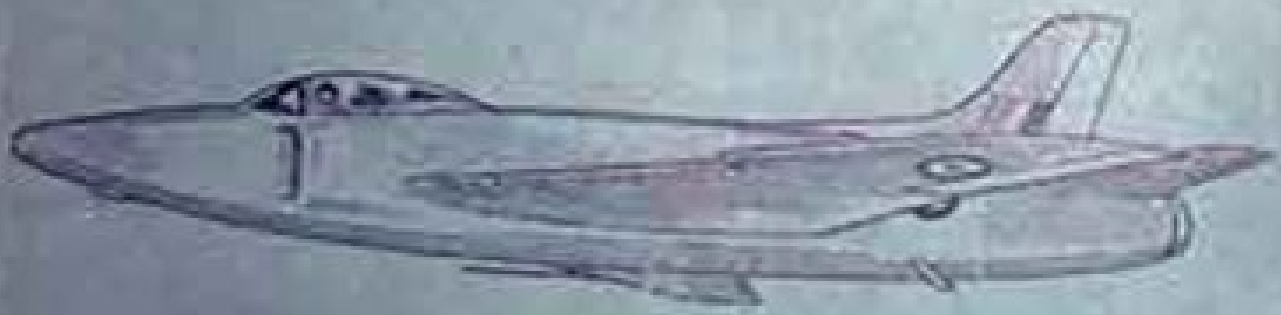
RESTRICTED

A.P.4348E—P.N.

1st Edition
April, 1956

PILOT'S NOTES

SWIFT F.R.5



Prepared by Direction
of the
Minister of Supply

J R C Helme

Promulgated by Order
of the
Air Council

L. J Dean.

RESTRICTED

AIR MINISTRY
January, 1953

Amendment List No. 4
to AP4344E—P.N.
Pilot's Notes

SWIFT F.R.5

NOTE.—1. Incorporation of this Amendment List must be certified by inserting the date of incorporation and initials in the spaces provided on page I of the Notes.

2. When a manuscript amendment is made, the adjacent margin should be endorsed with the AL number viz. "A.L.4".

3. This Amendment List also covers the following Modifications:—

347, 395, 599, Marin Baker 308, 309.

4. When the Amendment List is fully incorporated, affix this sheet to the inside front cover of the Notes.

PAGE	PARA.	AMENDMENT
20	16 (a) (iii)	*Delete* this sub-sub paragraph.
24	17 (c)	*Amend* by gummed slip herewith.
29	20 (b)	*Amend* by gummed slip herewith.
29	21 (a) (b)	*Amend* by gummed slip herewith.
30	22 (b) (ii) line 7	*Amend* "(the starboard)" to read "(the port)".
34	30 (a)	*Amend* by gummed slip herewith.
35	33	*Amend* by gummed slip herewith.
37 & 39	38	*Amend* by two gummed slips herewith.
53	59 (c) (v) line 5	*Delete* "the third successive" and *insert* "a".
56	60. Aileron checks	Above present checks *insert* "Aileron gear set to POWER".
70	76 (b) (iii) 2	*Amend* 2½ miles to read "2 miles".
71	79	*Amend* by gummed slip herewith.
73	80, line 1	*Insert* (a) at the beginning of the para.
73	80 (cont'd.)	*Amend* by gummed slip herewith.
74	82 (a) (ii) (b)	*Amend* by gummed slip herewith.

NOTES TO USERS

These Notes are complimentary to A.P. 129 (6th Edition), Flying and assumes a thorough knowledge of the chapters which are relevant to the operation of this type of aircraft. (see A.M.O. A.293/55.)

Additional copies may be obtained by the station publications officer by application on R.A.F. Form 294A in quadruplicate to Command Headquarters for onward transmission to A.P.F.S. (see A.P.113A). The number of this publication must be quoted in full-A.P. 4348E-P.N.

Comments and suggestions should be forwarded to Officer Commanding, Handling Squadron, R.A.F. Boscombe Down, Wilts.

AMENDMENTS

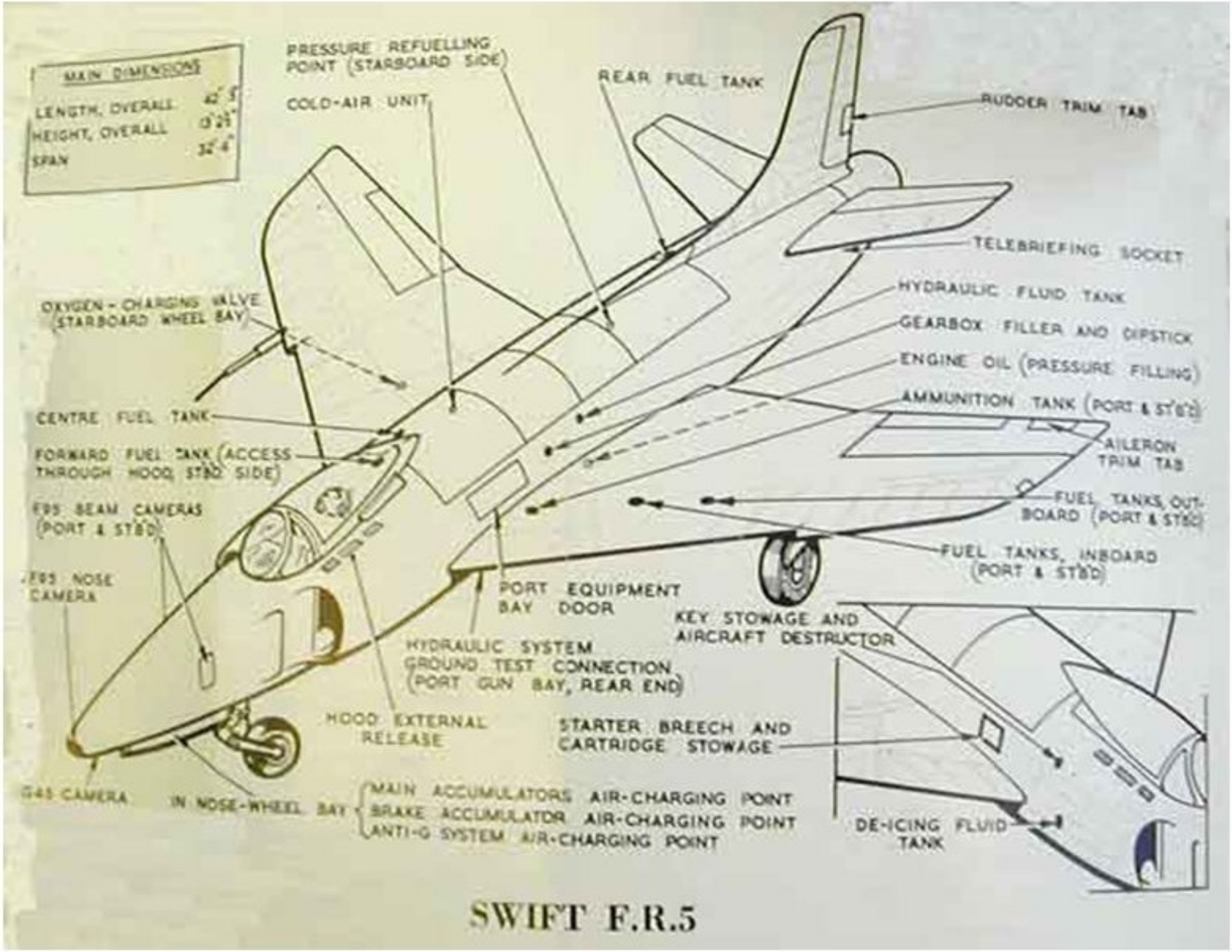
Amendment lists will be issued as necessary and will be gummed for affixing to the inside front cover of these notes. Each amendment list will, where applicable, be accompanied by gummed slips for sticking in the appropriate places in the text.

Incorporation of an amendment list must be certified by inserting date of incorporation and initials below.

A.L. NO.	INITIALS	DATE	A.L. NO.	INITIALS	DATE
1	E.G.S	5/5/57	4	E.S.	3/3/58
2	E.G.S	18/4/57	5		
3	E.G.S	27/5/57	6		

LIST OF ASSOCIATED PUBLICATIONS

	A.P.
Aircraft operation and servicing under low temperature conditions	1441B
Air pump units	1519
Avon Mk. 114 aero engine	4321H & M
Cartridges. miscellaneous	1661F
Cine cameras and accessories	1355D
Ejection seats, R.A.F. aircraft. Mk. 2 series	4288B
Electrical equipment manual	1095 series 4343 series
Fire prevention and fire extinguishing, aircraft	957C
Fuel system components "General" for gas turbine aero engines	4282
Gun firing control mechanisms	1641E
Gun, Aden 30 mm.	1641S
Gyro gun sights	1275E
Hydraulic and undercarriage equipment general information	1803A
Hydraulic and undercarriage equipment Electro-hydraulics	1803F
Hydraulic and undercarriage equipment Vickers	1803N
Instrument manual-general instruments	I275A
Instrument manual-navigation instruments	1275B
Leading particulars of photographic equipment	1355A & C
Pneumatic equipment aircraft	4303 series
Pressurizing and conditioning equipment aircraft	4340 series
Pyrotechnics	1661E
R.A.F. engineering aircraft	1464D
Rotol accessory gearboxes and drives and drives	2240A
Safety equipment manual	1182A, B, C & E
Signal manual	11186 series
Wheels, tyres and brakes, aircraft	2337


MAIN DIMENSIONS
LENGTH, OVERALL 42' 5"
HEIGHT, OVERALL 13' 2½"
SPAN 32' 4"
PRESSURE REFUELLING POINT (STARBOARD SIDE)
COLD-AIR UNIT
REAR FUEL TANK
RUDDER TRIM TAB
TELEBRIEFING SOCKET
HYDRAULIC FLUID TANK
GEARBOX FILLER AND DIPSTICK
ENGINE OIL (PRESSURE FILLING)
AMMUNITION TANK (PORT & STBD)
AILERON TRIM TAB
FUEL TANKS, OUTBOARD (PORT & STBD)
FUEL TANKS, INBOARD (PORT & STBD)
OXYGEN-CHARGING VALVE (STARBOARD WHEEL BAY)
CENTRE FUEL TANK
FORWARD FUEL TANK (ACCESS THROUGH HOOD, STBD. SIDE)
F95 BEAM CAMERAS (PORT & STBD)
F95 NOSE CAMERA
PORT EQUIPMENT BAY DOOR
KEY STOWAGE AND AIRCRAFT DESTRUCTOR
HYDRAULIC SYSTEM GROUND TEST CONNECTION (PORT GUN BAY, REAR END)
HOOD EXTERNAL RELEASE
STARTER BREECH AND CARTRIDGE STOWAGE
G45 CAMERA
IN NOSE-WHEEL BAY
MAIN ACCUMULATORS AIR-CHARGING POINT
BRAKE ACCUMULATOR AIR-CHARGING POINT
ANTI-G SYSTEM AIR-CHARGING POINT
DE-ICING FLUID TANK

SWIFT F.R.5

SWIFT F.R.5

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PART I
DESCRIPTIVE

NOTE.-Throughout this publication the following conventions apply:-

(a) Words in capital letters indicate the actual markings on the controls concerned.

(b) Numbers quoted after items in the text refer to the illustrations in Part VI.

(c) Unless otherwise stated all airspeeds and Mach numbers quoted are "Indicated".

1. Introduction

(a) The Swift F.R.5 is a single-seat, swept-wing fighter reconnaissance aircraft powered by a single Avon Mk. 114 axial-flow turbo-jet engine with reheat. The engine develops 7,175 lb. (approx.) static thrust at sea level without reheat and 9,450 lb. (approx.) with reheat in use.

(b) The armament consists of two 30-mm. Aden guns and provision is made for the carriage of two beam oblique and one forward-facing oblique F.95 cameras. (See para 46(a))

(c) The cockpit is pressurized and is equipped with a Mk. 2G fully automatic pilot-ejection seat.

(d) Full-power ailerons and a power-assisted elevator are fitted, both with manual reversion.

FUEL SYSTEM

2. Fuel tanks and gauge

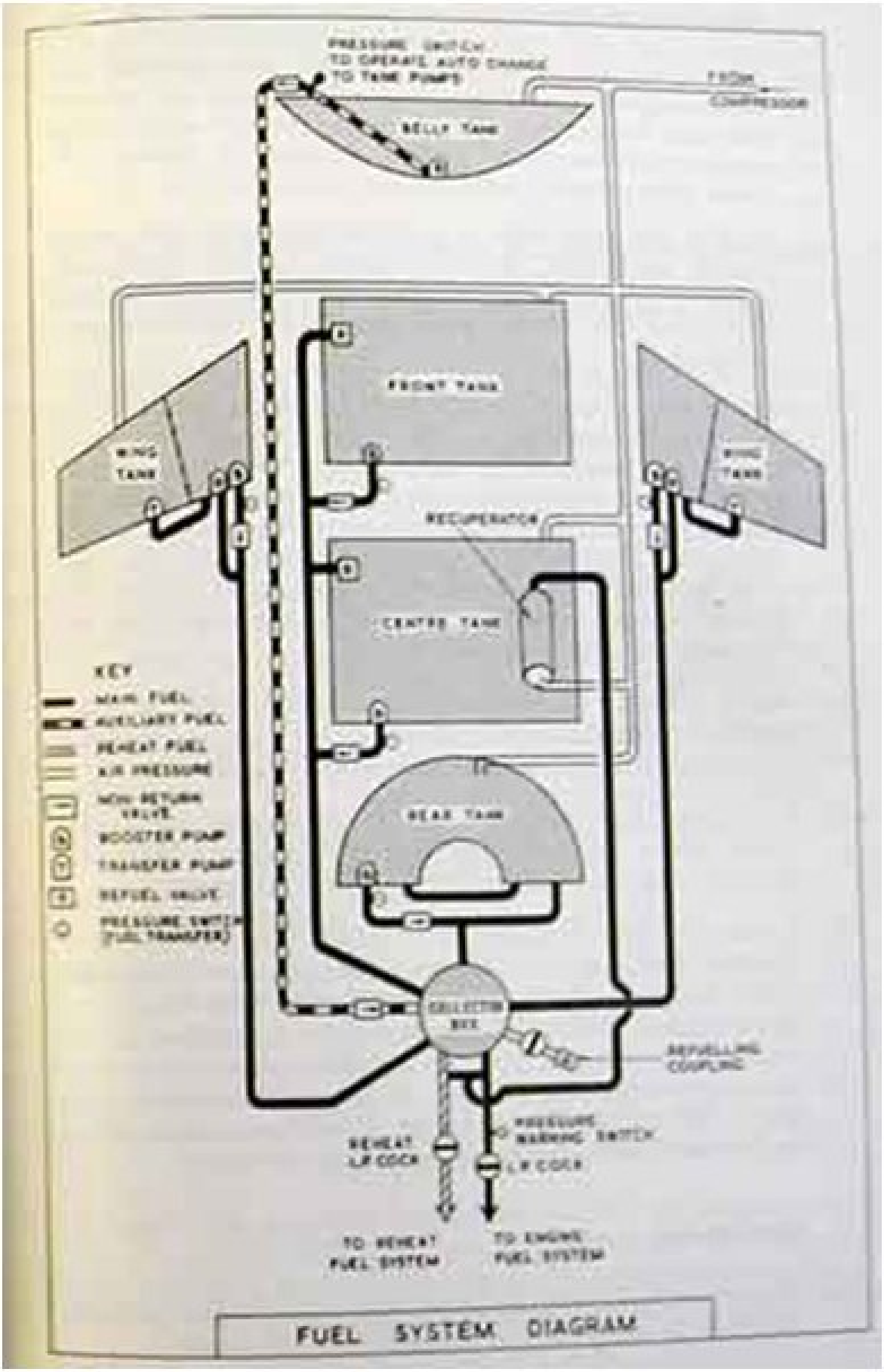
(a) Fuel is carried in five tanks, three in the fuselage and one in each wing. Incorporated in the centre fuselage tank is a fuel recuperator, the contents of which are used only during inverted flight.

(b) A 220-gallon jettisonable belly tank is normally carried beneath the fuselage. The mechanical jettison handle (3) is on the port shelf.

(c) The tank capacities will vary slightly from aircraft to aircraft and according to whether the aircraft is pressure or open-line refuelled; the following should be taken as minimum capacities:

		Gall.	Wt. at 7.7 lb./gall.
Front tank	...	112	862
Centre tank ... ... (excluding recuperator)	98	755	
Rear tank	...	104	801
Wing tanks (2 x 96)	192	1,478	
Total internal	506	3,896 lb.	
Belly tank		220	1,694
Total all tanks		726	5,590 lb.

(d) A single contents gauge (60) on the starboard side of the instrument panel records the total contents, in pounds, of all internal tanks whenever electrical power is available.



FUEL SYSTEM DIAGRAM

3. Main fuel system

(a) Fuel from all tanks is fed under low pressure, by immersed booster pumps, to a collector box and then to two pipe lines, one to the engine-driven H.P. fuel pumps and one to the reheat system through the reheat L.P. cock. (See paras. 5 and 12.)

(b) Fuel in the belly tank is automatically used first under normal conditions. When this tank is empty its booster pump is automatically switched off by a float-operated switch and the internal tanks pumps are simultaneously switched on.

(c) For short periods of inverted flying, fuel is provided by the fuel recuperator in the centre tank. This is a flexible bag inside a cylindrical tank. When the aircraft is inverted no pressure supply is available from the booster pumps and the fuel from the recuperator is forced out by air pressure from the engine acting on the bag. When normal flight is resumed, the pressure from the booster pumps is greater than the air pressure and the recuperator is automatically refilled.

(d) An air pressurizing system tapped from the engine compressor, maintains a pressure of 3 lb./sq. in. in all tanks to prevent boiling and to assist in fuel transfer.

(e) A magnetic indicator (59) on the starboard instrument panel shows white if fuel delivery pressure from the collector box drops appreciably below normal.

(f) A panel of five magnetic indicators (58), one for each internal tank, is fitted beside the pressure indicator. Each indicator shows white only when fuel flow from its associated tank is below normal. A cancelling device ensures that the indicators do not show white when their associated tanks are empty. A magnetic indicator (63) below the starboard instrument panel shows white when fuel is not flowing from the belly tank.

4. Fuel booster pumps

(a) Eight booster pumps are fitted, one in each fuselage tank, two in each wing tank and one in the belly tank.

(b) Three switches control the booster pumps. They are the FUEL MASTER ON/OFF switch (31), the two-position TAKE-OFF-NORMAL auto override switch (36) and the three-position AUTO-RETRIM switch (at 61). Circuit breakers and test switches are in the starboard side of the equipment bay. Below generator cut-in speed the wing and rear tanks booster pumps do not switch on.

(c) At all times when the engine is running, the fuel master switch should be ON and, unless manual fuel balancing is necessary, the balance switch should be at AUTO.

(d) When the belly tank is carried and the override switch is set to TAKE-OFF, the internal booster pumps operate in the normal manner but the belly tank booster pump is inoperative. When the switch is set to NORMAL, if the belly tank contains fuel and the fuel is transferring correctly, only the belly tank booster pump remains in operation. The other booster pumps are inoperative until either a pressure switch (transfer rate below minimum) or a float switch (tank empty) operates to switch off the belly tank pump and to switch on the internal tanks pumps. Automatic balancing then commences.
NOTE-When reheat is in use below 15,000 ft., all pumps are in operation irrespective of the switch setting. Above 15,000 ft. with the switch at NORMAL, belly tank fuel is used first, and then auto balancing commences.

(e) (i) When automatic fuel balancing is in operation. the fuel in the front and centre tank group is kept in balance with that of the rear and wing tank group, in order to keep the C.G. within reasonable limits. To achieve this balancing, a relay, working with the fuel contents amplifiers, varies the speed of operation, and thus the output, of the booster pumps.

(ii) Two magnetic indicators (at 61) are alongside the AUTO-RETRIM switch, and provide nose- or tail-heavy indications. The appropriate indicator shows white when such a state occurs and remains so until correct balance is again achieved.

(iii) If the automatic balancing system, it can be overridden by setting the retrim switch in the direction of the white indication to RETRIM as required. This causes an alternative feed to the booster pump speed relays to obtained.

5. L.P. fuel cock controls

(a) The engine L.P. cock (27) on the port shelf controls the flow of fuel from the collector box to the engine-driven H.P. pumps and throttle. It is moved forward to on and should never be used to stop the engine except in an emergency. This cock cannot be set to off without moving the reheat L.P. cock to off.

(b) The reheat L.P. cock (28) controls the flow of fuel to the reheat H.P. pump. The cock should normally be ON but may be set to off without affecting the normal engine fuel supply (see para. 11).

(c) Both L.P. cocks must be off before pressure refuelling is possible.

ENGINE CONTROLS

6. Avon 114 engine

(a) General

The engine is a 12-stage axial-flow gas turbine developing 7,175 lb. static thrust at sea level without reheat and 9,450 lb. with reheat. The main engine systems include:-

A cartridge starting system. (See para. 7.)

Relighting facilities. (See para. 8.)

A high pressure fuel and reheat system. (See paras. 10-13.)

Variable swirl vanes and air bleed valves. (See para. 14.)

Self-contained oil system.

(b) *H.P. fuel pumps*

Two engine-driven pumps are housed in a single casing but are separated from each other. A single overspeed governor controls the maximum speed of both pumps, and a single servo control system connects both pumps to the B.P.C. and A.C.U.

(c) *H.P. pump isolating valve and warning light (when fitted)*

(i) The isolating valve is intended as a means of restoring power in flight in the event of a failure of the H.P. pumps servo system causing a sudden loss of power. (See para. 76(a).)

