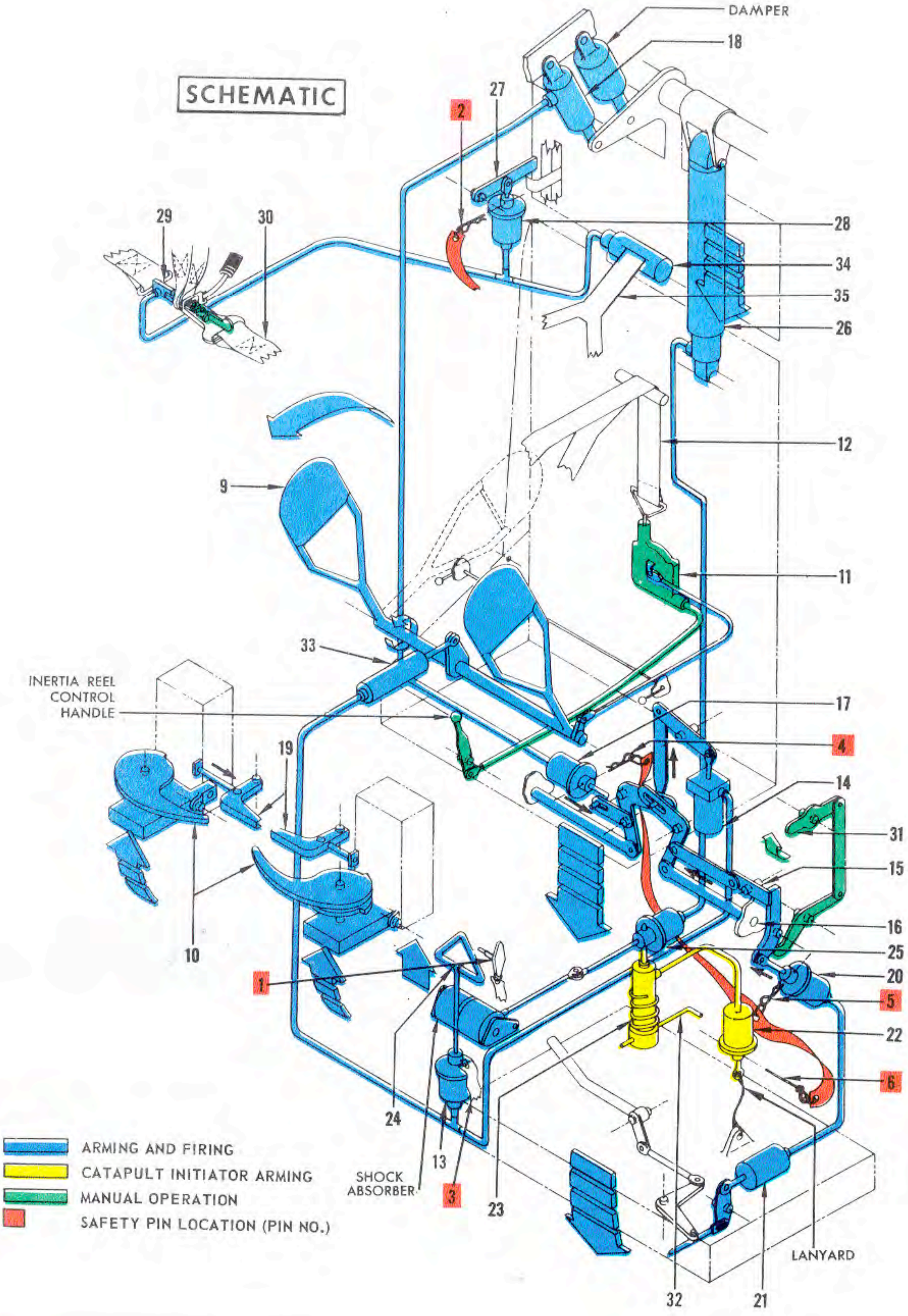
If the lower navigator's hatch jettison thruster fails to fire after the seat is positioned, pull the **MANUAL HATCH JETTISONING HANDLE** (31) which will fire the hatch jettisoning initiator. Simultaneously push the safety latch down with the thumb and pull the **MANUAL HATCH JETTISON HANDLE** (31) up with the forefinger. If after the hatch has been jettisoned pulling the firing trigger ring will not fire the catapult, pull the **MANUAL CATAPULT PIN-PULL HANDLE** (32) withdrawing the safety pin from the catapult initiator. Again pull the firing trigger ring to fire the catapult.

PREFLIGHT STATUS AND LOCATION OF SAFETY PINS

PIN NO.	LOCATION	REMOVED BY GROUND CREW	REMOVED BY FLIGHT CREW
No. 1	Front center of seat bucket (Ejection Control Trigger Ring Release Mechanism Pin)		✓
No. 2	LH Ejectable Rail (Safety Belt Release Initiator)	✓	
No. 3	Front center of seat bucket (Arming Initiator)	✓	
No. 4	Fixed rail structure on lower LH side (Seat Positioning Thruster Initiator)	✓	
No. 5	On rear corner of each hatch (Hatch Jettisoning Initiator)	✓	
No. 6	Body structure just aft of hatch only (Catapult Safety Pin Pull Initiator)		✓

DOWNWARD EJECTION SYSTEM

Figure 7-14 (Sheet 3 of 4).



DOWNWARD EJECTION SYSTEM

Figure 7-14 (Sheet 4 of 4).

NOTE

This is the key for sheets 2 and 3.

JETTISON SEQUENCE

PRE-JETTISON SEQUENCE

One **FLIGHT SAFETY PIN** (1) and two **MAINTENANCE SAFETY PINS** (2 and 3) must be removed before turret jettison sequence can be accomplished.

The **TURRET-DRAG CHUTE INTERCONNECT CONTROL KNOB** (4) is normally down. Pull up only on specific command of airplane commander.

JETTISONING

Pull **INNER EMERGENCY RELEASE HANDLE** (5) outward and forward (toward the gunner). Action of linkage fires the **INNER EMERGENCY RELEASE HANDLE INITIATOR** (6). Gas expansion from the initiator activates the **TIME DELAY INITIATOR** (7) and operates the **DUMP VALVE PIN-PULL CYLINDER** (8) opening the dump valve and depressurizing the compartment. After a delay of 2 seconds, the mechanism actuating thruster initiator fires. Gas expansion from the initiator fires the **MECHANISM ACTUATING THRUSTER** (9) which rotates a torque tube. During the first part of rotation of the torque tube, the **LOCK PLATES** (10) are released by means of mechanical linkage and the **DEACTIVATION ACTUATOR SPRING CARTRIDGE** (11) is released. The action of the spring will disconnect the drag chute ripcord and unlock the drag chute jettison mechanism thus deactivating the drag chute.

NOTE

> If the turret-drag chute interconnect control knob is pulled up prior to pulling the inner emergency release handle, a pin will have been inserted in the deactivation actuator preventing release of the spring cartridge, thus causing subsequent retention of the drag chute.

The release of the lock plates frees the turret attaching pins. A **CROSSOVER ROD STOP** (12) serves as a dampening device preventing the lock plate mechanism from rebounding and jamming the attachment pins. During the latter part of the torque tube rotation the **PUSH OFF THRUSTER INITIATOR** (13) is fired. Gas expansion from the initiator fires the two **PUSH OFF THRUSTERS** (14), thus jettisoning the turret.

EMERGENCY EXTERIOR OPERATION

The turret may be jettisoned from the exterior of the airplane. To initiate the jettison sequence from outside, pull the **OUTER EMERGENCY RELEASE HANDLE** (15). Pulling the release handle fires the **OUTER EMERGENCY RELEASE HANDLE INITIATOR** (16). Gas expansion flowing through the check valve fires the booster initiator (17) which in turn fires the mechanism actuating thruster (9) which through the normal sequence causes the turret to jettison. Note that the compartment dump valve is not actuated. On aircraft **ZR** pulling the release handle also actuates the canopy release mechanism. See figure 7-16.

PREFLIGHT STATUS AND LOCATION OF SAFETY PINS

PIN NO.	LOCATION	REMOVED BY GROUND CREW	REMOVED BY FLIGHT CREW
No. 1	Inner Emergency Release Handle Initiator (Turret)		✓
No. 2	Outer Emergency Release Handle Initiator (Turret Less **ZR**) (Turret and Canopy **ZR**)	✓	
No. 3	Pushoff Thruster Initiator (Turret)	✓	
No. 4	Inner Emergency Release Handle Initiator **ZR** (Canopy and Turret)		✓

TURRET JETTISONING SYSTEM (Typical)

Figure 7-15 (Sheet 1 of 3).

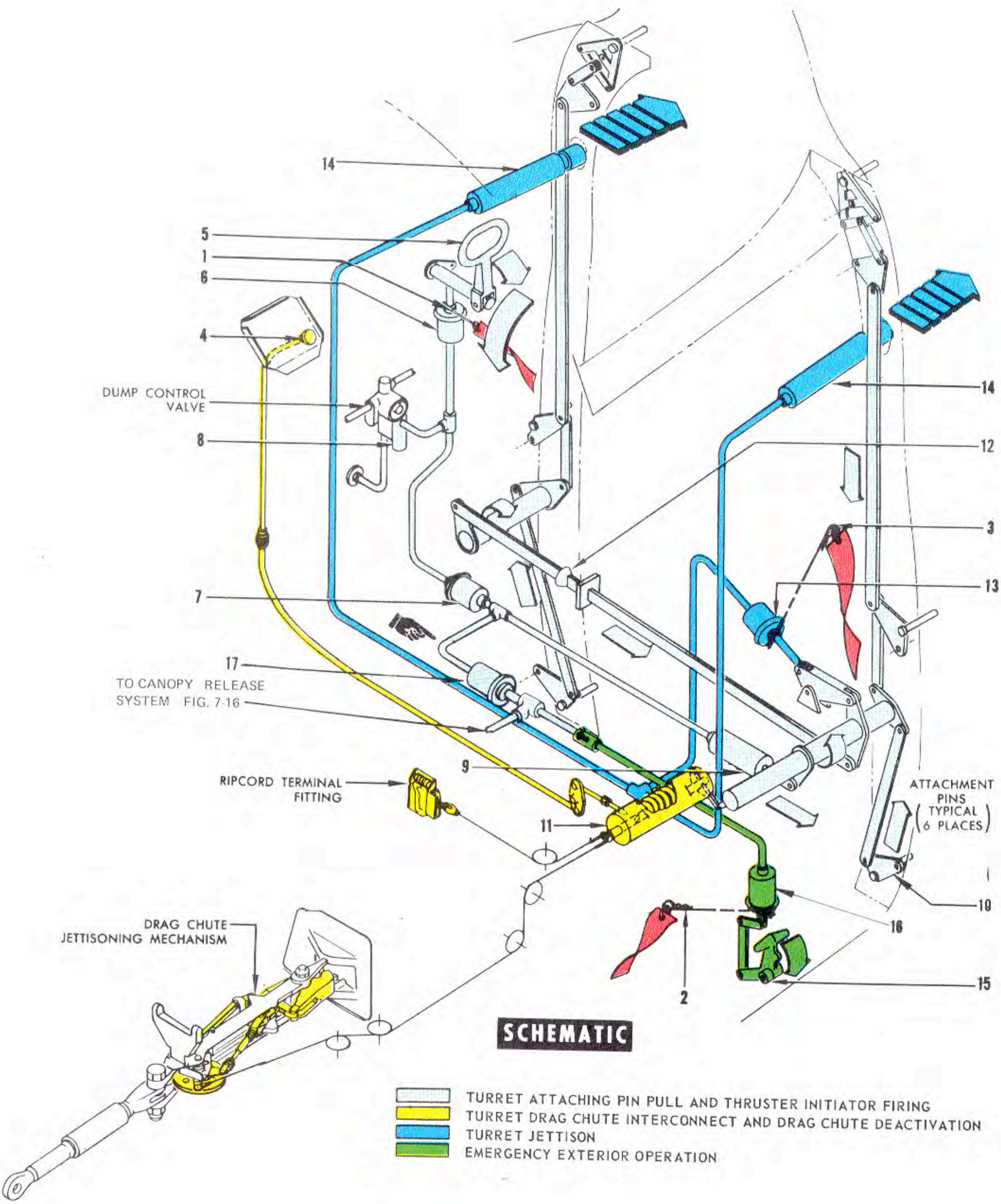
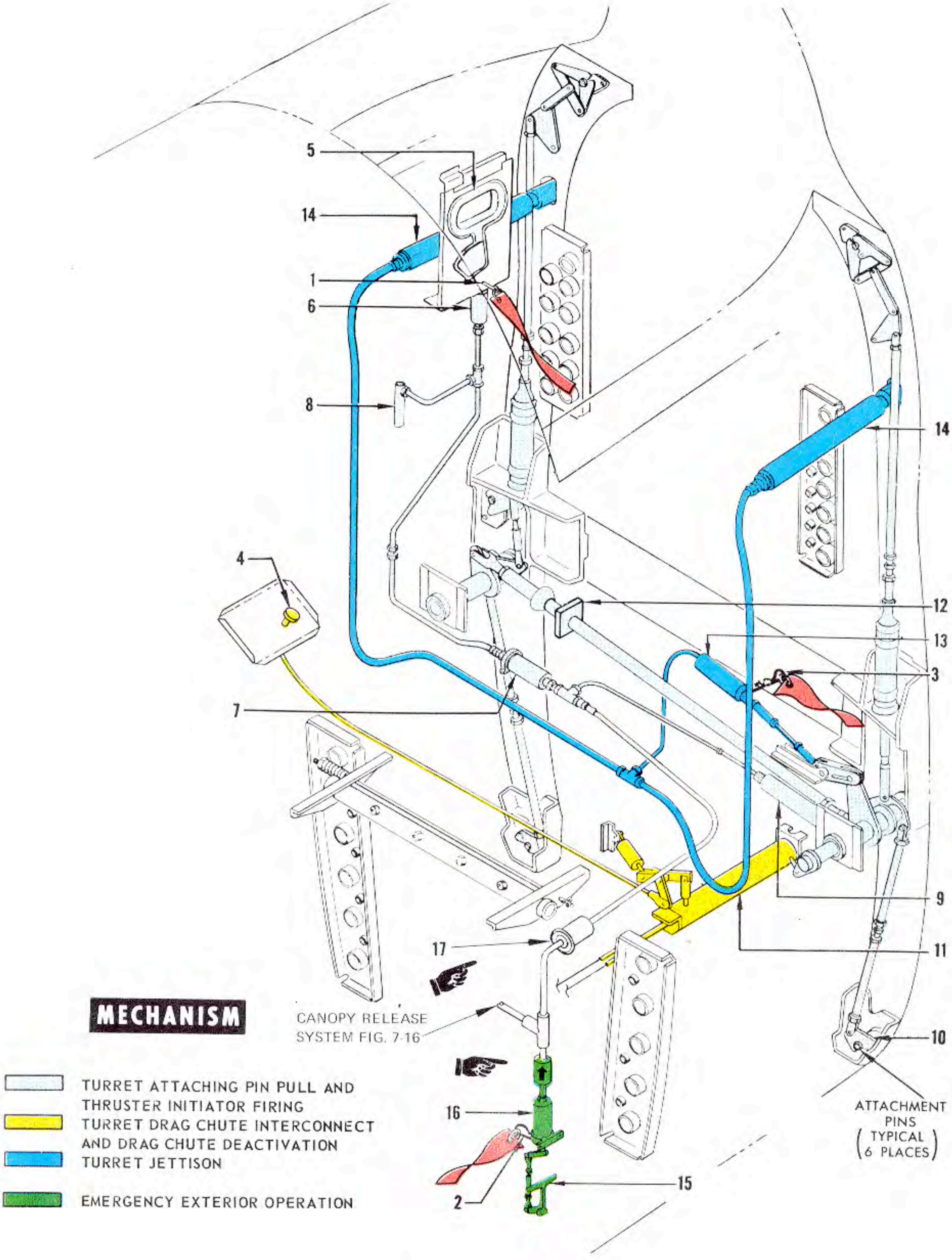
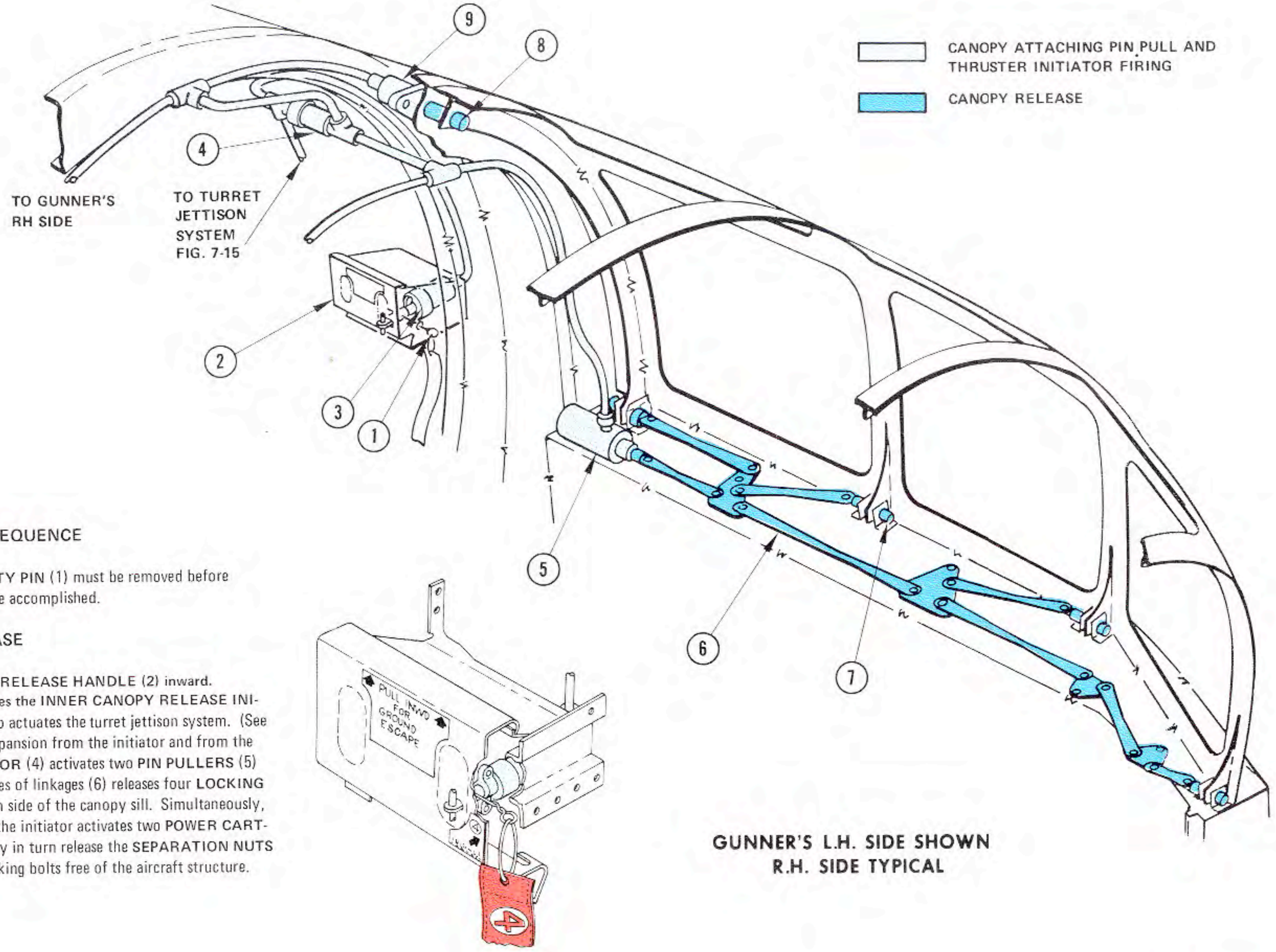


Figure 7-15 (Sheet 2 of 3).



TURRET JETTISONING SYSTEM (Typical)

Figure 7-15 (Sheet 3 of 3).



PRE-RELEASE SEQUENCE

One **FLIGHT SAFETY PIN** (1) must be removed before canopy release can be accomplished.

CANOPY RELEASE

Pull inner **CANOPY RELEASE HANDLE** (2) inward. Action of linkage fires the **INNER CANOPY RELEASE INITIATOR** (3) and also actuates the turret jettison system. (See figure 7-15.) Gas expansion from the initiator and from the **BOOSTER INITIATOR** (4) activates two **PIN PULLERS** (5) which through a series of linkages (6) releases four **LOCKING PIN(S)** (7) from each side of the canopy sill. Simultaneously, gas expansion from the initiator activates two **POWER CARTRIDGES** (8) and they in turn release the **SEPARATION NUTS** (9) and push the locking bolts free of the aircraft structure.

CANOPY RELEASE SYSTEM ZR

Figure 7-16.

section VIII

CREW DUTIES

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (cont)

INTRODUCTION

The purpose of this section is to provide a compact collection of material wherein each crew member can readily determine his duties in relation to the accomplishment of the overall mission. Instructions relating to crew duties do not include information which is already covered in other sections.

CREW COORDINATION

Coordination of actions within a crew is of prime importance to insure the optimum degree of mission success and safety during all phases of operation. This coordination is not necessarily limited to actions alone. Complete familiarity with one's crew position, the responsibilities thereof, and a working knowledge of the other crew members' duties will contribute immeasurably toward crew coordination. Each crew member must be constantly on the alert and should notify the responsible crew member of any deviation or discrepancy which will affect successful accomplishment of the mission. Liaison between individuals concerned must be established prior to initiating any action or procedure which will alter aircraft configuration or require correlation of activities between crew members. Prior to flight, the pilot must insure that all crew members are thoroughly familiar with all aspects of the assigned mission as pertains to their crew specialty to include:

- Applicable instructions in the Flight Information Publications
- Departure routes, altitudes, obstructions, and traffic procedures
- Route of flight
- Navigation (to include low altitude)
- Air refueling information
- Bombing
- EW activities
- FCS operation activities
- Normal and emergency communications procedures
- Any special instructions or procedures pertaining to the mission.

NOTE

- It is imperative that the pilot, copilot, radar navigator, and navigator be thoroughly familiar with all planned altitudes to be flown throughout the mission. In flight, the pilot, copilot, and radar navigator/navigator having primary altimeter monitoring responsibility must monitor all altitudes being flown to insure no deviations of flight altitude clearances. Throughout the flight, when required altitude changes are being made, the responsible radar navigator/navigator must call off altitude to pilot every 5000 feet during climb/descent beginning at the first multiple of 5000 feet. Upon reaching level-off altitude plus or minus 5000 feet, report altitude to pilot every 1000 feet and at level-off altitude.
- It is imperative that the pilot, copilot, radar navigator, and navigator be thoroughly familiar with the penetration, approach, missed approach, landing patterns, altitudes, and obstructions at both destination and alternate airfields. Available aids such as current FLIP Terminal and approach charts must be studied. A complete set of current approach charts must be available for inflight use of both the pilot and the radar navigator. The radar navigator, as well as the pilot not actually flying the aircraft, will closely monitor all penetrations and approaches. The pilot at the controls will be notified immediately of any deviation from published procedures.

It is imperative that positive measures be taken to insure that safety of personnel and aircraft are not jeopardized. Flight attitude of the aircraft must be carefully monitored by either the pilot or copilot at all times. Prior to accomplishment of any of the following, verbal coordination between applicable crew members will be required when:

1. Control of the aircraft is transferred between pilot and copilot.
2. Control column of either the pilot or copilot is disconnected or reengaged.
3. Changing fuel control settings, except when done silently during a checklist.
4. A crew member returns to position, comes back on interphone, and removes his inflight safety pins or unstows downward ejection control trigger ring.
5. A crew member leaves position or goes off interphone.
6. A crew member goes off oxygen and when he resumes oxygen use during flight when oxygen is required.
7. Autopilot control of aircraft is transferred between the radar navigator and pilot.
8. Any electrical power source is changed.
9. It is necessary for the pilot flying the aircraft to transfer control of the aircraft to the other pilot when he is required to do something which will divert his attention from flying, such as check oxygen, tune radios, change fuel control settings, etc.
10. The pilot intends to perform any critical maneuver, at which time all crew members will be secured in their respective positions.

11. Changing air outlet knob positions (notify copilot) (not required for gunner).
12. The inflight safety pins are installed or the downward ejection trigger ring is stowed. Conditions requiring pin installation or trigger ring stowage are:
   a. All ground operations.
   b. Whenever the crew member leaves his seat in flight.
   c. When the parachute is not worn.
   d. When the seat belt and shoulder straps are not fastened.

All applicable crew members will acknowledge that the intended course of action is understood prior to actual accomplishment and will conduct themselves accordingly. All crew positions, when practical, should monitor communications outside the aircraft at all times.

WARNING

- Whenever a change of crew position is necessary, climb to a safe altitude and area before the change is made. The pilots will not exchange seats when only two pilots are aboard the aircraft.

- Any time during critical phases of flight and especially during night and/or instrument conditions, the pilot not flying the aircraft will closely monitor his flight instruments and cross-check them against the instruments of the other pilot. If an apparent error in aircraft attitude is detected, the pilot flying the aircraft will be advised immediately. The pilot not flying the aircraft will also monitor the engine instruments.

- Extreme care must be exercised by the pilots when leaving seats to avoid inadvertent operation of switches or controls on the aisle stand or overhead panel.

- Before leaving a pilots' ejection seat, stow the control column prior to releasing the safety belt. When returning to the seat, fasten the safety belt prior to engaging the control column. This should prevent inadvertent actuation of the control column by an unrestrained crewmember.

- If the safety belt is removed in flight or on the ground, place the belt carefully so as not to inadvertently operate any switch.

- To prevent accidental firing of downward ejection seat, stow the ejection control trigger ring prior to leaving the seat during flight. Upon returning to the seat, fasten parachute and safety belt, then unstow the ejection control trigger ring from the stowed position.

- When moving around an ejection seat, care must be taken not to actuate the seat ejection mechanism.

- Extreme caution must be exercised by all crew members when stowing and securing gear aboard the aircraft. Care must be taken to assure that gear is safely secured and is not stowed on or near heating ducts, outlets, electrical wiring, and electronic equipment. Periodically during flight, each crew member should check ducts, outlets, electrical wiring, and electronic equipment in his immediate area to see that they are free of combustible materials. For location of hot air ducts and outlets, see figure 4-2A.

CAUTION

The gunner will exercise extreme caution when using the aft handholds during unstable flight conditions to preclude inadvertent activation of the turret jettison system.

CHECKLISTS

The flight manual checklists have been designed so that they may be used for training missions with or without bombs or missiles, for alert posture, and for EWO missions.

NOTE

When no nuclear bombs or missiles are loaded, safety wires and seals are not required on the associated monitor control and release system controls.

Nuclear Bombs

Nuclear bomb strike mission amplified checklists appear in Section I of T. O. 1B-52C-25-2. The Pre-Takeoff and Inflight sections, only, have been integrated within the flight manual checklists. The integrated items appear without amplification in both the amplified and abbreviated checklists. T. O. 1B-52C-25-2CL-1 "Nuclear Bomb Delivery Procedures" will be maintained as a separate checklist and will be available for use as required. The following additional checklists also appear in T. O.'s 1B-52C-25-2 and 1B-52C-25-2CL-1:

- Tactical Ferry Procedures
- EWO Restrike Procedures (MMS Not Available)
- Emergency Procedures

Conventional Munitions

Conventional munitions procedures from T.O. 1B-52C-34-2-1 have been integrated with the affected flight crew checklists.

Missiles

The procedures that lend themselves to integration in existing checklists have been so integrated for applicable crew members. Otherwise, the procedures have been integrated as complete checklists. The integrated procedures appear as line items without amplification in both the amplified and abbreviated checklists. Amplification of the line items pertinent to missile normal procedures may be found in Section II of the appropriate publication as listed below. Numbering of checklist items in the abbreviated checklists will not coincide with the numbering in the amplified checklists as listed below unless the procedure has been integrated as a complete checklist.

AGM-28 CHECKLISTS. The AGM-28 normal procedures amplified checklists will appear in the B-52/AGM-28 Aircrew Weapon Delivery Technical Manual, T.O. 1B-52C-30-1. The abbreviated checklists for certain AGM-28 normal procedures are integrated in the "Normal" part of the pilots', navigator's, and radar navigator's abbreviated flight crew checklists. However, "AGM-28 Inflight Procedures" and "Tactical Ferry Procedures" will appear nonintegrated in the "Missile" part of the pilots', navigator's, and radar navigator's abbreviated flight crew checklists. "Unscheduled Landing With AGM-28 Missiles" will appear in the navigator's and radar navigator's abbreviated flight crew checklists only. The emergency procedures for AGM-28 will appear in the "Emergency" portion of the aircrew abbreviated checklists as nonintegrated items. In the pilots' checklists, these are the "Emergency Shutdown," "Engine Fire During Ground Start," and "Missile Safe Jettison." In the navigator's and radar navigator's checklists, these are the "Armament System Malfunction Indications" and "Missile Safe Jettison."

Bomb Runs

The bomb run checklists in Section VIII have been designed so that they may be used for both training and EWO missions. They have been consolidated for use by both the navigator and radar navigator.

ELECTRONIC EQUIPMENT INTERFERENCE

Due to the electronic characteristics of certain aircraft equipment, intraplane interaction/interference may occur. An interference check will be accomplished in such detail as necessary so that each crewmember responsible for operation of electronic equipment will be thoroughly familiar with the effect of interaction, magnitude of interference, presence of spurious responses, and be able to determine the usable portion of the frequency spectrum that will allow the most effective and coordinated operation of this equipment. Amplification of the interference check will appear in the EW officer's checklist.

LOW ALTITUDE NAVIGATION

During low altitude flight, special emphasis by all crew members will be directed to maintaining route corridor and prescribed altitudes. Crew coordination is extremely essential for each change of heading and/or altitude. The navigator will notify the pilot when altitude deviates significantly from that planned. The navigator will announce the new magnetic heading, altitude, and ETA/ETE. This information will be cross-checked by the pilot. The pilot/copilot will monitor the aircraft position and take action as necessary to insure corridor limits are not exceeded.

PILOT

The pilot is the aircraft commander and is responsible for the aircraft and crew. For simplification and to avoid any misunderstanding, the pilot and copilot will be referred to as such during interphone transmissions. The successful accomplishment of the mission is of prime importance; in no instance, however, will the safety of the aircraft or crew be compromised. The pilot is responsible for the issuance of instructions governing all phases of flight operation. In addition to his regular function, the pilot will perform the following.

Mission Preparation

1. Attend general briefing.
2. Coordinate with other crew members on route, charts, targets, and items pertinent to individual crew procedures and supervise the completion of required forms.
   a. The pilot's low level chart will contain data as required to orient the pilot to actions necessary for the accomplishment of the low level portion of the mission.

NOTE

> If the planned mission includes a low altitude portion, a forecast altimeter setting will be obtained for the low altitude entry point. This forecast setting will be compared with that received from the Air Traffic Control agency prior to starting the descent. When executing a descent prior to landing or for low altitude tactic, the pilot coordinates the altimeter setting with the navigator and both will compare actual and forecast altimeter settings at this time.

3. Complete and file Form 175.
4. Attend the specialized briefings for air refueling, weather, and other pertinent information.
5. Compile latest information relative to flight to brief the crew.
6. Conduct specialized crew and emergency procedures briefing.
7. Check personal and professional equipment for completeness and working order.
8. Check publications and technical data for currency.

Bomb Run

1. Center PDI on radar navigator's request and transfer control of the aircraft to the radar navigator.

NOTE

> One of the pilots should maintain the desired IAS and monitor engine instruments on the bomb run to enable the other pilot to handle any emergency in minimum time and to visually clear the aircraft.

2. The pilot will call time to go and heading error indicator position at appropriate intervals and request "Tone on" at 20 seconds time to go.

COPILOT

The copilot is the deputy aircraft commander and will assist the pilot in the proper flight of the aircraft. Inasmuch as the fuel panel and electrical system are controlled by the copilot, he will also act as the flight engineer.

NOTE

> Increased attention must be devoted to monitoring all engine instruments and warning indicators any time the pilot's attention must be devoted solely outside the cockpit, i.e., during rendezvous, air refueling, formation flying, etc.

In addition to this regular function, the copilot will perform the following:

Mission Preparation

1. Attend general briefing.
2. Assist the pilot and navigator in mission planning and flight plan preparation. The copilot will prepare the fuel prediction curve and compute takeoff performance data.
3. Prepare aircraft loading and weight and balance forms for pilot's signature.
4. Attend specialized briefings with pilot.
5. Check personal and professional equipment for completeness and working order.
6. Check publications and technical data for currency.

RADAR NAVIGATOR/NAVIGATOR

The navigator and radar navigator must work together continuously to insure successful completion of the mission. Each must have sufficient knowledge of the other's duties to enable him to perform them if the need arises.

Whenever a mission is flown with only a radar navigator or navigator, the RN/N flying will perform all applicable checklist items of his assigned position. In addition, he must accomplish all items in the RN/N not-flying checklist for the position not occupied by a qualified RN/N. These items are minimum steps to be accomplished. Additional items may be accomplished if needed or desired.

Mission Preparation

1. Attend general and specialized mission briefings as required. (RN-N)
2. Accomplish target study on assigned targets. (RN-N)
3. Accomplish study of AGM-28 programming leg as required. (RN-N)
4. Coordinate with maintenance personnel to determine status and history of bombing and navigation equipment and missiles as applicable. (RN-N)
5. Select maps and charts of suitable scale and projection as dictated by requirements of the mission. (RN-N)
6. Procure additional charts to provide coverage for emergency changes in flight. (N)
7. Procure all flight planning, inflight, and postflight forms which are needed to plan, fly, and record the flight. (RN-N)
8. Procure letdown information for primary and alternate destinations. (Flight Information Publication Terminal is adequate.) (RN-N)
9. Procure or prepare bomb run inserts and AGM-28 programming leg inserts. (RN)
10. Check personal and professional equipment for completeness and working order. (RN-N)
11. Check publications and technical data for currency. (RN-N)

Preparation of Charts

1. The complete route will be correctly plotted. The routes will be planned from point to point. (N)
2. All pertinent prohibited, restricted, warning, and caution areas within 50 NM of planned route (20 NM for low level portion) and within the planned altitude structure (high altitude versus low altitude) will be clearly marked with time and altitude limitations. (N)
3. Planned air refueling ARIP, ARCP, exit point, refueling altitude, and start descent point will be annotated in the chart. (N)
4. Coordinates of prominent radar returns along the route no more than 100 NM apart for high altitude or 60 NM apart for low altitude will be annotated for updating position counters. Coordinates of all turn points will be annotated. (RN)

5. All pertinent action points will be annotated on the chart. The crew will be notified by the navigator when each of these points is reached. (N/RN)
    a. PCTAP and HHCL.
    b. SCM, TAT, TTAT, and TCM points.
    c. Start and termination of gunnery activity.
    d. Terrain computer turn-on point.
    e. Grid entry and exit points. Convergency angles will be available.
    f. Pre-IP, IP, Timing Initiation Point, and Target.
6. All AGM-28 action points will be annotated. (RN-N)
    a. Start Programming Point.
    b. Check Point Fix Points.
    c. Prelaunch Check.
    d. Launch/Simulated Launch Points.
    e. Simulated Launch Targets.
7. The low altitude portion of the mission will be plotted on current edition of ONC/WAC charts. ONC charts are mandatory when available. Low altitude planning and annotations will be in accordance with applicable directives. (RN-N)

Preparation of Forms

1. Complete Flight Plan. (N)
2. Complete Bombing Computation Forms. A complete computation form is required for each RBS, NIKE, and camera target. Only the release data need be filled in for subsequent, identical bomb runs. (RN)
3. Complete AGM-28 Forms. (N)
4. Complete Celestial Precomputation Forms as desired. (N)
5. Complete Radar Scope Photo Log as desired. (RN)

EW OFFICER

The primary responsibility of the EW officer is the utilization of the installed electronic countermeasures equipment to provide an active electronic defense against ground-based or airborne electronic devices that pose a threat to the safety of the aircraft and the completion of its mission. This is accomplished through the coordinated efforts and aid of all crew members. Secondary responsibility is obtaining celestial observations by use of the periscopic sextant when requested by the navigator. This activity is accomplished through coordination with the radar navigator and navigator. In addition, the EW officer will monitor liaison radio communications as prescribed in governing directives. Monitoring responsibility may be assumed by another crewmember during those periods in which the EW is accomplishing required checklists, ECM activity, or celestial observations.

Mission Preparation

1. Attend general briefing.
2. Accomplish study of all intelligence data necessary for the accomplishment of the EW portion of the mission.
3. The EW officer will accomplish flight planning, coordinating with other crew members on the necessary phases of EW activity, celestial navigation, interference checks, and DCE exercises.
4. Complete required logs/forms in accordance with applicable directives.
5. Attend specialized briefing when applicable.
6. Attend crew briefing.
7. Check personal and professional equipment for completeness and working order.
8. Check publications and technical data for currency.

GUNNER

The gunner is responsible for employment of the fire control system for active defense of the bomber against enemy fighters. He maintains constant visual and radar search for enemy aircraft, reporting enemy aircraft activity to other members of the crew. Such coordination permits the crew to utilize defensive maneuvers, electronic countermeasures, chaff, and gun fire to the optimum extent in defending the aircraft. The gunner must also act as a scanner by assisting the pilot in clearing the aircraft during ground operation and flight. He reports on abnormal operation of engines, control surfaces, tip gear, and drag chute.

Mission Preparation

1. Attend general briefing.
2. Accomplish mission planning, coordinating with other crew members concerning FCS activity. Insure that required FCS forms are obtained for use on the mission.
3. Attend specialized briefing as required. Receive and study available intelligence data regarding anticipated fighter attacks.
4. Review all data on the gunner's flimsy.
5. Check personal and professional equipment for completeness and working order.
6. Check publications and technical data for currency.

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR)

BEFORE EXTERIOR INSPECTION (POWER OFF)

1. Ejection Trigger Ring - Stowed, pin No. 1 installed (RN)

   Check that ejection trigger ring is properly seated in detent.

   WARNING

   If the ejection trigger ring is not properly seated in the detent, call maintenance and ascertain status of arming initiator before continuing seat inspection.

2. Readiness Switch Cover - Closed, sealed (N)
3. Special Weapons Manual Lock Handle - Sealed (N)
4. External Missile Manual Release Handle - Sealed (N)
5. Forward & Rear Special Weapons Manual Release Handles - Sealed (N)
6. Release Circuits Disconnect - Disconnected, sealed (RN)
7. Circuit Breaker Panels: (RN/N)
   - a. Normal Release, Salvo Power & B-52D External Release Circuit Breakers - Out
   - b. Emer Door Open & Rel Circuit Breaker B-52D - Out
   - c. ASM Separation (4) & Jettison Control (2) Circuit Breakers - Out
   - d. ASM Auto Nav AC PWR A, B & C (3) Circuit Breakers - Out (ground alert only)
   - e. All Other Circuit Breakers & Fuses - In
8. Radar Navigator's SWESS Arm-Safe Switch **Less** A - SAFE, sealed (RN)

8A. CSS Indicator Windows A - Checked "A" (RN)

NOTE

Cease all activity and request CSS custodians (through the Command Post) if any CSSC indicator window is found set to other than "A."

9. DCU-9/A Control Levers - OS, sealed (RN)
10. DCU-9/A Selector Switches - OFF (RN)
11. SWK Monitor Select Switch - OFF (RN)
12. Emergency Armed Release Switch B-52D - OFF, sealed (RN)
13. AGM-28 Armament Selector Switches - OFF, sealed (N)
14. AGM-28 Launch Switches - OFF (guard closed) (N)
15. AGM-28 Electrical Power Panel: (N)
    - a. Missile Power Switches - OFF
    - b. B-52 Power Switches - OFF

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

EXTERIOR INSPECTION (BOMB BAY INTERIOR)

WARNING

The bomb door actuator struts must be disconnected before entering the bomb bay.

1. General Condition of Bomb Bay - Checked (RN)

   Check for fuel and hydraulic leaks and security of equipment (include check of walkways for loose objects).

2. Nuclear Bombs - Checked (RN)

   When nuclear bombs are aboard, use the appropriate bomb preflight checklist from T. O. 1B-52C-25-2CL-1.

INTERIOR INSPECTION

1. Equipment - Stowed

WARNING

Insure that no equipment is stowed on or near the lower deck heating duct and outlets, electrical wiring, or electronic equipment.

2. Compass Cutoff Switch - ON
3. Ejection Seat & Escape Hatch:

WARNING

- Carefully check to assure that no streamer has been torn from a safety pin, thus inadvertently leaving the pin installed. See figure 7-14 for location of pins.
- If a maintenance safety pin is installed, the status of the seat will be ascertained prior to removal of the pin.

   a. Manual Catapult Initiator Safety Pin-Pull Handle - Secure

   Handle should be properly seated below left leg guard.

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

b. Ankle Restraints - Checked

Inspect ankle restraints for proper operation and stow in downward position.

c. Catapult Initiator - Checked

Inspect initiator for condition and installation. Insure pin-pull cylinder safety pin (plunger) is installed in catapult initiator.

d. Catapult Initiator Safety Pin-Pull Cylinder - Checked

Inspect position and condition of cylinder and safety pin (plunger).

e. Arming Initiator & Control Linkage - Checked, pin No. 3 removed

Check maintenance safety pin No. 3 removed. Inspect initiator for condition and installation.

f. Emergency Escape Hatch - Secure

Check that paint stripe on the lockpin is visible or the flat surface of the lockpin extends 1/4 inch from its housing. Check that latch pins overlap the long lip of the latch hooks by approximately 1/8 inch. Check that the escape hatch manual release handle is stowed. Check all foreign matter removed from hatch.

g. Initiator Tube Runs - Check connected

Check tube runs for proper and secure connections.

h. Catapult Pin-Pull Initiator - Checked, pin No. 6 removed

Check maintenance safety pin No. 6 removed. Inspect link for condition and installation.

i. Hatch Jettison Initiator - Checked, pin No. 5 removed

Check maintenance safety pin No. 5 removed. Inspect initiator for condition and installation.

j. Manual Hatch Jettison Handle & Safety Latch - Checked

Check the manual jettison handle and safety latch for proper engagement by pushing up and aft on the safety latch. Freedom of motion of the safety latch indicates that the latch has not properly engaged the hatch jettison handle.

WARNING

If the safety latch has not properly engaged the manual hatch jettison handle, the hatch can be inadvertently jettisoned. Call maintenance before performing any further checks.

k. Seat Positioning Initiator - Checked, pin No. 4 removed

Check maintenance safety pin No. 4 removed. Inspect initiator for condition and installation.

l. Hatch Jettison Firing Lug - Checked

Inspect firing lug for condition and mounting.

m. Safety Belt Release Initiator - Checked, pin No. 2 removed

Check maintenance safety pin No. 2 removed. Inspect initiator for condition and installation.

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

n. Inertia Reel - Checked

Check inertia reel lock for proper functioning.

4. Man-Seat Separator - Checked

Insure that the nylon man-seat separator straps are placed over the parachute blocks and then on the bare seat. Survival kit is then placed over man-seat separator straps. See figure 7-14 for correct arrangement of man-seat separator straps without survival kit and parachute in place.

5. Parachute Preflight:

a. Inspection Record:

(1) Inspection & Repack Date - Checked

(2) Automatic Release Time & Altitude Setting - Checked

b. Personal Locator Beacon Lanyard - Snapped

For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 4-85).

c. Bailout Bottle Pressure & Hose Connector - Checked

d. Parachute Straps - Adjusted (as required)

e. Zero Delay Lanyard - Unhooked from parachute ripcord T-handle.

WARNING

Do not hook zero delay lanyard to parachute ripcord T-handle when using a downward ejection seat since it is equipped with a man-seat separator.

6. MD-1 Survival Kit Preflight:

a. Kit Release Knob Snapped - Checked

b. Zipper Closed & Seal Intact - Checked

c. Kit Straps to Parachute - As required

WARNING

Care must be taken to assure that the survival kit attachment straps are not fastened over the safety belt.

7. Interphone - Connected

8. Oxygen System:

a. Regulator Diluter Lever - 100% OXYGEN

b. Shutoff Lever - OFF

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

c. Mask & Hose - Check disconnect, then reconnect

Check for 10- to 20-pound pull for disconnect, then reconnect mask and hose.

d. Diluter Valve - Checked

Attempt to draw air through the oxygen mask. Ability to draw air indicates a defective diluter valve, oxygen hose and/or connections, or mask. Then place the diluter valve to NORMAL position, draw air through the mask, if unable, this would indicate that only 100% oxygen will be available.

NOTE

If the diluter valve is stuck in the 100% position, this will prohibit the detection of smoke or fumes when use of normal oxygen is required.

e. Shutoff Lever - ON

f. Pressure - Checked

Pressure gage reads approximately 300 psi.

g. Emergency Toggle Lever - TEST MASK

With mask disconnected at one side of helmet, the flow indicator should indicate continuous flow.

h. Mask - Test

Attach mask to helmet and hold breath; indicator should indicate no flow.

NOTE

Flow condition may be indicated by a slight leak around the face form. If light hand-pressure against the mask does not stop the flow, the mask is unacceptable.

i. Emergency Toggle Lever - NORMAL

j. Regulator Diluter Lever - NORMAL/100% (as required)

9. PMG Control Switch - ON

10. Ground Blowers Switch - OFF

11. K-3A Heat Control Switch - As required

The PREHEAT position is used on the ground when temperature is below 0° C and in flight when the BNS is off.

12. Master Bomb Control Panel:

    a. Master Bomb Control Switch - OFF

    b. Bomb Indicator Lights Switch - ON

    c. Bombing System Switch - MANUAL

    d. Lights - Checked, tested

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

13. Nuclear Bombs/ASM Checklist:

    a. Special Weapons & ASM Lock Indicators - Indicate locked

    b. Bomb Indicator Lights - Off, tested (applicable lights for multiple carriage)

    b. Forward/Aft Weapon Released Lights - Off, tested (single carriage)

    c. ASM Released Lights - Off, tested (if missiles aboard)

    d. Special Weapons Select Switch - FWD/AFT (as briefed)

    e. Bomb Release Mode Selector Switch **B-52** **1** - NORMAL, safetied

    f. Emergency Bomb Door Open Switch **B-52D** - OFF

    g. Release Circuits Connected Light - Tested

14. IFC Power Select Switch **B-52D** - TR (guard closed)

15. Coded Switch Set Control (CSSC) **A**:

NOTE

> Cease all activity and request CSS custodians (through the Command Post) if the ENABLE light comes on at any time other than during the lamp test button check. For other abnormal indications, refer to "CSS Malfunction Analysis" in T.O. 1B-52C-25-2 or T.O. 1B-52C-30-1.

    a. Oper/Mon Switch - MON, DISEN light on

    Hold the OPER/MON switch in MON and check DISEN light on.

    b. Lamp Test Button - Depressed

    DISEN, ENABLE, and CODE lights should illuminate.

    c. Sum Code ________- Set

    Set briefed sum code in CSSC by rotating thumbwheels.

    d. Oper/Mon Switch - OPER

    Code light should blink until end of cycle (approximately 2 minutes)

    e. Code & Disen Lights - On

    Illumination of the CODE and DISEN lights verifies operation of system, that proper enable codes have been entered in the code enable switch, and that the system is disenabled.

    f. Oper/Mon Switch - MON (momentarily)

    CODE and DISEN lights should go off.

NOTE

> System status (enable/disenable) may be verified at any time by holding the OPER/MON switch in MON and observing DISEN and ENABLE light indication.

    g. CSSC Indicator Windows - Set all "A's"

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

16. DCU-9/A and SWK Box (Multiple Carriage):
    a. SWK Monitor Select Switch - First bomb to be released
    b. DCU-9/A Selector Switch - Safe
    c. DCU-9/A Warning Light - Off, tested (each position of SWK box)
    d. SWK Monitor Select Switch - OFF
    e. DCU-9/A Warning Light - Off, tested
    f. DCU-9/A Selector Switch - OFF
    g. SWK Box Illumination Control - Full CCW
16. DCU-9/A (Single Carriage):
    a. DCU-9/A Selector Switches - SAFE
    b. DCU-9/A Warning Lights - Off, tested
    c. DCU-9/A Selector Switches - OFF
17. Internal BRIC - TRAIN and zero
18. Radar Pressure Pump Control Switch - NORMAL ON
19. Radar Camera Power Switch - OFF
20. Line-of-Sight Control:
    a. Boresight Switch - NOR
    b. Sighting Angle Control - Set 85
    c. Drift Control - Set 180
    d. Illum Switch - ON
21. Radar Control Unit:
    a. Power Switch - OFF
    b. Meter Switch - AC
    c. FTC Switch - OFF
    d. Illum Knob - CW

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

   e. Log-Lin Switch - LIN
   f. Operations Switch - RAD HI RES
   g. Sweep Delay Control - CCW and depressed
   h. Tilt Control - Zero
   i. Range Dial Control - Set 25 to 45 nautical miles

22. STC Amplitude Control Panel:
   a. STC Receiver Gain Control Switch - CCW
   b. STC Select Control - OFF
23. Radar Display Selector Switch - GM
24. Waveguide Selector Switch - MAN LOAD
25. Terrain Computer Power Switch - OFF
26. Air Outlet & Auxiliary Heat Knobs:
   a. Upper Outlet Knobs - 1/2 to full out
   b. Lower Outlet Knobs - Full out
   c. Auxiliary Heat Knob - Full in

NOTE

These knob settings are approximate settings only. After the cabin temperature has stabilized, knob adjustment may then be varied slightly for crew comfort.

27. Altitude Disable Switch - NORMAL
28. Optional Bombing Switch B-52D - AN/ASQ-48 NORMAL
29. BNS Primary Control:
   a. Function Switch - STAB
   b. PPI-OB Switch - PPI
   c. Radar Altitude Switch - OFF
   d. Illum Switch - ON
   e. Offset Switch - OUT
   f. Aux PPI or Nav Track Switch - OUT
30. Periscopic Bombsight:
   a. Main Switch - NORMAL
   b. Transfer Knob - NORMAL
   c. Filter Selector Knob - CLEAR

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

31. D-2 Bomb Release Switch - Stowed
32. Variac Control - CCW (to stop)
33. IP-618 Indicator:
    a. Bias Control - CCW
    b. Video Gain Control - CCW
    c. Bril Mark Control - CCW
    d. Range Lights Control - CW
34. Radar Camera:
    a. Recording Chamber Data Plate - Completed

    EXAMPLE:

    LAJUNTA
    OB-21
    P.D. 2-7
    30 June 70
    B-52D 5068
    SMITH C. S.

    b. Clock - Set to GMT

34A. Offset 1-2 or 3-4 Selector Switch **D** - OFFSET 1-2

35. Primary Control Function Switch - NAV
36. Ballistics Control Panel (Offset 1-2):
    a. ATF - Set
    b. Trail - Set
    c. Offset 1 - Set
    d. Offset 2 - Set
    e. Altitude Indicator - Set to minimum altitude
    f. Bomb Select Switch - L/S
    g. Illum Control - CW
37. Primary Control Function Switch - STAB (OFF for alert)
38. Altimeter - Set

    Set in accordance with AFM 51-37. On aircraft **ZV**, check that altimeter correction cards are installed.

WARNING

When setting altimeter, special attention should be given to the altimeter to insure the 10,000-foot pointer is reading correctly.

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

39. Crew Report - Completed (at pilot's request)
    a. The sequence for crew reporting is as follows: G, N, EW, RN, CP, P, IN, 10th man, bunk, and IP.
    b. Switch to CALL and report, "Radar navigator's station check complete."

       Station check consists of seat, oxygen, abandon signal and call light, interphone, and zero delay lanyard stowed.
40. Oxygen Regulator - OFF and 100% OXYGEN (if leaving the aircraft for an extended period of time)

AFTER ENGINE START

CAUTION

After engine start, do not turn BNS on until after being notified by the copilot that aircraft power is on the line and cooling air is available.

1. K-3A Heat Control Switch - NORMAL
2. Ground Blowers Switch - ON
3. Cabin Low Airflow Warning Light - Out
4. RCU Power Switch - STBY
5. Test Lights:
    a. Bomb Door Control Valve Lights - Tested
    b. Tone On Light - Tested
    c. Radar Low Pressure Warning Light - Tested
    d. Cabin Low Airflow Warning Light - Tested
    e. Autopilot Remote Controller Light - Tested
    f. Autopilot Engaged Light - Tested
    g. Autosteer Light - Tested
    h. MD-1 Light - Tested
    i. ACL Light - Tested
6. Radar Tuneup: (10-mile range light illuminated)
    a. Waveguide Selector Switch - AUTO
    b. RCU Power Switch - SCAN FAST
    c. Variac Control - Mag current 4.6 (check all voltages)
    d. STC Select Switch - 3
    e. STC Gate Amplitude Switch - 80
    f. STC Shape Switch - 75

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

g. Radar Indicator - Adjust and check

    (1) Range Marks - As desired

    (2) Scope - Centered

    (3) Heading Mark - 360 (±2°)

    (4) Scope Presentation - Optimum

    (5) Tilt - Adjusted

NOTE

If the AFC fails to lock on, turn the waveguide selector switch to MAN LOAD. Lock-on should occur. After lock-on, return waveguide selector switch to AUTO.

7. Radar Camera - Operation checked

8. BNS Check:

    a. Bomb Select Switch - SYN

    b. Primary Control Function Switch - NAV

    c. Crosshairs - Checked

    Check movement with tracking handle.

    d. Wind Dials - Set

    e. Latitude, Longitude & Magnetic Variation - Set

    Set to runway coordinates and correct magnetic variation if necessary.

    f. Primary Control Function Switch - STAB

    g. Bomb Select Switch - L/S

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

BEFORE TAKEOFF

NOTE

If BNS has not been turned off, omit circled items.

1. K-3A Heat Control Switch - NORMAL
② Ground Blowers Switch - ON
③ RCU Power Switch - STBY
④ Primary Control Function Switch - STAB
⑤ Radar Tuneup: (10-mile range light illuminated)
    a. Waveguide Selector Switch - AUTO
    b. RCU Power Switch - SCAN FAST
    c. Variac Control - Mag current 4.6 (check all voltages)
    d. STC - As desired
    e. Radar Indicator - Adjust and check
        (1) Range Marks - As desired
        (2) Scope - Centered
        (3) Heading Mark - 360 (±2°)
        (4) Scope Presentation - Optimum
        (5) Tilt - Adjusted
6. Special Weapons & ASM Lock Indicators - Indicate locked
7. Vertical Camera Master Switch - ON (after bomb bay doors are closed)
8. Vertical Camera Doors - Closed, light out
9. Vertical Camera Master Switch - OFF
10. Parachute, Survival Kit, Shoulder Harness, Arming Lanyard & Safety Belt - Fastened

Adjust shoulder harness to a snug condition while sitting well back in seat. Assemble shoulder harness loops and parachute arming lanyard anchor on safety belt as shown in figure 1-55.

WARNING

- To insure operation of the automatic opening parachute, arming lanyard anchor must be assembled on the safety belt in the manner shown in figure 1-55. Failure to properly assemble these units may cause fatal delay in separating from the seat and in opening the parachute.
- Insure that the parachute arming lanyard is not entangled in the parachute harness. Lanyard entanglement could cause failure in seat separation and failure of the automatic features of the parachute.

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

11. Pin No. 1 - Removed

12. Ejection Control Trigger Ring - Unstowed (respond at pilot's request)

WARNING

Check that the ejection trigger ring clears the periscopic bombsight. In the event it does not, position the seat aft until it does, then the seat may be positioned as desired. Interference between ejection trigger ring and periscopic bombsight could prevent successful ejection.

13. Bailout Bottle - Connected

14. Oxygen Regulator - As required

15. Forward Landing Gear - Checked

    Check visually through the optics for alignment. Check for evidence of fuel or hydraulic leaks in the landing gear area.

16. Optics - Closed (EWO only)

17. Altimeters - Rechecked and set (P-CP-RN)

    Pilot, copilot, and radar navigator recheck their altimeters with a known elevation.

18. Takeoff Report - As required

    Copilot announces over interphone "Crew, stand by for takeoff." Acknowledgement for crew members not required unless some discrepancy exists that may compromise successful completion of mission.

19. Overheat Protection Circuit Breaker - Out

NOTE

Accomplish just prior to aircraft air conditioning master switch being placed to RAM by the copilot.

CAUTION

Overheat protection circuit breaker must not be out for periods of time exceeding five (5) minutes with BNS turned on.

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

TAKEOFF

1. Acceleration Timing - Checked (navigator backup)

   As the pilot announces "Now" at 70 knots, start the stopwatch. If navigator is unable to check acceleration timing, announce over interphone "Coming up on ________ seconds" approximately 3 seconds prior to S_1 time. At S_1 time, announce "Now."

2. Primary Control Function Switch - NAV

3. Overheat Protection Circuit Breaker - In

AFTER TAKEOFF

1. Forward Landing Gear - Checked (except EWO)

   Check that forward wheels are braked and that the gear is fully retracted. Report only apparent malfunctions. Observe closely for evidence of fuel or hydraulic leaks.

   NOTE

   When carrying AGM-28 missiles, the rotating beacon will reflect from the polished surfaces of the missiles. The reflection from the left missile could easily be interpreted as flame or fire. When in doubt, the radar navigator should request the rotating beacon be turned off momentarily for a positive check of fire.

2. Altitude & Airspeed - Monitored

   Monitor altitude and airspeed for safe margin until aircraft has attained an altitude of 5000 feet above the terrain. Advise pilot if altitude falls below a safe margin or airspeed fails to show a positive increase.

3. Line-of-Sight Drift Control - Set zero

4. Bombing Select Switch - SYN

5. BNS Altitude - Adjusted

6. Thermal Curtain - Installed (EWO only) (RN-P-CP)

   Notify pilot and copilot to install thermal curtains after climb configuration is established.

   WARNING

   Failure to close thermal curtains as soon as practicable after takeoff may result in flash blindness from nuclear detonation.

7. Oxygen Check - Completed (G-EW-RN-CP)

   a. During climb, copilot requests an oxygen check at 12,000 feet. The sequence for oxygen report is gunner, EW officer, radar navigator, copilot. The reporting crew member will visually check other crew member for alertness. He will report oxygen check for both positions. Oxygen panel at each occupied crew position will be checked on all oxygen checks for:

      (1) Oxygen Supply Shutoff Lever - ON

      (2) Regulator Diluter Lever - As required

      (3) Pressure - 300 psi

      (4) Flow Indicator - Functions normally

      (5) Emergency Toggle Lever - NORMAL

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

b. Gunner and copilot report, "Cabin altitude________ feet. Oxygen panel checked."

c. EW officer and radar navigator report, "Oxygen panel checked."

d. Copilot notify aircrew and receive gunner's acknowledgement when passing through 25,000, 35,000, and 40,000 feet.

e. The copilot will request an oxygen check at level-off. During cruise, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes and initiate the oxygen checks at 30-minute intervals when both cabin altitudes are below 12,000 feet, at 15-minute intervals when either cabin altitude is 12,000 to 25,000 feet, and at no longer than 10-minute intervals when either cabin altitude is above 25,000 feet. If cabin altitude is below 12,000 feet, only the gunner and copilot will report. The remaining crew members will check their equipment and report if abnormal.

8. Altimeter - Set

CSS ENABLING PROCEDURE A

CSS enabling will be accomplished as soon as possible after receipt of a valid "Go Code."

NOTE

> For any abnormal indications, refer to "CSS Malfunction Analysis" in T.O. 1B-52C-25-2 or T.O. 1B-52C-30-1.

1. Coded Switch Set Controller (CSSC):

   a. Lamp Test Button - DEPRESSED

   DISEN, ENABLE, and CODE lights should illuminate.

   b. Enable Code ________ - Set

   Set enable code received in strike message in CSSC by rotating thumbwheels.

   c. OPER/MON Switch - OPER

   Code light should blink until end of cycle (approximately 2 minutes).

   d. CODE & ENABLE Lights - On

   Illumination of ENABLE light indicates enabling of prearming circuits.

   e. OPER/MON Switch - MON (momentarily)

   CODE and ENABLE lights should go off.

NOTE

> System status (enable/disenable) may be verified at any time by holding the OPER/MON switch in MON and observing DISEN and ENABLE light indication.

All data on pages 8-20A and 8-20B (Deleted)

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

AFTER LEVEL-OFF

1. BNS - Set

   Assure the proper setting of altitude, wind, latitude, and longitude for accurate route navigation.

BEFORE DESCENT

1. Terrain Computer Power Switch - As required

   If terminal area TA calibration is required, a 30-minute warmup period for the terrain computer is necessary.

2. Time of Fall Indicator - Set 0 sec
3. Trail Indicator - Set 0 ft
4. Offset - Set

   Set components from approach end of runway to selected OAP.

NOTE

Nuclear bombs aboard, complete the following safety check.

5. Normal Release & Salvo Power Circuit Breakers - Out
6. Emer Door Open & Rel Circuit Breaker **B-52D** - Out
7. Release Circuits Disconnect - Disconnected
8. Master Bomb Control Switch - OFF
9. Bombing System Switch - MANUAL
10. Readiness Switch Cover - Closed, latched (RN-P)
11. Special Weapons Lock Indicators - Indicate locked
12. Special Weapons Monitor Check (Multiple Carriage):
    a. DCU-9/A Selector Switch - SAFE
    b. DCU-9/A Warning Light - Off, tested (each position of SWK box)
    c. DCU-9/A Selector Switch - OFF
    d. SWK Monitor Select Switch - OFF
    e. SWK Box Illumination Control - Full CCW

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

12. Special Weapons Monitor Check (Single Carriage):
    a. DCU-9/A Selector Switch(es) - SAFE
    b. DCU-9/A Warning Light(s) - Off
    c. DCU-9/A Selector Switch(es) - OFF

NOTE

External missiles aboard, complete the following safety check.

13. Release Circuits Disconnect - Disconnected
14. ASM Lock Indicators - Indicate locked
15. Readiness Switch Cover - Closed, latched (RN-P)

DESCENT AND BEFORE LANDING

CAUTION

Monitor the overheat and low airflow warning lights. If necessary, request that power be advanced on engine 3 or 4 (usually No. 4) to keep the cabin low airflow light out.

1. Penetration & Approach - Reviewed (P-CP-RN-N)

   Review the planned penetration and approach with the applicable crewmembers. Intermediate altitude restrictions, ceiling and visibility minimums, MDA/DH, and missed approach procedures will be emphasized.

2. Altimeter Setting - Determined and set (RN-N-P-CP)

   When the altimeter setting is received from appropriate air traffic control facility, a comparison should be made with the appropriate forecasted altimeter setting. Reset altimeter to station pressure immediately prior to initiating penetration or upon passing through transition altitude. When mission requirements dictate and current altimeter setting is not available, compute an altimeter setting using metro or in-flight "D" values.

3. Initial Point - Made good

   The radar navigator coordinates with the pilot in monitoring or directing aircraft path to the VOR station or any other reference point to be used for initiating the penetration, arriving over the point on the desired heading for initial descent.

4. Penetration - Initiated

   Upon reaching point of initial penetration, the jet penetration as published in the Flight Information Publication will be initiated. Monitor or direct aircraft path over the ground and advise the pilot of any deviation from published penetration.

5. Descent Altitude Calls - Accomplish
   a. Coordinate with the pilot as to level-off altitude(s) to be used for descent and entry to landing pattern.
   b. Call off altitude to pilot every 5000 feet during descent beginning at first multiple of 5000 feet. Upon reaching level-off altitude plus 5000 feet, report altitude to pilot every 1000 feet and at level-off altitude.

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

6. Forward Landing Gear - Checked

   Immediately after gear is extended, check for proper extension and alignment. Observe closely for indications of fuel or hydraulic leaks. During transition, the radar navigator will check the gear after each landing. Do not report unless a discrepancy exists.

   NOTE

   When carrying AGM-28 missiles, the rotating beacon will reflect from the polished surfaces of the missiles. The reflection from the left missile could easily be interpreted as flame or fire. When in doubt, the radar navigator should request the rotating beacon be turned off momentarily for a positive check of fire.

7. Altitude - Set

   Upon reaching traffic pattern altitude, set pressure altitude minus field elevation.

