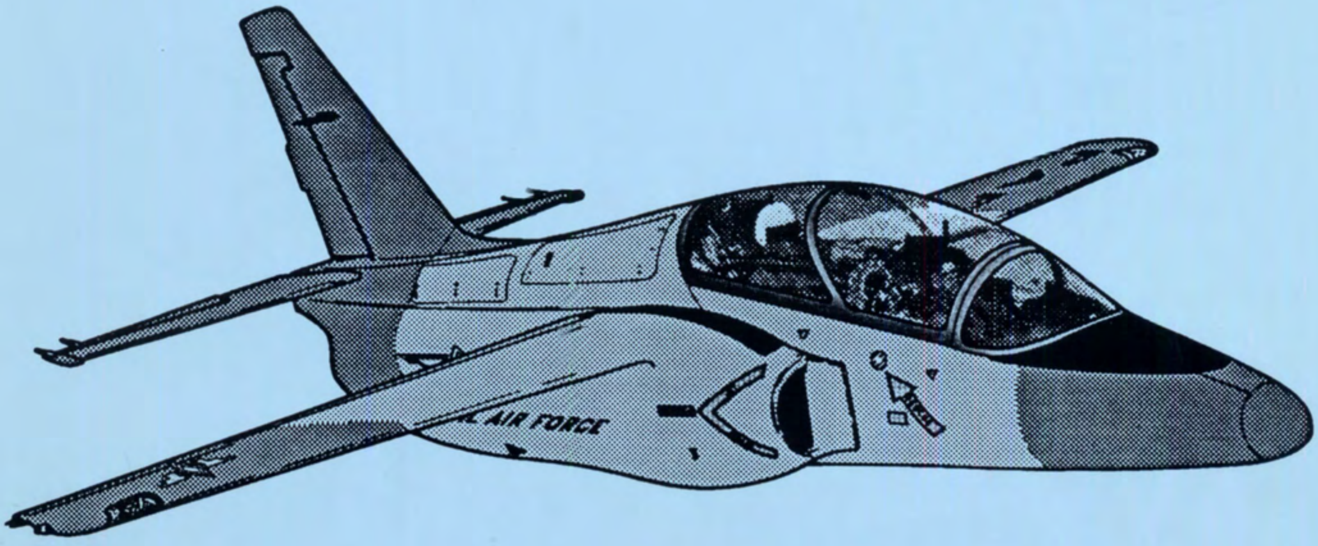
FLIGHT MANUAL



S211PAF

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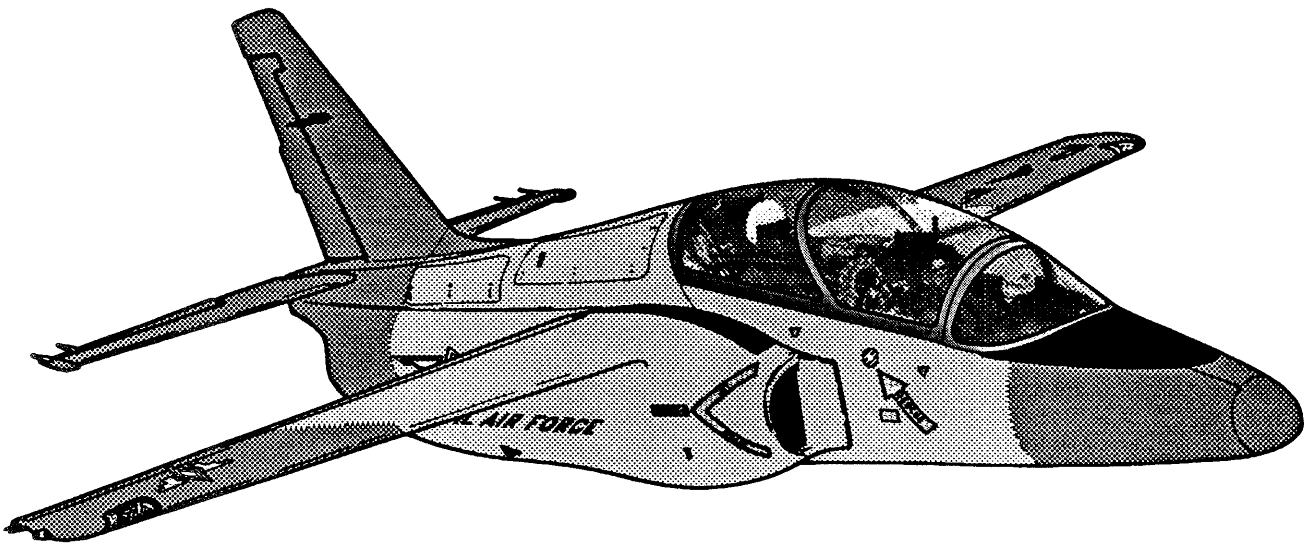
SIAI MARCHETTI S.r.l.

FLIGHT MANUAL



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THIS MANUAL SUPERSEDES EDITION
DATED 5 FEBRUARY 1991

SIAI MARCHETTI S.r.l.

8 MARCH 1994

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES, DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the change is indicated by a vertical line in the outer margins of the page.

Dates of issure for original and changed pages are:

Original . . . . 0 . . . . 8 March 1994

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 214 CONSISTING OF THE FOLLOWING:

Page N°	Change N°	Page N°	Change N°
Title	0		
A	0		
i thru iii	0		
iv Blank	0		
v thru vi	0		
1-1thru1-119	0		
1-120 Blank	0		
2-1 thru 2-19	0		
2-20 Blank	0		
3-1 thru 3-25	0		
3-26 Blank	0		
4-1	0		
4-2 Blank	0		
5-1 thru 5-22	0		
6-1 thru 6-7	0		
6-8 Blank	0		
7-1 thru 7-4	0		
G-1 thru G-2	0		
I-1 thru I-4	0		

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

STATUS OF SAFETY AND OPERATIONAL SUPPLEMENTS

This page is published with each Safety and Operational Supplement. It provides the current status of the supplements at the date of issue of the latest supplement (indicated in the list by two continuous lines). This page is:

- Replaced by the issue of a subsequent supplement
- Deleted by the issue of a change or a new issue incorporating all supplements.

SAFETY AND OPERATIONAL SUPPLEMENTS

Number	Date	Short Title
-1 OS-006	19 Apr 94	Landing gear emergency lowering/landing
-1 OS-007	12 Jun 95	"Oxygen Failures" emergency procedure
-1 OS-008	10 Jan 96	Loss of NL signal
-1 OS-009	2 May 96	Inverted flight limitations
-1 OS-010	03 Feb 97	Instrument tolerances
========	========	========
-1 OS-011	17 Jun 97	NL speed exceeding 106%
========	========	========

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL
S211
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This document supplements publication 1T-S211PAF-1 dated 8 March 1994. Reference to this operational supplement will be made on the title page of the basic publication by personnel responsible for maintaining the publication in current status.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

Aer Macchi

3 FEBRUARY 1997

TITLE: INSTRUMENT TOLERANCES

1. PURPOSE

To inform the pilots about the maximum acceptable difference between the front and the rear cockpit instrument indications .

2. INSTRUCTIONS

On page 1-120, at the end of Section I, add the following paragraph and figure:

FRONT AND REAR COCKPIT INSTRUMENT INDICATIONS

The indication of an instrument located in the front cockpit may be different from the indication provided by the same instrument in the rear cockpit because of the instrument tolerances.
The difference between the two indications shall not exceed the maximum permitted tolerance limits shown in the table of figure 1-56.

MAX ALLOWED DIFFERENCE BETWEEN FRONT AND REAR COCKPIT INSTRUMENT READINGS	
INSTRUMENT	**ALLOWED DIFFERENCE**
ACCELEROMETER	0,5 G
FUEL FLOW	40 PPH
OIL PRESSURE	2 PSI (Range 30 ÷ 80 PSI) 3 PSI (All other ranges)
HYDRAULIC PRESSURE	80 PSI (Range 1000 ÷ 3000 PSI) 120 PSI (All other ranges)
RPM	Digital 0,2% Analog 0,5% (Above 85%) 1,0% (Range 0 ÷ 85%)
ITT	5° C (Range 600 ÷ 800° C) 15° C (All other ranges)
AIRSPEED	3 KIAS (Range 40 ÷ 200 KIAS) 5 KIAS (Above 200 KIAS)
V.S.I.	100 ft/min at 500 ft/min 300 ft/min at 2000 ft/min 400 ft/min at 4000 ft/min
ALTIMETER (AT ZERO SETTING)	25 ft
ST BY	1 degree
AHRS	1 degree
HSI	1 degree

Figure 1-56

THE END

OPERATIONAL SUPPLEMENT

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2 May 1996

TITLE: INVERTED FLIGHT LIMITATIONS

1. PURPOSE

To update "Inverted Flight Limitations" procedure in Section V, page 5-4.

2. INSTRUCTIONS

Replace paragraph "Inverted Flight Limitations" reported in Section V, page 5-4 with the following paragraph:

INVERTED FLIGHT LIMITATIONS

Inverted flight or any maneuver resulting in negative G conditions is allowed up to 30 seconds due to fuel system limitations.

An interval of at least 15 seconds shall be allowed between repeated negative g maneuvers.

OPERATIONAL SUPPLEMENT

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12 JUNE 1995

SHORT TITLE: "OXYGEN FAILURES" EMERGENCY PROCEDURE

1. PURPOSE

To improve "Oxygen failures" emergency procedure described in Section III.

2. INSTRUCTIONS

Replace the following "OXYGEN FAILURES" emergency procedure given at page 3-15 of Section III:

OXYGEN FAILURES
If the OXY LOW caution light comes on or suspected hypoxia, resistance to breathing ....

with the following:

OXYGEN FAILURES
If the OXY LOW warning light comes on while the quantity pointer is not within the red arc or suspected hypoxia, resistance to breathing ....

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

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10 JANUARY 1996

TITLE: LOSS OF NL SIGNAL

1. PURPOSE

To include the loss of NL signal in the emergency procedures.

2. INSTRUCTIONS

Section III, EMERGENCY PROCEDURES, Page 3-9, add the following sub-paragraph before "ECU FAILURE".

LOSS OF NL SIGNAL

NL signal is an input for cockpit indication and ECU operation.
Loss of NL signal should be considered for the following three cases:

a. Loss of NL input to cockpit indicators only
b. Loss of NL input to ECU only
c. Loss of NL input to both indicators and ECU.

LOSS OF NL INDICATION

If loss of NL reading is detected:

1. Retard throttle to a lower power setting if flying conditions permit.
2. Check indication of the other NL instrument if feasible.
   - If proper indication is confirmed, proceed the sortie according to the original flight plan and operate throttle as required..
   - If check of the other indicator is not feasible or loss of indication is confirmed
   - Check engine response to throttle inputs.
   a. If the engine responds normally, land as soon as practical.
   b. If an abnormal engine response is detected:
3. Select ECU OFF.

4. Throttle as required monitoring engine speed (NH) and ITT.

NOTE

The THROTTLE can be advanced to the EMERGENCY sector by pulling the engine throttle extra stroke control lever in the front cockpit. In this range aircrew will have the possibility to recover thrust and acceleration losses due to ECU off but manual control is required to maintain the engine parameters within limits.

5. Land as soon as practical

WARNING

During approach for landing with ECU off do not retard the throttle below 75% NH to maintain an acceptable engine acceleration capability. Reduce throttle to idle only when sure to have the runway made.

ABNORMAL ENGINE RESPONSE

If an abnormal engine response is experienced with or without loss of NL indication:
1. Retard throttle to a lower power setting If flying conditions permit.
2. Select ECU OFF.
3. Throttle as required monitoring engine speed and ITT.

NOTE

The THROTTLE can be advanced to the EMERGENCY sector by pulling the engine throttle extra stroke control lever in the front cockpit. In this range aircrew will have the possibility to recover thrust and acceleration losses due to ECU off but manual control is required to maintain the engine parameters within limits.

4. Land as soon as practical

WARNING

During approach for landing with ECU off do not retard the throttle below 75% NH approx. to maintain an acceptable engine acceleration capability. Reduce throttle to idle only when sure to have the runway made.

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

S211

AIRCRAFT

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19 APRIL 1994

SHORT TITLE: LANDING GEAR EMERGENCY LOWERING/LANDING

1. PURPOSE

To expand the landing gear emergency procedures covering the occurrence of landing gear extended but not locked.

2. INSTRUCTIONS

Page 3-22, Paragraph " LANDING GEAR EMERGENCY LOWERING", Replace with the following:

LANDING GEAR EMERGENCY LOWERING /LANDING

If the landing gear fails to lower or to lock in the DOWN position (one or more green lights OFF), attempt a re-cycle. If recycling is unsuccessfull.

1. AIRSPEED - 140 KIAS.
2. Landing gear handle - Check down.

NOTE

If the LDG handle cannot be lowered, ensure HYD CB is pulled OUT. This is to prevent inadvertant collapsing of the landing gear after landing.

3. EMER LDG CR handle - pull fully OUT and ROTATE 90° clockwise.

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

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19 APRIL 1994

NOTE

* The DOWN locking of the gears is favourably affected by positive load factor and aerodynamic pressure.
* Should any of the gears fail to lock in the down position, increase airspeed and load factor up to 160 KIAS/2G to help mechanical down lock by air pressure and/or vertical load.

4. Ensure that the landing gear position indicator lights give confirmation that the landing gear is down and locked, (three green lights ON). The red warning light in the landing gear handle will remain illuminated.

NOTE

After the landing gear emergency lowering the air conditioning cooling operation will be interrupted. Under this condition proceed as follows:
a. DEMIST - as required .
b. PRESS DUMP switch and Emergency Ventilation - "OPEN" if required

5. In case one or more green light remains Off:
a. Check green light operation (Push to test)
b. Get confirmation the three gears are down, otherwise refer to landing gear emergency landing in figure 3-9.

NOTE

Both mlg fwd doors should be observed open due to landing gear down sequence not complete.

c. HYD CB - IN
d. Hydraulic pressure - Check normal
e. Landing gear control handle - Check DOWN position.

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

S211

AIRCRAFT

This document supplements publication 1T-S211PAF-1 dated 2 September 1991. Reference to this operational supplement will be made on the title page of the basic publication by personnel responsible for maintaining the publication in current status.

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19 APRIL 1994

f. Restore EMER LDG CR handle - IN
g. Land as smooth as possible.

WARNING

BEFORE SHUTTING THE ENGINE DOWN, BE SURE THAT THREE JACKS ARE IN PLACE WITHOUT LIFTING THE AIRCRAFT FROM GROUND.

NOTE

Engine shut-down would remove hydraulic pressure to landing gear actuators and the unlocked gears could collapse.

h. Shut-down the engine.
i. Warn the maintenance personnel the landing gear is in unsafe condition so that proper action will be taken.

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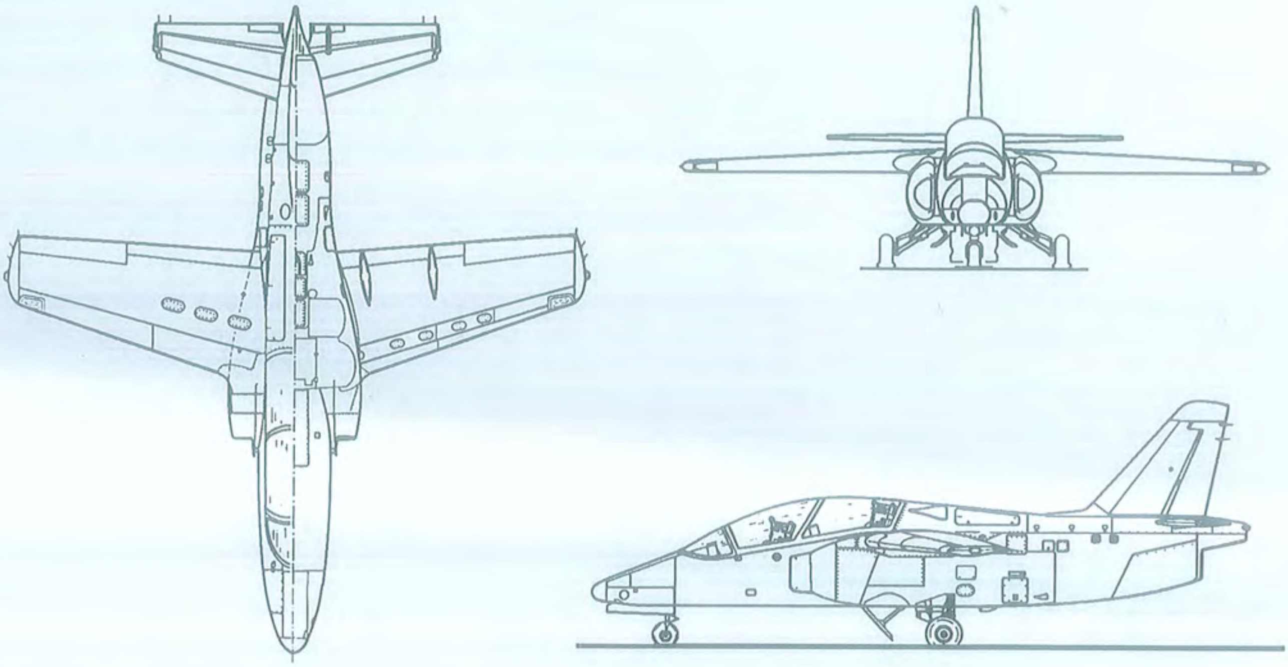
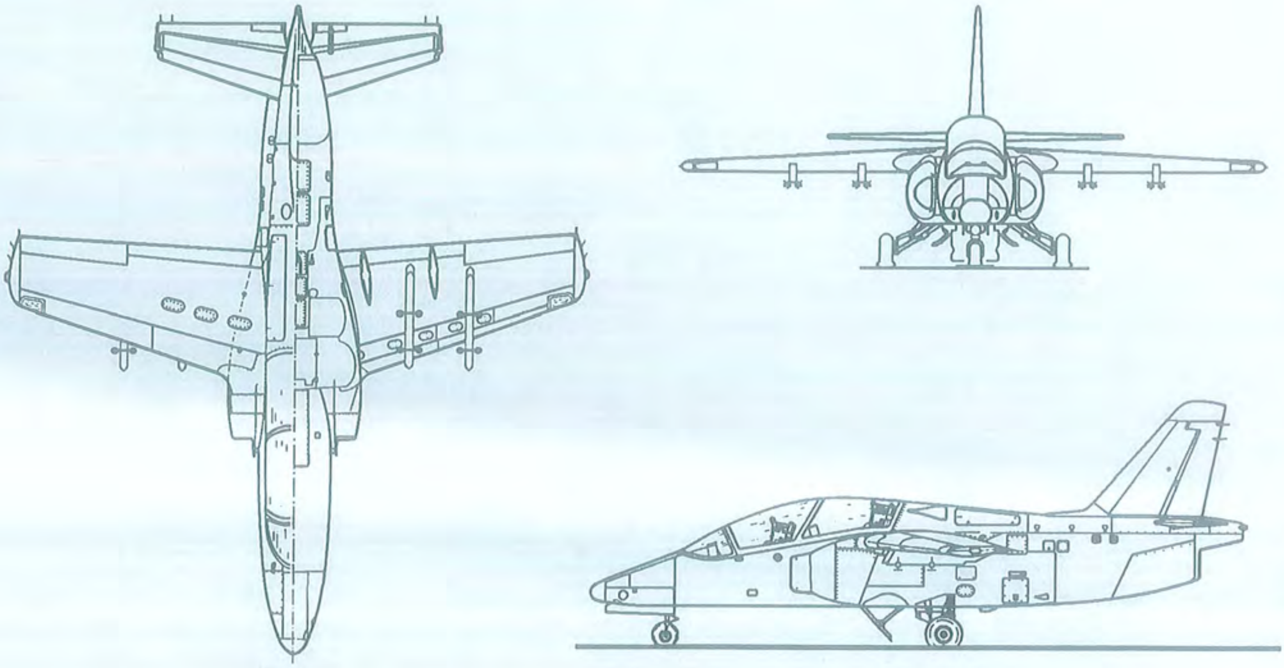


S211PAF [TRAINER]



S211PAF [WARRIOR]

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL
S211
AIRCRAFT

This document supplements publication 1T-S211PAF-1 dated 8 March 1994. Reference to this operational supplement will be made on the title page of the basic publication by personnel responsible for maintaining the publication in current status.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

17 JUNE 1997

TITLE: NL SPEED EXCEEDING 106%

1. PURPOSE

To include the procedure to be followed in case **NL** exceeds 106% .

2. INSTRUCTIONS

Page 3-9, Section III Emergency Procedure, add the following sub-paragraph before "**ECU FAILURE**":

NL EXCEEDING 106%

If NL tends to exceed the operational limitations (106%):

1. Select ECU off and check:
   a. If NL has not dropped:
      - ECU switch ON.
      - Retard THROTTLE as required to maintain NL within limits.
   b. If NL has dropped:
      - THROTTLE as required monitoring engine NL, NH and ITT.

NOTE

The THROTTLE can be advanced to the EMERGENCY sector by pulling the engine throttle extra stroke control lever in the front cockpit. In this range aircrew will have the possibility of regaining full thrust, but manual control is required to maintain the engine parameters within limits.

- Land as soon as practical.

WARNING

During approach for landing with ECU off, do not retard the throttle below 65% NL to maintain an acceptable engine acceleration capability. Reduce throttle to idle only when landing is assured.

THE END

INTRODUCTION

SCOPE

This manual contains the necessary information for safe and efficient operation of the Siai Marchetti S211 aircraft. These instructions provide the pilot with a general knowledge of the aircraft and its characteristics and a specific knowledge of the normal and emergency operating procedures.
This manual provides the best possible operating instructions under most circumstances. Multiple emergencies, adverse weather conditions, terrain etc. may require modifications to the procedures.

PERMISSIBLE OPERATIONS

The flight manual takes a positive "approach" and normally states only what you can do. Unusual operations or configurations are prohibited unless specifically covered herein. Clearance must be obtained before any questionable operation, which is not specifically permitted in the manual, is attempted.

ARRANGEMENT

The manual is divided into seven sections to simplify reading it straight through, or using it as a reference manual.
Performance data are contained in 1T-S211-1-1 Manual.

SAFETY SUPPLEMENTS

Information involving safety will be promptly forwarded to you in a safety supplement. Urgent information is published in interim safety supplements and transmitted by teletype. Formal supplements are mailed. The supplement title block and status page (published with formal supplements only) should be checked to determine the supplements effect on the manual and other outstanding supplements.

OPERATIONAL SUPPLEMENTS

Information involving changes to operating procedures will be forwarded to you by operational supplements. The procedure for handling operational supplements is the same as for safety supplements.

CHECKLISTS

The flight manual contains itemized procedures with necessary
amplifications. The checklist contains itemized procedures without the amplifications. Primary line items in the flight manual and checklist are identical. If a formal safety or operation supplement affects your checklist, the affected checklist page will attached to the supplement. Cut it out and insert it over the affected page but never discard the checklist page in case the supplement is rescinded and the page is needed.

WARNING, CAUTION AND NOTE

The following definitions apply to Warnings, Cautions and Notes, found throughout the manual:

WARNING

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

CAUTION

Operating procedures, techniques etc. which may result in damage to equipment if not carefully followed.

NOTE

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

YOUR RESPONSIBILITY - TO LET US KNOW

Every effort is made to keep the flight manual current. Comments, corrections and questions regarding this manual are welcome. These should be forwarded to:

Siai Marchetti S.r.l.
Technical Publication Dept.
Via Indipendenza, 2
21018 SESTO CALENDE - ITALY

PUBLICATION DATE

The date appearing on the title page of this flight manual represents the currency of material contained herein.

OPERATIONAL SUPPLEMENTS

INCORPORATING RECORD

The following operational supplements have been incorporated.

DESCRIPTION	O.S. Number
Engine Starting Procedure . . .	1T-S211PAF-OS-001
Starter Duty Cycle	1T-S211PAF-OS-002
Operating Limitations for Auxiliary Fuel Tank (Without Fins)	1T-S211PAF-OS-003
Engine Air Start Automatic Sequence Failure	1T-S211PAF-OS-004
ECS Manual Mode Operation	1T-S211PAF-OS-005

SAFETY SUPPLEMENTS

INCORPORATING RECORD

The following safety supplements have been incorporated.

DESCRIPTION	S.S. Number
Maximum NL and Engine Oil Pressure Operating Limitations	1T-S211PAF-1SS-001

AIRCRAFT DESIGNATION CODES

Differences among aircraft series (Warrior or Trainer) which affect descriptions, illustrations or procedures contained in this manual, are indicated by a coding system. The coding system assigns symbols which represent the serial numbers of the aircraft. No code is used when descriptions, illustrations or procedures apply to all aircraft series. Reference code meaning is as indicated in the "Table i".

Table i.

AIRCRAFT DESIGNATION CODES		
[ACFT A] (WARRIOR) S/N	[ACFT B] (TRAINER) S/N	[ACFT C] (TRAINER - See Note) S/N
059/07-009	047/07-001	051/09-001
060/07-010	048/07-002	052/09-002
061/07-011	049/07-003	053/09-003
062/07-012	050/07-004	054/09-004
067/07-017	055/07-005	069/09-005
068/07-018	056/07-006	071/09-006
	057/07-007	
	058/07-008	
	063/07-013	
	064/07-014	
	065/07-015	
	066/07-016	
NOTE Trainer configuration with warrior external paint scheme		

SECTION I
DESCRIPTION AND OPERATION

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THE AIRCRAFT

The SIAI MARCHETTI S211 is a single engine, two tandem seats, medium wing subsonic aircraft, equipped with a tricycle retractable landing gear.
The aircraft is powered by one JT15D-4C Turbofan engine, developing an uninstalled static thrust of 2,500 lbs (1,134 Kg).
The aircraft is designed for basic and intermediate training.
The wing has structural provisions to carry four underwing pylons. The total suspended load is up to 1,455 lbs (660 Kg), with a maximum of 728 lbs (330 Kg) at each inboard station and 364 lbs (165 Kg) at each outboard station.

AIRCRAFT DIMENSIONS

The overall dimensions of the aircraft under normal conditions of weights, shock absorbers and tire inflation are as follows:

Wing span	27.66 ft	(8.43 m)
Length	31.16 ft	(9.50 m)
Height	13.45 ft	(4.10 m)

AIRCRAFT GROSS WEIGHT

NOTE

These weights shall not be used for computing aircraft performance or for any operational purposes.

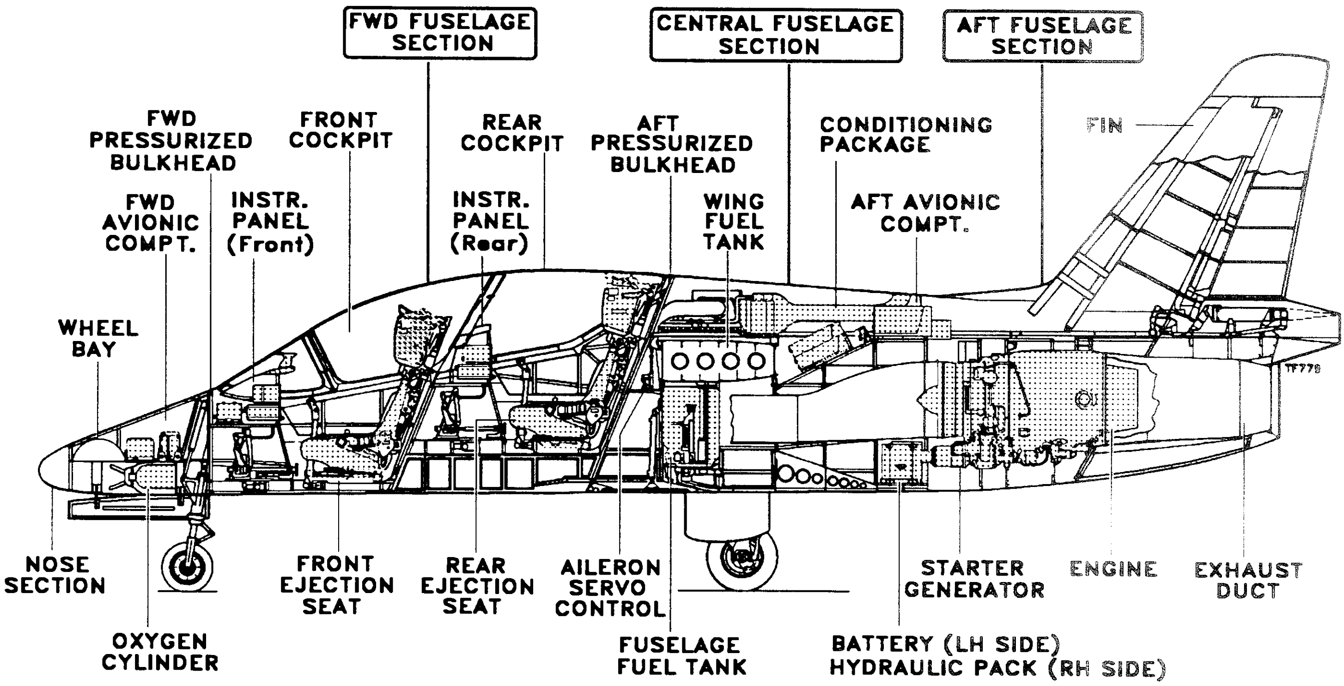
The maximum take-off and landing weight in clean configuration is 6,063 lbs (2,750 Kg).
The maximum take-off weight with external stores is 6,944 lbs (3,150 Kg) and the maximum weight at landing is 6,834 lbs (3,100 kg).
The maximum take-off weight with auxiliary fuel tanks is 7,165 lbs (3,250 kg).
For detailed information relevant to the maximum take-off and landing weight see Section V of this Manual.

GENERAL ARRANGEMENT

The aircraft fuselage (See figure 1-1) consists of the forward, central and aft sections.
The forward section consists of a pressurized cabin closed by a single canopy, hinged on the right side and of a nose section which houses the steerable nose landing gear, the gaseous oxygen cylinders and the forward avionic compartment.
The central section contains the fuselage fuel tank and accessories, the main landing gear compartments, the air brake in the central lower part, the air conditioning package, the battery and the hydraulic accessories pack.
The aft section contains the engine, the air exhaust duct and their supporting structures.
The wing is a two spar, one piece assembly, bolted to the central fuselage by four bolts; the rear spar supports the ailerons and the electrically operated semifowler flaps.

GENERAL ARRANGEMENT

INTERNAL PROFILE



EXTERNAL PROFILE

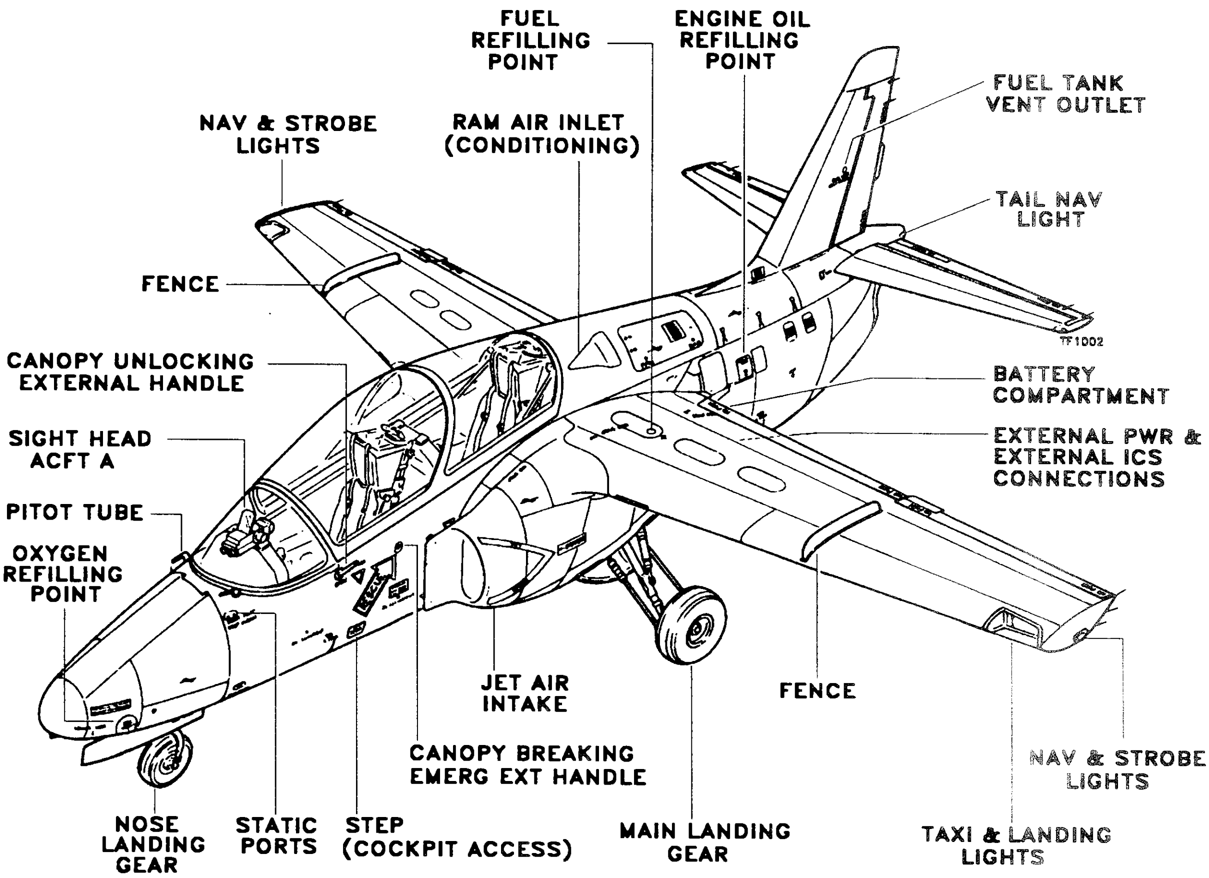


Figure 1-1.

The integral fuel tank, containing more than 3/4 of the total internal fuel, is located between the two spars and the two sealed ribs.
The empennage consists of a conventional vertical fin and rudder and of a one-piece horizontal trimmable stabilizer with elevator.
The flight control system consists of push-pull rods, directly operated by interconnected control sticks, and rudder pedals in each cockpit.

COCKPIT ARRANGEMENT

The S211 (See figure 1-2, sheet 1 thru 8) has conventional cockpits with ejection seats and central mounted flight control sticks.
Adjustable rudder pedals and seat elevation adjustment devices are provided at each pilot station to accommodate different percentile pilots.
The interior arrangement includes two ejection seats in tandem which are staggered in height to provide the maximum visibility from the rear cockpit.
The front pilot has a complete range of instruments and controls on the instrument panel and on two side consoles.
The rear cockpit has a similar arrangement, but not all the instruments and controls are duplicated. Hence solo flight is performed only from the front cockpit.

ENGINE

The aircraft is equipped with a Pratt & Whitney JT15D-4C (See figure 1-3, sheet 1) is a light weight twin-spool, front turbofan, jet propulsion engine, having a full length annular by-pass duct.