(ii) The valve is controlled by an ONE-OFF switch on the port wall, forward of item (18). When the switch is set ON one H.P. pump is cut off from the servo system, which continues to control only the other H.P. pump. The isolated pump moves to full stroke and is controlled only by its over-speed governor.

(iii) A magnetic indicator on the port instrument panel, shows white when the isolating valve is closed and black with the valve switched off.

(d) *H.P. fuel cock control*

(i) The H.P. fuel cock lever (2) on the port shelf controls the fuel flow to the pressurising valve and burners. It should be moved down (off) to stop the engine. A catch on the control holds it in the open position.

(ii) A relight pushbutton is on the inboard side of the H.P. cock lever.

(e) *Oil system*

Oil is carried in the engine sump. the capacity of which is 17 pints. One pressure and four scavenge pumps maintain a continuous circulation through a cooler and filter to the engine bearings and gears. An oil pressure gauge is on the starboard side of the instrument panel.

7. Engine starting system

(a) Starting is by a triple-breech turbo-starter, using one cartridge for each start.

(b) (i) The STARTER MASTER switch (33) completes the circuit to the STARTER button (see para. 7 (b) (ii)). When the starter button is pressed, with the IGNITION switch (32) on, the circuit to the igniter plugs is completed. Both the master and ignition switches should be on for starting and at all times when the engine is running.

(ii) When Mod. 571 is incorporated a circuit breaker is introduced into the ignition circuit and is fitted at the aft end of the port shelf. It must be in for starting and at a11 times when the engine is running.

(c) When the guarded STARTER button (65) is pressed it is held in the depressed position by a solenoid and the automatic starting cycle is then initiated. the cartridge firing over a period of 2-3 seconds. The engine should accelerate up to normal idling r.p.m. of 2,750 ± 100 in approximately 30 seconds.

8. Relighting pushbutton

The igniter plugs are used to relight the engine in flight by pressing the relight button on the inboard side the H.P. cock with the ignition switch on.

9. Throttle control

(a) The throttle lever (21) moves in a quadrant which incorporates a reheat gate forward of the normal full throttle position.

(b) Incorporated in the throttle handle is the GGS manual ranging twist-grip, together with the flaps inching switch and press-to-transmit button.

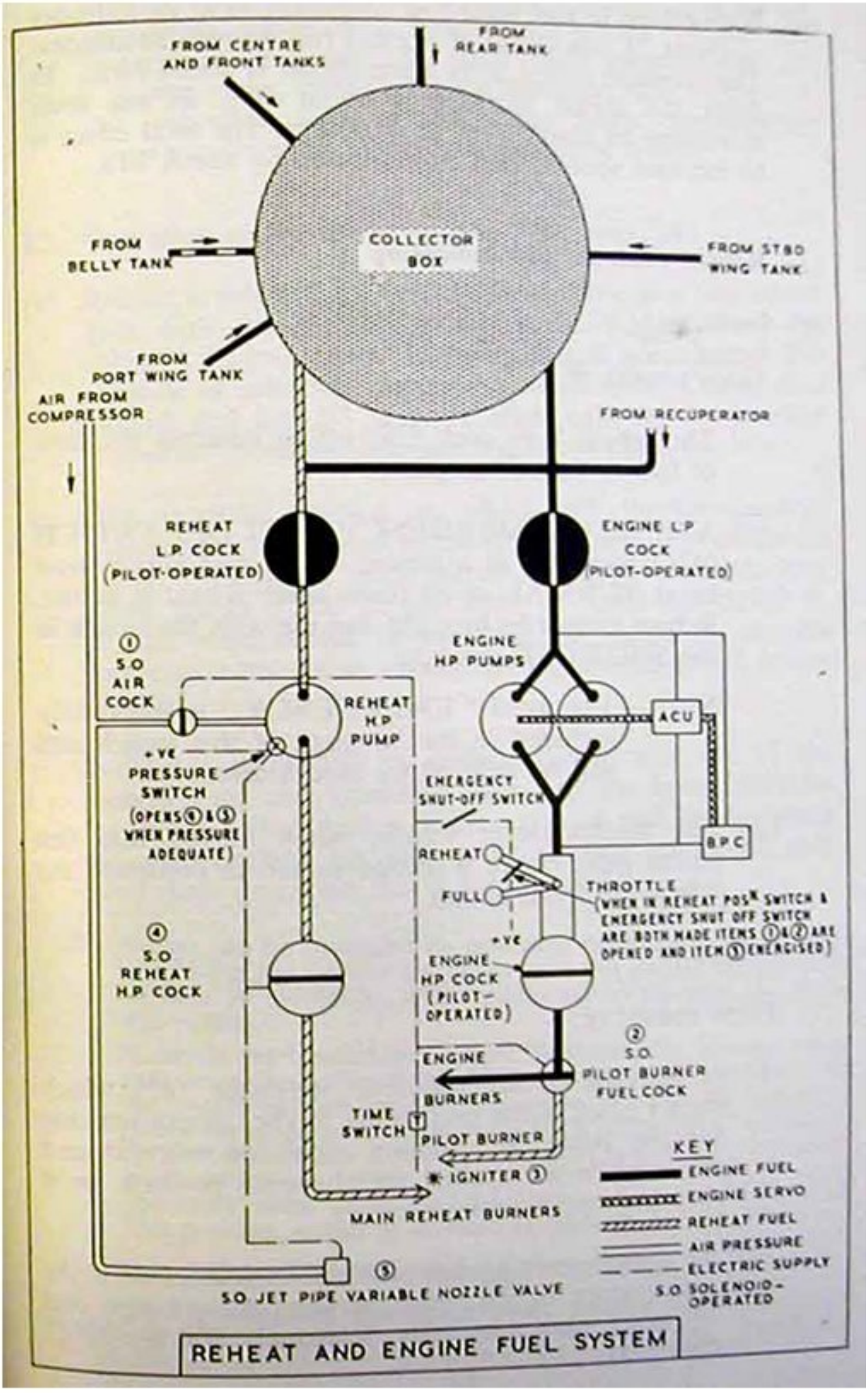
10. Reheat system

(a) The purpose of the system is to augment engine thrust by burning injected fuel in the jet-pipe. The temperature of the exhaust gases and hence their efflux speed from the jet-pipe nozzle is thereby increased, giving added thrust.

(b) When reheat is selected (see para. 12), the reheat igniter is energized for about 30 seconds and simultaneously causes solenoids to open two cocks. One cock permits fuel from the engine H.P. system to flow to a reheat pilot burner where it is lit by the igniter: the other cock allows air from the engine compressor to start up the reheat pump. As fuel pressure from the reheat pump builds up a pressure switch energizes a solenoid to open the reheat H.P. fuel cock allowing fuel to pass to the main reheat burner where it is ignited by the pilot burner flame.

(c) The pressure switch also energizes a second solenoid on the jet-pipe nozzle control valve. Air from the compressor then operates four ram jacks which open the jet pipe "eyelids" thereby increasing the final nozzle area.

(d) After about 30 seconds a time switch operates to cut off current to the reheat igniter.



REHEAT AND ENGINE FUEL SYSTEM

(e) With reheat in use, total fuel consumption at all altitudes is about 2½ times that of normal full throttle conditions. The increase in sea level static thrust is about 30%. In flight the thrust increase is about 50% at sea level increasing to about 60% at 40,000 ft. The total effect is to increase specific fuel consumption by about 70%.

11. Reheat controls and indicators

(a) *Controls*

These consist of:-

(i) The reheat L.P. cock (28) which controls the flow of fuel to the reheat pump.

(ii) A REHEAT EMERGENCY SHUTOFF SWITCH (47) which acts as a master switch and which must be at NORMAL at all times when reheat is in use. Reheat cannot be brought into use with the switch in the SHUT-OFF position.

Note.-The word "EMERGENCY" is incorrectly included in the labelling of this switch and will be deleted by modification.

(iii) The throttle lever which, when moved into the reheat gate, closes a second switch to complete the reheat electrical circuit.

(b) *Indicators*

These consist of:-

(i) A jet-pipe eyelid magnetic indicator (43) which shows black if the eyelids are in the correct position for the particular running condition selected and white while the eyelids are changing position, or if they are in the wrong position.

(ii) An amber warning light (48) which comes on if the temperature in the space between the jet pipe and its outer casing in zone 3 exceeds 300 ± 30°C. (See para. 13.)

(iii) An AIR EXTRACT magnetic indicator (49) which shows white if a breakdown occurs in the air extraction system for the space between the jet pipe outer casing and the fuselage skin in zone 4 (see para. 13). It also shows white momentarily when selecting undercarriage up or down.

12. Operation of the reheat system. (See para. 54.)

(a) Reheat is selected by moving the throttle into the reheat gate with the shut-off switch at NORMAL, and the reheat L.P. cock open. Light up should occur within 2-5 seconds of selection, depending on altitude. During this period and for 2-3 seconds after light-up the jet-pipe "eyelids" position indicator will show white.

(b) The throttle position at which the throttle-operated reheat switch is closed is always the same. but minimum r.p.m. obtainable, once reheat has been engaged, vary from about 7,300 at sea level to 7,800 at 45,000 ft. R.p.m. with reheat in use may be varied by throttle movement but r.p.m. should not be allowed to fall below 7,600.

(c) Reheat is cancelled by pulling the throttle out of the reheat gate and throttling back. At the lower altitudes to avoid falling below 7,600 r.p.m. it will be necessary to cancel reheat by pulling the throttle out of the gate and then operating the shut-off switch.

(d) Reheat can be cancelled by operating the shutoff switch *without* pulling the throttle out of the gate. but should the switch be set back to NORMAL with throttle still in the gate. the reheat will relight.

(e) A reheat top-temperature limiter automatically cancels reheat and closes the eyelids if the J.P.T. exceeds 700°C. In this event the nozzle position indictor shows white until the throttle is pulled out of the gate. When mod. 739 is embodied a NORMAL/ OVERRIDE switch (36) is fitted to the port side of the instrument panel. When the switch is set to NORMAL the limiter is in operation; when set to OVERRIDE the limiter is inoperative. This position should be selected at take-off.

13. **Fire-extinguishers and fuselage ventilation**

(a) Two independent fire-extinguisher systems are fitted and may be operated by combined warning light/press

switches (45) (46) on the port quarter panel. The outboard warning light/press switch is for zones 1 and 2, which are the compressor and flame tube zones respectively; the inboard switch is for zone 4. which is the rear fuselage. The bulbs may be tested by pulling the switches out.

(b) Zone 3 comprises the turbine and exhaust cone regions of the engine also the interspace between the inner and outer jet-pipe skins, via which the ventilating air for this zone is exhausted. This zone is fire-protected by stainless steel but should high temperatures occur due to a gas leak or a break-down in ventilation the HOT GAS amber warning light (48) will come on.

(c) All three warning lights are controfled by resetting flame switches, i.e., indication that a dangerous condition no longer exists is given by the warning light going out when the circuit is broken as the flame switches cool.

(d) The crash-operated inertia switch automatically discharges the contents of both bottles in the event of a crash, irrespective of the position of the battery isolating switch.

(e) To assist in cooling zone 4 on the ground, air from the seventh stage of the engine compressor is blown through the zone 4 extractor. The valve controlling this air is operated by the undercarriage selector and the position of the valve is shown by the magnetic indicator (49), on the port quarter panel, labelled AIR EXTRACT. The indicator will show white if the valve is in the wrong position relative to the selected undercarriage position. Overheating will occur if the indicator shows white on the ground.

14. Variable pitch guide vanes and air-bleed valves

(a) The first row of stator blades in the engine compressor consists of variable pitch inlet guide vanes which assist in imparting swirl to the incoming air. At r.p.m. below 6,200 the first stages of the compressor deliver more air than is acceptable to the later stages. To prevent

instability of flow, i.e. surge, the surplus air is bled off through air-bleed valves and the guide vanes are held in the maximum swirl position. When the normal flight r.p.m. are reached, the air-bleed valves are closed and the guide vanes move progressively to the minimum swirl position which occurs at 7,200 r.p.m.

(b) No noticeable change in r.p.m. or thrust occurs when the air-bleeds change over, nor do the guide vanes have any noticeable effect on engine operation. However, until the guide vanes reach the minimum swirl position at about 7,200 r.p.m. the compressor is not operating at maximum efficiency.

13. Engine instruments and anti-icing control

(a) The tachometer, jet pipe temperature gauge and oil pressure gauge are grouped on the starboard side of the instrument panel.

(b) *Anti-icing control*

NOTE.-Use of this system is at present prohibited.

The on/off switch (11) for the automatic anti-icing system is on the port wall. When set to on, hot air is bled from the engine and fed to the engine intakes. The system is intended only for icing prevention and is *not* intended for de-icing purposes.

MAIN SERVICES

16. Electrical system (24 volt)

(a) *D.C. supply*

(i) Two 6,000-watt engine-driven generators supply the whole of the electrical system and charge a single 24 volt aircraft battery. Two magnetic indicators, (55) one for each generator, on the upper starboard coaming show white when their respective generator is not supplying power. Generator cut-in speed is approximately 1,900 r.p.m.

(ii) Control of the battery is effected by a battery isolating switch (30) on the starter panel. If a crash occurs, an inertia switch de-energizes the battery isolating relay and automatically isolates the battery and at the sane time energizes the generator field isolation relay which de-energizes the field circuits of both generators. (See para. 13(d).)

(iii) ~~There are no circuit breakers in the cockpit: they are either in the nose of the aircraft or in the fuel tank bay.~~

(iv) The ground supply plug is on a recessed panel covered by a removeable door under the port wing fillet. This supply point is for testing and servicing, but if an external ground battery is used for starting, the battery isolation switch should be set to ON before the ground supply is disconnected.

(b) *A.C. supply*

(i) A.C. for the Mk.4F compass, the artificial horizon and reheat top temperature limiter is supplied by two inverters. No. 1 inverter, controlled by the starter master switch, normally supplies the flight instruments and top temperature limiter. No. 2 inverter, controlled by the ignition switch acts as a standby to No. 1 inverter.

(ii) If No. 1 inverter fails, automatic changeover to No. 2 inverter occurs. (38)

(iii) Circuit breakers for No. 1 and No. 2 inverter supplies are in the port and starboard sides of the nosewheel bay respectively, together with an indicator which shows white if inverter changeover has occurred during flight. None of these is accessible in flight.

(iv) The A.C. supply for the guns is automatically supplied by a third inverter.

(c) A.C. Supply-post mod. 607

(i) When mod. 607 is embodied, separate switches are provided for the inverters together with a changeover magnetic indicator (38). The magnetic indicator is situated on the port instrument panel, the FLIGHT INSTRUMENTS EARLY START switch adjacent to the starter button on the centre instrument panel and the INVERTER RESET switch on the starboard shelf aft of the D.M.E. control panel.

(ii) Before starting, when the EARLY START switch is set ON, No. 2 inverter starts up and supplies A.C. The magnetic indicator shows white. When the engine is started, auto-changeover to No. 1 inverter occurs when engine r.p.m. are at ground idling: the magnetic indicator changes to black.

(iii) If, during taxying, the magnetic indicator changes to white again it shows that auto-change back to No. 2 inverter has occurred. If this occurs the INVERTER RESET switch should be held momentarily to OFF, when a black indication should be restored. If the indicator remains white, it is an indication that No. 1 inverter has failed and No. 2 only will he operative.

(iv) After take-off, when the nose-wheel door is retracted, an override relay ensures an alternative supply circuit so that, even if the EARLY START switch is inadvertently knocked OFF during flight, continuity of supply to No. 2 inverter will be available. If No. 1 inverter fails in flight, auto-changeover to No. 2 occurs and the magnetic indicator shows white.

(v) A No. 1 INVERTER GROUND TEST switch is located in the port side of the nose-wheel hay and is for servicing purposes only.

(d) Warning indicators

The following table lists the various warning lights and indicators in the cockpit:-

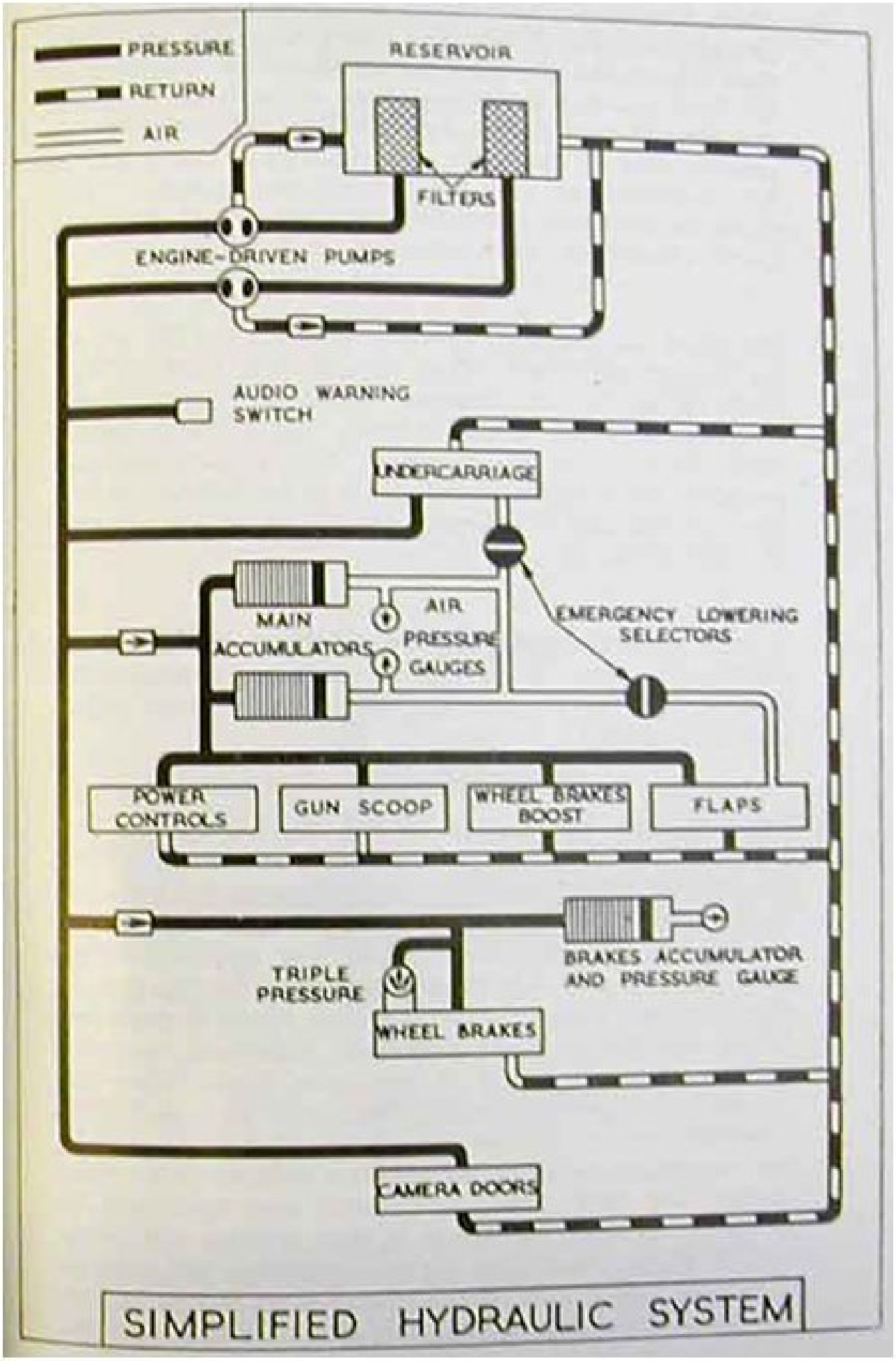
Service	Indication	Function
Fire warning	2 red lights (45) (46)	Give warning when temperature in engine bay or jet pipe zone exceeds 300 ± 30°C.
Hot gas warning	1 amber light (48)	Gives warning when temperature in zone 3 exceeds 300 ± 30°C.
Reheat nozzle position	1 white magnetic indicator (43)	Indicates nozzle position incorrect for throttle setting.
Air extraction failure	1 white magnetic indicator (49)	Indicates that air extraction valve is in wrong position relative to selected undercarriage position.
Fuel balance warning	2 white magnetic indicators (61)	Give warning of "nose-heavy" or "tail-heavy" conditions when energized by out of trim coil in balancer relay.
Fuel pressure warning	1 white magnetic indicator (59)	Gives warning when the fuel pressure falls below a safe limit.
Fuel flow failure warning	5 white magnetic indicators (58)	Each gives warning that transfer is unsatisfactory from its associated tank.
Belly tank transfer warning	1 white magnetic indicator (63)	Indicates that fuel has ceased to flow from the drop tank.

Service	Indication	Function
Generator warning	2 white magnetic indicators (55)	Gives warning of electrical power failure from one of following causes:- (1) Cut-out not closed. (2) A fault in either generator, i.e. field circuit-breaker open or main fuze blown.
Undercarriage position	3 red or green lights (42)	Indicate position of each u/c unit separately. No light-leg up and locked. Red light -leg unlocked and out of safety. Green light -leg down and locked.
Undercarriage	1 red light (centre light on position indicator) (42)	Gives warning when u/c is up and throttle less than 1/4 open.
Power controls	2 green lights (35) (62)	Indicate associated control surfaces in Power.
Power controls warning	1 flashing red light (52)	Indicates when any control surface not correctly engaged in Power.
Cockpit pressure warning	1 white light (53)	Gives warning that pressure differential is below minimum.
F.95 cameras	3 green lights (one for each camera). (56)	Out-Shutters closed. Dim-Shutters open flashing - Cameras operating.