8. Crosshairs - Positioned

   Place crosshairs on offset aimpoint or the approach end of runway with the inner edge of the range marker on the edge of no return.

9. Primary Control Function Switch - TRACK

   Monitor aircraft path over the ground and advise pilot of any departure from prescribed penetration.

10. Traffic Pattern - Monitored or directed

    Monitor or direct the aircraft throughout the approach pattern being flown, advising the pilot of any deviation noted or discrepancies between the approach and airborne radar. Radar navigator will monitor altitude throughout the pattern.

11. PDI - Centered (on final approach)

    If it is a directed approach, the PDI and time-to-go meter will be used to make the final approach. If it is a monitored approach, the PDI and time-to-go meter may be cross-checked by the pilot to determine progress on final approach.

12. Final Descent - Initiated

    The descent phase normally will be commenced when the time-to-go meter reads approximately 200 seconds. Altitude should be checked at 100 seconds (1000 feet altitude) and 60 seconds (600 feet altitude). The time-to-go meter will read zero when the aircraft is approximately 1000 feet down the runway.

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

AFTER LANDING

CAUTION

Monitor the overheat and low airflow warning lights. If necessary, turn equipment off.

1. Radar Camera:
    - a. Expose 20 frames
    - b. Power Switch - OFF
2. Primary Control Function Switch - STAB
3. Bias Control - CCW
4. Video Gain Control - CCW
5. Variac Control - CCW (to stop)
6. STC Receiver Gain Control Switch - CCW
7. Waveguide Selector Switch - MAN LOAD
8. RCU Power Switch - STBY
9. Ejection Control Trigger Ring - Stowed
10. Pin No. 1 - Installed
11. Nuclear Bombs Aboard - Accomplish bomb "After Landing" checklist (T.O. 1B-52C-25-2CL-1)

All data on pages 8-22C and 8-22D (Deleted)

RADAR NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

AFTER PARKING

1. Ejection Seat - Position forward and up
2. Primary Control Function Switch - OFF
3. Terrain Computer Power Switch - OFF
4. RCU Power Switch - OFF
5. Ground Blowers Switch - OFF
6. Inform Pilot - BNS off
7. Bomb Indicator Lights Switch - OFF
8. Interphone - Disconnected after engines off
9. Radar Pressure Pump Control Switch - OFF
10. Oxygen System:
    a. Regulator - OFF and 100% OXYGEN
    b. Supply Hose & Interphone Cord - Stowed
11. Compass Cutoff Switch - OFF
12. Nuclear Bombs Aboard - Accomplish "Ground Safeing Checklist" (T.O. 1B-52C-25-2CL-1) (MMS not available)
13. Missiles Aboard & Qualified Personnel Not Available - Accomplish "Missile Ground Safeing" checklist (N/RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING PROCEDURES (NUCLEAR)

BOMBING-GENERAL

On training missions after practice bombs have been released, a crew member will make a visual check of the bomb bay prior to RBS runs, camera attacks, or landing. This is to insure that all bombs and munitions have been released and that there are no objects that could fall from the bomb bay when the bomb doors are opened.

Procedures for use of the special weapons manual release handles are contained in the checklist "Emergency Manual Bomb Release." Proper usage of the special weapons manual release handles for each bomb and the type of release system is described in T.O. 1B-52C-25-1, Section II. If the planned method of release fails, an emergency release will be accomplished by use of the special weapons manual release handles.

The normal multiple carriage release sequence is LR, UR, LL, and UL. This sequence is dependent on closing the doors between releases. If the doors do not close after any release, the master bomb control switch can be turned OFF and then ON in order to maintain the normal sequence.

Prior to making any bomb runs, the BNS true heading will be checked using the automatic astrocompass on headings as close as possible to the planned bomb run headings. This heading error will be recorded. If the automatic astrocompass is inoperative, these heading checks will be made with the periscopic sextant. If, for any reason, it is impossible to obtain an astro heading check on or near the bomb run heading, the best available true heading correction will be applied to the BNS true heading for the bomb run.

The radar navigator will advise the pilot to center the PDI during the bomb run. If desired, BNS (second station) steering may be requested.

The navigator will monitor all phases of the bomb run. He will indicate to the radar navigator any apparent errors in crosshair placement, proper use of offset, GPI coordinate settings, timing, and release headings. Switch positions, warning lights, the MD-1, and doppler will be continuously checked and the radar navigator advised as necessary. The navigator will record all pertinent bombing data, monitor the breakaway turn, and provide the crew adequate warning concerning detonation times and, for programmed high altitude releases, shock arrival times.

MULTIPLE RELEASES

A Large Charge bomb run is normally accomplished by bombing the first target, using radar synchronous techniques and either timing the second bomb run or if the distance between targets permits, bombing both targets radar synchronous, using ACL or GPI techniques. In either case, the navigator determines a time and heading from the first release to the second release, using the most reliable information available. For all practical purposes, the time and heading between releases is the same as the time and heading between targets. The pilot must turn the aircraft to the desired heading immediately after release and stopwatches will be started by applicable crew members. Use the "Bomb Run (Synchronous)" checklist through "bombs away" on the first target and either timing or synchronous procedures for the second target. If the second release is by timing, the bomb doors must be opened manually and the D-2 bomb release switch activated at the expiration of the time between targets. Large Charge bomb runs may also be accomplished using timing procedures over, or abeam, a known timing point using the "Bomb Run (Alternate)" checklist for both releases.

Other multiple releases may be accomplished, bombing three or four targets from a single IP. This will require various combinations of synchronous and timing procedures, necessitating careful planning, precise crew coordination, and optimum use of bomb run checklists. The navigator will determine a time from the first target to each of the succeeding targets and the headings between each target. Additional timing computations will be necessary whenever timing is to be restarted from a synchronous second or third release of a series. Use the "Bomb Run (Synchronous)" checklist if the first target is radar synchronous. For succeeding targets, use timing or synchronous checklist block, as required. Use the "Bomb Run (Alternate)" checklist if the release on the first target requires timing procedures, repeating for succeeding targets, as required.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING PROCEDURES (NUCLEAR) (Cont)

BOMBING—ALTERNATE

When the status of the BNS is such that a radar synchronous bomb run cannot be accomplished, the crew must evaluate the system and complete the bomb run by the most accurate and reliable means remaining.

GPI Bombing

If the computer is operational, but the radar presentation is unusable, or offset distance is too great, a GPI bomb run may be accomplished using the "Bomb Run (Synchronous)" checklist.

Timing

All other alternate bomb runs are basically timing runs and the "Bomb Run (Alternate)" checklist will be used. Bombing by timing is primarily a method of bombing by establishing a track, and determining an ETA, to the bomb release point. Every bomb run should be planned as a timing bomb run so that if, at any time, a radar synchronous run is not possible, the bomb run can be completed using a timing backup.

Timing can be from a visual, celestial, or radar fix. A stopwatch can be started at a certain TG value while on a synchronous bomb run. Timing can be initiated when the target, or aiming point, is coincident with a fixed range mark. In this case, track is established by using multiple drift procedures, or by placing the etched cursor through the target, and turning the aircraft so that the heading marker is drift angle upwind. The "Multiple Drift Factors Chart" may be used as an aid in establishing the track to the target. The ETA to the bomb release point can be computed by determining the ETA to the target and subtracting the actual range expressed in time. Actual range in seconds can be extracted from the "Actual Range in Seconds Computation Chart" or by using this formula:

$$\text{AR in seconds} = \frac{\text{AR (feet)}}{\text{GS (feet per second)}}$$

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR)

BOMBING SYSTEMS CHECK

NOTE

- This check may be performed as soon as practicable after level-off and must be completed prior to Missile Preparation for Launch or Weapons Preparation for Release, whichever occurs first.
- It is imperative that the following steps be completed in sequence:

1. Safety Check: (RN) Monitor (N)
    a. Bombing System Switch - MANUAL
    b. Special Weapons & ASM Lock Indicators - Indicate locked
    c. Release Circuits Disconnect - Disconnected, sealed
    d. Master Bomb Control Switch - OFF
    e. Emergency Armed Release Switch B-52D - OFF, sealed
    f. Notify Crew "Safety check complete"
2. MADREC - AUTO (N)
3. Bombing Equipment Check: (RN)
    a. Normal Release Circuit Breaker - Out (RBS only - In)
    b. Circuit Breakers - Checked, set

NOTE

AGM-28 circuit breakers set as required.

    c. Internal BRIC (RBS Only) - SEL, light on B-52C, light dim B-52D
    d. Bomb Select Switch - SYN
    e. PPI-OB Switch - OB
    f. Crosshairs - Positioned

    Position crosshairs along the heading of the aircraft a sufficient distance to permit completion of the equipment check.

    g. Function Switch - BOMB
    h. Time-to-Go Indicator - Checked for drive (RN-P)

    Request pilot call TG at 30-second intervals, at 20 seconds for RBS, and at TG zero.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

i. ATF - Checked

Increase; drive of time-to-go meter should be momentarily speeded up. Decrease; drive of time-to-go meter should stop momentarily.

j. Trail - Checked

Increase; drive of time-to-go meter should stop momentarily. Decrease; drive of time-to-go meter should be speeded up momentarily.

k. PDI - Checked (RN-P)

Request pilot observe steering needle response to tracking handle corrections to both sides of center and return to zero.

l. Second Station - Requested

m. Second Station Check - Completed

Using tracking control, check for response of the aircraft to a turn. Release tracking control; aircraft should return to straight and level flight with steering needle centered. Repeat for a turn in the opposite direction.

n. Offset Checks - Completed

Check offsets 1 and 2 (and, on **D** aircraft, offsets 3 and 4) in turn, and observe that the crosshairs are correctly displaced.

o. UHF Radios (RBS Only) - Set (RN-CP)

Notify copilot to switch radio to briefed frequency.

p. Bomb Tone Scoring Switch (RBS Only) - INITIATE

Check tone break with D-2 bomb release switch, reinitiate tone at 20 seconds T_G for automatic tone break.

q. Bomb Release Check: (RN)

    (1) Tone Break (RBS Only) - Checked

    (2) Time-to-Go Indicator - Indicates zero

    (3) Bomb Release Light - On momentarily

    (4) Function Switch - TRACK

r. PPI-OB Switch - PPI

s. Internal BRIC - TRAIN, zero

4. Crew notified "Bombing system check complete"

5. MADREC - STDBY (N)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST NUCLEAR (Cont)

WEAPONS PREPARATION FOR RELEASE/MISSILE PREPARATION FOR LAUNCH (STRIKE MISSIONS ONLY)

NOTE

- Perform this checklist within the 15-minute period prior to HHCL or within the 15-minute period prior to point of descent, or within the 15-minute period prior to launch, whichever is reached first, and only after the receipt of a valid "Go Code."
- Navigator will monitor the WPR and insure completion of all items. Radar navigator will monitor the MPL and insure completion of all items.
- It is imperative that the following steps be completed in sequence. Missile preparation for launch may occur before weapons preparation for release and therefore alter the sequence of weapons preparation for release steps.

1. Thermal Curtains & Optics - Checked, closed, and fastened (RN-G-P-CP)
2. Cabin Pressurization - Combat (if applicable) (RN-G-CP)
3. Personal Locator Beacon Lanyards - Notify crew to set as required (N)

   Mission requirements will dictate the configuration of the personal locator beacon lanyard.
4. Bomb Bay & Walkway Lights Circuit Breakers - Out (RN)
5. Normal Release & Salvo Power Circuit Breakers - In (RN)
6. Release Circuits Disconnect Door - Seal broken, opened (RN)
7. Special Weapons Manual Lock Handle - Pulled, stowed (RN-EW)

NOTE

Accomplish these steps if internal bombs are to be released.

8. Forward & Rear Special Weapon Manual Release Handles - Seals broken (RN/N)
9. Bomb Readiness Switches - READY (RN-P)
10. DCU-9/A Selector Switches - SAFE (RN)
11. Special Weapons, Pre-Arming (Multiple Carriage): (RN)
    a. DCU-9/A Warning Light - Off, tested (each position of SWK box)
    b. DCU-9/A Selector Switch - GND or AIR (as briefed)
    c. DCU-9/A Warning Light - Off, tested (each position of SWK box)
    d. SWK Monitor Select Switch - First bomb to be released

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

11. Special Weapons Pre-Arming (Single Carriage): (RN)
    - a. **DCU-9/A Warning Light(s) - Off, tested**
    - b. DCU-9/A Selector Switch(es) - GND or AIR (as briefed)
    - c. DCU-9/A Warning Light(s) - Off, tested
12. Special Weapons Lock Indicators - Indicate unlocked (RN)
13. Bomb Indicator Lights - Off, tested (multiple carriage) (RN)
13. Fwd/Aft Weapon Released Lights - Off, tested (single carriage) (RN)
14. Special Weapons Select Switch - FWD/AFT (as required) (RN)
15. Bomb Release Mode Selector Switch **B-52 I** - NORMAL, safetied (RN)

NOTE

Accomplish these steps if AGM-28 missiles are to be launched.

16. AGM-28:
    - a. ASM Separation (4) & Jettison Control (2) Circuit Breakers - In (N)
    - b. All ASM Circuit Breakers - Checked in (N)
    - c. ASM Lock Indicators - Indicate UNLOCKED (RN)
    - d. External Missile Manual Release Seal - Broken (RN)
    - e. Tactical Altitude Selector Switches - As briefed (N)
    - f. Armament Selector Switches - SAFE (N)
    - g. Armament Warning Lights - Off, tested (N)
    - h. Warhead Lights - Off, tested (N)
    - i. Safe Time Interval Knobs - Briefed setting (N)
    - j. ASM Readiness Switches - **READY (N-P)**
    - k. Armament Selector Switches - Briefed setting (N)
    - l. Armament Warning Lights - Off, tested (N)
    - m. Warhead Lights - On (N)
    - n. ASM Released Lights - Off, tested (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

WEAPONS PREPARATION FOR SIMULATED RELEASE/MISSILE PREPARATION FOR SIMULATED LAUNCH (TRAINING MISSIONS ONLY)

NOTE

- Perform this checklist within the 15-minute period prior to HHCL or within the 15-minute period prior to point of descent or within the 15-minute period prior to simulated launch, whichever is reached first.
- Navigator will monitor the WPSR and insure completion of all items. Radar navigator will monitor the MPSL and insure completion of all items.
- It is imperative that the following steps be completed in sequence. Missile preparation for simulated launch may occur before WPSR and therefore alter the sequence of WPSR steps.

1. Thermal Curtains & Optics - Checked, closed and fastened (RN-G-P-CP)
2. Cabin Pressurization - Combat (if applicable) (RN-G-CP)
3. Personal Locator Beacon Lanyards - Notify crew to set as required (RN/N)

   Mission requirements will dictate the configuration of the personal locator beacon lanyard.
4. Bomb Bay & Walkway Lights Circuit Breakers - Out (RN)
5. Normal Release & Salvo Power Circuit Breakers - In (RN)
6. Released Circuits Disconnect Door - Seal broken, opened (RN)

NOTE

Do not break seal on training missions when AGM-28 missiles are carried.

7. Special Weapons Manual Lock Handle - Pulled, stowed (RN-EW)

WARNING

Do not pull special weapons manual lock handle on training missions when AGM-28 missiles are carried.

NOTE

- For training, when releases are to be made on a designated bombing range, the special weapons racks will not be unlocked until the aircraft is actually over the bombing range.
- Accomplish these steps if internal bombs are to be simulated released.

8. Forward & Rear Special Weapon Manual Release Handles - Seals broken (RN/N)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

9. Bomb Readiness Switches - READY (RN-P)

WARNING

On training missions when AGM-28 missiles are carried, the readiness switch cover will remain closed and sealed.

10. DCU-9/A Selector Switches - SAFE (RN)

11. Special Weapons, Pre-Arming (Multiple Carriage): (RN)

    a. DCU-9/A Warning Light - Off, tested (each position of SWK box)

    b. DCU-9/A Selector Switch - GND or AIR (as briefed)

    c. DCU-9/A Warning Light - Off, tested (each position of SWK box)

NOTE

On training missions when AGM-28 missiles are carried and the readiness switch cover remains closed, the warning lights will be on.

    d. SWK Monitor Select Switch - First bomb to be released

11. Special Weapons Pre-Arming (Single Carriage): (RN)

    a. DCU-9/A Warning Lights - Off, tested

    b. DCU-9/A Selector Switches - GND or AIR (as briefed)

    c. DCU-9/A Warning Lights - Off, tested

NOTE

On training missions when AGM-28 missiles are carried and the readiness switch cover remains closed, the warning lights will be on.

12. Special Weapons Lock Indicators - Indicate unlocked (RN)

NOTE

On training missions when AGM-28 missiles are carried, the ASM lock indicators must indicate locked.

13. Bomb Indicator Lights - Off, tested (multiple carriage) (RN)

13. Fwd/Aft Weapon Released Lights - Off, tested (single carriage) (RN)

14. Special Weapons Select Switch - FWD/AFT (as required) (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

15. Bomb Release Mode Selector Switch **B-52** **1** - NORMAL, safetied (RN)

NOTE

Accomplish these steps if AGM-28 missiles are to be simulated launched.

16. AGM-28:
    - a. ASM Circuit Breaker Panels: (N)
        - (1) ASM Separation (4) & Jettison Control (2) Circuit Breakers - Out
        - (2) All Other Circuit Breakers - In
    - b. ASM Lock Indicators - Indicate locked (RN)
    - c. External Missile Manual Release Handle - Sealed (RN)
    - d. Tactical Altitude Selector Switches - As briefed (N)
    - e. Readiness Switch Cover - Closed and sealed (N-P)
    - f. Armament Selector Switches - SAFE (N)
    - g. Armament Warning Lights - OFF, tested (N)
    - h. Safe Time Interval Knobs - As briefed (N)
    - i. Warhead Lights - Off (N)
    - j. ASM Released Lights - OFF, tested (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

HIGH ALTITUDE (NUCLEAR)

BEFORE PRE-IP

The following checks are to be completed within 1 hour of the Pre-IP:

1. Altitude Measurement - Completed (RN)
2. Bombing Data Form - Completed, cross-checked (RN-N)
3. Bombing Data: (RN-N)
    a. ATF - Set (RN)
    b. Trail - Set (RN)
    c. Offset 1 & 2 - Set (RN)
    d. Offset 3 & 4 D - Set (N)
4. Heading Mode Selector Switch - Best available position (N)

BEFORE IP

1. DCU-9/A Selector Switch(es) - GND or AIR (as briefed) (RN)
2. DCU-9/A Warning Light(s) - Off, tested (each position of SWK box-multiple carriage) (RN)

NOTE

> On training missions when AGM-28 missiles are carried and the readiness switch cover remains closed, the warning lights will be on.

3. SWK Monitor Select Switch - Bomb to be released (multiple carriage) (RN)

All data on page 8-29 (Deleted)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

4. Circuit Breakers - Checked (RN)

5. Bomb Door Control Circuit Breakers - Checked (RN-P)

6. Internal BRIC - SEL, light on **B-52C**, light dim **B-52D** (RN)

CAUTION

B-52D

A steady bright light will indicate internal shorting of the B-3C BRIC. If this malfunction occurs, do not attempt release using the BNS or D-2. Release will be accomplished using the "Emergency Manual Bomb Release" procedures.

7. MADREC - AUTO (N)

8. AGM-28 Simulated Launch Switches (RBS only) - OFF (N)

9. Special Weapons Select Switch - FWD/AFT (as required) (RN)

10. Bombing Data Check:

	NAV CALLS	RESPONSE
a.	"Altitude"	"Reads ________" Set TGT/OAP (RN)
b.	"ATF"	"Reads ________" (RN)
c.	"Trail"	"Reads ________" (RN)
d.	"Offset 1"	"Reads ________ and ________" (RN)
e.	"Offset 2"	"Reads ________ and ________" (RN)
f.	"Offset 3 **D** "	"Reads ________ and ________" (N)
g.	"Offset 4 **D** "	"Reads ________ and ________" (N)

11. Over IP - Notify pilot and give initial headings for all bomb runs (N)

12. Radar Recording Camera Switches - 1:4 (RN)

13. Terrain Computer Power Switch - As required (RN)

NOTE

The terrain computer power switch must be on for at least 90 seconds to provide AJ1 capability.

14. Landing Gear Standby Pumps **B-52D** - ON (combat only) (N-P)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

LOW ALTITUDE (NUCLEAR)

BEFORE DESCENT

NOTE

The circled numbers indicate items that must be rechecked or reaccomplished prior to additional low level bomb runs.

1. Terrain Computer Power Switch - ON (approximately 1 hour prior to descent) (RN)

WARNING

A 30-minute warmup time for the terrain computer is required before reliable terrain avoidance operation is available.

2. In-Flight TA Functional Check - Accomplished (RN-N)

Use the "In-Flight TA Functional Check" checklist.

③ Circuit Breakers - Checked (RN)

④ Bomb Door Control Circuit Breakers - Checked (RN-P)

⑤ Special Weapons Select Switch - FWD/AFT (as required) (RN)

6. BRIC - SEL, light on **B-52C**, light dim **B-52D** (RN)

CAUTION

B-52D

A steady bright light will indicate internal shorting of the B-3C BRIC. If this malfunction occurs, do not attempt release using the BNS or D-2. Release will be accomplished using the "Emergency Manual Bomb Release" procedures.

7. Radar Recording Camera Switches - ON, 1:12 (RN)

⑧ FRL Angle-of-Attack Indicator - Set (N); Cross-checked (RN)

Set FRL angle-of-attack indicator for the predicted conditions at the TA calibration point, reference figure 8-7. The FRL angle-of-attack will have to be reset periodically during terrain avoidance system flight due to changes in aircraft gross weight and/or airspeed.

NOTE

- The FRL angle-of-attack should be up-dated to maintain the set-in value accurate within 0.2°.
- The FRL angle-of-attack values should be computed for zero airbrakes, as required.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

9. Bombing Data Form - Completed, cross-checked (RN-N)
10. TA Calibration Altitude - Computed and cross-checked (RN-N)

    Forecast altimeter setting and "D" values from PFSV will be used.

11. Bombing Data: (RN-N)
    a. ATF - Set (RN)
    b. Trail - Set (RN)
    c. Offsets 1 & 2 - Set (RN)
    d. Offsets 3 & 4 **D** - Set (N)
12. Bombing Data Check:

	NAV CALLS	RESPONSE
a.	"ATF"	"Reads ________." (RN)
b.	"Trail"	"Reads ________." (RN)
c.	"Offset 1"	"Reads ________ and ________." (RN)
d.	"Offset 2"	"Reads ________ and ________." (RN)
e.	"Offset 3 **D**"	"Reads ________ and ________." (N)
f.	"Offset 4 **D**"	"Reads ________ and ________." (N)

13. MADREC - AUTO AGM-28 (N)
14. Engine Control Knobs (AGM-28B) - MAX CONT (N-CP)
15. AGM-28 Flight Control Power Switch(es) - ON (N)

NOTE

On AGM-28 sorties, the flight control power switch(es) should be placed on for any altitude changes of 5000 feet or more.

16. AGM-28 Track Switch - STANDBY (if applicable) (N)
17. AGM-28 Simulated Launch Switches - ON (if applicable) (N)
18. BNS Radar Set to Alignment Frequency - Accomplished (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

DESCENT AND AFTER DESCENT

NOTE

> The circled numbers indicate steps that must be rechecked or reaccomplished prior to additional low level bomb runs.

1. Altimeter Setting - Determined and set (RN-N-P-CP)

   Compute a level-off altimeter setting using metro or in-flight D values. PFSV or ARTC altimeter settings will be used if available. Reset altimeter to station pressure immediately prior to initiating penetration or upon passing through transition altitude.

2. Descent Point - Pilot notified (N)

3. Altitude Calls - Accomplished (RN)

   Coordinate with the pilot as to level-off altitude(s) to be used for descent and entry to the low altitude navigation leg. Radar navigator calls off altitude to the pilot every 5000 feet starting with the first multiple of 5000 feet. Upon reaching initial level-off altitude plus 5000 feet, the radar navigator informs the pilot every 1000 feet and at level-off altitude. Coordinate with the pilot as to proper heading and altitude to be used during the low altitude navigation leg at each change of heading and/or altitude.

4. Altitude Measured (if applicable) - Accomplished (RN)

   Level-off momentarily and measure altitude at as low an altitude as practical if over reasonably level terrain of known elevation.

5. Level Off at IFR Altitude/Emergency Minimum Safe Altitude - Accomplished (P-CP-RN-N)

NOTE

> For descent into Low Altitude High Speed routes (VFR), initial level-off should be made at the planned emergency minimum safe altitude for that segment.

6. AGM-28 Simulated Launch Switches - OFF (if applicable) (N)

7. AGM-28 Track Switch - SLAVE (if applicable) (N)

⑧ Bombing Altitude - Set (for target No. 1) (RN)

⑨ Altitude Disable Switch - DISABLE (RN)

10. Radar Altimeter Indicators & Pressure Altimeters - Cross-checked (P-CP-RN-N)

    Compute true altitude by adding radar altimeter reading to terrain elevation and cross-check with the pressure altimeters. If the IFR altitude/emergency minimum safe altitude exceeds 5000 feet absolute altitude (radar altimeter capability), the cross-check must be made as soon as a lower absolute altitude permits.

10A. Altimeters - Reset (P-CP-RN)

Forecast altimeter setting obtained from PFSV will be used for TA calibration.

11. Level Off at Predetermined TA Calibration Altitude - Accomplished (P-CP-RN-N)

    Level off will be at 800 feet above the calibration terrain feature or point.

12. Radar Altimeter Indicators & Pressure Altimeters - Cross-checked (P-CP-RN-N)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

13. TA Calibration - Accomplished (P-CP-RN-N)

NOTE

- The radar navigator will be responsible for monitoring altitude and position during the TA calibration checks.
- The radar navigator is responsible for monitoring terrain beyond the range selected on the pilots' terrain display indicators. The radar navigator will alert the pilot when approaching the preselected calibration area and will make a 10-mile range call and continue 1-mile range calls until the pilot acknowledges that the terrain feature is present on the terrain display indicator.
- The navigator will record all readings made by the pilot during this check on SAC Form 449 and announce the corrections to be applied.

14. TA System Error Compensation - Accomplish if applicable (P-CP-N/RN)

If a system error exists, the TA system error compensation procedures in Section IV should be accomplished, time and/or conditions permitting. Normally, a minimum of 60 miles will be required prior to commencing the bomb run to facilitate accomplishment of calibration and error compensations, if required. If time and/or conditions do not allow the necessary compensation procedures to be accomplished, the published IFR altitude will be maintained. In any event, in-flight calibration data and TA system error computations will be recorded on SAC Form 449.

15. Altimeters - Set (to true altitude) (P-CP-N)

True altitude will be determined from an altitude measurement if possible; otherwise, use the predicted "D" value converted to an altimeter setting. When accurate altimeter settings for the route are available, set and update as necessary.

NOTE

If over reasonably level terrain of known elevation and absolute altitude is less than 5000 feet, true altitude may be determined by adding radar altimeter reading to terrain elevation.

16. Final Descent to TA Altitude - Monitored (RN-N)

NOTE

- Radar navigator and navigator will monitor radar scope presentations. The navigator will monitor all other instruments available.
- The radar navigator provides terrain assessments beyond the pilot's range. When hazardous terrain is observed, the radar navigator will continue to advise pilot until pilot is tracking obstacle on his indicator.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (cont)

BEFORE IP

NOTE

These steps must be rechecked or reaccomplished prior to additional low level bomb runs.

1. DCU-9/A Warning Light(s) - Off, tested (each position of SWK box-multiple carriage) (RN)

NOTE

On training missions when AGM-28 missiles are carried and the readiness switch cover remains closed, the warning lights will be on.

2. SWK Monitor Select Switch - Bomb to be released (multiple carriage) (RN)
3. Target Area Altimeter Setting - Set (P-CP-N)

   Pressure altimeters may be calibrated using radar altimeter if time and conditions permit.

4. Radar Recording Camera - 1:4 (RN)
5. FRL Angle-of-Attack Indicator - Updated (N); Cross-checked (RN)
6. Over IP - Notify pilot and give initial headings for all bomb runs (N)

BOMB RUN (NUCLEAR)

SYNCHRONOUS

1. Bomb Select Switch - SYN (RN)
2. Target or Offset - Acquired (RN)
3. Target No. 2, 3, or 4 Coordinates (As Required) - Set (RN-N)
4. Primary Control Function Switch - BOMB (RN)

NOTE

To withhold release, place function switch to TRACK and proceed (multiple release) to applicable checklist for next release or (single release) to "Post Bomb Release Checklist." If no further releases are to be made, accomplish "Abort Procedures Checklist."

5. Pilot's Bombs-Released Light - Off, tested (RN-P)

   If the pilot's bombs-released light is illuminated, attempt to reset BRIC by moving BRIC switch to TRAIN with counter knob at zero, then back to SEL.

WARNING

With the pilot's bombs-released light illuminated, opening the bomb doors after completion of the release configuration check could result in an immediate release.

NOTE

If pilot's bombs-released light remains illuminated, release must be accomplished using the "Emergency Manual Bomb Release" procedures.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

6. Release Configuration Check:

	NAV CALLS	RN RESPONSE
a.	"RCD"	"Connected, light on"
b.	"BRIC"	"SEL, light on B-52C, light dim B-52D"
c.	"Master Bomb Control Switch"	"ON, light on"
d.	"Bombing System Switch"	"AUTO"
e.	"Bomb Door Control Valve Lights Off"	

7. Bomb Tone (RBS Only) - On (20 seconds prior to bomb release) (RN)

8. Bomb Door Opening Monitored - Bomb doors open (RN/P)

NOTE

- If doors fail to open automatically, place the bombing system switch in MANUAL and attempt opening with bomb door open switch. If doors cannot be opened by any means, release must be accomplished using "Emergency Manual Bomb Release" procedures.
- Emergency bomb door open switch is restricted from use with nuclear weapons.

9. Bomb Release Monitored - "Bomb Away" (RN/P)

Bomb release will be indicated by the applicable weapon released or bomb indicator light illuminating.

NOTE

- If the BNS fails to effect a release, release must be accomplished using "Emergency Manual Bomb Release" procedures.
- The D-2 switch will never be used as an alternate method of triggering the BRIC during an apparent failure of the BNS to effect a release. A premature actuation of the D-2 switch could result in a multiple release.

10. Bomb Doors - Closed (multiple carriage) (RN)

NOTE

If BNS fails to close bomb doors automatically, place bombing system switch in MANUAL and attempt closure using bomb door switch. If doors still fail to close, recycle master bomb control switch to OFF then ON to maintain normal release sequence.

11. Special Weapons Select Switch - FWD/AFT (as required) (single carriage) (RN)

For single carriage, alternate bay must be selected for release of second bomb.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (cont)

Multiple Releases

NOTE

- If any subsequent release is to be synchronous, accomplish the following.
- Step "12" will be accomplished only if DTO method is being utilized.

12. DTO Only: (RN)

    a. Offset Switch - 1 (or as required) and IN

    b. DTO Switch - Depressed (if applicable)

    Depress momentarily and immediately following release of DTO switch, perform step "c." R_G limit light should illuminate and remain illuminated for 5 seconds after DTO switch is released.

    c. Offset Switch - 2 (or as required) and IN

13. Sight Switch - X-HAIR (if desired) (RN)

14. Offset Switches - As required (RN)

    Insure that the applicable ballistics control panel offset selector switch, the primary control panel offset switch, and, on D aircraft, the offset 1-2 or 3-4 selector switch are in the required position.

Timing

NOTE

Accomplish applicable steps for any timing run during multiple releases.

15. Bomb Door Control Valve Lights - Off (RN)

16. Bombing System Switch - MANUAL (RN)

17. Bomb Doors - Opened (RN)

NOTE

If bomb doors fail to open with bomb door open switch, proceed immediately to "Emergency Manual Bomb Release" procedures.

18. Bomb Tone (RBS Only) - On (20 seconds prior to bomb release) (RN)

19. D-2 Bomb Release Switch - Actuated (RN)

NOTE

If the D-2 switch fails to effect a release, release must be accomplished using "Emergency Manual Bomb Release" procedures.

20. Bomb Release Monitored - "Bomb away" (RN/P)

NOTE

If required by Command Tactical Doctrine, bomb doors will be closed between releases.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

Synchronous

NOTE

Accomplish applicable steps for any subsequent synchronous run during multiple releases.

15. Target or Offset - Acquired (RN)
16. Function Switch - BOMB (RN)

NOTE

To withhold release, position function switch to TRACK and proceed (multiple release) to applicable checklist for next release or to "Post Bomb Release Checklist." If no further releases are to be made accomplish "Abort Procedures Checklist."

17. Bombing System Switch - AUTO (RN)
18. Bomb Door Control Valve Lights - Off (RN)
19. Bomb Tone (RBS Only) - On (20 seconds prior to bomb release) (RN)
20. Bomb Door Opening Monitored - Bomb doors open (RN/P)

NOTE

- If doors fail to open automatically, place the bombing system switch in MANUAL and attempt opening with bomb door open switch. If doors cannot be opened by any means, release must be accomplished using "Emergency Manual Bomb Release" procedures.
- Emergency bomb door open switch is restricted from use with nuclear weapons.

21. Bomb Release Monitored - "Bomb away" (RN/P)

NOTE

- If the BNS fails to effect a release, release must be accomplished using "Emergency Manual Bomb Release" procedures.
- The D-2 switch will never be used as an alternate method of triggering the BRIC during an apparent failure of the BNS to effect a release. A premature actuation of the D-2 switch could result in a multiple release.
- If more than two synchronous runs are programmed during a multiple release, accomplish steps "12" thru "21" as applicable after entering new target coordinates.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

ALTERNATE

1. Pilot's Bombs-Released Light - Off, tested (RN-P)

If the pilot's bombs-released light is illuminated, attempt to reset BRIC by moving BRIC switch to TRAIN with counter knob at zero, then back to SEL.

WARNING

With the pilot's bombs-released light illuminated, opening the bomb doors after completion of the release configuration check could result in an immediate release.

NOTE

If pilot's bombs-released light remains illuminated, release must be accomplished using "Emergency Manual Bomb Release" procedures.

2. Multiple Drift Corrections/Timing - Accomplish (as required) (RN-N)

3. Release Configuration Check:

	NAV CALLS	RN RESPONSE
a.	"RCD"	"Connected, light on"
b.	"BRIC"	"SEL, light on **B-52C**, light dim **B-52D**"
c.	"Master Bomb Control Switch"	"ON, light on"
d.	"Bomb Door Control Valve Lights Off"	
e.	"Bombing System Switch"	"MANUAL"
f.	"Bomb Doors"	"Opened (approximately 120 seconds prior to release)"

Bomb doors will be opened manually using bomb door switch, approximately 120 seconds prior to release.

NOTE

If bomb doors fail to open with bomb door open switch, proceed immediately to "Emergency Manual Bomb Release" procedures.

4. Bomb Tone (RBS Only) - On (20 seconds prior to bomb release) (RN)

5. D-2 Bomb Release Switch - Actuated (RN)

At expiration of time to release/ETA to bomb release line, accomplish release using D-2 bomb release switch.

NOTE

If the D-2 switch fails to effect a release, release must be accomplished using "Emergency Manual Bomb Release" procedures.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

6. Bomb Release Monitored - "Bomb Away" (RN/P)

Bomb release will be indicated by the applicable weapon released or bomb indicator light illuminating.

NOTE

- Perform the following steps for multiple release.
- If required by Command Tactical Doctrine, bomb doors will be closed between releases.

7. Multiple Drift Corrections/Timing - Accomplish (as required) (RN-N)

If target separation allows, radar navigator will reinitiate multiple drift corrections/timing procedures. Radar navigator will be prepared to release second bomb at expiration of a predetermined time interval between releases.

8. Special Weapons Select Switch - FWD/AFT (as required) (single carriage) (RN)
9. Master Bomb Control Switch - OFF, then ON (multiple carriage) (RN)

This step is applicable only when bomb bay doors are not closed between the first and second release.

10. Bomb Doors - Opened (RN/P)
11. Bomb Tone (RBS Only) - On (20 seconds prior to bomb release) (RN)
12. D-2 Bomb Release Switch - Actuated (RN)

NOTE

If the D-2 switch fails to effect a release, release must be accomplished using "Emergency Manual Bomb Release" procedures.

13. Bomb Release Monitored - "Bomb Away" (RN/P)

NOTE

Repeat steps "7" thru "13" for releases on subsequent targets of a multiple release.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

POST BOMB RELEASE/ABORT (NUCLEAR) (RN-N)

Accomplish immediately after any single release or last release of a multiple release, or an abort if WPR and/or MPL check has been performed (RN); perform required steps and assure accomplishment of checks (N).

1. Release Circuits Disconnect - Disconnected (RN)
2. Primary Control Function Switch - TRACK (RN)
3. Bombing System Switch - MANUAL (RN)
4. Bomb Doors - Closed (RN)
5. Master Bomb Control Switch - OFF (RN)
6. Terrain Computer Power Switch - As required (RN)
7. Offset Switches - OUT (RN)
8. Altitude Disable Switch - NORMAL (RN)
9. Nav Mode Selector Switch - As desired (N)
10. Radar Recording Camera Switches - As required (RN)
11. Landing Gear Standby Pumps **B-52D** - OFF (high altitude only) (RN-P)
12. Applicable Hydraulic Packs - Indicate shutdown (RN-P)
13. MADREC - As required (N)

NOTE

Accomplish steps "14" and "15" for mission abort when no further releases/launches are to be attempted.

14. Internal Bombs:
    a. DCU-9/A Selector Switches - SAFE (RN)
    b. DCU-9/A Control Levers - OS (RN)
    c. DCU-9/A Warning Lights - Off, tested (each position of SWK box) (RN)
    d. DCU-9/A Selector Switches - OFF (RN)
    e. Readiness Switch Cover - Closed, latched (RN-P)
    f. Special Weapons Manual Lock Handle - Locked (RN-EW)
    g. Special Weapons Lock Indicators - Indicate locked (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (NUCLEAR) (Cont)

h. Normal Release & Salvo Power Circuit Breakers - Out (RN)

i. Emer Door Open & Rel Circuit Breaker **B-52D** - Out (RN)

j. BRIC - TRAIN, zero, light off (RN)

15. AGM-28

a. Special Weapons Manual Lock Handle - Locked (N-EW)

CAUTION

> In the event it becomes necessary to relock the remaining missile after one missile has been launched, the LOCK CONTROL A and LOCK CONTROL B circuit breakers for the launched missile shall be pulled before the special weapons manual lock handle is placed to the LOCK position. This is to prevent damage to the lock motor in the collet release system in the affected pylon.

b. ASM Lock Indicators - Indicate locked (RN)

c. ASM Separation (4) & Jettison Control (2) Circuit Breakers - Out (N)

d. Armament Selector Switches - SAFE (N)

e. Readiness Switch Cover - Closed, latched (N-P)

f. Armament Warning Lights - Off, tested (N)

g. Armament Selector Switches - OFF (N)

h. Safe Time Interval Knobs - Set 30.0 minutes (N)

i. Warhead Lights - Off (N)

j. Tactical Altitude Selector Switches - LOW (N)

k. ASM No. 1 & No. 2 Armament Control Circuit Breakers - Checked in (N)

NOTE

After all bombs and missiles are released, perform the following:

16. BRIC - TRAIN, zero, light off (RN)

17. DCU-9/A Selector Switches - OFF (RN)

NOTE

Accomplish the following steps when departing enemy territory:

18. Bomb Bay & Walkway Lights Circuit Breakers - In (RN)

19. Personal Locator Beacon Lanyard - Notify crew to set as required (N)

NAVIGATOR'S CHECKLIST (NUCLEAR)

BEFORE EXTERIOR INSPECTION (POWER OFF)

1. Ejection Seat: (N)

WARNING

- ● Carefully check to assure that no streamer has been torn from a maintenance safety pin, thus inadvertently leaving the pin installed. See figure 7-14 for location of pins.
- ● If a maintenance safety pin, except No. 6, is installed, the status of seat will be ascertained prior to removal of the pin.

a. Catapult Pin-Pull Initiator - Checked, pin No. 6 installed

Check maintenance pin No. 6 installed. Inspect link for condition and installation.

b. Ejection Trigger Ring - Stowed, pin No. 1 installed

Check that ejection trigger ring is properly seated in detent.

WARNING

If the ejection trigger ring is not properly seated in the detent, call maintenance and ascertain status of arming initiator before continuing seat inspection.

c. Catapult Initiator - Checked

Inspect initiator for condition and installation. Insure pin-pull cylinder safety pin (plunger) is installed in catapult initiator.

d. Catapult Initiator Safety Pin-Pull Cylinder - Checked

Inspect position and condition of cylinder and safety pin (plunger).

e. Arming Initiator & Control Linkage - Checked, pin No. 3 removed

Check maintenance safety pin No. 3 removed. Inspect initiator for condition and installation.

f. Hatch Jettison Initiator - Checked, pin No. 5 removed

Check maintenance safety pin No. 5 removed. Inspect initiator for condition and installation.

g. Seat Positioning Initiator - Checked, pin No. 4 removed

Check maintenance safety pin No. 4 removed. Inspect initiator for condition and installation.

2. Readiness Switch Cover - Closed, sealed (N)

3. Special Weapons Manual Lock Handle - Sealed (N)

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

4. External Missile Manual Release Handle - Sealed (N)
5. Forward & Rear Special Weapons Manual Release Handles - Sealed (N)
6. Release Circuits Disconnect - Disconnected, sealed (RN)
7. Circuit Breaker Panels: (RN/N)
    - a. Normal Release, Salvo Power & B-52D External Release Circuit Breakers - Out
    - b. Emer Door Open & Rel Circuit Breaker B-52D - Out
    - c. ASM Separation (4) & Jettison Control (2) Circuit Breakers - Out
    - d. ASM Auto Nav AC PWR A, B & C (3) Circuit Breakers - Out (ground alert only)
    - e. All Other Circuit Breakers & Fuses - In
8. Radar Navigator's SWESS Arm-Safe Switch **Less** A - SAFE, sealed (RN)

8A. CSS Indicator Windows A - Checked "A" (RN)

NOTE

Cease all activity and request CSS custodians (through the Command Post) if any CSSC indicator window is found set to other than "A."

9. DCU-9/A Control Levers - OS, sealed (RN)
10. DCU-9/A Selector Switches - OFF (RN)
11. SWK Monitor Select Switch - OFF (RN)
12. Emergency Armed Release Switch B-52D - OFF, sealed (RN)
13. AGM-28 Armament Selector Switches - OFF, sealed (N)
14. AGM-28 Launch Switches - OFF (guard closed) (N)
15. AGM-28 Electrical Power Panel: (N)
    - a. Missile Power Switches - OFF
    - b. B-52 Power Switches - OFF

EXTERIOR INSPECTION (BOMB BAY INTERIOR)

WARNING

The bomb door actuator struts must be disconnected before entering the bomb bay.

1. General Condition of Bomb Bay - Checked (RN)

    Check for fuel and hydraulic leaks and security of equipment (include check of walkways for loose objects).

2. Nuclear Bombs - Checked (RN)

    When nuclear bombs are aboard, use the appropriate bomb preflight checklist from T. O. 1B-52C-25-2CL-1.

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

INTERIOR INSPECTION

1. Equipment - Stowed

WARNING

Insure that no equipment is stowed on or near the lower deck heating ducts and outlets, electrical wiring, or electronic equipment.

2. Lower Deck Spare Parachute Preflight:

   a. Inspection Record:

      (1) Inspection & Repack Date - Checked

      (2) Automatic Release Time & Altitude Setting - Checked

   b. Bailout Bottle Pressure & Hose Connector - Checked

   c. Parachute - Unbuckled and stowed

   Spare parachute will be unbuckled and stowed in an easily accessible location.

3. Lower Deck Fire Extinguisher - Checked

   Insure that appropriate safety device (safety wire/seal or locking pin/lever as applicable) is installed. Check for fully serviced pressure.

4. CSM Switch - ON

   CSM switch is located on the aft module rack.

5. Normal-Test-Run Switch - NORMAL

   Normal-test-run switch is located on the aft module rack.

6. Doppler System Pressurization Shutoff Valve Handle - NORMAL

7. MADREC Recorder Clock - Wound, set to GMT

8. Sight Reduction Tables - Checked (if applicable)

   When tables are stored aboard aircraft, check that all three volumes are current.

9. Ejection Seat:

   a. Manual Catapult Initiator Safety Pin-Pull Handle - Secure

   Handle should be properly seated below left leg guard.

   b. Ankle Restraints - Checked

   Inspect ankle restraints for proper operation and stow in downward position.

   c. Initiator Tube Runs - Check connected

   Check tube runs for proper and secure connections.

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

d. Hatch Jettison Firing Lug - Checked

Inspect firing lug for condition and mounting.

e. Safety Belt Release Initiator - Checked, pin No. 2 removed

Check maintenance safety pin No. 2 removed. Inspect initiator for condition and installation.

f. Inertia Reel - Checked

Check inertia reel lock for proper functioning.

10. Man-Seat Separator - Checked

Insure that the nylon man-seat separator straps are placed over the parachute blocks and then on the bare seat. Survival kit is then placed over man-seat separator straps. See figure 7-14 for correct arrangement of man-seat separator straps without survival kit and parachute in place.

11. Parachute Preflight:

a. Inspection Record:

(1) Inspection & Repack Date - Checked

(2) Automatic Release Time & Altitude Setting - Checked

b. Personal Locator Beacon Lanyard - Snapped

For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 4-85).

c. Bailout Bottle Pressure & Hose Connector - Checked

d. Parachute Straps - Adjusted (as required)

e. Zero Delay Lanyard - Unhooked from parachute ripcord T-handle

WARNING

Do not hook zero delay lanyard to parachute ripcord T-handle when using a downward ejection seat since it is equipped with a man-seat separator.

12. MD-1 Survival Kit Preflight:

a. Kit Release Knob Snapped - Checked

b. Zipper Closed & Seal Intact - Checked

c. Kit Straps to Parachute - As required

WARNING

Care must be taken to assure that the survival kit attachment straps are not fastened over the safety belt.

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

13. Interphone - Connected
14. Oxygen System:
    a. Regulator Diluter Lever - 100% OXYGEN
    b. Shutoff Lever - OFF
    c. Mask & Hose - Check disconnect, then reconnect

       Check for 10- to 20-pound pull for disconnect, then reconnect mask and hose.

    d. Diluter Valve - Checked

       Attempt to draw air through the oxygen mask. Ability to draw air indicates a defective diluter valve, oxygen hose and/or connections, or mask. Then place the diluter valve to NORMAL position, draw air through the mask, if unable, this would indicate that only 100% oxygen will be available.

       NOTE

       If the diluter valve is stuck in the 100% position, this will prohibit the detection of smoke or fumes when use of normal oxygen is required.

    e. Shutoff Lever - ON
    f. Pressure - Checked

       Pressure gage reads approximately 300 psi.

    g. Emergency Toggle Lever - TEST MASK

       With mask disconnected at one side of helmet the flow indicator should indicate continuous flow.

    h. Mask - Test

       Attach mask to helmet and hold breath; indicator should indicate no flow.

       NOTE

       Flow condition may be indicated by a slight leak around the face form. If light hand-pressure against the mask does not stop the flow, the mask is unacceptable.

    i. Emergency Toggle Lever - NORMAL
    j. Regulator Diluter Lever - NORMAL/100% (as required)
15. Heading Reference Control:
    a. Polar Angle Indicator - 000°
    b. Heading Mode Selector Switch - MAG
    c. Pole Switch - As required
    d. Illum Switch - As desired
    e. Wind Test Switch - OFF
16. Doppler Drift Switch - NORMAL
17. N-1 Compass Master Indicator:
    a. Latitude Correction Knob - OFF
    b. Synchronizer Knob - Zero annunciator

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

18. Sky Spot Power Switch **B-52D** - OFF
19. Sky Spot Mode Switch **B-52D** - DOUBLE PULSE
20. Sky Spot Function Switch (if installed) - STBY
21. Navigation Unit:
    a. Nav Mode Selector Switch - NORM NAV
    b. Illum Control - CW
    c. Doppler Switch - OUT
22. Heading Select Control:
    a. BATH Switch - BNS
    b. ASM/DOPPLER Switch - BNS
23. Automatic Astrocompass Power Filter Switch - Checked OFF
24. Auxiliary Radar Indicator:
    a. Video Gain Control - CCW
    b. Bias Control - CCW
25. Doppler Radar Silence Switch - SILENT
26. Doppler Radar System Power Switch - OFF

26A. Ballistics Control Panel (Offsets 3-4) **D** :

NOTE

- Primary control function switch must be in NAV, TRACK, or BOMB to permit presetting offsets.
- T_F, L, and altitude functions for offsets 3 and 4 are applied using ballistics control panel (offset 1-2).

    a. Offset 3 - Set
    b. Offset 4 - Set

27. AGM-28(s) Check:
    a. Electrical Power Panel:
        (1) Missile Power Switches - OFF
        (2) B-52 Power Switch(es) - ON
        (3) Electric Out Light(s) - On
        (4) High Temperature Light(s) - Tested
    b. Flight Control Panel:
        (1) Flight Control Power Switches - OFF
        (2) Tactical Altitude Selector Switches - LOW and locked
        (3) F/C No Go Light(s) - On

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

- c. Armament Panel:
  - (1) Safe Time Interval Knobs - Set 30.0 min
  - (2) Armament Selector Switch(es) - SAFE
  - (3) Armament Warning Light(s) - Off, tested
  - (4) Armament Selector Switches - OFF
- d. Launch Panel:
  - (1) Engine Ready Lights - Off, tested
  - (2) Warhead Light(s) - Off, tested
- e. Indicator Lights Panel:
  - (1) Track Lights - Off
  - (2) Az Aline Lights - Off
  - (3) Level Aline Lights - Off
  - (4) A/N No Go Lights - Off
- f. Guidance Panel:
  - (1) ASM Selector Switch - As required
  - (2) Guidance System Power Switches - OFF
  - (3) Maneuver Switches - STRAIGHT IN (STR IN)
  - (4) Phototube Switches - NO. 1
  - (5) Secondary Azimuth Switches - OFF
  - (6) Slaving Master Switch - OFF
  - (7) Wait Lights - Off, tested
- g. Guidance Data Panel:
  - (1) Function Selector Switch - OFF
  - (2) Slew Switch - OFF
  - (3) Sun-Star Switch - SUN
  - (4) Track Switch - STANDBY
  - (5) Alt-Az Error Switch - AZ ERROR
  - (6) Tgt Fix Switch - SET
  - (7) GHA Set Switch - GHA SET
  - (8) Check Point Fix Switch - SET

28. AGM-28 Simulated Launch Switches - OFF
29. Radar Altimeter Check Panel Selector Switches - OFF
30. APN-69 Power Switch (if installed) - OFF (code set)

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

31. MADREC - OFF
32. Attitude Reference Control Cover - Closed, secured
33. Ground Locks & Bypass Keys - Counted, stowed
34. Pressure Bulkhead Door - Closed, latched, locked (alert only)
35. Crew Report - Completed (at pilot's request)
    a. The sequence for crew reporting is as follows: G, N, EW, RN, CP, P, IN, 10th man, bunk, and IP.
    b. Switch to CALL and report, "Navigator's station check complete." Station check consists of seat, oxygen, abandon signal and call light, interphone, and zero delay lanyard stowed.
36. Oxygen Regulator - OFF and 100% OXYGEN (if leaving the aircraft for an extended period of time)
37. AGM-28 B-52 Power Switches - OFF (ground alert only)

CAUTION

When AGM-28's are not installed, check both B-52 power switches OFF.

BEFORE TAKEOFF

1. Emergency Escape Hatch - Secure

   Check that paint stripe on the lockpin is visible or the flat surface of the lockpin extends 1/4 inch from its housing. Check that latch pins overlap the long lip of the latch hooks by approximately 1/8 inch. Check that the escape hatch manual release handle is full right.

2. Pin No. 6 (catapult pin-pull initiator) - Removed
3. Pressure Bulkhead Door - Closed, latched, unlocked
4. Emergency Cabin Pressure Dump Handle - Closed
5. Doppler Radar System Power Switch - ON

CAUTION

Do not turn doppler radar system power switch on until cooling air is available and the ground blowers switch is ON.

NOTE

Accomplish the following steps after BNS is on.

6. Automatic Astrocompass:

CAUTION

The declination and SHA for Polaris are to be inserted into the No. 1 star data panel for MD-1 astrocompass operation between the latitudes of 0° - 75° N to reduce the potential of "limits" or "lock-up" damage to the altitude-azimuth computer.

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

- a. Star Selector Switch - OFF
- b. Rate Switch - SOL or SID
- c. Power Filter Switch - SUN or STAR
- d. Lat-Long Switch - AUTO

NOTE

> There is a 2-minute delay before information may be preset and an additional 5-minute delay before the system can track. If the celestial coordinates for Polaris are not displayed in star data panel No. 1, they are to be inserted as soon as the 2-minute delay has elapsed.

6A. ASM Auto Nav AC PWR A, B & C (3) Circuit Breakers - In

7. AGM-28 B-52 Power Switches - ON

8. AGM-28 Armament Selector Switches - OFF

9. MADREC:

    a. System Select Switch - STDBY

    The recorder failure light will remain on for approximately 20 seconds.

    b. Press-To-Test Button - Depressed

    The ready and failure indicators should illuminate.

10. Oxygen Regulator - As required

11. Auxiliary Radar Indicator - Tuned

12. Automatic Astrocompass:

    a. Heading Correction - Set zero

    b. Clock - Set GMT

    When set time comes up, switch to GHA and check for clock drive.

    c. GHA - Set

    When set time comes up, switch to SHA and check GHA for drive.

    d. SHA & Dec - Set (Polaris coordinates in No. 1 star data panel)

    e. Star Selector Switch - As desired

13. ASM/DOPPLER Switch - BNS

14. APN-69 Power Switch (if installed) - STDBY

15. Heading Indicators - Cross-checked (P-CP-N)

    a. Pilot, copilot, and navigator cross-check heading indicators and magnetic standby compass.

16. MADREC - BOMB (if ready indicator is illuminated)

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

17. Parachute, Survival Kit, Shoulder Harness, Arming Lanyard & Safety Belt - Fastened

    Adjust shoulder harness to a snug condition while sitting well back in seat. Assemble shoulder harness loops and parachute arming lanyard anchor on safety belt as shown in figure 1-55.

WARNING

- To insure operation of the automatic opening parachute, arming lanyard anchor must be assembled on the safety belt in the manner shown in figure 1-55. Failure to properly assemble these units may cause fatal delay in separating from the seat and in opening the parachute.
- Insure that the parachute arming lanyard is not entangled in the parachute harness. Lanyard entanglement could cause failure in seat separation and failure of the automatic features of the parachute.

18. Pin No. 1 - Removed
19. Ejection Control Trigger Ring - Unstowed (respond at pilot's request)
20. Bailout Bottle - Connected
21. Takeoff Data - Reviewed (P-CP-N)

TAKEOFF

1. Acceleration Timing - Checked

   As the pilot announces "Now" at 70 knots, start the stopwatch. Announce over the interphone "coming up on ________ seconds" approximately 3 seconds prior to S_1 time. At S_1 time, announce "Now."

AFTER TAKEOFF

1. Doppler Radar Silence Switch - TRANSMIT

   Place the doppler radar silence switch in TRANSMIT when attaining an altitude of approximately 200 feet above the ground.

2. Doppler Switch - IN

   Place the doppler switch IN when attaining an altitude of approximately 200 feet above the ground and only after the doppler memory light has gone out.

3. APN-69 Power Switch (if installed) - OPERATE (if required)

   APN-69 should be placed in operation at takeoff whenever buddy refueling or cell tactics are to be employed.

4. Departure Plan - Monitored

   Monitor the aircraft position to assure adherence to the planned departure.

5. Climb EPR Value - Computed (if requested)

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

6. AGM-28 After Engine Start:

NOTE

> The copilot will start the engine at the briefed time and notify navigator when the engine has stabilized.

   a. MADREC - AGM-28

   b. Electrical Power Panel:

      (1) Electric Out Lights - Off

      (2) Missile Power Switch(es) - ON

   c. Guidance Panel:

      (1) Guidance System Power Switch(es) - STBY

      (2) Wait Light(s) - On

   d. High Temp Light(s) - Off

   e. MADREC - As desired

7. Oxygen Check - Completed (G-EW-RN-CP)

   a. During climb, copilot requests an oxygen check at 12,000 feet. The sequence for oxygen report is gunner, EW officer, radar navigator, copilot. The reporting crew member will visually check other crew member(s) for alertness. He will report oxygen check for both positions. Oxygen panel at each occupied crew position will be checked on all oxygen checks for:

      (1) Oxygen Supply Shutoff Lever - ON

      (2) Regulator Diluter Lever - As required

      (3) Pressure - 300 psi

      (4) Flow Indicator - Functions normally

      (5) Emergency Toggle Lever - NORMAL

   b. Gunner and copilot report, "Cabin altitude _____ feet. Oxygen panel checked."

   c. EW officer and radar navigator report, "Oxygen panel checked."

   d. Copilot notify aircrew and receive gunner's acknowledgment when passing through 25,000, 35,000, and 40,000 feet.

   e. The copilot will request an oxygen check at level-off. During cruise, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes and initiate the oxygen checks at 30-minute intervals when both cabin altitudes are below 12,000 feet, at 15-minute intervals when either cabin altitude is 12,000 to 25,000 feet, and at no longer than 10-minute intervals when either cabin altitude is above 25,000 feet. If cabin altitude is below 12,000 feet, only the gunner and copilot will report. The remaining crew members will check their equipment and report if abnormal.

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

AFTER LEVEL-OFF

1. Heading Mode Selector Switch - Best available heading
2. True Airspeed - Computed (indicators - cross-checked)

   Compute true airspeed from the pilot's indicated airspeed. If the BNS true airspeed is materially different from both the navigator's true airspeed indicator and the computed true airspeed, the BNS true airspeed may be set manually.

3. MADREC - STDBY

BEFORE DESCENT

1. Plane Latitude, Longitude & Mag Var Counters - Corrected
2. AGM-28 Check:
   - a. Secondary Azimuth Switches - OFF
   - b. Track Switch - STANDBY
   - c. ASM Separation (4) & Jettison Control (2) Circuit Breakers - Out
   - d. Armament Selector Switches - SAFE
   - e. Armament Warning Lights - Off, tested
   - f. Armament Selector Switches - OFF
   - g. Safe Time Indicators - Checked 30.0 minutes
   - h. Tactical Altitude Selector Switches - LOW and locked
   - i. Warhead Lights - Off
3. MADREC - AUTO
4. Best Flare Speed - Computed and cross-checked with copilot

All data on pages 8-55 and 8-56 (Deleted)

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

DESCENT AND BEFORE LANDING

CAUTION

If turbulence or icing conditions are anticipated during descent or if touch-and-go landings are scheduled, delay steps "1A" and "2" until just prior to final landing and/or engine shutdown.

1. Penetration & Approach - Reviewed (P-CP-RN-N)

   Review the planned penetration and approach with the applicable crewmembers. Intermediate altitude restrictions, ceiling and visibility minimums, MDA/DH, and missed approach procedures will be emphasized.

1A. AGM-28 Guidance System Power Switches - OFF

2. AGM-28 Missile Power Switches - OFF (N-CP)
3. AGM-28 Flight Control Power Switch(es) - ON
4. Heading Mode Selector Switch - MAG
5. Penetration & Approach Altitudes - Monitored
6. Automatic Astrocompass:
   a. Star Data Panel No. 1 - Polaris coordinates set
   b. Set Selector Switch - GHA
   c. Power Filter Switch - SUN
   d. Star Selector Switch - OFF
   e. Lat-Long Switch - MANUAL
7. Doppler Radar Silence Switch - SILENT

   Place the doppler radar silence switch to SILENT when approximately 200 feet above the ground for low approaches and landings. For subsequent activity, the doppler may be left in SILENT.

AFTER LANDING

1. Auxiliary Indicator:
   a. Video Gain Control - CCW
   b. Bias Control - CCW
2. APN-69 Power Switch (if installed) - OFF
3. Ejection Control Trigger Ring - Stowed
4. Pin No. 1 - Installed
5. Pin No. 6 - Installed

   Install maintenance safety pin No. 6 in catapult pin-pull initiator prior to opening of hatch.

6. Nuclear Bombs Aboard - Accomplish bomb "After Landing" checklist (T.O. 1B-52C-25-2CL-1)

NAVIGATOR'S CHECKLIST (NUCLEAR) (Cont)

AFTER PARKING

1. Ejection Seat - Position forward and up
2. Astro Power Filter Switch - POWER OFF
3. Doppler Radar System Power Switch - OFF
4. AGM-28 Flight Control Power Switches - OFF
5. AGM-28 B-52 Power Switches - OFF (CP-N)

NOTE

Do not turn B-52 power switch OFF until called for by the copilot. If the B-52 power switch is turned OFF before the engine control knob is placed to OFF, engine control will be lost.

6. MADREC - OFF
7. Oxygen System:
   a. Regulator - OFF and 100% OXYGEN
   b. Supply Hose & Interphone Cord - Stowed
8. Nuclear Bombs Aboard - Accomplish "Ground Safeing Checklist" (T. O. 1B-52C-25-2CL-1) (MMS not available)
9. Missiles Aboard & Qualified Personnel Not Available - Accomplish "Missile Ground Safeing" checklist (N/RN)

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS)

EXTERIOR INSPECTION (POWER OFF) (RN/N)

WARNING

- The bomb door actuator struts must be disconnected before entering the bomb bay.
- To prevent personnel injury in the event of inadvertent actuation of the release system, the following checks will be accomplished prior to any power (aircraft or external) being applied to the aircraft.

NOTE

If any discrepancies are found, notify MMS personnel.

1. General Condition of Bomb Bay - Checked

   Check for fuel and hydraulic leaks and security of equipment (include check of walkways for loose objects).

2. Bomb Door Actuator Locks **B-52D** - Checked

   Check that actuator locks (2) are securely stowed in the stowage racks provided near the forward and aft bomb door actuators respectively.

Clip-In

3. MB-3A Bomb Rack Lockpins (Lower Only) - Inserted
4. General Condition of Bombs/Mines - Checked
5. Arming Wires & Fuzes - Checked

   Visually check that arming wires are properly inserted in fuze/arming assemblies and that Fahnestock clips are installed where applicable.

Cluster or Hi-Density

3. General Condition of Bombs/Mines - Checked
4. Nose Fuzes & Arming Wires - Checked

   Visually check that arming wires are properly inserted in nose fuze/arming assemblies and that Fahnestock clips are installed when applicable.

5. Shackle Locking Pin(s) - Removed, counted, and stowed

   For cluster bomb racks, there should be a locking pin for each shackle. For hi-density racks, there should be a locking pin for each of the lower shackles.

WARNING

Prior to removing any shackle locking pin, insure that the A-5/A-6 release is cocked and the B-11 shackle release lever is mated with the release arm of the A-5/A-6 release.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

MER B-52D

WARNING

When high speed faired mines MK 52, MK 55, and MK 56 are loaded, do not put fingers in fairing shroud holes at any time. Accidental actuation of the retraction mechanism will severely damage or sever fingers.

1. General Condition of Munitions - Checked
2. Arming Wires & Fuzes - Checked

   Check that the arming wires are properly inserted in fuze/arming assemblies and free from kinks. Check that arming wires are secured in the proper receptacle, safety pins have been removed from each fuze/arming assembly, and the Fahnestock clips are installed.

3. Release Mode Selector Switch - SINGLE BOMB
4. Electrical Safety Pins - Removed and stowed
5. Rack Locking Pins - Removed, counted, and stowed

   There should be a locking pin for each rack.

External Heavy Stores ZX

WARNING

When high speed faired mines MK 52, MK 55, and MK 56 are loaded, do not put fingers in fairing shroud holes at any time. Accidental actuation of the retraction mechanism will severely damage or sever fingers.

1. Beam Control Panel:
   - a. 9 Store Switch - As required

     NOTE

     The 9 store switch must be OFF with 6 store or less configuration.

   - b. Release Delay Switch - As required

     With the release delay switches ON the first external munition release will not occur until the ninth external release pulse.