GENERAL DESCRIPTION

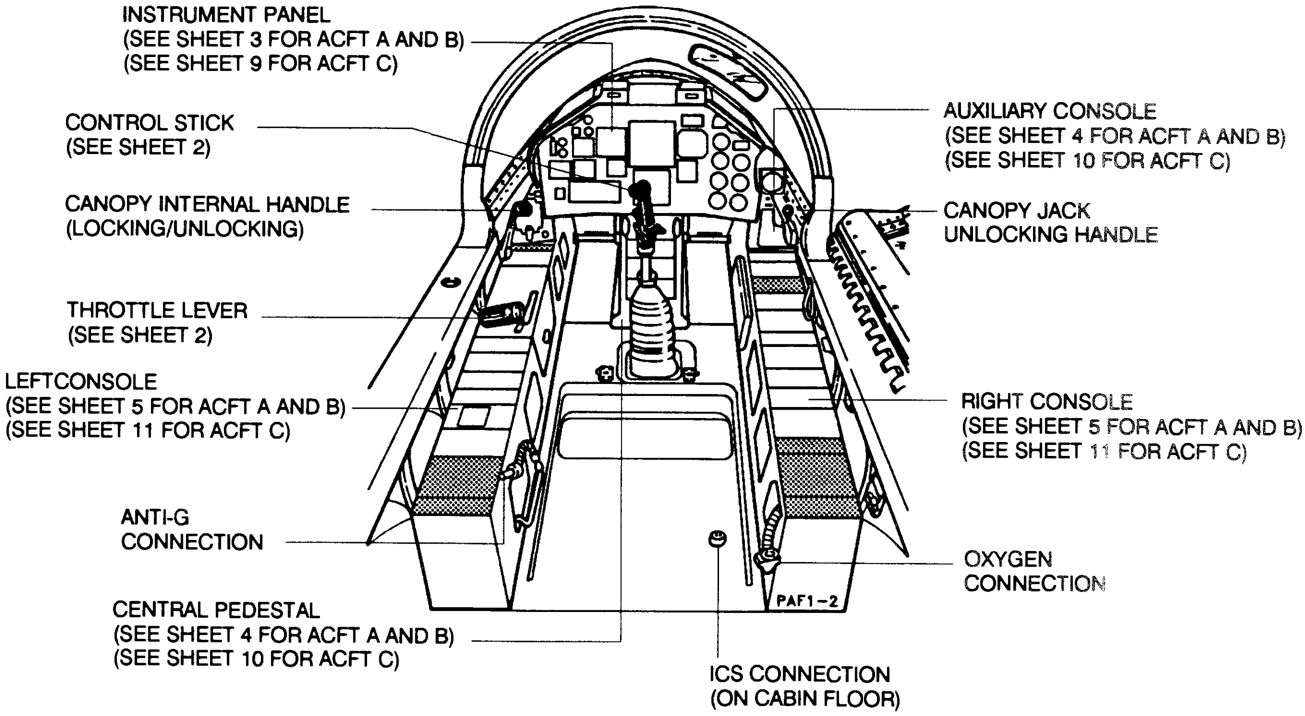
The engine has a high pressure and a low pressure compressor driven by a concentric shaft sysytem.
The low compressor consists of a main front fan followed by an axial booster stage. The inner shaft shaft supports the fan and booster stage and is driven by a two stage turbine supported at the rear. The outer shaft supports the high pressure centrifugal compressor and is driven by a single-stage turbine.
The accessory gear box is mounted below the engine and is driven through a vertical tower shaft. All enginedriven accessories (starter-generator drive shaft, engine oil pump etc.), except the NL speed sensor and secondary scavenge oil pump, are mounted on the accesory gearbox. The splines of the tower shaft engage bevel gears at both ends, the upper gear meshing with the bevel gear on the high pressure compressor rotor shaft, and the lower gear meshing with the bevel gear on the starter generator driveshaft in the accessory gearbox. Two NH speed sensor units, in the left side of the gearbox casing, pick up NH speed signal pulses from the oil pump drive spur gear and supply NH speed signals to ECU and to NL/NH indicators in the front and rear cockpit.
A vertical spline driveshaft, housed in the upper half of the intermediate casing and geared to the low pressure compressor rotor, drives a secondary scavenge oil pump. Splined to an extension of the driveshaft is the NL pulse generator rotor located in a housing bolted to the intermediate casing. Two NL speed sensor, located in the pulse generator housing, supply NL speed signals to ECU and to NL/NH indicators in the front and rear cockpit.
During engine operation, the air flows through two air intakes to the engine low pressure compressor case and is accelerated rearward by the fan and discharged through concentric dividing ducts. The airflow (secondary) at the inlet of the by-pass duct passes through two rows of staggered stator vanes and flows rearward to discharge through the annular nozzle. The airflow (primary) at the inlet of the inner duct is passed through a single row of stator vanes following the fan rotor, then through a single row of stator vanes following the booster rotor. Primary air is then directed through an inlet guide stator vane assembly to the centrifugal impeller. The high pressure air from the impeller passes through a diffuser assembly which returns the flow direction to axial; the air then passes around the combustion chamber liner. The primary combustion air enters the combustion chamber liner and mixes with fuel. Secondary dilution air enters the liners downstream to drop temperature and smooth temperature peaks.
Fuel is injected into the combustion chamber by 12 dual orifice type nozzles supplied by a dual manifold. The mixture is ignited by two spark igniters which protrude into the combustion chamber liner.The resultant gases expand from the combustion chamber liner, reverse direction, and pass through the high pressure turbine guide vanes to the high pressure turbine (NH). The still expanding gases pass rearward to the two-stage low pressure turbine and associated guide vanes, then to the atmosphere through the exhaust duct.
High temperature pressurized air, bled from the high pressure compressor delivery, is used for cabin conditioning and pressurization, for de-icing and demisting of the transparent surfaces, for anti-g suits, for pressurization of the hydraulic system reservoir and for engine anti-icing.
An Electronic Control Unit (ECU) controls the fuel flow to the engine in order to produce, at full throttle, the maximum allowable thrust at any combination of ambient and flight parameters, while keeping the engine within its limits. In case of ECU failure, the maximum allowable thrust can be attained by breaking the lockwire of the Engine Throttle Extra-stroke Control Lever and positioning the Throttle lever in the EMERGENCY sector.

ENGINE OIL SYSTEM

The engine oil system is of the self-contained type with

COCKPIT ARRANGEMENT

FRONT COCKPIT - TYPICAL



REAR COCKPIT - TYPICAL

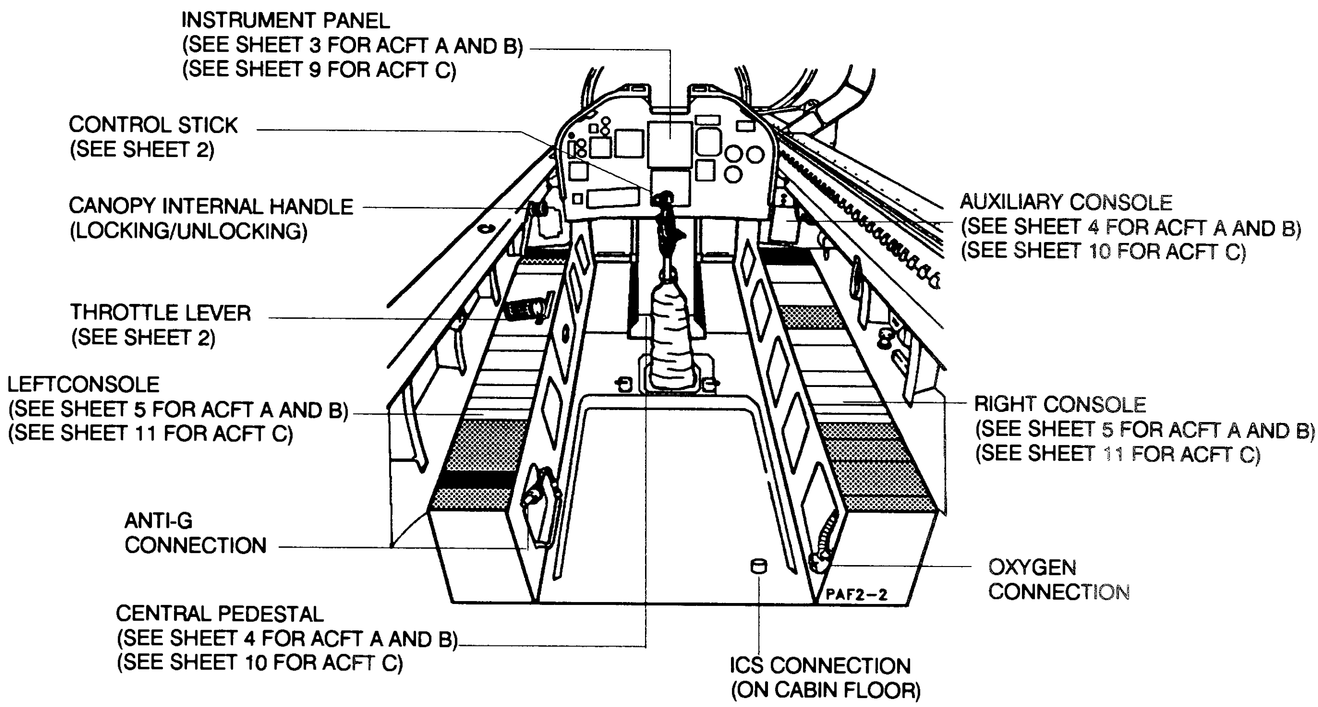
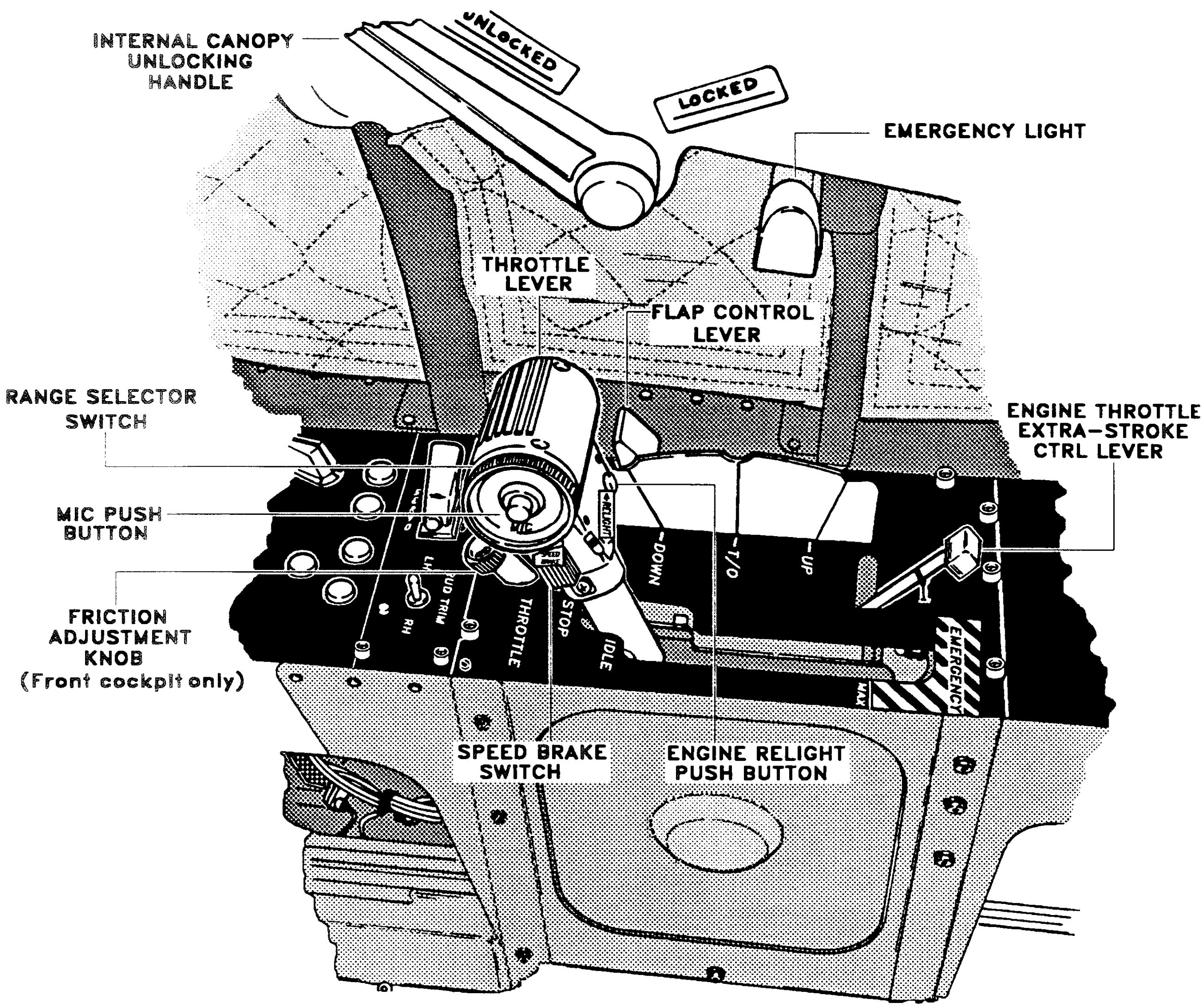


Figure 1-2. (Sheet 1 of 13)

COCKPIT ARRANGEMENT

THROTTLE LEVER - FRONT COCKPIT TYPICAL VIEW



CONTROL STICK GRIP

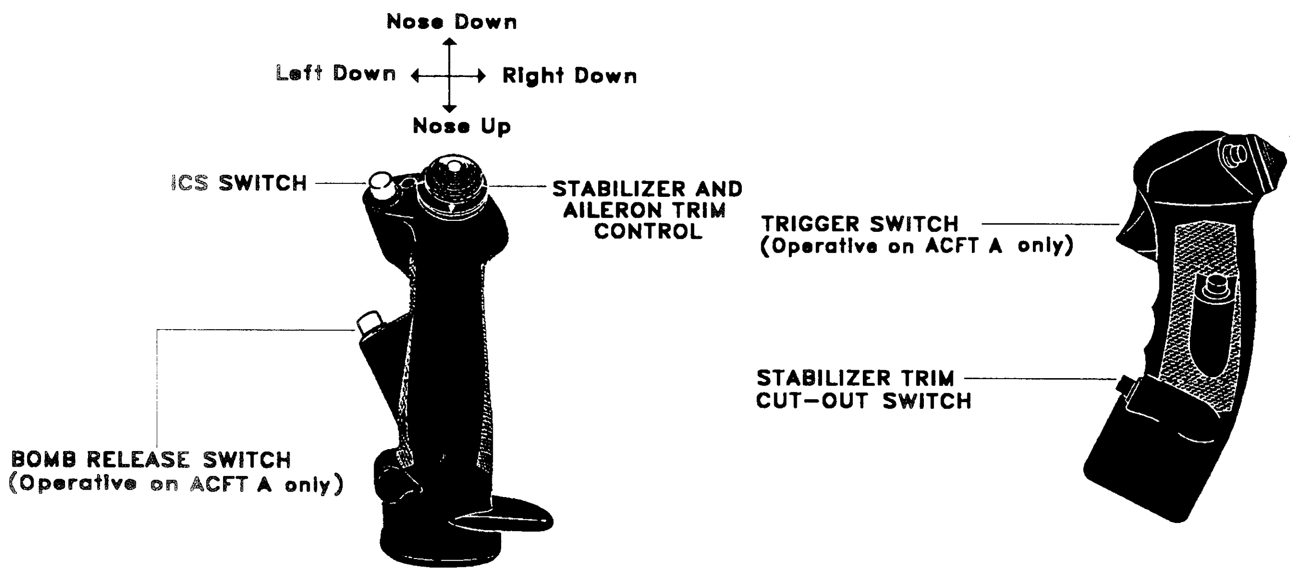
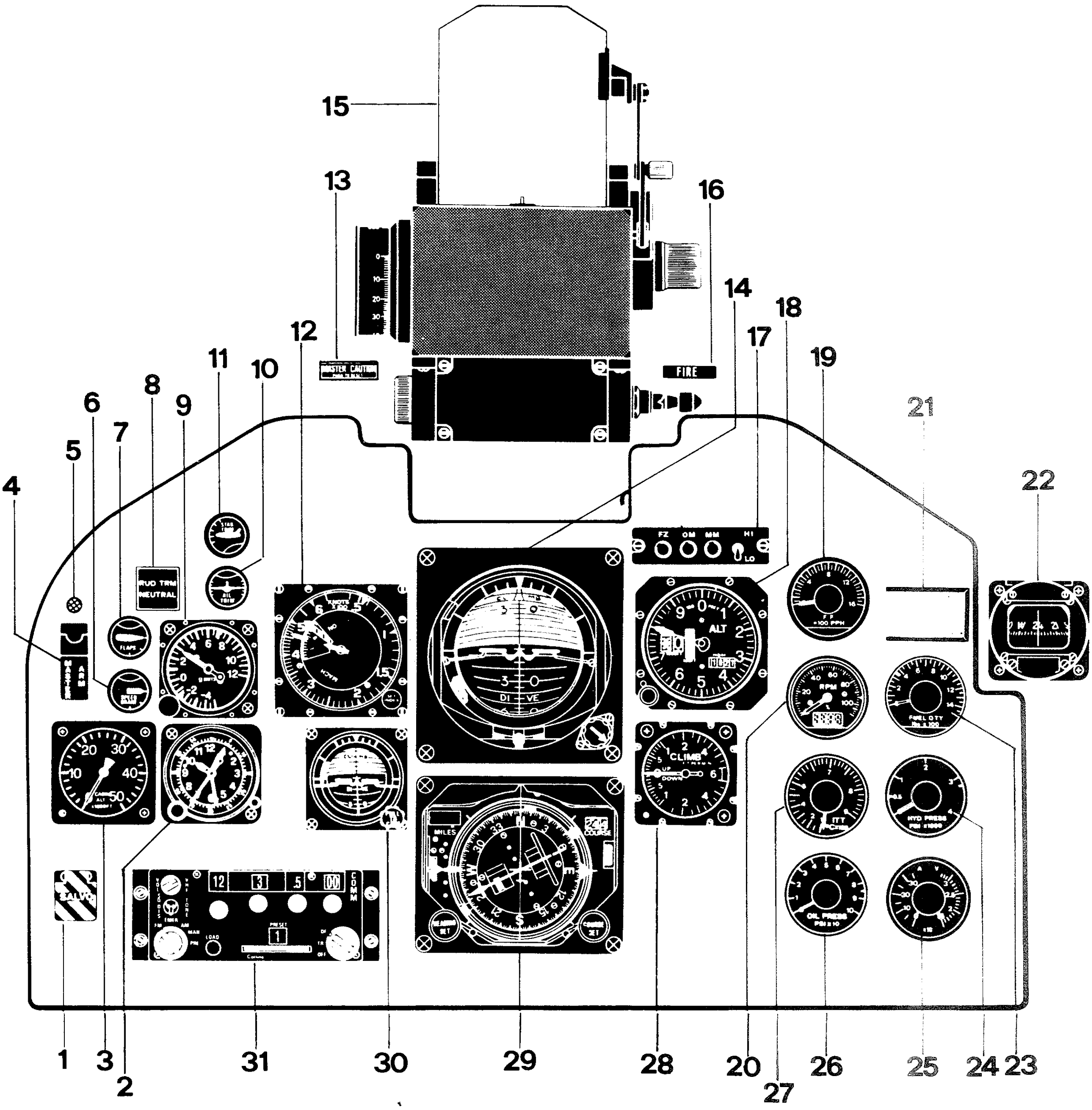


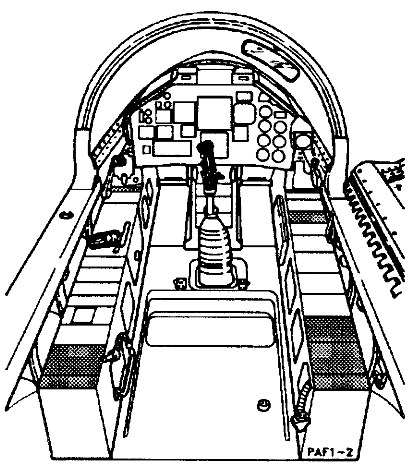
Figure 1-2. (Sheet 2)

COCKPIT ARRANGEMENT

FRONT COCKPIT - INSTRUMENT PANEL - ACFT A AND B



1. SALVO SWITCH
2. STOP WATCH
3. CABIN ALTITUDE INDICATOR
4. MASTER ARM SWITCH (OPERATIVE ON ACFT A ONLY)
5. ARMAMENT SYSTEM INDICATING LIGHT
6. SPEED BRAKE POSITION INDICATOR
7. FLAP POSITION INDICATOR
8. RUDDER TRIM LIGHT (NEUTRAL POSITION)
9. ACCELEROMETER
10. AILERON TRIM INDICATOR
11. STABILIZER TRIM INDICATOR
12. AIRSPEED/MACH INDICATOR
13. MASTER CAUTION LIGHT
14. ATTITUDE INDICATOR
15. SIGHTHEAD (ACFT A ONLY)



16. FIRE WARNING LIGHT
17. MKR CONTROLLER
18. ALTIMETER
19. FUEL FLOW INDICATOR
20. NL/NH INDICATOR
21. COMPENSATOR CARD (MAGNETIC COMPASS)
22. STBY MAGNETIC COMPASS
23. FUEL QTY INDICATOR
24. HYDRAULIC PRESSURE INDICATOR
25. VOLTAMMETER
26. OIL PRESSURE INDICATOR
27. ITT INDICATOR
28. VERTICAL SPEED INDICATOR
29. HSI
30. STBY ATTITUDE INDICATOR
31. VHF COMM1 CONTROL PANEL

Figure 1-2. (Sheet 3)

COCKPIT ARRANGEMENT

FRONT COCKPIT - AUXILIARY CONSOLES - ACFT A AND B

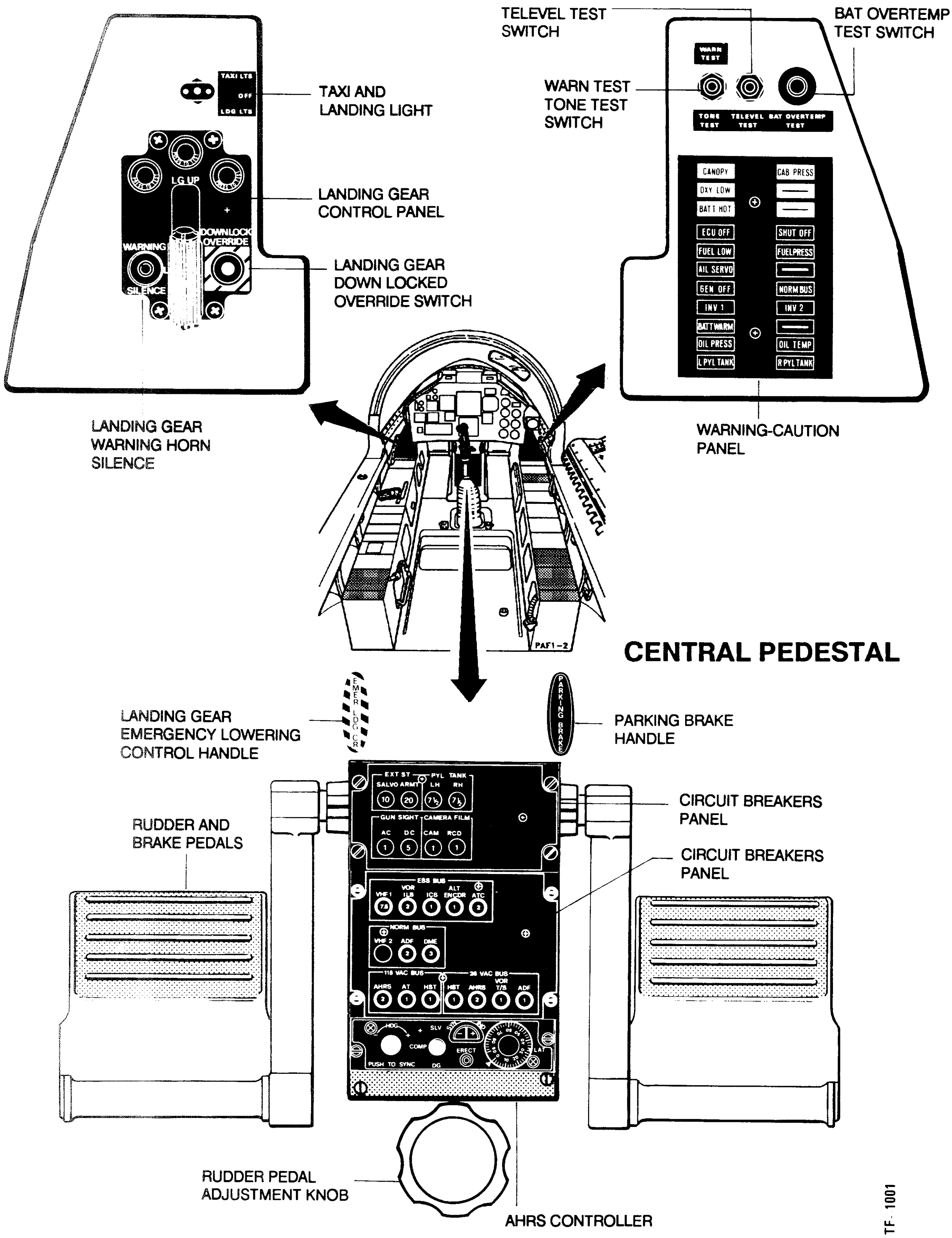


Figure 1-2. (Sheet 4)

COCKPIT ARRANGEMENT

FRONT COCKPIT - LATERAL CONSOLES - ACFT A AND B

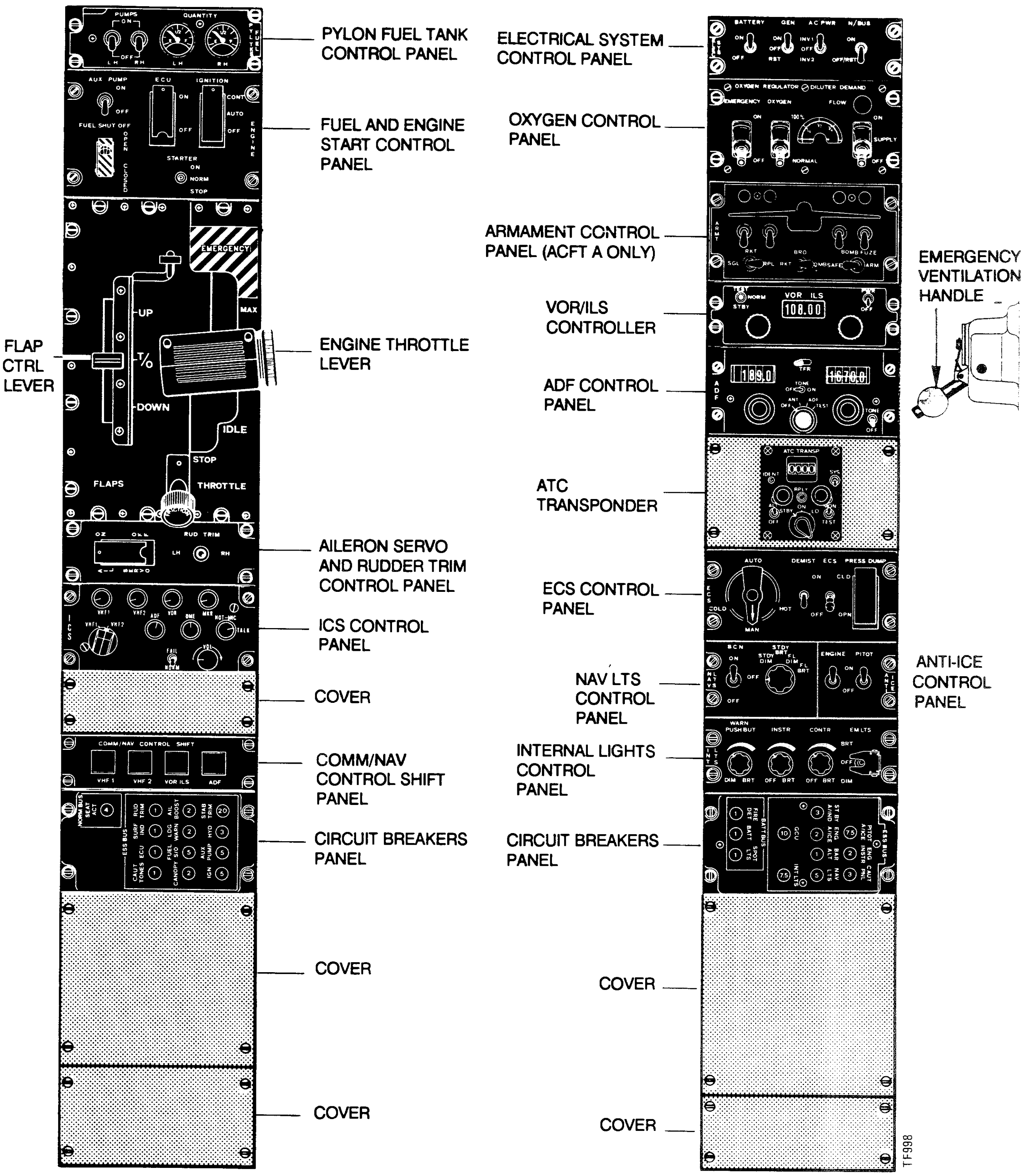
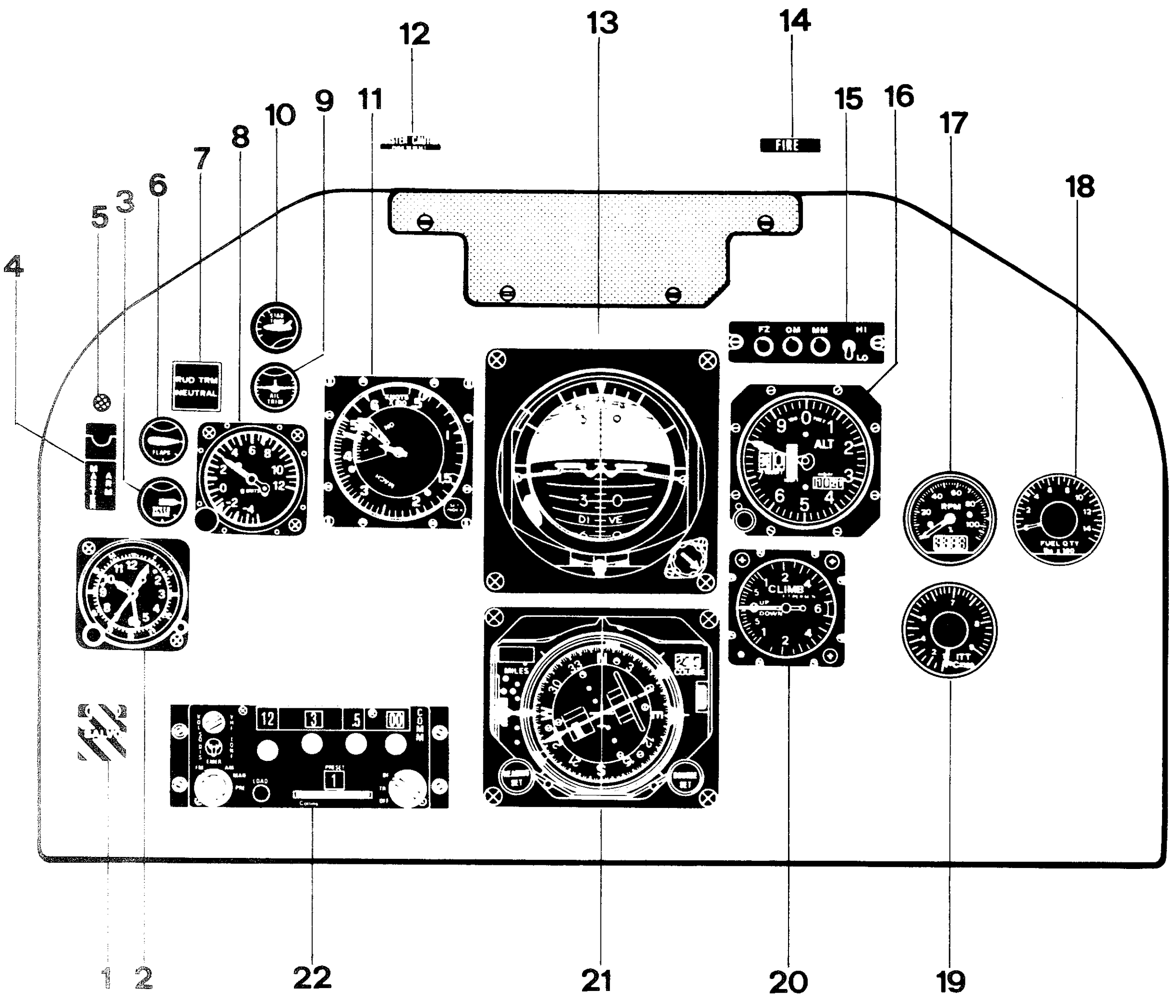
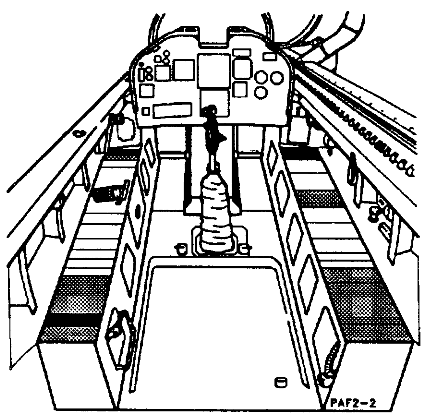


Figure 1-2. (Sheet 5)

COCKPIT ARRANGEMENT

REAR COCKPIT - INSTRUMENT PANEL - ACFT A AND B





1. SALVO SWITCH
2. STOP WATCH
3. SPEED BRAKE POSITION INDICATOR
4. MASTER ARM OVRD SWITCH (OPERATIVE ON ACFT A ONLY)
5. ARMAMENT SYSTEM INDICATING LIGHT
6. FLAP POSITION INDICATOR
7. RUDDER TRIM LIGHT (NEUTRAL POSITION)
8. ACCELEROMETER
9. AILERON TRIM INDICATOR
10. STABILIZER TRIM INDICATOR
11. AIRSPEED/MACH INDICATOR
12. MASTER CAUTION LIGHT
13. ATTITUDE INDICATOR
14. FIRE WARNING LIGHT
15. MKR CONTROLLER
16. ALTIMETER
17. NL/NH INDICATOR
18. FUEL QTY INDICATOR
19. ITT INDICATOR
20. VERTICAL SPEED INDICATOR
21. HSI
22. VHF COMM1 CONTROL PANEL

Figure 1-2. (Sheet 6)