17. Hydraulic system

(a) Two-engine driven hydraulic pumps maintain a live-line pressure of 3,150 ± 150 lb./sq. in. for the normal operation of the:-

Undercarriage
Wheel brakes
Flaps
Gun-bay scavenging flap
Aileron and elevator hydroboosters
F.95 camera window shutters.


PRESSURE
RETURN
AIR
RESERVOIR
FILTERS
ENGINE-DRIVEN PUMPS
AUDIO WARNING SWITCH
UNDERCARRIAGE
MAIN ACCUMULATORS
AIR PRESSURE GAUGES
EMERGENCY LOWERING SELECTORS
POWER CONTROLS
GUN SCOOP
WHEEL BRAKES BOOST
FLAPS
BRAKES ACCUMULATOR AND PRESSURE GAUGE
TRIPLE PRESSURE
WHEEL BRAKES
CAMERA DOORS
SIMPLIFIED HYDRAULIC SYSTEM

(b) Three hydraulic accumulators are fitted in the circuit to provide a reserve of power in emergency. The hydraulic fluid side of the two main accumulators is connected to the flaps, gun-bay scavenging flap, wheel brake override and elevator and aileron hydrobooster circuits. The air pressure side of the main accumulators is connected to the undercarriage and flaps emergency systems. The hydraulic fluid side of the third accumulator is connected to the wheel brake circuit.

(c) The main accumulators pressure gauges (9) (10) are on the cockpit port wall. They should both read 2,150 lb./sq. in. (air pressure) when the engine is not running and hydraulic pressure is exhausted. With the engine running, the pressure should build up to 3,150±150 lb./sq. in. A third pressure gauge for the brakes accumulator is in the nose-wheel bay. This accumulator is charged initially to an air pressure of 1,750 lb./sq. in.

(d) A triple pressure gauge (24) is on the port side of the instrument panel. It records the pressure available for braking and the pressure applied at each wheel brake. (See para. 29(c).)

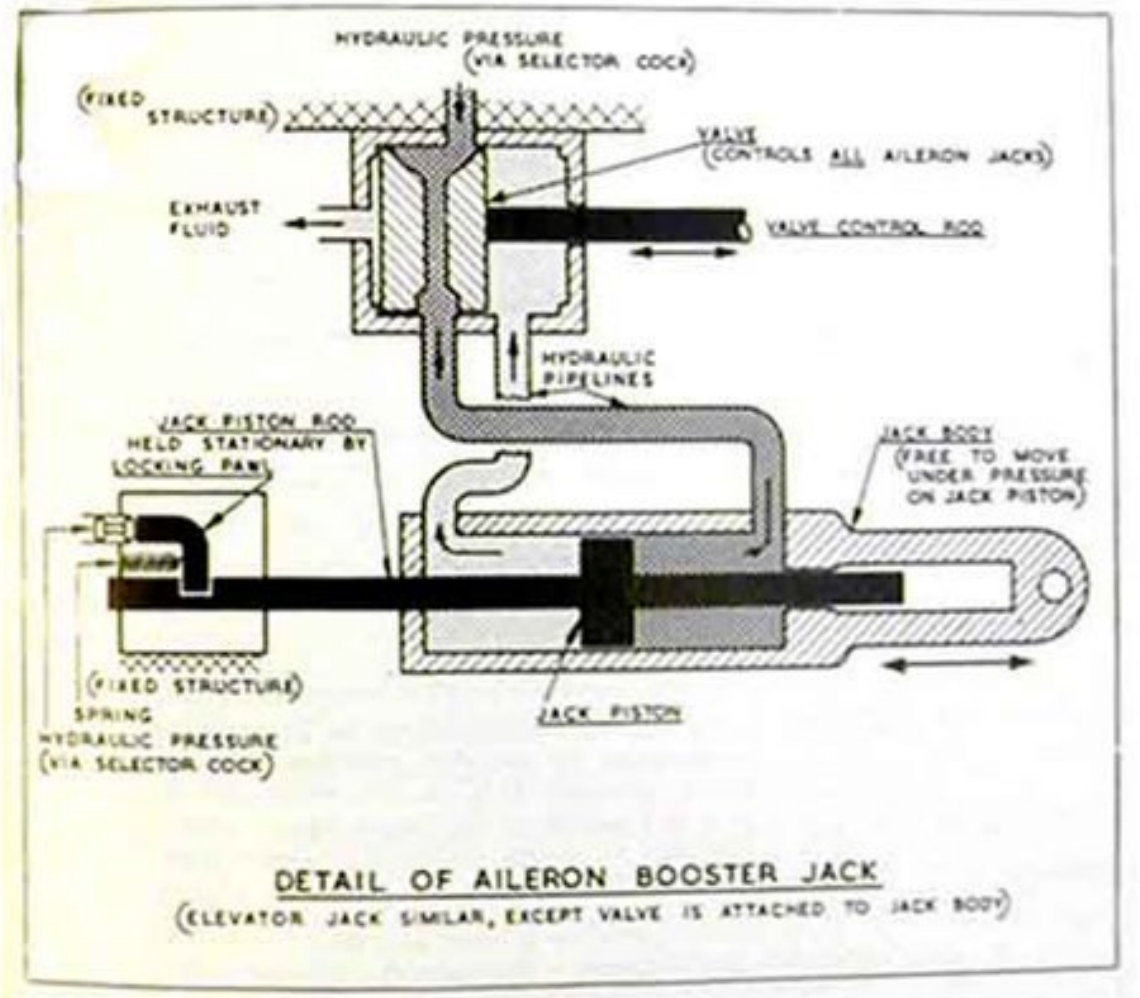
(e) An indication that failure of the live-line system has occurred is given by an intermittent audio-warning over the pilot's headset. Its purpose is to indicate immediately to the pilot that failure has occurred and that due to the limited accumulator capacity, the power controls hydroboosters will only be available for a limited period. The pilot will then be able to reduce speed if necessary before reverting to Manual control. Automatic reversion to Manual control will in any case occur when the accumulators are exhausted. (See para. 18.) A TEST-ON-OFF switch (85) on the starboard console enables the warning to be switched off once indication has been given. The OFF position is wired and force will be necessary to push the switch to that position. With the weight of the aircraft on the undercarriage the warning system is inoperative. If the system is to be checked on the ground the switch should be set to TEST with the R/T on.

POWERED FLYING CONTROLS AND VARIABLE INCIDENCE TAILPLANE

18. Flying controls operation

(a) *General*

The ailerons and elevator are power-operated. the power being supplied by hydraulic oil under pressure from the aircraft hydraulic system, through two manual selector cocks under the control of the pilot. Four hydroboosters each consisting of a jack body and piston rod are fitted, three in the aileron circuit and one in the elevator circuit. Two hydraulic valves are provided, one controlling the three aileron boosters and the other controlling the elevator booster.



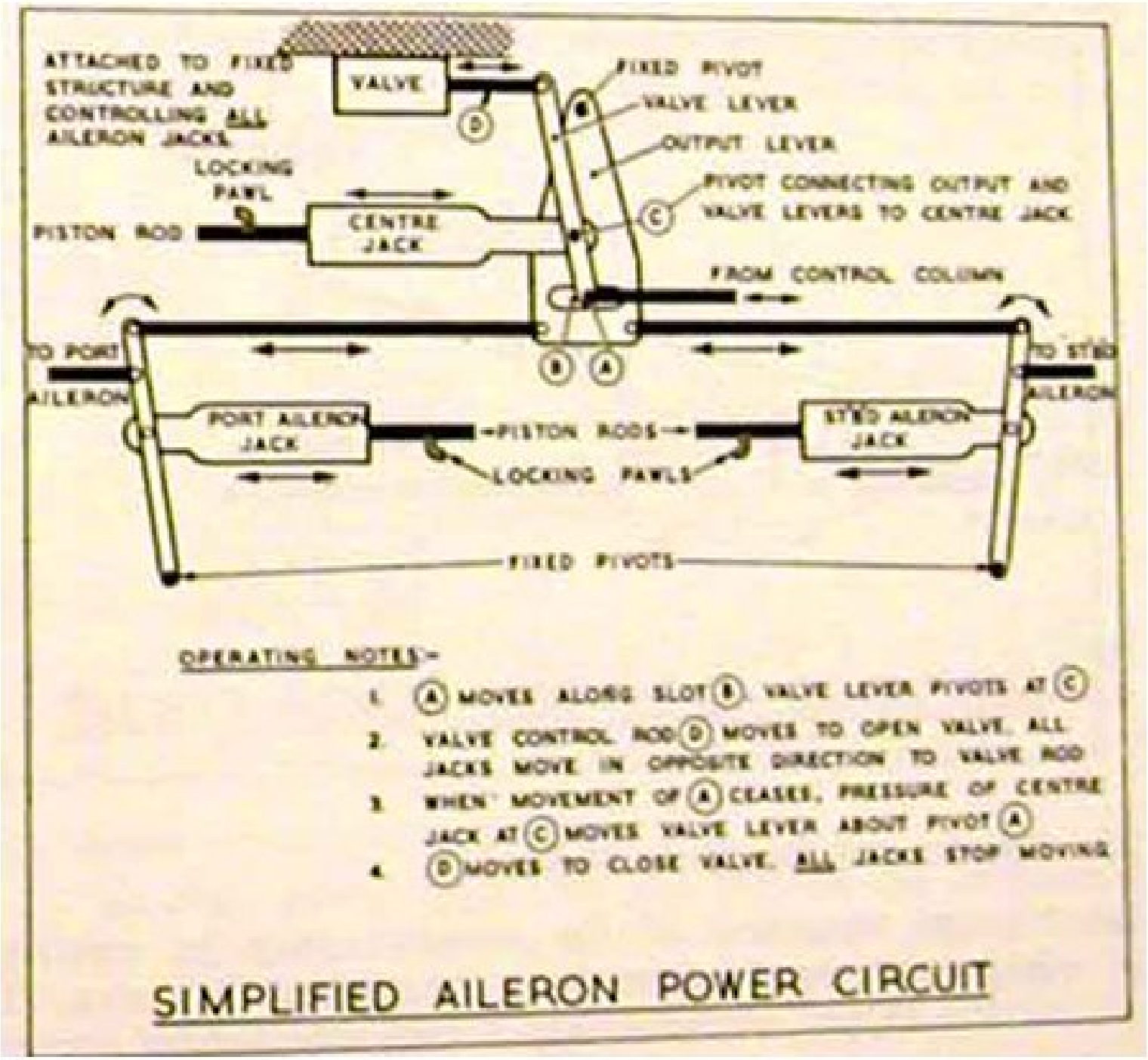
DETAIL OF AILERON BOOSTER JACK

(ELEVATOR JACK SIMILAR, EXCEPT VALVE IS ATTACHED TO JACK BODY)

(b) *Aileron power circuit*

In the aileron circuit the centre booster of the three operates an output lever which is connected to two aileron control rods. The other two boosters are situated, one adjacent to each control surface and connected through a linkage to the respective control rod. When

hydraulic powet is available, movement of the control column, through a linkage, opens the aileton control valve which admits pressure oil to one side of all three booster jack pistons and at the same time opens the other sides to return. All three booster piston rods are anchored to the aircraft structure by means of spring-



(c) *Hydraulic power reserve*

Two accumulators are fitted in the power controls circuits to provide a reserve of power if the main supply fails. This reserve may be sufficient for several cycles of aileron and elevator movement before the controls revert automatically to Manual. Even if no control movement is made, accumulator pressure will not be maintained for a long period due to seepage through the hydraulic components. Certain hydraulic pipe failures can cause immediate reversion to Manual.

19. Controls and indicators

(a) *Ailerons*

Hydraulic pressure to the aileron hydroboosters is selected by pushing in the AILeron POWER on/off selector (34) below the port side of the instrument panel. It is pulled out to select Power off.

(b) *Elevator*

A similar control (64) ELevator POWER on/off is fitted below the starboard side of the instrument panel for hydraulic selection to the elevator hydrobooster.

(c) *Power controls engagement warning*

(i) Two green lights (35) and (62) on the instrument panel near their respective selectors come on when their associated boosters are correctly engaged in Power.

(ii) A red warning light (52) in the centre of the instrument panel flashes if any one of the boosters is not correctly engaged in Power, once power has been selected.

(d) *Hydraulic failure warning*

An audio warning over the pilot's headset, providing the R/T is on, provides indication that the hydraulic system is losing pressure. It sounds when pump delivery has fallen to below 2,150 lb./sq. in.

20. Engaging power controls

(a) When Power is initially engaged on the ground it is possible that the locking pawls will not be opposite their

slots in the piston rods. The hydraulic pressure acting on the pawls will cause them to clamp on the rods giving a false lock, or anchorage, which will slip when moderate jack loads are imposed. Although the feel on the control column will be one of apparent Power, the red warning light will flash and full control column travel will not be obtainable.

(b) The pawls may be correctly engaged in their slots by exercising force on the stick in the direction of restricted travel to overcome the friction of the pawl clamping on the rod. Easier engagement is obtained with the aileron gear selector set to POWER. (See para. 21 (c).)

(c) In the air the pawls will normally engage immediately on selection, but should they fail to do so the instructions in (b) above should be carried out.

(d) When all pawls are correctly engaged the control column can be moved freely in all directions and will be felt to come up against positive stops at the extremes of its movements. The red light will go out and the green lights will then come on.

21. **Aileron feel and trim**

(a) On the ailerons, the piston rod is anchored to the aircraft structure the air loads are resisted entirely by the hydraulic jack effect and no load is fed back to the control column. To provide control feel, a spring is fixed in the control circuit and gives an artificial stick force which is proportional to aileron deflection but not to airspeed. A small handwheel (72), mounted on the control column, is provided for adjustment to lateral trim when flying in Power.

(b) A trim tab is fixed on the port aileron for use in Manual only. It has no effect on lateral trim when the ailerons are in Power, but should it have been offset and Manual reversion takes place, the effect will be immediate. A trim control switch (6), which operates in the normal sense, is on the port shelf, aft of the throttle quadrant. The trim position indicator (17) is adjacent.

(c) When mod. 395 is embodied the control column aileron gearing can be adjusted by means of a lever on the right of the control column. Two positions, POWER and MANUAL, can be selected. For the same stick movement aileron travel with MANUAL selected is approximately half of that with POWER selected.

22. Elevator feel and trim

(a) On the elevator the piston rod is anchored to the control circuit itself, to that approximately 1/15th of the air loads on the control surface are fed back to the stick, and changes of air load on the elevator will be felt by the pilot as changes of stick force, thus providing a measure of control feel.

(b) (i) The variable incidence tailplane is provided to trim out the changes of stick force with speed. After selecting by feel the required tailplane angle to give zero stick force for a given flight condition, the elevator is trailing with no air load imposed on it.

(ii) The tailplane is operated by two electric motors controlled normally by a spring-loaded three-position switch (69) on the control column hand grip. A speed control snitch (8) on the port shelf is provided for FAST or SLOW operation. When set to FAST the tailplane is operated by both motors: when set to SLOW only one motor (the ~~starboard~~ port) A.L.1 operates and tailplane movement is about half the fast rate.

(iii) A DUPLICATE SLOW CONTROL switch (16) on the port shelf can be used to operate the tailplane on the port motor only, regardless of the setting of the FAST SLOW switch. When the duplicate switch is in use the control column switch is inoperative.

(iv) If any fault develops in the control column switch leading to a "runaway" tailplane, the switch may be isolated by means of the MAIN TRIM ISOLATION switch (15) on the port shelf and trimming achieved by means of the DUPLICATE SLOW CONTROL.

(v) A.T.P. INCIDENCE PRESELECTOR lever (29) inboard of the throttle, when set forward permits operation of the tail within a + 4° to - 4° range. When set aft the negative limit is increased to -9°. The lever must only be moved to the - 9° position when the tail is clear of the -4° limit stop.

Conversely the lever must not be moved to the forward position when the tail is between -9° and -4°.

(vi) A tailplane incidence indicator (20), which is combined with the cockpit temperature indicator, is on the port shelf.

OTHER AIRCRAFT CONTROLS

23. **Flying controls locking gear**

Detachable locks are provided for the internal locking of the flying controls. A stowage is provided at the aft end of the port wall. No external locks are provided.

24. **Rudder bar adjustment and rudder trimmer**

(a) The rudder bar has parallel-motion pedals which are adjustable for leg reach by pulling up a handle (93) on the starboard shelf and allowing the pedals to move aft under the action of a spring. or forward by pushing against the spring. Releasing the handle holds the pedals in the desired position.

(b) The rudder trim tab is operated electrically by a switch (1) on the port shelf aft of the throttle quadrant. The switch works in the natural sense.

(c) The trim position indicator (17), which is combined with the aileron trim position indicator, is on the port shelf.

25. **Undercarriage control and position indicator**

(a) The undercarriage is operated hydraulically after electrical selection by either the UP or DOWN push-button (41) on the port side of the instrument panel.

(b) A standard indicator (42) is on the inboard side of the undercarriage selector buttons. The nosewheel light shows red if the throttle is lees than ¼ open when the undercarriage is up.

26. Undercarriage emergency operation

(a) If electric or hydraulic failure occurs, the undercarriage may be lowered irrespective of the position of the normal selector button by pressing the emergency pushbutton (5) on the port shelf. This releases the air trapped in the main hydraulic accumulators, which in turn releases the "up" locks and applies pneumatic pressure to the jack pistons of the undercarriage units.

(b) If it is required to retract the undercarriage on the ground. the "up" selector button should be rotated clockwise and then pressed. It must never he so used when the aircraft is airborne otherwise damage may be caused to the wings.

27. Flaps/airbrakes control and position indicator

(a) The split trailing edge flaps. which also act as airbrakes, are selected electrically and operated hydraulically. They may be selected down at any speed but the amount to which they will lower depends upon the air loads. If speed is increased with the flaps extended, the air loads will reduce the flap angle.

(b) Control of the flaps is by an inching switch on the throttle lever in conjunction with a limit setting switch (22) on the instrument panel. Rearward movement of the inching switch lowers the flaps, forward movement raises them. When the inching switch is released it returns to the central (off) position and flap movement is arrested.

(c) The limit setting switch may be set to either:-

(1) TAKEOFF AND AIRBRAKES

or (2) LANDING

When set to (1) the limit to which the flaps may be lowered is 35°. When set to (2) the limit is increased to 50° (fully down).

(d) The use of flaps for airbraking is restricted to 35° to avoid slight directional snaking which might occur if larger flap angles were selected.

(e) A position indicator (23) is situated adjacent to the limit setting switch.

28. Flaps/airbrakes emergency operation

(a) If the live-line pressure fails, the flaps may be lowered, raised and re-lowered by the hydraulic pressure of the two main accumulators, after normal selection, providing no other hydraulically-operated system is used, e.g. powered controls.

(b) If no hydraulic pressure is available the flaps may be lowered *fully down* only, irrespective of the position of the limit switch, by pressing the emergency button (4) on the port shelf.

29. Wheel brakes control

(a) The maxaret wheel brakes are operated hydraulically by means of a lever (71) on the control column and a differential relay controlled by the rudder bar. When the brakes are applied, the maxaret units automatically prevent the wheels locking irrespective of the rate of deceleration and type of landing surface in use. For maximum braking the brakes should be applied fully and the maxaret units allowed to vary the pressure as necessary. Normally the maxaret units should not be allowed to operate (indicated by violent oscillation of the triple pressure gauge needles) as this leads to excessive brake wear.

(b) The available hydraulic pressure (3,150 ± 150 lb./sq. in.) is shown on the triple pressure gauge (24) together with the pressure at each wheel brake (1,750 lb./sq. in. max.).

(c) When the boost switch (39) on the instrument panel is placed up to ON the entire hydraulic pressure is made

available at the wheel brakes, the operation by-passing the differential relay valve and reducing valve. The pressure at each wheel will not in this case be shown on the triple pressure gauge. Use of this control enables full reheat power to be used without brakes slipping.

(d) If the hydraulic system has failed, the pressure in the wheel brakes accumulator as shown on the triple pressure gauge will be sufficient for landing but will leave little in hand for subsequent taxying. When pressure falls to below 1,750 lb./sq. in. no further braking will be available, since the accumulator is then empty of hydraulic fluid.

30. **Flight instruments**

(a) The turn and slip indicator is operated by D.C. whenever electrical supply is available. If electrical supply is lacking the word OFF appears in the face of the instrument. When Mod. 599 is embodied a TURN & SLIP NORMAL-EMERG switch on the instrument panel provides a separate emergency d.c. supply when set to EMERG.

(b) The Mk.4 artificial horizon is operated by A.C. (see para. 16(b)). A power failure indicator shows the word OFF when electrical supply is lacking. If the fast erection button (51) is used before flight to erect the horizon it must not be kept depressed after satisfactory erection is achieved. In flight the button should only be used in unaccelerated level flight.

(c) The Mk.4F compass is also operated by A.C. (see para. 16(b)).

(d) The accelerometer indicates all normal accelerations imposed on the aircraft by means of three concentrically mounted pointers. One pointer indicates instantaneous G, the other two register the maximum positive and negative G readings respectively until re-set.

(e) The heater element in the pressure head is controlled by switch (37) on the port side of the instrument panel.

COCKPIT EQUIPMENT

31. Entry to aircraft

Entry to the cockpit is by means of a special ladder supplied as ground equipment.

32. Hood operation

(a) The hood is opened or closed electrically by means of a three-position OPEN-off-SHUT switch (18) under the port coaming, provided that the clutch a engaged. The clutch is operated by a knob (86) on the starboard coaming; when this control is set to FREE the hood can be moved by hand.