NOTE

Perform steps "2" thru "5" for each loaded store.

2. General Condition of Bomb/Mine - Checked
3. Arming Wires & Fuzes - Checked

   Visually check that arming wires are properly inserted in fuze/arming assemblies and that Fahnestock clips are installed where applicable.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

4. MAU-12 In-Flight Safety Lock - Unlock, lockout pin installed
5. MAU-12 Ground Safety Lockpin - Removed
6. Ground Safety Lockpins - Counted, stowed

   There should be a lockpin for each loaded store.

INTERIOR INSPECTION

1. Equipment - Stowed

WARNING

Insure that no equipment is stowed on or near the lower deck heating duct and outlets, electrical wiring, or electronic equipment.

2. Compass Cutoff Switch - ON
3. Single String Switch B-52D - OFF
4. Single String Trigger Selector Switch B-52D - Set as briefed

NOTE

Do not set this switch to positions warned against in T. O. 1B-52C-34-2-1.

5. Ejection Seat & Escape Hatch:

WARNING

- Carefully check to assure that no streamer has been torn from a safety pin, thus inadvertently leaving the pin installed. See figure 7-14 for location of pins.
- If a maintenance safety pin is installed, the status of the seat will be ascertained prior to removal of the pin.

a. Ejection Trigger Ring - Stowed, pin No. 1 installed

Check that ejection trigger ring is properly seated in detent.

WARNING

If the ejection trigger ring is not properly seated in the detent, call maintenance and ascertain status of arming initiator before continuing seat inspection.

b. Manual Catapult Initiator Safety Pin-Pull Handle - Secure

Handle should be properly seated below left leg guard.

c. Ankle Restraints - Checked

Inspect ankle restraints for proper operation and stow in downward position.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

d. Catapult Initiator - Checked

Inspect initiator for condition and installation. Insure pin-pull cylinder safety pin (plunger) is installed in catapult initiator.

e. Catapult Initiator Safety Pin-Pull Cylinder - Checked

Inspect position and condition of cylinder and safety pin (plunger).

f. Arming Initiator & Control Linkage - Checked, pin No. 3 removed

Check maintenance safety pin No. 3 removed. Inspect initiator for condition and installation.

g. Emergency Escape Hatch - Secure

Check that paint stripe on the lockpin is visible or the flat surface of the lockpin extends 1/4 inch from its housing. Check that latch pins overlap the long lip of the latch hooks by approximately 1/8 inch. Check that the escape hatch manual release handle is stowed. Check all foreign matter removed from hatch.

h. Initiator Tube Runs - Check connected

Check tube runs for proper and secure connections.

i. Catapult Pin-Pull Initiator - Checked, pin No. 6 removed

Check maintenance safety pin No. 6 removed. Inspect link for condition and installation.

j. Hatch Jettison Initiator - Checked, pin No. 5 removed

Check maintenance safety pin No. 5 removed. Inspect initiator for condition and installation.

k. Manual Hatch Jettison Handle & Safety Latch - Checked

Check the manual jettison handle and safety latch for proper engagement by pushing up and aft on the safety latch. Freedom of motion of the safety latch indicates that the latch has not properly engaged the hatch jettison handle.

WARNING

If the safety latch has not properly engaged the manual hatch jettison handle, the hatch can be inadvertently jettisoned. Call maintenance before performing any further checks.

l. Seat Positioning Initiator - Checked, pin No. 4 removed

Check maintenance safety pin No. 4 removed. Inspect initiator for condition and installation.

m. Hatch Jettison Firing Lug - Checked

Inspect firing lug for condition and mounting.

n. Safety Belt Release Initiator - Checked, pin No. 2 removed

Check maintenance safety pin No. 2 removed. Inspect initiator for condition and installation.

o. Inertia Reel - Checked

Check inertia reel lock for proper functioning.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

6. Man-Seat Separator - Checked

   Insure that the nylon man-seat separator straps are placed over the parachute blocks and then on the bare seat. Survival kit is then placed over man-seat separator straps. See figure 7-14 for correct arrangement of man-seat separator straps without survival kit and parachute in place.

7. Parachute Preflight:

   a. Inspection Record:

      (1) Inspection & Repack Date - Checked

      (2) Automatic Release Time & Altitude Setting - Checked

   b. Personal Locator Beacon Lanyard - Snapped

      For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 4-85).

   c. Bailout Bottle Pressure & Hose Connector - Checked

   d. Parachute Straps - Adjusted (as required)

   e. Zero Delay Lanyard - Unhooked from parachute ripcord T-handle

WARNING

Do not hook zero delay lanyard to parachute ripcord T-handle when using a downward ejection seat since it is equipped with a man-seat separator.

8. MD-1 Survival Kit Preflight:

   a. Kit Release Knob Snapped - Checked

   b. Zipper Closed & Seal Intact - Checked

   c. Kit Straps to Parachute - As required

WARNING

Care must be taken to assure that the survival kit attachment straps are not fastened over the safety belt.

9. Interphone - Connected

10. Oxygen System:

    a. Regulator Diluter Lever - 100% OXYGEN

    b. Shutoff Lever - OFF

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

c. Mask & Hose - Check disconnect, then reconnect

Check for 10- to 20-pound pull for disconnect, then reconnect mask and hose.

d. Diluter Valve - Checked

Attempt to draw air through the oxygen mask. Ability to draw air indicates a defective diluter valve, oxygen hose and/or connections, or mask. Then place the diluter valve to NORMAL position, draw air through the mask, if unable, this would indicate that only 100% oxygen will be available.

NOTE

If the diluter valve is stuck in the 100% position, this will prohibit the detection of smoke or fumes when use of normal oxygen is required.

e. Shutoff Lever - ON

f. Pressure - Checked

Pressure gage reads approximately 300 psi.

g. Emergency Toggle Lever - TEST MASK

With mask disconnected at one side of helmet, the flow indicator should indicate continuous flow.

h. Mask - Test

Attach mask to helmet and hold breath; indicator should indicate no flow.

NOTE

Flow condition may be indicated by a slight leak around the face form. If light hand-pressure against the mask does not stop the flow, the mask is unacceptable.

i. Emergency Toggle Lever - NORMAL

j. Regulator Diluter Lever - NORMAL/100% (as required)

11. PMG Control Switch - ON

12. Ground Blowers Switch - OFF

13. K-3A Heat Control Switch - As required

The PREHEAT position is used on the ground when temperature is below 0° C and in flight when the BNS is off.

14. External BRIC B-52D - TRAIN and zero

15. IFC Power Select Switch B-52D - TR (guard closed)

16. DCU-9/A Selector Switches - OFF (clip-in)

17. Internal BRIC - TRAIN and zero

18. Radar Pressure Pump Control Switch - NORMAL ON

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

19. Radar Camera Power Switch - OFF
20. Line-of-Sight Control:
    a. Boresight Switch - NOR
    b. Sighting Angle Control - Set 85
    c. Drift Control - Set 180
    d. Illum Switch - ON
21. Radar Control Unit:
    a. Power Switch - OFF
    b. Meter Switch - AC
    c. FTC Switch - OFF
    d. Illum Knob - CW
    e. Log-Lin Switch - LIN
    f. Operations Switch - RAD HI RES
    g. Sweep Delay Control - CCW and depressed
    h. Tilt Control - Zero
    i. Range Dial Control - Set 25 to 45 nautical miles
22. STC Amplitude Control Panel:
    a. STC Receiver Gain Control Switch - CCW
    b. STC Select Control - OFF
23. Radar Display Selector Switch - GM
24. Vertical Camera Master Switch - ON
25. Waveguide Selector Switch - MAN LOAD
26. Terrain Computer Power Switch - OFF
27. Air Outlet & Auxiliary Heat Knobs:
    a. Upper Outlet Knobs - 1/2 to full out
    b. Lower Outlet Knobs - Full out
    c. Auxiliary Heat Knob - Full in

NOTE

These knob settings are approximate settings only. After the cabin temperature has stabilized, knob adjustment may then be varied slightly for crew comfort.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

28. Master Bomb Control Panel:

    a. Master Bomb Control Switch - OFF

    b. Bomb Indicator Lights Switch - ON

    c. Bombing System Switch - MANUAL

    d. Lights - Checked, tested

29. Altitude Disable Switch - NORMAL

30. Special Weapons Select Switch - FWD

31. Optional Bombing Switch B-52D - AN/ASQ-48 NORMAL

32. Release Circuits Connected Light - Tested

33. External Bomb Rack Control Panel B-52D:

    a. Arming Switch - SAFE

    b. Release Power Switch - OFF

    c. Racks Loaded Lights Switch - ON

    d. Racks Loaded Lights - On (for applicable racks)

34. Special Weapons Lock Indicators - Indicate locked (clip-in)

35. Emergency Bomb Door Open Switch B-52D - OFF

36. Bomb Indicator Lights - On (for applicable munitions); Off, tested (clip-in)

37. Internal Bomb Indicator Light Control Switch B-52D - Bays checked; set as briefed (hi-density)

    Check illumination of indicator lights for each hi-density bay assembly loaded by rotating the switch to each corresponding bay assembly position. Upon completion of check, set switch to bay assembly position as briefed.

38. BNS Primary Control:

    a. Function Switch - STAB

    b. PPI-OB Switch - PPI

    c. Radar Altitude Switch - OFF

    d. Illum Switch - ON

    e. Offset Switch - OUT

    f. Aux PPI or Nav Track Switch - OUT

39. Periscopic Bombsight:

    a. Main Switch - NORMAL

    b. Transfer Knob - NORMAL

    c. Filter Selector Knob - CLEAR

40. D-2 Bomb Release Switch - Stowed

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

41. Variac Control - CCW (to stop)
42. IP-618 Indicator:
    a. Bias Control - CCW
    b. Video Gain Control - CCW
    c. Bril Mark Control - CCW
    d. Range Lights Control - CW
43. Radar Camera:
    a. Recording Chamber Data Plate - Completed

    EXAMPLE:

    LAJUNTA
    OB-21
    P.D. 2-7
    30 June 70
    B-52D 5068
    SMITH, C.S.

    b. Clock - Set to GMT
44. Offset 1-2 or 3-4 Selector Switch **D** - OFFSET 1-2
45. Primary Control Function Switch - NAV
46. Ballistics Control Panel (Offset 1-2):
    a. ATF - Set
    b. Trail - Set
    c. Offset 1 - Set
    d. Offset 2 - Set
    e. Altitude Indicator - Set to minimum altitude
    f. Bomb Select Switch - L/S
    g. Illum Control - CW
47. Primary Control Function Switch - STAB (OFF for alert)
48. Altimeter - Set

    Set in accordance with AFM 51-37. On aircraft **ZV**, check that altimeter correction cards are installed.

WARNING

When setting altimeter, special attention should be given to the altimeter to insure the 10,000-foot pointer is reading correctly.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

49. Crew Report - Completed (at pilot's request)
    - a. The sequence for crew reporting is as follows: G, N, EW, RN, CP, P, IN, 10th man, bunk, and IP.
    - b. Switch to CALL and report, "Radar navigator's station check complete."

      Station check consists of seat, oxygen, abandon signal and call light, interphone, and zero delay lanyard stowed.
50. Oxygen Regulator - OFF and 100% OXYGEN (if leaving the aircraft for an extended period of time)

AFTER ENGINE START

CAUTION

After engine start, do not turn BNS on until after being notified by the copilot that aircraft power is on the line and cooling air is available.

1. K-3A Heat Control Switch - NORMAL
2. Ground Blowers Switch - ON
3. Cabin Low Airflow Warning Light - Out
4. RCU Power Switch - STBY
5. Test Lights:
    - a. Bomb Door Control Valve Lights - Tested
    - b. Tone On Light - Tested
    - c. Radar Low Pressure Warning Light - Tested
    - d. Cabin Low Airflow Warning Light - Tested
    - e. Autopilot Remote Controller Light - Tested
    - f. Autopilot Engaged Light - Tested
    - g. Autosteer Light - Tested
    - h. MD-1 Light - Tested
    - i. ACL Light - Tested
6. Radar Tuneup: (10-mile range light illuminated)
    - a. Waveguide Selector Switch - AUTO
    - b. RCU Power Switch - SCAN FAST
    - c. Variac Control - Mag current 4.6 (check all voltages)
    - d. STC Select Switch - 3
    - e. STC Gate Amplitude Switch - 80
    - f. STC Shape Switch - 75

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

g. Radar Indicator - Adjust and check

(1) Range Marks - As desired

(2) Scope - Centered

(3) Heading Mark - 360° (±2°)

(4) Scope Presentation - Optimum

(5) Tilt - Adjusted

NOTE

If the AFC fails to lock on, turn the waveguide selector switch to MAN LOAD. Lock-on should occur. After lock-on, return waveguide selector switch to AUTO.

7. Radar Camera - Operation checked

8. BNS Check:

a. Bomb Select Switch - SYN

b. Primary Control Function Switch - NAV

c. Crosshairs - Checked

Check movement with tracking handle.

d. Wind Dials - Set

e. Latitude, Longitude & Magnetic Variation - Set

Set to runway coordinates and correct magnetic variation if necessary.

f. Primary Control Function Switch - STAB

g. Bomb Select Switch - L/S

BEFORE TAKEOFF

NOTE

If BNS has not been turned off, omit circled items.

1. K-3A Heat Control Switch - NORMAL

② Ground Blowers Switch - ON

③ RCU Power Switch - STBY

④ Primary Control Function Switch - STAB

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

⑤ Radar Tuneup: (10-mile range light illuminated)

- a. Waveguide Selector Switch - AUTO
- b. RCU Power Switch - SCAN FAST
- c. Variac Control - Mag current 4.6 (check all voltages)
- d. STC - As desired
- e. Radar Indicator - Adjust and check
    - (1) Range Marks - As desired
    - (2) Scope - Centered
    - (3) Heading Mark - 360° (±2°)
    - (4) Scope Presentation - Optimum
    - (5) Tilt - Adjusted

6. Camera Door - Closed (after bomb doors are closed)
7. Camera Door Closed Light (if installed) - On
8. Vertical Camera Master Switch - ON (camera or loaded magazine not installed - OFF)
9. Vertical Camera Intervalometer:
    - a. Intervalometer Power Switch - OFF
    - b. Exposure Delay Control - Set (as briefed)
    - c. Interval Control - Set (as briefed)
    - d. Exposure Limiter - Set (as briefed)
10. Parachute, Survival Kit, Shoulder Harness, Arming Lanyard & Safety Belt - Fastened

Adjust shoulder harness to a snug condition while sitting well back in seat. Assemble shoulder harness loops and parachute arming lanyard anchor on safety belt as shown in figure 1-55.

WARNING

- To insure operation of the automatic opening parachute, arming lanyard anchor must be assembled on the safety belt in the manner shown in figure 1-55. Failure to properly assemble these units may cause fatal delay in separating from the seat and in opening the parachute.
- Insure that the parachute arming lanyard is not entangled in the parachute harness. Lanyard entanglement could cause failure in seat separation and failure of the automatic features of the parachute.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

11. Pin No. 1 - Removed

12. Ejection Control Trigger Ring - Unstowed (respond at pilot's request)

WARNING

To prevent accidental firing of ejection seat, stow the ejection control trigger ring prior to leaving the seat during flight. Upon returning to the seat, fasten parachute, shoulder harness, and safety belt, then unstow the ejection control trigger ring from the stowed position.

13. Bailout Bottle - Connected

14. Oxygen Regulator - As required

15. Forward Landing Gear - Checked

    Check visually through the optics for alignment. Check for evidence of fuel or hydraulic leaks in the landing gear area.

16. Altimeters - Rechecked and set (P-CP-RN)

    Pilot, copilot and radar navigator recheck their altimeters with a known elevation.

17. Takeoff Report - As required

    Copilot announces over interphone "Crew, stand by for takeoff." Acknowledgment for crew members not required unless some discrepancy exists that may compromise successful completion of mission.

18. Overheat Protection Circuit Breaker - Out

    Accomplish just prior to aircraft air conditioning master switch being placed to RAM by the copilot.

CAUTION

Overheat protection circuit breaker must not be out for periods of time exceeding 5 minutes with BNS turned on.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

TAKEOFF

1. Acceleration Timing - Checked (navigator backup)

   As the pilot announces "Now" at 70 knots, start the stopwatch. If navigator is unable to check acceleration timing, announce over interphone "Coming up on_______seconds" approximately 3 seconds prior to S_1 time. At S_1 time, announce "Now."

2. Primary Control Function Switch - NAV

3. Overheat Protection Circuit Breaker - In

AFTER TAKEOFF

NOTE

B-52D

In the event an aircraft emergency or aircraft configuration and mission requirement dictates the release of external conventional munitions. Refer to "Release of External Munitions While Retaining Internal Munitions Checklist" under "Conventional Munitions Emergency Operation," Section III of T.O. 1B-52C-34-2-1.

1. Forward Landing Gear - Checked

   Check that forward wheels are braked and that the gear is fully retracted. Report only apparent malfunctions. Observe closely for evidence of fuel or hydraulic leaks.

2. Altitude & Airspeed - Monitored

   Monitor altitude and airspeed for safe margin until aircraft has attained an altitude of 5000 feet above the terrain. Advise pilot if altitude falls below a safe margin or airspeed fails to show a positive increase.

3. Line-of-Sight Drift Control - Set zero

4. Bombing Select Switch - SYN

5. BNS Altitude - Adjusted

6. Oxygen Check - Completed (G-EW-RN-CP)

   a. During climb, copilot requests an oxygen check at 12,000 feet. The sequence for oxygen report is gunner, EW officer, radar navigator, copilot. The reporting crew member will visually check other crew member(s) for alertness. He will report oxygen check for both positions. Oxygen panel at each occupied crew position will be checked on all oxygen checks for:

      (1) Oxygen Supply Shutoff Lever - ON

      (2) Regulator Diluter Lever - As required

      (3) Pressure - 300 psi

      (4) Flow Indicator - Functions normally

      (5) Emergency Toggle Lever - NORMAL

   b. Gunner and copilot report, "Cabin altitude_______feet. Oxygen panel checked."

   c. EW officer and radar navigator report, "Oxygen panel checked."

   d. Copilot notify aircrew and receive gunner's acknowledgment when passing through 25,000, 35,000, and 40,000 feet.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

e. The copilot will request an oxygen check at level-off. During cruise, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes and initiate the oxygen checks at 30-minute intervals when both cabin altitudes are below 12,000 feet, at 15-minute intervals when either cabin altitude is 12,000 to 25,000 feet, and at no longer than 10-minute intervals when either cabin altitude is above 25,000 feet. If cabin altitude is below 12,000 feet, only the gunner and copilot will report. The remaining crew members will check their equipment and report if abnormal.

7. Altimeter - Set

AFTER LEVEL-OFF

1. BNS - Set

   Assure the proper setting of altitude, wind, latitude, and longitude for accurate route navigation.

BEFORE DESCENT

1. Terrain Computer Power Switch - As required

   If terminal area TA calibration is required, a 30-minute warmup period for the terrain computer is necessary.

2. Time of Fall Indicator - Set 0 sec

3. Trail Indicator - Set 0 ft

4. Offset - Set

   Set components from approach end of runway to selected OAP.

5. Conventional Munitions Safety Checklist:

   If conventional munitions are aboard or have been released, a safety check must be accomplished.

   a. Normal Release, Salvo Power & **B-52D** External Rel Circuit Breakers - Out

   b. Emer Door Open & Rel Circuit Breaker **B-52D** - Out

   c. Release Circuits Disconnect - Disconnected

   d. Master Bomb Control Switch - OFF

   e. Bombing System Switch - MANUAL

   f. Readiness Switch Cover - Closed, latched (clip-in) (RN-P)

   g. Special Weapons Lock Indicators - Indicate locked (clip-in)

   h. DCU-9 A Selector Switches - OFF (clip-in)

   i. External Bomb Rack Control Panel **B-52D** :

      (1) Arming Switch - SAFE

      (2) Release Power Switch - OFF

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

DESCENT AND BEFORE LANDING

CAUTION

Monitor the overheat and low airflow warning lights. If necessary, request that power be advanced on engine 3 or 4 (usually No. 4) to keep the cabin low airflow light out.

1. Penetration & Approach - Reviewed (P-CP-RN-N)

   Review the planned penetration and approach with the applicable crewmembers. Intermediate altitude restrictions, ceiling and visibility minimums, MDA/DH, and missed approach procedures will be emphasized.

2. Altimeter Setting - Determined and set (RN-N-P-CP)

   When the altimeter setting is received from appropriate air traffic control facility, a comparison should be made with the appropriate forecasted altimeter setting. Reset altimeter to station pressure immediately prior to initiating penetration or upon passing through transition altitude. When mission requirements dictate and current altimeter setting is not available, compute an altimeter setting using a metro or in-flight "D" values.

3. Initial Point - Made good

   The radar navigator coordinates with the pilot in monitoring or directing aircraft path to the VOR station or any other reference point to be used for initiating the penetration, arriving over the point on the desired heading for initial descent.

4. Penetration - Initiated

   Upon reaching point of initial penetration, the jet penetration as published in the Flight Information Publication will be initiated. Monitor or direct aircraft path over the ground and advise the pilot of any deviation from published penetration.

5. Descent Altitude Calls - Accomplish

   a. Coordinate with the pilot as to level-off altitude(s) to be used for descent and entry to landing pattern.

   b. Call off altitude to pilot every 5000 feet during descent beginning at first multiple of 5000 feet. Upon reaching level-off altitude plus 5000 feet, report altitude to pilot every 1000 feet and at level-off altitude.

6. Forward Landing Gear - Checked

   Immediately after gear is extended, check for proper extension and alignment. Observe closely for indications of fuel or hydraulic leaks. During transition, the radar navigator will check the gear after each landing. Do not report unless a discrepancy exists.

NOTE

When carrying AGM-28 missiles, the rotating beacon will reflect from the polished surfaces of the missiles. The reflection from the left missile could easily be interpreted as flame or fire. When in doubt, the radar navigator should request the rotating beacon be turned off momentarily for a positive check of fire.

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

7. Altitude - Set

   Upon reaching traffic pattern altitude, set pressure altitude minus field elevation.

8. Crosshairs - Positioned

   Place crosshairs on offset aimpoint or the approach end of runway with the inner edge of the range marker on the edge of no return.

9. Primary Control Function Switch - TRACK

   Monitor aircraft path over the ground and advise pilot of any departure from prescribed penetration.

10. Traffic Pattern - Monitored or directed

    Monitor or direct the aircraft throughout the approach pattern being flown, advising the pilot of any deviation noted or discrepancies between the approach and airborne radar. Radar navigator will monitor altitude throughout the pattern.

11. PDI - Centered (on final approach)

    If it is a directed approach, the PDI and time-to-go meter will be used to make the final approach. If it is a monitored approach, the PDI and time-to-go meter may be cross-checked by the pilot to determine progress on final approach.

12. Final Descent - Initiated

AFTER LANDING

CAUTION

Monitor the overheat and low airflow warning lights. If necessary, turn equipment off.

1. Radar Camera:
   a. Expose 20 frames
   b. Power Switch - OFF
2. Vertical Camera Master Switch - OFF
3. Primary Control Function Switch - STAB
4. Bias Control - CCW

RADAR NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

5. Video Gain Control - CCW
6. Variac Control - CCW (to stop)
7. STC Receiver Gain Control Switch - CCW
8. Waveguide Selector Switch - MAN LOAD
9. RCU Power Switch - STBY
10. Ejection Control Trigger Ring - Stowed
11. Pin No. 1 - Installed

AFTER PARKING

1. Ejection Seat - Position forward and up
2. Primary Control Function Switch - OFF
3. Terrain Computer Power Switch - OFF
4. RCU Power Switch - OFF
5. Ground Blowers Switch - OFF
6. Inform Pilot - BNS off
7. Bomb Indicator Lights Switch - OFF
8. External Racks Loaded Lights Switch B-52D - OFF
9. Interphone - Disconnected after engines off
10. Radar Pressure Pump Control Switch - OFF
11. Oxygen System:
    a. Regulator - OFF and 100% OXYGEN
    b. Supply Hose & Interphone Cord - Stowed
12. Compass Cutoff Switch - OFF
13. **Conventional Munitions Aboard - Install shackle locking pins and MER/MAU-12C/A rack locking and MER electrical safety pins**

    RN/N perform if qualified personnel are not available. For internal munitions, install a shackle locking pin in each shackle (bottom shackles only, for hi-density). On B-52D aircraft with external munitions, install a rack locking pin in each MER/MAU-12C/A rack and an electrical safety pin in each MER.

WARNING

External power will not be applied until step "13" has been completed.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING PROCEDURES (CONVENTIONAL MUNITIONS)

BOMBING — GENERAL

On training missions after practice bombs or conventional munitions have been released, a crew member will make a visual check of the bomb bay prior to RBS runs, camera attacks, or landing. This is to insure that all bombs and munitions have been released and that there are no objects that could fall from the bomb bay when the bomb doors are opened. On strike missions, a visual check of the bomb bay will be accomplished prior to landing if the tactical/fuel/recovery situation permits.

Proper usage of the conventional munitions release system is described in T.O. 1B-52C-34-2-1, Section I. If a release over any authorized area cannot be accomplished, release system power will be isolated and the aircraft will proceed by a safe route to the briefed base.

Prior to making any bomb runs, the BNS true heading will be checked using the automatic astrocompass on headings as close as possible to the planned bomb run headings. This heading error will be recorded. If the automatic astrocompass is inoperative, these heading checks will be made with the periscopic sextant. If, for any reason, it is impossible to obtain an astro heading check on or near the bomb run heading, the best available true heading correction will be applied to the BNS true heading for the bomb run.

The radar navigator will advise the pilot to center the PDI during the bomb run. If desired, BNS (second station) steering may be requested.

The navigator will monitor all phases of the bomb run. He will indicate to the radar navigator any apparent errors in crosshair placement, proper use of offset, GPI coordinate settings, timing, and release headings. Switch positions, warning lights, the MD-1, and doppler will be continuously checked and the radar navigator advised as necessary. The navigator will record all pertinent bombing data.

MULTIPLE TARGET RELEASES (HIGH ALTITUDE)

The checklist is designed to give the radar navigator and navigator the option of releasing conventional munitions by either radar synchronous techniques or by the alternate (Sky Spot) method. Careful attention must be given when selecting the desired Bomb Run checklist. Equal attention must be given to BRIC settings and light indications.

Use the Bomb Run (Synchronous-Normal Release) checklist when both internal and external munitions are to be released on a single bomb run. This checklist can also be used on subsequent releases when directed and EAR is authorized. Two other synchronous checklists are available; the Bomb Run (Synchronous-Internal Release), to be used when only internal munitions are to be released and the Bomb Run (Synchronous-External Release), to release only external munitions.

Use the Bomb Run (Alternate-Normal Release) checklist when both internal and external munitions are to be released on a single bomb run using the Sky Spot method. This checklist can also be used on subsequent releases when directed and EAR is authorized. Two other alternate checklists are available; the Bomb Run (Alternate-Internal Release), to be used when only internal munitions are to be released and the Bomb Run (Alternate-External Release), to release only external munitions.

The CMPR need only be accomplished once. The Post Bomb Release/Abort check must be accomplished immediately after each release. If further release attempts are to be made, proceed to the Before Pre-IP, Before IP, and appropriate Bomb Run checklist.

BOMBING — ALTERNATE

When the status of the BNS is such that a radar synchronous bomb run cannot be accomplished, the crew will refer to Volume IX, SACM 55-20, for emergency bombing procedures.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS)

BOMBING SYSTEMS CHECK

NOTE

- This check will normally be performed after level-off but may be performed prior to level-off to meet operational requirements but must always be completed prior to Conventional Munitions Preparation for Release.
- It is imperative that the following steps be completed in sequence:

1. Safety Check: (RN), Monitor (N)
   - a. Bombing System Switch - MANUAL
   - b. Master Bomb Control Switch - OFF
   - c. Special Weapons Lock Indicators - Indicate locked (clip-in)
   - d. Release Circuits Disconnect - Disconnected
   - e. External Release Power Switch **B-52D** - OFF
   - f. Notify Crew "Safety check complete"
2. MADREC - AUTO (N)
3. Bombing Equipment Check: (RN)
   - a. Normal Release Circuit Breaker - Out (RBS only - In)
   - b. Circuit Breakers - Checked, set
   - c. Internal BRIC - TRAIN, zero, light off; (RBS - SEL, light on **B-52C**, light dim **B-52D**)
   - d. Bomb Select Switch - SYN
   - e. PPI-OB Switch - OB
   - f. Crosshairs - Positioned

     Position crosshairs along the heading of the aircraft a sufficient distance to permit completion of the equipment check.
   - g. Function Switch - BOMB
   - h. Time-To-Go Indicator - Checked for drive (RN-P)

     Request pilot call TG at 30-second intervals, at 20 seconds TG for RBS, and at TG zero.
   - i. ATF - Checked

     Increase: drive of time-to-go meter should be momentarily speeded up. Decrease: drive of time-to-go meter should stop momentarily.
   - j. Trail - Checked

     Increase; drive of time-to-go meter should stop momentarily. Decrease; drive of time-to-go meter should be speeded up momentarily.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

k. PDI - Checked (RN-P)

Request pilot observe steering needle response to tracking handle corrections to both sides of center and return to zero.

l. Second Station - Requested

m. Second Station Check - Completed

Using tracking control, check for response of the aircraft to a turn. Release tracking control; aircraft should return to straight and level flight with steering needle centered. Repeat for a turn in the opposite direction.

n. Offset Checks - Completed

Check offsets 1 and 2 (and, on **D** aircraft, offsets 3 and 4) in turn, and observe that the crosshairs are correctly displaced.

o. VRM Check **B-52D** - Completed (Wet Snow only)

(1) Offset Selector Switch - OFFSET 2

(2) Radar Altitude Switch - ON

Expand scope presentation.

(3) Optional Bombing Switch - OPTIONAL RADAR

At switch actuation, observe that the VRM (checked against PMG marks) increases in range by 400 to 600 feet.

(4) Optional Bombing Switch - AN/ASQ-48 NORMAL

At switch actuation, observe that VRM decreases in range by 400 to 600 feet.

(5) Radar Altitude Switch - OFF

p. UHF Radios (RBS Only) - Set (RN-CP)

Notify copilot to switch radio to briefed frequency.

q. Bomb Tone Scoring Switch (RBS Only) - INITIATE

Check tone break with D-2 bomb release switch; reinitiate tone at 20 seconds T_G for automatic tone break.

r. Bomb Release Check: (RN)

(1) Bomb Tone Break (RBS Only) - Checked

(2) Time-to-Go Indicator - Indicates zero

(3) Bomb Release Light - On momentarily

(4) Function Switch - TRACK

s. PPI-OB Switch - PPI

t. Internal BRIC - TRAIN, zero, light off

4. Crew notified "Bombing system check complete"

5. MADREC - STDBY/OFF (as required) (N)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

BEFORE SKY SPOT TACTIC

- This checklist must be accomplished prior to CMPR for Sky Spot Tactics.
- Refer to T.O. 1B-52C-1-1 for additional information concerning Sky Spot Tactic.

1. Sky Spot Power Switch - Checked ON (N)
2. Sky Spot Mode Switch - As briefed (N)
3. Sky Spot Function Switch (if installed) - STBY (N)
4. APN-69 Power Switch - STDBY (N)
5. BNS Radar Frequency Control Switch - Decrease (set frequency near lower limit) (RN)

CONVENTIONAL MUNITIONS PREPARATION FOR RELEASE

NOTE

- Perform this checklist not later than 15 minutes prior to the Pre-IP (high deliveries), or not later than 15 minutes prior to descent (low deliveries).
- It is imperative that the following steps be completed in sequence.

1. Personal Locator Beacon Lanyard - Notify crew to set as required (N)

   For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation.

2. Bomb Bay & Walkway Lights Circuit Breakers - Out (RN)
3. Special Weapons Manual Lock Handle - Pulled and stowed (clip-in) (RN-EW)
4. Readiness Switches - READY (clip-in) (RN-P)
5. DCU-9/A Selector Switches - GND (clip-in) (RN)

   DCU-9/A must be in GND to obtain an armed release.

6. Special Weapons Lock Indicators - Indicate unlocked (clip-in) (RN)
7. Bomb Indicator Lights - On (for applicable munitions); Off, tested (clip-in) (RN)

   For hi-density loads, check each installed bay assembly by rotating the internal bomb indicator light control switch.

8. Internal Bomb Indicator Light Control Switch **B-52D** - Set as briefed (hi-density) (RN)

NOTE

For single string release, do not set this switch to a position for which no bay assembly is installed.

9. External Racks Loaded Light Switch **B-52D** - OFF (momentarily) then ON (RN)

   Actuation of the racks loaded light switch to OFF momentarily will open the isolation relay in the external release circuit.

10. External Racks Loaded Lights **B-52D** - ON (for applicable racks) (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

BEFORE PRE-IP

The following checklist will be completed within 1 hour of the Pre-IP.

1. Terrain Computer Power Switch - As required (RN)

   NOTE

   The terrain computer power switch must be ON for at least 90 seconds to provide AJ-1 capability.

2. Bombing Computations - Completed (Synchronous/Sky Spot Monitor)
   - a. Altitude - Measured (RN)
   - b. Bombing Data - Computed and cross-checked (RN-N)
   - c. Bombing Data - Set (RN-N)
     - (1) ATF - Set (RN)
     - (2) Trail - Set (RN)
     - (3) Offsets 1 & 2 **D** - Set (RN)
     - (4) Offsets 3 & 4 **D** - Set (N)
   - d. Bomb Run Data - Determined (N)
     - (1) Drift Correction Angle
     - (2) Initial Heading
     - (3) Ground Speed
     - (4) ETA to Bomb Release Line
3. Internal BRIC: (RN)
   - a. BRIC Switch - TRAIN
   - b. BRIC Counter - As briefed

     NOTE

     B-52D

     If release pulse requirement exceeds 50, set the BRIC counter to 50 and install the BRIC counter stop or restrain the BRIC counter during release.

   - c. BRIC Light - Off (counter set at zero for external release only)

     NOTE

     On subsequent releases, the BRIC light will be on when counter is set above zero.

   - d. BRIC Interval - As briefed

     WARNING

     B-52D

     If high drag munitions are carried, observe BRIC minimum interval restrictions of T.O. 1B-52C-34-2-1.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

4. External BRIC **B-52D**: (RN)

   a. BRIC Switch - TRAIN

   b. BRIC Counter - As briefed

   c. BRIC Light - Off (counter set at zero for internal release only)

NOTE

On subsequent releases, the BRIC light will be on when counter is set above zero.

   d. BRIC Interval - As briefed

WARNING

B-52D

If high drag munitions are carried externally, observe BRIC minimum interval restrictions of T.O. 1B-52C-34-2-1.

5. Optional Bombing Procedure **B-52D** - Accomplished (Wet Snow only) (RN)

   Refer to T.O. 1B-52C-1-1 for this procedure.

6. Bomb Run Review:

NOTE

- Accomplish within 1 hour prior to Pre-IP or after receipt of bombing information.
- Applicable items will be briefed by the crewmember having the response and acknowledgment of receipt and understanding given by each crewmember at completion of the review.

	NAV CALLS	RESPONSE
a.	"Radio Monitor Plan"	"Brief" (CP)
b.	"ETA to Bombs Away"	"__________" (N)
c.	"Bomb Door Open Point"	"__________" (RN)
ⓓ.	"Cell Color and Position"	"__________" (RN)
ⓔ.	"Bombing Procedures"	"Brief" (RN)
ⓕ.	"Emergency Bombing Procedure"	"Brief" (RN)
ⓖ.	"Time Delay-Separation Distance"	"__________ Seconds for __________ NM Separation " (RN)
h.	"EAR/RCD Time"	"__________" (RN)
i.	"Post Release Turn"	"__________" (RN)
j.	"Acknowledge Understanding and Code Words Reviewed"	"UNDERSTAND, REVIEWED" (ALL)

NOTE

If aircraft positions are changed after accomplishment of bomb run review, reaccomplish steps "d," "e," "f," and "g."

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

HIGH ALTITUDE BOMBING (CONVENTIONAL MUNITIONS)

BEFORE IP

1. Normal Release & Salvo Power Circuit Breakers - In (RN)
2. External Release Circuit Breaker **B-52D** - In; Out (internal release only) (RN)
3. Emer Door Open & Rel Circuit Breaker **B-52D** - In; Out (high drag munitions or partial release option) (RN)

   The emergency armed release system will not be used with high drag munitions.
4. Circuit Breakers - Checked (RN)
5. Bomb Door Control Circuit Breakers - Checked (RN-P)
6. MADREC - AUTO (N)
7. Bomb Indicator Lights Switch - ON (RN)
8. Special Weapons Select Switch - FWD (RN)
9. External Racks Loaded Lights Switch **B-52D** - ON (RN)
10. Bomb Release Mode Selector Switch **B-52** **1** - NORMAL/RAPID (as briefed) (RN)

WARNING

B-52D

If high drag munitions are carried, the bomb release mode selector switch must be in the NORMAL position to prevent bomb drafting and collisions.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

11. Internal Bomb Indicator Light Control Switch **B-52D** - As briefed (hi-density) (RN)

NOTE

B-52D

For single string release, during the release cycle the internal bomb indicator light control switch must remain positioned as briefed. Only when the release is complete may it be used to check other bay assemblies for hung munitions.

12. Single String Switch **B-52D** - As briefed (RN)
13. TAS - Checked (for planned TAS) (N-P)
14. Bombing Data Check: (Synchronous/Sky Spot Monitor)

	NAV CALLS	RESPONSE
a.	"Altitude"	"Reads ________" Set TGT/OAP (RN)
b.	"ATF"	"Reads ________" (RN)
c.	"Trail"	"Reads ________" (RN)
d.	"Offset 1"	"Reads ________ and ________" (RN)
e.	"Offset 2"	"Reads ________ and ________" (RN)
f.	"Offset 3 **D** "	"Reads ________ and ________" (N)
g.	"Offset 4 **D** "	"Reads ________ and ________" (N)

15. Internal BRIC:

	NAV CALLS	RN RESPONSE
a.	"BRIC Switch"	"________"
b.	"BRIC Counter"	"________"
c.	"BRIC Light"	"On **B-52C**, light dim **B-52D** ; Off" (external release only)

CAUTION

B-52D

A steady bright light will indicate internal shorting of the B-3C BRIC, preventing a BNS or D-2 release. An armed release can be accomplished using the emergency armed release system.

d.	"BRIC Interval"	"________"

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

16. External BRIC B-52D :

	NAV CALLS	RN RESPONSE
a.	"BRIC Switch"	"____________"
b.	"BRIC Counter"	"____________"
c.	"BRIC Light"	"Light dim; Off" (internal release only)

CAUTION

B-52D

A steady bright light will indicate internal shorting of the B-3C BRIC, preventing a BNS or D-2 release. An armed release can be accomplished using the emergency armed release system.

d.	"BRIC Interval"	"____________"

17. Radar Camera: (RN)
    - a. Power Switch - ON
    - b. Selector Switch - 1:12
18. Vertical Camera Intervalometer Power Switch - As briefed (RN)
19. Destination Latitude & Longitude Indicators - Set as required (N)
20. Over IP - Notify pilot and give initial heading for bomb run (N)
21. Landing Gear Standby Pumps B-52D - ON (combat only) (N-P)
22. ETA to Bomb Release Line - Rechecked (N)
23. Release Circuits Disconnect Door - Open (RN)

BOMB RUN (SYNCHRONOUS — NORMAL RELEASE)

1. Radar Recording Camera - 1:2 (RN)

② Bomb Select Switch - SYN (RN)

3. Heading Systems - Cross-checked (RN/N)

④ BNS Altitude - Checked for TGT/OAP (RN)

⑤ Offset Switches - As desired (RN)

Insure that the applicable ballistics control panel offset selector switch, the primary control panel offset switch, and, on D aircraft, the offset 1-2 or 3-4 selector switch are in the required position.

6. Aux PPI Switch - IN (RN)

⑦ Crosshairs on Aiming Point - Notify navigator (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

⑧ Navigation Unit - Updated (should read target coordinates) (RN-N)

9. Primary Control Function Switch - BOMB (RN)

10. Aux PPI Switch - OUT (RN)

11. PDI - Centered (ADF as required) (RN-P)

12. Pilot's Bombs-Released Light - Off (RN-P)

If the pilot's bombs-released light is illuminated, attempt to reset the internal BRIC by moving the BRIC switch to SEL, then to TRAIN and ZERO, then back to briefed setting. (**B-52D** Presence of a release pulse will be confirmed if the B-3C BRIC light is on bright.)

NOTE

If pilot's bombs-released light is illuminated and the internal BRIC cannot be reset, training missions do not attempt release. Combat missions complete steps "15.a" thru "15.f" and release using emergency armed release procedures.

WARNING

Completion of the bomb run check through RCD closure with the pilot's bombs-released light illuminated could result in immediate release of internal munitions.

13. External BRIC Light **B-52D** - Dim (RN)

A steady bright light will indicate internal shorting of the B-3C BRIC.

NOTE

B-52D

If the external B-3C BRIC light is bright, training missions do not attempt release. Combat missions complete the release configuration check; however, the external release power switch will remain OFF (step "15.f"). Release external munitions using the emergency armed release procedures at EAR time.

WARNING

B-52D

Completion of the bomb run check through external release power switch ON and RCD closure with the external B-3C BRIC light on bright will result in an inadvertent release of one or more external munitions.

14. MADREC **B-52D** or **J** - BOMB (N)

15. Release Configuration Check: (RN-N)

NOTE

When releases are to be made on a designated bombing range, do not perform this check until the aircraft is on the range.

	NAV CALLS	RN RESPONSE
a.	"Special Weapons Lock Indicators (Clip-In)"	"Indicate unlocked"

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

	NAV CALLS	RN RESPONSE
b.	"Master Bomb Control Switch"	"ON, light on"
c.	"Bombing System Switch"	"MANUAL"
d.	"Bomb Door Control Valve Lights Off"	
e.	"External Arming Switch B-52D "	"ARMED"
f.	"External Release Power Switch B-52D "	"ON"

16. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds Time-To-Go"	"60 TG (P)"
b.	"Bomb Doors"	"Opened"

Bomb doors will be opened manually using bomb door switch.

WARNING

If the bomb door not latched light is illuminated or there is an indicated bomb release, do not open the bomb doors. B-52D Release by the emergency armed release procedure at the proper release point.

NOTE

If bomb doors fail to open normally, use of standby pumps and/or emergency bomb door opening system is restricted to combat only.

c.	"RCD"	"Connected light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to Post Release/Abort checklist.

d.	"Doppler"	"OUT" (if desired)
e.	"Ready to Release Call"	"BNS in BOMB" (RN) "Doors open" "OAP ____________acquired" "Offset ____________IN" "EAR time______seconds" (if authorized) "Standing by to release"
f.	"20 seconds TG" (RBS only)	"Tone on" (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

17. Bomb Release Monitored - "Bombs away" (RN-P)

NOTE

- Combat Missions Only - If a bomb release indication is not received immediately after illumination of the bomb release light, actuate the D-2 release switch.
- The navigator will continue countdown from release "HACK" to "EAR time" (if authorized for release malfunction or BNS/D-2 backup). At action word "EAR" the RN will actuate the emergency armed release system. (Refer to Section III of T.O. 1B-52C-34-2-1.)

POST BOMB RELEASE/ABORT CHECK

Proceed to post bomb release/abort checklist.

BOMB RUN (SYNCHRONOUS — INTERNAL RELEASE)

1. Radar Recording Camera - 1:2 (RN)

② Bomb Select Switch - SYN (RN)

3. Heading Systems - Cross-checked (RN/N)

④ BNS Altitude - Checked for TGT/OAP (RN)

⑤ Offset Switches - As desired (RN)

Insure that the applicable ballistics control panel offset selector switch, the primary control panel offset switch, and, on **D** aircraft, the offset 1-2 or 3-4 selector switch are in the required position.

6. Aux PPI Switch - IN (RN)

⑦ Crosshairs on Aiming Point - Notify navigator (RN)

⑧ Navigation Unit - Updated (should read target coordinates) (RN-N)

9. Primary Control Function Switch - BOMB (RN)

10. Aux PPI Switch - OUT (RN)

11. PDI - Centered (ADF as required) (RN-P)

12. Pilot's Bombs-Released Light - Off (RN-P)

If the pilot's bombs-released light is illuminated, attempt to reset the internal BRIC by moving the BRIC switch to SEL, then to TRAIN and ZERO, then back to briefed setting. (**B-52D** Presence of a release pulse will be confirmed if the B-3C BRIC light is on bright.)

NOTE

If pilot's bombs-released light is illuminated and the internal BRIC cannot be reset, do not attempt release. Proceed to the Post Release/Abort checklist.

WARNING

Completion of the bomb run check through RCD closure with the pilot's bombs-released light illuminated could result in immediate release of internal munitions.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

13. External Rel Circuit Breaker **B-52D** - Out (RN)

14. Emer Door Open & Rel Circuit Breaker **B-52D** - Checked Out (RN)

15. MADREC **B-52D** or **J** - BOMB (N)

16. Release Configuration Check: (RN-N)

NOTE

When releases are to be made on a designated bombing range, do not perform this check until the aircraft is on the range.

	NAV CALLS	RN RESPONSE
a.	"Special Weapons Lock Indicators (Clip-In)"	"Indicate unlocked"
b.	"Master Bomb Control Switch"	"ON, light on"
c.	"Bombing System Switch"	"MANUAL"
d.	"Bomb Door Control Valve Lights Off"	
e.	"External Arming Switch **B-52D** "	"ARMED"
f.	"External Release Power Switch **B-52D** "	"OFF"

17. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds Time-To-Go"	"60 TG" (P)
b.	"Bomb Doors"	"Opened" (RN)

Bomb doors will be opened manually using bomb door switch.

WARNING

If the bomb door not latched light is illuminated or there is an indicated bomb release, do not open the bomb doors or attempt release. Proceed to the Post Release/Abort checklist.

NOTE

If bomb doors fail to open normally, use of standby pumps and/or emergency bomb door opening is not authorized.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

NAV CALLS	RESPONSE
c. "RCD"	"Connected light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to the Post Release/Abort checklist.

NAV CALLS	RESPONSE
d. "Doppler"	"OUT" (if desired)
e. "Ready to Release Call"	"BNS in BOMB" (RN) "Doors open" "OAP________acquired" "Offset________IN" "RCD time_____seconds" "Standing by to release"
f. "20 seconds TG" (RBS only)	"Tone on" (RN)

18. Bomb Release Monitored - "Bombs away" (RN-P)

WARNING

Actuate "EAR" on last release only.

NOTE

- Combat Missions Only - If a bomb release indication is not received immediately after illumination of the bomb release light, actuate the D-2 release switch.
- The navigator will continue countdown from release "HACK" to "RCD time." At action word "RCD" the RN will disconnect the release circuits disconnect to stop release.

POST BOMB RELEASE/ABORT CHECK

Proceed to post bomb release/abort checklist.

NOTE

After completing the Post Bomb Release/Abort check, to release externals on subsequent run, proceed to the Before Pre-IP, Before IP, and appropriate Bomb Run (Normal Release) checklist.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

BOMB RUN (SYNCHRONOUS — EXTERNAL RELEASE)

1. Radar Recording Camera - 1:2 (RN)

② Bomb Select Switch - SYN (RN)

3. Heading Systems - Cross-checked (RN/N)

④ BNS Altitude - Checked for TGT/OAP (RN)

⑤ Offset Switches - As desired (RN)

Insure that the applicable ballistics control panel offset selector switch, the primary control panel offset switch, and, on **D** aircraft, the offset 1-2 or 3-4 selector switch are in the required position.

6. Aux PPI Switch - IN (RN)

⑦ Crosshairs on Aiming Point - Notify navigator (RN)

⑧ Navigation Unit - Updated (should read target coordinates) (RN-N)

9. Primary Control Function Switch - BOMB (RN)

10. Aux PPI Switch - OUT (RN)

11. PDI - Centered (ADF as required) (RN-P)

12. K-17 Camera Door - Opened (RN)

13. Emer Door Open & Rel Circuit Breaker **B-52D** - Checked Out (RN)

14. External BRIC Light **B-52D** - Dim (RN)

A steady bright light will indicate internal shorting of the B-3C BRIC.

NOTE

If the external B-3C BRIC light is bright, do not release. Proceed to the Post Release/Abort checklist.

WARNING

Completion of the bomb run check through external release power switch ON and RCD closure with the external B-3C BRIC light on bright will result in an inadvertent release of one or more external munitions.

15. MADREC **B-52D** or **J** - BOMB (N)

16. Release Configuration Check: (RN-N)

NOTE

When releases are to be made on a designated bombing range, do not perform this check until the aircraft is on the range.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

	NAV CALLS	RN RESPONSE
a.	"Bombing System Switch"	"MANUAL"
b.	"External Arming Switch **B-52D** "	"ARMED"
c.	"External Release Power Switch **B-52D** "	"ON"

17. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds Time-To-Go"	"60 TG" (P)
b.	"Bomb Doors"	"Closed" (RN)

NOTE

For external release only, bomb doors will not be opened.

c.	"RCD"	"Connected, light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to the Post Release/Abort checklist.

d.	"Doppler"	"OUT" (if desired)
e.	"Ready to Release Call"	"BNS in BOMB" (RN) "Doors closed" "OAP __________ acquired" "Offset __________ IN" "RCD time _____ seconds" "Standing by to release"
f.	"20 Seconds TG" (RBS only)	"Tone On" (RN)

18. Bomb Release Monitored - "Bombs away" (RN-P)

WARNING

Actuate "EAR" on last release only.

NOTE

- Combat Missions Only - If a bomb release indication is not received immediately after illumination of the bomb release light, actuate the D-2 release switch.
- The navigator will continue countdown from release "HACK" to "RCD time." At action word "RCD" the RN will disconnect the release circuits disconnect to stop release.

19. K-17 Camera Manual Initiation Switch - Depressed (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

POST BOMB RELEASE/ABORT CHECK

Proceed to post bomb release/abort checklist.

NOTE

> After completing the Post Bomb Release/Abort check, to release internals on subsequent run, proceed to the Before Pre-IP, Before IP, and appropriate Bomb Run (Normal Release) checklist.

BOMB RUN (ALTERNATE — NORMAL RELEASE)

1. Radar Recording Camera - 1:2 (RN)
2. Time to Release - Computed and cross-checked (RN-N)
3. Sky Spot Power Switch - As briefed (N)
4. Sky Spot Function Switch (if installed) - As briefed (N)
5. Heading Systems - Cross-checked (RN/N)
6. Primary Control Function Switch - NAV (RN)
7. NAV Mode Selector Switch - NORM NAV (N)
8. Authentication - Complete (Sky Spot as required) (N-CP)
9. Trail/Dask Corrections - Accomplished (as required) (RN-N)
10. Sky Spot Bomb Run - Monitored (RN-N-P)

NOTE

(Lead/Single Aircraft)

- If BNS monitoring of Sky Spot bomb run is required, accomplish steps "2," "4," "5," "7," and "8" (circled items) of Bomb Run (Synchronous) checklist and place primary control function switch to TRACK. Use of BOMB function is not authorized.
- If a Synchronous Backup is authorized, remain in TRACK and release by D-2 at the proper release time.

11. Pilot's Bombs-Released Light - Off (RN-P)

If the pilot's bombs-released light is illuminated, attempt to reset internal BRIC by moving the BRIC switch to SEL, then to TRAIN and ZERO, then back to briefed setting. (**B-52D** Presence of a release pulse will be confirmed if the B-3C BRIC light is on bright.)

NOTE

> If pilot's bombs-released light is illuminated and internal BRIC cannot be reset, training missions do not attempt release. Combat missions complete steps "14.a" thru "14.f" and release using the emergency armed release procedures.

WARNING

> Completion of the bomb run check through RCD closure with the pilot's bombs-released light illuminated could result in immediate release of internal munitions.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

12. External BRIC Light **B-52D** - Dim (RN)

A steady bright light will indicate internal shorting of the B-3C BRIC.

NOTE

B-52D

If the external B-3C BRIC light is bright, training missions do not attempt release. Combat missions complete the release configuration check; however, the external release power switch will remain OFF (step "14.f"). Release external munitions using the emergency armed release procedures at EAR time.

WARNING

B-52D

Completion of the bomb run check through external release power switch ON and RCD closure with the external B-3C BRIC light on bright will result in an inadvertent release of one or more external munitions.

13. MADREC **B-52D** or **J** - BOMB (N)

14. Release Configuration Check: (RN-N)

NOTE

When releases are to be made on a designated bombing range, do not perform this check until the aircraft is on the range.

	NAV CALLS	RN RESPONSE
a.	"Special Weapons Lock Indicators (Clip-In)"	"Indicate unlocked"
b.	"Master Bomb Control Switch"	"ON, light on"
c.	"Bombing System Switch"	"MANUAL"
d.	"Bomb Door Control Valve Lights Off"	
e.	"External Arming Switch **B-52D** "	"ARMED"
f.	"External Release Power Switch **B-52D** "	"ON"

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

Lead/Single Aircraft

15. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds TG"	"60 TG" (MSQ/P/RN-N)

For alternate releases, RN/N will determine 60 seconds to release from timing point or by best means possible.

NOTE

Sky Spot releases - Bomb doors will be opened after MSQ or the pilot calls 60 seconds TG.

b.	"Stopwatch Started" (as required) (RN-N)	
c.	"Bomb Doors"	"Opened"

Bomb doors will be opened manually using bomb door switch.

WARNING

If the bomb door not latched light is illuminated or there is an indicated bomb release, do not open the bomb doors. **B-52D** Release by the emergency armed release procedure at the proper release point.

NOTE

If bomb doors fail to open normally, use of standby pumps and/or emergency bomb door opening is restricted to combat only.

d.	"RCD"	"Connected, light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to the Post Release/Abort checklist.

e.	"Ready to Release Call"	"Doors open" (RN) "EAR time______seconds" "Standing by MSQ countdown"
f.	"30 Seconds TG" (Sky Spot Monitor)	"TG and PDI within limits" (RN-P)

NOTE

With crosshairs positioned on OAP and primary control function switch in TRACK, monitor TG and PDI. If readings are not within briefed limits, withhold release. Proceed to the Post Release/Abort checklist.

g.	"20 Seconds TG" (RBS only)	"Tone on" (RN)
h.	"Bomb Release"	"HACK" (MSQ/N)

WARNING

Crew will insure that release of weapons is not initiated prematurely when hearing word "HACK" pertaining to another aircraft.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

16. At Bomb Release Time/Signal:

    a. D-2 Bomb Release Switch - Actuated (RN)

    b. Bomb Release Monitored - "Bombs away" (RN-P)

NOTE

> The navigator will continue countdown from release "HACK" to "EAR time" (if authorized for release malfunction or D-2 backup). At action word "EAR" the RN will actuate the emergency armed release system. (Refer to Section III of T.O. 1B-52C-34-2-1.)

Trailing/Emergency

15. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds TG"	"60 TG" (MSQ/P/RN-N)

For alternate releases, RN/N will determine 60 seconds to release from timing point or by best means possible.

NOTE

> Sky Spot releases - Bomb doors will be opened after MSQ or the pilot calls 60 seconds TG.

b.	"Stopwatch Started" (as required) (RN-N)	
c.	"Bomb Doors"	"Opened"

Bomb doors will be opened manually using bomb door switch.

WARNING

> If the bomb door not latched light is illuminated or there is an indicated bomb release, do not open the bomb doors. **B-52D** Release by the emergency armed release procedure at the proper release point.

NOTE

> If bomb doors fail to open normally, use of standby pumps and/or emergency bomb door opening is restricted to combat only.

d.	"RCD"	"Connected, light on" (RN/N)

NOTE

> To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to the Post Release/Abort checklist.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

NAV CALLS	RN RESPONSE
e. "Ready to Release Call"	"Doors open" (RN) "Release delay_____seconds" "Separation_____mile(s)" "EAR time_____seconds" "Standing by MSQ/release countdown"

NOTE

Trailing aircraft navigator will initiate release timing on MSQ/directing aircraft release "HACK."

f. "MSQ/Lead Release"	"Stopwatch started" (RN-N)

WARNING

Crew will insure that release of weapons is not initiated prematurely when hearing word "HACK" pertaining to another aircraft.

16. At Bomb Release Time/Signal:
    a. D-2 Bomb Release Switch - Actuated (RN)
    b. Bomb Release Monitored - "Bombs away" (RN-P)

NOTE

The navigator will continue countdown from release "HACK" to "EAR Time" (if authorized for release malfunction or D-2 backup). At action word "EAR" the RN will actuate the emergency armed release system. (Refer to Section III of T.O. 1B-52C-34-2-1.)

POST BOMB RELEASE/ABORT CHECK

Proceed to the post bomb release/abort checklist.

BOMB RUN (ALTERNATE — INTERNAL RELEASE)

1. Radar Recording Camera - 1:2 (RN)
2. Time to Release - Computed and cross-checked (RN-N)
3. Sky Spot Power Switch - As briefed (N)
4. Sky Spot Function Switch (if installed) - As briefed (N)
5. Heading Systems - Cross-checked (RN/N)
6. Primary Control Function Switch - NAV (RN)
7. NAV Mode Selector Switch - NORM NAV (N)
8. Authentication - Complete (Sky Spot as required) (N-CP)
9. Trail/Dask Corrections - Accomplished (as required) (RN-N)
10. Sky Spot Bomb Run - Monitored (RN-N-P)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

NOTE

(Lead/Single Aircraft)

- If BNS monitoring of Sky Spot bomb run is required, accomplish steps "2," "4," "5," "7," and "8" (circled items) of Bomb Run (Synchronous) checklist and place primary control function switch to TRACK. Use of BOMB function is not authorized.
- If a Synchronous Backup is authorized, remain in TRACK and release by D-2 at the proper release time.

11. Pilot's Bombs-Released Light - Off (RN-P)

If the pilot's bombs released light is illuminated, attempt to reset the internal BRIC by moving the BRIC switch to SEL, then to TRAIN and ZERO, then back to briefed setting. **B-52D** Presence of a release pulse will be confirmed if the B-3C BRIC light is on bright.

NOTE

If pilot's bombs-released light is illuminated and the internal BRIC cannot be reset, do not attempt release. Proceed to the Post Release/Abort checklist.

WARNING

Completion of the bomb run check through RCD closure with the pilot's bombs-released light illuminated could result in immediate release of internal munitions.

12. External Rel Circuit Breaker **B-52D** - Out (RN)
13. Emer Door Open & Rel Circuit Breaker **B-52D** - Checked Out (RN)
14. MADREC **B-52D** or **J** - BOMB (N)
15. Release Configuration Check:

NOTE

When releases are to be made on a designated bombing range, do not perform this check until the aircraft is on the range.

	NAV CALLS	RN RESPONSE
a.	"Special Weapons Lock Indicators (Clip-In)"	"Indicate unlocked"
b.	"Master Bomb Control Switch"	"ON, light on"
c.	"Bombing System Switch"	"MANUAL"
d.	"Bomb Door Control Valve Lights Off"	
e.	"External Arming Switch **B-52D** "	"ARMED"
f.	"External Release Power Switch **B-52D** "	"OFF"

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

(Lead/Single Aircraft)

16. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds TG"	"60 TG" (MSQ/P/RN-N)

For alternate releases, RN/N will determine 60 seconds to release from timing point or by best means possible.

NOTE

Sky Spot releases - Bomb doors will be opened after MSQ or the pilot calls 60 seconds TG.

b.	"Stopwatch Started" (as required) (RN-N)	
c.	"Bomb Doors"	"Opened" (RN)

Bomb doors will be opened manually using bomb door switch.

WARNING

If the bomb door not latched light is illuminated or there is an indicated bomb release, do not open the bomb doors or attempt release. Proceed to the Post Release/Abort checklist.

NOTE

If bomb doors fail to open normally, use of standby pumps and/or emergency bomb door opening is restricted to combat only.

d.	"RCD"	"Connected, light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to the Post Release/Abort checklist.

e.	"Ready to Release Call"	"Doors open" (RN) "RCD time____ seconds" "Standing by MSQ countdown"
f.	"30 Seconds TG" (Sky Spot Monitor)	"TG and PDI within limits" (RN-P)

NOTE

With crosshairs positioned on OAP and primary control function switch in TRACK, monitor TG and PDI. If readings are not within briefed limits, withhold release. Proceed to the Post Release/Abort checklist.

g.	"20 Seconds TG" (RBS only)	"Tone on" (RN)
h.	"Bomb Release"	"HACK" (MSQ/N)

WARNING

Crew will insure that release of weapons is not initiated prematurely when hearing word "HACK" pertaining to another aircraft.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

17. At Bomb Release Time/Signal:

    a. D-2 Bomb Release Switch - Actuated (RN)

    b. Bomb Release Monitored - "Bombs away" (RN-P)

WARNING

Actuate "EAR" on last release only.

NOTE

The navigator will continue countdown from release "HACK" to "RCD time." At action word "RCD" the RN will disconnect the release circuits disconnect to stop release.

Trailing/Emergency

16. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds TG"	"60 TG" (MSQ/P/RN-N)

For alternate releases, RN/N will determine 60 seconds to release from timing point or by best means possible.

NOTE

Sky Spot releases - Bomb doors will be opened after MSQ or the pilot calls 60 seconds TG.

b.	"Stopwatch Started" (as required) (RN-N)	
c.	"Bomb Doors"	"Opened" (RN)

Bomb doors will be opened manually using bomb door switch.

WARNING

If the bomb door not latched light is illuminated or there is an indicated bomb release, do not open the bomb doors or attempt release. Proceed to the Post Release/Abort checklist.

NOTE

If bomb doors fail to open normally, use of standby pumps and/or emergency bomb door opening is restricted to combat only.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

	NAV CALLS	RESPONSE
d.	"RCD"	"Connected, light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to the Post Release/Abort checklist.

e.	"Ready to Release Call"	"Doors open" (RN) "Release delay_____seconds" "Separation_____mile(s)" "RCD time_____seconds" "Standing by MSQ/release countdown"

NOTE

Trailing aircraft navigator will initiate release timing on MSQ/directing aircraft release "HACK."

f.	"MSQ/Lead Release"	"Stopwatch started" (RN-N)

WARNING

Crew will insure that release of weapons is not initiated prematurely when hearing word "HACK" pertaining to another aircraft.

17. At Bomb Release Time/Signal:
    a. D-2 Bomb Release Switch - Actuated (RN)
    b. Bomb Release Monitored - "Bombs away" (RN-P)

WARNING

Actuate "EAR" on last release only.

NOTE

The navigator will continue countdown from release "HACK" to "RCD time." At action word "RCD" the RN will disconnect the release circuits disconnect to stop release.

POST BOMB RELEASE/ABORT CHECK

Proceed to post bomb release/abort checklist.

NOTE

After completing the Post Bomb Release/Abort check, to release externals on subsequent run, proceed to the Before Pre-IP, Before IP, and appropriate Bomb Run (Normal Release) checklist.

BOMB RUN (ALTERNATE – EXTERNAL RELEASE)

1. Radar Recording Camera - 1:2 (RN)
2. Time to Release - Computed and cross-checked (RN-N)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

3. Sky Spot Power Switch - As briefed (N)
4. Sky Spot Function Switch (if installed) - As briefed (N)
5. Heading Systems - Cross-checked (RN/N)
6. Primary Control Function Switch - NAV (RN)
7. NAV Mode Selector Switch - NORM NAV (N)
8. Authentication - Complete (Skyspot as required) (N-CP)
9. Trail/DASK Corrections - Accomplished (as required) (RN-N)
10. Sky Spot Bomb Run - Monitored (RN-N-P)

NOTE

(Lead/Single Aircraft)

- If BNS monitoring of Sky Spot bomb run is required, accomplish steps "2," "4," "5," "7," and "8" (circled items) of Bomb Run (Synchronous) checklist and place primary control function switch to TRACK. Use of BOMB function is not authorized.
- If a Synchronous Backup is authorized, remain in TRACK and release by D-2 at the proper release time.

