Approved by

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Federation Republic in Prague on

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STÁTNÍ LETECKÁ INSPEKCE

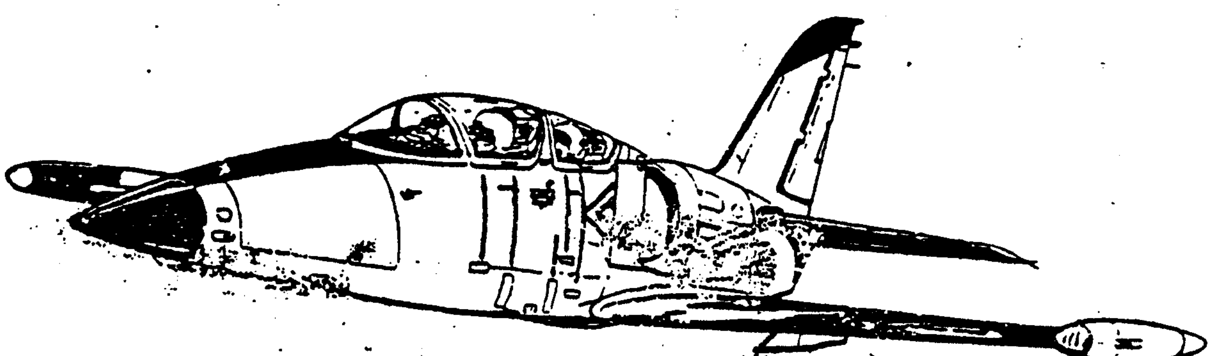
FLIGHT MANUAL

L-39C

ALBATROS

N5683D

SERIAL No. 931529



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Aero VODOCHODY

1991

LIST OF EFFECTIVE PAGES

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TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 349 /+5/

Date of issue for this Flight manual and for Pilot´s flight crew checklists is 1991

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If no page change is stated, then the page of the first copy issued in 1991 is still in force.

Read these pages carefully!

Scope. This manual contains all the information necessary for the safe and efficient operation of the L 39CT. These instructions do not teach basic flight principles but are designed to provide you with a general knowledge of the aircraft, its flight characteristics, and specific normal emergency procedures. Your flying experience is recognized; therefore, elementary instructions have been avoided.

Sound Judgement. The instructions in this manual are designed to provide for the needs of a crew unexperienced in the operation of this aircraft. This book provides the best possible operating instructions under most circumstances, but it is a poor substitute for sound judgement. Multiple emergencies, adverse weather, terrain, etd. may require modification of the procedures described herein.

Permissible Operations. This flight manual takes a "positive approach" and normally tells you only what you can do. Any unusual operation or configuration (such as asymetrical load) is prohibited unless specifically covered in the flight manual. Clearance must be obtained from the flight manual manager before any questionable operation is attempted which is not specifically covered in the flight manual.

Standardization and Arrangement. Standardization ensures that the scope and arrangement of all flight manuals are indentical. The manual is divided into ten fairly independent sections to simplify reading it straight through or using it as a reference manual. The first three sections must be read thoroughly and fully understoood before attempting to fly the aircraft. The remaining sections provide important information for safe and efficient mission accomplishment.

Checklists. The flight manual contains amplified normal and emergency procedures. Checklists contain these procedures in abbreviated form and are issued as separate technical orders. Line items in the flight manual and checklists are identical with respect to the arrangement and item number.

How to get Personal Copies. Each flight crew member is entitled to personal copies of the flight manual, safety supplements, operational supplement, and flight crew checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your supply personnel; it is their job to fulfill your technical order requests.

Warnings, Cautions, and Notes. For your information, the following definitions apply to the "Warnings", "Cautions", and "Notes" found throughout the manual.

WARNING

Operating procedures, techniques, etc. which will result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc. which, if not strictly observed, will result in damage to equipment.

N O T E

An operating procedure, condition, technique, etc., which is considered essential to emphasize.

Illustrations Changes. To help more easily to find changes on illustrations that might otherwise be inconspicuous, the following identifier may be used instead of a vertical line in the outer margin of the page.

Your Responsibility - to let us know. Every effort is made to keep the flight manual up-to-date. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the Manual.

However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this Manual or any phase of the flight manual program are welcomed and should be forwarded to

Aero Vodochody
Czechoslovakia

LIST OF ABBREVIATIONS

A	-	Ampere
AC	-	Alternate current
A/C	-	Aircraft
ACCU	-	Accumulator
ADF	-	Automatic direction finder
AGL	-	Above ground level
ASAP	-	Land as soon as possible
ATC	-	Air Traffic Centre
ATT	-	Attitude
BATT	-	Battery
°C	-	Degrees centigrade/Celsius
CAB	-	Cabin
C/B	-	Circuit breaker
CCW	-	Counter clockwise
Cg	-	Center of gravity
cm	-	Centimeter
°C/s	-	°celsius/second
CW	-	Clockwise
C+W	-	Caution and warning
DC	-	Direct current
DME	-	Distance measuring equipment
EGT	-	Exhaust gas temperature
ENG	-	Engine
EPU	-	External power unit
EXT	-	External/Extension
FL	-	Flight level
F/C	-	Front cockpit
FOD	-	Foreign object damage
"g"	-	Unit for load factor
GCA	-	Ground controlled approach
GEN	-	Generator
GND	-	Ground
HPC	-	High pressure compressor

Hz - Hertz (cycles)
IAF - Initial approach flight

ICS - Intercommunication system
IDB - Inlet directing body
IMC - Instrument meteo condition
IFR - Instrument flight rules
IM - Inner marker
ISA - International standard atmosphere

kg - Kilogram
kg/cm² - Kilogram per square centimeter
kg/h - Kilogram per hour
kg/s - Kilogram per second
kHz - Kilohertz
km - Kilometer
km/h - Kilometer per hour
kts - Knots
kW - Kilowatt
KIAS - Indicated air speed in Knots/$KIAS_{H=O\ m}$ =KCAS/
KTAS - True air speed in Knots

l - Liter
LDG - Landing
LG - Landing gear (undercarriage)
LH - Left hand
l/min - Liter per minute
LPC - Low pressure compressor

M - Mach
m - Meter
MAC - Mean aerodynamic chord
max - Maximum
MCP - Maximum continuous power
MHz - Megahertz
min - Minimum
mm Hg - Milimeter of Mercury
MM - Middle marker
MSL - Mean sea level

NAV/COM - Navigation/Communication
NM - Nautical miles
Oe - Density of magnetic
OM - Outer marker

P - Pilot pressure
P1 - Air intake pressure
PR ALT - Pressure altitude
PRIM - Primary
PSI - Pounds per square inch
PVD -
R/C - Rear cockpit
RH - Right hand
ROC - Rate of climb
ROD - Rate of descent
RPM - Revolutions per minute

S - Static pressure
s - Second
SEC - Secondary
SL - Sea level

T/O - Takeoff

U/C - Undercarriage (LDG-gear)
UV light Ultraviolet ligth

V - Volt
VA - Volt/Amperes
VAC - Volts alternating current
VDC - Volts direct current
VFR - Visual flight rules
VHF - Very high frequency
VMC - Visual Meteo conditions
V - Stalling speed/landing configuration
V - Stalling speed/T/O configuration

WPN - Weapon(s)
- The reciprocal of the square roof of the density ration, at the density altitude (the greek letter Sigma is used to represent the density ratio)

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SECTION I

DESCRIPTION

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AIRCRAFT DIMENSIONS /in meters/

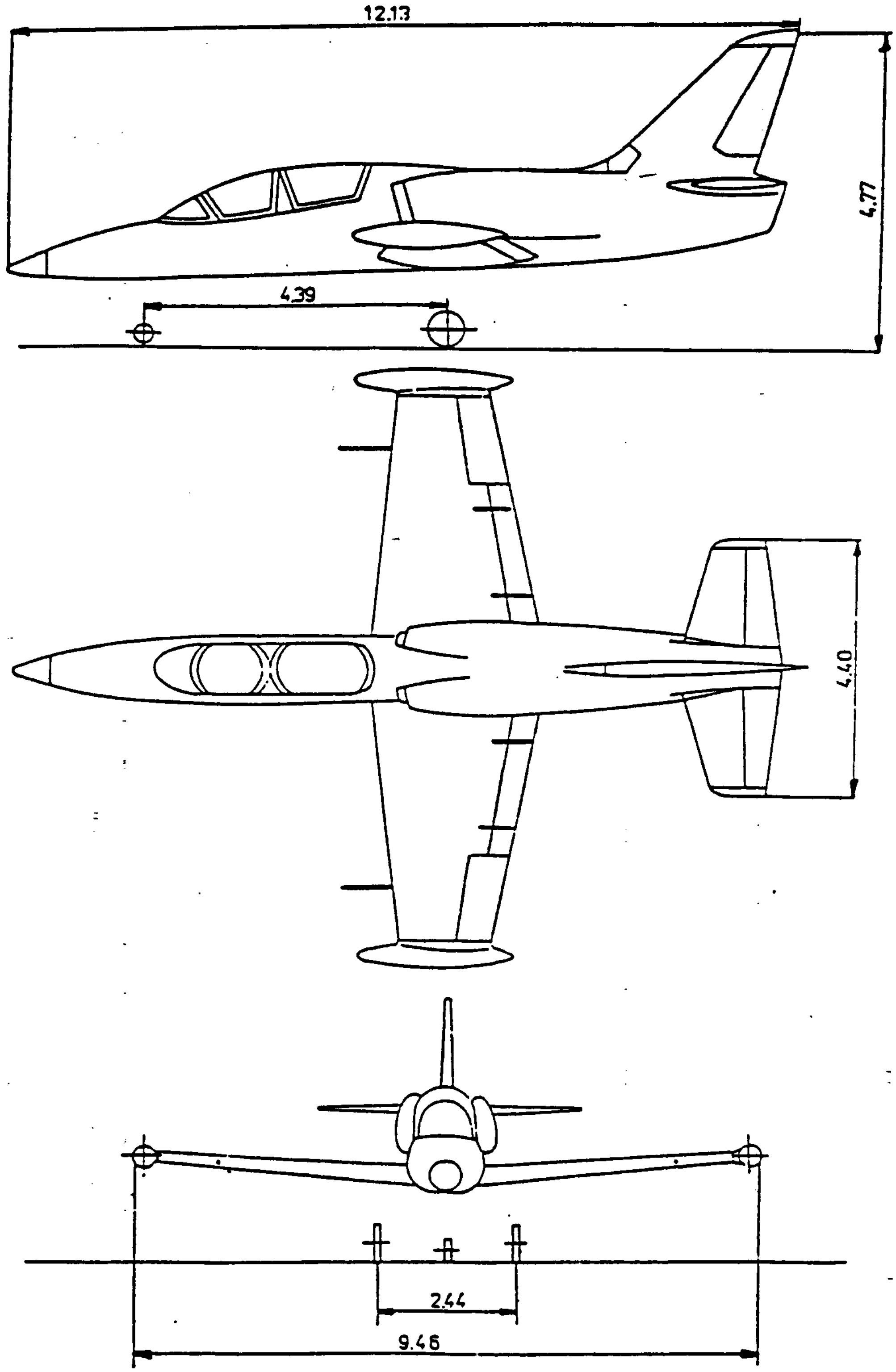


Fig. 1-1

THE AIRCRAFT

The L-39CT is a single-engine, two seater, subsonic aircraft manufactured by Aero Vodochody of Czechoslovakia. The aircraft primary mission is basic and advanced training.

The aircraft is powered by a by-pass turbofan engine developing approximately 16.85 KN standard day, sea level static thrust. The aircraft can take-off with a maximum weight of 5220 (11,843#) kg and land with a maximum weight of 4600 kg. (10,120#)

AIRCRAFT DIMENSION (fig 1-1)

The maximum dimensions of the aircraft, under normal conditions of weight, shock absorber compression and tire inflation are as follows:

- Wing span .... 9.46 m (30.3')
- Overall length ....12.13 m (39.8')
- Height .... 4.77 m (15.3')
- Wing Area ....18.8 m²
- Wing Aspect Ration 5.2

For more technical data, refer to Book 1: Instructions for pilots parts 1 and 2.

AIRCRAFT GROSS MASS

The aircraft basic empty mass is approximately 3304 kg (7284 LB) (which includes hydraulic fluid, unsable engine oil and non-useable fuel). The aircraft total weight in typical configurations are as follows:

- Flight training (crew of two plus internal fuel) 4600 kg
- Ferry mission (crew of two plus internal and external fuel) .... 5100 kg

The above weight data is based on calculated averages and is therefore given for guidance only.

GENERAL ARRANGEMENT

The fusselage is divided into two sections to permit engine removal. The forward section contains the nose landing gear and part of the electronic equipment, the cabin, the five rubber fuselage tanks, the airbrakes control and the engine bay. The cabin enclosed by canopies attached by hinges and tiltable to the fuselage right side, contains the two pilot's cockpits with ejection seats. Each cockpit comprises the instrument panels and lateral consoles figs 1-1÷8/. Under the floor of the cabin, there are compartments for eléctrical radio installations and hydraulic systems Behind the rear cockpit is the compartments for fuel tanks. The rear fuselage section to which the tail units is attached contains the exhaust pipe. The tail unit consists of vertical and horizontal stabilizers to which the rudder and elevator are attached respectively. The wing, has bays for the retracted main landing gear; carries the airbrakes flaps and ailerons, and is fitted with two hard points for two underwing pylons designed to carry fuel drop tanks. Two non-droppable tip tanks of 100L capacity each are mounted at the wingtips.

GENERAL ARRANGEMENT

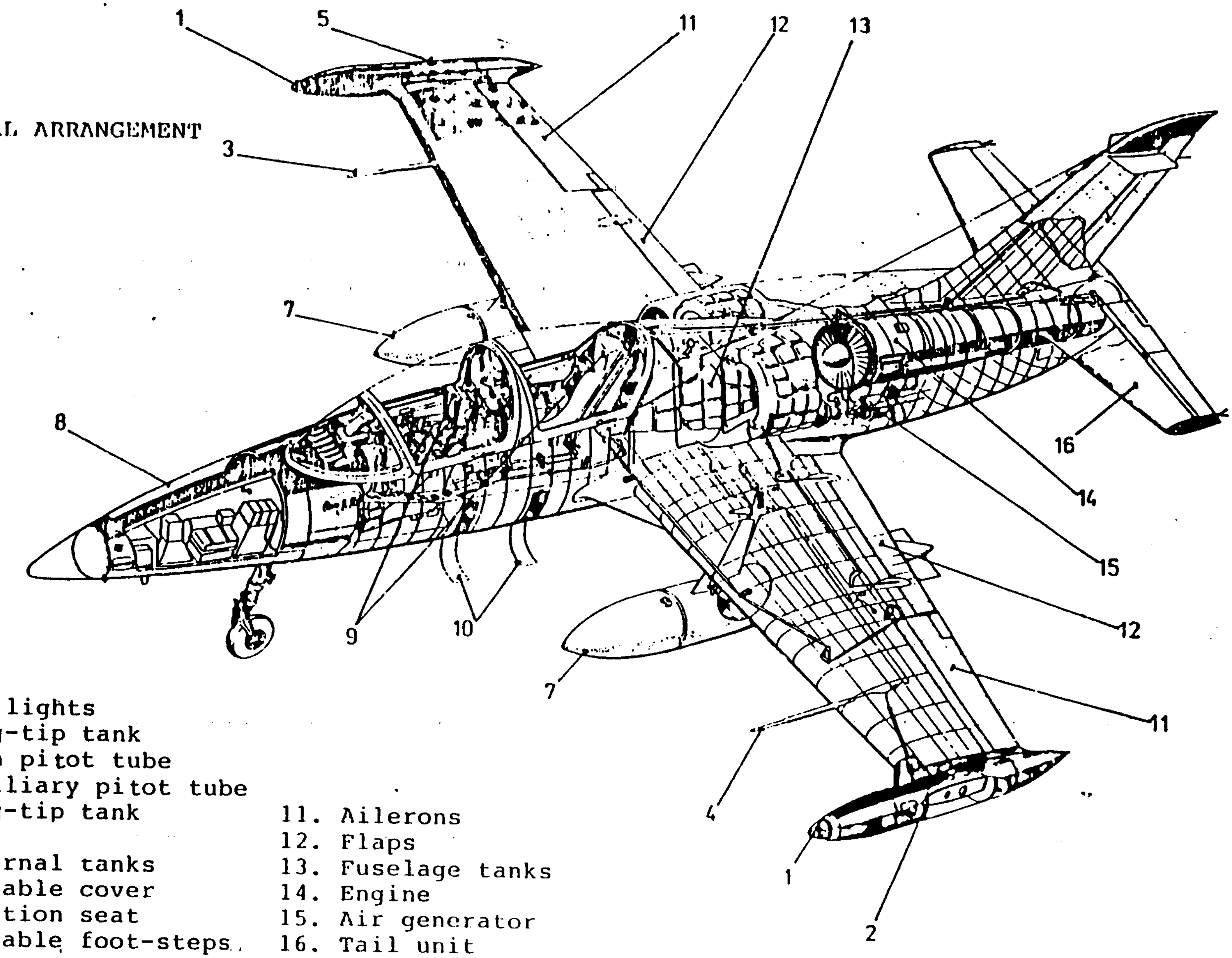


Fig. 1-2

1. LDG lights
2. Wing-tip tank
3. Main pitot tube
4. Auxiliary pitot tube
5. Wing-tip tank

7. External tanks
8. Tiltable cover
9. Ejection seat
10. Tiltable foot-steps

11. Ailerons
12. Flaps
13. Fuselage tanks
14. Engine
15. Air generator
16. Tail unit

FRONT COCKPIT INSTRUMENT PANEL

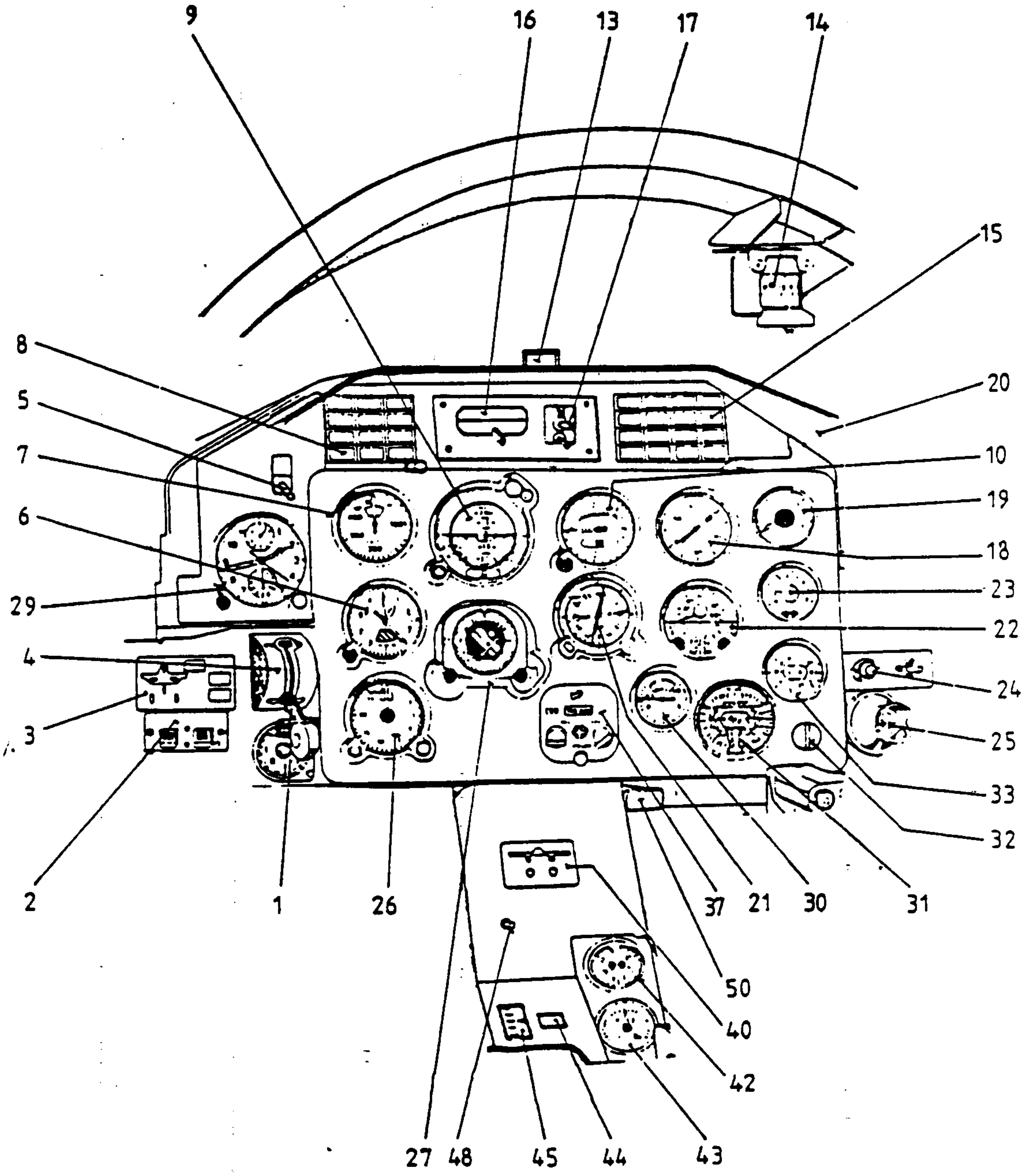


Figure 1 - 3 /sheet 1/

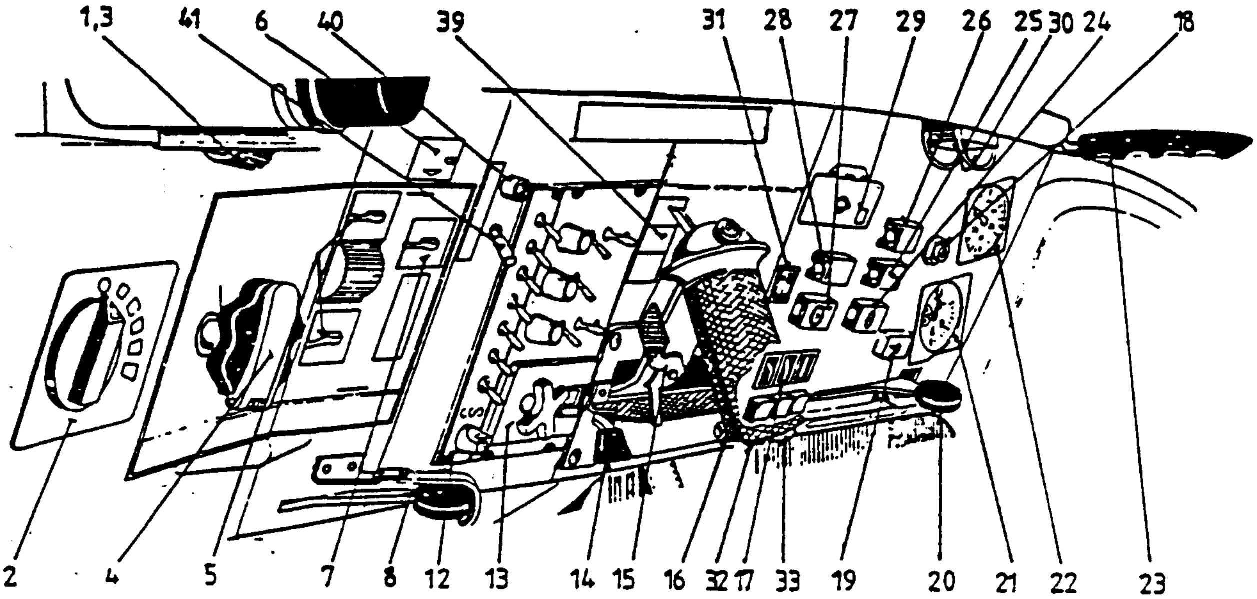
1. Accelerometer
2. PVD heating
3. U/C attitude indicator
4. U/C controller
5. Emerg. drop
6. Altimeter
7. Airspeed indicator-M-meter
8. Warning panel
9. Attitude indicator
10. Combined vario-turn indicator

13. Combined tally system of crash situations
14. Standby compass
15. Caution panel
16. DME display unit
17. KCS alignment
18. RPM indicator
19. EGT gauge
20. Catch of antireflection screen
21. Remote gyro compass
22. Tripple engine indicator
23. FUEL gauge
24. Control panel of air temp. in suit and shower
25. Air shower
26. RADIO ALT indicator
27. NAV indicator
29. Clock
30. Cockpit pressure/attitude indicator
31. ENG vibrations ind.
32. Socket of panel vibrator
33. VOLT/AM METER

37. Standby radio
40. Warning screen
42. Pressure gauge of brakes
43. Emerg. pressure gauge of brakes
44. Centr. position of lateral trimming
45. Longitud., trimming ind.
48. Check of fire telltaling
50. Pedal adjust. knob

Figure 1 - 3 /sheet 2/

FRONT COCKPIT LEFT CONSOLE



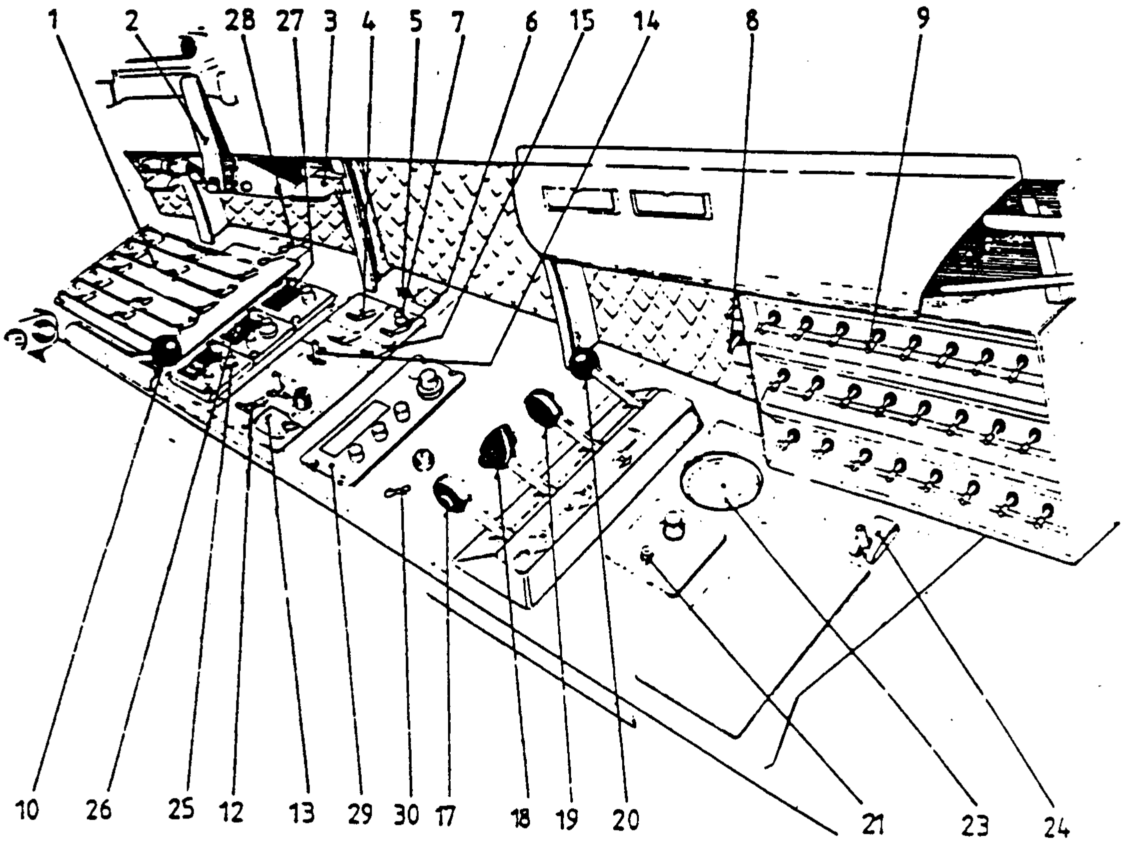
1. Filter AD-5
2. Cock of suit ventilation
3. Automatic AD-6E
4. Oxygen shut-off valve
5. Controller of oxygen delivery
6. Ground test of helmet overpressure
7. Cock of helmet ventilation
8. Fuel shut-off lever

12. Radio control change-over box
13. Radio control box
14. Arrestment of throttle handle
15. Latch of "STOP" position
16. Throttle handle
17. Controlling and tally syst of landing flaps
18. Check up on IV-300
19. Push-button of fire extinguishing
20. Lever of emergency and parking brake
21. Oxygen indicator IK-52
22. Oxygen pressure indicator in helmet M 2000
23. Lever of cockpit locks
24. Push-button of engine starting
25. Switch of engine cutting off
26. Switch of emergency fuel circuit
27. Push-button of air generator SAPHIRE-5 starting „TURBO"
28. Switch of air generator stopping - "TURBO STOP"
29. Change-over switch for engine starting mode
30. Search lights switch
31. Outer source connection tell-tale lamp
32. Control of speed brakes
33. Push-button of transmission of radiostation

39. Change-over cock of PVD (main and emergency)
40. Film movement control of SARPP
41. Switch of registering apparatus SARPP

Figure 1 - 4

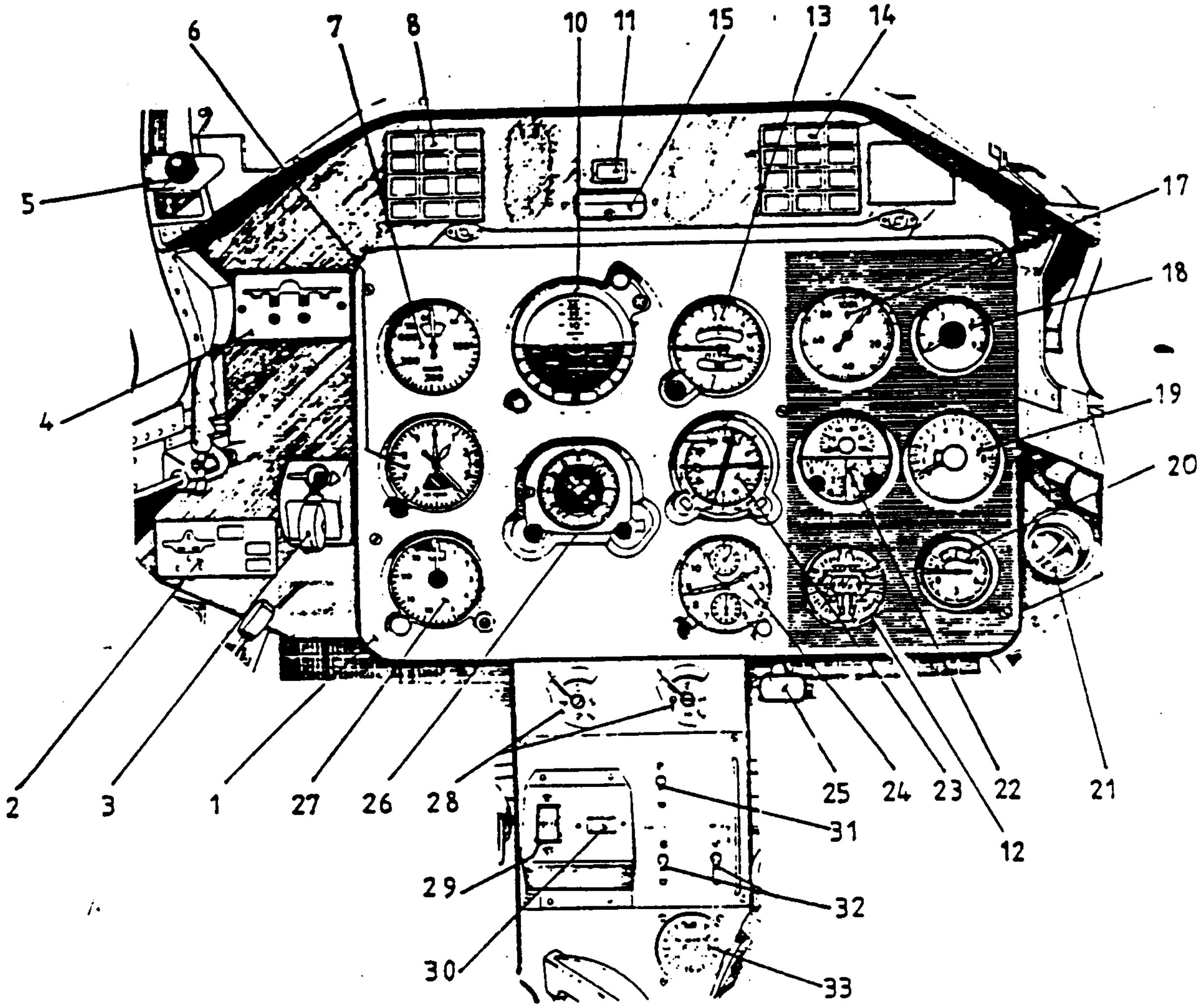
FRONT COCKPIT RIGHT CONSOLE



1. Main switchboard
2. Lever of emergency canopy jettisoning
3. Lamp of desk illumination
4. ADF change-over switch
5. Push-button of checking the heating of sensor RIO-3
6. Change-over switch of Marker-Sensitivity
7. MKR test
8. Circuit RT-12 braker
9. Auxiliary switchboard
10. Lever of pressurizing and air-conditioning system
12. Switch "ENGINE INSTRUMENTS IN EMERGENCY"
13. Unblocking the ejection seat
14. Control of de-icing system
15. Control of navigation lights
17. Emergency extension of u/c
18. Emergency extension of landing flaps
19. Emergency extension of stand-by generator
20. Interconnection of main and emergency hydraulic circuits
21. Rheostat and control push-button of central tally system
23. Double pressure gauge of main and emergency hydraulic circuits
24. Control RT-12 change-over switch
25. Control box ov NAV I
26. Control box of ADF
27. Control box of transporder
28. Circuit-breaker RDO S-BY
29. Control box of KHF 950
30. Circuit-breaker and fuse of KHF

Figure 1 - 5

REAR COCKPIT INSTRUMENT PANEL

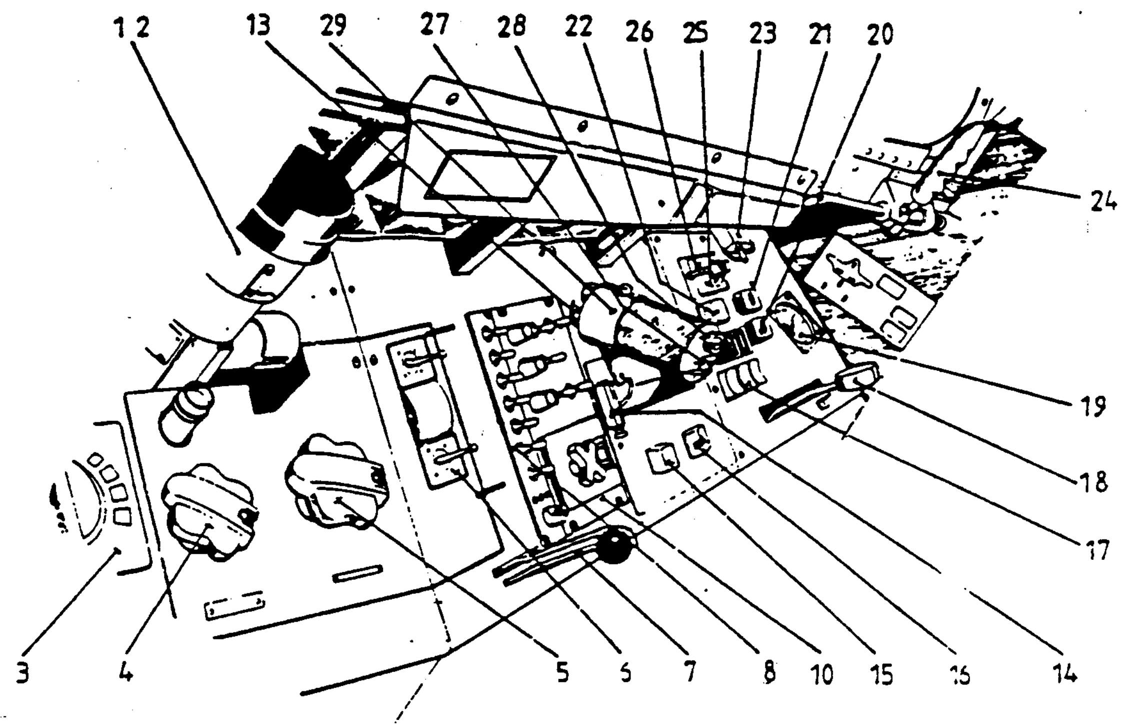


1. Desk
2. U/C attitude indicator
3. U/C contoller
4. warning screen
5. IFR curtain lever
6. Altimeter
7. Airspeed indicator-M-meter
8. Warning panel

10. Attitude indicator
11. Combined tally system of crash situation
12. Eng. vibrations indicator
13. Combined vario-turn indicator
14. Caution panel
15. DME display unit
17. RPM indicator
18. EGT gauge
19. FUEL gauge
20. Cockpit pressure/altitude indicator
21. Air shower
22. Tripple engine indicator
23. Remote gyro compass
24. Clock
25. Pedal adjust knob
26. NAV indicator
27. RADIO ALT indicator
28. Introducing errors for Pitot system
29. Longitud. trimming indicator
30. Centr. position of lateral trimming
31. Errors introducing of cadet´s KCS
32. Errors introducing of AGD inclination
33. Pressure gauge of brakes

Figure 1 - 6

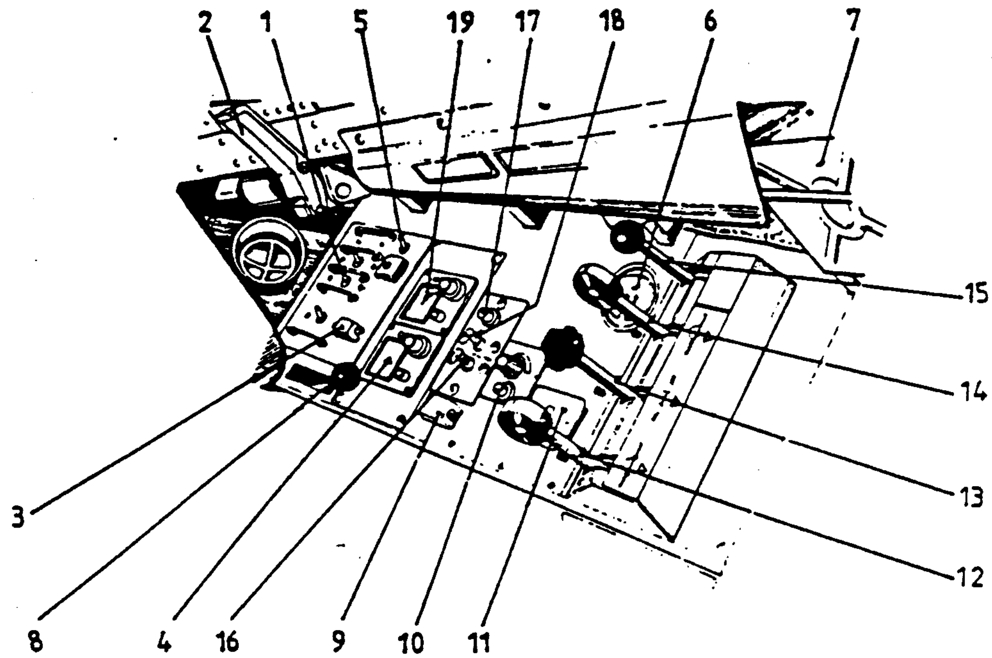
REAR COCKPIT LEFT CONSOLE



1. Filter AD-5
2. Automatic AD-6E
3. Cock of suit ventilation
4. Valve of interconnection of oxygen b...tles
5. Oxygen shut-off valve
6. Regulator of oxygen delivery
7. Fuel shut-off lever
8. Radio station control change-over box
10. Radio control box
13. Change-over switch of EGT "FRONT - REAR"
14. Arrestment of throttle handle "STOP" position
15. Switch "EMERG. FUEL"
16. Push button of "FIRE EXTINQUISHING"
17. Control and tally system of landing flaps
18. Emergency brake lever
19. Oxygen indicator IK-3
20. Engine starting push-button
21. Starting push-button generator SAPF -5 „TURBO"
22. Switch of engine cut
23. Switch of search lights
24. Lever of canopy lock
25. Rheostat of illuminations
26. Change-over switch of cockpit illumi... "RED-WHITE"
27. Controller of speed brakes
28. Push-button of transmission of radio-... n
29. Throttle handle

Figure 1 -

REAR COCKPIT RIGHT CONSOLE



1. Rear switchboard
2. Canopy emergency jettisoning lever
3. Emerg. drop
4. NAV II control box
5. C/B of SBY intercom
6. Double pressure gauge of main and emergency hydraulic
7. Air shower control box
8. Lever of pressurizing and air-conditioning system
9. Unblocking of the ejection seat
10. Rheostat and control push-button of central tally system
11. Check door of AGD
12. Emergency extension of U/C
13. Emergency extension of landing flaps
14. Emergency extension of auxiliary generator
15. Interconnection of main and emergency hydraulic curcuits
16. Radiocompass change-over switch
17. Push-button of marker test
18. Change-over switch of marker sensitivity
19. Radiocompass control box

Figure 1 - 8

ENGINE

The aircraft is powered by A1-25TL engine. The engine is a twin shaft by-pass turbofan with a 3 stage low pressure (LP) axial flow cmpressor and a 9 -stage high pressure (HP) axial flow compressor.

The LP Compressor is driven by a 2-stage axial turbine.

The HP Compressor is driven by a single stage axial turbine.

The air passing through the LP compressor is divided into two concentric flows:

- The primary, inner hot flow which is compressed by the HP compressor before it reaches the combustion chamber
- The secondary, by-pass, which is led to the by-pass exhaust through a mixer, where the inherent energy of this flow is converted to kinetic energy.

Engine bleed air, taken from the nineth stage of the HP Compressor, is used for cabin air-conditioning and pressurization, for de-icing and demisting of the transparent surfaces, for the anti-g suits, for fuel transfer from the tip and external tanks and for engine anti-icing.

Two bleed air vents at the 3rd and 5th stage of HPC compressor prevent HPC surging during low speeds. These bleed vents are spring valves, the vents are normally closed when below 86-89 % RPM from the 5th stage and 74-76 % in the 3rd stage of the LPC.

The engine is equiped with an annular combustion chamber containing 12 main fuel nozzles and two igniter plugs for engine starting.

ENGINE AI- 25TL

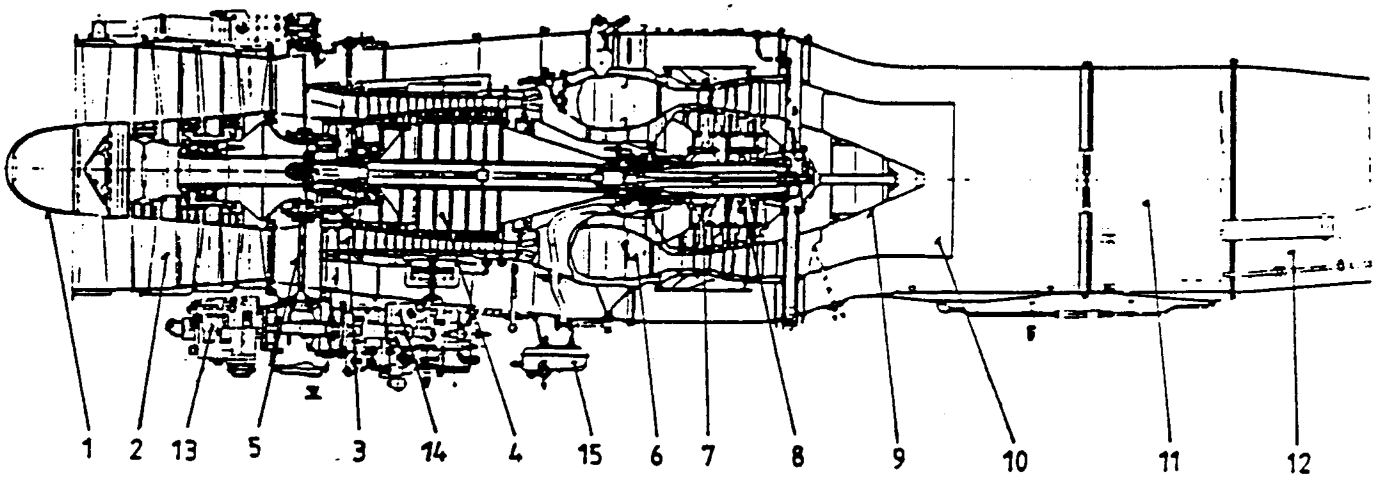


Figure 1 - 9

1. Inlet directing body (IDB)
2. Rotor of LPC
3. Inlet directing body of HPC
4. Rotor of HPC
5. Box of drives
6. Combustion chamber
7. HP turbine rotor
8. LP turbine rotor
9. Inner cone
10. Jet nozzle of inner stream
11. Extension pipe
12. Nozzle
13. FUEL pump
14. FUEL regulator
15. Waste tank

PERFORMANCE DATA

Total ratio of compression .... 9,5 (at H=0, V=0,ISA)

Air flow .... 47,- kg/s(at H=0, V=0,ISA, RPM max)

Mass overall ....406,- kg

The mass of airframe aggregates is not included into the engine weight:

- hydraulic pump, -generator,
- emergency source of current
- starting aggregates
- starting panel, -extension pipe

Thrust	RPM max 1720 kp	= 3784 # thrust
	RPM idle 135 kp	= 297 #
FUEL consumption	RPM max 0,600 kg/kp of thrust p. hr (H=0,V=0,ISA)	
	RPM 0,85 nom 0,580 kg/kp of thrust	

OIL SUPPLY SYSTEM

The engine oil system (fig. 1-11) performs the basic function of distributing oil within the engine. The oil is circulated by the main pump through the oil/fuel heat exchanger which is designed for cooling the oil circulating inside the engine oil system, for filtering and warming up the fuel in order to prevent the formation of ice on the fuel filter.

Oil is supplied from the oil tank to the oil pump and from the oil pump it passes through the oil filter in the oil pump, thereafter, the oil passes through the diffuser gear box, from there it is separated into two flows:
First to the berings of the rotors of compressors, the central drive, and to the LPC RPM transmitter drive. The second flow is used for lubricating and cooling the bearings of turbines. All other parts are lubricated by spraying. The oil is scavenged back into the de-aerator. The oil which is deprived of air, passes to fuel-oil exchanger, where it is cooled and from there back to the oil tank.

The oil system incorporates a selector valve during inverted flight which changes scavenging from the bottom part of the engine to the upper part of the engine. It also has a magnetic plug for detecting iron particles in the scavenging part of the engine oil system. The maximum and min. oil quantities for flight is 7.5 and 4.5 litres respectively. The gauge is located on the rear right part of the fuselage. A low oil warning light is also incorporated which is illuminated (FC) when the oil pressure is less than 1.4 bars. The red warning light OIL LOW is connected to the red Master Caution light in both cockpits.

ENGINE INSTRUMENTS

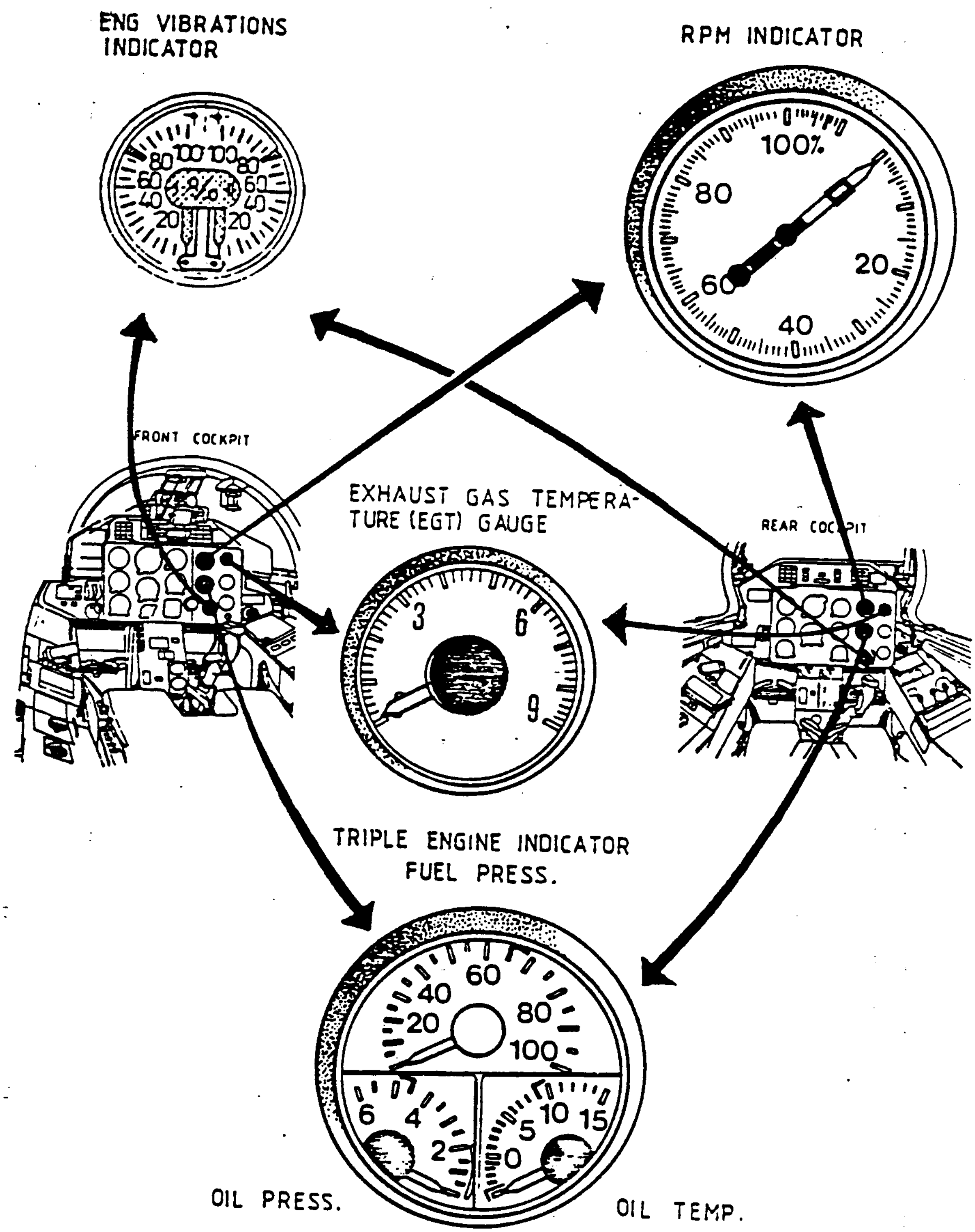
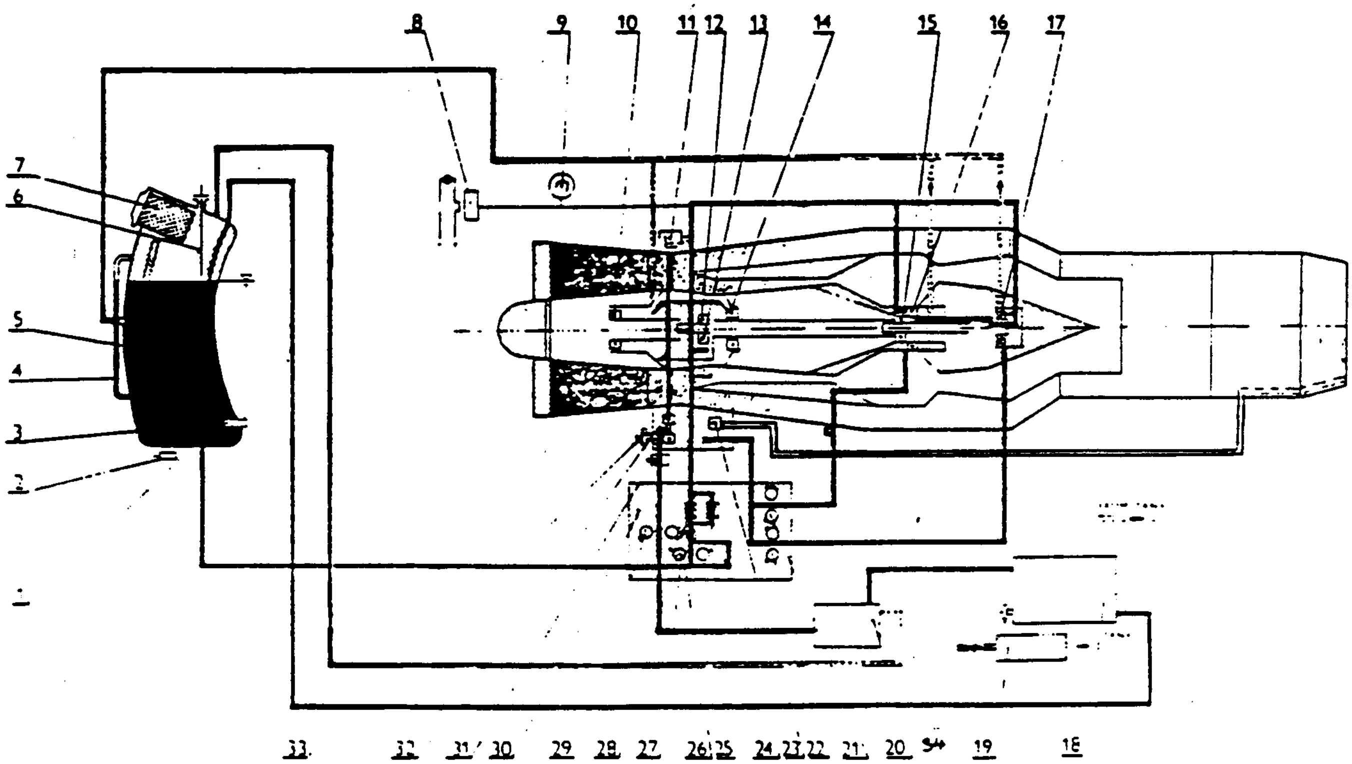


Figure 1 - 10

ENGINE OIL SYSTEM



1. Oil tank
2. Drain valve
3. Oil temperature transmitter
4. Transparent glass
5. Rotary suction pipe
6. Gauge stick
7. Filler
8. Signaller of minimum oil pressure (installed by airframe works)
9. Oil pressure transmitter
10. Ball bearing of LPC
11. Upper drive
12. Roller bearing of LPC
13. Toothed wheel of central drive
14. Ball bearing of HPC
15. Front roller bearing of LPTurb.
16. Roller bearing of HPT
17. Rear roller bearing of LP Turb.
18. FUEL-oil exchanger
19. Thermostatic valve
20. De-aerator
21. Section of oil offpumping from the room of front turbine bearings
22. Section of oil offpumping from the room of rear turbine bearing
23. Centrifugal de-aerator
24. Reduction valve
25. By-pass valve
26. One way valve
27. Pressure section
28. Fine filter
29. Main offpumping section
30. Oil aggregate
31. Magnetic plug
32. Switch valve of offpumping section
33. Drain valve
34. Oil pressure temperature and impurity transmitter

Figure 1 - 11

ENGINE FUEL CONTROL SYSTEM

The engine fuel control system (figure 1-12) is a wide range governor '4000' which automatically provides optimum fuel flow for any throttle setting.

HP Fuel System

The HP Fuel System consists of HP fuel pump 4001 and the fuel governor 4000. The automatic fuel control system ensures:

a. Supply of starting fuel
b. Fuel metering during start, acceleration and deceleration
c. Fuel metering according to throttle setting, airspeed and altitude
d. Maintenance of constant HP rotor speed with respect to throttle setting
e. Maintenance of constant RPM at Idle
f. Limiting of HP rotor RPM
g. Control of air draining valves from Stages III and V of HPC
h. Disconnection of airstarter depending on HPC RPM.
i. Manual and electrical stopping of engine
j. Setting of inlet guide vanes of HPC
k. Fuel filtering

The starting system ensures both ground and air starts and it comprised essentially of a starting fuel manifold, igniters and a starting fuel solenoid.

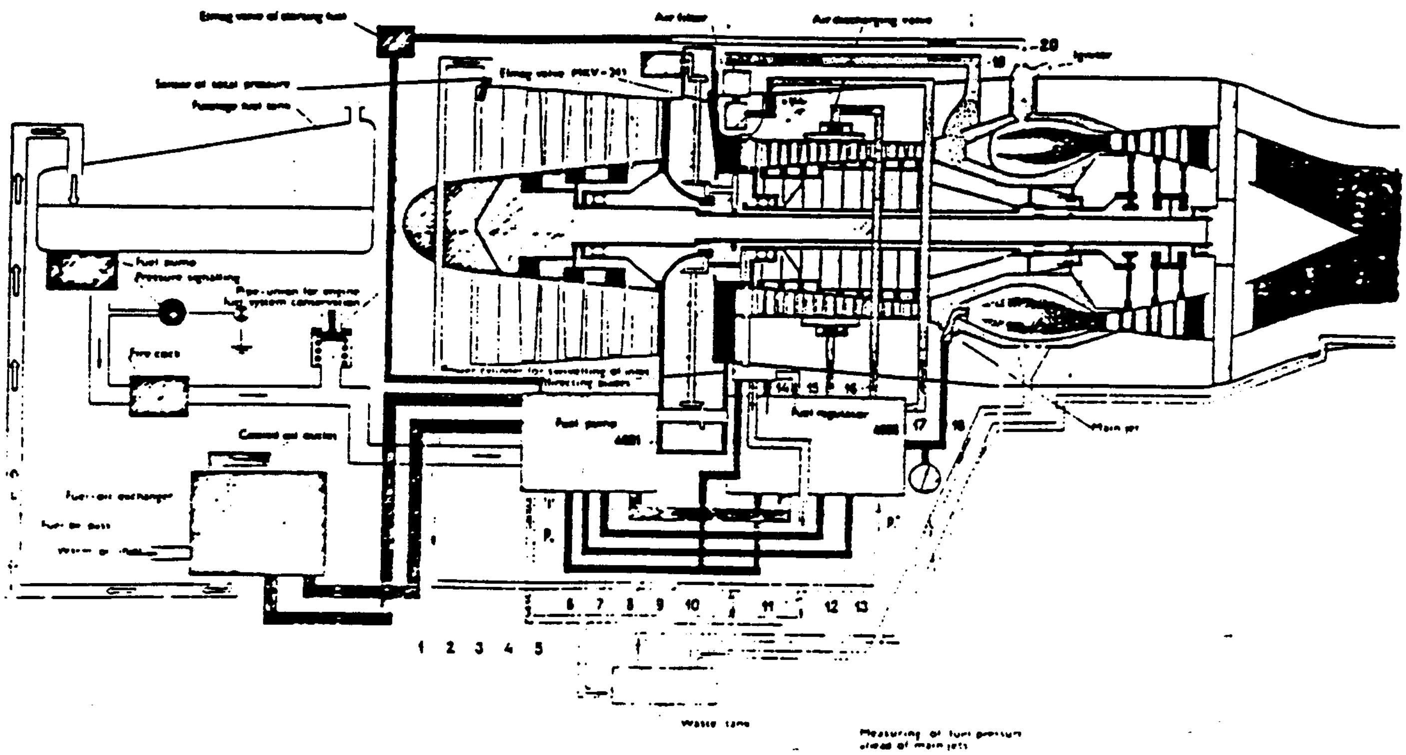
STARTING SYSTEM

The engine is started by the Sapphire 5 starting unit through the air starter which is a component of the engine. The air starter motors the engine to 22-24 % RPM and as soon as 43± 1.5 % engine RPM is attained, the air starter is automatically disconnected from the power source. The engine-driven generator cuts in at a approximately 47 % RPM. The starting system is controlled by the "ENGINE" switch and the "ENGINE START" pushbutton. When the "ENGINE START" button is pressed, the starting sequence is initiated it will continue automatically until the engine has reached self-sustaining speed. If the engine does not attain 43± 1.5 % RPM within 45 secs of its cycle, the air starter switches off automatically and the sapphire 5 reverts to its idle run ready for another attempt. The starting sequence can be terminated at any time by means of the "ENGINE STOP" pushbutton.

ENGINE THROTTLE

The engine throttle is basically used for setting the engine RPM. The throttle has two ranges of travel. From stop to idle from idle to max. RPM. In the first range of travel it operates the fuel cock. A fingerlift, hinged on the throttle in the front cockpit when lifted, allows the throttle to be moved to the stop position. The rear cockpit also has a throttle lock gate to prevent the front cockpit pilot from moving the throttle to stop inadvertently. A pawl, sliding in a slot, provides for the adjustment of the throttle friction. The engine controls and instruments are shown in figure 1 - 10.

ENGINE FUEL SYSTEM



1. Fuel outlet from fuel-oil exchanger to pump 4001
2. Fuel supply from pump 4001 to fuel-oil exchanger
3. Air supply to regulator 4000
4. Fuel supply from tank to pump 4001
5. Fuel drain from pump 4001
6. Fuel piping for controlling of constant pressure gradient valve
7. Low pressure fuel from regulator 4000
8. Fueldelivery to regulator 4000
9. Stand-by system of fuel delivery to power cylinder and regulator 4000
10. Fuel drain from regulator 4000
11. Fuel drain from power cylinder
12. Outlet of waste fuel from tank
13. Waste fuel from combustion chamber
14. Constant pressure delivery to power cylinder
15. Controlling pressure delivery to power cylind.
16. Air delivery to ADV
17. Air delivery to regulator 4000 for ADV controll
18. Fuel delivery to main jets
19. Air off-take behind compressor
20. Fuel delivery to starting jets igniter

Figure 1 - 12

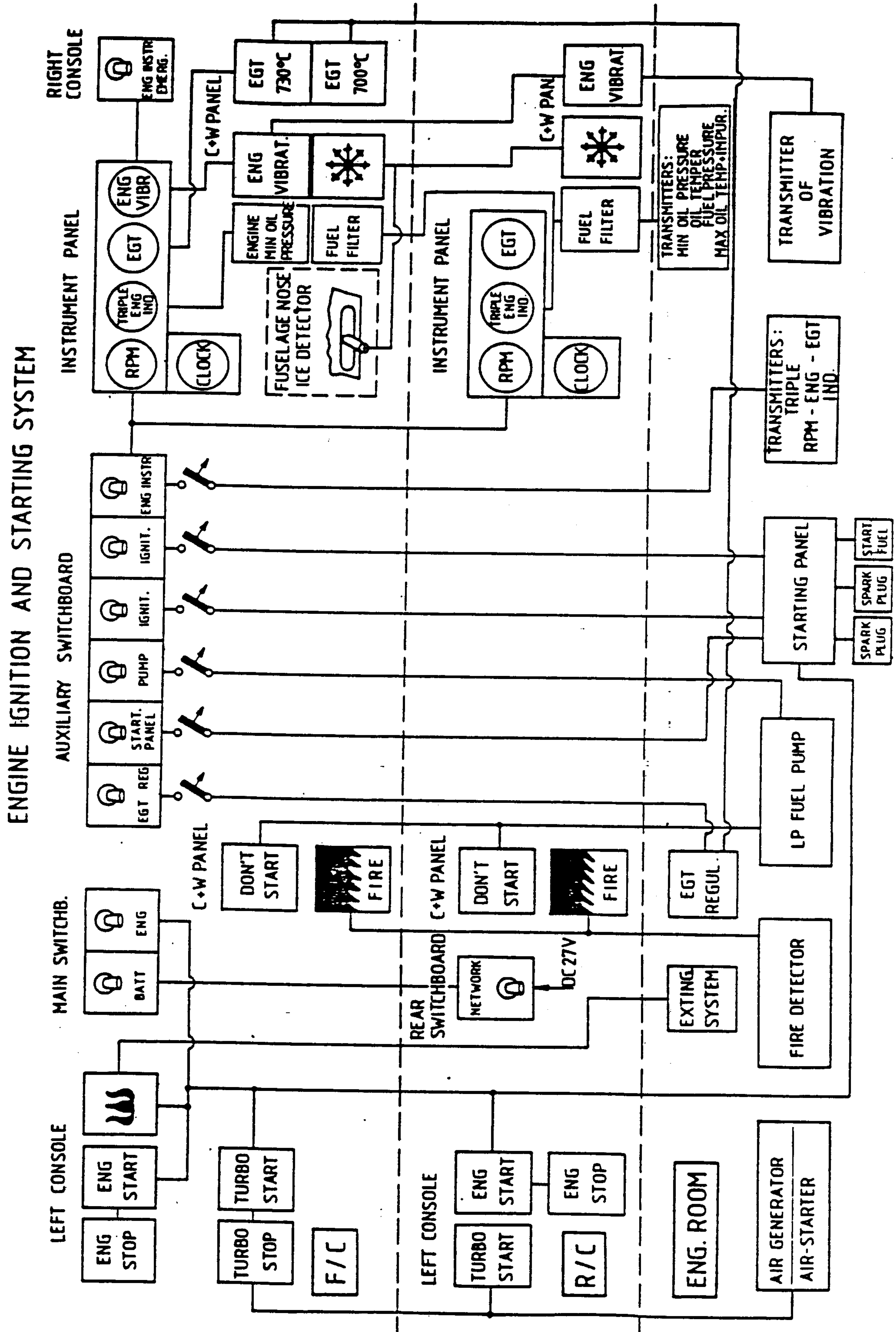

ENGINE IGNITION AND STARTING SYSTEM
AUXILIARY SWITCHBOARD
INSTRUMENT PANEL
RIGHT CONSOLE
ENG INSTR EMERG.
RPM
TRIPLE ENG IND.
EGT
ENG VIBR
CLOCK
C+W PANEL
ENG VIBRAT.
EGT 730°C
EGT 700°C
ENGINE MIN OIL PRESSURE
FUEL FILTER
FUSELAGE NOSE ICE DETECTOR
C+W PAN
ENG VIBRAT
TRANSMITTERS: MIN OIL PRESSURE OIL TEMPER FUEL PRESSURE MAX OIL TEMP+IMPUR.
TRANSMITTER OF VIBRATION
TRANSMITTERS: TRIPLE RPM - ENG - EGT IND.
ENG INSTR
IGNIT.
PUMP
START. PANEL
EGT REG
STARTING PANEL
START FUEL
SPARK PLUG
LP FUEL PUMP
DON'T START
FIRE
EGT REGUL.
FIRE DETECTOR
MAIN SWITCHB.
BATT
ENG
REAR SWITCHBOARD
NETWORK
DC27V
EXTING SYSTEM
LEFT CONSOLE
ENG STOP
ENG START
TURBO START
TURBO STOP
F/C
R/C
ENG. ROOM
AIR GENERATOR
AIR-STARTER

Figure 1 - 13

ENGINE OPERATION

The "ENGINE" switch, when selected to ON connects power to the engine circuits and to the booster pump which creats pressure in the line to the engine-driven pump (the "DONT´T START" caution light goes out). Moving the engine throttle from STOP to IDLE opens the fuel cock. When the "ENGINE START" button is pressed, the automatic sequence begins: the air starter drives the engine into rotation the engine driven HP pump delivers fuel to the engine fuel system (previously described in this section), the starting fuel solenoid valve opens to supply fuel to the combustion chamber, the ignition system provides ignition for approximately 15 secs after the beginning of the cycle-and the engine is motored up to the selfsustaining speed. If the engine fails to start, the automatic starting cycle is terminated after 35 secs. However, the cycle can be prolonged to 45 secs by depressing and holding the start button. After starting, the engine stabilizes at the idle RPM of 56 ± 1,5 %.

AUTOMATIC EGT LIMITER - RT-12

The system is designed to protect the engine against overtemperature and comprises of a cutoff valve located on the nosewheel and limiting valves located on the engine. The system operates in conjunction with the "JPT 700°C" and "JPT 730°C" lights on the warning panels as follows:

1. On the ground, it indicates the temperature of 700°C with simultaneous operation of the limiting valve and engine cutoff at 730°C.
2. In flight with either LG or flaps extended, it indicates the temperature of 700°C and 730°C after nosewheel is lifted with no limiting or engine cutoff.
3. In flight with LG and flaps retracted, it indicates the temperature of 700°C and 730°C with simultaneous operation of the limiting valve.

After signalling of 730°C in flight as soon as the nosewheel touches runway, the engine is automatically cut off. In case of

RT-12 failure, turn it off by using the RT-12 switch located above the right console in the front cockpit.

ENGINE STARTING MODES

The engine can be started in three different modes by means of a three-position switch covered by a panel located on the left console in the front cockpit only. The starting modes are as follows:

I - Starting Mode: In this position, the saphire 5 works normally

II - Preservation Mode: In this position, the saphire 5 cranks the engine to 24 %, which cuts off at 44 % with the sapphire 5 dropping to its idle RPM run to the 45th sec. There is no ignition.

III - Cold Starting or Cranking Mode: This position is used when fuel accumulates in the pipe. There is no ignition.

AIR GENERATOR "SAPPHIRE 5"

The sapphire 5 starting unit is used for starting the engine by means of selfgenerating compressed air which is fed into the air starter. The air starter is a component part of the engine. The sapphire 5 allows motoring of the engine to the required RPM of approximately 24 %. Fuel is delivered to the system from the aircraft main fuel system. Otherwise, the sapphire 5 is an independent system and consists of an air generator in a housing incorporating turbine engine, gearbox, oil pump, electric starter, oil distributor and independent associated systems. The sapphire 5 is used in flight for starting the engine only when the HPC RPM is less than 15 % and it is garanted to operate up on an altitude of 20,000 ft. It is possible to make a total of three engine starting attemps for each running cycle of the sapphire 5. Control of the sapphire 5 is by means of the "TURBO" and "TURBO STOP" guarded push-buttons in the front cockpit and the "TURBO" push-button in the rear cockpit. If the sapphire 5 fails due to fuel ignition malfunction, it automatically switches off after 13.5 sec. Attempt another start after 2 mins.

OPERATION OF SAPPHIRE 5

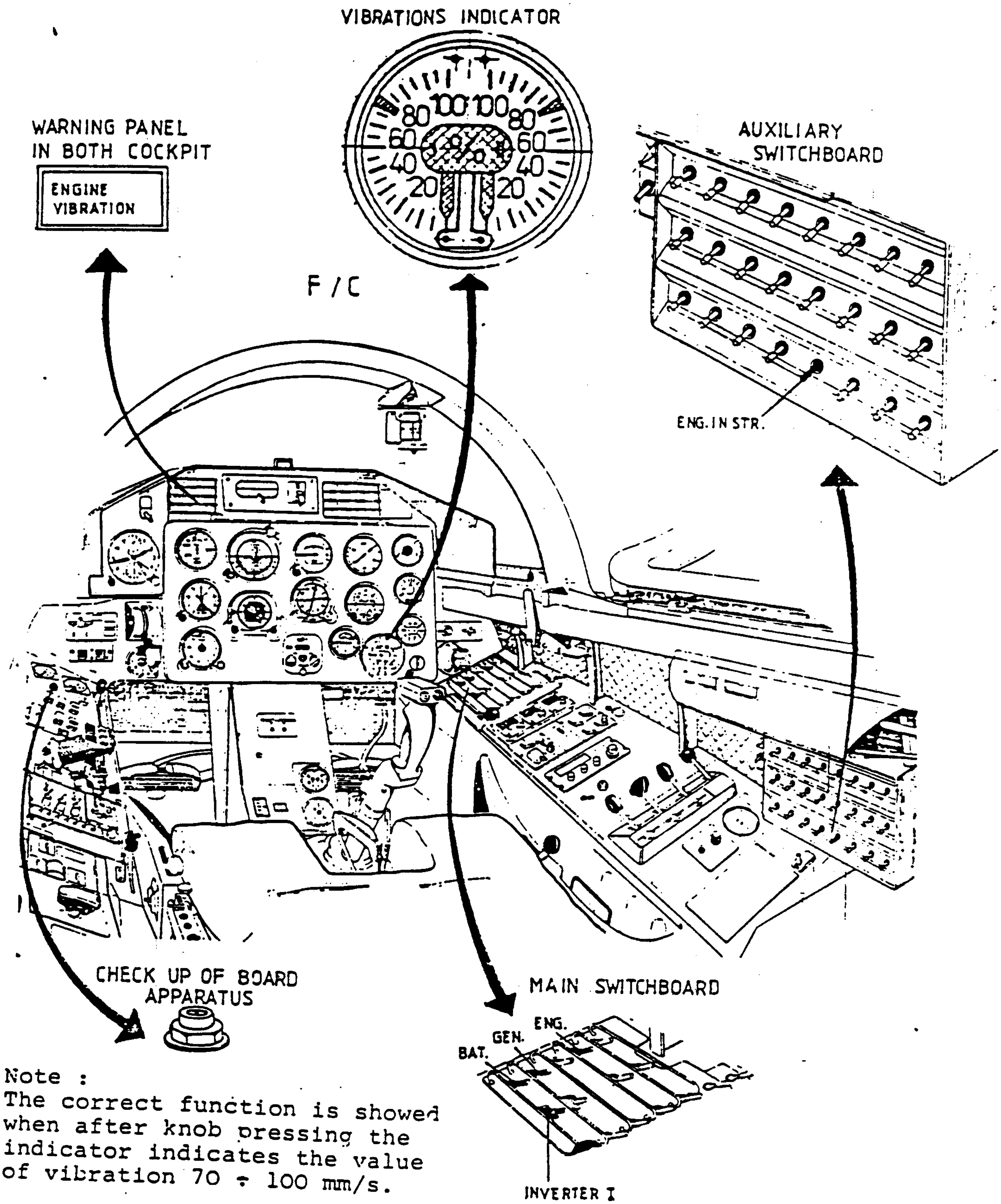
The sapphire 5 starting sequence begins when the "TURBO" push -button is depressed. When the idle RPM is attained, the "TURBO START" light on the warning panel illuminates. During the idle run of the sapphire excess air is led from the unit into the at-mosphere through a relief valve on the right side of the fuse-lage. The unit is ready to start the aircraft engine as soon as the "TURBO" light comes on. When the engine start push-button is depressed, the sapphire unit accelerates to its maximum RPM and simultaneously, the air relief valve closes to direct all available air into the intake of the air starter. The intake into the air starter is then opened by an alectromagnetic valve and the air starter starts motoring the HPC to the require RPM of 24 % (20 % minimum). After the engine has aatained 43 ± 1,5 % RPM both the air starter and the sapphire unit automatically switches off and the "TURBO" light goes off. If the engine does automatically switches off and the "TURBO" light goes off. If the engine does not attain 43 ± 1,5 % within 45 sec after de-pressing the engine start button, only the air starter will be switched off and the sapphire 5 reverts to its idle run RPM and is ready for another engine start which may be attempted after 30 sec.

ENGINE VIBRATIONS INDICATION

Allowed vibration in vertical direction is up to 40 mm/s in the plane of front hinges and up to 50 mm/s in the plane of rear The size of engine vibrations is to be checked by means of board apparatus and namely when on ground.

When in flight, this check shall be executed by means of tell-tale lamp "ENGINE VIBRATION". When making some simple or advan-ced manoeuvres then the operation of apparatus is not correct and that is why in such a case the reading cannot be considered.

ARRANGEMENT OF ENGINE VIBRATIONS INDICATION



Note :
The correct function is showed when after knob pressing the indicator indicates the value of vibration 70 ÷ 100 mm/s.

Figure 1 - 14

LP FUEL SUPPLY SYSTEM

The aircraft fuel low pressure (LP) Supply System (figure 1 - 16) extends from the fuel tanks up to the engine fuel control. It consists of 5 fuselage fuel tanks, 2 tip tanks, 2 pylon tanks and one inverted flight reservoir.

A fire cock, a LP fuel pump, a LP fuel filter with a LP sensor and a fuel gauge complete the system. Sapphire 5 fuel system is also connected to the ac fuel system.

For fuel grades, refer to the Servicing Diagram (figure 1 - 50) and for fuel quantity information, refer to Fuel Quantity Data table (figure 1 - 35) this section.

FUEL TANKS

The LP fuel system consists of the following fuel tanks:

Fuselage Tanks

Five rubber fuselage tanks are located between the rear cockpit and the engine. Tank NO 2 is provided with venting filter, filler cap, fuel capacity transmitter, overflow between tanks 2 and 5, 150 kg fuel remaining warning light.

Tank No.5 is a collecting tank from all the other tanks including the external and tip tanks. In the bottom section of the tank is located the booster pump and in the upper section is located the float valve for control of fuel transfer from tip or underwing tanks. The valve is opened for transfer of fuel to tanks No. 5 when the level is reduced by 200 L.

Tanks No. 3 and 4 fill up the room between air intake ducts and the fuselage contour.

Fuel from the booster pump is supplied to the HP fuel pump through the inter connecting pipe between tanks No. 5 and the HP Fuel pump. The interconnecting pipe incorporates; a non-return valve, stop cock, drain valve, fuel accumulator and a fire cock controlled mechanically from the 2 cockpits.

Inverted Flight Reservoir

An inverted or negative "g" accumulator with a capacity of 10.5 litres is located on the interconnecting fuel pipe between tank No. 5 and the HP fuel pump.

Air pressure /0.4÷0.45 kp/cm^2/ bled from the engine HPC is used in pressurizing the accumulator. During inverted flight, the booster pump in tank No. 5 is deprived of fuel which drops the booster pump pressure to zero. With an accumulator pressure of 0.4 ÷ 0.45 kp/cm^2 , and a capacity of 10.5 L, fuel is still transferred, although under a lower pressure, to the HP Fuel pump to sustain engine operation for 20s at max rating. The accumulator refill time is 10s after inverted flight.

Under Wing Tanks

Two droppable underwing tanks with a capacity of either 150 litres or 350 litres can be suspended on the pylons, fuel is transferred by air pressure /0.4 ÷ 0.45 kp/cm^2 / into fuselage tank No.5.

Tip Tanks

Two non-droppable tip tanks with a capacity of 100 L each is connected to the wing main girder. Fuel is also transferred by air pressure /0.4 ÷ 0.45 kp/cm^2 / into fuselage tank No. 5.

Fuel Transfer

Fuel from external and tip tanks is transferred to fuselage tank No. 5 by air pressure /0.4 ÷ 0.45 kp/cm^2 /. The feeding is controlled by a float valve. Whenever the fuel level in tank No. 5 drops to 200L, the float valve will open to allow fuel supply from either the tips or external tanks. A diaphragm valve controls the sequence of fuel transfer from under wing tanks or tip tanks. The fuel is transferred first from the under wing tanks and then the tip tanks.