(b) The hood seal is inflated automatically when the hood is fully closed with the switch at SHUT, provided that the clutch control is set to ENGAGED.

33. **Hood jettisoning**

(a) *Pre-mod. 347*
The hood may br jettisoned by pulling the control handle (40) on the port coaming panel. This action also operates a micro switch which if electrical power is available, automatically lowers the gunsight. The hood will not jettison cleanly unless it is fully closed and the three-position switch is in the off position. An indicator on the port wall shows that the jettison mechanism is locked. The pointer is on the line when indicating safe.

(b) *Post-mod. 347*
The hood is jettisoned by gas pressure from a jettison gun acting on two pistons which unlock the hood rail latches and then push the hood upwards. This action may be in initiated by pulling the hood jettison handle or will occur if either ejection seat handle is pulled. The GGS is automatically lowered, if electrical power is available, when the hood jettison handle is pulled but if either ejection seat handle is used the GGS must be lowered manually before ejection.

(c) *External emergency release*
An external jettison control is on the port side of the fuselage. When pulled it releases the hood thereby enabling it to be lifted clear manually.

34. Cockpit pressurization and heating

(a) Control of cockpit pressure is by means of a master ON/OFF switch (13) and control of temperature is by means of the spring-loaded selector switch (14) both

on the port wall. A temperature indicator (19) on the port shelf registers whenever the master switch is ON and electrical power is available.

(b) When the master switch is ON, air is bled from the engine compressor and fed to three entry points in the cockpit. One at the extreme rear end of the port shelf can be blanked off at will: the same feed line supplies air to a small louvre (44) on the port side of the instrument panel. The quantity of air entering the cockpit via this louvre will depend on whether the inlet port is blanked off or not. The third entry point is a larger louvre (78) on the starboard wall, above the oxygen regulator.

(c) The cockpit pressure control valve limits the pressure differential to 3¾ lb./sq. in. at 27,000 ft. and above. If the pressure differential falls below a predetermined minimum, a warning light (53) on the instrument panel comes on. Should the differential fall still further a warning horn sounds. The horn may be silenced by the operation of a guarded switch (76) on the starboard wall. An altimeter (68) which shows the equivalent cockpit altitude is on the starboard shelf.

(d) A manually operated vent (7) on the port wall admits air at atmospheric pressure, and may be opened when the pressurization system is OFF or to release pressure in an emergency.

(e) The hood seal and the cartridge starter access door seal are inflated by air direct from the engine compressor.

35. Hood and windscreen de-misting

(a) Hot air for de-misting the windscreen interspace is fed direct from the engine compressor.

(b) Hot air supply to the windscreen and hood gallery pipes is controlled by a DEMIST switch (12) on the port wall. The air supplied is very hot at high power and low altitude and in these circumstances should only be used if mist has already formed. It should be used at high altitude and, to reduce the possibility of mist forming. it should be left on for the descent.

36. Windscreen de-icing system

The system is operated by compressed air from the cockpit air system, passing into the storage tank and forcing fluid from the tank onto the windscreen via a spray tube. The system is controlled by an ON/OFF cock (88) on the starboard shelf.

37. Anti-G suit system

(a) Air under pressure is stored in an air bottle and is controlled by an ON/OFF cock (92) on the starboard shelf. When the cock is ON, and G in excess of approximately 1½ is applied, a spring-loaded valve operates and allows air at low pressure to pass to and inflate the anti-G suit The amount of inflation will depend on the amount of G applied.

(b) The system may be tested, with the cock ON, by pressing the TEST button on the starboard bulkhead.

(c) An air pressure gauge, in the nosewheel bay shows the pressure in the system (1,800 lb./sq. in. max.).

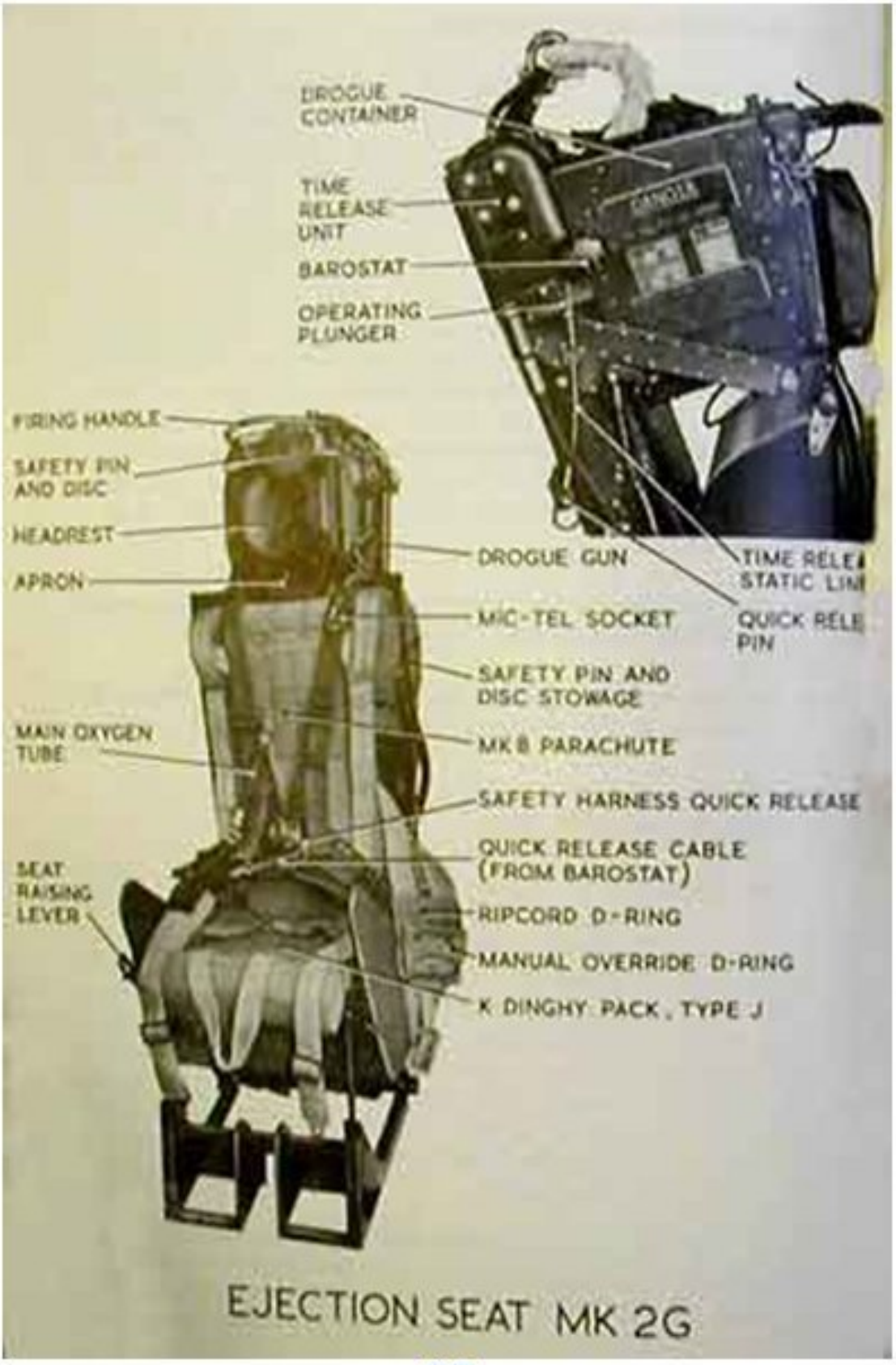
38. **Ejection seat Mk. 2G**

WARNING.-1. The pilot must ensure that each safety pin is removed and stowed before flight. He must also ensure before leaving the cockpit after flight, that each handle is locked against the possibility of accidental withdrawal on the ground by passing the appropriate safety strap through its associated handle and securing it with its spring safety pin. All personnel must ensure that both firing handles are locked before entering the cockpit.

2. If it is necessary to leave the aircraft in an emergency on the ground, special care must be taken not to foul the secondary firing handle (on the scat pan) if its safety strap and pin are not in position.

(a) A Mk. 2G pilot ejection seat is fitted incorporating a type ZF harness, headrest, footrests, parachute container and a seat well for the dinghy and emergency oxygen supply. An 80 ft./sec. ejection gun is fitted.

(b) The height may be adjusted by a lever on the starboard side of the seat; the harness release is also on the starboard side.


DROGUE CONTAINER
TIME RELEASE UNIT
BAROSTAT
OPERATING PLUNGER
FIRING HANDLE
SAFETY PIN AND DISC
HEADREST
APRON
MAIN OXYGEN TUBE
SEAT RAISING LEVER
DROGUE GUN
MIC-TEL SOCKET
SAFETY PIN AND DISC STOWAGE
MK 8 PARACHUTE
SAFETY HARNESS QUICK RELEASE
QUICK RELEASE CABLE (FROM BAROSTAT)
RIPCORD D-RING
MANUAL OVERRIDE D-RING
K DINGHY PACK, TYPE J
TIME RELEA
STATIC LINE
QUICK RELE
PIN
EJECTION SEAT MK 2G

(c) The ejection gun is fired by pulling the handle above the headrest. When Martin Baker Mod. 309 is embodied a secondary firing handle is fitted to the forward edge of the seat pan and is intended for use when ejecting in positive G conditions. When either firing handle is pulled the ejection gun is fired and ejection follows.

(d) All leads incorporate quick releases which are automatically broken on ejection.

(e) After ejection, at heights of l0,000 ft. and below, a barostat causes an automatic cycle to commence. After 3 seconds the safety harness is released as are the face screen, firing handle and headrest pad. An apron attached to the seat drogue then pitches the pilot head first out of the seat, at the same time opening his parachute.

(f) A manual override D-ring is fitted over the ripcord D-ring and should be operated to isolate the automatic device if the system has failed.

(g) *Leg restraining cords*

(i) When Martin Baker Mod. 308 is embodied, leg restraining cords are fitted in lieu of footrests. The thigh guards are retained.

(ii) The leg restraining cords ensure that the occupant's legs are drawn back automatically and restrained close to the seat pan during ejection, thus providing leg clearance and preventing the legs being blown apart after ejection. The restraining cords pass through snubbing units at the front of the scat pan. These units allow the cords to pass freely *down* through the unit, but prevent them passing *upwards*. A release button is provided under each snubbing unit to allow the occupant to adjust the cords to give comfortable leg movement in the aircraft.

(h) *Single lever ejection (Mod. 347)*

With Mod. 347 embodied, when either firing handle is pulled the hood is jettisoned immediately by gas pressure from a hood jettison cartridge; at the same time a delay unit at the back of the headrest is started. This unit withdraws the sear from the seat one second after the handle is pulled. Ejection then follows.

NOTE.-Either handle must be pulled firmly to its fullest extent to ensure correct operation.

39. Oxygen system

(a) Oxygen is carried in a Mk. 5D cylinder in the starboard wing (Mod. 682 introduces a second cylinder.) A Mk. 17 or 17B demand regulator controls the supply to the pilot.

(b) A contents gauge (67) is aft of the regulator (66) on the forward end of the starboard shelf. The regulator consists of an ON/OFF valve which controls the flow of

oxygen, an air inlet NORMAL-100% OXYGEN switch, an emergency three-position switch and a combined flow and blinker unit.

(c) When the ON/OFF valve is on and the inlet switch is at NORMAL, an air/oxygen mixture is fed to the pilot's mask, up to a height at which 100% oxygen is automatically delivered. When the inlet switch is at 100% OXYGEN no air is added irrespective of the height. This position should normally be selected if any symptoms of anoxia are present. The emergency switch when moved to either right or left admits oxygen under greater pressure. Normally it should be central, but in the event of loss of cabin pressure should be offset.

(d) The mask may be tested before flight by firmly pressing in the EMERGENCY switch, when in the central position. Oxygen is then supplied under pressure, the firmer the switch is pressed the greater the pressure (up to 5 times that obtained with the switch in either side position). The mask can then be adjusted until no leaks are apparent.

(e) *Emergency system*

A manual control (94) on the starboard shelf operates the emergency oxygen bottle in the seat well, providing the safety pin on the bottle is withdrawn.

40. Internal lighting

(a) *Cockpit lamps*

The lamps are controlled by five on-off dimmer switches (80) (87) on the starboard wall.

(b) *Emergency lamp*

The emergency lamp, powered by a separate battery, is controlled by an on/off switch (77) on the switch panel on the starboard wall.

41. External lighting

Navigation lights only are fitted, which are controlled by a BRIGHT-OFF-DIM switch (79) on the switch panel.

42. Emergency equipment

(a) *Crowbar*

This is clipped to the aft end of the cockpit port wall.

(b) *Survival equipment*

This is stowed in the starboard ammunition tank.

(c) *First-aid equipment*

This is stowed in the starboard ammunition tank. Access to the ammunition tanks is via the ammunition tank doors which are unlocked by a key stowed in the aircraft destructor stowage.

(d) *Aircraft destructor*

A quick release panel with hand-operated latches gives access to the aircraft destructor, stowed in the starboard side of the fuselage level with the cockpit.

(e) *E.2 compass*

This is attached to the starboard side of the windscreen arch.

OPERATIONAL CONTROLS

43. Gyro gunsight Mk. 5A

(a) The G.G.S. is housed in a retractable mounting above the instrument panel. Retraction is controlled by an electric motor in circuit with the G.G.S. ON OFF switch above

the coaming on the left of the sight. Ranging is effected by rotating the throttle twist-grip.

(b) Altitude and ballistics units automatically compensate for the time of flight and gravity drop of the particular ammunition in use, The altitude unit is fully automatic but the ballistics unit must be preset before flight.

(c) The selector dimmer control (54) contains a dimmer switch and a five-position selector switch. The five positions are:-

G. (gyro)	Moving. graticule only is visible.
F. and G. (fixed and gyro)	Both graticules are visible.
F. (fixed)	Fixed graticule only is visible.
M.R.P. (Medium R.P.)) S.R.P. (Steep R.P.))	The sight is set for use with R.P's.

(d) Emergency manual lowering is effected by striking the knob (50) on the left of the sight.

44. V.H.F.-TR. 1985/1986 with telebriefing-ARI. 18064

(a) The two 10-channel V.H.F. controllers. (25) with an adjacent changeover switch, (26) are at the bottom of the port instrument panel. A press-to-transmit switch is in the end of the throttle lever handle. The sets are stowed in the starboard equipment bay. The TR. 1985 aerial is mounted on top of the fuselage and the TR. 1986 aerial is below the fuselage.

(b) The telebriefing land-line is at the aft end of the fuselage port side. When the plug is connected the V.H.F. circuit is de-energized and a red warning light (90) on the starboard shelf indicates that telebriefing is in use. The pilot's press-to-speak switch is adjacent.

45. I.F.F. (when filled)

At a later dale Mk. 10 I.F.F. will be fitted

46. D.M.E. (Rebecca Mk. 7) ARI.5849

(a) The control unit (89) is on the starboard shelf. A range and heading meter (57), which indicates range and left right heading from the homing beacon, is on the starboard instrument panel.

(b) Three suppressed receiver aerials are fitted, one in each wing leading edge and one in the rear fuselage undersurface. A suppressed transmitter aerial is also inside the rear fuselage undersurface.

47. Gun firing

(a) The gun firing switch is on the forward face of the control column handgrip. The circuit is automatically isolated when the undercarriage is locked down. A butt test switch is in the starboard wheel bay and provides an override for the automatic isolation of the gun firing circuit.

(b) When the guns are fired, an electrically-operated selector is energized allowing hydraulic fluid to open the gun bay scavenging flap. This causes air to clear the gases from the link and empty case chutes. When the trigger is released the scoop closes and the air flow is cut off.

48. F.95 cameras

Three oblique cameras may be carried, one in the nose of the aircraft and one in each side of the nose. When Mod. 499 is incorporated, alternative facilities for vertical photography are provided for the nose camera only. The windows of all three cameras are protected by hydraulically-operated shutters.

(b) The following controls are lilted:-

(i) Heater ON/OFF switch (83).

(ii) F.95-G.45 SELECTOR switch (84).

(iii) An IRIS SETTING switch (82).

(iv) A camera WINDOW OPEN-SHUT switch (73) controls the opening and closing of these protective shutters. The shutters will open automatically with the switch in the OFF position when the camera button is pressed, but can only be closed by use of the selector switch. The shutters will also open automatically when the engine is stopped and shut when it starts. There is no method. other than starting the engine, of opening the shutters on the ground if the switch is set to SHUT when the engine is shut down.

(v) Footage indicators (81) with resetting controls. Provision is made here for a fourth indicator for a downward facing camera (at present not fitted).

NOTE.-Items (i) to (v) are on the switch panel on the starboard wall.

(vi) Individual 4FPS-OFF-8FPS selector and speed control switches together with green indicator lights (56) on the starboard quarter panel. The lights glow dimly when the shutters are open and flash when the cameras are in operation.

(vii) The cameras are operated by the button (70) on the left-hand side of the control column hand grip. They will also be set in operation if the F.95/G.45 selector switch is set to F.95 and the gun tiring button is pressed.

49. G.45 and recorder cameras

In additions to the F.95-G.45 selector switch (84), a G.45 MASTER switch (75) and a CLOUDY/SUNNY switch (74) are fitted. The MASTER switch must be ON and the selector switch must be at G.45 before the camera will operate. Operation is by means of the camera button (70), or when the gun tiring button is pressed.

PART II
LIMITATIONS

50. Engine limitations-Avon Mk. 114

Condition	Time Limit	R.p.m.	Max. J.P.T. °C.
Take-off and Operational Necessity (with or without reheat)	10 mins. combined	7,900 ± 50	700°C.
Intermediate	30 mins.	7,800	685°C.
Max. Continuous	Unrestricted	7,550	645°C.
Approach	-	4,500 min.	-
Ground Idling	Unrestricted	2,750 ± 100	550°C.

Oil pressures

At 7,550 r.p.m. and above:- 15 lb./sq. in. (min.)
20 lb./sq. in. (normal)

Negative G

The application of negative G is limited to 15 seconds at all altitudes. With reheat in use below 30,000 ft. this limit is reduced to 7 seconds.

51. Flying limitations

(a) Intentional spinning is prohibited.

(b) *Maximum speeds*

Clean aircraft 600 knots. No mach limit but see para. 65.

With belly tank

Below 10,000 ft.	585 knots or 0.92M.
Above 10,000 ft.	585 knots or no mach limit.

Flying in Manual (with or without belly tank) 500 knots or 0.90M.

Undercarriage Operation and flight with u/c lowered 250 knots

Belly tank jettisoning 550 knots (180 knots min.)

(c) *G limitations*

Clean, or with empty belly tank	7.5G
With full belly tank	6.5G

(d) *Weight limitations*

Take-off	21,500 lb.
All permitted forms of flying...	19.500 lb.
Normal landing	17,000 lb.

NOTE.-For landing at higher weights, special care is necessary as full strength factors are exceeded.

(e) *Temporary limitations*

Pending trials, or the completion of trials, the following limitations should be adhered to:-

(i) *Engine anti-icing*

Use of the system is prohibited.

(ii) *Pressurization, heating and cooling*

To allow sufficient time to clear any possible misting, a reserve of fuel sufficient for 5 minutes high speed low level flight should be allowed.

(iii) *Gun firing*

Gun firing above 10,000 ft. or below 350 knots I.A.S. is prohibited.

PART III
HANDLING

MANAGEMENT OF SYSTEMS

52. Management of the fuel system

(a) The L.P. and H.P. cocks and fuel master switch may be on for starting and at all times when the engine is running.

(b) Set the retrim switch to AUTO and the override switch to NORMAL, to ensure all fuel is fed automatically and in the correct sequence, the belly tank (when fitted) being used first.

(c) For take-off, with the belly tank fitted, set the override switch to TAKEOFF. This allows fuel to be fed from the rear internal tank first thus ensuring that the C.G. remains within limits for the whole trip. Once comfortably airborne the switch should be returned to NORMAL.

(d) If the automatic balancing system fails, and a nose or tail heavy indication is given, trim can he restored by operating the retrim switch in the direction of the white indicator until it returns to black. When less than 1,000 lb. of fuel remain, any out-of-trim indications may be safely ignored, unless the aircraft appears to be abnormally nose- or tail-heavy. Lateral out of balance may occur due to unequal feeding, but, unless this is due to a booster pump failure, balance will be restored as the wing tanks empty.

(c) If a booster pump fails, the appropriate magnetic indicator will show white and the fuel from this tank should be considered unusable.

(f) If the fuel pressure indicator shows white (fuel pressure low) when the belly tank is being used, switch the over-ride switch to TAKE-OFF immediately.

53. Engine handling

(a) The acceleration control unit (A.C.U.) ensures optimum acceleration under normal flight conditions at low altitude but becomes progressively less effective with increase in height. Except in cases of necessity throttle movements should be smooth and progressive. Damage to the engine may result if the throttle is closed too rapidly at high R.P.M.

(b) When the compressor is hot the engine will not accelerate from low r.p.m., (below about 3,500). These conditions can only be reached if the throttle is closed after a period at high or moderate power at low speed (e.g. the approach to land). At high speed this will not occur as the r.p.m. will not fall low enough until the speed has dropped off by which time the compressor will have cooled. It may be found, particularly in hot weather, that the engine will not accelerate when the throttle is opened to taxy away at the end of the landing run. In this case the throttle should be closed and opened again to assist the engine to pick up but careful watch must be kept on j.p.t.

WARNING.-Except in cases of extreme emergency no attempt should be made to overshoot once the throttle has been fully closed for landing.