11. K-17 Camera Door - Opened (RN)
12. Emer Bomb Door Open & Rel Circuit Breaker **B-52D** - Checked out (RN)
13. External BRIC Light **B-52D** - Dim (RN)

NOTE

If the external B-3C BRIC light is bright, do not release. Proceed to the Post Release/Abort checklist.

WARNING

Completion of the bomb run check through external release power switch ON and RCD closure with the external B-3C BRIC light on bright will result in an inadvertent release of one or more external munitions.

14. MADREC **B-52D** or **J** - BOMB (N)
15. Release Configuration Check:

NOTE

When releases are to be made on a designated bombing range, do not perform this check until the aircraft is on the range.

	NAV CALLS	RN RESPONSE
a.	"Bombing System Switch"	"MANUAL"
b.	"External Arming Switch **B-52D** "	"ARMED"
c.	"External Release Power Switch **B-52D** "	"ON"

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

Lead/Single Aircraft

16. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds TG"	"60 TG" (MSQ/P/RN-N)

"For alternate releases, RN/N will determine 60 seconds to release from timing point or by best means possible.

b.	"Stopwatch Started" (as required) (RN-N)	
c.	"Bomb Doors"	"Closed" (RN)

NOTE

For external release only, bomb doors will not be opened.

d.	"RCD"	"Connected, light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to the Post Release/Abort checklist.

e.	"Ready to Release Call"	"Doors closed" (RN) "RCD time________seconds" "Standing by MSQ countdown"
f.	"30 Seconds TG" (Sky Spot Monitor)	"TG and PDI within limits" (RN-P)

NOTE

With crosshairs positioned on OAP and primary control function switch in TRACK, monitor TG and PDI. If readings are not within briefed limits, withhold release. Proceed to the Post Release/Abort checklist.

g.	"20 Seconds TG" (RBS only)	"Tone on" (RN)
h.	"Bomb Release"	"HACK" (MSQ/N)

WARNING

Crew will insure that release of weapons is not initiated prematurely when hearing word "HACK" pertaining to another aircraft.

17. At Bomb Release Time/Signal:

    a. D-2 Bomb Release Switch - Actuated (RN)

    b. K-17 Camera Manual Initiation Switch - Depressed (RN)

    c. Bomb Release Monitored - "Bombs away" (RN-P)

WARNING

Actuate "EAR" on last release only.

NOTE

The navigator will continue countdown from release "HACK" to "RCD time." At action word "RCD" the RN will disconnect the release circuits disconnect to stop release.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

Trailing/Emergency

16. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"Standing By 60 Seconds TG"	"60 TG" (MSQ/RN-N)

For alternate releases, RN/N will determine 60 seconds to release from timing point or by best means possible.

b.	"Stopwatch Started" (as required) (RN-N)	
c.	"Bomb Doors"	"Closed" (RN-P)

NOTE

For external release only, bomb doors will not be opened.

d.	"RCD"	"Connected, light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to the Post Release/Abort checklist.

e.	"Ready to Release Call"	"Doors, Closed" (RN) "Release Delay_____seconds" "Separation_____mile(s)" "RCD time_____seconds" "Standing by MSQ/release countdown

NOTE

Trailing aircraft navigator will initiate release timing on MSQ/directing aircraft release "HACK."

f.	"MSQ/Lead Release"	"Stopwatch started" (RN-N)

WARNING

Crew will insure that release of weapons is not initiated prematurely when hearing word "HACK" pertaining to another aircraft.

17. At Bomb Release Time/Signal:

  a. D-2 Bomb Release Switch - Actuated (RN)

  b. K-17 Camera Manual Initiation Switch - Depressed (RN)

  c. Bomb Release Monitored (RN-P)

WARNING

Actuate "EAR" on last release only.

NOTE

The navigator will continue countdown from release "HACK" to "RCD time." At action word "RCD" the RN will disconnect the release circuits disconnect to stop release.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

POST BOMB RELEASE/ABORT CHECK

Proceed to post bomb release/abort checklist.

NOTE

> After completing the Post Bomb Release/Abort check, to release internals on subsequent run, proceed to the Before Pre-IP, Before IP, and appropriate Bomb Run (Normal Release) checklist.

LOW ALTITUDE BOMBING (CONVENTIONAL MUNITIONS)

BEFORE DESCENT

1. Terrain Computer Power Switch - ON (approximately 1 hour prior to descent) (RN)

WARNING

> A 30-minute warmup time for the terrain computer is required before reliable terrain avoidance operation is available.

2. Inflight TA Functional Check - Accomplished (RN-N)

   Use the "Inflight TA Functional Check" checklist.

3. Normal Release, Salvo Power & **B-52D** External Rel Circuit Breakers - In (RN)
4. Emer Door Open & Rel Circuit Breaker **B-52D** - In; Out (high drag munitions) (RN)

   The emergency armed release system will not be used with high drag munitions.

5. Circuit Breakers - Set (RN)
6. Bomb Door Control Circuit Breakers - Set (RN-P)
7. Special Weapons Select Switch - FWD (RN)
8. Bomb Release Mode Selector Switch **B-52** **1** - NORMAL/RAPID (as briefed) (RN)

WARNING

> **B-52D**
>
> If high drag munitions are carried, the bomb release mode selector switch must be in the NORMAL position to prevent bomb drafting and collisions.

9. Bomb Indicator Lights Switch - ON (RN)
10. External Racks Loaded Lights Switch **B-52D** - ON (RN)
11. Internal Bomb Indicator Light Control Switch **B-52D** - As briefed (hi-density) (RN)

NOTE

> **B-52D**
>
> For single string release, during the release cycle the internal bomb indicator light control switch must remain positioned as briefed. Only when the release is complete may it be used to check other bay assemblies for hung munitions.

12. Single String Switch **B-52D** - As briefed (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

13. FRL Angle of Attack Indicator - Set (N); Cross-checked (RN)

Set FRL angle of attack indicator for the predicted conditions at the TA calibration point (figure 8-8). The FRL angle of attack will have to be reset periodically during terrain avoidance system flight due to changes in aircraft gross weight and/or airspeed.

NOTE

- The FRL angle of attack should be updated to maintain the set-in value accurate within 0.2°.
- The FRL angle of attack values should be computed for zero airbrakes or as required.

14. Bombing Altitude - Computed, cross-checked (RN-N)
15. TA Calibration Altitude - Computed, cross-checked (RN-N)

Forecast altimeter setting and "D" values from PFSV will be used.

16. Bombing Data - Computed and cross-checked (RN-N)
17. Bombing Data: (RN-N)
    - a. ATF - Set (RN)
    - b. Trail - Set (RN)
    - c. Offsets 1 & 2 - Set (RN)
    - d. Offsets 3 & 4 **D** - Set (N)
18. Internal BRIC: (RN)
    - a. BRIC Switch - TRAIN
    - b. BRIC Counter - As briefed

NOTE

B-52D

If release pulse requirement exceeds 50, set the BRIC counter to 50 and install the BRIC counter stop or restrain the BRIC counter during release.

- c. BRIC Light - On **B-52C** , dim **B-52D**

CAUTION

B-52D

A steady bright light will indicate internal shorting of the B-3C BRIC, preventing a BNS or D-2 release. An armed release can be accomplished using the emergency armed release system.

- d. BRIC Interval - As briefed

WARNING

B-52D

If high drag munitions are carried, observe BRIC minimum interval restrictions of T.O. 1B-52C-34-2-1.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

19. External BRIC B-52D : (RN)

    a. BRIC Switch - TRAIN

    b. BRIC Counter - As briefed

    c. BRIC Light - On B-52C, dim B-52D

CAUTION

B-52D

A steady bright light will indicate internal shorting of the B-3C BRIC, preventing a BNS or D-2 release. An armed release can be accomplished using the emergency armed release system.

    d. BRIC Interval - As briefed

WARNING

B-52D

If high drag munitions are carried externally, observe BRIC minimum interval restrictions of T.O. 1B-52C-34-2-1.

20. Bomb Data Check: (RN-N)

	NAV CALLS	RESPONSE
a.	"ATF"	"Reads__________" (RN)
b.	"TRAIL"	"Reads__________" (RN)
c.	"Offset 1"	"Reads__________and__________" (RN)
d.	"Offset 2"	"Reads__________and__________" (RN)
e.	"Offset 3 D "	"Reads__________and__________" (N)
f.	"Offset 4 D "	"Reads__________and__________" (N)

21. Internal BRIC:

	NAV CALLS	RN RESPONSE
a.	"BRIC Switch"	"__________"
b.	"BRIC Counter"	"__________"
c.	"BRIC Light"	"On B-52C , light dim B-52D "

CAUTION

B-52D

A steady bright light will indicate internal shorting of the B-3C BRIC, preventing a BNS or D-2 release. An armed release can be accomplished using the emergency armed release system.

d.	"BRIC Interval"	"__________"

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

22. External BRIC **B-52D** :

	NAV CALLS	RN RESPONSE
a.	"BRIC Switch"	"__________"
b.	"BRIC Counter"	"__________"
c.	"BRIC Light"	"Dim"

CAUTION

B-52D

A steady bright light will indicate internal shorting of the B-3C BRIC, preventing a BNS or D-2 release. An armed release can be accomplished using the emergency armed release system.

d.	"BRIC Interval"	"__________"

23. Radar Camera: (RN)
    - a. Power Switch - ON
    - b. Selector Switch - As required

24. Bomb Run Headings & Timing Data - Determined and cross-checked (RN-N)

    Use latest metro information to compute heading and timing data for all low level targets prior to descent. Revise as necessary if significantly different winds are encountered in the target area.

25. Navigation Unit - Updated (RN-N)

26. Initial Level-Off Indicated Altitude - Determined (RN-N)

27. MADREC - AUTO (N)

28. BNS Radar Set to Alignment Frequency - Accomplished (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

DESCENT AND AFTER DESCENT

1. Altimeter Setting - Determined and set (RN-N-P-CP)

   Compute a level-off altimeter setting using metro or in-flight "D" values. PFSV or ARTC altimeter settings will be used if available. Reset altimeter to station pressure immediately prior to initiating penetration or upon passing through transition altitude.

2. Descent Point - Pilot notified (N)

3. Altitude Calls - Accomplished (RN)

   Coordinate with the pilot as to level-off altitude(s) to be used for descent and entry to the low altitude navigation leg. Radar navigator calls off altitude to the pilot every 5000 feet, starting with the first multiple of 5000 feet. Upon reaching initial level-off altitude plus 5000 feet, radar navigator informs the pilot every 1000 feet and at level-off altitude. Coordinate with the pilot as to proper heading and altitude to be used during the low altitude navigation leg at each change of heading and/or altitude.

4. Altitude Measured (if applicable) - Accomplished (RN)

   Level off momentarily and measure altitude at as low an altitude as practical if over reasonabley level terrain of known elevation.

5. Level Off at IFR Altitude/Emergency Minimum Safe Altitude - Accomplished (P-CP-RN-N)

   NOTE

   For descent into Low Altitude High Speed routes (VFR), initial level off should be made at the planned emergency minimum safe altitude for that sequence.

6. Bombing Altitude - Set (RN)

7. Altitude Disable Switch - DISABLE (RN)

8. Radar Altimeter Indicators & Pressure Altimeters - Cross-checked (P-CP-RN-N)

   Compute true altitude by adding radar altimeter reading to terrain elevation and cross-check with the pressure altimeters. If the IFR altitude/emergency minimum safe altitude exceeds 5000 feet absolute altitude (radar altimeter capability), the cross-check must be made as soon as a lower absolute altitude permits.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

8A. Altimeters - Reset (P-CP-RN)

Forecast altimeter setting obtained from PFSV will be used for TA calibration.

9. Level Off at Predetermined TA Calibration Altitude - Accomplished (P-CP-RN-N)

Level off will be at 800 feet above the calibration terrain feature or point.

10. Radar Altimeter Indicators & Pressure Altimeters - Cross-checked (P-CP-RN-N)

11. TA Calibration - Accomplished (P-CP-RN-N)

NOTE

- The radar navigator will be responsible for monitoring altitude and position during the TA calibration checks.
- The radar navigator is responsible for monitoring terrain beyond the range selected on the pilots' terrain display indicators. The radar navigator will alert the pilot when approaching the preselected calibration area and will make a 10-mile range call and continue 1-mile range calls until the pilot acknowledges that the terrain feature is present on the terrain display indicator.
- The navigator will record all readings made by the pilot during this check on SAC Form 449 and announce the corrections to be applied.

12. TA System Error Compensation - Accomplish, if applicable (P-CP-N/RN)

If a system error exists, the TA system error compensation procedures in Section IV should be accomplished, time and/or conditions permitting. Normally, a minimum of 60 miles will be required prior to commencing the bomb run to facilitate accomplishment of calibration and error compensations, if required. If time and/or conditions do not allow the necessary compensation procedures to be accomplished, the published IFR altitude will be maintained. In any event, inflight calibration data and TA system error computations will be recorded on SAC Form 449.

13. Altimeters - Set (to true altitude) (P-CP-RN)

True altitude will be determined from an altitude measurement if possible; otherwise, use the predicted D value converted to an altimeter setting. When accurate altimeter settings for the route are available, set and update as necessary.

NOTE

If over reasonably level terrain of known elevation and absolute altitude is less than 5000 feet, true altitude may be determined by adding radar altimeter reading to terrain elevation.

14. Final Descent to TA Altitude - Monitored (RN-N)

NOTE

- Radar navigator and navigator will monitor radar scope presentations. The navigator will monitor all other instruments available.
- The radar navigator provides terrain assessments beyond the pilot's range. When hazardous terrain is observed, the radar navigator will continue to advise pilot until pilot is tracking obstacle on his indicator.

15. MADREC - AUTO (N)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

BEFORE IP

1. Target Area Altimeter Setting - Set (P-CP-RN)

   Pressure altimeters may be calibrated using radar altimeter if time and conditions permit.

2. Radar Camera Selector Switch - Set 1:4 (RN)
3. Vertical Camera Intervalometer Power Switch - As briefed (RN)
4. Destination Latitude & Longitude Indicators - Set to target coordinates (N)
5. Heading Systems - Cross-checked (RN/N)
6. Release Circuits Disconnect Door - Open (RN)
7. FRL Angle of Attack Indicator - Updated (N); Cross-checked (RN)

BOMB RUN (SYNCHRONOUS)

1. Bomb Select Switch - SYN (RN)
2. BNS Altitude - Set for target or OAP (RN)
3. Nav Mode Selector Switch - AUTO STEER (if desired) (N)
4. Offset Switches - As desired (RN)

   Insure that the applicable ballistics control panel offset selector switch, the primary control panel offset switch, and, on D aircraft, the offset 1-2 or 3-4 selector switch are in the required position.

5. Aux PPI Switch - IN (RN)
6. Crosshairs on Aiming Point - Notify navigator (RN)
7. Navigation Unit - Updated (should read target coordinates) (RN-N)
8. Primary Control Function Switch - BOMB (RN)
9. Aux PPI Switch - OUT (RN)
10. PDI - Centered (ADF as required) (RN-P)
11. Second Station (if applicable) - Requested, light on (RN-P)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

12. Pilot's Bombs-Released Light - Off (RN-P)

If the pilot's bombs released light is illuminated, attempt to reset the internal BRIC by moving the BRIC switch to SEL, then to TRAIN and ZERO, then back to briefed setting. (B-52D Presence of a release pulse will be confirmed if the B-3C BRIC light is on bright.)

NOTE

If pilot's bombs-released light is illuminated and the internal BRIC cannot be reset, training missions do not attempt release. Combat missions complete steps "14.a" thru "14.h" and release using emergency armed release procedures.

WARNING

Completion of the bomb run check through RCD closure with the pilot's bombs-released light illuminated could result in immediate release of internal munitions.

13. External BRIC light B-52D - Dim (RN)

A steady bright light will indicate internal shorting of the B-3C BRIC.

NOTE

B-52D

If the external B-3C BRIC light is bright, training missions do not attempt release. Combat missions complete the release configuration check; however, the external release power switch will remain OFF (step "14.g."). Release external munitions using emergency armed release procedures at EAR time.

WARNING

B-52D

Completion of the bomb run check through external release power switch ON and RCD closure with the external B-3C BRIC light on bright will result in an inadvertent release of one or more external munitions.

13A. MADREC J - BOMB (N)

14. Release Configuration Check:

NOTE

When releases are to be made on a designated bombing range, do not perform this check until the aircraft is on the range.

	NAV CALLS	RN RESPONSE
a.	"SUU-24/A Reset Indicator Lights"	"Reset, lights on" (if applicable)
b.	"Special Weapons Lock Indicators (Clip-In or SUU-24/A)"	"Indicate unlocked"
c.	"Master Bomb Control Switch"	"ON, light on"
d.	"Bombing System Switch"	"MANUAL"

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

	NAV CALLS	RN RESPONSE
e.	"Bomb Door Control Valve Lights Off"	
f.	"External Arming Switch B-52D "	"ARMED"
g.	"External Release Power Switch B-52D "	"ON"
h.	"Standing By 60 Seconds Time-To-Go"	"60 TG" (P)
i.	"Bomb Doors"	"Opened"

Bomb Doors will be opened manually using bomb door switch.

WARNING

If the bomb door not latched light is illuminated or there is an indicated bomb release, do not open the bomb doors. Release by the emergency armed release procedure at the proper release point.

NOTE

If bomb doors fail to open normally, use of standby pumps and/or emergency bomb door opening system is restricted to combat only.

j.	"Doppler"	"OUT" (if desired)

15. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"RCD"	"Connected, light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to abort procedures checklist.

b.	"Ready to Release Call"	"BNS in BOMB" (RN) "Doors open" "OAP one (or as required) acquired" "Offset one (or as required) IN" "EAR time_____ seconds" (if authorized) "Standing by to release"
c.	"20 Seconds TG" (RBS only)	"Tone On" (RN)

16. Bomb Release Monitored - "Bombs away" (RN-P)

NOTE

- Combat Missions Only - If a bomb release indication is not received immediately after illumination of the bomb release light, actuate the D-2 release switch.
- The navigator will continue countdown from release "HACK" to "EAR time" (if authorized for release malfunction or BNS/D-2 backup). At action word "EAR" the RN will actuate the emergency armed release system. (Refer to Section III of T.O. 1B-52C-34-2-1.)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

POST BOMB RELEASE/ABORT CHECK

Proceed to post bomb release/abort checklist.

BOMB RUN (ALTERNATE)

1. Time to Release - Computed and cross-checked (RN-N)
2. Primary Control Function Switch - NAV (RN)
3. NAV Mode Selector Switch - NAV (N)
4. Pilot's Bombs-Released Light - Off (RN-P)

If the pilot's bombs-released light is illuminated, attempt to reset internal BRIC by moving the BRIC switch to SEL, then to TRAIN and ZERO, then back to briefed setting. (B-52D Presence of a release pulse will be confirmed if the B-3C BRIC light is on bright.)

NOTE

If pilot's bombs-released light is illuminated and internal BRIC cannot be reset, training missions do not attempt release. Combat missions complete steps "7.a" thru "7.h" and release using emergency armed release procedures.

WARNING

Completion of the bomb run check through RCD closure with the pilot's bombs-released light illuminated could result in immediate release of internal munitions.

5. External BRIC Light B-52D - Dim (RN)

A steady bright light will indicate internal shorting of the B-3C BRIC.

NOTE

B-52D

If the external B-3C BRIC light is bright, training missions do not attempt release. Combat missions complete the release configuration check; however, the external release power switch will remain OFF (step "7.g."). Release external munitions using emergency armed release procedures at EAR time.

WARNING

B-52D

Completion of the bomb run check through external release power switch ON and RCD closure with the external B-3C BRIC light on bright will result in an inadvertent release of one or more external munitions.

6. MADREC B-52D or J - BOMB (N)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

7. Release Configuration Check: (RN-N)

NOTE

When releases are to be made on a designated bombing range, do not perform this check until the aircraft is on the range.

	NAV CALLS	RN RESPONSE
a.	"SUU-24/A Reset Indicator Lights"	"Reset, light on" (if applicable)
b.	"Special Weapons Lock Indicators (Clip-In or SUU-24/A)"	"Indicate unlocked"
c.	"Master Bomb Control Switch"	"ON, light on"
d.	"Bombing System Switch"	"MANUAL"
e.	"Bomb Door Control Valve Lights Off"	
f.	"External Arming Switch **B-52D**"	"ARMED"
g.	"External Release Power Switch **B-52D**"	"ON"
h.	60 Seconds Time to Release	

RN/N will determine 60 seconds to release from timing point or by best means possible.

i.	"Bomb Doors"	"Opened"

Bomb doors will be opened manually using bomb door switch.

WARNING

If the bomb door not latched light is illuminated or there is an indicated bomb release, do not open the bomb doors. Release by the emergency armed release procedure at the proper release point.

NOTE

If bomb doors fail to open normally, use of standby pumps and/or emergency bomb door opening is restricted to combat only.

8. Stopwatch - Started (as required) (RN-N)

9. Ready to Release Check:

	NAV CALLS	RESPONSE
a.	"RCD"	"Connected, light on" (RN/N)

NOTE

To withhold release or interrupt an initiated release, immediately disconnect the release circuits disconnect and proceed to abort procedures checklist.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

10. 20 Seconds TG (RBS only) - "Tone on" (RN)
11. At Bomb Release Time/Signal:
    a. D-2 Bomb Release Switch - Actuated (RN)
    b. Bomb Release Monitored - "Bombs away" (RN-P)

NOTE

The navigator will continue countdown from release "HACK" to "EAR time" (if authorized for release malfunction or D-2 backup). At action word "EAR" the RN will actuate the emergency armed release system. (Refer to Section III of T. O. 1B-52C-34-2-1.)

POST BOMB RELEASE/ABORT PROCEDURES (CONVENTIONAL MUNITIONS)

Accomplish immediately after bomb release or abort/withhold (RN); as soon as possible, perform required items and assure accomplishment of check (N).

WARNING

Following an attempted release or jettison of external B-52D or internal munitions, any munition that does not separate from the aircraft should be considered possibly armed and susceptible to inadvertent release during landing impact. Refer to "Internal Hung Bomb Procedures Checklist" under "Conventional Munitions Emergency Operation," in Section III of T.O. 1B-52C-34-2-1.

NOTE

- If internal hung bombs are indicated after an internal release and the bombs remaining are the last bombs in the release sequence (i.e. 77 thru 84) the most probable cause is a stopped release (RCD disconnected early, slow BRIC, or improper switch positioning). Any out of sequence lights (i.e. 13, 18, 23) is a positive indication of release malfunction.
- For stopped release or aborted release where release of all bombs is desired on next target, a release of retained internal bombs and normal external bombs may be accomplished by completing all items of the Before Pre-IP checklist through applicable Bomb Run (Normal Release) checklist.
- For a positive release malfunction or if any doubt exists, use the applicable Bomb Run (External Release) checklist, and do not EAR.

1. Release Circuits Disconnect - Disconnected
2. Primary Control Function Switch - TRACK
3. Emergency Bomb Door Open Switch B-52D - OFF

CAUTION

If closing of bomb doors is attempted with this switch in OPEN, damage to bomb doors could result.

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

4. Bomb Doors - Closed

CAUTION

> If the bomb doors not latched light remains illuminated, do not cycle bomb doors until a bomb bay check has been performed. If hung bombs or door resters are discovered, comply with "Internal Hung Bombs Procedures Checklist" in Section III of T.O. 1B-52C-34-2-1.

5. Master Bomb Control Switch - OFF
6. External Release Power Switch B-52D - OFF
7. External Arming Switch B-52D - SAFE
8. Applicable Bomb Indicator Lights - Off; On (clip-in)

   Check indicator lights for each hi-density bay loaded by rotating the internal bomb indicator light control switch to applicable positions.

9. External Racks Loaded Lights B-52D - Off (after all external munitions have been released)
10. Offset Switch - OUT
11. Radar Camera Switches - As required
12. Vertical Camera Intervalometer Power Switch - OFF
13. Vertical Camera Doors - Closed
14. Landing Gear Standby Pumps B-52D - OFF (high altitude only) (RN-P)
15. Applicable Hydraulic Packs - Indicate shutdown (RN-P)

NOTE

- If further release attempts are to be made, proceed to the Before Pre-IP, Before IP, and the appropriate bomb run checklists.
- Accomplish the remaining items only when no further releases are to be made.

16. Normal Release, Salvo Power & B-52D External Rel Circuit Breakers - Out
17. Emer Door Open & Rel Circuit Breaker B-52D - Out
18. Internal BRIC - TRAIN, zero, light off

    If BRIC counter stop is installed, remove and set counter to zero.

19. External BRIC B-52D - TRAIN, zero, light off
20. Single String Switch B-52D - OFF

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

21. MADREC - As required (N)
22. Altitude Disable Switch - NORMAL
23. Optional Bombing Switch **B-52D** - AN/ASQ-48 NORMAL
24. DCU-9/A Selector Switches - OFF (clip-in)
25. Readiness Switch Cover - Closed, latched (clip-in) (RN-P)
26. Special Weapons Manual Lock Handle - Locked (clip-in) (RN-EW)
27. Special Weapons Lock Indicators - Indicate locked (clip-in)

NOTE

Accomplish the following step when departing enemy territory.

28. Personal Locator Beacon Lanyard - Notify crew to set as required (N)
29. Bomb Bay & Walkway Lights Circuit Breakers - In

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

POST STRIKE RBS/EVS/CAMERA ATTACK

This checklist may be used only in combat areas when specifically directed by the applicable operations order.

NOTE

Post strike RBS/EVS/camera attacks will not be accomplished if hung bombs are known or suspected.

SAFETY CHECK

1. Bombing System Switch - MANUAL (RN)
2. Release Circuits Disconnect - Disconnected, light off (RN)
3. Master Bomb Control Switch - OFF (RN)
4. External Release Power Switch - OFF (RN)
5. External Racks Loaded Lights Switch - OFF (RN)
6. Notify Crew "Safety check complete" (RN)

BEFORE PRE-IP

1. Altitude - Measured (RN)
2. Bombing Data - Computed and cross-checked (RN-N)
3. Bombing Data - Set (RN-N)
    - a. ATF - Set (RN)
    - b. Trail - Set (RN)
    - c. Offsets 1 & 2 - Set (RN)
    - d. Offsets 3 & 4 **D** - Set (N)
4. MADREC - AUTO (N)

BEFORE IP

1. Bomb Doors - Check closed (RN)
2. Bomb Door Control Circuit Breakers (FWD, AFT & Emergency FWD Valve) - Out (RN-P)
3. Salvo Power Circuit Breaker - Out (RN)
4. Emer Door Open & Rel & External Rel Circuit Breakers - Out (RN)
5. Normal Release Circuit Breaker - In (RN)
6. All Other Circuit Breakers - Set (RN)
7. Internal Bric - SEL, light on **B-52C**, light dim **B-52D** (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

8. Bomb Indicator Lights Switch - ON (RN)
9. TAS - Checked (for planned TAS) (RN-P)
10. Bombing Data Check:

	NAV CALLS	RESPONSE
a.	"Altitude"	"Reads " Set TGT/OAP (RN)
b.	"ATF"	"Reads" (RN)
c.	"Trail"	"Reads" (RN)
d.	"Offset 1"	"Reads" (RN)
e.	"Offset 2"	"Reads" (RN)
f.	"Offset 3 D "	"Reads" (N)
g.	"Offset 4 D "	"Reads" (N)
h.	"Internal BRIC Switch"	"SEL" (RN)
i.	"External BRIC Switch"	"Train, zero, light off" (RN)

11. Radar Camera: (RN)
    - a. Power Switch - ON
    - b. Selector Switch - 1:2
12. Navigation Unit - Updated (RN-N)
13. Destination Latitude & Longitude Indicators - Set to target coordinates (N)
14. Over IP - Notify pilot and give initial heading for bomb run (N)
15. ETA to Bomb Release Line - Rechecked (N)

BOMB RUN (SYNCHRONOUS)

1. Bomb Select Switch - SYN (RN)
2. Heading Systems - Cross-checked (RN/N)
3. BNS Altitude - Set for target or OAP (RN)
4. Nav Mode Selector Switch - AUTO STEER (if desired) (N)
5. Offset Switches - As desired (RN)

   Insure that the applicable ballistics control panel offset selector switch, the primary control panel offset switch, and, on D aircraft, the offset 1-2 or 3-4 selector switch are in the required position.

6. Aux PPI Switch - IN (RN)
7. Crosshairs on Aiming Point - Notify navigator (RN)
8. Navigation Unit - Updated (should read target coordinates) (RN-N)
9. Primary Control Function Switch - BOMB (RN)

RADAR NAVIGATOR'S AND NAVIGATOR'S BOMBING CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

10. Aux PPI Switch - OUT (RN)
11. PDI - Centered (ADF as required) (RN-P)
12. Second Station (if applicable) - Requested, light on (RN-P)
13. Release Configuration Check:

	NAV CALLS	RN RESPONSE
a.	"RCD"	"Disconnected"
b.	"Master Bomb Control Switch"	"OFF"
c.	"External Release Power Switch"	"OFF"
d.	"External Racks Loaded Lights Switch"	"OFF"
e.	"Bombing System Switch"	"MANUAL"
f.	"Bomb Doors"	"Closed"

14. Bomb Run Call Down:
    - a. Time-To-Go-Meter - Checked for drive (RN-P)
    - b. Bomb Tone Scoring Switch - Initiate (20 seconds TG) (RN)
    - c. Bomb Release Check: (RN)
        - (1) Time-To-Go Indicators - Indicate zero
        - (2) Bomb Tone Break - Noted
        - (3) Bomb Release Light - On momentarily
        - (4) Function Switch - Track

POST BOMB RELEASE/ABORT

Accomplish all items on the conventional munitions post bomb release/abort checklist plus the following item.

- **a. Bomb Door Control Circuit Breakers (FWD, AFT, & Emergency FWD Valve) - In (RN-P)**

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS)

BEFORE EXTERIOR INSPECTION (POWER OFF)

1. Ejection Seat:

WARNING

- Carefully check to assure that no streamer has been torn from a maintenance safety pin, thus inadvertently leaving the pin installed. See figure 7-14 for location of pins.
- If a maintenance safety pin, except No. 6, is installed, the status of the seat will be ascertained prior to removal of the pin.

a. Catapult Pin-Pull Initiator - Checked, pin No. 6 installed

Check maintenance pin No. 6 installed. Inspect link for condition and installation.

b. Ejection Trigger Ring - Stowed, pin No. 1 installed

Check that ejection trigger ring is properly seated in detent.

WARNING

If the ejection trigger ring is not properly seated in the detent, call maintenance and ascertain status of arming initiator before continuing seat inspection.

c. Catapult Initiator - Checked

Inspect initiator for condition and installation. Insure pin-pull cylinder safety pin (plunger) is installed in catapult initiator.

d. Catapult Initiator Safety Pin-Pull Cylinder - Checked

Inspect position and condition of cylinder and safety pin (plunger).

e. Arming Initiator & Control Linkage - Checked, pin No. 3 removed

Check maintenance safety pin No. 3 removed. Inspect initiator for condition and installation.

f. Hatch Jettison Initiator - Checked, pin No. 5 removed

Check maintenance safety pin No. 5 removed. Inspect initiator for condition and installation.

g. Seat Positioning Initiator - Checked, pin No. 4 removed

Check maintenance safety pin No. 4 removed. Inspect initiator for condition and installation.

2. Readiness Switch Cover - Closed, latched (clip-in)
3. Special Weapons Manual Lock Handle - Stowed (clip-in)
4. Forward & Rear Special Weapons Manual Release Handles - Stowed (clip-in)

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

5. Release Circuits Disconnect - Disconnected
6. Circuit Breaker Panels:
   a. Normal Release, Salvo Power & **B-52D** External Release Circuit Breakers - Out
   b. Emer Door Open & Rel Circuit Breaker **B-52D** - Out
   c. All Other Circuit Breakers & Fuses - In
7. DCU-9/A Selector Switches - OFF (clip-in)
8. External Release Power Switch **B-52D** - OFF
9. External Arming Switch **B-52D** - SAFE
10. B-52 Power Switches (if installed) - OFF

EXTERIOR INSPECTION (POWER OFF) (RN/N)

WARNING

- The bomb door actuator struts must be disconnected before entering the bomb bay.
- To prevent personnel injury in the event of inadvertent actuation of the release system, the following checks will be accomplished prior to any power (aircraft or external) being applied to the aircraft.

NOTE

If any discrepancies are found, notify MMS personnel.

1. General Condition of Bomb Bay - Checked

   Check for fuel and hydraulic leaks and security of equipment (include check of walkways for loose objects).

2. Bomb Door Actuator Locks **B-52D** - Checked

   Check that actuator locks (2) are securely stowed in the stowage racks provided near the forward and aft bomb door actuators respectively.

Clip-In

3. MB-3A Bomb Rack Lockpins (Lower Only) - Inserted
4. General Condition of Bombs/Mines - Checked
5. Arming Wires & Fuzes - Checked

   Visually check that arming wires are properly inserted in fuze/arming assemblies and that Fahnestock clips are installed where applicable.

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

Cluster or Hi-Density

3. General Condition of Bombs/Mines - Checked
4. Nose Fuzes & Arming Wires - Checked

   Visually check that arming wires are properly inserted in nose fuze/arming assemblies and that Fahnestock clips are installed when applicable.

5. Shackle Locking Pin(s) - Removed, counted, and stowed

   For cluster bomb racks, there should be a locking pin for each shackle. For hi-density racks, there should be a locking pin for each of the lower shackles.

WARNING

Prior to removing any shackle locking pin insure that the A-5/A-6 release is cocked and the B-11 shackle release lever is mated with the release arm of the A-5/A-6 release.

MER B-52D

WARNING

When high speed faired mines MK 52, MK 55, and MK 56 are loaded, do not put fingers in fairing shroud holes at any time. Accidental actuation of the retraction mechanism will severely damage or sever fingers.

1. General Condition of Munitions - Checked
2. Arming Wires & Fuzes - Checked

   Check that the arming wires are properly inserted in fuze/arming assemblies and free from kinks. Check that arming wires are secured in the proper receptacle, safety pins have been removed from each fuze/arming assembly, and the Fahnestock clips are installed.

3. Release Mode Selector Switch - SINGLE BOMB
4. Electrical Safety Pins - Removed and stowed
5. Rack Locking Pins - Removed, counted, and stowed

   There should be a locking pin for each rack.

External Heavy Stores ZX

WARNING

When high speed faired mines MK 52, MK 55, and MK 56 are loaded, do not put fingers in fairing shroud holes at any time. Accidental actuation of the retraction mechanism will severely damage or sever fingers.

1. Beam Control Panel:
   a. 9 Store Switch - As required

NOTE

The 9 store switch must be OFF with 6 store or less configuration.

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

b. Release Delay Switch - As required

With the release delay switches ON the first external munition release will not occur until the ninth external release pulse.

NOTE

Perform steps "2" thru "5" for each loaded store.

2. General Condition of Bomb/Mine - Checked

3. Arming Wires & Fuzes - Checked

Visually check that arming wires are properly inserted in fuze/arming assemblies and that Fahnestock clips are installed where applicable.

4. MAU-12 In-Flight Safety Lock - Unlock, lockout pin installed

5. MAU-12 Ground Safety Lockpin - Removed

6. Ground Safety Lockpins - Counted, stowed

There should be a lockpin for each loaded store.

INTERIOR INSPECTION

1. Equipment - Stowed

WARNING

Insure that no equipment is stowed on or near the lower deck heating duct outlets, electrical wiring, or electronic equipment.

2. Lower Deck Spare Parachute Preflight:

a. Inspection Record:

(1) Inspection & Repack Date - Checked

(2) Automatic Release Time & Altitude Setting - Checked

b. Bailout Bottle Pressure & Hose Connector - Checked

c. Parachute - Unbuckled and stowed

Spare parachute will be unbuckled and stowed in an easily accessible location.

3. Lower Deck Fire Extinguisher - Checked

Insure that appropriate safety device (safety wire/seal or locking pin/lever as applicable) is installed. Check for fully serviced pressure.

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

4. CSM Switch - ON

   CSM switch is located on the aft module rack.

5. Normal-Test-Run Switch - NORMAL

   Normal-test-run switch is located on the aft module rack.

6. Doppler System Pressurization Shutoff Valve Handle - NORMAL

7. MADREC Recorder Clock - Wound, set to GMT

8. Sight Reduction Tables - Checked (if applicable)

   When tables are stowed aboard aircraft, check that all three volumes are current.

9. Ejection Seat:

   a. Manual Catapult Initiator Safety Pin-Pull Handle - Secure

      Handle should be properly seated below left leg guard.

   b. Ankle Restraints - Checked

      Inspect ankle restraints for proper operation and stow in downward position.

   c. Initiator Tube Runs - Check connected

      Check tube runs for proper and secure connections.

   d. Hatch Jettison Firing Lug - Checked

      Inspect firing lug for condition and mounting.

   e. Safety Belt Release Initiator - Checked, pin No. 2 removed

      Check maintenance safety pin No. 2 removed. Inspect initiator for condition and installation.

   f. Inertia Reel - Checked

      Check inertia reel lock for proper functioning.

10. Man-Seat Separator - Checked

    Insure that the nylon man-seat separator straps are placed over the parachute blocks and then on the bare seat. Survival kit is then placed over man-seat separator straps. See figure 7-14 for correct arrangement of man-seat separator straps without survival kit and parachute in place.

11. Parachute Preflight:

    a. Inspection Record:

       (1) Inspection & Repack Date - Checked

       (2) Automatic Release Time & Altitude Setting - Checked

    b. Personal Locator Beacon Lanyard - Snapped

       For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 4-85).

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

c. Bailout Bottle Pressure & Hose Connector - Checked

d. Parachute Straps - Adjusted (as required)

e. Zero Delay Lanyard - Unhooked from parachute ripcord T-handle.

WARNING

Do not hook zero delay lanyard to parachute ripcord T-handle when using a downward ejection seat since it is equipped with a man-seat separator.

12\. MD-1 Survival Kit Preflight:

a. Kit Release Knob Snapped - Checked

b. Zipper Closed & Seal Intact - Checked

c. Kit Straps to Parachute - As required

WARNING

Care must be taken to assure that the survival kit attachment straps are not fastened over the safety belt.

13\. Interphone - Connected

14\. Oxygen System:

a. Regulator Diluter Lever - 100% OXYGEN

b. Shutoff Lever - OFF

c. Mask & Hose - Check disconnect, then reconnect

Check for 10- to 20-pound pull for disconnect, then reconnect mask and hose.

d. Diluter Valve - Checked

Attempt to draw air through the oxygen mask. Ability to draw air indicates a defective diluter valve, oxygen hose and/or connections, or mask. Then place the diluter valve to NORMAL position, draw air through the mask, if unable, this would indicate that only 100% oxygen will be available.

NOTE

If the diluter valve is stuck in the 100% position, this will prohibit the detection of smoke or fumes when use of normal oxygen is required.

e. Shutoff Lever - ON

f. Pressure - Checked

Pressure gage reads approximately 300 psi.

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

g. Emergency Toggle Lever - TEST MASK

With mask disconnected at one side of helmet the flow indicator should indicate continuous flow.

h. Mask - Test

Attach mask to helmet and hold breath; indicator should indicate no flow.

NOTE

Flow condition may be indicated by a slight leak around the face form. If light hand-pressure against the mask does not stop the flow, the mask is unacceptable.

i. Emergency Toggle Lever - NORMAL

j. Regulator Diluter Lever - NORMAL/100% (as required)

15. Heading Reference Control:

a. Polar Angle Indicator - 000°

b. Heading Mode Selector Switch - MAG

c. Pole Switch - As required

d. Illum Switch - As desired

e. Wind Test Switch - OFF

16. Doppler Drift Switch - NORMAL

17. N-1 Compass Master Indicator:

a. Latitude Correction Knob - OFF

b. Synchronizer Knob - Zero annunciator

18. Sky Spot Power Switch **B-52D** - OFF

19. Sky Spot Mode Switch **B-52D** - DOUBLE PULSE

20. Sky Spot Function Switch (if installed) - STBY

21. Navigation Unit:

a. Nav Mode Selector Switch - NORM NAV

b. Illum Control - CW

c. Doppler Switch - OUT

22. Heading Select Control:

a. BATH Switch - BNS

b. ASM/DOPPLER Switch - BNS

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

23. Automatic Astrocompass Power Filter Switch - Checked OFF

24. Auxiliary Radar Indicator:

    a. Video Gain Control - CCW

    b. Bias Control - CCW

25. Doppler Radar Silence Switch - SILENT

26. Doppler Radar System Power Switch - OFF

26A. Ballistics Control Panel (Offset 3-4) **D** :

NOTE

- Primary control function switch must be in NAV, TRACK, or BOMB to permit presetting offsets.
- T_F, L, and altitude functions for offsets 3 and 4 are applied using ballistics control panel (offset 1-2).

    a. Offset 3 - Set

    b. Offset 4 - Set

27. ASM Separation (4) & Jettison Control (2) Circuit Breakers - Out

28. AGM-28 Simulated Launch Switches - OFF

29. APN-69 Power Switch (if installed) - OFF (code set)

30. MADREC - OFF

31. Attitude Reference Control Cover - Closed, secured

32. Ground Locks & Bypass Keys - Counted, stowed

33. Crew Report - Completed (at pilot's request)

    a. The sequence for crew reporting is as follows: G, N, EW, RN, CP, P, IN, 10th man, bunk, and IP.

    b. Switch to CALL and report, "Navigator's station check complete." Station check consists of seat, oxygen, abandon signal and call light, interphone, and zero delay lanyard stowed.

34. Oxygen Regulator - OFF and 100% OXYGEN (if leaving the aircraft for an extended period of time)

BEFORE TAKEOFF

1. Emergency Escape Hatch - Secure

    Check that paint stripe on the lockpin is visible or the flat surface of the lockpin extends 1/4 inch from its housing. Check that latch pins overlap the long lip of the latch hooks by approximately 1/8 inch. Check that the escape hatch manual release handle is full right.

2. Pin No. 6 (catapult pin-pull initiator) - Removed

3. Pressure Bulkhead Door - Closed, latched, unlocked

4. Emergency Cabin Pressure Dump Handle - Closed

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

5. Doppler Radar System Power Switch - ON

CAUTION

Do not turn doppler radar system power switch on until cooling air is available and the ground blowers switch is ON.

NOTE

Accomplish following steps after BNS ON.

6. Automatic Astrocompass:

CAUTION

The declination and SHA for Polaris are to be inserted into the No. 1 star data panel for MD-1 astrocompass operation between the latitudes of 0 - 75 N to reduce the potential of "limits" or "lock-up" damage to the altitude-azimuth computer.

   a. Star Selector Switch - OFF

   b. Rate Switch - SOL or SID

   c. Power Filter Switch - SUN or STAR

   d. Lat-Long Switch - AUTO

NOTE

There is a 2-minute delay before information may be preset and an additional 5-minute delay before the system can track. If the celestial coordinates for Polaris are not displayed in star data panel No. 1, they are to be inserted as soon as the 2-minute delay has elapsed.

7. MADREC:

   a. System Select Switch - STDBY

   The recorder failure light will remain on for approximately 20 seconds.

   b. Press-To-Test Button - Depressed

   The ready and failure indicators should illuminate.

8. Oxygen Regulator - As required

9. Auxiliary Radar Indicator - Tuned

10. Automatic Astrocompass:

   a. Heading Correction - Set zero

   b. Clock - Set GMT

   When set time comes up, switch to GHA and check for clock drive.

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

c. GHA - Set

When set time comes up, switch to SHA and check GHA for drive.

d. SHA & Dec - Set (Polaris coordinates in No. 1 star data panel)

e. Star Selector Switch - As desired

11. ASM/DOPPLER Switch - BNS

12. APN-69 Power Switch (if installed) - STDBY

13. Heading Indicators - Cross-checked (P-CP-N)

Pilot, copilot, and navigator cross-check heading indicators, and standby compass.

14. MADREC - BOMB (if ready indicator is illuminated)

15. Parachute, Survival Kit, Shoulder Harness, Arming Lanyard & Safety Belt - Fastened

Adjust shoulder harness to a snug condition while sitting well back in seat. Assemble shoulder harness loops and parachute arming lanyard anchor on safety belt as shown in figure 1-55.

WARNING

- To insure operation of the automatic opening parachute, arming lanyard anchor must be assembled on the safety belt in the manner shown in figure 1-55. Failure to properly assemble these units may cause fatal delay in separating from the seat and in opening the parachute.
- Insure that the parachute arming lanyard is not entangled in the parachute harness. Lanyard entanglement could cause failure in seat separation and failure of the automatic features of the parachute.

16. Pin No. 1 - Removed

17. Ejection Control Trigger Ring - Unstowed (respond at pilot's request)

18. Bailout Bottle - Connected

19. Takeoff Data - Reviewed (P-CP-N)

TAKEOFF

1. Acceleration Timing - Checked

As the pilot announces "Now" at 70 knots, start the stopwatch. Announce over the interphone "coming up on_____seconds" approximately 3 seconds prior to S_1 time. At S_1 time, announce "Now."

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

AFTER TAKEOFF

1. Doppler Radar Silence Switch - TRANSMIT

   Place the doppler radar silence switch in TRANSMIT when attaining an altitude of approximately 200 feet above the ground.

2. Doppler Switch - IN

   Place the doppler switch IN when attaining an altitude of approximately 200 feet above the ground and only after the doppler memory light has gone out.

3. APN-69 Power Switch (if installed) - OPERATE (if required)

   APN-69 should be placed in operation at takeoff whenever buddy refueling or cell tactics are to be employed.

4. Sky Spot Power Switch **B-52D** - ON

5. Departure Plan - Monitored

   Monitor the aircraft position to assure adherence to the planned departure.

6. Climb EPR Value - Computed (if requested)

7. Oxygen Check - Completed (G-EW-RN-CP)

   a. During climb, copilot requests an oxygen check at 12,000 feet. The sequence for oxygen report is gunner, EW officer, radar navigator, copilot. The reporting crew member will visually check other crew member(s) for alertness. He will report oxygen check for both positions. Oxygen panel at each occupied crew position will be checked on all oxygen checks for:

      (1) Oxygen Supply Shutoff Lever - ON

      (2) Regulator Diluter Lever - As required

      (3) Pressure - 300 psi

      (4) Flow Indicator - Functions normally

      (5) Emergency Toggle Lever - NORMAL

   b. Gunner and copilot report, "Cabin altitude ______ feet. Oxygen panel checked."

   c. EW Officer and radar navigator report, "Oxygen panel checked."

   d. Copilot notify aircrew and receive gunner's acknowledgment when passing through 25,000, 35,000, and 40,000 feet.

   e. The copilot will request an oxygen check at leve-off. During cruise, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes and initiate the oxygen checks at 30-minute intervals when both cabin altitudes are below 12,000 feet, at 15-minute intervals when either cabin altitude is 12,000 to 25,000 feet, and at no longer than 10-minute intervals when either cabin altitude is above 25,000 feet. If cabin altitude is below 12,000 feet, only the gunner and copilot will report. The remaining crew members will check their equipment and report if abnormal.

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

AFTER LEVEL-OFF

1. Heading Mode Selector Switch - Best available heading
2. True Airspeed - Computed (indicators - cross-checked)

   Compute true airspeed from the pilot's indicated airspeed. If the BNS true airspeed is materially different from both the navigator's true airspeed indicator and the computed true airspeed, the BNS true airspeed may be set manually.

3. MADREC - STDBY

BEFORE DESCENT

1. Plane Latitude Longitude & Mag Var Counters - Corrected
2. MADREC - AUTO
3. Best Flare Speed - Computed and cross-checked with copilot

DESCENT AND BEFORE LANDING

1. Penetration & Approach - Reviewed (P-CP-RN-N)

   Review the planned penetration and approach with the applicable crewmembers. Intermediate altitude restrictions, ceiling and visibility minimums, MDA/DH, and missed approach procedures will be emphasized.

1A. Heading Mode Selector Switch - MAG

2. Penetration & Approach Altitudes - Monitored
3. Automatic Astrocompass:
   a. Star Data Panel No. 1 - Polaris coordinates set
   b. Set Selector Switch - GHA
   c. Power Filter Switch - SUN
   d. Star Selector Switch - OFF
   e. Lat-Long Switch - MANUAL
4. Doppler Radar Silence Switch - SILENT

   Place the doppler radar silence switch to SILENT when approximately 200 feet above the ground for low approaches and landings. For subsequent activity the doppler may be left in SILENT.

NAVIGATOR'S CHECKLIST (CONVENTIONAL MUNITIONS) (Cont)

AFTER LANDING

1. Auxiliary Indicator:
   a. Video Gain Control - CCW
   b. Bias Control - CCW
2. APN-69 Power Switch (if installed) - OFF
3. Sky Spot Power Switch B-52D - OFF
4. Sky Spot Mode Switch B-52D - DOUBLE PULSE
5. Ejection Control Trigger Ring - Stowed
6. Pin No. 1 - Installed
7. Pin No. 6 - Installed

   Install maintenance safety pin No. 6 in catapult pin-pull initiator prior to opening of hatch.

AFTER PARKING

1. Ejection Seat - Position forward and up
2. Astro Power Filter Switch - POWER OFF
3. Doppler Radar System Power Switch - OFF
4. MADREC - OFF
5. Oxygen System:
   a. Regulator - OFF and 100% OXYGEN
   b. Supply Hose & Interphone Cord - Stowed
6. Conventional Munitions Aboard - Install shackle locking pins and MER/MAU-12C/A rack locking and electrical safety pins

   RN/N perform if qualified personnel are not available. For internal munitions, install a shackle locking pin in each shackle (bottom shackles only, for hi-density). On B-52D aircraft with external munitions, install a rack locking pin in each MER/MAU-12C/A rack and an electrical safety pin in each MER.

WARNING

External power will not be applied until step "6" has been completed.

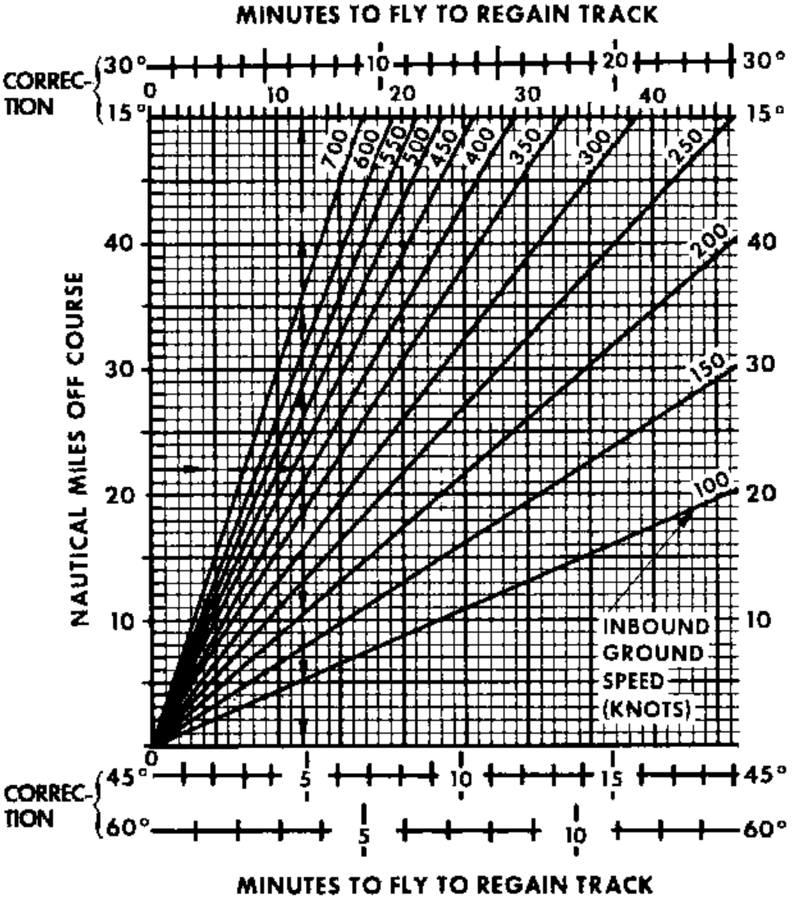
GROSS WEIGHT	FLAPS DOWN 100%	
	BEST FLARE SPEED (AIR-BRAKES NO. 4)	MINIMUM TOUCH-DOWN
175,000	109	97
180,000	110	98
185,000	112	100
190,000	113	101
195,000	115	102
200,000	116	104
205,000	118	105
210,000	119	106
215,000	121	107
220,000	122	109
225,000	123	110
230,000	125	111
235,000	126	112
240,000	128	114
245,000	129	115
250,000	130	116
255,000	131	117
260,000	133	118
265,000	134	119
270,000	135	120
275,000	136	121
280,000	138	122
285,000	139	124
290,000	140	125
	BEST FLARE (AIRBRAKES NO. 2)	
295,000	135	126
300,000	136	127
305,000	137	128
310,000	138	129
315,000	139	131
320,000	140	132
325,000	142	133
	BEST FLARE NO AIR-BRAKES	
330,000	137	134
335,000	138	135
340,000	140	136
345,000	141	137
350,000	142	138
355,000	143	139
360,000	144	141
365,000	145	142
370,000	146	143
375,000	147	144
400,000	152	146
425,000	156	151
450,000	161	155

DATA CONTAINED IN T.O. 1B-52C-1CL-1 AND T.O. 1B-52C-1CL-2.

BEST FLARE SPEED (KNOTS IAS) COMPUTATION TABLE

Figure 8-1.

All data on pages 8-95 thru 8-104, including figures 8-2 thru 8-6 (Deleted)

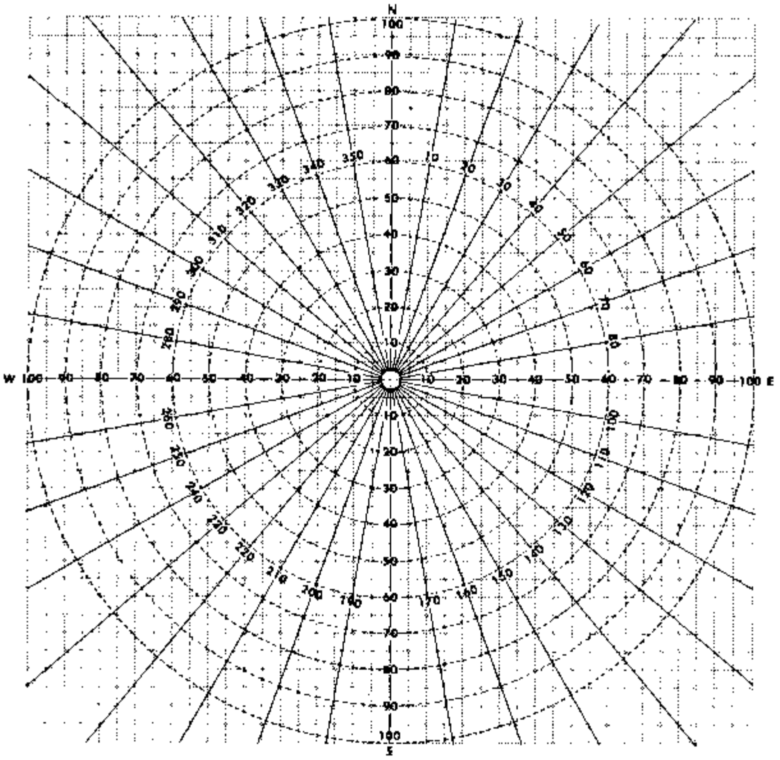


EXAMPLE:

22 NM off course
Ground speed (on inbound track) = 425 knots
Minutes required to regain track
15° correction = 12 minutes
30° correction = 6.4 minutes
45° correction = 4.9 minutes
60° correction = 3.5 minutes

OFF-COURSE CORRECTION TO TRACK CHART

Figure 8-5.



POLAR-RECTANGULAR COORDINATES CHART

Figure 8-6.

LAT	DRIFT IN DEGREES	LAT	DRIFT IN DEGREES	LAT	DRIFT IN DEGREES
1	14.10	25	8.02	49	3.05
2	13.84	26	7.78	50	2.87
3	13.58	27	7.55	51	2.70
4	13.31	28	7.32	52	7.54
5	13.05	29	7.09	53	2.38
6	12.79	30	6.86	54	2.22
7	12.53	31	6.63	55	2.07
8	12.27	32	6.41	56	1.92
9	12.01	33	6.19	57	1.78
10	11.76	34	5.97	58	1.64
11	11.50	35	5.76	59	1.51
12	11.24	36	5.54	60	1.37
13	10.98	37	5.33	61	1.24
14	10.73	38	5.12	62	1.12
15	10.48	39	4.92	63	0.99
16	10.23	40	4.72	64	0.88
17	9.97	41	4.52	65	0.77
18	9.72	42	4.32	66	0.66
19	9.48	43	4.13	67	0.55
20	9.23	44	3.94	68	0.45
21	8.98	45	3.75	69	0.36
22	8.74	46	3.57	70	0.26
23	8.50	47	3.39		
24	6.26	48	3.21		

The figures represent the amount of earth rate correction per hour that will affect the C - gyro when the navigation method switch is in POLAR. Earth rate correction has been computed for latitude 0 degrees to 70 degrees inclusive and has been rounded off to the nearest one hundredth of a degree for accuracy. The earth rate correction was obtained by subtracting the precession correction, 14.36 degrees, for the C - gyro from 15 X sine of the latitude concerned.

When flying in northern latitudes the earth rate correction is to the right and the correction is minus. In southern latitudes the earth rate correction is to the left and the correction is plus.

EARTH RATE CORRECTION TABLE

Figure 8-7.

MISSION DATA RECORDING PROCEDURES

1. High level.

   a. Flight data will be recorded on the chart or on a separate form. The information recorded must permit complete and accurate reconstruction of the mission. Minimum information will consist of time, true heading, true airspeed, and wind for each position or fix. These items may reflect average data since the last position or fix or may show the information used in computing a new true heading and ETA. A stamp with a format similar to that shown below may be used as an aid.

Time

TC______________ TH______/______
GS______________ TAS____________
W/V_____________ ETA____________

   b. Positions and fixes will be indicated on the chart by appropriate symbols and time in GMT. A fix or position is required at least every 30 minutes and at each turning point. This requirement is waived during departure, penetration, transition, holding patterns, fighter/bomber intercept areas, gunnery ranges, and instrument practice.

   c. Altitude normally will be flown as planned. If a change is necessary, the new altitude will be recorded.

   d. Pertinent observations will be noted with the time they take place.

2. Low level.

   a. The navigator must devote his major attention to maintaining course through scope interpretation and monitoring of equipment to maintain desired track during low level operations. Turbulence, frequent turn points, and added checklist activity may make recording difficult. Completion of navigation information blocks similar to the one illustrated below prior to flight will minimize low level inflight recording requirements.

TIME:______________PT______________
COORD______________________________
TO PT.______________HI TERR________
TC________W/V________TH________VAR________
MH__________DIST__________ETE__________
GS__________TAS__________ETA__________

   b. Low level data recording procedures begin at the high altitude entry fix and terminate at the high altitude exit fix for the route being flown.

   c. Fix symbols, times, and wind information will be recorded at each turning point or at 15 minute intervals, whichever is less. Compliance with these instructions provides adequate information for replot purposes.

SEA LEVEL TO 10,000 FEET
NO AIRBRAKES — FLAPS UP

INDICATED AIRSPEED — KNOTS

GROSS WEIGHT — 1000 LB	220	260	270	280	300	325	340	370
380	+1.7	-0.2	-0.5	-0.8	-1.3	-1.9	-2.1	-2.6
370	+1.5	-0.3	-0.6	-1.0	-1.4	-1.9	-2.2	-2.6
360	+1.3	-0.4	-0.8	-1.1	-1.5	-2.0	-2.3	-2.7
350	+1.2	-0.6	-0.9	-1.2	-1.6	-2.1	-2.4	-2.7
340	+1.0	-0.7	-1.0	-1.3	-1.7	-2.2	-2.4	-2.8
330	+0.8	-0.8	-1.1	-1.4	-1.8	-2.3	-2.5	-2.9
320	+0.6	-1.0	-1.2	-1.5	-1.9	-2.4	-2.6	-2.9
310	+0.4	-1.1	-1.4	-1.6	-2.0	-2.4	-2.7	-3.0
300	+0.3	-1.2	-1.4	-1.7	-2.1	-2.5	-2.7	-3.0
290	+0.1	-1.3	-1.6	-1.8	-2.2	-2.6	-2.8	-3.1
280	0.0	-1.4	-1.7	-1.9	-2.3	-2.7	-2.9	-3.2
270	-0.2	-1.6	-1.8	-2.0	-2.4	-2.8	-2.9	-3.2
260	-0.4	-1.7	-1.9	-2.1	-2.5	-2.8	-3.0	-3.3
250	-0.6	-1.8	-2.0	-2.2	-2.6	-2.9	-3.1	-3.4
240	-0.8	-1.9	-2.2	-2.3	-2.7	-3.0	-3.2	-3.4
230	-1.0	-2.1	-2.3	-2.4	-2.8	-3.1	-3.2	-3.5
220	-1.1	-2.2	-2.4	-2.6	-2.9	-3.2	-3.3	-3.5

NOTE

- For gross weight values falling between the tabulated values, use the nearest gross weight listed.
- For indicated airspeeds other than those tabulated, use figure 4-51.

NOTE

- Use airbrake corrections in airbrake position 2 column when the inboard airbrake circuit breaker is pulled out and airbrake position 4 is selected per low altitude tactic in Section II.
- When flying with constant airspeed and a gross weight less than that used to compute the FRL potentiometer settings, the use of airbrakes will tend to improve the accuracy of the TA system display by providing a more nose-up angle of attack. At heavier gross weights, the use of airbrakes will tend to degrade the accuracy of the TA system display.
- One or two AGM-28 missiles installed on the aircraft changes the angle of attack 0.1° and 0.2° respectively in the positive direction due to aircraft loss of lift when missiles are installed.
  EXAMPLE:
  If the aircraft gross weight (including two missiles) is 300,000 pounds, the angle of attack value at 260 knots indicated airspeed from the table is −1.2° then add + 0.2° correction for the missiles which results in an angle of attack setting of −1.0°.

INDICATED AIRSPEED KNOTS	AIRBRAKE CORRECTION	
	ADD THIS CORRECTION TO THE ANGLE OF ATTACK FROM THE TABLE	
	AIRBRAKE POSITION 2	AIRBRAKE POSITION 4
220	-0.3°	+0.7°
260 – 280	+0.3°	+0.6°
325 – 340	+0.3°	+0.5°
370	+0.3°	+0.4°

FRL ANGLE OF ATTACK (LEVEL FLIGHT) SETTINGS — DEGREES

Figure 8-8.

INFLIGHT TA FUNCTIONAL CHECK (RN-N)

NOTE

- This check will be accomplished after level-off but prior to descent.
- This check must be accomplished prior to the pilots performing their "Inflight TA Functional Check."
- Photograph any unusual or abnormal radar displays with radar recording camera operating at every other scan for all phases of TA system operation.
- Notify pilot prior to performing this check.

1. Terrain Computer Power Switch - ON (RN)
2. MADREC - STDBY (N)
3. BNS Radar Meter Readings - Checked (RN)

   Check BNS radar meter readings -300, -105, +150, +300, -600, SEARCH XTAL 1 & XTAL 2, MAG, MOD HV, AC, IND HV

4. Terrain Test Panel: (RN)

   The BNS radar must be in radiate mode while performing this check.

   a. Radar Display Selector Switch - TA
   b. Terrain Test Selector Switch - Checked

      Check meter readings RDPS - 150, RDPS + 150, RDPS +120, RDPS - 300, RDPS + 300, TC + 105, TC + 50, TC - 150. All readings should read midscale plus or minus tolerance on meter.

   c. BNS Frequency - Set to briefed frequency
   d. Terrain Test Selector Switch - Checked XL-1, XL-2, then OFF

      All readings should be three divisions or higher. XL-1 and XL-2 should agree within three divisions.

WARNING

If test results are not within limits, the terrain avoidance system should not be considered reliable.

5. MADREC - RADAR (N)

INFLIGHT TA FUNCTIONAL CHECK (RN-N) (Cont)

6. Doppler Drift Switch - ZERO DRIFT (N)

   Place the doppler drift switch to ZERO DRIFT and check for a 170° (+0°/-10°) sector about heading marker on 10-inch radar indicator.