COCKPIT ARRANGEMENT

REAR COCKPIT - AUXILIARY CONSOLES - ACFT A AND B

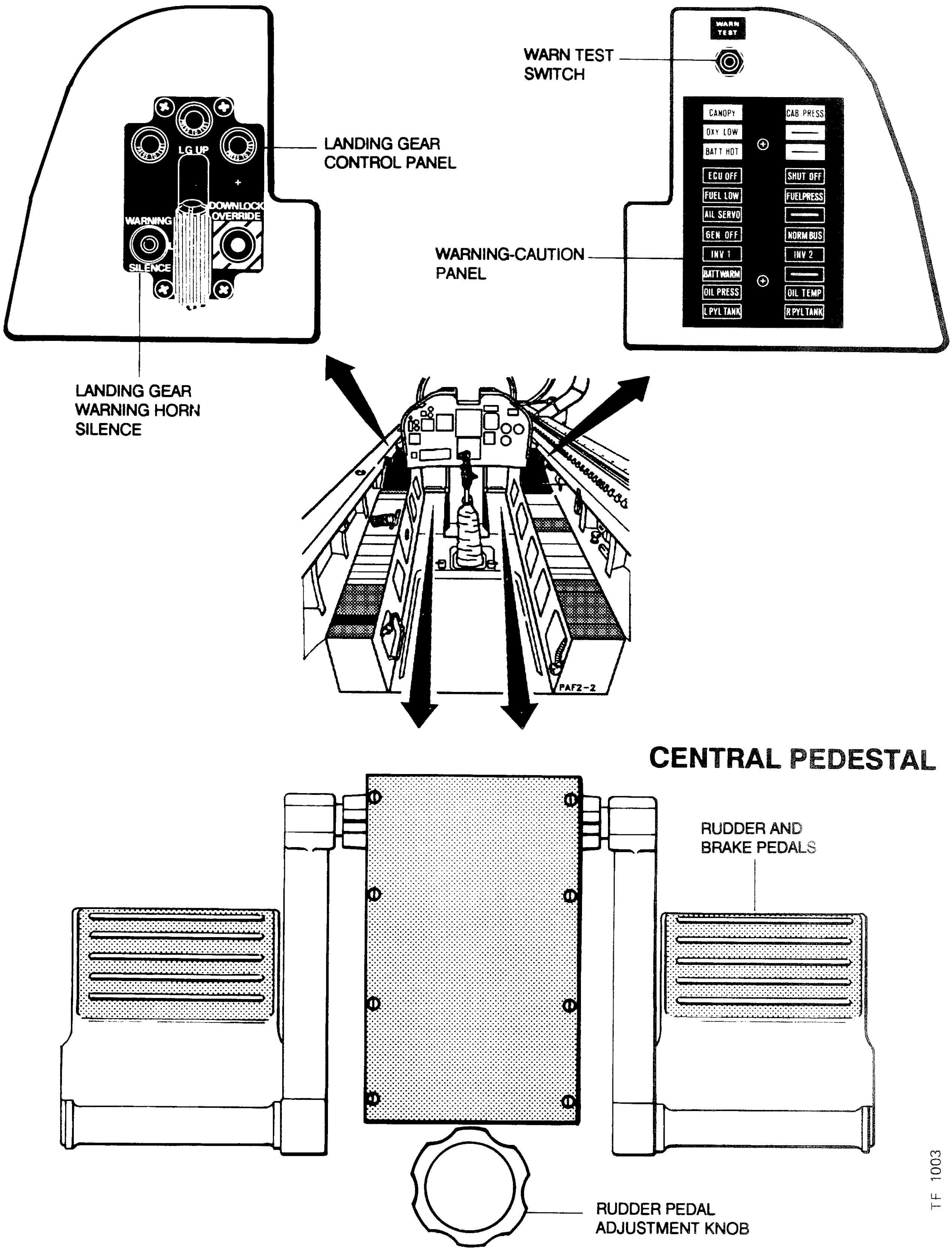


Figure 1-2. (Sheet 7)

COCKPIT ARRANGEMENT

REAR COCKPIT - LATERAL CONSOLES - ACFT A AND B

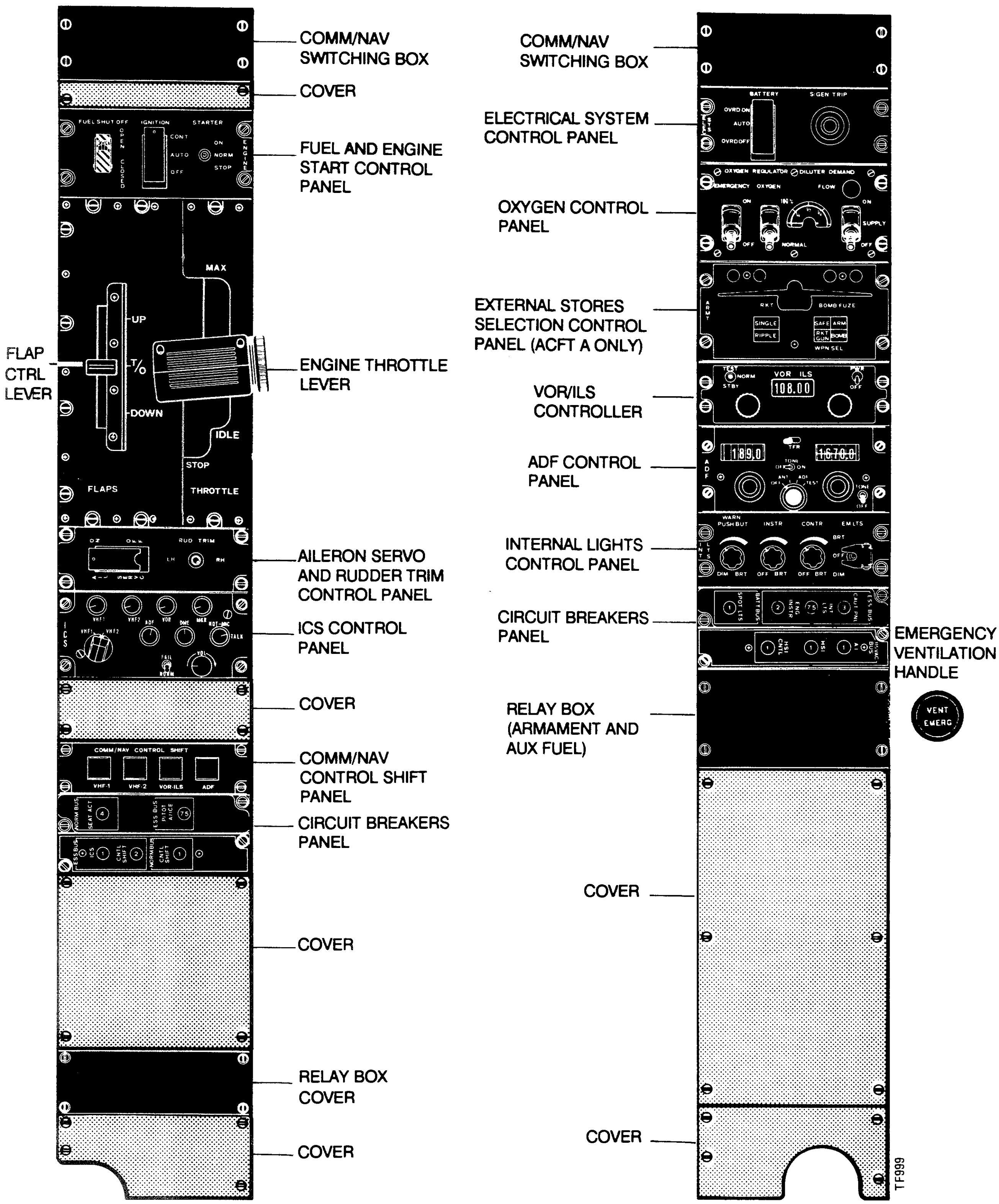
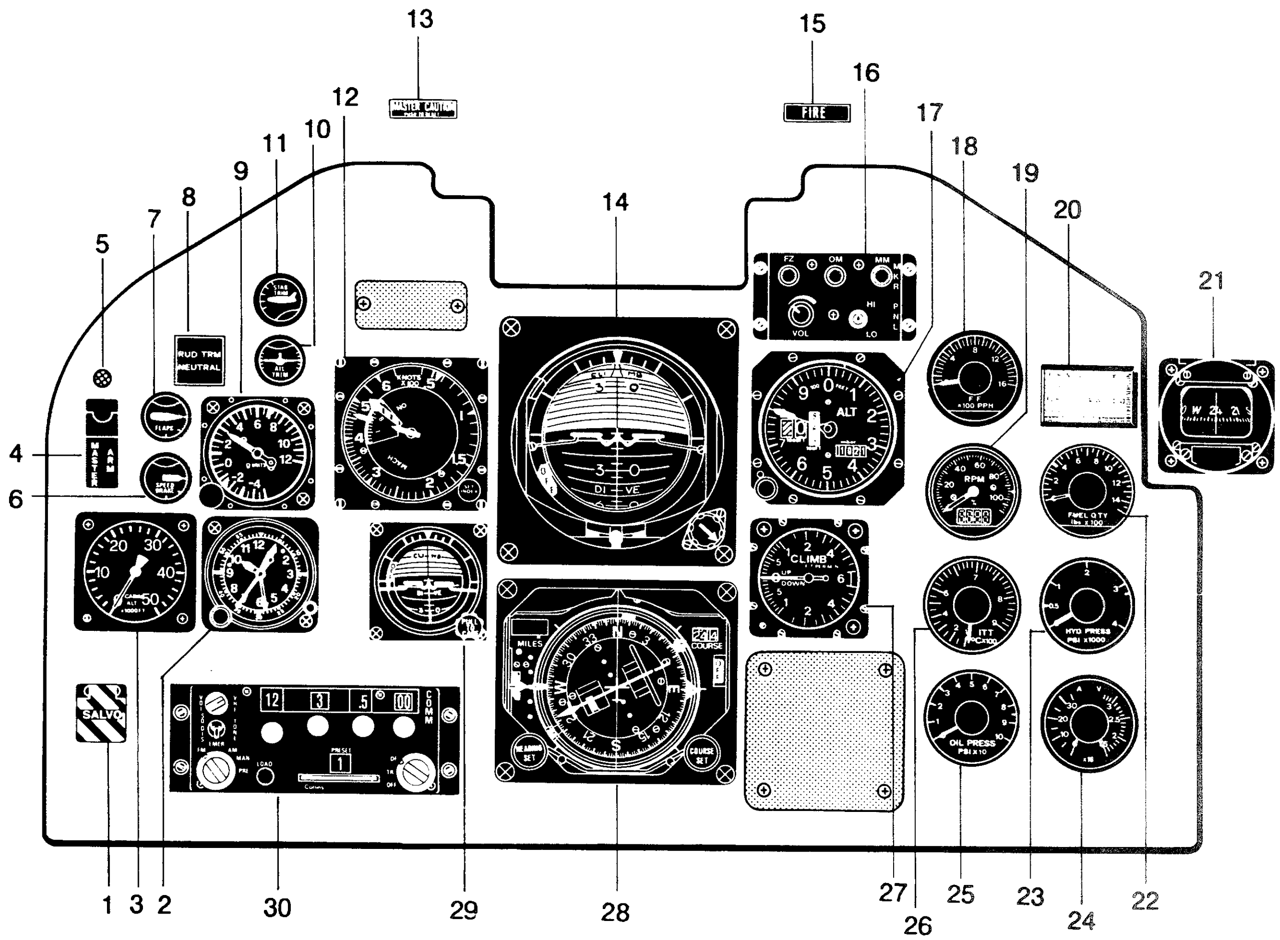


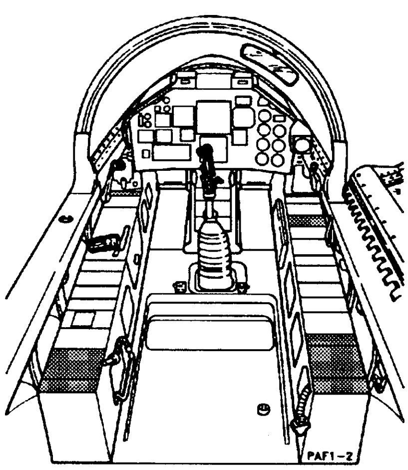
Figure 1-2. (Sheet 8)

COCKPIT ARRANGEMENT

FRONT COCKPIT - INSTRUMENT PANEL - ACFT C



1. SALVO SWITCH
2. STOP WATCH
3. CABIN ALTITUDE INDICATOR
4. MASTER ARM SWITCH (OPERATIVE ON ACFT A ONLY)
5. ARMAMENT SYSTEM INDICATING LIGHT
6. SPEED BRAKE POSITION INDICATOR
7. FLAP POSITION INDICATOR
8. RUDDER TRIM LIGHT (NEUTRAL POSITION)
9. ACCELEROMETER
10. AILERON TRIM INDICATOR
11. STABILIZER TRIM INDICATOR
12. AIRSPEED/MACH INDICATOR
13. MASTER CAUTION LIGHT
14. ATTITUDE INDICATOR
15. COVER
16. FIRE WARNING LIGHT



17. MKR CONTROLLER
18. ALTIMETER
19. FUEL FLOW INDICATOR
20. NL/NH INDICATOR
21. COMPENSATOR CARD (MAGNETIC COMPASS)
22. STBY MAGNETIC COMPASS
23. FUEL QTY INDICATOR
24. HYDRAULIC PRESSURE INDICATOR
25. VOLTAMMETER
26. OIL PRESSURE INDICATOR
27. ITT INDICATOR
28. VERTICAL SPEED INDICATOR
29. HSI
30. STBY ATTITUDE INDICATOR
31. VHF COMM1 CONTROL PANEL
32. COVER

Figure 1-2. (Sheet 9)

COCKPIT ARRANGEMENT

FRONT COCKPIT - AUXILIARY CONSOLES - ACFT C

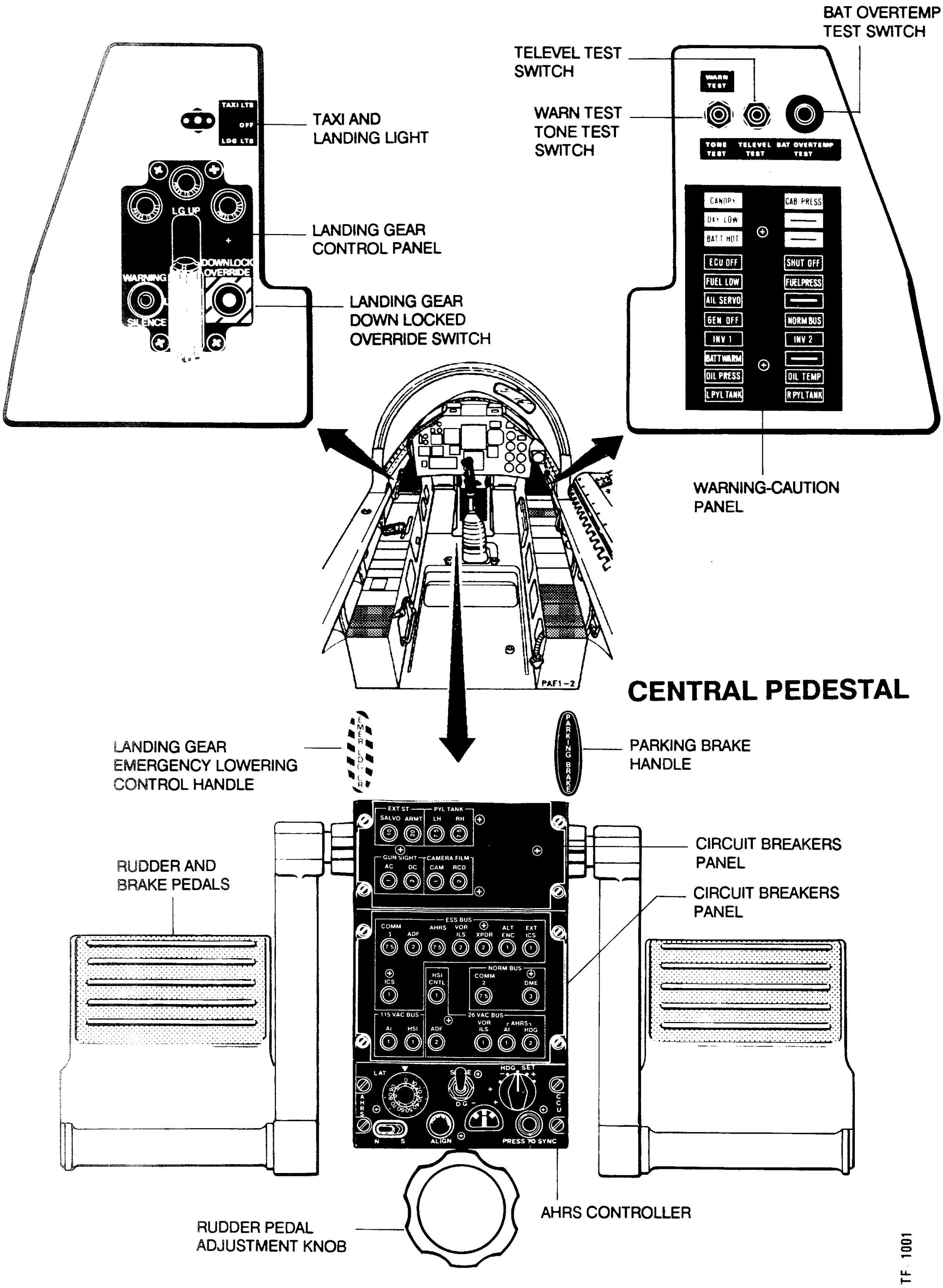


Figure 1-2. (Sheet 10)

COCKPIT ARRANGEMENT

FRONT COCKPIT - LATERAL CONSOLES - ACFT C

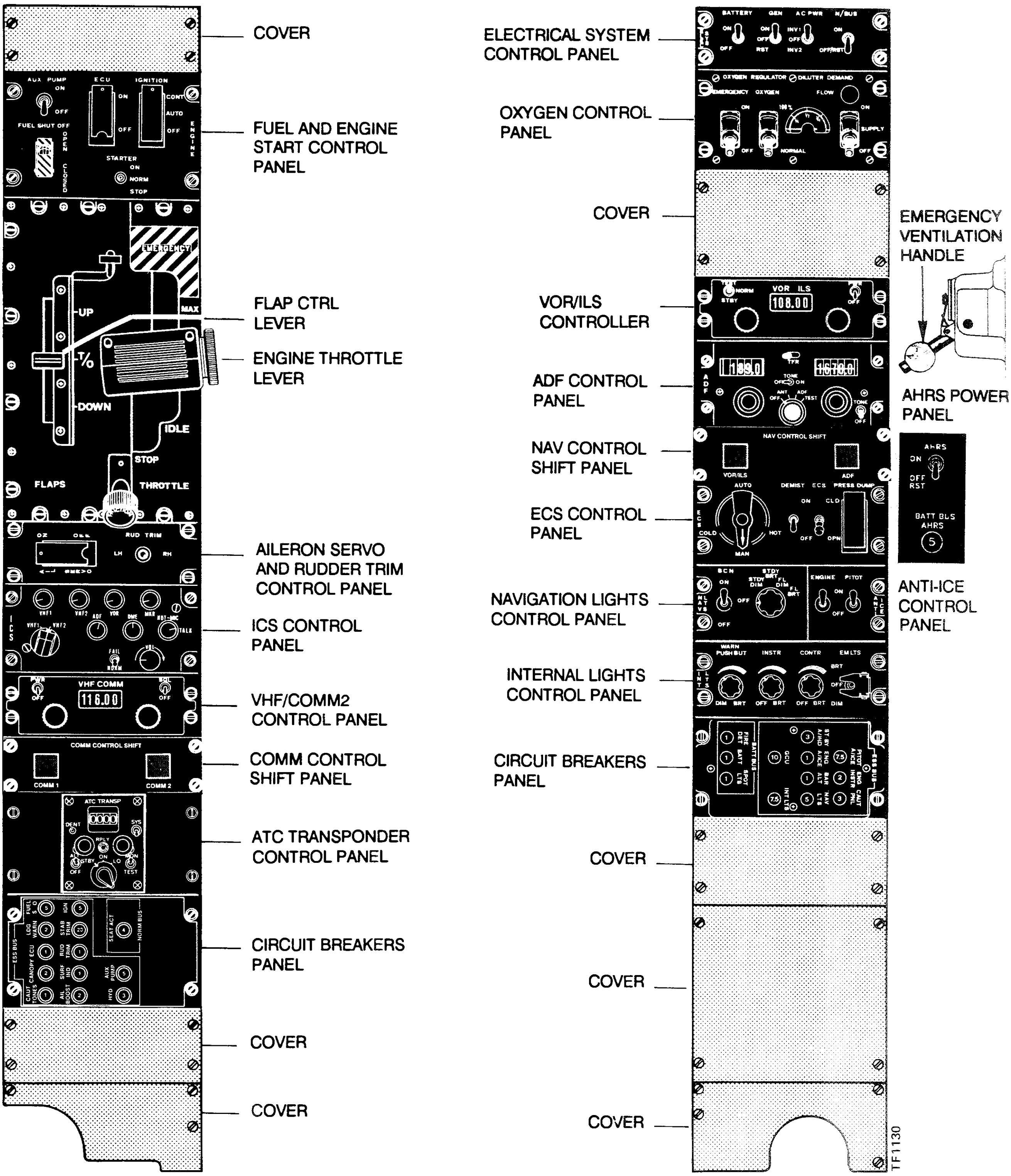
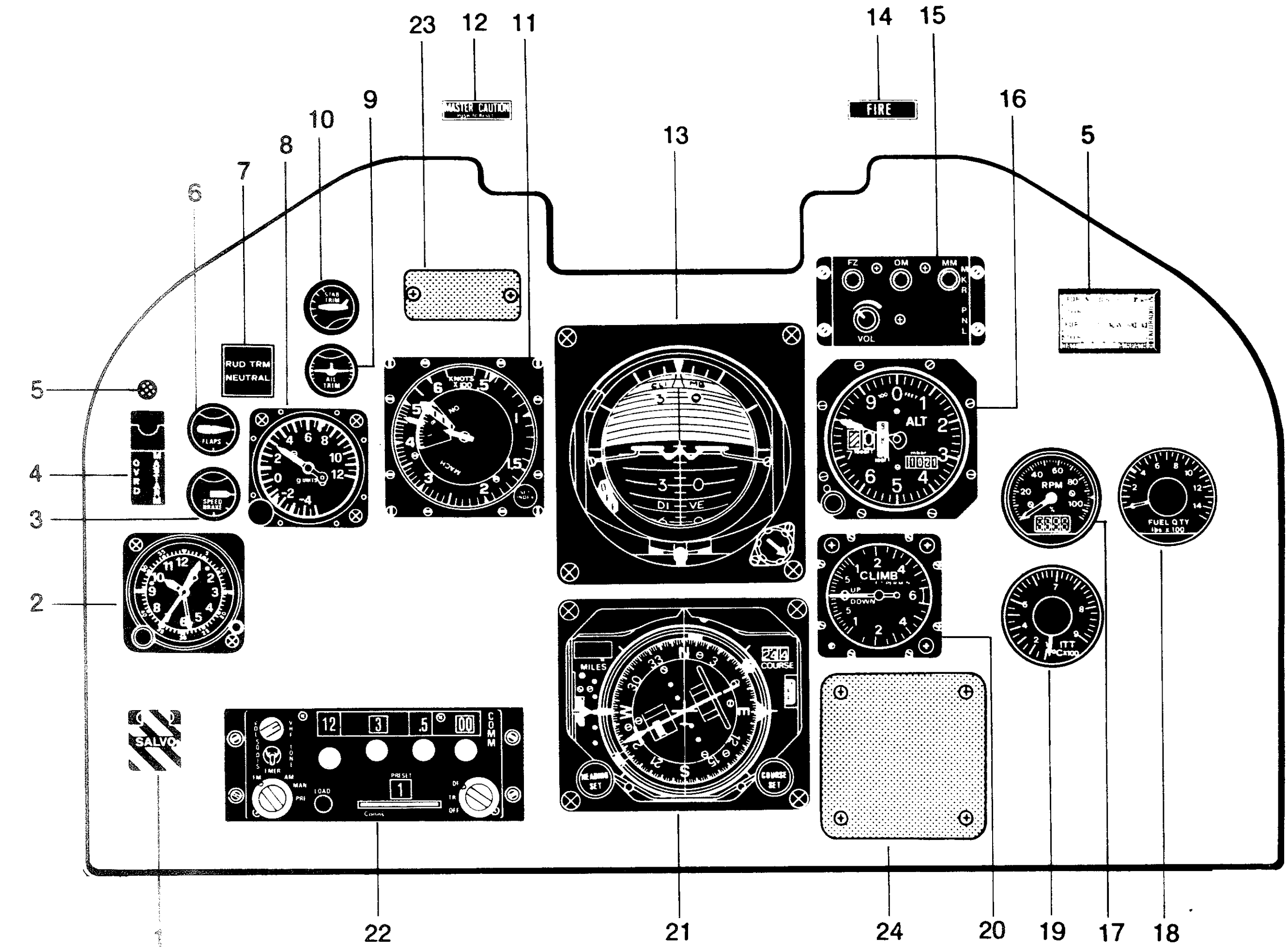


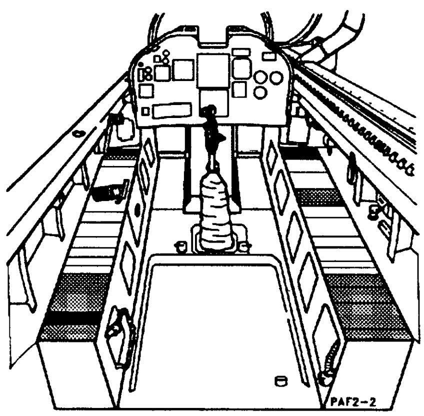
Figure 1-2. (Sheet 11)

COCKPIT ARRANGEMENT

REAR COCKPIT - INSTRUMENT PANEL - ACFT C



1. SALVO SWITCH
2. STOP WATCH
3. SPEED BRAKE POSITION INDICATOR
4. MASTER ARM OVRD SWITCH (OPERATIVE ON ACFT A ONLY)
5. ARMAMENT SYSTEM INDICATING LIGHT
6. FLAP POSITION INDICATOR
7. RUDDER TRIM LIGHT (NEUTRAL POSITION)
8. ACCELEROMETER
9. AILERON TRIM INDICATOR
10. STABILIZER TRIM INDICATOR
11. AIRSPEED/MACH INDICATOR



12. MASTER CAUTION LIGHT
13. ATTITUDE INDICATOR
14. FIRE WARNING LIGHT
15. MKR CONTROLLER
16. ALTIMETER
17. NL/NH INDICATOR
18. FUEL QTY INDICATOR
19. ITT INDICATOR
20. VERTICAL SPEED INDICATOR
21. HSI
22. VHF COMM1 CONTROL PANEL
23. COVER
24. COVER

Figure 1-2. (Sheet 12)

COCKPIT ARRANGEMENT

REAR COCKPIT - AUXILIARY CONSOLES - ACFT C

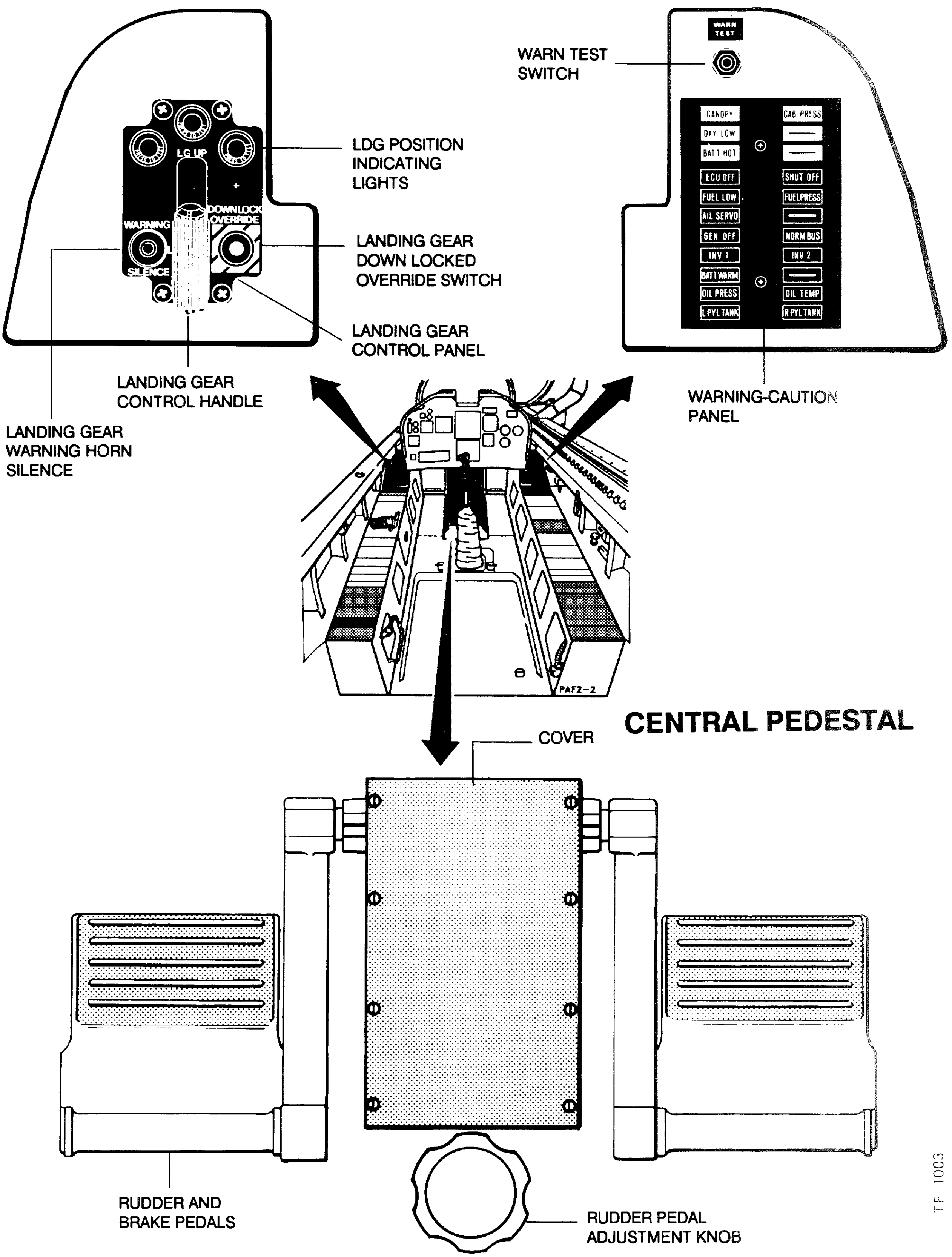


Figure 1-2. (Sheet 13)

COCKPIT ARRANGEMENT

REAR COCKPIT - LATERAL CONSOLES - ACFT C

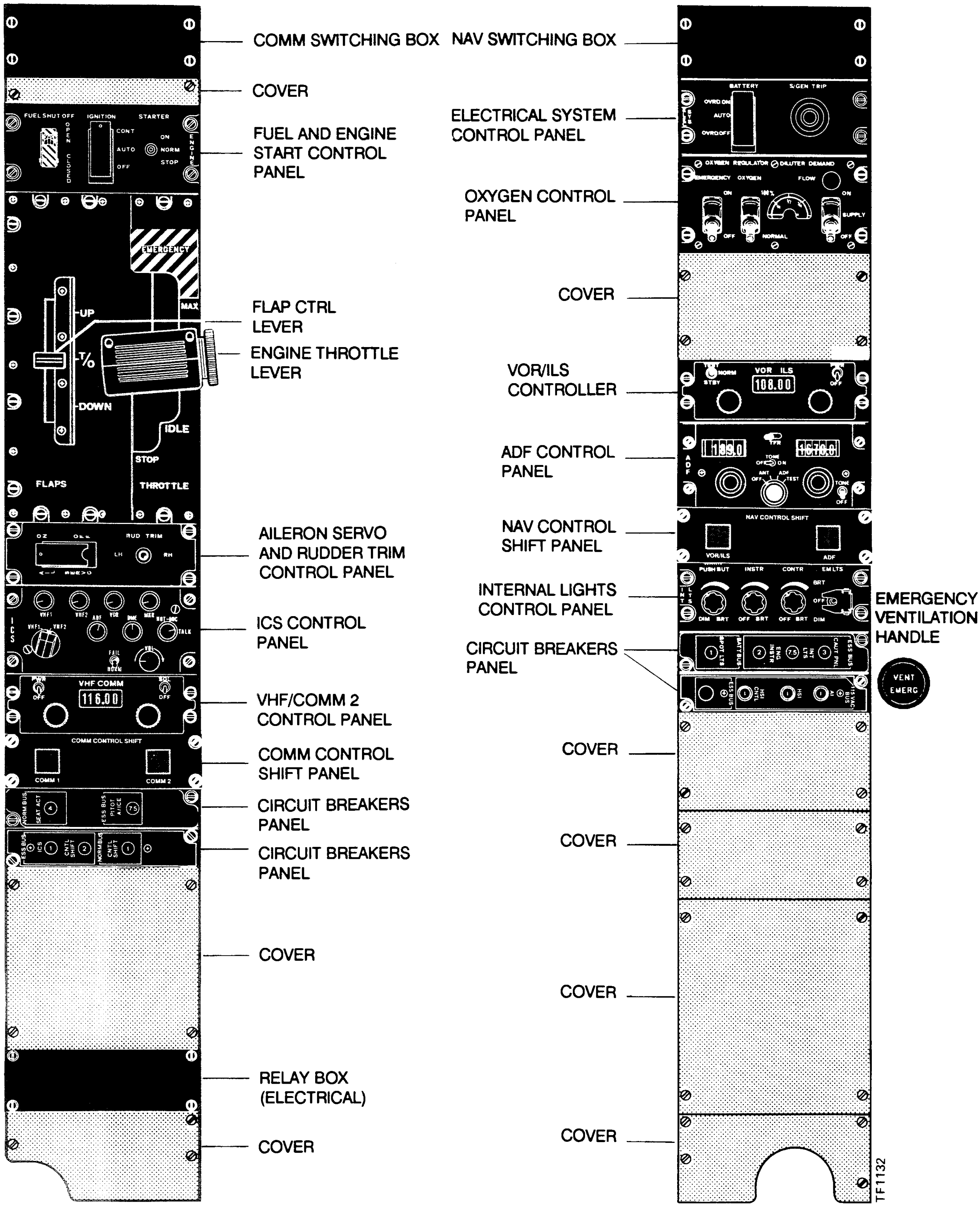
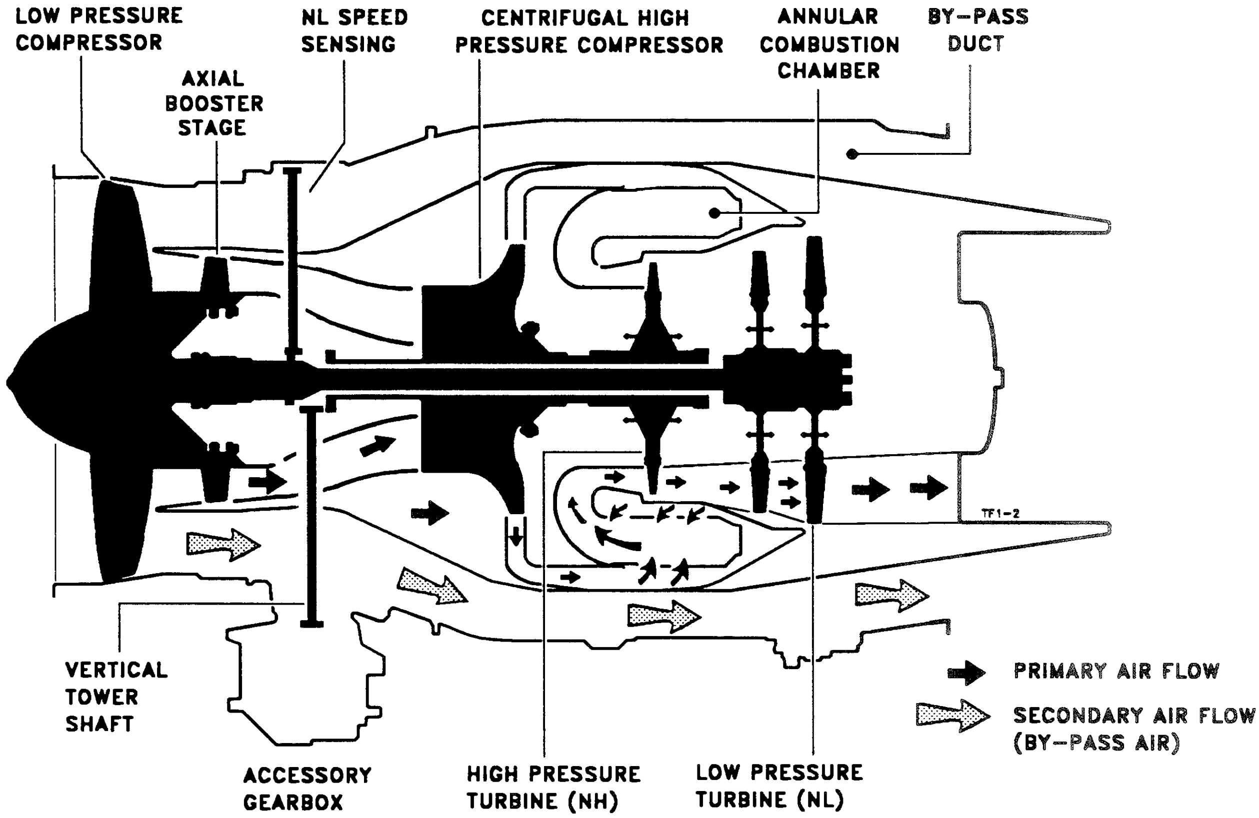