FIRE COCK

A fire cock installed at the fuel outlet of the fuel accumulator is a mechanical control system which can be operated in both cockpits.

kg : 3 = GAL FUEL !
(0,299)

FUEL QUANTITY INDICATOR

The fuel quantity indicator measure the quantity of fuel in the fuselage tanks expressed as a mass (kg) and not as a volume (L). This design characteristic of the system offers the advantage of providing a value directly proportional to the amount of energy available on board (the fuel heat energy is directly proportional to the mass unit and not to the volume unit). The indication is however subject to change as a result of the various densities of the fuel used or a variation of the fuel temperature. The system is set to provide indications as a function of the dielectric constant related to a sample fuel with approximately 0.777 kg/dm³ density. (1100 litres x 0.777 kg/dm³= 854 kg). The Jet A 1 fuel density at 15°C can vary from 0.775 to 0.840 kg/dm³ (in accordance with production specifications). When the indicator reads zero, there is approximately 37 kg of fuel in the fuselage tanks.

1100 ltr x 0,26 = 286 GAL.
286 x X = 854 kg : 2,99 = GAL
X = 854/286 = 2,99

FUEL WARNING INDICATOR LIGHTS

The system comprises of four indicator lights as follows

1. Indicator light captioned "150 kg of FUEL" which illuminates when 150 kg of fuel is remaining in the fuselage tanks. 150 : 0,777 kg/dm³ = 193,05 x 0,26 ≙ 50,19 GAL
2. Indicator light captioned "DO NOT START" which illuminates when fuel pressure behind the booster pump drops below 3 Atmospheres.
3. Indicator lights captioned "UNDERWING TANKS" and "WINGTIP TANKS" which goes off when air pressure in the underwing and wingtip tank increases above 0.4 - 0.45 kp/cm² and illuminates individually when fuel in underwing and wingtip tanks are used up or when the pressu-

re drops (throttle idle).

4. Indicator light capitioned "FUEL FILTER" which illuminates.

FUEL SYSTEM OPERATION

When the "ENGINE" switch is switched on, the booster pump in tank No. 5 starts operating and when fuel pressure is 3 kp/cm^2 minimum, the "DON'T START" light comes on. Fuel is then supplied both to the engine and the sapphire 5 fuel system. After the engine has started, the air bled from the engine compressor is directed at a regulated pressure into the wingtip or underwing tanks. If underwing tanks are installed, air will build up a pressure in the underwing tanks thus forcing fuel to transfer into the delivery tank as soon as the level of this tank decreases by 150 kg. When the underwing tanks are empty, the pressure in the tanks drops and the "UNDERWING TANKS" light illuminates. The pressure in the wingtip tanks increases and forces the diaphragm to permit fuel feeding from the wingtip tanks until all fuel is transferred into the delivery tank and the "WINGTIP TANKS" light comes on. After this, the air will flow from the wingtips into fuselage tanks to maintain the required pressure. When usable fuel has dropped below 150 kg in tank No. 2, the "150 kg of FUEL" light illuminates to warn the pilot of the reduced fuel state.

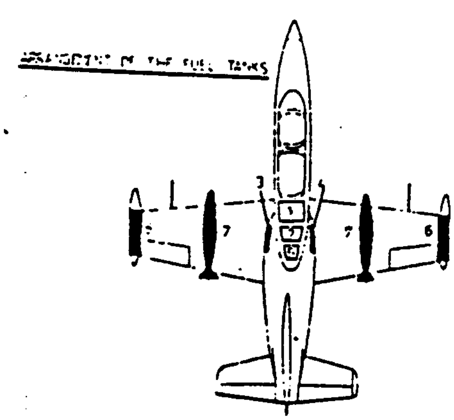


Figure 1 - [illegible]

HAUPTTANK = 1100 l × 0.26 = 286 GAL × 3 = 858

+ TIPTANK = 1300 l × 0.26 = 338 GAL × 3 = 1014 kg

+ UNDERWING = 2050 l × 0.26 = 533 GAL × 3 = 1599 kg

1. The tanks capacities:

No. 1 ÷ 5		1100 l ÷ 3.8 =	289.4 gal (1939 #) fuse
No. 6.	2x100 l	1300 l	342 gal (2292 #) fuse + tip tanks
No. 7.	2x150 l	1600 l	421 gal (2821) fuse + tips + wing tanks
	2x350 l	2000 l	

2. Sequence of fuel transfer:
   Initial transfer of 150 kg from fuselage tanks
   a) From the tanks: 1,2,3,4,5
   b) Underwing tanks 7 (if suspended)
   c) Wing tip tanks 6
   d) Remaining fuel from fuselage tanks
3. Warning of 150 kg of fuel remaining = 50 GAL Restmenge 330 # fuel remaining 193 ltr.
4. Fuel transfer:
   a) From tanks 6 and 7 by means of pressure air 0,4 ÷ 0,45 kp/cm² NO PRESSURE ≙ NO TIP + WING
   b) From tanks 1, 2, 3, 4, 5 by means of the fuel pump (pressure 0,9 ÷ 1,1 kp/cm²)
5. Time of inverted flight
   Limited to 20 sec! at max, mode of engine
   Refilling of the fuel accumulator during the normal flight 20 sec. (10 SEC SEITE I-25)

NOTE:

1. When flying with empty underwing tanks the "UNDERWING TANKS" light doesn't iluminate during fuel delivery from fuselage tanks until the quantity is less than approx. 625 kg.
2. After delivery from wing tip tanks, with fuel quantity more than 600 kg in the fuselage tanks, there may occur short-time blinking "UNDERWING TANKS", "WINGTIP TANKS" - lights. This is no malfunction.
3. During fuel delivery from wing tip tanks at the RPM lower than 85 %, "WINGTIP TANKS" may come on. (Air pressure too low???) ?

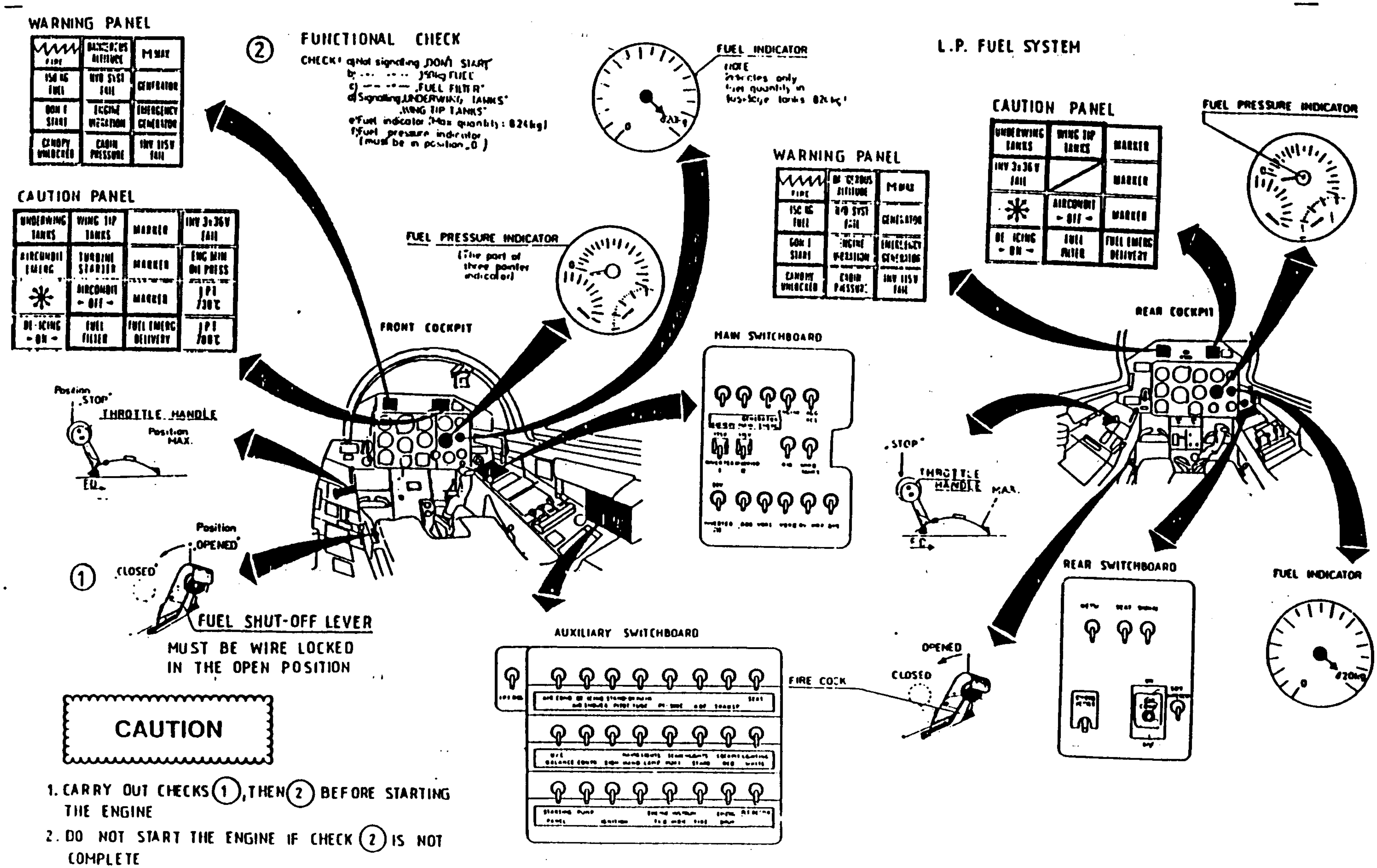

L.P. FUEL SYSTEM
WARNING PANEL
CAUTION PANEL
② FUNCTIONAL CHECK
FUEL INDICATOR
FUEL PRESSURE INDICATOR
(The part of three pointer indicator)
FRONT COCKPIT
REAR COCKPIT
MAIN SWITCHBOARD
AUXILIARY SWITCHBOARD
REAR SWITCHBOARD
THROTTLE HANDLE
Position STOP
Position MAX.
FIRE COCK
OPENED
CLOSED
① FUEL SHUT-OFF LEVER
MUST BE WIRE LOCKED IN THE OPEN POSITION
CAUTION
1. CARRY OUT CHECKS ①, THEN ② BEFORE STARTING THE ENGINE
2. DO NOT START THE ENGINE IF CHECK ② IS NOT COMPLETE

Figure 1 - 16

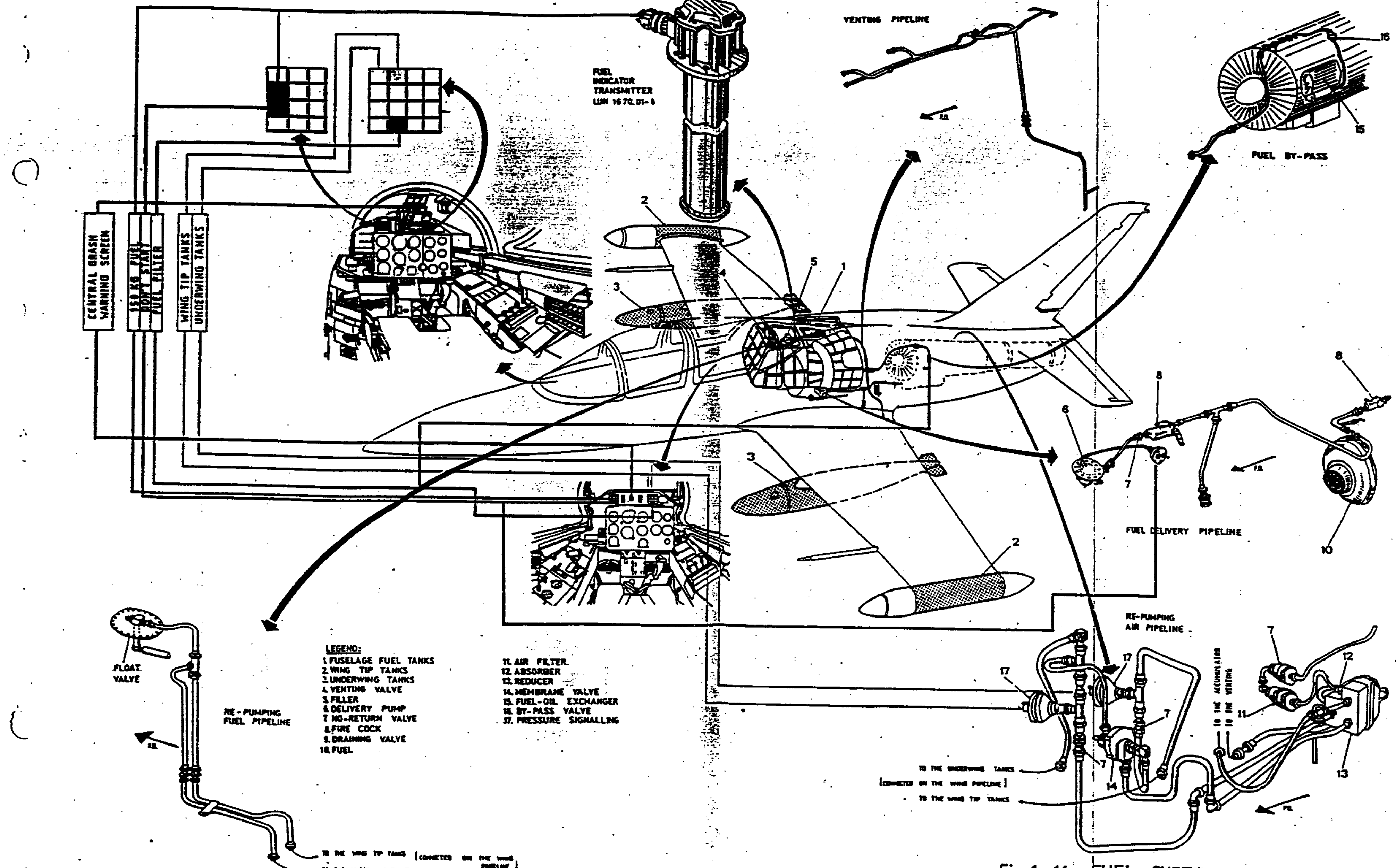


Fig.1-16a FUEL SYSTEM

ELECTRICAL POWER SUPPLY SYSTEM

The aircraft electrical power supply is obtained from a 28V DC system through an engine-driven generator, a ram-jet turbine and a battery. Alternating current of 115V, 26V and 3x36V is obtained from 5 inverters. An external power receptable for connecting an external power source when the engine is not operating is located on the fuselage left side. EPU ≙ LINKS

DC POWER SUPPLY SYSTEM

The main DC power supply system consists essentially of a 9 kw engine-driven generator type VG-7500 JAL. The generator can be connected to the circuit by means of the switch "MAIN GENER." located on the main switchboard in the front cockpit and by means of the "NETWORK" switch in the rear cockpit.

An auxilliary DC power source is provided by a 3 kw generator driven by the ram-jet turbine which extends out of the fuselage into the airstream automatically when the main power supply fails and/or when the engine fails in flight.

This generator is connected to the circuit by means of the "EMERG.GENERATOR" switch located on the main switchboard in the front cockpit. It is manually extended by means of a lever located on the right panel in both cockpits.

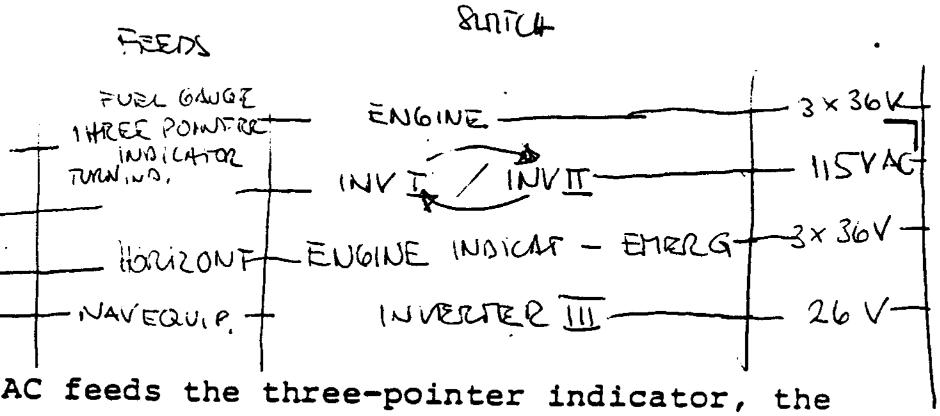
An emergency DC power source is provided by a 24V battery located in the left side of the fuselage nose, and controlled by the "BATTERY" switch located on the main switchboard in the front cockpit and by the "NETWORK" switch in the rear cockpit.

A voltammeter type VA-62-8 located on the instrument panel in the front cockpit indicates battery or generator voltage.

AC POWER SUPPLY SYSTEM

Alternating current is furnished by 5 inverters. These are:

- 1x LUN 2456.01-8
- 2x LUN 2458-8
- 1x PT-500 CB
- 1x PC - 250



The inverter 3x36V AC feeds the three-pointer indicator, the fuel gauge and the turn slip indicator. This inverter can be connected to the DC circuit by means of the "ENGINE" switch on the main switchboard in the front cockpit and by the "ENGINE-INSTRUM, T & B" cct breaker on the auxilliary switchboard.In case of failure of the inverter, the warning light "INV 3 x 36V FAIL" illuminates in both cockpits. Alternate feeding of affected indicators is ensured by means of inverter PT-500 CB using the switch "ENGINE INDICAT: EMERG" located on the right console in the front cockpit.

Inverters of type LUN-2458-8 which supply 115V AC are connected to the circuit by means of the "INV I and INV II" switches located on the front cockpit main switchboard. See figure 1-18 for systems powered by the respective inverters. In case of failure of one of the inverters, the other inverter automatically assumes the load of the failed inverter.

Rotary inverter PT-500 CB supplies 3 x 36V AC current and under normal operations powers the AGD-1 artificial horizon. This inverter also acts as a backup in case of failure of the static 3 x 36V AC by means of t-he "ENGINE INDICAT EMERG" switch.

The inverter PC-250 supplies 26V AC to the navigation equipment and can be connected to the circuit by means of the "INVERTER III" switch located on the main switchboard in the front cockpit. See fig.1-18 for systems fed by this inverter.

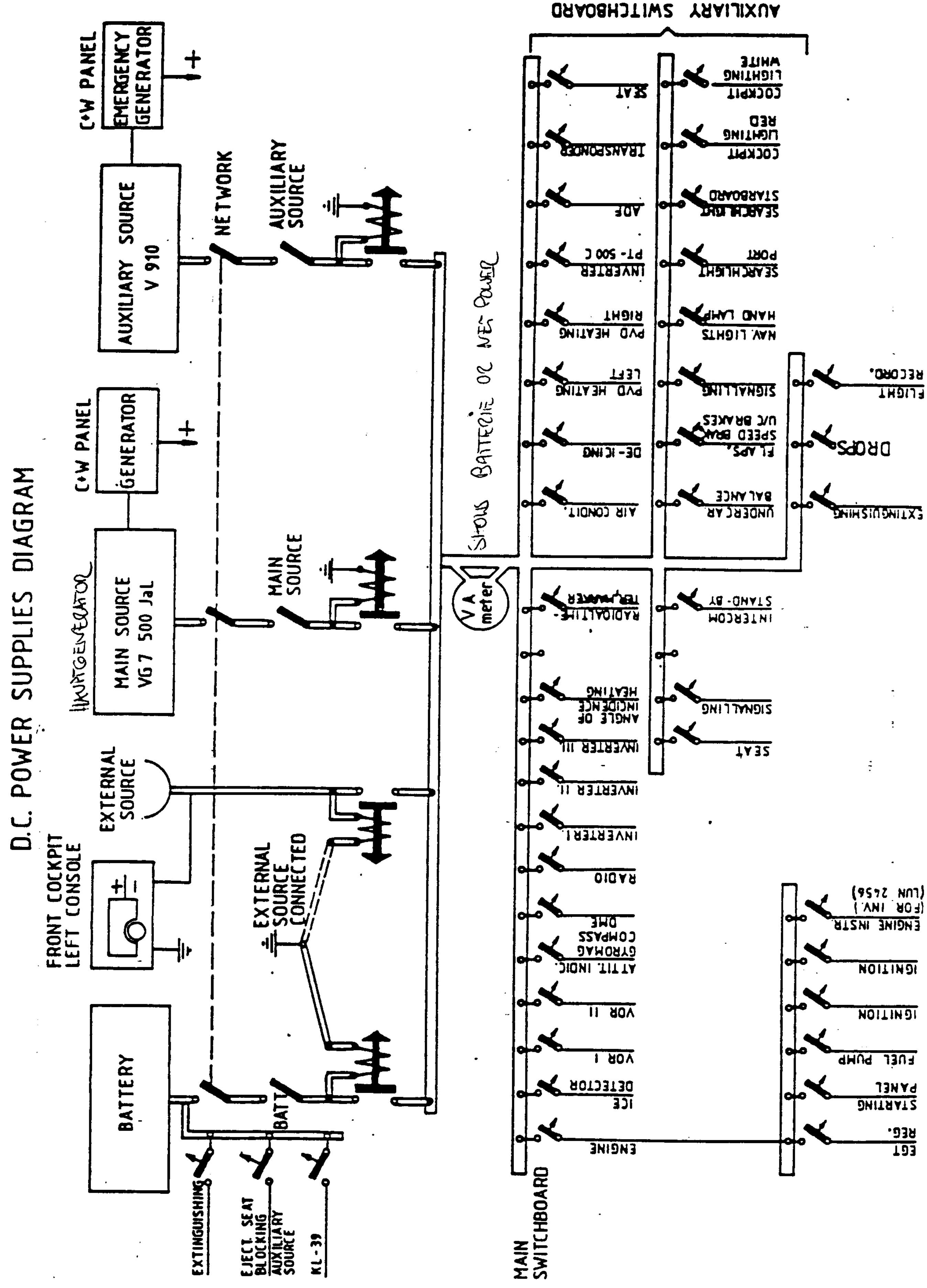
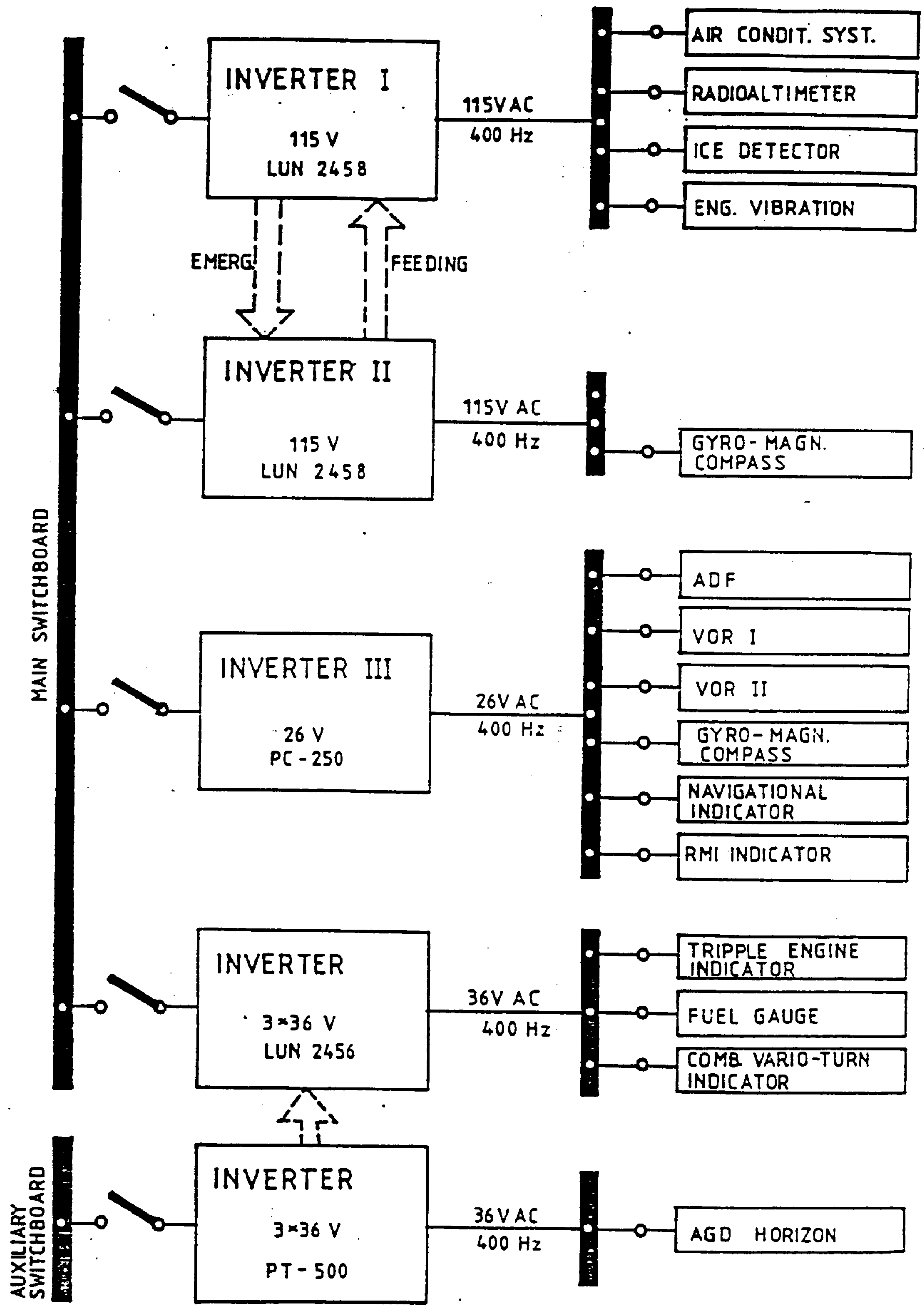
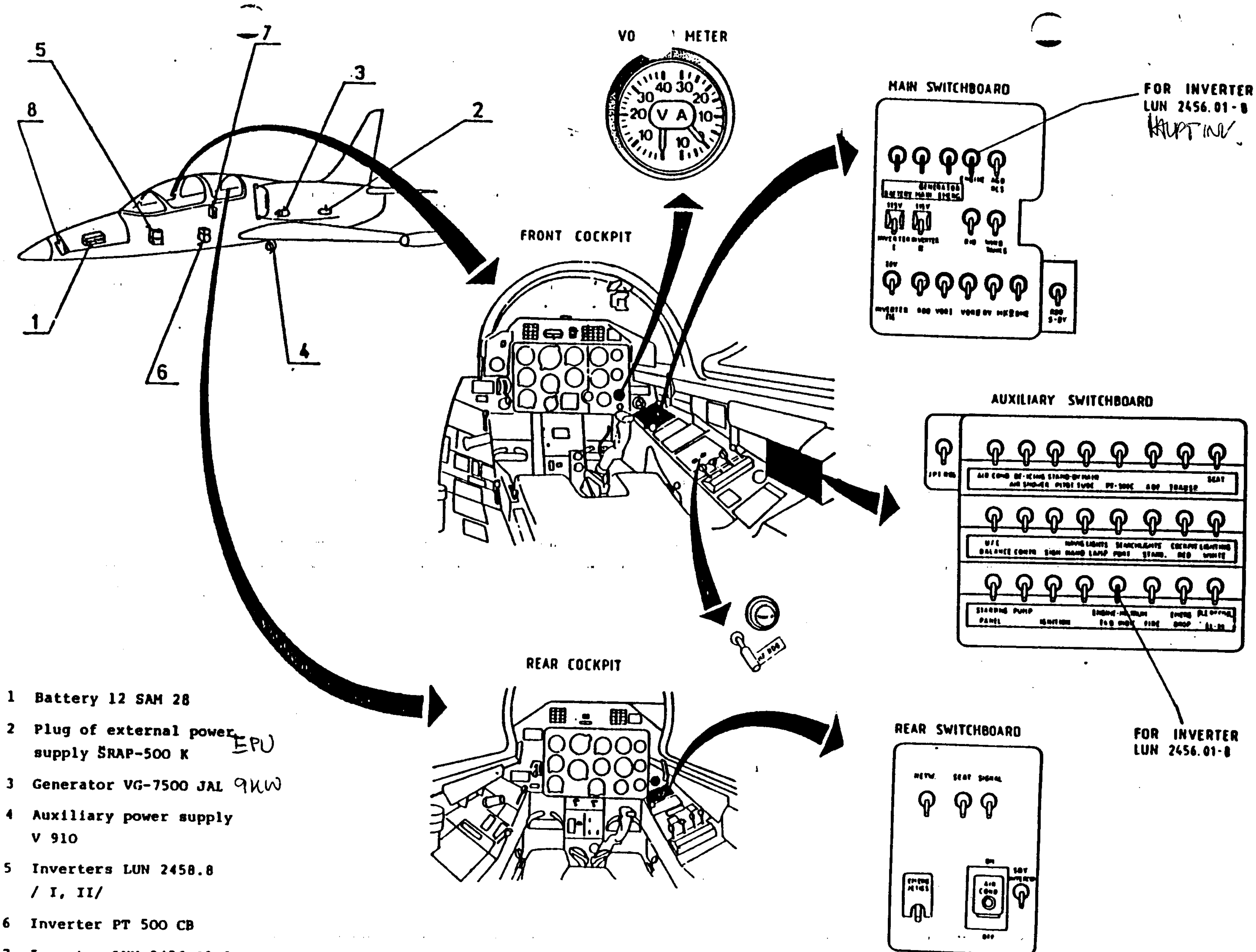

D.C. POWER SUPPLIES DIAGRAM
BATTERY
FRONT COCKPIT LEFT CONSOLE
EXTERNAL SOURCE
MAIN SOURCE VG7 500 JaL
GENERATOR
C+W PANEL
AUXILIARY SOURCE V 910
EMERGENCY GENERATOR
C+W PANEL
NETWORK
AUXILIARY SOURCE
MAIN SOURCE
EXTERNAL SOURCE CONNECTED
BATT
EXTINGUISHING
EJECT. SEAT BLOCKING AUXILIARY SOURCE
KL-39
V A meter
MAIN SWITCHBOARD
AUXILIARY SWITCHBOARD
ENGINE
ICE DETECTOR
VOR I
VOR II
ATTIT. INDIC.
GYROMAG COMPASS
DME
RADIO
INVERTER I.
INVERTER II.
INVERTER III
ANGLE OF INCIDENCE HEATING
RADIOALTIMETER
SEAT
SIGNALLING
INTERCOM STAND-BY
AIR CONDIT.
DE-ICING
PVD HEATING LEFT
PVD HEATING RIGHT
INVERTER PT-500 C
ADF
TRANSPONDER
SEAT
UNDERCAR. BALANCE
FLAPS, SPEED BRAKE U/C BRAKES
SIGNALLING
NAV. LIGHTS HAND LAMP
SEARCHLIGHT PORT
SEARCHLIGHT STARBOARD
COCKPIT LIGHTING RED
COCKPIT LIGHTING WHITE
EXTINGUISHING
DROPS
FLIGHT RECORD.
EGT REG.
STARTING PANEL
FUEL PUMP
IGNITION
IGNITION
ENGINE INSTR (FOR INV.) (LUN 2456)

Figure 1 - 17

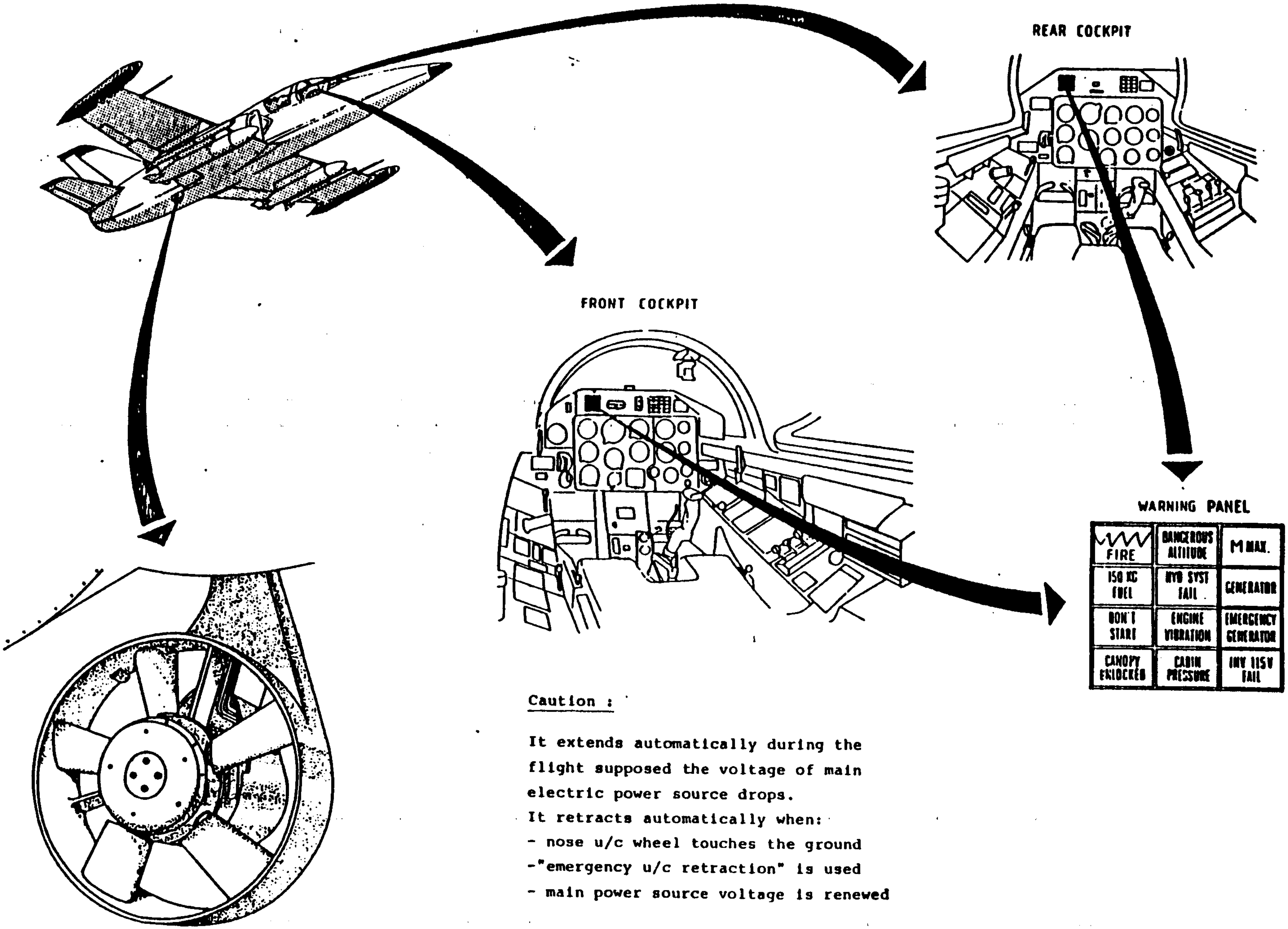
AC ELECTRICAL SYSTEM



ELECTRICAL POWER SUPPLY SYSTEM



1 Battery 12 SAM 28
2 Plug of external power supply ŠRAP-500 K EPU
3 Generator VG-7500 JAL 9KW
4 Auxiliary power supply V 910
5 Inverters LUN 2458.8 / I, II/
6 Inverter PT 500 CB
7 Inverter LUN 2456.01-8
8 Inverter PC-250



Caution :

It extends automatically during the flight supposed the voltage of main electric power source drops.
It retracts automatically when:
- nose u/c wheel touches the ground
-"emergency u/c retraction" is used
- main power source voltage is renewed

Figure 1 - 20

HYDRAULIC POWER SUPPLY SYSTEM (fig 1-21)

The hydraulic power supply system operates at a nominal pressure of 150kp/cm^2 and consists of a main and emergency system. The main hydraulic power supply system provides the hydraulic pressure necessary to operate the landing gear wheel, brakes, wing flaps, airbrakes and the ram-jet turbine.

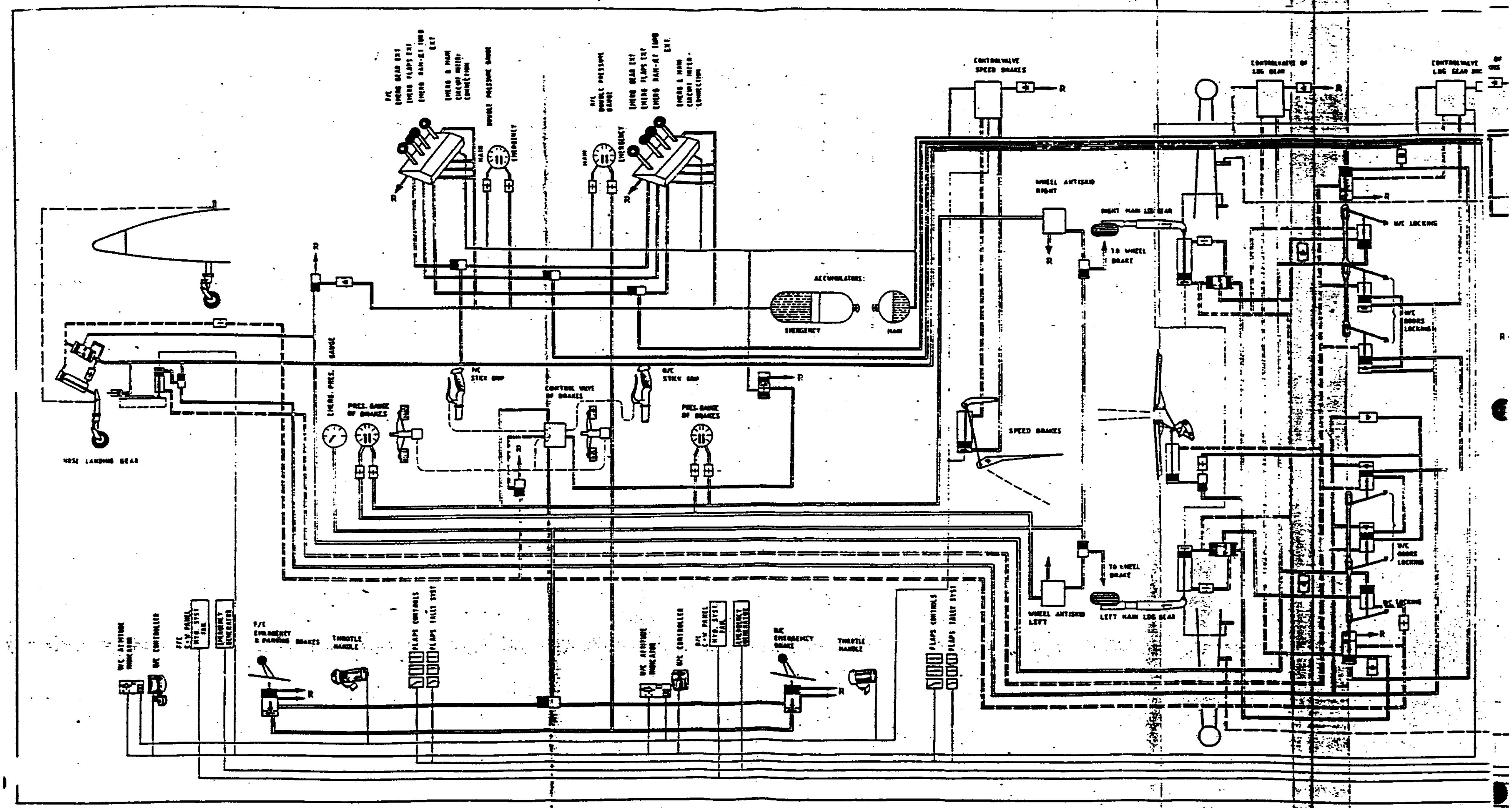
The main supply system consists of a reservoir, an engine-driven variable flow hydraulic pump, filters, a relief valve and a pressure accumulator. The pressure that builds in the accumulator from its initial charge is sufficient for extension of the landing gear, wing flaps, ram-jet turbine and operation of the wheel brakes in case of hydraulic pump failure. The emergency system provides the hydraulic pressure required for extension of the landing gear, wing flaps and the ram-jet turbine in an emergency and also for the operation of the emergency brake.

The system comprises a solenoid-operated separation valve preset to a certain value and controlled by a switch on the landing gear leg, and a pressure accumulator. Both the main and emergency systems are fitted with a pressure indicating system connected to two pressure gauges labelled "MAIN" and "EMERGENCY" located on the rear right console in both cockpits. A lever on the right console in both cockpits permits interconnection of the main and emergency systems. A pressure drop in the main system 60kp/cm^2 is indicated by the "HYD SYSTE FAIL" warning light. The hydraulic system is pressurized by air from the aircraft pneumatic system.

90 kp/cm² ≙ FAILURE

OPERATION OF THE HYDRAULIC SYSTEM

When the engine is running, hydraulic is pumped out of the pressurized reservoir into the main system. When a certain pressure value is exceeded, a solenoid-operated separation valve set to operate at 90kp/cm^2 between the main and emergency system opens and permits hydraulics to be directed from the main to the emergency system until this is also brought to operating pressure of 150kp/cm^2. At this stage both the "MAIN" and "EMERGENCY" pre-



CONTROLVALVE SPEED BRAKES
CONTROLVALVE OF LDG GEAR
WHEEL ANTISKID RIGHT
RIGHT MAIN LDG GEAR
TO WHEEL BRAKE
W/C LOCKING
ACCUMULATORS:
EMERGENCY
MAIN
SPEED BRAKES
WHEEL ANTISKID LEFT
LEFT MAIN LDG GEAR
NOSE LANDING GEAR
EMERG. PRES. GAUGE
PRES. GAUGE OF BRAKES
CONTROL VALVE OF BRAKES
STICK GRIP
DOUBLE PRESSURE GAUGE
THROTTLE HANDLE
FLAPS CONTROLS
FLAPS TALLY SYST
EMERGENCY GENERATOR

/ k letounu barevný /

LEGEND:

- MAIN HYDRAULIC POWER DISTRIBUTION
- EMERGENCY HYDRAULIC POWER DISTRIBUTION
- SUCTION PART
- SUCTION PART FROM GROUND SERVICE
- CONTROL PUMP DRAINAGE
- AIR PRESSURE
- CIRCULATION PART
- RETURN LINE
- LDG GEAR DOORS EXTENSION
- LDG GEAR DOORS RETRACTION
- LDG GEAR EXTENSION
- LDG GEAR RETRACTION
- FLAPS EXTENSION
- FLAPS RETRACTION
- RAM - JET TURBINE EXTENSION
- RAM - JET TURBINE RETRACTION
- SPEED BRAKES EXTENSION
- SPEED BRAKES RETRACTION
- U/C WHEEL BRAKES
- ELECTRICAL CONNECTION
- MECHANICAL LINKAGE

- CONTROL PUMP
- CHECK VALVE
- DAMPING VALVE
- FILTER
- SHUTTLE VALVE
- BY - PASS VALVE
- SAFETY VALVE
- PRESSURE ANNUNCIATOR
- ACTUATORS
- REDUCTION VALVE
- HYDRAULIC LOCK SIMPLE
- HYDRAULIC LOCK DOUBLE
- EMERGENCY CYLINDER OF LOCK
- AIR DRYER
- RECEIVER

Figure 1 - 21 /sheet 2/

ssure gauges in the cockpit will read the same max value which is the hydraulic pump output. This value will be constantly restored as it is decreased by application of hydraulic load. The same operating pressure is also available in the two pressure accumulators of the main and emergency systems with a reserve of hydraulics pressure sufficient to execute vital actions in the event of hydraulic pump failure. This balanced condition between the pressures in the main and emergency systems takes place only when the gear is in the extended position.

NORMAL CONTROL

Under normal operations, distribution of hydraulics to the actuating cylinders is by means of remote-controlled electro - magnetic switches with the rear cockpit controls overriding the front cockpit controls.

EMERGENCY CONTROL

Control during emergency operation is by means of emergency levers but rear cockpit controls cannot override the front controls. After an emergency operation has been executed, it is possible to return any used emergency to its initial position. In this case, a service will only return to the position set by the normal operating device.

LANDING GEAR SYSTEM (fig 1-2)

The landing gear system provides normal extension and retraction of the landing gear and also emergency extension and retraction of the gear. Hydraulic pressure for operation of the landing gear is supplied by the hydraulic system through a selector valve which is electrically controlled by the landing gear lever. The gear doors are always closed after either extension or retraction of the landing gear except during emergency extesion when the doors remain open. The landing gear is held in the retracted position both by the mechanical locks. In the extended position each landing gear leg is maintained in the locked position by hydraulic pressure. A handle is available for the emergency extension of the landing gear should hydraulic or electrical malfunction occur in the main system.

CAUTION

When the aircraft is on the ground and rests on the wheels, if the gear lever is set to retracted position, the gear extend horn will come on.

Emergency ground retraction of the landing gear is possible ONLY when the nose landing gear is off the ground.

LANDING GEAR CONTROLS

Control of the landing gear from the front cockpit is by means of two-position lever with built-in third position for emergency extension. In the rear cockpit, control is by means of a three-position lever with built-in fourth position for emergency retraction.

WARNING

The landing gear can be controlled from the front cockpit ONLY when the rear cockpit lever is in the neutral position.

LANDING GEAR INDICATING SYSTEM

The indicating system for the landing gear system are indentical in both cockpit and consists of the landing gear position indicator panel and mechanical indicators. The LG position indicator panel is comprised of three green lights that illuminate to indicate that the gear is down and locked, three red lights that illuminate to indicate LG is up and in locked position and three advisory lights. The red "EXTEND U/C" light is accompanied by a sound signal from a horn in the cockpit comes on whenever "44°" flaps is selected with the LG in the UP position.

The red "U/C DOORS OUT" light illuminates when the LG doors are opened (LG in transit) while the green "AIR BRAKE OUT" light is self explanatory. Three mechanical external indicators provide visual confirmation that thelanding gear is down and locked.

GOOD

LANDING GEAR EMERGENCY EXTENSION

The LG emergency lever on the rear right console in each cockpit provides an emergency means of extending the landing gear in case electrical or hydraulic malfunction should prevent use of the main system. When this lever is operated, a separate circuit fed by the emergency accumulator operates the landing gears and doors actuating cylinders until the landing gear is locked in the down position. In this case, the doors remain opened.

WHEEL BRAKES SYSTEM

The wheel brake control circuit is connected and fed by the main hydraulic system. It consists essentially of two pairs of sensitive selector valves connected to the brake lever on the control stick and two disc braking units on the wheels of the main landing gear. In case of failure of the hydraulic pump, application of the brakes is possible by use of the hydraulic pressure stored in the main accumulator. If no pressure is available in the main system the brakes can still be operated using the pressure stored in the emergency accumulator. In this case, however, the brakes are not applied by means of the brake lever on the control stick but by operation of the "PARK and EMERG BRAKE" lever in the front cockpit or of the "EMERGENCY BRAKE" in the rear cockpit. Also, no differential braking is possible since the hydraulic pressure acts simultaneously and equally on both brakes. The main wheels are automatically braked after retraction.

WARNING

The wheel brakes operate ONLY when the aircraft weight is on the nose wheel. To operate the wheel brakes after landing, centralize the rudder pedals before operating the brake lever so as to preclude an indavertent swerve and possible cocking of the nosewheel.

WARNING

Rear cockpit brake lever has priority. After rear lever has been used, for the front lever to regain control, it must be completely released and re-applied. PUMP

WARNING

The wheel brakes operate only when there is a minimum pressure of 50 kp/cm^2 in the main system. If the main pressure falls below this value, the wheel brakes connect automatically to the emergency system and the emergency brake must be used. This is to prevent damage to the control valves.

WHEEL BRAKE INDICATION

Application of the wheel brakes is indicated by means of double pressure gauges located on the pedestal in both cockpits. The gauges indicate pressure during normal and automatic braking of the left and right wheels of the landing gear. Indication of emergency brake application is by means of a separate pressure gauge.

ANTI SKID SYSTEM

The system is designed to modulate the hydraulic pressure delivered to the brakes in order to obtain at any time maximum coefficient of friction between the wheel and the runway for any aircraft configuration, runway condition and pressure on the brake lever and to prevent a locked wheel.

STEERING

Steering the aircraft during taxiing is by means of differential braking of the right and left wheels through simultaneous operation of the brake lever and appropriate rudder. pedal. The turn radius is directly proportional to the pressure applied on the brake lever with max deflection of the rudder pedal. Nosewheel maximum deflection is ± 60°.

WING FLAP SYSTEM

The hydraulically-operated and electrically-controlled wing flaps are of the slotted fowler type. The two wing flaps are inter-connected and actuated by a single actuating cylinder. The wing flaps can be set to one of three positions corresponding to the appropriate control button located on the left console namely: "zero", "25°" and "44°". Synchronization of both left and right flaps is executed mechanically. There are three indicator lights beside the buttons that illuminate to indicate the appropriate flap position. After executing the hydraulic function, the pressed button returns to its initial position. The flaps are automatically retracted at 170 kts.

AIR BRAKE SYSTEM

The hydraulically-operated and electrically-controlled airbrake is mounted on the lower side of the fuselage and consist of 2 hinged panels which, when opened, extends into the airstream. Control from the front cockpit is by means af a springloaded push-button and a two-position switch located on the throttle handle. The push-button permits temporary operation of the airbrake, i.e., when pressed, the airbrakes extend; when released, it retracts. The two-position switch is for permanent operation as follows: rear position for extension, front position for retraction.

In the rear cockpit, control is by means of a three-position switch on the throttle lever as follows: rear position for extension, front position for retraction; neutral position to enable front cockpit control.

NOTE

The airbrake can be controlled from the front cockpit ONLY when the rear switch is in the neutral position.

Indication is identical in both cockpits and consists of a green "AIRBRAKE OUT" light on the landing gear position indicator panel. On attaining the flight speed of 0.78 ± 0.02, the airbrakes extend automatically and retracts when speed is reduced below this value.

RAM-JET TURBINE

The ram-jet turbine uses pressure from the main hydraulic system for extension and retraction and provides an alternate source of electric power in case the engine-driven main generator fails. The ram-jet turbine extends automatically whenever the main voltage drops. The ram-jet turbine is automatically retracted when main voltage is restored, when the nosewheel contacts the runway and during emergency ground retraction of the landing gear. In case of failure of the main hydraulic system, the ram-jet turbine can be extended by means of the emergency lever located on the right console. Operation of the ram-jet turbine is indicated by a combination of the "GENERATOR" and the "EMERG GEN" as follows:

1. "GENERATOR" light-OFF) idnicates RJT is retracted and
   "EMERG GEN" light-OFF) out of operation
2. "GENERATOR" light - FLASHING
   "EMERG GEN" light - OFF — indicates RJT is extended and in operation
3. "GENERATOR" light - FLASHING
   "EMERGE GEN" light -FLASHING — indicates RJT is either extended or retracted and out of operation

PNEUMATIC POWER SUPPLY SYSTEM /Figure 1 - 22/

Aircraft air system is used for filling the sealing hoses of the windshield and canopies of both the cockpits and for pressurizing the hydraulic tank. The air source for sealing hoses is an air bottle with volume of 2 litres and pressure of 15 MPa (150 kp/cm sq.). reduction valves in the front cockpit reduce gradually this pressure to value of 15/5 MPa; 5/0.11÷MPa (150/50 kp/cm sq. snf 50/1.1÷kp/cm sq.).

Sealing effect of the windshield and canopies is produced after previous closing and locking the cockpit locks by moving the lever controlling the pressurizing and air-conditioning systems forwards to central position. This can be executed from both the cockpits.

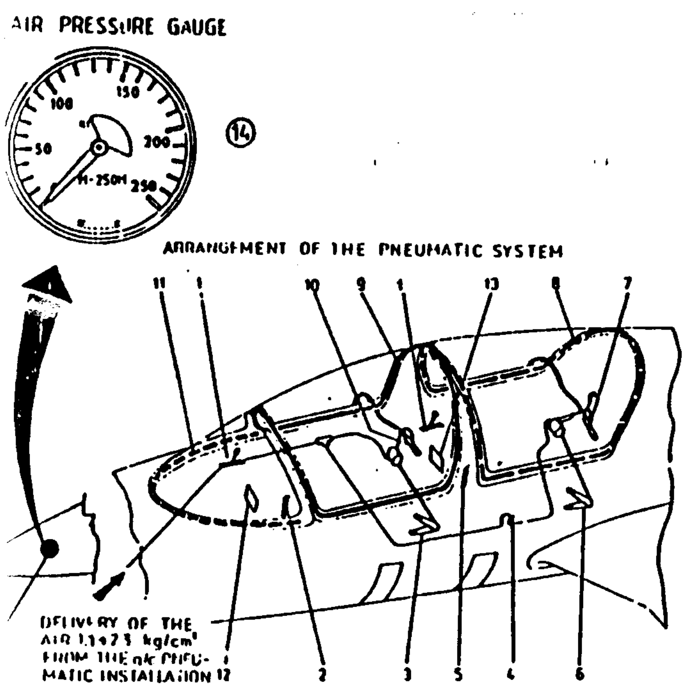
Reverse sequence is used for draining the air from sealing hoses.

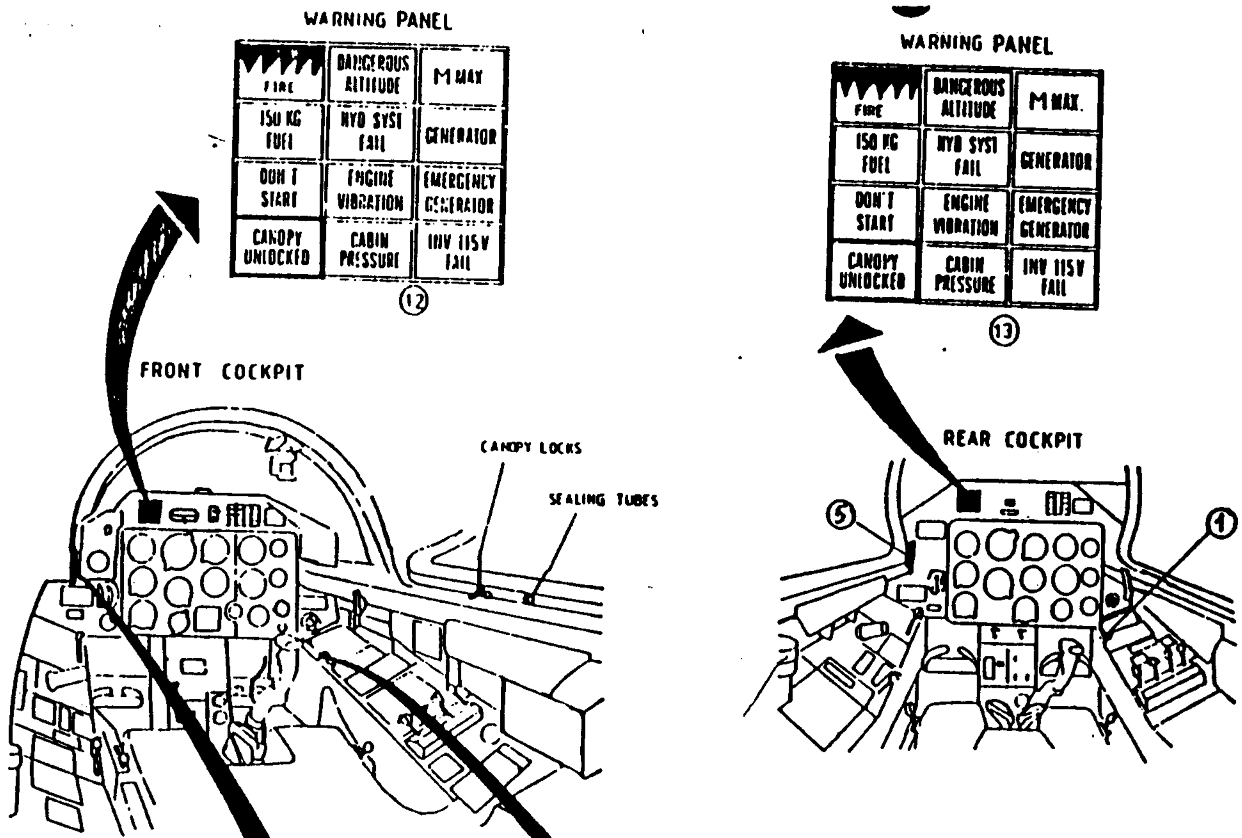
WARNING

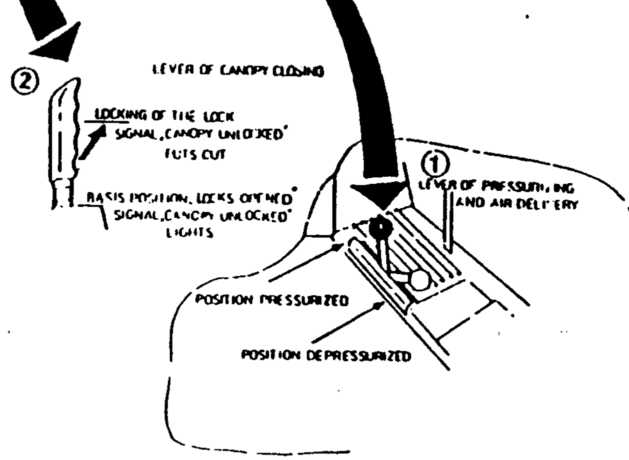
When unlocking the locks without previous depressurizing (and/or during ejectioning), the air in sealing hoses becomes drained automatically. This way is not recommended since the canopies could jump out of their hinges.

N O T E

It is needed before engine test to move the lever of "PRESSURIZING and AIR DELIVERY" forwards to central position for pressurizing of the hydraulic tank.







LEGEND:

1. Lever of pressurizing and air delivery
2. Lever of canopy closing /front cockpit-inner/
3. Lever of canopy closing /front cockpit-outer/
4. PIPE LINE
5. Lever of canopy closing /rear cockpit-inner/
6. Lever of canopy closing /rear cockpit-outer/
7. Telescopic joint-rear
8. Sealing tube of the rear cockpit
9. Sealing tube of the front cockpit
10. Telescopic joint-front
11. Sealing tube of the tiltable windshield
12. Warning panel in the front cockpit
13. Warning panel in the rear cockpit
14. Air pressure gauge

COCKPIT PRESSURIZING /for the pilot in the front or rear cockpit/

1. Close the canopy
2. Lock the locks of the canopy /signal CANOPY UNLOCKED/ puts out/

CAUTION If the signal continues is needed to remove the failure on the canopy

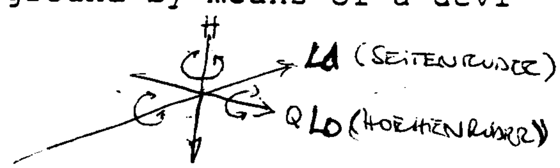
3. Shift the lever of pressurizing and air delivery into position canopy sealing.

COCKPIT DEPRESSURIZING

1. Shift the lever of pressurizing into rear position /pressure air from the sealing tubes vents/
2. Open the locks of canopy /signal "CANOPY UNLOCKED" lights/

FLIGHT CONTROLS SYSTEM /Figure 1 - 23/

The primary flight controls (aileron, elevator and rudder) are moved by a system of push-rods and levers while the secondary flight controls (trim tabs) are controlled by combined electro-mechanical control systems. The aileron and elevator control systems consist of two interconnected control sticks. The rudder control system consists of two pairs of interconnected rudder pedals. Aerodynamic balance of the ailerons are obtained by trim tabs mounted in trailing edge while that of the elevator is also mounted in the trailing edge. The elevator control system is provided with a spring-loaded booster. This booster is activated by elevator deflection of approx. 13° or more. The flight controls can be locked on the ground by means of a device under the instrument panel.



TRIM TABS

The trim tabs provide aircraft trimming along the longitudinal and lateral axes. Longitudinal trimming is provided by trim tabs fitted to the right and left elevators and operated by an electrical actuator which deflects the tabs simultaneously up or down. It should be noted that the left trim tab automatically deflects downward when the wing flaps are moved from 25° to 44° positions. Lateral trimming is provided by trim tabs fitted to the left and right ailerons and are operated by an electrical actuator which deflects the tabs up or down. Both longitudinal and lateral trimming are controlled by a five-position spring-loaded switch located on the top of the control stick grip. Longitudinal trim position indicated by an indicator consisting of a pointer and a top-viewed miniature aircraft and a graduated scale. Consistent with movement of the elevator tab, the pointer takes a nose-up or nose-down attitude proportional to the amount of tab displacement. Lateral trim position indicator is a "NEUTRAL POSITION" green light that indicates only when the aileron trim is in the neutral position.

FLIGHT CONTROLS SYSTEM

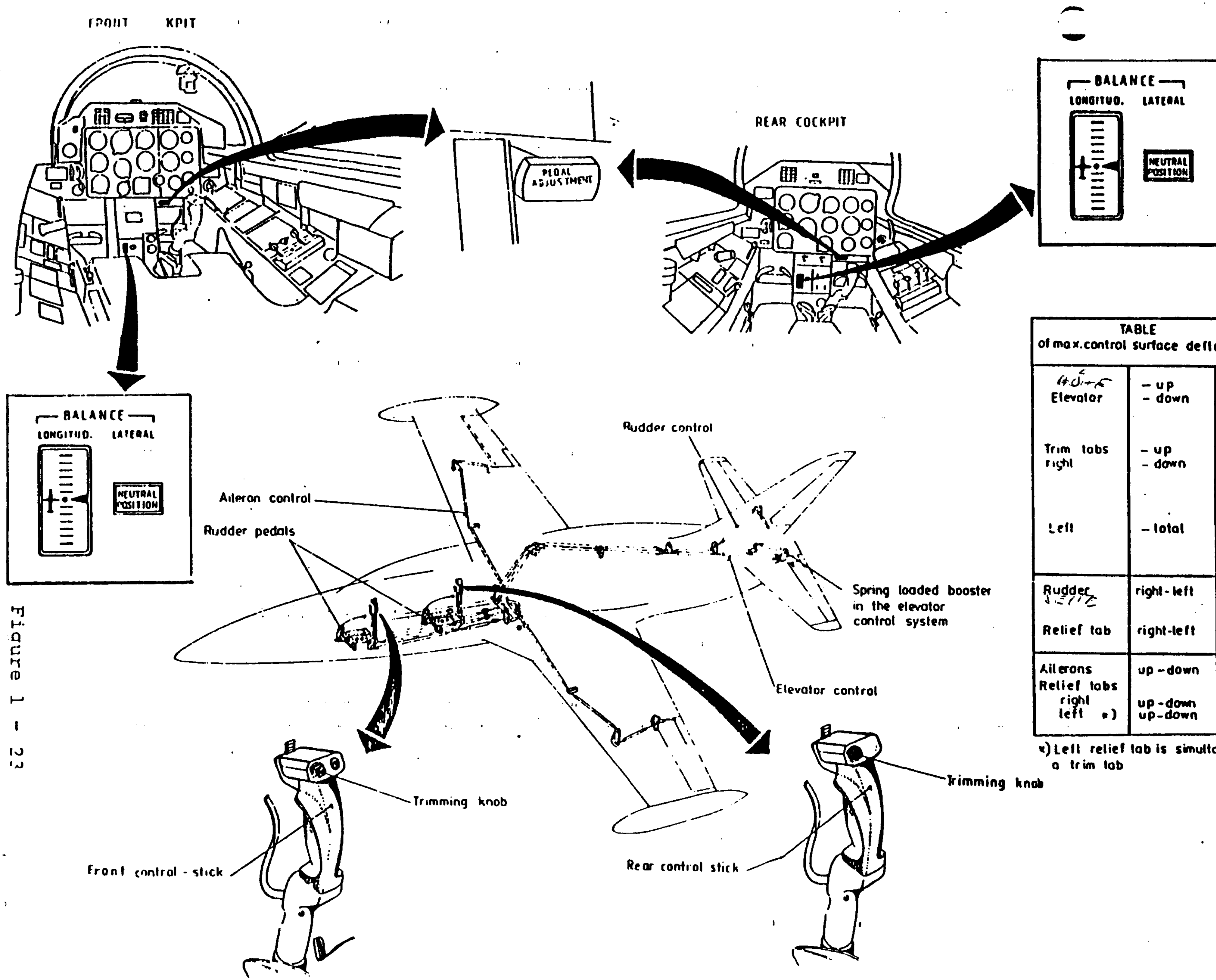


TABLE
of max. control surface deflections

Elevator	– up – down	30° 20°
Trim tabs right	– up – down	7°30' 15°
Left	– total	15°
Rudder	right-left	30°
Relief tab	right-left	15°
Ailerons	up-down	16°
Relief tabs right left x)	 up-down up-down	 2°45' 3°30

x) Left relief tab is simultaneously a trim tab

Figure 1 - 23

FLAPS SYSTEM /Figure 1 - 24/

Pressure liquid is used for extending and retracting the landing flaps to "FLIGHT", "TAKE-OFF" and "LANDING" positions. Synchronization of both left and right flaps is executed mechanically.

The landing flaps turn automatically closed when the flight speed exceeds 310 km/hr (170 KTS) provided they have been extended.

CONTROLLING

The control system is identical in both the cockpits - by means of three-push-button electric actuator situated on the left board desk.

Front push-button:	"FLIGHT"
Central push-button:	"TAKE-OFF"
Rear push-button:	"LANDING"

After finishing the hydraulic function, the pressed push-button returns to its initial position. LIGHTS INDICATORS ??

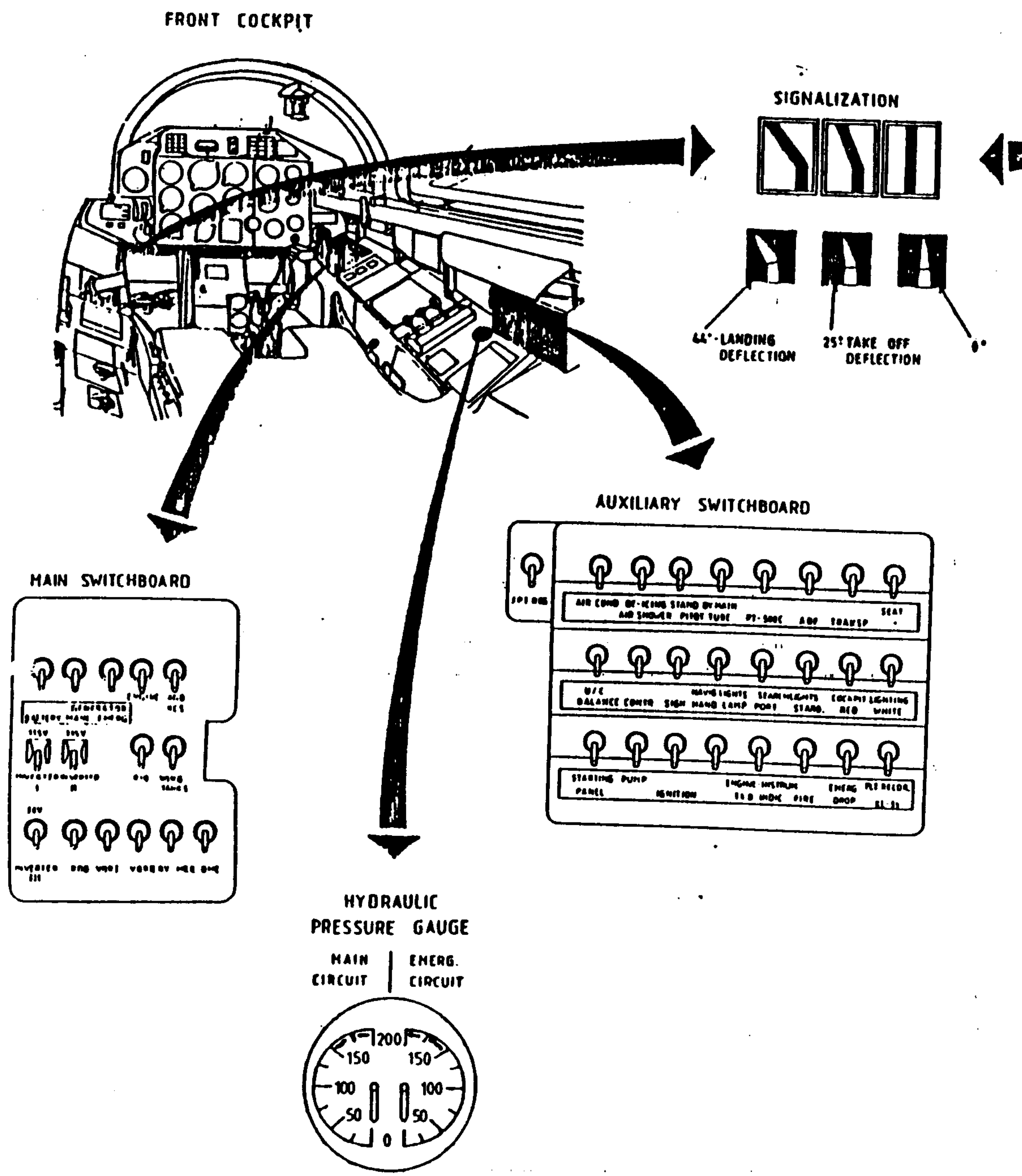
TALLY SYSTEM

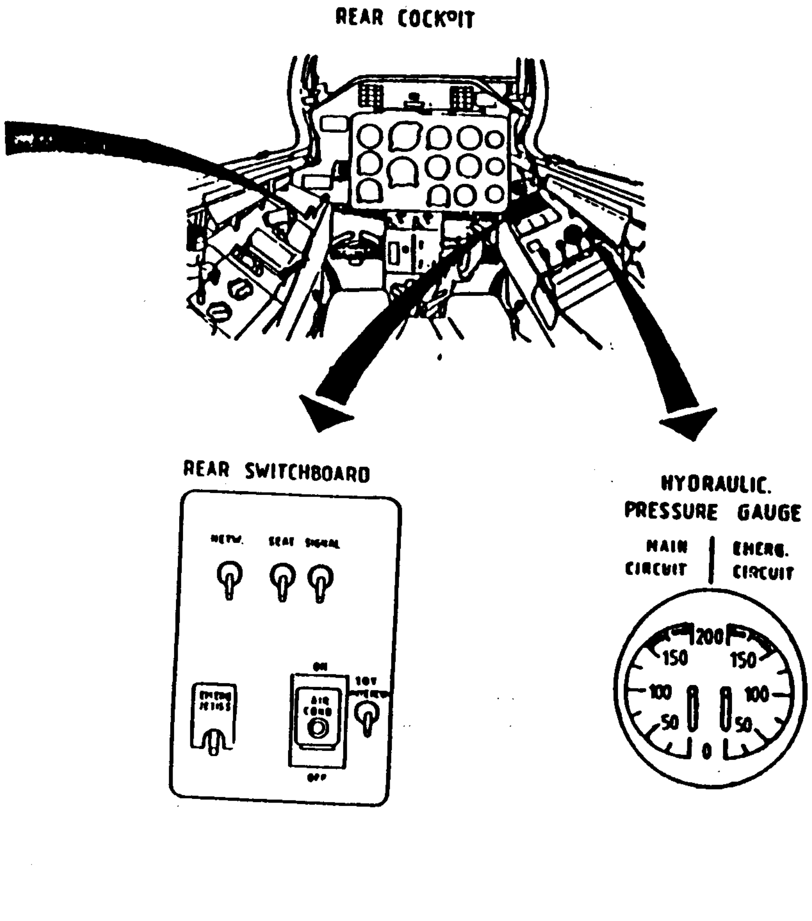
Identical in both the canopies. Three green light symbols on the left borad desk near to three-push-button actuator:

Front one for	"FLIGHT"
Central one for	"TAKE-OFF"
Rear one for	"LANDING"

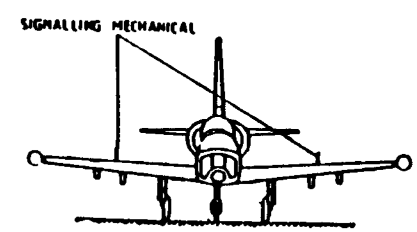
Mechanical signalling of flaps extended position is by means of indicator on the upper wing surface.

FLAPS SYSTEM





NOTE : The landing flaps turn automatically closed when the flight speed exceeds 310 km/h /170 KTS/ provided they have been extended.



SPEED BRAKES SYSTEM /Figure 1 - 25/

Pressure liquid is used for extending and retracting the air brake. Synchronization is mechanical.

a) Controlling:

Front cockpit:

Toggle-push-button actuator on the throttle handle accomplishes two functions:

1) Reversible push-button - for immediate position
   - when pressed - for "EXTENSION"
   - when released - for "RETRACTION"

2) Two positional non-reversible switch for permanent positions:
   - front position for "RETRACTION"
   - rear position for "EXTENSION".

The air brake can be controlled from the front cockpit only when the rear actuator is in its neutral position.

Rear cockpit:

Three-positional reversible switch on the throttle handle.
Front position for "RETRACTION"
Central position (neutral) - when the switch is in the position then it is possible to control the air brake from the front cockpit.

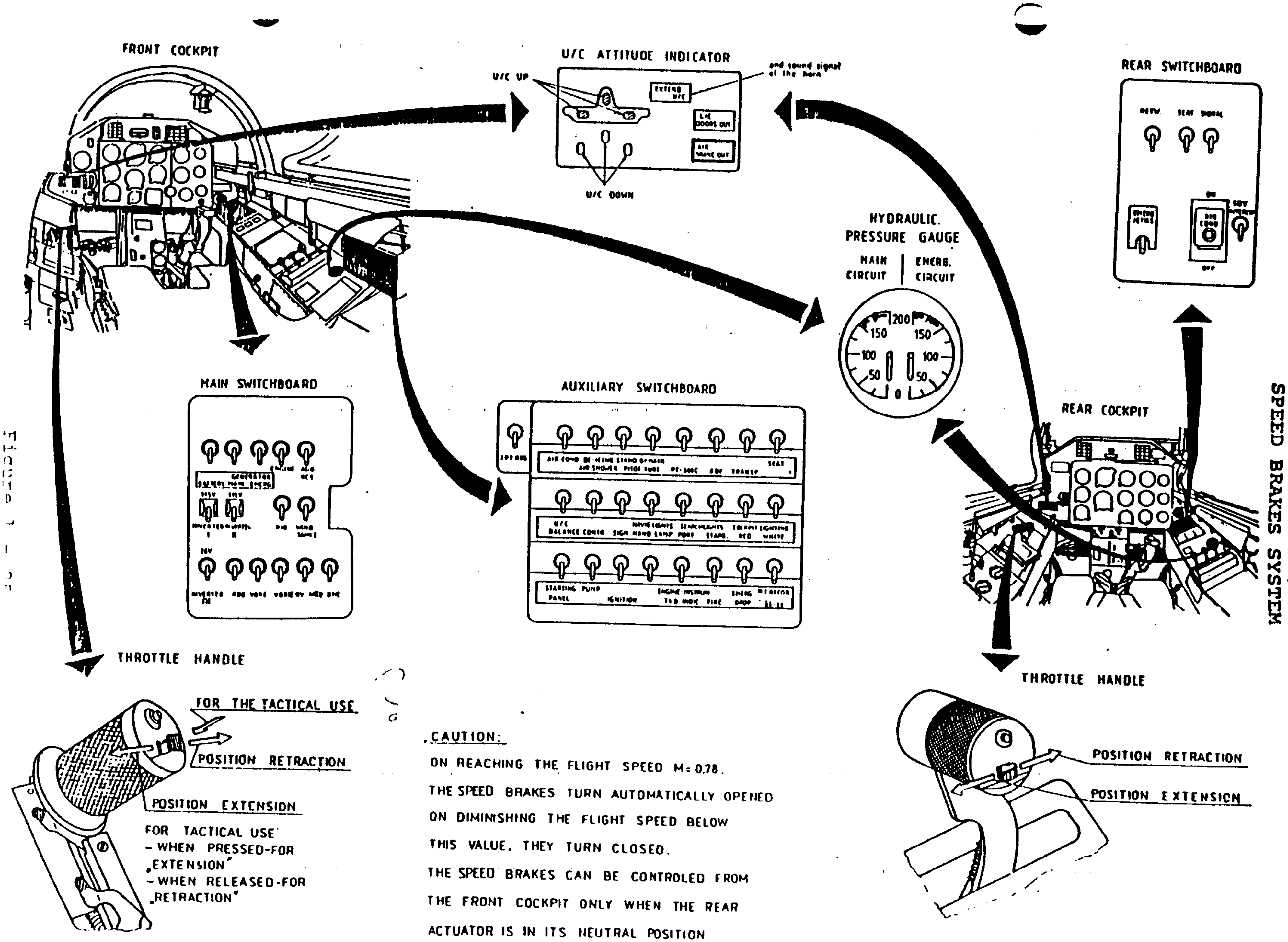
rear position for "EXTENSION".

b) Tally system:

It is indentical in both the cockpits.
Green light in u/c attitude indicator in the left section of board panel "AIR BRAKE OUT".

On reaching the flight speed M = 0.78, the air brake turns automatically opened. On diminishing the flight speed below this value, it turns closed.

SPEED BRAKES SYSTEM



CAUTION:

ON REACHING THE FLIGHT SPEED M=0.78, THE SPEED BRAKES TURN AUTOMATICALLY OPENED. ON DIMINISHING THE FLIGHT SPEED BELOW THIS VALUE, THEY TURN CLOSED.

THE SPEED BRAKES CAN BE CONTROLED FROM THE FRONT COCKPIT ONLY WHEN THE REAR ACTUATOR IS IN ITS NEUTRAL POSITION.

Figure 1 -

LANDING GEAR AND LANDING DOORS SYSTEM /Figure 1 - 26/

Pressure liquid is used for extending and retracting the A/C landing gears and their proper doors. The doors are always closed after either extension or retraction of landing gears. In case of emergency extension of undercarriage then the doors remain open.

a) Controlling

Front cockpit:

By means non-reversible two-positional electric switch provided with built-in third reversible position for emergency retraction of auxiliary source.

Location:

In the left section of board panel. Upper position - "RETRACTION", lower position - "EXTENSION"

WARNING

The undercarriage can be controlled from the front cockpit provided the actuator in the rear cockpit is in its neutral position.

Rear cockpit:

By means of electrical three-positional non-reversible switch provided with built-in fourth reversible position for emergency retraction of auxiliary source.

Location:

In the left section of board panel.
Upper position - "RETRACTION"
Lower position - "EXTENSION"
Neutral position - central one, when the switch is in this position then the undercarriage can be controlled from the front cockpit.

b) Tally sytem

The tally system both for undercarriage and the doors is identical in both the cockpits.