7. Doppler Drift Switch - NORMAL (N)

   Note where edges of sector appear on 10-inch radar indicator scale, place doppler drift switch to NORMAL. Note that the sector will shift by the amount of drift on doppler drift angle indicator.

8. Radar Display Selector Switch - AJ1 (RN)

   NOTE

   - Pilots' terrain display mode selector switch must be OFF during the AJ1 check.
   - Ranges in excess of 75 miles should not be selected while in AJ1 mode because the video from the terrain computer is limited to 75 miles.

   Adjust AJ1 gain control and note that a satisfactory presentation is available.

9. Radar Display Selector Switch - As required (RN)
10. Terrain Computer Power Switch - As required (RN)

    NOTE

    - If terrain avoidance is not to be utilized for an extended period, the terrain computer power switch should be turned off.
    - The terrain computer power switch must be on for at least 90 seconds to provide AJ-1 capability.

11. MADREC - As required (N)

AIRBORNE RADAR APPROACHES

1. In view of the fact that radar equipment installed in the airplane permits the radar navigator to monitor the position of the aircraft constantly, regardless of weather conditions or outside approach facilities, it is essential that the equipment be utilized during instrument approaches. In an emergency, the equipment within the airplane will make it possible for the radar navigator to direct the pilot to a safe approach.

2. Radar navigators will properly monitor all letdowns and approaches regardless of type (i.e., VFR, GCA, ILS, etc) until the aircraft is in the landing pattern and the pilot is definitely assured that visual contact with the runway can be maintained during the remainder of the approach, including an emergency go-around if necessary.

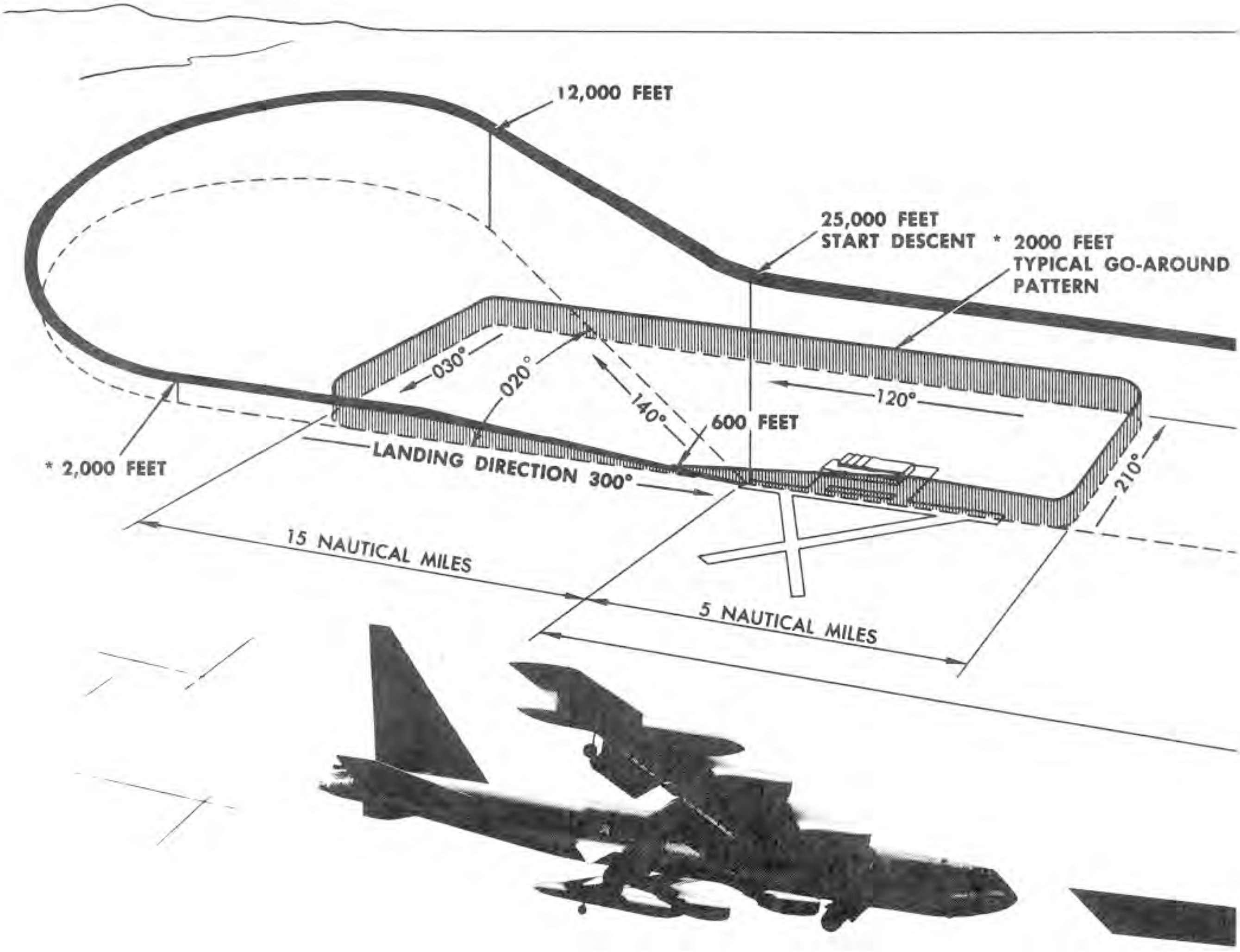
3. Radar approaches are divided into two classes:

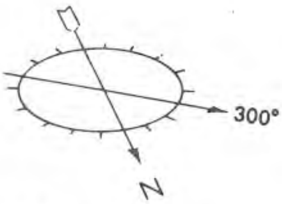
    a. Radar monitored or directed approaches: These are approaches to fields for which standard jet penetrations or enroute penetrations have been published. The pilot directs the aircraft by using normal approach facilities or the radar navigator directs the airplane using the BNS.

    b. Radar directed emergency approaches: These are approaches to fields for which no published letdown procedures have been established or where the normal ground or airplane field approach facilities are inoperative (e.g., GCA or omni equipment failure). The radar navigator directs the aircraft by using the procedure outlined in this manual (figure 8-9).

RADAR MONITORED OR RADAR DIRECTED PRACTICE APPROACH

Pilots and radar navigators should become completely familiar with the penetration patterns and approach and landing patterns to be used at both the destination and alternates. Applicable publication should be studied. Annotated scope photos of previous approaches, if available, will be a great aid to radar navigators.



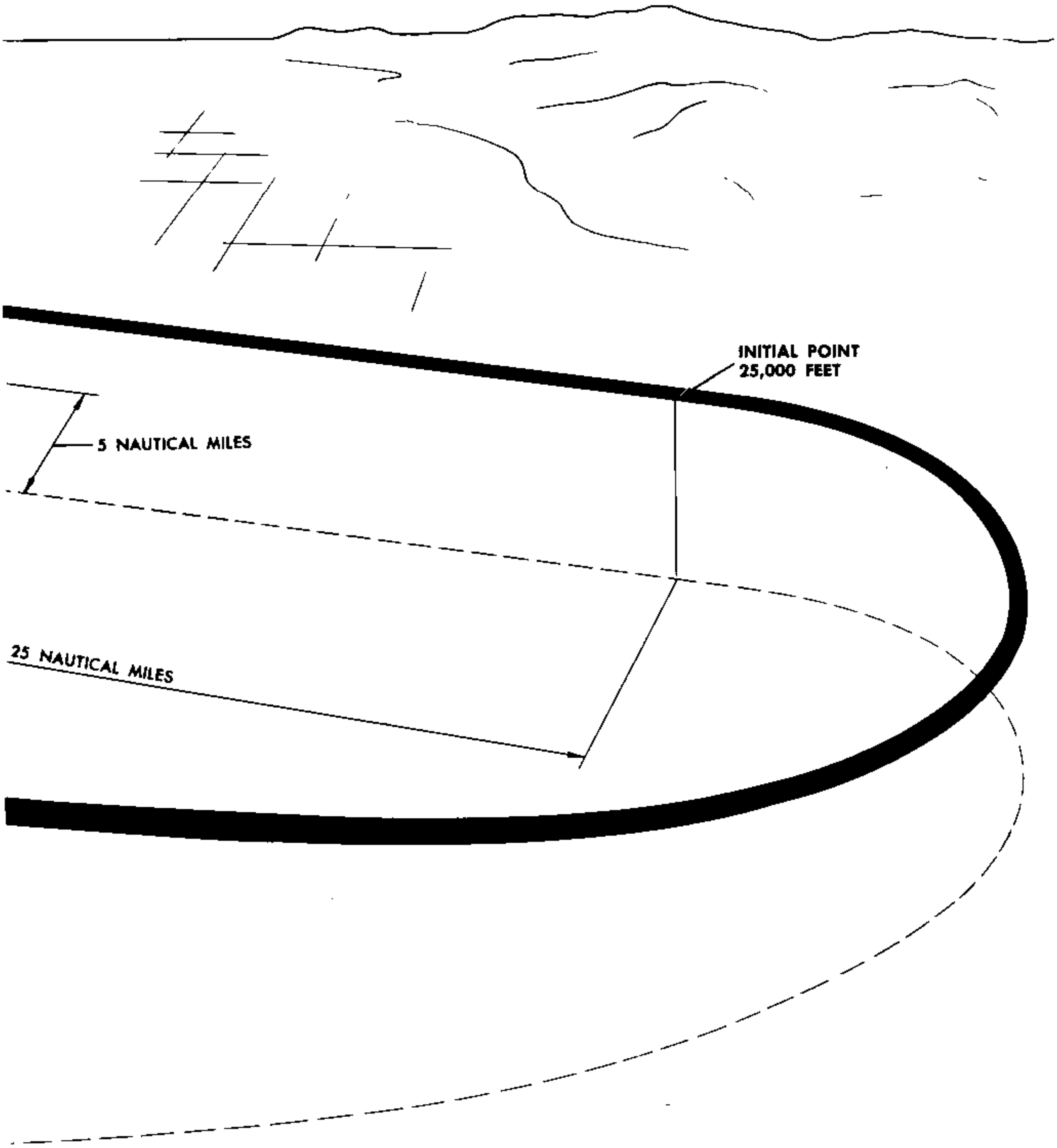


NOTE

ALL HEADINGS ON DIAGRAM ARE MAGNETIC. PUBLISHED RUNWAY HEADINGS ARE MAGNETIC HEADINGS AND MUST BE CORRECTED FOR VARIATION.

* 2,000 FEET ABOVE RUNWAY OR 1,000 FEET ABOVE HIGHEST TERRAIN WITHIN FIVE MILES.

Figure 8-9 (Sheet 1 of 2).



TYPICAL RADAR DIRECTED EMERGENCY APPROACH

Figure 8-9 (Sheet 2 of 2).

AIRBORNE RADAR APPROACHES (cont)

Penetration Pattern

The published or interim jet penetration patterns for the specific stations will be utilized by the pilot for the initial portion of the pattern.

Approach and Landing Pattern

The standard GCA pattern will be followed from the termination of the penetration. Radar navigators should be prepared for an approach to the active runway from either landing direction. The feasibility of entering the GCA pattern for a straight-in approach on the final should be considered.

Altitudes

Altitudes for any phase of this approach will be those in the published penetration procedures and the normal GCA (ASR) pattern. The approach will be discontinued at the minimum altitude for GCA (ASR) approaches. (During radar monitored approaches, altitudes for type of approach being accomplished will apply.)

Airspeeds

1. Penetration - Maximum 250 knots IAS (landing gear down, throttles IDLE)
2. From end of penetration to base leg - Best flare speed plus 30 knots
3. Base leg or positive radar contact with GCA for straight-in approach - Best flare speed plus 20 knots
4. Final approach (glide path) - Best flare speed plus 10 knots.

RADAR DIRECTED EMERGENCY APPROACH

The radar navigator may accomplish a radar directed approach when:

1. An instrument approach is necessary at a field without a published penetration.
2. A normal instrument or visual approach cannot be made because of failure of ground or airplane equipment.
3. It is not prohibited by directives or known traffic at base of intended landing.

Required Information

Prior to attempting a radar directed emergency approach, the following information should be known:

1. Field elevation
2. Active runway
3. All terrain and prominent radar returns within a 25-mile radius of the airbase
4. Obstructions located on the final approach
5. Offset aiming point
6. Initial point will be a point approximately 25 miles beyond the approach end of the runway in the direction of intended landing
7. Terminal weather.

AIRBORNE RADAR APPROACHES (cont)

Approach Procedure

NOTE

All radar approaches will be made with the function switch in TRACK.

1. Preparation of the BNS will be in accordance with procedures listed under "Before Descent" and "Descent and Before Landing" checklists.
2. Airplane will descend to 25, 000 feet.
3. The "Descent and Before Landing" checklist will be completed as applicable.
4. The radar navigator will direct the aircraft to the initial point and then start a simulated bombing run on the approach end of the runway. (Initial phase of run may be made with crosshairs on the airbase built-up area and crosshairs may be placed on the runway or OAP when identification becomes possible.)
5. Pilot should be instructed to follow the PDI over the runway.
6. When the time-to-go meter reads zero, the pilot will execute a standard rate turn to the right to the reciprocal of the runway heading plus 20° (drift must be considered if crosswind exists) and an immediate penetration will be initiated from 25, 000 feet.
7. Upon reaching 12, 000 feet, a 200° standard rate turn to the left will be initiated, rolling out on the runway heading (to which drift correction angle has been applied), continuing the descent to 2, 000 feet above runway or 1, 000 feet above highest terrain within 5 miles of either side of approach heading, whichever is higher. After rolling out and leveling off, an IAS of best flare speed plus 20 knots will be established.

NOTE

Right and left turns indicated above may be reversed if local terrain makes this advisable.

8. The radar navigator will reposition the crosshairs on the end of the runway or OAP and notify the pilot when this has been accomplished.

NOTE

If the aircraft is not flying BFS plus 10, the time-to-go meter reading of 200 seconds will indicate an erroneous descent point.

9. The pilot will continue to track the PDI using standard ADF instrument technique. Example: If aircraft is on runway heading and PDI is 10° to the left, pilot should turn 20° to the left and hold the new heading until the PDI moves 20° to the right. At this point, the pilot should turn back 20° to the right. This will center the PDI and put the aircraft on the runway heading. Corrections should be continued as required to maintain PDI centering with aircraft on runway heading. The radar navigator should occasionally view a full scan presentation to check the position of the aircraft with respect to the on course track to the runway. If necessary, appropriate heading changes will be made to reposition the aircraft to the runway track, after which the aircraft will be returned to the runway heading.
10. When the time-to-go meter reads 200 seconds, a 600 foot per minute descent will be initiated at an IAS of best flare speed plus 10 knots. If aircraft was leveled off above 2000 feet, the descent will be initiated at a time to go equal to altitude divided by 10.
11. During descent, the radar navigator will maintain crosshairs on approach end of runway or OAP. Navigator will call off time-to-go meter readings at 200, 150, 100, and 60 seconds.

AIRBORNE RADAR APPROACHES (cont)

12. The pilot will cross-check altimeter readings with navigator's calls and will adjust rate of descent as required. At 60 seconds, the aircraft should be at 600 feet and under visual conditions. Except under extreme emergency conditions, descents will not be made below 600 feet unless pilot has visual contact with runway. If the approach is continued, the aircraft will be approximately 1000 feet down the runway when time to go is zero.

NOTE

The 1000-foot distance is based on a combination of pulse length and spot size error and the average width of the range crosshair. It is predicated on the procedure of placing the inner edge of the range marker on the apparent end of the area of no return representing the runway. While the exact distance will vary somewhat with control setting, this procedure will establish a glide path comparable to that of GCA and should insure the aircraft will not land short of the runway.

MISSED APPROACH PROCEDURE

1. Go-arounds or GCA patterns: If a go-around becomes necessary or the pilot desires to complete the pattern utilized under normal GCA procedures, a pull-up will be made to 2000 feet at best flare speed plus 30 knots. Radar navigator will position the Aux PPI or Nav Track switch to IN. This will allow him to utilize full scan and range marks during GCA pattern while crosshairs remain on runway.

2. Heading and altitude will be maintained until the radar navigator has reached a point approximately 5 miles beyond the approach end of runway. This may be determined by timing (90 seconds) or by reference to the N-S, E-W counters. At this point, the pilot will be directed to execute a 90° turn to the left. This heading will be the crosswind leg and will be maintained for 90 seconds or until the runway is approximately 5 miles behind. At this point, the radar navigator will direct the pilot to turn 90° left to the downwind heading. Downwind heading should be maintained until the aircraft is approximately 15 miles beyond the approach end of the runway. When the aircraft is 15 miles beyond the approach end of the runway, another 90° turn to the left will be executed to the base leg and the IAS will be reduced to best flare speed plus 20 knots. After completion of the turn onto the base leg, the radar navigator will position the Aux PPI or Nav Track switch to OUT. When PDI reads 80° left, the pilot will execute the turn to runway heading and steps "9" thru "12" of "Approach Procedure, Radar Directed Emergency Approach" will be repeated.

3. In the event of failure of the PDI or time-to-go meter, the same approach may be made utilizing range marks and azimuth marker. Under these conditions, the radar navigator will direct the aircraft. The 600 foot per minute descent will be started at 8 miles. The standard GCA glide path closely approximates 250 feet per mile and this may be cross-checked by checking ranges against the altimeter.

4. To prevent conflict with other traffic during simulated radar directed emergency approaches, the pilot will remain in contact with approach control or the tower and will keep them informed of aircraft location.

5. The pilot will evaluate the approach at the point go-around is initiated. The approach will be considered successful if, in his opinion, a safe landing could be accomplished from that point. He will further note the position of the aircraft when the time-to-go meter reads zero to evaluate the glide path.

WARNING

All altitudes referred to above, except penetration altitudes, are absolute altitudes above terrain.

GRID NAVIGATION

USAF grid system will be used at all times when flying in areas where magnetic compass indications become unreliable, where course angles change rapidly because of meridian convergence, and where large and rapidly changing magnetic variations exist. The unslaved N-1 compass is used as the primary steering instrument; however, grid legs may be flown with BNS steering engaged. Grid heading will be checked at appropriate intervals by celestial means. The MD-1 astrocompass may be used to accomplish these checks. Grid headings, gyro readings of the N-1 compass, and the heading indicator (gyro) will be recorded. The precession rate for either gyro need not be determined unless it is used as the primary steering instrument, and then only if the difference between the steering gyro and celestial grid heading exceeds 4°. The latitude pointer on the N-1 compass must be reset periodically to conform to the actual geographical latitude of the aircraft. Ordinarily, resetting every 4° of latitude will give acceptable accuracy. Full use will be made of the information displayed by the present position indicators unless restricted by training directives.

GRID NAVIGATION PROCEDURES (RN-N)

Entry

NOTE

During the grid navigation leg, step "6" of the grid entry checklist will be accomplished at appropriate intervals.

1. Radar Recording Camera - As desired (RN)
2. AGM-28 Simulated Launch Switches - ON (if applicable)
3. Grid Heading - Determined

   Apply convergence angle or longitude, as applicable, to aircraft true heading.
4. N-1 Compass Master Indicator:
   a. Latitude Correction Pointer - Entry geographic latitude
   b. Sychronizer Knob - Set grid heading
5. Alter Heading - Completed (if applicable)

   When over start navigation point, turn aircraft to grid heading. Omit this step if grid entry is desired prior to the start navigation point.
6. Heading Check:
   a. Grid Heading - Checked by celestial means
   b. N-1 Compass - Reset to grid heading
   c. Heading Indicator (Gyro) - Set to grid heading (P/CP)
7. Aircraft Heading - Corrected
8. AGM-28 Simulated Launch Switches - OFF (if applicable)

GRID NAVIGATION (cont)

Exit

1. N-1 Compass Master Indicator:
   a. Latitude Correction Pointer - OFF
   b. Synchronizer Knob - Center annunciator
2. Heading Check:
   a. True Heading - Checked by celestial means
   b. Heading Indicator (Gyro) - Reset to mag heading (P/CP)

Subpolar and Polar Reorientation

Since the convergence factor of the polar series JN charts is different from the subpolar series, their respective grid north orientations are not compatible. It is therefore necessary to reorient the compasses when changing from one chart to the other. If no change of course is intended, the reorientation is made as follows:

1. Reorientation Point - Determined

   Select a point that is common to the chart that is being departed and the new chart. This point should be a prominent radar return if possible.

2. Conversion Correction - Determined
3. N-1 Compass - Reset

   Reset the N-1 compass by the amount of the conversion correction (in the direction indicated) using the synchronizer knob.

4. Heading Indicator (Gyro) - Reset (P/CP)

   Reset the heading indicator (gyro) to the same value as the N-1.

5. Grid Heading - Checked

   Check grid heading by celestial means, using TH plus or minus longitude when going to polar areas (TH plus or minus convergence angle when going to subpolar areas).

If a change of course is intended at the reorientation point, then after completing the grid heading check, steer the aircraft to the intended new grid heading.

PHOTOGRAPHY

RADAR CAMERA

Radar Camera Data Plates

The following data will be entered on the camera data plate during preflight.

TARGET COMPLEXES. The complexes or ranges to be bombed during the mission will be entered in chronological order. A maximum of three complexes will be listed; if a greater number of targets are to be attacked, the data plate must be changed in flight after the first three targets are bombed. At the discretion of the radar navigator, the data plate may be corrected prior to bombing each complex to facilitate identification of film during critique. However, the complex bombed must appear on the data plate regardless of the method used.

DATE. The date entered on the data plate during preflight will be the Greenwich date of the ETA to the first complex.

AIRCRAFT TYPE AND NUMBER. The airplane type will be completely identified: B-52D, etc. The last four digits of the tail number of the airplane will also be entered.

LAST NAME OF RADAR NAVIGATOR. The last name (and initials, in those cases requiring further identification) of the radar navigator will be entered.

EXAMPLE

LAJUNTA
OB-21
P. D. 2-7
30 June 70
B-52D 5068
SMITH, C. S.

Operation

INFLIGHT OPERATION (GENERAL). General inflight operation procedures are as follows:

1. If power fails to reach the camera, check the fuses on the camera control unit. Also check that the sector amplitude control on the indicator is full clockwise and in detent, particularly if the camera operates when the function switch is in TRACK or BOMB but does not operate when the function switch is in NAV.
2. A minimum of five blank exposures (receiver gain control full counterclockwise) should be taken at the end of each photo strip.
3. The PMG switch will be left in ON at all times unless it interferes with bombing accuracy.

All data on pages 8-120 thru 8-124 (Deleted)

PHOTOGRAPHY (cont)

INFLIGHT OPERATION (NAVIGATION). Navigation radar photography will be accomplished in accordance with current procedures. Other mission navigation photography requirements will be accomplished as briefed.

INFLIGHT OPERATION (STRIKE). RBS camera runs and conventional bomb drops:

1. During the Before IP check, turn radar camera power switch ON and selector switch to 1 EVERY 4.
2. After recording bombing data and release frame number and prior to impact time, retune for optimum presentation of the crosshairs.
3. After completing the turn off the target or at the expiration of the briefed time, record the position of the crosshairs relative to the target for use in bombing analysis.
4. At a minimum of 2 minutes after release, or as briefed, turn the radar camera power switch OFF.

NOTE

No radar photo procedures will be used which will hinder bombing accuracy.

VERTICAL (STRIKE) CAMERA

Inflight Operation Using the Vertical Camera Intervalometer

1. Camera Control Panel:
   a. Camera Master Switch - ON
   b. Camera Intervalometer Switch - AUTO
2. Delay, Interval & Exposure Limiter Control Knobs - Set as desired
   a. The camera exposure delay control setting is the time between initiation of the intervalometer (whether normal or remote) and the time the camera actually starts taking pictures. In normal operation, this will be the ATF minus the time before impact it is desired to start taking pictures.
   b. The camera exposure interval control setting is either the desired setting between pictures or the length of time the camera will take pictures. When the camera intervalometer power switch is on BOMBSPOT (B-8B), ON (B-8A), the exposure interval control determines the length of time between pictures. When the B-8B camera intervalometer power switch is on RUNAWAY, the exposure interval control determines the total length of time pictures will be taken.
   c. The camera exposure limiter control is set for the desired number of pictures. This control is not effective on the B-8B intervalometer if the camera intervalometer power switch is on RUNAWAY.
3. Camera Intervalometer Power Switch - ON (B-8A), BOMBSPOT or RUNAWAY (B-8B)

   The camera intervalometer may be initiated manually by depressing the camera intervalometer manual initiation switch or remotely by a bomb release pulse.

Miscellaneous Data

With the camera master switch in ON position, the camera door opens automatically with the bomb bay doors, but does not close automatically. The camera door switch must be held in CLOSED position until the camera door closes when it is desired to close the camera door after the bomb bay doors have closed. If photos are desired at other than bomb release, the camera door must be opened manually.

PHOTOGRAPHY (cont)

TYPES OF OPERATION. There are two main types of vertical camera operation. IBDA is the most common, while bomb spotting and reconnaissance combine to form another. Interval between exposures is the distinguishing factor. IBDA requires a minimum interval between exposures which constitutes a maximum rate of operation. Bomb spotting and reconnaissance each utilize a much lower rate of operation.

Camera Operation for Bomb Spotting or Reconnaissance

1. With Vertical Camera Intervalometer (Automatic):
   a. B-8A Camera Intervalometer Power Switch - ON
   b. B-8B Camera Intervalometer Power Switch - BOMBSPOT
2. The following settings are common to both the B-8A and B-8B:
   a. Camera Exposure Interval Control - As desired
   b. Camera Exposure Limiter Control - As desired
   c. Camera Exposure Delay Control - As applicable
   d. Camera Intervalometer - Initiate either remotely by a bomb release pulse or by depressing the camera manual initiation switch.

Camera Operation for IBDA (B-8A)

1. With Vertical Camera Intervalometer (Automatic):
   a. Camera Intervalometer Power Switch - ON
   b. Camera Exposure Interval Control - Full CW then return to the first CCW detent
   c. Camera Exposure Limiter Control - 75
   d. Camera Exposure Delay Control - ATF-15
   e. Camera Intervalometer - Initiate either remotely by a bomb release pulse or by depressing the camera manual initiation switch.
2. Manual Operation (B-8A):
   a. Camera Intervalometer Power Switch - ON
   b Camera Trip Switch - Depressed

      Hold camera trip switch on camera intervalometer in depressed position until the desired number of pictures are obtained.

   c. Camera Panel Intervalometer Switch - MANUAL

      Hold camera intervalometer switch on the vertical camera control panel in MANUAL until desired number of pictures are obtained.

PHOTOGRAPHY (Cont)

Camera Operation for IBDA (B-8B):

1. With Vertical Camera Intervalometer (Automatic):

   a. Camera Intervalometer Power Switch - RUNAWAY

   b. Camera Exposure Interval Control - 75

   c. Camera Exposure Limiter Control - OFF

   d. Camera Exposure Delay Control - ATF-15

   e. Camera Intervalometer - Initiate either remotely by a bomb release pulse or by depressing the camera manual initiation switch.

2. Manual Operation (B-8B):

   a. Camera Intervalometer Power Switch - BOMBSPOT, OFF, or RUNAWAY

   b. Camera Trip Switch - Depressed

   Actuation of the trip switch will result in one exposure.

   c. Camera Panel Intervalometer Switch - MANUAL

   Hold camera intervalometer switch on the vertical camera control panel in MANUAL until the desired number of pictures are obtained.

RADAR NAVIGATOR NOT FLYING CHECKLIST (NAVIGATOR ACCOMPLISHES)

NOTE

- This checklist will be used by the navigator with the radar navigator not flying. The navigator will accomplish both his normal checklist and the items contained in this checklist. The navigator's normal checklist will be used for amplification of required checks for the radar navigator's ejection seat and escape hatch, parachute, survival kit, and oxygen system.
- This checklist does not appear as an abbreviated checklist.

INTERIOR INSPECTION

1. Ejection Seat & Escape Hatch - Checked
2. Parachute Preflight - Accomplished
3. Man-Seat Separator - Checked
4. MD-1 Survival Kit - Checked
5. Compass Cutoff Switch - ON
6. Radar Navigator's Circuit Breaker Panels:
    a. Normal Release, Salvo Power & **B-52D** External Rel Circuit Breakers - Out
    b. Emer Door Open & Rel Circuit Breaker **B-52D** - Out
    c. All Other Circuit Breakers & Fuses - In
7. Oxygen System - Checked
8. Ground Blowers Switch - OFF
9. Radar Pressure Pump Control Switch - NORMAL ON
10. Terrain Computer Power Switch - OFF
11. Radar Control Unit Power Switch - OFF
12. Air Outlet & Auxiliary Heat Knobs:
    a. Upper Outlet Knobs - 1/2 to full out
    b. Lower Outlet Knobs - Full out
    c. Auxiliary Heat Knob - Full in

NOTE

These knob settings are approximate settings only. After the cabin temperature has stabilized, knob adjustment may then be varied slightly for crew comfort.

RADAR NAVIGATOR NOT FLYING CHECKLIST (NAVIGATOR ACCOMPLISHES) (Cont)

13. Bomb Control Panel:
    a. Master Bomb Control Switch - OFF
    b. Bomb Indicator Lights Switch - ON
    c. Bombing System Switch - MANUAL
    d. Lights - Checked, tested
14. BNS Primary Control Function Switch - STAB

AFTER ENGINE START

CAUTION

After engine start, do not turn BNS on until after being notified by the copilot that aircraft power is on the line and a-c and d-c power has been checked within tolerances and cooling air is available.

1. Ground Blowers Switch - ON

BEFORE TAKEOFF

1. Altimeter - Set

   Set in accordance with AFM 51-37. On aircraft **ZV** , check that altimeter correction cards are installed.

WARNING

When setting altimeter, special attention should be given to the altimeter to insure the 10,000-foot pointer is reading correctly.

AFTER TAKEOFF

1. Altitude & Airspeed - Monitored

   Monitor altitude and airspeed for safe margin until aircraft has attained an altitude of 5000 feet above the terrain. Advise pilot if altitude falls below a safe margin or airspeed fails to show a positive increase.

2. Altimeter - Set

RADAR NAVIGATOR NOT FLYING CHECKLIST (NAVIGATOR ACCOMPLISHES) (Cont)

DESCENT AND BEFORE LANDING

1. Altimeter Setting - Determined and set (RN-N-P-CP)

   Compute a level-off altimeter setting using metro or inflight "D" values. Enroute metro or ARTC altimeter settings will be used if available.

2. Descent Altitude Calls - Accomplish

   a. Coordinate with the pilot as to level-off altitude(s) to be used for descent and entry to landing pattern.

   b. Call off altitude to pilot every 5000 feet during descent beginning at first multiple of 5000 feet. Upon reaching level-off altitude plus 5000 feet, report altitude to pilot every 1000 feet and at level-off altitude.

AFTER PARKING

1. Primary Control Function Switch - OFF
2. Ground Blowers Switch - OFF
3. Inform Pilot - BNS off
4. Bomb Indicator Lights Switch - OFF
5. Radar Pressure Pump Control Switch - OFF
6. Compass Cutoff Switch - OFF

NAVIGATOR NOT FLYING CHECKLIST (RADAR NAVIGATOR ACCOMPLISHES)

NOTE

- This checklist will be used by the radar navigator with the navigator not flying. The radar navigator will accomplish both his normal checklist and the items contained in this checklist. The radar navigator's normal checklist will be used for amplification of required checks for the navigator's ejection seat, parachute, survival kit, and oxygen system.
- This checklist does not appear as an abbreviated checklist.

BEFORE EXTERIOR INSPECTION (POWER OFF)

1. Ejection Seat:

WARNING

- Carefully check to assure that no streamer has been torn from a maintenance safety pin, thus inadvertently leaving the pin installed.
- If a maintenance safety pin, except No. 6, is installed, that status of the seat will be ascertained prior to removal of the pin.

    a. Catapult Pin-Pull Initiator - Checked, pin No. 6 installed

    Check maintenance pin No. 6 installed. Inspect link for condition and installation.

INTERIOR INSPECTION

1. Lower Deck Spare Parachute Preflight:
    - a. Inspection Record:
        - (1) Inspection & Repack Date - Checked
        - (2) Automatic Release Time & Altitude Setting - Checked
    - b. Bailout Bottle Pressure & Hose Connector - Checked
    - c. Parachute - Unbuckled and stowed

      Spare parachute will be unbuckled and stowed in an easily accessible location.
2. Lower Deck Fire Extinguisher - Checked

   Assure that appropriate safety device (safety wire/seal or locking pin/lever as applicable) is installed. Check for fully serviced pressure.
3. Ejection Seat - Checked
4. Parachute - Checked
5. Man-Seat Separator - Checked

NAVIGATOR NOT FLYING CHECKLIST (RADAR NAVIGATOR ACCOMPLISHES) (Cont)

6. MD-1 Survival Kit - Checked
7. CSM Switch - ON

   CSM switch is located on the aft module rack.
8. Doppler System Pressurization Shutoff Valve Handle - NORMAL
9. Oxygen System - Checked
10. Heading Reference Control:
    - a. Polar Angle Indicator - 360°
    - b. Heading Mode Selector Switch - MAG
    - c. Pole Switch - As required
    - d. Illum Switch - As desired
    - e. Wind Test Switch - OFF
11. Navigation Unit:
    - a. Nav Mode Selector Switch - NORM NAV
    - b. Illum Control - CW
12. Heading Select Control:
    - a. BATH Switch - BNS
    - b. ASM/DOPPLER Switch - BNS
13. Doppler Drift Switch - NORMAL
14. N-1 Compass Preflight:
    - a. Latitude Correction Knob - OFF
    - b. Synchronizer Knob - Zero annunciator
15. Auxiliary Radar Indicator:
    - a. Video Gain Control - CCW
    - b. Bias Control - CCW
16. Doppler Radar Silence Switch - SILENT
17. Doppler Radar System Power Switch - OFF
18. Ground Locks & Bypass Keys - Counted and stowed

NAVIGATOR'S NOT FLYING CHECKLIST (RADAR NAVIGATOR ACCOMPLISHES) (Cont)

BEFORE TAKEOFF

1. Emergency Escape Hatch - Secure

   Check that paint stripe on the lockpin is visible or the flat surface of the lockpin extends 1/4 inch from its housing. Check that latch pins overlap the long lip of the latch hooks by approximately 1/8 inch. Check that the escape hatch manual release handle is full right.

2. Pin No. 6 (catapult pin-pull initiator) - Removed
3. Pressure Bulkhead Door - Closed, latched, and unlocked
4. Emergency Cabin Pressure Dump Handle - Closed
5. Doppler Radar System Power Switch - ON

   CAUTION

   Do not turn doppler radar system power switch on until cooling air is available and the ground blowers switch is ON.

6. Automatic Astrocompass:

   CAUTION

   The declination and SHA for Polaris are to be inserted into the No. 1 star data panel for astrocompass operation (including standby) between the latitudes of 0° and 75° N to reduce the potential of limits of "lock-up" damage to the altitude-azimuth computer.

   a. Star Selector Switch - OFF

   b. Rate Switch - SOL or SID (as required)

   c. Lat-Long Switch - AUTO

   d. Power Filter Switch - SUN or STAR

   NOTE

   There is a 2-minute delay before information may be preset and an additional 5-minute delay before the system can track. If the celestial coordinates for Polaris are not displayed in star data panel No. 1, they are to be inserted as soon as the 2-minute delay has elapsed.

7. Heading Indicators - Cross-checked

   Cross-check heading indicators and magnetic standby compass.

NAVIGATOR NOT FLYING CHECKLIST (RADAR NAVIGATOR ACCOMPLISHES) (Cont)

AFTER TAKEOFF

1. Departure Plan - Monitored

   Monitor the aircraft position to assure adherence to the planned departure.

2. Doppler Radar Silence Switch - TRANSMIT (if desired)

   Place the doppler radar silence switch in TRANSMIT when attaining an altitude of approximately 200 feet above the ground.

3. Climb EPR Value - Computed (if requested)

AFTER LEVEL-OFF

1. True Airspeed Indicators - Cross-checked

   If a significant difference exists (allowing for Va correction), compute true airspeed from the pilot's indicated airspeed. If the BNS true airspeed is materially different from both the navigator's true airspeed indicator and the computed true airspeed, the BNS true airspeed may be set manually.

BEFORE DESCENT

1. Best Flare Speed - Computed and cross-checked with copilot

   Obtain operating weight and total fuel from copilot. Using best flare speed chart, enter with gross weight and compute best flare speed for actual landing configuration.

DESCENT AND BEFORE LANDING

1. Penetration & Approach Altitudes - Monitored

2. Doppler Radar Silence Switch - SILENT (if required)

   Place the doppler radar silence switch to SILENT when approximately 200 feet above the ground for low approaches and landings. Return the switch to TRANSMIT when above 200 feet during missed approach or after subsequent takeoffs.

AFTER LANDING

1. Pin No. 6 - Installed

   Install maintenance safety pin No. 6 in catapult pin-pull initiator prior to opening of hatch.

AFTER PARKING

1. Astro Power Filter Switch - POWER OFF

2. Doppler Radar System Power Switch - OFF

EW OFFICER'S CHECKLIST

BEFORE EXTERIOR INSPECTION — SAFETY CHECK

1. Form 781 - Checked

   Check Form 781 for pertinent equipment writeups and chaff loadings not specifically covered in the pilot's review of the form. Confirm with ground crew that any missing transmitter component receiving ram air cooling has been replaced by a dummy box to block ram air outlet. If any ECM equipment that receives air from a common cooling duct is removed and not replaced with a dummy box, none of the other equipment that receives cooling from that cooling duct can be operated since the cooling air will be lost through the open hole and adequate cooling will not be available for the remaining equipment. If this is applicable, see "Airspeed Limitation," Section V.

2. Arming Levers - Stowed, No. 1 safety pin installed

   WARNING

   If the right arming lever is rotated on either a stowed or raised armrest, the arming initiator will fire. If the arming lever has been rotated or the arming lever safety pin is not installed, call maintenance immediately and stay clear of the seat.

3. Liaison Radio Control Switch - OFF

4. ECM Equipment/Expendables Safety Check - Completed

   a. ECM Equipment, Chaff & Flare Power Switches - OFF

   b. Chaff & Flare Circuit Breakers - Out

   c. APR-25 Circuit Breaker **B-52D** - Out

   NOTE

   - During this inspection, the EW officer will ensure that all systems are deactivated to prevent inadvertent jamming or dispensing of expendables with the application of ground power.

   - ALT-31 system status **B-52D**, cannot be determined until power is available to the system. A self-protection circuit will insure the system remains off until the STBY pushbutton is activated after power is applied.

5. Upper Deck Fire Extinguisher - Checked

   Assure that appropriate safety device (safety wire/seal or locking pin/lever as applicable) is installed. Check for fully serviced pressure.

6. KY-28 Power Switch **B-52D** - OFF

7. KY-28 Keyer **B-52D** - Coded

EXTERIOR INSPECTION

1. Forward Exterior Antennas - Checked

   Check protruding ECM antennas and antenna covers mounted on the fuselage for condition, security, and cleanliness.

1A. Center Exterior Antennas - Checked

2. ALE-20 Ground Test Switch - OFF

   Check that the ALE-20 ground test switch (in forward wheel well) has not been inadvertently left propped in the ON position. (Switch is spring-loaded to OFF position.)

EW OFFICER'S CHECKLIST (cont)

3. Left AFT Exterior Antennas - Checked

   Check protruding ECM antennas and antenna covers mounted on the fuselage for condition, security, and cleanliness.

4. Left ALE-27 Fuselage Chaff Dispenser Ports - Checked

   Visually check that exposed chaff packages conform with mission requirements.

5. **Left ALE-20 Flare Ejectors** - Checked

   Visually check that the ejector covers are secure (if flares are not loaded) or that the openings are unobstructed (if flares are loaded).

6. Tail Mounted Antennas - Checked

   Check protruding ECM antennas and antenna covers mounted on the fuselage for condition, security, and cleanliness.

7. Right ALE-20 Flare Ejectors - Checked

   Visually check that the ejector covers are secure (if flares are not loaded) or that openings are unobstructed (if flares are loaded).

8. **ALE-20 Safety Interlock Switch Door - Check open, remove streamer, and close**

   Check that the ALE-20 flare ejector safety interlock door is open, then remove streamer and close the door. If the door is found closed, check with maintenance personnel on the status of the ALE-20 equipment. When the aircraft is on ground alert in a cocked configuration, the streamer will be removed and the door closed.

9. Right ALE-27 Fuselage Chaff Dispenser Ports - Checked

   Visually check that exposed chaff packages conform with mission requirements.

10. Right Aft Exterior Antennas - Checked

    Check protruding ECM antennas and antenna covers mounted on the fuselage for condition, security, and cleanliness.

11. SST-181 Antenna **B-52D** - Checked

INTERIOR INSPECTION

1. Section 41 Power Distribution Panel Circuit Breakers - Checked

2. Equipment - Stowed

WARNING

Insure that no equipment is stowed on or near the heating duct, electrical wiring, or electronic equipment.

3. Upper Deck Spare Parachute Preflight:

   a. Inspection Record:

      (1) Inspection & Repack Date - Checked

      (2) Automatic Release Time & Altitude Setting - Checked

EW OFFICER'S CHECKLIST (cont)

b. Bailout Bottle Pressure & Hose Connector - Checked

c. Parachute - Unbuckled and stowed

Spare parachute will be unbuckled and stowed in an easily accessible location.

4. Ejection Seat:

a. Hatch Lanyard - Checked

Check lanyard connecting escape hatch to catapult safety pin-pull initiator.

b. Maintenance Safety Pins - Checked removed

Check No. 2 and 3 pins removed. Take care that no streamer was torn free of a safety pin during removal, thus inadvertently leaving the pin installed. Also make certain that no safety pin is overlooked because the streamer has been detached previously. See figure 1-53 for location of safety pins.

c. Catapult Initiator Safety Pin-Pull Cylinder - Pin in place

Visually check pin installed in catapult initiator. If not installed, call maintenance immediately.

d. Initiator Tube Runs - Check connected

Check tubes for proper and secure connections.

e. Inertia Reel - Checked

Check inertia reel lock for proper functioning.

5. Parachute Preflight:

a. Inspection Record:

(1) Inspection & Repack Date - Checked

(2) Automatic Release Time & Altitude Setting - Checked

b. Personal Locator Beacon Lanyard - Snapped/Unsnapped (as required)

For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 1-56).

c. Bailout Bottle Pressure & Hose Connector - Checked

d. Zero Delay Lanyard - Hooked

e. Parachute Straps - Adjusted (as required)

5A. MD-1 Survival Kit Preflight:

a. Kit Release Knob Snapped - Checked

EW OFFICER'S CHECKLIST (Cont)

b. Zipper Closed & Seal Intact - Checked

c. Kit Straps to Parachute - As required

WARNING

Care must be taken to assure the survival kit attachment straps are not entangled in the safety belt. Always fasten the survival kit to the parachute before fastening the safety belt.

6. Circuit Breakers - Set

Check that all circuit breakers on ECM circuit breaker panel are set to "in" position. Chaff dispenser and flare ejector circuit breakers will be left "out" until ready to dispense chaff or eject flares and "out" after activity is complete. APR-25 circuit breaker will be left "out" until required "in" by the "After Takeoff - Climb" checklist.

7. Air Outlet Knobs:

a. Upper - 1/2 to full out

b. Lower - Full out

c. Spray Bar - Full out

NOTE

These knob settings are approximate settings only. After the cabin temperature has stabilized, knob adjustment may then be varied slightly for crew comfort.

EW OFFICER'S CHECKLIST (Cont)

8. Interphone - Monitor

   The EW officer will monitor the interphone at the station he is occupying.

9. Oxygen System:

   a. Regulator Diluter Lever - 100% OXYGEN

   b. Shutoff Lever - OFF

   c. Mask & Hose - Check disconnect, then reconnect

      Check for 10- to 20-pound pull for disconnect, then reconnect mask and hose.

   d. Diluter Valve - Checked

      Attempt to draw air through the oxygen mask. Ability to draw air indicates a defective diluter valve, oxygen hose and/or connections, or mask. Then place the diluter valve to NORMAL position, draw air through the mask, if unable, this would indicate that only 100% oxygen will be available.

NOTE

If the diluter valve is stuck in the 100% position, this will prohibit the detection of smoke or fumes when use of normal oxygen is required.

   e. Shutoff Lever - ON

   f. Pressure - Checked

      Pressure gage reads approximately 300 psi.

   g. Emergency Toggle Lever - TEST MASK

      With mask disconnected at one side of helmet the flow indicator should indicate continuous flow.

   h. Mask - Test

      Attach mask to helmet and hold breath; indicator should indicate no flow.

NOTE

Flow condition may be indicated by a slight leak around the face form. If light hand-pressure against the mask does not stop the flow, the mask is unacceptable.

   i. Emergency Toggle Lever - NORMAL

   j. Regulator Diluter Lever - NORMAL/100% (as required)

10. Lights - Checked and set

    Check light switches and controls for proper operation and set as desired.

11. ECM Equipment Controls Preset:

    a. Flare & Chaff Counters - Checked

       Check all counters for correct loading (should agree with Form 781 entry).

    b. ALT-6B/ALT-22 Operate-Standby Switches - STBY

EW OFFICER'S CHECKLIST (Cont)

c. ALR-18 Mode Switches - STBY

d. APR-25 Intensity & Audio Controls **B-52D** - Minimum

e. QRC-218:

(1) Individual Output Switches - OFF

(2) Master Output Switch - ON

(3) Manual-Preset Switches - PRESET

(4) Modulation Control - 1/2 CW or as required

f. ARC-65:

WARNING

Observe ARC-65 ground operation limitations in Section V.

(1) Control Switch - ON

(2) Volume Control - Midposition

(3) Emission Switch - SSB/AME as required

(4) Power Switch - HIGH or as directed

(5) Frequency Channelization Card - Checked

Check frequency card for standard or briefed frequency listings. Enter discrepancies in Form 781 and correct as required for mission.

(6) Access Door Thumbscrews - Locked

(7) Reception - Checked

Allow 15 minutes warmup before any transmission.

(8) Control Switch - OFF (if transmission check is not required)

NOTE

The celestial station check may be performed before or after the EW station check according to the dictates of the situation.

11A. ALR-20/ALR-20A Rack - Unlocked and latched

Unlock and release the ALR-20/ALR-20A rack prior to checking celestial station.

12. Celestial Station Lights - Checked and set

Check lights and controls for proper operation.

EW OFFICER'S CHECKLIST (Cont)

13. Celestial Station Oxygen System:

When the station is not occupied:

a. Regulator Diluter Lever - 100% OXYGEN

b. Shutoff Lever - OFF

c. Mask & Hose - Check disconnect, then reconnect

Check for 10- to 20-pound pull for disconnect, then reconnect mask and hose.

d. Diluter Valve - Checked

Attempt to draw air through the oxygen mask. Ability to draw air indicates a defective diluter valve, oxygen hose and/or connections, or mask. Then place the diluter valve to NORMAL position, draw air through the mask, if unable, this would indicate that only 100% oxygen will be available.

NOTE

If the diluter valve is stuck in the 100% position, this will prohibit the detection of smoke or fumes when use of normal oxygen is required.

e. Shutoff Lever - ON

f. Pressure - Checked

Pressure gage reads approximately 300 psi.

g. Emergency Toggle Lever - TEST MASK

With mask disconnected at one side of helmet the flow indicator should indicate continuous flow.

h. Emergency Toggle Lever - NORMAL

i. Oxygen Regulator - 100% and OFF

When the oxygen system at the celestial station is not in use, place the regulator diluter lever to 100% OXYGEN and the shutoff lever to OFF.

14. Periscopic Sextant & Mount - Checked

NOTE

If sextant is not stored in the aircraft, steps "a" and "b" may be performed at any time prior to arrival at aircraft.

a. Sextant Desiccant - Checked

b. Halftime Dial Accuracy Check - Completed

(1) Depress averager winding lever; averager indicator should align. Allow averager to operate for 4 seconds. Averager should stop automatically and time dial should indicate zero.

(2) Rotate altitude knob. Rotation of the altitude knob should not cause the average indices to move more than twice the width of the index line.

(3) Depress actuating lever (or button) and read watch.

EW OFFICER'S CHECKLIST (cont)

(4) Check halftime dial and averager indicators and watch. Read when shutter clicks and compare with watch. Dial should read 59 since shutter closes 2 seconds before averager stops. The period of operation of the averager should be 120 (±2) seconds. If any of the tolerances are exceeded, the navigator should be notified.

NOTE

Step "b" may be performed while accomplishing steps "c" and "d."

c. Sextant - Inserted and lights checked

Connect power cable and check sextant and mount for proper lighting.

d. Alignment - Checked

Rotate azimuth knob unitl 0 degrees is on the index and compare with azimuth counters. Variations over 1/2 degrees should be entered into AFTO Form 781. Reset azimuth counters to 0 degrees. Collimate on the center line of the vertical stabilizer; 180 degrees should be read under the vertical stabilizer. Small errors may be removed by rotation of the projection lens.

e. Sextant - Removed and stowed

Rotate bubble adjust knob to full increase and depress and release averager actuating lever (button).

CAUTION

When the sextant is not being used for an observation, the averager actuating lever (button) should always be depressed to allow the averager to run down and prevent damage to the spring.

f. Spare Bulbs in Sextant Case - Checked

g. Sextant Mount - Drained (may be open on alert)

h. Sextant Port - Checked closed

15. Celestial Station:

a. Scanning Lamp & Filters - Checked

Check for presence and secure stowage, and that the lamp is unplugged when not in use.

b. Thermal Curtains - Stowed (training); installed and checked (EWO)

During initial acceptance (alert aircraft only), thermal curtains will be installed on all transparent openings.

WARNING

- Thermal curtains must be kept free from grease, oil, and mold as any discoloration will seriously impair the value of the curtains. Oil or grease base materials will ignite upon exposure to thermal radiation. Dirty or cracked thermal curtains must be replaced.
- Failure to close thermal curtains (during EWO) may result in flash blindness from nuclear detonation.

EW OFFICER'S CHECKLIST (cont)

16. ECM Console Cabling - Checked visually

    Perform a visual check of all accessible ECM cabling and cable connections for security and excessive wear or unsafe condition.

16A. ALR-20/ALR-20A Rack - Stowed and locked

    Stow and lock the ALR-20/ALR-20A rack after returning to the EW officer's seat.

17. Liaison Radio:

    a. Transmission - Checked (if required)

        Allow 40 seconds for channelization and 15 minutes warmup before any transmission.

WARNING

Ground operation of the AN/ARC-65 transmitter (interphone selector switch positioned to LIA and mike switch actuated) is prohibited on any tactical aircraft with nuclear weapons loaded and bomb bay doors open.

NOTE

- This restriction applies only to AN/ARC-65 installed on the tactical aircraft having nuclear weapons aboard and does not apply to adjacent aircraft regardless of separation distance. This does not prohibit AN/ARC-65 receiver operation on the ground.
- If the AN/ARC-65 liaison radio transmission cannot be checked at this time, it may be checked during the taxiing checklist after the bomb bay doors are closed.

    b. Control/Power Switch - OFF

18. Crew Report - Completed

    a. Pilot actuates emergency alarm switch to ABANDON, switches interphone to CALL, and announces "Crew report."

    b. EW officer reports on interphone following navigator. Switch interphone to CALL and report "EW station check complete." Station check consists of seat, oxygen, alarm light/abandon signal, interphone, and zero delay lanyard check.

    c. If the celestial preflight is interrupted by "Crew report," the EW officer may report from the celestial station. On return to his seat, the interphone CALL position will be checked with another crew member.

19. Oxygen Regulator - OFF and 100% OXYGEN (if leaving the aircraft for an extended period of time)

STARTING ENGINES

WARNING

Whenever contamination is suspected, 100% oxygen will be used during ground operation and takeoff.

1. Interphone & UHF Radios - Monitored

EW OFFICER'S CHECKLIST (cont)

2. ALR-20/ALR-20A Rack - Stowed and locked

WARNING

To prevent serious injury, the ALR-20 rack must be stowed and locked before ejection from the EW officer's seat.

3. Stand By to Taxi - Report if not ready to taxi

NOTE

Steps "4" through "7" may be accomplished during taxi.

4. Liaison Radio - On

CAUTION

Operating the liaison radio during periods of abnormally high voltage or fluctuating power will decrease the operational life of the equipment and can cause material failure.

5. Parachute, Safety Belt, Parachute Arming Lanyard & Shoulder Harness - Fastened

Adjust shoulder harness to a snug condition while sitting well back in seat. Assemble shoulder harness loops and parachute arming lanyard anchor on safety belt as shown in figure 1-55.

WARNING

- Adjusting the shoulder harness loosely increases the amount of play before the inertial reel locks. A tight harness is necessary to avoid injury during impact deceleration.
- Insure that the parachute arming lanyard is not entangled in the parachute harness. Lanyard entanglement could cause failure in seat separation and failure of the automatic features of the parachute.

6. Oxygen Hose & Bailout Bottle - Connected to mask
7. Oxygen Regulator - As required

TAXIING CHECKLIST (Copilot/EW reads)

Checklist appears in EW officer's abbreviated checklists and will be read on request of the pilot.

EW OFFICER'S CHECKLIST (Cont)

BEFORE LINEUP CHECKLIST (Copilot/EW reads)

Checklist appears in EW officer's abbreviated checklists and will be read on request of the pilot.

AFTER TAKEOFF/CLIMB

1. ECM Equipment:
   a. APR-25 Circuit Breaker **B-52D** - In

   b. All ECM power switches (except chaff/flare) will be turned on during climbout after flaps up and will remain on until after landing. Care should be exercised that ECM transmitters are in standby except when they are to be used.

WARNING

To prevent accidental actuation of the transmitter switches, extreme care must be exercised when leaving or returning to the seat.

NOTE

ALT-13/28 transmitters will be momentarily placed to RESET then back to STBY.

   c. ALT-6B/ALT-22 Slow Width Controls - Approximately 1/4 turn CCW

   d. ALR-18 Sweep Width Controls - Approximately 1/4 turn CCW

NOTE

During all periods when the ALT-6B, ALT-22, and ALR-18 have power on but are not in transmit mode, the slow width and sweep width controls will be opened to approximately 1/4 turn CCW.

2. Zero Delay Lanyard - Stowed (P-CP-EW-G)

3. Oxygen Check - Completed (G-EW-RN-CP)

   a. During the climb, copilot requests an oxygen check at 12,000 feet. The sequence for oxygen report is gunner, EW officer, radar navigator, copilot. The reporting crew member will check crew members for alertness. He will report oxygen check for other position(s). Oxygen panel at each occupied crew position will be checked on all oxygen checks for:

      (1) Oxygen Supply Shutoff Lever - ON

      (2) Regulator Diluter Lever - As required

      (3) Pressure - 300 psi

      (4) Flow Indicator - Functions normally

      (5) Emergency Toggle Lever - NORMAL

   b. Gunner and copilot report, "Cabin altitude__________feet. Oxygen panel checked."

   c. EW officer and radar navigator report, "Oxygen panel checked."

   d. Copilot notifies aircrew and receives gunner's acknowledgment when passing through 25,000, 35,000, and 40,000 feet.

EW OFFICER'S CHECKLIST (Cont)

e. The copilot will request an oxygen check at level-off. During cruise, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes and initiate the oxygen checks at 30-minute intervals when both cabin altitudes are below 12,000 feet, at 15-minute intervals when either cabin altitude is 12,000 to 25,000, and at no longer than 10-minute intervals when either cabin altitude is above 25,000 feet. If cabin altitude is below 12,000 feet, only the gunner and copilot will report. The remaining crew members will check their equipment and report if abnormal.

4. Periscopic Sextant - Inserted as required

WARNING

The EW officer's ejection seat will remain unoccupied during the time he is performing celestial duties. His parachute may remain in the seat which will be configured for immediate reoccupancy and ejection, except that the No. 1 safety pin will be installed. Should the EW officer elect to return to his seat between celestial observations, he will fasten parachute, install shoulder harness and lanyard key, fasten seat belt, and remove No. 1 safety pin.

AIR REFUELING

Checklist appears in T.O. 1-1C-1-5.

EW CALIBRATION AND INTERFERENCE

The calibration of ECM equipment and interference to and from other aircraft systems will be determined as soon as practical after takeoff. The purpose of this check is to determine whether the equipment meets the minimum requirements for dependable operation. If this abbreviated check reveals a malfunction or failure and conditions permit, refer to the applicable portion of the Malfunction and Analysis Checklist, T.O. 1B-52C-1CL-4 and T.O. 1B-52D-1-2, Malfunction, Analysis, and Emergency Operation section. Each transmitter will be checked for normal efficiency by comparing the output with like systems, taking the antenna position into consideration. Transmitters will be momentarily activated in a clear band, consistent with clearance and operating restrictions. On training missions only, when the mission profile precludes accomplishing the entire check prior to the HHCL, only systems and frequency bands programmed for use will be checked. Deviations from checklist sequence to comply with local area clearances are authorized. The entire crew must be alerted for coordination during this check. UHF guard frequency must be monitored throughout the check.

NOTE

- Receivers and appropriate transmitters may be checked during climb commensurate with clearance and crew coordination.
- ALT-13/28 transmitters will be placed in "Warmup Mode" after completion of calibration and interference check. Equipment programmed for use will be placed in "Standby Mode" no more than 30 minutes prior to ECM activity. Equipment will be placed back to "Warmup Mode" upon completion of ECM activity or during any time period exceeding 30 minutes between activity.
- Items that are circled will be repeated for each receiver band/trace and like transmitter.

1. AIC-10 Mixer Switches - As required

EW OFFICER'S CHECKLIST (cont)

2. ALR-20 **B-52D** **Less** **V**:

   a. Mode Selectors (7) - AUTO

   b. RF Level Controls (7) - Checked, adjust for optimum signal presentation

   Check for a change in signal amplitude by varying each RF level control, then set to optimum level.

CAUTION

Do not "pull out" on any RF level control knob in an attempt to interrupt BNS/FCS blanking to the receiver. Complete receiver loss may occur due to circuit overloads created within system.

NOTE

Use RF test if no signals are available on trace.

   c. Scale Illumination - Optimum

   d. RF Test Button - Depressed, signals checked

   Hold RF test button depressed; test signals should appear on each trace.

   e. Percent Expansion Selectors - Checked

   Set expansion A selector on the desired trace and rotate the percentage selector control. The pedestal should increase or decrease in length. Vary the manual frequency control and the pedestal should move across the trace. Repeat procedure for expansion B.

   ⓕ. Mode Selector - MAN

   ⓖ. Manual Frequency Control - Adjust to signal frequency

NOTE

Use RF test if no signals are available on trace; however, it may be necessary to move manual frequency control back and forth through test frequency for audio to be heard.

   h. Volume Control - Adjusted

   ⓘ. Mode Selector - AUTO

   j. Scope Presentation - Checked

   Check for presence of known signals and interference.

2A. ALR-20A **V**:

   a. Sweep Width (7) - Full CW

EW OFFICER'S CHECKLIST (Cont)

b. RF Level Controls (7) - Checked, adjust for optimum signal presentation

Check for a change in signal amplitude by varying each RF level control, then set to optimum level.

CAUTION

Do not "pull out" on any RF level control knob in an attempt to interrupt BNS blanking to the receiver. Complete receiver loss may occur due to circuit overloads created within system.

NOTE

Use RF test if no signals are available.

c. Scale Illumination - Optimum

d. Scope Presentation - Checked

Check for presence of known signals and interference.

e. RF Test Button - Depressed, signals checked

f. Expansion Trace Selectors A & B - Checked

Select positions 1 thru 7 in turn. Monitor expansion trace A for display of each main trace. Repeat procedure for expansion trace selector B.

g. Right & Left Marker Controls - Checked

Vary the marker control. Marker should move across both expansion traces. Repeat procedure for left marker control.

h. Sweep Width Control - Checked, then full CCW

Rotate the sweep width control CCW from the full CW position to select a segment approximately 1/4 of the trace. Vary the manual frequency control and the segment should move across the trace. Continue rotation of the sweep width control to the full CCW position (in detent).

i. Manual Frequency Control - Adjust to signal frequency

NOTE

Use RF test if no signals are present.

j. Volume Control - Adjusted

k. Sweep Width Control - Full CW

3. APR-25 **B-52D**:

a. APR-25 Mixer Switch - Up (EW-G)

b. Intensity Control - Optimum

Adjust intensity control clockwise until dot appears in center of indicator, then decrease to just below visibility.

c. Audio Control - Optimum

If no signals are present, accomplish this step during self-test.

EW OFFICER'S CHECKLIST (Cont)

d. Threshold Controls - Zero

e. Logic Buttons - In

f. Self Test - Accomplished (notify gunner)

g. Logic Buttons - Out (check for inteference)

NOTE

> If interference is received, have FCS radar go to OFF or BNS go to STANDBY, as necessary, to isolate the interference source.

h. Threshold Controls - Readjusted, as required

4. ALT-16:

a. Channel Selector Buttons - Depressed as desired

b. Power Selector - TRANSMIT

c. Power Monitor Meter - Checked

Meter should read 50 or greater.

d. VSWR Button - Depressed, meter checked

Meter should read 30% or less of reading in step "c" for scimitar antennas or 40% or less of reading in step "c" for stub antennas.

CAUTION

> Do not operate transmitter if meter reading in step "d" is more than 30% (or 40%) of step "c" as damage to the transmitter may result.

e. Signal Presentation, Calibration & Interference - Checked

f. Power Selector - STANDBY

5. ALT-32 **B-52D**:

a. Spot A & B Bandwidth Controls - CCW to minimum

b. Spot A & B Frequency Controls - Set to clear frequencies

c. Transmit Channel Selector - A

d. Signal Presentation, Calibration & Interference - Checked

e. Spot A Bandwidth Control - Checked and CCW

f. Transmit Channel Selector - B

g. Signal Presentation, Calibration & Interference - Checked

h. Spot B Bandwidth Control - Checked and CCW

i. Transmit Channel Selector - A & B

Check that both A & B signals are present.

EW OFFICER'S CHECKLIST (Cont)

ⓙ. Transmit Channel Selector - BARRAGE 1, 2, 3 and 4

ⓚ. Signal Presentation, Calibration & Interference - Checked

ⓛ. Transmit Channel Selector - STBY

6. ALT-31 B-52D :

   a. Channel Selector Buttons A & B - Depressed OFF

   b. Channel Selector Buttons 1 thru 10 - Depressed as desired

CAUTION

If no channel selector buttons are activated and the transmit pushbutton is activated, the system will go to fault and the fault indicator will illuminate. Placing the ALT-31 to transmit without activating a channel selector button may result in equipment damage.

   c. Transmit Pushbutton - Depressed ON, radiate light illuminated

   d. Signal Presentation, Calibration & Interference - Checked

   e. STBY Pushbutton - Depressed OFF, radiate light out

   f. Channel Selector Buttons 1 thru 10 - Depressed OFF

   g. Channel A & B Frequency Controls - Set to clear frequencies

   h. Channel A & B Bandwidth Controls - CCW to minimum

   i. Channel Selector Button A - Depressed ON

   j. Transmit Pushbutton - Depressed ON, radiate light illuminated

   k. Signal Presentation, Calibration & Interference - Checked

   l. Bandwidth A Control - Checked and CCW

   m. Channel Selector Button B - Depressed ON

   n. Channel Selector Button A - Depressed OFF

   o. Signal Presentation, Calibration & Interference - Checked

   p. Bandwidth B Control - Checked and CCW

   q. STBY Pushbutton - Depressed OFF, radiate light out

7. ALT-6B/ALT-22/C-7211:

NOTE

- B-52D The C-7211 programmer must be installed in the aircraft before the ALT-22 can be operated.
- B-52D The ALT-22 transmitters can be operated without external (C-7211) modulation. However, to do this, the C-7211 power switch must be in ON position and the applicable mode selectors in N position.

ⓐ. C-7211 Mode Selector B-52D - N (Normal)

EW OFFICER'S CHECKLIST (Cont)

(b.) Width Controls - CW to zero

(c.) Tuning Control - Set to clear frequency

CAUTION

Observe restriction on 58D2098-13A, 58D2098-30, and 58D2098-37 antennas listed in T.O. 1B-52D-1-2.