(c) When temperatures at high altitude are below normal a combination of high r.p.m. and low forward speed can produce a compressor stall which is accompanied by one or more loud bangs. With the compressor in a stalled condition the engine will idle at lower r.p.m. than is normal at high altitude and a slight buzzing noise may be discernible, in this condition the engine will not accelerate when the throttle is opened. If this occurs the throttle should be closed at once to prevent excessive j.p.t. and speed increased until the compressor unstalls and buzzing ceases. Up to 8,000 feet may be lost before the compressor will unstall and it should not be assumed that a flame out has occurred unless the r.p.m. are substantially below 3,000. If flame out has occurred the

H.P. cock should be closed and all unnecessary electrical services switched off. (See para. 76).

(d) With reheat on. any form of compressor stall is unlikely to occur but if it does the reheat will cancel automatically and the throttle should be closed.

54. Management of the reheat system

(a) To operate the reheat, check that the shut-off switch is at NORMAL and open the throttle to the reheat gate. Cheek that the j.p.t. exceeds 600°C. at 7,900 ± 50 r.p.m. and then push the throttle through the gate. The reheat will light after about three seconds.

(b) When the reheat lights up momentary fluctuation of r.p.m. occurs but should damp out quickly. If, when reheat is on at high altitude, a fluctuation of r.p.m. accompanied by a sympathetic thrust variation sets in, it is due to malfunctioning of the reheat controller. If the fluctuation becomes large (more than 100 r.p.m.) reheat should he cancelled.

(c) Reheat light-up at heights above 25,000 feet is not 100% certain.

(d) To cancel reheat pull the throttle out of the gate and throttle back. However at lower altitudes it will be necessary to pull the throttle out of the gate and then operate the REHEAT SHUT-OFF switch in order to prevent r.p.m. falling below 7,600. If the shut-off switch has been used to cancel reheat it must afterwards be returned to NORMAL, so that reheat will be available when next required.

(e) The nozzle position indicator shows white only when the nozzle eyelids are in the incorrect position for the running condition selected. It shows white therefore momentarily, whilst the eyelids are changing position when reheat is selected or cancelled.

(f) *Failure of the reheat system*

(i) If the eyelids fail to open after light-up occurs, pressure will build up in the jet pipe and will automatically cut off the reheat fuel. Reheat should then

be cancelled by use of the shutoff switch. If there is any delay in cancelling, the reheat will light intermittently as pressure rises and falls. The indicator will remain white from the time the throttle is put through the gate until reheat is cancelled.

(ii) If the eyelids fail to open fully after light-up occurs, but back pressure is insufficient to operate the automatic cut-off, then the reheat will continue to burn. If the indicator does not go black after a maximum of five seconds after light-up then the reheat should be cancelled by use of the shut-off switch. Delay in cancelling will cause the amber hot gas warning light to come on. The indicator will behave as in (a) above.

(iii) If the reheat fails to light up or flames out, the eyelids will remain open, or partially open, causing a large drop in thrust and j.p.t. until reheat is cancelled, the eyelids will then close. The indicator will be unreliable until the reheat has been cancelled.

(iv) If the eyelids remain open after the cancellation of reheat, a large drop in thrust and j.p.t. will he apparent and the indicator will remain white.

(v) If the amber hot gas warning light comes on, reheat should be cancelled if in use.

55. Cockpit temperature control and demisting air

(a) When the indicator is set at the junction of the medium (green) and cold (blue) sectors, cockpit air temperature will he comfortable for the initial climb. When a change in temperature is required the indicator should not be moved more than one division as there is a delay, in the temperature change and the control is very sensitive.

(b) With high power settings at low altitude the demisting air is very hot, it should therefore only be switched on if misting occurs. In order to prevent mist and ice formation at high altitude however, the air should be switched on and left on until descent is complete.

STARTING, TAXYING AND TAKE-OFF

56. External checks

(a) The outside of the aircraft should be systematically checked for obvious signs of damage, security of panels, filler caps, doors, wheel fairings and belly tank. The engine intakes and boundary layer bleeds must be free from any obstruction or debris, and the jet pipe should be checked for distortion. Oleos should be checked for equal extension, the tyres for creep, excessive wear or cuts, and the brake leads for damage. The pitot head cover and the undercarriage ground locks must be removed. Check the BUTT TEST switch and the GUN FIRING GROUND TEST NOSEWHEEL RETRACTION switch in the starboard wheel bay are set to OFF and the locking bolt on the latter is in position. If the retraction switch is ON with no pressure in the system the nosewheel will retract when the engine is started.

(b) Check that the pressure gauges in the nosewheel bay read as follows:-

Brake accumulator pressure	1,750 lb./sq. in. min.
Anti-G pressure	1,800 lb./sq. in. max. 500 lb./sq. in. min. (Max. consumption in one flight).

57. Cockpit checks

(a) Strap in and then make the necessary oxygen, emergency oxygen and anti-G suit connections. have the seat safety pin removed and stowed and the emergency oxygen pin removed. Then check:-

Belly tank jettison (3)	Down and locked (irrespective of whether belly tank fitted or not to prevent fouling the H.P. cock).
Ignition circuit breaker	
Undercarriage selector (41)	Down, button fully in.
Hood jettison indicator	Safe. Pointer on line.
Armament switches	Safe or off.

Brakes	On. Equal pressure at each wheel with rudder bar central. (If pressure is zero, check after starting.)
Air inlet cover	As required.
IFF	(Not titled.)
Cockpit vent (7)	Closed (fully clockwise.)
Port and starboard accumulator gauges (9) (10)	2,150 lb./sq. in. (min.)
H.P. cock (2)	OFF.
V.I. tailplane speed control switch (8)	FAST.
Main trim isolation switch (15)	NORMAL (locking wire in position).
Auto stabiliser	(Not fitted.)
Windscreen de-mist (12)	OFF.
Engine anti-ice	Not in use.
Cockpit master switch (13)	OFF.
Throttle (21)	Closed.
Engine L.P. cock (27)	On.
Reheat L.P. cock (28)	On.
V.H.F. (25)	Select No. I or 2 set. as required.
Aileron power selector (34)	Out (aft).
Flap limit setting switch (22)	TAKE OFF AND AIR-BRAKES.
Fuel override switch (36)	NORMAL.
Pitot head heater (37)	OFF.
Fire warning lights (45) (46)	Pull to test.
Reheat emergency shut-off switch (47)	NORMAL.
F.95 Camera switches (56)	OFF.
Fuel retrim switch (61)	AUTO.
Elevator power selector (64)	Out (aft).

Reheat top temperature control (when fitted)

Oxygen (66)	Contents and delivery. 100%.
	Blinker annunciating.
Armament panel switches	Cockpit pressure warning (76) on.
	Camera window switch (73) off (central).
	Remainder as required.
Rudder pedals	Adjust as required.
Seat	Adjust as required.
Anti-G suit valve (92)	ON and test.
Emergency oxygen control (94)	Off (fully down).
Hood clutch (86)	ENGAGED.
Battery isolating switch (30)	ON.
Flight instruments early start switch	ON.
Inverter changeover indicator	White.
Fuel flow failure indicators (58)	White.
Fuel pressure warning indicator (59)	White.
Belly tank empty indicator (63)	White.
Generator failure indicators (55)	White.
Air extraction failure indicator (49)	Black.
Nozzle position indicator (43)	Black (if white, check that it goes black after starting and opening the throttle).
Turn and slip indicator	Functioning.
Undercarriage position indicator (42)	Three green lights. Check changeover and day/night switches.
Fuel contents gauge (60)	Contents.
Cockpit lighting	As required.
Ignition switch (52)	ON. Check No. 2 inverter aurally and gyro instruments erect. (Pw-Mod. 607)
Starter master switch (33)	ON. Check aurally No. 1 inverter takes over. (Pw-Mod. 607)

58. Cheeks before starting

Batten isolation switch (30)	ON.
Throttle (21)	Closed.
Engine L.P. cock (27)	On.
Reheat L.P. cock (28)	On.
Ignition switch (32)	ON. Circuit breaker ???
Starter master switch (33)	ON.
Fuel muster switch (31)	ON, check fuel pressure indicator black.
	1. *Clean aircraft* Forward and centre indicators black.
	2. *Full belly tank* All internal indicators white, belly tank indicator black.
H.P. cock (2)	OFF, check relight aurally by pressing the button on the side of the H.P. cock. Then set cock fully ON.

59. Starting the engine

(a) With the H.P. cock fully on. press the starter button.

(b) The starter cartridge fires over a period of 2-3 seconds during which time the engine speed should rise to approximately 1,450 r.p.m., and light-up occur. The engine should accelerate to the idling r.p.m., 2,750 ± 100 in approximately 30 seconds.

(c) *Failure to start*

(i) If the cartridge does not fire, close the H.P. cock immediately. It must not be assumed that the breech is empty and the time switch should be allowed to run out (30 seconds) before attempting a further start. If the second and third cartridges fail to fire have the defect investigated.

(ii) If the cartridge fires, but the engine fails to light up, close the H.P. cock without delay. If it is suspected that an excess of fuel has collected in the engine, a

second cartridge should be fired with the ignition switch and the H.P. cock off. This procedure entails a 30-second delay whilst the time switch runs out. A third attempt may be made after an interval of at least 30 seconds as controlled by the time switch.

(iii) If, due to a circuit fault, the starter button does not hold in, irrespective of whether a cartridge is fired or not, a period of at least 30 seconds must elapse before the button is again pressed.

(iv) If the pressure relief valve sticks open, as indicated by intermittent clouds of black or yellow smoke from the starter exhaust without r.p.m. indication, wait at least until the time switch runs out (30 seconds) and then fire a second cartridge.

(v) The run of the time switch must not be shortened by the use of the master switch, otherwise over-speeding of the starter may occur in some circumstances. A period of at least 10 minutes must elapse between firing ~~the third successive~~ a cartridge and reloading the breech.

60. Checks after starting

R.p.m.	2,750 ± 100.
J.p.t.	550°C. Maximum.
Fire warning lights	Out.
Oil pressure	Registering, needle off the stop.
Port and starboard hydraulic pressure gauges	3,150 ± 150 lb/sq. in.
Inverter changeover indicator	Black.
Generator failure indicator	Black.
Fuel override switch	TAKE-OFF if full belly tank fitted.
Fuel flow failure warning indicator	All black. Belly tank indicator white.
Nozzle position indicator	Black (if white, check at higher r.p.m.)

Power controls	Aileron gear set to POWER.
	Ailerons: Push selector fully forward and move the slick laterally until full and free movement is obtained; check that the green light comes on and the red warning light stops flashing.
	Elevator: Push selector fully forward and move the stick until full and free movement is obtained, check that green light comes on and the red warning light stops flashing. Easier engagement may result if the stick is put fully forward before selecting power on.

NOTE.-The red waning light will slop flashing only when both aileron and elevator hydroboosters are fully engaged. having been selected on. Considerable force may be required to move the stick laterally until proper engagement of the ailerons is achieved.

Undue force should not be used to achieve elevator engagement. It is better to select Manual and try again with the control column in a different position. Engagement of the powered controls is sometimes easier at r.p.m. above 4,500.

Rudder trim	Operation and set normal.
Aileron trim	Operation and set neutral.
V.I. tail	Check rate of operation with T.P. INCIDENCE PRE-SELECTOR at -4° to -9° position (aft) using control column switch with speed control switch at FAST and SLOW. Then return PRE-SELECTOR to +4°, -4° position (forward). (See para. 22(b)(v).)
	Return FAST/SLOW switch to FAST.

V.I. tail duplicate slow control	Operation and set neutral.
Flaps	Check operation to the TAKE-OFF/AIR-BRAKE and LANDING positions. Check that the hydraulic accumulator pressures return to 3.150 ±150 lb./sq. in.
Radio	On and test.
Audio warning snitch	TEST, then set to ON.
Instruments	Check artificial horizon. Set Mk. 4F compass and altimeter.
Brakes	3,150 ±150 lb./sq. in. Equal pressure with rudder bar central. Boost switch off.

61. Taxying

Taxy forward and check for equal braking effect. Taxying is easy and the characteristics are those of a normal nosewheel undercarriage jet aircraft.

62. Checks before take-off

Trims	All neutral.
Fuel	H.P. cock locked on.
	L.P. cocks both on.
	Override snitch NORMAL (TAKE-OFF if belly tank fitted).
	Reheat emergency cut-off switch NORMAL.
	Fuel master switch ON.
	Fuel pressure indicator black.
	Internal flow indicators black.
	Contents sufficient.
	Retrim switch AUTO, indicators black.
	(See NOTE overleaf.)

Reheat top temperature control (when fitted) OVERRIDE.

Flaps	Take-off.
Instruments	Check (Press fast erection on artificial horizon if necessary).
	Pressure head heater ON.
Oxygen	ON. 100%-reaching mask, blinker annunciating.
Hood	Closed. OFF
	Switch at ~~SHUT~~ 033, clutch ENGAGED. Cockpit pressure on. Temperature as required.
Harness	Tight and locked.
Flying controls	Full, free and correct movement. Green lights on, red warning light out.

NOTE.-It is possible that the retrim indicators will flicker white during taxying out and take-off.

63. Take-off

NOTE.-Unless maximum range is essential and the runway length is in excess of 2,500 yards, take-offs should be made with reheat on. If reheat is used for take-off and acceleration to 250 knots, only 80 lb. more fuel is used than on a non-reheat take-off and acceleration to the same speed.

(a) Align the aircraft on the runway and check that the brakes hold at an absolute minimum of 7,000 r.p.m. Then with the aircraft stationary, switch on the brake boost and release the brake lever.

(b) Open the throttle to the reheat gate and check that the j.p.t. exceeds 600°C. at 7,900 ± 50θ r.p.m. The normal j.p.t. at 7,900 r.p.m. (reheat or non-reheat) is 610° to 620°C.

(c) Push the throttle through the reheat gate. The reheat will light after about three seconds. As the throttle is pushed through the gate, check that the nozzle position indicator changes to white and back to black about three seconds after light-up. *Check that the j.p.t. exceeds 600°C., and both power control green lights are on:* then switch off the brake boost.

(d) The aircraft accelerates rapidly with no tendency to swing, the rudder becoming effective at 60 to 70 knots: until this speed is reached directional corrections should be made on the brakes.

WARNING.-There is a high degree of elevator boosting (15:1) and care should be taken to avoid over-controlling during take-off.

(c) The elevator becomes effective suddenly at just over 100 knots and a slight backward pressure will raise the nose-wheel at 110 to 115 knots. The aircraft should be flown off at 145 to 150 knots (155 to 160 knots with full belly tank), and should not be pulled off the ground. Apply the brakes momentarily and retract the undercarriage. The nosewheel locks up with a distinct thud and may cause slight vibration until it stops spinning. *The audio warning may sound whilst the undercarriage is coming* up.

(f) When the undercarriage is up. raise the flaps; there is no tendency to sink although a nose-up change of attitude occurs.

(g) To cancel reheat bring the throttle back through the reheat gate and operate the shut-off switch. Return it to NORMAL after cancelling so that reheat will be available when nest required (again the nozzle position indicator will momentarily show white whilst the eyelids are changing position).

(h) If the fuel override switch has been selected to TAKE-OFF, return it to NORMAL.

When safely airborne switch the wheel bay temperature control to normal.

HANDLING IN PLIGHT

64. Climbing

(a) The recommended climbing speeds are given below. Nothing is gained by holding the aircraft down; speed should be allowed to increase to the recommended figure as 5,000 ft. is reached. At high altitude it is particularly important to maintain the correct climbing speed. If speed is reduced the rate of climb will fall off rapidly and it will take a long uric to regain speed without losing height.

Height	*Reheat off*	*Reheat on*
5,000	400 kts.	0.81M
10,000	400 kts.	0.83M
15,000	400 kts.	0.84M
20,000	0.8M	0.85M
25,000	0.83M	0.85M
30,000	0.85M	0.86M
35,000	0.85M	0.86M
40,000	0.84M	0.86M
45,000	0.83M	0.86M

(b) For maximum range, reheat should not be used on the climb and to avoid exceeding the engine limitations it is recommended that 7,750 r.p.m. be used up to 20,000 ft. and full power thereafter. At full power no throttle adjustments should be required but at lower r.p.m. it may be necessary to throttle back as height is gained to maintain the selected r.p.m.

65. General flying

(a) *Longitudinal stability and control*

(i) Stability

The aircraft is statically stable throughout the speed range up to about 0.86M, when a nose-down trim change sets in. The trim change continues up to about 0.91M, when little further trim change occurs up to about 0.955M (which is sonic speed). At this speed a slight nose-up trim change occurs and above this speed the aircraft is stable. The trim changes can be held on the elevator but the aircraft should normally be kept trimmed on the V.I. tailplane. For high mach number and low and medium indicated airspeed flying, it is recommended that the tailplane be operated with the speed control in FAST. For flying at high indicated airspeeds the control should be set to SLOW otherwise this control will be over-sensitive.

(ii) *Elevator control*

At low and medium speeds the elevator is very light. It becomes heavier as speed is increased up to about 0.88M when it begins to heavy-up more rapidly. As the aircraft becomes supersonic a slight kick may be felt on the elevator and the stick may move back slightly without affecting the flight path of the aircraft. Above this speed the elevator is heavy and its effectiveness is reduced, the G available from the trimmed value being about 1.25 (i.e. an accelerometer reading of 2.25 when trimmed at 1G) when applying a maximum stick force. Under

these conditions it is recommended that the V.I. tail be used to assist the elevator and when this is done longitudinal control is entirely adequate. It must he realised, however, that if the tail is used to assist manoeuvring at mach numbers between about 0.88 and 0.95 a strong push force will develop if speed falls off.

(b) *Lateral control*

(i) The ailerons are light and powerful. At speeds below 300 knots use of full aileron causes slight yaw in the opposite direction to that in which aileron is applied and this should be counteracted with rudder. When the belly tank is fitted this characteristic is more marked and is present up to about 350 knots.

(ii) Up to about 0.935M, when wing heavying may occur, the ailerons give a high rate of roll: at this speed and up to about 0.945M the rate of roll is reduced but increases again at higher mach numbers. With the belly tank fitted the wing drop is more severe and may require up to 3/4 aileron to hold. For this reason the limitation of 0.92 below 10,000 ft. must not be exceeded.

WARNING.-If the wing drop mach number is reached below 5.000 ft. particularly in bumpy air or when pulling G, the aileron boosters will stall and limit the amount of aileron available. If this occurs speed must be reduced.

(c) *Directional control*

(i) The rudder is light and effective at low speed but becomes progressively heavier as speed is increased.

(ii) At speeds below 250 knots, if rudder is applied beyond two-thirds travel, there is a gradual lightening off of foot load. This is more pronounced with the undercarriage down, particularly when right-rudder is applied, this being due to the effect of the nosewheel door.

(iii) As the aircraft becomes supersonic a slight change in rudder angle may be felt but this does not affect directional trim.

(iv) The rudder tab loses effectiveness above 0.9M and excessive amounts should not be applied owing to the foot force which will develop as speed is reduced.

(d) *Airbrakes*

The flaps may be used as airbrakes at any speed or mach number. Up to about 0.9M there is very little trim change, but at higher mach numbers a nose-down trim change occurs; this can be held on the elevator.

(e) *Changes of trim*

Undercarriage DOWN	Negligible fore and aft. Yaw to starboard.
Flaps/Airbrakes	Negligible up to 0.94M above which nose-down change occurs.

(f) *Flying at reduced airspeed*

(i) Fly at 180 to 200 knots, using the flaps as required.

(ii) The hood may he opened if necessary but an uncomfortable drumming roar is caused when fully open. The maximum speed for opening the hood is 240 knots.

(g) *Flying in turbulence*

The recommended speeds for flight in turbulent conditions are as follows:-

Level flight, or climbing	300 knots/0.79M.
Descending, airbrakes out	270 knots/0.79M.

66. Practice flying in Manual control

NOTE.-If, after practice flying in Manual, it is not possible to re-engage Power correctly (indicated by the red light flashing) select Power off. If subsequent attempts to re-engage Power are unavailing the remainder of the flight and the landing must be carried out in Manual.

(a) *Ailerons*

(i) Before selecting aileron power OFF in flight, check that the aileron trim is neutral and speed is below 280 knots or 0.8M. If an aileron has been changed, or any adjustments made which may affect lateral trim, check the aircraft in Manual at 200 knots, and set the aileron trim as required.

(ii) The stick forces are high and there is a small amount of backlash, but the aircraft may be flown to 0.9M. and 500 knots without undue difficulty.

(iii) Aileron Power can be reselected at any speed and engagement is instantaneous on reselection.

(b) *Elevator*

The elevator may be selected off and re-engaged in flight without difficulty. The stick forces in Manual are high, but these can readily be trimmed out on the variable incidence tailplane.

(c) *Landing*

(i) Practice Manual landings should not be carried out in very gusty and/or crosswind condition. A circuit and landing in Manual, elevator and/or ailerons, presents no special difficulties once the difference in feel is appreciated. It is recommended that a wider circuit is made but otherwise a normal approach.

(ii) In an emergency, when landing in Manual in very gusty or crosswind conditions, special care is needed to allow for backlash in the controls and in these circumstances consideration should be given to jettisoning the belly tank, if fitted.

67. Stalling

NOTE.-Pending the completion of trials, deliberate low speed stalling is not to be carried out beyond the buffet stage nor is it to be carried out below 20,000 feet. Information regarding behaviour beyond the buffet stage is included below to assist pilots who inadvertently enter the fully-stalled condition.