Figure 1-2. (Sheet 14)

P&W JT15D-4C ENGINE



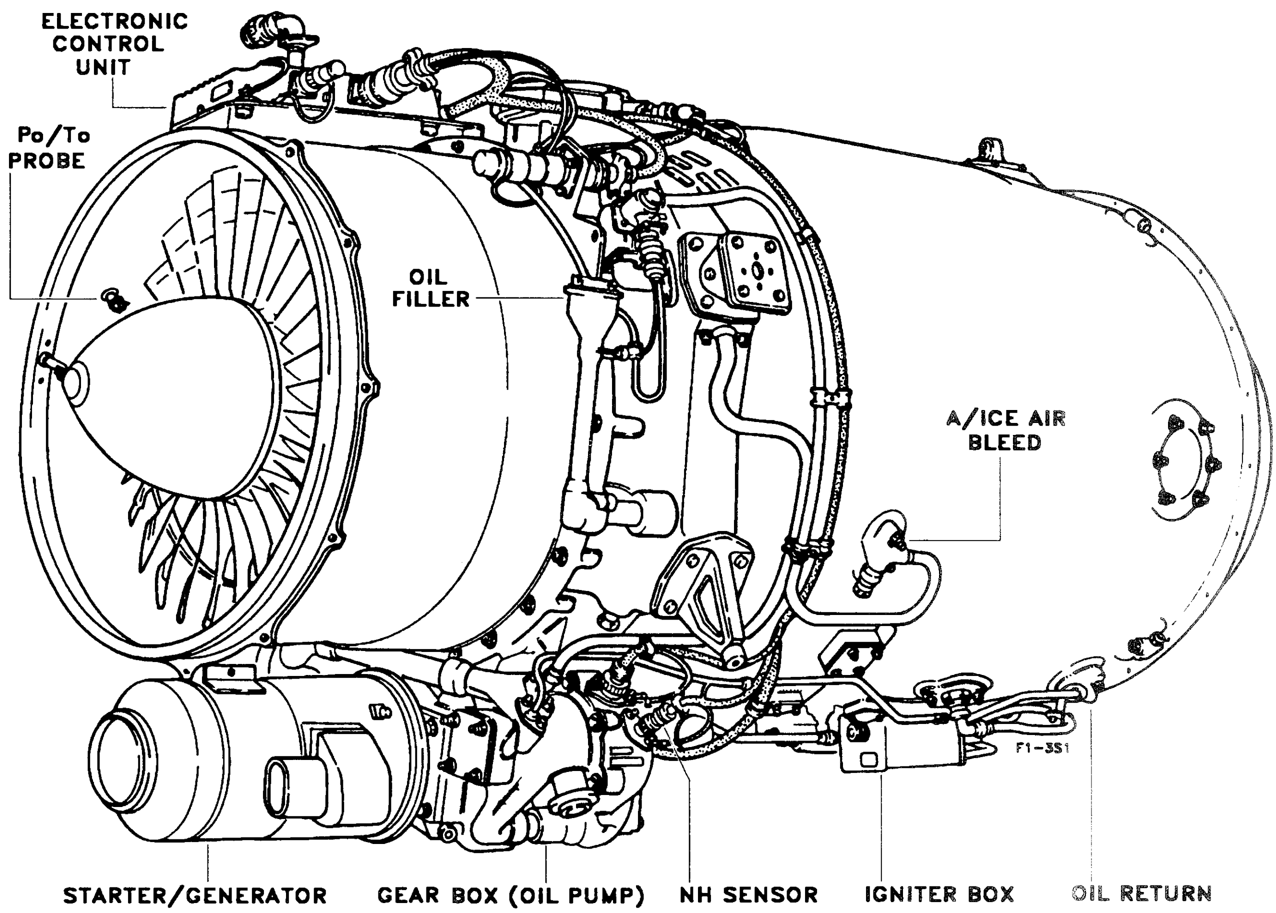


Figure 1-3. (Sheet 1 of 2)

P & W JT15D-4C ENGINE

OIL SYSTEM SCHEMATIC

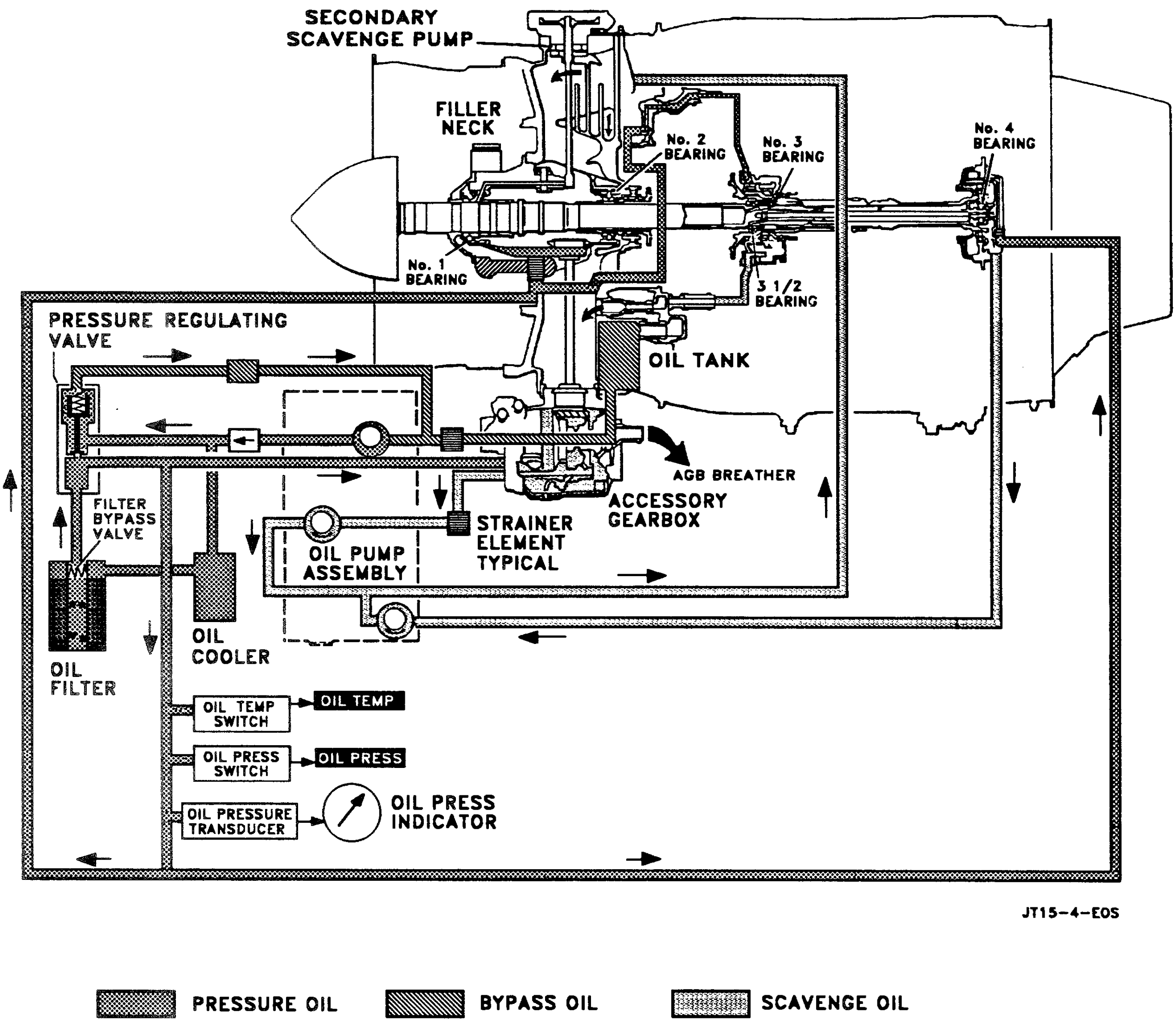


Figure 1-3. (Sheet 2)

an integral tank with a capacity of 10,4 liters.
The system is designed to supply clean lubricating oil, at a constant pressure, to the engine bearings and all accessory drive gears and bearings. The oil flow lubricates and cools the bearings and carries foreign matter to the oil filter where it is retained. A dual action gravity operated valve bolted to the front inner face of the oil tank cover in the intermediate casing, together with a secondary scavenge oil pump, provide for inverted flight operation. Calibrated oil nozzles on the main engine bearing compartments ensure that an optimum oil flow is maintained under all operating conditions.
The system consists basically of a pressure system, a scavenge system and a breather system.

Description and Operation (See fig. 1-3, sheet 2)

Pressure Oil System

Oil drawn from the tank by the pressure oil pump element is ducted through a check valve to the pressure relief valve inlet of the oil filter assembly. The oil is than passed through the oil cooler, (mounted on the oil filter housing) and the filter element, which, in the event of clogging, is bypassed by a valve. Oil pressure in excess of specification pressure at the oil filter outlet opens the pressure regulating valve and some of the oil is bypassed and ducted externally through a second check valve to the oil pressure pump inlet.
External transfer tubes provide lubrication for the Nos. 1, 2, 3, 3-1/2, and 4 bearings.
An internal transfer tube located between the oil filter housing and the accessory gearbox routes pressure oil to the gearbox for gearbox bearing lubrication.
In the inverted flight attitude, the dual action gravity operated valve moves to close the normal attitude inlet passage to pressure pump and opens to allow oil to be drawn from the inverted "top" of the tank and thence through internal ducting to the pressure pump inlet.

Scavenge Oil System

The function of the scavenge oil system is to return oil to the tank. This is achieved by allowing the oil from Nos. 1, 2, 3 and 3-1/2 bearings to drain into the accessory gearbox, aided by the airflow from the bearing compartment labyrinth seals. The No. 4 bearing scavenge oil is pumped by a separate pump element in the oil pump assembly.
The scavenge oil returned to the accessory gearbox collects in a sump at the bottom of the housing. Sump oil is pumped out by a separate and larger scavenge pump element. This pump element returns gearbox scavenge oil to the oil tank and, through an external transfer tube which connects to a boss in the 12 o'clock position on the intermediate casing; from this boss, the oil flows directly to the tank.
Under inverted flight conditions, a secondary scavenge pump located at 12 o'clock in the intermediate casing and driven by a vertical tower shaft, returns scavenge oil immediately to the lower half of the oil tank via a cored passage tube; thus providing almost unlimited inverted flight capability. The tower shaft is hollow and under normal flight conditions, oil passes up to the shaft to keep the secondary pump primed and prevent cavitation.

Breather System

Breather air from the engine bearing compartments and from the accessory gearbox is vented overboard through an impeller-type centrifugal breather installed in the accessory gearbox. The bearing compartments are connected to the accessory gearbox by cored passages and existing scavenge oil return lines.
Under inverted flight conditions venting of the oil tank to the intermediate casing is provided by two breather pipes bolted internally to the intermediate case assembly.
The oil system is fully aerobatic. (For Aerobatic Maneuvers refer to Section V, Operating Limitations).

Engine Oil Indication

The pressure of engine oil is monitored by the pilots through OIL PRESS gauges on instrument panel and caution lights on the caution panel. The caution lights come on when the oil pressure is less than 35 + 2/-0 psi.
The temperature of the engine oil is monitored by the pilots through the OIL TEMP caution lights, on the caution panel, which come on when the oil temperature exceeds 120 ± 3 ° C.

ENGINE FUEL CONTROL SYSTEM

The basic fuel system (See figure 1-4) consists mainly of an engine driven sandwich-mounted pump, a fuel control system, a flowmeter, an oil cooler (see engine oil system), a flow divider with dump valve, a primary and secondary manifold (with 12 dual orifice fuel nozzles) and automatic fuel shut-off valve.
The pump delivers fuel at adequate pressure to the engine, and provides through the HMU, the motive flow for the operation of the main jet pump of the fuselage fuel tank.
The fuel control system consists mainly of two units: the Electronic Control Unit (ECU) and the Hydro-mechanical Metering Unit (HMU).
The ECU is the system electronic device that processes several parameters such as power lever angle position (PLA), through a potentiometer installed on the HMU, ambient temperature (To), ambient pressure (Po), compressor discharge pressure (Pc), NL and NH RPM and sends an output signal to drive the torque motor of the HMU for scheduling engine fuel flow at all altitudes.
The HMU is the mechanical device of the fuel control system that provides metered fuel flow to the engine and motive flow to the Main Jet Pump. In normal operation, the HMU is fully responsible for fuel flow only during engine start-up. Once started, the ECU assumes control of engine operation, as speed gover-

ENGINE FUEL SYSTEM SCHEMATIC

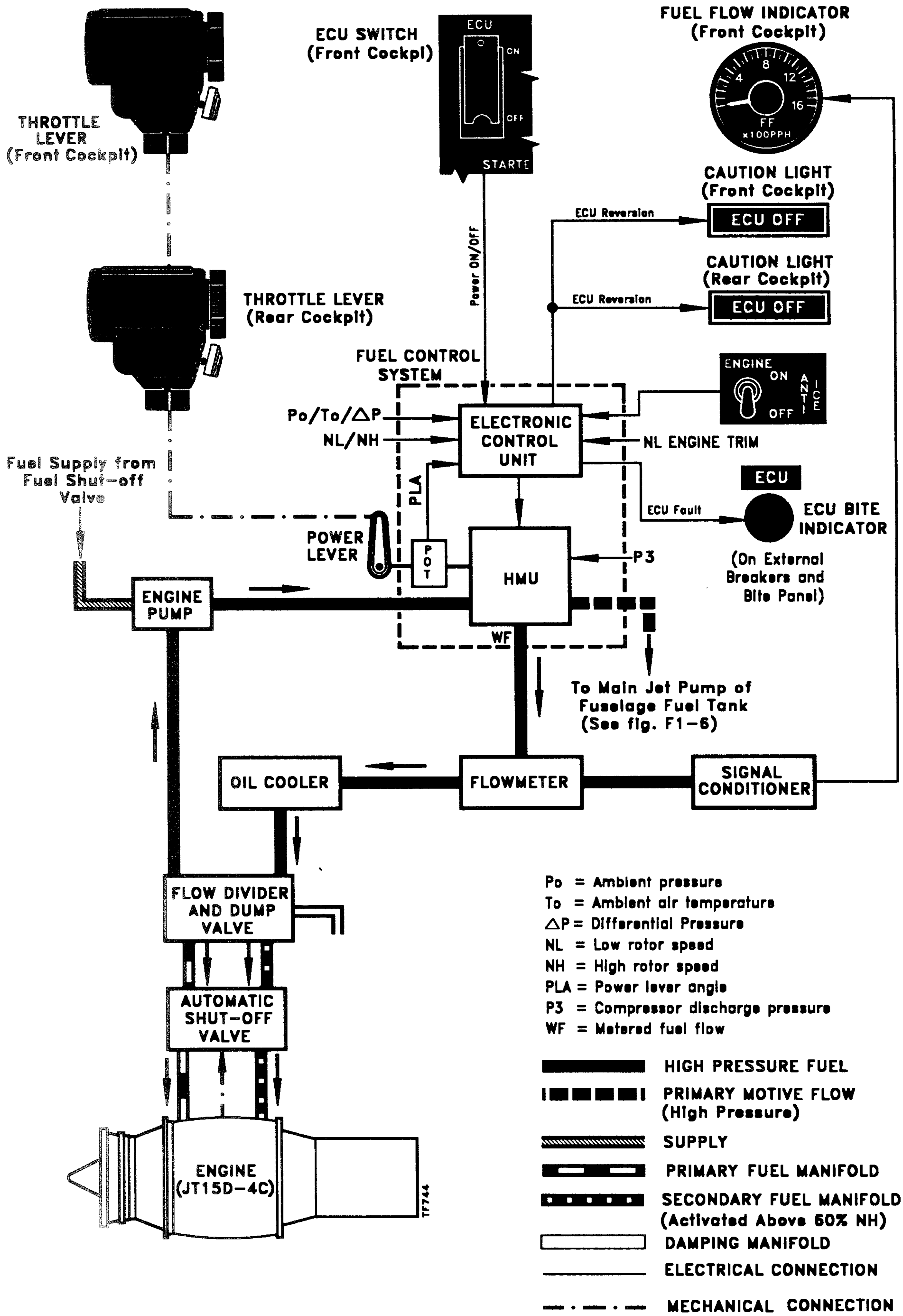


Figure 1-4.

ning, engine limiting, acceleration and deceleration. During operation with ECU OFF, it delivers metered fuel to the engine in function of the PLA and Pc. In this case engine acceleration is lower and engine parameters have to be monitored by the pilot.
The flowmeter, installed between the HMU and the oil cooler, provides through a signal conditioner, indication of the scheduled fuel flow on the fuel flow indicator of the front instrument panel.
The flow divider and dump valve is provided to divide the metered fuel flow, supplied by the HMU, between primary and secondary fuel manifold; the secondary fuel flow is activated above 60% NH. It also provides a minimum back pressure to the HMU to maintain servo pressure during low engine speed, and minimum fill volume to enhance quick starting, and dumps the engine fuel manifold on shutdown.
A drain hole, in the low turbine stator support, and two outlet bosses connected to the single drain valve on the by-pass duct , on the gas generator case, ensure drainage of residual fuel from gas generator case and exhaust areas after engine shutdown or an aborted wet start.

ENGINE CONTROLS AND INSTRUMENTS

For engine controls and instruments description and operation see figure 1-5.

IGNITION SYSTEM

Ignition is provided through two spark igniters, for normal starting on the ground and relighting in flight. During ground starting or relighting in flight, the 28 Vdc current is converted, by an Exciter Box, into high voltage current and is fed to the spark igniters.
During relighting in flight the ignition system is energized by pressing the relight push-button switch mounted on the engine throttle lever grip in either pilot's station. The IGNITION switch, when set to CONT position, provides continuous operation of spark igniters.
Priority between ignition controls is as follows:

FRONT	REAR	RELIGHT	RESULT
OFF	AUTO/CONT	-	OFF
AUTO/CONT	OFF	-	OFF
AUTO	CONT	-	CONT
CONT	AUTO	-	CONT
AUTO	AUTO	-	AUTO
OFF	OFF	PRESS	RELIGHT

ENGINE ANTI-ICING

Anti-icing is provided for inlet cone, low pressure compressor inner stator, T1 thermocouple probe and ECU inlet temperature and pressure probe.
The inlet cone is heated by compressor discharge air which is routed internally along the front low compressor shaft. Warm air,discharged from the high pressure compressor, is routed through an external tube to the T1 inlet thermocouple housing in the low pressure compressor case.
The low pressure compressor inner stator is heated by pressurized hot air, ducted externally from the gas generator case through a tube assembly and solenoid shut-off valve.
The ECU inlet temperature and pressure probe is electrically heated through a resistor incorporated in the probe and controlled by the ENGINE anti-ice switch.
The low pressure inner stator and ECU inlet temperature and pressure probe anti-icing are controlled by the ENGINE anti-ice switch installed on the ANTI-ICE panel on the right console of the front cockpit.
Electrical power for the operation of the engine anti-icing circuits is supplied by the ESS BUS via ENG A/ICE circuit breaker installed on the Circuit Breaker Panel of the right console of the front cockpit.

STARTING SYSTEM

The engine is started by means of a starter-generator which acts as a starter until the engine NH speed reaches about 40% rpm. When this value of rpm is attained, the starter-generator is automatically disconnected from the power source and, with the increase of rpm, it acts as a generator, provided the generator control switch is set to ON position and the GPU has been disconnected or battery switched ON. The generator voltage output depends on engine speed and connected loads.
The starter-generator can be energized either from the aircraft battery or from the external power source. Starting shall normally be performed on internal battery. However, starting on external power supply is recommended for maintenance activities.
When starting is carried out using an external power source, the starter and all the electrical loads are directly energized from the external power source.

POWER CONTROL

Engine power is controlled by the pilot(s) through a throttle lever on each cockpit. (See Fig. 1-2, Sheet 2). Along its travel from STOP, IDLE to MAX position, the throttle operates three switches installed on the HMU.
The first microswitch prevents the igniter operation when the HMU lever is below IDLE.
The second microswitch warns the pilot in flight whenever the throttle is at low power setting and the landing gear is up.
The third microswitch cuts off the engine bleed air when the engine RPM is over 80% NL with aircraft on the ground.
A friction knob is provided on the front control lever quadrant to adjust the throttle friction.

ENGINE INSTRUMENTS

The engine indicating system consists of engine

ENGINE CONTROLS - FRONT COCKPIT

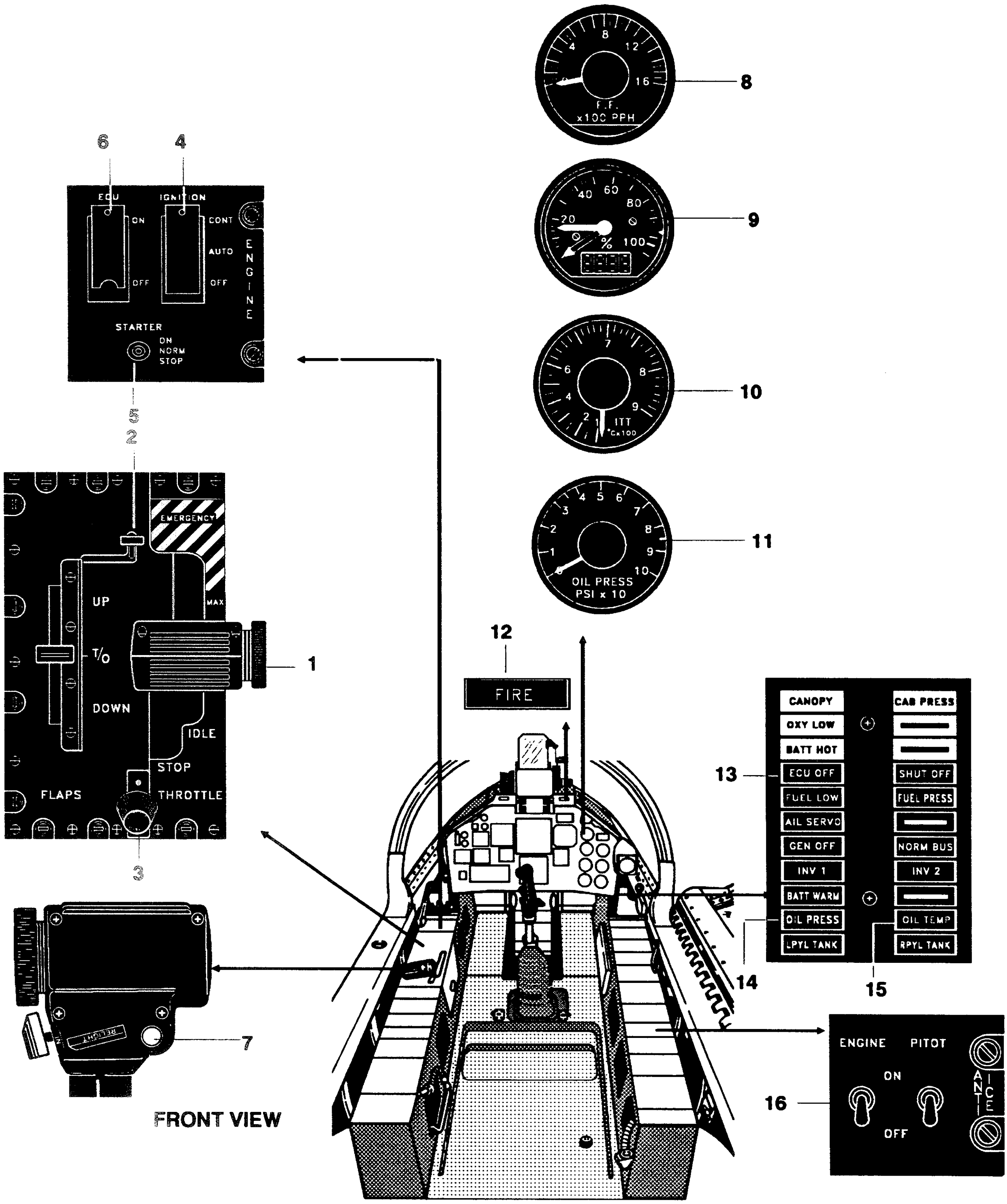


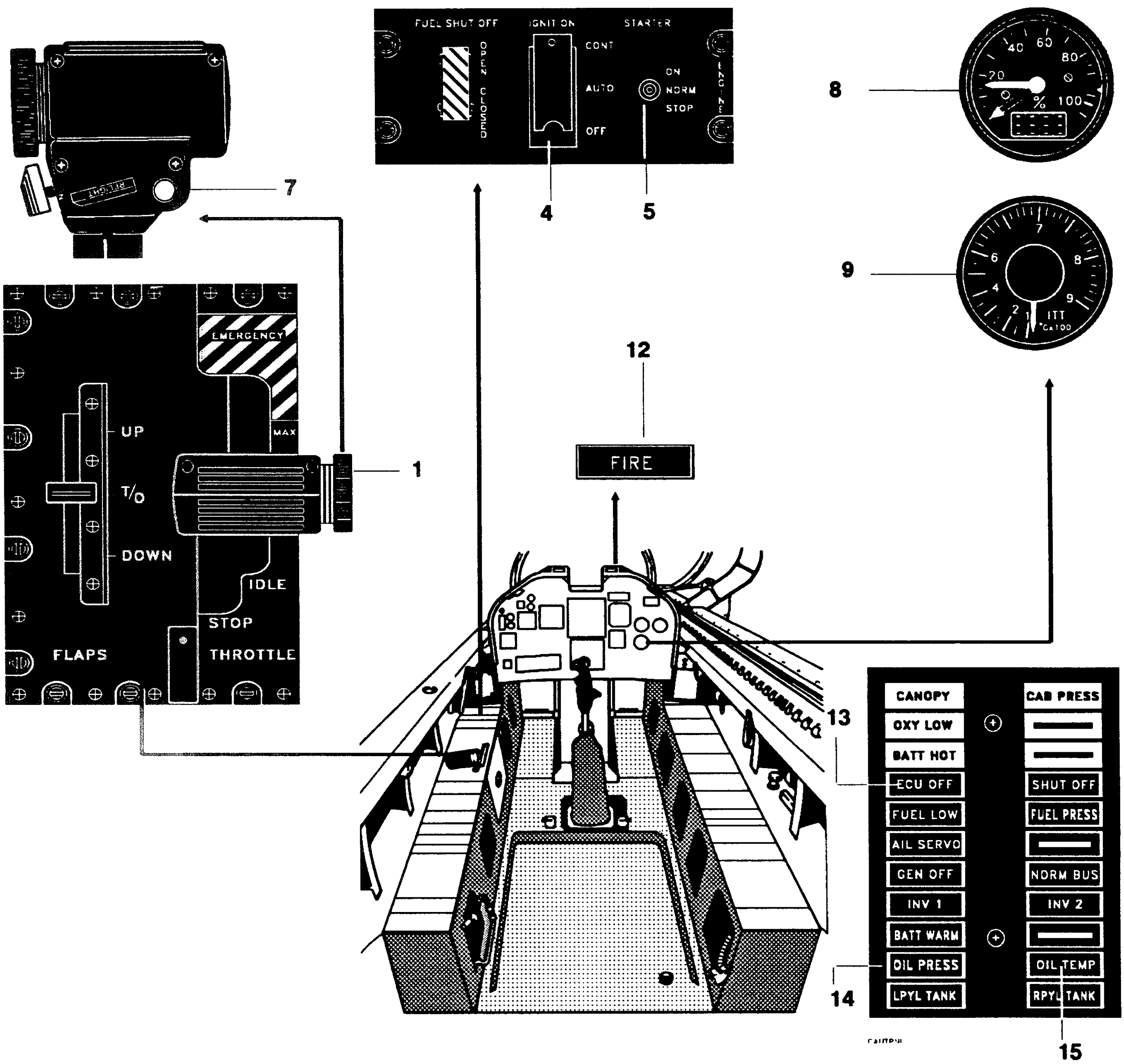
Figure 1-5. (Sheet 1 of 3)

ENGINE CONTROLS

DESCRIPTION			FUNCTION
1.	Engine Throttle (s) lever	STOP	Fuel flow to the engine is cut-out by the hmu.
		IDLE	The engine operates at IDLE RPM.
		MAX	The engine operates at MAX RPM.
2.	Extra -stroke ctrl lever (front throttle only)(safety-wired)	Safetied	Limits the Engine Throttle lever stroke up the the MAX position.
		Pulled	Disengages the Throttle lever limit stop. The Throttle lever (1) can be set in the EMERGENCY position.
3.	Pawl (Throttle lever) friction adjustment (front only)	-	Permis to adjust the friction of the engine throttle lever.
4.	IGNITION switch	OFF	De-energized position.
		AUTO	Selects the iautomatic starting sequence mode.
		CONT	Provides continous operation of the spark igniters.
5.	STARTER switch	ON	Initiates the engine starting cycle.
	(Spring loaded to NORM)	NORM	Allows the starter to perform the previously initiated operation.
		STOP	Stops the starting sequence.
6.	ECU switch	ON	Engine fuel flow is scheduled by the ECU.
		OFF	The engine fuel flow is scheduled only by the HMU.
7.	Relight push-button	Pressed	Operates the ignition circuit to allow engine relighting in flight, for any throtttle position.
8.	FF indicator	-	Indicates the fuel flow to the engine in PPH.
9.	NH/NL Indicator	NH	Indicates the high rotor speed in percentage of nominal rpm value.
		NL	Indicates the low rotor speed in percentage of nominal rpm value.
10.	ITT Indicator	-	Provides an indications of the engine intertubine (T5) operating temperature in degrees Celsius.
11.	OIL PRESS indicator	-	Indicates the oil pressure (psi) at the pump outlet.
12.	FIRE warning light (push-to-test)	On	Indicates fire or overheat condition in the engine compartment.
		Pressed (Either front or rear)	Self test of fire warning sensor of warning light.
13.	ECU OFF caution light	On	Indicates that the ECU is disconnected (ECU switch OFF) or ECU fault.
14.	OIL PRESS caution light	On	Indicates that the pressure at the engine oil pump outlet is below the minimum permitted value.(35 + 2/- 0 psi)
15.	OIL TEMP caution light	On	Indicates that the oil temperature exceeds the maximum temperature value (120 ± 3°C).
16.	ENGINE ANTI-ICE switch	OFF	De-energized position.
		ON	Operates the solenoid shut -off valve providing bleed air anti-icing to fan stator vanes and energizes the heating element of ECU inlet temperature and pressure probe.
17.	ECU BITE indicator	White	Indicates a momentary or permanent ECU fault.
		Black	Normal operating condition.
18.	BITE reset push button sw	Pressed	White ECU bite indication goes out only if ECU BITE change-over has been caused by an ECU momentary fault.

Figure 1-5. (Sheet 2)

ENGINE CONTROLS - FRONT COCKPIT



EXTERNAL BREAKERS AND BITE PANEL

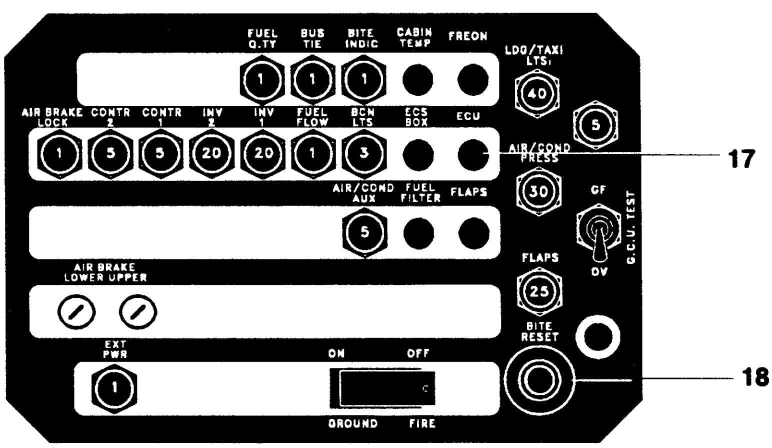


Figure 1-5. (Sheet 3)

exhaust temperature, engine speed, engine oil pressure gages and fuel flow gages.
The engine temperature indicating system consists of an integrated ITT sensing system connected to the ITT indicators mounted on the front and rear instruments panel. ITT is not measured directly, but is computed from the exhaust temperature T6 as the temperature increase in by-pass duct.
The engine speed indicating system consists of two speed sensors (magnetic pick-up), installed within the engine which provide NL and NH RPM information to NL/NH Indicators mounted on the front and rear instrument panel.

ENGINE FIRE OR OVERHEAT WARNING SYSTEM

A fire and overheat detector circuit is provided to detect and indicate fire or overheat in the engine compartment.
The system consists of a tube detector unit, fitted all around the engine bay, capable to sense the pressure increase in the tube due to a fire/overheat condition within the engine compartment. Should this occurs, it will cause the FIRE warning lights, mounted on the top of the front and rear instrument panels, to come on to warn the pilots of the engine fire condition.
The indication system can be tested by pushing either of two FIRE warning lights (push-to-test function) in each cockpit.
The system is powered by the battery bus bar via the FIRE circuit breaker and is operative independently from the BATT switch position.