LANDING GEAR AND LANDING DOORS SYSTEM

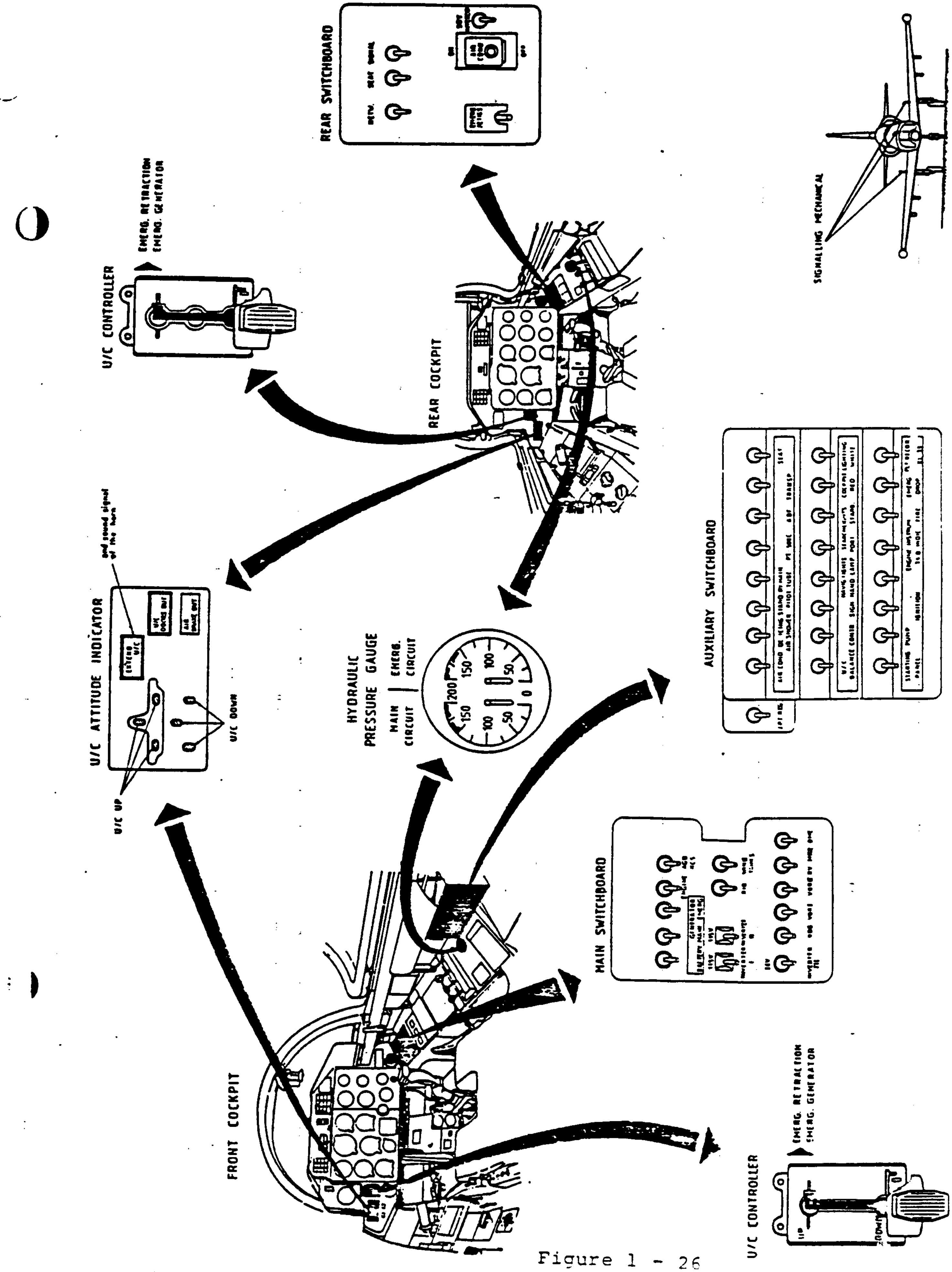


Figure 1 - 26

Location:

U/C attitude indicator in the left section of board panel.

3 red lights - "U/C RETRACTED"

3 green lights - "U/C EXTENDED"

1 red light with inscription "DOORS OPENED"

1 red light with inscription "EXTEND THE U/C"
when this light shines the horn is hooting
Mechanical signalling of u/c extended position is by means of indicator on the upper surface of fuselage nose and wing.

WHEEL BRAKES SYSTEM /Figure 1 - 27/

Pressure liquid is used for controlling the disk brakes of the main U/C legs using smoothly controlled pressure from 0.2 to 3.3 MPa (2 to 33 kp/cm sq/.

a) Controlling

The controlling is identical in both the cockpits.

Hand-operated controlling:
The lever on the control stick is used for smooth pressure regulation from 0.2 to 3.3 MPa (2 to 33 kp/cm sq.).

Foot controlling:
If applying a rudder pedal then, according to the degree of deflection, the proper wheel braking effect is going to diminish. The braked wheel is under pressure chosen in advance by hand-operated control.

Automatic braking:
When the undercarriage is being retracted, the main U/C wheels turn automatically braked.

Taxying with the nose wheel lifted:
It is impossible to brake the wheels in this very phase!

Taxying with the wheels blocked up:
If, during normal braking, any wheel is blocked up then the anti-skid system is put automatically into operation thus relieving liquid gradually and diminishing the pressure to value enabling wheel revolving.

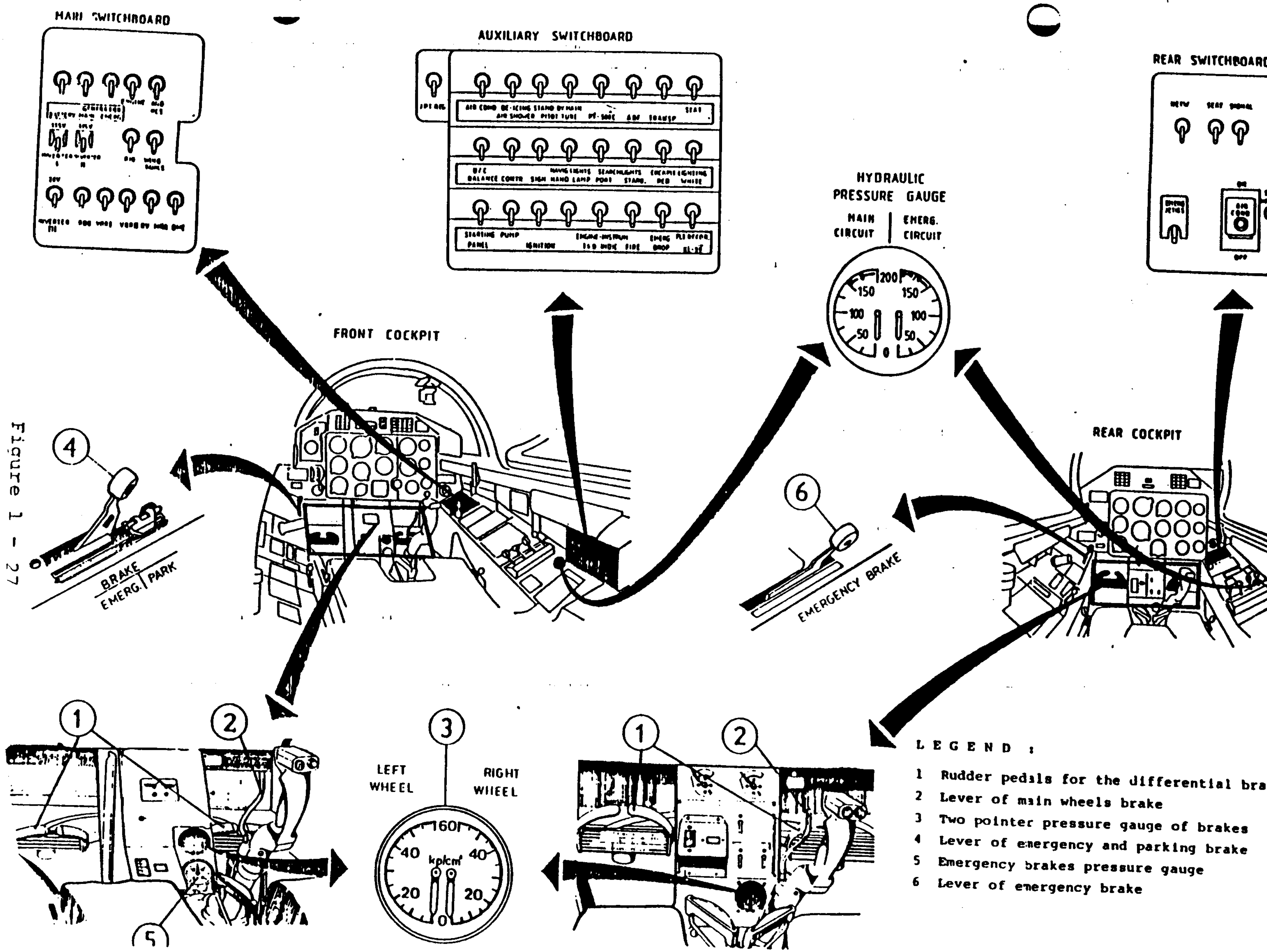
b) Pressure indication

Pressure in the operational circuit of U/C brakes is indicated by means of double pressure-gauges situated on central desk in both the cockpits. The scale indicates the pressure magnitude during both operational and automatic braking in the left and right brake of main undercarriage.

WARNING

It is possible to brake only when the pressure in the main circuit is 5 MPa (50 kp/cm sq.) minimum. Otherwise danger of damage of the control valve of brakes.

WHEEL BRAKES SYSTEM



LEGEND :

1 Rudder pedals for the differential braking
2 Lever of main wheels brake
3 Two pointer pressure gauge of brakes
4 Lever of emergency and parking brake
5 Emergency brakes pressure gauge
6 Lever of emergency brake

Figure 1 - 27

1-I-. STATIC SYSTEM

The pitot static system supplies pitot (dynamic) and static (atmospheric) pressure to various flight instruments and airspeed switches.

The system comprises two separate systems that receive inputs from the pitot booms situated on each wing. Normally the pitot boom on the right wing is connected to the pressure instruments and the left one serves as a back up system. A lever in the front cockpit enables the pilot to select either the right or the left pitot boom pressure to the system.

Both systems are provided with drains at their lowest points located in the right adn left wing central sections.

Static pressure

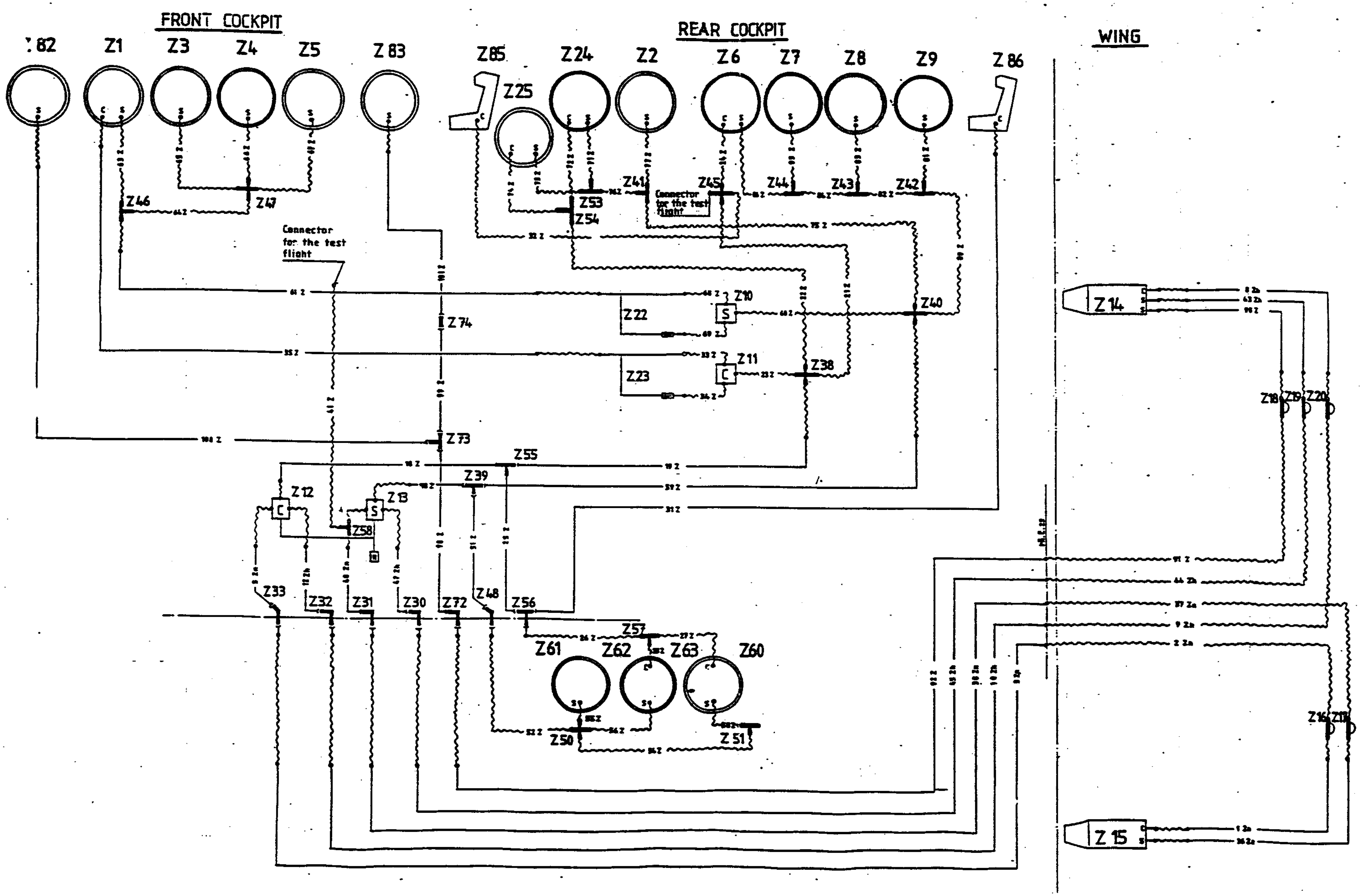
Static (atmospheric) pressure is disdtributed to the following instruments and switches:

- ...ical speed indicator
- Cabin altitude/pressure indicator
- Altimeter
- Airspeed indicator
- Machmeter
- Cabin pressure sensor
- Flaps air pressure switch
- Cockpit dangerous pressure sensor

Pitot pressure

Pitot (dynamic) pressure is distributed to the following instruments and switches:

- Airspeed indicator
- Machmeter
- Flaps air pressure switch
- F... t seat
- Rear seat


FRONT COCKPIT
REAR COCKPIT
WING
Z82
Z1
Z3
Z4
Z5
Z83
Z85
Z25
Z24
Z2
Z6
Z7
Z8
Z9
Z86
Z46
Z47
Z53
Z54
Z41
Z45
Z44
Z43
Z42
Connector for the test flight
Z10
Z11
Z22
Z23
Z38
Z40
Z74
Z73
Z55
Z39
Z12
Z13
Z58
Z33
Z32
Z31
Z30
Z72
Z48
Z56
Z57
Z61
Z62
Z63
Z60
Z50
Z51
Z14
Z15
Z18
Z19
Z20
Z16
Z17

3.2. List of devices for PVD system

Z 1	M-meter - speed indicator	LUN 1170-04.8	front board panel
Z 2	Dangerous pressure tally system	LUN 1460-8	cockpit left side, behind blkhd 16
Z 3	Encoding altimeter	KEA-130	front board panel
Z 4	Combined variometer - turn-indicator	LUN 1180-03.8	front board panel
Z 5	Indicator of cockpit altitude and pressure	LUN 1130-04.8	front board panel
Z 6	M-meter-speed indicator	LUN 1170-24.8	rear board panel
Z 7	Encoding altimeter	KEA-130	rear board panel
Z 8	Indicator of cockpit altitude and pressure	LUN 1130-04.8	rear board panel
Z 9	Combined variometer - turn-indicator	LUN 1180-04.8	rear board panel
Z 10	Switching cock	LUN 7375.02-8	front central desk
Z 11	Switching cock	LUN 7375.02-8	rear central desk
Z 12	Switching cock	LUN 7375.02-8	left front desk
Z 13	Switching cock	LUN 7375.02-8	left front desk
Z 14	Right main Pitot tube	LUN 1153-7	right wing
Z 15	Left auxiliary Pitot tube	LUN 1150-7	left wing
Z 16	Separator	3981 7003	left wing
Z 17	Separator	3981 7004	left wing
Z 18	Separator	3981 7003	right wing
Z 19	Separator	3981 7003	right wing
Z 20	Separator	3981 7004	right wing
Z22,23	Chokes	-	rear central desk
Z 24	Pressure switch	LUN 1461-8	bulkhead No.16 left side
Z 25	Pressure switch	LUN 1461.01-8	bulkhead No.16 left side
Z 61	Altitude transmitter	MDD-Te-1-780	bulkhead No.18 SARPP
Z 62	Speed transmitter	MDD-Te-O-1,5	bulkhead No.18 SARPP
Z 63	Automatic switch	SSA	bulkhead No.18 SARPP
Z 82	Altitude mech.of gun sight		ASP-3NMU-39ZA
Z 83	Cockpit pressure controller	2013V	between blkhds 12-13 on the right
Z 85	Front ejection seat	VS1-BRI	front cockpit
Z 86	Rear ejection seat	VS1-BRI	rear cockpit

PITOT BOOM SELECTOR LEVER

The pitot boom selector lever, located on the left console in the front cockpit only, is labelled PITOT TUBE. It is manually operated selector valve with the position MAIN and STANDBY. With the lever in the MAIN position the normal systems is operated by pressure from the right pitot boom. STANDBY is the position to select the backup system.

F/C Static pressure Lever

A static pressure lever, located on the center pedestal in the rear cockpit only, is labelled START PRESS. In the position FAILURE this lever cuts off the static pressure to the instruments in the front cockpit.

Before returning the lever to ON, the system has to remain in the guarded STBY 30"position for 30 s to prevent a suden pressure impact on the instruments.

F/C Total pressure Lever

A total pressure cutoff lever, located on the center pedestal in the rear cockpit only, is labelled TOTAL PRESS. In the position FAILURE this lever cuts off the dynamic/total pressure to the instruments in the front cockpit.

Before returning the lever to ON, the system has to remain in the guarded STBY 30" position for 30s to prevent a sudden pressure impact on the instruments.

MACH - IAS-TAS INDICATOR

The Mach-IAS-TAS indicator (fig 1-28) provides indication of the indicated airspeed, true airspeed and mach number. This instrument is operated by the pitot-static system. Two pointers (the wider for IAS and the thinner TAS) indicate the airspeeds on a fixed dial. The IAS pointer indicates airspeed from 54 to 600 KIAS while the TAS pointer indicates airspeed from 162 KTAS to 600 KTAS, the corresponding mach number is on a moving scale calibrated from .5 mach to mach 1. The mach meter also incorporates the speed sensor for automatic deployment of the speedbrakes at .78 ±.02 mach.

ALTIMETERS

The altimeters (fig 1-28) located on the instrument panel in each cockpit, indicate aircraft altitude in feet.

The three-pointer altimeter has three concentrically mounted pointers coded in length and shape. The triangular-tipped pointer indicates 10,000's of feet, the small pointer indicates 1,000's of feet and the long pointer indicates 100's of feet and parts of hundreds. The smallest graduations are 20-foot increments between hundreds of feet. The 100-foot pointer makes one complete revolution per 1000 feet of altitude change; the 1000-foot pointer makes one complete revolution per 10,000 feet of altitude change; the 10,000-foot pointer makes one complete revolution per 100,000 feet of altitude change. A low altitude warning symbol is visible at altitudes below 16000 feet. To determine the indicated altitude, first read the 10,000-foot pointer, then the 1,000-foot pointer and last the 100-foot pointer. The front cockpit incorporates an internal encoder for transponder interrogations.

COMBINED VVI/TURN SLIP INDICATOR

The combined vertical velocity indicator/ Turn and Slip indicator located on the instrument panel in each cockpit /fig.1-28/ indicate the rate of climb or descent in feet/minute. The indicators are connected to the static pressure system. The indicator scale is graduated from 0 to 6,000 feet/min. From 0 to 2000'/min it is graduated in increments of 100 and from 2000 to 6000' in increments of 1000. The indicator has a lag of 9 secs.

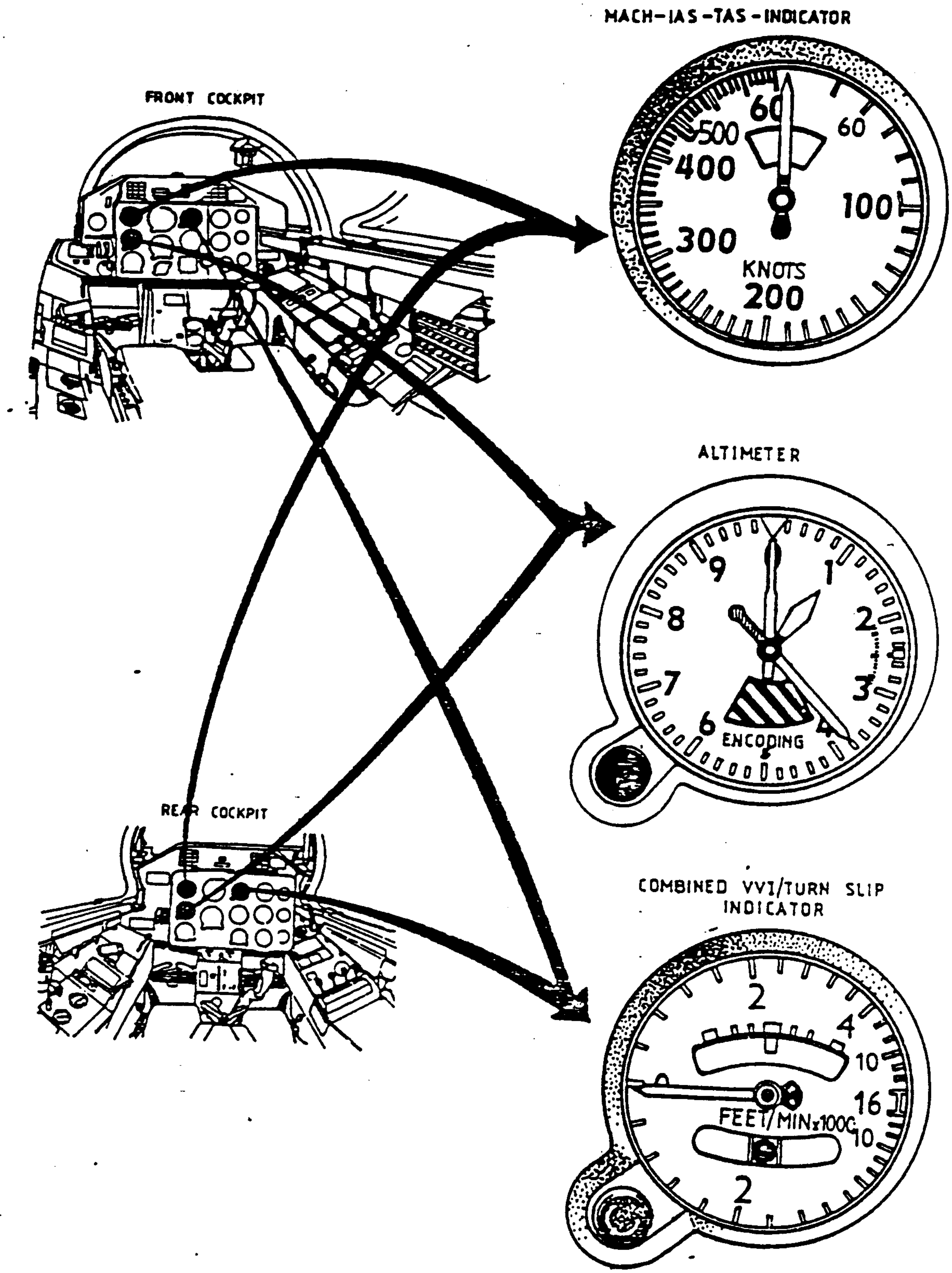

MACH-IAS-TAS-INDICATOR
FRONT COCKPIT
KNOTS
ALTIMETER
ENCODING
REAR COCKPIT
COMBINED VVI/TURN SLIP
INDICATOR
FEET/MINx1000

Figure 1 - 28

ATTITUDE INDICATOR /Figure 1 - 29/

The remote attitude indicators, located on the instrument panel in each cockpit provide indication of aircraft pitch and roll attitude. The attitude indicators receive electrical signals from the gyro platform and are powered by 27,5 VDC from the secondary bus and 3X36 VAC 400 Hz.

NOTE

When the attitude indicator is switched on, the slave light should go out within 15 seconds.

The indicator consists of:

Cylinder

A cylinder with an engraved scale is provided to indicate pitch. The scale, graduated from 0 to 90° in steps of 10° with subdivisions of 5°, on the blue background indicates climb angles, and the scale on the brown background indicates dive angles. The amount of pitch can be seen under the center dot of the aircraft symbol.

Aircraft Symbol

An adjustable aircraft symbol for bank indication is provided in the center of the instrument. Bank attitude is shown by corresponding movements of the aircraft symbol i.g. right bank is indicated by a drop of the right wing of the aircraft symbol. A scale, graduated from 0 to 45° in steps of 15° to either side of the lower part of the instrument, shows right or left bank. The scale between 0 and 30° is subdivided in 5° increments.

Slip Indicator

The attitude indicator incorporates a slip indicator on its lower part.

Slave Button

To slave attitude indicator, the red knob on the upper right side of the indicator has to be pushed in.

Do not use the slave pushbuttons during flight unless absolutely necessary.

Aircraft Symbol Adjustment Knob

A knob on the lower left edge of the instrument is provided to adjust the aircraft symbol on the 0° horizon line.

F/C Attitude Indicator Bank Switch

A two position toggle switch, located on the left console in the rear cockpit, is labeled F/C ATT IND BANK with the position OFF and NORMAL. Switching to the OFF position interrupts the bank signals to the remote attitude indicator in the front cockpit and there will be no or no correct bank indication.

F/C Attitude Indicator Pitch Switch

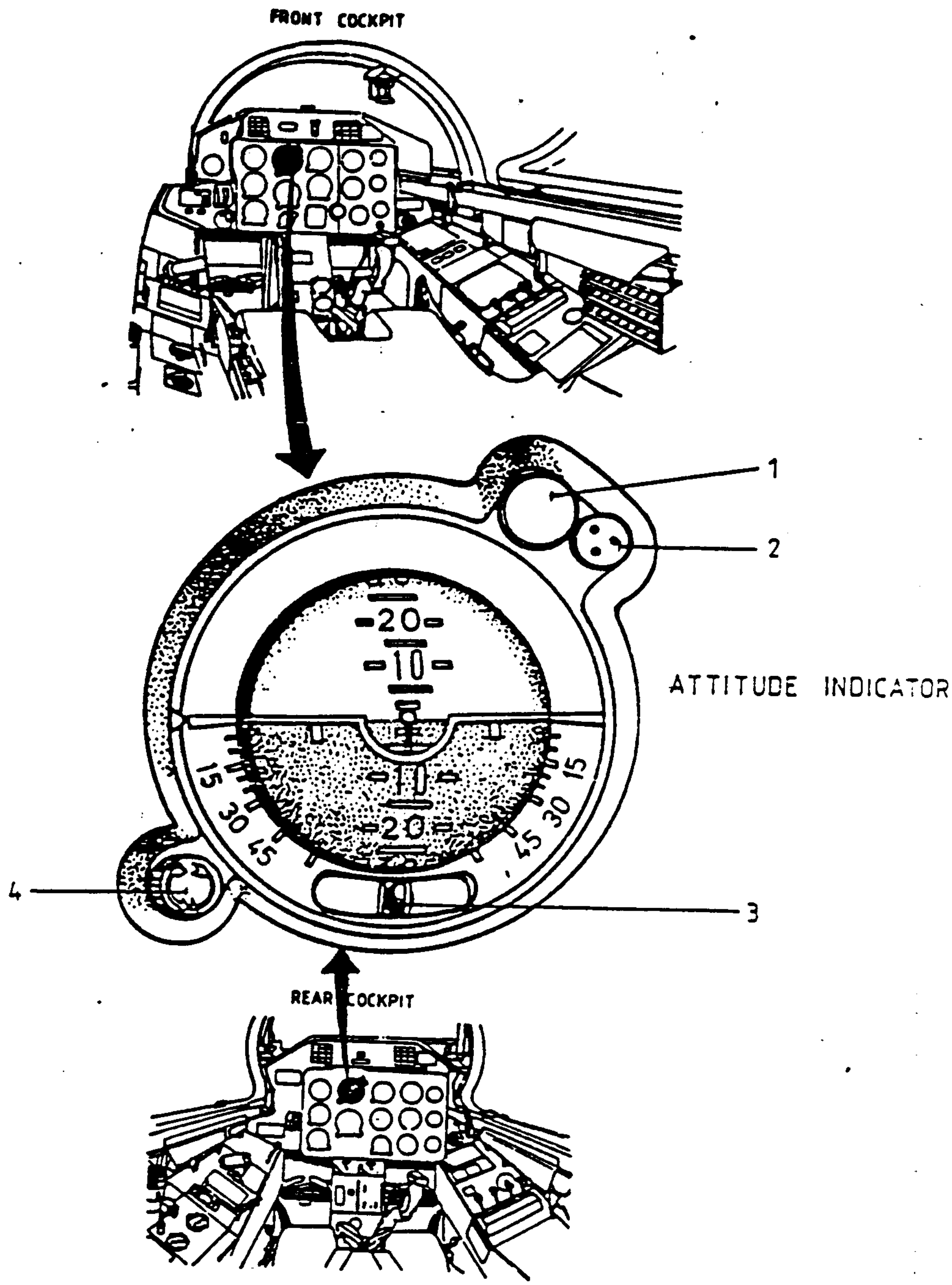
A two position toggle switch, located on the left console in the rear cockpit, is labeled F/C ATT IND PITCH with the positions OFF and NORMAL. Switching to the OFF position interrupts the pitch signals to the remote attitude indicator in the front cockpit and there will be no or no correct pitch indication.

"G" Meter /fig. 1-32/

The "g" meter installed on the instrument panel in the front cockpit only provides information of "g" loads. In addition to the indicating pointer there are two recording pointers (one for positive and one for negative "g" loads which follow the indicating pointer to its maximum attained travel. The recording pointers remain at the maximum travel position reached by the indicating pointer, thus providing a record of maximum "g" loads encountered. To return the recording pointers to the normal 1 "g" position, press the knob on the lower right side of the instrument. The scale of the instrument is graduated from 0 to 10 and from 0 to -5.

Aircraft load limits (clean aircraft) are marked by yellow circles.

A warning tone will be heard in the headset upon reaching the limiting "g" load of + 8 g or -4 g.



1. Slave push button
2. Slave light
3. Slip indicator
4. a/c symbol adjustment knob

Figure 1 - 29

For detailed information refer to Operating Limitations Section V.

MISCELLANEOUS INSTRUMENTS

STANDBY COMPASS

A conventional standby magnetic compass is mounted on the RH windshield from in the front cockpit only (fig. 1-30).

Lighting of the compass is provided via the front cockpit illumination system.

CLOCK

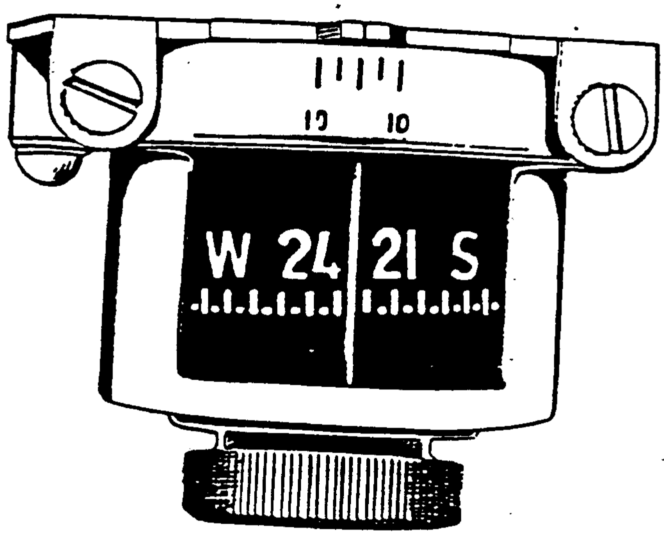
A 12 hour clock is installed in both cockpits in the instrument panel. It is handwound and equipped with two stop buttons.

The STOP button on the lower left, when turned to the left, will wind up the clock. Pulling it against spring pressure and turned, the time can be set.

Pushing this button, also against spring pressure, will actuate the 12 hour stop watch with minutes and hours (upper scale). A blue flag in the window, situated within this scale, indicates that the stop watch is actuated. Pushing this button a second time, will stop the time and will be indicated in the window by a blue and white flag. Pushing the button a third time will return the watch to the starting position and is indicated by a white flag in the window.

The button on the lower right, when turned to the left, will start the seconds pointer of the clock and bring the stop watch for the seconds and minutes (lower scale) in the standby mode. Pushing the same button will then actuate the lower stop watch.

To stop the time, push this button again. Pushing it a third time, will return this part of the clock to standby. Turning this button to the right, will deactivate the seconds pointer (it will stop at the present indication) and the lower stop watch.



STANDBY COMPASS

Figure 1-30

EMERGENCY EQUIPMENT

ENGINE FIRE WARNING SYSTEM

The fire warning system consists of the fire detectors and the FIRE warning lights in the C + W panels.

Fire Detectors

Two blocks of three fire detectors each are installed in the engine compartment for fire detection. Whenever the temperature in the engine compartment increases at a rate of more than 4° C/s a relay closes and the FIRE warning lights illuminate. After extinguishing of the fire or when the temperature in the engine compartment decreases rapidly, the warning lights will go out and the warning circuit is rearmed.

FIRE Warning Circuit Test Switch

A fire warning circuit test switch is located in front cockpit pedestal. The springloaded three position switch labelled FIRE has the position "CHECK" to either side to check the two blocks of fire detectors.

FIRE Warning Light

The red warning light labelled "FIRE" in the C + W panel in each cockpit illuminates whenever the relay, actuated by the fire detectors, closes.

FIRE EXTINGUISHING SYSTEM

The fire extinguishing system consists of the fire extinguisher both bottle and the distributions tubes on the forward part of the engine.

A pyrotechnical charge opens the valve of the bottle and its content will be distributed through the tubes.

Fire extinguisher Button. A fire extinguisher button is installed forward on the left console in each cockpit. The button is secured with a red cover labelled "FIRE EXT.". Pressing either one of these buttons fires the pyrotechnical charge electrically to open the fire extinguisher bottle.

The circuit is protected by the C/B labelled "FIRE EXTINGUISHER" situated in the nose compartment.

Board clock AČS-1M

This clock is designed for determining the running time in hours, minutes and seconds.

Measuring the flight time in duration up to one hour is done in minutes and seconds. The time of operation - - 3 days. Periodicity in winding the clock - 2 days.

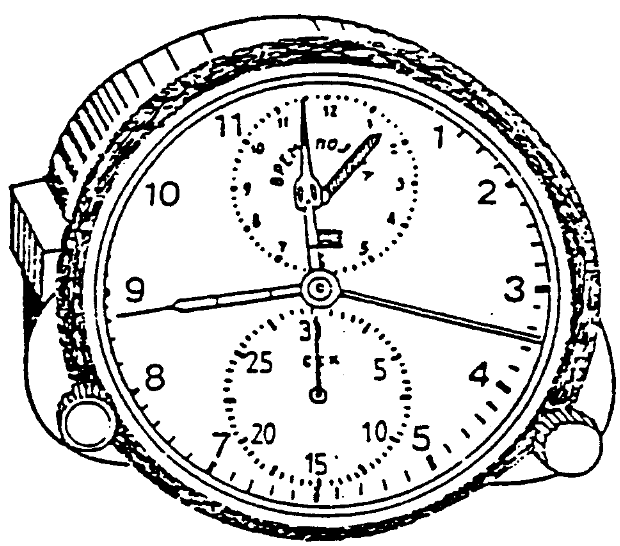
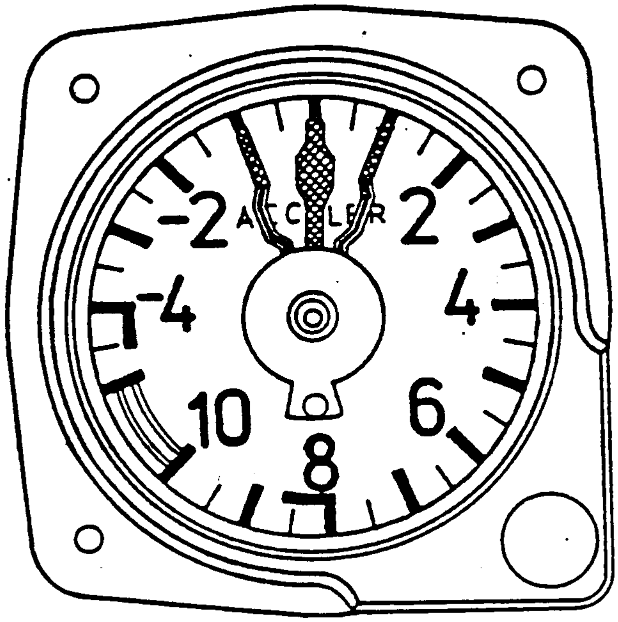


Fig.10 - Board clock AČS-1M



G-METER

Figure 1 - 32

ANTI-G SYSTEM

The aircraft together with the anti-G suit is used for increasing the resistance of a crew against the influence of positive G-factors of different magnitudes arising during flight.

The air pressure for the G-suit is fed from the AC engine.

This air is applied through piping to filter AD-5 and to an automatic device AD-6E where this air pressure is regulated depending on the magnitude of G-factor. The air is then ducted to the anti-G suit PPK-1U, or to the - VKK.

The automatic device AD-6E which can be set to two positions:

-MIN.: for the use of anti-G suit type PPK-1U or of altitude compensating suit VKK-3M; -Normal L-39 operations

-MAX.: for the use of altitude compensating suit VKK-4p or VKK-6M.

Setting

Setting the automatic device is executed on the ground. No handling of this automatic device is possible while in flight.

CAUTION, WARNING, AND ADVISORY LIGHT SYSTEM

Each cockpit is provided with an independent caution, warning and advisory light system. The colours are of white, orange, blue and green lights. They are rectangular in shape and are either with an inscription or with a symbol except the light indicator system of gear position, gear doors and speedbrakes. This indicator system comprises of an independent indicator located left of the instrument panel in the front and rear cockpit. The warning and caution lights are illuminated when the following occurs:

FIRE - Fire exists in the engine compartment or during testing of the fire warning circuit.

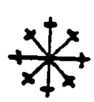
150 kg FUEL - Emergency fuel remaining in the fuselage tanks

DON'T START - Fuel pressure not sufficient in the LP fuel syst.

CANOPY UNLOCKED -The locks of any of the canopies are opened.

DANGEROUS ALTITUDE - The altitude set on the radio altimeter is reached.

HYD.SYSTEM-FAIL - There is pressure drop in the main circuit below the value 60 $\pm$ 5 kp/cm^2.

	The light will go out of the pressure increases up to/120/ kp/cm^2
ENGINE VIBRATION -	Engine vibration is over 40 mm/s – front hinges 50 mm s – rear hinges
CABIN PRESSURE -	Cabin pressure is either too high or too low
M MAX -	On reaching the flight speed M= 0,78 (the speed brakes are automatically extended
GENERATOR-	The emergency generator has failed or is not switched ON
EMERGENY - GENERATOR	The emergency generator has failed or is not switched ON
INV. 115V - FAIL	One of the inverters 115v/400Hz is out of operation
UNDERWING - TANKS	The underwing tanks are empty
AIRCONDITION EMERGENCY	Emergency regime of aircondition after failure of temperature resistor pick-up behind turbo-cooler. (The temperature of air supplied will be changed accordingly to ambient temperature and engine mode within acceptable limits)
	Icing conditions are detected by the R10-3 pick-up.
DE-ICING - -ON-	Both shut-off valves for engine and aircraft de-icing system are opened
WING TIP - TANKS	The wing-tip tanks are empty
TURBINE - STARTER	The SAPPHIRE 5 reaches the idle-run before the engine starts
AIRCONDITION -OFF-	Aircondition system is closed
FUEL - FILTER	The fuel filter pressure of 4 ± 0,5 MPa

MARKER (BLUE)	-	Passing over outer marker beacon
MARKER (ORANGE)	-	Passing over middle marker beacon
MARKER (WHITE)	-	Passing over inner marker beacon
FUEL EMERG DELIVERY		Fuel is delivered to the engine through the emergency fuel circuit (the switch is on the left console in front cockpit)
INV. 3 x 36V FAIL		The inverter for engine instruments and turn-indirector is out of operation. There is need to switch ON the inverter PT-500c by means of change-over switch "ENGINE INSTRUMENTS IN EMERGENCY" on the right concole in front cockpit
ENG. MIN. OIL PRESS	-	The oil pressure has dropped to 1.4 kp/cm^2 or the oil temperature of 205 $\pm \frac{5}{2}$ °C is reached or the oil impurities of 0.25 g minimum are reached
J.P.T 730°C		The exhaust gas temperature of 730°C is reached
J.P.T 700°C		The exhaust gas temperature of 700°C is reached

CANOPY SYSTEM /Figure 1 - 33/

The two jettisonable canopies consist of transparent plastic secured within a metal frame (figure 1-2)
They are operated manually.
The canopies open sideways to the right.

CANOPY CONTROL

The controls for the canopies consist of the internal locking levers, the external locking levers, and the canopy jettison levers. Locking rods are installed to control canopy position.

CANOPY CONTROL

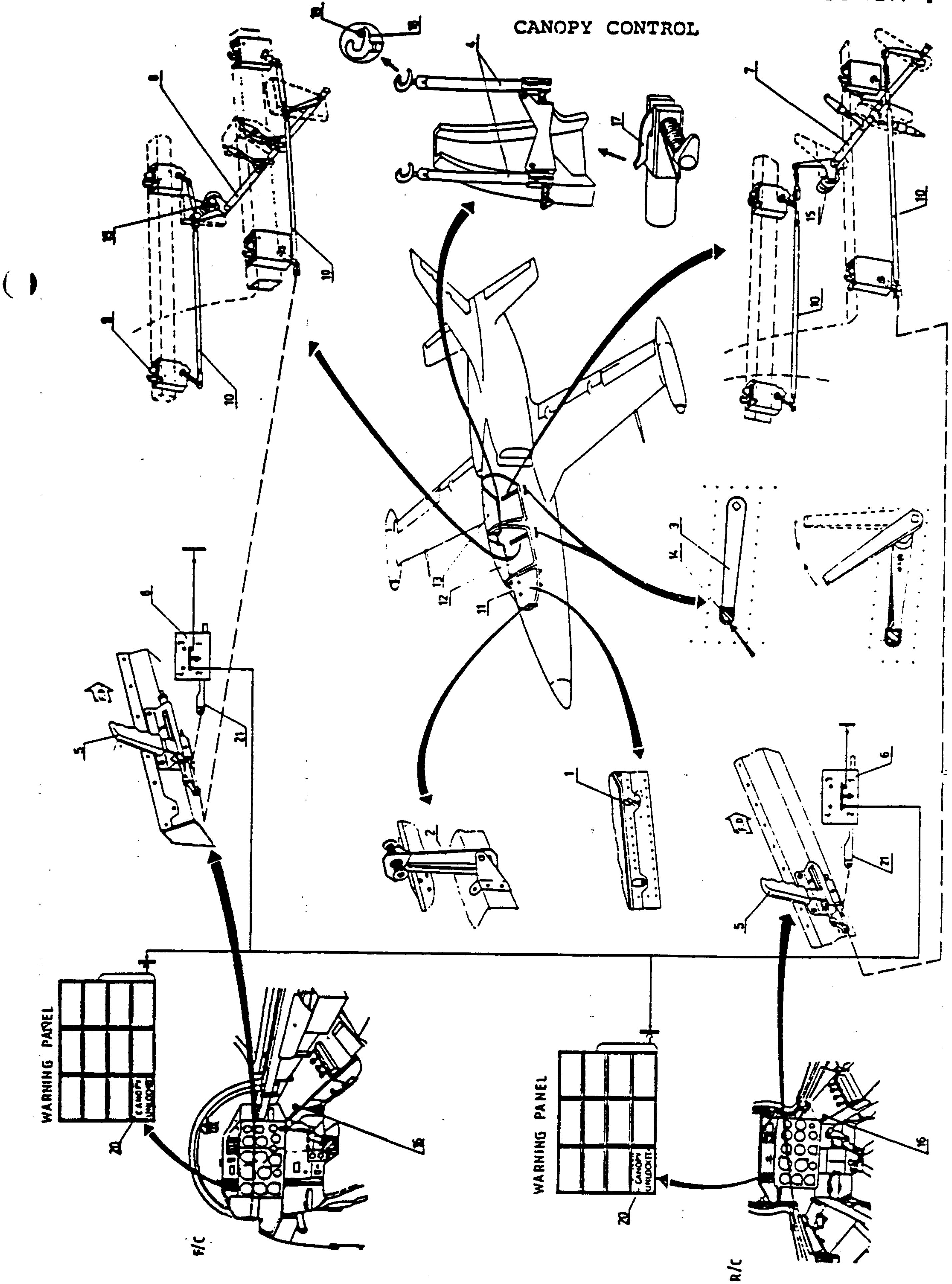


Figure 1 - 33 /sheet 1/

List of details

1/ Windshield pin
2/ Locking strut
3/ Outer lever
4/ Locking system of canopies
5/ Inner lever
6/ Terminal switch
7/ Rear transversal shaft
8/ Front transversal shaft
9/ Lock
10/ Pull-rod
11/ Windshield
12/ Front canopy
13/ Rear canopy
14/ Closure
15/ Pressurizing valve
16/ Lever of the valve of air-conditionig and pressurizing systems
17/ Locking element
18/ Hock
19/ Canopy pin
20/ Crash warning screen
21/ Control pull-rod

Figure 1 - 33/sheet 2/

Internal Canopy Locking Lever

The internal canopy locking levers (fig 1-33) are located on the left canopy rail in each cockpit. It has a red mark in the forward locked position. In the closed position each canopy is held by four locks. The locks in each canopy are opened or closed simultaneously by the canopy locking lever through a mechanical linkage. To open the canopy, the internal canopy lever is slided backwards. Sliding it forward closes the locks.

External Canopy Locking Lever

Locking and unlocking the canopies from outside is possible by external canopy locking lever located below the canopy rail on the left side of the fuselage by each cockpit canopy. The spring loaded lever is released by pushing the locking cover. A spring forces the lever to engage the mechanical linkage of the opening mechanism.

Turning the lever clockwise opens the canopy locks. To store the handle, it has to be pushed against the spring pressure and secured by the locking cover.

Canopy Jettison Lever

The red canopy jettison lever (fig 1-42) is located below the canopy rail on the right side of the canopy in each cockpit. Moving the lever anti-clockwise fires a cartridge located behind the ejection seat on the aircraft´s airframe. The gas disarged from the cartridge is distributed through three pipes. The first pipe is connected to a mechanical linkage of the opening mechanism of the four locks while the remaining two pipes are connected to the actuator on the canopy rail which in turn jettisons the canopy.

Seat Arming Ball

An arming ball attached with a safety cable to the canopy at the top left section of the seat assembly prevents unintentional ejection through the canopy. When the canopy is jettisoned, a cable attached to the canopy and linked to the arming ball, pulls the ball and arms the ejection seat.

Canopy Locking Rod

In the open position, the canopy is held by a rod. The canopy is ensured locked in the tilted opened position when the piston is extended and canopy tilted to maximum position. The locking element is then brought automatically to the groove. When closing the canopy, it is necessary, first to lift the locking element before the canopy can be moved from open-locked position.

WARNING

When the canopy is closed and locked, ensure the canopy pin bears against the bottom section of the hook.
If not, it may result in malfunction of the ejection system.

CANOPY UNLOCKED LIGHT

A red CANOPY UNLOCKED light (fig 1-33) located above the instrument panel on the caution and warning in each cockpit, illuminates when one of the canopy is not locked. The signal comes from a terminal switch on the left canopy rail in each cockpit. The light is also connected to the master caution red light.

FLIGHT RECORDER (SARPP-12)

The flight recorder is connected to the electrical network through the battery switch and protected by the circuit breaker SARPP.

The flight recorder records various aircraft flight parameters. This recorder together with protective box is located on the left side of the fuselage rear section.

The recording of the items are divided into two groups.

The first group are

- Altitude
- Airspeed

- g-loads
- RPM
- Elevator movements and
- Throttle handle position

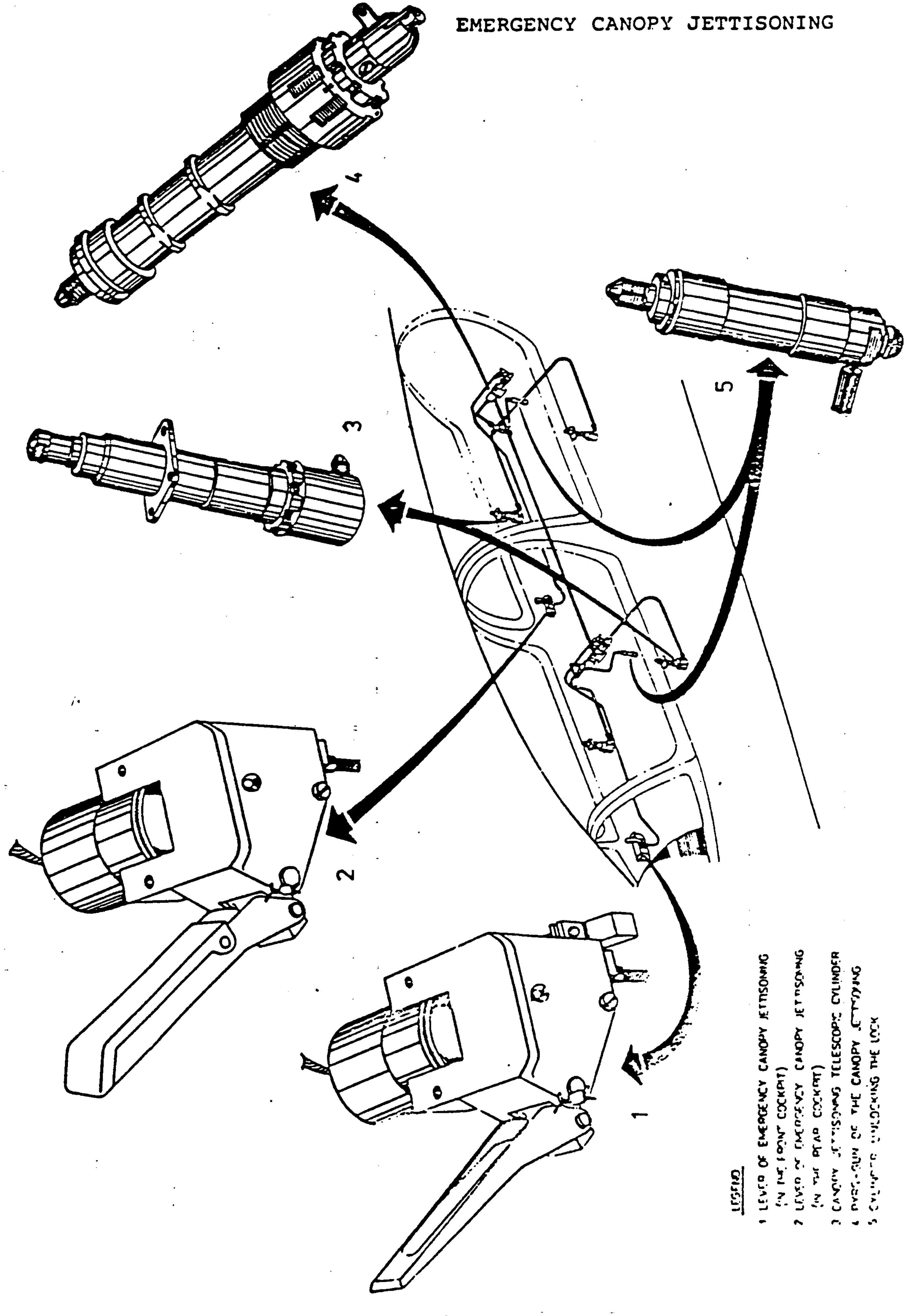
are continuously recorded super imposed an the second group.

The second group which are single acting signals are recorded at the point they occur with respect to time from the moment the ARPP switch is on or when automatically switched on at 65 ± 32 Kts during take off. They include

- Minimum fuel pressure
- Minimum oil pressure
- Fuel Closed
- Hydraulic pressure drop
- Undercarriage failure
- Ram Air Turbine Off
- Front Seat Ejection
- Rear Seat Ejection
- Cockpit dangerous pressure

The flight recorder switch is located on the left console behind the throttle handle. There is also a green light by the side of the switch to show that the film is feeding.

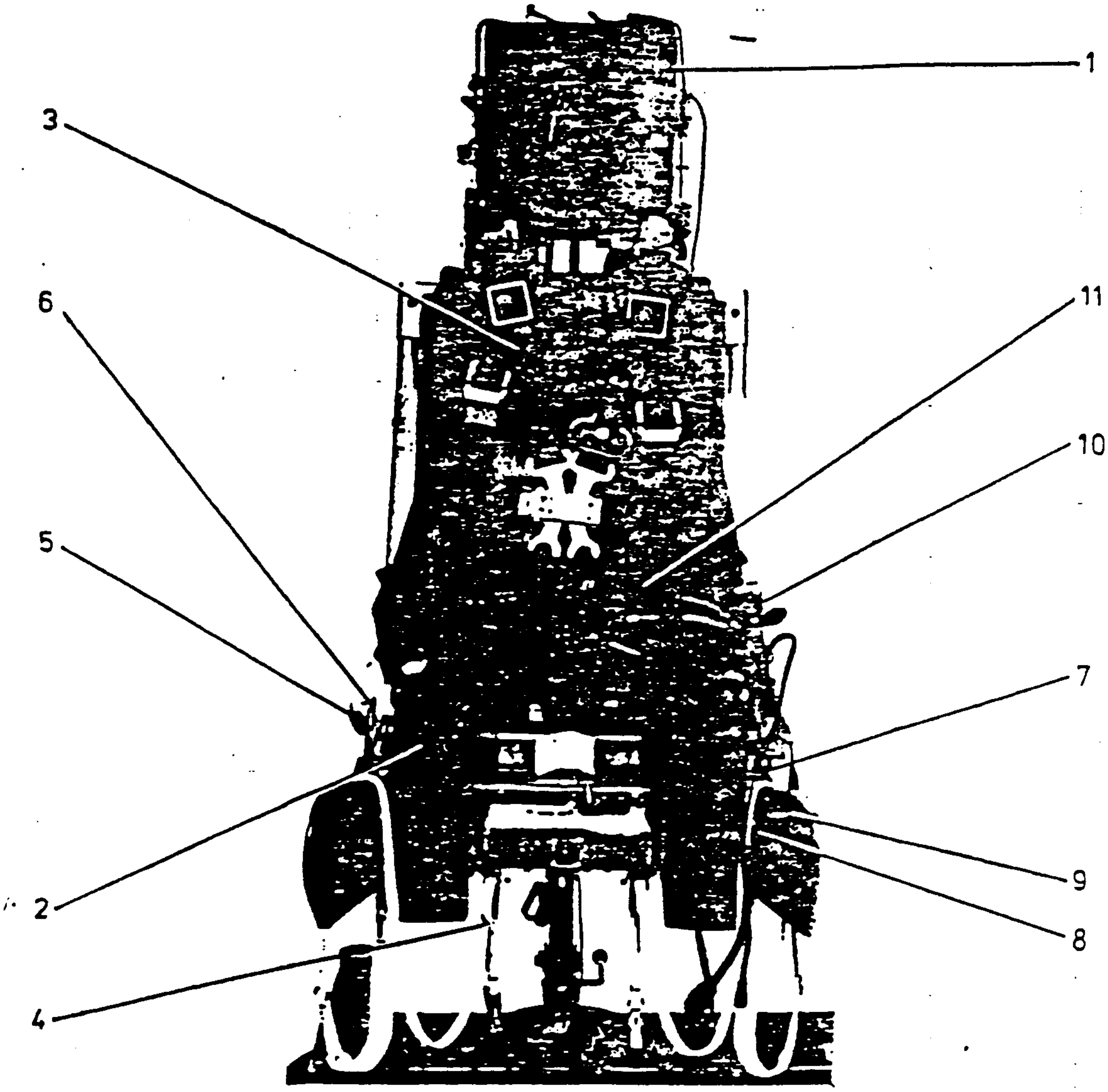
EMERGENCY CANOPY JETTISONING



LEGEND

1 LEVER OF EMERGENCY CANOPY JETTISONING (IN THE FRONT COCKPIT)
2 LEVER OF EMERGENCY CANOPY JETTISONING (IN THE REAR COCKPIT)
3 CANOPY JETTISONING TELESCOPIC CYLINDER
4 PYRO-GUN OF THE CANOPY JETTISONING
5 CYLINDER UNLOCKING THE LOCK

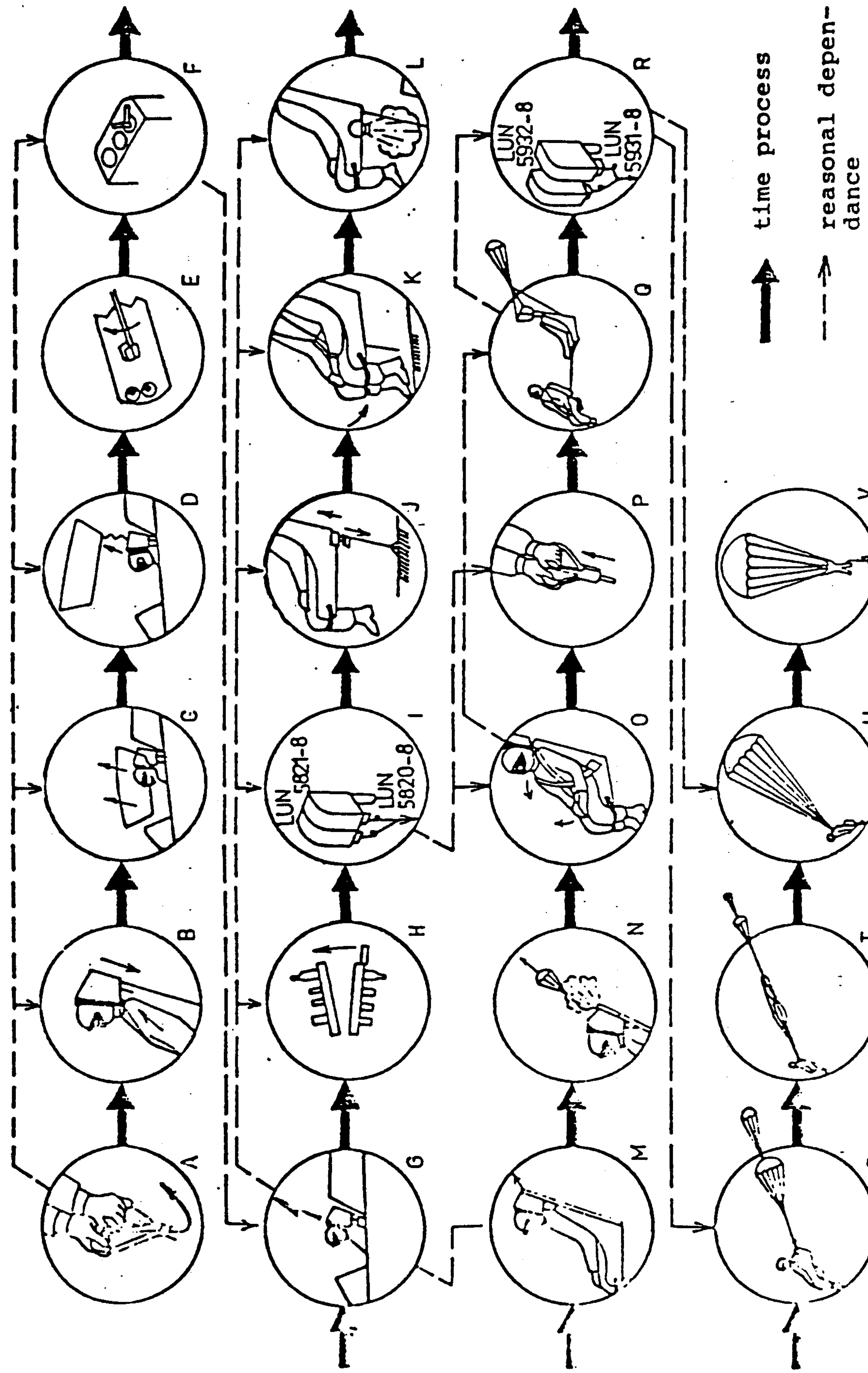
GENERAL VIEW OF EJECTION SEAT



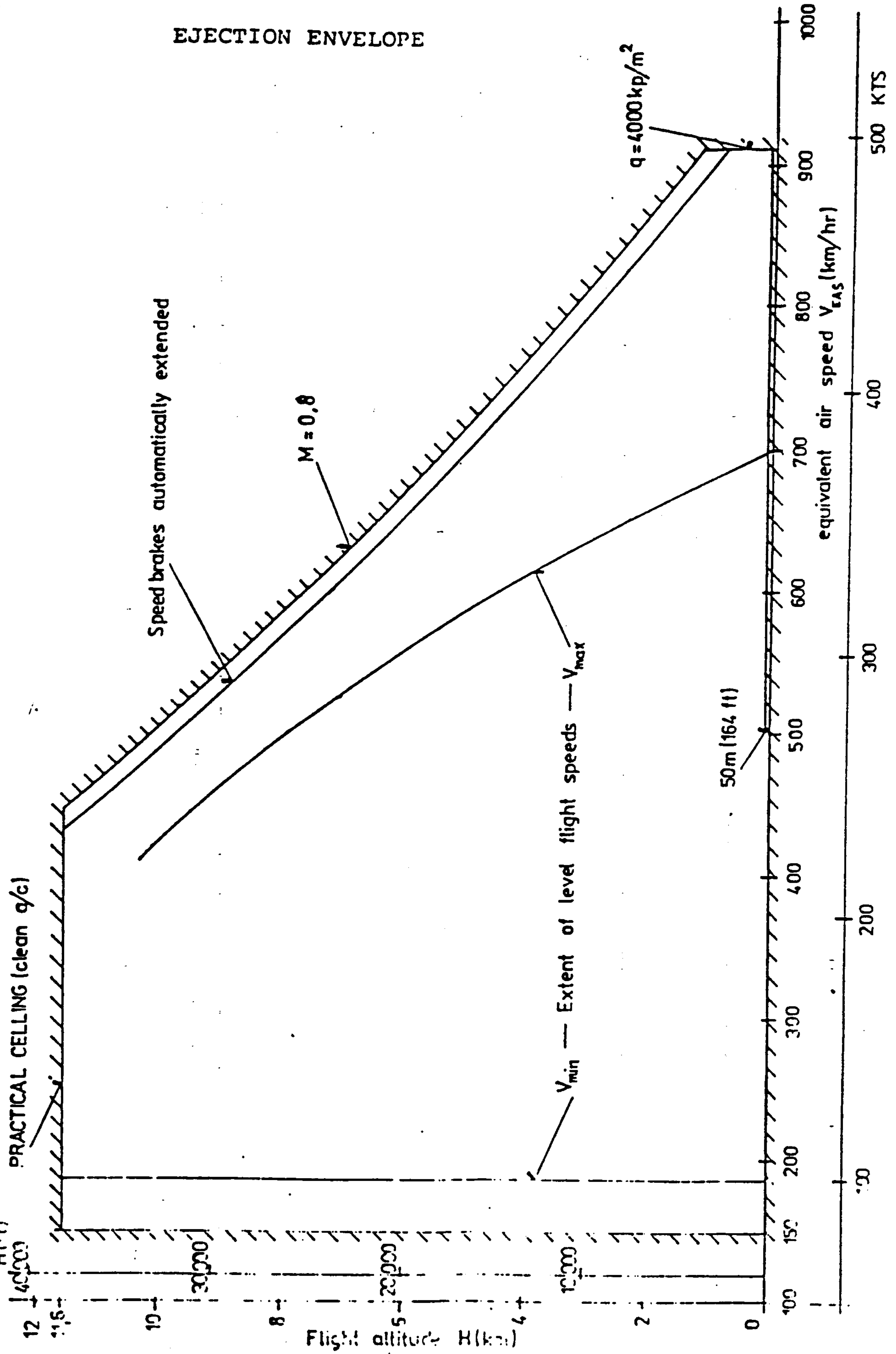
1. Head-rest
2. Emergency ration pack
3. Main parachute
4. Leg fasteners
5. Manual separation lever
6. Seat unblocking for ejection through canopy glass
7. Go-forward lever
8. Seat height adjustment switch
9. Weight setting knob
10. Joint of communication means
11. Twin ejection handle

Figure 1 - 43

SEQUENCE OF OPERATIONS OF SEAT MECHANISMS DURING EJECTIONING



EJECTION ENVELOPE



Double-seater

The time since decision making to abandon the aircraft up to the moment of aircraft abandonment by the first pilot amounts to 2 seconds and another 1 second longer for the other pilot.

Minimum height for safe ejection with VS 1 - BRI/L at different angles of bank (two-seater)

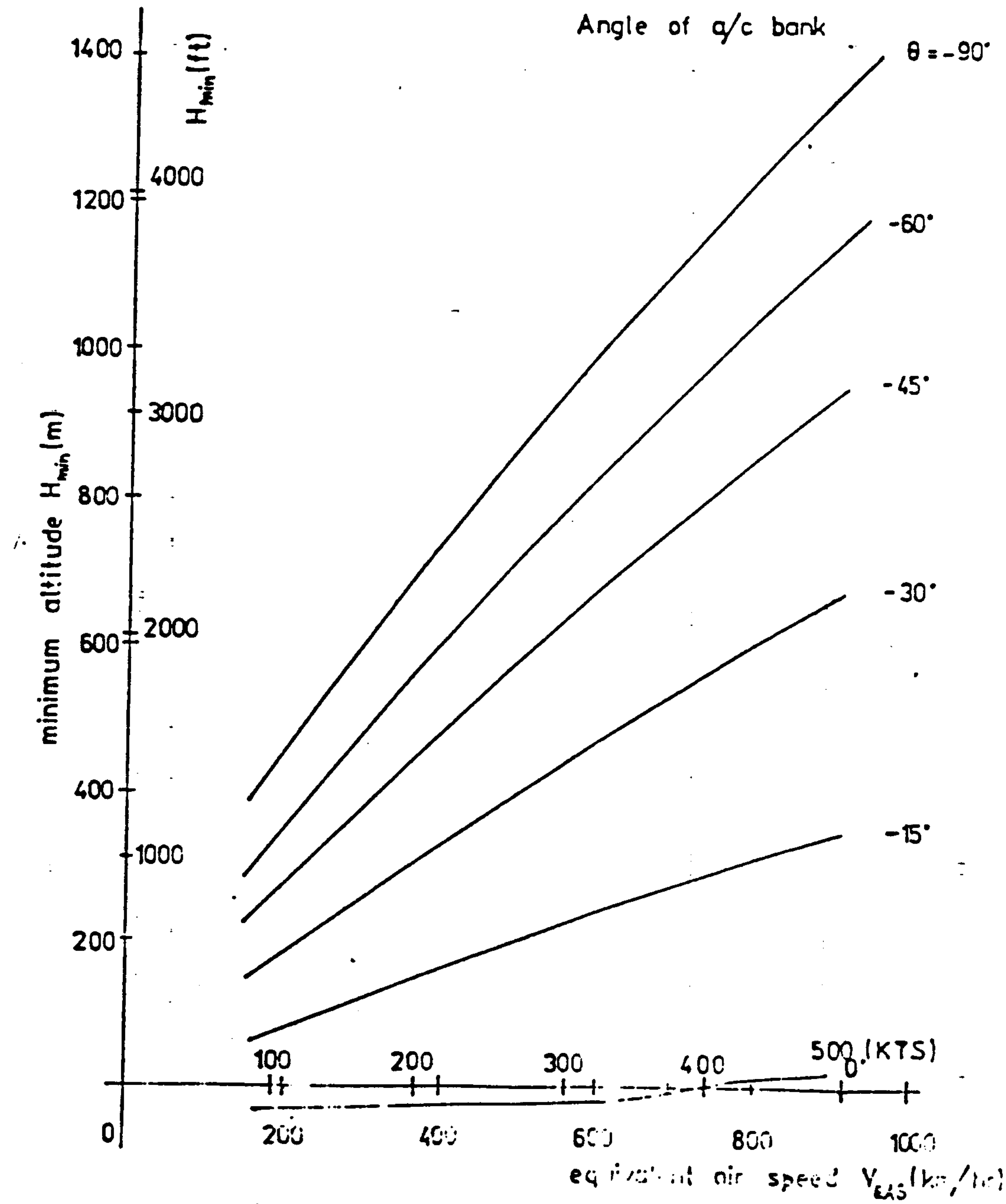
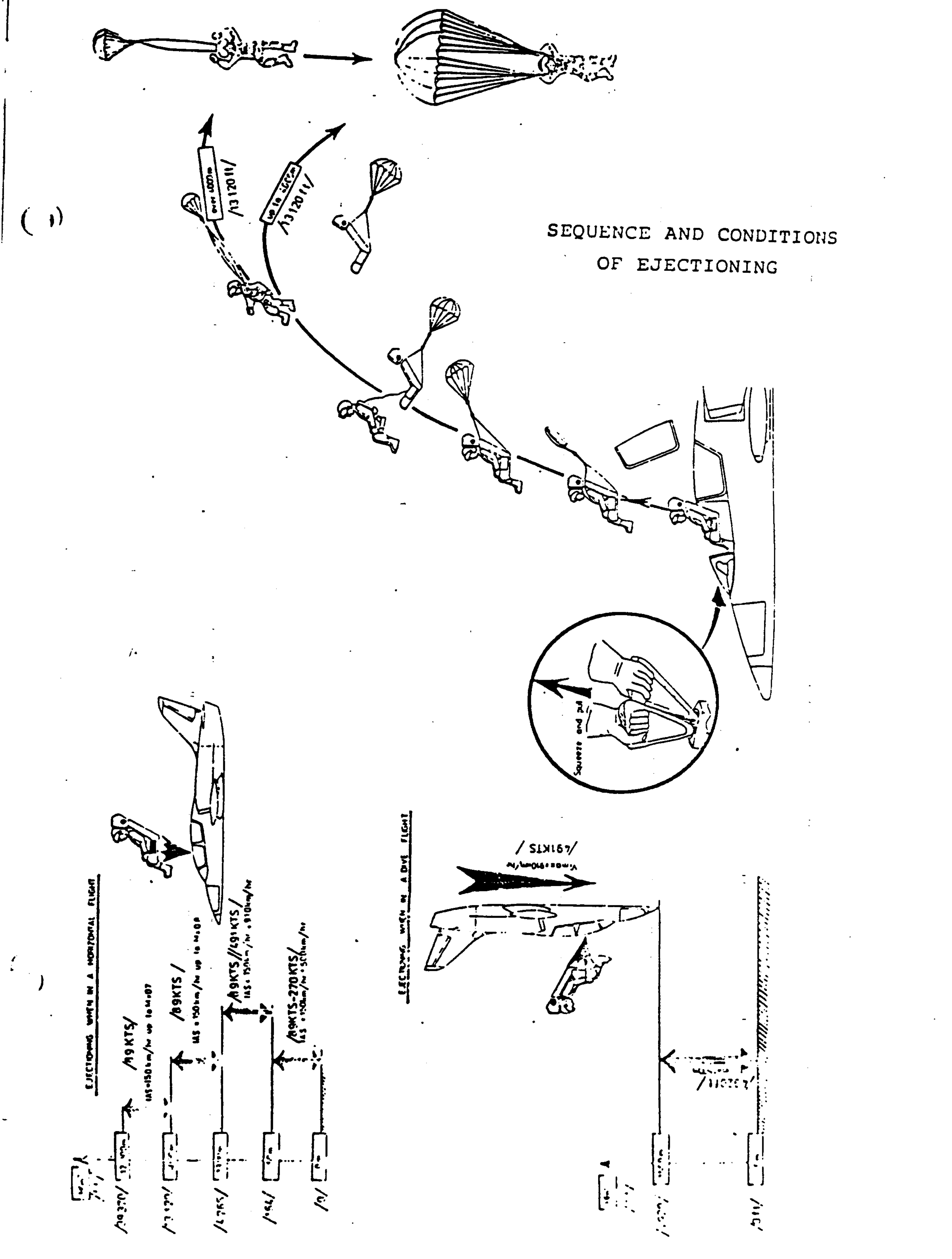


Fig. 1 - 46

SEQUENCE AND CONDITIONS OF EJECTIONING



<u>Single-seater</u>

The time since decision making to abandon aircraft till the moment of aircraft abandonment amounts to 2 seconds.

Minimum height for safe ejection with seat VS 1-BRI/L at different angles of bank (single-seater).