(a) *Speeds*

The minimum speed which can be reached depends upon the way in which the controls are handled and in particular upon the small amounts of G which may be

applied while reducing speed. The speeds and characteristics described are typical for an aircraft with wheels and flaps down, carrying full ammunition and with ½ fuel remaining but without a belly tank fitted.

Speed (knots)	*Remarks*
200 to 150	Progressively increasing left rudder trim is required to counteract the effect of the nosewheel door.
150 to 140	Slight directional wandering which should be corrected with rudder before the associated roll is counteracted with aileron. Slight buffet.
135 to 120	Increase in buffet to a high intensity, increase in rate of sink.
115	Very high rate of sink now present and possible wing drop. If this stage is reached recovery action must be taken immediately.

Note.-These speeds increase by about 5 knots when a drop tank is fitted.

(b) Coarse use of the ailerons may produce marked yaw in the opposite direction to that in which aileron is applied. This is not so likely to occur when the aircraft is being "pushed out" of the stall, i.e. when G is below 1, but whenever it occurs the aileron should be centralised and the wing picked up with rudder.

68. **High speed stalling**

(a) Below 0.85M the aircraft is stable at the G stall, marked by buffeting which increases to strong, before the stage is reached where further application of elevator does not increase the G. In this condition coarse use of the aileron causes the aircraft to yaw.

(b) Between 0.85M and 0.95M the stick force lightens off as G is increased above the value at which buffet sets in. Further increase of G results in a mild pitch-up which requires a rapid forward movement of the stick to check. In order to avoid the possibility of exceeding the airframe

limitations, G should not be increased beyond the initial buffet stage at speeds above 0.85M at heights below 25,000 ft.

69. Aerobatics

The following are the recommended minimum speeds, in knots, for aerobatics until experience is gained:-

Roll (full aileron)	350
Loop	460
Roll off	480
Vertical roll	520

70. Spinning

(a) Intentional spinning is prohibited.

(b) The aircraft is not prone to spin off a stall, either in level or turning flight.

(c) As a result of tests the following actions are recommended in the event of a spin developing:-

(i) Apply full opposite rudder and ease the stick forward taking care to ensure that the ailerons are central. If in doubt release the handgrip and allow the feel spring to centre the ailerons.

(ii) If the undercarriage and flaps arc down they should be retracted immediately.

(iii) Maintain full rudder until all rotation has ceased. Centralise the controls quickly when the spin stops.

(iv) If the aircraft stops in a steep nose-down attitude, extending the airbrakes will enable a tighter pullout to he made.

(v) If the aircraft is beyond the vertical when the spin stops, less height will be lost if it a half rolled before pulling out, but the ailerons must be used very gently.

(d) Flight tests with a ventral drop tank have not been made, but evidence from model tests shows that the tank does not affect a spin recovery and jettisoning the tank during the spin may cause damage to the wing. The tank should not therefore be jettisoned.

Note.- 1. The normal characteristics are a slow rate of spin with considerable oscillation in pitch, the nose dropping steeply down and rising almost to the horizon once in each turn. Recovery action is effective at once when taken with the nose up and within half a turn with the nose down. A moderate force is required to apply opposite rudder and a light force to hold the stick forward.

2. Some spins vary from Note 1 as regards recovery characteristics and are as follows:-
A very light force is required to apply the opposite rudder and a marked degree of sideslip may be felt. This is usually followed by a sudden increase in the rate of spin which may continue with the aircraft pointing steeply down for a further 1 or 1½ turns before stopping.

3. Height loss will nary considerably but the average height involved in making one turn of a spin and recovery to level flight is about 9,000 ft.

4. It is recommended that the aircraft be abandoned if a spin occurs below 15,000 ft. or if a spin which has developed above this height has not been stopped by 10,000 ft.

CIRCUIT PROCEDURE AND LANDING

71. Circuit procedure

NOTE.-460 lb. of fuel should be allowed for the circuit and landing.

(a) Reduce speed to below 250 knots with the airbrakes, then open the throttle to give 6,500 to 7,000 r.p.m. Lower the undercarriage and trim out the resultant foot loads. (See para. 65 (c)(ii).) A comfortable speed for the downwind leg is 180 to 200 knots.

(b) *Cheeks before landing*

Undercarriage	Down. 3 green lights
Brakes	Pressure, operation, off. Supply 3,150 ± 150. Each wheel 1,750 lb./sq. in. Boost switch off.
Flaps	As required. Limit switch to LANDING.
Fuel	Contents.
Harness	Tight and locked.

(c) *Approach*

(i) Turn on finals, at 170 knots, then lower full flop. At maximum overload landing weight in turbulent conditions a speed as high as 200 knots for the turn will he found to be more comfortable. Steep and/or turning approaches are not recommended.

(ii) To ensure quick engine response, r.p.m. should be maintained above 5,500.

(iii) The recommended minimum speeds at which to cross the runway threshold are:-

At normal landing weight (No ammunition and 800 lb. or less fuel)	140
At maximum normal landing weight (17,000 lb.)	145-150
At maximum overload landing weight (Full fuel and ammunition)	160

(d) Landing

(i) From the speeds quoted a roundout and landing in the normal manner can be made, but elevator movements should be gentle to avoid G-stalling the aircraft. If the aircraft is stalled on to the runway a wing drop is unlikely but a slight yaw may occur which should he corrected with rudder.

(ii) The shortest landing run is obtained by putting the nosewheel on to the runway as soon as possible after touch-down and applying the brakes, but when sufficient runway is available and/or the wind is strong (above 15 knots) brake wear can be reduced by holding the nose up until it falls at about 90 knots. An excessive nose-up attitude should be avoided otherwise the tail may strike the ground.

(iii) The maxaret units prevent the wheels locking when excessive brake is applied but unless the shortest possible run is required more gentle use of the brakes is recommended. When the runway is slippery a greater distance is needed to stop and braking should be started as early as possible. If difficulty is experienced in keeping straight release the brakes momentarily.

(iv) The aircraft must be firmly on the ground before the brakes are applied as the maxaret units do not operate until the wheels are revolving. As a safeguard against locking the wheels during a bounce the maxaret units do not cut out until 4 seconds have elapsed.

(v) For cross-wind landings the "crab" technique is recommended. There is no difficulty in kicking the aircraft straight before touchdown but some aileron movement is required to counteract the roll resulting from the yaw.

NOTE.-New brake pads require bedding in before they work efficiently. When these have been fitted the aircraft should be taxied up to 60-70 knots and stopped with *gentle* brake application. A definite pause, with the brakes off, should be made between runs to allow the brakes to cool. Following this procedure two landings should then be made, using the full runway length and with gentle brake application.

22. Instrument approach

The following are the recommended speeds and approximate power settings with the undercarriage down.

	R.p.m.	Flaps	Airspeed (Knots)
Downwind	7,100	Take-off	180/190
Base Leg	7,100	Take-off	180/190
Glide Path	6,500	Full	160

73. Going round again

WARNING: Except in cases of extreme emergency no attempt should be made overshoot once the throttle has been fully closed for landing, as the engine cannot be relied upon to accelerate from low r.p.m. when the compressor is hot (see para 53(b)).

Open the throttle smoothly to the power required and raise the undercarriage. When the wheels have locked raise the flaps.

74. Checks after landing

Brake pressure	Sufficient
Flaps	Up
Pressure head heater	Off

75. Stopping the engine

Close the throttle. When r.p.m. have dropped below 3,000, turn off the H.P. cock and check:-

All electric	Off.
Battery master switch	Off.
L.P. cocks	Off.
Ejection seat	Safe.

PART IV
EMERGENCY HANDLING

76. Engine failure and relighting in flight

(a) *Sudden drop in engine speed*

NOTE:-This procedure only applies if the H.P. pump isolating valve and switch are fitted (by engine mod. action).

(i) If a sudden inexplicable drop in engine speed occurs, which cannot be identified as engine surge (see para. 53(c)) proceed as follows:-

Above 20,000 ft. Close the throttle fully and descend: check engine response to throttle movement during the descent.
Below 20,000 ft. If the engine fails to respond to normal throttle movement, close the throttle fully and set the H.P. pump isolating switch ON. If the engine still fails to respond to throttle movement, leave the switch at ON and carry out relight action. Once the switch has been set ON it must be left there for the remainder of the flight; with it thus set the A.C.U. is ineffective and all throttle movement must be made with care.

(b) *Flame-out*

(i) If a flame-out occurs when the engine is at or above cruising power, it will be indicated by the r.p.m. decreasing at approximately 1,000 r.p.m. per second initially. A relight may he attempted immediately, while r.p.m. are decreasing, by pressing the relight button with the H.P. cock open and the throttle at its set position. A successful relight w111 he indicated by the r.p.m. stabilising and then commencing to rise; the likelihood of a successful relight is increased if the height and airspeed are below the permitted maxima for relighting.

(ii) If no relight occurs within 10 seconds, release the relight button and proceed as follows:-

H.P. cock	OFF.
Throttle	Closed.
Engine L.P. cock	Leave on.
Reheat L.P. cock	Closed.
All non-essential electrics	OFF (see para. 89 (b)).
If below 35,000 ft.	Relight at once.
If above 35,000 ft.	Switch off the booster pumps, descend to 35,000 ft. and carry out the relight drill.

(iii) If above 35,000 ft. the decision either to descend quickly or glide at 200 knots will depend on the prevailing circumstances e.g. weather conditions, distance to travel, etc. The following should be borne in mind:
1. The likelihood of obtaining a relight increases with decrease in altitude.

2. At best gliding speed the aircraft will cover approximately 2 miles per 1,000 ft.
3. With normal services running the battery cannot be relied on for more than approx. 5 minutes. All non-essential services including booster pumps should therefore be switched off to conserve battery power.
4. Descending rapidly at a speed above 200 knots will increase windmilling r.p.m. Consequently hydraulic pressure will be higher and the generators may continue to supply power.

(c) *Relighting*

NOTE:- This drill applies irrespective of the position of the jet pipe eyelids. Relights are obtained more easily at lower altitudes and with lower airspeeds. Every precaution should be taken to ensure success at the first attempt due to the loads on the battery. If the engine and its fuel system are serviceable and the drill is followed correctly, a relight should occur at the first attempt.

(i) Check and/or set:-

Maximum altitude	35,000 ft.
Maximum airspeed	200 knots above 25,000 ft. 0.80M below 25,000 ft.
All non-essential electrics	OFF (See para. 89(b)).
Throttle	Closed.
Battery master switch	ON.
Ignition circuit breaker	IN.
Starter master switch	ON.
Fuel master switch	ON.
Furl override switch	~~NORMAL (but~~ TAKE-OFF if low pressure warning is white).
Reheat L.P. cock	Closed

(ii) Press the relight button and al the same time open the H.P. cock fully, keeping the relight button pressed until the engine lights up and r.p.m. rise by about 200. R.p.m. should commence to rise almost immediately. When the r.p.m. rise to idling, increase power carefully.

(iii) If no relight occurs within 30 seconds, release the relight button. close the H.P. cock, switch off the booster pumps. Allow if possible, 30 seconds for the engine to dry out before the next attempt.

(d) *Emergency relighting*

(i) In circumstances where the engine cannot he relit by use of the above drill, *provided that the pilot is reasonably certain that the fault lies in the relight button circuit*, it may he possible to obtain a light-up using the starter pushbutton in the following way:-

(ii) To ensure that a live cartridge is not fired, the spent cartridge with which the engine was ground-started should first he mechanically reindexed. To do this, set the starter master switch OFF and then press the starter pushbutton fully in twice, pausing for an instant between each operation to allow the button to spring fully out.

(iii) Check and/or set:-

Maximum altitude	15,000 ft.	
Maximum airspeed	0.80M.	
All non-essential electrics		OFF (See para. 89(b)).
Throttle	Closed.	
Battery master switch		ON.
Booster pumps		ON.
Starter master switch		ON.
Ignition switch		ON.
Ignition circuit breaker		IN.

(iv) Press the starter push-button again and then open the H.P. cock fully. The igniters will then function but if the reindexing drill has been correctly carried out a cartridge will not be fired. If no relight occurs within 30 seconds, set the H.P. cock OFF when the starter button comes out. The spent cartridge must be reindexed as in (ii) above before any further attempt is made.
WARNING:-If for any reason the reindexing drill has not been correctly carried out and a live cartridge is indexed when the starter button is finally pressed, it is probable that damage will be caused to the starter and to the aircraft. This probability may be lessened to some extent if the engine windmilling speed is low and positive G is not applied at the time of operating the pushbutton.

(b) *Actions in the event1 of engine failure - hydraulics serviceable:*

(i) *Engine windmilling:* Sufficient hydraulic power should be available for power controls provided that unnecessary operation of airbrakes is avoided. Reference should be made to the hydraulic accumulator gauges to check the available hydraulic pressure remaining. Select elevator and aileron Power off before selecting normal or emergency undercarriage and flap down, if a wheels-down landing is being attempted.

(ii) *Engine seized:* Do not use the airbrakes to reduce speed. As soon as the aileron and elevator accumulators are exhausted the respective controls will revert to Manual, but in any case select elevator and aileron Power OFF before landing.

86. **Undercarriage and flaps emergency operation**

(a) (i) Although the emergency lowering systems will operate irrespective of the position of their normal selectors, the respective normal selector should whenever possible be set to the Down position before operating the emergency control. This will obviate any possibility of the service subsequently retracting should a fault occur in the emergency system.

(ii) Full flap only will be obtained regardless of the position of the limit setting switch.

(b) If either service fails to operate due to an electrical failure the appropriate emergency control should be operated. All other hydraulic services will then continue to operate normally.

(c) **[Line missing]**
warning, power controls should be selected to Manual. The undercarriage should be lowered by pressing the emergency button on the rear face of the port console, after which the flaps may be lowered by use of the adjacent emergency flap lowering button.

(d) If the undercarriage lowers when selected normally but three green lights are not obtained because of a microswitch failure or failure of an undercarriage lock to engage, operation of the emergency system will lower the hydraulic pressure available by approximately 1,000

lb. sq. in. Harsh movements of the power controls or use of airbrakes will then deplete the hydraulic accumulators and lead to Manual reversion. It is therefore recommended that if the emergency button is going to be used under these conditions power controls be selected to Manual first.

(c) To raise the undercarriage after use of the emergency system, reselect the emergency button and select UP on the normal system. If hydraulic pressure is available, the undercarriage should retract.

(d) If it is necessary to retract the undercarriage whilst the aircraft is on the ground, rotate the UP selector button clockwise and press.

NOTE:-1. This must not be used to retract the undercarriage in the air if it is found that the UP button cannot he pressed in. In this case the wheels must he left down and the aircraft landed.

2. If the undercarriage has not been lowered by normal selection the air extractor valve will not be in the correct position. The engine should he shut down at the end of the landing run to prevent overheating.

87. **Wheel brakes emergency operation**

(a) The wheel brakes accumulator provides sufficient pressure for brake operation during landing down to a pressure Of 1,750 lb./sq. in. approximately.

(b) If full brake is applied, the maxaret units will deplete the accumulators sooner than necessary. It is therefore recommended that a visual check of the brake gauge is kept and a steady application of approximately 600 lb./sq. in. is made. The amount of pressure remaining is shown by the top needle of the triple pressure gauge. Brakes will fail completely at approximately 1,750 lb/sq. in.

88. **Flapless landing**

A normal circuit and approach should he made and the threshold crossed at a speed 5 to 10 knots in excess of the normal final approach speed.

89. Forced landing

NOTE:-1. Unless the proposed landing area is known to be suitable in all respects ~~(e.g. 3,000 yards of runway)~~ it is recommended that the aircraft is abandoned.

2. The minimum height/airspeed combination for safe ejection in straight and level flight is 100 ft./120 knots.

(a) The engine, unless it is damaged, will windmill at sufficient r.p.m. to provide power for the flying controls. but excessive and coarse control movements must be avoided to prevent using hydraulic pressure more rapidly than the pump can replace it.

(b) With a windmilling engine (1,800 r.p.m. at 200 knots), the generator r.p.m. are too low to provide power for all the electrical services. There will therefore be some drain on the batteries. Switch off all unnecessary electrical services.

(c) If committed to a forced landing on the airfield without power the recommended procedure is as follows:-

(i) Jettison the belly tank (if fitted) and the hood.

(ii) The best range gliding speed for the clean aircraft is 200 knots.

(iii) Aim to be over the airfield at 6,000 ft. (7,000 ft. in Manual) and downwind opposite the caravan at 4,000 ft. (4,500 ft. in Manual) A.G.L.

(iv) Maintain 200 knots until the turn on to the final approach has been completed.

(v) The final approach should be made at 190 knots. When it is certain that there is no possibility of undershooting or overshooting, the power controls should be set to off and emergency undercarriage and flap selected.

90. Belly tank jettisoning

The belly tank mechanical release is operated by pulling up the jettison handle, on the port shelf. A nose-down pitch is apparent when jettison takes place. It is therefore recommended that a slight nose-up attitude is adopted before jettisoning at very low altitude. Belly tank jettison tests have been carried out between 180 and 550 knots.

91. Ditching

(a) Model tests indicate that except in calm sea and air conditions the pilot should bale out rather than attempt ditching.

91A. Landing with an undercarriage unit not locked down

NOTE:-Experience has shown that these techniques cause minimum damage to the aircraft and none to the pilot.

(a) *Both main wheels only locked down*

(i) Use up as much fuel as is safe in order to move the C. of G. as far aft as possible. Unless circumstances dictate otherwise land on a runway.

(ii) Check harness tight and locked.

(iii) Select hood open when crossing the threshold.

(iv) Make a powered approach at the normal speed; on touch-down turn the H.P. cock off and maintain a moderate nose-up attitude.

(v) Trim the tailplane to give full nose-up trim and as the speed falls below 100 knots maintain a high nose-up attitude without actually touching the tail cone on the ground.

(vi) When the nose drops on to the runway at approximately 80 knots use the brakes gently to keep straight.

(b) *Nosewheel and one main wheel locked down*

If all attempts to lower the undercarriage satisfactorily fail and only the nosewheel and one main wheel come down, make a normal approach and landing; on touchdown turn the H.P. cock off and hold the wings level for as long as possible by use of the ailerons. When aileron is applied and when the wing finally drops, the aircraft will swing in the direction of the unlocked wheel; this should be counteracted as much as possible by opposite brake. Experience has shown that the distance from the landing path to the point of rest averages approximately 250 yards, varying from 100 yards (min.) to 400 yards (max.). A runway should be chosen which has an area about 400 yards wide available in the direction of the anticipated swing.

(c) *Belly landing*

If it is necessary to land with the undercarriage retracted, make a normal approach and fly the aircraft gently on to the runway at the normal speed.

PART V
OPERATING DATA

92. Loading and C.G. data

NOTE:-When making C.G. calculations reference should always be made to AP4348 Vol. 1. Sect 2 Chap 3.

(a) *C.G. Limits*

The following are the C.G. limits With the undercarriage up.

Forward limit	9.5 ins. aft of datum
Aft limit	9.9 ins. aft of datum

(b) Ballasting

If any of the following are not installed, the aircraft must be ballasted according to the following table:

Item	No. of 10 lb. ballast weights (see NOTE 2)
Guns and fittings	14
D.M.E.	1
I.F.F.	1
V.H.F.	1 per set
G.G.S.	1
G.45 camera	1
F.95 beam camera	2 per camera
F.95 nose camera (12" lens)	5 (see NOTE 1)

NOTE:-1 If F.95 nose camera is fitted with 4" lens, then 1 ballast weight must be carried. If the camera is subsequently removed. 4 further ballast weights must be fitted.

NOTE:-2 The ballast weight bars are *each* equivalent to one standard weight, the ballast pedestals are *together* equivalent to one standard weight. Allowance must he made for the effect of either or both e.g. if 14 weights are specified above, this is equivalent to 2 bars and 12 weights.

(c) *Effect of expendable stores*

(i) Firing ammunition causes the C.G. to move aft.

(ii) Use of belly tank fuel causes the C.G. to move slightly forward. Consumption of internal fuel causes the C.G. to move forward, the furthest forward position being reached when about 1,500 lb. (195 gallons) fuel remain. The C.G. then moves aft again.

(d) *Typical service loads*

Reference fuel - AVTAG. 7.7 lb./gall.

Condition	Approx. all up weight (lb.)
Fighter recce role Cameras, full ammo. and full internal fuel.	19,200
Long range fighter recce role Cameras, full ammo. full internal and belly tank fuel.	21,250

(e) *Baggage*

Personal baggage and small items of equipment may be carried in the empty ammunition tanks (170 lb. max. per tank) and in the equipment bays (50 lb. max. per bay). No alteration to ballast is required.

93. Pressure error correction

(a) ASI sea level pressure error corrections:

A.S.I. Kts.	150	200	250	300	350	400	450	500	550	600
PEC	4	4	4	6	3-4	3-4	3-4	4	3	3-4

(b) Machmeter pressure error corrections:

FIGURES TO BE ADDED

Mach number	0.9	0.925	0.95	0.925	1.0
Sea Level	?M	?M	?M	?M	?M
10,000 ft.	?M	?M	?M	?M	?M
20,000 ft.	?M	?M	?M	?M	?M
30,000 ft.	?M	?M	?M	?M	?M
40,000 ft.	?M	?M	?M	?M	?M

94. Fuel consumption

The approximate fuel consumption in lb./min., at various r.p.m. and altitudes are given below:

FIGURES TO BE ADDED

Height	Full Throttle		7,000 r.p.m.	7,680 r.p.m.
	Reheat	Non-reheat		
Sea Level	?	?	?	?
10,000 ft.	?	?	?	?
20,000 ft.	?	?	?	?
40,000 ft.	?	?	?	?