ENGINE OPERATION

Ground Starting

Ground starting may be carried out from both front and rear cockpit.
With fuel control switches (FUEL SHUT-OFF and AUX PUMP) activated, the electrically operated auxiliary fuel pump supplies fuel to engine driven pump and fuel pressure caution light goes out. When the starter switch is momentary set to ON, the starter drives the engine into rotation and consequently the engine driven pump delivers fuel to the hydro-mechanical metering unit (HMU).
When NH reaches 10% RPM, moving the engine throttle to IDLE, fuel is supplied to the combustion chamber and igniters are energized lighting up the engine.
At about 40 % NH RPM the automatic starting cycle is completed, the starter is automatically disconnected by the GCU and the starter/generator operates as a generator whenever the generator switch is set to ON.
At IDLE, the engine stabilizes at 49% NH RPM under ISA conditions.

Normal Operation

With the ECU switch set to ON, engine operation is controlled by the electronic control unit which regulates, through the HMU, the fuel flow during steady state and transient operation within prescribed engine limitations. The ECU senses power lever angle, engine RPM (NL and NH), compressor discharge pressure, ambient air temperature and pressure to maintain scheduled engine speed for a specific power control setting at all altitudes.

ECU OFF Operation

In case the ECU senses a faulty input, indicated by the ECU OFF caution light ON and by a reduction in engine thrust, the fuel management authority is assured by the HMU. This will result in a reduction of the maximum power depending on the flight conditions and the engine response to throttle movements will become slower.
Reduction in maximum power may be regained positioning the THROTTLE lever in the EMERGENCY sector. In this condition engine parameters such as engine speed and ITT must be monitored by the pilots.
However, if the faulty input has been caused by a momentary fault, the ECU can be resumed to normal operation by pressing the MASTER CAUTION light.
For detail information on engine operation with ECU OFF refer to Section III, "EMERGENCY PROCEDURES"

Flight Relighting

With the engine throttle lever in IDLE position, the engine may be relighted in flight by pressing the RELIGHT push-button switch on the engine throttle lever whenever engine windmilling is above 10% NH RPM. The RELIGHT push-button switch acts on the ignition system, by-passing the IGNITION switches, on the ENGINE start and control panels.
The AUX PUMP and the FUEL SHUT-OFF switches must be in ON position. The RELIGHT push-button must be held pressed until an increase in temperature and rpm indicates that the engine has been relighted.

NOTE

Below 10% NH, the engine can be relighted only by accomplishing the ground starting procedure.

For detailed information on "In Flight Relighting" refer to Section III.

AIRCRAFT FUEL SYSTEM

The aircraft fuel system (see figure 1-6) consists of the following subsystems:
- Fuel storage and venting
- Fuel Supply and Automatic Fuel Transfer
- Fuel Quantity Indication and Warning
- Auxiliary Fuel [ACFT A].

AIRCRAFT FUEL SYSTEM SCHEMATIC

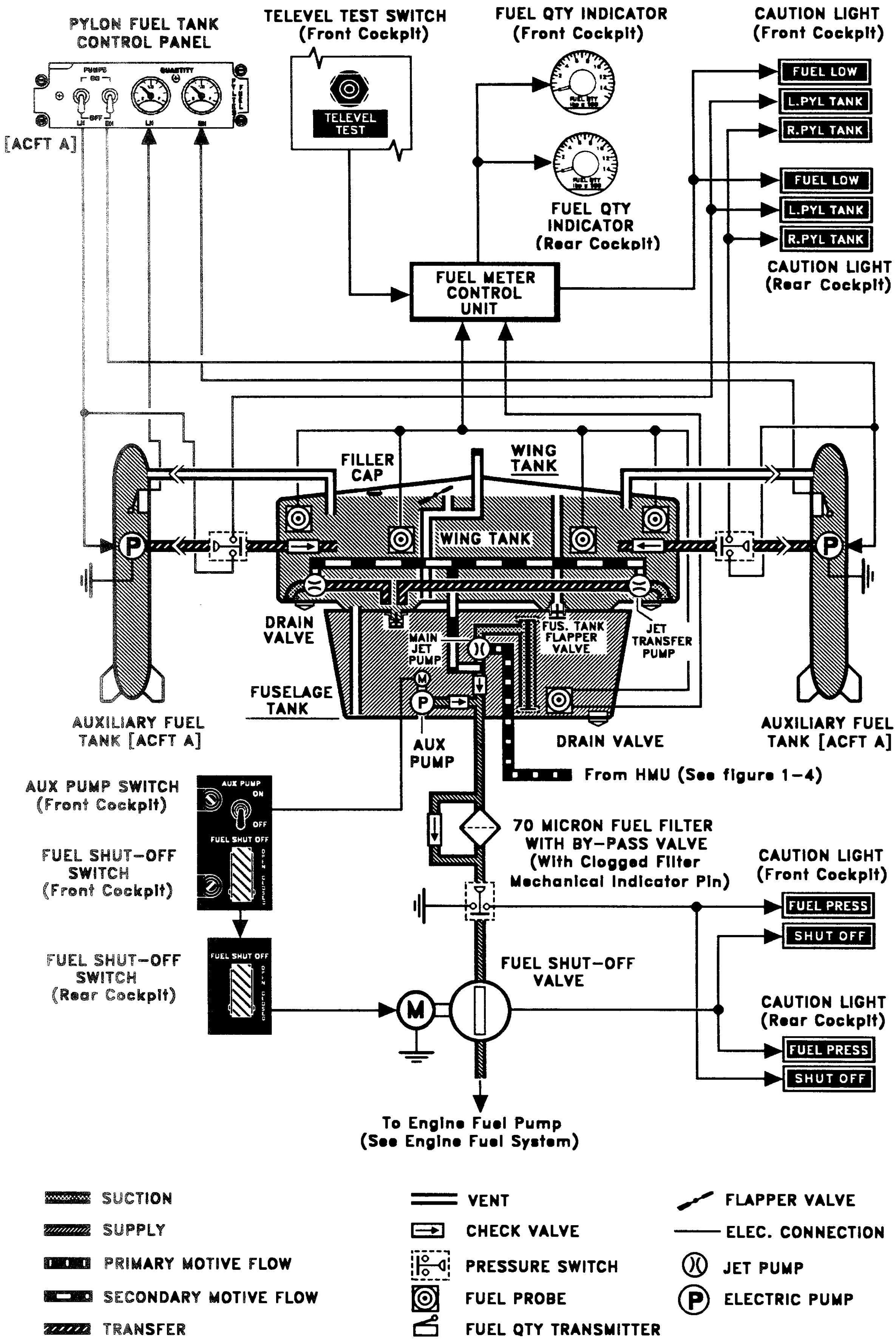


Figure 1-6.

FUEL STORAGE AND VENTING

The fuel storage system consists of an integral wing tank and a bladder cell type fuselage tank.
The two tanks are mechanically connected to allow ground refueling of the fuselage tank via the wing tank.
Fuel refilling is accomplished through a single fuel filler neck on the upper side of the left wing. The fuel filler neck is designed to determine the maximum fuel filling level and consequently to allow sufficient volume for fuel expansion.
Fuel draining of wing and fuselage tank is accomplished through flush-mounted drain valves installed in the lower side of each tank.
A vent system connects the wing and fuselage tank to the atmosphere to allow correct fuel system operation in all flight attitudes.
Tanks to atmosphere connection is obtained by means of two vent tubes in the fuselage and wing tank. The vent tube in the wing tank extends up to the vertical fin.
For wing and fuselage tank capacities see figure 1-7.

FUEL SUPPLY AND AUTOMATIC FUEL TRANSFER

The fuel supply system consists mainly of an Auxiliary Fuel Pump, Main Jet Pump, Fuel Filter and Fuel Shut-off Valve.
The fuel contained in the fuselage fuel tank is supplied to the engine by means of the Main Jet Pump, powered by the motive flow fuel which is supplied by the engine pump through the HMU. The main jet pump is connected to a double ended suction tube which allows up to 30 seconds of inverted flight at max thrust.
The Auxiliary Fuel Pump, mounted in the fuselage fuel tank, maintains positive pressure in the fuel line upstream the engine pump during engine starting and when required in flight.
Electrical controls for the auxiliary fuel pump are provided in the front cockpit only.
The 28 vdc power is supplied by the Essential Bus via the AUX PUMP circuit breaker.
A 70 micron fuel filter, provided with a by-pass valve and a clogged filter mechanical indicator pin, is installed on the supply line up-stream of the fuel shut-off valve.
A Fuel Shut-off Valve is installed on the supply line and is electrically controlled from the front and rear cockpit by two Fuel Shut-off Valve switches safetied in the OPEN position.
Electrical power for the operation of the fuel shut-off valve is provided by the 28 vdc Essential Bus via FUEL S/O circuit breaker on the left console of front cockpit.
A secondary motive flow line, taken downstream of the main jet pump is provided to transfer fuel from wing to fuselage tank.
A fuselage tank flapper valve prevents fuel transfer from fuselage to wing tank during inverted flight.

Operation

During starting, the auxiliary fuel pump maintains a positive fuel pressure to the engine driven pump, which in turn feeds the HMU. From the HMU, a high pressure motive flow line delivers high pressure fuel to main jet pump in the fuselage fuel tank. High pressure fuel flowing through the main jet pump provides the fuel suction and, when fuel pressure downstream of the jet pump overcomes the fuel pressure of the auxiliary pump, closes the fuel circuit between main jet pump and HMU and self-maintains the fuel supply to the engine.
The secondary motive flow, downstream of the main jet pump, operates the two wing fuel jet transfer pumps and ensures continuous automatic fuel transfer from wing to fuselage tank.

FUEL QUANTITY INDICATING AND WARNING SYSTEM

The fuel indicating system (See figure 1-6) consists mainly of the fuel quantity indicating, fuel warning and fuel low level warning circuits.
•The fuel quantity indicating circuit consists of Fuel Probes, four in the wing tank and one in the fuselage tank, an Electronic Fuel Control Unit (EFCU) on the upper side of fuselage central section and Fuel Quantity Indicators on front and rear instrument panel.
The electronic fuel control unit processes fuel level information, obtained through the fuel probes, and sends an electrical signal proportional to the total amount of fuel on board, to fuel quantity indicators.
For system accuracy refer to figure 1-7.
The fuel quantity indicating system has a manually initiated built-in test circuit and an automatic self-monitoring circuit.
The manually initiated built-in test circuit allows the pilot to control the fuel probes and fuel quantity indicators for correct operation. (Refer to figure 1-8).
During test and in case of fuel probe failure, the index of the fuel quantity indicators will stop for about five seconds to indicate the faulty fuel probe. The correspondance between the indication shown on the fuel quantity indicators and the fuel probe at fault is the following :

compensation	2
left inboard	4
left outboard	6
right inboard	8
right outboard	10
fuselage	12

After system testing, the index of the fuel quantity indicators will move to display the total amount of fuel on board.
The automatic self-monitoring circuit starts to operate as soon as the system is turned on and provides a routine check of the microprocessor card main programs of the EFCU. Should a mulfunction occur in the circuit, the index of the fuel quantity indicators will be parked 15° below the zero fuel indication.
•The fuel warning circuit consists of two FUEL PRESS and fuel SHUT-OFF caution lights on front and rear

FUEL TANK LOCATION AND CAPACITIES

NATO F-40 / JP4	Based on common delivery density of 0.77 Kg/l. (The density may range from 0.75 to 0.80 Kg/l)				
TANKS	CAPACITIES				
	Litres	U.S. Gals	Imp. Gals	Kg	Lb
WING	668	177	147	514	1133
FUSELAGE	132	35	29	101	222
TOTAL	800	212	176	616	1358
PYLON TANKS (2)	530	140	116	408	900
TOTAL	1330	352	292	1024	2257

NATO F-35 / JET A-1	Based on common delivery density of 0.81 Kg/l. (The density may range from 0.77 to 0.84 Kg/l)				
TANKS	CAPACITIES				
	Litres	U.S. Gals	Imp. Gals	Kg	Lb
WING	668	177	147	541	1192
FUSELAGE	132	35	29	107	236
TOTAL	800	212	176	648	1428
PYLON TANKS (2)	530	140	116	429	946
TOTAL	1330	352	292	1077	2374

NOTE

During level flight and during climb and descent with pitch attitudes within ± 6° the system accuracy is better than ± 3% of the fuel quantity reading.

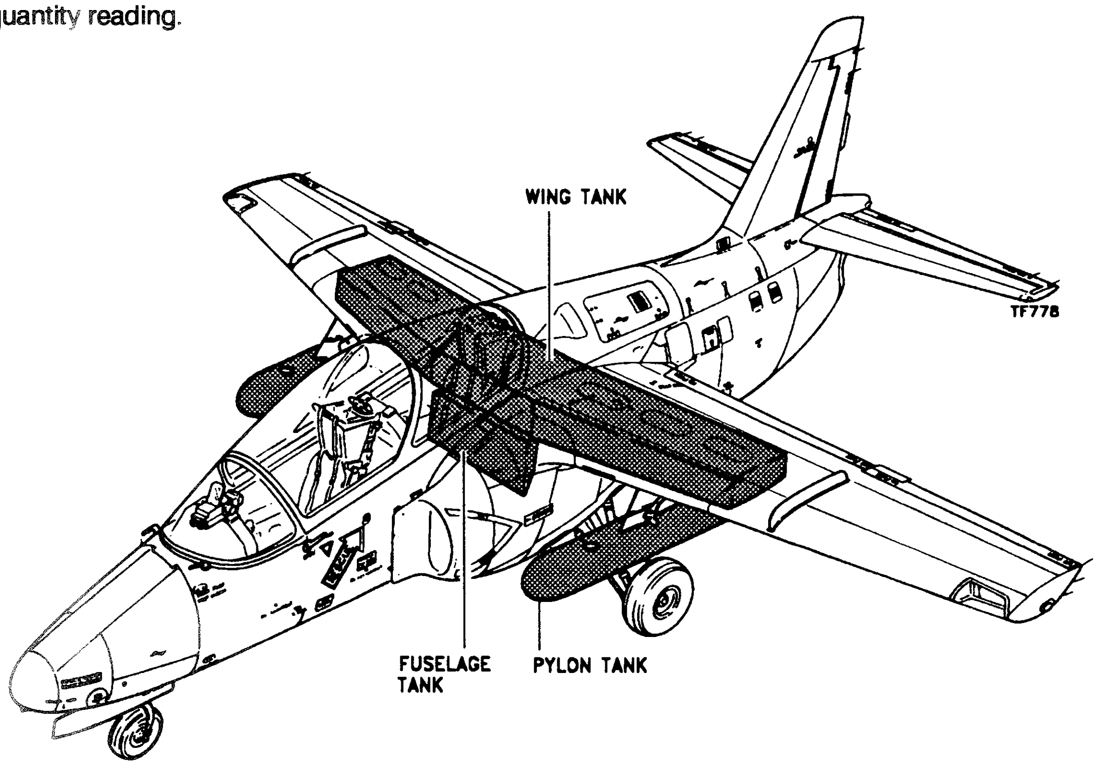


Figure 1-7.

FUEL SYSTEM CONTROLS

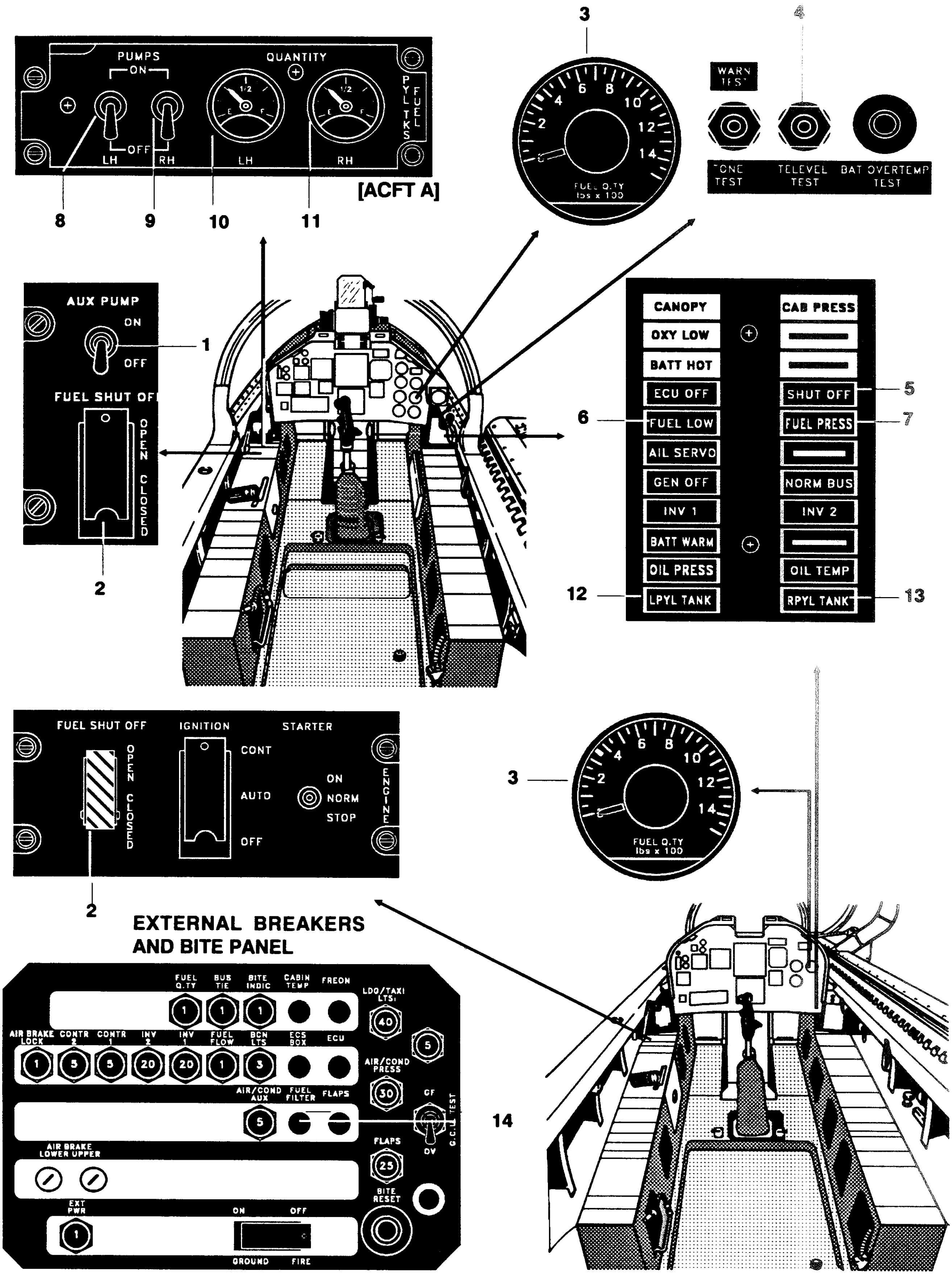


Figure 1-8. (Sheet 1 of 2)

FUEL SYSTEM CONTROLS

DESCRIPTION		FUNCTION
1. AUX PUMP sw (front only)	ON	Fuel is supplied to the engine pump by the auxiliary pump.
	OFF	Fuel is supplied to the engine pump by the main ejector pump, if the engine is operating.
2. FUEL SHUT-OFF (Safety Guard switch)	OPEN	The valve is open, thus allowing fuel to the HMU thru the engine pump.
	CLOSED	The valve is closed.
3. Fuel Quantity indicators	-	Indicate the total fuel on board in lbs.
4. TELEVEL TEST switch (front cockpit only)	Pressed	Initiates the self test of the fuel indicating system: the index of fuel quantity indicator moves to zero and then toward full scale passing through the last test point (at 1,200 lbs) within about 10 seconds.
5. SHUT-OFF caution light	On	Indicates that the fuel shut-off valve is closed.
6. FUEL LOW caution light	On	Indicates that the fuel quantity in the fuselage tank is below 170± 15 lbs (JP4) or 180 ± 15 lbs (JET A1).
7. FUEL PRESS caution light	On	Indicates that the fuel press to the engine pump inlet is below the minimum required for normal engine operation. It will lit below 3.5 ± 0.5 psi and will go out above 5 ±1 psi.
8. LH PYL FUEL TKS PUMPS switch	ON	The electric pump in the LH pylon tank transfers fuel from the pylon tank to wing tank.
	OFF	The electric pump in the LH pylon tank is de-energized.
9. RH PYL FUEL TKS PUMPS switch	ON	The electric pump in the RH pylon tank transfers fuel from the pylon tank to wing tank.
	OFF	The electric pump in the RH pylon tank is de-energized
10. LH PYL FUEL TKS QUANTITY indicator	-	Indicates the fuel quantity contained in the LH pylon tank.
11. RH PYL FUEL TKS QUANTITY indicator	-	Indicates the fuel quantity contained in the RH pylon tank.
12. L PYL TANK caution light	On	Low fuel level in the LH pylon tank.
13. R PYL TANK caution light	On	Low fuel level in the RH pylon tank.
14. FUEL FILTER bite indicator	White	Not in use
	Black	Not in use.

Figure 1-8. (Sheet 2)

caution panels, operated respectively by a pressure switch on the fuel supply line and by the fuel shut-off valve motor.
The pressure switch causes the FUEL PRESS caution lights to come on when the fuel supply pressure up-stream the fuel shut-off valve drops below 3.5 psi. The fuel SHUT-OFF caution lights come on when either front or rear FUEL SHUT-OFF switch is set to CLOSED.

• A fuel low level warning circuit is provided to warn the pilot when a fuel low level condition occurs in the fuselage fuel tank.
The system consists of an optoelectronic device on the fuselage fuel probe and FUEL LOW level caution lights on front and rear caution panel. The optoelectronic device causes, via EFCU, the FUEL LOW level caution lights to come on when the fuel quantity in the fuselage fuel tank drops below 170 ± 15 lbs for JP4 type fuel or 180 ± 15 lbs for JET A1 type fuel.

AUXILIARY FUEL SYSTEM [ACFT A]

The inboard wing pylons have provision for the installation of auxiliary fuel tanks (See figure 1-7).
Each tank contains a submerged fuel pump and a fuel quantity transmitter.
The fuel pump supplies fuel to the wing fuel tank, through a fuel transfer line installed within the pylon.
Fuel quantity is transmitted, through float type fuel quantity transmitter, to the LH and RH QUANTITY indicator on the PYL TKS FUEL control panel in the front cockpit.
A pressure switch, on the left and right fuel transfer line, causes the L PYL TANK and R PYL TANK caution lights to come on when there is no pressure in the transfer line.
The pump is controlled by the LH or RH PUMPS switch on the PYL TKS FUEL control panel, on the front console only, and is energized with 28 VDC normal bus via the relevant PYL TANK LH or RH circuit breaker.

FUEL SYSTEM CONTROLS

The fuel system controls and indicators are described and illustrated in figure 1-8.

ELECTRICAL SYSTEM

The aircraft electrical system consists mainly of the DC and AC power generation and distribution systems.

DC POWER GENERATION SYSTEM

The DC power generating system (see figure 1-9) consists of a Nickel-Cadmium battery (24 V, 27 Ah) and a 28V, 300A starter-generator operating as a generator at NH engine speed above 40 %RPM.

On the ground, the aircraft electrical system may be powered by the battery or by an external power source (28VDC, 1200 A maximum for engine starting) through an external power receptacle provided on the left fuselage side.
During engine start and in the generator operating mode the starter-generator is controlled by the GCU (Generator Control Unit).
The battery internal temperature is controlled by two thermostats which cause the BATT WARM caution light and BATT HOT warning light to come on when battery temperature reaches respectively 55°C and 65°C. When the BATT WARM caution light comes on the following conditions may occur :

• Battery is disconnected from essential bus bar if generator is on.
• Battery is connected to essential bus bar if generator is off.

When the BATT HOT caution light comes on the battery must be disconnected.
Two voltammeters, on the front and rear instrument panel, show the ESS BUS voltage (V) and current loading of the generator (A) to the aircraft electrical systems.

DC POWER DISTRIBUTION

The DC power given by the battery, or by the generator, or by an external power source is supplied to the aircraft ESSENTIAL BUSES. (External, front and rear cockpit).
A N/BUS switch, on the Electrical System Panel in the front cockpit, allows to supply 28 vdc to the external, front and rear cockpit NORMAL BUSES.
A NORM BUS caution light, on both front and rear caution panel, comes on when the normal buses are not supplied with power.
A BATTERY BUS, on both front and rear cockpit, supplies 28 vdc to the spot lights, external stores jettison emergency circuits and to the engine fire detection circuits, in case of a complete electrical system failure.

GENERATOR CONTROL UNIT DESCRIPTION

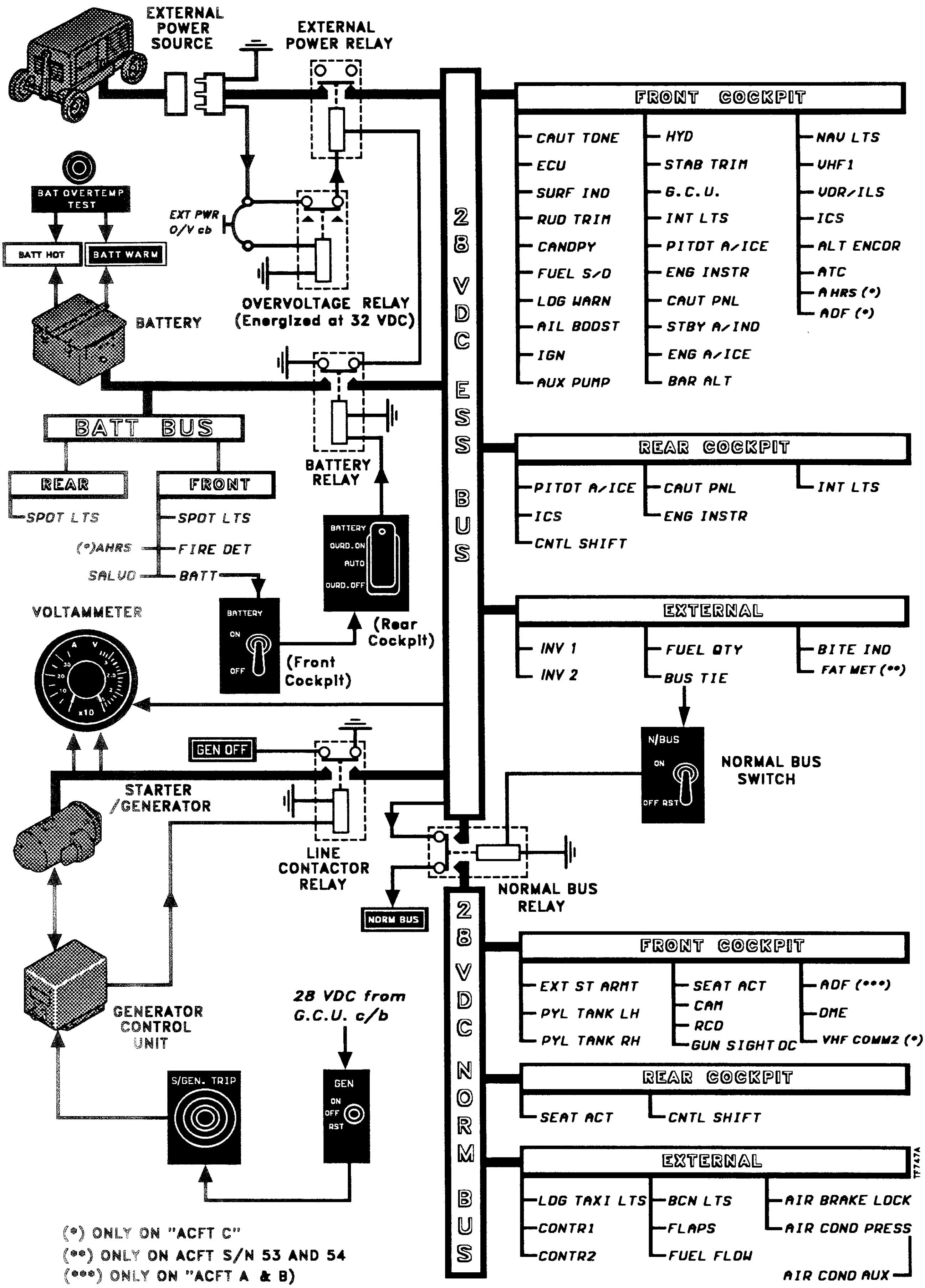
The generator control unit controls the operation of the generator and performs the following specific functions:

• Voltage regulator
• Starter field current-control (field weakening)
• Automatic starter cut-off control
• Overvoltage protection
• Ground fault protection
• Line contactor control
• Reverse current protection.

Description of GCU functions

• **Voltage Regulator:**
provides control of the generator voltage in varying system conditions: speed, load and temperature.

DC POWER GENERATION SYSTEM SCHEMATIC



(*) ONLY ON "ACFT C"
(**) ONLY ON ACFT S/N 53 AND 54
(***) ONLY ON "ACFT A & B)

Figure 1-9.

provides control of the shunt field current to maintain a positive level of acceleration torque to the engine throughout the entire start sequence.

- **Automatic starter cut-off control:**
  provides automatic termination of start cycle and converts generator operation provided the correct engine speed is reached and GEN switch is ON.

- **Overvoltage protection:**
  provides protection from excessive bus voltage. The circuit has an inverse time-voltage characteristic, i.e., the greater the voltage the shorter the time delay.

- **Ground fault protection:**
  provides protection against a feeder or generator fault to ground at any point within the protection zone: i.e., the neutral of the generator to the generator contactor.

- **Line contactor control:**
  provides automatic control of the generator contactor which connects the generator to the generator bus. Prevents closure of the contactor if a differential voltage (bus voltage greater than generator voltage) exists across the open main contacts.

- **Reverse current protection:**
  provides protection to the generator against reverse current.

AC POWER GENERATION AND DISTRIBUTION SYSTEM

The AC power system (see figure 1-10) consists mainly of two static inverters, powered by the 28 VDC ESS BUS through the INV 1 and INV 2 circuit breakers on the External Breakers and Bite Panel.
An AC POWER inverter selector switch, on the electrical system panel, (on front cockpit right console) allows to select inverter N.1 or N.2 outputs as required.
Each inverter supplies 26 and 115 VAC to the internal AC Buses, to operate the aircraft navigation systems requiring AC power.
INV 1 and INV 2 caution lights are provided on front and rear caution panel.
When the caution lights come on, it indicates that the relevant inverter is at fault independently from the AC PWR switch position.

ELECTRICAL CONTROLS

For electrical controls description see figure 1-11.

CIRCUIT BREAKERS

For circuit breakers description see fig. 1-12 and 1-13.

AC POWER GENERATION SYSTEM SCHEMATIC

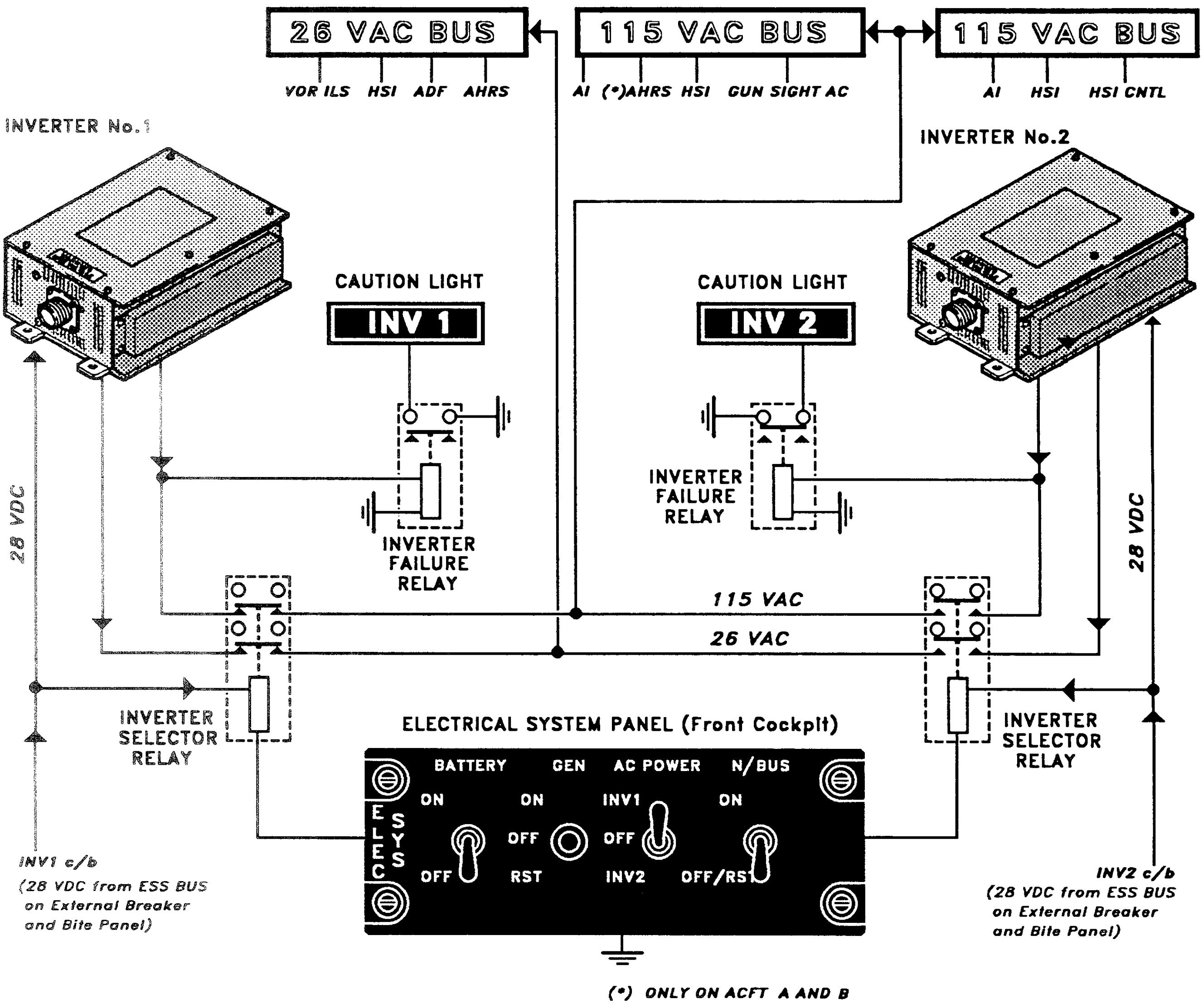


Figure 1-10.