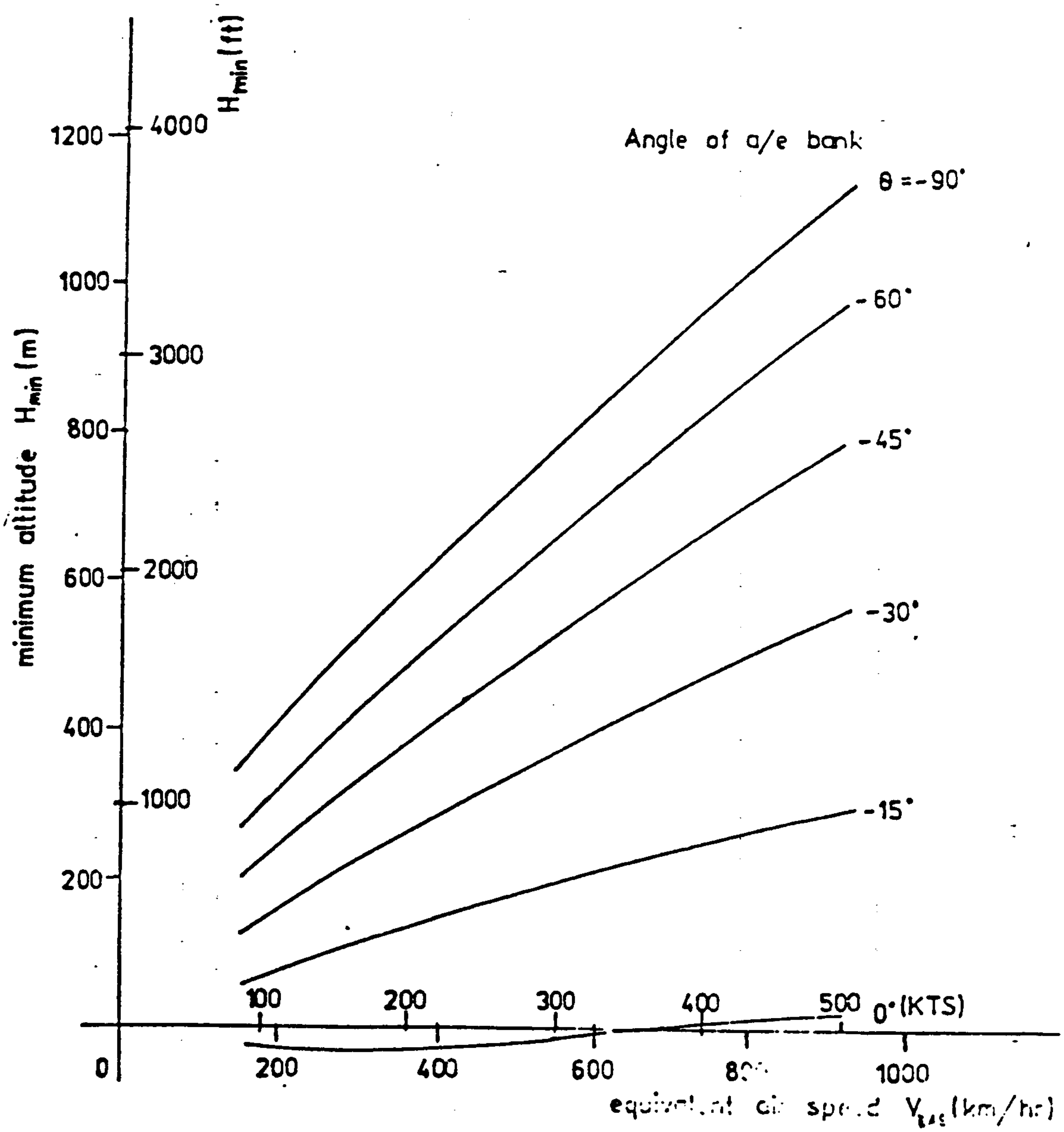
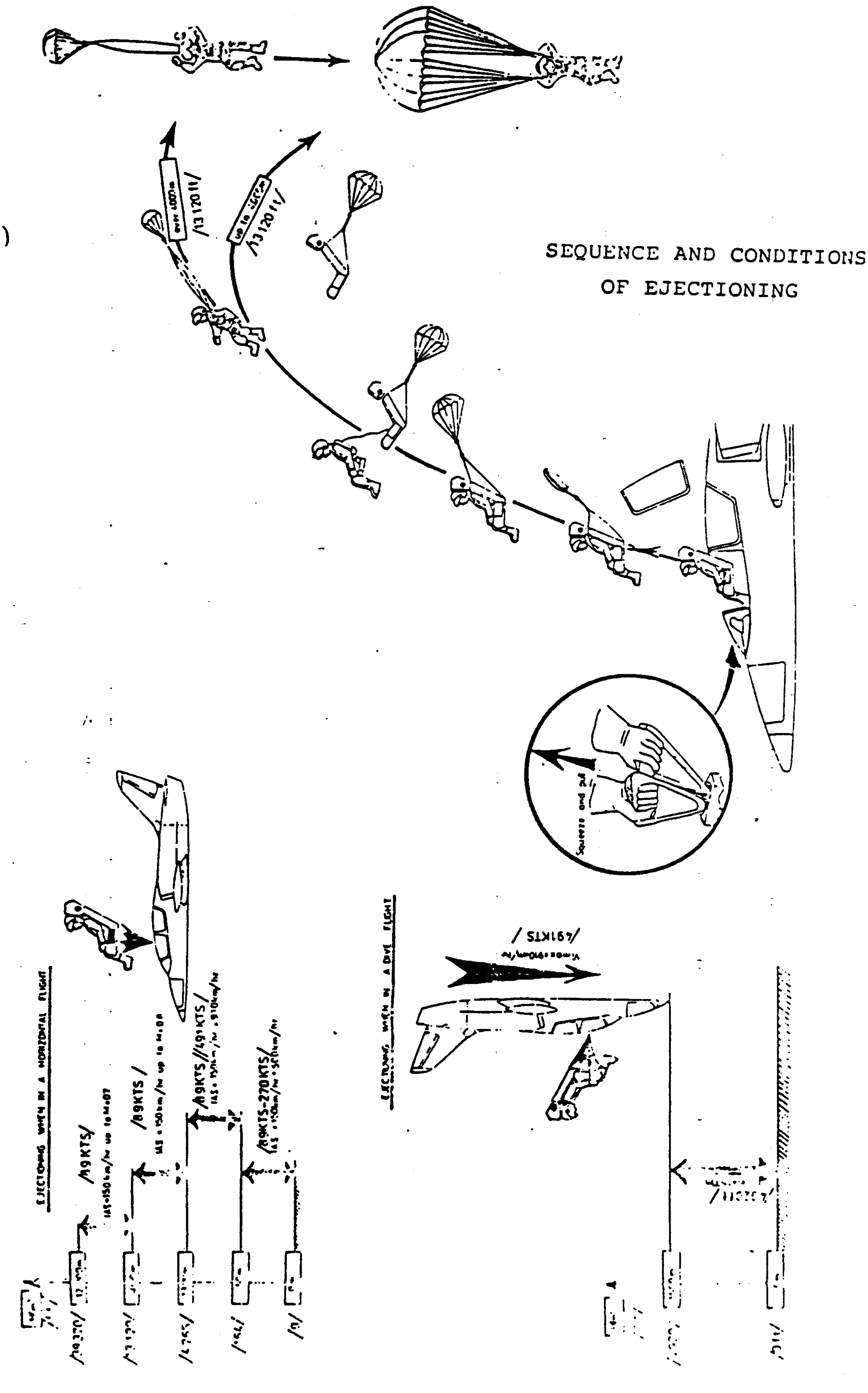


Fig. 1- 47

SEQUENCE AND CONDITIONS OF EJECTIONING



AIRCRAFT SERVICING

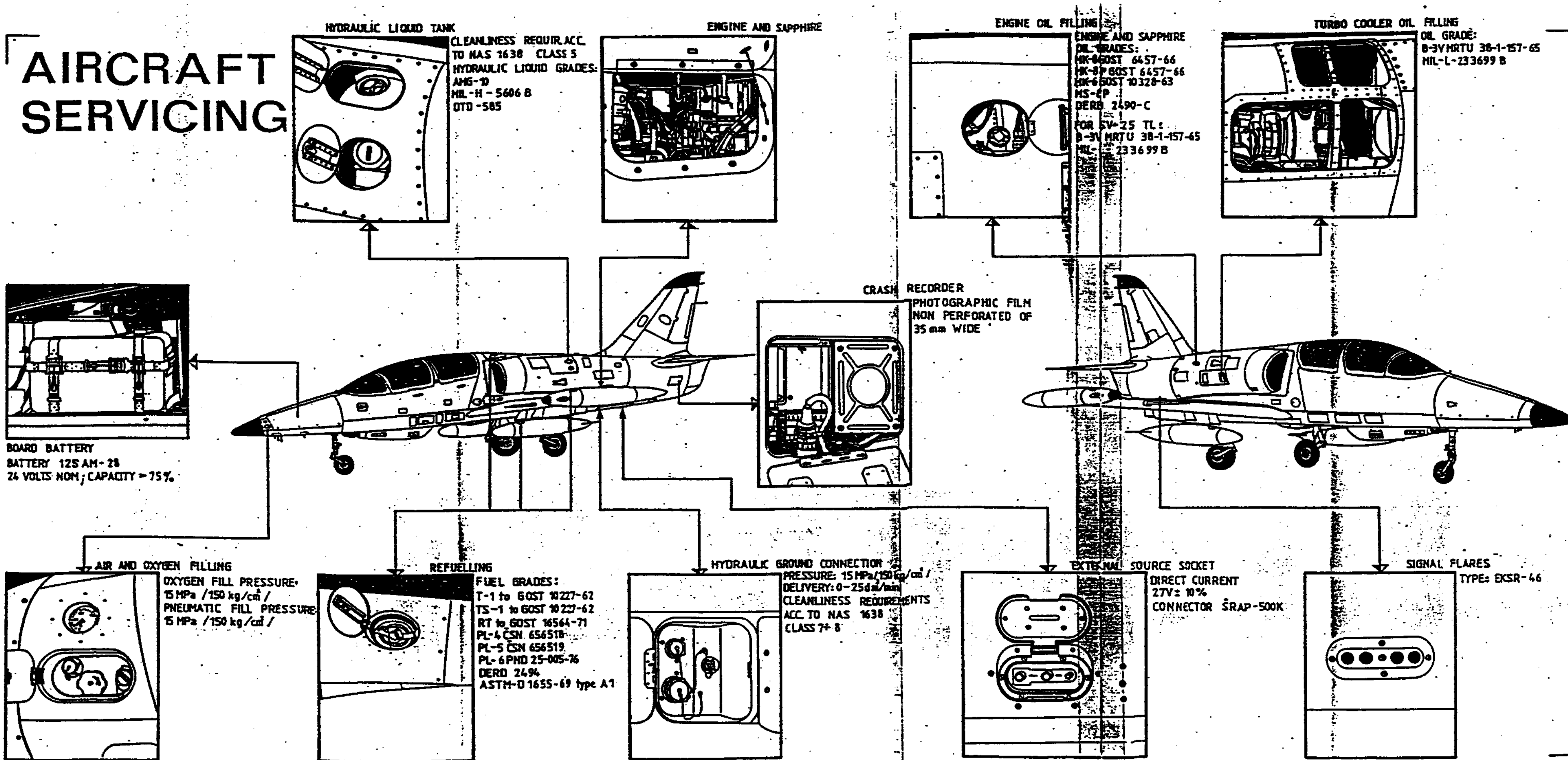


FIG. 50

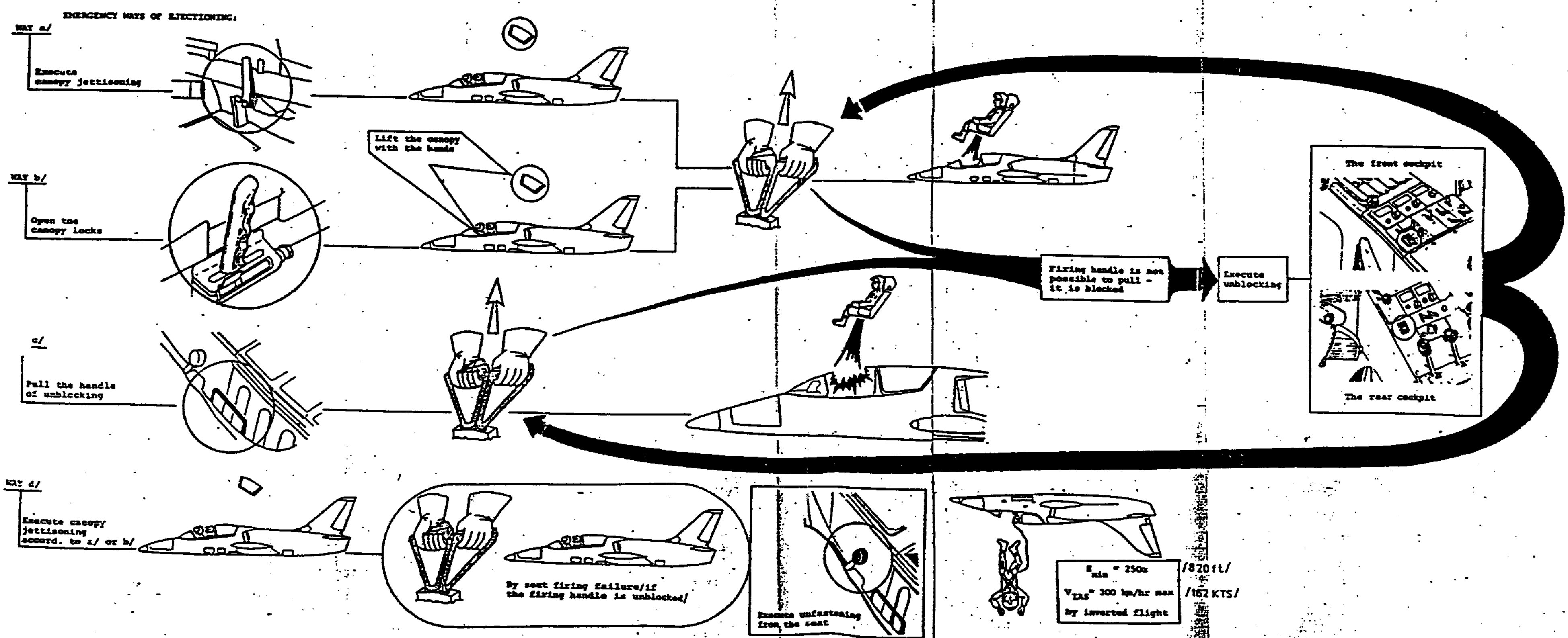

EMERGENCY WAYS OF EJECTIONING:
WAY a/
Execute canopy jettisoning
WAY b/
Open the canopy locks
Lift the canopy with the hands
c/
Pull the handle of unblocking
WAY d/
Execute canopy jettisoning accord. to a/ or b/
By seat firing failure/if the firing handle is unblocked/
Execute unfastening from the seat
Firing handle is not possible to pull - it is blocked
Execute unblocking
The front cockpit
The rear cockpit
H_{min} = 250m /820ft/
V_{IAS} = 300 km/hr max /162 KTS/
by inverted flight

Figure 1-49

SECTION II

NORMAL PROCEDURES

TABLE OF CONTENTS

PREPARATION FOR FLIGHT

Refer to section V for all Operating Limitations concerning the aircraft and the engine.

FLIGHT PLANNING

The perfomance Data in Appendix 1 contains all informations about the aircraft such as estimation of fuel consumption, corrected airspeed, engine setting and altitude for proposed flights and missions.

PROCEDURES

The procedures described in this section are given in detail, where possible. The same procedures are given in an abbreviated form in the pilot's Checklist.

CONTROL AVAILABILITY IN THE TWO COCKPITS

The procedures given in this section refer to the pilot in the front cockpit. The controls in the front cockpit are not fully duplicated and available in the rear cockpit. The pilot occupying the rear cockpit must therefore bear this in mind and instruct the crew member in the front cockpit to actuate, when necessary, the following controls available in the front cockpit only:

- Power supply switches: "BATT", MAIN GENER","EMERG GENER", "INVI", "INV II", "INV III",
- Engine switches: "ENGINE", "ENGINE INDICATING EMERG" and the ENGINE STARTING REGIMES /MODES/ SWITCHES.
- "TURBO STOP" SWITCH
- Compass slaving panel.
- DME switch and control panel.
- Air conditioning control panel.
- NAV lights control panel.
- AGD/KCS switch.

- Anti-ice switches.
- HF radio and changeover switch.
- Ventilation suit temperature control switches.
- Pitot tube heating.

- Flight Recorder switch
- Transponder /IFF/ control panel
- Vibration check pushbutton, indicator
- De-icing signal check pushbutton

CAUTION

The engine throttle fingerlift to retard the throttle from IDLE TO STOP is avaiable in the front cockpit only. It is therefore necessary that the front pilot be prepared to retard the throttle to STOP in case of an engine hot Start or at any other time the engine must be shutdown.

PREFLIGHT CHECKS
BEFORE EXTERIOR INSPECTION

1. Check the general surrounding of the aircraft :
   . Chocks - In place
   - Fuel/Hydraulic leaks - None
   - Fire Guard - In place
2. Form 781 - Check for aircraft status and proper servicing
3. Ejection Seats - Inspect+carry out the following checks on the seat :
   . Man/Seat separation lever safety-wired in the rear position
   . Normal ejection channel indicator is aligned with red mark
   - Spring hooks of static lines are fastened in the rings of central static lines
   - Blocking line of ejection is located in head-rest and with the spring hook fastened to the yoke of canopy
   - Ring of static line of the parachute timer is fastened to the hinge on the seat right side

WARNING

Incorrect connection of the short and long static lines of the saving parachute to the hinge causes :

- in case of unconnection of the short static line during ejection the undesirable pause in parachute releasing
- in case of unconnecting of the long static line /in case of emergency releasing of the pilot - lever on the seat right side/ the absence of parachute releasing/.

4. Canopy and Seat pins - Installed
5. Pilot Weight - Set
6. Fuel, Oxygen nad Voltage Indicators - check
7. Landing Gear lever - Down

8. All Unguarded Switches-Off
9. Emergency Levers - Forward and safety-wired.
10. All Circuit Breakers - On /up position/.
11. Flight control lock - Removed.

CAUTION

Strong tailwind can cause an exhaust gas temperature increase and aggravate an incipient fire condition.

EXTERIOR INSPECTION

The exterior inspection procedures are based on the fact that maintenance personnel have completed all pre-flight and post--flight requirements specified in the appropriate technical publications. The pilot need not therefore repeat the same inspections except for certain items required in the interest of safety.

NOSE SECTION

1. Air pressure Gauge - 0 to 250 kp/cm^2
2. Side panels - Closed and Secured.
3. Nosewheel - Check the strut, tire and microswitch
4. Gear Down light - Condition
5. DME Antenna - Condition

FUSELAGE RIGHT SIDE

1. Canopy - Condition
2. Air Intake - Clear
3. Speed Brakes - Retracted and condition
4. Right Main Gear - Check strut, tire, brake assembly and gear down light.
5. VHF Rdo Antenna/STBY/- Condition
6. ADF Antenna - Condition
7. Wing - Condition
8. Underwing Tanks - Condition
9. Pitot tubes and static ports - Condition
10. Landing light - Condition
11. Position light - Condition

12. Tip Tank Filler Cap - Closed and safety-wired.
13. Aileron - Full and free movement /Check trimtab/
14. Flap - Condition
15. Oil quantity - Check /4.5-7.5L/
16. Access panels - Closed

RIGHT TAIL SECTION

1. IFF and Marker Antennas - Condition
2. Rudder - Condition
3. VHF Radio Antennas - Condition
4. Static dischargers - Condition
5. Elevator - Full and free movement
6. Exhaust cone - No craks, dents and fuel leaks

TAIL FUSELAGE LEFT SECTION - Same as Right Section.

SOLO CHECK REAR COCKPIT

1. Parachute harnesses - Secured
2. Solo cover - In place
3. Seat safety pins - In place
4. Loose items - Stowed
5. Oxygen interconnect - Open /counter-clockwise/
6. Oxygen shut off valve - Closed /Clockwise/
7. Fuel shut-off lever - Forward and guarded position
8. Throttle cut off lock gate- Open
9. UHF/VHF Radio - Set required channel
10. EGT Control Switch - Front cockpit
11. All guarded switches - Covered
12. Gear lever - Neutral position
13. Pitot-static failure switches- Off /left position/
14. Board net-work and signal switches - On
15. Nav equipment - On/Set desired Frequencies
16. Emergency levers - Forward position and safety-wired
17. Canopy - Closed and locked

INTERIOR INSPECTIONS

1. Battery/External power - On
2. Standby Intercomm - On
3. Crew Retractable Steps - Stowed
4. Paraschute Harness, Zero delay lanyard hook, oxygen and radio connectors, Anti G suit and Helmet chin strap - Fasten and adjust
5. Oxygen system - Check /PRICE/
6. Fuel shut-off lever - Forward and guarded
7. Sarrp Switch - Off
8. Pitot tube selector - Main
9. Throttle - Full and free movement /adjust friction/
10. Landing/Taxi light Switch- Off
11. Parking brake - Neutral
12. G-meter - Reset
13. Landing Gear lever - Down
14. Pitot-Heat buttons - Off

16. Airspeed/mach indicator - Check
17. Altimeter - Set field elevation
18. Radio Altimeter - Condition
19. Artificial horizon - Condition
20. Pictorial Nav Indicator - Condition /Set VOR/ADF/
21. Vertical velocity Indicator - Zero
22. Radio magnetic indicator - Condition /Set VOR/ADF/
23. Clock - Set
24. Engine instruments - Condition
25. Cabin Pressure/Altimeter - Condition, check field elevation
26. Voltammeter - Check battery voltage /21.6-24 Volts/
27. Compass slave switch - Slaved

CENTRE PEDESTAL

2. Trim Indicator -Condition

3. Main Brake Pressure Indicator - Condition
4. Emergency Brake Press. Indicator - Condition
5. Error Introduction levers - Off/Left side/

RIGHT INSTRUMENT PANEL

1. Airscoop A\C - Auto, set temperature
2. Pressurization/Aircon lever - Off
3. VOR/ADF - Off
4. IFF - Off
5. Navigation lights - As required
6. Air-cond/De-icing - Off
7. Emergency Engine instruments switch - Off
8. Seat Unblocking Switch - Off /guarded/
9. Emergency levers - Forward and safety-wired
10. Hydraulic gauge - Condition
11. Caution and Warning lights - Test /Adjust brightness/
12. All circuit breakers on the auxiliary switchboard - On
13. RT 12 changeover switch - Guarded

PRE-START CHECKS

1. Radio - On /request engine start/
2. Radio - Off
3. Seat and Canopy pins - Removed
4. Engine switch - On /"DON'T START" light out/

Do not start the engine if the "DON'T START" Warning light does not go out after approximately 5 secs.

5. Check GEN, EMERG GEN, CANOPY - ON
   AIRCON and OIL PRESS Warning lights - Blinking
6. Sarrp switch - On
7. Throttle - Stop
8. Battery/APU voltage - Check /21.6. volts minimum/

Do not attempt to start the engine using the battery if battery voltage is less than 21.6 volts.

9. Signal for start -
10. Rear Canopy - Closed
11. RIO-3 Cover - Removed

ENGINE START

1. Turbo Start button - Depress for 2 sec and release
2. TURBINE STARTER light - On /20 sec max/
3. Engine start button and clock-Depress for 2 sec and release
4. Throttle - Idle
5. 15TH SEC - 22-26% RPM

If the HPC RPM does not rise within 8 seconds and attain a minimum of 22% within 15 seconds after depressing the engine start button, abort the start by retarding the throttle to STOP.

6. 18TH-25 SEC - Ignition

If there is no ignition /as indicated by EGT rise/ within 25 seconds, abort the start by retarding the throttle to STOP.

7. EGT - 550°C Max

CAUTION

If the exhaust gas temperature rises too rapidly and approaches the maximum limit, immediately retard the throttle to STOP.

If EGT exceeds 550°C during engine start on the ground it is necessary to check setting of the temperature regulator in the LIMITATION mode with the aid of the PKPT test set.

8. 41.5-44.5% RPM - Turbine starter light out.

CAUTION

- If the turbostarrter is not disconnected after 45 seconds when HPC RPM is 44.5%, abort the start and place the Turbostop-switch to STOP.

9. Idle RPM - 56± 1.5%

CAUTION

. If the engine does not attain idle within 50 seconds retard the throttle to STOP.

10. Oil Pressure - 2 kp/cm^2/minimum at idle/

CAUTION

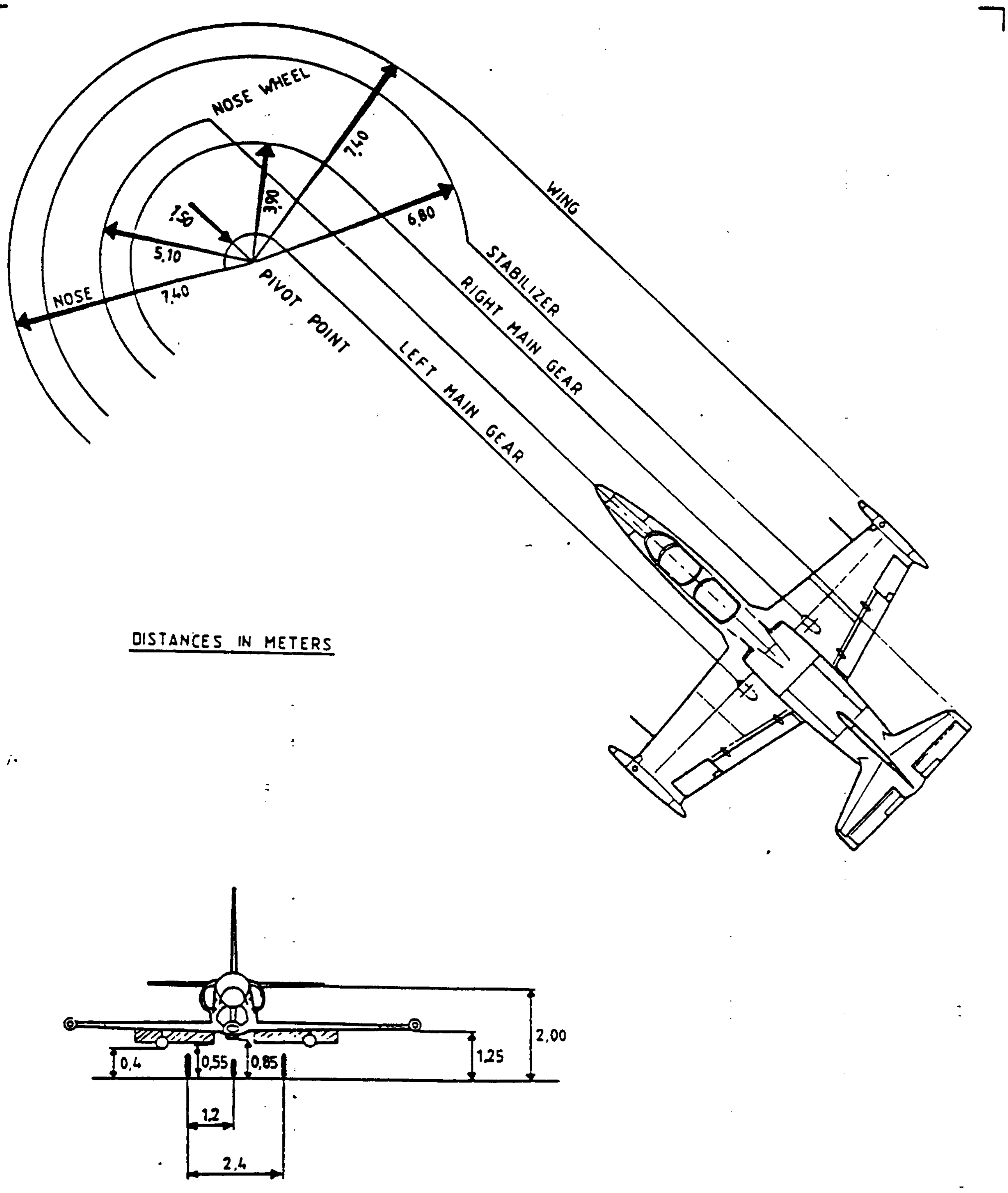
. If the oil pressure does not attain a minimum of 2 kp/cm^2 at idle, retard the throttle to STOP.

11. Caution and Warning light panel - Out
12. APU - Disconnect

AFTER ENGINE START CHECKS

1.	Canopy	- Closed and Locked /lights out/
2.	Pressurization/Airconditioning lever	- Fully forward /light out/
3.	Generator switch	- On
4.	Emergency generator switch	- On
5.	AGD/KCS switch	- On
6.	INV I, II, III switches	- On
7.	Wingtanks switch	- On /if the wing tanks are suspended/
8.	RIO-3 switch	- As required.
9.	Radio switch	- On
10.	VOR I and VOR II switches	- On
11.	Radio Altimeter/Markerswitch	- On
12.	DME switch	- On
13.	VOR/ILS Control panel	- On /refer to section IV for functional test/
14.	ADF Control panel	- On /refer to section IV for functional test/
15.	IFF Control panel	- On /refer to section IV for functional test/
16.	Airconditioner	- Automatic
17.	De-icing	- As required
18.	Navigation lights	- As required
19.	DME control panel	- On /as required/

MINIMUM TURNING RADIUS AND GROUND CLEARENCE



CHECKS BEFORE TAXIING

1. Aileron trim - Neutral
2. Elevator trim - 2 Marks down
3. Flight controls - Check for free movement and correct response of elevators, ailerons and rudders.
4. Brakes - Apply
5. Power - 85% RPM /check engine instruments/
6. Voltammeter - 28.5 volts
7. Tanks light/s/ - Out
8. Hydraulic pressure - 135-150kp/cm^2 /both main and emerg/
9. Speedbrakes - Check normal and extended positions. Confirm with crew chief.
10. Flaps - Check LANDING and "UP" positions and set to TAKE OFF. Check indicator and confirm with crew chief.
11. Throttle - Idle
12. Taxi - Request
13. Differential brake pressure-Check

TAXIING

CAUTION

. Taxi must be made with the canopies closed.

. Check that the areas behind and to the sides of the aircraft are clear of obtstacles, personnel or other aircraft.

1. Wheel chocks - Removed
2. "PARK EMERG BRAKE" lever - Release
3. Power - 80-85%

CAUTION

. Taxi at the lowest practicable RPM and at moderate speed.

. To move away from the chocks, avoid the use of excessive RPM. Once the aircraft has started moving, retard the throttle to IDLE so as to prevent blowing foreign objects which may injure ground crew or cause damage to equipment on the ground.

4. Flight Instruments - Check for proper operation of the compasses, the turn needles and the balance balls.

PRE-TAKEOFF CHECKS

1. Aileron trim - Neutral
2. Elevator trim - 2 Marks down
3. Airbrakes - In
4. Flaps - "TAKEOFF" position
5. Fuel quantity and Tank lights-Check
6. Flight and Engine Instruments-Check
7. Oxygen -Check quantity and set the diluter switch as required.

If the aircraft must be operated on the ground under conditions of carbon monoxide contamination /Such as when taxiing directly behind another aircraft or during operation with the aircraft tail pointed into the wind/, use oxygen with diluter lever at 100%.

8. Hood /Canopy/ - Closed + locked, handle forward, light out

WARNING

The instrument flying hood must be kept in the retracted position throughout the takeoff and landing phases in order to ensure safe ejection in case of an emergency.

9. Parachute Harness - Tight and locked
10. Hydraulic pressure -135 - 150kp/cm^2/both main and emerg./
11. Caution and Warning panels- Check, lights out
12. Controls - Check
13. Pressurization/Airconditioner lever - Fully forward
14. Safety pins - Check removed

LINE UP CHECKS

1. Nosewheel - Straight
2. Artificial Horizon - Erect
3. Heading Systems - Check
4. Altimeter - Check field elevation
5. IFF - ALT

ENGINE RUN-UP /First flight of the day/

1. Throttle - Idle /note fuel pressure/
2. Throttle - Slam to maximum /no stagnation/ /note fuel pressure at 106.8%±1/
3. Throttle - Idle /deceleration time should be 5 sec/
4. Request for takeoff
5. Throttle - Max and simultaneously hack clock /acceleration time should be 9-12 sec at max fuel pressure minus 10%/

TAKEOFF

Before starting the takeoff roll, mentally go through the "Abort" procedure and relevant takeoff data.

1. Engine instruments - Check
   a. RPM-Within limits
   b. EGT-Within limits
   c. Oil Pressure-within limits.
   d. Caution and Warning lights-out
2. Wheel Brakes - Release

Maintain directional control by differential braking. The rudder becomes effective at approximately 30 KIAS.

3. At 90 KIAS, smoothly raise the nosewheel. For an aircraft in clean configuration, the aircraft becomes airborne at approximately 110 KIAS.
4. Gear UP - positively airborne

   Check that the green landing gear indicator lights are out.

   Mechanical indicators - Check

CAUTION

The landing gear should be completely up and locked before reaching the limit airspeed excessive air loads may damage the landing gear doors and prevent their subsequent operation.

5. Flaps Up - 140 KIAS minimum /check for retraction , eletrical + mechanical indicators/

CROSSWIND TAKEOFF

During a crosswind takeoff, use the same procedures as for normal takeoff. However, it is recommended that the ailerons is put into the wind moved upwind and the nose wheel lifted off at the recommended speed in the performance Data manual to improve aircraft controllability. During the takeoff roll, the aircraft nose tends to crab into wind. Be prepared to apply rudder pressure to keep the takeoff roll straight down the runway until the aircraft is airborne.. After breaking ground , be prepared to counteract aircraft drift.

The crosswind effect increases as a function of the external stores.

CLIMB

Refer to the performance data manual for climb speeds, distances travelled in the climb, time to climb and fuel consumption. Maintain the best climb speed for minimum time to altitude.

After retracting the flaps, retard the throttle to 103% and maintain a 5-degree nose-up attitude until the best initial climb speed of 220 KIAS /wide needle/ is attained. The first turn out of traffic will be made at a minimum of 200 KIAS and 500 FT AGL.

1. Oxygen system - Check pressure and blinker
2. Flight and Engine instruments. - Check
3. Hydraulic pressure - Check
4. Cabin Altimeter - Check
5. Altimeter - Set QNE

TAKEOFF /TYPICAL/

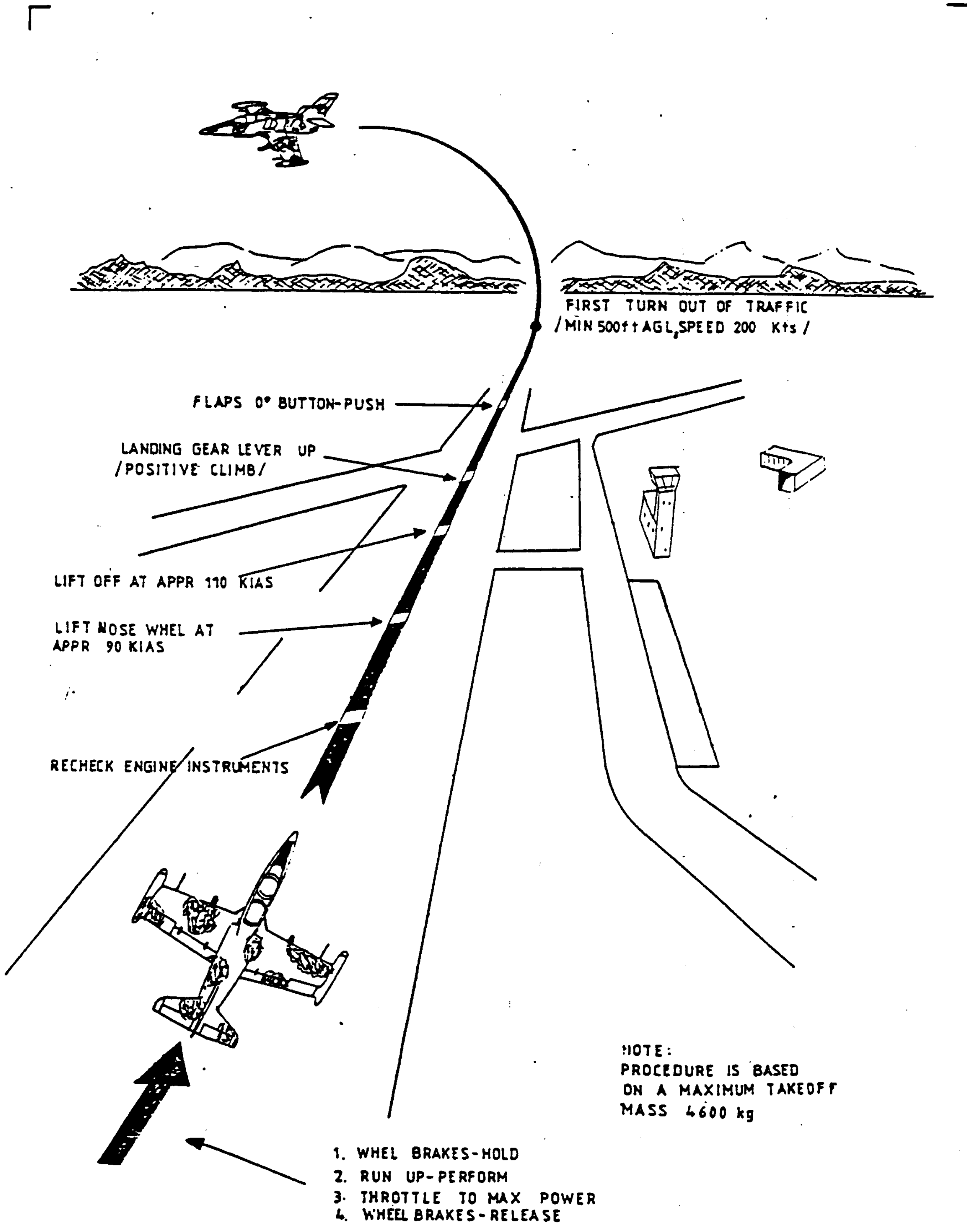


FIGURE 2-2

LEVEL OFF

As soon as practical after levelling off, accomplish the following:

1. Fuel quantity - Check
2. Oxygen - Check
3. Engine Instruments - Check
4. Location - Identify

CRUISE

For cruise data, refer to the "Performance data". The throttle may be slammed open when required, for a rapid acceleration but the engine life and characteristics will be maintained longer if the throttle is operated slowly and abrupt RPM variations kept to a minimum.

FLIGHT CHARACTERISTICS

For information regarding the aircraft flight characteristics, refer to section VI.

DESCENT

Refere to the "Performance data" for recommended descent speeds, time required, fuel consumed and distances travelled in the descent.

In flight phases where it is required to retard the throttle to IDLE, be careful the throttle fingerlift is not lifted and the IDLE position inadvertently exceeded.

1. Fuel quantity - Check
2. Flight and Engine instruments - Check
3. Radio - Request rejoining instructions
4. Altimeter - Reset as required.
5. De-icing - As required

APPROACH TO FIELD

1. Caution and Warning panels - Check

2. Fuel quantity - Check
3. Hydraulic pressure - 135-150 kp/cm^2
4. Landing light - As required
5. Shoulder and lap straps - Tight
6. Visors - Down as required
7. Plan the approach

APPROACH AND LANDING

WARNING

In flight phases where it is required to retard the throttle to IDLE, be careful the throttle fingerlift is not lifted and the IDLE position inadvertently exceed. For a normal landing procedure, refer to fig 2-3

INITIAL

1. Speed - 250 KIAS
2. Altitude - 1 500 AGL

BREAK

1. Throttle - Idle
2. Spreedbrakes - As required

DOWNWIND

1. Landing Gear - Down /below 180 KIAS/. Check the three gear advisory lights and the three mechanical indicators for confirmation that the gear is down and locked.
2. Speedbrakes - Retract if extended /check indicator/.
3. Wing Flaps - T/O /below 160 KIAS/. Check the corresponding light and the two mechanical indicators for confirmation.

NOTE

The flaps will NOT extend if speed is above the flaps limiting speed. /170 KIAS/

4. Hydraulic Pressures - Check 135-150 kp/cm^2 /main and emerg/.
5. Throttle - As required to maintain 150 KIAS /95-100%/.

FINAL TURN

1. Before starting the final turn: Wing Flaps - LAND /check corresponding indicators/.
2. Throttle - As required to maintain 135 KIAS minimum.

FINAL

NOTE

When established on final, it is recommended that a minimum of 70% RPM be maintained in order to obtain optimum engine acceleration if required.

1. Speed - 120 KIAS minimum
2. Altitude - 400 FT AGL minimum
3. Landing light - As required.
4. Threshold speed - 110 KIAS
5. Touchdown speed - 95-100 KIAS

When full underwing tanks of 350L are carried, increase final approach airspeed by 15 Kts.

NORMAL LANDING

Throughout the final approach phase, use the airspeed indicator and the runway as primary references. For landing speeds and ground run distances, refer to the Performance Data. If runway length and conditions permit, an aerodynamic braking may be carried out to conserve brakes and tires. To perform an aerodynamic braking, increase the aircraft pitch attitude after touchdown by gradually pulling the control stick to the full aft position. Lower the nose and bring the nosewheel in contact with the runway before the elevator becomes ineffective /approximately 70 KIAS/. Start braking by gently increasing pressure on the brake lever and maintain directional control by use of rudder. At a speed below approximately 60 KIAS, use diffential braking to maintain directional control.

WARNING

- The wheel brakes will operate ONLY when the nosewheel is in contact with the runway.
- To regain control of the wheel brakes in the front cockpit after its operation from the rear cockpit, the front brake lever must be completely released and then re-applied.
- Be prepared to use the emergency brake lever if there is no response from the normal lever.

MINIMUM RUN LANDING /Optimum braking/

For minimum run landing, fly an accurate final approach and touchdown speeds. After touchdown, lower the nosewheel, retract the flaps and push the control stick fully forward. These actions will put more weight on the wheels reducing tire skidding in case of anti-skid system failure. Apply brakes gently in a single smooth application with constantly increasing lever pressure as the speed decreases.

CROSSWIND LANDING

Crosswind landings may be peformed by using normal landing procedures. However, while using normal approach speeds, counteract drift by using the crab or the upwind wing down methods or by a combination of both, to keep the aircraft ground track aligned with the runway, levelling the wings just prior to touchdown.In case of strong crosswind and /or gusting wind with possibility of windshear, it is recommended that the flaps be maintained in TAKE-OFF position on landing to improve aircraft lateral control and to obtain, if required, a quicker increase of airspeed with engine thrust. After touchdown, keep the control stick upwind and lower the nosewheel smoothly to the runway as soon as practical, maintaining a centre line track with rudder and, if required, moderate use of differential braking.Crabbing at the moment of touchdown must be avoided. If a heavy weight landing must be made, bear in mind that the maximum rate of sink to touchdown, within the aircraft structural limits, is considerably higher with increased weight than with normal landing weight. A straight-in approach should therefore be flown with airspeeds specified in the performance Data, using power to control the sink rate. Flare should be gradual and touchdown smooth. A stall prior to touchdown could result in an abrupt and uncontrollable increase in sink rate with possibility of exceeding permissible limits.

CAUTION

The vertical velocity indicator readings are subject to a remarkable lag; they are therefore reliable during an approach but not in transient phases such as during the flare and contact with the runway.

USE OF WHEEL BRAKES

NOTE

The anti-skid system regulates the hydraulic pressure delivered to the brakes in order to obtain at any time the maximum coefficient of friction between the wheels and the runway for any aircraft configuration.

To minimise brake wear, brakes should be used as sparingly as possible. Care should be exercised to take full advantage of the length of the runway during landing or aborted takeoff. Although the anti-skid system operates automatically during braking thereby minimising the possibility of a locked wheel, heavy wheel braking will lock the wheels more easily when there is considerable lift on the wings than when the same pressure is aplied with the full weight of the aircraft on the wheels. If the anti-skid system fails and a locked wheel is suspected, momentarily release the brake lever and then continuously re-apply.

Rough braking when the anti-skid system has failed may cause damage of the under carriage main wheel tyres. Therefore in case of anti-skid failure it is necessarg to brake interruptively.

GO-AROUND

Make the decision to go-around as early as possible and do not hesitate to use maximum power. If conditions do not permit an aerial go-around, do not attempt to keep the aircraft off the ground; continue to fly the aircraft to touchdown an proceed as follows:

1. Advance throttle to MAX.
2. Speedbrakes - In, if extended
3. Flaps - T/O
4. Establish takeoff attitude /approx 8^{o}/
5. Landing Gear -Up/with positive climb indications/.
6. Flaps - Up /140 KIAS minimum/
7. Landing light - As required
8. Trim - as required
9. Check the LG, Spreedbrake and flaps position indicators.

NOTE

If a touchdown is made, lower the nose slightly, avoiding nosewheel contact with the ground and accelerate to takeoff speed, then establish takeoff attitude and allow the aircraft to fly off the ground.

TOUCH-AND-GO LANDING

The following procedure is to be adopted when a normal landing has been attempted with the main wheels in contact with the runway and another approach and landing is desired.

1. Throttle -Max.
2. Spreedbrakes - In, if extended /Check indicator/
3. Flaps - T/O /Check indicators/

LANDING AND GO AROUND / TYPICAL /

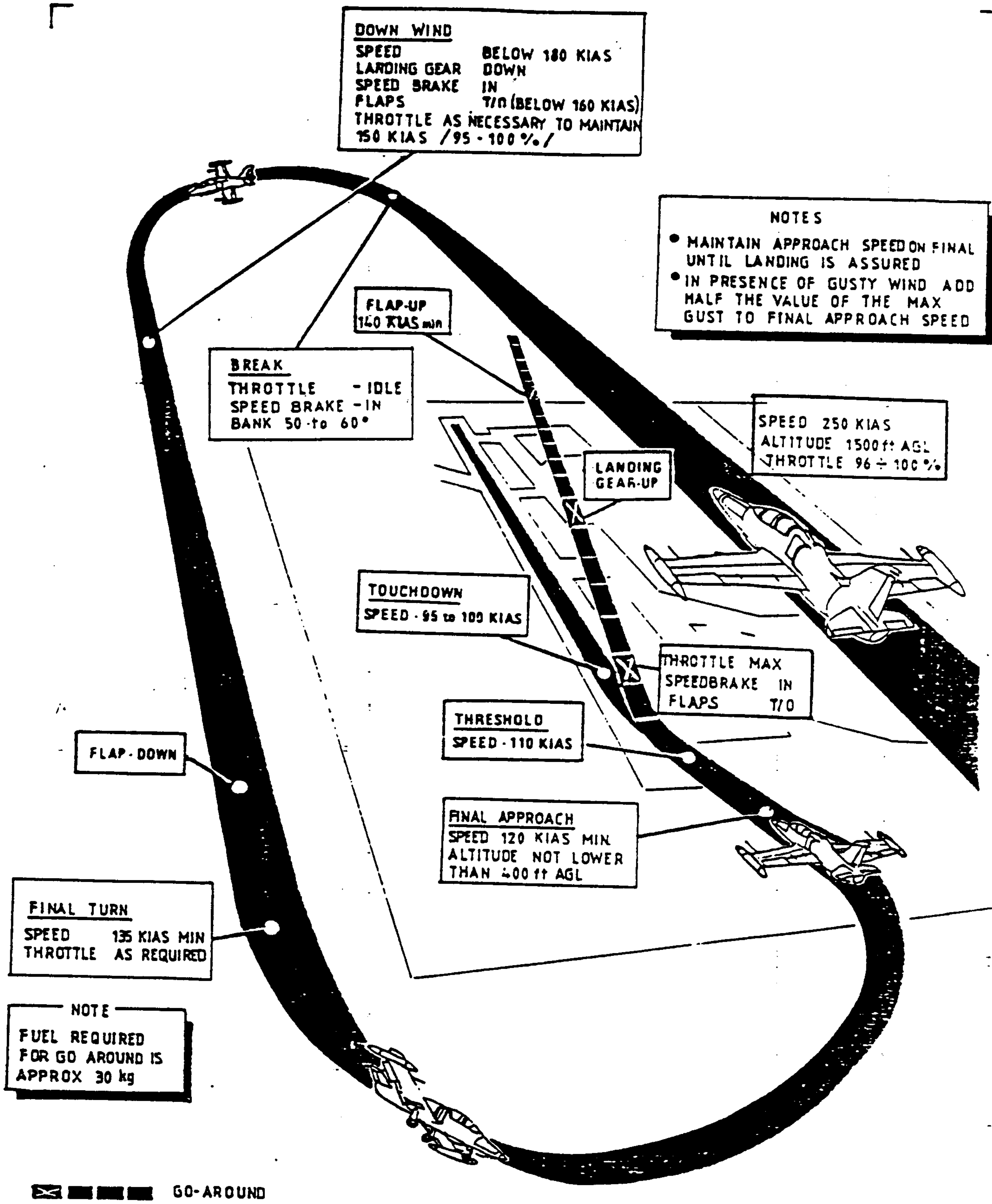


FIGURE 2-3

4. Engine Instruments - Check
5. Continue as per normal takeoff.

WARNING

- Touch and go landings encompass all aspects of the landing and takeoff procedures in a relatively short time. Be constantly alert for possible aircraft malfunctions incorrect procedures during these two critical phases of flight.
- The instrument flying hood must be kept in the retracted position throughout the takeoff and landing phases in order to ensure safe ejection in case of an emergency.

ILS APPROACH /fig 2-4/

ENTRY

1. Configuration - Cruise
2. Speed - 200 KIAS
3. Throttle - As required to maintain speed /91-95%/.

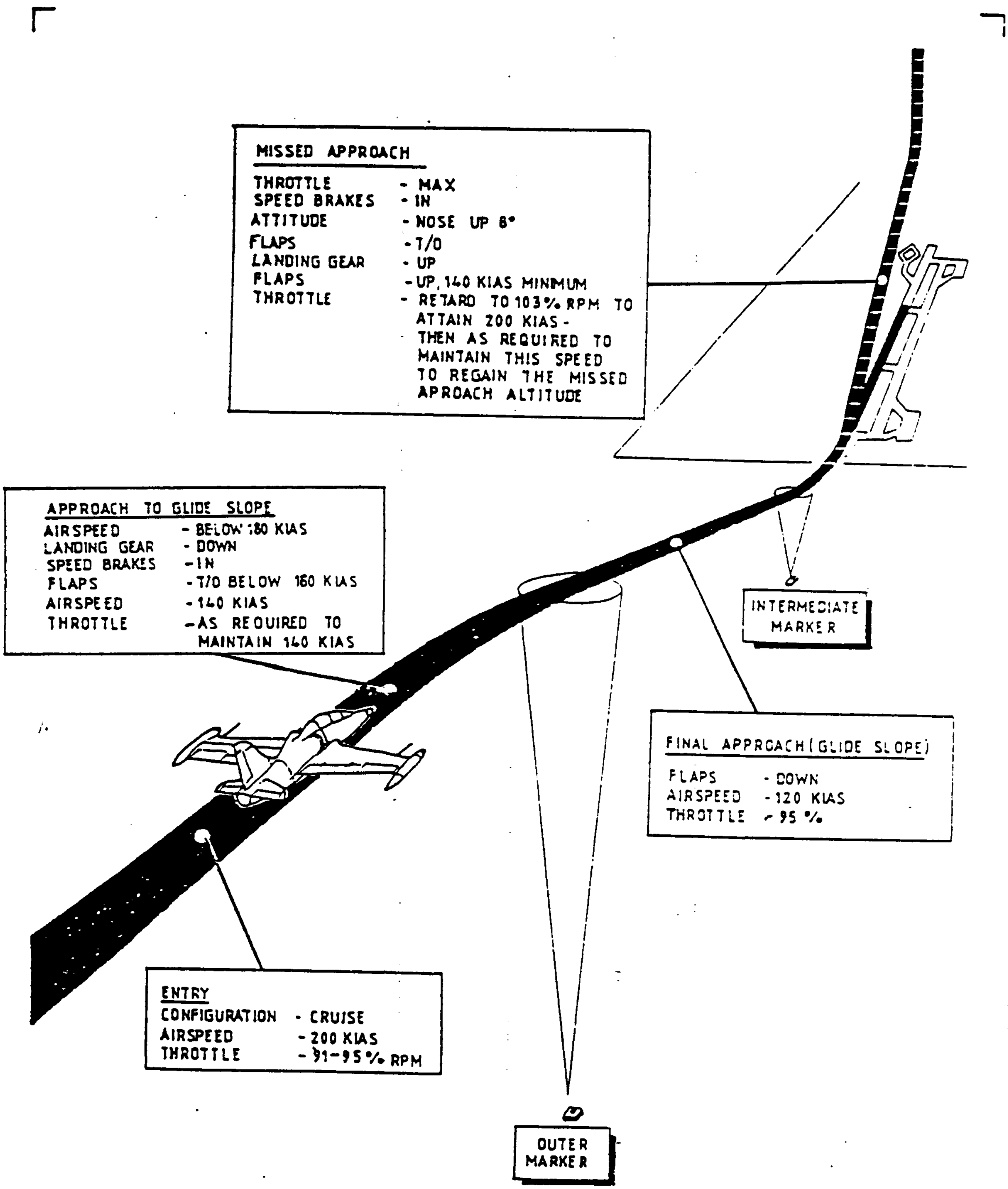
APPROACH TO GLIDESLOPE

1. Speed - Below 180 KIAS
2. Landing Gear- Down /Check light and mechanical indicators/.
3. Spreedbrakes- In, if extended /Check indicator/
4. Flaps - T/O /Check light and mechanical indicator/. Below 160 KIAS
5. Speed - 140 KIAS
6. Throttle - As required to maintain 140 KIAS.
7. Maintain speed and configuration until glideslope is intercepted.

FINAL APPROACH /GLIDESLOPE/

1. Flaps - Down /starting descent/
2. Speed - 120 KIAS minimum
3. Throttle - As required to maintain 120 KIAS minimum /95 - 100%/.

ILS APPROACH /TYPICAL/



VOR APPROACH

HOLDING

1. Configuration - Cruise
2. Airspeed - 200 KIAS
3. Throttle - As required /approx. 95%/

PROCEDURE TURN

1. Bank Angle - 30° max
2. Airspeed - 200 KIAS

PROCEDURE TURN COMPLETE

1. Airspeed - Below 180 KIAS
2. Landing Gear - Down /Check indicators/.
3. Speedbrakes - In, if extended
4. Flaps - T/O, below 160 KIAS
5. Airspeed - 140 KIAS
6. Throttle - As required to maintain 140 KIAS /approx. 95%/

FINAL APPROACH

1. Flaps - Land
2. Airspeed - 120 KIAS minimum
3. Throttle - As required to maintain 120 KIAS /approx. 95%-100%/

MISSED APPROACH

1. Throttle - Max
2. Spreedbrakes - In, if extended
3. Flaps - T/O below 160 KIAS
4. Attitude - 8° nose-up
5. Landing gear - Up
6. Flaps - Up /140 KIAS min/
7. Throttle - Retard to 103% to attain 200 KIAS, then as required to maintain 200 KIAS to missed approach altitude

HOLDING PROCEDURE TURN AND VOR APPROACH

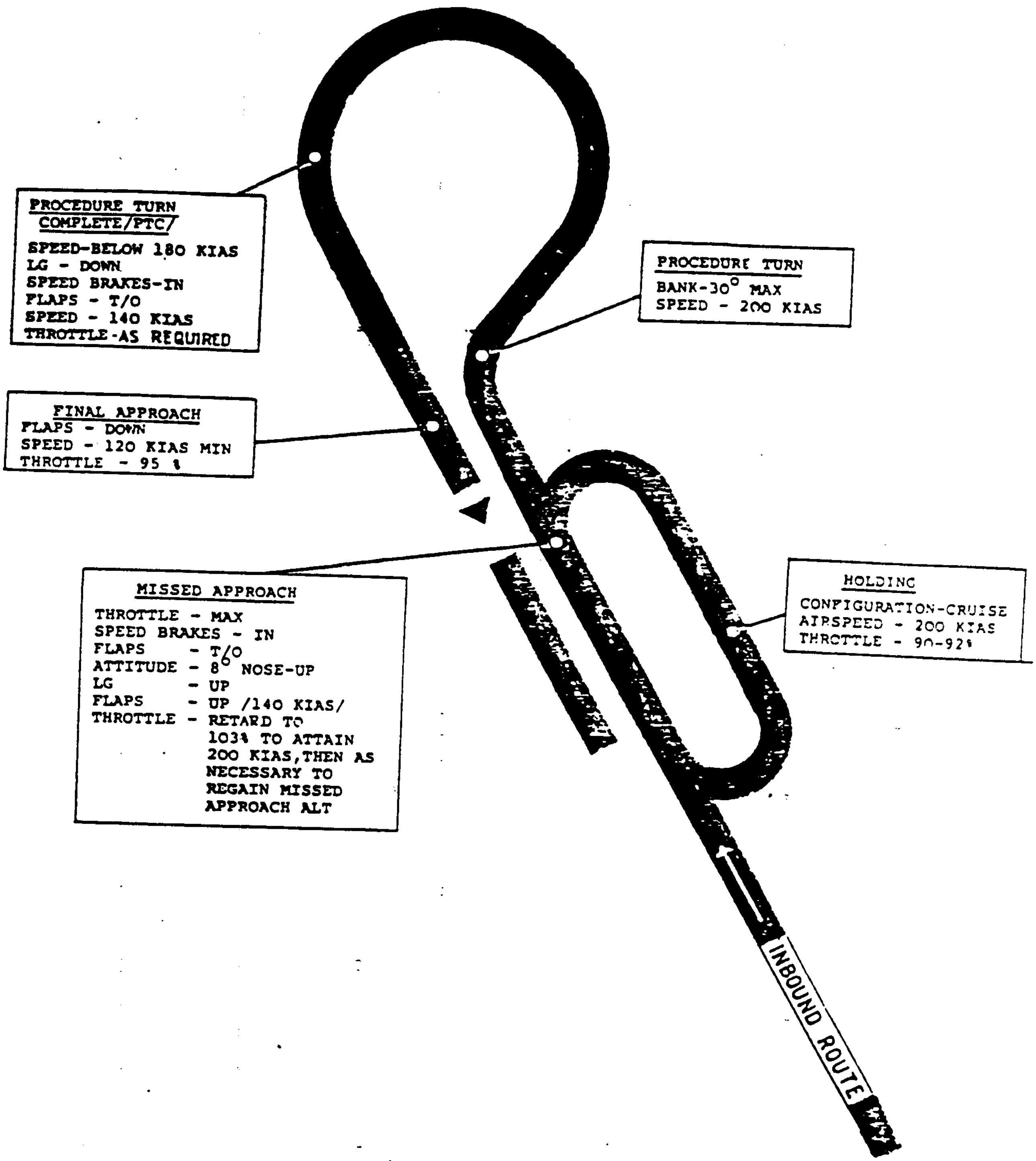


FIGURE 2-5

RADAR APPROACH /Fig 2-6/

ENTRY

1. Configuration - Cruise
2. Airspeed - 200 KIAS
3. Throttle - As required /approx 95%/

DOWNWIND

1. Configuration - Cruise
2. Airspeed - 200 KIAS
3. Throttle - As required to maintain 200 KIAS /approx. 95%/
4. Speedbrakes - Retracted

BASE LEG

1. Airspeed - Below 180 KIAS
2. Landing Gear - Down
3. Flaps - T/O /below 160 KIAS/
4. Airspeed - 140 KIAS
5. Throttle - As required to maintain 140 KIAS /approx 95%/

FINAL TURN

1. Airspeed - 140 KIAS
2. Throttle - As required

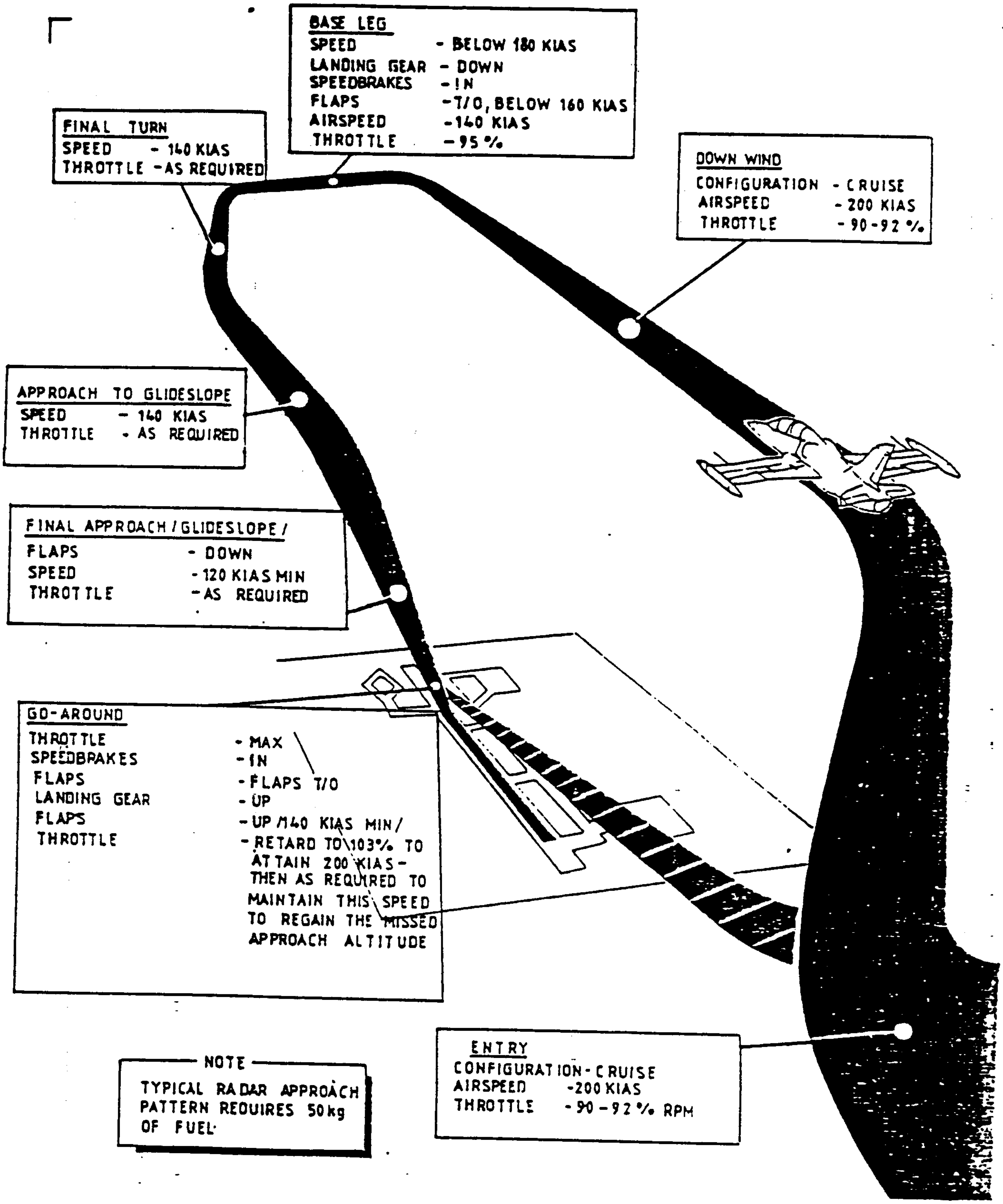
FINAL APPROACH /Glideslope/

1. Flaps - Land /starting descent/
2. Airspeed - 120 KIAS minimum
3. Throttle - As required to maintain 120 KIAS

GO-AROUND

1. Throttle - Max
2. Speedbrakes - In, if extended
3. Flaps - T/O
4. Attitude - 8° nose-up

RADAR APPROACH /TYPICAL/



NOTE

TYPICAL RADAR APPROACH PATTERN REQUIRES 50 kg OF FUEL

FIGURE 2-6

5. Landing Gear - Up
6. Flaps - Up /140 KIAS min/
7. Throttle - Retard to 103% to attain 200 KIAS, then as required to maintain 200 KIAS to the missed approach altitude.

AFTER LANDING CHECKS

After completion of the landing roll and when clear of the runway:

1. Landing/Taxi light - As required
2. Flaps - up
3. Spreedbrakes - In
4. Trims - Neutral
5. RIO-3 switch - Off
6. Tanks switch - Off
7. VOR/ADF/DME - Off
8. De-icing switch - Off

ENGINE SHUTDOWN

1. Parking Brake - Apply

CAUTION

Avoid applying the parking brake if hot brakes are suspected.

2. Pressurization/Air Cond lever - Off
3. Throttle - Stop
4. Engine rundown - Check /from 10% to 0 RPM-10 secs HPC; 15 secs LPC/
5. All unguarded switches - Off
6. Battery - Off
7. Canopy - Open
8. Seat Pins - Insert /Safety/

BEFORE LEAVING THE AIRCRAFT

1. Wheel Chocks - In place
2. PARKING brake - Release when chocks are in place
3. Oxygen valve - Close
4. Disconnect all personal leads and lock the control stick if desired.
5. Leave the aircraft
6. If required, close and lock the canopy.
7. Form 781 - Complete.

FRONT COCKPIT INSTRUMENT PANEL

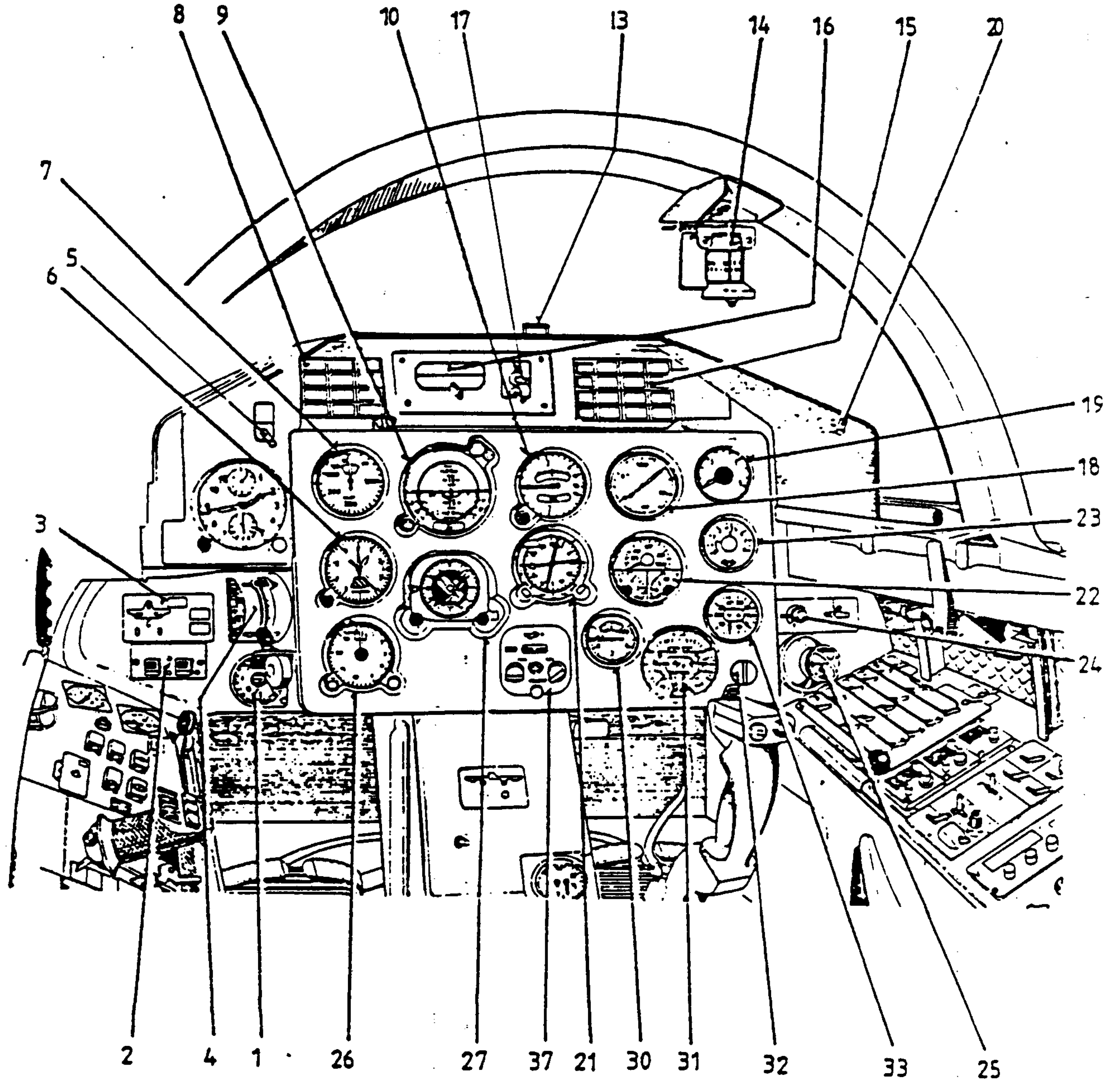


FIGURE 2-7 / SHEET 1 /

FRONT COCKPIT LEFT CONSOLE

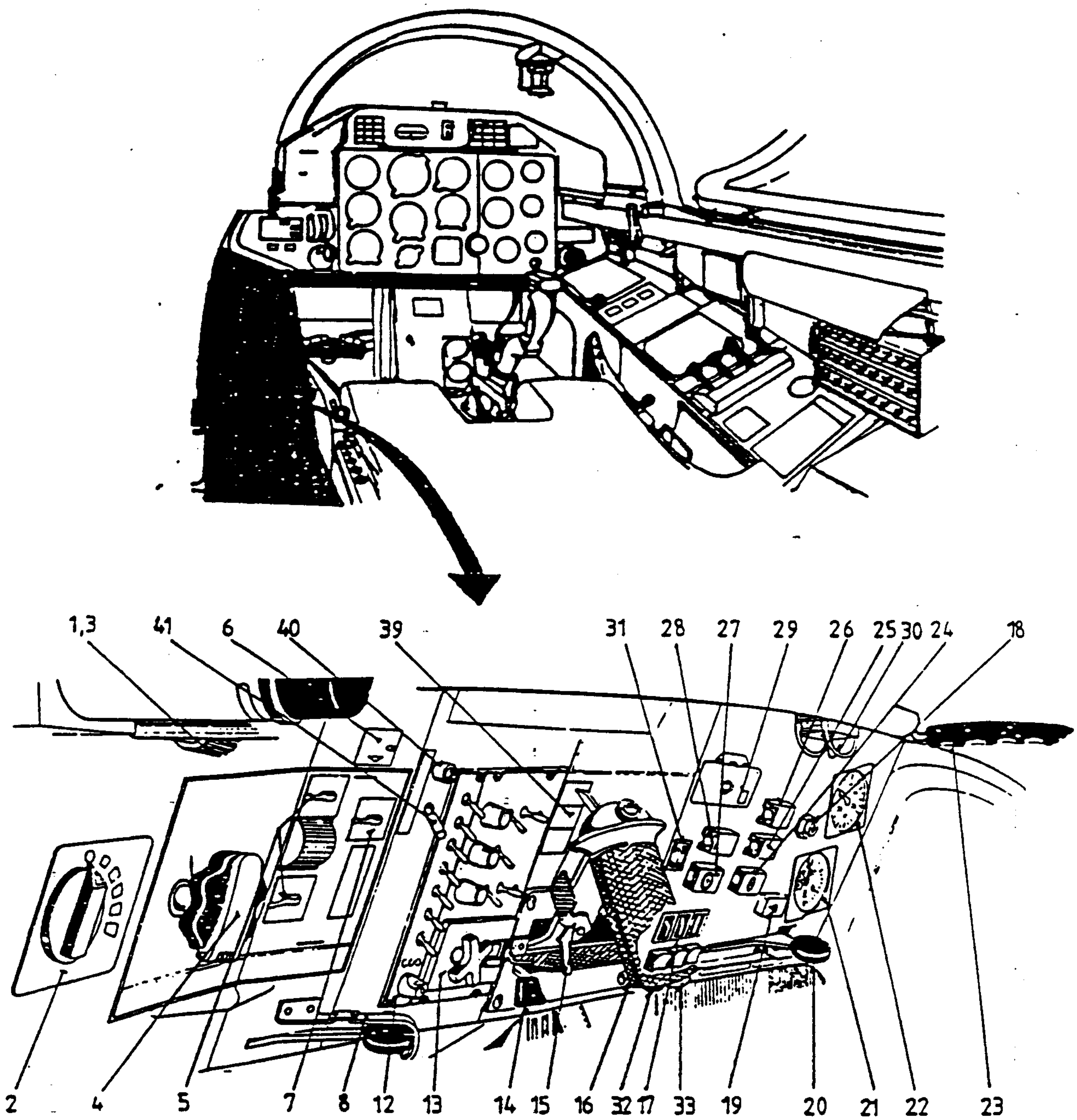


FIGURE 2-8 /SHEET 1/

1. Filter AD-5
2. Cock of suit ventilation
3. Automatic AD-6E
4. Oxygen shut-off valve
5. Controller of oxygen delivery
6. Ground test of helmet overpressure
7. Cock of helmet ventilation
8. Fuel shut-off lever

12. Radio control change-over box
13. Radio control box
14. Arrestment of throttle handle
15. Latch of "STOP" position
16. Throttle handle
17. Controlling and tally system of landing flaps
18. Check up on IV-300
19. Push-button of fire extinguishing
20. Lever of emergency and parking brake
21. Oxygen indicator IK-52
22. Oxygen pressure indicator in helmet M 2000
23. Lever of cockpit locks
24. Push-button of engine starting
25. Switch of engine cutting off
26. Switch of emegergency fuel circuit
27. Push-button of air generator SAPHIRE-5 starting "TURBO"
28. Switch of air generator SAPHIRE-5 stopping - "TURBO STOP"
29. Change-over switch for engine starting mode
30. Search lights switch
31. Outer source connection tell-tale lamp
32. Control of speed brakes
33. Push-button of transmission of radiostation

39. Change-over cock of PVD /main and emergency/
40. Film movement control ~~of~~ SARPP
41. Switch of registering apparatus SARPP ON/OFF

1. Main switchboard
2. Lever of emergency canopy jettisoning
3. Lamps of desk illumination
4. ADF change-over switch
5. Push-button of checking the heating of sensor RIO-3
6. Change-over switch of Marker-Sensitivity
7. MKR test
8. Circuit RT-12 braker ?? ~~[illegible]~~ Engine Out Test,
9. Auxiliary switchboard
10. Lever of pressurizing and air-conditioning system
12. Switch "ENGINE INSTRUMENTS IN EMERGENCY"
13. Unblocking the ejection seat
14. Control of de-icing system
15. Control of navigation lights
17. Emergency extension of U/C
18. Emergency extension of landing flaps
19. Emergency extension of stand-by generator
20. Interconnection of main and emergency hydraulic circuits
21. Rheostat and control push-button of central tally system
23. Double pressure gauge of main and emergency hydraulic circuits
24. Control RT-12 change-over switch
25. Control box of NAV I
26. Control box of ADF
27. Control box of transponder
28. Circuit-breaker RDO S-BY
~~29. Control box of KHF 950~~
30. Circuit-breaker and fuse KHF

FIGURE 2-5 /SHEET 2/

FRONT COCKPIT RIGHT CONSOLE

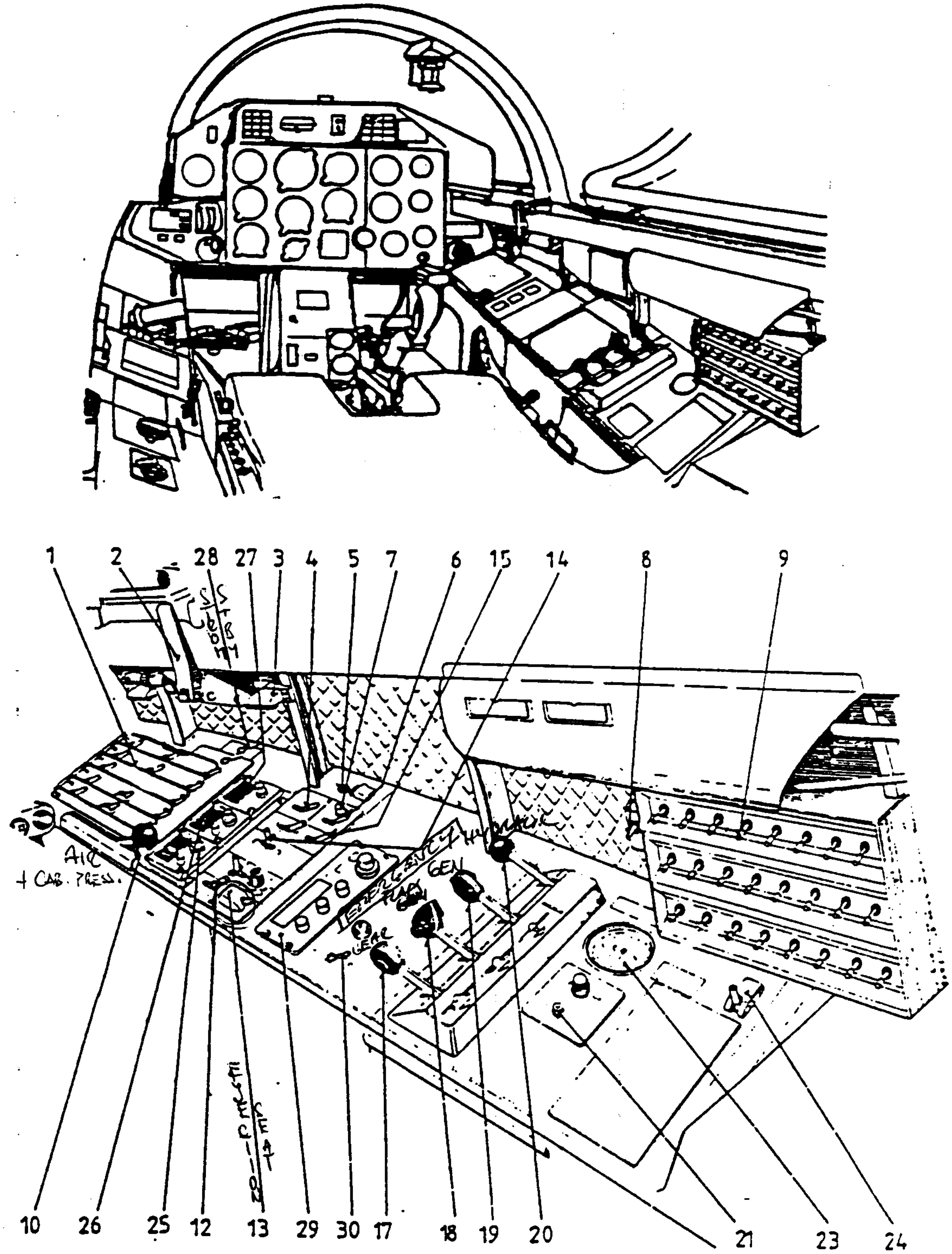
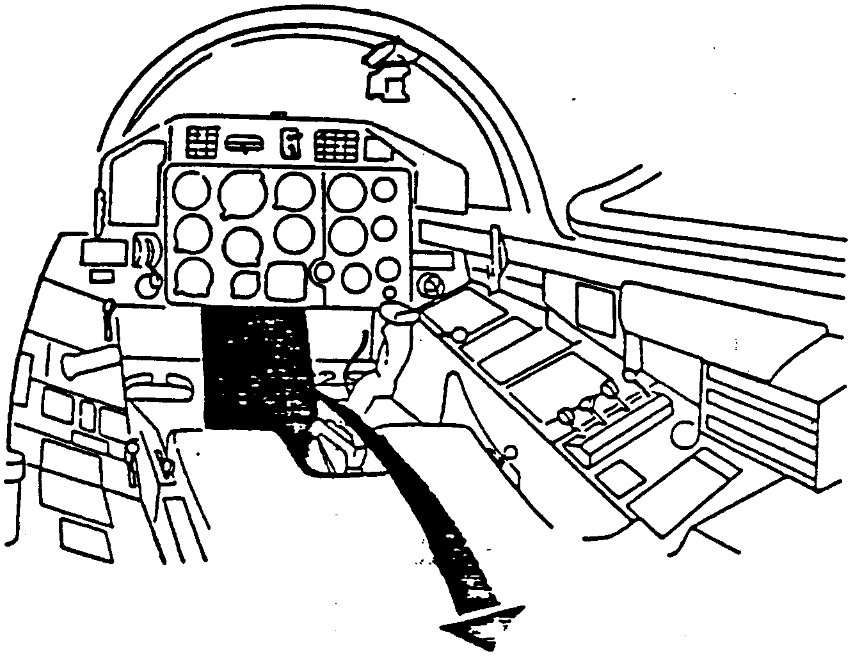
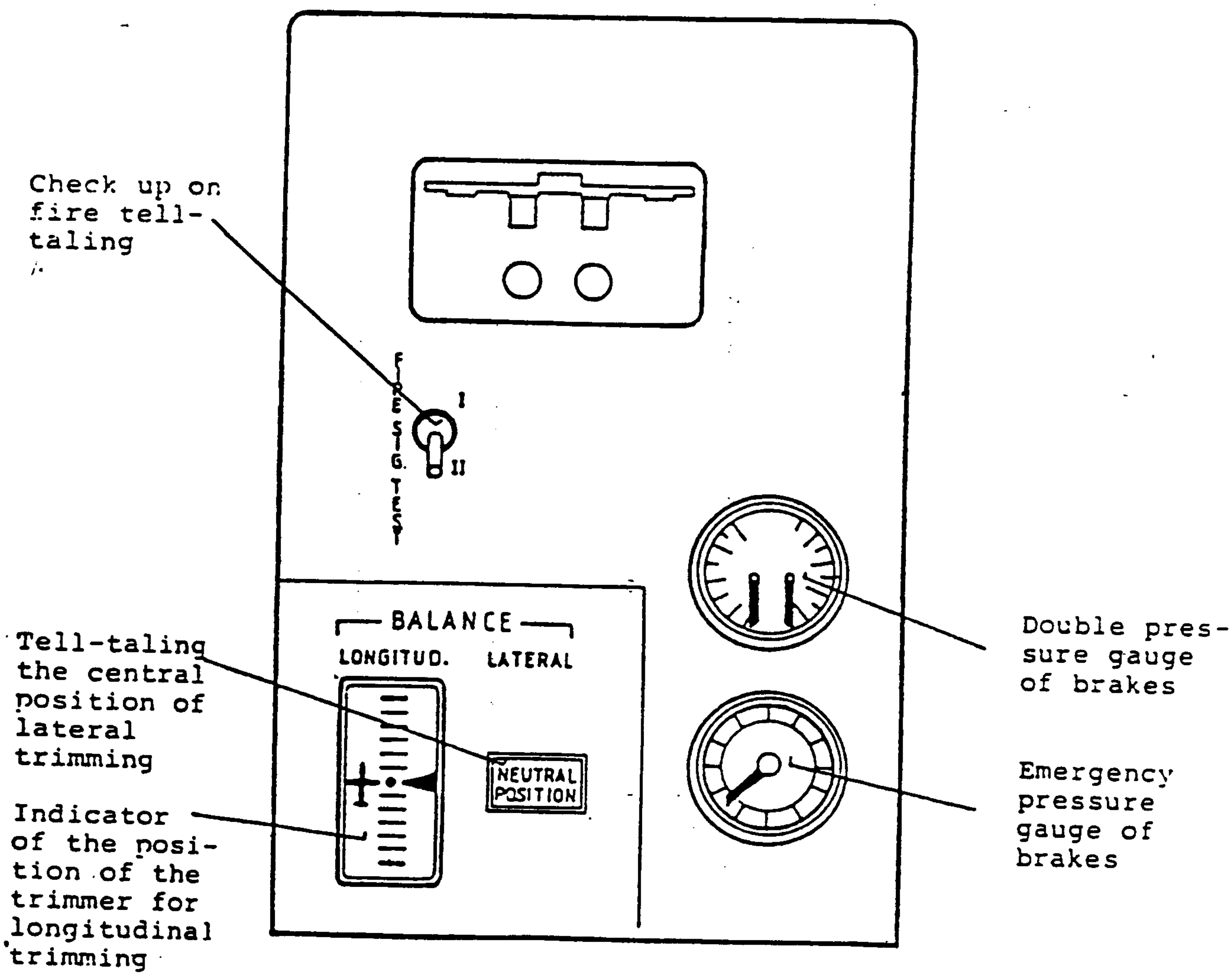


FIGURE 2-9 /SHEET 1 /

FRONT COCKPIT CENTRE PEDESTAL





SECTION III

EMERGENCY PROCEDURES

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SECTION IV

AUXILIARY EQUIPMENT

TABLE OF CONTENTS

KILOMETERS/NM PER 100 kg FUEL

ISA CONDITIONS

H = 26300 ft (8000 m)

Model : L-39, Clean Version
Date : July, 1987
Data Basis : Calculated

Engine : AI-25TL
Fuel Density : 0,78 kg/l

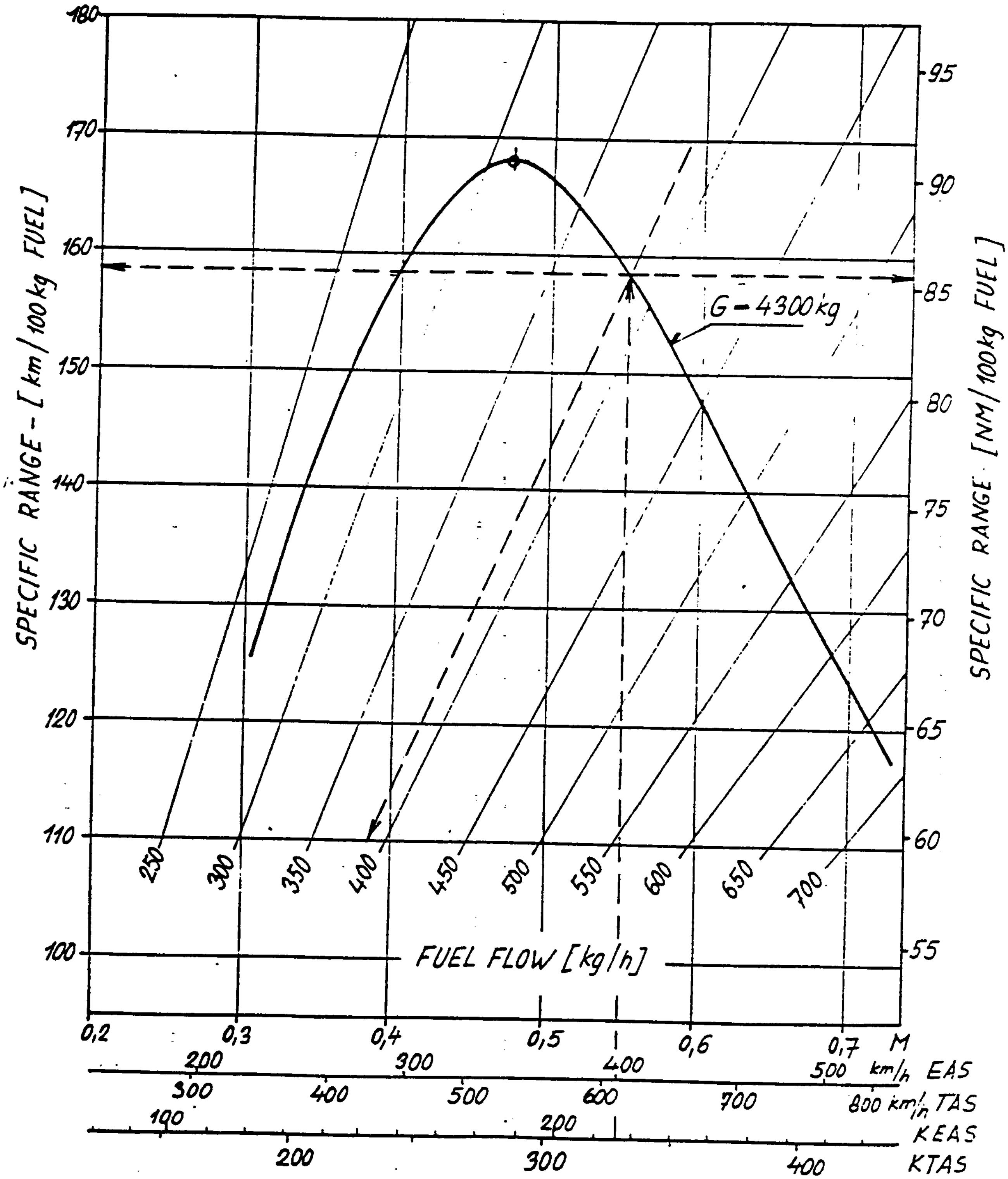


Fig. A4-4

AIRCONDITIONING AND PRESSURIZATION SYSTEM

The airconditioning and pressurization system provides conditioned air and pressurization for the cockpits. The system uses bleed air from the nineth stage of the HP compressors and 115 V/400 Hz. inverter.