95. Take-off distance

The following tables give the take-off distance in yards, clean and with belly tank, with and without reheat.

CLEAN AIRCRAFT, WITHOUT REHEAT

Caution figures unreadable so approximate numbers used as place holders on this page

Temperature			I.C.A.O. -30°C	I.C.A.O. -15°C	I.C.A.O.	I.C.A.O. +15°C	I.C.A.O. +30°C
Sea Level	Zero wind	Ground run	1080	1250	1500	1600	
		Dist. to 50'	1640	1900	2200	2600	
	30K wind	Ground run	680	785	990	1170	
		Dist. to 50'	1105	1320	1570	1830	
2,000'	Zero wind	Ground run	1220	1420	1700	2080	
		Dist. to 50'	1800	2150	2570	3240	
	30K wind	Ground run	780	940	1095	1830	
		Dist. to 50'	1250	1500	1800	2000	
							REHEAT SHOULD BE USED
4,000'	Zero wind	Ground run	1380	1620	1940		
		Dist. to 50'	2090	2400	2800		
	30K wind	Ground run	900	1000	1270		
		Dist. to 50'	1475	1700	2040		
						REHEAT SHOULD BE USED	
6,000'	Zero wind	Ground run	1560	1850	2770		
		Dist. to 50'	2280	2680	2950		
	30K wind	Ground run	1075	1230	1475		
		Dist. to 50'	1625	1870	2375		

CLEAN AIRCRAFT, WITH REHEAT

Temperature			I.C.A.O. -30°C	I.C.A.O. -15°C	I.C.A.O.	I.C.A.O. +15°C	I.C.A.O. +30°C
Sea Level	Zero wind	Ground run	760	875	1045	1260	1520
		Dist. to 50'	1200	1340	1560	1840	2180
	30K wind	Ground run	480	550	660	790	955
		Dist. to 50'	835	925	1070	1260	1490
2,000'	Zero wind	Ground run	840	990	1175	1420	1710
		Dist. to 50'	1320	1500	1760	2060	2470
	30K wind	Ground run	540	635	755	910	1100
		Dist. to 50'	930	1050	1230	1430	1720
4,000'	Zero wind	Ground run	950	1120	1340	1600	1920
		Dist. to 50'	1400	1680	2020	2360	2800
	30K wind	Ground run	620	730	875	1045	1250
		Dist. to 50'	990	1190	1435	1670	1975
6,000'	Zero wind	Ground run	1070	1260	1500	1800	2150
		Dist. to 50'	1540	1860	2280	2720	3220
	30K wind	Ground run	710	835	995	1195	1430
		Dist. to 50'	1100	1335	1645	1910	2320

WITH BELLY TANK, WITHOUT REHEAT

Temperature			I.C.A.O. -30°C	I.C.A.O. -15°C	I.C.A.O.	I.C.A.O. +15°C	I.C.A.O. +30°C
Sea Level	Zero wind	Ground run	1340	1600	1900	2300	REHEAT SHOULD BE USED
		Dist. to 50'	1960	2340	2840	3420	
	30K	Ground run	865	1035	1230	1480	
		Dist. to 50'	1380	1640	2000	2395	
2,000'	Zero wind	Ground run	1520	1820	2180	REHEAT SHOULD BE USED	
		Dist. to 50'	2180	2640	3240		
	30K wind	Ground run	1000	1200	1440		
		Dist. to 50'	1535	1875	2315		

For higher altitudes reheat should be used

WITH BELLY TANK, WITH REHEAT

Temperature			I.C.A.O. -30°C	I.C.A.O. -15°C	I.C.A.O.	I.C.A.O. +15°C	I.C.A.O. +30°C
Sea Level	Zero wind	Ground run	935	1100	1310	1560	1920
		Dist. to 50'	1440	1620	1920	2280	2760
	30K wind	Ground run	605	710	845	1010	1240
		Dist. to 50'	1020	1135	1345	1600	1930
2,000'	Zero wind	Ground run	1070	1250	1490	1790	2160
		Dist. to 50'	1540	1860	2230	2640	3130
	30K wind	Ground run	705	825	980	1180	1420
		Dist. to 50'	1090	1325	1590	1880	2220
4,000'	Zero wind	Ground run	1200	1400	1680	2000	2420
		Dist. to 50'	1620	2060	2560	3070	3600
	30K wind	Ground run	805	935	1125	1340	1620
		Dist. to 50'	1155	1485	1855	2230	2600
6,000'	Zero wind	Ground run	1320	1560	1880	2270	2710
		Dist. to 50'	1680	2260	2880	3500	4180
	30K wind	Ground run	895	1060	1275	1540	1840
		Dist. to 50'	1200	1645	2165	2570	3070

96. Flight planning data

(a) The tables on the following pages show the flight planning data for:-

(i) *Climbing*

The climb tables give the data for climbs in I.S.A. conditions using the speeds recommended in para. 64. (Repeated in Col. 1 of the tables.) The cruise data tables are based on rehear take-offs followed by non-reheat climbs. (Reheat climb data is given on page 92.)

(ii) *Cruising*

Each separate altitude block in the cruise table shows:-

(1) The speed for maximum range, the approximate A.N.M./I00 lb. and the approximate fuel consumption for the particular height. In addition a speed band is given, use of any speed within which should not cause more than a 5% reduction in range-.

(2) The range obtainable for various amounts of available fuel when flying at the best range speed for the height. The range given is to the point of let-down, allowance being made for the descent fuel required.

(3) The range obtainable for various amounts of available fuel, including the distance covered on the climb, if a climb is made to another altitude. In this case the climb must be made at the speed given in para. 64 and the flight continued at the new altitude at the best range speed for that height.

NOTE.-The range at any altitude is independent of temperature, but dependent on the weight of fuel carried.

(iii) *Descent*

The descent tables give the data for descending from one height to another.

(b) *Use of the tables*

(i) *Pre-flight planning*

Enter the cruise data table in the sea level block at the fuel state applying immediately after take-off.

Select the height at which maximum range is available at that fuel state. The distance available includes distance covered on the climb, but not on the descent. (Absolute maximum range is obtained by adding on the descent distance, provided that the let-down is commenced at that distance from the destination.)

For short range flights inspect the sea level block and select the height at which the distance to be covered requires the least amount of fuel. This is the best altitude for the flight.

(ii) *In-flight planning*

At any stage of a flight the available range may be ascertained by applying the fuel state to the level flight range in the particular altitude block. If an increase in range is required, or if a climb has to be made, the new available range may be obtained by entering the existing altitude block at the particular fuel state and moving vertically downwards within the block until the new altitude is reached. Figures in heavy type indicate the best altitude for the maximum increase in range. Above these heights no further range increase is possible. If a descent is necessitated, the new range is shown by moving direct from the existing altitude level flight range for the particular fuel state to the new altitude level flight range.

(c) *ANM per 100 lb./T.M.N./R.p.m. curves*

The graphs on pages 93 and 94 show the ANM per 100 lb., for various altitudes, plotted against True Mach Number. Superimposed on the curves are dotted lines which show the approximate r.p.m. required for a given speed.

CLEAN AIRCRAFT

CONTENTS:- 506 gall. 3,900 lb. AVTAG
4,048 lb. AVTUR

TAKE-OFF AND TAXY ALLOWANCE ... 350 lb.

LANDING ALLOWANCE ... ... 460 lb.
(excluding descent fuel)

CLIMB DATA

From	To	Fuel (lb.)	Dist (N.M.)	Mins.
Sea Level* (400 K)	5,000'	470	5	2
	10,000'	585	15	3¼
	20,000'	810	35	5¾
	30,000'	1,010	60	8¾
	40,000'	1,240	95	13¾
5,000' (400 K)	10,000'	115	10	1¼
	20,000'	340	30	3¾
	30,000'	540	55	6¾
	40,000'	770	90	11¾
10,000' (400 K)	20,000'	225	20	2¾
	30,000'	425	45	5⅛
	40,000'	655	80	10⅛
20,000' (0.8M)	30,000'	200	25	3
	40,000'	430	60	8
30,000' (0.85M)	40,000'	230	35	5

* In this block times are from wheels rolling. Fuel used taxy and take-off allowance. Climb at 7,750 r.p.m. to 20,000 ft. then at full throttle.

DESCENT DATA

(Excluding landing allowance)

From	To	Fuel (lb.)	Dist. (N.M.)	Mins.
40,000'	30,000'	15	5	1
	20,000'	30	10	1⅛
	10,000'	60	15	2⅛
	5,000'	100	20	3⅛
	Sea Level	175	30	5¼
30,000'	20,000'	15	5	⅛
	10,000'	45	10	1⅛
	5,000'	85	15	2⅛
	Sea Level	160	25	4⅛
20,000'	10,000'	30	5	1
	5,000'	70	10	2
	Sea Level	145	20	4
10,000'	5,000'	40	5	1
	Sea Level	115	15	3
5,000'	Sea Level	75	10	2

R.P.M. - 6,000 down to 2,000'. Then 6,500'.
AIRBRAKES - OUT
SPEEDS - 0.79M to 33,000'. Then 270K reducing to 240K at 2,000'.

CRUISE DATA-CLEAN AIRCRAFT

FUEL STATE - LB.		3,550	3,400	3,000	2,600	2,200	1,800	1,400	1,000
Sea Level	Range	315	300	260	220	180	140	100	**60**
	5,000'	340	325	280	235	190	140	95	50
ANM/100 lb. -10.2	10,000'	375	355	305	250	200	145	95	**40**
Lb./hr. -3430	20,000'	455	430	365	295	230	165	95	-
Speed -0.53M	30,000'	555	525	440	355	265	**170**	80	-
95% Range -0.42-0.63M	40,000'	**620**	**580**	**475**	**370**	**265**	160	-	-
5,000 ft.	Range	-	330	285	240	195	150	105	**55**
	10,000'	-	365	315	260	210	160	105	50
ANM/100 lb. -11.65	20,000'	-	445	380	315	250	180	**110**	**40**
Lb./hr. -3100	30,000'	-	540	455	370	280	**190**	100	-
Speed -0.58M	40,000'	-	**610**	**505**	**400**	**285**	180	-	-
95% Range 0.45-0.62M									
10,000 ft.	Range	-	370	320	270	215	165	110	**55**
	20,000'	-	455	390	325	260	190	120	**50**
ANM/100 lb. -13.15	30,000'	-	565	480	395	310	**220**	**130**	-
Lb./hr. -2910	40,000'	-	**630**	**525**	**420**	**315**	210	105	-
Speed -0.6M									
95% Range 0.5-0.7M									
20,000 ft.	Range	-	-	400	335	270	200	130	**60**
ANM/100 lb. -16.9	30,000'	-	-	505	420	335	**245**	**155**	**60**
Lb./hr. -2510	40,000'	-	-	**560**	**455**	**350**	**245**	140	-
Speed-0.68M									
95% Range 0.55-0.8M									
30,000 ft.	Range	-	-	525	440	355	265	**175**	**85**
	40,000'	-	-	**590**	**485**	**380**	**275**	170	**65**
ANM/100 lb. -21.8									
Lb./hr. -2140									
Speed-0.8M									
95% Range 0.67-0.85M									
40,000 ft.	Range	-	-	-	**510**	**405**	**300**	**195**	**90**
ANM/100 lb. -25.9									
Lb./hr. -1800									
Speed-0.81M									
95% Range 0.74-0.85M									
FUEL STATE - LB.		3550	3400	3000	2600	2200	1800	1,400	1,000

WITH BELLY TANK

CONTENTS:- 726 gall.=5,590 lb. AVTAG
5,808 lb. AVTUR
TAKE-OFF AND TAXY ALLOWANCE ... 350 lb.
LANDING ALLOWANCE ... ... 460 lb.
(excluding descent fuel)

CLIMB DATA

From	To	Fuel (lb.)	Dist (M.N.)	Mins.
Sea Level* (400 K)	5,000'	485	5	2¼
	10,000'	620	15	3½
	20,000'	890	35	6¾
	30,000'	1,160	70	11
	40,000'	1,580	140	20½
5,000' (400 K)	10,000'	135	10	1¼
	20,000'	405	30	4½
	30,000'	675	65	8¾
	40,000'	1,095	135	18¼
10,000' (400 K)	20,000'	270	20	3¼
	30,000'	540	55	7½
	40,000'	960	125	17
20,000' (0.8M)	30,000'	270	35	4¼
	40,000'	690	105	13¾
30,000' (0.85M)	40,000'	420	70	9½

* In this block times are from wheels rolling. Fuel used includes taxy and take-off allowance. Climb at 7,750 r.p.m. to 20,000 ft. then at full throttle.

DESCENT DATA

(Excluding landing allowance)

From	To	Fuel (lb.)	Dist. (N.M.)	Mins.
40,000'	30,000'	15	5	1
	20,000'	30	10	1½
	10,000'	60	15	2½
	5,000'	100	20	3½
	Sea Level	175	30	5½
30,000'	20,000'	15	5	½
	10,000'	45	10	1½
	5,000'	85	15	2½
	Sea Level	160	25	4½
20,000'	10,000'	30	5	1
	5,000'	70	10	2
	Sea Level	145	20	4
10,000'	5,000'	40	5	1
	Sea Level	115	15	3
5,000'	Sea Level	75	10	2

R.P.M. - 6,000 down to 2,000'. Then 6,500'.
AIRBRAKES - OUT
SPEEDS - 0.79M to 33,000'. Then 270K reducing to 240K at 2,000'.

CRUISE DATA-WITH BELLY TANK

FUEL STATE - LB.		5240	5000	4000	3000	2000	1000
Sea Level	Range	445	425	330	235	140	45
	5,000'	485	460	355	250	145	40
ANM/100 lb. -9.3	10,000'	535	510	390	270	150	30
Lb./hr. -3480	20,000'	660	625	475	325	170	-
Speed -0.5M	30,000'	830	785	585	385	185	-
95% Range -0.45-0.6M	40,000'	930	875	640	405	170	-
5,000'	Range	-	470	365	260	155	50
	10,000'	-	515	400	280	160	40
ANM/100 lb. -10.5	20,000'	-	645	495	340	190	35
Lb./hr. -3190	30,000'	-	805	605	405	205	-
Speed -0.52M	40,000'	-	900	665	430	195	-
95% Range-0.45-.6M							
10,000'	Range	-	525	410	290	170	50
	20,000'	-	650	500	345	190	40
ANM/100 lb. -11.8	30,000'	-	825	625	425	225	-
Lb./hr. -3000	40,000'	-	930	695	460	225	-
Speed -0.57M							
95% Range-0.5-0.65M							
20,000'	Range	-	-	525	375	220	65
	30,000'	-	-	655	455	255	55
ANM/100 lb. -15.3	40,000'	-	-	730	495	260	-
Lb./hr. -2630							
Speed -0.63M							
95% Range-0.55-0.75M							
30,000'	Range	-	-	675	475	275	75
	40,000'	-	-	760	525	290	-
ANM/100 lb. -20							
Lb./hr. -2230							
Speed -0.75M							
95% Range 0.63-0.81M							
40,000'	Range	-	-	790	555	320	85
ANM/100 lb. -23.5							
Lb./hr. -1970							
Speed -0.78M							
95% Range 0.72-0.81M							
FUEL STATE - LB.		5240	5000	4000	3000	2000	1000

REHEAT CLIMB DATA

CLEAN

HEIGHT (Feet)	TIME (Minutes)	DISTANCE (N. Miles)	FUEL (lb.)
S.L.	1	0	350
5,000'	1.4	3	480
10,000'	1.8	6	610
15,000'	2.2	10	720
20,000'	2.7	15	820
25,000'	3.3	20	920
30,000'	3.9	25	1,010
35,000'	4.7	30	1,110
40,000'	5.7	40	1,220

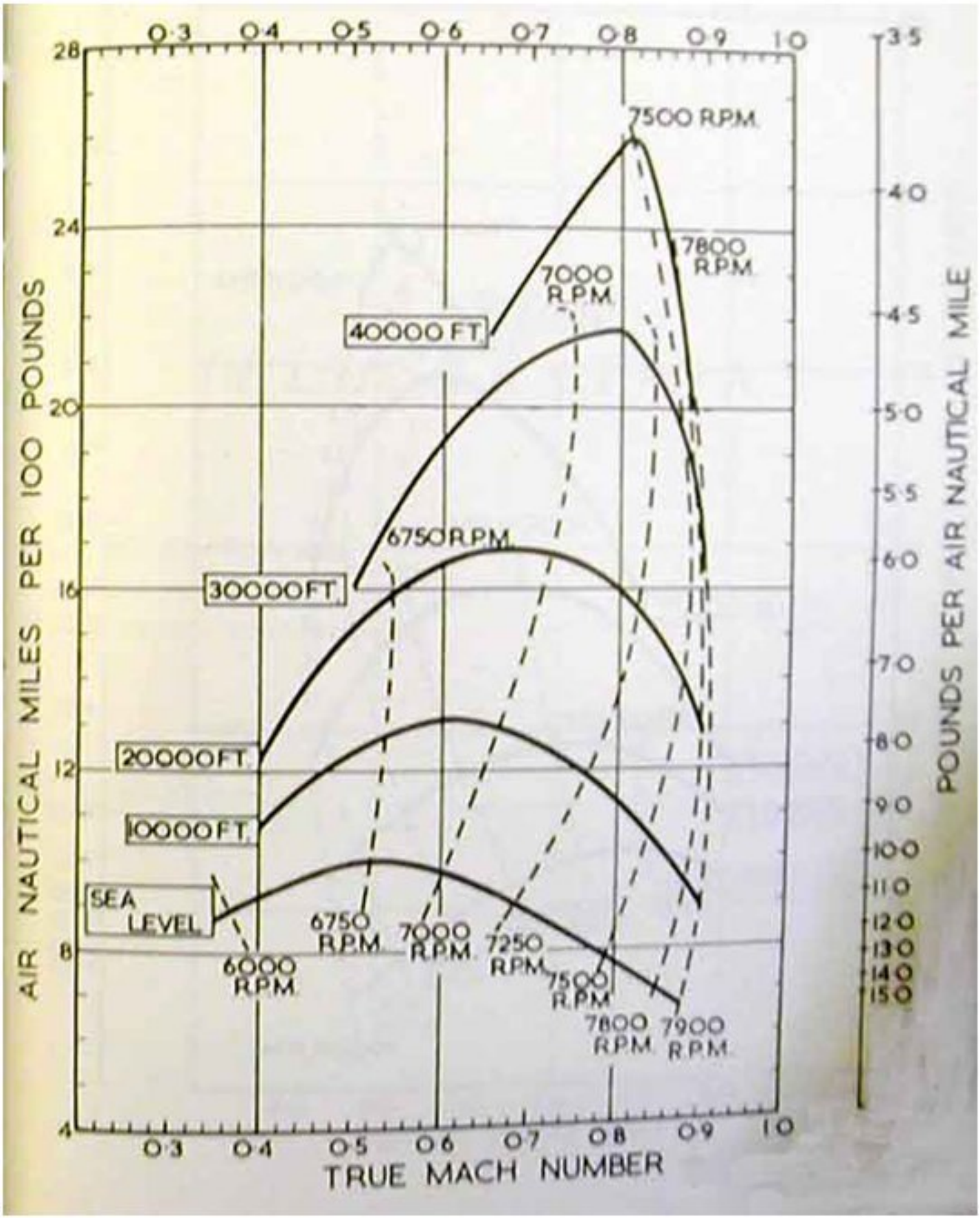
WITH BELLY TANK

HEIGHT (Feet)	TIME (Minutes)	DISTANCE (N. Miles)	FUEL (lb.)
S.L.	1	0	350
5,000'	1.5	4	510
10,000'	2.1	8	660
15,000'	2.6	12	810
20,000'	3.2	17	920
25,000'	3.9	22	1,040
30,000'	4.8	28	1,150
35,000'	5.4	35	1,260
40,000'	6.5	43	1,360

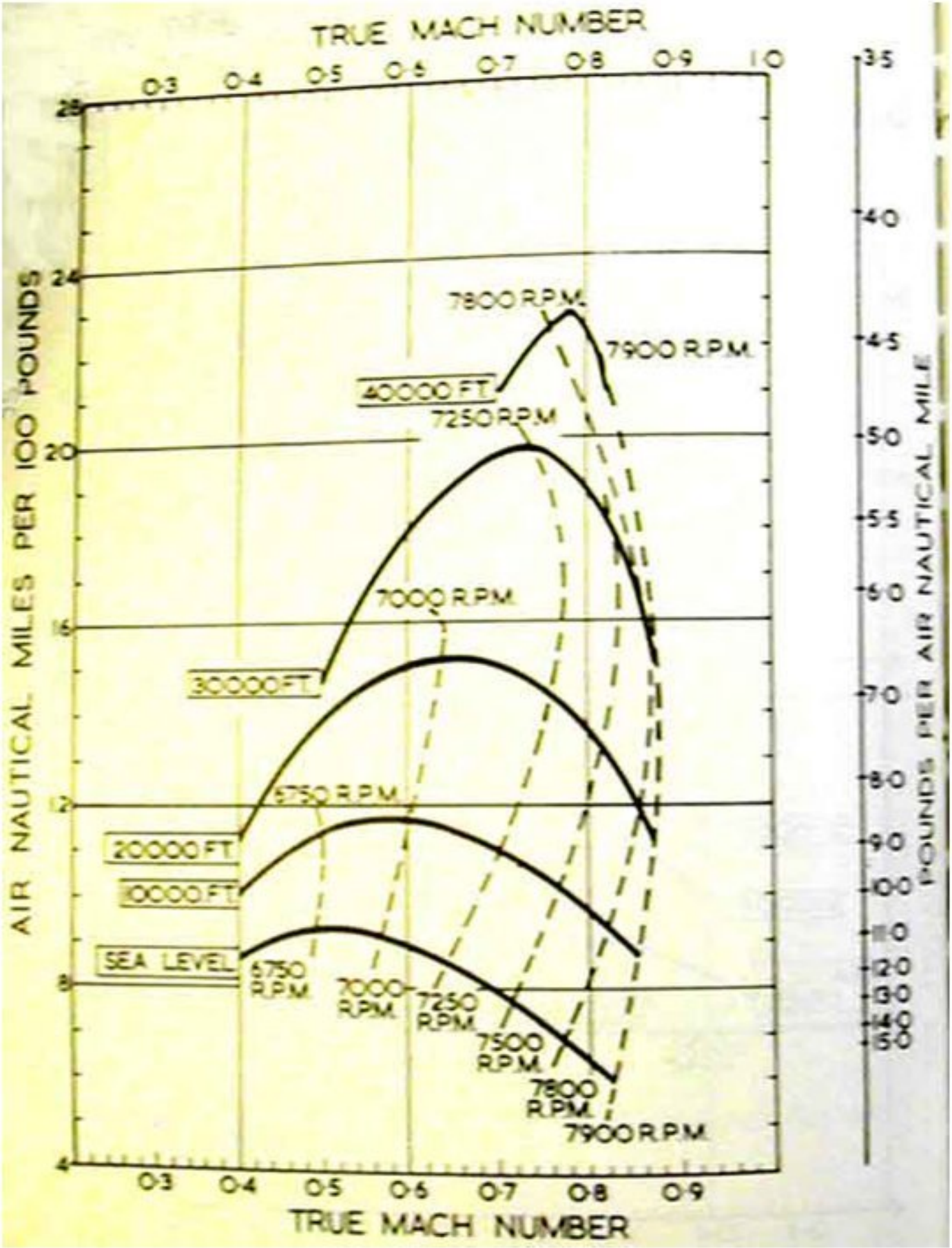
Times are from wheels rolling. Fuel used includes taxy and take-off allowance.