ELECTRICAL SYSTEM CONTROLS

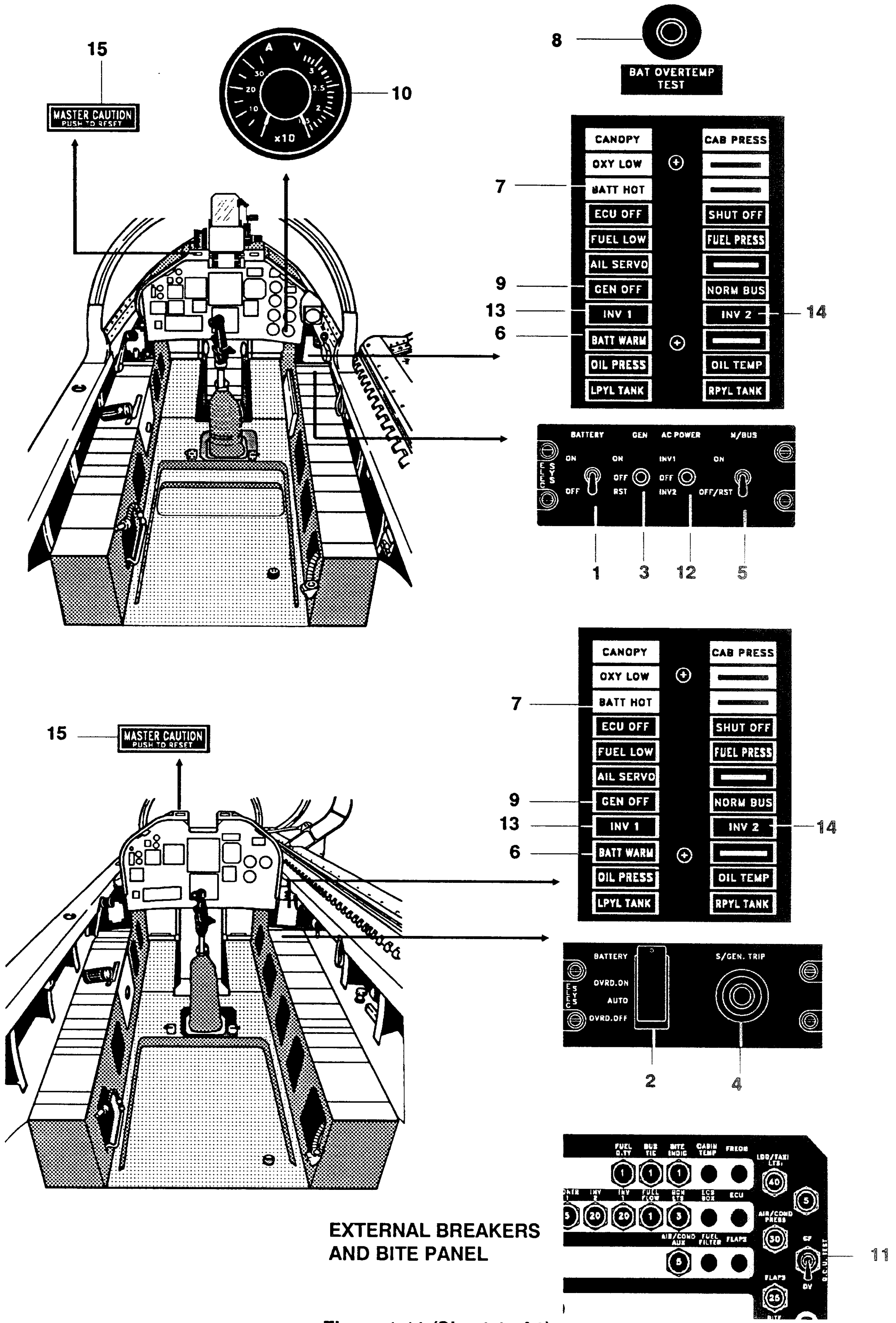


Figure 1-11.(Sheet 1 of 3)

ELECTRICAL SYSTEM CONTROLS

DESCRIPTION			FUNCTION
1.	BATTERY switch (front cockpit)	OFF	De-energized position.
		ON	Battery connected to the ESS BUS. **NOTE** On the ground with the BATTERY switch set to ON the external power circuit is cut-out.
2.	BATTERYswitch (Rear cockpit)	OVRD OFF	Disconnect the battery from the ESS BUS irrespective to the position of the front BATTERY switch (1).
		OVRD ON	Connect the battery to the ESS BUS by-passing the eventually OFF position of the front BATTERY switch (1).
		AUTO	Enables BATTERY switch (1) to connect the battery to the ESS BUS. **NOTE** The AUTO position must be selected in the solo flight configuration.
3.	GEN switch (Front cockpit)	OFF	De-energized position.
		ON	The generator supplies 28 VDC power to the ESS BUS when engine reaches the self sustained speed.
		RST	Reset all fault monitoring circuits of the Generator Control Unit. Used to allow GEN selection after transient tripping of one of monitoring circuits.
4.	S/GEN TRIP (Rear cockpit)	Pressed	Disconnect the generator from the ESS BUS (when engine speed is above 40% NH) or de-activates the starter below 40 % NH.
5.	N/BUS switch (Front cockpit)	OFF/RST	De-energized position.
		ON	NORMAL BUS is connected and powered by the ESSENTIAL BUS. **NOTE** If a short or an overload occurs the NORM BUS is automatically disconnected from the ESS BUS. (N/BUS caution lights ON).
6.	BATT WARM caution light	On	Indicates that the battery internal temperature has reached 55°C and that the battery has been automatically disconnected from the ESS BUS (provided the generator is connected to ESS BUS).
7.	BATT HOT warning light	On	Indicates that the battery internal temperature has reached 65°C and the battery may still be connected to the ESS BUS. **WARNING** When BATT HOT warning light comes on, the BATTERY switch must be set to OFF.

Figure 1-11. (Sheet 2)

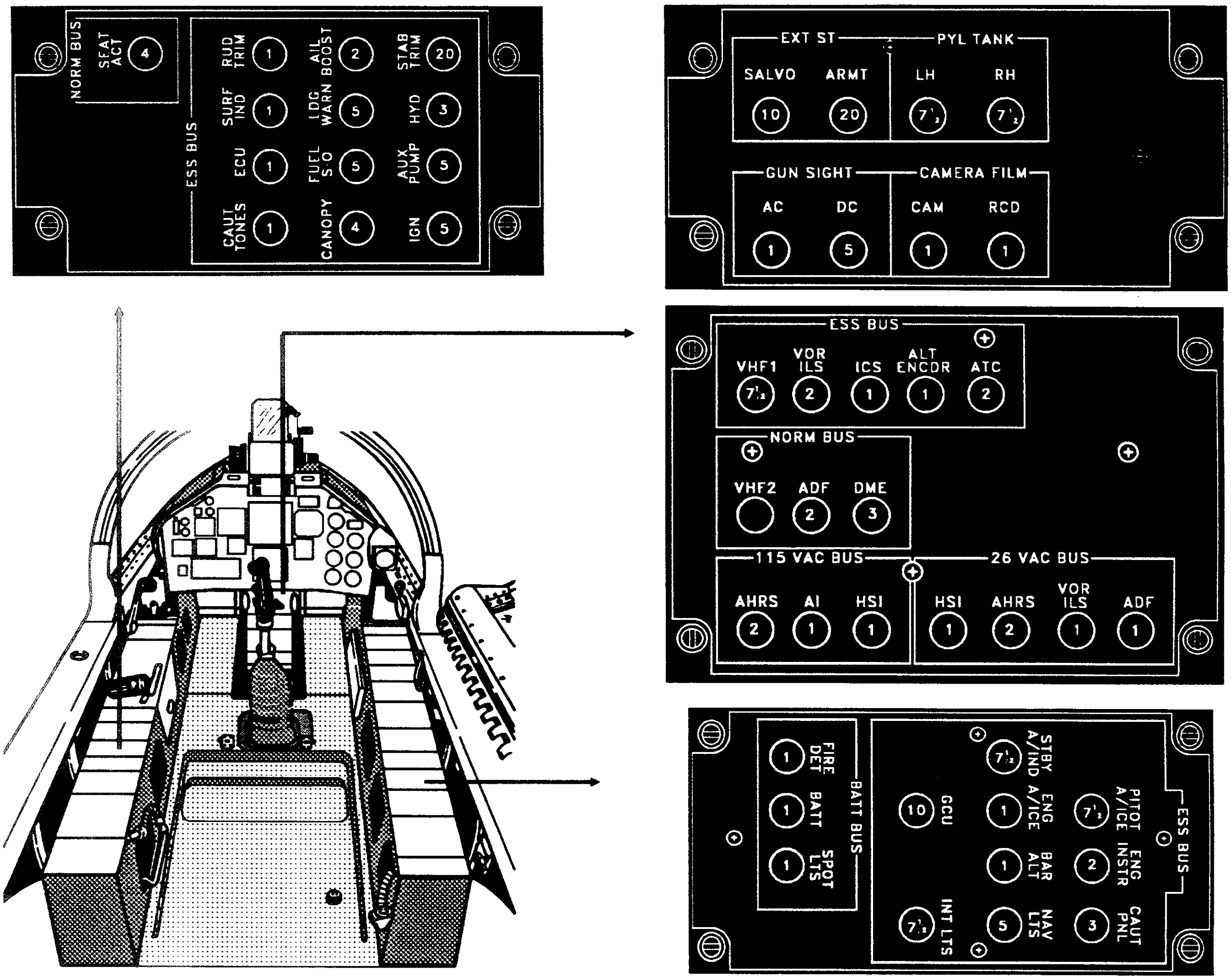
ELECTRICAL SYSTEM CONTROLS

DESCRIPTION			FUNCTION
8.	BATT OVER TEMP TEST switch (front cockpit only)	Pushed	Causes the BATT WARM caution and BATT HOT warning lights to come on for testing purpose.
9.	GEN OFF caution light	On	Indicates that the generator is at fault or disconnected.
10.	Voltammeter	Voltmeter	Indicates the voltage present at the essential bus.
		Ammeter	Indicates the current supplied by the generator.
11.	G.C.U. TEST switch (Spring loaded center off position) (External breakers and bite panel)	GF	Causes the GEN OFF caution lights to come on by simulating a GCU ground fault. (Generator disconnected from the ESS BUS). **NOTE** The GEN OFF caution lights goes out when both the MASTER CAUTION lights are pushed and the GEN switch set to RST and then to ON.
		OV	Causes both GEN OFF caution lights to come on by simulating an overvoltage condition. (Generator disconected from the ESS BUS).
12.	AC PWR switch	OFF	AC power circuits de-energized.
		INV1	Inverter No. 1 is connected and supplies 26 and 115 VAC to AC busses.
		INV2	Inverter No. 2 is connected and supplies 26 and 115 VAC to AC busses.
13.	INV 1 Caution light	On	Indicates that the inverter No. 1 is at fault .
14.	INV 2 caution light	On	Indicates that the inverter No. 2 is at fault.
15.	MASTER CAUTION light	On	Indicates that a warning or caution light is on. (For detailed description and operation refer to Warning and Caution System.).

Figure 1-11. (Sheet 3)

CIRCUIT BREAKERS - FRONT COCKPIT

(ACFT A & B)



CIRCUIT BREAKERS	(A)	PRETECTED CIRCUIT
28 VDC "ESS BUS" (left console)		
CAUT TONES	(1)	Caution acustic tone generator.
ECU	(1)	Electronic Control Unit.(of the engine)
SURF IND	(1)	Speed brake position indicator, aileron trim actuator and stabilizer trim position transmitter circuits
RUD TRIM	(1)	Rudder trim actuator circuit.
CANOPY	(2)	Canopy inflation valve circuit.
FUEL S/O	(5)	Fuel Shut-off valve circuit.
LDG WARN	(5)	Landing gear position indicating and warning circuit
AIL BOOST	(2)	Aileron booster circuit
IGN	(5)	Ignition and starting circuits
AUX PUMP	(5)	Fuel auxiliary pump
HYD	(3)	Hydraulic pressure indicators, front LG selector, speed brake control circuits.
STAB TRIM	(20)	Stabilizer trim power circuit.

Figure 1-12. (Sheet 1 of 5)

CIRCUIT BREAKERS - FRONT COCKPIT

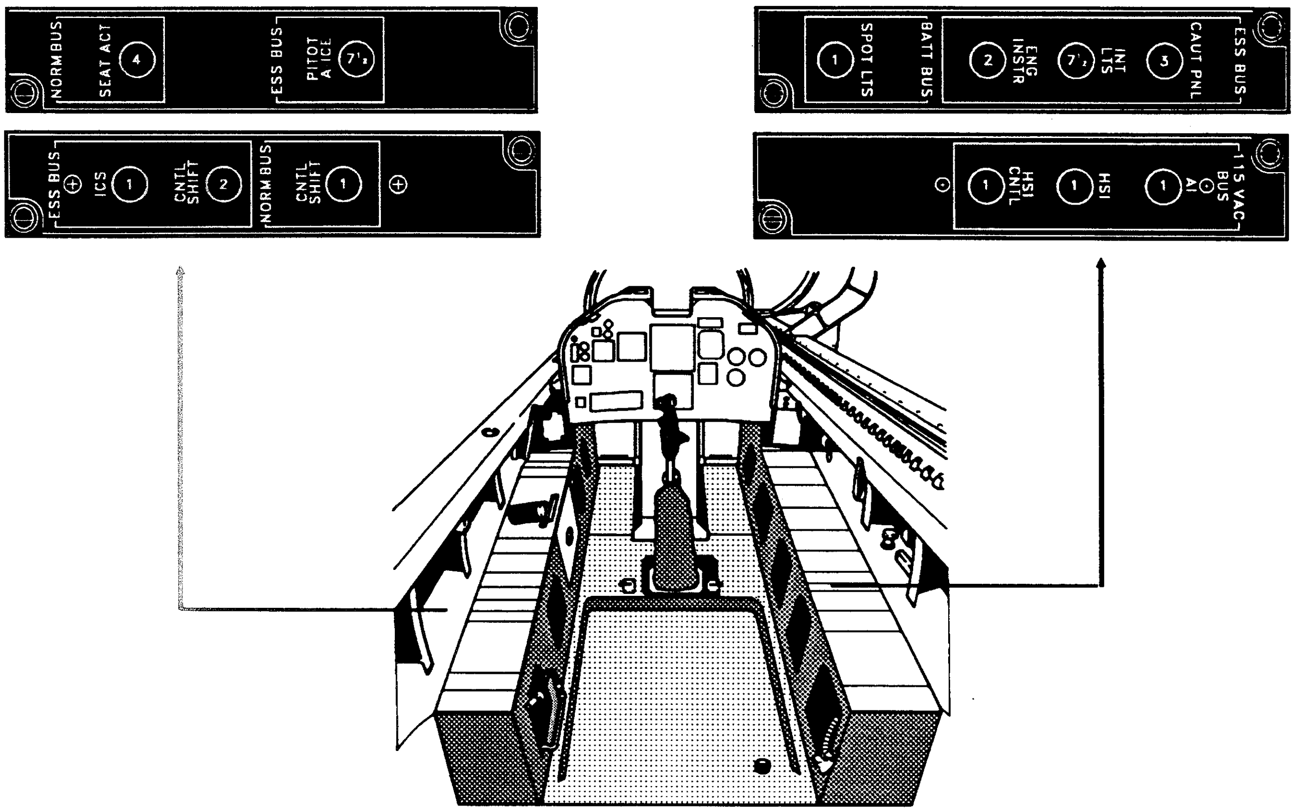
(ACFT A & B)

CIRCUIT BREAKERS	(A)	PRETECTED CIRCUIT
28 VDC "ESS BUS" (right console)		
GCU	(10)	GCU Circuit (Electronic control of starter/generator).
INT LTS	(7.1/2)	Internal light circuits.
PITOT A/ICE	(7.1/2)	Pitot anti-ice circuit
ENG INSTR	(2)	ITT, NH/NL and OIL PRESS power circuits.
CAUT PNL	(3)	Caution panel circuit.
STBY A/IND	(3)	Stand-by attitude indicator.
ENG A/ICE	(2)	Engine anti-ice intake pressure sensor circuit.
BAR ALT	(1)	Barometric altimeter circuit.
NAV LTS	(5)	Navigation lights circuit.
28 VDC "NORM BUS" (left console)		
SEAT ACT	(4)	Ejection seat adjustment actuator circuit.
28 VDC "NORM BUS" (right console)		
FIRE DET	(1)	Fire detector circuit.
BATT	(1)	Battery contactor circuit.
SPOT LTS	(1)	Spot lights
28 VDC " ESS BUS " (Central Pedestal)		
EXT ST ARMT	(20)	Armament Circuit.
PYL TANK LH	(7.1/2)	External fuel tank circuit (LH)
PYL TANK RH	(7.1/2)	External fuel tank circuit (RH)
28 VDC "ESS BUS " (Central Pedestal)		
VHF1	(7. 1/2)	VHF Transceiver circuit
VOR ILS	(2)	VOR ILS section of VHF NAV circuit.
ICS	(1)	ICS power circuit
ALT ENCDR	(1)	Encoder altimeter vibrator circuit.
ATC	(2)	ATC power circuit
28 VDC "ESS BUS " (Central Pedestal)		
GUN SIGHT DC	(5)	Gun sight circuit (D.C.section).
CAM	(1)	Not in use .
RCD	(1)	Not in use .
ADF	(2)	ADF power circuit.
DME	(3)	DME power circuit of VHF NAV system.
28 VDC "BATTERY" (Central Pedestal)		
SALVO	(10)	Armament Jettison Circuit .
115 "VAC BUS" (Central Pedestal)		
AI	(1)	Front attitude indicator power circuit
AHRS	(2)	Attitude and heading reference power section.
HSI	(1)	HSI power circuit.
GUN SIGHT AC	(1)	Gun sight circuit (A.C.section)
26 "VAC BUS" (Central Pedestal)		
AHRS	(1)	Attitude and heading reference system (HDG Exciter).
ADF	(1)	ADF controller circuit (Front and rear).
HSI	(1)	HSI power circuit.
VOR ILS	(1)	VOR ILS section of VHF NAV system

Figure 1-12. (Sheet 2)

CIRCUIT BREAKERS - REAR COCKPIT

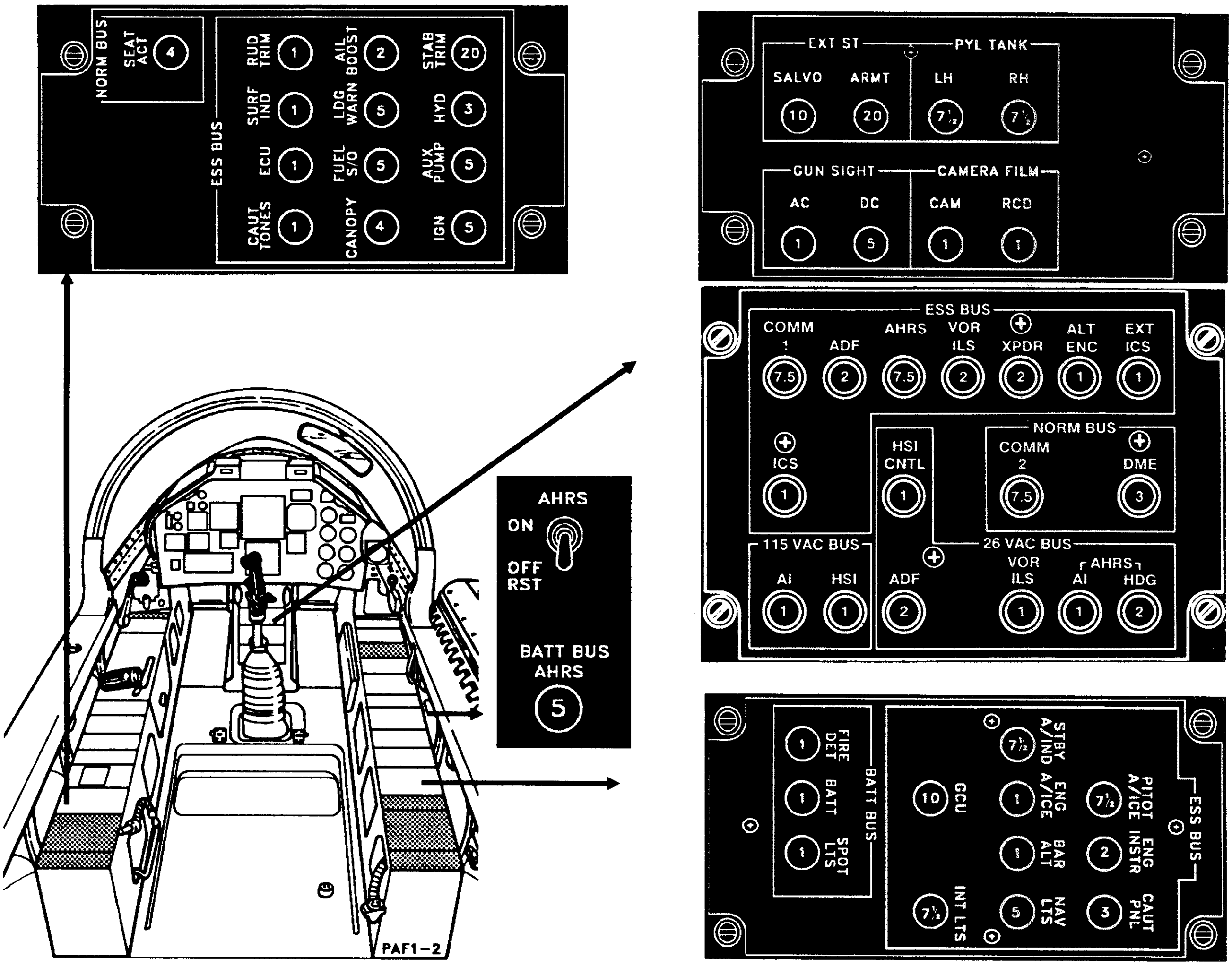
(TYPICAL FOR ACFT A, B AND C)



CIRCUIT BREAKERS	(A)	PRETECTED CIRCUIT
28 VDC "ESS BUS" (left console)		
PITOT A/ICE	(7.1/2)	Pitot anti-ice system.
ICS	(1)	Rear ICS panel power circuit.
CNTL SHIFT	(2)	Rear control shift panel power circuit.
	(1)	
28 VDC "ESS BUS"(right console)		
CAUT PNL	(3)	Caution panel circuit.
INT LTS	(7.1/2)	Internal light circuit.
ENG INSTR	(2)	ITT, NH/NL power circuits.
	(5)	
28 VDC "NORM BUS" (left console)		
SEAT ACT	(4)	Ejection seat adjustment actuator circuit.
28 VDC "BATT BUS" (right console)		
SPOT LTS	(1)	Spot light circuit.
115 "VAC BUS" (right console)		
AI	(1)	Rear attitude indicator power circuit.
HSI	(1)	HSI power circuit.
HSI CNTL	(1)	HSI Control power circuit.

Figure 1-12. (Sheet 3)

CIRCUIT BREAKERS - FRONT COCKPIT
(ACFT C)



CIRCUIT BREAKERS	(A)	PRETECTED CIRCUIT
28 VDC "ESS BUS" (left console)		
CAUT TONES	(1)	Caution acustic tone generator.
ECU	(1)	Electronic Control Unit.(of the engine)
SURF IND	(1)	Speed brake position indicator, aileron trim actuator and stabilizer trim position transmitter circuits
RUD TRIM	(1)	Rudder trim actuator circuit.
CANOPY	(2)	Canopy inflation valve circuit.
FUEL S/O	(5)	Fuel Shut-off valve circuit.
LDG WARN	(5)	Landing gear position indicating and warning circuit
AIL BOOST	(2)	Aileron booster circuit
IGN	(5)	Ignition and starting circuits
AUX PUMP	(5)	Fuel auxiliary pump
HYD	(3)	Hydraulic pressure indicators, front LG selector, speed brake control circuits.
STAB TRIM	(20)	Stabilizer trim power circuit.
28 VDC "NORM BUS" (left console)		
SEAT ACT	(4)	Ejection seat adjustment actuator circuit.

Figure 1-12. (sheet 4)

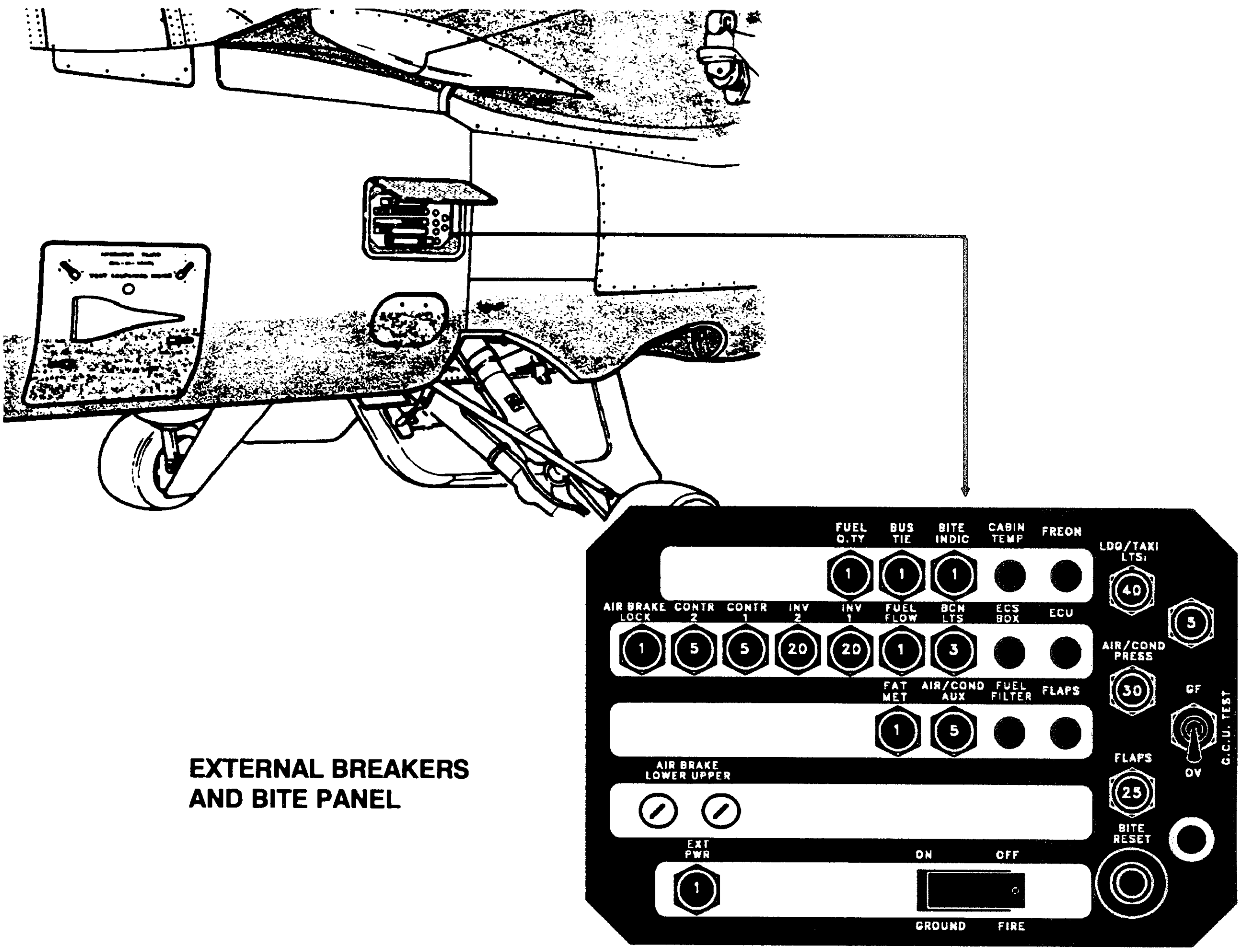
CIRCUIT BREAKERS - FRONT COCKPIT

(ACFT C)

CIRCUIT BREAKERS	(A)	PRETECTED CIRCUIT
28 VDC "ESS BUS" (right console)		
GCU	(10)	GCU Circuit (Electronic control of starter/generator).
INT LTS	(7.1/2)	Internal light circuits.
PITOT A/ICE	(7.1/2)	Pitot anti-ice circuit
ENG INSTR	(2)	ITT, NH/NL and OIL PRESS power circuits.
CAUT PNL	(3)	Caution panel circuit.
STBY A/IND	(3)	Stand-by attitude indicator.
ENG A/ICE	(2)	Engine anti-ice intake pressure sensor circuit.
BAR ALT	(1)	Barometric altimeter circuit.
NAV LTS	(5)	Navigation lights circuit.
28 VDC " ESS BUS " (Central Pedestal)		
EXT ST ARMT	(20)	Not in use .
PYL TANK LH	(7.1/2)	Not in use .
PYL TANK RH	(7.1/2)	Not in use .
GUN SIGHT DC	(5)	Not in use.
GUN SIGHT AC	(1)	Not in use .
CAMERA FILM CAM	(1)	Not in use .
CAMERA FILM RCD	(1)	Not in use .
28 VDC "ESS BUS " (Central Pedestal)		
COMM 1	(7. 1/2)	VHF COMM 1 Transceiver circuit
ADF	(2)	ADF power circuit.
AHRS	(1)	AHRS power circuit
VOR ILS	(2)	VOR ILS section of VHF NAV circuit.
XPDR	(2)	ATC power circuit
ALT ENCDR	(1)	Encoder altimeter vibrator circuit.
EXT ICS	(1)	External ICS power circuit.
ICS	(1)	ICS power circuit
28 VDC "NORM BUS" (Central pedestal)		
COMM 2	(7.1/2)	VHF COMM 2 Transceiver circuit
DME	(3)	DME power section.
28 VDC "BATTERY" (Central Pedestal)		
SALVO	(10)	Not in use.
28 VDC "BATTERY" (right console)		
FIRE DET	(1)	Fire detector circuit.
BATT	(1)	Battery contactor circuit.
SPOT LTS	(1)	Spot lights
BUT BUS AHRS	(5)	AHRS power circuit
115 "VAC BUS" (Central Pedestal)		
AI	(1)	Front attitude indicator power circuit
HSI	(1)	HSI power circuit.
26 "VAC BUS" (Central Pedestal)		
AHRS HDG	(2)	Heading reference system (HDG Exciter).
AHRS AI	(1)	Attitude Indicators reference system.
ADF	(2)	ADF controller circuit. (Front and rear)
HSI CNTL	(1)	HSI control power circuit.

Figure 1-12. (sheet 5)

CIRCUIT BREAKERS - EXTERNAL



CIRCUIT BREAKERS	(A)	PROTECTED CIRCUIT
28 VDC "ESS BUS" (On External Circuit Breaker and Bite Panel)		
FUEL QTY	(1)	Fuel quantity indicating circuit .
BITE IND	(1)	Bite indicating circuit .
BUS TIE	(1)	Main NORMAL BUS switch power circuit.
INV 1	(20)	Inverter No.1 power circuit.
INV 2	(20)	Inverter No. 2 power circuit.
FAT MET	(1)	Fatiguemeter system (Only on ACFT S/N 053 and 054)
28 VDC "NORMAL BUS" (On External Circuit Breaker and Bite Panel)		
LDG TAXI LTS	(40)	Landing and taxi light power circuit .
AIR BRAKE LOCK	(1)	Speed brake retracted position retaining circuit.
FLAPS	(25)	Wing flap power circuit.
CONTR 1	(5)	Front internal light controller power circuit .
CONTR 2	(5)	Rear internal light controller power circuit .
BCN LTS	(3)	Anticollision light circuit.
FUEL FLOW	(1)	Fuel flow circuit .
AIR COND PRESS	(30)	Electro-fan power circuit.
AIR COND AUX	(5)	ECS system circuit.
28 VDC "EXTERNAL POWER BUS" (On External Circuit Breaker and Bite Panel)		
EXTERNAL POWER	(1)	External power relay power circuit.

Figure 1-13.

HYDRAULIC POWER SUPPLY SYSTEM

The hydraulic power supply system (see figure 1-14) operates at a pressure of approximately 2,700÷3,400 PSI and provides the hydraulic power for the operation of the following circuits:

- Aileron Servo Control.
- Landing Gear Retraction/Extension Mechanism.
- Landing Gear Doors.
- Speed Brake Actuator.
- Hydraulic Motor of the Freon Compressor.

The system consists of an Engine Driven Self Regulating Pump, a Pressurized Reservoir, an Accumulator, a Filter on the delivery line, a Pressure Relief Valve, a Pump Case Drain Line Filter, a Filter with a By-Pass Valve on the return line, a By-pass Valve for landing gear emergency operation, a Balance Relief Valve on the freon compressor circuit, valves and delivery lines. The system has a pressure indicating circuit consisting of a Pressure Transducer and a Pressure Indicators on the instrument panels.
Electrical power for the indicating system is provided by the ESS BUS through the HYD circuit breaker.
With the HYD circuit breaker OFF (as for Emergengy Landing Gear Operation practice) the following conditions occur:

- The hydraulic pressure indication drops to zero.
- The landing gear may only be extended and speed brake retracted, if operated.
- The landing gear control lever light is on.
- The ECS cabin conditioning stops to operate.

HYDRAULIC POWER SUPPLY SYSTEM SCHEMATIC

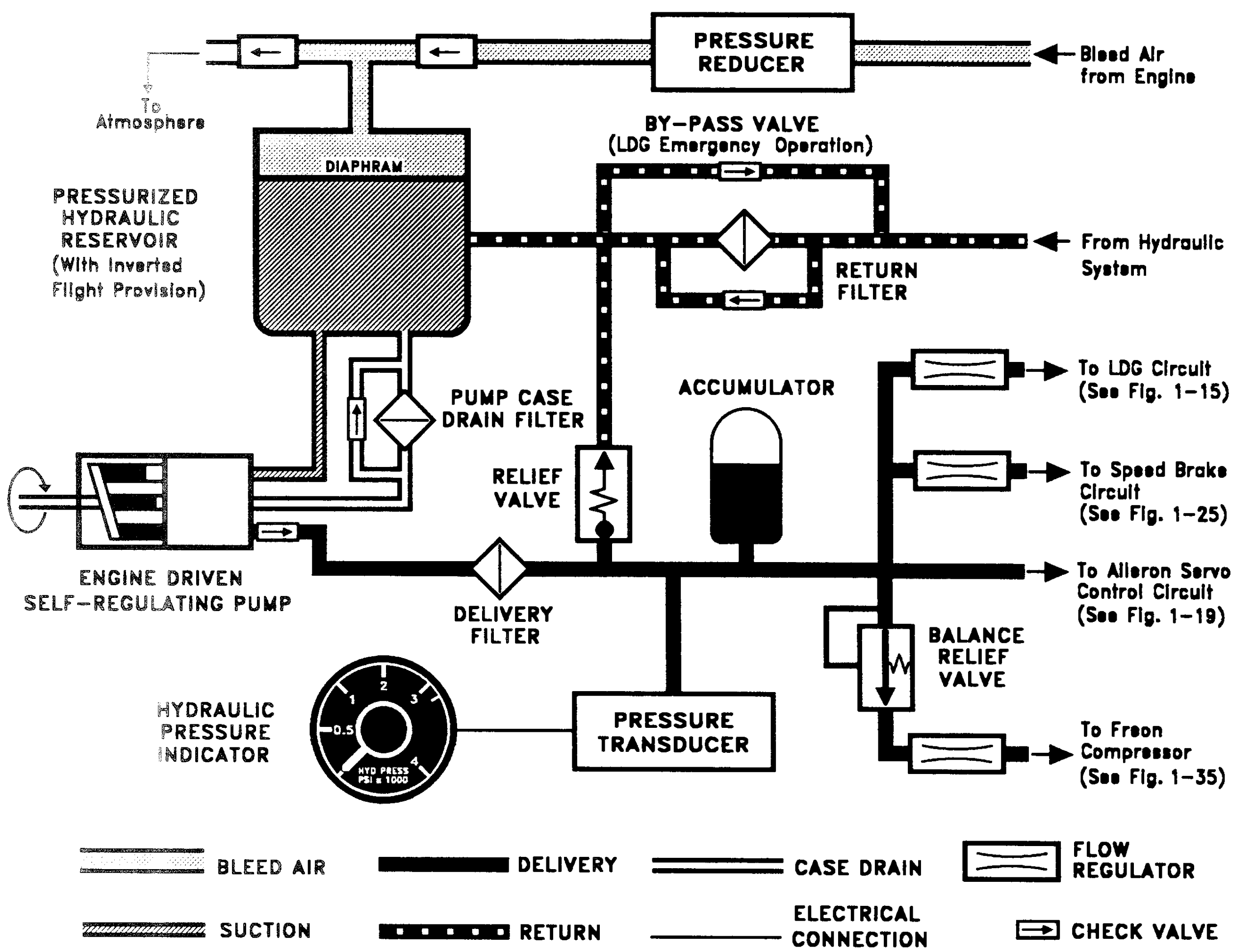


Figure 1-14.