AIRCONDITIONING SYSTEM

High pressure and high temperature bleed air from the engine flows via an electric shut-off valve to an air filter to the heat exchanger and to the cooler. Behind the turbo cooler, there is an automatic temperature control selector with positions, Winter 9°C, and Summer 4°C.
The turbo cooled air is then passed through the water separator where moisture is condensed from the air. The cooled air from the water separator is routed through two pipings. The air enters the cockpit at a preselected temperature through the first set of pipings with air outlets on the glare shield and through the second set of pipings with swivel-type air outlets located on the right subpanel in each cockpit.

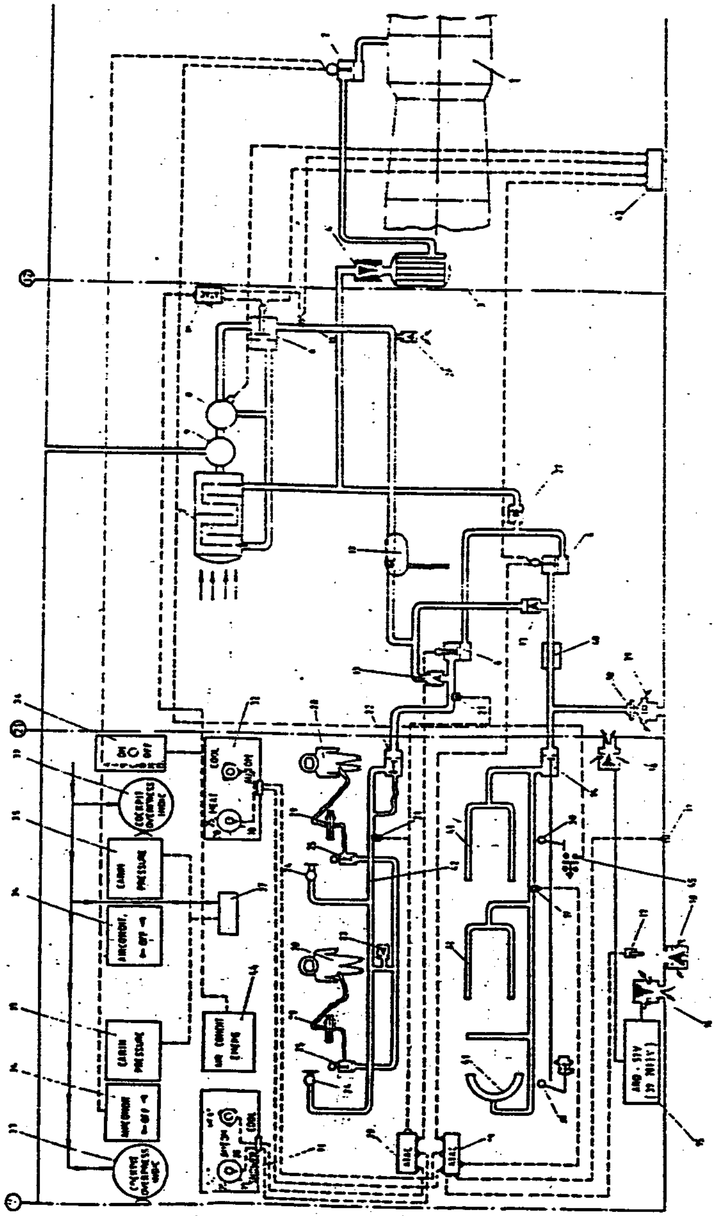
COCKPIT AIRCONDITION CONTROL AND WARNING SYSTEM

The cockpit temperature controls are located only in the front cockpit except the compressor bleed air shut-off valve switch labelled AIRCON in the RC main switch board.

AIRCON/PRESSURIZATION LEVER

The aircon/press levers located at the right console in each cockpit controls air supply to the cockpit by positioning the shut-off valve powered by 115 VAC from INV I. The lever is mechanically connected to the lever in the rear cockpit. The lever has three positions. With the lever in the forward position, the aircon is put on and the canopy seal inflated.

Air-conditioning system



1. Engine
2. Electric shut valve
3. Air filter
4. Limiter of air volume

6. Slide valve with electric motor
7. Static-cooler
8. Turbo-cooler
9. Pan
10. Air temperature automatic control behind turbo-cooler with the change-over switch /Summer-winter/
11. Temperature receiver
12. Water separator
13. Non-return valve
14. Shut valve
15. Pressure controller
16. Valve of pressure controller
17. Temperature receiver
18. Safety valve of the cockpit
19. Air temperature automatic control in the cockpit
20. Air temperature automatic control in the air shower and ventilating suits
21. Temperature receiver
22. Controller of surplus pressure
23. Safety valve
24. Air shower cock
25. Manual valve
26. Safety valve
27. Non-return valve
28. Ventilating suit
29. Quick release joint
30. Lever of pressurizing and air delivery
31. Control of suits and air showers temperature
32. Control of cabin air temperature
33. Cockpit over pressure indicator
34. Information screen /Air condition off/
35. Crash warning screen /Cabin pressure/
36. Change-over switch of air consumption from the engine
37. Pressure receiver in the cockpit
38. Screwed union of the ground source
39. Safety valve
40. Noise damper
41. The piping of air inlet to the cockpit
42. The piping of air inlet to the showers and ventilating suits
43. Socket for the ground test of turbocooler
44. Information screen /AIR CONDIT.EMERG./ in the front cockpit
45. Micro-switch /air condit.ON-OFF/

FIGURE 4-1

CONTROLLING AND SIGNAL SYSTEM

CAUTION: Opening of the air-conditioning system is possible only by engine running

1. Close the canopy locks-signal "canopy unlocked" puts cut.

2. Shift the lever of pressurizing and air delivery into position 3.

3. Check position "On" of the circuit-breakers "AIR COND", "SIGN." and "AIR SHOWER"

A. AIR-CONDITIONING SYSTEM - air delivery into cockpits - Pressure creating /indicates cockpit overpressure indicator/
   a/ Air conditioning control panel-regime choice - automatic
   - manual/emerg
   b/ Air delivery into cockpits
   c/ Rated overpressure in the cockpit at heights from 0 to 6562 ft (2000 m) max. 20 mm Hg /2.66 kPa/, from 6562 to 22966 ft (2000 to 7000m)

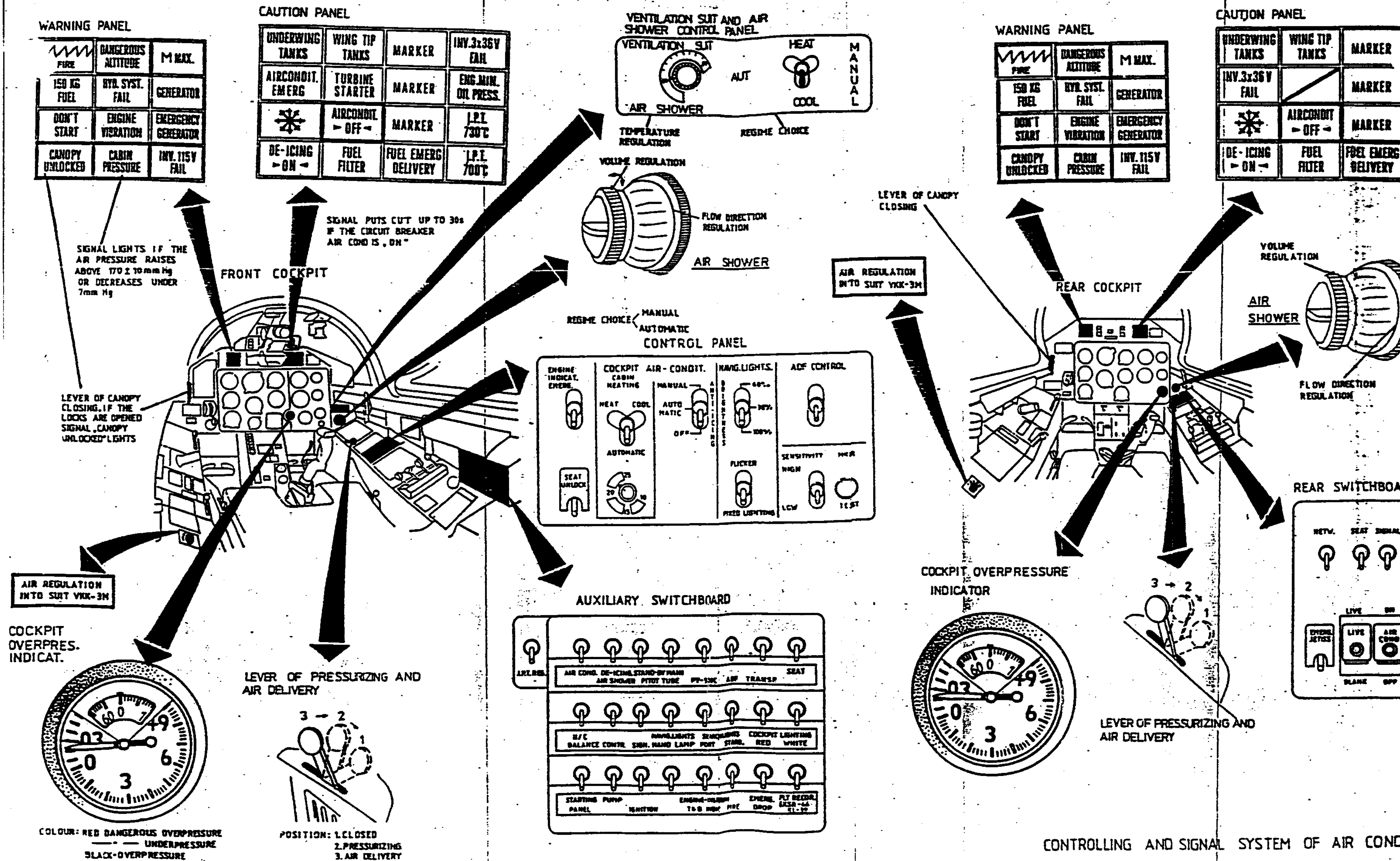
4. from 20 to 170 ± 10 mm Hg /2.66 to 22.66 ± 1.33 kPa/, from 22966 ft (7000) to the ceiling 170 ± 10 mm Hg /22.66 ± 1.33 kPa/.
   d/ In the event of cockpit pressure increase lights signal "CABIN PRESSURE" and the cockpit overpressure indicator indicates the overpressure rate.

B. VENTILATION SUIT AND AIR SHOWER SYSTEM - air delivery into suit VKK-3M and into cockpit.
   a/ Switch on the main switch "Air condit."
   b/ Turn the collar into position of suitable air volume and air flow direction. /The air volume into VKK-3M - regul. No. 5/
   c/ Temperature regulation and regime choice of the suit and shower is on the its control panel.

5. CLOSING OF THE WHOLE SYSTEM BEFORE ENGINE STOPPING IS NEEDED!
   a/ Switch off circuit-breakers "Air cond" and "Air shower". /Signal "Aircondit off" lights/
   b/ Shift the lever of pressurizing and air delivery into position 1.
   c/ Open the canopy locks /signal "Canopy unlocked" lights/.

NOTE: The signal "AIRCONDIT. EMERG" lights after failure of temperature resistor pic-up behind turbocooler. /The temperature of delivered air will be change according to temperature of ambient air and engine mode in acceptable limits/.

Figure 4-2



CONTROLLING AND SIGNAL SYSTEM OF AIR CONDI

Placing the lever in the centre position inflates the seat and aircon off. Pulling the lever in the rear position the canopy seals are deflated and aircon off.

Cockpit Air Temperature Control Switch

Temperature of the air admitted to the cockpit is controlled by a four-position cockpit air temperature control switch located on the right console in the front cockpit.

Temperature control is maintained automatically when the switch is in the AUTOMATIC position. When the switch is in NEUTRAL-OFF, the automatic control system is inoperative and the sliding valve remains fixed in the position at the time the switch was set to the off position. If the automatic control system fails or if the desired temperature cannot be obtained with the switch in the AUTOMATIC position, the switch may be held in the HOT or COLD position temporarily and back to NEUTRAL. The manual HOT or COLD positions should be used with caution due to the inertia from the time the slide valve is opened for either cold, or hot air till the time the air enters the cockpit.

Excessive hot air with a max of 200°C will be admitted into the cockpit if the switch is held in manual HOT position longer than necessary.

Cockpit Air Temperature Control Rheostat

The rheostat controls cockpit air temperature and functions only when the cockpit air temperature switch is in the AUTOMATIC position and when AC power is available at the cockpit temperature control unit. The scale is graduated from 10 to 25°C.

Cockpit Airshower Temperature Control Switch

Temperature of the airshower/ventilating suit is controlled by a four position airshower/ventilating temperature control switch located on the instrument right sub panel in the front cockpit. The operation is identical to Cockpit Air temperature control explained above.

Airshower/ventilating Air Temperature Control Rheostat
The Airshower/ventilating Air Temperature control Rheostat is identical to the cockpit Air Temperature Control Rheostat in operation. The scale is graduated from 10 - 80°C.

Aircondit off Warning Light
A red warning light AIRCONDIT OFF, located on the warning light panels in both cockpits. The light is activated when the air-con-pressurizing is in the seal or off position or when the rear cockpit aircon switch is put to the off position.

Aircondition Emergency Warning Light
A red warning light AIRDIT EMERG located on the warning panel in the front cockpit is activated when the temperature resistor pick up behind the turbo cooler has failed. The slide value of Summer or Winter selector is fully opened. The temperature of air supplied will depend on the ambient temperature.

PRESSURIZATION SYSTEM

With the canopies closed, the engine running and the airconditioning system in operation, the cockpits automatically become pressurized at an altitude of 6,500 feet and above. The pressure in the cockpits is maintained by a pressure regulating valve , which controls the outflow of air from the cockpits. A cabin pressure safety valve is used to prevent cabin pressure differential from exceeding positive or negative pressure limits above 205 ±10 mm Hg and below 7 mm Hg, in case of a malfunction of the pressure regulating valve. Up to 6,500 feet there is a max pressure differential of 20 mm Hg, from 6,500 feet to 23,000 the pressure differential gradually rises up to 170 ±10 mm Hg and above 23,000 feet, the pressure differential remain constant at 170 ±10 mm Hg.

cabin press at

Cabin pressure Warning Light
A red warning light, CABIN PRESS, located on the warning light panels in both cockpits.

ANTI ICING AND DEICING SYSTEM

PITOT HEAT SYSTEM
Each pitot boom is equipped with a heating element to prevent ice accumulation. They are powered by 27 VDC and protected by two C/Bs labelled PVD right and PVD left situated at the auxiliary switch board in the front cockpit. Heating of pitot booms is controlled by the PITOT HEAT buttons located below the under carriage indicator panel in the front cockpit.

PITOT HEAT buttons
Two PITOT HEAT buttons control the pitot heat system. When pushed, the right button energises the heating element in the right pitot boom. The left button energises the heating element in the left pitot boom. Each button is mechanically held in the on position. They are released again when the release button below the green pitot heat buttons is pushed.

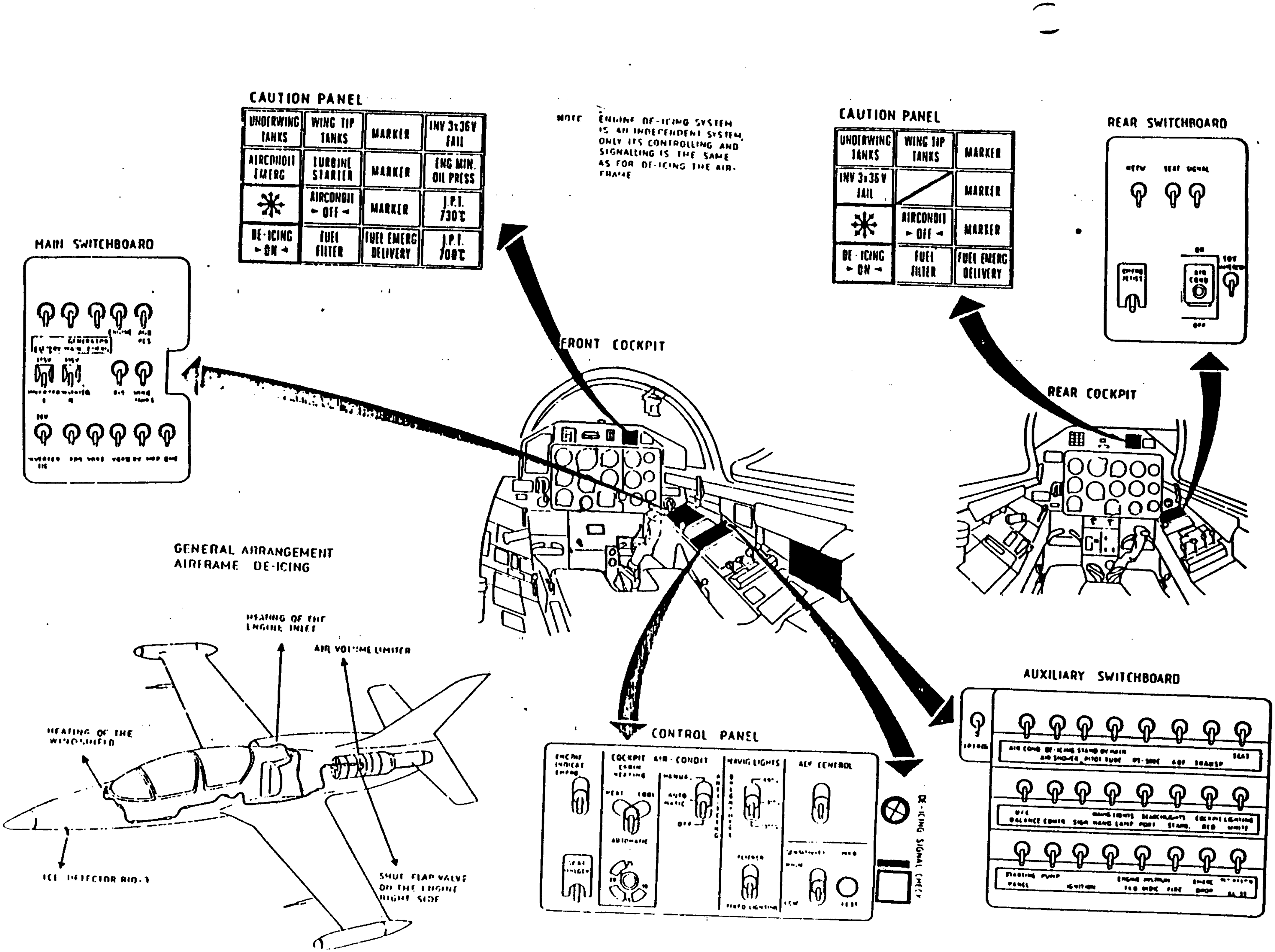
Pitot Heat Light
With the pitot heat button pushed, a lamp in the button will illuminate. Upon releasing the button, the lamp will extinguish.

WINDSHIELD AND ENGINE DE-ICING SYSTEM

The de-icing system uses bleed air from the ninth stage of the HPC. The air is directed to the windshield, engine air intake ducts, and the inlet guide vanes of the LPC.

DE-ICING CONTROL SWITCH

The de-icing switch is located on the right console in the front cockpit. It is a three-position switch with off, MANUAL


CAUTION PANEL
UNDERWING TANKS
WING TIP TANKS
MARKER
INV 3x36V FAIL
AIRCONDIT EMERG
TURBINE STARTER
MARKER
ENG MIN. OIL PRESS
AIRCONDIT ► OFF ◄
MARKER
J.P.T. 730°C
DE-ICING ► ON ◄
FUEL FILTER
FUEL EMERG DELIVERY
J.P.T. 700°C
NOTE ENGINE DE-ICING SYSTEM IS AN INDEPENDENT SYSTEM, ONLY ITS CONTROLLING AND SIGNALLING IS THE SAME AS FOR DE-ICING THE AIR-FRAME
CAUTION PANEL
UNDERWING TANKS
WING TIP TANKS
MARKER
INV 3x36V FAIL
MARKER
AIRCONDIT ► OFF ◄
MARKER
DE-ICING ► ON ◄
FUEL FILTER
FUEL EMERG DELIVERY
REAR SWITCHBOARD
MAIN SWITCHBOARD
FRONT COCKPIT
REAR COCKPIT
GENERAL ARRANGEMENT
AIRFRAME DE-ICING
HEATING OF THE ENGINE INLET
AIR VOLUME LIMITER
HEATING OF THE WINDSHIELD
ICE DETECTOR RIO-3
SHUT FLAP VALVE ON THE ENGINE RIGHT SIDE
CONTROL PANEL
COCKPIT AIR-CONDIT
NAVIG LIGHTS
ADF CONTROL
AUTOMATIC
DE-ICING SIGNAL CHECK
AUXILIARY SWITCHBOARD

and AUTOMATIC positions. The System is powered by inverter 115 V/400 Hz AC and protected by circuit breakers INVERTER and RIO-3 on the main Switch board.

Automatic position

In the automatic position, it utilizes the RIO-3 Sensor located on the left side of the nose to detect ice formation on the aircraft. When icing conditions are detected by the RIO-3 a signal is sent to activate the icing light /snow flakes/ or the C & W panel in both cockpits. Actuation of the caution light will close a relay that will open the shut-off valve thereby directing the bleed air to the de-icing surfaces. Opening of the shut-off valve is indicated by DE-ICING ON light on the C & W panel in both COCKPITS. This System is de-activated when the nose wheel is on the ground.

Manual position

With the switch in Manual position, the shut-off valve is opened and hot air from the compressor is directed to the de-icing surfaces and the DE-ICING ON Light will illuminate on the C & W panel.

RIO-3 Test button

The RIO-3 System is tested on the ground by setting the three-position switch to AUTOMATIC and pressing the push button CHECK UP ON RIO-3, the green lamp by the side will illuminate to show the system is operative.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

V/UHF RADIO LPR 80

The V/UHF equipment LPR 80 provides air to air and air to ground voice communications in the VHF and UHF frequency bands.

The equipment consists of the transmitter/receiver unit divided into the VHF and the UHF part, two identical control units situated on the left console behind the throttle in each cockpit.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

TYPE	DESIGNATION	FUNCTION	RANGE	CONTROL LOCATION
Interphone Communication	The part of radio Station LPR-80	Intercommunication between the pilots and moreover the communication with a mechanic by means of an extension cord -when on ground plugged in the fuselage nose		Left desk in front and rear cockpit
VHF/UHF Communication	LPR-80	Two-way voice communication in the frequency range of 100,000 to 155,975 MHz /VHF/ and of 220.000 to 399.975 MHz /UHF/	To ground station 120 km /65 NM at the flight height, H-1000 m /32807 and 250 km /135 NM/at the flight height H-5000m /16,400'/	Left desk and throttle handle in both cockpits
VHF Radio station	LUN 3524	Stand -by radio station in the frequency range of 118,10 to 137,975 MHz	"	Instrument desk and right desk in front cockpit
HF radio station	KHF-950	Stand-by radio station in the frequency of 2.0 to 29,9999 MHz		Right desk in front cockpit
Automatic direction finder	KDF-806	Station bearing in frequency range of 190 KHz to 1799 KHz	Range 150km /81 NM / from the height H-1000 m /3280 ft / and 210 km /133 NM / from the height H-5000 m /16,400 ft/	Instrument desk left and right desk in both cockpits

Fig. 4-4/1.sheet/

TYPE	DESIGNATION	FUNKCION	RANGE	CONTROL LOCATION
Radio altimeter	RV-5M	Measuring of a/c actual heights of 0 to 750 m /2500ft /		Instrument desk in both cockpits
VHF Navigation System	KNR 634	Station bearing in the frequency range of 108,00 to 117,95 MHz	1.Range 96km /52NM/ from altitude 1000 m /3280 ft/ and 187 km /101 NM/ from altitude 5000m /16.400 ft/ in VOR mode. 2.Range 46km /25 NM/ from altitude H+640m /2100 ft/ /H is sea level of GS/ in LOC mode and 18,5km /10 NM/in GS mode.Min. operational altitude range of MKR is 2000m /6400 ft/	Instrument desk and right desk in both cockpits
Distance Measuring Equipment	KDM 706	Distance measuring in the frequency range of 962 to 1213 MHz	Range from 96km /52 NM/ from altitude 1000m /3280 ft/ and 180km/97 NM/ from altitude 5000m /16.400 ft/	Instrument desk in both cockpits
Transponder	KXP 756	For a/c identification frequency of transmitter 1090 ± 3 MHz Frequency of receiver: 1030 MHz	"	Instrument desk and right desk in from cockpit

Fig. 4-/2 sheet/

V/UHF TRANSMITTER/RECEIVER

The transmitter/receiver operates in the VHF frequency band from 100 to 155.976 MHz and in the UHF frequency band from 220 to 399.975 MHz. The channel separation in VHF band is 25 and 83.3 MHz. The 83.3 MHz in VHF band makes communication with older radio sets possible. The channel seperation in UHF band is 25 KHz. On the whole, there are 9438 channels in both bands.

ON-OFF SWITCH

The LPR 80 Radio is switched on by the switch "RDO" on the main switch board.
The set is lighted when the "RDO" is on depending on the cockpit having control of the radio.

V/UHF CONTROL UNIT

TEST button
A test button and a red light is provided for equipment function checks in receive and transmit mode.

Receive Mode
When the TEST button is pressed, the test light should illuminate for four seconds when the receiver is working properly.

Transmit Mode
When the TEST button is pressed, a tone will be heard in the headset and in the ground station.

V/UHF Control Changeover Switch
This two-position toggle switch located on the V-UHF control unit is used to shift the V/UHF radio control. Below the switch is an amber light to indicate, when illuminated the cockpit that has the control of the V/UHF radio.

Power Output Selector Switch

This two-position toggle switch selects the power output of the V/UHF transmitter of either 5 or 20 W.

Frequency Band Output Selector Switch

This two-position toggle switch selects the frequency band output of V/UHF receiver of either 20 or 40 KHz in order to communicate with older radio communication equipment.

Intercom Volume Control Knob

An intercom volume control knob labelled INTERCOM is provided to control the audio level between the crew members and also between ground crew and the pilot when the ground connector is used.

Voice Level Control Knob

The voice level control knob labelled VOX is provided to control the voice level output of individual pilots in order to communicate with other crew member or the controlling agency - The level is adjusted to hear oneself when talking in a normal tone.

Radio Volume Control Knob

The radio volume control knob is provided to control the volume of the reception from the channel selected on the LPR 80 radio.

Inter Communication System /ICS/ Monitor Panel

The ICS monitor panel consists of seven monitor toggle switches for Com I, Com II, NAV I, NAV II, DME, ADF and HF. With the NAV I, NAV II, DME and ADF toggle switches in the forward position, it enables the coding of individual navigation equipment to be monitored.

The Com I, COm II, and HF monitor toggle switches work in conjuction with the transmitter selector knob.

Mode Selector Knob

The mode selector knob is a three-position selector knob located on the V/UHF control unit. It has the positions Com I, Com II and HF with amber light to indicate radio comm set the other cockpit is transmitting on.

COM I Position - It enables the pilot to transmit and receive on the LPR 80 radio in the front or rear cockpit.

COM II Position - It enables the pilot to transmit and receive on the standby radio located in the front cockpit.

HF Position - It enables the pilot to transmit or receive on the HF radio located in the front cockpit.

COM I, COM II and HF Monitoring Switches

The monitoring selector switches when put in the forward position allows monitoring of the other radio station outputs apart from the position selected by the mode selector knob.

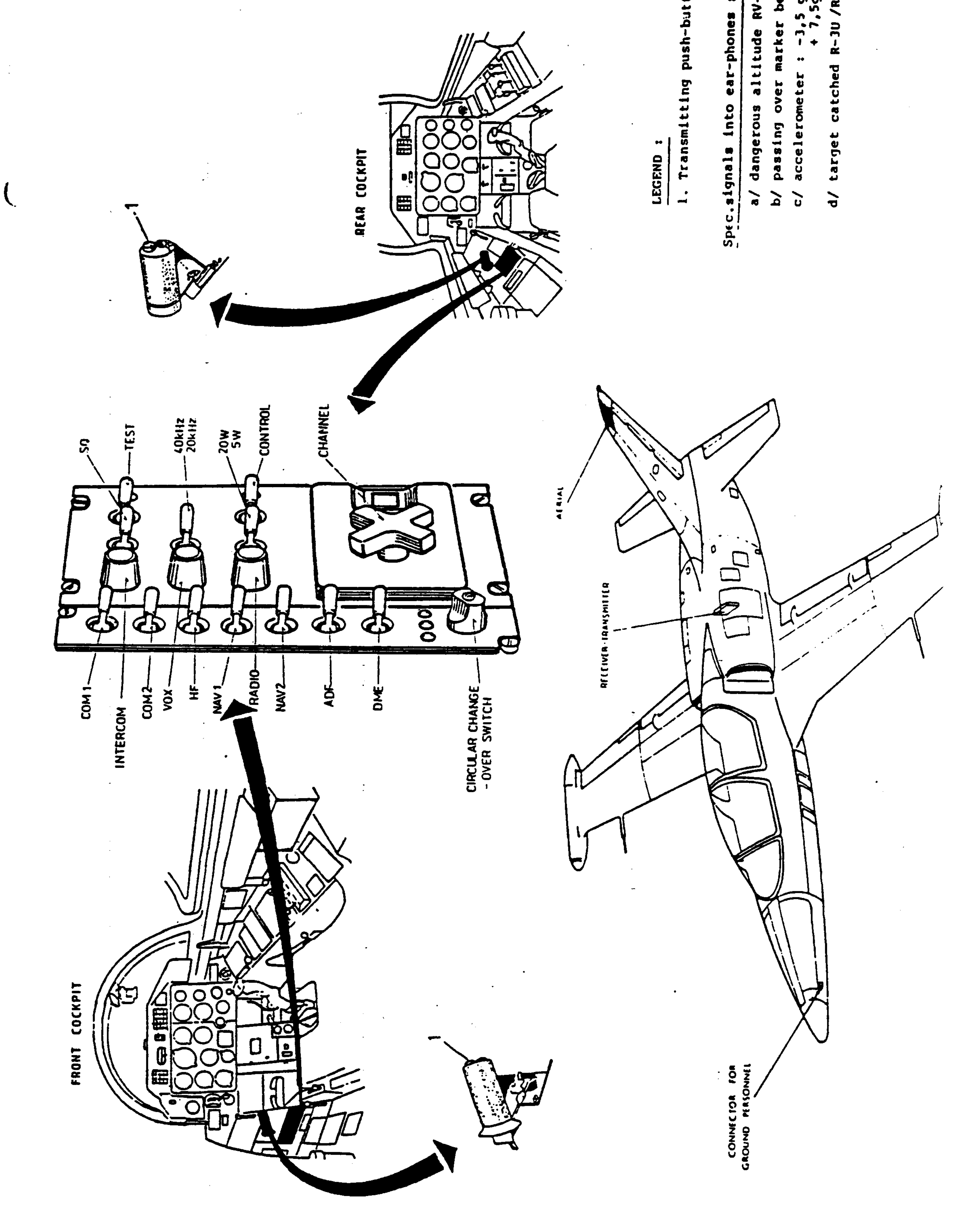
HOT MICROPHONE

LPR 80 radio set is equipped with a hot mike for intercom between the crew members. When the radio is switched off, there is a need to put the stdby intercom in the rear cockpit on to have intercom between the crew members.

Chanel Selector

A 20 -position channel selector provides the possibility to select 20 preselected frequencies in V/UHF frequency band. The 20th channel is indicated by "O" in the channel indicator window.

ARRANGEMENT OF RADIOSTATION LPR-80



LEGEND :

1. Transmitting push-button

Spec.signals into ear-phones :

a/ dangerous altitude RV-5M

b/ passing over marker beacon

c/ accelerometer : -3,5 g
+ 7,5g

d/ target catched R-3U /R-3S/

STANDBY VHF RADIO

The VHF communication system permits radio communication in the frequency range from 118.00 MHz to 135.975 MHz in 25 KHz steps. The radio set is located on the lower portion of the Instrument panel in the front cockpit. The set is powered by 28 VDC.

Communication is controlled by the microphone button on the two throttles via the transmitter selector and monitor control panel.

CONTROL PANEL

The control panel consists the following controls:

SQL Switch

This two-position switch has the positions "SQ" and "O". In the "SQ" position, the squelch suppression is disabled and very weak incoming VHF signals can be received.

ON/OFF Switch

The ON/OFF switch is located on the last row of the main switchboard lablled "STBY RDO", The set is put on when the switch is in the forward position. The frequency window is also lighted when the set is on.

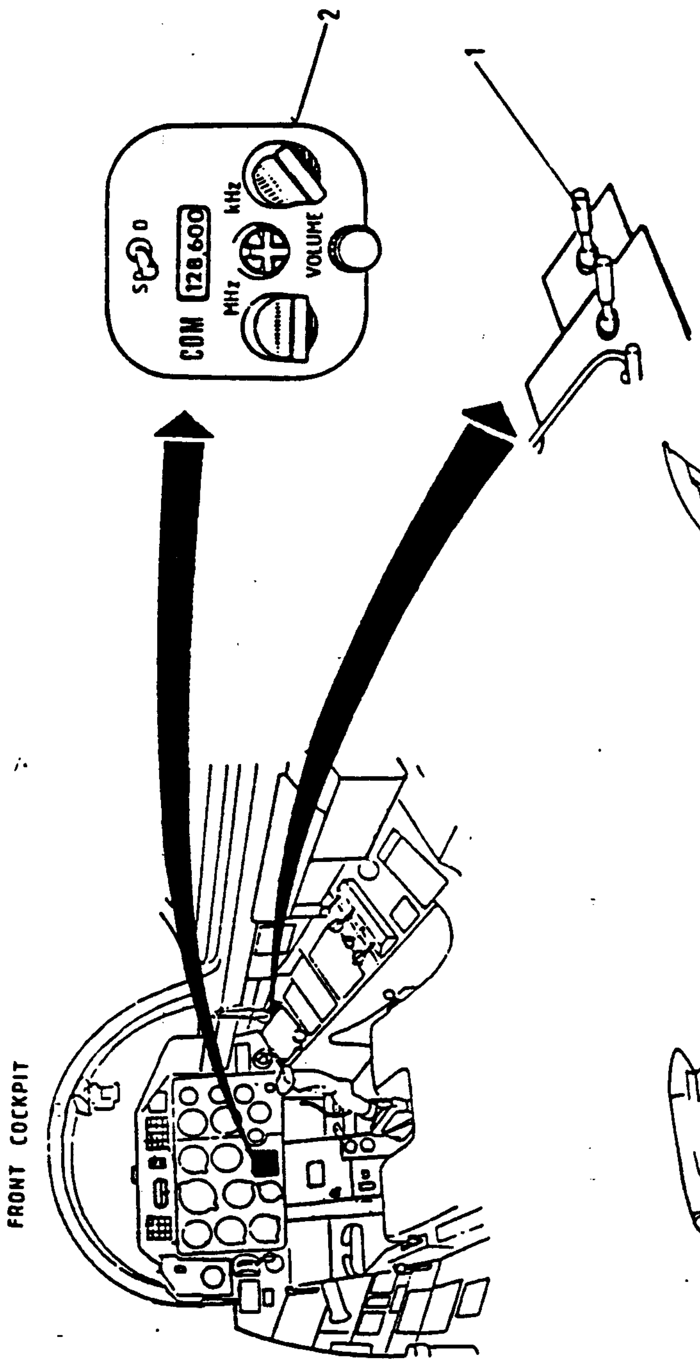
100 KHz Selector

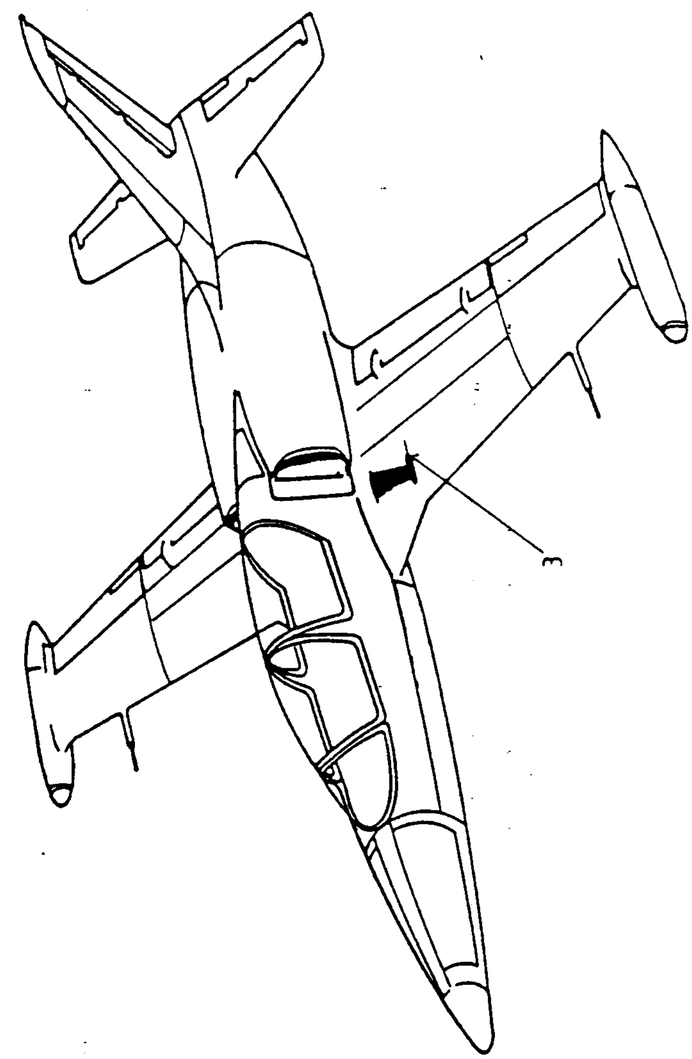
The 100 KHz selector is a 10-position rotary switch located on the left of the frequency window. It is used in selecting the frequency in 100 KHz steps.

25 KHz Selector

The 25 KHz selector is a 4-position rotary switch located right side of the frequency window. It is used for selecting the frequency in 25 KHz steps.

ARRANGEMENT OF S-BY RADIOSTATION





Legend :

1. Circuit-breaker·RDO S-BY
2. Control panel·RDO S-BY
3. Aerial·VHF

FIGURE 4-6

VOL Potentiometer

The middle knob labelled VOL is used for ajusting the audio reception level. The audio level is independent of the LPR 80 radio audio level.

Frequency Window

A frequency window is provided in the centre of the control unit which shows the frequency selected.

SHORT-WAVE RADIO STATION KHF 950

Switching the radio station ON

The short-wave radio station can be switched on by means of the circuit breaker marked as "HF RDO" which is situated on the right desk in the front cockpit and by means of "OFF/VOLUME" knob situated on the control box. To use the radio station also in the transmission mode, it is necesssary to put the circular change-over switch located on the switch box to "HF" position.

Functional description

Complete description of the controls, function and tactical use of radio station KHF 950 can be found out in the book "KING KHF 950 PILOT´S GUIDE AND DIRECTORY OF HF SERVISES". /KPN 006-8343-00/. The control box situated on the right desk in the front cockpit comprises the following controls:

a/ "OFF/VOLUME" knob-it switches on the supply voltage for the radio station and it is possible to use it for controlling the reception volume;

b/ "SQUELCH" knob - it enables the adjustment of the threshold level of the noise suppressor;

c/ "CLARIFIER" knob - with the knob pressed and when in reception mode, it allows tuning the oscillator by 250 Hz maximum. Fine tuning of the above specified oscillator improves the intelligibility of the message being received mainly in "USE" and "AM" modes;

d/ "MODE" push-button - it enables the selection of the transmission mode /USB, AM/;

e/ "FREQ/CHAN" push-button - it enables frequency selection from direct choice to the preset channel one. This push-button is provided with two stable positions. If pressed, the channel selection of operational frequency is actuated.

f/ "Coaxial frequency selection knob known as "CHANNEL/FREQUENCY SELECT" /it is not marked in this very way/ enables adjusting the operational frequency and/or the operational channel and to set the "cursor" position i.e. the mark which indicates what number is just being changed. The outer knob is functionless when the "CHAN/REQ" push-button is in channel position;

g/ flush-mounted push-button marked as "PGM" enables changing the set data in the channel mode;

h/ "STO" flush-mounted push-button is used when storing the displayed date during programming the pre-set channels.

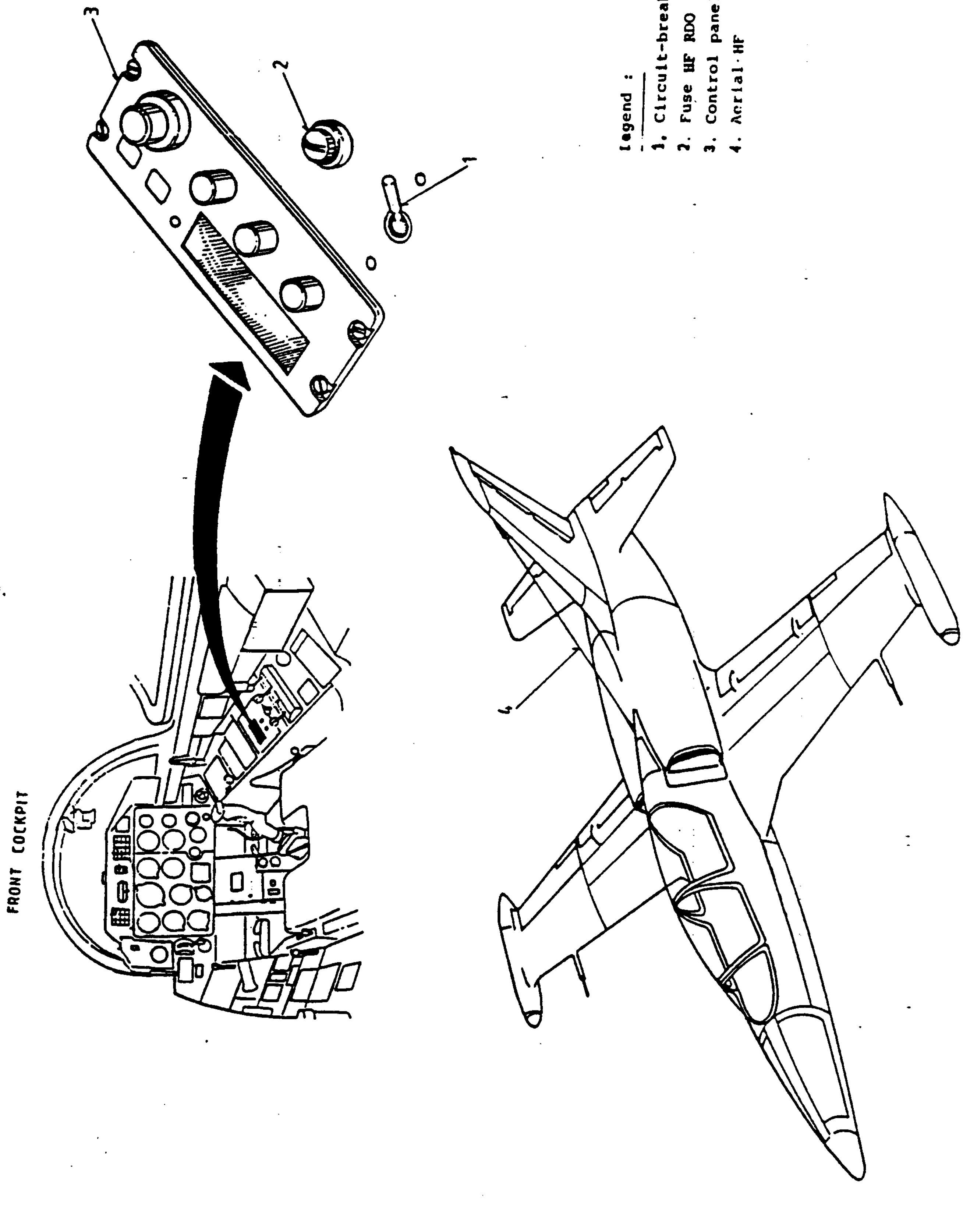
KHF 950 radio station Operation

On switching the radio station ON, the display remains empty /no numbers are displayed/ and transmission is blocked for serveral minutes until the temperature of synthesizer crystal is stabilized. If the "FREQ/CHAN" is in the depressed position, the number of the operational channel is displayed. In this phase the antenna automatic fine tuning system is in the "search" mode and the radio station receiver is connected to the antenna directly. The receiver tuning frequency will appear on the display within 1-3 minutes /dependent on the surrounding temperature/. On displaying the frequency, it is recommended to key in momentarily /but before it is necessary to put the rotary switch to "HF" position/, this actuates the automatic fine tuning cycle of the transmitter stage with respect to the antenna. The displayed frequency will disappear again and a symbol TX will flash on the display during the period of fine tuning. Both the channel number and transmission mode will be displayed continuously. After the fine tunning cycle is complete, the display will show the frequency reading /either the channel number or the frequency directly/. If there is a failure of the transmitter output stage, the fine tuning unit or of the antenna, then the transmission is blocked and the displayed frequency reading will flash. Provided the radio station is troublefree then this radio station is ready to communicate on the set frequency and mode after this procedure is completed. The radio station can be operated in the frequency channel selection mode, in the direct frequency selection mode and in the "programme" mode at which it can be continuously used in simplex and semiduplex operation.

Detailed description and setting these modes can be found out in the book "King KHF 950 pilot´s Guide and Directory of HF Services" and/or in Installation Manual 006-190-03 for KHF 950 radio station.

Basic information on the peculiarities of the propagation of short waves and on the conditions influencing the communication establishment during longdistance communication are detailed again in above stated book. Longdistance communication through the sky waves on short waves is dependent, in addition to the transmittter power out-put and the receiver sensitivity, mainly on the arrangement of the upper layers of the atmosphere which is dependent on the daily and yearly season. Moreover, this way of communication requires a certain experience in selecting the operational frequency. This is why it is necessary to observe the recommendations which, in the given field, guarantees good quality communication for a given distance or range.

ARRANGEMENT OF SHORT-WAVE RADIOSTATION



Legend :

1. Circuit-breaker HF RDO
2. Fuse HF RDO
3. Control panel RDO
4. Aerial HF

RADIO ALTIMETER /RV-5M/

General

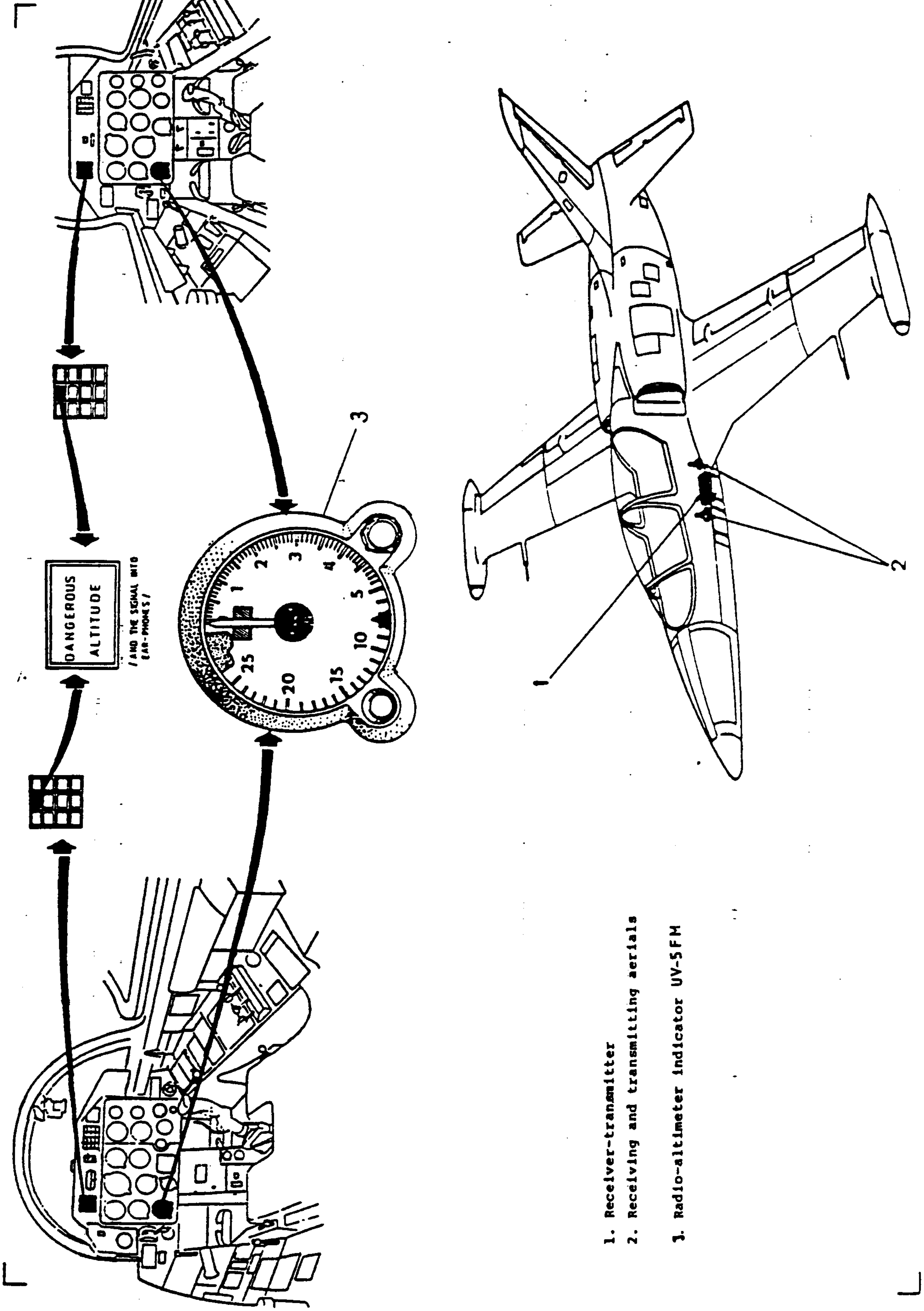
The low altitude radio altimeter RV-5M is inteded to measure the aircraft actual altitude above ground level and to warn of the dangerous altitude as determined and set by the pilot in advance. The radio altimeter measures altitudes from 0 to 750 m. It has an accurancy of $\pm$2 1/2 ft within 0 to 33 ft and AGL accuracy of $\pm$8 % within 33 to 2500 ft.

RV-5M system comprises the receiver-transmitter PP-5, 2 UV-5FM indicators, 2 funnel-shaped AR-5 aerials.

Functional description

This radio altimeter is operated by switching on the circuit-breakers marked "115 V - Inverter I" and "RV + MKR" situated on the main switchboard. A red warning flag on the indicator goes out of view and a zero value of altitude is indicated. Set the dangerous altitude index against required value on the dial by turning the knob situated on the right bottom part of the indicator. After the pointer has been moved to the position under the index, a sonic alarm /for about 7 sec./ is heard in the pilot's earphones and the tell-tale lamp, which is situated on the right bottom of the indicator, starts shining and the "dangerous altitude" indicator lamp situated in the left warning screen of the pilot will be flashing. The sonic alarm is dependent upon the dangerous altitude as set by the front pilot and is applied to both the cockpits simultaneously while the light indicator is individual in each cockpit depending upon the dangerous altitude aset on the respective instrument. The red flag reappears in case of a failure. It warns the pilot not to rely on the altimeter readings.

ARRANGEMENT OF RADIOALTIMETER



1. Receiver-transmitter
2. Receiving and transmitting aerials
3. Radio-altimeter indicator UV-5FM

FIGURE 4-8

A reading of 50 ± 5 ft will be indicated by the indicator on pressing the left "self-test" knob.
When in flight at altitudes greater than 2500 ft, the pointer is in the black tolerance area.

NAVIGATIONAL SYSTEMS /VOR/ILS/MKR/

General

The basic function of the VOR navigational equipment is to determine the aircraft position with respect to a VOR ground beacon and in distinguishing the flight path direction from or to that beacon.
ILS system gives the course and glide reading during the aircraft approach to land. Marker beacon receiver is used for determining the moment of passing outer, middle, inner/marker beacons. The output of VOR-ILS is applied to the indicators KPI 552 and KNI 582 situated in both cockpits; the output of MKR is applied to the warning screen situated on the right side of the instrument panel-lighting up of three lamps-blue, orange, and white ones. There is a simultaneous tone signal in the pilot's headset.
Each navigational system comprises :
receiver KNR 634; Control box KFS 564; GS-aerial LUN 3593.30-7 /one for both the systems/; NAV aerial LUN 3596 /one for both the systems; MB aerial KA-26/ one for both the systems, and antena adder DMH 21-1.

VOR/ILS SYSTEM - KNR 586

VOR

The VHF omindirectional Range /VOR/ is a radio facility used extensively for departure, enroute, and approach navigation. Distance measuring Equipment /DME/ may be installed with the VOR facility. Since VOR transmitting is working in the VHF frequency band, the signals are free of atmosphere disturbaces. VOR reception is limited to the line of sight and the usable range varies according to the altitude of the aircraft and the class of the station received. Station identification signals are supplied to the headset.

ILS

The instrument Landing System /ILS/ is a precision approach system that provides course slope guidance to the pilot. It consists of a highly directional localizer /course information/ and a glide slope transmitter with associated marker beacons, Compass locators, and at some sites DME. Localizer identification signals are supplied to the headset. The glide slope receivers is automatically tuned by selecting the localizer frequency.

VOR/ILS RECEIVER

The VOR/ILS receiver unit is divided into VOR/LOC receiver which operates in the VHF frequency band from 108 to 117.95 MHz /VOR/, 133 to 135.95 MHz /DME/ = 20 channels, and the glide slope receiver which operates in the UHF frequency band from 329.15 MHz to 335.0 MHz /ILS - 40 channels/.

NOTE:

VOR information is presented on the PNI /figure 4-11 / and the RMI /figure 4-12 /.
ILS information is presented on the PNI for detailed information refer to PNI and RMI this section.

VOR ILS CONTROLS AND INDICATORS

The system comprises the following control and indicators:

Frequency Display Window

This is a multiplexed gas discharge display that exhibits the Active and standby frequencies. The system incorporates an automatic dimming device throught a photocell. The selected VOR/ILS frequencies between 108 ant 117.95 are displayed on the frequency display window /figure 4-9 /. The Active frequency is displayed at the top while the standby frequency is displayed at the lower portion of the display window.

Frequency Selector Knobs

Two frequency selector Knobs /figure 4-9 / are provided to select the VOR/ILS frequencies. The larger knob will change the MHz /108 - 117 MHz/ portion of the display with a roll over at 108 MHz to 117 MHz and a roll under at 117 MHz to 108 MHz.

The smaller knob will change the KHz /00,95 KHz/ portion of the display with a roll over at 00 KHz to 95 KHz and a roll under at 95 KHz to 00 KHz.

Function Switch

This 2-position rotary switch /figure 4-9 / has the positions OFF and VOLUME. In the OFF position, the VOR/ILS, Marker and DME receiver are de-energised. In the VOLUME position, the receiver is energised and the audio reception level is increased with a further clockwise turn of the rotary switch.

Frequency selection

Frequency selection is performed either in the standby or in the active display modes. On the standby display entry mode, frequency selection is accomplished by pushing the smaller frequency selector knob in, and selecting the frequencies with the 2 frequency selector knobs. On the active display entry mode, frequency selection is accomplished directly on the active display by pulling the smaller frequency selector knob out, waiting until the standby display shows / figure 4-9 / and then entering the desired frequency. The receiver will remain tuned to the frequency displayed in the Active window at all times.

Transfer Button

The transfer button /figure 4-9 / is used in transfering the standby display to the Active display by momentarily pressing the button. The Active display will revert back to standby display.

VOR/ILS, MARKER OPERATION

1. Turn the function switch to VOL-check display window illuminated with Standby and Active frequencies.
2. Select desired VOR/ILS frequency either directly on the Active display or on the Standby display and transfer the standby display to Active display.
3. Select the ADF/VOR change over knob to VOR. Check the NAVIGATION warning flag on PNI disappear.
4. Set the desired volume level for station identification.

MARKER EQUIPMENT MRP-56 PS

MARKER beacons are very low powered, 75 MHz transmitters located along the ILS final approach course to provide fix position information. The beacons are identified by the aircraft visually /Marker beacon light/ and aurally /tone in headset/. The reception area of the aural signal is larger than that of visual signal.

MARKER BEACON RECEIVER

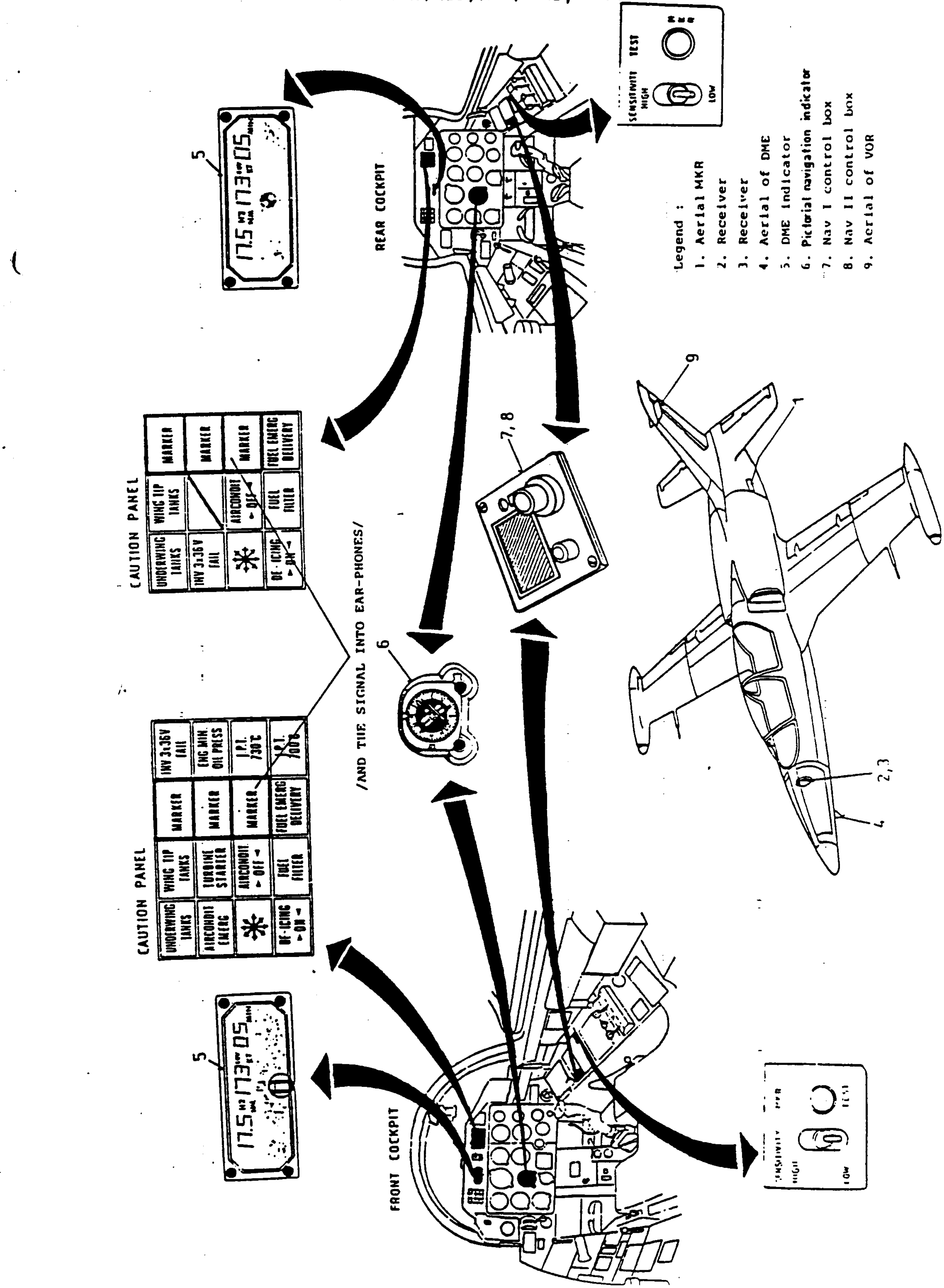
The marker beacon receiver unit operates on fixed frequency of 75 MHz.

This frequency amplitude is modulated to indicate an

- Outer Marker by 400 Hz
- Middle Marker by 1,300 Hz
- Inner Marker by 3000 Hz

Visually on the marker lights and aurally in the headset.

ARRANGEMENT OF NAV, ILS, MKR, DME, SYSTEMS



MARKER CONTROLS AND INDICATORS

Following controls and indicators are provided to operate the marker equipment.

Sensitivity Switch /Fig. 4-9/

Marker Beacon Lights /Fig. 4-9/

DME SYSTEM KDM 706

The distance measuring equipment /DME/ is an airborne avionics System which comprised a transmitter, a receiver, a computer, and a display that continuously measures the slant range between an airplane in flight and a ground station and displays this information to the pilot in terms of nautical miles. The DME utilizes the DME portions of a VOR/DME or localizer Stations. By combining the distance information derived from the ground station with the bearing information obtained from the co-located VOR station, the pilot can fix his position. The DME provides an audio output for the international morse code signal by wich the ground station identifies itself at approximately half-minute intervals.

DME TRANSMITTER/RECEIVER

The DME transmitter operates in the UHF frequency band from 1025 to 1150 MHz and the receiver from 962 to 1213 MHz. The transmitter receiver is tuned by the VOR control unit. The selected VOR/ILS frequency is automatically paired with the corresponding DME channel. There are 200 DME channels paired with the V UHF nav frequencies between 108.95 MHz and 117.95 MHz and 52 channels between 133.50 and 135.95 MHz. The transmitter/receiver computes the distance to the station by measuring the elapsed time between transmit and reply pulse pairs.

DME CONTROLS AND INDICATORS

The DME system is composed of the Master Indicator located on the right side of the gunsight, above the instrument panel in the front cockpit and the slave indicator located above the instrument panel in the rear cockpit.
The master indicator provides the ability to select NAV 1 /front cockpit/ or NAV 2 /rear cockpit/ as the DME frequency control source while also providing the Hold and ON-OFF functions. The indicator features simultaneous display of distance, ground speed and time to station on a high visibility gas discharge display. The display is automatically dimmed to adjust for a broad range of ambient light level.

Function Switch

The function switch / figure 4-14/ is a four position switch with the following positions:

- OFF

  In this position, the system is de-energised.
- N 1

  The DME source is from VOR/ILS Frequency selected in the front cockpit.
- HOLD

  In the HOLD position, the DME channel selection is disconnected from the selected NAV 1 or NAV 2 radio set so that the DME can remain tuned to a previously selected ground station regardless of subsequent frequency selection.
  "1 H" or "H 2" is displayed to indicate the channel source being held.

- N 2

  The DME source is from VOR/ILS frequency selected in the rear cockpit.

NOTE:

In the HOLD mode, "dashes" will be displayed while in search or when power is momentarily interrupted do indicate loss of DME holding frequency.

For normal operations a "1" when N 1 is selected or a "2" when N 2 is selected is displayed as the channel source of DME. The indicator displays range to the nearest nautical mile from 0 to 99.9 Nm and to the nearest one nautical mile from 100 - 389 NM. Ground speed up to 999 knots and time-to-station up to 99 minutes are displayed to the nearest one knot and minute respectively.

ADF SYSTEM KDF 806

The radio compass low frequency radio receive is capable of Automatic Direction Finding /ADF/. The KDF 806 will receive ~~any frequency between~~ 190 and 1749.5 MHz. It is used for plotting positions, homing, listening to weather broadcasts or commercial radio Stations in AM broadcast band.
It ~~automatically determines~~ the bearing to any radio station within its frequency and sensitivity range for navigation purposes which will be indicated on the PNI and RMI. The ADF system comprises an ADF receiver, two control units; one in each cockpit on the right console, and an antenna system consisting of a loop and a sense antenna. The system is powered by "Inverter III".

ADF CONTROL UNIT

The ADF display window contains a multiplexed gas discharge display that exhibits the active standby frequencies in its frequency mode of operation. In channel mode it exhibits channel number and frequency and in Programme mode, it exhibits programme channel number and frequency.

Mode Selector

The mode selector is rotary switch / figure 4-10 / which has the positions OFF and VOLUME. When in the VOL mode, the rotary switch has ANT, BFO and ADF modes when pressed. All the modes are displayed in the frequency/channel display window.

OFF - The system is de-energised.

VOL - The system is energised with control of audio level.

ANT - The loop antenna is disabled and the unit acts as a receiver, allowing audio reception. The indicator needles are parced at 90^{o} relative positions. The mode provides slightly clearer audio reception.

BFO - Beat frequency Oscillator is for identifying stations that uses an interrupted carrier for identification. The mode causes a 1000 Hz to be beard whenever there is a radio carrier signal present at the selected frequency.

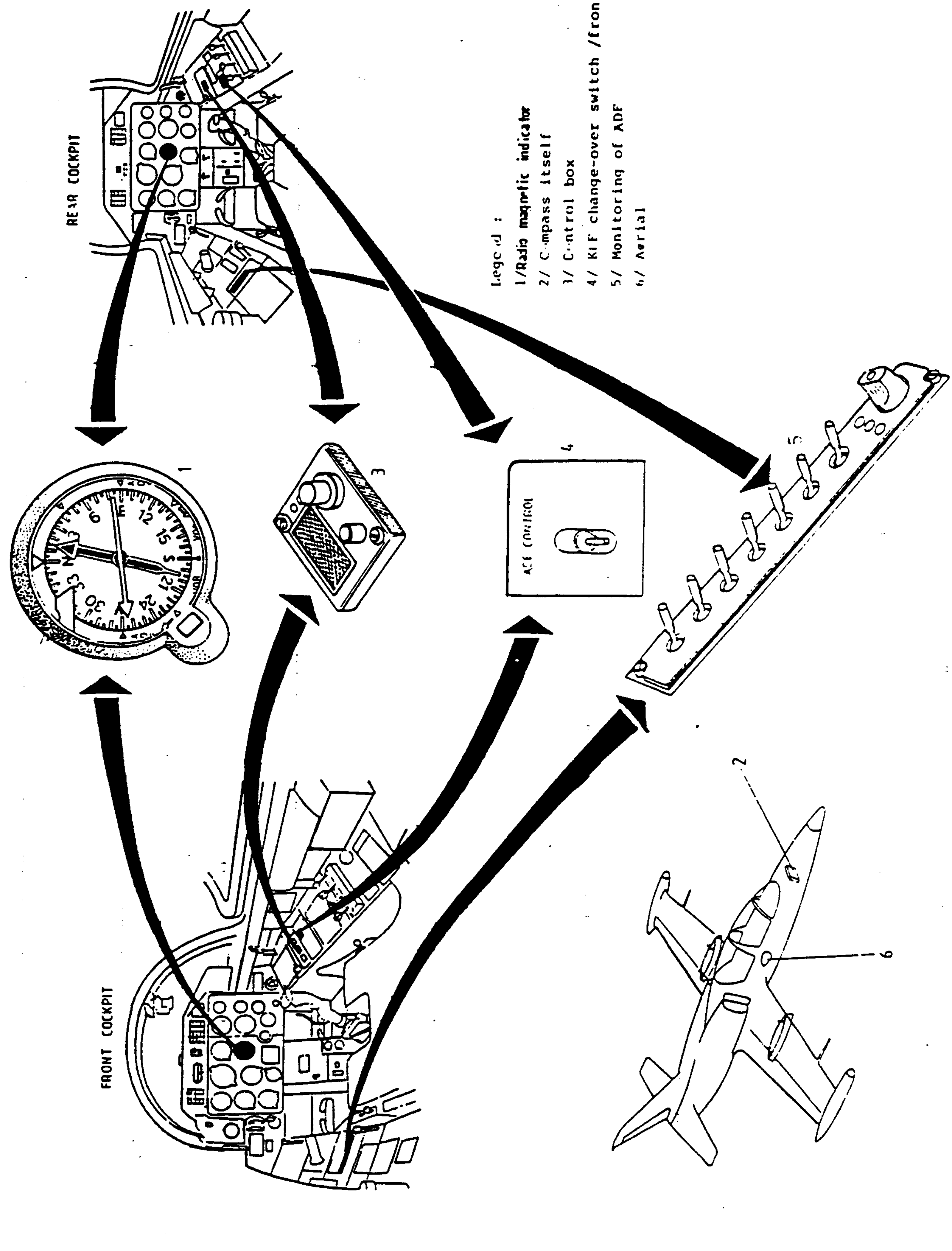
ADF - The loop and sense antenna is enabled.

FREQUENCY CONTROL

Active Entry

The Active frequency is displayed on the top portion of the display. Frequency selection is carried out directly on the Active display by pressing the transfer button longer than 2 sec; this will cause the standby display to go out. The Active frequency can now be controlled by the frequency selector knobs. The outer knob selects the 100'KHz from 1 to 17, with roll over from 1 to 17 and roll under from 17 to 1. The inner knob selects 10'KHz when pushed in and 1's KHz when pulled out.

ARRANGEMENT OF ADF SYSTEM



Standby Entry

The Standby frequency is displayed on the lower portion of the display. The frequency is selected by using the frequency selector knobs. Standby frequency tuning does not affect the Active frequency. Depressing the Transfer button momentarily will cause the standby frequency display to move to the Active /Upper portion/ and the Active frequency to revert to the standby /Lower portion/ of the display.

NOTE:

Any time the frequency displayed is below 190 KHz, the display flashes. The small "x" character to the left of the Active frequency disappears when in the ADF or ADF/BFO modes and the ADF needle is pointing.

Channel Mode

- Momentarily press chan button.
- Last used chan number will be displayed and the chan freq is displayed on the standby display.
- Check the validity of the frequency. If the frequency is not valid or the station is off the air, it will tune to the last Active frequency.
- When there is no programmed chan, CH 1 and dashes will be displayed.
- Use the frequency selector knobs to change the channels.
- Momentarily press the chan button to return to frequency mode; the Active/Standby frequencies before chan mode remain unchanged.

Program Ode

- Press and hold chan button longer than 2 sec
- The letter "p" will appear and channel number flashes
- The ADF receiver remains tuned to the last Active frequency
- Select desired chan using the freq selector knob
- Press Transfer button for the chan number to stop flashing and frequency to flash

- Select desired chan frequencies on the Standby flashing display
- During frequency roll over or under, dashes will be displayed leaving the dashes in the display unprogramms the chan when leaving Program Mode.

NOTE:

The unit returns to the mode and freq in use prior to program mode by momentarily pressing the chan button or if there is no activity for 20 sec after entering the Program mode. Taking over ADP control in both cockpits is by means of change-over switch labelled "ADF CONTROL" located next to the control boxes. The ADP system range is 81 Nm at a height of 3280 FT and 133 NM at a height of 16,4000 Ft.

PICTORIAL NAVIGATION INDICATOR /PNI/ /fig 4-11 /

The PNI, located on both main instrument panels /figure 4-9 / displays aircraft heading, selected course and navigational bearing data. It consists of a rotating compass card a bearing pointer and 2 Warning flaps.

Heading Marker and Head Se knob

The heading marker may be positioned about the compass card by use of heading set knob. Once positioned, the marker remains fixed relative to the card.

Course Arrow, Course set knob and Course Deviation Indicator:

The course arrow may be positioned about the compass card by use of the course set knob. Once positioned, the course arrow remains fixed relative to the compass card. When the course arrow is set, it will remain aligned /Parallel/ either the radial or localizer course selected providing the compass card is slaved to the magnetic north. The Course deviation indicator, which consists of the centre section of the course arrow, indicates lateral and angular displacement from the selected

Vor or localizer course. Each dot or the CDI scale represents 2° of VOR and 0.50 of localizer.

NOTE:
When the aid selector knob is on ADF, the CDI will still indicate relative to VOR or localizer signals selected on the VOR display unit.

BEARING POINTER

The bearing pointer indicates correct magnetic bearing to selected VOR or ADF station when the compass card is functioning in the slaved mode. With compass malfunction, the bearing pointer will still indicate the aircraft radial with respect to the selected VOR or ADF station. When there is malfunction in both the bearing pointer and compass, the CDI may be used to find magnetic headings to a VOR station by centering the CDI with a "to" indication, and flying the course using the standby compass.

TO/FROM INDICATOR

The to/from indication functions only for VOR. If the course deviation indicator is centred when the "to/from" reading is taken, it will immediately indicate whether the course selected, if intercepted and flown, will lead "to" or "from" the station. A "to" indication is presented when the "to/from" indicator appears on the same side of the instrument as the HEAD of the Course Arrow and conversely a "from" indication is presented when the indicator appears on the same side of the instrument as the TAIL of the course arrow.