(d.) Operate-Standby Switch - OPR, check meter

ALT-6B MOD CUR 4.5 to 5.5, MOD Volts 3.0 to 6.0
ALT-22 MOD CUR 4.0 to 5.0, MOD Volts 3.5 to 8.5

(e.) Signal Presentation, Calibration & Interference - Checked

(f.) Sweep Width & Rates - Checked, then CW to zero

(g.) C-7211 Modulation **B-52D** - Checked

Check for audible changes in all modes.

(h.) C-7211 Mode Selector **B-52D** - N (Normal)

(i.) Operate-Standby Switch - STBY

(j.) Slow Width Control - 1/4 CCW

8. ALT-28 D/E Band **B-52D**:

a. Program Selector - BARR

(b.) RF Bandwidth Control - FM OFF

(c.) Barrage Center Frequency Control - Set to clear frequency

(d.) Function Selector - BARRAGE

(e.) Signal Presentation Calibration & Interference - Checked

Compare and note transmitter interference with receiver systems.

(f.) RF Bandwidth Control - Checked and FM OFF

(g.) **Function Selector - Warmup mode (unless programmed for use)**

9. ALT-28 E/F Band **B-52D**:

a. Program Selector - BARR

b. Manual Rate Control - Full CW

(c.) RF Bandwidth Control - FM OFF

(d.) Barrage Center Frequency Control - Set to clear frequency

(e.) Function Selector - BARRAGE

(f.) Signal Presentation, Calibration & Interference - Checked

EW OFFICER'S CHECKLIST (Cont)

(g.) RF Bandwidth Control - Checked and FM OFF

(h.) Function Selector - A, set signal to coincidence check frequency

(i.) ALR-20/ALR-20A Expansion Trace Selector - Set to required trace

(j.) ALR-20 Percent Expansion Selector **Less** 🆅 - Minimum

Set selector to provide maximum expansion of selected frequency band - not CAL position. Adjust expansion pedestal to transmitter signal.

(j.) ALR-20A Sweep Width Control 🆅 - Set

Select approximately 1/4 of main trace. Position selected segment around transmitter signal.

(k.) Program Selector - MAN, check for coincidence and modulation

Adjustments of manual rate control and RF level may be necessary to properly display coincidence of back and peak power levels. Check visually for modulation.

NOTE

Perform programmer check on first transmitter only.

l. ALT-28 Programmer - Checked

(1) ALR-20 Mode Selector **Less** 🆅 - MAN

Tune to transmitter signal.

(1) ALR-20A Sweep Width Control 🆅 - Full CCW

Tune to transmitter signal.

(2) Manual Rate Control - Checked and full CW

Check for audible increase/decrease of pulse rate.

(3) Program Selector - CS2

Check for audible change in pulse rate.

(4) Program Selector - CS1

Check for audible change in pulse rate.

(5) Program Selector - TS

Check for audible change in pulse rate.

(6) ALR-20 Mode Selector **Less** 🆅 - AUTO

(6) ALR-20A Sweep Width Control 🆅 - Full CW

(m.) Program Selector - BARR

(n.) QRC-218 Output Switch - ON, checked, and OFF

Check visually for modulation.

EW OFFICER'S CHECKLIST (Cont)

(o.) Preset Center Frequency Controls - Checked, set to required frequency

Check limits in authorized band, then set to required frequency.

(p.) Function Selector - Warmup mode

10. ALT-28 G/H Band **B-52D**:

a. ALR-20 Antenna Selector Switch **Less V** - OMNI

NOTE

Switch should be momentarily placed in FWD position to insure a clear frequency band prior to activation of transmitters.

b. Program Selector - BARR

(c.) Manual Rate Control - Full CW

(d.) RF Bandwidth Control - FM OFF

(e.) Barrage Center Frequency Control - Set to clear frequency

(f.) Function Selector - BARRAGE

(g.) Signal Presentation Calibration & Interference - Checked

Check signal presentation in both positions of antenna selector switch.

(h.) RF Bandwidth Control - Checked and FM OFF

(i.) Function Selector - A (high power transmitter) or B (low power transmitter), set signal to coincidence check frequency

(j.) ALR-20/ALR-20A Expansion Trace Selector - Set to required trace

(k.) ALR-20 Percent Expansion Selector **Less V** - Minimum

Set selector to provide maximum expansion to selected frequency band, not CAL position. Adjust expansion pedestal to transmitter frequency.

(k.) ALR-20A Sweep Width Control **V** - Set

Select approximately 1/4 of main trace. Position selected segment around transmitter signal.

CAUTION

Do not adjust manual rate control below dial setting of 80 while accomplishing step "l."

(l.) Program Selector - MAN, check for coincidence and modulation

Adjustments of manual rate control and RF level may be necessary to properly display coincidence to back and peak power levels. Check visually for modulation.

m. Program Selector - TS (first transmitter only)

Check visually for modulation.

EW OFFICER'S CHECKLIST (Cont)

ⓝ. Program Selector - BARR

ⓞ. QRC-218 Output Switch - ON, checked, and OFF

Check visually for modulation.

ⓟ. ALR-20A Sweep Width Control 🅥 - FULL CW

ⓠ. Preset Center Frequency Control - Checked, set to required frequency

Check limits in authorized band, then set to required frequency.

ⓡ. Function Selector - Warmup mode

11. ALR-18:

a. Bottom C-7211 Mode Selector - N (normal)

ⓑ. Search Width - 600 MCS

ⓒ. Sweep Width & Rate Control - CW to zero

ⓓ. Center Frequency Control - Set to clear frequency

ⓔ. Mode Switch - MAN

ⓕ. Signal Presentation, Calibration & Interference - Checked (EW-G)

Align system 15 spot jamming to FCS search and track radar frequencies to provide gunner with system interference. Note FCS center frequencies by using ALR-18 center frequency control.

ⓖ. Sweep Width & Rate - Checked and CW to zero (EW-G)

Align system 15 sweep jamming to FCS search and track radar frequencies to provide gunner with system interference.

ⓗ. Deactivate Switch - Depressed

For system 15, have the gunner depress the deactivate switch. With the deactivate switch depressed, the reset light should illuminate, and the radiate light should go out.

ⓘ. C-7211 Modulation - Checked

Check for audible change in all modes.

ⓙ. Bottom C-7211 Mode Selector - N (normal)

ⓚ. Mode Switch - AUTO

ⓛ. Receiver Attenuation Selector - Adjusted

Adjust to lowest possible db setting which will eliminate noise triggering (db value should be 9 db or less).

ⓜ. Passive Override Button - Depressed

The passive override and radiate lights should illuminate immediately but the jam light should not illuminate. If the jam light illuminates, increase db setting (3 to 9 db setting) to extinguish jam light.

ⓝ. Mode Switch - STBY

ⓞ. Sweep Width Control - 1/4 CCW

EW OFFICER'S CHECKLIST (Cont)

EW EQUIPMENT SET

Operational ECM equipment will be programmed for use after completing the calibration and interference check, start of each EW attack, start of all penetration tactics, or any post target penetration by accomplishing the applicable portion of this checklist. Transmitters will not be reactivated. Antenna locations, axis of attack, and the results of the "EW Calibration and Interference Checklist" will be considered when selecting equipment to be used for each attack.

NOTE

- **ALT-13/28 transmitters programmed for use will be turned to STBY mode within 30 minutes prior to ECM activity.**
- Items that are circled will be repeated for each receiver band/trace and like transmitter.

1. AIC-10 Mixer Switches - As required
2. ALR-20/ALR-20A B-52D:
   - a. Antenna Selector Switch - As desired
   - b. Controls - Optimum
   - c. Expansion Traces - Set

     Adjust each pedestal so that the expansion traces will be monitoring a threat frequency band.
3. APR-25 B-52D:
   - a. Threshold Controls - Optimum
   - b. Audio Control - Optimum
   - c. Logic Buttons - As required
   - d. Button 9 - Not illuminated
4. ALT-15 & ALT-16.
   - ⓐ Channel Selector Buttons - Depressed as required
5. ALT-32 B-52D:
   - ⓐ Spot A Frequency Control - As required
   - ⓑ Spot A Bandwidth Control - As required
   - ⓒ Spot B Frequency Control - As required
   - ⓓ Spot B Bandwidth Control - As required

All data on page 8-144D (Deleted)

EW OFFICER'S CHECKLIST (Cont)

6. ALT-31 **B-52D**:
   - a. Channel Selector Buttons - Depressed as desired
   - b. Channel A Frequency Control - As required
   - c. Channel A Bandwidth Control - As required
   - d. Channel B Frequency Control - As required
   - e. Channel B Bandwidth Control - As required
7. ALT-6B/ALT-22:
   - a. Center Frequency - As required
   - b. Rate & Width Controls - As required
   - c. C-7211 Mode Selectors **B-52D** - As required
   - d. CS Frequency Selector - As required
8. QRC-218A-(T):
   - a. Manual-Preset Switch - As required
   - b. Master Output Switch - OFF
   - c. Output Switches - As required
   - d. Modulation - Set
9. ALT-28 **B-52D**:
   - a. Transmitter Mode - Warmup/STBY (as required)
   - b. Ctr Freq & Preset Ctr Freq Controls - As required
   - c. RF Bandwidth Control - As required

EW OFFICER'S CHECKLIST (Cont)

ⓓ Program Selector - As required

To be accomplished when presetting the first transmitter of each program selector.

ⓔ Manual Rate Control - As required

10. ALR-18:

ⓐ Seq-Track Switch - SEQ

ⓑ Receiver Attenuation Selector - Optimum

ⓒ Center Frequency Control - Set as required

ⓓ Sweep Width & Rate Controls - As required

ⓔ Search Width Control - As required

ⓕ Bottom C-7211 Mode Selector **B-52D** - As required

ⓖ C-7211 CS Frequency Selector - As required

ⓗ Mode Switch - As required

i. Advise RN of clear frequency range if applicable.

NOTE

- All chaff and flare circuit breakers available to the EW officer will be pulled at all times except when accomplishing this checklist in preparation for actual dispensing of chaff and/or flares. The proper positioning of circuit breakers will then be governed by existing directives.
- The pilot's ALE-20 flare set power switch will be in the OFF position at all times, except when accomplishing this checklist in preparation for actual dispensing of flares. (This check is only necessary for initial accomplishment of checklist unless flares are actually programmed to be dispensed.) The proper positioning of appropriate ALE-20 switches during preparation for actual dispensing will then be governed by existing directives.

11. ALE-27:

a. Power Switch - OFF

b. Programmer Selector Switches - As required

c. Dispense Switches - OFF

d. Circuit Breaker - In or as directed

e. Power Switch - ON or as directed

f. Press-to-Test Lights - Tested

12. ALE-20:

a. Power Switch - OFF

b. Flare Program - As required

c. Transfer Switch - Checked OFF

d. Pilot's Flare Set Power Switch - ON or as directed

e. Circuit Breakers - In or as directed

EW OFFICER'S CHECKLIST (Cont)

f. Power Switch - ON or as directed

CAUTION

Removing power from the system while a program is in progress can result in the clutch coil cam being stuck in the detent position making program mode inoperative.

g. Press-to-Test Lights - Tested

h. Crew Notified - Accomplished

NOTE

Prior to any normal dispensing or emergency jettisoning of flares, the EW officer will notify all crew members of his intended action.

PRELANDING OPERATIONAL CHECK

1. Periscopic Sextant - Stowed, port closed
2. Prelanding Operational Check - Completed

All ECM equipment not used for ECM runs during the sortie or checked during the EW calibration and interference check will be checked for operation prior to landing in accordance with procedures for the abbreviated check as outlined in the "EW Calibration and Interference Checklist," consistent with clearance requirements and operating restrictions. Discrepancies will be entered in the appropriate forms.

3. ECM Equipment - Checked

CAUTION

If one or more alternators are inoperative, all ECM equipment will be turned off during descent.

a. ECM Transmitters - STBY

b. Chaff & Flare Power Switches - OFF

c. Chaff Dispenser Circuit Breakers - Out

d. Flare Circuit Breakers - Out

e. APR-25 Intensity Control **B-52D** - Minimum (EW-G)

EW OFFICER'S CHECKLIST (Cont)

f. APR-25 Power Button B-52D - Depressed, power light off

CAUTION

Do not operate receiver when high power radars are known to be operating nearby. Video detector crystals in the preamplifiers can be damaged by I-band radars operating within 200 feet and E- or G-band radars operating within 1000 feet.

g. APR-25 Circuit Breaker B-52D - Out

h. ALR-20/ALR-20A Power Switch B-52D - OFF

4. Safety Belt & Shoulder Harness - Fastened

5. Dome & Flood Lights - Adjusted

   White lights will be adjusted to preclude interference with night vision of pilot and copilot.

6. Zero Delay Lanyard - Hooked (P-CP-EW-G)

DESCENT CHECKLIST (Pilot/Copilot/EW reads)

Checklist appears in EW officer's abbreviated checklists and will be read on request of the pilot.

BEFORE LANDING CHECKLIST (Copilot/EW reads)

Checklist appears in EW officer's abbreviated checklists and will be read on request of the pilot.

AFTER LANDING

NOTE

The "After Landing" checklist will be performed in the event the mission is ground aborted after preflight has been initiated.

1. Arming Lever Safety Pin (No. 1) - Installed
2. Armrests - Stowed
3. ECM & Communications Power Switches - OFF

NOTE

- Check all ECM power switches OFF and recheck all chaff and flare power switches OFF prior to leaving position to prevent inadvertent jamming or jettisoning of ECM expendables with the application of ground power.
- If taxiback landings are accomplished, the ECM equipment will be turned OFF on the first landing.

CAUTION

Aircraft electrical power must be maintained for 5 minutes after turning off ECM equipment to allow cooling system to cycle-out, thus preventing damage to the system.

EW OFFICER'S CHECKLIST (Cont)

4. Ejection Seat - Down and aft
5. Oxygen System:
    a. Regulator - OFF and 100% OXYGEN
    b. Supply Hose & Interphone Cord - Stowed
6. Celestial Station:
    a. Regulator - OFF and 100% OXYGEN
    b. Supply Hose & Interphone Cord - Stowed
    c. Scanning Lamp - Stowed

POSTFLIGHT

1. KY-28 Keyer Door **B-52D** - Open and closed (if required)

    If a code has been set in the KY-28 keyer, the door must be opened and closed to insure manual removal of code.

2. ALE-20 Safety Interlock Switch Door - Open, streamer installed

    On all training flights, the EW officer will ensure that the ALE-20 flare ejector safety interlock door is open and that streamer is installed.

NOTE

Aircraft accepted for alert status will have the streamer removed and the ALE-20 safety interlock switch door closed.

3. Required Forms - Completed
4. Crew Debriefing - Completed

    Forms, logs, and classified material turned in as briefed.

SYSTEM RESTRICTIONS

Restrictions to operation of any system will be governed by existing regulations and/or directives.

RADIATION RESTRICTIONS

WARNING

When ECM transmitters are operating, radiations hazardous to human life exist within a 10-foot radius of ALT-28 antennas and a 6-foot radius of remaining antennas. During periods of ground radiation, ground crews will be notified of the above restrictions.

EQUIPMENT COOLING

Critical cooling requirements of ECM equipment demand precautions during ground and inflight operations. Ground cooling must be supplied to the applicable ram air inlet or aircraft compartment when extended ground operation of ECM equipment is required. During inflight operations or ground operations with ground cooling connected, any removed ECM equipment that was located within a cooling shroud must be replaced with a dummy box or equivalent. Failure to do so will result in the loss of cooling air; therefore, operation of any equipment within that shroud is prohibited. Ground operation of ECM systems without cooling air is authorized provided the time and temperature limitations listed below are observed.

CAUTION

Due to probable equipment damage, operation of ECM equipment without complying with proper cooling, time and/or temperature limitations is prohibited.

MAXIMUM GROUND TIME AND TEMPERATURE LIMITATIONS WITHOUT GROUND COOLING

GROUP	SYSTEMS	TIME	OAT TEMP
1	1, 2* & 3*	10 min**	60° F
2	5, 7, 9 & 11		
3	6, 8, 10, 12 & 14		
4	13		
5	16		
6	15***	NO TIME LIMIT	80° F
	ALR-20/ALR-20A		60°F

*Transmitter must be moved away from the cooling shroud a minimum of 2 inches.

**ALT-32's are limited to 2 minutes maximum time limit. ALT-31's are limited to 5 minutes maximum time limit.

***The aft entry door must be open.

No more than one system per group may be operated at one time. After operation, ECM equipment must cool for at least 30 minutes before operation can be resumed. For time limitations, the system is considered on any time the power selector is not in OFF. ECM systems may be operated at OAT's above 60° F if detailed requirements of T.O. 1B-52C-2-28 are met.

ECM EQUIPMENT OPERATION REQUIREMENTS

Figure 8-10.

All data on pages 8-151 thru 8-164 (Deleted)

GUNNER'S CHECKLIST

MISSION PLANNING

MISSION PREPARATION

1. Mission Planning:

    a. Scheduled FCS Activity - Reviewed

    Review mission planning form and weekly aircrew flying schedule for scheduled FCS activity.

    b. Flight/FCS Activity Planning - Accomplished

    The gunner will accomplish flight planning, coordinating with other crew members on the necessary phases of FCS equipment checks, interference checks, DCE, fighter intercepts, live firing, FEO, and Bonus Deal activity.

    c. FCS Operator Mission Planning/Inflight Log - Completed

    The gunner will complete the applicable portion of the operator mission planning/inflight log in accordance with applicable directives and mission requirements.

    d. Publications & Technical Data - Checked

    Directives, manuals, and checklists will be checked for currency.

2. Crew Briefing - Attended and completed

    Gunner will attend crew briefing and will brief the other crew members and staff (as applicable) on the FCS activity to be accomplished during the mission.

3. Personal Equipment - Checked

    Prior to reporting to the aircraft, the gunner will determine that he has the required personal equipment and that it is in proper working order.

PREFLIGHT PROCEDURES

BEFORE EXTERIOR INSPECTION

1. Aircraft Form 781:

    Pilot reads Form 781, gunner checks/notes the following:

    a. Gun Status - Checked

    b. Ammunition Quantity & Type - Checked

    c. FEO Loading - Checked

    d. FCS Discrepancies & Status - Noted

GUNNER'S CHECKLIST (Cont)

EXTERIOR INSPECTION

1. Ammunition Access Bay:
   a. Turret Jettison Linkage - Checked

      The gunner visually checks jettison linkage for corrosion and disconnected lines.

   b. External Turret Jettison (& Canopy Release **ZR**) Handle Safety Pin - Removed
   c. Loose Objects - Secured or removed
2. Ammunition Access Door - Closed and locked
3. Walkaround Inspection - Completed
   a. Static Ports - Checked

NOTE

The gunner will perform a walkaround inspection and visually check FCS access doors, panels, antenna radomes, cowling, and turret.

INTERIOR INSPECTION

1. Spare Parachute Preflight:
   a. Inspection Record:
      (1) Inspection & Repack Date - Checked
      (2) Automatic Release Time & Altitude Setting - Checked
   b. Bailout Bottle Pressure & Hose Connector - Checked
   c. Parachute Straps - Adjusted
   d. Parachute - Stowed

      Spare parachute will be stowed on its side under the auxiliary oxygen panel with the straps facing outboard.
2. Equipment - Stowed

   Stow personal equipment in crew compartment insuring seat rails are clear.

WARNING

Insure that no equipment is stowed on or near the heating duct, electrical wiring, or electronic equipment.

2A. Interphone - Connected
   a. Volume Control - Maximum
   b. Selector Switch - Interphone

GUNNER'S CHECKLIST (Cont)

2B. Fire Extinguisher - Checked

Assure that appropriate safety device (safety wire/seal or locking pin/lever as applicable) is installed. Check for fully serviced pressure.

3. Auxiliary Oxygen Regulator - OFF and 100%

4. ALR-18/ALT-6B Waveguides & Coax Cables - Checked

Check the ALR-18 system for exposed portions of waveguides and coax cable for damage and proper connection.

WARNING

- Damaged or disconnected waveguides and/or coax cables may cause personal injury due to arcing or RF burns.
- Exercise extreme care when moving personal equipment or operating the seat back rest.
- Do not use waveguides or coax cables for hand holds.

5. Canopy Release System **ZR** - Checked

a. No. 4 Safety Pin - Installed

Check that the No. 4 safety pin is correctly installed in the canopy release initiator.

WARNING

Tail canopy release initiators do not have a positive ground safety lock feature. The ground safety pin can be installed in the initiator without engaging the safety pin in the sear pin groove. This results in an armed and dangerous condition of the tail canopy release system. Inadvertent operation of the canopy release handle could result in firing the initiator with the safety pin improperly installed. Be sure that the handle is stowed properly (all the way in) before installing the safety pin.

b. Canopy Release Handle - Secure

Check that the canopy release handle is secure and retained by spring safety latch.

c. Linkage & Line Connection - Checked

Check canopy release linkage and initiator tube run connections for security and continuity.

5A. Turret Jettison Handle - Stowed

a. No. 1 Safety Pin - Installed

Check that the safety pin is correctly installed in the inner emergency release handle initiator.

b. Linkage & Line Connection - Checked

Visually check linkage and line for proper connection.

GUNNER'S CHECKLIST (Cont)

6. Maintenance Pin No. 3 - Removed
7. Thermal Curtain - Checked and stowed (as required)

   On training missions, check that the thermal curtain is protected from damage and normal use as sunshades. Stow the curtain on the forward end of the slides in relation to the aircraft.

   WARNING

   - Thermal curtains must be kept free from grease, oil, and mold as any discoloration will seriously impair the value of the curtains. Oil or grease base materials will ignite upon exposure to thermal radiation. Dirty or cracked thermal curtains must be replaced.
   - Failure to close thermal curtains (during EWO) may result in flash blindness from nuclear detonation.

8. Gunner's Seat:

   a. Back Rest Locks in Horizontal & Vertical Positions - Checked

   b. Headrest - Checked and set

   c. Seat Belt - Fastened

   d. Fore & Aft Movement & Locking - Checked

   Check fore and aft seat movement insuring that it does not bind and will lock in position.

   e. Vertical Movement & Locking - Checked and set (as desired)

   CAUTION

   - The seat should be full aft position with respect to the aircraft before extending the seat backrest to recline position. Move seat fore and aft with caution when seat backrest is near 45° position. These procedures should be followed to prevent possible damage to equipment or cables.
   - When moving the seat, exercise extreme care to avoid catching the parachute arming knob and actuating the parachute arming mechanism.

9. Integrated Harness Manual Release Operation:

   a. Inertia Reel - Locked

   b. Integrated Harness Release Handle - Pulled

All data on pages 8-164D-1 and 8-164D-2 (Deleted)

GUNNER'S CHECKLIST (Cont)

c. Safety Belt & Shoulder Harness Releases from Seat - Checked

The integrated harness manual release handle is spring-loaded and will reposition when released.

d. Inertia Reel - Unlocked

e. Shoulder Harness & Safety Belt - Reconnected

10. Inertia Reel - Checked

Check inertia reel lock for proper operation.

11. Parachute Static Line:

a. Static Line Extends to Full Travel & Connected to Reel - Checked

b. Static Line Checked for Fraying - Checked

c. Static Line Returns to Stow When Released - Checked

d. Static Line to Arming Lanyard - Connected

12. Parachute Preflight:

a. Inspection Record:

(1) Inspection & Repack Date - Checked

(2) Automatic Release Time & Altitude Setting - Checked

b. Personal Locator Beacon Lanyard - Snapped/Unsnapped (as required)

For peacetime operations, the personal locator beacon lanyard must be configured for automatic operation. When mission requirements dictate the necessity to avoid detection and automatic actuation of the beacon is not desired, the lanyard must be configured for nonautomatic (manual) operation (figure 4-85).

c. Bailout Bottle Pressure & Hose Connector - Checked

d. Zero Delay Lanyard - Hooked

e. Parachute Straps - Adjusted (as required)

13. Survival Kit Preflight:

WARNING

When using the ML-2/CNU-68/P Global Survival Kit, the safety belt must be of the type that allows the survival kit attachment straps to be threaded through the survival kit threading loops.

a. ML-2/CNU-68/P Global Survival Kit:

(1) Kit Installed & Plunger Depressed - Checked

(2) Kit Release Handle: Locked Position & Strike Engaged - Checked

(3) Compartment Lid Locked - Checked

GUNNER'S CHECKLIST (Cont)

(4) Kit Straps to Parachute - Checked and attached

Check that the attachment fittings are properly connected to the kit, the attachment straps threaded in the safety belt and the quick-disconnect fittings are properly attached to the parachute.

WARNING

Care must be taken to insure that the survival kit attachment straps are properly threaded through the safety belt.

14. Gunner's Circuit Breaker Panel - Set

All circuit breakers in unless otherwise directed.

15. Interphone - Checked

a. Volume Control - As desired

b. Selector Switch - INTER

c. Auxiliary Listen Switch - NORMAL

d. Interphone Mixer Switches - As required

NOTE

The pilot actuates the emergency alarm switch to ALERT to check the alarm system on emergency battery power. At this time the gunner immediately goes on interphone to be ready for crew report.

16. Oxygen System:

a. Regulator Diluter Lever - 100% OXYGEN

b. Shutoff Lever - OFF

c. Mask & Hose - Check disconnect, then reconnect

Check for 10- to 20-pound pull for disconnect then reconnect mask and hose.

GUNNER'S CHECKLIST (Cont)

d. Diluter Valve - Checked

Attempt to draw air through the oxygen mask. Ability to draw air indicates a defective diluter valve, oxygen hose and/or connections, or mask. Then place the diluter valve to NORMAL position, draw air through the mask, if unable, this would indicate that only 100% oxygen will be available.

NOTE

If the diluter valve is stuck in the 100% position, this will prohibit the detection of smoke or fumes when use of normal oxygen is required.

e. Shutoff Lever - ON

f. Pressure - Checked

Pressure gage reads approximately 300 psi.

g. Emergency Toggle Lever - TEST MASK

With mask disconnected at one side of helmet, the flow indicator should indicate continuous flow.

h. Mask Test - Accomplished

Attach mask to helmet and hold breath; indicator should indicate no flow.

NOTE

Flow condition may be indicated by a slight leak around the face form. If light hand pressure against the mask does not stop the flow, the mask is unacceptable.

i. Emergency Toggle Lever - NORMAL

j. Regulator Diluter Lever - NORMAL/100% (as required)

17. Crew Report - Completed

NOTE

- Pilot actuates the emergency alarm switch to ABANDON, switches interphone to CALL and announces, "Crew report." Gunner switches to CALL and reports, "Station check complete." Station check consists of seat, oxygen, alarm lights, abandon signal, call light, interphone, and zero delay lanyard hooked. The sequence for crew reporting is: G, N, EW, RN, CP, P, IN, 10th man, bunk and IP.
- If pilot has not called for crew report by the time the gunner reaches this point in the checklist, the gunner should continue with his interior inspection.

18. Radar Control Panel:

a. Search Emergency OFF Switch - ON

b. Track Emergency OFF Switch - ON

c. Auxiliary Standby Switch - OFF

d. Search Auxiliary Operate Switch - OFF

e. Search Antenna Auxiliary ON Switch - OFF

f. Track Range Marker Switch - OFF

g. Track Auxiliary Operate Switch - OFF

GUNNER'S CHECKLIST (Cont)

19\. FEO Selector Switch - OFF

20\. FCS Control Panel:

  a. FCS Power Switch - OFF

  b. Search Radar Switch - OFF

  c. Emergency Search Switch - OFF

  d. Emergency Mode Switch - OFF

  e. Guns Charger Switch - RELEASE

  f. Guns Ready-Safe Switch - SAFE and pinned

  g. Spare Fuses - Checked and installed

  Spare fuses checked for proper amperage ratings.

21\. APR-25 Indicator Intensity Control **B-52D** - CCW

22\. Radar Indicator Panel:

  a. B & C Scope Intensity Controls - CCW

  b. Cursor Intensity Control - CCW

  c. ANL Control - CCW

23\. Control Column and Handle Switches:

  a. Track Select Switch - RADAR

  b. Range Select Switch - RADAR

  c. Course Switch - PURSUIT

24\. Hemispheric Sight:

  a. Spare Reticle Lamps - Checked

  b. Sight Cover & Handle - Checked and set open

  Operate handle to OPEN and CLOSE positions and observe movement of cover; leave in OPEN position.

25\. Gun Charger Air Pressure Gage 800 (±100) PSI - Checked

26\. Ammunition Counters - Set

If ammunition is loaded, rounds counters will be set to ammo load as indicated in AFTO Form 781.

27\. Air Conditioning Panel:

  a. Master Switch - OFF

  b. Master Switch Lockspring - Checked

  Check that the master switch lockspring exerts positive pressure against the master switch.

GUNNER'S CHECKLIST(Cont)

   c. Air Bleed Selector Switch - NORMAL

   d. Cabin Temperature Selector Switch - MANUAL

   e. Window Defog Switch - As desired

   f. Cabin Pressure Release Switch - RESET and safety wired

28. Warning & Indicator Lights:

   a. Auxiliary Standby Switch - ON

   b. Search & Track Low Pressure Lens Control - Open

   c. Press-to-Test Lights - Checked

   Check search and track low pressure warning, FEO, target warning, gyro ready, search operate, call, cabin pressure warning, and cabin depressure request lights.

   d. Auxiliary Standby Switch - OFF

29. Compartment Lights - Checked and set (as desired)

Check the dome, ammunition counters, panel lights, entrance lights, and spot light for proper operation.

30. Signal Lamp & Filters - Checked

31. Spare Lamps - Checked

32. Oxygen Regulator - OFF and 100% (if leaving the aircraft)

33. Hemispheric Sight Desiccator Switch - TEST, then NORMAL

Check that desiccator low pressure warning light comes on and then goes out, indicating normal pressurization of the hemispheric sight.

34. Bulkhead Spot Light - Checked

35. Aft Equipment Compartment Inspection - Completed

Perform a walk through inspection of the aft equipment compartment checking for loose objects and leakage of any unit.

WARNING

The aft equipment compartment walkway (47 section) is the only access to gunner's alternate bailout exit and for emergency inflight movement. It is imperative that this walkway be kept clear of equipment that would hamper or delay the gunner in reaching the entrance door at the aft wheel well.

36. Emergency Cabin Pressure Dump Handle - Closed and safetied.

37. Bulkhead Door - Closed and locked

GUNNER'S CHECKLIST (Cont)

PRETAKEOFF PROCEDURES

NOTE

Only the **boldface** items need be accomplished for scramble. On scramble takeoffs, all items remaining will be completed during climb or as soon as practicable.

BEFORE ENGINE START

1. **OXYGEN REGULATOR — ON and NORMAL/100% (AS REQUIRED)**
2. **TURRET JETTISON HANDLE NO 1 SAFETY PIN — REMOVED**
3. **CANOPY RELEASE INITIATOR NO. 4 SAFETY PIN ZR — REMOVED**
4. **TURRET DRAG CHUTE INTERCONNECT CONTROL KNOB —NORMAL (DOWN)**

AFTER ENGINE START/BEFORE TAKEOFF

WARNING

Whenever contamination is suspected, 100% oxygen will be used for ground operation and takeoff.

1. **AIR CONDITIONING MASTER SWITCH — 7.45 PSI**

   If subsequent reentry to the aft pressurized compartment is required, cabin pressure must be relieved by turning the air conditioning master switch to RAM prior to opening the aft entry door.

2. Cabin Temperature Selector Switch - As desired
3. Window Defog Switch - ON
4. **FCS POWER SWITCH — WARMUP (AFTER ALTERNATORS ARE ON THE LINE)**

   CAUTION

   To insure that damage to the FCS does not occur when operating on the ground, operate in WARMUP or ON no longer than 20 minutes prior to takeoff when OAT is 85°F or higher.

5. On Target & Target Warning Lights - Checked

   Check that the ON TARGET light comes on after a short period of time, goes out, and the TARGET WARNING light comes on. This indicates power is available to both radars.

6. **STANDBY TO TAXI — REPORT**

   Pilot announces, "Crew standby to taxi"; gunner reports, "Gunner ready/not ready for taxi."

   NOTE

   During taxi for Alert/Scramble, MITO exercises and when within congested ground areas, extreme vigilance must be maintained. The gunner will visually clear the aircraft at all times during taxi.

7. **TIP GEAR — MONITOR AND REPORT**

   Monitor and report clearance, obstructions, and movements.

GUNNER'S CHECKLIST (Cont)

8. **SEARCH ANTENNA AUXILIARY ON SWITCH — ON**

9. **RADAR INDICATOR CHECK:**

   a. **OVERLAY INTENSITY — SET**

   b. **B SCOPE INTENSITY & RASTERS (3 RANGE SWEEPS) — CHECKED AND ADJUSTED**

   Increase B intensity until rasters are visible. Focus rasters. Check that there are no broken or missing rasters. Check that rasters extend to both azimuth limits of the scope. Check that rasters extend from the bottom to the top of the scope in all three range sweeps. Reduce B intensity to just under raster visibility.

   c. C Gate Length Control - Checked

   Check that C gate marker is visible. Check that marker can be positioned farther than 10,000 yards, and closer than 3500 yards.

   d. **C SCOPE INTENSITY & RASTERS — CHECKED AND ADJUSTED**

   Increase C intensity until rasters are visible. Focus rasters. Check that rasters are not jagged or broken. Check that rasters cross at zero elevation and extend to scope limits in both azimuth and elevation. Reduce C intensity until sweeping rasters are just visible.

   e. Circle Cursor - Checked and adjusted

   Hold action switch closed. Turn up cursor intensity until circle cursor appears on C scope. Focus cursor with C focus control if necessary. Check that cursor is circular with a diameter of 1/8 to 1/4 inch. Adjust cursor intensity for optimum presentation.

   f. Dot Cursor - Checked

   With action switch closed, press second target button. Check that dot cursor appears within 5° of center of C scope.

10. Hemispheric Sight Check:

    a. Wingspan Card Maximum & Minimum Limits - Checked

    b. Wingspan Card at 43 Feet - Set (or as briefed)

11. **FCS POWER SWITCH — ON**

CAUTION

The track button will not be depressed until the gyros have timed out.

12. **SERVOS STOWED:**

    a. Range Card 5100 (.225) Feet - Checked

    b. Optics Straight Aft - Checked

    c. L/S Pointer Straight Aft - Checked

GUNNER'S CHECKLIST (Cont)

d. Circle Cursor - Checked

Close action switch with control handles centered. Check that circle cursor appears at center of C scope.

e. TURRET STOWED — CHECKED

Close action switch and press second target button. Check that dot cursor appears at center of C scope. Notify pilot if dot cursor position indicates turret not stowed.

13. SEARCH RADAR SWITCH — ON

14. SEARCH ANTENNA AUXILIARY ON SWITCH — OFF

15. SEARCH RADAR CHECK:

a. Search Operate Light On - Checked

Check that the search operate light comes on after the search radar has had at least a 3- to 4-minute timeout since placing the FCS power switch to WARMUP. Check that the light is not blinking.

b. Crystal Current - Checked

Check that the needle on the meter is locked in and holding steady between 0.3 and 0.8 MA.

c. VIDEO — CHECKED

Check that video on both scopes is strong and not breaking up. Check that some distant ground returns are present in range sweep 20.

d. ANL - Checked and adjusted

Rotate ANL control just out of detent. Check that noise and all but extremely strong ground returns disappear from both scopes. Rotate ANL control clockwise and check that noise increases to maximum at full clockwise positions. Set ANL for optimum video presentation.

NOTE

Normally, optimum presentation will occur when the ANL control is set at full counterclockwise (detent) position; however, if video is weak at this setting a higher noise level should be selected. Proper noise level is indicated when the scopes display a slight "salt and pepper" appearance when no video is being presented.

16. EMERGENCY SEARCH SWITCH — ON

17. Track Range Marker Switch - ON

18. TRACK RADAR CHECK:

a. Crystal Current 0.3 to 0.8 MA - Checked (if applicable)

b. VIDEO — CHECKED

Check that video appears on the programming on both scopes, and that it is strong and not breaking up. Check that distant ground returns are presented in range sweep 20.

GUNNER'S CHECKLIST (Cont)

c. Range Lock-On & AGC:

(1) Stow Button - Depressed and held

(2) Range Gate Locked on 500 Yard Marker - Accomplished

Use thumbwheels as necessary to lock range gate on the marker.

(3) Video Dimming - Checked

Check that video on both scopes dims as the range gate locks on.

(4) Range Dial Reads 1500 (±225) Feet - Checked

(5) Stow Button - Released

d. Track Range Marker Switch - OFF

e. EMERGENCY SEARCH SWITCH — OFF

19. CREW EQUIPMENT:

a. PARACHUTE — ON, FASTENED, AND ADJUSTED

WARNING

Insure that the parachute arming lanyard is not entangled in the parachute harness. Lanyard entanglement could cause failure in seat separation and failure of the automatic features of the parachute.

b. OXYGEN HOSE & BAILOUT BOTTLE — CONNECTED

c. SAFETY BELT — FASTENED

d. SURVIVAL KIT STRAPS — ADJUSTED

WARNING

When the gunner's seat is equipped with the global survival kit, tighten the parachute survival kit attachment straps as tightly as possible to prevent the safety belt from inflicting facial injuries during bailout.

e. PARACHUTE STATIC LINE HOOKED — CHECKED

20. ZERO DELAY LANYARD — HOOKED (P-CP-EW-G)

21. FLAPS & AIR BRAKES DOWN, TIP GEAR STRUTS OUTBOARD — CHECKED/REPORT (IF ABNORMAL)

22. AIR CONDITIONING MASTER SWITCH — RAM

GUNNER'S CHECKLIST (Cont)

23. THERMAL CURTAIN — INSTALLED (EWO ONLY)

WARNING

Failure to close thermal curtain as soon as possible after takeoff may result in flash blindness due to nuclear detonations.

24. HEMISPHERIC SIGHT COVER — CLOSED (EWO ONLY)

25. READY FOR TAKEOFF — REPORT

Gunner reports, "Ready for takeoff."

INFLIGHT PROCEDURES

TAKEOFF

1. ENGINES, CONTROL SURFACES, FLAPS & TIP GEAR — CHECKED (REPORT ONLY IF ABNORMAL)

After full power is applied to the engines and during takeoff roll/acceleration, the gunner monitors engines, wing flaps, and tip gear for abnormal operation whenever possible.

2. RADAR SCOPE — MONITORED AND REPORT (AS REQUIRED)

Report approximate clock angle and range of overtaking aircraft on the optics/FCS indicator.

3. AIR CONDITIONING MASTER SWITCH — 7.45 PSI (PRIOR TO 10,000 FEET)

Reposition the master switch to 7.45 PSI upon pilot's report, "Air conditioning master switch 7.45." The air conditioning master switch must be positioned to 7.45 PSI prior to reaching 10,000 feet.

CLIMB

WARNING

The ALR-18 system will be on during climbout and will remain on for the entire flight. If during flight it is observed that the wave guides or coax cable of the ALR-18 system in the gunner's area becomes disconnected, the gunner will immediately depress the system No. 15 deactivate foot switch and notify the EW officer to shut down the ECM system No. 15.

NOTE

The circled numbers indicate those items which will be accomplished during climbout from low level.

① Zero Delay Lanyard - Stowed (P-CP-EW-G)

Disconnect and stow zero delay lanyard on copilot's command.

② Air Conditioning Master Switch - 7.45 PSI (prior to 10,000 feet)

GUNNER'S CHECKLIST (Cont)

③ 12,000 Foot Oxygen Check - Completed (G-EW-RN-CP)

a. During the climb, copilot requests an oxygen check at 12,000 feet. The sequence for oxygen report is gunner, EW officer, radar navigator, copilot. The reporting crew member will check crew members for alertness. He will report oxygen check for other position(s). Oxygen panel at each occupied crew position will be checked on all oxygen checks for:

(1) Oxygen Supply Shutoff Lever - ON

(2) Regulator Diluter Lever - As required

(3) Pressure - 300 psi

(4) Flow Indicator - Functions normally

(5) Emergency Toggle Lever - NORMAL

b. Gunner and copilot report "Cabin altitude__________ feet. Oxygen panel checked."

c. EW officer and radar navigator report "Oxygen panel checked."

d. Copilot notify aircrew and receive gunner's acknowledgment when passing through 25,000, 35,000, and 40,000 feet.

4. Ammunition Chambered, EWO/Airborne Alert/Contingency Launches:

Ammo chambering procedures will be simulated on EWO profile training sorties.

WARNING

This procedure will be used only on EWO/Airborne Alert/Contingency Launches when chambering can be accomplished over uninhabited areas as soon as possible after takeoff. Under no circumstances will this procedure be used for routine training missions.

a. Guns Ready-Safe Switch - SAFE and pinned

b. Range Sweep Switch - 20

c. Area Clear & Not Over Populated Area - Checked

Radar navigator will ascertain forward area is clear; the gunner will clear the aft area.

d. Gun Charger Switch - CHARGE (one operation only) (simulated on training missions)

WARNING

- In the event of a runaway gun, the gunner will actuate the emergency mode switch to ON to gain positional control of the turret and point guns into an uninhabited area.
- On missions taking off in cell with ammunition loaded, the gunner will actuate the emergency mode switch to ON to gain positional control of the turret and point the guns away from the following aircraft in cell prior to actuating the gun charger switch.

GUNNER'S CHECKLIST (Cont)

5. Level-Off Oxygen Check - Completed (CP-G)

   The copilot requests an oxygen check at level off. Gunner checks cabin altimeter and oxygen panel in accordance with procedure outlined under CLIMB.

   a. Gunner reports "Cabin altitude__________feet. Oxygen panel checked."

FCS OPERATION/PROCEDURES

1. Equipment Interference Check:

   This check should be completed prior to FCS operational check.

   a. APS-54 **B-52C** :

      (1) Nose & Tail Lights - Checked (at EW's request) (G)

      (2) Search Radar Switch - OFF (at EW's request) (G)

      (3) Search Radar Switch - ON (at EW's request) (G)

   b. APR-25 **B-52D** :

      (1) APR-25 Mixer Switch - UP (EW-G)

      (2) Audio Control - Optimum (G)

      (3) Intensity Control - Adjusted (G)

      Adjust intensity control clockwise until dot appears in center of indicator, then decrease to just below visibility.

      (4) Self-Test Video & Audio Indications - Checked and reported (G)

      Report video and audio following each test cycle.

   c. ALR-18:

      (1) ECM Jamming vs Search Presentation - Checked and reported (EW-G)

      (2) Emergency Search Switch - ON (G)

      (3) ECM Jamming vs Emergency Search Presentation - Checked and reported (EW-G)

      A more positive indication of spot and sweep jamming can be obtained by turning the range sweep switch to the 20 position and lowering the turret until ground returns appear. The absence of ground returns during spot jamming and intermittent or broken ground returns during sweep jamming is the best indication of effective jamming of the track radar.

      (4) Emergency Search Switch - OFF (G)

      (5) Deactivate Switch Operation - Checked and reported (at EW's request)

2. Crew Notified Prior to Operating Turret - Accomplished

3. FCS Operational Check - Accomplished

   Accomplish FCS checkout procedures as outlined this section.

4. Defensive Coordination Exercise - Accomplished

   Accomplish DCE in accordance with applicable directives.

GUNNER'S CHECKLIST (Cont)

5. After Level Off/On Watch Procedures:

   These procedures will be accomplished in accordance with applicable directives upon completion of the equipment interference and FCS operational checks.

   a. Thermal Curtain - Installed (EWO only)

   b. Hemispheric Sight Cover - Closed

   c. FCS Switches Optimum Mode - Checked

NOTE

> Based on the results of the FCS equipment checks, the gunner will configure the FCS for the optimum mode available. This configuration may change if FCS malfunctions occur after completion of the FCS operational check.

      (1) Range Sweep Switch - 20

      (2) Guns Ready-Safe Switch - READY (simulated on training missions)

WARNING

> On missions flying in cell formation with ammunition loaded, the gunner will actuate the emergency mode switch to ON to gain positional control of the turret. Grasp the control handles being sure not to close an action switch or trigger and position the guns away from following aircraft. With guns pointing in a safe area, place the ready-safe switch to READY and close both action switches.

      (3) C Gate Marker - Set (as required)

   d. Air Conditioning Master Switch - Set (as required)

   e. FCS Indicator, APR-25/APS-54 & Optics - Monitored

6. On Watch & FCS Status:

   a. Gunner Reports:

      (1) "Gunner on Watch"

      (2) "FCS is Reliable/Unreliable"

      (3) "Bonus Deal Capable/Not Capable" (as required)

      Throughout the mission, the gunner will inform the pilot of any change of system capabilities for target detection and radar tracking. Bonus Deal reliability will only be reported on contingency missions or contingency training missions where actual range checks are accomplished.

7. HHCL Procedures:

   a. FCS Switches - As required

   FCS will be configured and operated in accordance with applicable directives.

   b. Air Conditioning Master Switch - Set (as required)

GUNNER'S CHECKLIST (Cont)

CRUISE

NOTE

- If the gunner must leave his seat during flight when using the integrated harness, he should open the safety belt and unfasten the parachute, leaving the parachute in the seat. If a parachute is desired, the spare parachute should be utilized.
- On extended flights (flights in excess of 17 hours duration), the gunner may be relieved of crew duties for periods of crew rest by the copilot. Before the gunner is relieved from crew duties, the copilot will request a cabin pressure and oxygen check and ascertain that the gunner is on interphone and oxygen. During the period of the gunner's crew rest, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes. Close crew coordination between the pilot and copilot is mandatory to insure frequent monitoring.

1. Aircraft Clearance - Check and report

During cruise, careful watch will be maintained for other aircraft. The approximate clock angle and range of overtaking aircraft detected on the FCS indicator/optics will be reported. In congested flying areas verbally clear the pilot in turns.

2. Oxygen Checks - Completed

Check equipment in accordance with procedure outlined under CLIMB.

NOTE

During cruise, the copilot will monitor the gunner's remote cabin altimeter and the tail compartment low pressure warning light at intervals not to exceed 15 minutes and initiate the oxygen checks at 30-minute intervals when both cabin altitudes are below 12,000 feet, at 15-minute intervals when either cabin altitude is 12,000 to 25,000 feet, and at no longer than 10-minute intervals when either cabin altitude is above 25,000 feet. If cabin altitude is below 12,000 feet, only the gunner and the copilot will report. The remaining crew members will check their equipment and report if abnormal. Oxygen checks are not required below 10,000 feet MSL.

3. Station Checks - Accomplished

The gunner will make frequent visual checks of the wings, control surfaces, and engines during flight, and report any abnormal conditions.

GUNNER'S CHECKLIST (Cont)

AIR REFUELING

1. UHF Mixer Switches - ON
2. Thermal Curtain - Unfastened (as required)
3. APR-25 Intensity Control **B-52D** - Minimum (at EW's request)
4. Tanker Position - Monitored and reported (if applicable)

   Keep the crew advised of tanker position.
5. FCS Switches:
   - a. FCS Power Switch - WARMUP
   - b. Search Radar Switch - OFF
   - c. FCS Switches Positioned - Report

     Report FCS switches positioned when the above actions have been completed.
6. Air Conditioning Master Switch - 7.45 PSI
7. Fuel Spillage - Report
8. FCS Switches - Positioned as required

   Switches will be placed ON (commensurate with system capability) immediately after final disconnect or emergency separation (either actual or practice) to notify crew of tanker position.
9. APR-25 Intensity Control **B-52D** - Adjusted (at EW's request)

DESCENT/LANDING

NOTE

The circled numbers indicate those line items which will be accomplished prior to low level.

1. Thermal Curtain - Unfastened and stowed (as required)
2. Hemispheric Sight Cover - Open

GUNNER'S CHECKLIST (cont)

3. APR-25 Audio & Intensity Control **B-52D** - Minimum

4. Mixer Switches - UP

5. Guns Ready-Safe Switch - SAFE and pinned

6. FCS Power Switch - ON

7. Turret Stowed - Checked (report as required)

   Insure that turret is stowed prior to each landing. Notify pilot if turret is not stowed.

CAUTION

Damage to turret may occur due to drag chute entanglement if turret is in the lower limit when drag chute is jettisoned.

8. Circuit Breaker Panel - Set (as required)

⑨ Safety Belt - Fastened

⑩ Zero Delay Lanyard - Hooked (P-CP-EW-G)

11. Tip Gear Position - Report (if abnormal)

NOTE

Gunner monitors wing flaps, tip gear, and engines for abnormal operation whenever possible. During touch-and-go landings, gunner checks tip gear after each landing; however, he will not make a verbal report unless gear appears to be abnormal.

POSTFLIGHT PROCEDURES

AFTER LANDING

1. Drag Chute:

   a. Drag Chute Deployed - Report

      If drag chute does not deploy within a few seconds after door opens, gunner advises pilot.

   b. Drag Chute Position - Monitored

      Advise pilot when additional air is needed to prevent chute deflation or dragging on runway. Monitor drag chute position in relation to horizontal stabilizer; advise pilot to jettison chute if danger of fouling exists.

   c. Clear to Jettison - Report

      Report if clear to jettison when intended jettison area is reached.

GUNNER'S CHECKLIST (cont)

d. Drag Chute Jettisoned - Report

Report when drag chute falls free of aircraft.

NOTE

If ammunition has been loaded, the following circled items will be accomplished in addition to the remaining required items of the "After Landing Checklist."

② Emergency Mode Switch - ON

③ Control Handles Upper Elevation Limit and Held - Accomplished

Maintain this control handle position until after the FCS power switch is turned off.

④ Turret Position - Checked

5\. B & C Scope Intensities - CCW

6\. Cursor Intensity - CCW

7\. Search Radar Switch - OFF

8\. FCS Power Switch - OFF

⑨ Turret Position - Maintained

Continue to hold control handles against the upper elevation limit for approximately 30 seconds after turning the FCS power switch off to insure that the turret remains elevated.

10\. FCS Control Panel Switches - OFF/SAFE and pinned

NOTE

- Do not pull FCS circuit breakers or remove FCS control panel fuses when recovering from practice alert exercises.
- The following circled items will be accomplished when uncocking alert aircraft.

⑪ FCS Circuit Breaker Panel:

a. Control Column DC Circuit Breakers (2 "DC PWR") - Pulled

b. Compressor Heater Circuit Breaker - Pulled

c. Ammo Booster Circuit Breakers - Pulled

⑫ FCS Control Panel Fuses (4) - Removed and stowed (B panel)

Stow fuses in the safety pin stowage container adjacent to the signal lamp.

13\. Wings & Tip Gear Clearance - Monitor and report

AFTER PARKING

1\. Turret Jettison Handle & No. 1 Safety Pin - Stowed and installed

Check safety pin installed in the inner emergency release handle initiator.

GUNNER'S CHECKLIST (cont)

1A. Canopy Release Handle & No. 4 Safety Pin **ZR** - Secure and installed

Check canopy release handle secure and No. 4 safety pin installed in canopy release initiator.

WARNING

Tail canopy release initiators do not have a positive ground safety lock feature. The ground safety pin can be installed in the initiator without engaging the safety pin in the sear pin groove. This results in an armed and dangerous condition of the tail canopy release system. Inadvertent operation of the canopy release handle could result in firing the initiator with the safety pin improperly installed. Be sure that the handle is stowed properly (all the way in) before installing the safety pin.

2. Parachute Static Line - Disconnected

2A. Survival Kit Attachment Straps - Disconnected

Disconnect survival kit attachment straps prior to lowering seat back rest.

3. Oxygen System - OFF/100%

4. Interphone & Oxygen Hose - Disconnected and stowed

5. Air Conditioning Panel:

   a. Cabin Temperature Selector Switch - MANUAL

   b. Air Conditioning Master Switch - OFF

   c. Window Defog Switch - OFF

6. "Hot Guns" Sign - As required

Install "Hot Guns" sign on FCS control panel.

7. Spot Light & Signal Lamp - Stowed

8. Interior Inspection - Completed

Check compartment for cleanliness.

9. Compartment Lighting Controls - As required

10. Exterior Inspection - Completed

NOTE

The gunner performs a walkaround inspection of the turret, visually checking for hydraulic leaks, FCS access doors/panels, antenna radomes, cowling, and azimuth and elevation stow position of the turret.

11. Crew Debriefing:

   a. FCS Operator Log/Forms - Completed

   b. Form 781 Entries - Completed

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES

NOTE

- Only portions of the "Warmup" and "On" modes are in the "After Engine Start/Before Takeoff Checklist." Proceed to next check if a part of this modes check has been previously completed.
- The procedures outlined in this checklist are designed as a guide for the gunner in determining the optimum operational capability of the system. If the gunner detects a malfunction of an operational mode, he may elect to use various operational configurations to cross check and isolate the malfunctions. If FCS malfunction(s) precludes accomplishment of a complete checkout, the applicable portions will be accomplished. Refer to T.O. 1B-52B-1-5, Section IV, for malfunction analysis and emergency operation.
- Unless the wing span knob has been set at a certain value for a specified theater of operations, it should be left at the 43-foot value instead of at the high or low end of the range.

WARNING

When performing operational checks on training missions with ammo loaded, the fire safety switch must be in SAFE and pinned, chargers released (gun charger switch in RELEASE), and trigger(s) not pressed except over designated firing areas.

CAUTION

- Do not operate system above 50,000 feet as arcing of components can occur at high altitudes.
- To prevent compressor failure due to low air volume available at high cabin altitudes, pull the compressor three-phase and heater circuit breakers when the aft cabin altitude is at or above 35,000 feet.
- If the search low pressure warning light comes on, position the search radar switch to OFF and operate in emergency search. If the track low pressure warning light comes on, position the track and range select switches to MANUAL and operate in Manual Track-Manual Range. If both low pressure warning lights are on at the same time, turn both the search radar and emergency search switches OFF and operate in Manual Track - Manual Range.
- The FCS may be operated below 6000 feet pressure altitude if either or both low pressure warning lights are on.
- Any time the radar system is not being monitored by the gunner, the search radar switch will be positioned to OFF.
- Illumination of the gyros ready light is the only indication that the gyros have timed out. If the gyros ready light does not indicate that the gyros have timed out, do not attempt operation of the system in any track mode. Notify crew prior to operating turret (movement of turret will cause vibration of the aircraft).
- System operation is limited to operation from radar control panel only when stow pin is installed in turret. Serious damage to turret drive system will result if power is applied from the FCS control panel.

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (Cont)

WARMUP MODE

1. FCS Master Switch - WARMUP
2. On Target & Target Warning Lights - Checked

   Check that the On Target light comes on for a short period of time. The On Target light should then go out and the Target Warning light come on. This sequence indicates that warmup power has been applied to the search and track radars.

3. Search Antenna Auxiliary On Switch - ON
4. Radar Indicator Check:
   - a. Overlay Intensity - Set
   - b. B Scope Intensity & Rasters (3 range sweeps) - Checked and adjusted

     Increase B intensity until rasters are visible. Focus rasters. Check that there are no broken or missing rasters. Check that rasters extend to both azimuth limits of the scope. Check that rasters extend from the bottom to the top of the scope in all three range sweeps. Reduce B intensity to just under raster visibility.

   - c. C Gate Length Control - Checked

     Check that C gate marker is visible. Check that marker can be positioned farther than 10,000 yards, and closer than 3500 yards.

   - d. C Scope Intensity & Rasters - Checked and adjusted

     Increase C intensity until rasters are visible. Focus rasters. Check that rasters are not jagged or broken. Check that rasters cross at zero elevation and extend to scope limits in both azimuth and elevation. Reduce C intensity until sweeping rasters are just visible.

   - e. Circle Cursor - Checked and adjusted

     Hold action switch closed. Turn up cursor intensity until circle cursor appears on C scope. Focus cursor with C focus control if necessary. Check that cursor is circular with a diameter of about 1/8 to 1/4 inch. Adjust cursor intensity for optimum presentation.

   - f. Dot Cursor - Checked

     With the action switch closed, press second target button and check the dot cursor appears within 5° of center C scope.

5. Hemispheric Sight Check:
   - a. Diopter Control - Focused
   - b. Sun Filter - Checked and adjusted

     Check that the filter can be set from "in" through any intermediate position to full "out." Adjust filter as desired.

   - c. Reticle Intensity - Checked and adjusted

     Check both filaments of reticle bulb. Adjust intensity for optimum illumination of reticle, range card, and wingspan card. (Some systems may have a separate intensity control for the cards.)

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (Cont)

d. Reticle Alignment - Checked (adjust if necessary)

Check that the reticle is centered over the crosshairs. If there is an apparent misalignment, determine that it is not caused by a cocked sun filter before attempting to adjust the alignment cables. Make the determination by moving the filter in and out several times, checking for a change in the misalignment.

e. Wing Span Control - Checked and set

Rotate wingspan control and check that wingspan card drives from 15 to 100 feet. Set the card at 43 feet, or as briefed.

ON MODE

1. FCS Power Switch - ON

CAUTION

The track button will not be depressed until the gyros have timed out.

2. Servos Stowed:

a. **Range Card 5100 (±225) Feet - Checked**

b. Optics Straight Aft - Checked

c. L/S Pointer Straight Aft - Checked

d. Circle Cursor - Checked

Close action switch with control handles centered. Check that circle cursor appears at center of C scope.

e. Turret Stowed - Checked

Close action switch and press second target button. Check that dot cursor appears at center of C scope.

3. Search Radar Switch - ON

4. **Search Antenna Auxiliary On Switch - OFF**

5. Search Radar Check:

a. Search Operate Light On - Checked

Check that the search operate light comes on after the search radar has had at least 3 to 4 minutes time-out since placing the FCS power switch to WARMUP. Check that the light is not blinking.

b. Crystal Current - Checked

Check that the needle on the meter is locked in and holding steady between 0.3 and 0.8 MA.

c. Video - Checked

Check that video on both scopes is strong and not breaking up. Check that some distant ground returns are presented in range sweep 20.

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (cont)

d. ANL - Checked and adjusted

Rotate ANL control just out of detent. Check that noise and all but extremely strong ground returns disappear from both scopes. Rotate ANL control clockwise and check that noise increases to maximum at full clockwise position. Set ANL for optimum video presentation.

NOTE

Normally, optimum presentation will occur when the ANL control is set at full counterclockwise (detent) position; however, if video is weak at this setting, higher noise levels should be selected. Proper noise level is indicated when the scopes display a slight "salt and pepper" appearance when no video is being presented.

6. Emergency Search Switch - ON

7. Track Range Marker Switch - ON

8. Track Radar Check:

a. Crystal Current 0.3 to 0.8 MA - Checked (if applicable)

b. Video - Checked

Check that video appears on the programming on both scopes and that it is strong and not breaking up. Check that distant ground returns are presented in range sweep 20.

c. Range Lock-On and AGC:

(1) Stow Button - Depressed and held

(2) Range Gate Locked on 500 Yard Marker - Accomplished

Use thumbwheels as necessary to lock range gate on the marker.

(3) Video Dimming - Checked

Check that video on both scopes dims as the range gate locks on.

(4) Range Dial Reads 1500 (±225) Feet - Checked

(5) Stow Button - Released

d. Emergency Search Switch - OFF

9. Range Sweep Calibration Check:

a. Range Sweep Switch - 10

b. C Gate Marker - 4000 yards

c. Track Auxiliary Operate Switch - ON

d. Track Range Marker Switch - ON

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (cont)

e. Action Switch - Closed

Close action switch to display a single range gate on the B cursor.

CAUTION

Do not press track button at any time during this check.

(1) Lock-On 2000 Yard Marker - Accomplished

Use thumbwheels as necessary to lock range gate on 2000 yard range marker.

(2) Range Card 6000 (±225) Feet - Checked

(3) Range Gate Appears at 2000 Yard Grid Line - Checked

f. Range Sweep Switch - 5

g. Range Gate & C Marker - Checked

Check that the range gate has moved to 4000 yards and the C gate marker has moved to 8000 yards on the grid overlay.

h. Range Sweep Switch - 20

i. Range Gate & C Marker - Checked

Check that the range gate is halfway between zero and 2000 yards, and C gate marker has moved to 2000 yards on the grid overlay.

NOTE

If the range card does not read 6000 (±225) feet with the range gate locked on the 2000 yard marker, it will be cross-checked by accomplishing steps "(1)" thru "(13)" below:

(1) Lock-On 500 Yard Marker - Accomplished

(2) Range Card Reading - Noted and recorded

(3) Track Select Switch - MANUAL

(4) Range Select Switch - MANUAL

(5) Emergency Mode Switch - ON

(6) Action Switch & Track Button - Depressed and released

(7) Rotate Range Wheels to Turn Ready-to-Fire Light on at Maximum Firing Range - Accomplished

(8) Range Card Reading - Noted and recorded

(9) Rotate Range Wheels to Turn Ready-to-Fire Light Off at Minimum Firing Range - Accomplished

(10) Range Card Reading - Noted and recorded

NOTE

Any difference between the actual and required readings obtained from steps "(1)" thru "(10)" should approximate the difference between actual and required readings when locked on the 2000 yard marker.

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (cont)

(11) Track Select Switch - RADAR

(12) Range Select Switch - RADAR

(13) Emergency Mode Switch - OFF

j. Track Auxiliary Operate Switch - OFF

k. Track Range Marker Switch - OFF

l. Range Sweep Switch - As desired

m. C Gate Marker - Set

Set the C gate marker as desired to eliminate unwanted ground returns from the C scope.

SEARCH MODE

1. Action Switch - Closed
2. Circle Cursor Appears - Checked
3. L/S Servos Rate Control Check (Azimuth & Elevation):
   a. Circle Cursor, Optics & L/S Pointer Drive Smoothly to Their Full Limits When Control Handles Are Displaced - Checked

   b. Circle Cursor, Optics & L/S Pointer May Be Stopped at Any Desired Position by Centering Control Handles - Checked
4. Boost Control of L/S Servos - Checked

   Move control handles rapidly and check that circle cursor appears to jump while handles are being moved. Check boost in both azimuth and elevation.
5. Action Switch - Released
6. Circle Cursor Disappears, Optics & L/S Pointer Stow - Checked
7. C Gate Marker - Checked

   Check C-gate marker controls the range of the C scope.

ACQUISITION MODE

NOTE

Do not continue with this check until gyros have timed out. Check gyro ready light is on by placing FCS power switch to WARMUP, and then return to ON.

1. Action Switch - Closed
2. Range Gate Sweep Check:
   a. Track Button - LIGHT PRESS and held

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (cont)

   b. Range Gate Sweeps to 7500 Yards - Checked

   c. Track Button - HARD PRESS and held

   d. Range Gate Sweeps to 2500 Yards - Checked

3. Nominal Prediction Check:

NOTE

If range gate is locking on noise or ground returns, place the range select switch to MANUAL for this check. When the check is completed, stow the system immediately by placing the range select switch back to RADAR.

   a. Second Target Button - Depressed and held

   b. Dot Cursor Appears at Center of Circle Cursor with L/S at Center - Checked

   c. Dot & Circle Cursors Maintain Nominal Prediction Separation as L/S Angle is Increased; Dot Cursor Stops at Turret Limit, Circle Cursor Drives to Edge of Scope (azimuth & elevation) - Checked

4. Control Handles - Released

5. System Stowed - Checked

RADAR TRACK MODE

1. Track Range Marker Switch - ON

2. Action Switch - Closed

3. Circle Cursor Centered on C Scope - Accomplished

4. Track Button - Depressed and held

5. Range Gate Locked on Marker - Noted

   Note that the ON target light comes on when range gate locks on.

6. System Controlled by Track Radar - Checked

   With the action switch and track button still depressed, move the control handles and check that the handles have lost control of the circle cursor.

7. Control Handles - Released

8. System Drift - Checked

   Check that the circle cursor remains at center or drifts slowly to a limit.

NOTE

If the turret (as indicated by the circle cursor) drives rapidly away from center, a tracking problem exists in the radar track mode and possibly in manual track as well. This rapid tracking will be cross-checked during the Manual Track-Manual Range mode checks.

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (cont)

SECOND TARGET MODE

NOTE

Second target mode can be entered only from radar track mode.