OPERATION

Hydraulic fluid is transferred, by the hydraulic pump, from the air pressurized reservoir to the hydraulic operated systems.
The hydraulic pump delivery is self regulating, with a linear decreasing from approximately 2,700 PSI to reach zero flow at approximately 3,400 PSI.
The pressure relief valve protects the system from pressure surges and relief pressures in excess of 3,850 PSI to the return line.
An accumulator, on the supply line, is provided for damping transients and dynamic effects.
The balance relief valve, on the freon compressor circuit, prevents operation of the freon compressor whenever pressure in the system drops below 2,500 PSI due to simultaneous operation of aircraft hydraulic system.
The By-pass Valve, on the return line, allows the hydraulic fluid to flow into the Landing Gear Control Valve Assembly to refill the Gear Cylinder Chambers during landing gear emergency lowering.

LANDING GEAR SYSTEM

The landing gear system (see figure 1-15) consists of an hydraulic operated trycicle landing gear electrically controlled from the front and rear cockpit by the landing gear control lever for normal extension and retraction.
Hydraulic power for the operation of the landing gear is controlled by the Landing Gear Control Valve Assembly on the right side of the main landing gear bay. The valve assembly consists of two solenoid operated selector valves (Main Forward Door and LDG Selector Valves) and of a Landing Gear Emergency Control Valve mechanically controlled by the LDG Emergency Extension Control Handle from the front cockpit.
During normal operation the hydraulic power, from the landing gear control valve assembly, is supplied to the solenoid operated selector valves which provide landing gear extension/retraction according to the position of the landing gear control lever and sequence microswitches.
Normal landing gear extension/retraction maneuver occurs as follows:

- **Extension of the main forward doors.**
  The main forward selector valve energized to release, through port C4, the hydraulic pressure from the aft door hooks. Then, hydraulic power is supplied, through port C3, to unlock the forward door and nose gear up-lock hook and, through the sequence valve, to forward door cylinders to extend the main forward doors.

- **Extension/retraction of the landing gear.**
  The landing gear selector valve energized to supply hydraulic power, through port C2, to the nose and main gear cylinders to extend the landing gear or , through port C1 to retract the landing gear.

- **Retraction of the main forward doors.**
  The main forward door selector valve supplies hydraulic power, through port C4, to forward door cylinders to retract the main forward doors. When retracted, the main forward doors up-lock hooks are maintained closed by the mechanical locks in the hooks.
  The aft doors of the main gear, to which landing gear leg are mechanically connected, are maintained in closed and locked position by the aft door hooks powered, though port C4, by the main forward door selector valve.

The nose landing gear is maintained in the retracted position by the nose gear up-lock hook, which is maintained closed by a mechanical lock.
The main landing gear is maintained in the retracted position by the hydraulic pressure acting on the main gear cylinders.
Should hydraulic power failure occur: the nose gear and forward door up-lock hooks remain mechanically locked while lack of hydraulic power will cause the aft door hooks to open and the main landing gear to lean onto the main forward doors.
Each landing gear leg is maintained locked in the extended position by a mechanical lock incorporated in the gear cylinders.
When the landing gear is extended, the main gear forward doors return to the up-locked position, except the nose landing gear doors which are mechanically connected to the nose gear leg.
Retraction time is approximately 6 seconds while extension time is approximately 5 seconds.
An EMER LDG CR handle, in the front cockpit, is available for emergency lowering of the landing gear.
Retraction of the landing gear on the ground, while the weight of the aircraft is on the wheels, is prevented by a mechanical device, which locks the landing gear control lever of the front cockpit in the DOWN position.
A push-button, labelled DOWN LOCK OVERRIDE, allows emergency unlocking of the landing gear control lever on the ground. The front push-button is mechanical, the rear push-button is electrical.
Electrical power for the operation of the landing gear control system is provided by the ESS BUS through the HYD circuit breaker.
With the HYD circuit breaker OFF the landing gear can be lowered only with the emergency release control.

LANDING GEAR INDICATING & WARNING SYSTEM

Three green landing gear position indicating lights are provided on the landing gear control panels (see figure 1-16) and come on to indicate that the landing gear is down and locked.
A red warning light, incorporated in the landing gear

LANDING GEAR SYSTEM SCHEMATIC

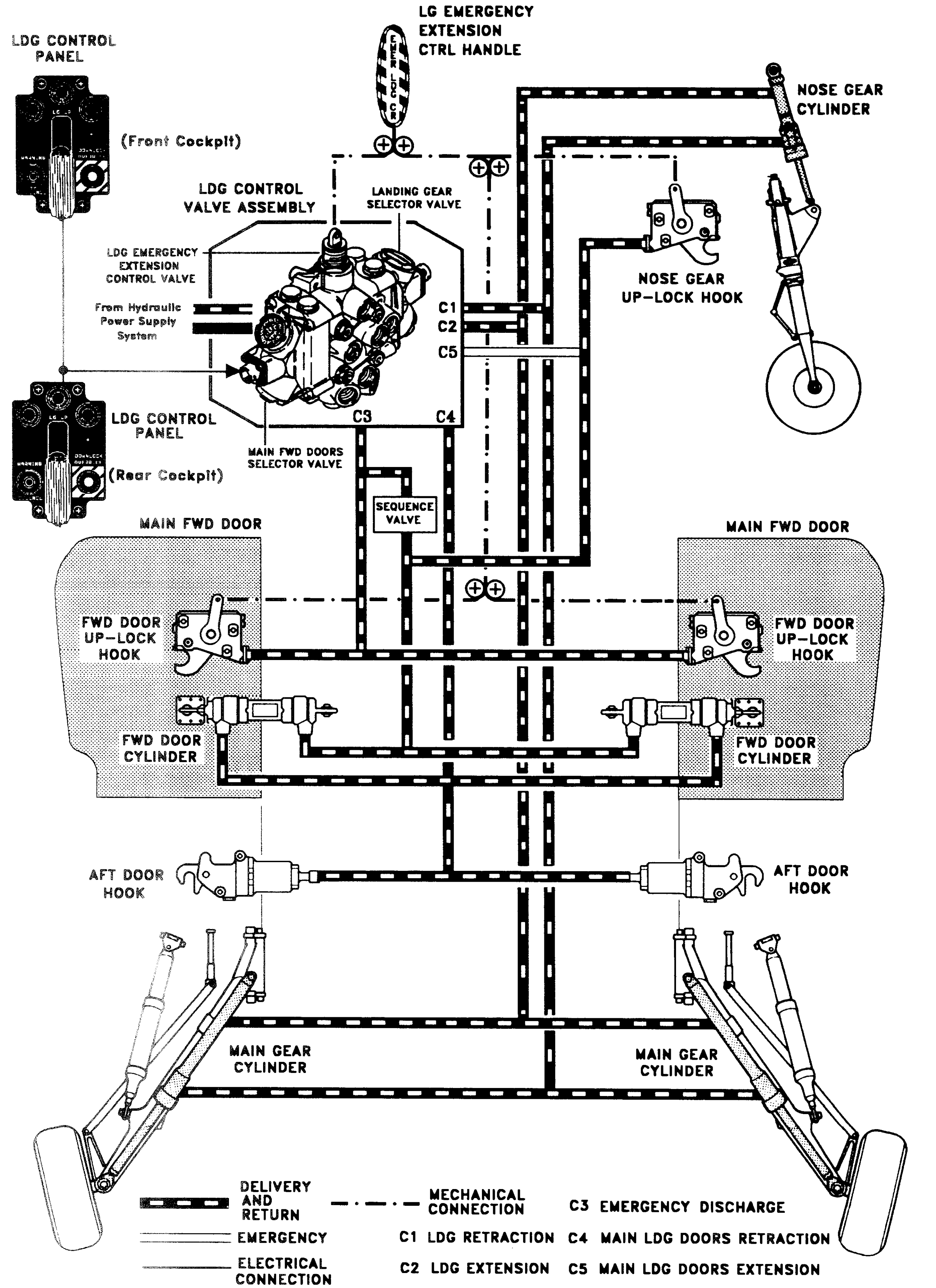


Figure 1-15.

control lever grip, glows whenever the position of the landing gear and main gear doors do not correspond to the position of the control lever.
Whenever the throttle is retarded to low power setting, while the landing gear is up, the landing gear control lever will flash and a warning tone will be fed into the headset. This warning tone can however be silenced (with 2 seconds delay) and the warning light extinguished, provided it was not due to the flap position, by means of the WARNING SILENCE push button near the landing gear control lever.
Silencing of the audible signal and extinguishment of the warning light is also obtained by moving the engine throttle lever forward, or the flaps away from land position.
Electrical power for the operation of the landing gear position indicating and warning system is provided by the 28VDC ESS BUS through the LDG WARN circuit breaker.

LANDING GEAR EMERGENCY LOWERING

The EMER LDG CR handle, on the central pedestal of the front cockpit, provides an emergency means of extending the landing gear in case of electrical or hydraulic system failure.
Pulling and locking the handle the following conditions occur (see figure 1-15):

- LDG emergency control valve is positioned to discharge the hydraulic pressure of the landing gear system.

- Nose gear and MLG forward door hooks are mechanically opened allowing extension and downlock of the gears by gravity and aerodynamic loads. In this condition the main gear forward doors will remain open.

If the emergency landing gear operation is not due to a system failure (i.e. LDG emergency lowering practice), the EMER LDG CR handle may be reset in place and the system returned to normal operation.
For simulated landing gear emergency lowering procedure refer to Section III, Emergency Procedures.

LANDING GEAR SYSTEM CONTROLS

The landing gear system controls are described and illustrated in figure 1-16.

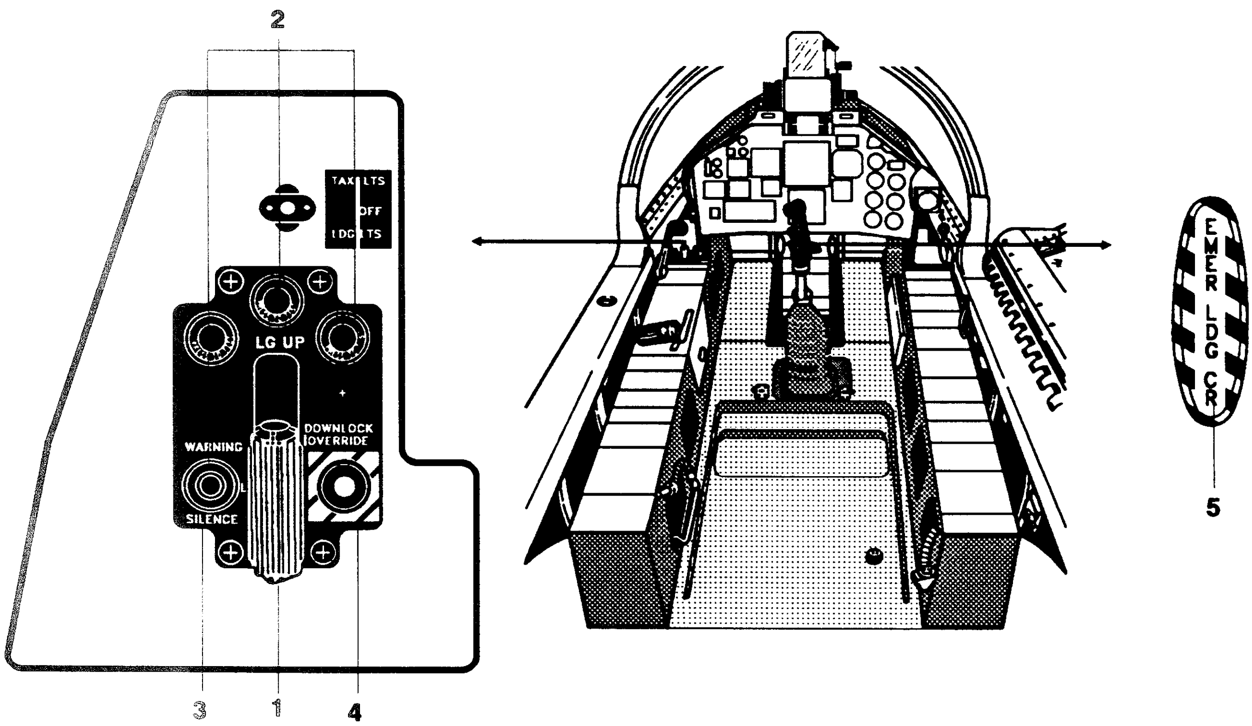
NOSE WHEEL STEERING SYSTEM

The nose wheel steering system is mechanically operated by rudder pedals.
The system provides directional control of the aircraft on the ground with a maximum steering angle of 18°±1 left and right, therefore for towing operations, it is mandatory to disconnect the torque link of the nose gear.
During landing gear retraction, the nose wheel will automatically center regardless of the rudder pedal position.

WHEEL BRAKE SYSTEM

The brakes, fitted on the main wheels are of the self-compensating multi-disc type.
The brake hydraulic system (see figure 1-17) consists of a reservoir, the master brake cylinders, a parking brake valve, shuttle valves and the brakes.
The reservoir is installed on the upper rear side of the aft bulkhead in the fuselage central section.
The master brake cylinders are connected to the toe pedals hinged to the rudder pedals.
The parking brake valve, below the front cockpit floor on the left side, is controlled by the PARKING BRAKE handle on the right side of the central pedestal.
The braking action is produced by applying pressure to the toe pedals. The hydraulic fluid is sucked from the reservoir and pressurizes the brake cylinders forcing the brakes linings against the rotating discs.
To operate the parking brake press the toe pedals then pullout and turn to lock the PARKING BRAKE handle 90°clockwise. This causes pressure to be retained in the brake lines, after releasing the toe pedals.

LANDING GEAR CONTROL DESCRIPTION



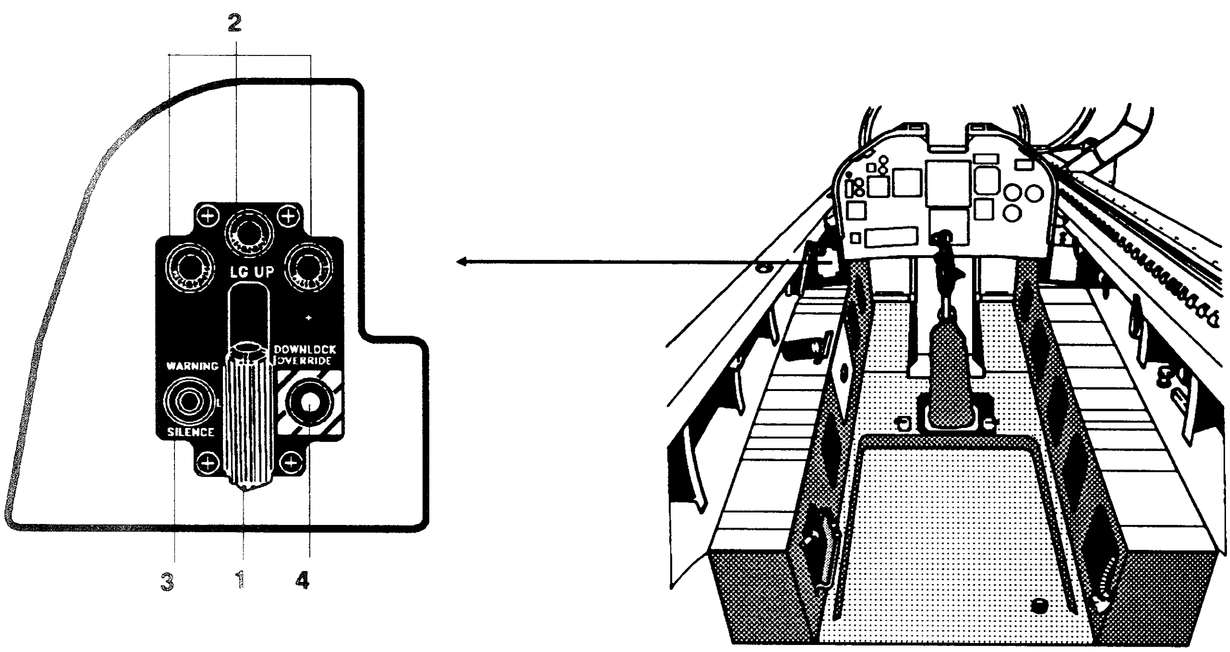


Figure 1-16. (Sheet 1 of 2)

LANDING GEAR CONTROLS

DESCRIPTION			FUNCTION
1.	Landing gear control lever	LG DOWN	The landing gear extends. **CAUTION** When the aircraft is on ground and rests on the wheels, a solenoid valve in the forward control lever box, prevents movement of the lever to the LG UP position.
		LG UP	The landing gear retracts.
		Grip On	Warns the pilot that the landing gear and/or gear doors position differ from the lever position.
		Grip blinking	The control lever grip blinks and an aural warning signal is heard in the headset any time the flaps are lowered to the DOWN position and/or throttle is retarded to IDLE, with the landing gear in the UP locked position.
2.	Landing gear position indicator lights	ON (green light)	Indicate that the corresponding gear leg is down and locked.
3.	WARNING SILENCE push-button	Pressed	Silences the aural signal and cut-out the grip blinking warning lights, if the warning is originated by throttle position (Inoperative if flaps are DOWN).
4.	DOWN LOCK OVERRIDE push-button	Pushed	Unlocks the LG DOWN position of the landing gear control lever (when the aircraft is on the ground) to allow landing gear emergency retraction. **NOTE** Forward switch is mechanical; aft switch is electrical.
5.	EMER LDG CR handle	Pulled out	Provides extension of the landing gear irrespective of the position of the landing gear control lever. **NOTE** The forward main landing gear doors remain open.

Figure 1-16. (Sheet 2)

WHEEL BRAKE SYSTEM SCHEMATIC

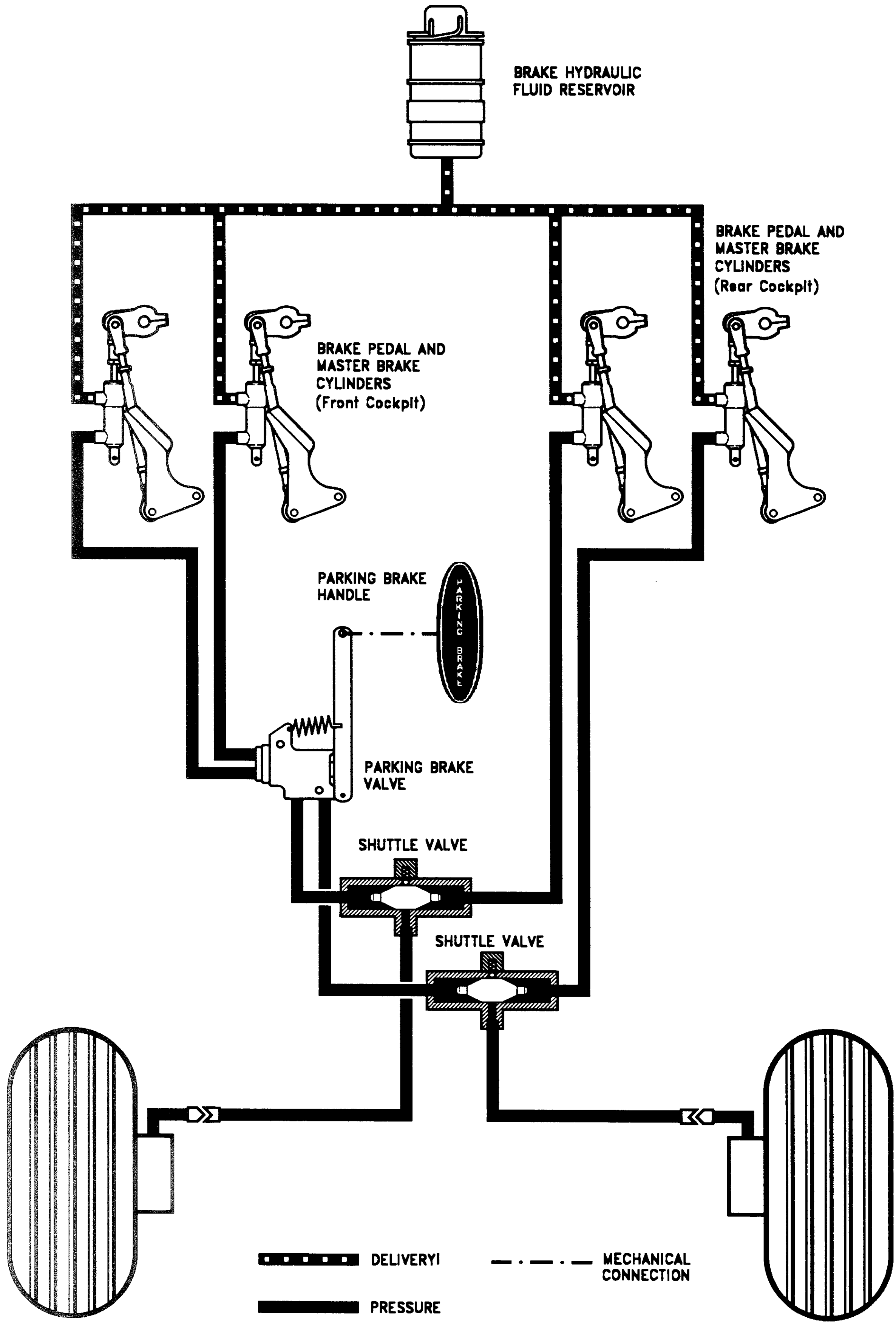


Figure 1-17.

FLIGHT CONTROLS

The flight controls (see figure 1-18) are divided into primary and secondary flight control system.
Primary flight control along pitch, roll and yaw axes is accomplished with elevator, aileron and rudder, controlled by conventional type push-pull rods connected to the dual control sticks and the rudder pedals.
The rudder pedals can be adjusted in length, to suit the pilot's leg length, by means of the pedal adjustment knob which protrudes from the central pedestal below the instrument panel. (see figure 1-2) .
The secondary flight controls comprise the aircraft trimming systems, required to balance the aircraft along the three axes, the speed brake and the wing flap systems.
The secondary flight controls are operated by combined electro-mechanical and hydraulic power.

PRIMARY FLIGHT CONTROLS

The following paragraphs provide a general description and operation of primary flight control systems.

Aileron Control System

The aileron control system (See figure 1-19) consists of dual control sticks connected to a single push-pull rod that operates an aileron servo control mounted on the rear side of the aft bulkhead.
An Artificial Feel Device is inserted in the aileron control linkage to give the pilots simulated feel of control surface deflection and to provide aileron control return to the neutral position.
Hydraulic power for the operation of the aileron servo control is provided by the hydraulic power supply systems.
A Control Valve Manifold is mounted on the servo control hydraulic circuit. The control valve manifold consists of a Shut-off Valve, controlled by AIL SERVO switches on front and rear consoles, a Pressure Reducer Valve and a Pressure Switch.
The pressure switch causes the AIL SERVO caution lights to come on whenever the hydraulic pressure, in the circuit, drops below 1,160 psi.
Electrical power for the operation of the shut-off valve is supplied by the 28 VDC Essential Bus through the AIL BOOST circuit breaker.

PRIMARY FLIGHT CONTROLS

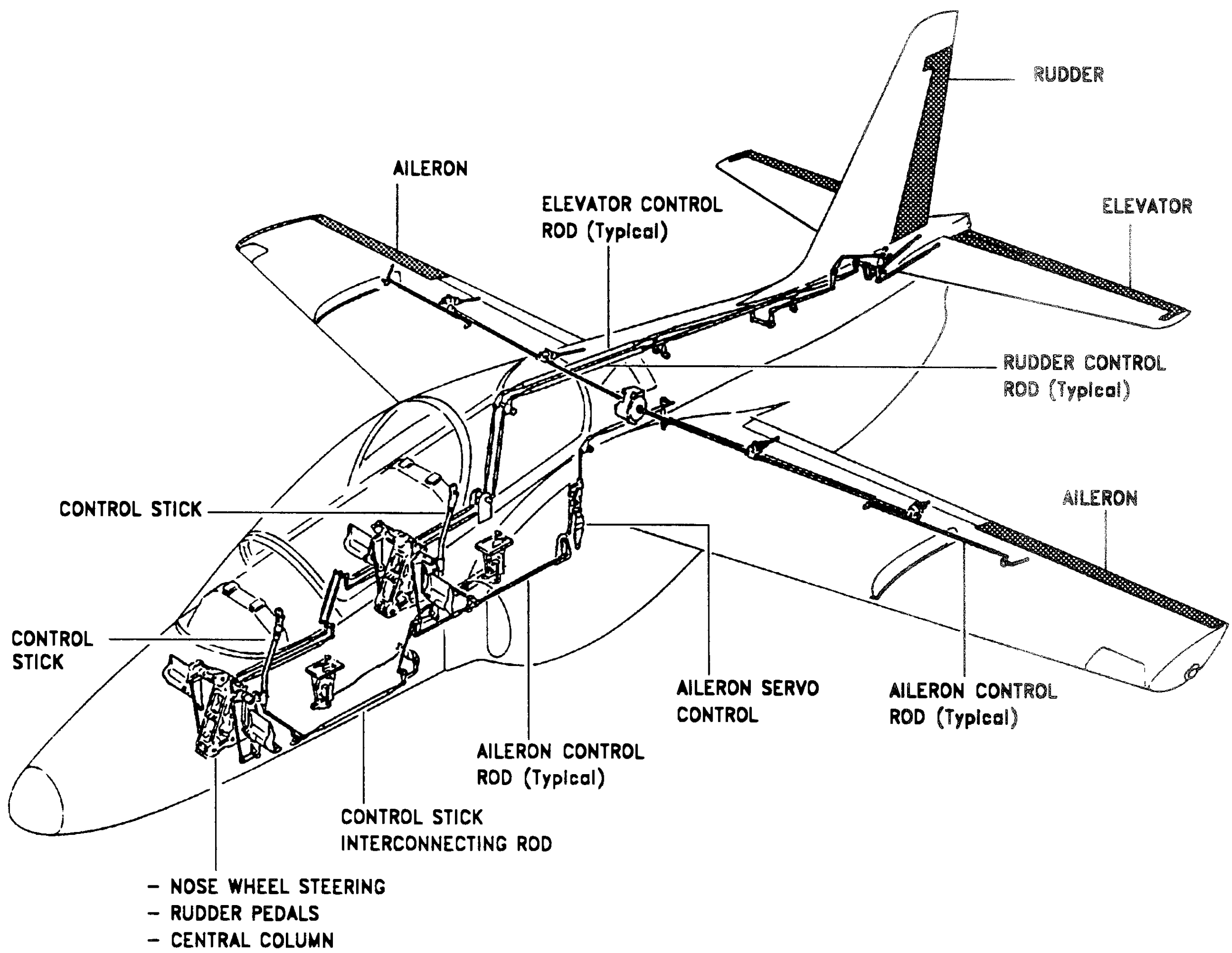


Figure 1-18.

AILERON SERVO CONTROL SYSTEM SCHEMATIC

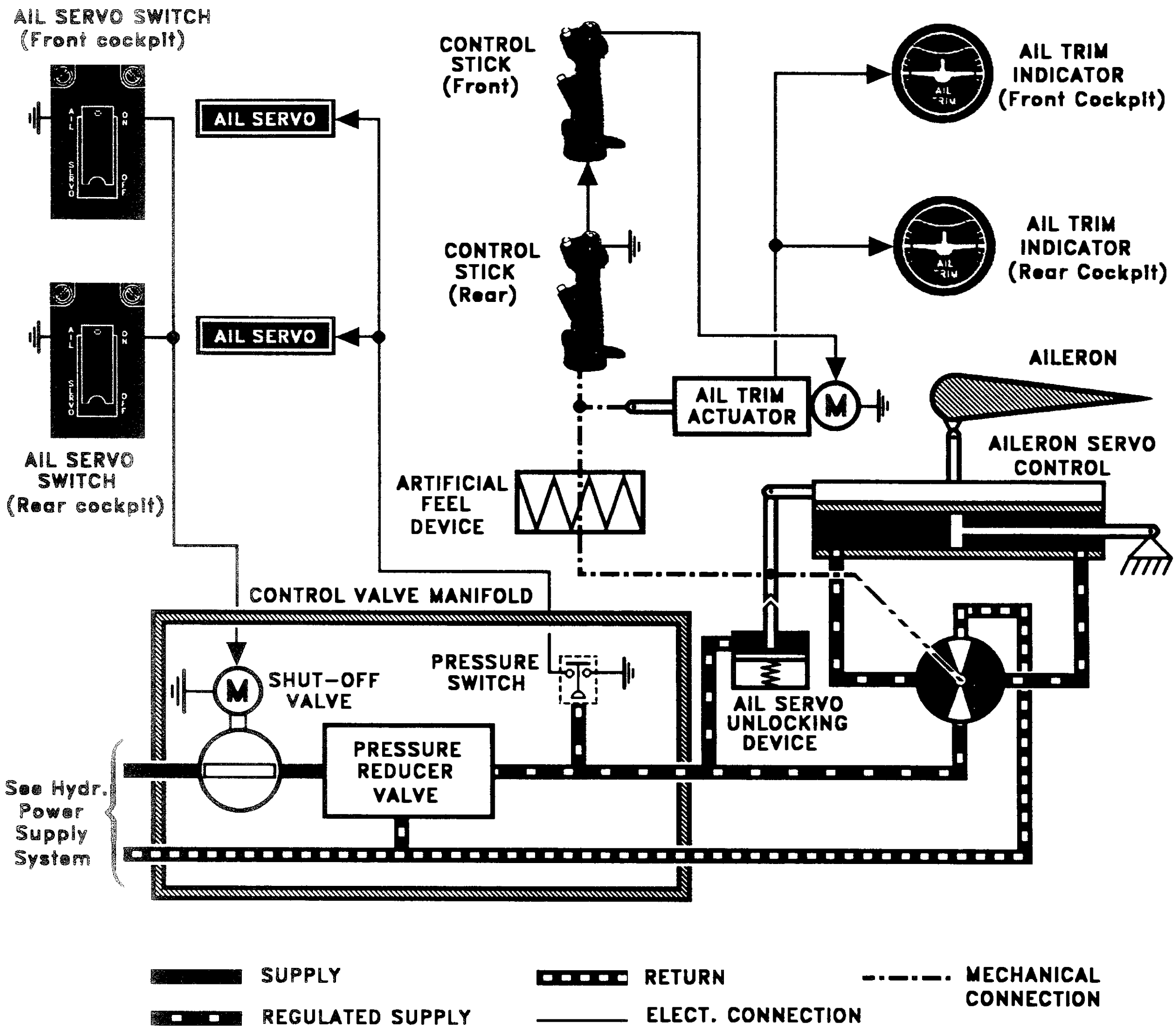
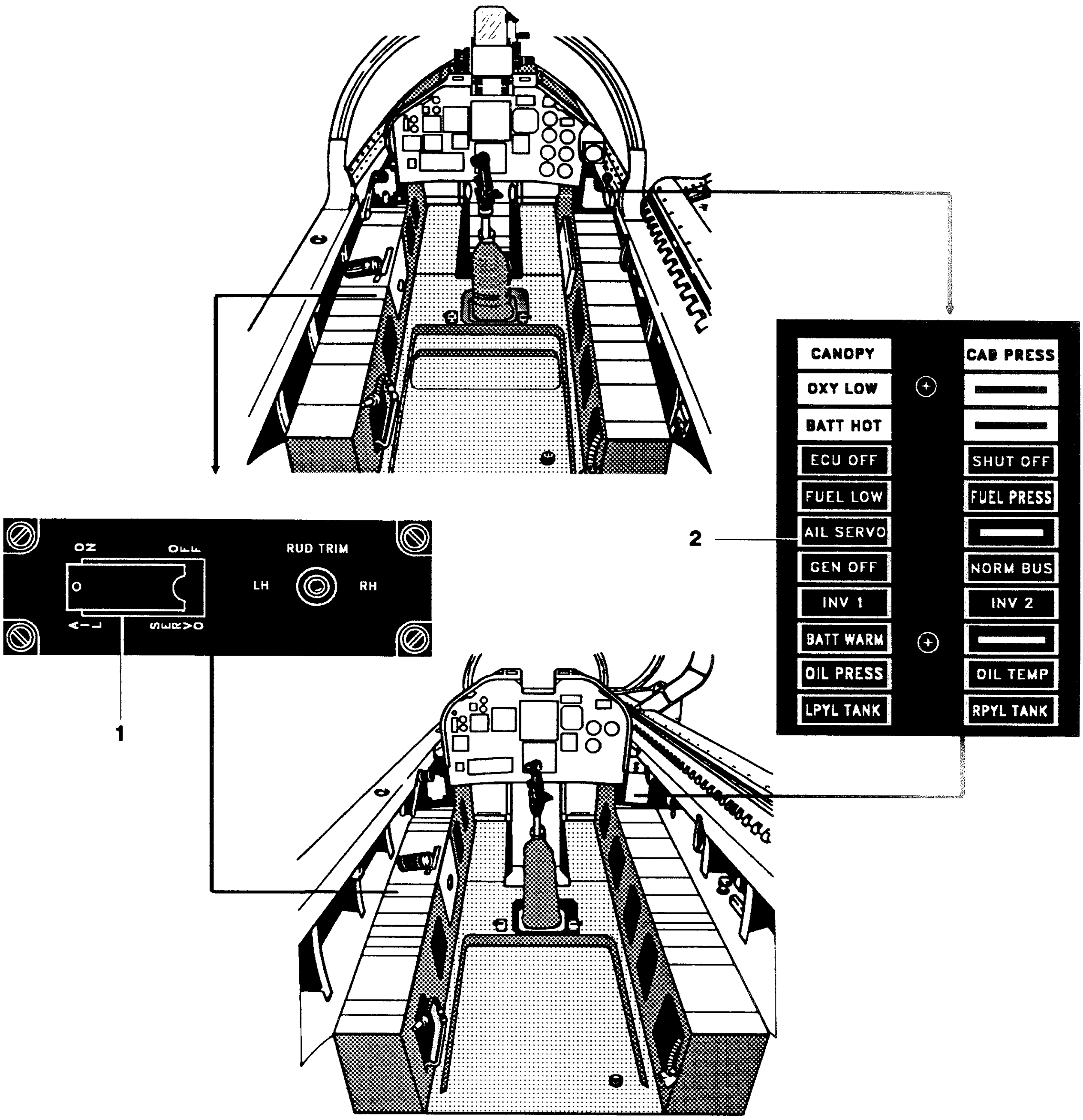


Figure 1-19.