AIRCRAFT SYMBOL

The aricraft symbol is presented at the centre of the PIN and is fixed relative to the instrument. Comparison of the

PICTORIAL NAVIGATION INDICATOR

KPI 552

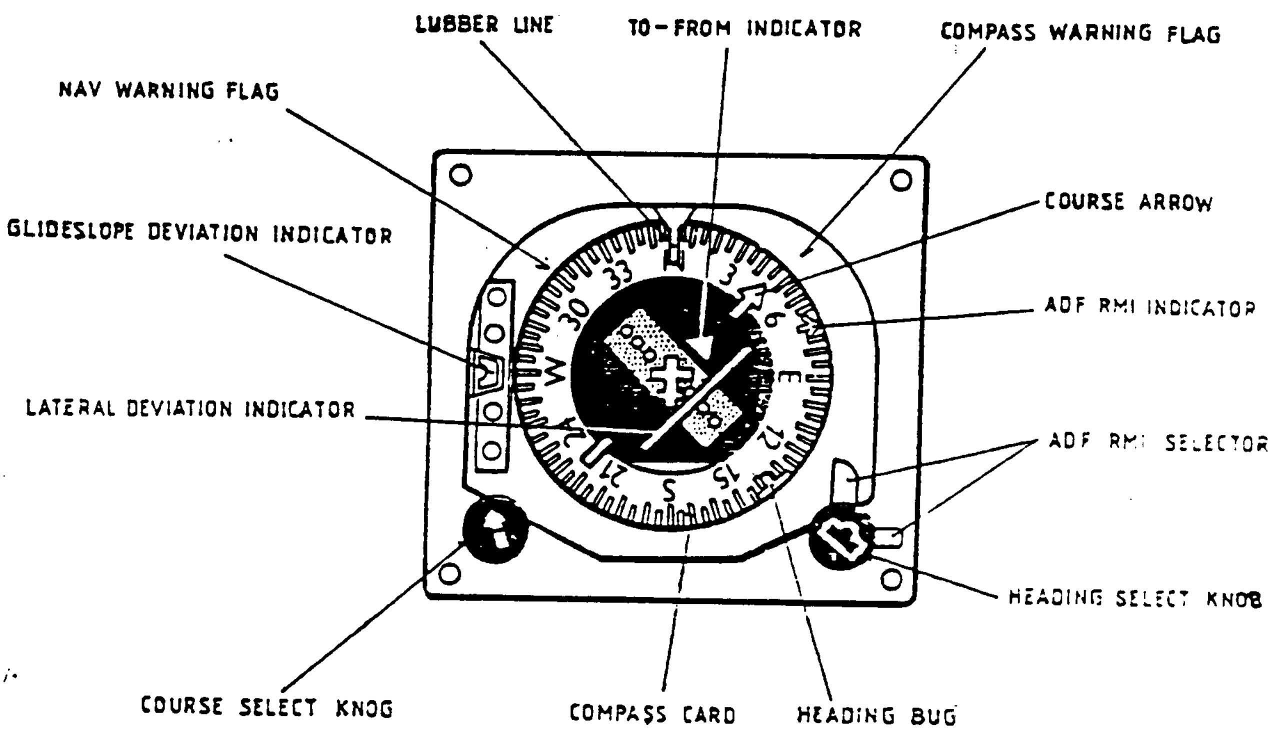


FIGURE 4-11

RADIO MAGNETIC INDICATOR

KNI. 582

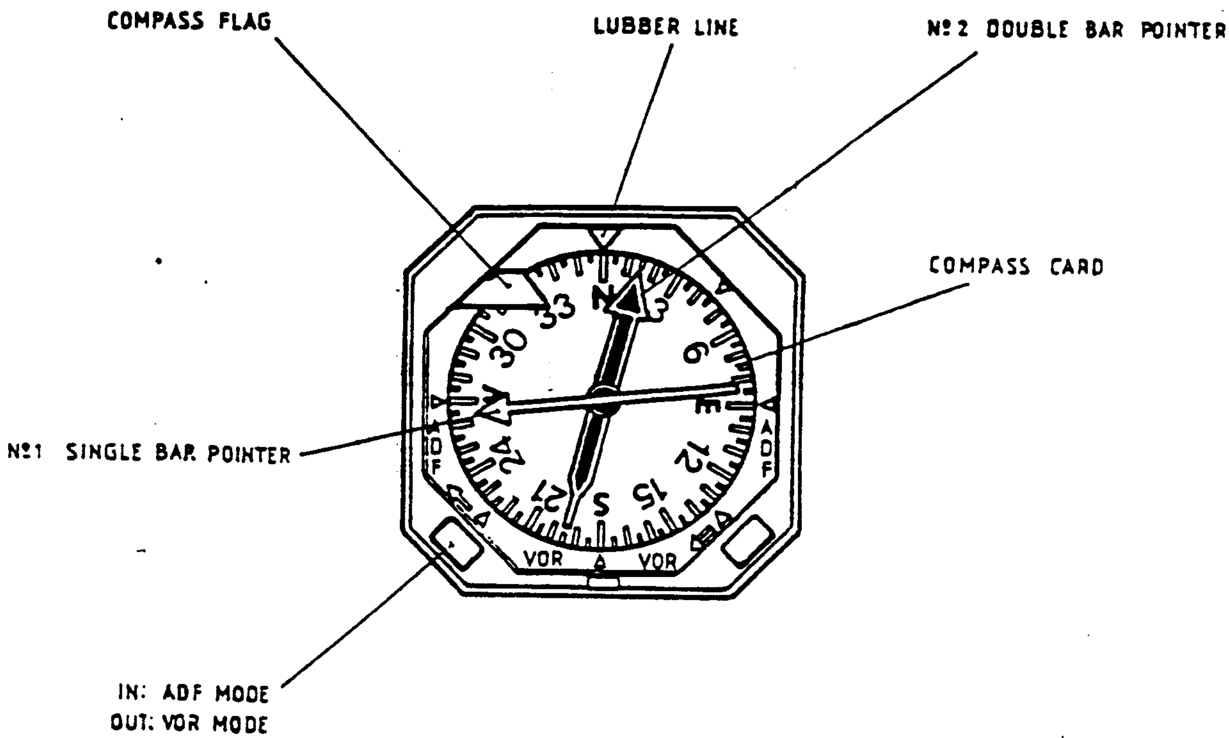


FIGURE 4-12

aircraft symbol with the compass card, course deviation indicator, and heading marker will give pictorial view of the angular relationship between the aircraft and the selected information.

RADIO MAGNETIC INDICATOR

Refer to AFM 31-37 for indications and operations of the RMI /figure 4-12/. The instrument consists of 2 bearing pointers and a white NAV/ADF selector button. The white NAV/ADF selector button controls the indications of the green pointer. When the NAV/ADF selector button is momentarily pressed, and the arrow in the left lower portion of the instrument is pointing to ADF, the green pointer points to the ADF station selected either in the front or rear cockpit depending on the cockpit with the control of the ADF and when the arrow is pointing to NAV the green needle points to the selected VOR station in the cockpit. The orange needle is always pointing to the VOR station selected in the other cockpit. The compass flag will come into view whenever the heading in invalid or the indicated heading has an error of 5° or more.

IFF/SIF SYSTEM KXP 756

Identification, Friend or Foe/selective Identification Feature /IFF/SIF/ provides a secondary surveillance radar capability which permits the aircraft to be reliably tracked through ground clutter and/or precipitation. In addition, it provides a positive means of identifying the aircraft to the airtraffic or radar controller. An altimeter encoder automatically transmits the altitude of the challenged aircraft. The interrogator responder transmits a pulse signal to the aircraft, which if friendly, receives and decodes the signal and then produces a reply by means of a pulse receiver transmitter known as transponder provided the respective mode is switched on the KXP 756 transponder, upon receiving Mode A, Mode B or Mode C interrogations, transmits coded returns that identify the aircraft by code number and or report the altitude at which the aircraft is flying. The range is 52 Nm at 3000′ and 100 NM at 16000′.

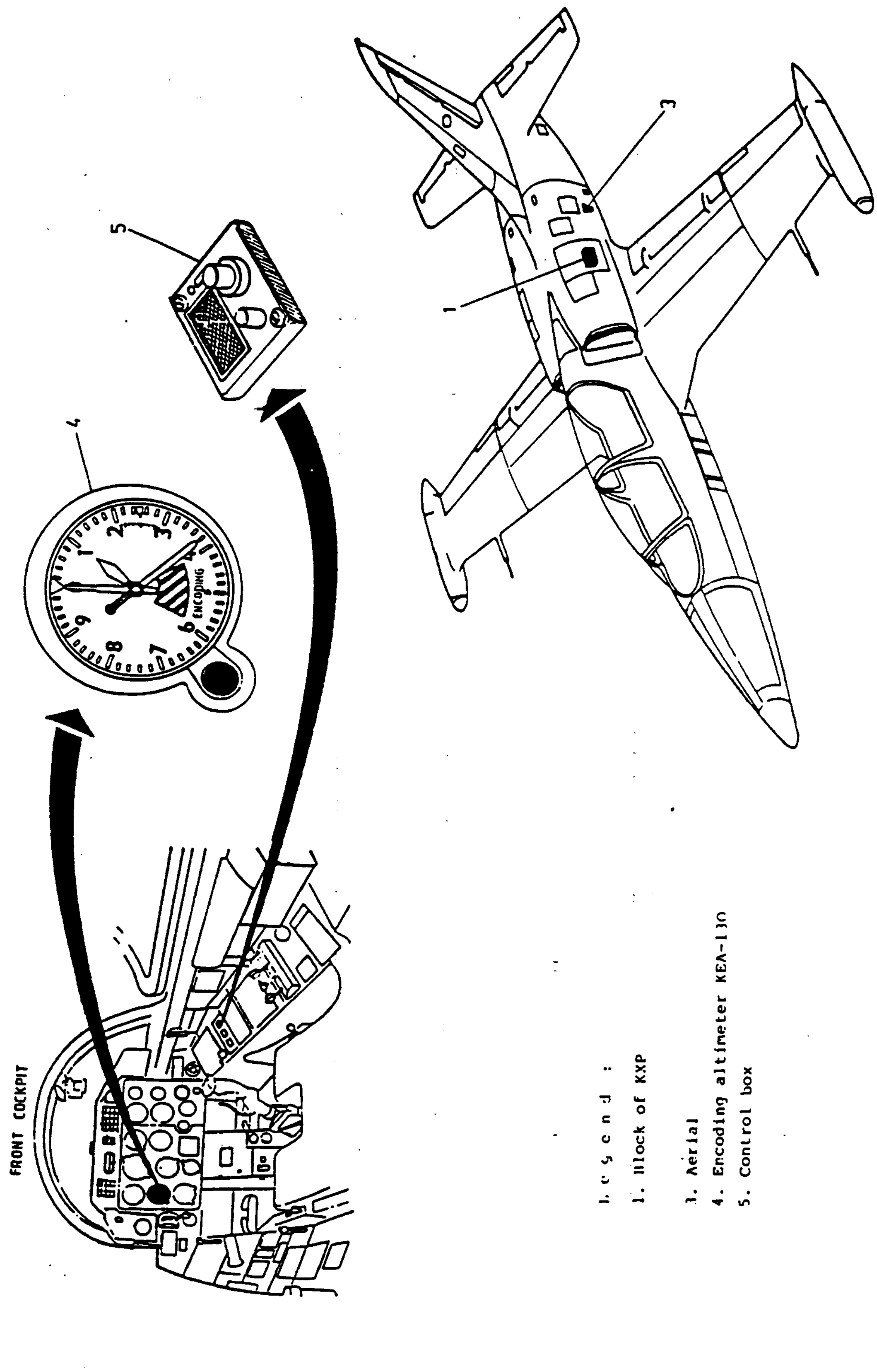
IFF/SIF CONTROLS

The IFF/SIF control panel /fig. 4-13 / is located on the right console in the front cockpit. The panel provides cockpit control of all the modes of operation.
The function mode selector is a 5-position rotary knob. The knob turns the transponder system on by rotating the knob from OFF to the SBY position.
When the selector is in the ON position, the transponder replies to both mode A nad C interrogations without flight level information and when in ALT position flight level information is transmitted.
In the TST position, it causes an "R", reply indicator to flash or illuminate continuously and the flight level with the letters "FL" will be displayed. The flight level display read out is in hundreds of feet. The function mode is displayed with either SBY, ON, ACT, IDT on the lower portion of the display window.

Code Selector Knob

A code selector knob is provided on the right lower portion of the control unit. Momentarily pressing the code selector knob moves a cursor /a small arrow/ under the displayed code digits from left to right-one at a time. Rotating knob clockwise or counterclockwise changes the numerical value of the digit under which the cursor is placed. Holding the code selector knob pressed for more than 3 sec causes the code to automatically change to 1200 or the programmed code.

ARRANGEMENT OF IFF/SIF SYSTEM



Legend :

1. Block of KXP
3. Aerial
4. Encoding altimeter KEA-130
5. Control box

FIGURE 1-[illegible]

The code can be programmed following the steps below:

a/ Place function selector to SBY.

b/ Select desired code.

c/ Push the IDT and the cursor buttons simultaneously.

The code is now programmed into memory and will appear whenever the cursor is pushed and held for 3 sec.

Identification button

The Ident button when pressed momentarily and then released, holds the IDENT reply for approx 25 sec. The IDT nomenclature will be displayed on the display window.

Photocell

An automatic dimming photocell adjusts the brighteness of the displayed data and nomenclature to compensate for changes in the ambient light level.

GYROMAGNETIC COMPASS KCS-305

Power for the gyromagnetic compass KCS-305 is ensured via "AGD-KCS" switch /A 27/ along with the
"INVERTER II" /A 34/ and
"INVERTER III" /A III/
all situated on the main switchboard.

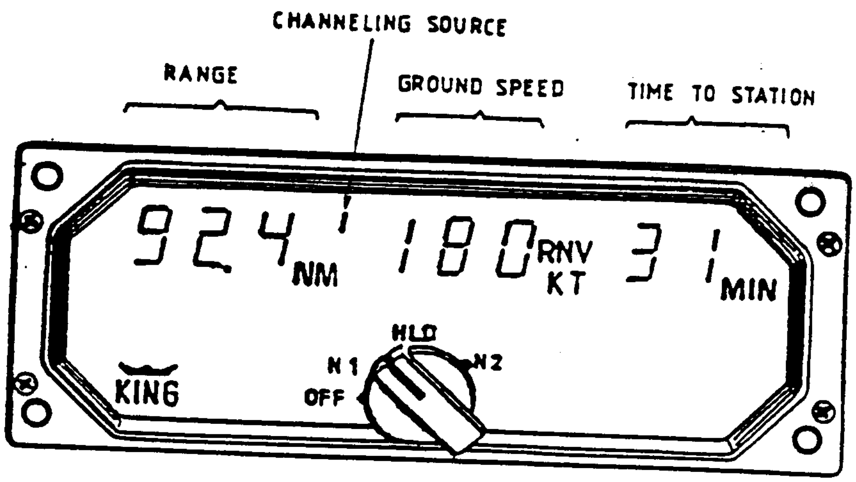
Magnetic course info are brought to combined indicators KPI-552 and KNI-582 which are situated both on the front and rear instrument board. Compass error shall not exceed $\pm 2^{o}$. Before take off, compass error must be removed. To train students in identifying failures of instruments, an artificial introduction of errors into instrument is achieved by means of the change-over switch L 12 situated on the central pedestal in the rear cockpit. By means of that switch two phases of compass KCS-305 transmission are mutually interchanged.

Note :

After performing advanced manoeuvres, the gyroscope may be dragged off. On indicators KPI and KNI in both cockpits flags "COMPASS" will appear and the indicator KA-51B will read deflection of division lines. After the aircraft is back in straight and level flight, the flags will disappear. In this case, in straight and level flight, it is obligatory to carry out alignment of the system quickly : i.e. take up the lever of the change-over switch and set the change-over switch in the position "FREE" and then back in the position "SLAVE". Flags "COMPASS" will appear on the indicators and the system will get aligned quickly after which the flags will disappear. The division lines will now square on another. After that readings of the compass will be true.

DME DISPLAY UNIT

MASTER DISPLAY UNIT



SLAVE DISPLAY UNIT

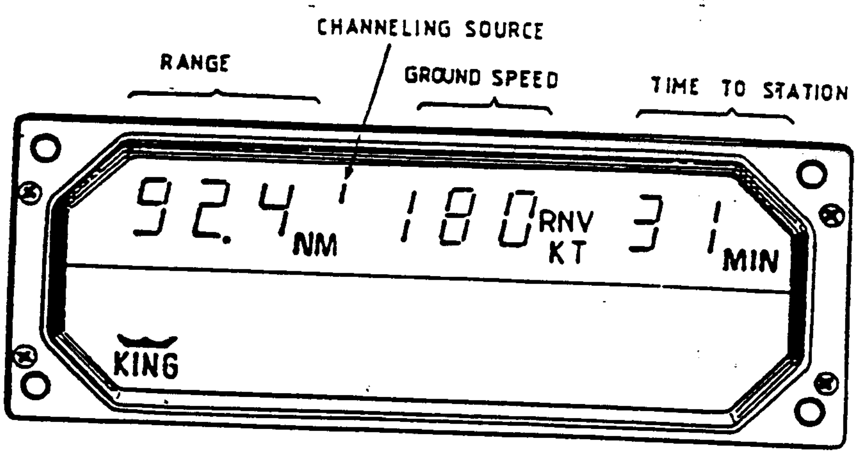


FIGURE 4-14

DME DISPLAY UNIT

The DME display unit /figure 4 - 14 /is located on top of the instrument panel in the front cockpit and on the instrument panel in the rear cockpit and provides the following controls and indication elements:

Display Window

The readout appearing in the display window /figure 4 -14 / consists of four LED /Liquid Emitting Diode/ digits. The distance readout additionally contains a decimal point to indicate tenth of nautical miles.
Depending upon the function selector button being depressed, the readout indicates distance /NM/, time to station /minutes/, or ground speed /KTS/.

NAV 1 - HOLD - NAV 2 Selector Switch

This selector switch / figure 4 -14 /is used to select either VHF NAV 1 or VHF NAV 2 radio set.
In the HOLD position, the DME channel selection is disconnected from the selected VHF NAV radio set so that the DME can remain tuned to a previously selected ground station regardless of subsequent frequency selection.

LIGHTING EQUIPMENT /Fig 4- 15/

The aircraft lighting equipment consists of the exterior and interior lighting.

EXTERIOR LIGHTING

The aircraft exterior lighting equipment consists of the following lights:

- two landing lights
- two taxi lights
- one left /red/ position light
- one right /green/ position light

- one /white/ tail position light
- one /white/ landing gear down light on each landing gear

LANDING LIGHT/TAXI LIGHT

A combined landing/taxi light is mounted to the tip of each Wing-Tiptank. The difference between these lights is that the landing beam covers a larger allround pattern.
A microswitch switches off the taxi lights automatically when the gear is retracting. When switched to position "Landing Light" the landing lights remain ON independent of the position of the landing gear.

POSITION LIGHTS

A red position light is located on the left Wing-Tiptank, a green light on the right Wing-Tiptank and a white position light is installed at the upper end of the vertical stabilizer.

LANDING GEAR DOWN LIGHTS

A landing gear down light /white/ is mounted on each landing gear strut. The lights are automatically switched on by a microswitch when the landing gear is extended in the locked down position, provided that electrical power is available and the navigation light switch is either in FLICKER or FIXED LIGHTING position.

EXTERIOR LIGHTING CONTROLS

The exterior lighting is controlled by two navigation light switches on the right console in the front cockpit.
One three-position switch controls the intensity of the navigation lights. An intensity of either 30%, 60% or 100% is selectable.

EXTERIOR LIGHTING

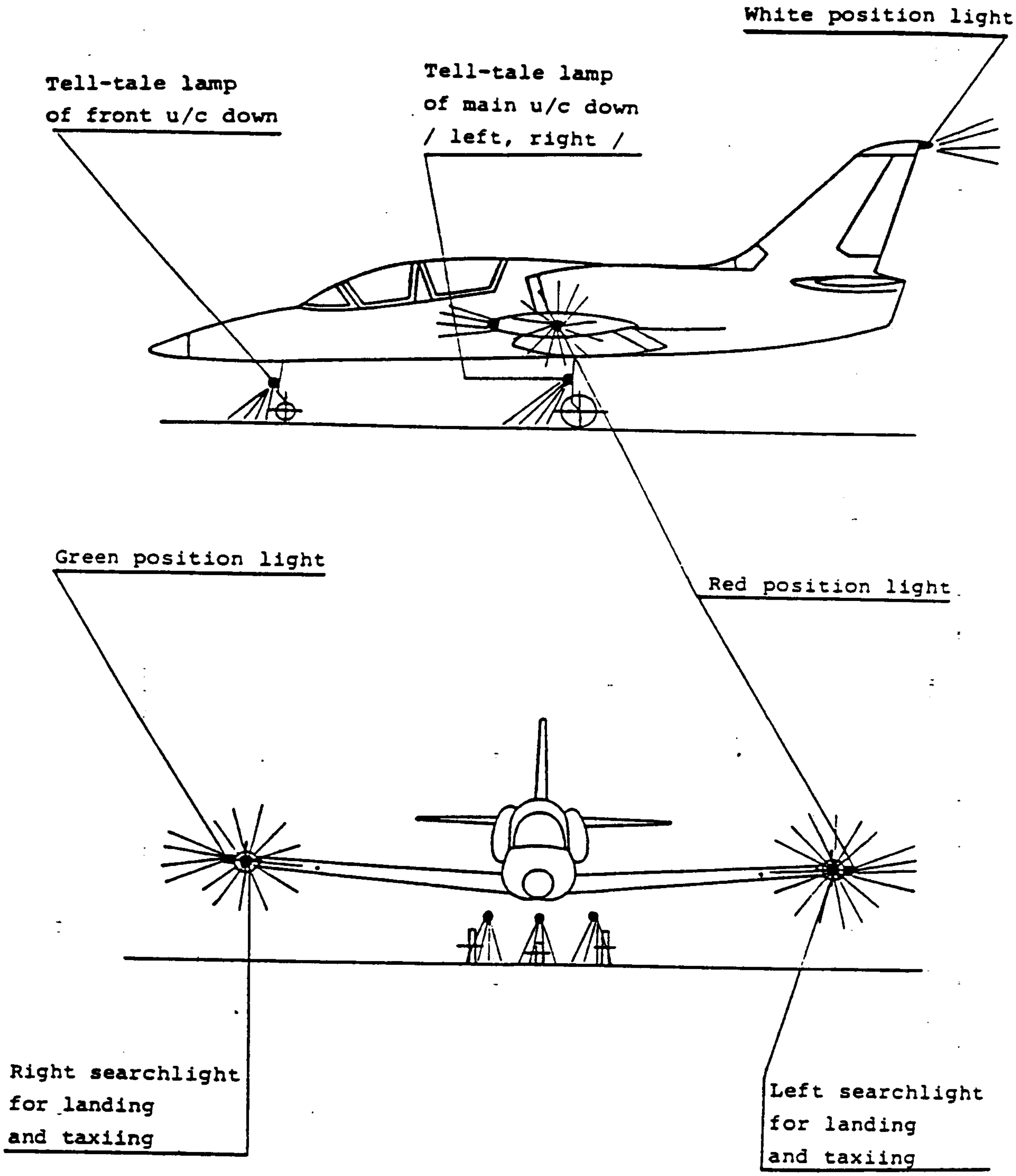


Figure 4 - 15

With the other three-position switch the navigation lights can be set to flashing /flicker/, steady /fixed lighting/ mode or to OFF /center position/.
The navigation lights are protected by the NAVIG LIGHTS/HAND LAMP C/B on the C/B-panel in the front cockpit.

LANDING LIGHT/TAXI LIGHT SWITCH /F/C + R/C/

A three-position control switch is situated above the front part of the left console in both cockpits.
The forward position activates the landing lights, the rearward position the taxi lights.
The center position is the OFF position.
The landing and taxi lights are protected by two circuit breakers labelled SEARCHLIGHT PORT and SEARCH LIGHT STARB on the C/B-panel in the front cockpit.

INTERIOR LIGHTING

The interior lighting of the aircraft consists of two separate circuits for both cockpits - the main /red lights/ and the auxiliary circuit /white lights/.
In case of a failure in the main circuit, /RED/ the system automatically switches to the auxiliary circuit /white/.

COCKPIT INTERIOR LIGHTING + CONTROLS

Both cockpit interior lighting consists of the following components:

Front Cockpit:
- Individual instrument lights
- 6 Console lights /red + white bulbs/
- 1 Center Pedestal light /red + white/
- 1 Emergency light /white/
- 1 Compass light
- 1 Socket for a portable lamp

Rear Cockpit:

- Individual instrument lights
- 4 Console lights /red + white bulbs/
- 1 Center Pedestal light /red + white/

INDIVIDUAL INSTRUMENT LIGHTS

Every instrument on the instrument panel in both cockpits is equipped with red and white bulbs for indirect illumination. The instrument lights are controlled by the instrument ligh-tinq switch and a rheostat situated abovc the left console in the front cockpit. For the rear cockpit the instrument lighting switch and rheostat are situated on the front part of the left console.

The instrument lighting switch has three positions:

- Center - OFF position
- Forward - Red instrument lights /bulbs/ are illuminated
- Rearward - White instrument lights /bulbs/ are illuminated

A rheostat is situated in front of the instrument lighting switch to regulate the intensity of the instrument lights. Turning the rheostat CW increases the intensity.

The instrument lights are protected by two circuit breakers on the C/B panel in the front cockpit.

They are labelled COCKPIT LIGHTING RED + COCKPIT LIGHTING WHITE.

CONSOLE LIGHTS

Two console lights are installed on the left side and four on the right side below the canopy rail in the front cockpit. Each light contains a red and a white bulb.

In the rear cockpit two of the same type of console lights are installed on each side below the canopy rail.

The console lights are controlled and protected by the same instrument lighting switch, rheostat and circuit breakers as the instrument lights.

CENTRE PEDESTAL LIGHT

This light is a similar type as a console light and is mounted on each control stick below the stick grip.
The light is controlled and protected as the instrument and console lights.

EMERGENCY LIGHT

A tiltable white emergency light is mounted on the lower left part of the gunsight. Its function is to illuminate the airspeed indicator, artificial horizon, altimeter and PNI in case of Main and auxiliary circuit failure /Red + white lights/.
The emergency light is controlled by the emergency light switch situated left of the optical sight.

COMPASS LIGHT

A lamp /bulb/ illuminates the scale of the standby magnetic compass in the front cockpit. The intensity is controlled by a photo-cell.

SOCKET

A socket for a portable lamp is provided right of the rear wall of the front cockpit.

INTEGRATED LIGHTING

Indirect illumination is achieved by lights integrated in the following control panels:
- DME control panel /F/C/
- VOR control panel /F/C + R/C/
- ADF control panel /F/C + R/C/
- Transponder control panel /F/C/
- HF control panel /F/C/

The light intensity of these control panels are controlled by a photo-cell on each of the control panels.

INTERIOR LIGHTING OF F/C

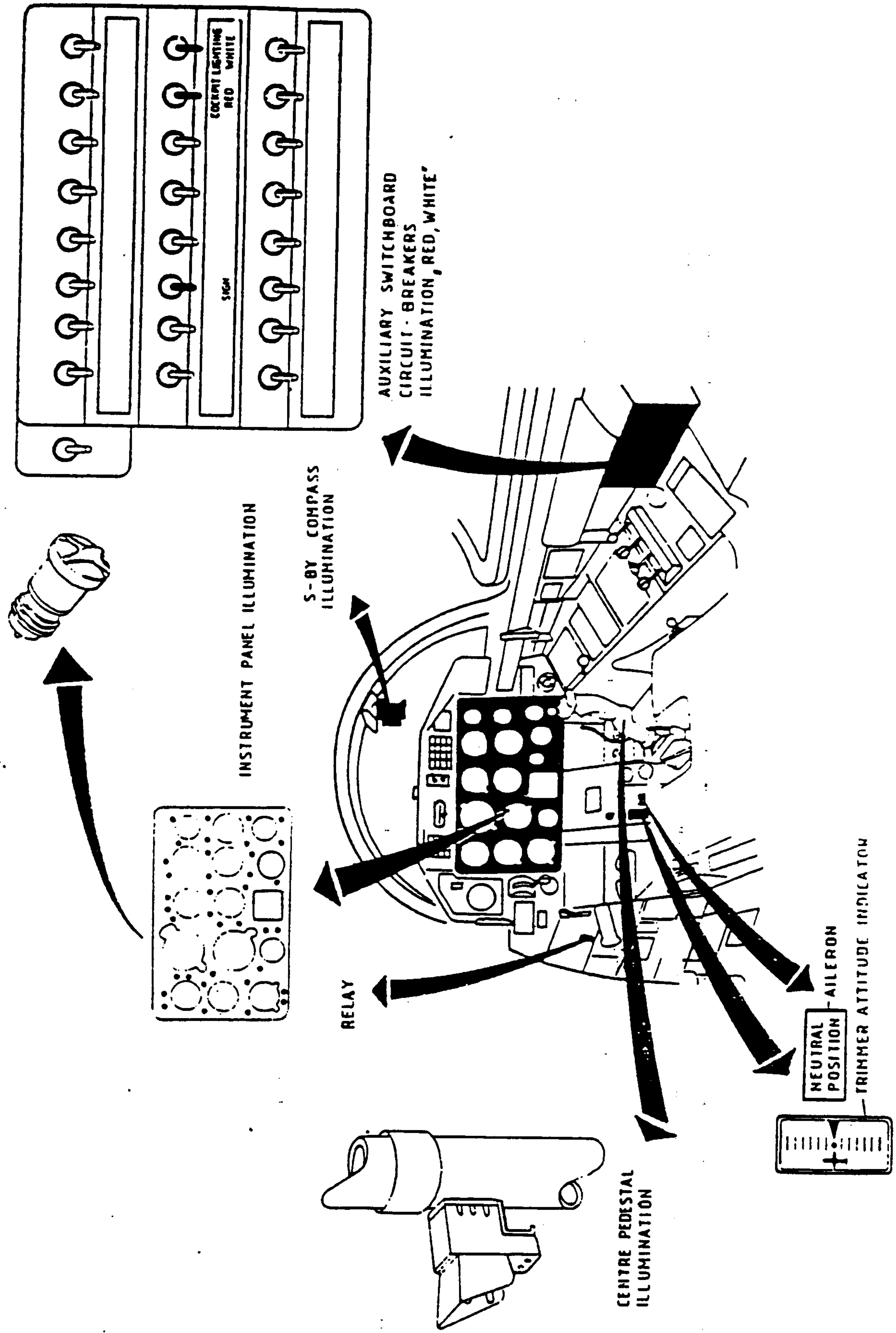


FIGURE 4-16

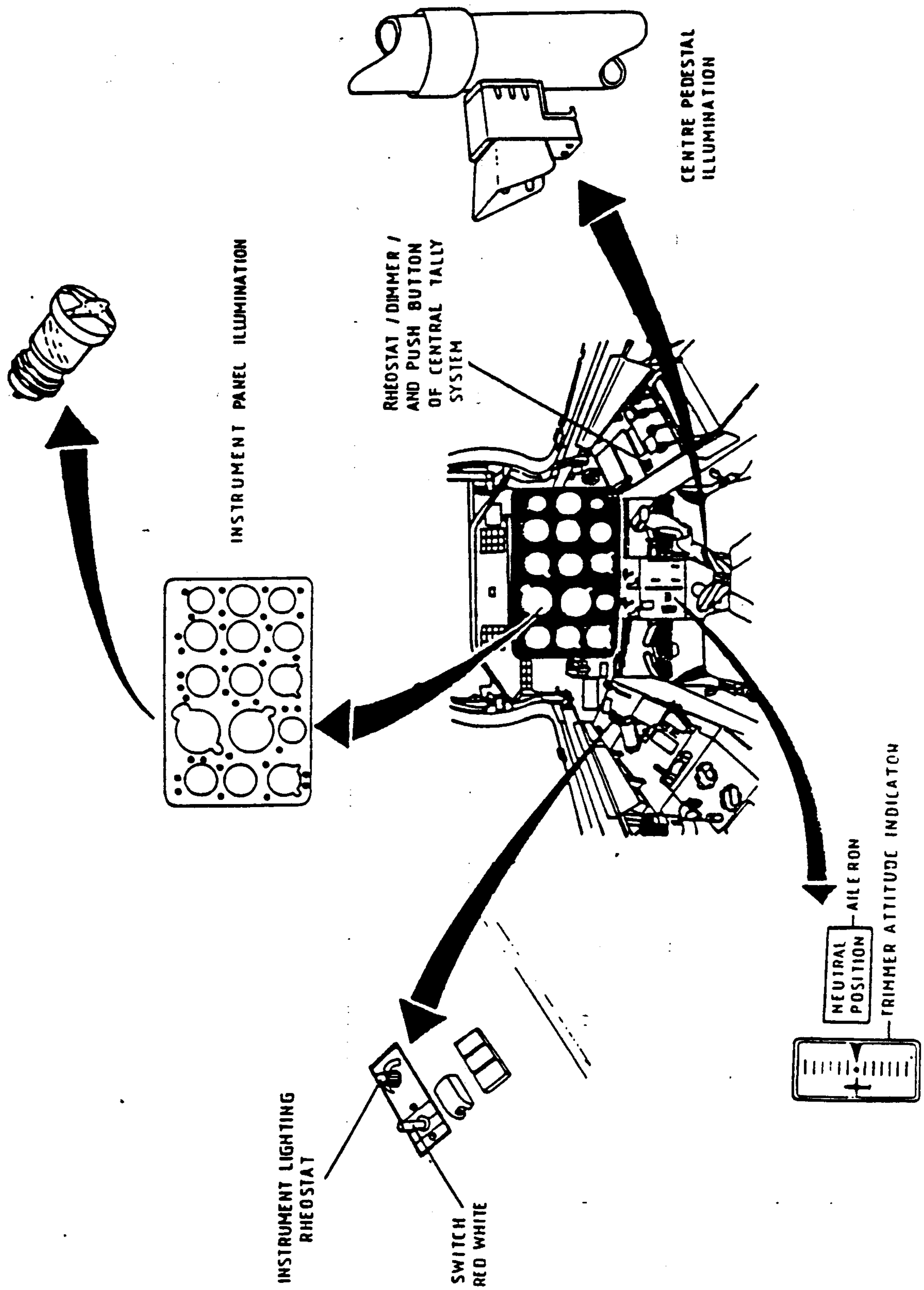

CENTRE PEDESTAL ILLUMINATION
RHEOSTAT / DIMMER / AND PUSH BUTTON OF CENTRAL TALLY SYSTEM
INSTRUMENT PANEL ILLUMINATION
NEUTRAL POSITION
AILERON
TRIMMER ATTITUDE INDICATOR
INSTRUMENT LIGHTING RHEOSTAT
SWITCH RED WHITE

FIGURE 4-17

DIMMING RHEOSTAT

Dimming of the following items is accomplished by the dimming rheostat situated on the right console in each cockpit:

- Master caution light
- All warning, caution and advisory lights
- Landing gear electrical indicator panel
- Flap electrical indicator panel
- Trim indicators

Dimming through the full intensity range is possible in five stages.

OXYGEN SYSTEM /Fig. 4-18 /

The aircraft is equipped with an oxygen system which is divided into a high and a low pressure circuit. The system utilizes four four-litre cylinders and two 2-liter installed in the nose section of the aricraft and an emergency oxygen container located in the seat pack of the parachute.

Each pilot is supplied by a separate pressure line. However, the systems are interconnected so that the oxygen from one system may be used in the other one. A pressure reducer in each circuit provides a reduced oxygen pressure to the diluter demand regulator. The oxygen mask can be connected directly to the LP oxygen system without using the emergency oxygen equipment.

HIGH PRESSURE OXYGEN SYSTEM

The HP Oxygen System consists mainly of the oxygen cylinders, check valves, the pressure reducer, and the HP oxygen indicators.

Oxygen Cylinder

Four oxygen cylinders with four litres each and two Cylinders with two litres each are filled by the oxygen filter valve.

Check valves

Six T-piece non-return valves are installed in the HP part of the oxygen system to prevent back flow of the oxygen.

HP Oxygen Gauge

A HP oxygen gauge is located on the forward left console in each cockpit /fig. 4-18/ to indicate the pressure of the HP oxygen System. The scale is graduated from 0-160 kp/cm^2 /0÷2276 PSI/. Normal System pressure is between 30 and 150 kp/cm^2 /427÷2133 PSI/. The flow indicator is in the lower part of the instrument. The front cockpit is also provided with a helmet pressure indicator by the left side of HP oxygen gauge.

LP OXYGEN SYSTEM

The LP oxygen system consists mainly of the diluter demand regulator. The diluter demand regulator provides an oxygen/ air mixture in proportion to a given altitude. If carries the following controls to operate the system.

Oxygen shut-off Valve

The oxygen shut-off valve has the positions CLOSED and OPENED. The valve when turned CCW opens the oxygen supply system.

Diluter Demand Switch

The diluter demand switch has the positions 100 % and MIXTURE. In the MIXTURE position, an air-oxygen mixture is provided by the regulator depending on flight altitude. In the 100 % position pure oxygen is delivered.

Emergency Switch

The red background switch has the positions OFF and ON. For normal operation the switch is set to OFF. In the ON position the oxygen-air mixture is delivered with pressure to the oxygen mask, depending on cabin altitude.

FLOW Indicator

The Flow indicator is provided to indicate proper Oxygen flow. During normal operation the blinker indicates a double butterfly white flags and blank when inhaling. In the emergency ON position, the blinker indicates open /white flags disappearing/.

NORMAL OPERATION

1. High pressure shut-off valve - Open /ccw/
2. Dilute demand switch - MIXTURE
3. Emergency Switch - OFF

EMERGENCY OPERATION

If Symptoms of hypoxia are suspected:

1. Diluter demand switch - 100 %
2. Emergency switch - ON

EMERGENCY OXYGEN SYSTEM

The emergency oxygen container is located in the parachute seat pack and is actuated automatically upon seat ejection. It can also be actuated manually in the cockpit through a red knob attached to the ORK-9, when the normal system fails.
The emergency oxygen container is charged with 0,7 L of oxygen at a pressure of 150 kp/cm^2. A built in pressure gauge permits checking of the pressure.
The container is connected directly to the lap belt Radio/Oxygen connector.
The container provides oxygen for about 10 minutes.
Oxygen Rear Cockpit Interconnect Valve.
The rear cockpit is provided with an interconnect valve on the left console behind the oxygen shut-off valve.

The valve is closed /C W/ during normal operations.

During solo flights or when the oxygen in the front cockpit is depleted, the shut-off valve is opened /CCW/ allowing the pilot in the front cockpit to breathe oxygen from the rear O_2 bottles through interconnection.

OXYGEN SYSTEM

1. Board screwed union
2. T-piece with non-return valve
3. Oxygen bottle - 4 lit.
4. Oxygen bottle - 2 lit.
5. Screwed union
6. Non-return valve
7. Shut valve
8. Reducer
9. Indicator
10. Controller of oxygen delivery
11. Cock of helmet ventillation
12. Helmet ventilating system
13. Joint
14. Oxygen reducer
15. Respirator
16. Pressurized helmet
17. Compensation suit
18. Screwed union
19. Pressure gauge
20. Parachute oxygen apparatus
21. T-piece

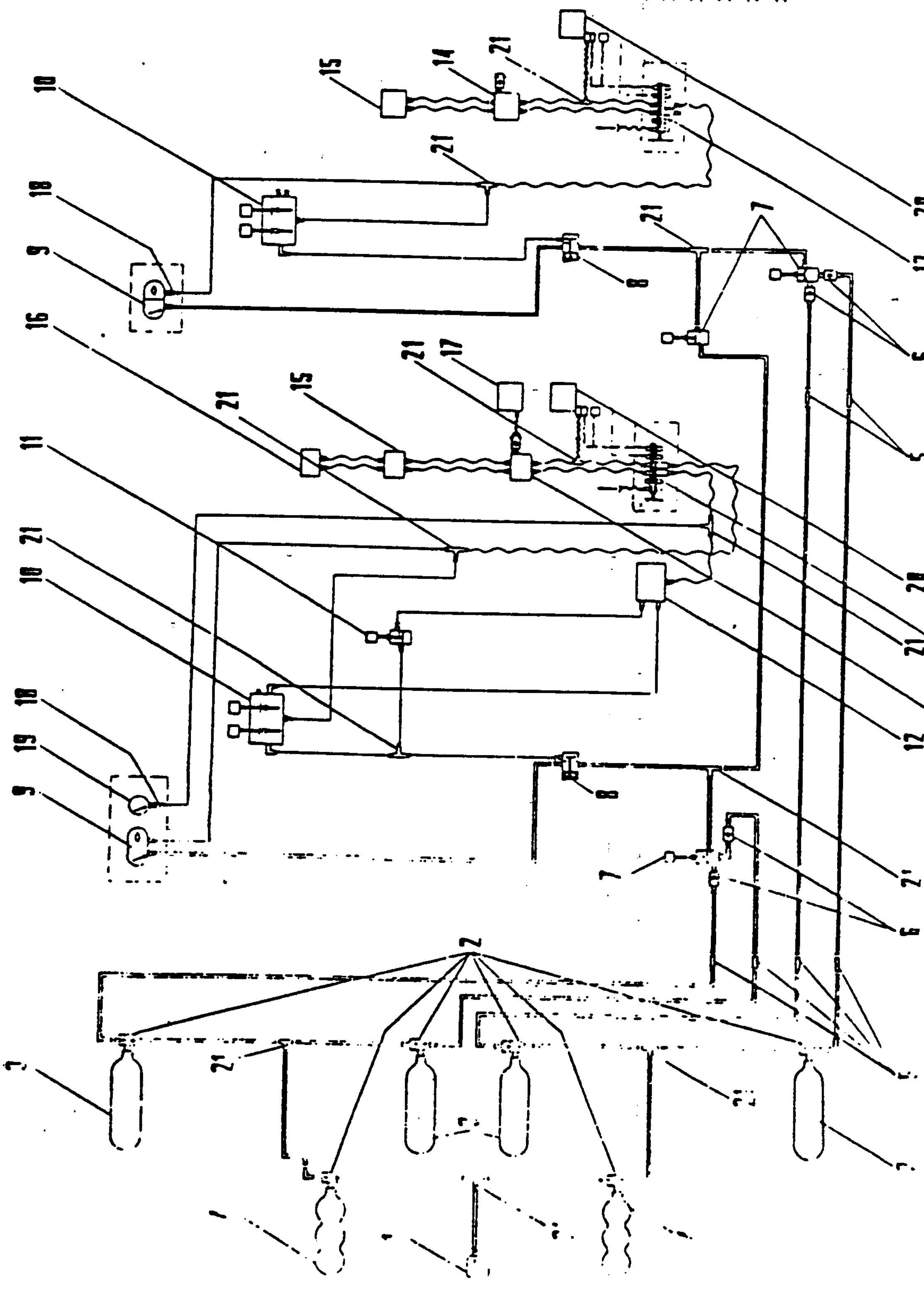


TABLE OF
OXYGEN DURATION IN HOURS AND MINUTES
/TWO CREW MEMBERS/

Contents of „O_2" / % /		Cabin altitude	HP OXYGEN PRESSURE IN kg/cm^2							
			150	130	110	90	70	50	30	10
	100	All altitudes	3.20	2.53	2.26	2.00	1.33	1.06	0,40	–
„MIXTURE"	24	2000	12.53	12.00	10.08	8.20	6.27	4.35	2.46	--
	32	4000	10.25	9.00	7.36	6.15	4.50	3.26	2.05	–
	43	6000	7.45	6.42	5.40	4.39	3.36	2.33	1.33	–
	60	8000	5.33	4.48	4.03	3.20	2.33	1.50	1.06	–
									WARNING	
									Descent to an altitude where oxygen is not required	Not to fly with oxygen

NOTE: 1. The values of oxygen durations in the table are valid for the flights at introduced altitudes,
2. During the flights physical more difficult the oxygen durations are shorter.
3. During solo flights the indicated valves are approximately doubled

Figure 4 - 19

Safety precautions for the installation of oxygen bottles

Only those bottles may be installed into the aircraft which have exhausted less than 25% of service life till the next test.

It is forbidden to install and fill the following bottles in the aircraft:

a/ the bottles which have not specified marking, paints, letters

b/ the bottles with damaged threads and screw unions

c/ the bottles with leaking non-return valve of the screw union

d/ the bottles with damaged surface

e/ the bottles which have been delivered from the store in empty state /not filled up/.

The bottles may be filled only with medical oxygen /next as oxygen only/ according to ČSN 654405 or GOST 5583-58.

After armouring, the oxygen bottles shall be immediately filled with oxygen to pressure of 3 MPa. /30 kp/cm^2/.

The oxygen bottles may be stored only when they are filled with oxygen to pressure of 3 MPa. /30 kp/cm^2/.

The oxygen bottles may be filled only with pressure which is in harmony with proper surrounding temperature - see the table which follows. The bottles with pressure lower than 2 MPa /20 kp/cm^2/ shall be unconditionally replenished. The same is true if the pressure dropped below this value during the tests.

The values in the following table are converted to new measuring units according to ČSN 654405 and GOST 5583-58.

°C	+35	+30	+25	+20	+15	+10	+5	0
MPa	15,8	15,5	15,3	15,0	14,7	14,5	14,2	14,0
kp/cm^2	160,4	157,4	155,4	152,3	149,3	147,2	144,2	142,1
°C	-5	-10	-15	-20	-25	-30	-35	-40
MPa	13,7	13,5	13,2	13,0	12,7	12,4	12,1	11,8
kp/cm^2	139,1	137,1	134,0	132,0	128,9	125,9	122,8	119,8

Filling of bottles which have not been filled yet or replenishing the bottles having their pressule below 2 mPa shall be executed according to special regulations /see ČSN 078304/.

The oxygen bottles installed in the aircraft already shall be painted in light-blue /light blue 4400 ČSN 673067/ and provided with letters "MEDICAL OXYGEN" using the medium letters according to 25 ČSN 010451.

Oxygen bottles /both filled up of those which are to be filled/ shall be protected againsh knocks or other damage.

Yet before installing the full oxygen bottles, drain the oxygen after careful loosening of the blind flange on the bottle screw union. While draining, the oxygen streem may not be pointed at the worker`s body nor at other objects, but to the free space /the best is to direct it obliquely upwards/ whole following all safety precautions /see step 2.1. and 2.2./.

The oxygen bottles shall be armoured within 36 months from the date of their production.

SECTION V

OPERATING LIMITATIONS

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INTRODUCTION

This section includes the limitations that must be observed during normal operation of the aircraft.The limitations are derived from actual flight testing limitations connected with particular operational procedures are given in other sections of this manual. The flight and engine instrument markings with their operating limitations are shown in figs 5-1 through 5-3.

DEFINITIONS

Cruise Conditions - LG and flaps up;speedbrakes retracted.

Landing Conditions - LG and flaps down;speedbrakes retracted.

Clean Configuration - Without external stores.

Symmetrical flight - Flight with no rolling tendency or use of ailerons in the manoeuvres.

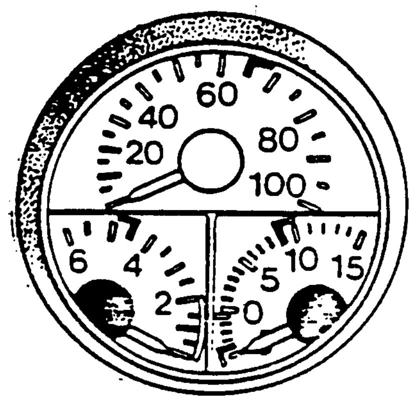
INSTRUMENT MARKINGS

TRIPLE ENGINE INDICATOR

(fuel pressure gauge)

fuel pressure 65 kp/cm^{2}max

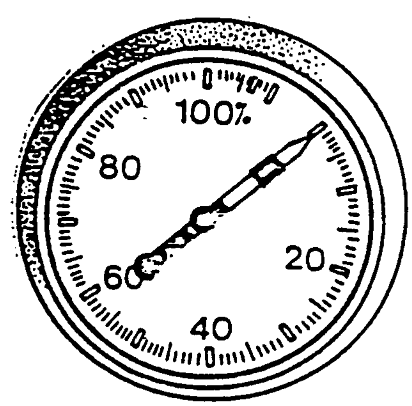
(oil pressure gauge)



(oil temperature gauge)

- oil pressure 4,5 kp/cm^{2}max
- under 2 kp/cm^2 at near zero loads for short time only
- oil temperature from -40°C min up to 90°C max
- from -5°C up to 90°C max in operation

TACHOMETER

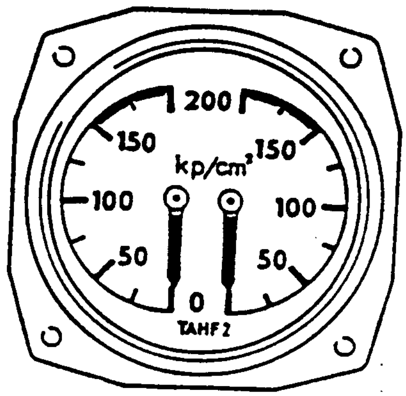


- RPM - 106,8$\pm$1%

Fig. 5-1

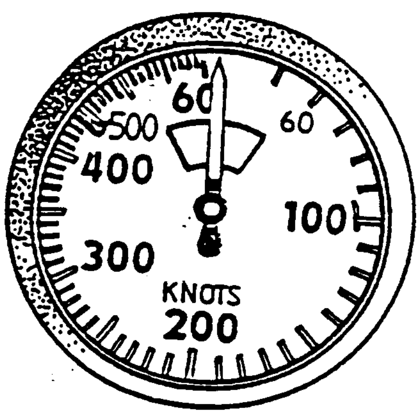
INSTRUMENTS MARKINGS

HYDRAULIC PRESSUR GAUGE



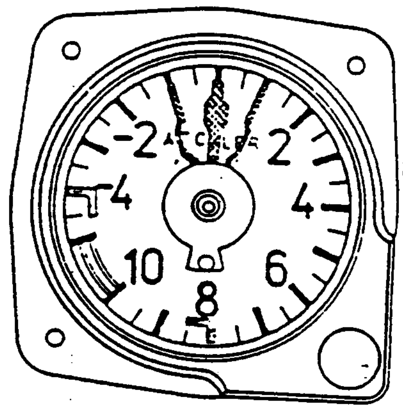
- pressure in main and emergency hydraulic circuits 150 kp/cm^2

MACH - IAS - TAS INDICATOR



- 490 KIAS max for configuration without external stores
- 0,8M max /The speedbrakes extend automatically at 0,78 ± 0,02M/

ACCELEROMETER



- "+8g","-4g"max fo the A/C mass 4 200 kg

Fig. 5 - 2

<u>Assymetrical Configurations</u> - when the configuration (fuel, external stores etc) is not equal on both wings of the aircraft.

<u>Engine Limitations</u>

In addition to the normal operating limitations shown in fig. 5-1, the following limitations shall apply:

- Duration of engine run shall not exceed the following:
  . 40% of total engine time at the RATED regime.
  . 10% of total engine time at the TAKE-OFF regime.
- When emergency fuel is in operation, the maximum and minimum HPC rpm are as follows:
  . Below 6,500 FT: 103,2% max; 56% min.
  . Above 6,500 FT: 99% max; 60% min.
- The maximum engine run time and altitude with emergency fuel circuit are 40 mins and 26000 FT respectively.
- After engine shutdown, the engine run down time should not be less than:
  . HPC from 10% to 0% - 10 sec
  . LPC from 10% to 0% - 15 sec
- Use of the HPC rpm within the ranges 74-77% and 86-89% is permitted for a short duration only (Reason: BOV at 5th and 3rd stage compressor.)
- Do not use the TAKE-OFF regime at altitudes above 32,800 FT.
- The maximum continuous engine run time at the TAKE-OFF regime is 20 mins.
- The maximum permissible HPC rpm in flight (max overspeed) is 107,8%.
- Throttle operation with emergency fuel circuit should be smooth so as to prevent fuel starvation and possible engine flameout.
- Engine operation with the fuel booster pump off is guaranteed up to approximately 20,000 FT.
- Do not attempt an engine relight with HPC rpm lower than 15% without the use of Sapphire 5 starting unit.

EGT Gauge

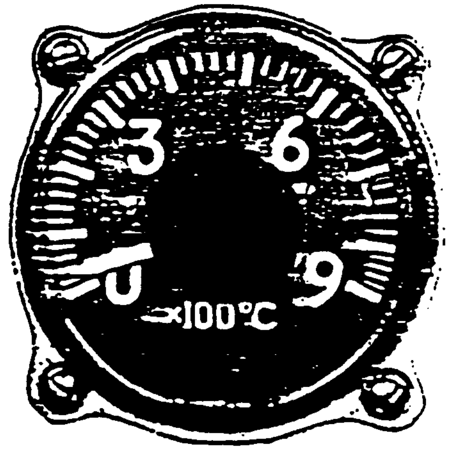


Fig. 5-3

ENGINE OPERATING LIMITATIONS

Eng Mode	HPC RPM (%)	EGT (°C) GRD	EGT (°C) FLT	FUEL PRESS kp/cm^2	OIL PRESS kp/cm^2	OIL TEMP / °C /	TIME OF OP /Mins/ GRD	TIME OF OP /Mins/ FT	ENG THRUST (KP)
(1) START	20 min in 15 sec	550	600	max 65	2 min	-40to90	1		-
IDLE	56±1.5	600	600	-	2min	-5to90	30	-	-
CRUISE	99.6±1	590	615	-	3-4.5	-5to90	-	-	1275
RATED	103.2	625	650	-	3-4.5	-5to90	-	-	1500
TAKE OFF (MAX)	106.8	660	685	max 65	3-4.5	-5to90	20	20	1720

Notes

1. Abort the start and shut down the engine if:
   - HPC rpm is less than 20% after 15 sec.
   - there is no ignition (EGT rise after 25 sec)
   - EGT rapidly approaches 550°C
2. EGT in flight is 20°C higher when de-icing system is on and can be as high as 705°C above 25000 FT.

AIRSPEED LIMITATIONS

For airspeed limitations, refer to figure 5-4.1; 5-4.2

FLIGHT, MANOEUVERING LIMITATIONS

INVERTED FLIGHT LIMITATION

Inverted flight or any manoeuver resulting in negative acceleration is permitted for not more than 20 sec. Fuel supply in inverted flight will last approximately 20 secs. The minimum interval between consecutive inverted flights is 20 sec.

ZERO "G" LIMITATION

Flights with zero "G" are permitted for not more than 5 sec - lubrication factor of the engine oil system.

STRUCTURAL LIMITATIONS (clean configuration)

The maximum permissible G-factors according to the aircraft weight are as follows:

G-factor	Weight (kg)
+8, -4	4200
+7, -3.5	4500
+6, -3	5000
+5, -2.5	5500

Aerobatic flights with full 350 l underwing tanks are prohibited.

LIMITATIONS OF THE SPIN TURNS NUMBER

Normal spin ....max. 2

Inverted spins are prohibited.

AIRSPEED LIMITATIONS

CONDITION	SPEED	REMARKS
Cruise configuration without external stores	490 KIAS or 0.8 Mach	The speedbrakes extends automatically at 0.78 $\pm$ .02 Mach
Cruise configuration with external stores	470 KIAS or 0.75 Mach	
With landing gear external	180 KIAS	The flaps will not extend above 165 KIAS and if extended,they automaticallyretract when 165 KIAS is exceeded
With flaps extended to either the TAKEOFF or LANDING positions	165 KIAS	
With canopy jettisoned	190 KIAS	

MAXIMUM PERMISSIBLE AIRSPEEDS

BASED ON MAXIMUM DYNAMIC PRESSURE AND MACH NUMBER

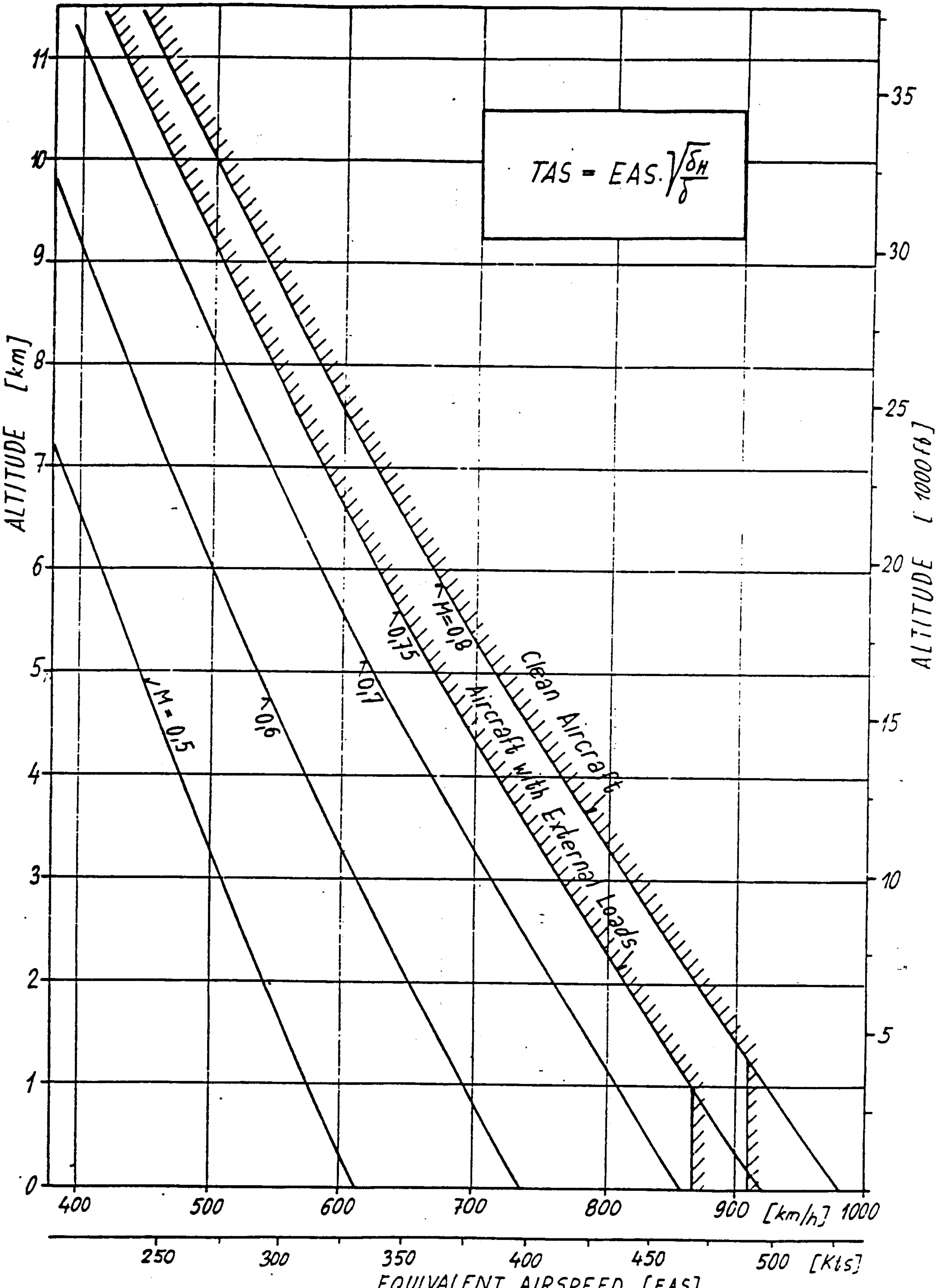


Fig. 5.4.1

MAXIMUM PERMISSIBLE AIRSPEEDS
BASED ON MAXIMUM DYNAMIC PRESSURE AND MACH NUMBER

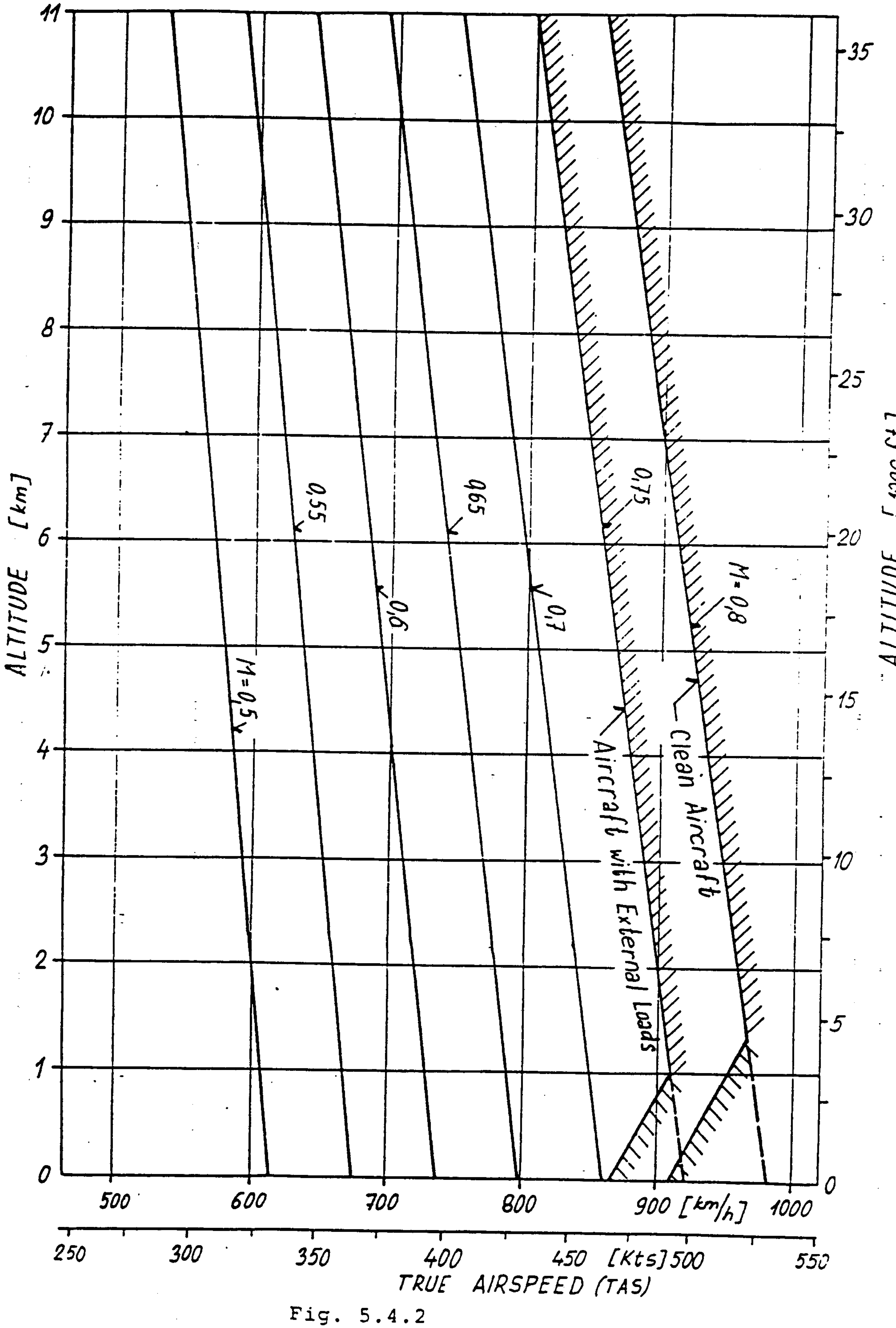


Fig. 5.4.2

CENTRE OF GRAVITY LIMITATION

The permissible range for centre of gravity positions is 20.7-26% MAC. In an emergency, if the front pilot ejects, the C of G is aproximately 30% MAC and the aircraft may still be landed from the rear cockpit. In this case, do not use flaps /the airbrakes use during the whole manoeuvering is permissible/. The final approach speed 125 KIAS.

MASS LIMITATION

The maximum takfeoff weight is 5220 kg and the maximum landing weight on a concrete is 4600 kg.

OTHER LIMITATIONS

CROSSWIND LIMITATION

The maximum permissible crosswind component perpendicular to the runway during take off and landing is 15 knots.

WHEEL BRAKES LIMITATION

When landing with gross weight up to 4600 kg, the maximum speed at which wheel brakes may be applied is 102 knots. In cases such as an aborted take off when full brakes are applied at speeds higher than 102 knots, the brakes must be allowed to cool before subsequent flight. For an aircraft with initial take off weight of up to 4400 kg, 10 landings with braking is permitted, with a minimum of 7 minutes interval between landings. For an aircraft with initial take off weight of more than 4400 kg, continuous circuits with braking is allowed, with a minimum of 30 minutes interval between landings.

NOTE

In an emergency, it is possible to commence braking at speeds over 102 knots and weight over 4600 kg. However, after this braking action, the brakes must be allowed to cool and proper inspection carried out prior to the next flight.

LANDING LIMITATION

If landing must be made with a gross weight higher than 4800 kg, the maximum permissible rate of descent and g-loading are 2.5 G respectively. These limits are exceeded, the wheel brakes and tyres must be changed prior to the next flight.

NOTE

Indications of the VVI at touchdown is not a valid indication of the actual rate of sink as the instrument is subject to a considerable lag.

EXTERNAL STORES LIMITATION

The drop of all external stores is to be accomplished in level altitude within the speed of 160-270 KIAS and at altitudes below 23,000 FT.

The Equivalents
of Servise Materials for L-39

	Name	Mark	Tech.conditions or standards	Equivalents west standards	Factory mark or type of product	Produser	Consumption for 1000 hours of service	Note
1.	Oil	B-3V	MRTU-38-1-157-65	MIL-L-233699B/2 DERD-2487	Aeroshell Turbine oil 500 0-156 Turbo Nycol 35M Castrol 98	USA NATO	0,8 kg	Oil are miscible in every rativ
2.	Engine oil	MS-8P	TO-38-401-53-73	DERD 2410-C	Aeroshell Turbooil 3 Castrol Aero-GT 11 Castrol Aero-GT 85 Turbo Nycol 321	GB USA	25 kg	Oils are not miscible
3.	Preserving oil	OK-2A Konkor101	PND 23-111-68		Tektyl 800	Sverige	0,5 kg	
4.	Hydraulic oil	AMG-10	GOST 6794-53	MIL-H-5606 B DTD-585	Aeroshell Fluid 41 Aeroshell Fluid 4	USA GB	210 kg	Oils are miscible in every rativ
5.	Vaseline	NH2	PND 25-024-69	MIL-G-8132221	Shell Aviation Grease 22	USA	10 kg	
6.	Vaseline	NK 50	GOST 55 73-50	MIL-C-7711A	Shell Aviation Grease 22	USA	17 kg	
7.	Vaseline	SP-2	ČSN 656917	MIL-C-7711A DTD-844D	Aeroshell Grease 6 Callex Regal Starpak Premium 2 Grease G-382	USA GB Fr NATO	36 kg	
8.	Silicon vaseline	OKB-122-7	MRTU-38-1-230-66	MIL-G-23827A DTD-844D DTD-866A	Aeroshell Grease 7 Dow cornig 33 Grease Light Medium	USA GB GB	2 kg	
9.	Fuel	PL-6 RT	PND 25005.76 ČSN 656520	DERD 2494	Aeroshell Turbine Fuel 650 Aeroshell Turbine Fuel 640 JET-A-1	GB USA USA,GB	710 000	Internacional AIR Transpor ATK Fuel is miscible in every rativ
10.	Techn.petrol	80/110	ČSN 666340		SBP-S80/110 Special Boiling Point Spirih 80/100	USA		

11.	Molybdenum tetrasulphide	Molyko-R			Molykote-PULVER/MF		0,5 kg	Ms_2-technical
12.	Medic. oxygen		ČSN 654405		Medicial oxygen dew-point -35°÷ - 45°			Consumption as to the pilot's use
13.	Nitrogen for incandescent lamp		ČSN 654335		Nitrogen dew-point -35°÷ -45°		10 dm^3/5n Pa	
14.	Top cover polyurethane	U 2054	PND-1-220-74		Titane PR-45/2 Polyurethane-Lacke	GB SRN		
15.	Cylinder Oil	B 31	ČSN 656655		VALVATA 85 NASSA OIL 85		1 kg	

SECTION VI

FLIGHT CHARACTERISTICS

TABLE OF CONTENTS

INTRODUCTION

The aircraft is directionally, longitudinally and laterally stable at all approved center-of-gravity positions, throughout the flight envelope. As the flight controls are not hydraulically boosted, stick forces will increase with increasing speed.

STALLS

During speed decreasing in the straight flight it is the unimportant difference of characteristics of the aircraft in all basic configurations /u/c rectracted, landing flaps 0°; u/c extended, landing flaps 25°; u/c extended, landing; these flaps 44° configurations at RPM max and idle/.

The prestall warning is very weak or none.The stall will occurs as a fall on the one or other side. After the fall of the nose, which follows, the a/c accelerates itself, comes out of the stall with the nose lifting and comes to the stall again.

These movement are relative slow. After elevator releasing the a/c comes out of the stall immediately and recovers the initial state. Also in the moment of stall the effects of the ailerons and ruder are sufficient. The remaining deflections of the elevator on both sides are considerable.

H = O ISA idle, No ground proximity

Configuration		Training
A/C mass G/kg/		4300
Landing flaps deflection	0°,u/c retracted	102,5 KIAS 190 km/hour
	25°,u/c extended	94,4 KIAS 175 km/hour
	44°	89 KIAS 165 km/hour

STALL SPEEDS: IDLE POWER
Model: L-39 clean A/C
Date: July 1987
Data basis: Calculated

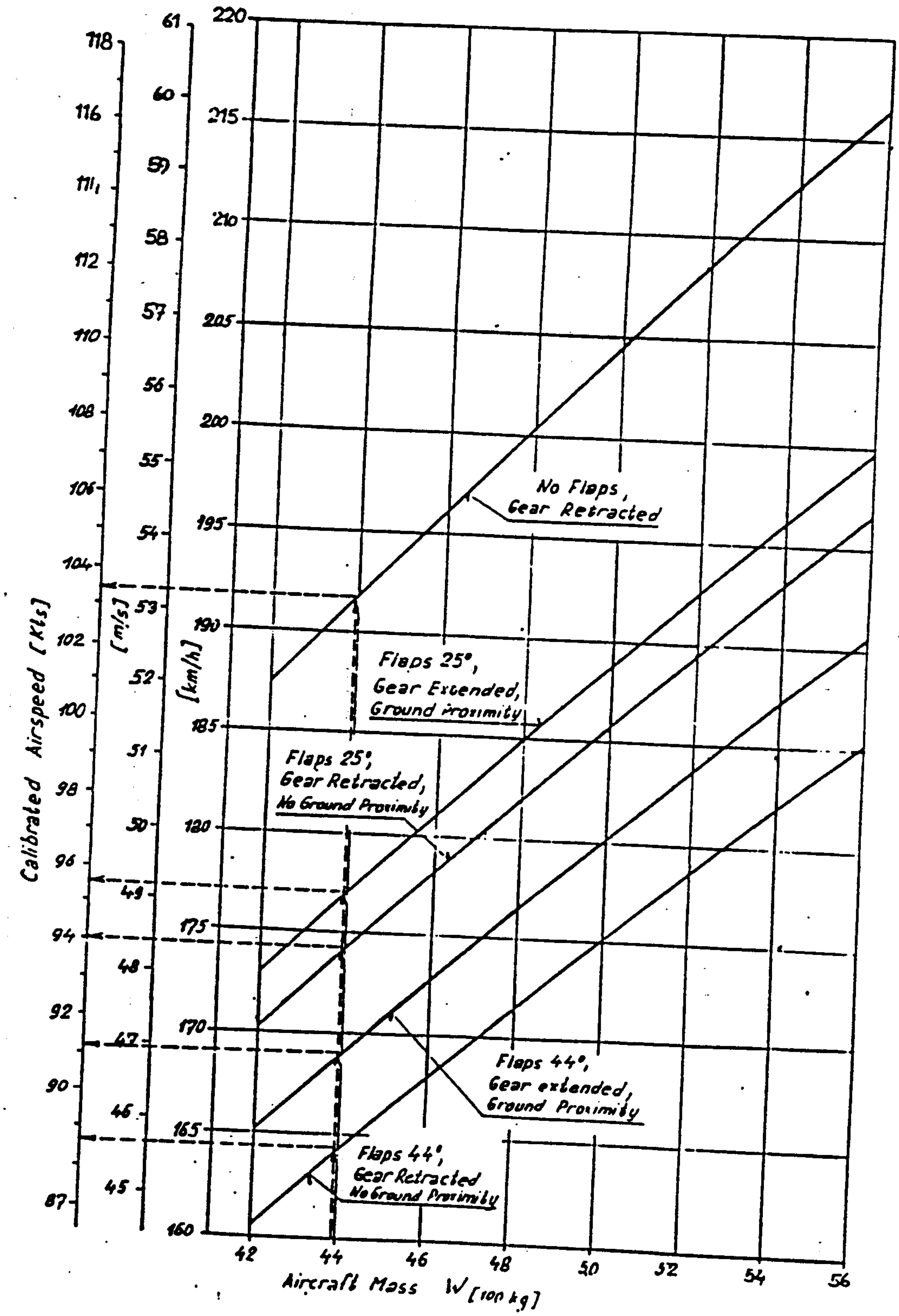


Fig. 6 - 1

SPINS

The aircraft stall during the straight flight without ruder deflection leads not to the spin.

Normal spin

Bringing the aircraft into the spin:

- altitude 5,000m (16 400 ft), maximum 6,000m (19 685 ft) /according to required number of revolutions/,
- to trim to neutral,
- to fix a characteristic point of reference that will serve to orientation and determination of number of revolutions,
- to adapt engine idling speed and to check temperature of exhaust gases,
- to turn the aircraft to the climb [illegible], or while gradually pulling the control stick to keep reducing forward speed in horizontal flight - to follow up reduction of speed,
- as soon as the aircraft begins to warn by shaking about the stall to apply full rudder in the direction of spin, ailerons are in neutral position,
- to follow up the banking of aircraft and at the bank of about 45° in the sense to the spin to pull the control stick to the extreme position /in case of need with both hands/,
- the aircraft enters the spin hesitantly, only after tilting the forward section the aircraft accelerates rotation in the sense of deflected rudder and the proper spin starts

Behaviour of the aircraft in spin.

In most cases the aircraft performs a stable spin, nevertheless it is also able to enter an unstable spin, when in changes direction of rotation against the applied rudder.

Each revolution of the spin begins with rapid turn and drop of the nose section till very steep position. Next moment the aircraft benings to raise the nose section, the speed of rotation decelerates till almost to a stop.

The nose section can be in this phase even above the horizon, the whole aircraft shakes violently, tilts from side to side and again drops its nose section below the horizon and increases the speed of rotation in the direction of applied rudder. Deceleration of the aircraft is more pronounced in the right spin than in the left one. With regard to the steep position of the aircraft in a sector of the revolution and therefore low drag the speed of flight increases and after the third revolution attains 300 [162 kts] to 350 [189 kts] km/hr. The number of longitudinal swings ranges from one to during one revolution.

Occasional transition to the change of sense of rotation may occur in the phase of raised nose section towards horizon. While shaking violently and banking the wing in a swinging manner the aircraft turns against the applied rudder, rapidly drops the nose section and continues in opposite rotation.

The right spin is less stable and less uniform than the left one.

Forces acting on the controls are both in the stable and unstable spins considerable and for the pilot quite unforeseeable. Despite the fact that controls are kept in extreme positions with considerable force, it happens that the pedals are as if "kicked" to full opposite deflection and the control stick deflects to the left as well as to the right unexpectedly for the pilot. Because of these reasons it is essential to handle the controls firmly and not to allow their release.

The force acting on the control stick of the elevator reaches up to 20-25 [196 - 245 N] kp and has an oscillatory character, according to inclination of the longitudinal axis of the aircraft. The force in pedals to keep the rudder in the extreme position in spin is 60 [588 N] to 100 [981 N] kp.

Throughout the continuence of the spin vigorous shaking of he whole aircraft takes place.

The duration of a revolution is 6 to 7 seconds. Total loss of height from the moment of entering the spin to recovery and transition to horizontal flight is 600 to 800m (1968 ft to 2 625 ft) per one revolution and 1,600 to 1,800 when making two revolutions.

Recovery from the spin

The inclination of the longitudinal axis of the fuselage at the beginning of recovery affects recovery of the aircraft from the spin. The best and mainly with the least continuation of rotation is the aircraft recovered in the moment when the forward section of the fuselage descends - in the vicinity of the steepest attitude:

- to return the pedals of rudder to neutral position and simultaneously to shift the control stick to central position or even to moderate pushing,
- ailerons remain permanently in neutral position,
- after the rudder and the elevator have been returned the aircraft ceases rotation and passes to straight descent flight. Continuation of rotation after the alignment of control surfaces is 1/2 to 1 revolution. At forward speed of about 350km/hr (189 kts) to 400km/hr (216 kts). to bring the aircraft to horizontal flight.

For training purposes, because of increasing the speed of flight in the spin, the aircraft is recovered after the second revolution has been accomplished. For proper practising the spin recovery from the spin after one longitudinal swing is enough.

When observing the prescribed procedure the aircraft recovers safely from the spin.

Notes

1. During recovery after the rotation has ceased in the descent flight to monitor engine r.p.m. and temperature of exhaust gases.

To increase power of the engine is allowed only in case that their values are within permitted limits. In case of decrease of r.p.m. below 54,5% and growth of temperature above 600° it is essential to shut down the engine and later to carry out relighting.

2. In case of unsuccessful entering the spin it is necessary to set the rudder to neutral, the elevator to moderate pushing and to pull-out of the descent flight in a normal way.

3. In case of unintentional stopping of rotation or in case of change of the sense of rotation in the spin it is essential to set the rudder and elevator to the position for the pull-out and to bring the aircraft to a steep descent flight.

4. Recovery from the spin by means of applying rudder to the extreme position against the spin (instead of to neutral) and moving the elevator to moderate pushing is quick and safe as well as the way prescribed. However, the pilot has immediately to return the pedals to neutral position after the rotation has ceased. When recovering from the spin by means of deflecting rudder against the spin and keeping the control stick in extreme deflection of pulling the aircraft recovers neither from right nor left spin.

5. On the loss of spatial orientation during the spin it is recommended to use the prescribed way of shifting the rudder and elevator to neutral. This method recovers safely the aircraft from every spin, that is from the left one, right one, normal and inverted ones in any of its phase.

6. It is necessary to observe unconditionally the prescribed method of piloting during entering and recovery of the aircraft from the spin. Non-observance of these conditions can be the cause of longer continuation of rotation, passing to a spin of opposite sense against the applied rudder or to an inverted spin.

7. Keeping the control stick in pulled position after applying rudder against the spin results in passing to spin with rotation in the sense of applied rudder.

8. If during recovery from the spin the pedals are kept deflected against the spin and the control stick fully pushed, the aircraft passes to an inverted spin.

9. Excessive pushing of the control stick beyond neutral during recovery results in a steep flight with negative load factor and a considerable loss of height when passing to the horizontal flight.

10. Excessively vigorous and energetic pull at the control stick after rotation has ceased during recovery from a steep descent flight can be the cause of the loss of speed, eventually a stall and resulting spin.

11. On recovery from the spin in the moment of raised forward section of the fuselage towards horizon a case of involuntary deflection of the control stick in the pulled position may occur, which means that pilot after releasing rudder has to push simultaneously the control stick in order to return it to neutral position.