CLEAN AIRCRAFT

TRUE MACH NUMBER



WITH BELLY TANK



PART VI
ILLUSTRATIONS

KEY TO FIG. 1 - COCKPIT PORT SIDE

1.Rudder trim switch.
2.H.P. cock control.
3.Belly tank jettison control.
4.Flap emergency selector.
5.Undercarriage emergency selector..
6.Aileron trim switch.
7.Cockpit vent.
8.Tailplane incidence FAST/SLOW switch.
9.Port main accumulator pressure gauge.
10.Starboard main accumulator pressure gauge.
11.Engine anti-icing switch.
12.Windscreen demist switch.
13.Cockpit pressure master switch.
14.Cockpit temperature control switch.
15.Tailplane incidence main trim isolation switch.
16.Tailplane duplicate slow control switch.
17.Rudder and aileron trim position indicators.
18.Hood motor control switch.
19.Cockpit temperature indicator.
20.Tailplane incidence position indicator.
21.Throttle lever. (NOTE:- Protective cover on lever obscurers inching switch and press-to-transmit switch.)
22.Flaps limit setting switch.
23.Flaps position indicator.
24.Triple pressure gauge.
25.V.H.F. controllers.
26. V.H.F. changeover switch.
27. Engine L.P. fuel cock.
28. Reheat L.P. fuel cock.
29. Tailplane incidence preselector switch.

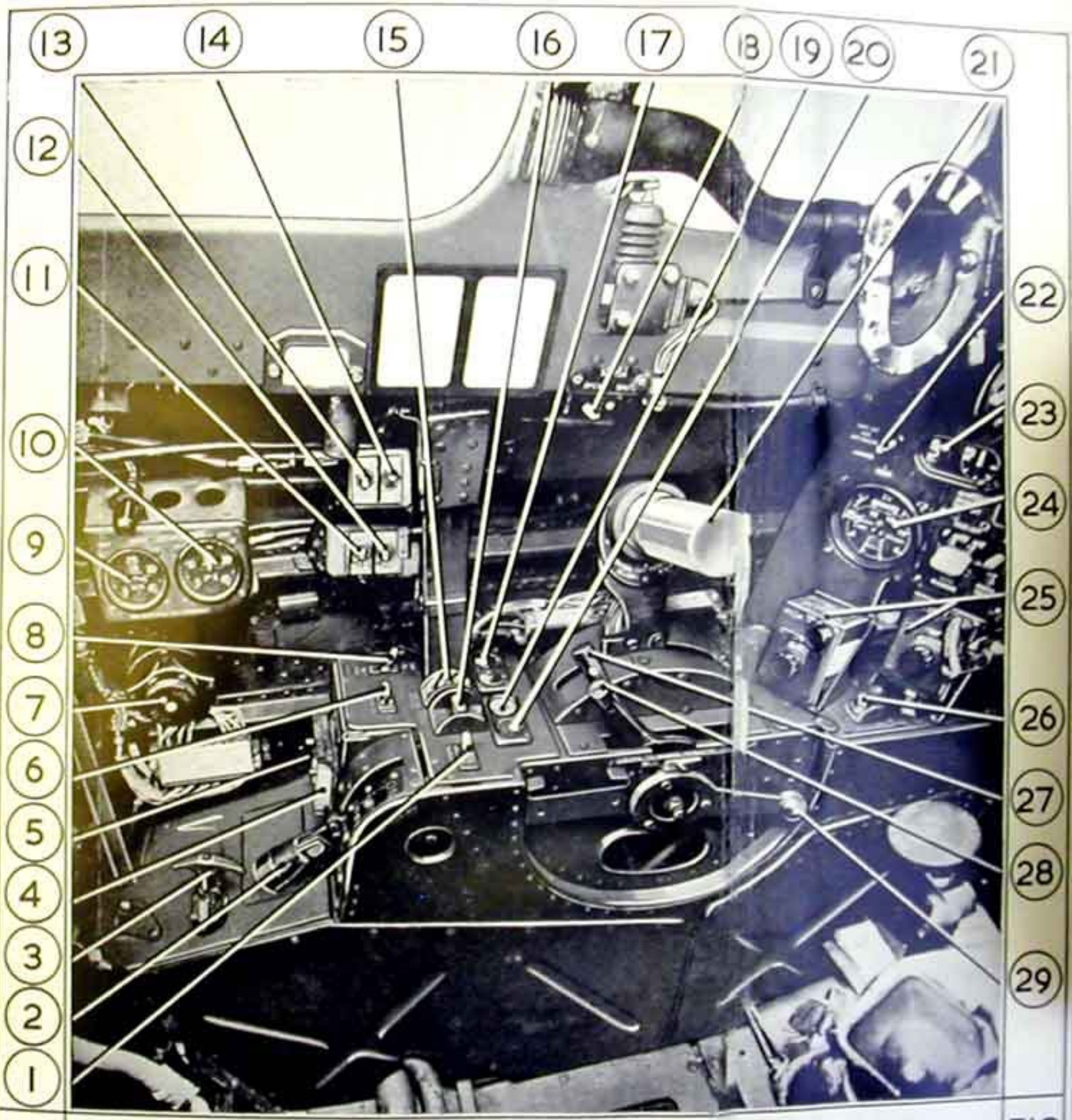


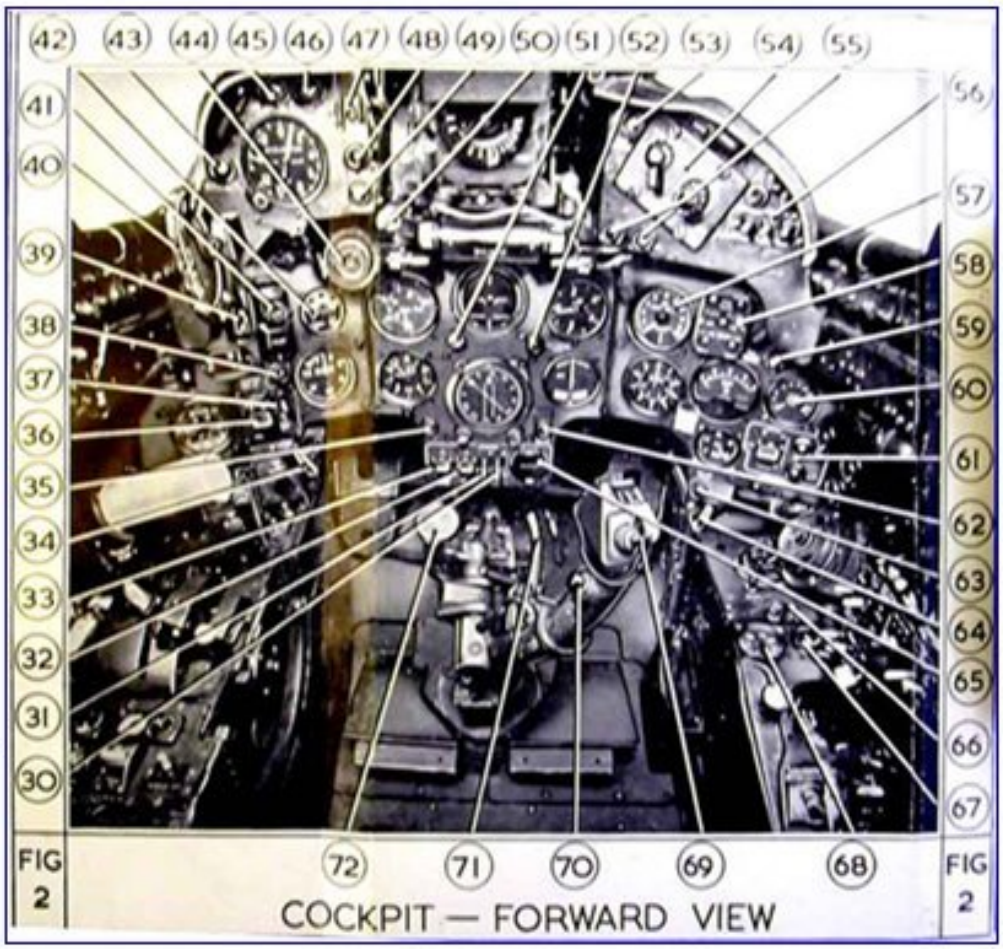
FIG 1

COCKPIT — PORT SIDE

FIG 1

KEY TO FIG. 2 - COCKPIT FORWARD VIEW

30.Battery isolation switch.
31.Fuel master switch.
32.Ignition switch.
33.Starter master switch.
34.Aileron power selector..
35.Aileron power engaged green light.
36.Fuel Take-off-Normal auto override switch.
37.Pitot head heater switch.
38.Inverter changeover indicator.AL1/57
39.Wheelbrakes boost switch.
40.Hood jettison control.
41.Undercarriage selector pushbuttons.
42.Undercarriage position indicator.
43.Reheat nozzle eyelids position indicator.
44.Cockpit ventilating louvre.
45.Zone 1 and 2 Fire warning light and pushbutton.
46.Zone 4 and 5 Fire warning light and pushbutton.
47.Reheat shut-off switch.
48.Hot gas amber warning light.
49.Air extraction failure magnetic indicator.
50.G.G.S. emergency lowering control.
51.Artificial horizon fast erection button.
52.Power controls unsafe flashing red light.
53.Cockpit pressure failure light.
54.G.G.S. selector dimmer.
55.Generator failure indicators.
56.F.95 camera switches and lights.
57.D.M.E. range and heading meter.
58.Fuel flow failure indicators.
59.Fuel pressure warning indicator.
60.Fuel contents gauge.
61.Fuel auto-retrim switch and indicators.
62.Elevator power engaged green light.
63.Belly tank empty indicator.
64.Elevator power selector.
65.Starter pushbutton.
66.Mk.17 demand oxygen regulator.
67.Oxygen contents gauge.
68.Cockpit altimeter.
69. Tailplane incidence control switch.
70. Camera pushbutton.
71. Wheelbrakes control.
72. Aileron artificial feel trim.



COCKPIT — FORWARD VIEW

KEY TO FIG. 3 - COCKPIT STARBOARD SIDE

73.F.95 camera window control switch.
74.G.45 camera aperture switch.
75.G.45 camera master switch.
76.Cockpit pressure warning horn override switch.
77.Emergency lamp switch..
78.Cockpit ventilating louvre.
79.navigation light switch.
80.Cockpit lamps switch.
81.F.95 cameras footage indicators.
82.F.95 cameras iris setting control.
83.F.95 cameras heater switch.
84.F.95/G.45 camera selector switch.
85.Hydraulic audio warning test and override switch.
86.Hood motor clutch control.
87.Cockpit lamps switches.
88.Windscreen de-icing control.
89.D.M.E. control panel.
90.Telebriefing light and push switch.
91.Main oxygen/seat supply tube clip.
92.Anti-G control (Test button aft on bulkhead).
93.Rudder bar adjustment control.
94.Emergency oxygen supply manual control.

NOTE:-The following are not keyed: Relight button, hood jettison indicator, G.G.S. master switch.

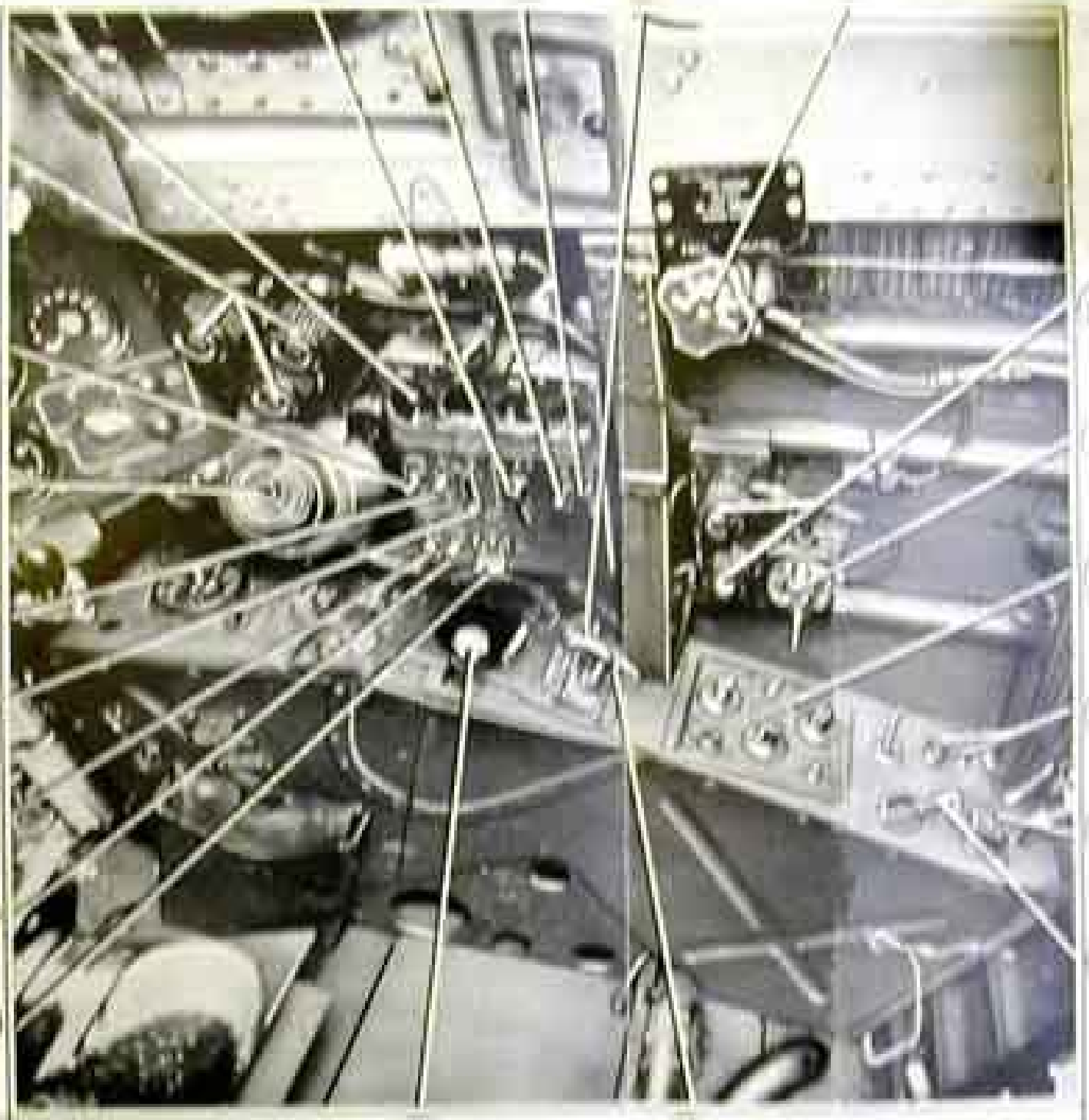


FIG 3

COCKPIT — STARBOARD SIDE

FIG 3

REMINDER

IF IT IS NOT POSSIBLE TO
CLEAR A STICK JAM
IN FLIGHT, SELECT
POWER OFF IMMEDIATELY

EMERGENCY DRILLS

MANUAL REVERSION (intentional)

Max. speed	280 knots or 0.80M
Tailplane	In trim
Aileron trim	Neutral
Selectors	Power off, aileron followed by elevator

ACTION IN THE EVENT OF FIRE

Close throttle immediately.
If light stays on:-

H.P. cock	Off.
L.P. cock	Off.
Fuel Master Switch	Off.

Reduce speed and press appropriate extinguisher button.
If fire goes out, light goes out.
Do not relight.
Carry out forced landing or abandon.
IF FIRE PERSISTS ABANDON.

HOT GAS WARNING

Cancel reheat and reduce speed below 0.92M.

HYDRAULIC FAILURE

Flying controls	Select Manual
U/C and Flaps	Lower on emergencies
Wheel brakes	Limited use.

FORCED LANDING

Best gliding speed	200K.
Airbrakes	IN.
H.P. and L.P. cocks	OFF.
Fuel master switch	OFF.
Belly tank and hood	Jettison.
All non-essential electrics	OFF.

Approach at 170 Knots.
When certain of landing select Manual and lower U/C flaps on emergencies.

ENGINE FAILURE

1. Seizure

Throttle	Close
H.P. cock	Off.
L.P. cock	Off.
Non-essential electrics	Off.

Carry out Forced Landing or abandon.

2. Flame-out

H.P. cock	Off.
Throttle	Closed.
AL3/57 Sqn. L.P. cock	Leave on.
All non-essential electrics	Off.

Descend below 35,000 ft..

RELIGHTING.

Height	Below 35,000 ft.
Speed	200 K above 25,000 ft.
Battery Isol.	ON
Starter master	ON.
Ignition	ON
Fuel master	ON
Fuel override	NORMAL (TAKE OFF If l.p. indicator white.)

AL3/57 Reheat L.P. cock closed
Press relight button (30 secs and open H.P. cock simultaneously
Release button when r.p.m. rise by about 200.

FAILURE TO RELIGHT

H.P. cock	Off.
Throttle	Closed.
L.P. cocks	On.
Fuel master	Off.
All non-essential electrics	Off.

Try again at lower altitude keeping airspeed as low as possible.

UNDERCARRIAGE AND FLAPS emergency

Lower U/C and flaps by use of emergency buttons.
U/C up on ground-Reset emergency button and use normal selector.

EMERGENCY DRILLS (continued)

ABANDONING

1. Reduce speed, jettison hood, retract G.G.S.
2. Feet in footrests, head on rest.
3. Pull blind handle
4. Auto separation at or before 10,000 ft.

MIN. HEIGHT AIRSPEED
100 Ft./120K

IF auto separation fails, operate override D-ring and seat harness release
Raise flap and grasp rip cord D-ring
Push clear of seat and pull D-ring.

IF seat fails to eject, pull Override D-ring and proceed as on a/c without ejection seat.

CHECK LISTS

FINAL CHECKS FOR TAKE-OFF

Trimer's	All neutral
Fuel	H.P. cock locked on L.P. cocks both on. Override switch NORMAL. (TAKE-OFF. If belly tank fitted). Reheat emergency cut-off switch NORMAL. Fuel master switch ON. Fuel pressure indicator black. Internal flow indicators black. Contents sufficient. Retrim switch AUTO, indicators black. (See NOTE below.)
AL1	Reheat top temperature selected OVERRIDE.
Flaps	Take-off
Instruments	Check (Press fast erection on artificial horizon. If necessary). Pressure head heater ON.
Oxygen	ON. 100% reaching mask, blinker annunciating.
Hood	Closed. Switch at SHUT, clutch ENGAGED. Cockpit pressure on. Temperature as required.
Harness	Tight and locked.
Flying controls	Full, free and correct movement,. Green lights on, red warning light out.

NOTE:- It is possible that the retrim indicators will flicker white during taxying out and take-off.

FINAL CHECKS FOR LANDING

Undercarriage	Down, 3 green lights
Brakes	Pressure, operating off. Supply 3,150± 150. Each side 1,750 lb./sq.in. Boost switch off.
Flaps	As required. Limit switch to LANDING.
Harness	Tight and locked

THRESHOLD SPEEDS

Light weight ... ... 140k.
Max. landing wt ... ...145-150k.
Overload wt ... ... 160k.

INSTRUMENT APPROACH

	Speed	Flap	R.p.m.
DOWNWIND	180/190	T/O	7,100
BASE LEG	180/190	T/O	7,100
GLIDE PATH	160	Full	6,900

ENGINE LIMITATIONS

Take-off (10 mins.)	7,900 ± 50	700°C
Intermediate (30 mins.)	7,800	685°C
Max. continuous	7,550	645°C
Min. approach	4,500	
Ground idling	2,750±100	550°C