1. Action Switch & Second Target Button - Depressed and held
2. Dot Cursor Appears at Turret Position - Checked
3. Circle Cursor Positioned on Opposite Side of Scope from Turret, but within Turret Limits - Accomplished
4. Track Button - Depressed and held
5. Dot Cursor Drives to 4.5 L/S Angle - Checked

   Since the range gate is locked on an internal marker, which has no azimuth or elevation position, the range gate will not unlock as the turret slews to a new position. The system will therefore remain in acquisition mode until the track button is released, or until a new lock-on is obtained.

6. Control Handles - Released
7. Circle Cursor Drives Toward Center of Scope - Checked

   The track radar does not develop tracking correction signals while locked on a range marker. The system tracks toward center at a nominal tracking rate that was determined by the angle-off of the L. S.

RADAR SILENCE

NOTE

The system is still in radar track mode with the range gate locked on a marker.

1. Search Radar Switch - OFF
2. Search Radar Continues to Transmit - Checked
3. Track Range Marker Switch - OFF
4. Search Radar Goes to Standby - Checked

   Check that the range gate stays locked on for about 2 1/2 seconds, then sweeps for another 2 1/2 seconds. Check that the search radar goes to standby when the range gate stops sweeping.

5. Action Switch & Track Button - Depressed and held
6. Search Radar Transmits - Checked

   Check that the search radar transmits and the range gate sweeps as long as the system is kept in acquisition.

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (Cont)

7. Control Handles - Released

8. Search Radar Switch - ON

MANUAL TRACK — MANUAL RANGE MODE

NOTE

If engaged in FEO activity, position track range marked switch to OFF.

1. Track Select Switch - MANUAL

2. Range Select Switch - MANUAL

3. System Drift Check:

NOTE

Do not move control handles during this check.

a. Action Switch & Track Button - Depressed and released

b. Circle Cursor Remains at Center of Scope or Drifts Slowly to a Limit - Checked

NOTE

- If the circle cursor drove rapidly away from center in radar track mode but performs properly in manual track, it is likely that the radar tracking circuits are malfunctioning. If the circle cursor drove rapidly away from center in both radar track and manual track, it is likely that the turret drive loop is malfunctioning.
- System drift is within tolerance when the turret (as indicated by the circle cursor) does not drift to a limit in less than 15 seconds.
- Any allowable drift that is present during step "3" will affect system performance during the following steps "4," "5," and "6." So long as this drift can be cancelled out with slight corrections from the control handles during these checks, no malfunction is indicated.

4. Azimuth Aided Rate & Gyro Servos Check:

NOTE

Perform this check on both sides in azimuth.

a. Action Switch & Track Button - Depressed and held

b. Circle Cursor 60° Azimuth, 0° Elevation - Positioned

c. Control Handles - Released

d. Circle Cursor & Optics Drive Smoothly Through Center at a Constant Rate; When Turret Reaches Opposite Limit, Circle Cursor Continues on to Edge of Scope - Checked

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (Cont)

5. Elevation Aided Rate & Gyro Servos Check:

NOTE

- Perform this check on both sides in elevation.
- Nominal tracking rates in elevation are inherently slow. It may be necessary to give the aided rate servo a slight additional signal with the control handles to start the system tracking in the proper direction.

   a. Action Switch & Track Button - Depressed and held

   b. Circle Cursor 45° Elevation, 0° Azimuth - Positioned

   c. Control Handles - Released

   d. Circle Cursor & Optics Drive Smoothly Through Center at a Constant Rate; When Turret Reaches Opposite Limit, Circle Cursor Continues on to Edge of Scope - Checked

6. Cross-Roll Gyro Check:

NOTE

Perform this check in all four quadrants.

   a. Action Switch & Track Button - Depressed and held

   b. Circle Cursor 60° Azimuth, 45° Elevation - Positioned

   c. Control Handles - Released

   d. Circle Cursor & Optics Drive Smoothly Toward Center & into the Opposite Quadrant - Checked

7. Acceleration Control Check:

NOTE

Perform this check in both azimuth and elevation.

   a. Control Handles - Centered

   b. Action Switch & Track Button - Depressed and released

   c. Control Handles Displaced & Held; Circle Cursor Accelerates - Checked

   d. Control Handles Displaced & Held in Opposite Direction of Cursor Movement; Circle Cursor Decelerates - Checked

8. Stow Button - Depressed and released

EMERGENCY SEARCH — ON MODE

1. Track & Range Select Switches - RADAR
2. Emergency Search Switch - ON
3. Search Operate Light Out - Checked

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (Cont)

4. Programming Pattern Check:
    a. B & C Intensities Adjusted - As required
    b. Programming Pattern Appears at Center of Scopes - Checked
    c. Programming Pattern Extends Approximately 45° in Azimuth & 10° in Elevation - Checked
    d. C Sweep Moves in Clockwise Direction - Checked

EMERGENCY SEARCH — SYNCHRONIZATION MODE

1. Range Sweep Switch - 20
2. Action Switch - Closed
3. Track Button - LIGHT PRESS
4. Rate Control of Programming Pattern - Checked
5. Track Antenna Movement Check:
    a. Programming Pattern Full Down in Elevation - Positioned
    b. Ground Returns on B Scope Appear at Longer Ranges on Left to Right Sweep Than on Right to Left Sweep - Checked
6. Control Handles - Released
7. Programming Pattern Appears at Scope Center - Checked

EMERGENCY SEARCH — ACQUISITION MODE

1. Action Switch - Closed
2. Track Button - HARD PRESS
3. Presentation Collapses at Center of Pattern; Range Gate Sweeps to 7500 Yards - Checked
4. Track Antenna Movement In - Limits Check:
    a. C Dot Full Down in Elevation - Positioned
    b. Keeping Turret in Limit, Move C Dot Up & Down; Leading Edge of Ground Return on B Line Moves Out & In as Dot Moves Up & Down - Checked
5. Control Handles - Released
6. Programming Pattern Reappears at Scope Center - Checked
7. Emergency Search Switch - OFF
8. B & C Intensities Readjusted for Search Presentation - As required

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (Cont)

EMERGENCY ON MODE

1. Emergency Mode Switch - ON
2. Circle Cursor Appears at Scope Center - Checked
3. Second Target Button - Depressed and held
4. Positional Control Check:
    a. Circle & Dot Cursors Follow Control Handle Movement & Stop When Handles Are Stopped - Checked
    b. Neither Cursor Moves Beyond Turret Limits - Checked

EMERGENCY MANUAL TRACK — MANUAL RANGE MODE

1. Track & Range Select Switches - MANUAL
2. Windage Correction Check:

NOTE

- ● Perform this check in all four limits.
- ● On certain unmodified systems, L/S elements run away in emergency acquisition and emergency manual track modes when the turret is against a limit. With such systems, care must be taken to hold the turret stationary just inside the limit during this check.

    a. Action Switch & Track Button - Depressed and held
    b. Range Wheels-Maximum Range - Out and held
    c. Circle Cursor/Optics Against a Limit - Positioned
    d. Track Button Released; Circle Cursor/Crosshairs Move in Slightly Toward Center - Checked
    e. Track Button Depressed & Held; Circle Cursor/Crosshairs Jump Back to Limit - Checked

3. Gravity Correction Check:

NOTE

Do not move control handles during this check.

    a. Action Switch & Track Button - Depressed and released
    b. Range Wheels Rotated to Maximum Range & Held; Circle Cursor/Crosshairs Move Down Slightly - Checked
    c. Range Wheels Rotated to Minimum & Held; Circle Cursor/Crosshairs Move Up Slightly - Checked

4. Lead Correction Check:

NOTE

Perform this check in all four directions away from center.

    a. Action Switch & Track Button - Depressed and released

FIRE CONTROL SYSTEM CHECKOUT PROCEDURES (Cont)

b. Range Wheels-Maximum Range - Out and held

c. Move Control Handles Rapidly Away from Center & Past Turret Limits; Circle Cursor Initially Moves Rapidly, Then Slows Down or Stops, Then Drifts Slowly Toward Turret Limit - Checked

5. Range Servo Check:

   a. Estimated Target Speed:

      (1) Scribe Mark on Right Range Wheel - Centered

      (2) Action Switch & Track Button Depressed & Held; Range Card Stowed - Checked

      (3) Track Button Released; Range Card Drives to Minimum Range at Nominal Range Rate - Checked

   b. Range Card Controlled by Range Wheels - Checked

   c. Ready-to-Fire Light On with Range Card Between 600 & 4500 Feet - Checked

6. Reticle Servo Calibration Check:

   a. Wingspan Card - 32 (±3) feet

   b. With Range Card at 1000 Feet, Reticle Encloses Crosshairs - Checked

   c. Wingspan Card - 96 (±3) feet

   d. With Range Card at 3000 Feet, Reticle Encloses Crosshairs - Checked

   e. Wingspan Card 43 Feet - Set, or as briefed

7. Stow Button - Pressed and released

8. Track & Range Select Switches - RADAR

9. Emergency Mode Switch - OFF

NOTE

If the system does not meet the requirements of this equipment check, the discrepancies will be entered in the AFTO Form 781 and in the FCS operator's Equipment Status/Activity Report.

DEFENSE COORDINATION EXERCISE

NOTE

If FCS malfunctions preclude accomplishment of the complete check as outlined below, the applicable portions will be accomplished.

1. FCS Configured for Radar Track/Radar Range - SET

   If system will not track in RT/RR, complete the applicable portions of line items 2 and 3 using MT/RR or EMERG MT/RR to determine system capability.

2. C Gate Marker - SET

DEFENSIVE COORDINATION EXERCISE (Cont)

3. Chaff Drop - Requested

    a. Minimum Target Presentation Range - Noted

    b. Lock-On - Accomplished

    c. Acquisition Range - Noted

    Depress second target button to determine radar tracking and turret stability.

    d. Range Sweep Switch - 20

    e. Maximum Tracking Range - Noted

    f. Maximum Target Presentation Range - Noted

4. Angular Track Check - Accomplished

    If the system is not capable of full automatic track (RT/RR), the angular track check is not required.

    a. Chaff Drop - Requested

    b. Lock-On - Accomplished

    Insure that system is in automatic track approximately 500 yards before proceeding with the angular track check. Depress second target button to determine turret stability.

    c. Request Pilot Initiate Maneuver - Accomplished

    Request pilot to initiate a 30° turn from track using a 30° bank angle. Upon completing the 30° heading change, return to the original heading. Initiate second maneuver and reaccomplish steps "4a" thru "4c," making the initial heading change in opposite direction from that previously conducted.

5. Emergency Search Switch - ON

    If search radar malfunctions preclude target presentation, applicable portions of the DCE will be accomplished in emergency search.

6. Chaff Drop - Requested

    a. Minimum Target Presentation Range - Noted

    b. Maximum Target Presentation Range - Noted

7. Emergency Search Switch - OFF

FIGHTER INTERCEPT EXERCISE

NOTE

Whenever scheduled fighter intercepts are to be conducted, the gunner will accomplish the armament safety procedures prior to the first attack by the interceptor.

1. Armament Safety Check:
    a. Guns Ready-Safe Switch - SAFE and pinned
    b. Gun Charger Switch - RELEASE
    c. Ammo Booster Circuit Breakers - Pulled
    d. Safety Check - Accomplished and report
    e. Notify Navigator/Note Time - Accomplished
2. Fighter Intercept Procedures:

NOTE

Do not press triggers during this activity.

   a. FCS Switches Optimum Mode - Set
   b. Search Radar Switch - ON
   c. Range Sweep Switch - 20
   d. C Gate Marker - Set
   e. UHF Mixer Switches - Up
   f. APS-54 Lights **B-52C** - Monitored
   g. APR-25 **B-52D** :
      (1) Mixer Switch - Up
      (2) Audio Control - Set (optimum)
      (3) Intensity Control - Set (optimum)
      (4) Audio/Indicator - Monitored
   h. Intercept Activity Conducted in Accordance with Governing Directives - Accomplished
   i. Log/Form Entries - Completed

FIREOUT PROCEDURE

1. FCS Switches Optimum Mode - Set
2. UHF Mixer Switches - Up
3. Search Radar Switch - ON

NOTE

If the search radar is inoperative, the track radar will be used for radar surveillance to clear the aft area.

4. Radar Clearance Check - Accomplished

   Gunner will monitor his scope to insure no targets are visible within his area of radar coverage.

5. Firing:
   a. Request Clearance to Fire from Pilot - Accomplished

NOTE

The following items will be accomplished after pilot authorizes firing.

   b. Ammo Chambering - Accomplished

      Place gun charger switch to CHARGE and then to RELEASE to chamber ammunition.

   c. Guns Ready-Safe Switch - READY
   d. Action & Trigger Switches - Depressed

      Use a 3-second burst (maximum) and a 45-second cooling period (minimum)between bursts.

6. Armament Safety Check:

NOTE

The following items will be accomplished prior to departing the firing area.

   a. Guns Ready-Safe Switch - SAFE and pinned
   b. Triggers - Depressed

      The guns should not fire.

   c. Safety Check Completed - Notify pilot

7. Log/Form Entries - Completed

FEO OPERATING PROCEDURES

NOTE

- Allow a minimum FEO warmup of five minutes prior to FEO operation.
- Guns ready-safe switch is not required for FEO operation and should be SAFE and pinned at all times.
- Should the gunner be required to perform other duties while operating in PHANTOM TARGET mode, the program may be interrupted by placing the selector switch back to WARMUP. The program will resume when the selector switch is again positioned to PHANTOM TARGET.

1. FEO Real Target FCS Equipment Checks:

NOTE

- FCS switches will be positioned to accomplish the required modes checks as outlined under the applicable FCS equipment checks, this section.
- Any time an action switch is closed, or the system is in a track mode, the FEO recorder will be operating.

    a. FEO Selector Switch - WARMUP

    b. FCS Switches - Positioned

    c. FEO Selector Switch - REAL TARGET

    d. FEO/FCS Modes Checks:

NOTE

FEO/FCS modes checks will include all FCS equipment checklist items for the following modes:

        (1) Acquisition Mode - Accomplished

        (2) Radar Track Mode - Accomplished

        (3) Manual Track Mode - Accomplished

        (4) Emergency Manual Track Mode - Accomplished

2. FEO Real Target DCE:

    a. FCS Switches - Positioned

    b. FEO Selector Switch - REAL TARGET

NOTE

The second target button should not be depressed when recording a DCE. Turret movement can be monitored by observing the circle cursor.

    c. DCE - Accomplished

DCE activity will be accomplished in accordance with DCE procedures, this section, and other governing directives.

FEO OPERATING PROCEDURES (Cont)

3. FEO Phantom Target Combat Exercise:

NOTE

> The circle cursor may have to be offset from the target to effect a lock-on. This is due to peculiarities in some FEO units, and may not be an FCS malfunction.

a. FCS Switches Positioned for Optimum Mode - Set

b. FEO Selector Switch - PHANTOM TARGET

c. Phantom Target Activity - Accomplished

Phantom Target activity will be conducted in accordance with the governing directives.

4. FEO Selector Switch - OFF

5. Log/Form Entries - Completed

CONTINGENCY PROCEDURES

1. Interphone Mixer Switch - Up
2. Interphone Selector Switch - UHF
3. Assistance Request - Acknowledged
4. FCS Power Switch - ON
5. Search Radar Switch - ON
6. Contingency Procedures - Accomplished

   Contingency activity will be conducted in accordance with governing directives.

7. Logs/Forms - Completed

STRANGE FIELD DISARMING PROCEDURE

When an aircraft lands with hot guns (rounds in the chambers), the guns will be disarmed as soon as practical, all other operational safety factors considered; e.g., weather, proper equipment, ample light, qualified personnel, etc. Until such time as guns are disarmed, turret will be stowed with guns up, FCS electrical circuits disabled, and the aircraft positioned so that guns point toward an uninhabited area.

NOTE

Gunner will supervise the following disarming procedure performed by the disarming team. In the event no team is present, he will accomplish disarming with the aid of another crew member.

WARNING

During the entire disarming procedure, use extreme caution to insure ammunition is handled in a safe manner and the guns are pointed in an area that assures maximum safety to personnel and property.

1. FCS Control Panel Fuses (4) (B-Panel) - Installed

   Remove fuses from the safety pin stowage container adjacent to the signal lamp.

2. Control Column DC Circuit Breakers (2 "DC PWR") - Reset

3. FCS Power Switch - Warmup

   Turret should stow through magnetic amplifiers, enabling gunner to remove turret side panels.

4. FCS Power Switch - OFF

5. FCS Control Panel Fuses (4) - Removed

   Stow fuses in the safety pin stowage container adjacent to the signal lamp.

6. FCS Switches - OFF/SAFE and pinned

7. Turret Cowling - Removed

NOTE

There is a turret interlock switch and one or two gun heater switch(es) located on each side arm. The turret interlock (three-position) switch is located on the left side arm. The gun heater switch(es) is located on the right side arm. The switch on the left side arm controls a-c power to the hydraulic system. The top switch on the right side arm controls d-c power to the two upper gun heaters and the lower switch controls d-c power to the two lower gun heaters. If there is only one gun heater switch, this switch controls d-c power to all four gun heaters. With the turret side panels on, the switches are held in, allowing power to be supplied to the gun heaters and the hydraulic system. By removing the turret side panels, the switches will spring to the intermediate position, preventing power from being supplied to the hydraulic system and gun heaters. When the interlock and gun heater switches are pulled to out position, power is supplied to the gun heaters and hydraulic systems.

   a. Remove left side panel and check turret interlock and gun heater switches in the intermediate position. Unfasten upper and lower cowling fasteners.

   b. Remove right side panel and check turret interlock and gun heater switches are in the intermediate position. Unfasten remaining fasteners on upper and lower cowling and remove.

STRANGE FIELD DISARMING PROCEDURE (Cont)

8. Ammunition Chutes - Disconnected

   a. Disconnect ammunition chutes from ammunition boosters and break belts at boosters.

   b. Position double link of each belt out through the side of the flexible chute and attach the single round.

9. Bolts Position - Checked

WARNING

If any gun is not in battery position, do not proceed with "Strange Field Disarming Procedures." Reconnect ammo chutes and replace turret cowling. Install FCS control panel fuses. Reset FCS circuit breakers, turn FCS power switch ON, search radar ON, and reaccomplish the required steps of the "After Landing" checklist.

   a. Visually check that upper gun bolts are in battery position by looking through the side of the receiver.

   b. Visually check that lower gun bolts are in battery position by looking up through the bottom of the receiver.

NOTE

The gunner may elect to clear one gun at a time. In this case he will complete steps "10" thru "14" for each weapon.

10. Gun Cover(s) - Raised

11. Link Chute(s) (upper) - Removed

12. Ammunition Booster(s) (lower) - Removed (if applicable)

STRANGE FIELD DISARMING PROCEDURE (Cont)

13. Feedway(s) - Cleared

    a. Remove ammunition by pulling belt toward direction of feed (upper).

    b. Remove ammunition by pulling opposite direction of feed (lower).

14. Gun Cover(s) - Closed

15. Gun Chambers Cleared - Accomplished

    a. External Gun Charger Switch or Valve - Actuated

    Actuate the gun charger switch or valve to clear the guns.

NOTE

If guns cannot be charged by the external gun charger switch, do not proceed with "Strange Field Disarming Procedures." Reconnect ammo chutes and replace turret cowling. Install FCS control panel fuses, reset FCS circuit breakers, turn FCS power switch ON, and reaccomplish the required steps of the "After Landing" checklist.

16. Bolts Position - Checked

WARNING

If any gun is not in battery position, do not proceed with "Strange Field Disarming Procedures." Reconnect ammo chutes and replace turret cowling, install FCS control panel fuses, reset FCS circuit breakers, turn FCS power switch ON, search radar ON, and reaccomplish the required steps of the "After Landing" checklist.

STRANGE FIELD DISARMING PROCEDURE (Cont)

NOTE

The gunner may elect to complete one gun at a time. In this case he will complete steps "17" thru "20" for each weapon.

17. Gun Cover(s) - Raised

    a. Visually check upper gun bolt(s) T-slot(s) clear.

    b. Visually check lower gun bolt(s) T-slot(s) clear by looking up through the bottom of the receiver.

NOTE

If gun chambers have not been cleared upon completion of step "17b," return to step "14" and repeat chamber clearing procedure through step "17b."

18. Link Chute(s) - Replaced

19. Ammunition Booster(s) - Replaced (if applicable)

20. Gun Cover(s) - Closed

21. Ammunition Chutes - Reconnected

22. Ammunition - Secured

    a. Position double link of each belt out through the side of the flexible chute and attach the remaining rounds (this precludes the possibility of ammunition feeding into the boosters).

    b. Safety wire loose end of ammunition belt to ammunition chutes.

23. Turret Cowling - Replaced

24. Crew Debriefing - Accomplished

    a. FCS Log - Completed

    b. Form 781 - Completed (if applicable)

    In the Form 781H, block "13," enter the gun status (i.e., "Hot" or "Cold") in red.
    Form 781C should reflect any remaining ammo and configuration, i.e., safetied in chute or can.
    If guns did not fire out, enter, "guns disarmed and ammunition safety wired in ammo chutes" in Form 781A.

GROUND CREW CHECKLIST

NOTE

The abbreviated ground crew checklist is contained in T.O. 1B-52C-1CL-6. The navigator's abbreviated scramble portion of ground crew checklist is contained in T.O. 1B-52C-1CL-2.

1. When the aircraft is moved into the alert line, the ground crew accomplishes the "Alert Line Preparation" checklist.
2. After the alert aircrew has "cocked" the aircraft, the ground crew will install "cocked" sign and clean up alert parking area.

WARNING

Entrance to the designated "No Lone Zone" of a "cocked" configured aircraft will be in accordance with command directives.

3. When the execution order to scramble is received, one ground crew member and the flight crew navigator will remove all plugs and covers and accomplish the applicable ground crew scramble checklist without delay.
4. When practice alerts are terminated, the "Alert Line Preparation" checklist will be completed in conjunction with the flight crew recocking the aircraft.

GROUND CREW CHECKLIST (Cont)

ALERT LINE PREPARATION

1. Position aircraft in designated parking position.
2. Position wheel chocks. Install one chock in front of each forward gear and one chock behind each aft gear.
3. Install static ground wire (forward).
4. Position AGE:
    - a. Position MD-3 on either side of the aircraft in a location that will permit the aircraft to taxi safely. Use 30-, 60-, or 120-foot cables.
    - b. When AGM-28's are installed, only MD-3's with 60- or 120-foot cables may be used. When 60-foot cable is used, position MD-3 between the inboard and outboard engine pods. When 120-foot cable is used, position MD-3's outboard of the wing tip.
5. Check AGE fuel and oil service.
6. Position fire extinguishers (one 50-pound CO_2 or one 10-gallon (CB) unit at each wing tip).
7. Connect interphone cord and headset. Headset and interphone cord will be stored in a suitable location out of the weather and near the ground cord receptacle.
8. Cold Weather Operation: Position ground heaters (as required) to preheat the MD-3 and crew compartment.
9. Position stands (as required).
10. Install nose and tail covers (climatic, or as desired).
11. Install chaff dispenser plugs or covers (as required).
12. Install pitot covers (climatic).
13. Install ram air inlet plugs (climatic, or as required).
14. Install engine inlet and tail cone plugs (climatic).
15. Windows and hatches (climatic). Normally open unless inclement weather prohibits.
16. Remove and secure all unnecessary stands and equipment.
17. After aircraft is cocked, place "cocked" sign on entrance hatch. If hatch is to remain closed, place "cocked" sign in cockpit facing pilots' window.

GROUND CREW SCRAMBLE

This checklist will be accomplished by one ground crew member and the flight crew navigator when the order to scramble is given.

WARNING

During aircraft engine cartridge starts, the cartridge starter exhaust is 850° F. Therefore, remain clear of a 4-foot radius area around the cartridge starter exhaust directly below nacelles of engines 2 and 8.

GROUND CREW CHECKLIST (cont)

Man No. 1 – Crew Chief

1. **REMOVE AIRCRAFT PITOT COVERS.**
2. **REMOVE FRONT AND REAR ENGINE PLUGS FROM ENGINES 5, 6, 7, AND 8, IN THAT ORDER, AND PLACE CLEAR OF AIRCRAFT (AS REQUIRED).**
3. **INSURE ENGINE PLUGS ARE REMOVED FROM LEFT WING ENGINES (AS REQUIRED).**
4. **START MD-3 AND APPLY POWER.**
5. **PUT ON HEADSET AND REPORT TO PILOT, "CLEAR TO START ENGINES."**
6. **REMOVE RIGHT AGM-28 PITOT COVER, ASTROTRACKER COVER, AND ENGINE PLUGS AND PLACE CLEAR OF AIRCRAFT (AS REQUIRED).**
7. **CUT OFF HEATER TO MD-3 AND REMOVE, ALONG WITH DUCTING, CLEAR OF RIGHT WING TIP (AS REQUIRED).**
8. **MONITOR STARTING OF ALL AIRCRAFT ENGINES.**
9. **ON HEARING COPILOT STATE "A-C POWER CHECKED, ALTERNATORS ON THE LINE," SHUT DOWN AND DISCONNECT MD-3.**
10. **CHECK ALTERNATOR COOLING AIR.**
11. **CLOSE ENTRANCE HATCH.**
12. **REMOVE CHOCKS FROM FORWARD GEAR WHEN INSTRUCTED BY THE PILOT.**
13. **ADVISE PILOT THAT "PITOT COVERS AND CHOCKS ARE REMOVED, GROUND EQUIPMENT IS CLEAR, LEAVING INTERPHONE". THE CREW CHIEF WILL THEN DISCONNECT GROUND CORD AND MOVE TO PROPER POSITION (AS LOCAL CONDITIONS REQUIRE) TO DIRECT PILOT WHILE TAXIING OUT OF PARKED POSITION.**
14. Accomplish the "Alert Line Preparation" checklist when practice alert is terminated (if applicable).

Man No. 2 – Navigator

1. **REMOVE FRONT AND REAR ENGINE PLUGS FROM ENGINES 4, 3, 2, AND 1, IN THAT ORDER, AND PLACE CLEAR OF AIRCRAFT (AS REQUIRED).**
2. **REMOVE LEFT AGM-28 PITOT COVER, ASTROTRACKER COVER AND ENGINE PLUGS AND PLACE CLEAR OF AIRCRAFT (AS REQUIRED).**
3. **CUT OFF FORWARD BAY HEATER AND REMOVE HEATER AND DUCTING CLEAR OF LEFT WING TIP (AS REQUIRED).**
4. **REMOVE FORWARD GROUND WIRE.**
5. **SIGNAL MAN NO. 1 WHEN ALL EQUIPMENT IS CLEAR AND BOARD THE AIRCRAFT.**

B-52C AND D EMERGENCY TAXI CHECKLIST

WARNING

DO NOT USE FOR FLIGHT.

NOTE

- Minimum cockpit crew may be one pilot and one ground crew member who serves as copilot. Both must meet the requirements of AFR 60-11 concerning movement of aircraft.
- Pilot and copilot will perform their respective "Before Starting Engines" checklists simultaneously.
- This checklist is designed for emergency use. Two copies of the abbreviated checklist are to be placed in the cockpit of each aircraft. It is not to be carried in the crew member's individual checklist folder.

BEFORE STARTING ENGINES (Pilot)

1. Status of Aircraft - Checked

   Pilot will check with ground crew for status of aircraft for taxiing and for desired starting mode (cartridge/pneumatic). He will issue instructions to clear aircraft of all obstructions and to stand by on interphone.

2. Circuit Breakers - Set
3. Interphone Power Switch - ON
4. Ground, Start External Power & Air - Roger (GC)
5. Landing Gear Standby Pump - ON
6. Navigation Lights - BRIGHT and FLASH
7. Antiskid Switch - As required

   Turn antiskid switch OFF if icy (slippery) taxiing conditions exist or if gross weight is less than 250,000 pounds. If these conditions do not exist, leave antiskid switch ON.

8. Parking Brakes - Set
9. Steering Ratio Selector Lever - TAXI
10. Ground, Remove Bypass Keys - Roger (GC)
11. Radio Call - Completed

    Contact Command Post or tower. Advise ready to start engines and request instructions.

B-52C AND D EMERGENCY TAXI CHECKLIST (cont)

BEFORE STARTING ENGINES (Copilot)

1. Circuit Breakers - Set
2. UHF Radios - ON
3. Firewall Switches - IN
4. Battery Switch - ON
5. External Power - Checked and ON
6. Engine Starter Switches - OFF and GROUND START (for pneumatic start); No. 2 and/or 8 START and FLIGHT START (for cartridge start)
7. Air Bleed Switches - OPEN
8. Fuel Switches 14 & 15 (pneumatic start); 13, 14, 15 & 16 (cartridge start) - ON
9. Wing Flaps - UP, lever OFF (lever up 54▶ 138 W1▶ W34) (GC)

   Ground crew will advise flap position and movement.

STARTING ENGINES AND TAXIING (Pilot /Copilot Reads)

1. Stand by to Start Engines - Fire guard posted and clear (GC)
2. Start Engines 4, 3, 5 & 6 (pneumatic start); 2 and/or 8, 3, 4, 5 & 6 (cartridge start) - Started (CP)

   Copilot starts No. 4 engine, then starts 3, 5, and 6 with normal starting procedures. When starting with cartridge(s) installed, copilot starts engines 3, 4, 5, and 6 after engines 2 and/or 8 are started. See Section II, "Starting Engines and Before Taxiing Checklist," line item "Start Engines - Started (CP)" for detailed starting procedures.
3. Starter Switches & Light - OFF and out (CP)
4. Left Aft Alternator - Started, checked, and on the line (CP)
5. Hydraulic Packs 1, 2, 3 & 4 - ON, pressures checked (P)
6. Ground, Clear Aircraft for Taxi, Remove Chocks & Disconnect Interphone - Roger (GC)
7. Anticollision & Navigation Lights - ON and STEADY (P)
8. Taxi on Crew Chief's Signal (P-CP)

   NOTE

   Engines 2 and/or 8 may be shut down if desired, if cartridges were used for starting.
9. Brakes - Checked (P)

B-52C AND D EMERGENCY TAXI CHECKLIST (cont)

ENGINE SHUTDOWN (Copilot Reads)

1. Parking Brakes - Set (P)
2. Landing Gear Standby Pump Switch - OFF (P)
3. Left Aft Alternator Switch - OFF (CP)
4. External Power - ON (if available) (CP)
5. Throttles - 75% rpm, then CLOSED (P)

   Advance throttles to 75% for 15 to 30 seconds, then retard to CLOSED.
6. UHF Radios - OFF (CP)
7. Fuel Switches - OFF (CP)
8. Hydraulic Pack Switches - OFF & RESET (guards open) (P)
9. Wheel Chocks - In place (GC)
10. Parking Brake Lever - OFF (P)
11. Light Switches - OFF, or as required (P-CP)
12. Battery Switch - OFF (CP)
13. Seat Positioning Switch - DOWN (external power available) (P-CP)
14. Interphone Switch - OFF (P)

CUT ON DASHED LINE

(Extracted from T.O. 1B-52C-1)

B-52C AND D EMERGENCY TAXI CHECKLIST

WARNING

DO NOT USE FOR FLIGHT

NOTE

- Minimum cockpit crew may be one pilot and one ground crew member who serves as copilot. Both must meet the requirements of AFR 60-11 concerning movement of aircraft.
- Pilot and copilot will perform their respective "Before Starting Engines" checklists simultaneously.
- This checklist is designed for emergency use. Two copies are to be placed in the cockpit of each aircraft. It is not to be carried in the crew member's individual checklist folder.

BEFORE STARTING ENGINES (Pilot)

1. Status of Aircraft – Checked
2. Circuit Breakers – Set
3. Interphone Switch – ON
4. Ground, Start External Power & Air – Roger (GC)
5. Gear Standby Pump – ON
6. Navigation Lights – BRIGHT and FLASH

30 Jul 1969 **Page 1 of 4**

CUT ON DASHED LINE

(Extracted from T.O. 1B-52C-1)

B-52C AND D EMERGENCY TAXI CHECKLIST (Cont)

7. Antiskid – As required
8. Parking Brakes – Set
9. Steering Ratio – TAXI
10. Ground, Remove Bypass Keys – Roger (GC)
11. Radio Call – Completed

BEFORE STARTING ENGINES (Copilot)

1. Circuit Breakers – Set
2. UHF Radios – ON
3. Firewall Switches – IN
4. Battery Switch – ON
5. External Power – Checked and ON
6. Starter Switches – OFF and GROUND START (for pneumatic start); No. 2 and/or 8 START and FLIGHT START (for cartridge start)
7. Air Bleed Switches – OPEN
8. Fuel Switches 14 & 15 (pneumatic start); 13, 14, 15 & 16 (cartridge start) – ON
9. Flaps – Up, lever OFF (lever UP **54** ▶ **138** **W2** ▶ **W34**) (GC)

CUT ON DASHED LINE

(Extracted from T.O. 1B-52C-1)

B-52C AND D EMERGENCY TAXI CHECKLIST (Cont)

STARTING ENGINES AND TAXIING (Pilot/Copilot Reads)

1. Stand By to Start Engines – Fire Guard posted and clear (GC)
2. Start Engines 4, 3, 5 & 6 (pneumatic start); 2 and/or 8, 3, 4, 5 & 6 (cartridge start) – Started (CP)
3. Starters & Light – OFF and out (CP)
4. Left Aft Alternator – Started, checked, and on the line (CP)
5. Hydraulic Packs 1, 2, 3 & 4 – ON, pressures checked (P)
6. Ground, Clear Aircraft for Taxi, Remove Chocks & Disconnect Interphone – Roger (GC)
7. Anticollision & Navigation Lights – ON and STEADY (P)
8. Taxi on Crew Chief's Signal (P-CP)
9. Brakes – Checked (P)

CUT ON DASHED LINE

(Extracted from T.O. 1B-52C-1)

B-52C AND D EMERGENCY TAXI CHECKLIST (Cont)

ENGINE SHUTDOWN (Copilot Reads)

1. Brakes – Set (P)
2. Standby Pump – OFF (P)
3. Alternator – OFF (CP)
4. External Power – ON (if available) (CP)
5. Throttles – 75% rpm, then CLOSED (P)
6. UHF Radios – OFF (CP)
7. Fuel Switches – OFF (CP)
8. Hydraulic Packs – OFF & RESET (guards open) (P)
9. Wheel Chocks – In place (GC)
10. Brakes – OFF (P)
11. Lights – OFF, or as required (P-CP)
12. Battery Switch – OFF (CP)
13. Seats – DOWN (external power available) (P-CP)
14. Interphone – OFF (P)

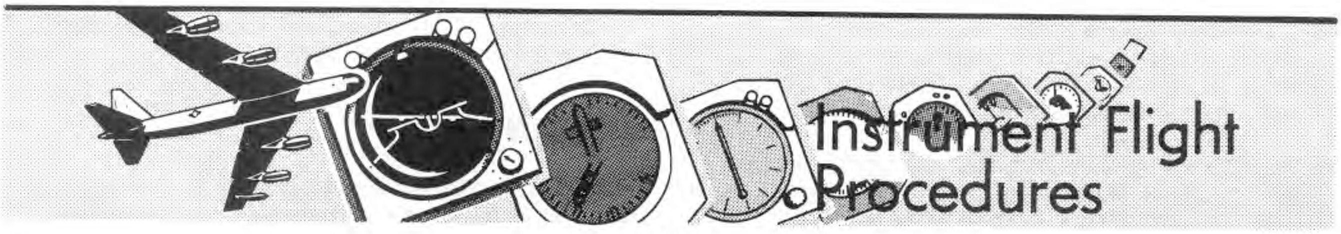
ACCEPTANCE AND/OR FUNCTIONAL CHECK FLIGHT CHECKS

Procedures and criteria for functional check flights will be accomplished in accordance with T.O. 1B-52B-6CF-1 and T.O. 1B-52B-6CF-1-1, Acceptance and/or Functional Check Flight Procedures manuals. Each manual contains amplified checklists identified as "Before Inflight Checklists," "Inflight System Operational Checks," and "After Inflight Checklists." Flight crew abbreviated checklists are contained in T.O. 1B-52B-6CL-1 thru -5. The "Emergency Procedures" contained in T.O. 1B-52C-1 will be used. Aircraft requiring functional check flights are redelivered aircraft, modification maintenance aircraft, and aircraft wherein maintenance performed requires a functional check flight as specified in T.O. 1-1-300.

section IX ALL WEATHER OPERATION

INTRODUCTION: Except for some repetition necessary for emphasis, clarity, or continuity of thought, this section contains only those procedures that differ or are in addition to the normal operating instructions covered in Section II. Any discussions relative to system operations are covered in Section VII.

TABLE OF CONTENTS



Instrument Flight Procedures

GENERAL

The procedures and techniques outlined in current instrument flying directives should be followed.

Flight characteristics during instrument conditions do not differ from those encountered during visual flight conditions. Limit angle of bank to 30° for all normal instrument maneuvers.

INSTRUMENT TAKEOFF AND INITIAL CLIMB

An instrument takeoff is essentially the same as a normal VFR takeoff. The same procedures are used as given in Section II. Ensure the attitude indicator is set for takeoff by aligning the horizon bar with the miniature aircraft.

1. Align the aircraft visually with the runway. The copilot will visually monitor the takeoff and initial climb. Due to acceleration error during the takeoff roll, the pilot's and copilot's attitude indicators show a climb indication at unstick speed. A takeoff with reference to instruments exclusively may be required because of low visibility conditions.

NOTE

The bank steering bar will be used during takeoff and climb as an aid in heading control. Cross-checking of the bank steering bar, turn needle, and heading indicator will provide indication of attitude indicator failure in the roll axis. If the roll axis of the ADI is inoperative on takeoff, the bank steering bar will aid in maintaining a wings-level attitude until a new heading is selected. This type of failure has occurred several times without a warning flag in view. If a new heading is selected, the roll axis failure should become apparent as the turn is initiated. A rapidly precessing heading indicator (gyro) will also give the same indications.

2. As the aircraft breaks ground, maintain the unstick attitude as indicated by the attitude indicator until a cross-check of vertical velocity indicator and altimeter indicate a definite rate of climb with increasing airspeed.

WARNING

- If a pitchup occurs as the aircraft becomes airborne, failure to initiate positive action with the elevator control and trim to stop the aircraft noseup rotation could result in a stall.
- The attitude warning flag will not appear during every attitude indicator failure. Therefore, it is possible that a malfunction of the attitude indicator might be determined only by cross-checking it with the turn and slip indicator and the other remaining flight instruments.

NOTE

An error in the pitch indication of the attitude indicators is generated during accelerations or decelerations. The error is indicated in a nose-high direction during and after a forward acceleration and in a nosedown direction during and after deceleration. The longer the duration of acceleration (or deceleration), the greater will be the indicated error and the longer it will persist when acceleration (or deceleration) ceases. The erection system will reduce the error at about the same rate it was generated. Pitch error may reach one bar width during a high gross weight takeoff.

3. Retract the gear as recommended in Section II for a VFR takeoff; however, be certain that a safe stabilized climb has been established. Adjust pitch as necessary to maintain a climb at 180 knots IAS.
4. Retract flaps as recommended in Section II for a VFR takeoff.

INSTRUMENT CLIMB

Maintain recommended best climb schedule as given in Part 4 of the Appendix.

INSTRUMENT CRUISE

The aircraft has satisfactory handling characteristics throughout the design airspeed and altitude range. Use recommended procedures given in Part 5 of the Appendix for cruise operation.

NOTE

The rotating anticollision lights should be turned off during actual instrument flight conditions whenever the pilot can notice the rotating light reflections in the cockpit. A pilot may experience vertigo from these reflections. In addition, the lights will be ineffective during such instrument flight conditions.

HOLDING

Enter the holding pattern in accordance with procedures as outlined in current directives. Establish a holding airspeed of 230 knots IAS for all altitudes from 15,000 to 35,000 feet and for all gross weights up to 300,000 pounds. For all gross weights greater than 300,000 pounds, refer to the appropriate fuel mileage chart in Part 5 of the Appendix with the existing gross weight and altitude for a best endurance indicated airspeed. Maintain the airspeed 10 knots above that given or Mach .77, whichever is less, for endurance at the given weight to allow for holding turns.

NOTE

> If it is necessary to endure and fuel quantity is low, establish the holding airspeed recommended in Part 6 of the Appendix for the existing gross weight and altitude. Increase the airspeed 10 knots or maintain Mach .77, whichever is less. Maximum endurance altitude is recommended.

TYPICAL DESCENTS AND JET PENETRATIONS

1. A typical penetration is shown in figure 9-1. Prior to starting a penetration, initiate descent checklist.
2. A normal penetration is accomplished with the gear down, throttles idle, airbrakes position 4 or as required at 240 knots IAS or .75 Mach, whichever is slower.

WARNING

> Care should be taken to retrim between each 2-unit increment of airbrake operation.

NOTE

> Rate of descent may be varied (by airbrakes and/or throttle position) to satisfy local penetration procedures. See "Ice and Rain," this section, for icing descent procedures.

3. Conform to published procedures.
4. See Part 8 of the Appendix for time, fuel, and distance requirements.
5. Copilot obtains altimeter setting prior to descent and pilot, copilot, and radar navigator set altimeters at the prescribed time during descent. During the descent, the radar navigator will call off passing through each 5000-foot level down to 5000 feet above level-off and each 1000 feet thereafter to the level-off altitude. The pilot and copilot will cross-check each altitude called by the radar navigator.
6. Retract airbrakes as required. Allow the aircraft to decelerate to 220 knots IAS. Complete the "Before Landing Checklist" as required. Establish best flare speed plus 30 knots. Reduce airspeed to best flare plus 10 knots prior to the final approach fix or glide slope interception. (About 25,000 pounds per hour total fuel flow will be required during descent on final approach.) Maintain best flare plus 10 knots until the flare for landing is started. If visual references at the missed approached point are insufficient to land, execute the missed approach procedure.
7. For a circling approach, use airspeeds and configuration as specified under "Approach Procedure," Section II.

INSTRUMENT APPROACHES

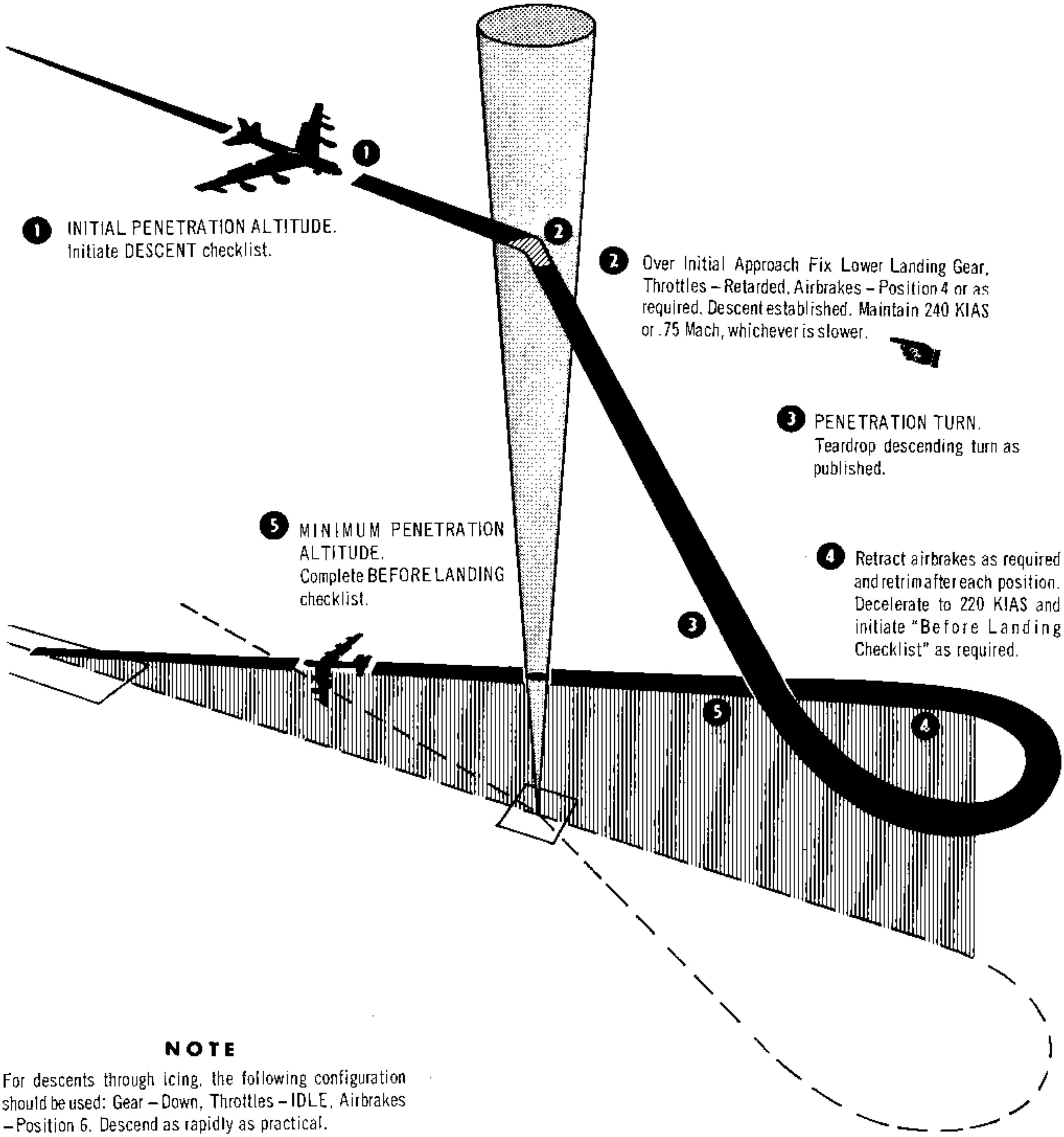
In accordance with the United States Standard for Terminal Instrument Procedures (TERPS), this aircraft and all modified versions thereof, are placed in approach category "E."

RADAR APPROACH

Entry into the radar approach pattern (figure 9-2) is normally made with gear down at 220 knots IAS. Complete "Before Landing Checklist" as outlined in Section II. Adjust power to maintain best flare speed plus 30 knots IAS after the flaps are down. Reduce airspeed to best flare plus 20 knots on base leg. After the turn to final approach and prior to reaching the glide slope, reduce airspeed to best flare plus 10 knots IAS. (About 25,000 pounds per hour total fuel flow will be required during descent on final approach.) Maintain best flare plus 10 knots until the flare for landing is started. When the minimum altitude is reached as indicated by the altimeter or when advised by the controller, whichever occurs first, perform the missed approach procedure if visual references are inadequate for landing. A 28-nautical mile radar approach pattern requires an average of 10 minutes and 5000 pounds of fuel.

INSTRUMENT LANDING SYSTEM

The aircraft is equipped with an approach coupler which permits automatic ILS approaches. Except for the use of the autopilot and approach coupler, the following procedures also apply to manual approaches. For automatic approach procedures, see figure 9-4.



❶ INITIAL PENETRATION ALTITUDE.
Initiate DESCENT checklist.

❷ Over Initial Approach Fix Lower Landing Gear, Throttles – Retarded, Airbrakes – Position 4 or as required. Descent established. Maintain 240 KIAS or .75 Mach, whichever is slower.

❸ PENETRATION TURN.
Teardrop descending turn as published.

❹ Retract airbrakes as required and retrim after each position. Decelerate to 220 KIAS and initiate "Before Landing Checklist" as required.

❺ MINIMUM PENETRATION ALTITUDE.
Complete BEFORE LANDING checklist.

NOTE

- For descents through icing, the following configuration should be used: Gear – Down, Throttles – IDLE, Airbrakes – Position 6. Descend as rapidly as practical.
- For a penetration, throttles and airbrakes may be used as required.

TYPICAL JET PENETRATION

Figure 9-1.

Transition to Final

Accomplish a normal transition as specified in the FLIP terminal charts. Set the nav mode select switch to ILS, tune the ILS frequency, set the inbound localizer course in the course selector window, and set the heading selector switch to NOR. Complete the "Before Landing Checklist," as outlined in Section II, and establish best flare plus 30 knots IAS. Engage the autopilot and turn altitude control switch ON when at glide slope interception altitude. When the aircraft is within 90° of the inbound course, decelerate to best flare plus 20 knots IAS and center the bank steering bar. This will initially establish up to a 45° intercept to the localizer. As the aircraft approaches the localizer, the bank steering bar will direct a turn-on course. When the aircraft is on the localizer course inbound (CDI centered), engage the autopilot localizer and place the nav mode select switch to ILS APP. Stabilize the aircraft at best flare plus 10 knots IAS prior to the glide slope interception point. Eliminate localizer standoff by use of the roll trim knob.

Final Approach

When the glide slope indicator reaches center, engage the glide slope switch and adjust power to maintain best flare plus 10 knots IAS. For a manual approach, keeping the bank steering bar centered will automatically correct for wind and keeping the pitch steering bar centered will establish the pitch attitude necessary to correct to or maintain the glide slope. Continue the approach until visual references are sufficient to land or to published minimums, whichever is higher. At this point, disengage the autopilot to land or to follow the missed approach procedures. Check trim indicators prior to disengaging autopilot. An ILS approach requires an average of 5000 pounds of fuel and 10 minutes.

WARNING

During an ILS final approach using the Flight Director System (ILS APP mode selected) the loss, or reduction in strength, of the glide slope signal will normally cause the glide slope warning flag to appear. Simultaneously with the warning flag appearance, the glide slope indicator and pitch steering bar may remain at or slowly move toward a centered position. Failure to immediately observe the (red) warning flag under conditions requiring high instrument (red) lighting intensities, coupled with the false "on glide slope" indication, could result in misinterpretation by the pilot. During the ILS final approach phase, a frequent cross-check should be made for the glide slope warning flag and/or unduly stabilized glide slope indicator/pitch steering bar combination. A continuous cross-check of altitude and rate of descent should be made as well as monitoring marker beacons, aural signals, and radar altimeters, whenever possible.

MISSED APPROACH

Missed approaches are accomplished using the same procedures as given in Section II for VFR go-arounds. Advance throttles as required, retract airbrakes, establish a positive climb (approximately 1000 feet per minute is appropriate for most missed approaches), trim as required, and check for a positive increase in airspeed. Aircraft acceleration upon executing the missed approach procedure is such that at light weights under instrument conditions flap placard speeds may be rather quickly exceeded.

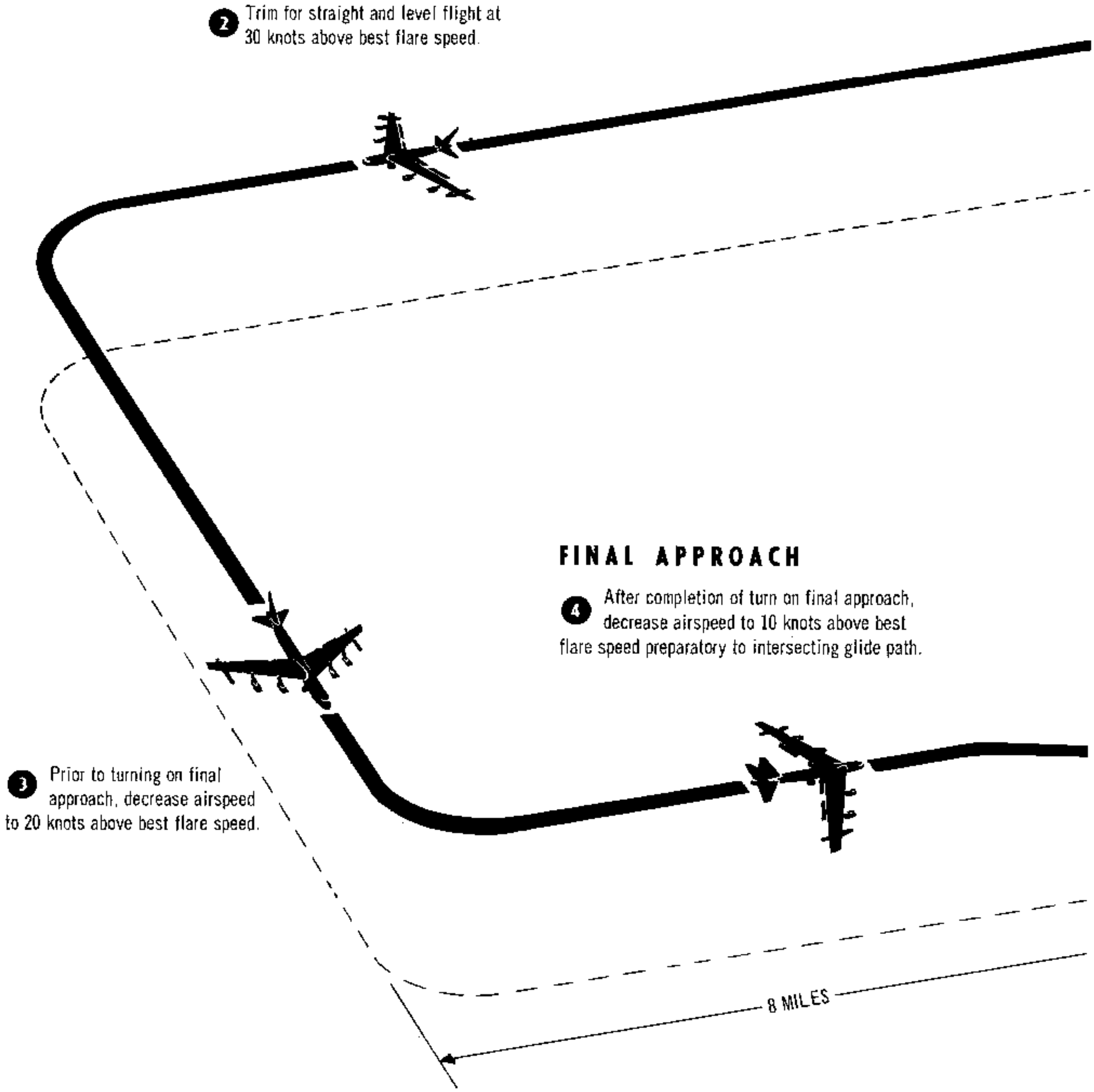
WARNING

Care should be exercised in applying power at light gross weights due to pitchup developing during acceleration. See "Go-Around," Section VI, for a detailed discussion of this characteristic.

Retract gear as soon as it is certain that the aircraft will not touch the ground and retract flaps as specified in Section II if the published missed approach procedure is to be followed or if proceeding to an alternate airport. During the flap retraction cycle, it is required that the pilot monitor the aircraft attitude indications as closely as possible, keeping the aircraft trimmed to a zero stick force, especially during the last 20% of flap retraction.

NOTE

- If a closed radar approach pattern is approved and another approach is to be made, leave the gear and flaps down and maintain airspeed as specified for a normal radar approach pattern.
- Allow approximately 7000 pounds of fuel and 12 minutes for a closed radar approach pattern.



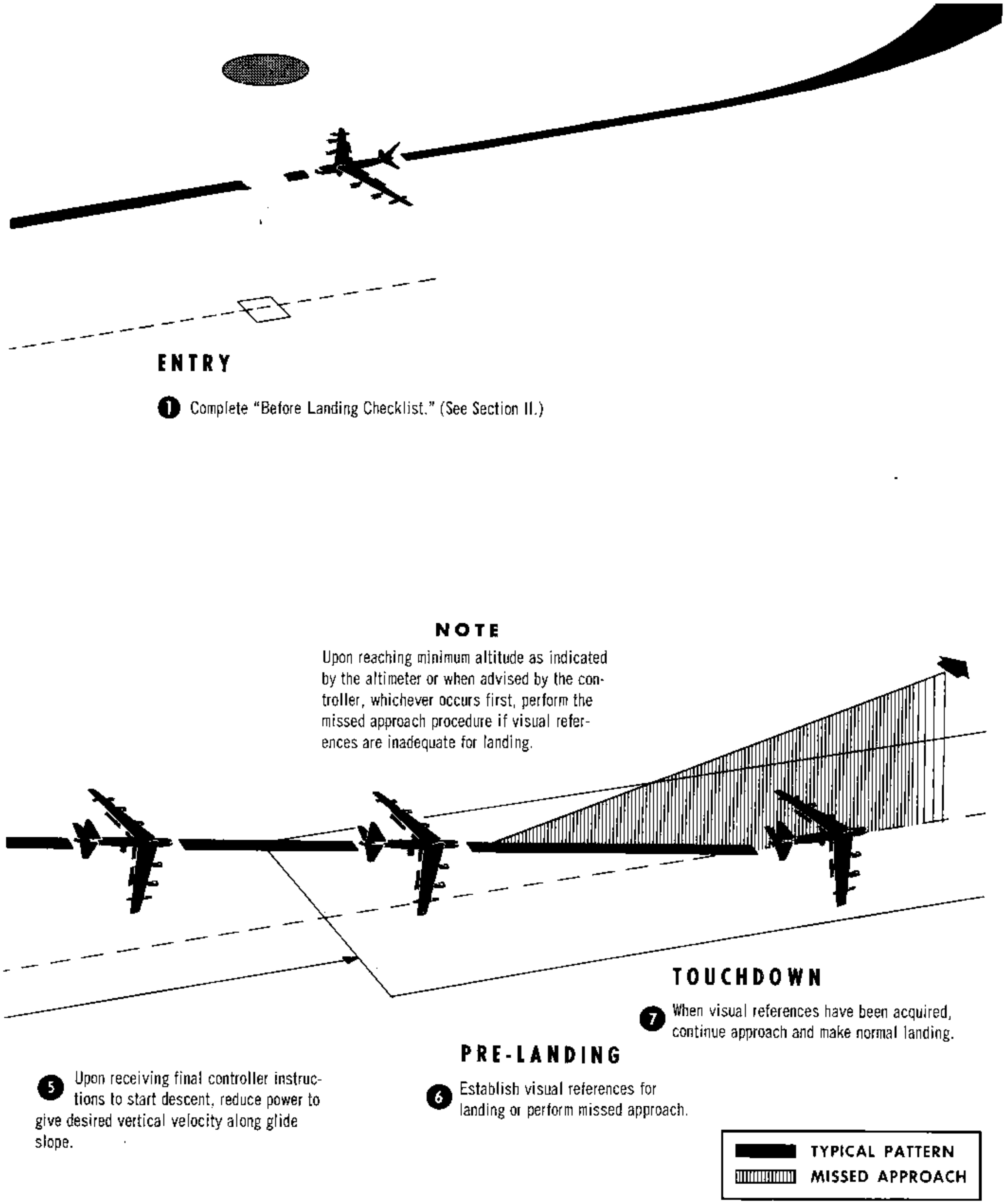
❷ Trim for straight and level flight at 30 knots above best flare speed.

FINAL APPROACH

❹ After completion of turn on final approach, decrease airspeed to 10 knots above best flare speed preparatory to intersecting glide path.

❸ Prior to turning on final approach, decrease airspeed to 20 knots above best flare speed.

Figure 9-2 (Sheet 1 of 2).



ENTRY

❶ Complete "Before Landing Checklist." (See Section II.)

NOTE

Upon reaching minimum altitude as indicated by the altimeter or when advised by the controller, whichever occurs first, perform the missed approach procedure if visual references are inadequate for landing.

❺ Upon receiving final controller instructions to start descent, reduce power to give desired vertical velocity along glide slope.

PRE-LANDING

❻ Establish visual references for landing or perform missed approach.

TOUCHDOWN

❼ When visual references have been acquired, continue approach and make normal landing.

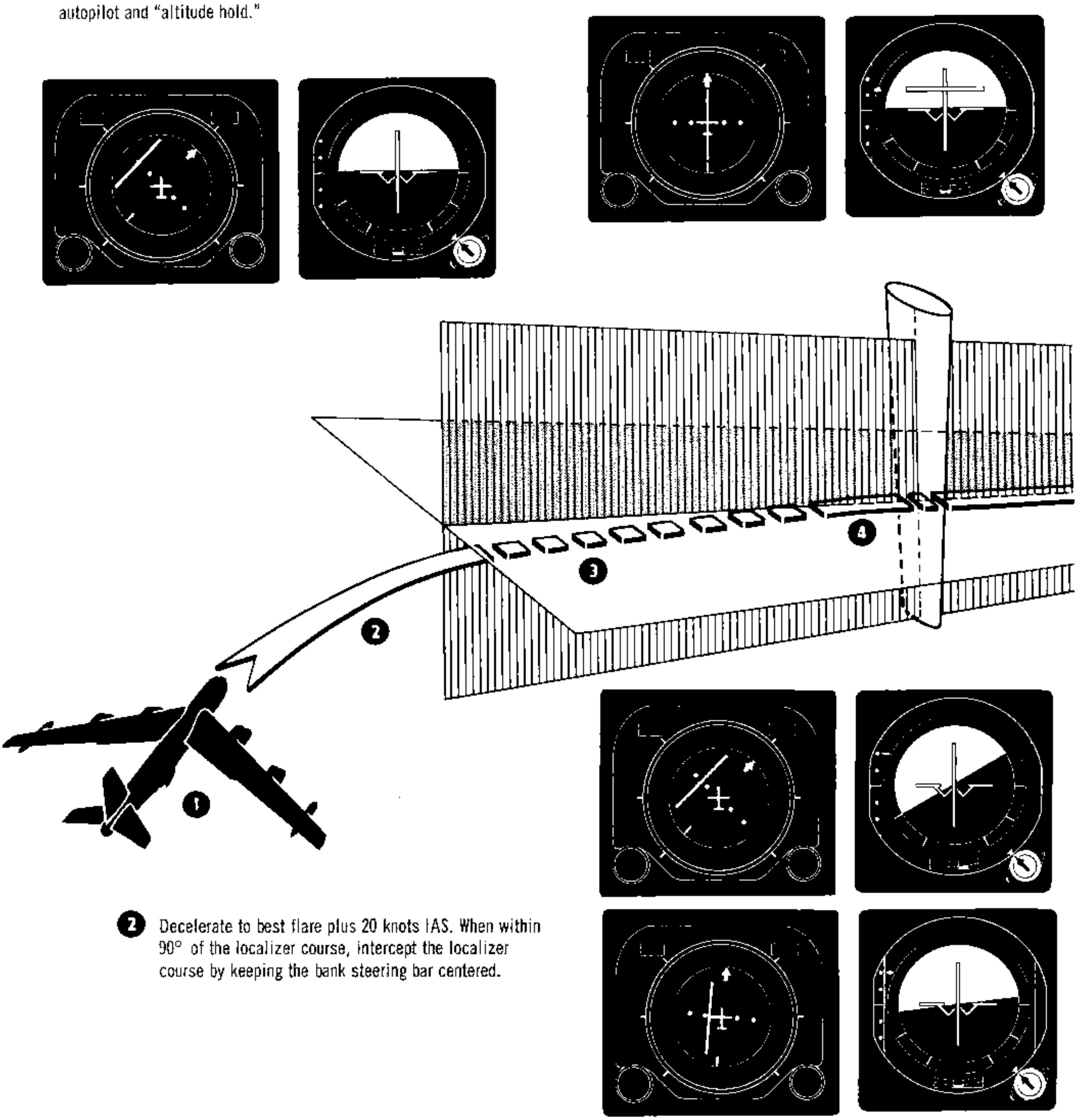
RADAR APPROACH

Figure 9-2 (Sheet 2 of 2).

Figure 9-3. (Deleted)

① TRANSITION TO FINAL – Set the nav mode select switch to ILS, tune the ILS frequency, set the inbound course, and set the heading selector switch to NOR. Complete the "Before Landing Checklist" as outlined in Section II. Establish best flare plus 30 knots IAS. Engage autopilot and "altitude hold."

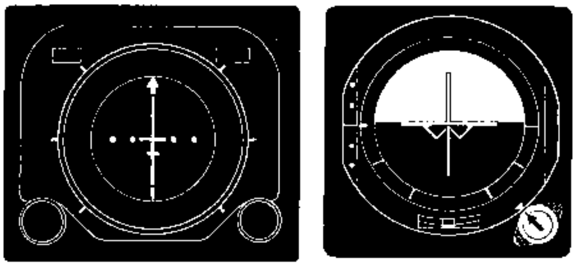
③ When established on localizer course (CDI centered), engage the autopilot localizer and place the nav mode select switch to ILS APP. Stabilize aircraft at best flare plus 10 knots IAS. Eliminate localizer standoff by use of the roll trim knob.