WARNING

12. In case the aircraft did not recover at 1,500m (4 921 ft) of height the crew must bail out.

13. The spin with full wing-tip tanks is more steady and stable; recovery of the aircraft from the spin is not affected by the mass of fuel in the wing-tip tanks.

14. Extended undercarriage, landing flaps, speed brakes and position of the centre of gravity in the permitted limits have no noticeable influence on the character of spin and its recovery.

15. Deflection of ailerons towards the spin to 1/2 - 2/3 of their maximum deflections has little influence upon its characteristics. Deflection of ailerons against the spin increases ununiformity of rotation both in the left and right spins. The aircraft tends to pass to a spin with opposite rotation; full deflection of ailerons in the sense to the spin accelerates rotational movements and increases their amplitudes.

INVERTED SPIN

WARNING

Intentional inverted spins are prohibited.

The aircraft will enter to an inverted spin, when during normal spin recovery the control stick is pushed forward too far and too quickly when rotation stops during recovery from an erect spin.

If this occurs, it may be difficult for the pilot to determine the direction of rotation. However, the turn needle still provide a valid indication of the direction of the rotation.

Recovery From An Inverted Spin

1. Throttle - Idle
2. Neutralize the control and progressively apply opposite rudder to the direction of rotation

Simultaneously:

3. Control stick - Backwards, forward of neutral
4. Controls - Neutral after spin stops
5. Recover from dive

SIDE SLIPS

The aircraft can be slipped at an airspeed of 135 KTS up to the full deflection of the rudder pedals and still afford excellent control and recovery characteristics. Sideslip characteristics are good, however, when slipping with landing gear and flaps extended, a considerable nose-down moment will be experienced. Sideslips should therefore be initiated cautiously.

FLIGHT CONTROLS

Speed Brakes

The speed brakes are a drag-producing device to slow the aircraft down. They can be extended or retracted at any speed or in any flight attitude. The speed brakes are extended automatically at 0,78 Mach, to prevent exceeding the airspeed limits. The speed brakes extend 55 degrees into the airstream from the bottom of the fuselage section.

Extending of the speedbrakes at high IAS or MN causes a nose-up moment which can easily be counteracted by the pilot.

Flaps

Extension of the flaps for landing will create a nose-up moment. This moment is elliminated by the use of trim on the left side of elevator.

Trim

The elevator and aileron trim tabs can be trimmed over the whole speed range. During descent at speeds near the limiting speed stick forces can become excessive even with the elevator trim tab in full up position.

FLIGHT CHARACTERISTICS

Approach and Landinc

Because of the time required for the engine to accelerate low engine speed (9 to 12 s from idle to max power) it is desirable, for safety reasons to maintain at least 70 % RPM on landing approach until landing is assured.

After touchdown the aircraft has no tendency to swing or bounce. The nose wheel can be held off the ground to a speed of 100 km/h ≙ 75 KTS. No-flaps landing does not affect the landing characteristics of the aircraft.

MANOEUVERING FLIGHT

Low Altitude Flights

Low altitude flights are easily accomplished and no special technique is required. Handling qualities are good throughout the entire speed range.

High Altitude Flight

The aircraft is equipped with an airconditioning/pressurization system and an oxygen system to permit high altitude flights. Flight characteristics during high altitude flights are normal, and require no special techniques.

AEROBATICS

Only normal techniques and knowledge are required when performing aerobatic manoeuvers

The following aerobatic manoeuvers may be performed with and without external fuel tanks:

Manoeuver	Power	Speed KTS
Loop	nom	320
Immelmann	nom	320
Aileron roll	nom	150 min
Barrel roll	nom	280
Split S	0,85 nom	120
Stalled turn	nom	120
Chandelle	nom	280
Lazy eight	nom	280
Clover leaf	nom	280

NOTE

During over-top maneuvers, the airspeed will decrease rapidly, even to where 0 airspeed is indicated. Therefore, the controls should be used with care.

Pulling into buffeting throughout any position of an aerobatic manoeuver should be avoided.

The limitations stated in Section V. are to be observed.

Dives

At 0.78 ±0,02 Mach the speed brakes will extend automatically and thereby prevent exceeding the limiting Mach. At 0,80 Mach (M crit.) a pronounced buffeting of the flight controls (aileron, rudder) occurs, indicating that the limiting Mach number is reached. Up to the limiting Mach number handling qualities of the aircraft are good. At speeds above 0,80 there is a noticeable reduction of elevator effectiveness.

Dive Recovery

For minimum loss of altitude during dive recovery the following procedure is recommended:

CAUTION

During dive recovery at speeds near the limiting speed, stick forces can become excessive even with the elevator trim tab in the full up position.

Simultaneously:

1. Power - Idle
2. Speed rakes - Out
3. Wings - Level
4. Backstick pressure - Apply

Care must be taken, that "g" limitation stated in Section are not exceeded.

For altitude loss in a dive refer to figure 6-2

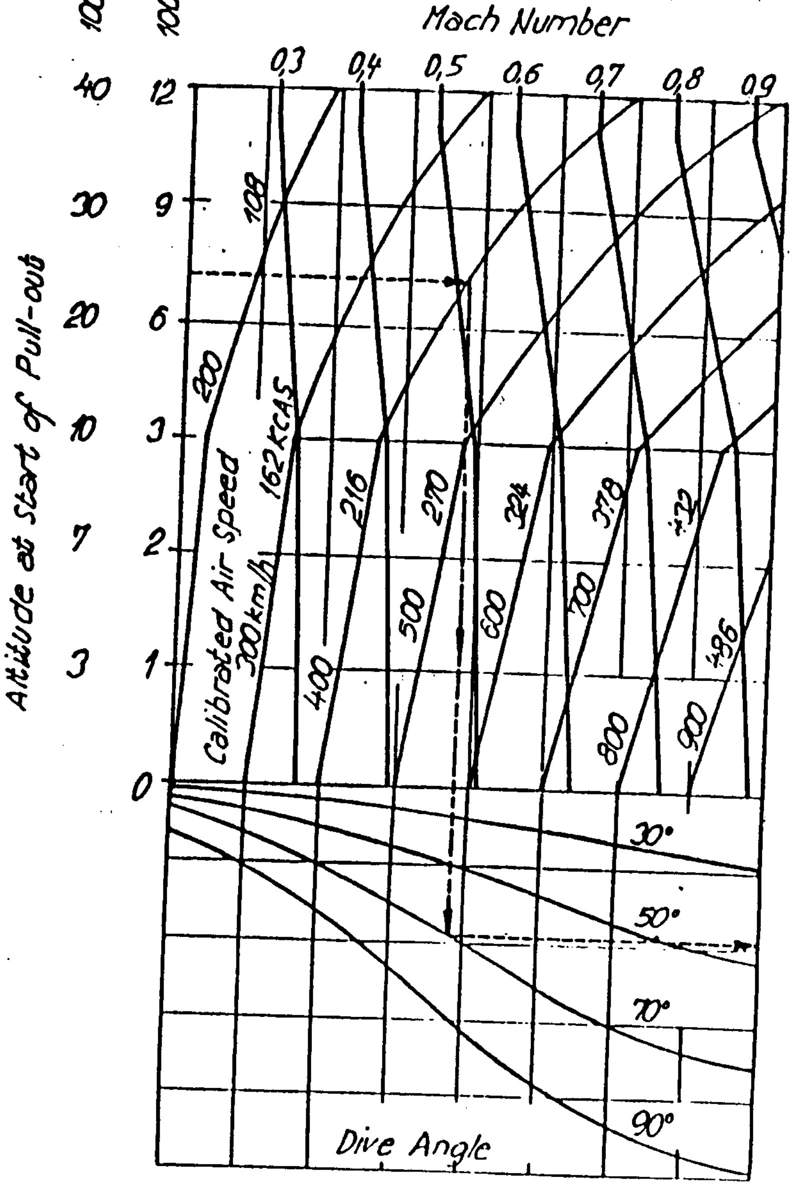
Flight with External Loads

The flight characteristics with external loads are identical with those without external loads, and no special techniques are required.

Flight with Asymetrical External Loads

Flights with asymetrical external loads do not present any problems, and no special technique are required.

Altitude Loss in Dive Recovery (All Configurations)



How to Use The Chart :

1. Enter Chart at start of pull-out altitude
2. Move right at constant altitude to air speed at which pull-out is started
3. Move vertically down to dive angle
4. Move right to pull-out load factor
5. Move vertically up to read altitude lost during pull-out

Note :

Pull-out based on 2.06 per second acceleration
Pover setting during pull-out-idle
Speed brakes extending automatically at M ~0,78

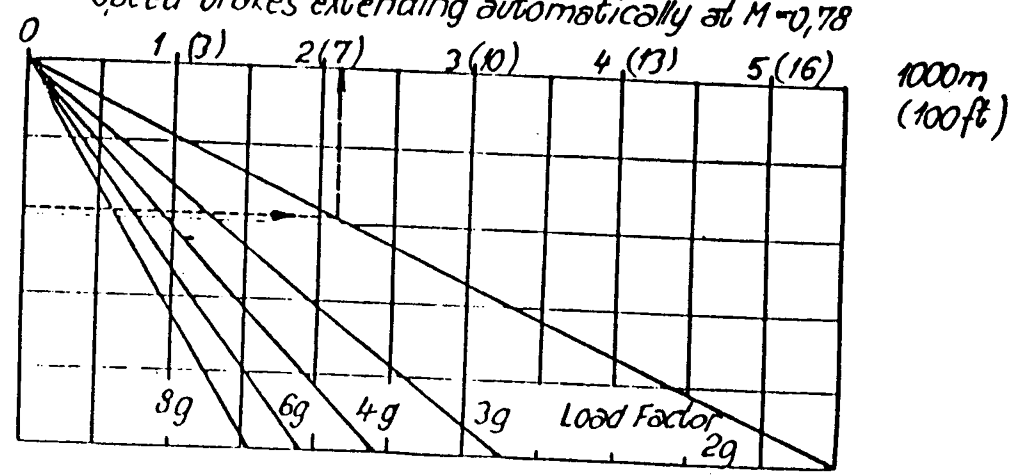


Fig. 6 - 2

SECTION VII

ALL WEATHER OPERATION

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List of Illustrations

INTRODUCTION

This section contains only those procedures which differ from or are in addition to the normal operating instructions covered in section II . Discussion relative to equipment operation is covered in section I.

INSTRUMENT FLIGHT PROCEDURES

Flying the aircraft in all weather conditions requires instrument proficiency and conscientious preflight planning standard procedures should be used during all phases of instrument flight. The aircraft's flight and handling characteristics under IMC are indentical to those encountered in VMC. Power, airspeed, and attitude changes should be performed smoothly and accurate trimming is mandatory. All airspeed limitations recommended should be adhered to during instrument flight, especially during landing approaches. Turns with more than 30° bank are not recommended during IFR operations.

PRE-FLIGHT AND TAXIING

Complete the normal preflight inspection for this aircraft prescribed in section II. Particular attention should be paid to those items essential to instrument flight. Complete the taxiing checklist outlined in section II.

INSTRUMENT TAKEOFF

Align the aircraft visually with the runway and set the heading under the top index. For takeoff the normal take off procedures and techniques should be used. During take off run correct heading deviations by differential braking until the rudder becomes effective at approximately 25 KTS.

During take off run, the heading indicator, is used for directional control;, however, while runway marking remain visible they should be used as an aid to maintain the proper heading.

INSTRUMENT CLIMB

As the aircraft leaves the ground the attitude indicator is used to maintain pitch and bank control and continues as such until a positive rate of climb is established. Climb in accordance with normal procedures.

INSTRUMENT CRUISE

After levelling off the climb, it may be necessary to maintain climb power until cruising airspeed is established.

For cruising data the applicable Appendix information should be used.

NOTE

> The attitude indicator may precess in pitch and bank during turns, so a constant crosscheck of the other flight instruments is necessary to maintain the desired attitude.

Before entering clouds, pre_cipitations, or visible moisture:

1. PITOT HEAT buttons-push
2. DEICING Switch - ON

RADIO AND NAVIGATION EQUIPMENT

For description of the radio and navigation equipment refer to section I.

DESCENT

When cruising at high altitude a descent to initial penetration altitude prior to reaching the destination fix may be made at airspeed and power setting given in the descent charts in the Appendix. For a normal penetration, reduce power to 85 % RPM, lower the nose to establish a descent attitude. Establish and maintain an airspeed of 250 KIAS. This will provide a comfortable rate of descent.

WARNING

> Descents at idle RPM may result in insufficient deicing; therefore descents of this type are not recommended below 20 000 ft 6 100 m under instrument conditions.

For approach procedures refer to instrument Approaches in this section.

HOLDING/LOITER

The recommended airspeed for holding patterns or loitering is 200 KIAS. For maximum endurance while holding refer to the Appendix for airspeeds, power settings, and fuel consumption. Descents to traffic pattern altitude should be excuted in accordance with published instrument procedures.

INSTRUMENT APPROACHES

The equipment provided is described in Section I. Instrument approaches can be performed at any allowable gross weight. The

ILS APPROACH /TYPICAL/

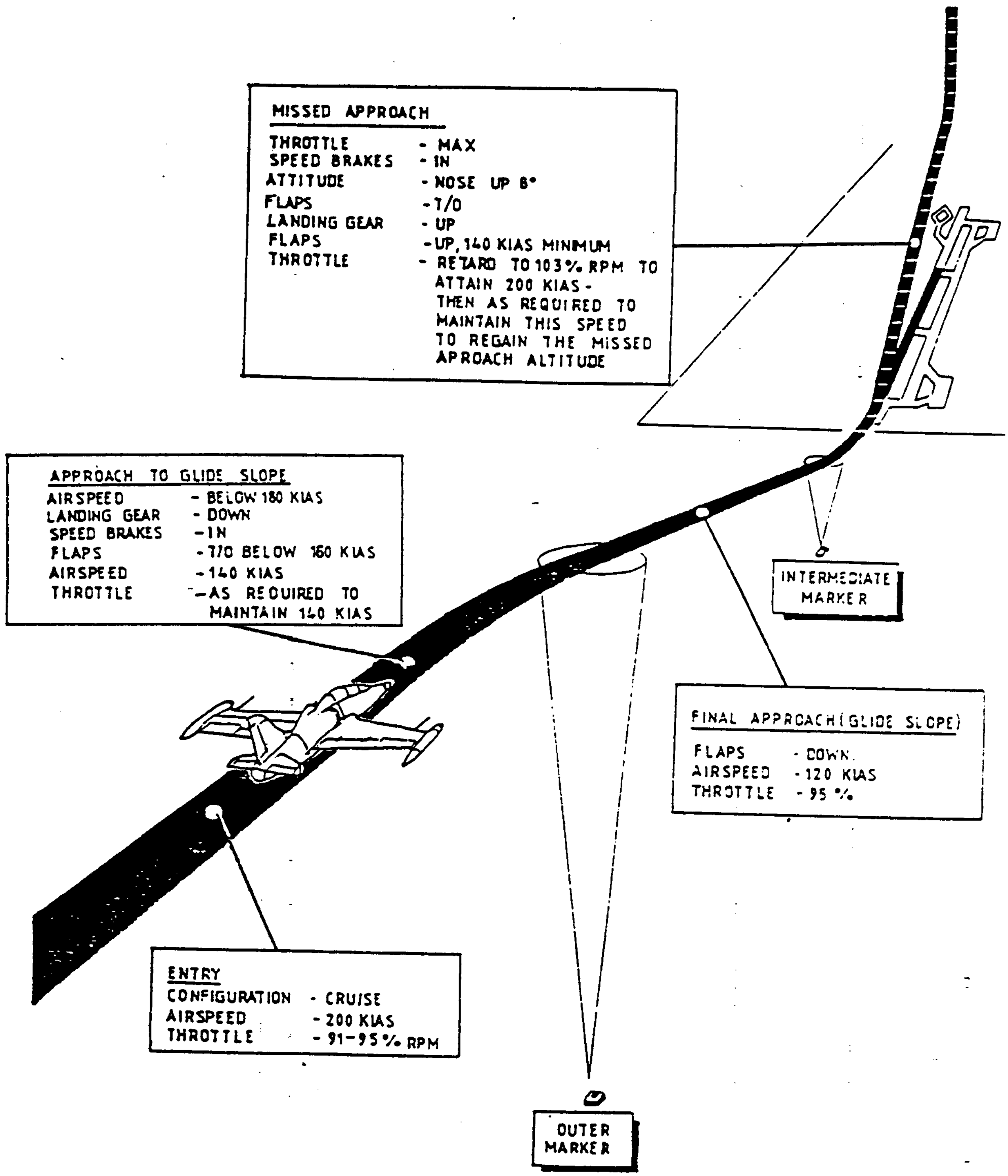


Fig. 7-1

RADAR APPROACH /TYPICAL /

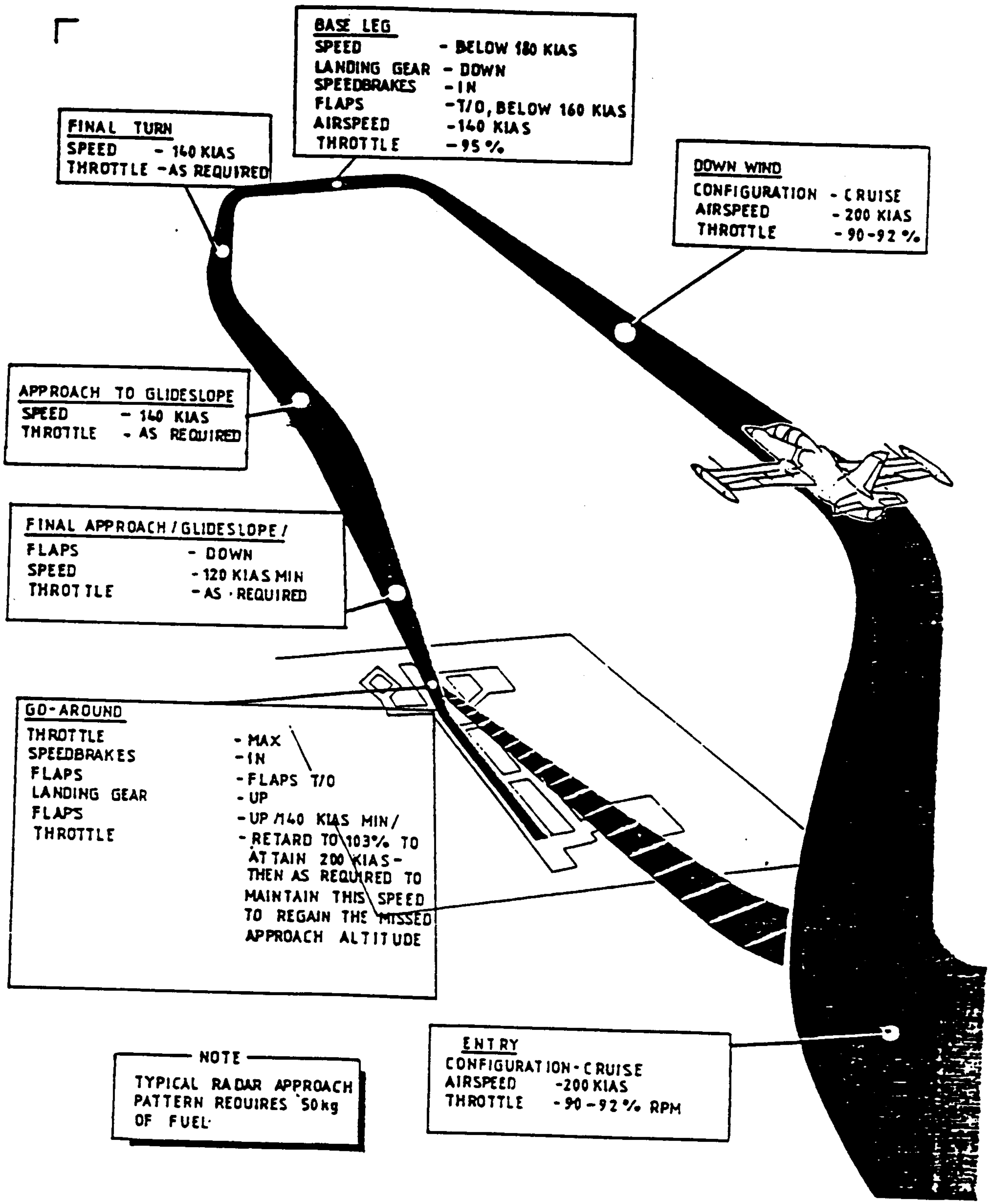


Fig. 7-2

initial approach from the fix or holding pattern should be accomplisched at 200 KIAS prelanding cockpit check will be started when cleared for an approach and should be finished after completion of the procedure turn. The final approach is made at 140 KTS with gear and flaps at T/O and at 120 KTS minimum with gear and full flaps before starting final descent.

RADAR APPROACH (GCA)

A typical approach is shown in figure 3-6. When cleared for an approach, the prelanding cockpit check should be performed. Altitude, course, and rate of descent should be adjusted as directed by the radar controller. Perform final cockpit check prior to starting final descent. The fuel and time required for the pattern at different bases depend upon local procedures and the type of patterm in use. Emergency radar approaches may be made with less fuel by requesting the radar controller to shorten the pattern.

MISSED APPROACH

If visual contact is not established by the time the D.H altitude is reached or the M.A.P is reached, execute a missed approach as published or directed by the air traffic controller. The recommended procedure for missed approach is to simultaneously apply max power check speedbrake in and retract flaps to T/O.

Establish an instrument takeoff attitude and retract the landing gear and flaps in the same manner and with the same restrictions as in an instrument takeoff. Power should be reduced as soon as a safe altitude and an airspeed of 200 KTS has been obtained.

ICE AND RAIN

WARNING

Flying through areas of possible ice formation conditions is prohibited.

If flying through clouds and or visible moisture at atmospheric temperature of + 5°C or less is unavoidable ensure that the De-icing system is on and functioning.

Switching on of the De-icing heating system is accompanied by a small drop of engine RPM and by an increase in EGT (20°- 30°).

Before taxiing, select De-icing switch to "AUTOMAT" if the condition above is prevalent.

If the "SNOW FLAKE" light on the warning panel appears, proceed as follows:

a. De-icing switch - select "MAN"
b. Depart the area of the icing condition.

If RIO-3 fails and you are in the area of icing conditions the warning lights "SNOW FLAKE" and "DE-ICING ON" will not show on the warning panel. In this case proceed as follows:

a. De-icing switch - select "MAN"
b. "DE-ICING ON" Light - Check ON.

When landing under icing conditions, extend flaps only to take off position (25°) and increase final approach speed by 20 KIAS above normal approach speed.

TURBULENCE AND THUNDERSTORMS

A safe and comfortable penetration speed into zones of turbulence air is 350 km/h = 189 KTS. If the power setting and attitude is maintained in the turbulent area the airspeed and altitude will remain fairly constant regardless of false airspeed and altitude indications.

If the penetration or flight in the vicinity of a thunderstorm is unavoidable, the following precautions should be taken:

> Adjust power as necessary to obtain approximately 350 km/h = 189 KTS. Turn the pitot heat and all deicing equipment on. Check the gyro instruments for proper settings and tighten flap belt and shoulder harness. Adjust the instrument and cockpit lights to full bright to minimize blinding effects of lighting. Do not extend gear and flaps since they do not increase aerodynamic efficiency. Use as little ele-

T-37

Take off 145

SC 25000

SC ROC 1000

SL ROC 2900

Climb Speed 1800

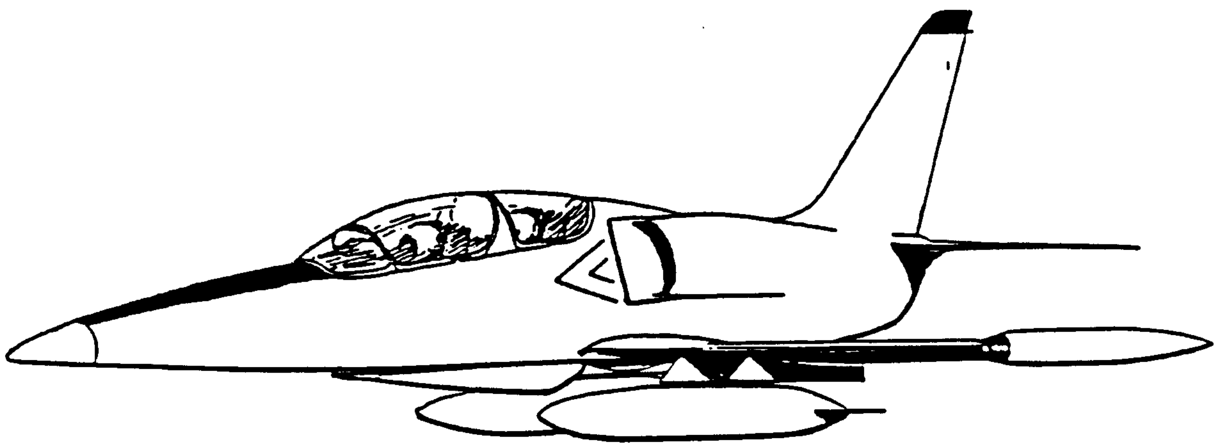
Ind Des Speed 200

Descent Rate 2500

SL Climb Fuel 1680.

SC Climb Fuel 780

APPENDIX
PERFORMANCE DATA



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Part 1

INTRODUCTION

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LIST OF CHARTS

DEFINITIONS AND ABBREVIATIONS

Definitions

Takeoff Speed.

The speed at which the aircraft attains 1,1 V_{s1}.

Takeoff Ground Run

The distance measured from brake release to the point where the aircraft reaches takeoff speed.

Takeoff Distance.

The horizontal distance measured from brake release until a height of 15 m ≙ 50 feet is attained.

Climb Speed

The speed after completion of the takeoff phase. This speed provides maximum rate of climb.

Approach Speed

Is the speed which must be maintained down to a height of 15 m ≙ 50 feet (over the threshold) and should be 1,3 V_{so}.

Touchdown Speed

Is the speed of 1,1 V_{so}.

Landing Distance

The horizontal distance from a 15 m ≙ 50 feet height above the landing surface to the point where the A/C comes to a complete stop.

Landing Ground Roll

The distance required from touchdown to a complete stop under the following conditions:

dry hard runway, full braking applied after nose wheel touchdown and after passing brake limiting speed.

Maximum Refusal Speed

The maximum speed at which an abort may be started and the aircraft stopped within the remaining runway length.

Accelerate-Stop-Distance

The distance required to accelerate the aircraft (in takeoff configuration) to the maximum refusal speed and bring it to a complete stop on the runway length remaining under the following conditions:

dry hard runway, full braking 3 s after engine has failed.

Abbreviations

Alt	Altitude
CAS	Calibrated airspeed: Indicated airspeed corrected for position error (CAS = IAS + Correction)
EAS	Equivalent airspeed: Calibrated airspeed corrected for compressibility (EAS = CAS - Correction)
ft	Feet
ft/min	Feet per minute
AS	Indicated airspeed
KCAS	Calibrated airspeed in knots
kg	Kilogram
kg/h	Kilogram/hour
KIAS	Indicated airspeed in knots
km	Kilometers
km/h	Kilometers per hour
KTAS	True airspeed in knots
KTS	Knots
lbs	Pounds
M	Mach number (Instrument and position error negligible) Indicated Mach number = True Mach number
m/s	meter per second
NM	Nautical miles
PA	
PR ALT	Pressure altitude
PSI	Pounds per square inch
ROC	Rate of climb
ROD	Rate of descent
RPM	Revolutions per minute
TAS	true airspeed (EAS corrected for density) $TAS = EAS \times 1/\sqrt{\sigma}$

V_{so}	Stall speed landing configuration
V_{s1}	Stall speed T/O configuration

Miscellaneoeus

$1/\sqrt{\sigma}$	the reciprocal of the square root of the density ratio, at the density altitude (the Greek letter sigma is used to represent the density ratio).

DISCUSSION OF PERFORMANCE CHARTS

The purpose of performance charts is for planning complete missions from takeoff to landing for operating conditions normally encountered. The conditions and operating procedures on which the performance is based are shown on the charts or in the text. To obtain the best performance from the aircraft, these conditions and procedures must be followed.

The operating procedures are consistent with the Normal Procedures in section II and the Operating Limitations in Section V.

A part type arrangement groups the data as needed for planning general phases of flight. Descriptive text and sample problems in each part discuss and explain the use of the types of charts provided.

PERFORMANCE DATA BASIS

Flight planning data shown in this Appendix are derived from the results of flight tests conducted by the contractor and are identified as FLIGHT TEST. All data are based on the thrust of an average engine, however, the actual thrust between engines varies and may cause variation in performance.

Unless specifically stated, the data are consistent with the recommended operating procedures and techniques set forth elsewhere in the Flight Manual. The charts are based on performance under standard atmospheric conditions, however, correstions for nonstandard temperature conditions have been included wherever possible.

FUEL AND FUEL DENSITY

The fuel density used in the Appendix is 0,78 kg/l. The density of JET A1 varies from 0,75 kg/l to 0.80 kg/l, depending upon manufacturer. This will cause a variation in grossmass and result in some variation in performance.

AIRSPEED CORRECTION CHART

Figure A1-1.

The airspeed correction chart is provided to show position error correction which must be applied to obtain calibrated airspeed (CAS) from values indicated on the airspeed indicator.

Example

Enter the chart at 420 km/h $\hat{=}$ 227 KTS and move up to the correction curve. From there move left and read the airspeed correction of 13 km/h $\hat{=}$ 7 KTS. CAS is 433 km/h $\hat{=}$ 234 KTS.

AIRSPEED/MACH NUMBER CURVES

Figure A1-2

These diagrams show the relationship between true Mach number, true airspeed, calibrated airspeed, air temperature and pressure altitude.

The diagram ranges from 0-600 KTS $\hat{=}$ 1 112 km/h CAS and up to 0,9 Mach.

Example

Enter the chart at a CAS of 399 km/h $\hat{=}$ 215 KTS and move straight up to the left and read 0,428 Mach. If you move parallel along the guide line right of left the SL line you read a TAS of 495 km/h $\hat{=}$ 267 KTS at standard temperature. If you move straight right to the sea level line and from there down to the

30° temperature line, from there again right, you read a TAS of 537 km/h ≙ 290 KTS at a temperature of 30 °C.

COMPRESSIBILITY CORRECTION CHART

Figure A1-3

The airspeed/compressibility correction that must be subtracted from calibrated airspeed in order to obtain equivalent airspeed is shown in figure A1-3. Equivalent airspeed is used in determining true airspedd. True airspeed equals equivalent airspeed times .

<u>Example</u>

Enter the chart at a CAS of 300 KTS and move straight up to the 25 000 feet line. Move right or left and read a correction of 11,5 KTS. Subtract this value from the CAS to obtain an EAS of 288,5 KTS.

DENSITY ALTITUDE CHART

Figure A1-4

The chart shows the relationship of outside air temperature, pressure altitude, and density altitude. A line showing the standard day variation of temperature with altitude is included for reference, as is a scale of $1/\sqrt{\sigma}$.

<u>Example</u>

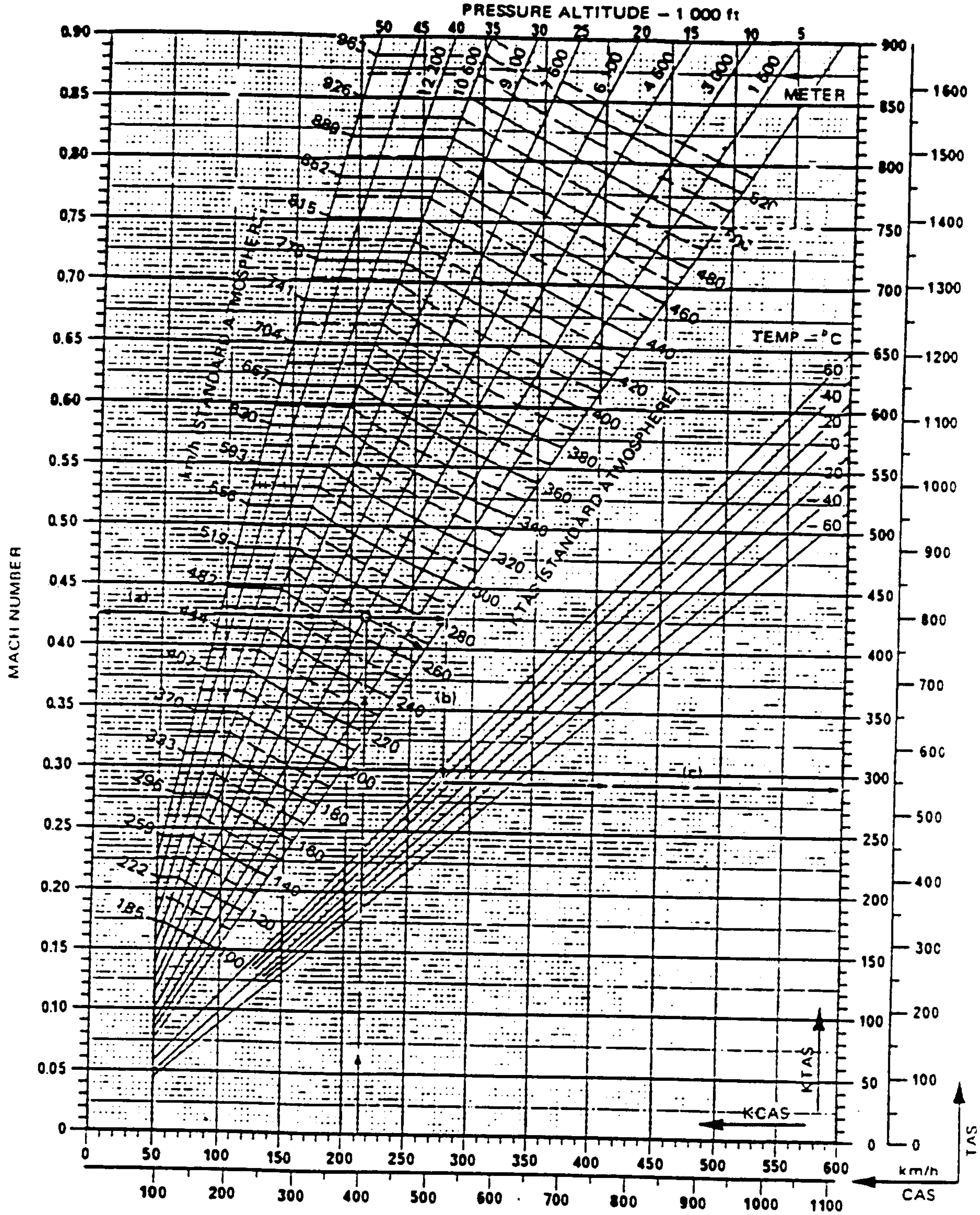
Enter the chart at -15°C and move straigth up to the pressure altitude line 6 000 ft.
From this intersection move straight to the left and right.
On the left scale you will read a density altitude of 3 700 feet and on the right scale you will read that $1/\sqrt{\sigma}$ is 1,06.

STANDARD ATMOSPHERE TABLE

Figure A1-5

The standard atmosphere table is provided, to show standard values of the atmosphere as defined by the International Ci-

AIRSPEED MACH NUMBER CURVES



EXAMPLE:			
KCAS	215 ≙ 400 km/h	(a) TMN	.428
ALT	15 000 ft ≙ 4 600 m	(b) KTAS	267 ≙ 494 km/h at standard temp. (– 14.7 °C)
		(c) KTAS	290 ≙ 537 km/h at temp. of + 30 °C

Fig.A1-2

COMPRESSIBILITY CORRECTION CHART

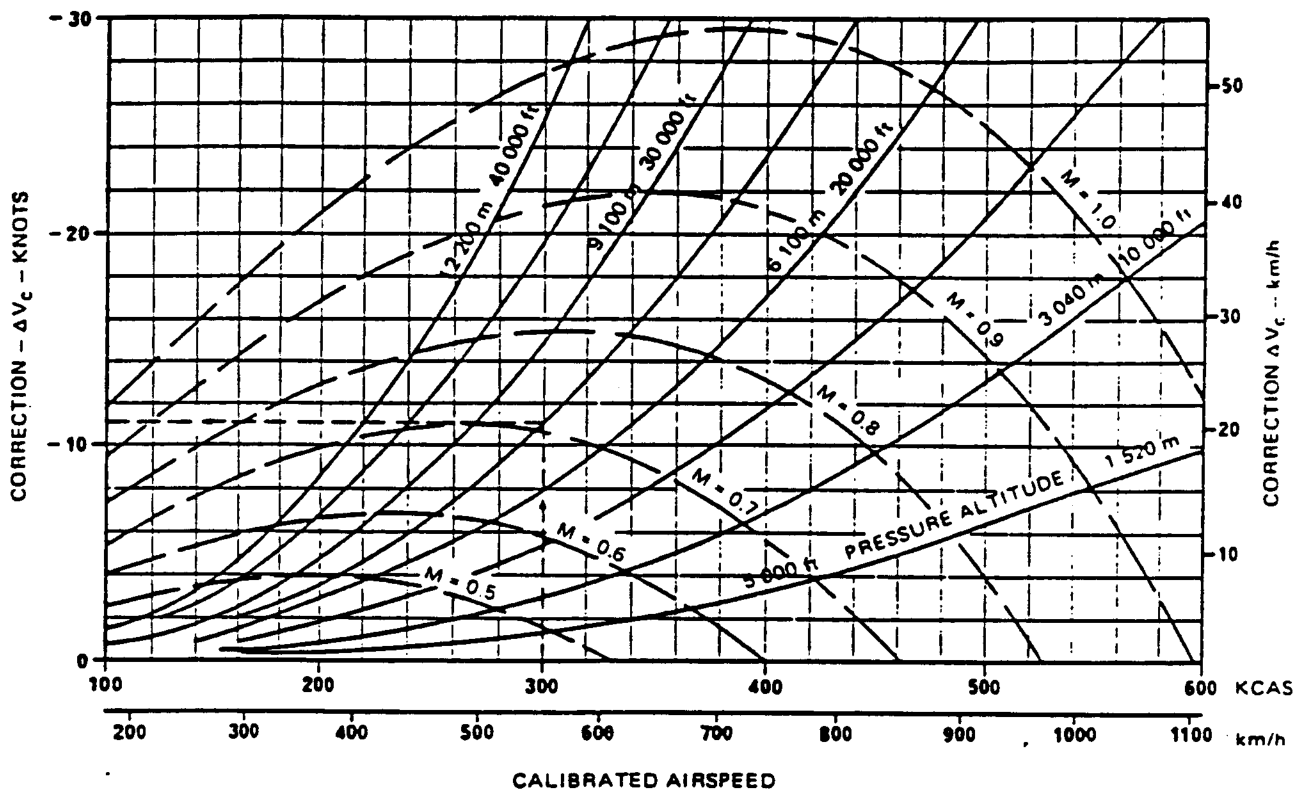
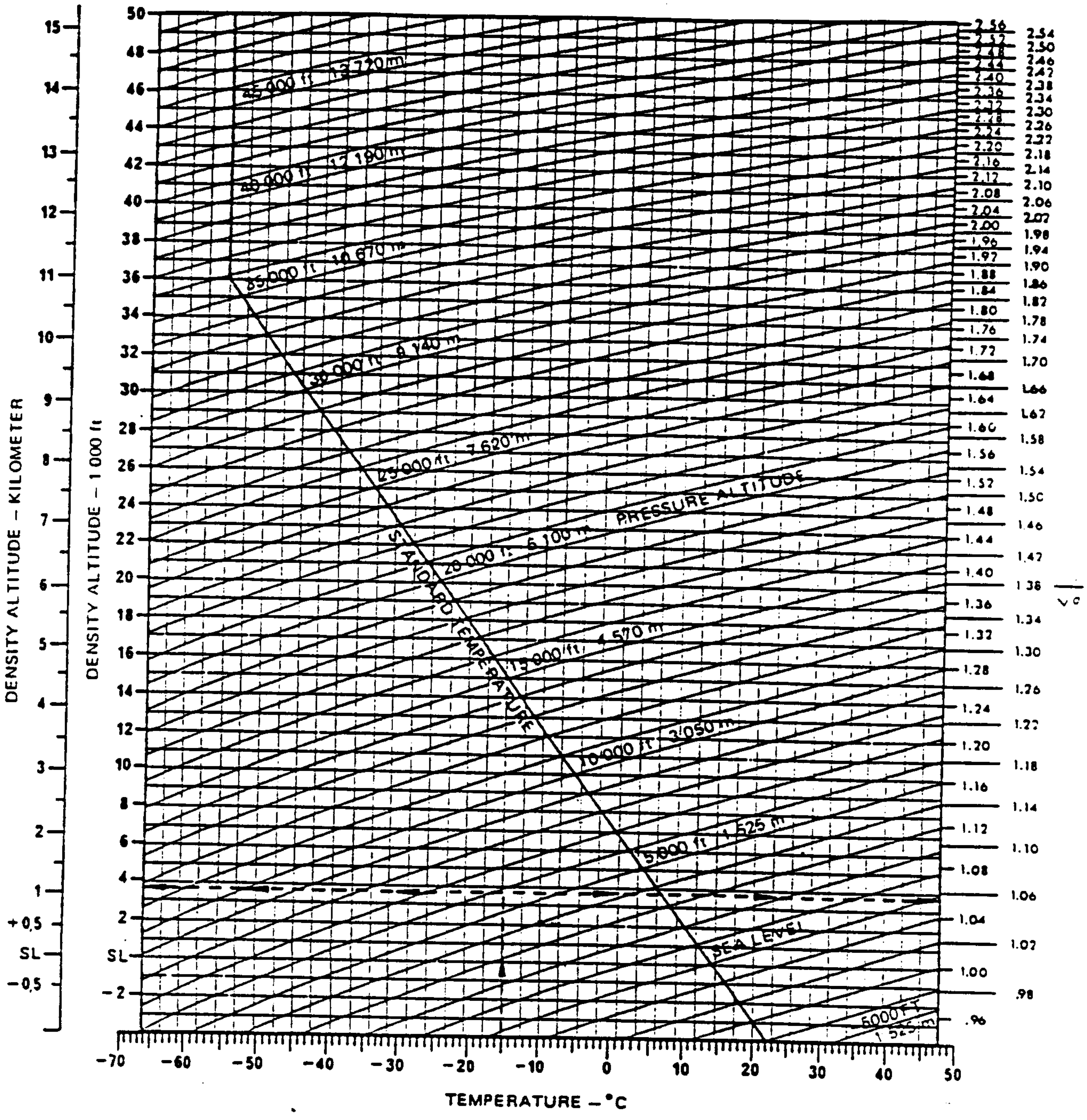


Fig. A1-3

DENSITY ALTITUDE CHART



EXAMPLE:
If ambient temperature is – 15 °C and pressure altitude is 6 000 ft (≈ 1 830 m), the density altitude is 3 700 ft (≈ 1 130 m) and $\frac{1}{\sqrt{\sigma}}$ is about 1.06.

NOTE:
Set altimeter setting to 1013.25 mb = 760 mm/Hg before reading pressure altitude and temperature in order to determine density altitude.

Fig. A1-4

STANDARD ATMOSPHERE TABLE

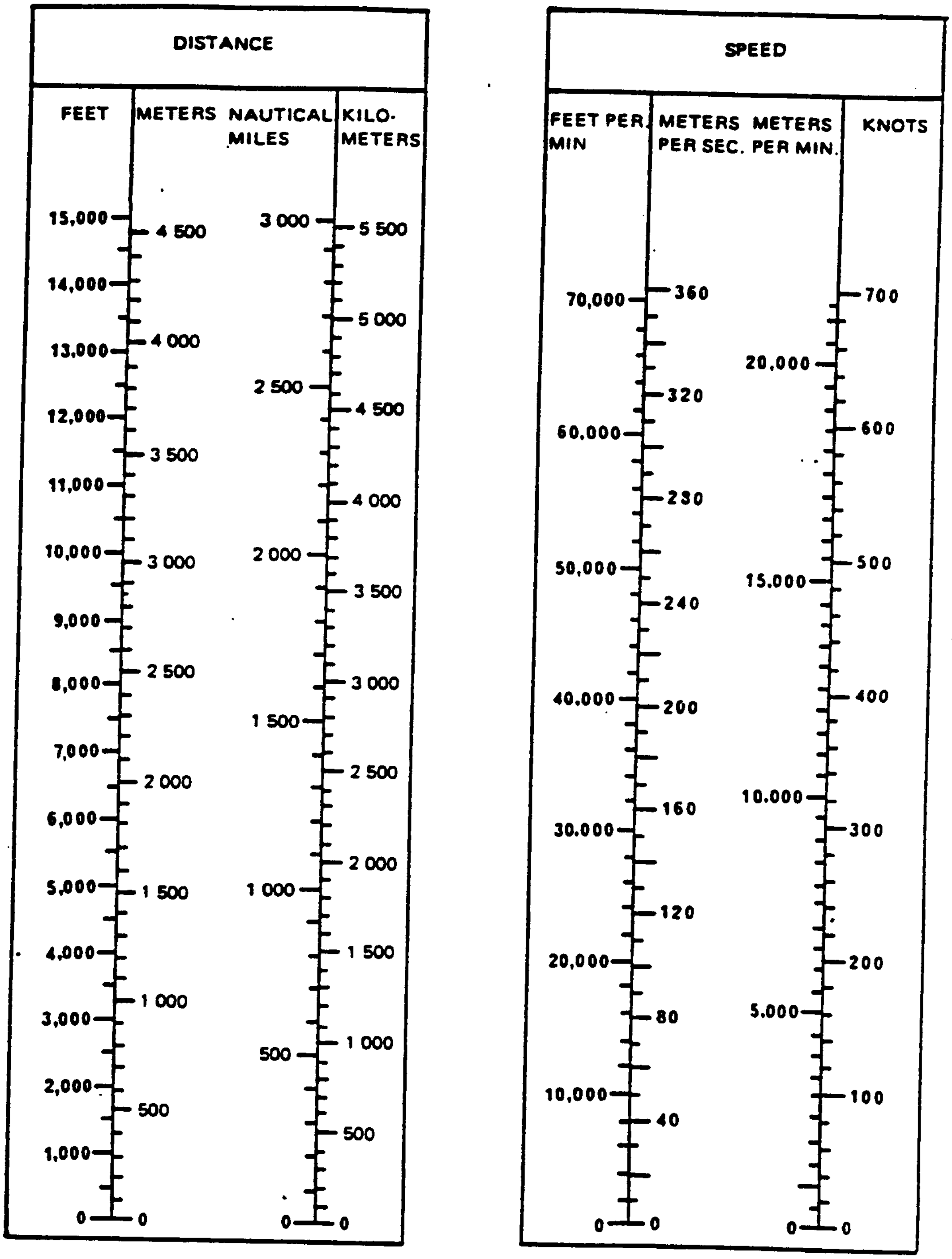
STANDARD SL CONDITION:
TEMPERATURE: + 15 °C = 59 °F
PRESSURE : 1 013,25 mb = 29,92 in.hg = 760 mm/Hg
DENSITY: 1,225 kg/m³
SPEED OF SOUND: 1 116,89 ft/sec = 330 m/sec

CONVERSION FORMULA:
1 kp/cm² – 14,223 psi
1 in.Hg – 0,4912 psi
1 knot – 1,852 km/h
1 knot – 1,688 ft/sec
1 km – 0,53959 kts

ALTITUDE FEET	DENSITY RATIO σ	$\frac{1}{\sqrt{\sigma}}$	SPEED OF SOUND KNOTS	TEMPERATURE °C	°F	PRESSURE mb	PRESSURE IN Hg	PRESSURE RATIO δ
0	1.000	1.0000	661.7	15.0	59.0	1013.25	29.92	1.0000
1.000	.9711	1.0148	659.5	13.0	55.4	977.18	28.85	.9644
2.000	.9428	1.0299	657.2	11.0	51.8	942.12	27.82	.9298
3.000	.9151	1.0454	654.9	9.0	48.3	908.07	26.81	.8962
4.000	.8881	1.0611	652.6	7.0	44.7	875.24	25.84	.8637
5.000	.8617	1.0773	650.3	5.0	41.1	843.02	24.89	.8320
6.000	.8359	1.0938	648.7	3.1	37.6	812.02	23.97	.8014
7.000	.8106	1.1107	645.6	1.1	34.0	781.87	23.08	.7716
8.000	.7860	1.1279	643.3	– 0.8	30.4	752.63	22.22	.7428
9.000	.7620	1.1456	640.9	– 2.8	26.9	724.27	21.38	.7148
10.000	.7385	1.1637	638.6	– 4.8	23.2	696.81	20.57	.6877
11.000	.7155	1.1822	636.2	– 6.7	19.7	669.16	19.79	.6614
12.000	.6932	1.2011	633.9	– 8.7	16.2	644.43	19.02	.6360
13.000	.6713	1.2205	631.5	– 10.7	12.6	619.40	18.29	.6113
14.000	.6500	1.2403	629.0	– 12.7	9.0	595.28	17.57	.5875
15.000	.6292	1.2606	626.6	– 14.7	5.5	571.78	16.88	.5643
16.000	.6090	1.2815	624.2	– 16.6	1.9	549.18	16.21	.5420
17.000	.5892	1.3028	621.8	– 18.6	– 1.6	527.19	15.56	.5203
18.000	.5699	1.3246	619.4	– 20.6	– 5.1	506.02	14.94	.4994
19.000	.5511	1.3470	617.0	– 22.6	– 8.7	485.45	14.33	.4791
20.000	.5328	1.3700	614.6	– 24.6	– 12.3	465.59	13.75	.4595
21.000	.5150	1.3935	612.1	– 26.2	– 15.8	446.44	13.18	.4406
22.000	.4976	1.4176	609.6	– 28.5	– 19.4	427.90	12.63	.4223
23.000	.4806	1.4424	607.1	– 30.5	– 23.0	409.96	12.10	.4046
24.000	.4642	1.4678	604.6	– 32.5	– 26.5	392.74	11.59	.3876
25.000	.4481	1.4938	602.1	– 34.5	– 30.1	376.02	11.10	.3711
26.000	.4325	1.5206	599.6	– 36.5	– 33.7	359.91	10.62	.3552
27.000	.4173	1.5480	597.1	– 38.4	– 37.2	344.30	10.16	.3398
28.000	.4025	1.5762	594.6	– 40.4	– 40.8	329.31	9.72	.3250
29.000	.3881	1.6052	592.1	– 42.4	– 44.4	314.82	9.29	.3107
30.000	.3741	1.6349	589.5	– 44.4	– 47.9	300.94	8.88	.2970
31.000	.3605	1.6654	586.9	– 46.4	– 51.5	287.46	8.48	.2837
32.000	.3473	1.6968	584.4	– 48.3	– 55.1	274.49	8.10	.2709
33.000	.3345	1.7291	581.8	– 50.3	– 58.6	262.03	7.73	.2586
34.000	.3220	1.7623	579.2	– 52.3	– 62.2	249.97	7.38	.2467
35.000	.3099	1.7964	576.6	– 54.3	– 65.8	238.42	7.04	.2353
36.000	.2981	1.8315	574.0	– 56.3	– 69.3	227.27	6.71	.2243
36.089	.2971	1.8347	573.7	– 56.5	– 69.7	226.36	6.68	.2234
37.000	.2843	1.8753	573.7	– 56.5	– 69.7	216.63	6.39	.2138
38.000	.2710	1.9209	573.7	– 56.5	– 69.7	206.50	6.09	.2038
39.000	.2583	1.9677	573.7	– 56.5	– 69.7	196.77	5.81	.1942
40.000	.2462	2.0155	573.7	– 56.5	– 69.7	187.55	5,53	.1851
41.000	.2346	2.0645	573.7	– 56.5	– 69.7	176.37	5.28	.1764
42.000	.2236	2.1148	573.7	– 56.5	– 69.7	170.44	5.03	.1681
43.000	.2131	2.1662	573.7	– 56.5	– 69.7	162.21	4.79	.1602
44.000	.2031	2.2189	573.7	– 56.5	– 69.7	154.76	4.57	.1527
45.000	.1936	2.2728	573.7	– 56.5	– 69.7	147.65	4.36	.1455

Fig. A1-5

STANDARD UNITS CONVERSION CHART



Conversion formula:

Kilometer/km/h into knots:	km	x	0,53959	=	kts/NM
Knots/NM into kilometer:	kts	x	1,853	=	km
Feet into meters:	ft	x	0,304801	=	m
Meters into feet:	m	x	3,28083	=	ft

Fig. A1-6

CONVERSION mm OF MERCURY-MILLIBAR

MILLIMETERS to MILLIBARS (1 millimeter of mercury = 1.3332 millibars)

Milli-meters	0	1	2	3	4	5	6	7	8	9
	MILLIBARS									
530	706,6	707,9	709,3	710,6	711,9	713,3	714,6	715,9	717,3	718,6
540	719,9	721,3	722,6	723,9	725,3	726,6	727,9	729,3	730,6	731,9
550	733,3	734,6	735,9	737,3	738,6	739,9	741,3	742,6	743,9	745,3
560	746,6	747,9	749,3	750,6	751,9	753,3	754,6	755,9	757,3	758,6
570	759,9	761,3	762,6	763,9	765,3	766,6	767,9	769,3	770,6	771,9
580	773,3	774,6	775,9	777,3	778,6	779,9	781,3	782,6	783,9	785,3
590	786,6	787,9	789,3	790,6	791,9	793,3	794,6	795,9	797,3	798,6
600	799,9	801,3	802,6	803,9	805,3	806,6	807,9	809,3	810,6	811,9
610	813,3	814,6	815,9	817,3	818,6	819,9	821,3	822,6	823,9	825,3
620	826,6	827,9	829,3	830,6	831,9	833,3	834,6	835,9	837,3	838,6
630	839,9	841,3	842,6	843,9	845,3	846,6	847,9	849,3	850,6	851,9
640	853,3	854,6	855,9	857,3	858,6	859,9	861,3	862,6	863,9	865,3
650	866,6	867,9	869,3	870,6	871,9	873,3	874,6	875,9	877,3	878,6
660	879,9	881,3	882,6	883,9	885,3	886,6	887,9	889,3	890,6	891,9
670	893,3	894,6	895,9	897,3	898,6	899,9	901,3	902,6	903,9	905,3
680	906,6	907,9	909,3	910,6	911,9	913,3	914,6	915,9	917,3	918,6
690	919,9	921,3	922,6	923,9	925,3	926,6	927,9	929,3	930,6	931,9
700	933,3	934,6	935,9	937,3	938,6	939,9	941,3	942,6	943,9	945,3
710	946,6	947,9	949,3	950,6	951,9	953,3	954,6	955,9	957,3	958,6
720	959,9	961,3	962,6	963,9	965,3	966,6	967,9	969,3	970,6	971,9
730	973,3	974,6	975,9	977,3	978,6	979,9	981,3	982,6	983,9	985,3
740	986,6	987,9	989,3	990,6	991,9	993,3	994,6	995,9	997,3	998,6
750	999,9	1001,3	1002,6	1003,9	1005,3	1006,6	1007,9	1009,3	1010,6	1011,9
760	1013,3	1014,6	1015,9	1017,3	1018,6	1019,9	1021,3	1022,6	1023,9	1025,3
770	1026,6	1027,9	1029,3	1030,6	1031,9	1033,3	1034,6	1035,9	1037,3	1038,9
780	1039,9	1041,3	1042,6	1043,9	1045,3	1046,6	1047,9	1049,3	1050,6	1051,9
790	1053,3	1054,6	1055,9	1057,3	1058,6	1059,9	1061,3	1062,6	1063,9	1065,3
800	1066,6	1057,9	1069,3	1070,6	1071,9	1073,3	1074,6	1075,9	1077,3	1078,6

Fig. A1-7

CONVERSION liter – kg

FUEL DENSITY AT ISA (15 °C) 0,78 kg/l

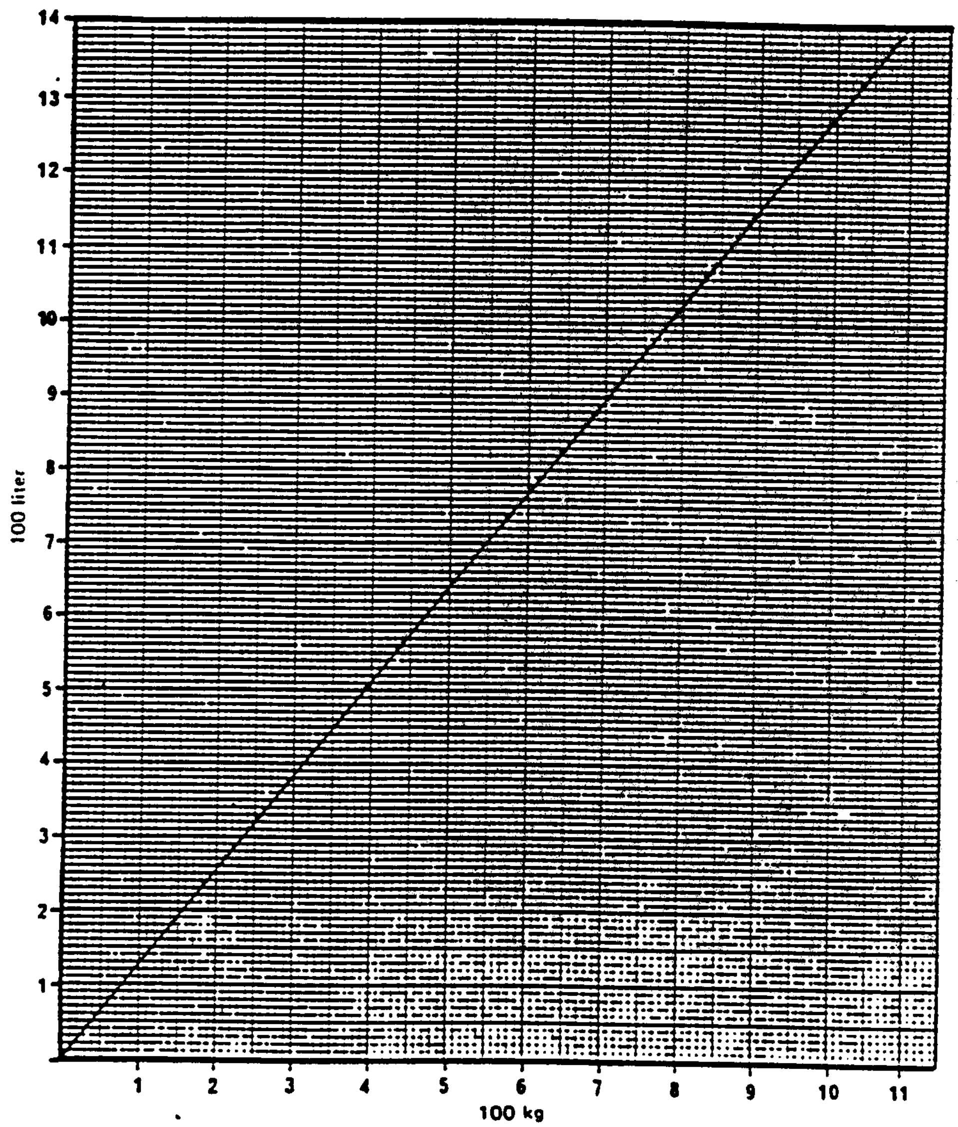
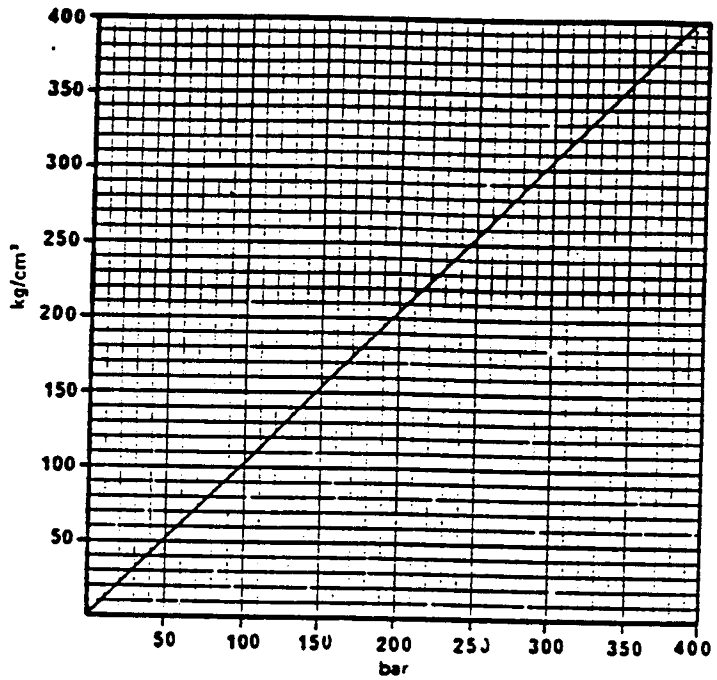


Fig. A1-8

CONVERSION kg/cm² – bar – psi



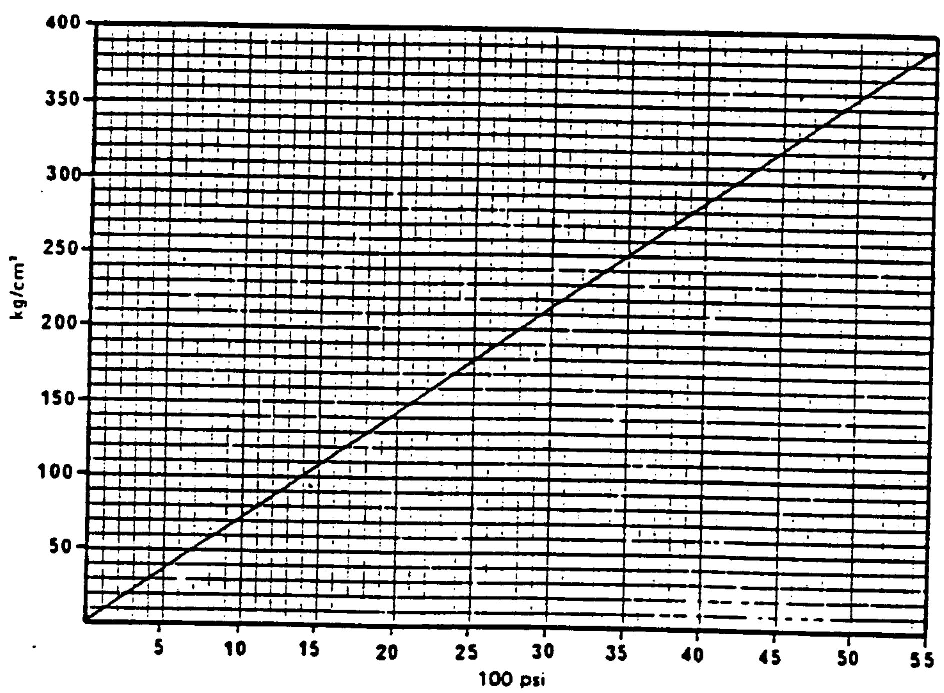


Fig. A1-9

FUEL LOAD - AIRCRAFT MASS

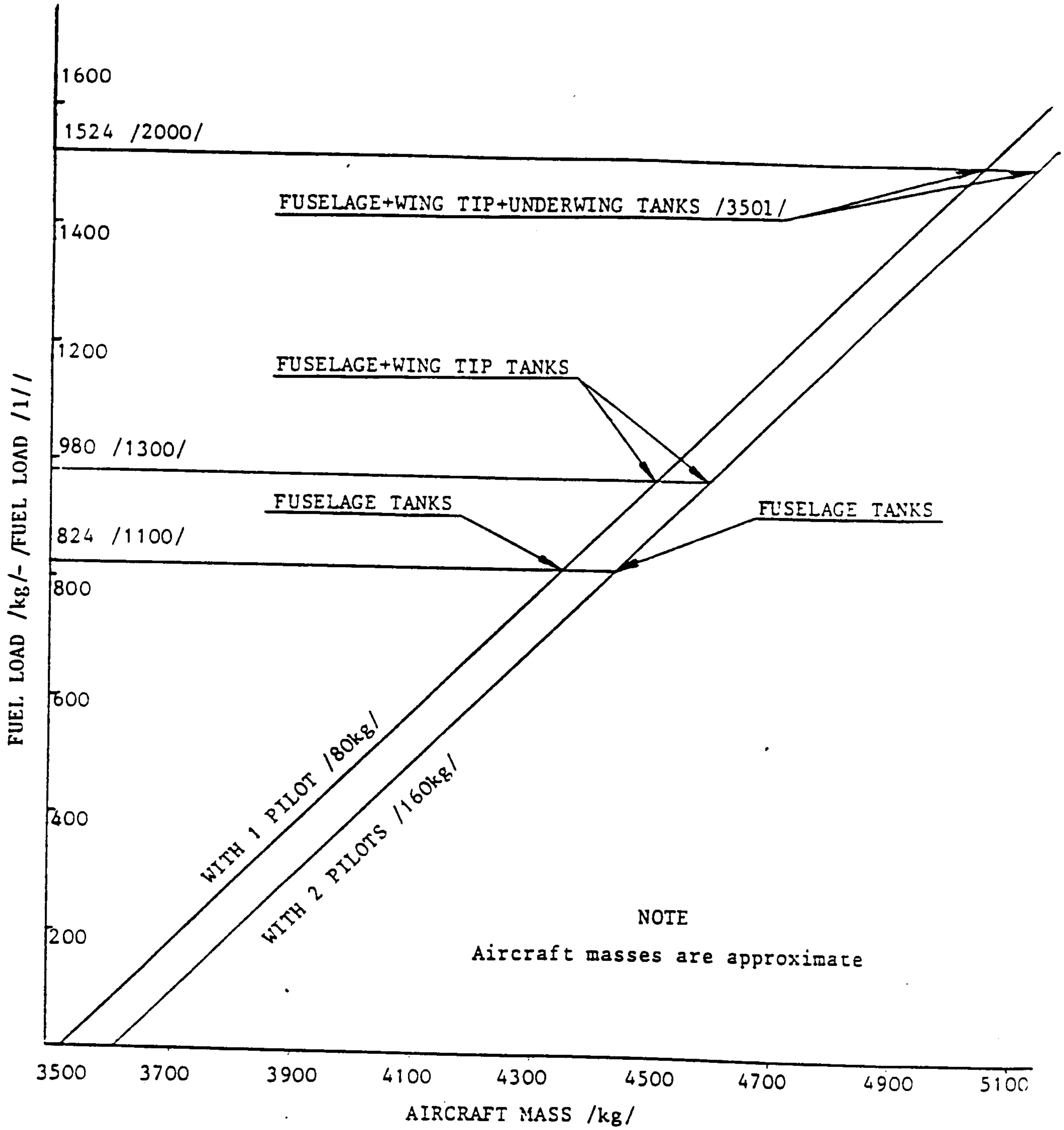


Fig. A1-10

Part 2

TAKEOFF

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LIST OF CHARTS

DESCRIPTION AND USE OF CHARTS

TAKEOFF SPEEDS

Figure A2-1/1, -1/2

Normal takeoff speeds, stall speeds, and the speeds at which a height of 15 m ≙ 50 feet should be attained are given for the entire range of takeoff gross masses.

USE

Enter the chart with the takeoff mass to obtain the correspon-ding speeds.

EXAMPLE

The example shows for a takeoff mass of 4 400 kg a stalling speed of 177 km/h /96 kts/, and a normal takeoff speed of 195 km/h /105 kts/. The speed over a 15 m ≙ 50 feet obstacle is 212 km/h /114 kts/.

TAKEOFF GROUND RUN

Figure A2-2

This chart shows the takeoff ground run for different density altitudes /ISA/, and gross masses. Correction grids for head/tailwind components are included in the chart.

EXAMPLE

Enter the chart at the OAT and pressure altitude. Then move straight to the right to your takeoff mass /4 100 kg/, and from this point down to your headwind-tailwind base line. Draw the line parallel to the headwind line to the 10 m/s point, from this point straight down to obtain the take-off ground run 790 m /2400 ft/

ACCELERATE-STOP-DISTANCE

Figure A2-3

This chart shows the distance required to accelerate the aircraft to takeoff speed and, assuming an engine failure, bring it to a full stop on the runway length remaining.

EXAMPLE

The example shows for a takeoff mass 4 400 kg an accelerate--stop-distance for clean a/c 1150 m /3750 ft/ on the concrete runway and on the grassy runway 1250 m /4100 ft/ under standard atmospheric conditions.

TAKEOFF DISTANCE OVER 15-M-OBSTACLE

Figure A2-4

This chart shows for different, takeoff masses takeoff distance over A 15 m ≙ 50 feet obstacle.

NOTE

Takeoff distance to clear a 15 m ≙ 50 feet obstacle is only obtained, if the proper normal takeoff speed from the TAKEOFF SPEEDS chart is maintained during takeoff.

EXAMPLE

The example shows for a takeoff mass of 4 400 kg a takeoff distance for clean a/c 675 m /2200 ft/ on the concrete runway and on the grassy runway 790 m /2600ft/ under standard atmospheric conditions.

TAKEOFF AND LANDING CROSSWIND CHART

Figure A2-5

The wind component chart is used to determine the wind component parallel and perpendicular to the runway. The crosswind component must be based on maximum gusts velocities. This chart shows three different wind velocities and wind directions. The headwind and crosswind component and the maximum crosswind component for takeoff and landing. The limit line represents the demonstrated crosswind component of 10 m/s.

USE

Enter the chart with the difference between wind and runway direction and the wind velocity and mark this point on the chart. From this point head and crosswind components may easily be obtained.

EXAMPLE

The example shows head and crosswind components, and the allowance for takeoff and landing for a wind 30^{o} off the runway in use with 12,5 m/s :

Headwind component	11 m/s
Crosswind component	6,5 m/s

Takeff and landing are allowed.

Take-Off Speeds ; Flaps 25°

Model : L-39 clean version	Engine : AI-25TL
Date : July 1987	Fuel :
Data bassis : calculated	Density: 0,78 kg/l

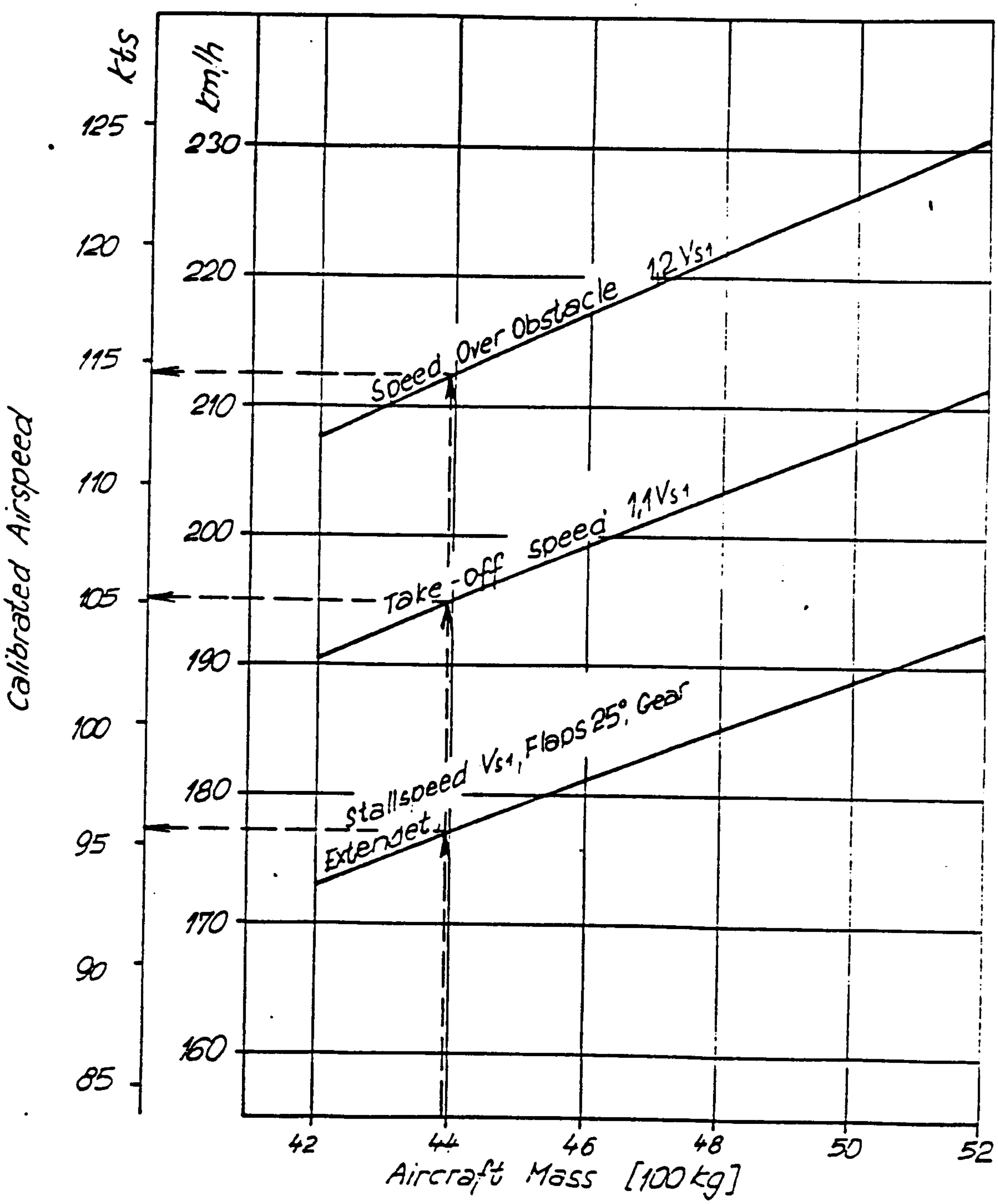


Fig.A2-1/1

TAKE-OFF SPEEDS

FLAPS 25°

Model : L-39
Date : July, 1987
Data basis : Calculated

Engine : AI-25TL
Fuel Density : 0,78 kg/l

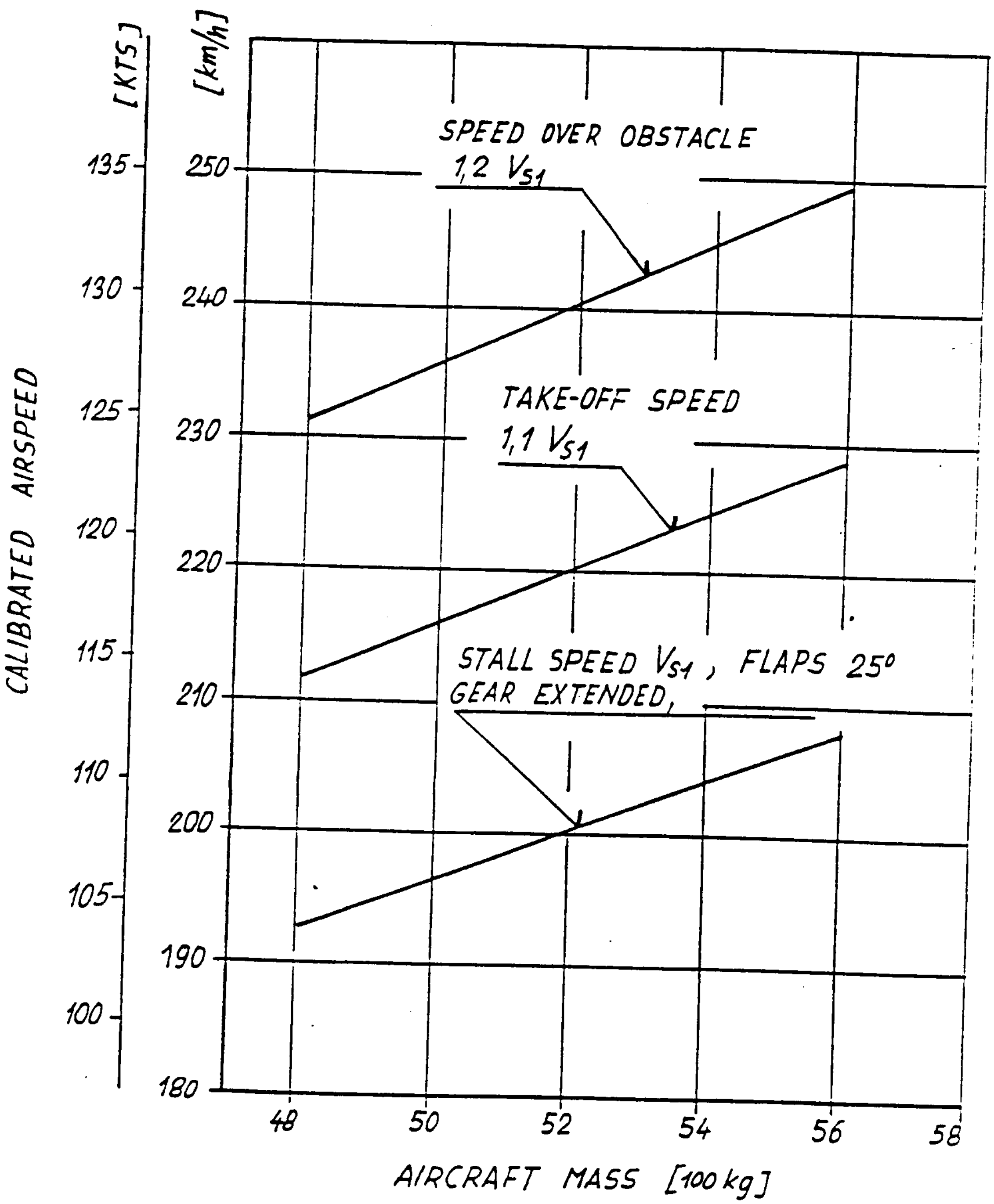


Fig. A2-1/2

Flaps 25°, Max. Power

Model : L-39 *Engine : AI-25TL*

Date : July, 1987 *Fuel Density : 0,78 kg/l*

Data Basis : Calculated

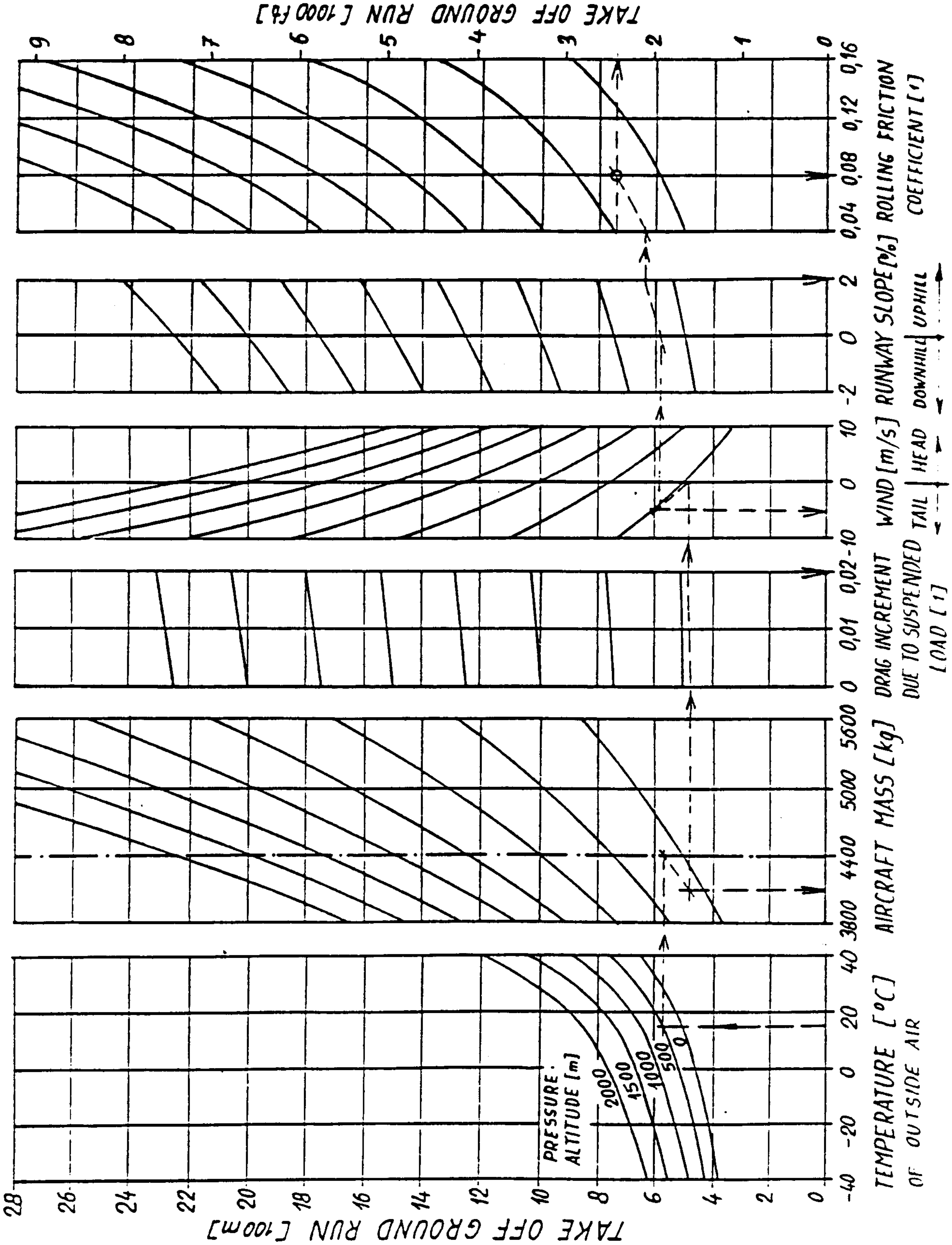


Fig. A2-2

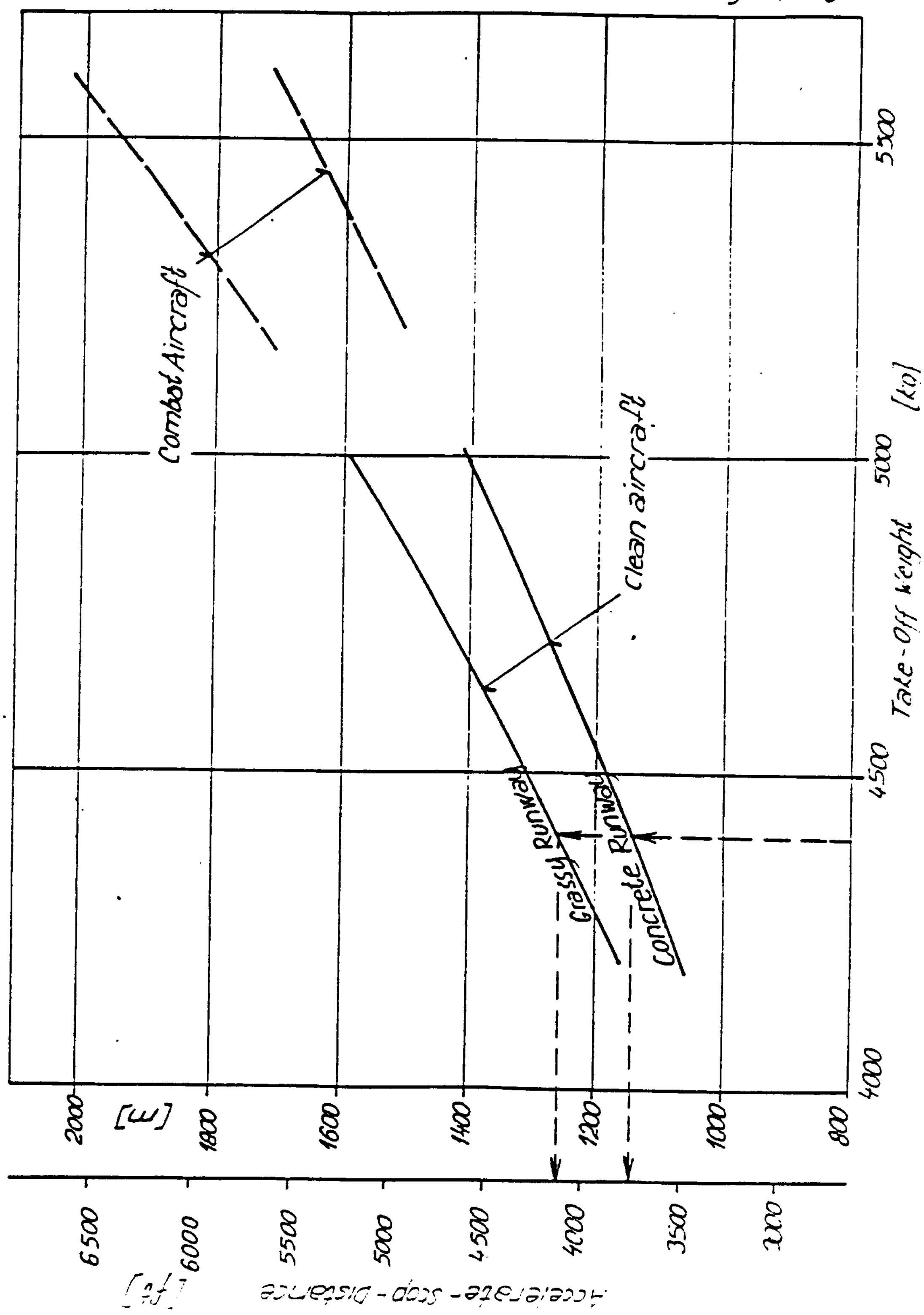
Accelerate - Stop - Distance

Take-Off Power - Engine Failure At V_1

Maximum Braking 3sec After Engine Failure

Model : L-39 Data basis : calculated Fuel :

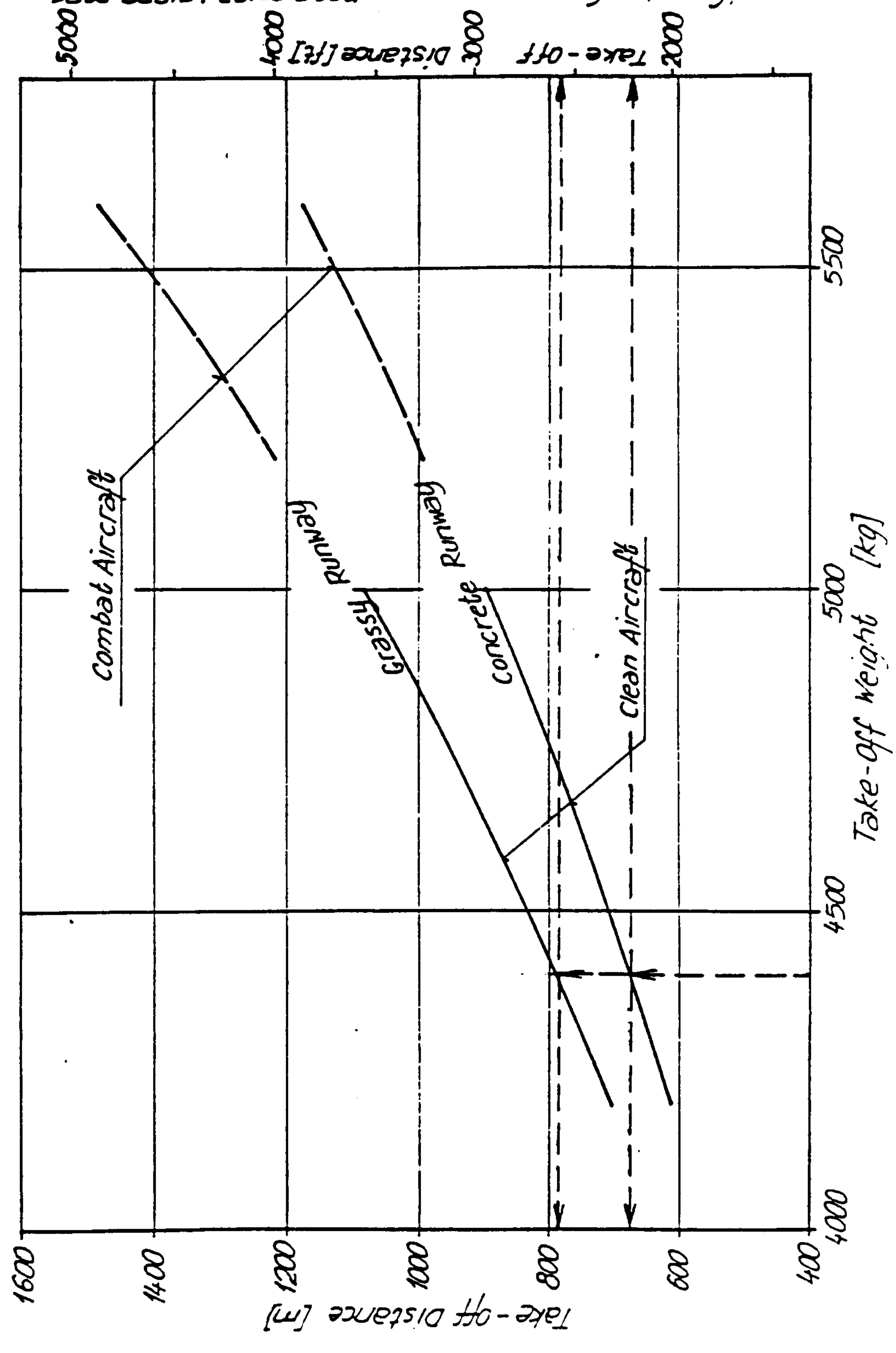
Date : July, 1987 Engine : AI-25TL Density : 0,87 kg/l



Take-off Distance Over 15m-Obstacle; Take Off Power Flaps 25°; Dry and hard Runway

Model : L-39
Data : July 1987
Data basis : calculatea

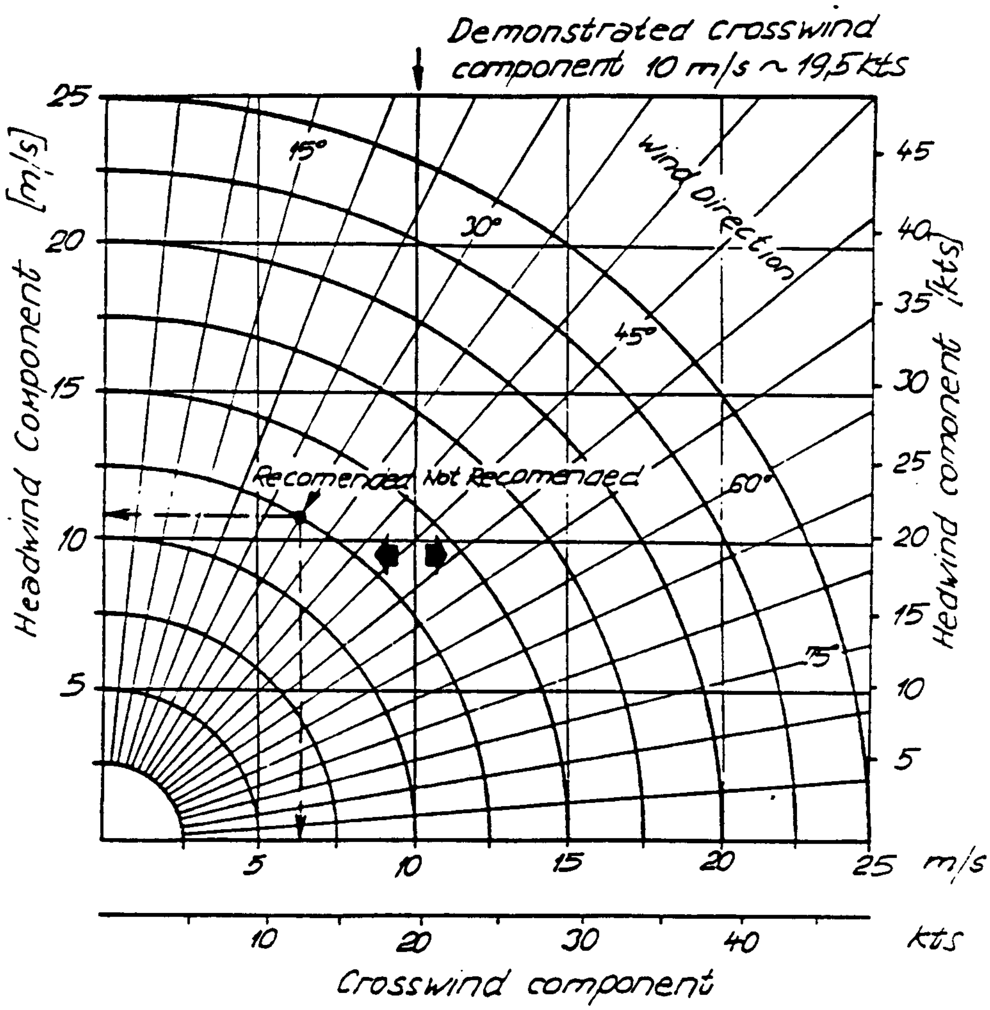
Engine : AI-25 TL
Fuel :
Density : 0,78 kg/l



Takeoff and Landing Crosswing Chart

Model : L-39
Date : July 1987
Data Basis : Calculated

Engine : AI-25TL
Fuel :
Density : 0,78 kg



Note:
For Crosswind componententer chart with maximum reported velocity

Fig. A2-5

Part 3

CLIMB

TABLE OF CONTENTS | Page

LIST OF CHARTS

DESCRIPTION AND USE OF CHARTS

CLIMB CONTROL

Rate of climb and climb speed
Figure A3-1

The climb control charts present the climb speed schedule for the maximum rate of climb with maximum rated power for different masses and all air temperatures. The charts also show the rate of climb at several altitudes and aircraft masses for standard day.

EXAMPLE
The example shows rate of climb and climb speed at 4000 m /13 100 ft/ with an aircraft mass of 4 200 kg.

Rate of climb – 15 m/s /2 950 f/min/
Climb speed – In the begining climb at the speed 400 km/h / 216 kts/ according to the air speed indicator thick pointer up to the altitude when the speed 500 km/h /270 kts / is reached according to thin pointer of the air speed indicator. Then climb at the speed 500 km/h / 270 kts / according to the air speed indicator thin pointer up to the ceiling.

CLIMB CONTROL
TIME, DISTANCE, AND FUEL USED
DURING CLIMB
Figure A3-2 thru A3-4

These charts are based on full power and the maximum rate of climb schedules. The charts show time, distance, and fuel used during climb, and the reduction of aircraft mass during climb. Performance data range from sea level to the combat ceiling /altitude at which rate of climb has decreased to 0,5 m/s/.

CAUTION

For altitude higher than 10 km /32 800 ft/ and after 20 min. max. power, must be reduced to nom. regime.

The climb charts can be read directly to obtain performance data for standard day conditions. When the temperature is higher than standard /a hot day/, the aircraft will perform as though the mass is greater than actual. When air temperature is lower than standard /a cold day/ the aircraft will perform as though the mass is less than actual.

USE

To obtain the climb data desired, enter the appropriate charts at the aircraft mass and altitude at start of climb. Note time, fuel, and distance at this point. From the initial altitude trace a line parallel to the guide line unitil it intersects the desired altitude at the end of climb. Note time, fuel, distance, and aircraft mass at this intersection.

The difference between the final and initial entry, is the time, fuel, and distance required. If starting the climb from sea level, the time, fuel and distance may be read directly.

EXAMPLE

The example shows the time, fuel, distance, and the reduction of aircraft mass for a climb from 5 000 (16 400 ft) to 8 000 (26 300 ft) m with an initial mass of 4 400 kg at the start of climb.

The chart A3-2 is used to find out the time needed for climb Enter chart at 4 400 kg and move straight up to the 5 000 (16 400 ft) m line and from there move straight to the left and read 5 minutes. From the 5 000 (16 400 ft) m line follow parallel the guide line up to 8 000 (26 300 ft) m. Move straight to the left and read 11 minutes. The time used in climb is 6 /11-5/ minutes.

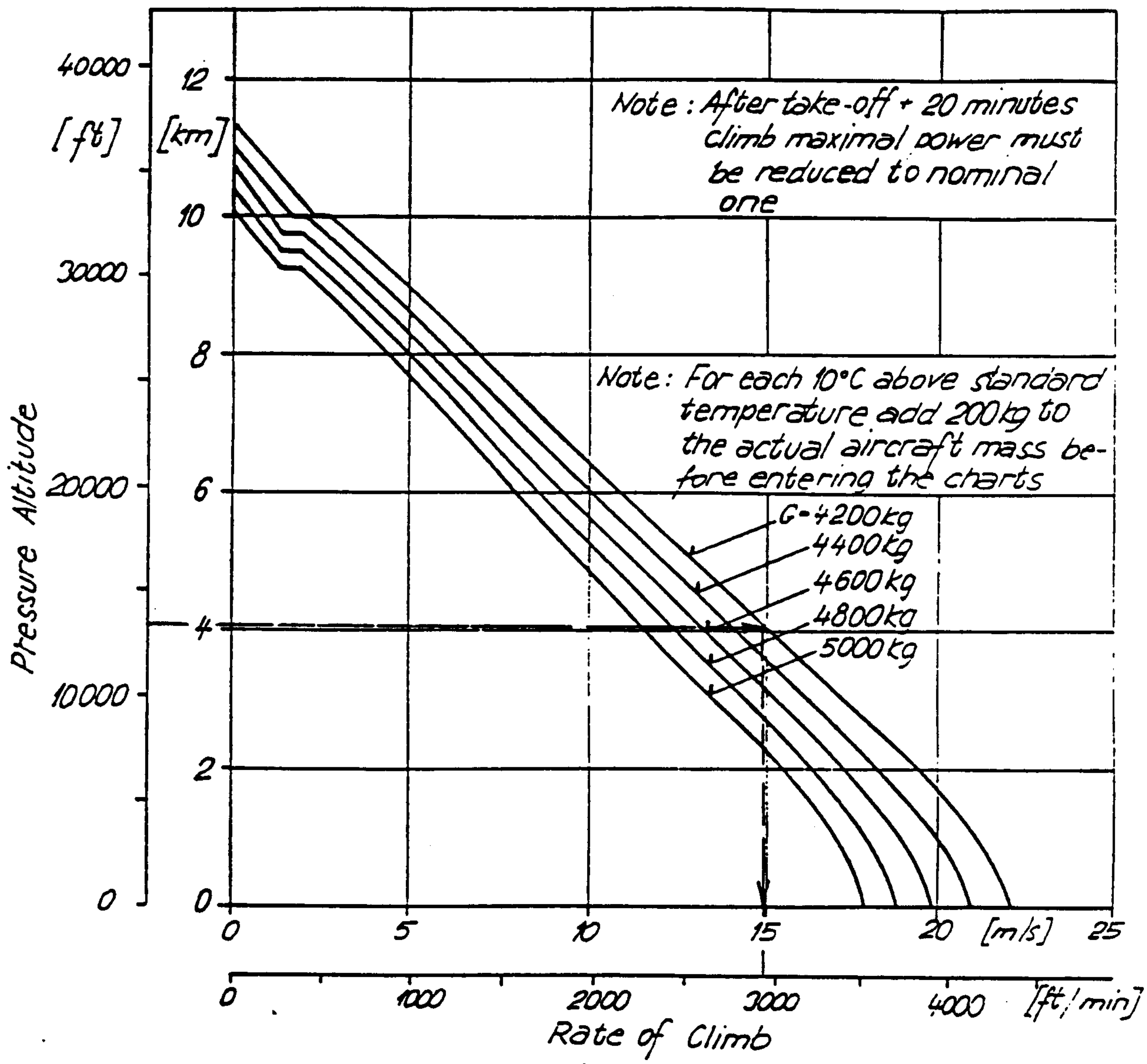
To find the distance covered in climb enter the figure A3-3 at 4 400 kg and move straight up to the 5 000 m (16 400 ft) line. From there move straight to the left and read 40 km/22 n.m./. From the 5 000 m (16 400 ft) line move parallel the guide line up to 8 000 m (26 300 ft). Move straight to the left and read 90 km /49 n.m./ Distance covered in climb is 50 km /27 n.m./.

Enter the chart A3-4 at 4 400 kg and move straight up to the 5 000 m line /start of climb/. At this intersection move up parallel to the nearest guide line to 8 000 m (26 300 ft) /end of climb/. From this intersection move straight down and read an aircraft mass of 4 340 kg. From the 5 000 m (16 400 ft) intersection move straight to the left and read 73 kg. From the 8 000 m (26 300 ft) intersection move straight left and read 133 kg. The fuel used for this climb is 60 /133-73/ kg.

RATE OF CLIMB AND CLIMB SPEED

Model : L-39 clean version
Date : July 1987
Date basis : calculated

Engine : AI-25TL
Fuel :
Density : 0,78 kg/l



NOTE
Climb speed - In the begining climb at the speed 400 km/h /216 kts/ according to the air apeed indicator thick pointer up to the altitude when the speed 500 km/h /270 kts/ is reached according to thin pointer of the air speed indicator. Then climb at the speed 500 km/h /270 kts/ according to the air speed indicator thin pointer up to the ceiling.

Fig. A3-1

Maximal Power - ISA Conditions

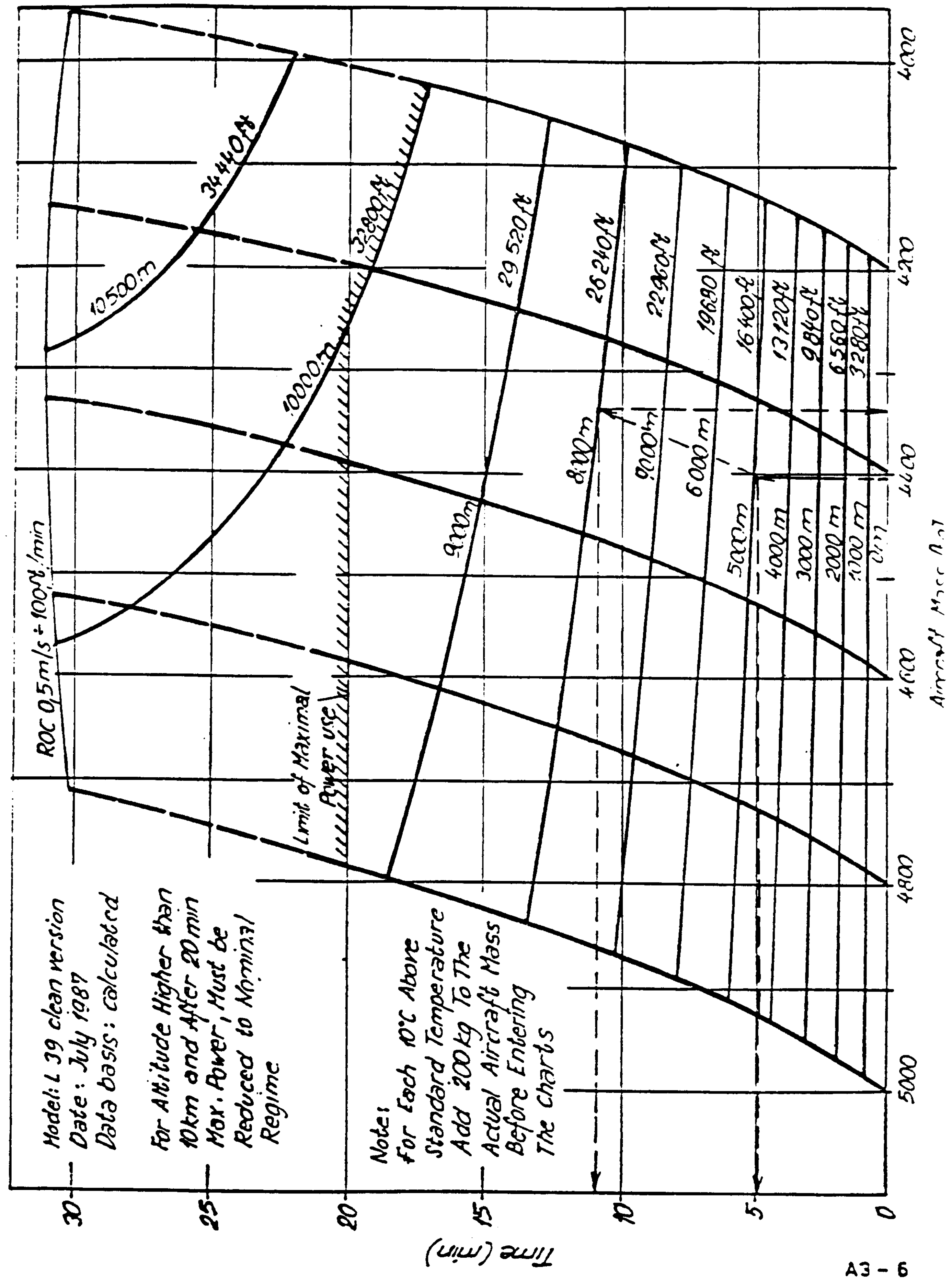


Fig. A3-2

MAXIMUM POWER

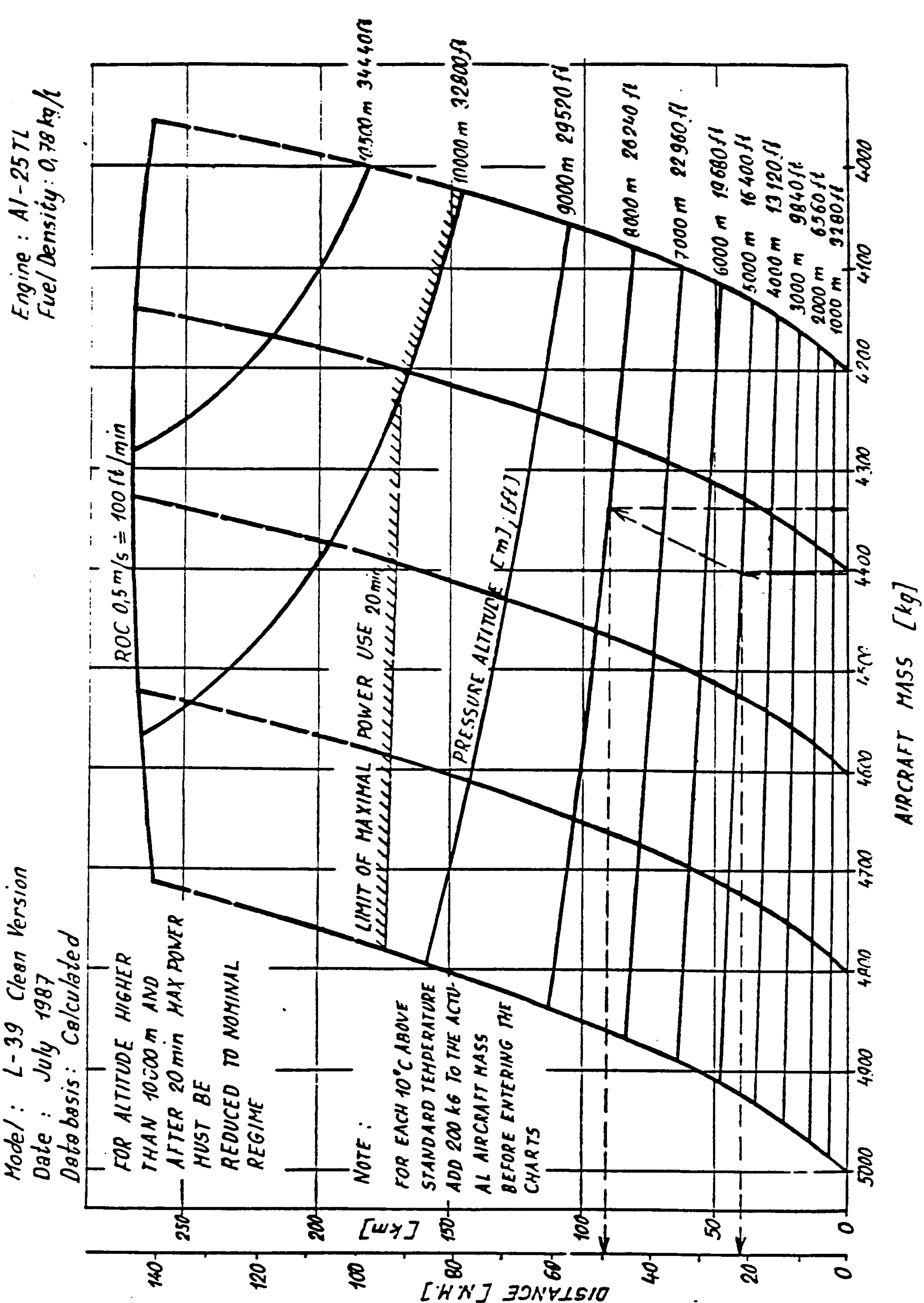


Fig. A3-3

CLIMB CONTROL - FUEL

MAXIMAL POWER , ISA CONDITIONS

Model : L-39 Clean Version
Date : July 1987
Data basis : Caculated

Engine : AI-25TL
Fuel Density : 0,78 kg/l

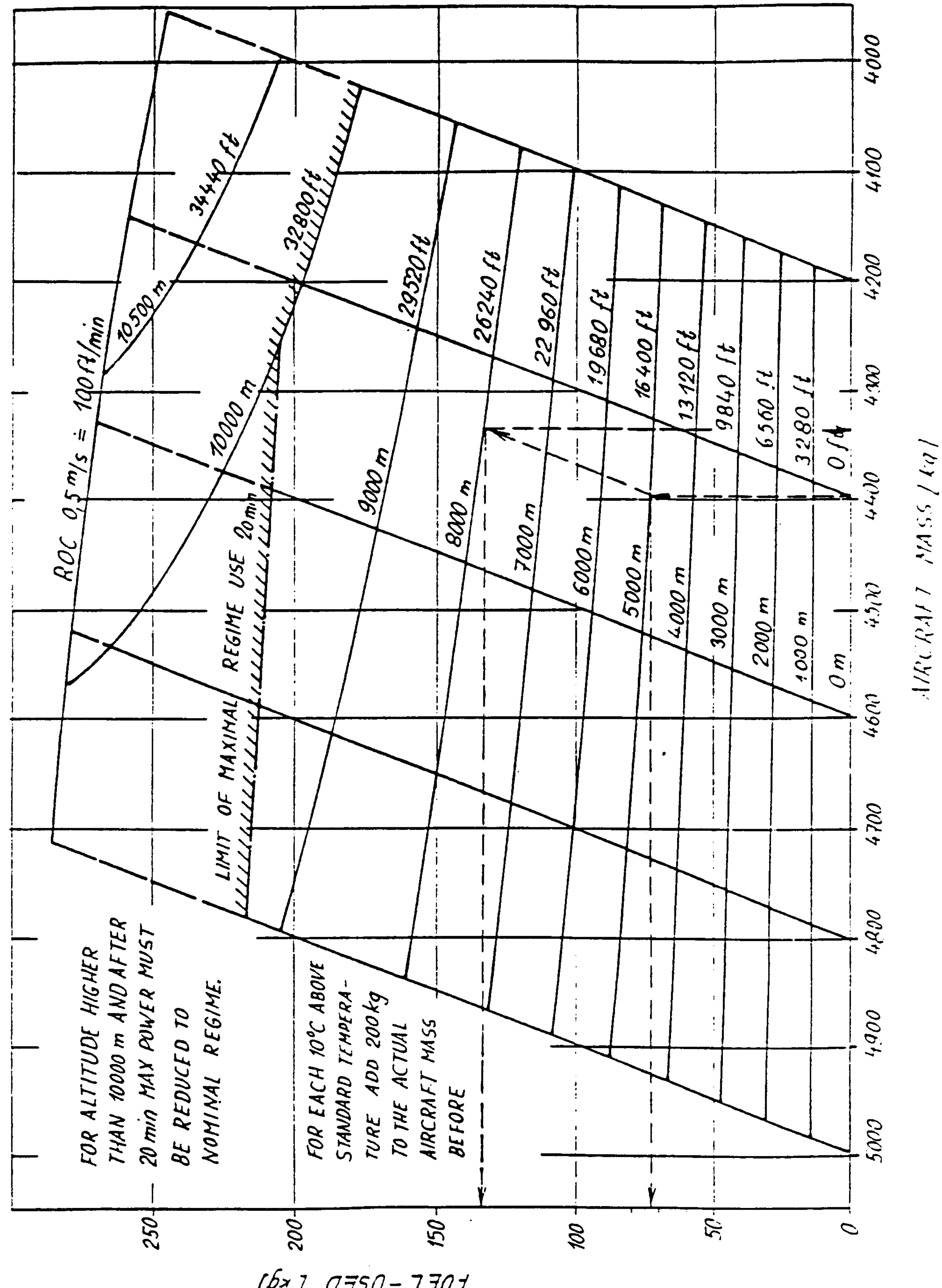


Fig. A3-4

Part 4

RANGE

TABLE OF CONTENTS

LIST OF CHARTS

DESCRIPTION AND USE OF CHART

KILOMETERS PER 100 kg FUEL

Figures A4-1 thru A4-4

The kilometers per 100 kg fuel charts furnish standard day aircraft performance in terms of kilometers per 100 kg fuel flow for level flight operation in zero wind under any condition from maximum to loiter speed.

Charts are given from sea level up to 8000 m ≙ 26 300 ft. Speed lines of maximum range are marked.

USE

Select proper chart for aircraft altitude. Determine average aircraft mass for the amount of fuel being considered. Enter the chart with the desired airspeed or Mach number and aircraft mass and note fuel flow and specific range /kilometer per 100 kg fuel/.

EXAMPLE

Enter the chart /figure A4-4/ at 400 km/h - EAS /216 KEAS/ and move up to 4 300 kg. From there move left and parallel the fuel flow line up right. On the left you will read a specific range of roughly 159 km/100 kg /86 NM/100 kg/ fuel and in radial direction a fuel flow of about 390 kg/h.

KILOMETERS/NM PER 100 kg FUEL
ISA – CONDITIONS

SEA LEVEL

Date : July, 1987
Data basis : Calculated

Engine : AI-25TL
Fuel Density: 0,78 kg/l

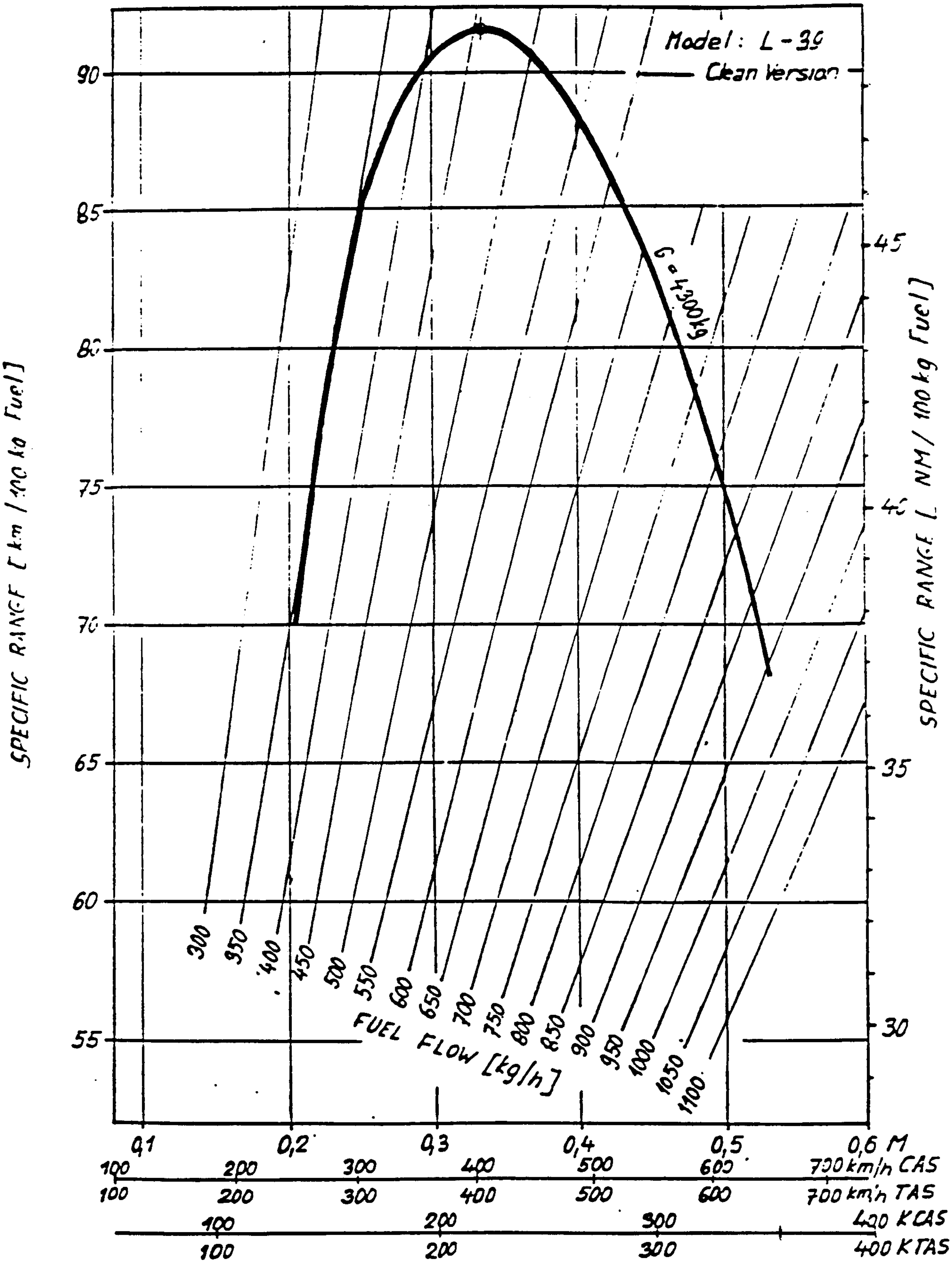


Fig. A4-1

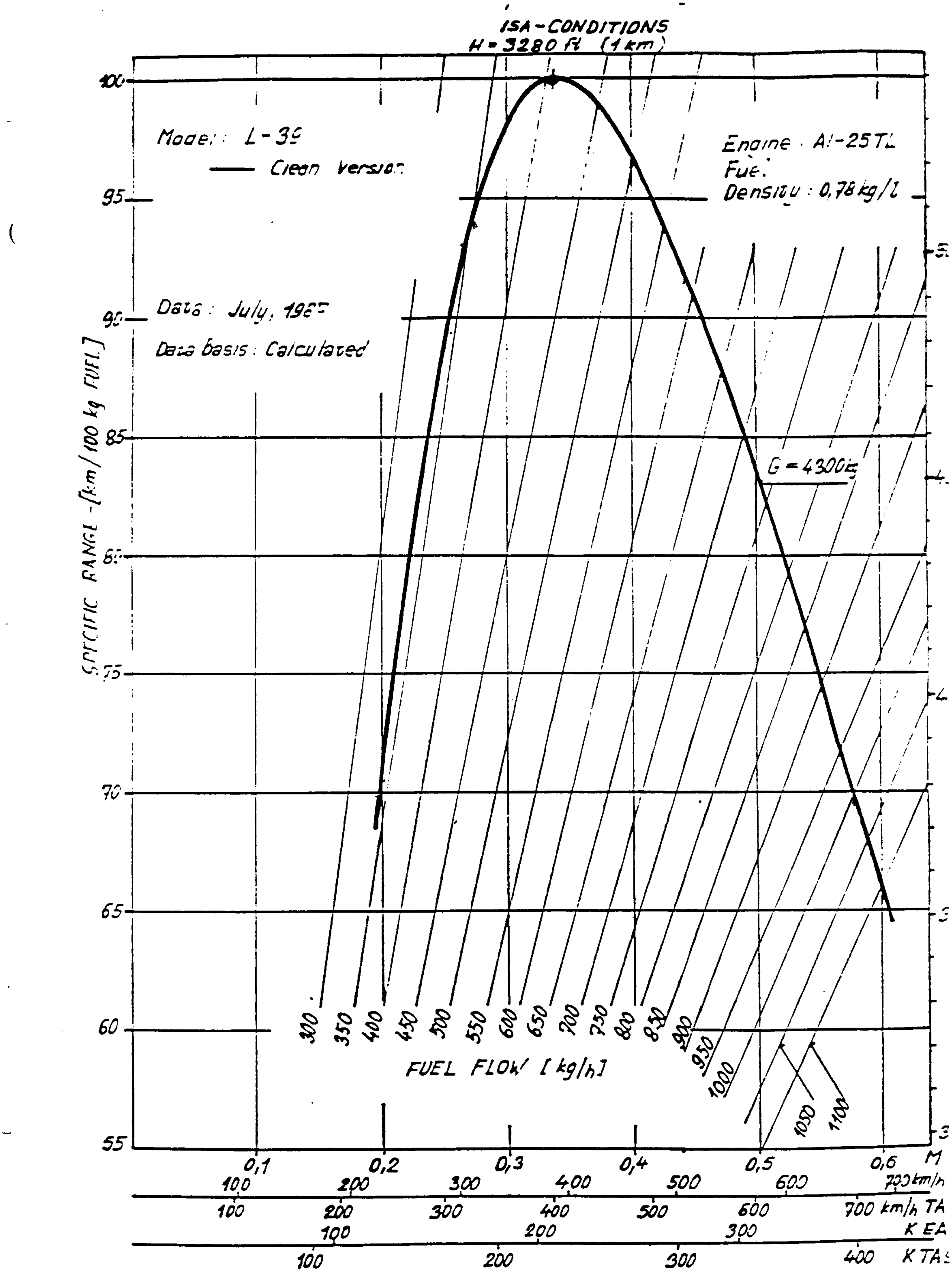

ISA-CONDITIONS
H = 3280 ft (1 km)
Model: L-39
Clean version
Engine: AI-25TL
Fuel:
Density: 0,78 kg/l
Data: July, 198
Data basis: Calculated
G = 4300 kg
SPECIFIC RANGE - [km/100 kg FUEL]
FUEL FLOW [kg/h]
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
100
95
90
85
80
75
70
65
60
55
0,1
0,2
0,3
0,4
0,5
0,6
M
100
200
300
400
500
600
700 km/h
700 km/h TA
K EA
K TAS

Fig. A4-2

KILOMETERS/NM PER 100 kg FUEL

H = 16400 ft (5000 m)

Model : L-39
—— Clean Version

Engine : AI-25TL
Fuel
Density : 0.78 kg/l

Date : July, 1985
Data Basis : Calculated

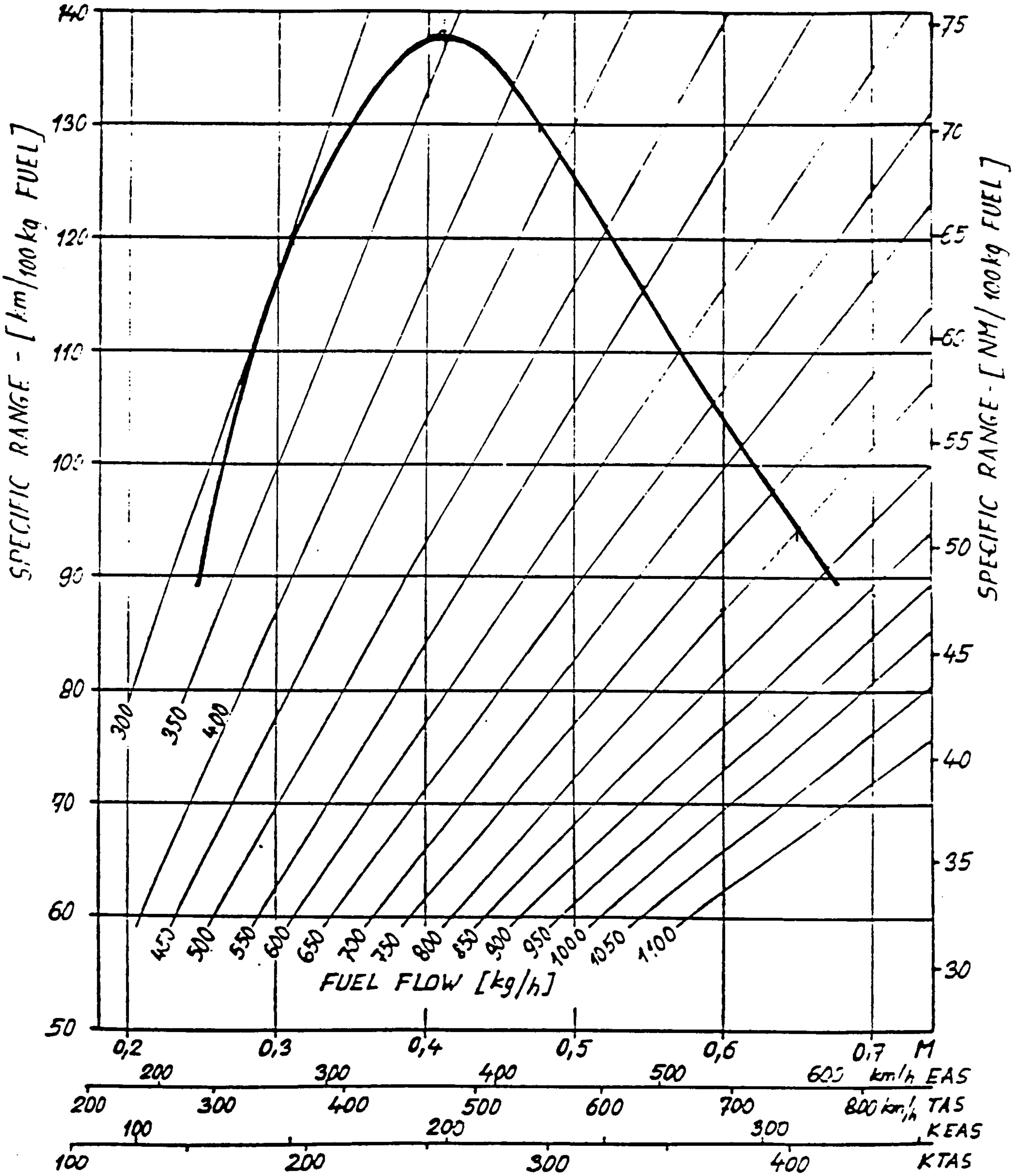


Fig. A4-3

KILOMETERS/NM PER 100 kg FUEL

ISA CONDITIONS

H = 26300 ft (8000 m)

Model : L-39, Clean Version
Date : July, 1987
Data Basis : Calculated

Engine : AI-25TL
Fuel Density : 0,78 kg/l

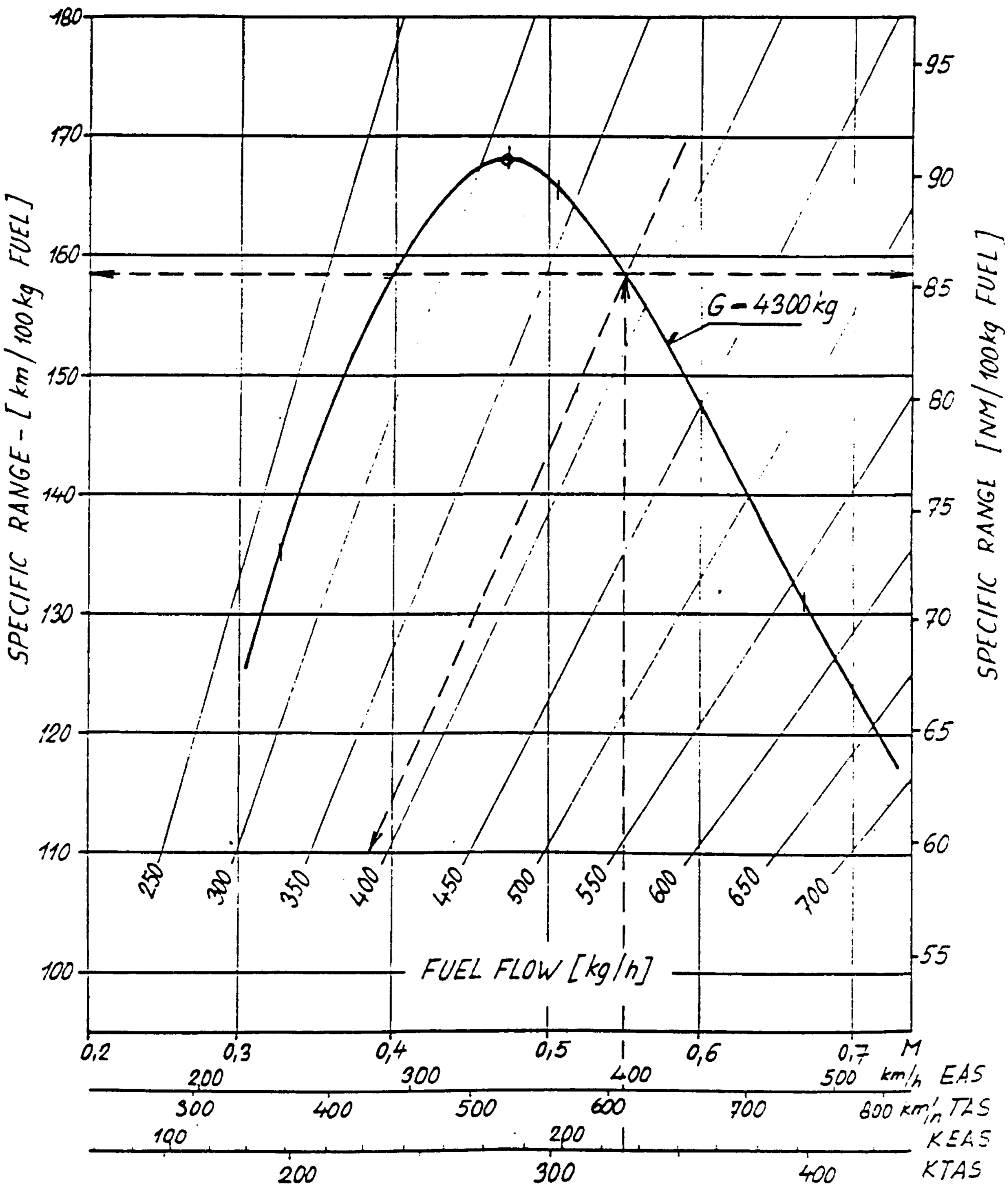


Fig. A4-4

Part 5

ENDURANCE

TABLE OF CONTENTS Page

LIST OF CHARTS

DESCRIPTION AND USE OF CHARTS

MAXIMUM ENDURANCE

Figure A5-1

Maximum endurance is obtained at a given altitude by flying under conditons which will give the lowest rate of fuel consumption at that altitude. The recommended schedule is given on the Maximum Endurance chart. Maximum endurance obtainable with any fuel loading when loitering at constant altitude is shown in figure A5-1.

The approximate fuel flow for a certain speed is given on the loiter table.

USE

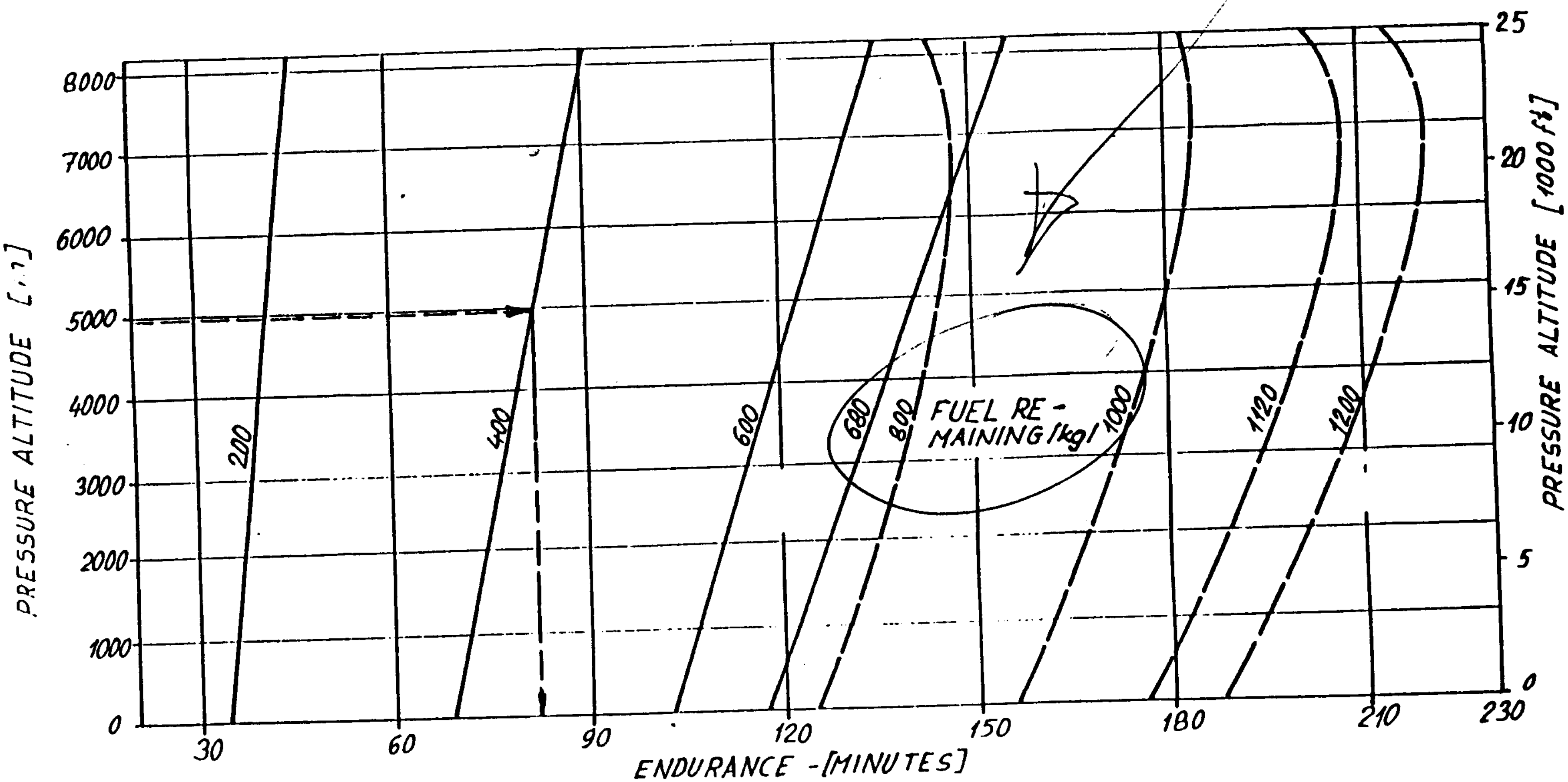
To determine the loiter time available for a given amount of fuel, enter the chart at the flight altitude and move right to the amount of fuel remaining. From there move down and read the endurance in minutes.

EXAMPLE

The example shows the maximum endurance at 5 000 m /16 400 ft/ with 400 kg fuel remaining. Endurance in this example is 82 minutes or 01:22 hours.

MAXIMUM ENDURANCE

STANDARD DAY



Engine : AI-25TL

Fuel Density : 0,78 kg/l

Model : L-39

——— Clean Version

– – – Two Underwing Tanks, 350 l each

Date : July, 1987

Data Basis : Calculated

LOITER (A/C with two tanks 350 l each)							
ALTIT	ALTIT	FUEL	CAS	TAS	M	KCAS	KTAS
m	ft	kg/h	km/h	km/h	–		
0	0	385	300	300	0,245	162	162
2000	6096	360	300	330	0,276	162	178
4000	12192	340	300	370	0,317	162	200
6000	18288	330	300	410	0,360	162	220

Part 6

DESCENT

TABLE OF CONTENTS

DESCRIPTION AND USE OF CHART

Descent

Figure A6-1

The descent chart is based on normal descent and presents the rate of descent, time for descent, distance travelled in descent, and fuel used in descent. The corresponding speed and power setting is stated on the chart.

Use.

To determine the descent data, enter the chart at the initial altitude at the start of descent and move to the aircraft mass lines. At this intersection move straight down to find the rate of descent, time to descent, distance travelled, and fuel used in descent.

EXAMPLE

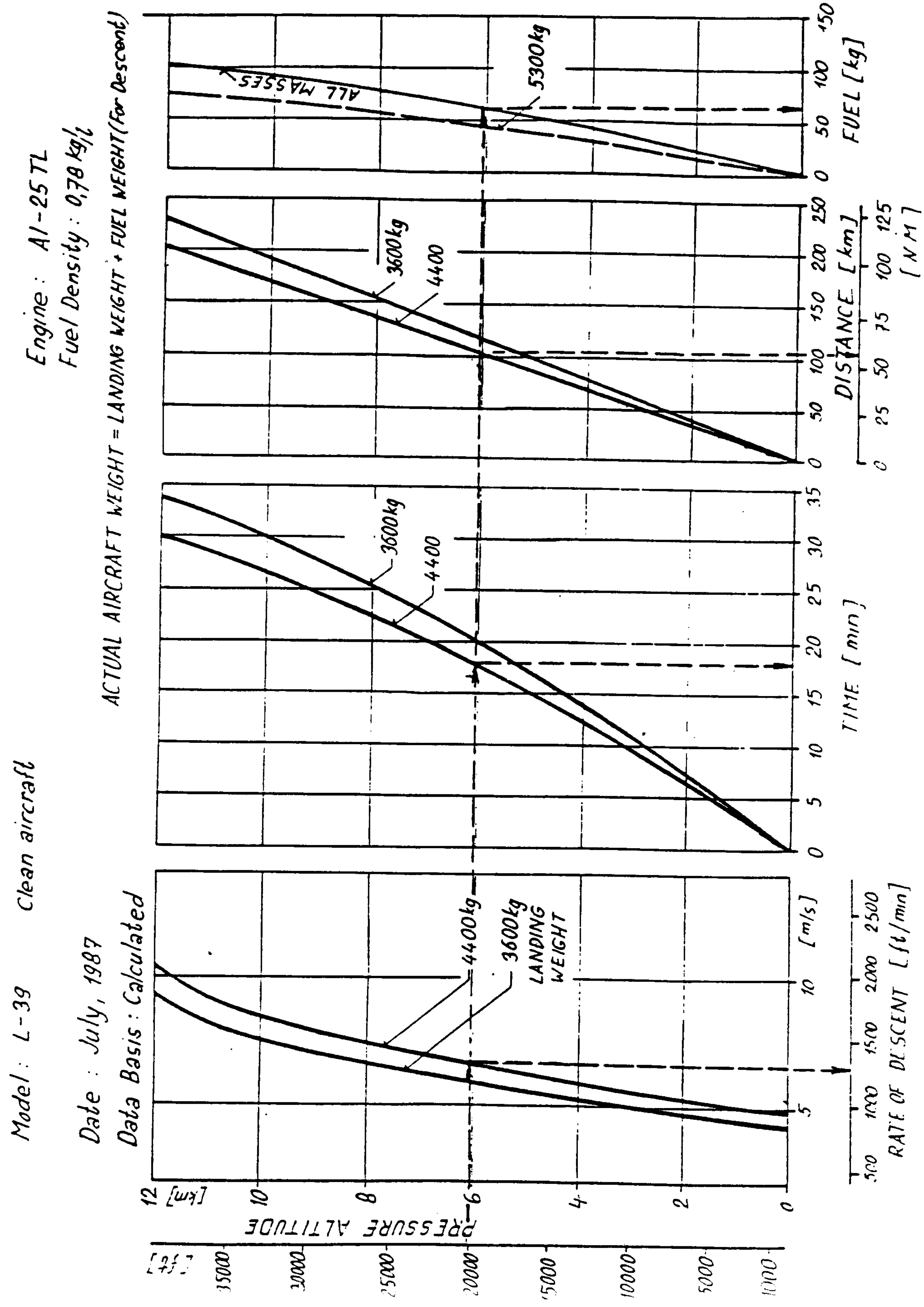
The example shows rate of descent, time to descent, distance travelled in descent, and fuel used in descent for a descent from 6 000 m ≙ 20 000 ft altitude to sea level, for aircraft mass 4 400 kg :

Rate of descent	6,6 m/s ≙ 1 300 ft/min
Time to descent	18,0 minutes
Distance travelled	105 km ≙ 57 NM
Fuel used	65 kg

NORMAL DESCENT

Descent Speed (IAS) 300 km/h, Idle Power
/162 KIAS/

ISA CONDITION



Part 7

LANDING

TABLE OF CONTENTS

LIST OF CHARTS

LANDING

DESCRIPTION AND USE OF CHARTS LANDING SPEEDS

Figure A7-1

This chart /figure A7-1/ provides for different landing masses the stalling speed /engine idling, flaps 44°/, the touchdown speed and the approach speed.

USE

Enter the chart with the landing mass to obtain the corresponding speeds.

EXAMPLE

The example shows for a landing mass of 4 200 kg, a stalling speed of 165 km/h ≙ 89 kts, a touchdown speed of 177 km/h ≙ 96 kts and approach speed of 209 km/h ≙ 113 kts under ISA conditions.

LANDING DISTANCE

Figure A7-2

Figure A7-2 present the landing distance required to clear a 15 m ≙ 50 ft obstacle, land and stop the aircraft. Values shown are directly applicable to operation with landing flaps, and hard, dry runway conditions.

It is assumed that an approach flight path of approximately 4° is maintained by use of thrust until the 15 m ≙ 50 ft obstacle is cleared, and that thrust is reduced to idle while the flare is started.

EXAMPLE

The example shows for a landing mass of 4 200 kg at SL, a landing distance of 875 m ≙ 2 850 ft under ISA conditions and with intensive braking.

LANDING GROUND RUN

Figure A7-3

This chart presents the landing ground run distance from touchdown point to aircraft stop, using the wheel brakes according to brake limiting speed chart in Section II. Values given are for a hard dry runway.

EXAMPLE

The example shows for a landing mass of 4 200 kg, at SL, a runway air temperature of 15°C, and a tailwind component of 5 m/s, a landing ground run of 520 m ≙ 1 700 ft.

LANDING SPEEDS

FLAPS 44°, IDLE POWER

Model : L-39
Date : July, 1987
Data Basis: Calculated

Engine : AI-25TL
Fuel Density: 0,78 kg/l

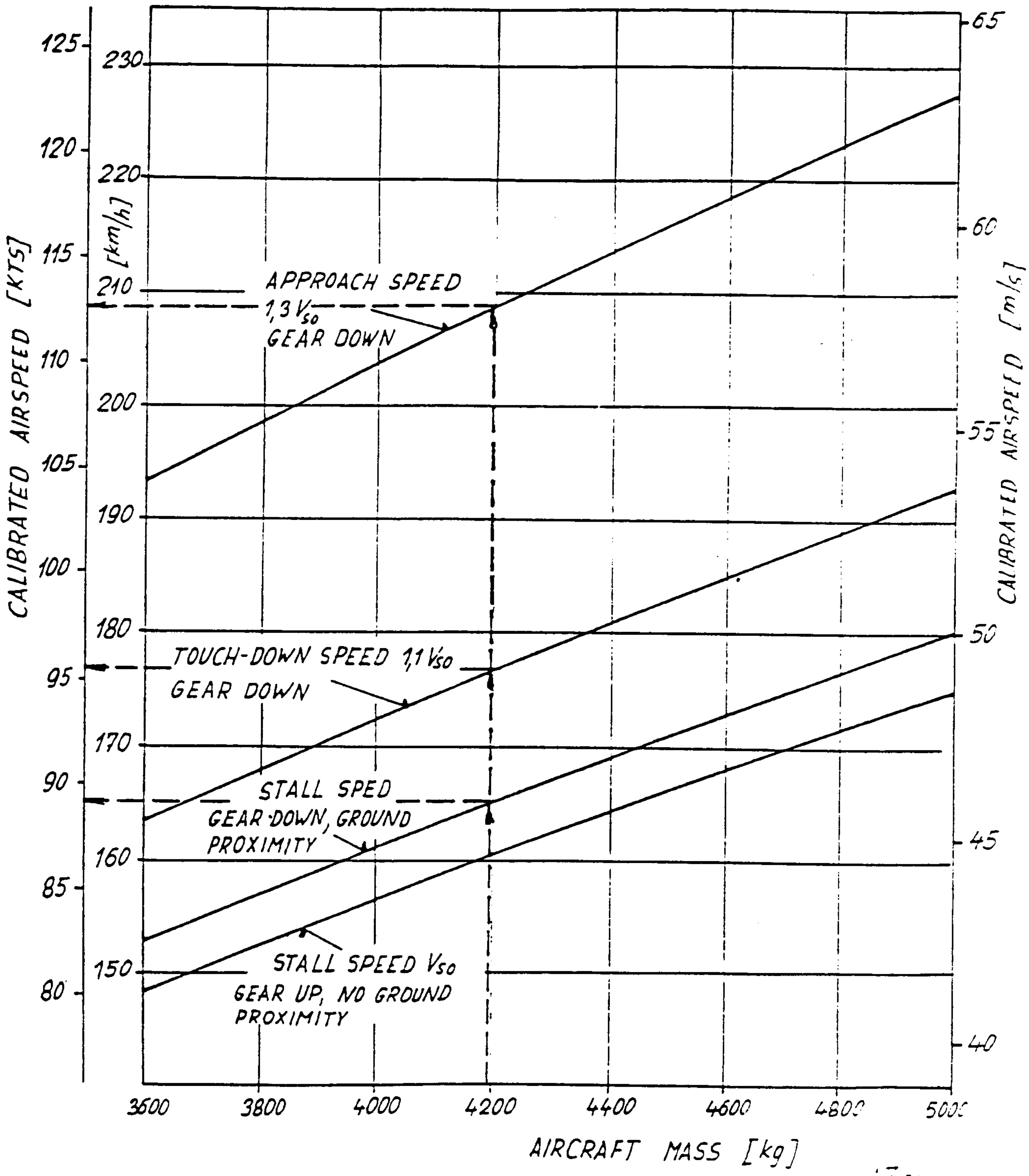
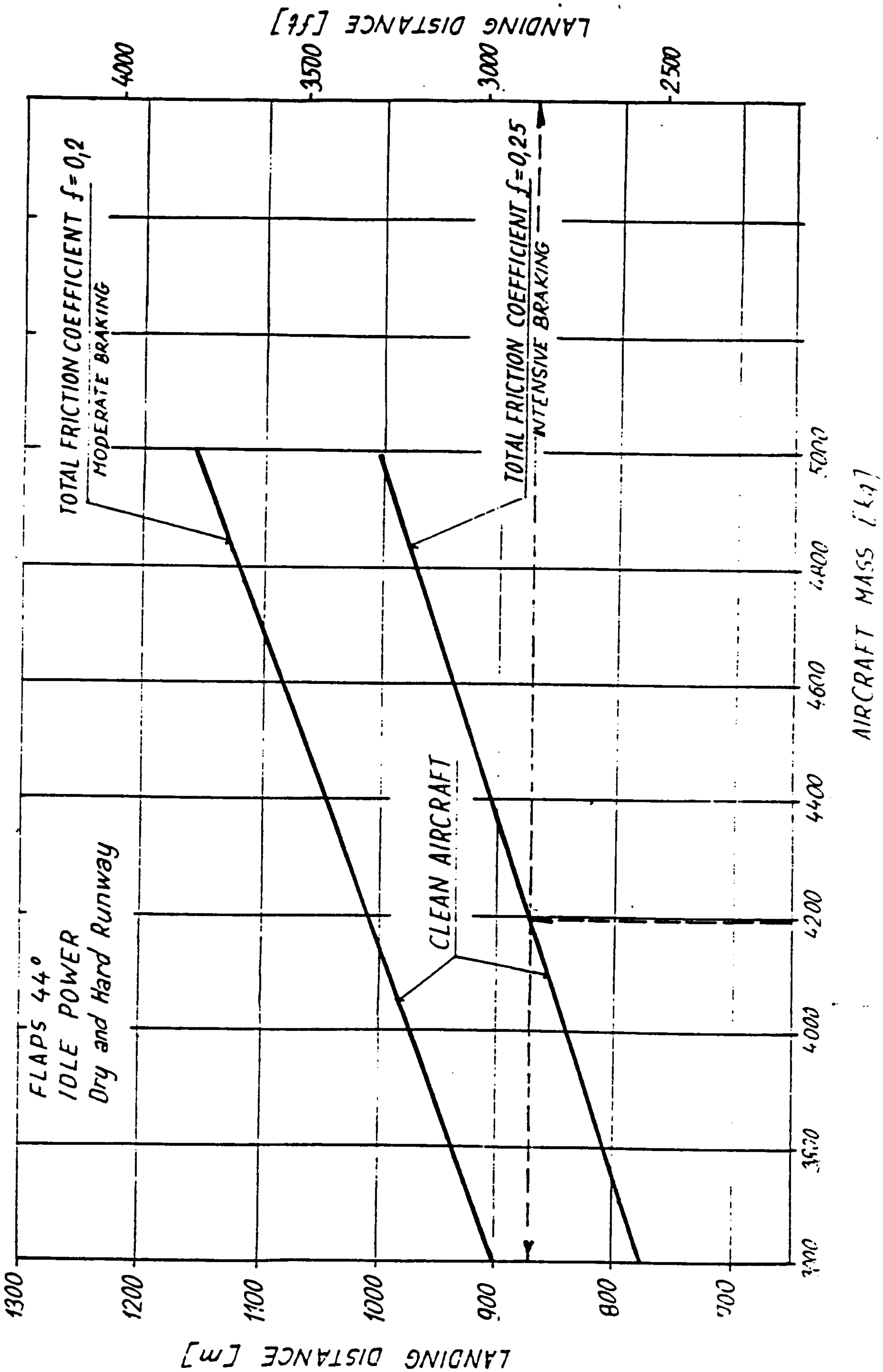


Fig. A7-1

LANDING DISTANCE FROM 15 m OBSTACLE

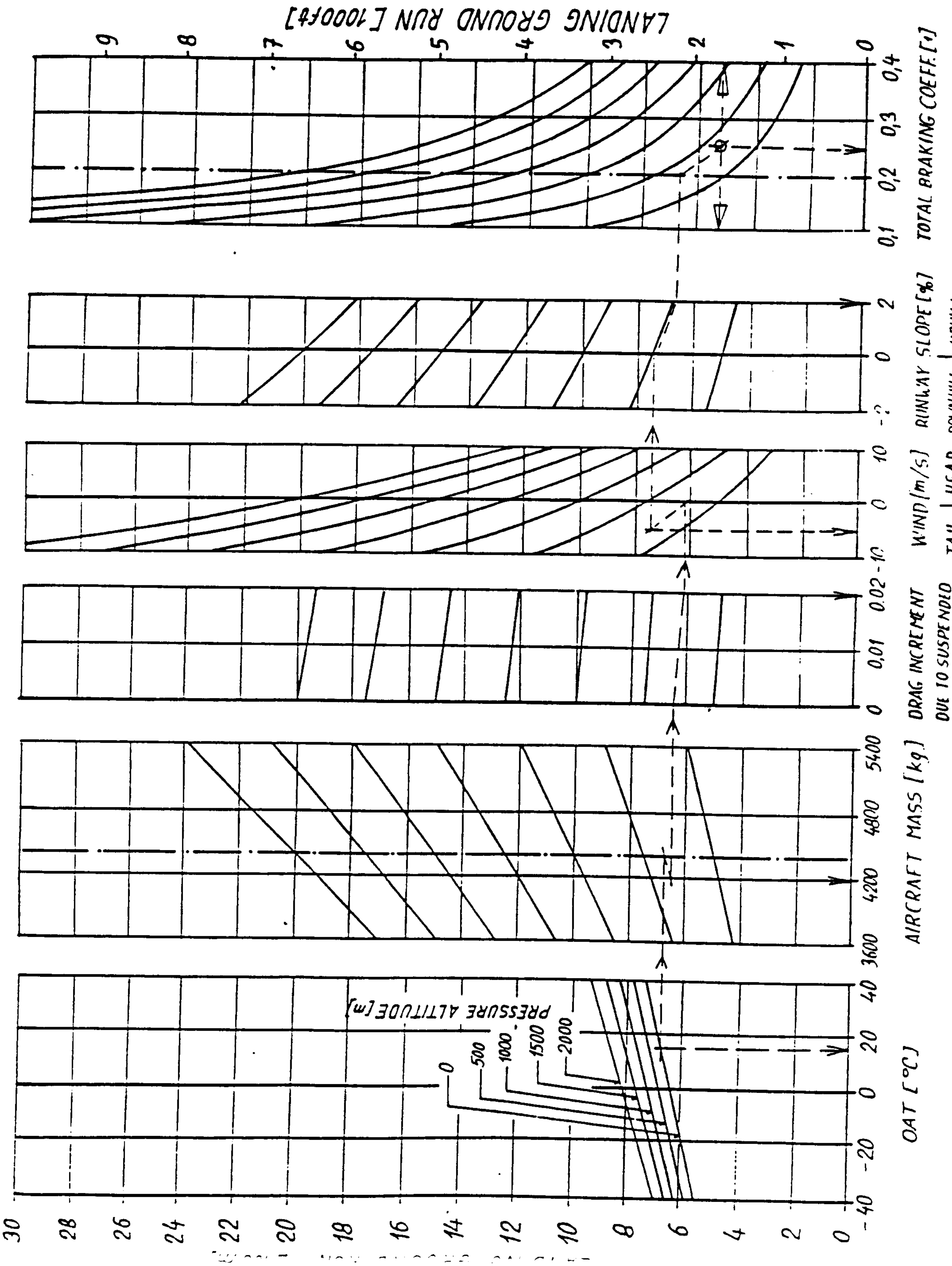
Model : L-39
Date : July, 1987
Data Basis : Calculated

Engine : AI-25TL
Fuel Density : 0,78 kg/l



Model : L-39
Date : July, 1987
Data Basis: Calculated

Engine : AI-25TL
Fuel Density: 0,78 kg/l



Part 8

MISSION PLANNING

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LIST OF CHARTS

MISSION PLANNING

The charts, presented in part 1 through 7 of this appendix, provide all performance information necessary to plan many different types of missions. The procedure for integrating the available performance information into a workable flight plan depends upon the type of mission involved. Accurate mission planning and constant checking of progress against flight plan are necessary to obtain optimum use of the aircraft.

Flight planning is normally accomplished as follows.

TAKEOFF

Determine from

1. TAKEOFF AND LANDING CROSSWIND chart using airbase wind conditions:

   a. Head- and crosswind component
   b. Takeoff allowance decision

2. TAKEOFF SPEEDS chart, using aircraft mass:

   a. Takeoff speed

3. TAKEOFF GROUND RUN chart using airfield conditions and aircraft mass:

   a. Takeoff ground run

4. TAKEOFF DISTANCE chart using airfield conditions and aircraft mass:

   a. Distance to clear a 15 m $\hat{=}$ 50 feet obstacle

5. MAXIMUM REFUSAL SPEED chart, using airfield conditions and aircraft mass:

   a. Maximum refusal speed

6. ACCELERATE STOP DISTANCE chart using airfield conditions and aircraft mass:

   a. Accelerate-stop-distance

CLIMB

7. MAXIMUM RATE CLIMB chart:

   Climb speed schedule for applicable aircraft configuration.

8. CLIMB CONTROL chart for applicable aircraft configuration, takeoff mass and air temperature:

a. Range

b. Time

c. Fuel used in climb

CRUISE

9. km/100 kg FUEL chart for applicable aircraft configuration and desired cruising conditions :

   a. Range

   b. Fuel flow

   c. RPM

   d. CAS, TAS and Mach number

10. DESCENT chart for applicable aircraft configuration and desired descent :

    a. Fuel used

    b. Rate of descent

    c. Time

    d. Distance travelled in descent

LANDING

11. LANDING SPEED chart for applicable aircraft landing mass :

    a. Normal approach speed

    b. Minimum touchdown speed

12. LANDING DISTANCE chart for applicable aircraft landing mass, field pressure altitude, runway air temperature and headwind component :

    a. Distance from 15 m $\widehat{=}$ 50 feet obstacle to stop

13. LANDING GROUND RUN chart for applicable aircraft mass, field pressure altitude, runway air temperature and headwind component.

    a. Landing ground run.

TAKEOFF DATA

CONDITION

RUNWAY AIR TEMP .... °C

FIELD PRESS. ALT ..../ft/-m

HEADWIND COMPONENT ..../KTS/-m/s

CROSSWIND COMPONENT ..../KTS/-m/s

RUWAY LENGTH .... /ft/-m

TAKEOFF MASS......................... kg

TAKEOFF

MAXIMUM REFUSAL SPEED .... KTS -km/h

NORMAL TAKEOFF SPEED .... KTS -km/h

TAKEOFF GROUND RUN .... /ft/ - m

DISTANCE TO CLEAR 50 ft OBSTACLE .../ft/ - m

Fig. A8-1

LANDING DATA
NOTE

MAX. PERMISSIBLE LANDING MASS:

NORMAL: kg
EXCEPT: kg

CONDITION

RUNWAY AIR TEMP .... °C

FIELD PRESS. ALT ..../ft/- m

HEADWIND COMPONENT ..../KTS/-m/s

CROSSWIND COMPONENT ..../KTS/-m/s

RUNWAY LENGTH .... /ft/-m

TAKEOFF MASS .... kg

LANDING

NORMAL APPROACH SPEED ..../KTS/-km/h

MINIMUM TOUCH DOWN SPEED ..../KTS/-km/h

DISTANCE FROM 50 ft OBSTACLE .... /ft/ - m

LANDING GROUND RUN .... /ft/ - m

BRAKE LIMITING SPEED .... /KTS/-km/h