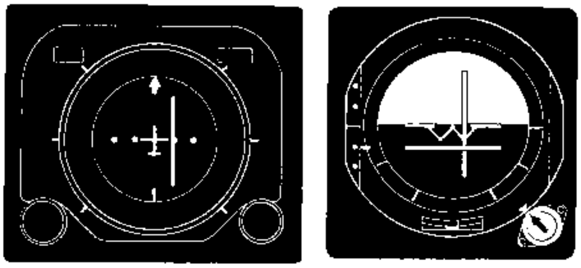
② Decelerate to best flare plus 20 knots IAS. When within 90° of the localizer course, intercept the localizer course by keeping the bank steering bar centered.

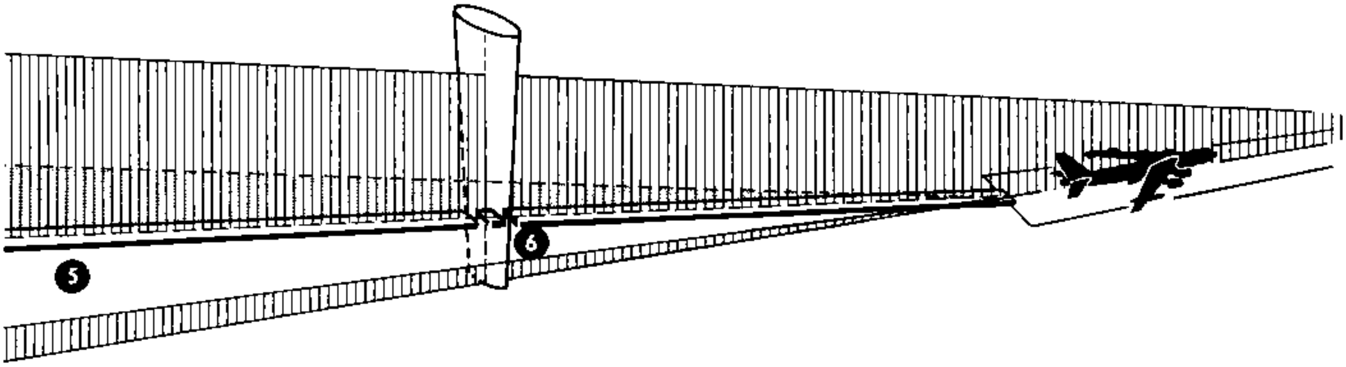
Figure 9-4 (Sheet 1 of 2).

❹ When the glide slope reaches center, engage glide slope switch. Adjust power to maintain best flare plus 10 knots IAS.

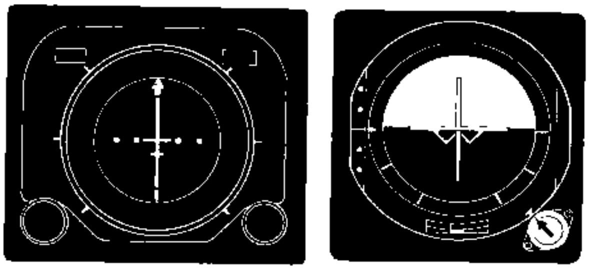


❺ Maintain crosscheck of ADI and HSI. Maintain airspeed at best flare plus 10 knots.





❻ Check trim indicators before disengaging autopilot. Disengage autopilot and accomplish landing or perform missed approach.



FLIGHT DIRECTOR SYSTEM AUTOMATIC APPROACH

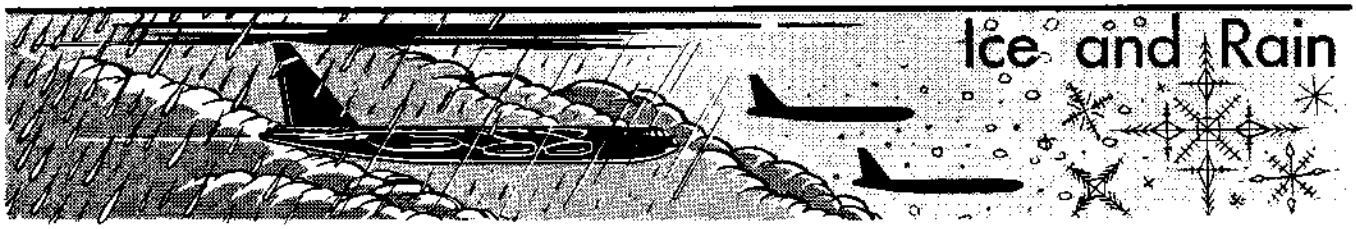
Figure 9-4 (Sheet 2 of 2).

AIRBORNE RADAR APPROACH

See "Airborne Radar Approaches," Section VIII, for proper procedures and techniques.

PARTIAL PANEL OPERATION

In case of flight instrument failure, especially the attitude indicators and heading indicator, do not use airbrakes during descent and use minimum angles of bank in all turns (1 1/2° per second maximum rate). Make descent under radar control if possible and maintain .75 Mach or 240 knots IAS, whichever is slower, but not less than 220 knots IAS. Plan a long straight-in approach, keeping turns to a minimum.



Ice and Rain

ICING

The aircraft is provided with equipment which will prevent ice formation in and around the critical areas of each engine, nacelle, alternator, forward air conditioning ram airscoop, and the Q-spring ram air inlet. In addition, anti-icing heat is provided for the pitot heads, pitot mast fairings, pilots' windshield and windows, and the gunner's windows. If rain repellent has been applied to the windshield, do not use windshield wipers unless necessary.

WARNING

- Ice formation in the Q-spring system is possible during some flight conditions even with the anti-icing system on. This may constitute a hazardous flight condition due to loss of Q-spring pressure. An additional tension spring in the elevator system will provide partial artificial feel. For additional information, see "Q-Spring" under "Flight Control System Components," Section VI.
- Caution must be observed to avoid areas of known or suspected icing conditions when flying with complete a-c power failure since no pitot anti-icing is available.

TAXIING

Following heavy rain, large amounts of water may be observed coming from the alternator air inlets during taxiing and takeoff.

On ice-covered taxiways and runways and on painted areas that are moisture covered, taxi with extreme caution. High crosswinds or excessive speed during turns may start a skid. Also, be alert for extreme slipperiness at the approach end of snow-covered runways. The intense heat produced by jet engine blasts may form ice due to melting and refreezing.

FLIGHT OPERATION

CAUTION

There is a possibility of engine damage occurring when the engine is operated during freezing rain. No part of the system has sufficient capacity to anti-ice during extended operation in a freezing rain.

NOTE

- The engine and nacelle anti-icing system should be turned ON 5 minutes before suspected icing conditions are encountered. All engines should show a noticeable EPR drop at time of switch actuation to indicate a properly operating system.
- If anti-icing is required, refer to the Appendix for range degradation.

Takeoff

WARNING

- Takeoffs should not be attempted when runway is covered by water and/or slush in excess of 0.3 inch depth. If an abort is attempted under such conditions, hydroplaning, which will cause severe control and braking losses, may occur at higher ground roll speeds even though a low RCR reading has not been reported.
- If aborted takoff considerations are to be disregarded, takeoff should not be attempted if the depth of the water or slush on the runway exceeds 0.4 inch because of extreme performance loss.

If icing conditions are anticipated during or immediately after takeoff, place starter switches to START and anti-icing switches to ON before advancing throttles to takeoff thrust. This is to prevent engine surge and flameout. If anti-icing is turned on at high power settings (above NRT), do not turn starter switches OFF until rpm and EPR have stabilized.

Climb

If icing conditions are known to exist within the climb flight path, the anti-icing switches should be turned to ON position prior to the time the icing conditions are encountered since less heat is required to keep the ice from forming than for removal once ice has formed. If sudden icing conditions or freezing rains are encountered, anti-icing switches should be turned ON at the first sign of icing. Ice collected during climb will reduce the rate of climb and range. If excessive ice formations remain on the aircraft after climbing through an icing layer, flexing of the wings at normal climb speed may be beneficial in removing the larger formations.

Cruise

Icing conditions at cruise altitude will be rare, with the area and vertical extent of these conditions being generally small. Normally these areas may be avoided by slight changes in course or altitude. Icing of the vortex generators will not create a hazardous flight condition.

Descent

If forecasted or suspected icing conditions exist within the descent flight path, anti-icing switches should be turned to ON 5 minutes prior to the time icing conditions are encountered since less heat is required to keep ice from forming than for removal once ice has formed. When the engine and nacelle anti-icing switch is turned on, check for an appreciable RPR drop on all engines.

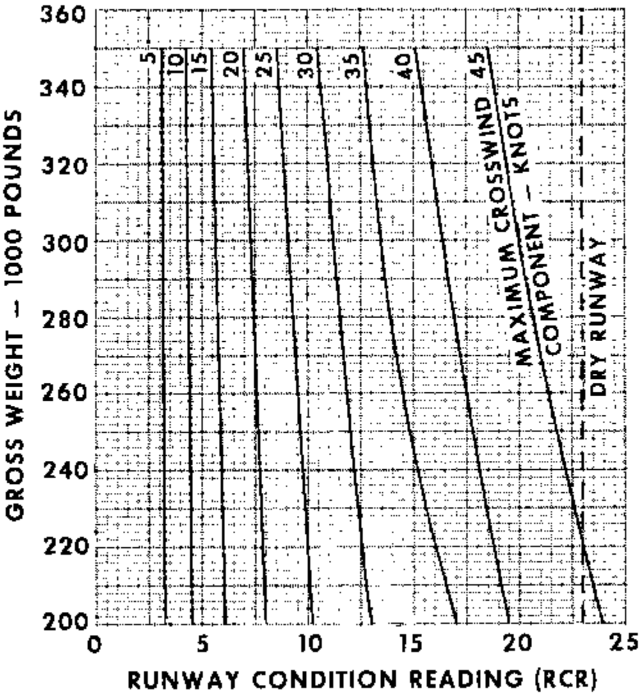
CAUTION

No EPR drop noted on one or more engines upon actuating the engine and nacelle anti-icing control switch would indicate possible malfunction of the anti-icing system and known or suspected icing conditions should be avoided.

For descent through or into known or suspected icing conditions, turn the engine and nacelle anti-icing system on and make the descent as rapidly as practical, using gear down and airbrakes position 6. No minimum EPR is held during the descent so that anti-icing is not insured during this time. This is the most practical procedure since a rapid descent to pattern altitude will minimize exposure to icing conditions. Once the pattern altitude is reached and flaps extended the minimum EPR to insure anti-ice can readily be held. See "Approach and Landing," this section.

CAUTION

- Ignition should be turned ON during descent. Leave ignition ON until sufficient power for anti-ice heat has been reestablished and stable engine operation obtained.
- With the gear extended during descent, it is possible for ice to build up on the landing gear and landing gear doors. This could result in damage to the doors if the gear was retracted.



CONDITIONS:

- FLAPS DOWN
- AIRBRAKE POSITION 6 IMMEDIATELY AFTER TOUCHDOWN
- WITH OR WITHOUT DRAG CHUTE

REMARKS:

Use average heading of a variable wind and one-third gust value to compute crosswind component. The crosswind landing gear position chart may be used for the computation.

MAXIMUM ALLOWABLE CROSSWIND COMPONENT

Figure 9-5.

NOTE

The landing lights generate sufficient heat to remove, within a few minutes, any ice which may accumulate on them while the wheels are down during descent.

Approach and Landing

WARNING

Care should be exercised when landing on a runway covered by water and/or slush. Under such conditions, hydroplaning, which will cause severe control and braking losses, may occur even though a low RCR reading has not been reported.

Ice formations on the aircraft will increase the stalling speed and, consequently, the final approach speed should be increased above normal. The amount of increase required depends upon the thickness and shape of the ice formations on the wings and empennage of the aircraft. For ice formations less than 1 inch in thickness, increase final approach speed 5 knots IAS. Increase speed 10 knots IAS for 1 to 2 inches and 15 knots IAS for more than 2 inches. Except for increased speed on final approach, use normal approach and landing procedures. When making an approach under known or suspected icing conditions, the minimum EPR given in the following table must be maintained to insure adequate anti-icing for the engines and nacelles. Under most conditions normal approach configuration (flaps and gear down, airbrakes position 4) will be sufficient to maintain these EPR's. However, if necessary, the airbrakes may be further extended.

ALTITUDE	MINIMUM EPR
Sea Level	1.60
5,000 Feet	1.60
10,000 Feet	1.70

When landing under possible inlet icing conditions, ignition should be ON prior to final power reduction. Turn ignition OFF as soon as possible after landing to keep operating time to a minimum.

Anti-Icing System Inoperative

In cases of engine and nacelle anti-icing system malfunction wherein ice formations are observed on the engine cowl lips, engine struts, and oil coolers, insure that ignition is ON and idle the respective engines if operating conditions permit before the ice is ingested. There is considerably less possibility of damage at low engine rpm. After the ice has been ingested, check idle engine operation and, if normal, increase power.

Landing with Crosswind on Slippery Runways

When landing with a strong crosswind and a low RCR, directional control may be lost which could allow the aircraft to skid sideways off the downwind side of the runway. This loss of directional control will occur at low speeds where the aerodynamic controls will have lost their effectiveness and the steering forces are small because of the slippery runway. Figure 9-5 shows the maximum crosswind component which will allow a safe landing under a given weight and RCR conditions. In order to accomplish a safe landing when the crosswind component is near the maximum, it is imperative that the crosswind gear be left at the landing setting during rollout and not centered until ready to turn off the runway. If these conditions exist, the following is recommended:

1. Landing should not be attempted if the stopping distance is critical since the drag chute may have to be jettisoned and braking stopped during the

ground run to maintain directional control. Compute and set in the crosswind crab in the normal manner noting the crosswind component for use in determining if safe conditions exist from figure 9-5.

2. Anticipate that the aircraft will have a tendency to skid downwind at slow speeds. Therefore, in the early part of the roll, take advantage of any desirable runway position that might be attainable at that time. Retain the drag chute as long as possible but, if difficulty is encountered in maintaining directional control, the drag chute should be jettisoned.

3. After touchdown, use normal procedures for applying the brakes and deploying the drag chute. Use normal steering techniques in the first part of the ground roll. Do not center the gear. As the aircraft slows, the nose will tend to rotate into the wind and more and more rudder will be required to maintain track down the runway. At speeds below approximately 60 knots, nearly full rudder may be required. Keep the wings level by using lateral control until difficulty is encountered in maintaining track down the runway, then center the control wheel. Failure to center the control wheel will allow an asymmetric spoiler condition which will cause an unfavorable turning force at low speeds.

NOTE

- As the aircraft slows on the runway, the relative wind comes more and more directly from the side. Because of the large side area of the fuselage and fin, a large force is generated at low speed which tends to force the aircraft sideways off the downwind side of the runway. Normally, this side force is opposed by the friction of the tires on the runway and the aerodynamic controls. However, when the runway is slick, the tire force is not sufficient to maintain steering control. Therefore, use of the crosswind crab system will relieve some of this side force by turning the nose of the aircraft into the wind which will give less exposed side area.
- Most aircraft which slip off the runway under crosswind conditions do so between speeds of approximately 10 to 30 knots. Therefore, do not relax steering or center the crosswind crab until after the aircraft is ready to turn off the runway.

HYDROPLANING

When a tire hydroplanes during the aircraft ground roll it is either partially or totally supported by a thin layer of water and/or slush covering the runway. If hydroplaning occurs, the pilot may have difficulty stopping the aircraft or controlling it directionally unless adequate precautions are taken against: 1) dynamic hydroplaning, 2) viscous hydroplaning and 3) reverted rubber skidding.

DYNAMIC HYDROPLANING

Dynamic hydroplaning can occur during takeoff or stopping whenever water or slush stands on the runway. It is caused by the buildup of hydrodynamic pressure between the tire and the runway. When this water pressure builds up to the tire inflation pressure, the tire is deflected, forming a wedge of water which initiates the partial hydroplaning condition. For a takeoff roll condition the tire "footprint" dry area decreases at a faster rate during partial hydroplaning than would normally occur during a dry runway takeoff. When total hydroplaning speed is reached the tire to runway dry footprint area reduces to zero. The tire is then supported above the runway and rolls (with perhaps some spin-down) on a thin film of water or slush until the aircraft reaches its takeoff (S_2) speed. With the exception of a hysteresis effect (delay) on total hydroplaning speed, these same hydroplaning conditions occur in reverse order for landing or aborted takeoff. The reduction in normal dry footprint area can present problems in braking and directional control of the aircraft. These takeoff and landing problems can be compounded if there is a significant crosswind or tailwind. There are many factors which influence or contribute to the hydroplaning condition of an aircraft tire, and it is difficult to determine which factors and the extent of each that exist for a given time and location.

1. Velocity of aircraft. Since the rate of buildup of hydrodynamic pressure ahead of the tire is proportional to the square of the aircraft ground speed, onset of partial hydroplaning for some conditions can occur at a relatively low indicated airspeed during the ground roll.
2. Tire inflation pressure. Partial and total dynamic hydroplaning speeds are proportional to the square root of tire inflation pressure which is a linear function of takeoff gross weight. Therefore the tires should be properly inflated in order to keep the hydroplaning speeds as high as possible.
3. Depth of water or slush. Depths of about .1 inch or greater on non-grooved runways will cause dynamic hydroplaning at predicted indicated airspeeds if the depth is equal to or greater than the average tire tread groove depth. Although .1 inch depth is approximately the minimum for dynamic hydroplaning, other types of hydroplaning exist at shallower depths or on a damp runway surface.
4. Slush. Hydroplaning speeds in slush are approximately 8% higher than on water.
5. Tire tread groove depth. Tests show that for tire tread groove depths which are less than the water/slush depth covering the runway, the tread pattern and wear have no effect on total dynamic hydroplaning speed, but if 50% or more of the tread depth remains, the braking coefficient of friction is increased in the partial hydroplaning region. If the average groove depth is greater than the water/slush depth, hydroplaning will be delayed to higher speeds since the water or slush will be allowed to escape from the tire footprint, relieving hydrodynamic pressure.
6. Runway surface texture. Open textured or coarse runway surfaces tend to relieve hydrodynamic pressures and delay slightly the onset of hydroplaning. Recent tests show that grooved runways (perpendicular to the runway centerline) have a very pronounced effect on hydroplaning, and may prevent it in some cases.
7. Tire geometry and design. Rib tread tires with circumferential grooves of optimum width are best for the relief of hydrodynamic pressure during the ground roll. Also for a given tire diameter, wider tires hydroplane earlier than the narrow ones.
8. Aft gear tracking. When there is no crosswind during the takeoff or landing roll, the aft gear will track the forward gear and will usually be exposed to a much shallower depth of water or slush. Depending on the average depth of the tread, the aft gear tires may not hydroplane at all.

VISCOUS HYDROPLANING

Viscous hydroplaning (or thin film lubrication) is potentially as much of a problem as dynamic hydroplaning. It can occur at lower indicated airspeeds than dynamic hydroplaning on damp runway surfaces that are wet but without standing water. It is caused by the formation of a viscous film between the tire and the runway surface which prevents traction, especially when both surfaces are smooth. The more significant factors which influence this type of hydroplaning are as follows, although the magnitude of their effects are difficult to estimate:

1. Viscosity of water contaminants. The more contaminated the water film with viscous foreign materials such as oil, dust, etc., the higher the viscosity of the mixture and the greater the chance for hydroplaning. Conditions such as this result from a light rain shower following an extended dry period. The lubricating properties of these viscous contaminants adversely affect the braking friction coefficient.
2. Runway surface texture. Coarseness of the runway surface is a very important factor in the prevention of viscous hydroplaning since the depth of the film of fluid coating the runway is quite small and therefore only requires small openings in the surface to break up this film.

3. Tire tread design and wear. Viscous hydroplaning can be prevented on a coarse runway surface by proper tire tread grooving. Wet braking friction coefficients are higher on a grooved tire than on a smooth, badly worn tire.

REVERTED RUBBER SKIDDING

In addition to the problem of hydroplaning when decelerating on wet runway surfaces, there also exists the possibility of reverted rubber skidding. If the wheel brake antiskid system is turned off, or if it malfunctions and the brakes lock, elevated tire footprint temperatures soon cause the rubber tread to revert to its uncured state. This may also happen momentarily at landing touchdown, prior to wheel spin-up. If the temperatures are high enough, superheated steam may be generated and trapped in the forward part of the footprint, raising that portion off the runway similar to dynamic hydroplaning. Since the outer portion of the tread near the carcass sidewall is much softer than normal, due to its reverted rubber condition, it may prevent runway surface roughness from penetrating the film of water, thereby causing viscous hydroplaning. If this occurs, a seal is created which traps the water/steam mixture. This type of hydroplaning results in near zero braking friction coefficients and has been known to continue almost to the point of zero ground speed. The characteristic white skid marks associated with reverted rubber skidding are the resust of a "steam cleaning" effect caused by the high temperature and velocity of the trapped water/steam mixture. Runway surface texture has little effect on the alleviation of reverted rubber skidding, although tests indicate that transverse grooving will raise the braking coefficient considerably.

SUMMARY OF HYDROPLANING FACTORS

As discussed under "Hydroplaning," hydroplaning is a phenomenon with many variables. However, certain factors should be considered in order to properly plan for takeoff or landing under hydroplaning conditions.

1. An approximate speed at which dynamic hydroplaning occurs can be determined by reference to figure 9-5A. Smooth tires or tires with very little tread remaining will result in hydroplaning with less water depth on the runway.
2. Antiskid operation will provide the maximum effective braking during an aborted takeoff or landing roll. Therefore, antiskid should remain on unless a known loss of brakes or failure of the antiskid system has occurred.
3. Areas of rubber deposits on the runway will have a detrimental effect on braking action. Therefore, reduce speed as much as possible prior to entering these areas.
4. Minimum landing run technique should be used to reduce the flare distance and allow more runway remaining after touchdown. (See Section II for discussion.)
5. Tires should be properly inflated for the operating gross weight at takeoff. If the tire pressures are low, hydroplaning will occur at a lower speed.
6. In total dynamic hydroplaning conditions, landing gear steering and wheel braking are ineffective. Therefore, it is important that the ground track at touchdown be properly aligned with the runway. As speed is reduced, viscous hydroplaning may occur. Under this condition, simultaneous steering and braking may result in neither being effective. It may be more advantageous to avoid simultaneous steering and braking.
7. The advantages of delayed landing or proceeding to an alternate should be considered when dynamic hydroplaning conditions exist.

EXAMPLE 1:

GIVEN:

Gross weight = 450,000 lb

Runway wind component = 10 knot headwind

Runway pressure altitude = 2000 ft

Runway temperature = 60°F

FIND:

Total and partial hydroplaning speeds for takeoff.

SOLUTION:

Total hydroplaning speed is 127 knots IAS, and the partial hydroplaning speed is 96 knots IAS.

EXAMPLE 2:

GIVEN:

Gross weight = 450,000 lb

Runway wind component = 10 knot headwind

Runway pressure altitude = 2000 ft

Runway temperature = 60°F

FIND:

Total and partial hydroplaning speeds for an aborted takeoff.

SOLUTION:

Total hydroplaning speed is 115 knots IAS, and the partial hydroplaning speed is 96 knots IAS.

EXAMPLE 3:

GIVEN:

Takeoff gross weight = 450,000 (gross weight entry is based on takeoff tire pressure)

Landing gross weight = 270,000 lb

Runway wind component = 10 knot headwind

Runway pressure altitude = 2000 ft

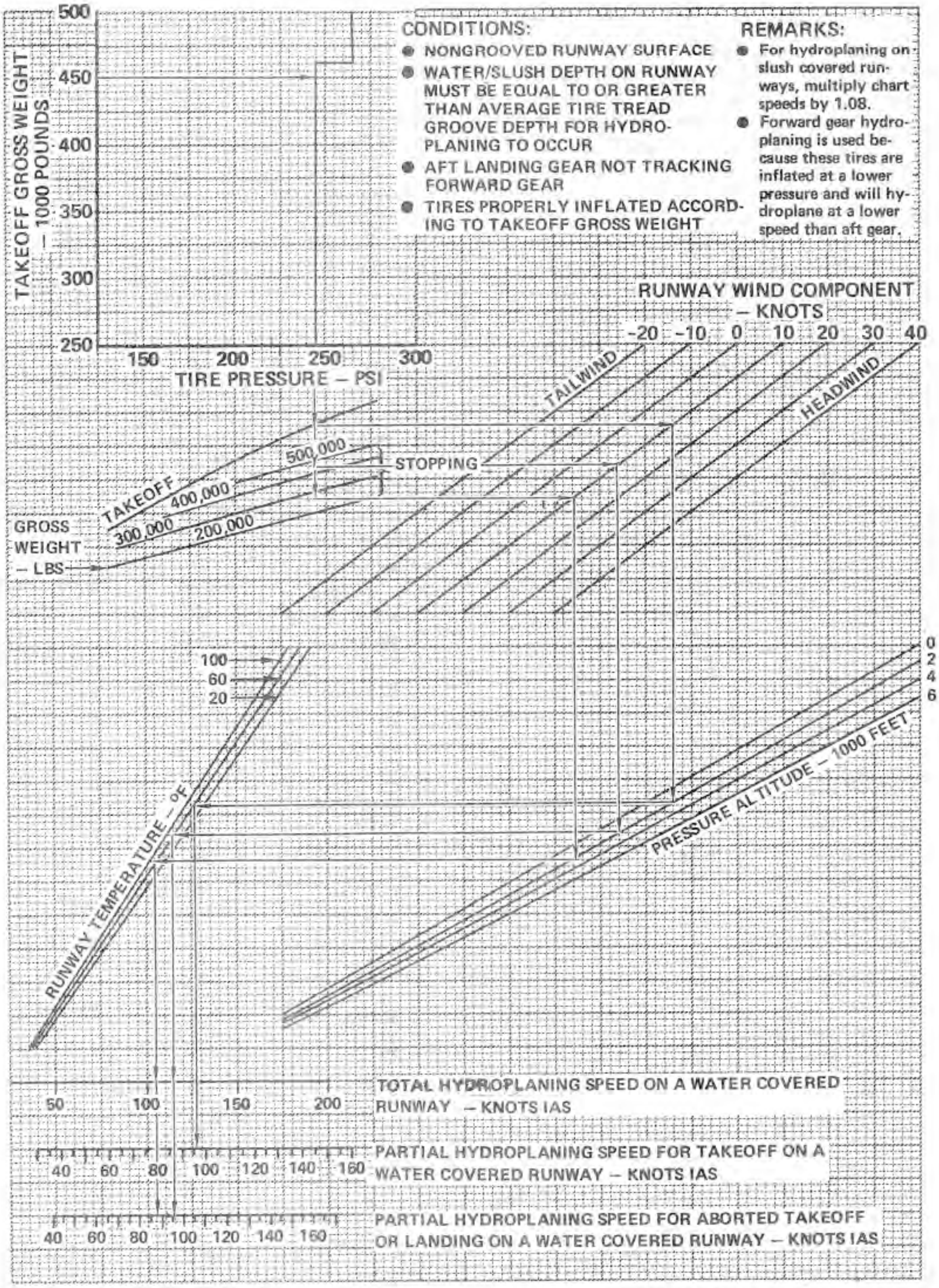
Runway temperature = 60°F

FIND:

Total and partial hydroplaning speeds for landing.

SOLUTION:

Total hydroplaning speed is 105 knots IAS, and partial hydroplaning speed is 88 knots IAS.



CONDITIONS:

- NONGROOVED RUNWAY SURFACE
- WATER/SLUSH DEPTH ON RUNWAY MUST BE EQUAL TO OR GREATER THAN AVERAGE TIRE TREAD GROOVE DEPTH FOR HYDROPLANING TO OCCUR
- AFT LANDING GEAR NOT TRACKING FORWARD GEAR
- TIRES PROPERLY INFLATED ACCORDING TO TAKEOFF GROSS WEIGHT

REMARKS:

- For hydroplaning on slush covered runways, multiply chart speeds by 1.08.
- Forward gear hydroplaning is used because these tires are inflated at a lower pressure and will hydroplane at a lower speed than aft gear.

DYNAMIC HYDROPLANING SPEEDS

Figure 9-5A.

Turbulence and Thunderstorms

The swept wing on this aircraft is thin and therefore naturally flexible. It will withstand a movement arc at the tip of 31 feet before collapsing. This means a smoother and safer ride under turbulent conditions as the wing tends to absorb much of the shock.

NOTE

- During turbulent flight conditions, liquid oxygen sloshes inside the converter, cooling the gas and allowing part of it to return to the liquid state, resulting in a lowered gas pressure. Lowering of the gas pressure is not detrimental to crew consumption as long as pressure remains above 150 psi
- Negative "g" loading during turbulence could cause temporary loss of quantity indication. Stabilization of flight conditions should result in reasonably rapid stabilization of the oxygen pressure and quantity indications.

MOUNTAIN WAVE TURBULENCE

Turbulence created by mountain wave activity occurs when a strong wind blows from a direction nearly perpendicular to a large mountain range. The air is forced up and over the mountain range and a series of standing waves is formed in the flow downstream of the range (figure 9-6). The mountain wave effect extends up above the range and, if well developed, will extend up into the stratosphere. The wave is created when the air is deflected upward by the mountain and the air, having some degree of stability, tends to return to its original level. Due to its momentum, it will overshoot and an oscillatory motion will be set up in the lee of the mountain range. Isolated peaks will not produce as strong an effect as a ridge or range of mountains extending across the wind and the higher the mountain range and the stronger the wind, the more pronounced the wave will be. A reversal in wind direction on the ground occurs in the lee of the mountain range because of the presence of a rotor. The name "rotor" is derived from the rotating appearance of clouds of dust that may be visible in the area. Mountain waves are sometimes accompanied by unique cloud formations which serve as a warning of turbulent and possible hazardous flying conditions. The level of turbulence associated with mountain waves can be as strong as that found in thunderstorms but the entire region influenced by the wave may not be turbulent. The bulk of the wave may consist of a smooth flow of air with strong vertical components while certain parts will break down into true turbulence. Maximum turbulent areas during mountain wave activity occur just downwind and below the ridge line, from the top of the range upward for several thousand feet, and at the tropopause. Turbulence created by the mountain wave may extend leeward as much as 300 miles.

TURBULENT AIR PENETRATION

The following restrictions and operating procedures are necessary to avoid severe turbulence and reduce the effects of turbulent air:

1. Do not intentionally fly into areas at altitudes of known or forecast severe turbulence.
2. Thunderstorm cells must be avoided and operation in thunderstorm areas is prohibited unless the aircraft is equipped with a serviceable radar system which will permit the crew to identify and avoid the cells. If thunderstorm activity cannot be avoided, the following procedures are recommended prior to entering the storm:
    a. Use a penetration altitude of at least 5000 feet below maximum range altitude for better control of the aircraft and establish turbulent air penetration speed.
    b. Turn on the engine and nacelle anti-icing system.
    c. Energize engine ignition systems by placing starter switches to the START position for the operative engines.
    d. Thunderstorm lights may be used to lessen the blinding effect of lightning flashes.
3. Corrective action to be taken if turbulence greater than forecast is encountered will be preplanned with the assistance of the weather forecaster during the weather briefing for all flights. For further information on corrective action, see step "6."

CAUTION

- Turbulent air penetration speed is 270 KIAS or .77 Mach, whichever is less.
- When in turbulence at any altitude, extreme care should be exercised to assure that all control and thrust inputs are applied in a smooth positive manner, avoiding abrupt application of thrust and flight controls whenever possible. Uncoordinated control inputs and applied corrections out of phase with the inherent aircraft stability reactions will aggravate and increase yaw deviations and Dutch roll. Such out-of-phase inputs can induce large structural loads on the aircraft empennage and must be avoided.
- If the aircraft has been trimmed for the turbulent air penetration speed, disregard momentary airspeed changes and do not change the stabilizer trim setting.

NOTE

- The autopilot in nonsteering modes will repeatedly disengage in turbulence and should not be used in turbulence at low altitudes. The autopilot will not disengage in turbulent conditions when operated in low level mode and will assist in relieving the effect of gust loads on the aircraft.
- The electromechanical yaw damper will assist in relieving the effect of gust loads and should be left on at all times.
- Bank angles in excess of 15° should be avoided.
- Allow the aircraft to ride out gust strikes.

4. At altitudes other than low level, if turbulence is encountered observe the MA-1 accelerometer readings immediately. If the readings exceed 1.4 or 0.6 "g" (1.0 (±0.4) "g"), disengage autopilot to prevent an inadvertent disconnect in an unusual attitude and to allow the pilot to assess the degree of turbulence. If the readings reach 1.6 or 0.4 "g" (1.0 (±0.6) "g") more than twice per minute, adjust speed immediately to the appropriate turbulent air penetration speed and place airbrakes in position 2. (See "Dutch Roll Damping," this section.)

WARNING

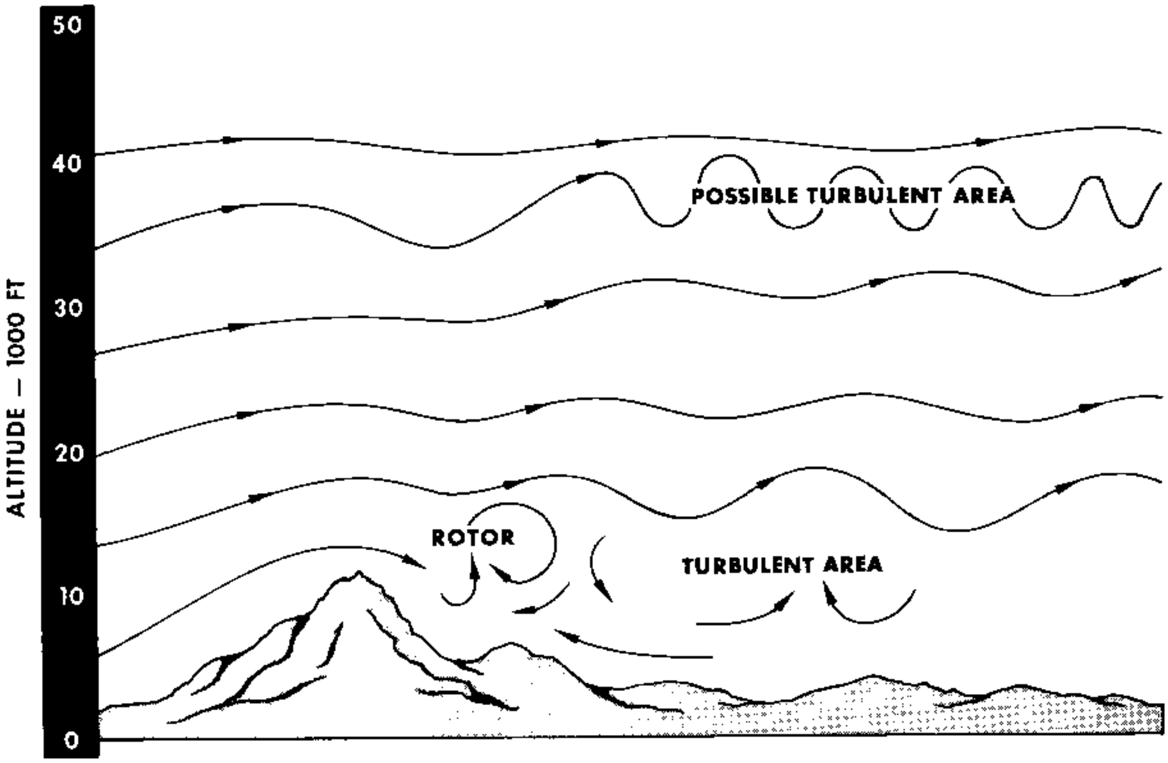
Never climb above maximum range cruise altitude to clear the turbulence.

5. During TA contour operations, flights are prohibited in mountainous areas if peaks extend more than 1000 feet above the terrain within 5 miles either side of the low level corridor when reported or observed flight level winds are 40 knots or greater. All low level operations, either TA or highest terrain clearance, are prohibited when moderate or severe turbulence in mountain wave activity is reported or forecast.

NOTE

- Prior to descending for any low level operation, the latest forecast or inflight reports regarding winds or mountain wave activity along the intended low level route will be obtained from the Air Traffic Control facility or the nearest Pilot to Forecaster service.
- See Section VI for "Low Altitude Flight Characteristics."

Doppler radar will be used to measure flight level winds. If doppler is not fitted or is inoperable, alternate wind finding methods will be used. If



MOUNTAIN WAVE TURBULENCE

Figure 9-6.

turbulence is encountered, observe the MA-1 accelerometer readings immediately. If the magnitude and frequency of the readings reach 1.6 or 0.4 "g" (1.0 (±0.6) "g") more than twice per minute, adjust speed immediately to the appropriate turbulent air penetration speed. If autopilot low level mode is not available, place airbrakes in position 2.

6. When operating at turbulent air penetration speed and the MA-1 accelerometer readings reach 1.6 or 0.4 "g" (1.0 (±0.6) "g") more than twice per minute, preplanned corrective action must be initiated. Corrective action will be as follows:

a. During low level training (highest terrain clearance or contour operations), start a gradual climb not to exceed 1000 feet per minute at turbulent air penetration speed. Continue the climb until the turbulence decreases to an allowable level or the altitude becomes too high to be of value for low level training, then resort to alternate training, mission abort, etc, as planned or directed.

b. During operations other than low level, corrective action may include turns, descent, or climb at penetration airspeed to avoid the areas of turbulence. When the turbulence decreases to an allowable level, continue the mission or resort to alternate training as planned or directed.

NOTE

- The incremental acceleration criteria based on MA-1 accelerometer readings are intended for use as a guide to assist in identifying the level of turbulence in which the aircraft should not be operated without severely compromising flight safety. Turbulence having intensity levels below that associated with these criteria may cause incremental accelerations in excess of the values previously noted at frequencies less than twice per minute. These criteria alone will not provide adequate warning in cases where the turbulence intensity increases abruptly from light or moderate to extremely severe.
- At any time in the pilot's judgment, if turbulence is approaching a critical level (horizontal or vertical) regardless of whether limiting accelerometer readings are observed or not, penetration airspeed should be established and preplanned corrective action taken.

7. If turbulence is encountered such that the MA-1 accelerometer readings exceed those charted on figure 5-6, or if, in the pilot's opinion, the aircraft has encountered heavy loads due to turbulence, the pilot will make entry on Form 781 after landing to the effect that turbulence was encountered and will enter the highest and lowest accelerometer readings so that the appropriate structural inspection will be made prior to the next flight.

DUTCH ROLL DAMPING

"Dutch roll" is the name given to a combined rolling, yawing motion, often described as "wallowing." The motion is named for its resemblance to the characteristic rhythm of an ice skater, where the yawing is out of phase with the rolling; e.g., the nose will be yawing to the left while the right wing is still going down. This motion is more pronounced with swept wing aircraft than with straight wing aircraft of similar size because of the larger rolling moments produced by side slip or yaw. Dutch roll is usually generated by disturbances such as gust encounters together with lateral/directional overcontrolling. The frequency of the Dutch roll oscillation in the B-52 will be one complete cycle in 6 to 8 seconds. The amplitude, however, depends on the magnitude of the disturbances, the fuel loading, and the flight condition (angle of attack). Because the cyclic yawing motion of the Dutch roll will add to the loading already imposed on the vertical tail by random turbulence, it is important to minimize the Dutch roll, particularly when flying in turbulence.

The directional damping stability of the aircraft has been increased by means of a mechanical yaw damper and an electromechanical yaw damper. These devices will operate satisfactorily in turbulence unless the magnitude of the turbulence becomes so great that the yaw dampers no longer have sufficient authority to overcome the resulting Dutch roll. In this event, the pilot will have to use manual inputs to assist in damping the Dutch roll. If these manual inputs are not correctly applied, the Dutch roll will be aggravated and the loads on the vertical tail increased. Dutch roll exists because of a combination of rolling and yawing motions which, being out of phase, tend to complement or "feed" each other. Dutch roll cannot exist in the absence of either of these motions. In order to stop Dutch roll, at least one of these motions must be controlled. Rudder control can be used to damp Dutch roll, but this action requires close observance of the turn rate needle since it can and does become erratic in turbulence. Because the yawing motion is out of phase with, and of considerably lower amplitude than the rolling motion, it is considered most effective to apply corrective action with lateral control.

In the application of lateral control corrections, the pilot's natural inclination will be to correct for displacement rather than rate; i.e., he will apply control inputs to raise the low wing rather than to stop the rolling motion. Continued lateral control inputs in this manner can cause the Dutch roll to diverge (increase in amplitude). The pilot will actually be "feeding" the Dutch roll rather than damping it. The lateral control inputs must therefore be applied in opposition to the rolling motion. In the turbulence-induced Dutch roll situation, the mechanical yaw damper and the electromechanical yaw damper are still attempting to stabilize the aircraft about the yaw axis but are prevented from being fully effective by the magnitude of the turbulence upsets. The pilot, by applying lateral control deflections in opposition to the direction of the rolling motion, reduces the magnitude of the Dutch roll sufficiently to allow the yaw damper to regain control of the yawing motion. Thereafter, continued lateral control inputs as necessary to oppose any tendency to roll away from a wings-level attitude should prevent regeneration of the Dutch roll. Extending the airbrakes will increase the Dutch roll stability and therefore decrease the vertical tail loads. For low altitude airbrake usage, see "Turbulent Air Penetration," this section. The maximum recommended position is airbrake position 2. Although some spoiler buffet will be experienced in airbrake position 2, this is not considered detrimental. Airbrake positions greater than 2 are not recommended because of the associated pitch trim change and the possibility of an unfavorable gust encounter while the aircraft is in a mistrimmed condition. Extension of airbrakes to position 2 should be accomplished cautiously in turbulence, making every effort to maintain zero mistrim throughout the procedure to minimize loading. The transient mistrim incurred during airbrake extension is justified by the considerably more stable configuration which results. Based on the foregoing discussion, the following technique for manually damping Dutch roll is recommended:

1. Apply lateral control as necessary in opposition to the direction of the rolling motion.
2. Continue lateral control inputs in small pulses to maintain wings-level attitude.
3. When moderate or greater turbulence is encountered, raise airbrakes to position 2 except when in autopilot low level mode.

NOTE

> Extend airbrakes cautiously and maintain as near to zero mistrim as possible during extension.

MULTIPLE ENGINE FLAMEOUT

Flight through cumulus clouds or areas of severe turbulence at 40,000 feet or above may result in multiple engine flameout. (See "Engine Operation," Section VII.) To reduce the possibility of flameout under these conditions, the following procedures are recommended:

1. Turn on the engine and nacelle anti-icing system as soon as possible prior to weather penetration. (The system is not fully effective unless used before ice buildup occurs.)
2. Energize all engine ignition systems by checking the starter selector switch in FLIGHT START and moving all starter switches to START. Energizing the ignition systems will aid in preventing a stalled or surging engine from flaming out. Under these circumstances, continuous use of the ignition system for a period of time not in excess of that given in Section V under "Ignition System Limitations" is permissible.

CAUTION

During flight through severe turbulence at altitudes of 40,000 feet and above, monitor EGT and EPR for possible increase above operating limits. If limits are exceeded, reduce power. Lose altitude in order to maintain adequate airspeed for optimum engine inlet airflow.

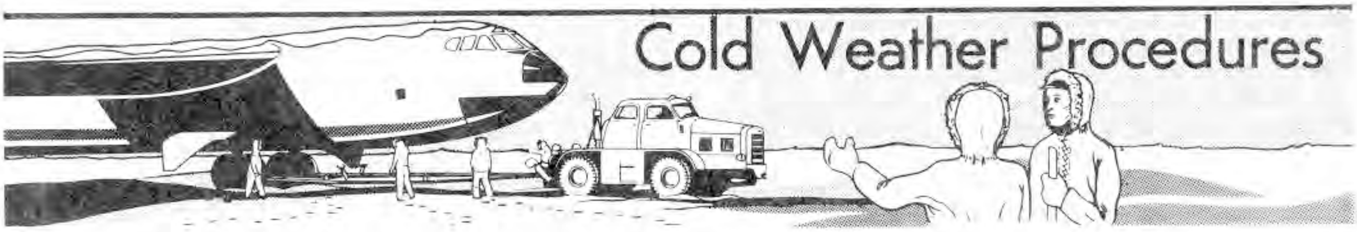
3. If multiple engine flameout occurs, retard the affected engine throttles to OFF, reduce altitude, and employ normal engine restart procedures. (See "Engine Failure," Section III.)

NOTE

During descent and restart procedure, maintain the highest practicable airspeed permitted by flight conditions and airspeed limitations in order to regain normal engine inlet airflow.

ENGINE COMPRESSOR STALL

Compressor stall may occur when flying in or around thunderheads due to ice crystal ingestion. At high altitudes, the weight of airflow into the engine is low so the water/air ratio for water injection may be exceeded as the ice crystals melt, causing compressor stall in extreme cases. Normal compressor stall procedures as described in Section VII under "Engine Operation" should be employed to counter this condition.



Cold Weather Procedures

NOTE

Only those cold weather operating procedures not common to all large jet aircraft are included here. Icing conditions during flight are covered under "Ice and Rain," this section.

Many cold weather operating difficulties can be eliminated by proper caution during ground operation. Extreme diligence on the part of both flight and ground crews is essential to successful cold weather operation. If preheating is required, arrange preheating periods so that all aircraft equipment will be inspected, warmed, ready, and operating at the time of starting the engines. While preheating is being accomplished, inspections and operational checks can be made. This work must be thorough since low temperatures may cause hidden difficulties. Avoid touching cold metal with bare skin; it may freeze to the metal.

GROUND

BEFORE ENTERING THE AIRCRAFT

Snow removal should be completed prior to beginning the preheating operation since running water from melted snow will seek hidden places and refreeze. Any personnel on the wings and fuselage should be protected by safety lines to prevent their falling to the ground. All surfaces should be swept with brooms and not beaten or chopped since skin damage may result. Isopropyl alcohol applied with sprayers is effective in removing ice and snow and is particularly valuable in removing ice from between the stabilizer and the fuselage. Snow or ice accumulations can increase takeoff distance and adversely affect climbout performance, stalling speed, and handling characteristics. Inflight structural damage can result from vibrations induced by unremoved accumulations. Preheat the aircraft preferably by placing in a warm hangar or dock at least 6 hours prior to takeoff. If hangar facilities are not available and the aircraft has been severely cold soaked, it will be necessary to preheat the alternators and hydraulic packs to insure their starting. Although not required, it is desirable to preheat the crew compartment during cold weather operations.

CAUTION

Failure to remove snow from the fuselage before applying interior heat will result in ice refreezing on the sides of the fuselage, causing drag and possible erratic airspeed indications if it forms around the pitot heads or static ports.

Ice formed from runoff water has been found in a thin clear sheet over static ports. The air refueling slipway doors are vulnerable to runoff icing as are the static ports for both the forward and aft air conditioning systems. Melting snow from above the aft compartment may refreeze on the junction of fuselage and horizontal stabilizer, thus preventing movement of the stabilizer. Check control surface hinge lines for ice as the primary flight control surfaces, with the exception of the elevators, cannot be moved on the ground by manipulation of the controls in the cabin. These surfaces should be checked for freedom of movement prior to entry into the aircraft. When operating out of a nose dock and snowfall is occuring, open nose dock doors in time to cool the skin of the aircraft before removing it from the dock, as snow will cling to a warm surface and freeze. Flight tests have revealed that takeoff can be made with frost formations up to 1/8 inch thick on the lifting surfaces without appreciably affecting performance.

CAUTION

- If heat is used to remove ice or snow, check that the runback of water does not freeze on the aircraft surfaces. Check control surface hinge lines for ice as the primary flight control surfaces, with the exception of the elevators, cannot be moved on the ground by manipulation of the controls in the cabin. These surfaces should be checked for freedom of movement prior to entry into the aircraft.
- Before removing snow and ice from the empennage of the aircraft, the stabilizer leading edge should be placed in the up position. Start hydraulic packs 9 and 10 and set the stabilizer trim to 8 units aircraft nosedown position. The stabilizer should be retained in this position during deicing and for a period of 10 to 15 minutes after deicing so that runoff from the deicing operation does not seep into the balance bay areas and refreeze. Any ice or slush in the balance bay could possibly limit control surface movement and reduce aircraft control. If the aircraft is to be left unattended or is to be put on alert for extended periods under snow and icing conditions, the stabilizer may be left in this position and will be reset to takeoff trim setting prior to takeoff during the "Before Lineup" checklist.

STARTING ENGINES

Whenever an aircraft is removed from a heated hangar or dock, a ground heater should be available to supply heat to the engine fuel control units, starter valves, and starter turbine if this becomes necessary. If an air supply is available inside the dock or hangar, the engines should be motored for a short period before removing the aircraft. This procedure should remove any moisture from the ducts and starter system.

NOTE

- The indicated oil pressure may be slow to rise to the normal operating range after starting a cold-soaked engine during very cold weather. Provided some indication of oil pressure is observed when the engine is first started, up to 3 1/2 minutes may be allowed for the indicated oil pressure to reach the minimum limit.
- If a starter valve fails to open during engine start, use of the starter switch and hot pressurized air is recommended for thawing of the starter valve. Often the starter valve will open after the starter switch has been energized for 3 minutes and hot pressurized air is being supplied from an adjacent engine or ground cart. The heat created by the energized starter solenoid will penetrate the regulator housing and the hot pneumatic air, through gradual flow, will help heat the valve area thus allowing the valve to open and operate properly.

AFTER STARTING ENGINES

NOTE

If the ambient temperature is -30° C (-22° F) or below, idle the engines for a 2-minute warmup period.

Lubrication pump failures on hydraulic packs can be lessened in cold weather if the pack is idled for approximately 15 minutes during preflight. Operating the pack at low rpm thins the hydraulic fluid which may have congealed in the lubrication pump shaft housing and prevents lubrication pump shaft failures. This idling operation is accomplished on external air by operating five or six hydraulic packs simultaneously as necessary to lower pneumatic duct pressures below 10 psi. Control switches of packs to be idled should be turned to ON position prior to application of external air. This prevents high speed pack operation. When a pack is started on high air pressure, as in normal operation, it accelerates to its normal operating rpm in several seconds. This rapid acceleration of a cold hydraulic pack is the cause of many cold weather pack failures.

NOTE

> Apply external electrical power to the aircraft, position the desired hydraulic pack switches to ON position, disconnect the external electrical power, then position the hydraulic pack switches to OFF position. External air may be applied periodically to the aircraft to preheat the hydraulic packs. If external electrical power is reapplied, all hydraulic pack shutoff valves will close.

Several minutes prior to closing the navigator's entrance hatch, heat should be applied to soften the door seal to insure proper latching.

Alternators are subject to difficult starts during cold weather operation. Preheating of drives prior to starting will aid lubrication, assist regulatory systems and valves to work properly, and improve alternator reliability. Heated air from a ground heater with a maximum gage temperature of 250° F should be directed through the drive cooling air exhaust for approximately 30 minutes. After this is accomplished, if a drive will not rotate with the alternator switch turned to the ON position, if it rotates and is automatically tripped to OFF position, or if the speed oscillates, it is possible that the shutoff and modulating valve actuators are not warm enough to function properly. If this occurs, the drive should be shut down and hot air directed from the ground heater directly on the shutoff and modulating valve actuators for a period of 15 minutes or until the drive starts and operates properly. Under extremely cold operating conditions, the control circuitry on the bottom of the alternator drive may require from 10 to 20 minutes of drive operation before it becomes warm enough to provide normal frequency control.

CAUTION

> No attempt should be made to heat control circuitry with hot air from a ground heater as extreme heat will damage circuitry components.

If an alternator fails to start properly and adequate heat is not available or time does not permit additional ground heating, the modulator valve and pilot piston may be heated by operating the alternator on very low air pressure. If the alternator is operated on very low air pressure, it will not operate fast enough to trip off from overspeed. It will be necessary to remain on ground power during the low air idling procedure. All engines may remain operating. With all possible hydraulic packs, air conditioning packs, and alternators operative, retard the throttles and adjust pneumatic pressure to 10 psi or below. Attempt to start the affected alternator. If no other difficulty exists but a frozen modulator valve or pilot piston, the alternator will rotate slowly. Allow the alternator to operate for 3 to 5 minutes, then increase pneumatic pressure with the throttles. If it runs normally, parallel and proceed.

NOTE

> If a B-52 remains on the ground for an extended period of several days during subfreezing ambient temperatures, and has been in and out of a heated hangar during this period, an ice block due to condensation in the drop tank bleed air line can occur. During missions in which drop tank fuel transfer failure could be extremely critical and the foregoing conditions have occurred, it is recommended that the drop tank transfer system be checked after engines have been started and while the ground crew is still available to verify air bleed from the drop tank exhaust port. See "Fuel Feed and Transfer System Inflight Checklist Procedures for Drop Tanks," Section VII, if inflight check procedures are deemed necessary.

TAXIING

On ice- and snow-covered areas, taxi speed should be reduced and the normal taxi interval between aircraft should be increased. Taxiing in deep snow should be avoided as taxiing and steering are extremely difficult and frozen brakes and gear may result. During low temperatures, a slight delay in brake response can be expected. Care should be taken when maneuvering near other parked aircraft as the jet blast will blow melted snow onto other aircraft where cold metal will freeze it. The wide span of the wing tip protection gear requires close observation during taxiing to prevent damage from snow banks.

WARNING

> In cold weather, make sure all instruments have warmed up sufficiently to insure normal operation. Check for sluggish instruments during taxiing.

CAUTION

- On very slick surfaces, come to a complete stop prior to attempting to turn the aircraft.
- Under no circumstances allow a drop tank to be pushed through or dragged over a snow bank. Dislocation of the tank from the suspension lugs and damage to the tailcone may result, causing unplanned jettisoning of the damaged tank.
- Under certain atmospheric conditions, at temperatures of -30° C (-22° F) and lower, a large amount of ice fog may be caused by the engines. Taxiing on the runway should be kept to a minimum to avoid lowering the visibility.

FLIGHT

TAKEOFF

Water and slush standing on the runway will decrease the acceleration rate and extend the ground run. For effect of water or slush on takeoff performance, refer to Part 2 of the Appendix.

WARNING

- Takeoffs should not be attempted when runway is covered by water and/or slush in excess of 0.3-inch depth. If an abort is attempted under such conditions, hydroplaning, which will cause severe control and braking losses, may occur at higher ground roll speeds even though a low RCR reading has not been reported.
- If aborted takeoff considerations are to be disregarded, takeoff should not be attempted if the depth of the water or slush on the runway exceeds 0.4 inch because of extreme performance loss.

When icy runways exist, move the decision point back 1000 feet from normal and determine the balance of the takeoff data using the shorter decision distance. Refer to Part 2 of the Appendix for additional information.

NOTE

At very low temperature and low pressure altitude, burner pressure limiters on the engines will operate to keep the internal engine pressure from exceeding fixed limits. This operation is very smooth, causing no temporary drops in thrust, and cannot be detected by the crew.

It is recommended that the anti-icing switches be turned to ON position on takeoff when icing conditions prevail, especially if slush or water is on the runway. Under slush and wet runway conditions in winter weather, leave landing gear down approximately 30 seconds after takeoff to allow moisture to be blown from landing gear prior to braking wheels and retraction. If the engine and nacelle anti-icing is to be used during takeoff, refer to Part 2 of the Appendix for performance loss.

WARNING

170▶ W52▶

- Due to engine performance loss, the use of engine, nacelle, and scoops anti-icing during takeoff will reduce EPR settings, increase both takeoff ground roll and minimum runway required by 2.5%, and reduce the initial climb rate. Refer to Parts 2 and 3 of the Appendix for specific effects on performance.

54▶ 169 W1▶ W51

- Due to engine performance loss, the use of engine, nacelle, and scoops (surface) anti-icing during takeoff will reduce EPR settings, increase both takeoff ground roll and minimum runway required by 3.5%, and reduce the initial climb rate. Refer to Parts 2 and 3 of the Appendix for specific effects on performance.

DURING FLIGHT

Range and endurance are both affected favorably by low temperatures. Refer to Parts 5 and 6 of the Appendix for appropriate correction factors. Information regarding inflight icing may be found under "Ice and Rain," this section.

CROSSWIND OPERATION

On takeoffs and landings, set in any crosswind crab component required. Refer to the crosswind landing gear position charts in Parts 2 and 3 of the Appendix.

NOTE

When landing on a slippery runway, do not center the crosswind crab until ready to turn off the runway.

LANDING APPROACH

Long flat unbroken stretches of snow make depth perception difficult. The tendency is to overestimate the aircraft altitude. During snow periods, if approaching at night, visibility will be reduced by using both landing lights.

LANDING

A slippery runway combined with a crosswind may result in a condition such that a landing is not recommended. For further information, see "Landing with Crosswind on Slippery Runways" under "Ice and Rain" in this section. Braking action approaches normal on a slippery runway if all-weather tires are installed. When landing on snow or ice, use normal braking action except when large amounts of crosswind crab are used. Refer to Part 9 of the Appendix for increase in ground run using the proper RCR number.

WARNING

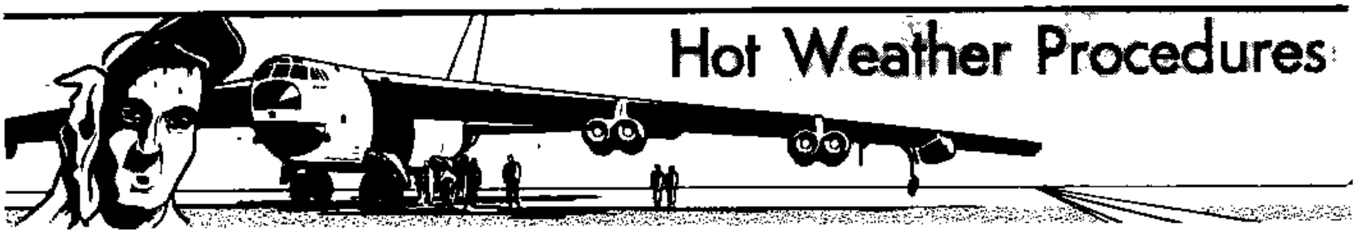
Care should be exercised when landing on a runway covered by water and/or slush in excess of 0.3 inch depth. Under such conditions, hydroplaning, which will cause severe control and braking losses, may occur even though a low RCR reading has not been reported.

AFTER LANDING

STOPPING OF ENGINES

At temperatures of -30° C (-22° F) or below, the engines should be permitted to idle for at least 2 minutes before normal shutdown procedures are accomplished. This will prevent damage resulting from rapid temperature changes.

Hot Weather Procedures



Hot weather operation, both arid and topical, requires additional attention and preparation other than the normal operating instructions given in Section II. Only specific information for care of the aircraft during ground and flight operation will be covered in this section.

GROUND

BEFORE ENTERING THE AIRCRAFT

1. Wear gloves and use care when working around metal surfaces of the aircraft that are exposed to the sun.
2. Delicate electrical equipment such as communications and instruments must be completely dry. In locations where high humidity is encountered, equipment will be subject to malfunctions due to corrosion, fungus, and moisture absorption by nonmetallic materials. Such equipment should be kept warmer than the ambient temperature if possible to prevent condensation of moisture inside the units.
3. Units incorporating plastic or rubber should be protected from excessive temperatures and direct sun rays by the use of suitable covers.
4. Crew compartments will be cooled with a portable air conditioner prior to entering the aircraft.

WARNING

When outside temperature is 80° F or above, the tail compartment must be precooled by a portable air conditioner. This will prevent the excessive heat condition that could cause serious injury to the gunner.

ON ENTERING THE AIRCRAFT

If high humidity has caused instruments and cabin controls to become covered with moisture, dry thoroughly with flow of warm air from portable ground heater.

STARTING ENGINES

Use normal engine starting procedures, keeping ground tests to the minimum required time.

NOTE

> Engines will accelerate to idle rpm on a hot day much more slowly than on a normal or cold day.

TAXIING

Use brakes as little as possible as cooling will be retarded by high temperatures.

FLIGHT

TAKEOFF AND CLIMB

1. Required takeoff distance increases during hot weather operation. See Parts 2 and 3 in the Appendix for takeoff distances.
2. Follow normal climb pattern for conditions prevailing.

NOTE

> The rate of climb should be held as low as practicable to reduce fuel vaporization losses.

LANDING

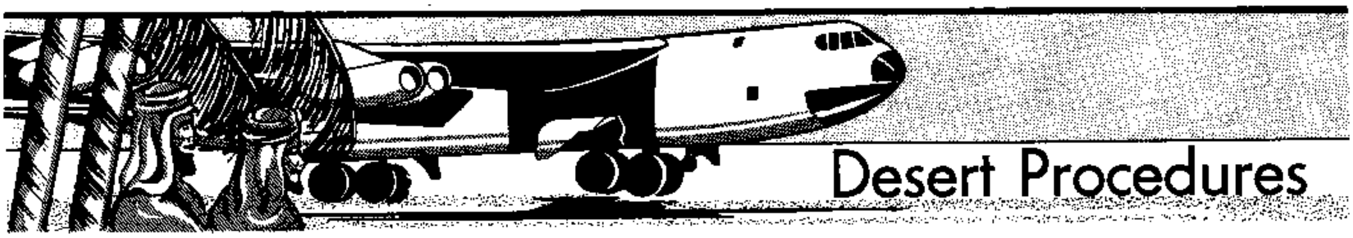
Use normal landing technique but expect a longer ground roll in hot weather. As soon as the parking position has been reached, have wheel chocks securely placed and release parking brakes at once to forestall possible damage to brake discs because of excess heat generated during taxiing.

POST FLIGHT

1. Have closures and covers installed for protection from sun.
2. Leave windows and doors open for ventilation.

NOTE

> If fuel tanks are topped off, overflow from expansion may present a fire hazard.



Desert Procedures

Very high and low temperatures and low humidity, together with the abrasive effect of blowing sand and dust, make desert operation considerably more difficult than normal conditions which are covered by operating instructions in Section II. Considerable damage to both aircraft and engines can occur if the extra precautions covered here are not observed.

GROUND

BEFORE ENTERING THE AIRCRAFT

On exterior inspection, if sand is evident on shock strut pistons or other hydraulic pistons where piston touches cylinder seal, have it removed with a dry soft cloth.

CAUTION

> Position the aircraft so that consideration can be given to other aircraft, personnel, and ground installations when engines are started. Sand blown by operating engines of one aircraft can add hours to the maintenance problems of other aircraft or do bodily harm to personnel.

ON ENTERING THE AIRCRAFT

Excessive dust accumulations on instrument dials and blown sand on and around movable flight controls, dials, and switches must be cleaned away.

STARTING ENGINES

Use normal starting procedures.

CAUTION

Get the aircraft into the air as soon as possible after engines have been started so that dust and blowing sand will not be drawn through the engines with resultant damage to internal parts.

TAXIING

When taxiing, keep adequate distance between aircraft to prevent sand and dust kicked up by engine blast from being blown on and into the aircraft and engines.

BEFORE TAKEOFF

Do not take off during sand or dust storms unless absolutely necessary; instead, head aircraft into wind, stop engines, and have all protective covers and closures installed.

FLIGHT

TAKEOFF

Be prepared for sudden gusts of wind during takeoff run. In arid localities, extreme temperature variations may occur within a relatively short time; therefore, takeoff data should be reviewed immediately prior to takeoff.

DURING FLIGHT

CAUTION

Avoid flying through dust storms if possible; excessive dust and grit in the air will cause considerable damage to internal parts of the engine.

STOPPING ENGINES

Have dust covers and closures installed immediately to prevent blowing sand and dust from entering the engines.

POSTFLIGHT

See that all ducts and openings are covered. Have both forward and aft main landing gear wheel wells, fuselage, nose, pitot tube, and windshield covers installed if such covers are available.

NOTE

In extremely dusty locations where it is necessary to leave hatches or doors open for ventilation, all equipment in the cabin should be covered with dust-proof covers where possible to keep out dust and blowing sand.

NOTE

For Performance Data, refer to T.O. 1B-52B-1-2.

ALPHABETICAL INDEX

*DENOTES ILLUSTRATION

☆ U.S. GOVERNMENT PRINTING OFFICE: 1974— 779-866/276

☆ U. S. GOVERNMENT PRINTING OFFICE: 1973- 779-331/397

★U. S. GOVERNMENT PRINTING OFFICE: 1973--779858/31