AILERON SERVO CONTROL DESCRIPTION



	DESCRIPTION		FUNCTION
1.	*AIL SERVO* switch	*OFF*	The aileron control surfaces are mechanically controlled by the control sticks.
		ON	Applies hydraulic power to aileron servo booster. The aileron control surfaces are controlled by the control sticks through the aileron servo control.
2.	*AIL SERVO* caution light	Out	Indicates that the aileron servo control is operative.
		On	Indicates that the aileron servo control is inoperative (loss of hydraulic pressure or AIL SERVO switch set to OFF).

Figure 1-20.

In case of loss of the hydraulic power or when the AIL SERVO switches are set to OFF, the aileron surfaces are mechanically controlled by the control sticks, as the servo control operates as a rigid body on the kinematic transmission line.
For detailed control description and operation see figure 1-20.

Elevator Control System

The front and rear pilot's control sticks are interconnected and mechanically operate, via push-pull rods, the elevator surface.
To decrease the elevator loads, two servo tabs are provided on the elevator and are mechanically operated by the elevator movement.
To correct the aerodynamic loads, the mechanic control chain is provided with a down-spring.

Rudder Control System

The rudder is deflected by interconnected and conventional adjustable rudder pedals through push-pull rods connected to the rudder.

SECONDARY FLIGHT CONTROLS

The aircraft is equipped with the following secondary flight control systems (See figure 1-21):

- Lateral (roll) trim
- Longitudinal (pitch) trim
- Directional (yaw) trim
- Wing flaps and Speed Brake Systems.

Lateral (roll) Trim System

Aircraft lateral trimming is obtained by positioning the ailerons as required to balance asymmetrical loads.
The system consists mainly of an Aileron Trim Actuator, controlled by two aileron trim control switches mounted on the front and rear control stick handgrips, an Artificial Feel Device, an Aileron Servo Control and two panel mounted Aileron Trim Position Indicators (See figure 1-19).
The system may operate either with aileron servo ON or OFF (electro-mechanical-hydraulic or electro-mechanical mode).
In the electro-mechanical hydraulic operating mode, aircraft lateral trimming is obtained by means of the Aileron Trim Actuator (electrically controlled by the Aileron Trim switches) which, through the Artificial Feel Device (Mechanical) operates the Aileron Servo Actuator (Hydraulic) positioning the aileron as required to obtain aircraft lateral trimming. The Artificial Feel Device, concurrent to the Aileron Servo Actuator

SECONDARY FLIGHT CONTROLS

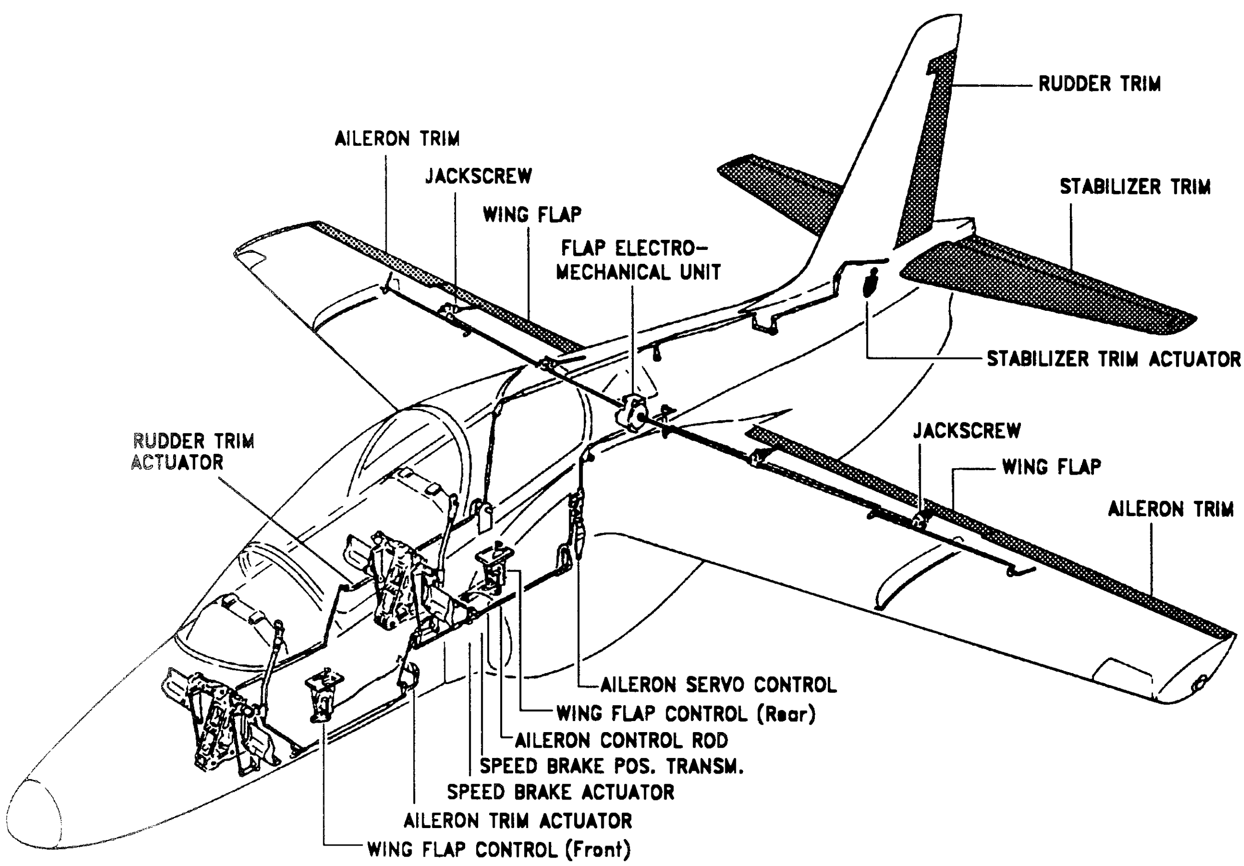


Figure 1-21.

operation, provides control sticks deflection in an amount proportional to the aileron lateral trimming, giving to the pilots simulated control forces.
Should the hydraulic power fail or the AIL SERVO switch(es) be set to OFF (Solenoid Shut-off Valve Closed), the aircraft lateral trimming is accomplished by actuating the Aileron Trim Control switch(es). This operate(s) the Aileron Trim Actuator and in turn the Artificial Feel Device, positioning the ailerons as required to obtain the aircraft lateral trimming. In this case the Aileron Servo Actuator operates as a rigid body in the aileron kinematic transmission line. In such condition, actuator performance may be insufficient to counteract asymmetric lateral loads. Control surface position is determined by the balance of all the forces acting on trim.
Aircraft lateral trimming indication is provided by two AIL TRIM indicators (front and rear instrument panel).
Aircraft lateral trim position is transmitted to the AIL TRIM indicators through a potentiometer in the aileron trim actuator case.
A three second time delay relay is installed on the AIL SERVO caution light circuit.
Electrical power for the operation of the aileron trim actuator is suppllied by 28 VDC ESS BUS via AIL BOOST circuit breaker.
Electrical power for the operation of aileron trim position indicating circuit is supplied by the 28 VDC ESS BUS via SURF IND circuit breaker on front console.
For lateral trimming control description and operation see figure 1-22.

Longitudinal (pitch) Trim System

Aircraft trimming along pitch axis is accomplished by positioning the stabilizer surface in an amount required to obtain aircraft trimming.
The system consists mainly of a Stabilizer Actuator, Extraction and Retraction Relays, Stabilizer Actuator Disconnect Relay, Overtorque Cut-out Relay, Control Switches and Stabilizer Trim Position Indicators.
Operation of the stabilizer actuator is controlled by stabilizer trim switches, on the front and rear control stick grip, and by retraction and extraction relays on the upper side of the aft fuselage.
A stabilizer actuator disconnect relay, controlled by stabilizer circuit cut-out switch on the two control stick grips, allows removal of 28VDC from the stabilizer actuator should any failure occur in the stabilizer control circuit.
An over-torque cut-out relay, on the upper side of the aft fuselage, automatically disengages the stabilizer actuator should aerodynamic loads exceed 1800÷ 2,000 kg.
Trim position indication is provided by two panel mounted STAB TRIM position indicators. STAB TRIM position indicating signal to the idicators is supplied by a potentiometer, mounted within the stabilizer actuator case. The potentiometer is powered by the 28 VDC ESS BUS through the SURF IND circuit breaker on the left front console.
The stabilizer actuator disconnecting circuit is powered by the ESS BUS through the STAB TRIM circuit breaker on left side of front console.
For longitudinal trimming control description and operation see figure 1-22.

Directional (yaw) Trim System

Aircraft trimming along yaw axis is accomplished by positioning the rudder surface in an amount required to obtain aircraft trimming.
The system consists mainly of a Rudder Trim Actuator, an Artificial Feel Device on the bottom right side of the rear cockpit and front and rear Rudder Trim Control Switches on the left consoles.
Aircraft trimming along the yaw axis is accomplished by means of the rudder trim actuator, (electrically controlled by the rudder trim switches) which, through the artificial feel device, acts on the rudder kinematic transmission line and positions the rudder as required to balance asymmetric load.
The artificial feel device also provides simulated control surface forces by operating and positioning the rudder pedals in an amount proportional to the rudder trim deflection. Rudder trim position is indicated by two panel mounted rudder trim position indicating lights. With the aircraft on ground, the green lights are on to indicate that the rudder is set to the neutral position (take-off).
When in flight, the rudder trim position indicating lights are inoperative (rudder in neutral position signal cut-out by the left and right main landing gear position indicating microswitches).
Electrical power for the operation of the rudder trim actuator is supplied by the 28 VDC ESS BUS through the RUD TRIM circuit breaker on the left front console.
For directional trim controls description and illustration see figure 1-22.

WING FLAP SYSTEM

The aircraft is equipped with a slotted type trailing edge electrically operated flaps.
The system (see figure 1-23) consists mainly of Flap Control Levers, on the left consoles, Flap Control Switches (UP, T/O and DOWN) below the rear flap control lever, a Flap Control Unit on the central fuselage section, a Flap Actuator, torque tubes and screwjacks for the extension and retraction of the Wing Flaps.
The flap actuator comprises a brushless synchromotor, powered by the flap control unit, and a reduction gear box for the operation of the flap screwjacks.
The flap control unit incorporates also the flap position switches which transmits flaps position to the front and rear flap position indicators.
A flap position multiplier relay, on the flap (DOWN) lowering circuit, provides, through the landing gear position microswitch, a warning signal to the landing gear warning circuit when the flap levers are in DOWN position and the landing gear up lock.

AIRCRAFT TRIM CONTROLS

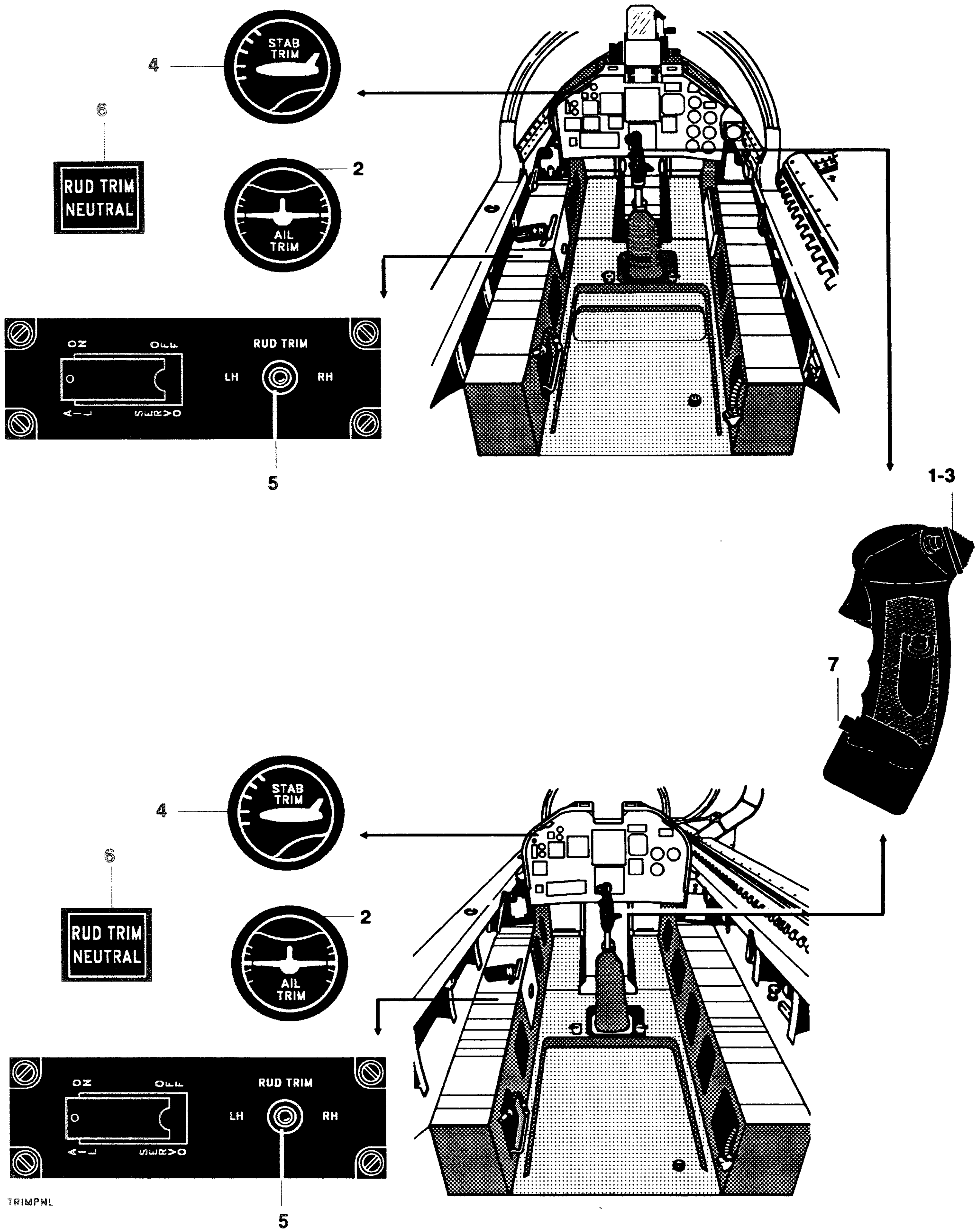


Figure 1-22. (Sheet 1 of 2)

AIRCRAFT TRIM CONTROLS

	DESCRIPTION		FUNCTION
1.	Lateral Trim (spring loaded switch)	Left or Right	Operates the aileron actuator providing lateral trimming of the aircraft.
2.	AIL TRIM Position Indicators	-	Provides, through the miniature aircraft, a visual indication of the aileron trim setting.
3.	Longitudinal Trim spring loaded switch	Fwd (Nose down) or aft (Nose-up)	Operate the stabilizer actuator providing longitudinal trimming of the aircraft.
4.	STAB TRIM Indicators	-	Provides through the miniature aircraft, an indication of stabilizer setting in the nose-up or nose-down direction .
5.	RUD TRIM NEUTRAL spring loaded switches	LH or RH	Operate the rudder actuator providing directional trimming of the aircraft.
6.	RUD TRIM NEUTRAL position indicating lights	On	Indicate that the rudder is set to the neutral position. **NOTE** The indicating lights illuminate only when the aircraft is on the ground (Main gear shock struts compressed).
7.	Stabilizer Trim Control .	At rest	Allows 28 VDC power supply to the stabilizer actuator.
	circuit cut-out switch (front and rear control stick grip)	Pushed	Removes 28 VDC power from the stabilizer trim actuator. (Self-latching) **NOTE** To reset the system pull out then in the STAB TRIM circuit breaker .

Figure 1-22. (Sheet 2)

A Flap Bite Indicator, on the External Breaker and Bite Panel, provides an indication of correct flap control unit operation. The bite changes in status when an overtemperature condition is sensed by the Flap Control Unit.
The flap control circuit is powered by the NORM BUS through the FLAP circuit breaker on the External Breaker and Bite Panel.
The flap position indicating circuit is powered by the ESS BUS through the SURF IND circuit breaker on the Circuit Breaker Panel of the left front console.
For wing flaps controls and indicators description see figure 1-24.

SPEED BRAKE SYSTEM

An electrically controlled, hydraulic actuated speed brake is mounted under the fuselage central section. The system (See figure 1-25) consists mainly of a Hydraulic Flow Regulator on the hydraulic power supply line, a Speed Brake Solenoid Valve controlled by two speed brake switches on front and rear throttle levers, Retraction and Extension Relays, Speed Brake Actuator, Speed brake Panel and Speed Brake Position Indicator.

The hydraulic flow regulator provides a constant rate of flow to the solenoid valve at any hydraulic pump operating speed.

Speed brake extension or retraction is accomplished by maintaining the switch forward to retract and aft to extend as desired. The pilot and copilot switches are spring loaded to the center position and electrically interlocked to prevent simultaneous extend and retract commands. Surface will not move under simultaneous opposing deflection.

A speed brake retracted position retaining circuit (speed brake up-locked) is provided to prevent partial unwanted speed brake extension during flight. With the speed brake up-locked, the circuit energizes the speed brake solenoid valve which applies hydraulic pressure to the retraction line of the speed brake actuator.

The speed brake position is transmitted to the speed brake indicators by a position transmitter (potentiometer) operated by the speed brake actuator control rod.

The speed brake opens in about 4 seconds and closes in about 2.5 seconds.

The speed brake can be positioned as desired, in all intermediate positions.

The maximum extended position is 37 degrees.

The speed brake control is powered by the EXTERNAL NORM Bus through the AIR BRAKE LOCK circuit breaker.

In case of hydraulic failure, the speed brake can be retracted by aerodynamic loads.

For speed brake controls description and illustration see figure 1-26.

WING FLAPS SYSTEM SCHEMATIC

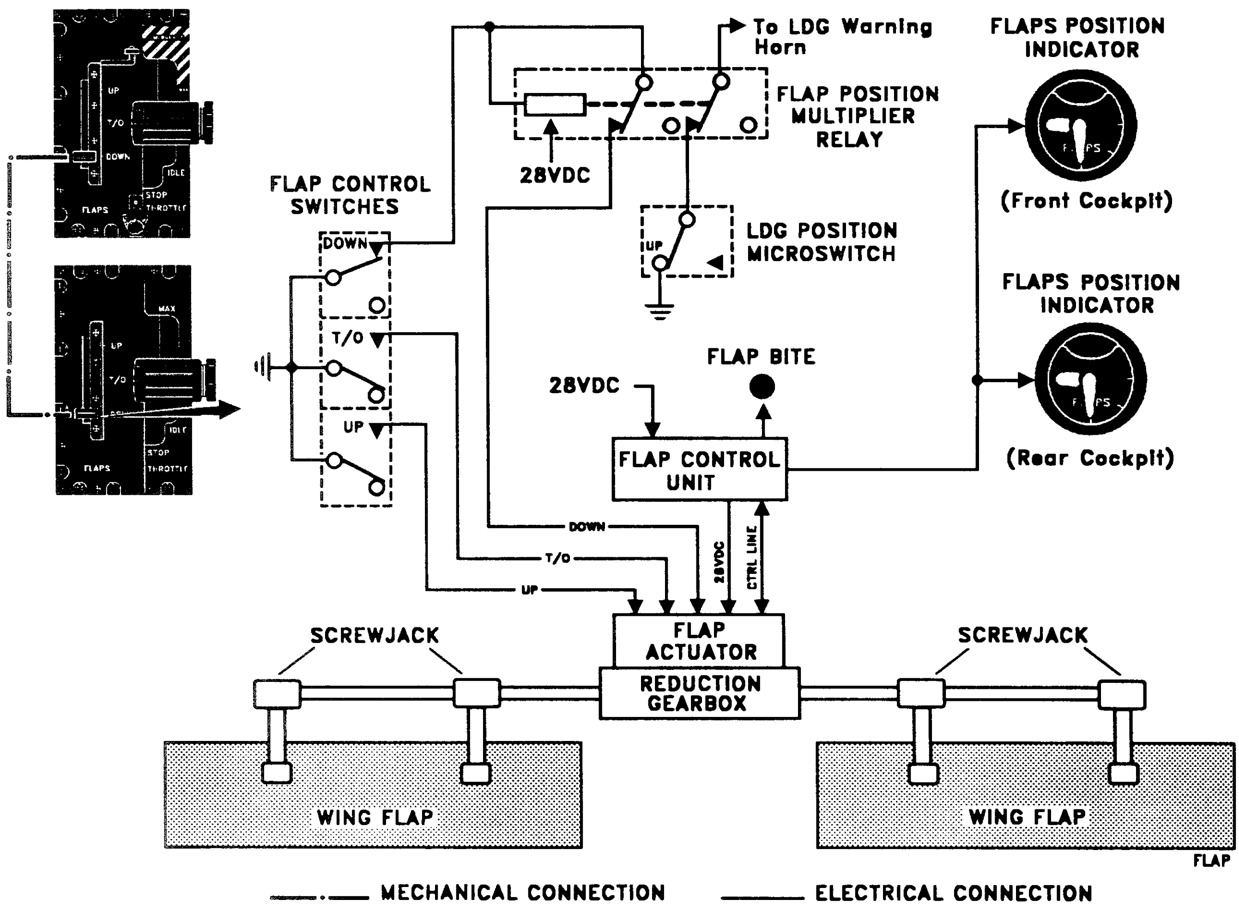
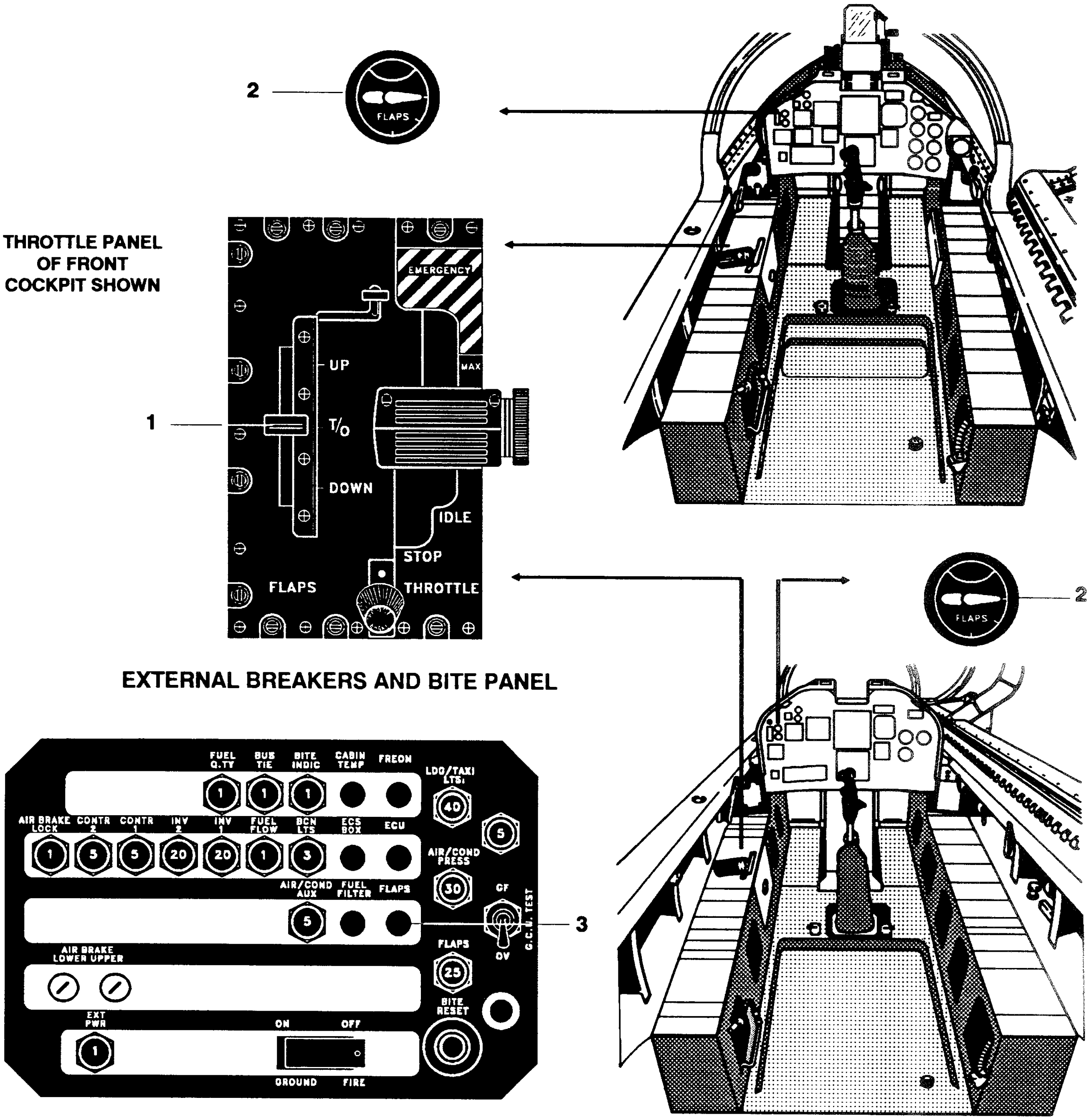


Figure 1-23.

WING FLAPS CONTROLS AND INDICATORS



DESCRIPTION		FUNCTION
1. *FLAPS* control handle	*UP*	The wing flaps retract to the full up position.
	T/O	The wing flaps are set to take-off position. (22°)
	DOWN	The wing flaps extend to the fully down position. (35°)
2. *FLAPS* position indicator	First Mark	Indicates that the wing flaps are in up position.
	Second Mark	Indicates that the wing flaps are in T/O position.
	Third Mark	Indicates that the wing flaps are in DOWN position.
3. *FLAPS* bite *	White	Indicate that an overtemperature condition has been sensed by the Electronic Control Unit.
	Black	Normal operating conditions.

* On external breakers and bites panel

Figure 1-24.

SPEED BRAKE SYSTEM SCHEMATIC

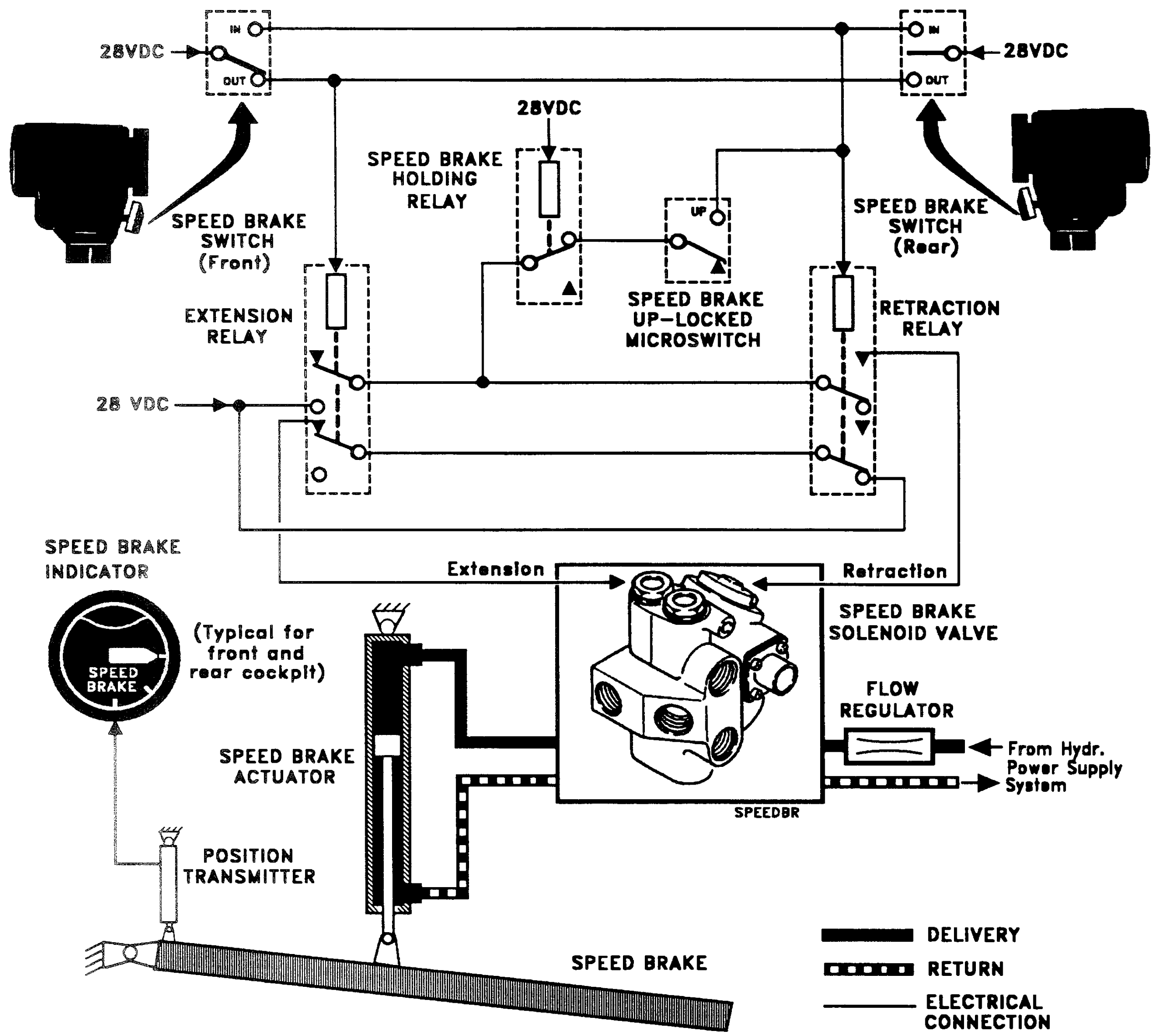
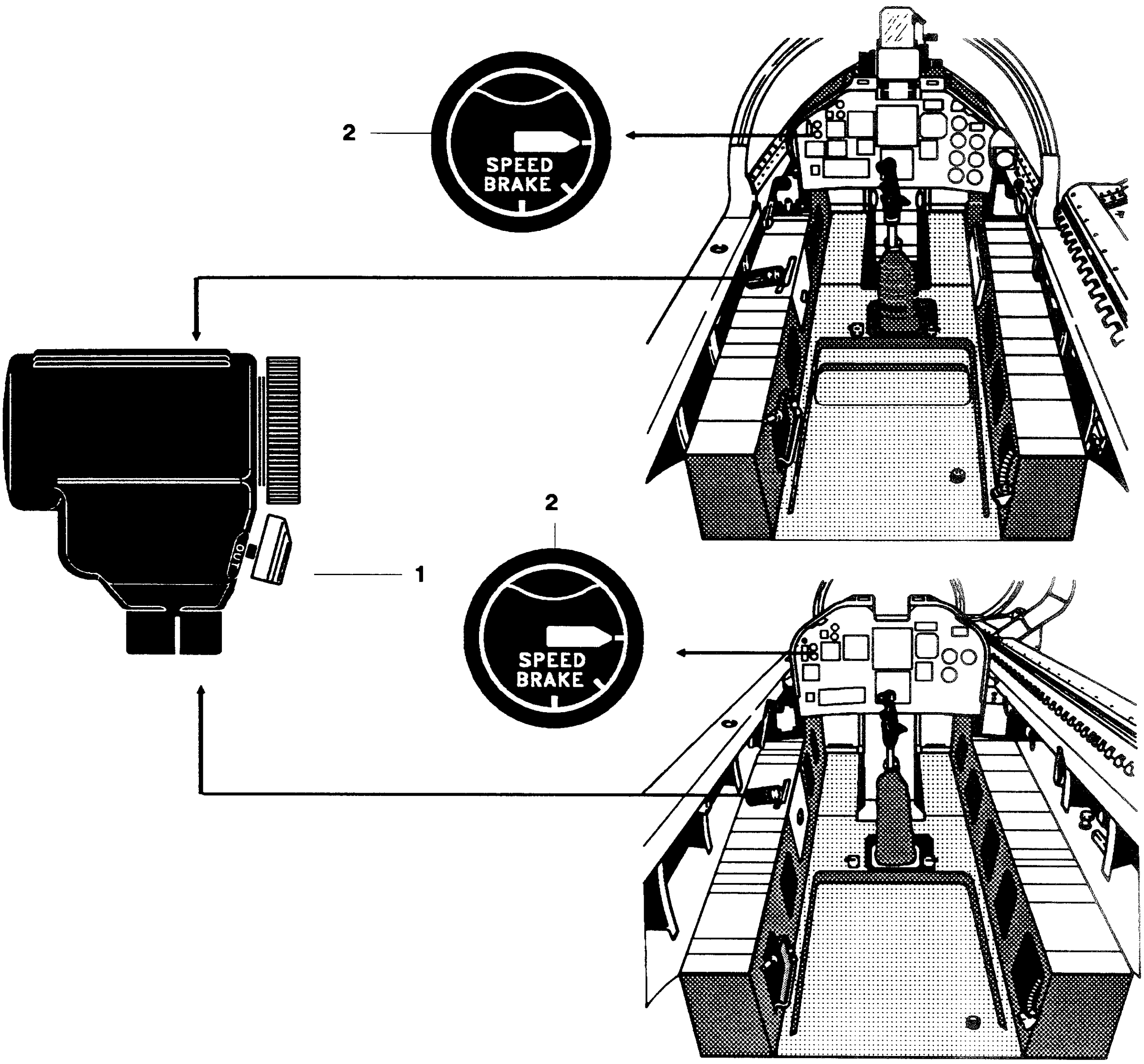


Figure 1-25.

SPEED BRAKE CONTROLS AND INDICATORS



	DESCRIPTION		FUNCTION
1.	Speed brake control switches (Thumb operated momentary)	Aft	Applies electrical POWER to the solenoid valve and extends the speed brake through the hydraulic operated speed brake actuator. The speed brake extends as long as switch(es) is held in the aft position. (Max fully extension time about 4 sec.)
		Center	Removes electrical power from the solenoid valve, stops the speed brake actuator and maintains the selected position.
		Forward	Applies electrical power to the solenoid valve to hydraulically retract the speed brake through the speed brake actuator. (Max speed brake retraction time about 2.5 seconds).
2.	SPEED BRAKE position indicator(s)	-	Indicate(s) the actual position of the speed brake between the fully retracted (1st mark and the fully extended (3rd mark) positions.

Figure 1-26.

PITOT-STATIC SYSTEM

The pitot-static system (see figure 1-27) operates the air speed-mach indicators, the altimeters and the vertical speed indicators.
The pitot heads are mounted on the left and right side of the upper fuselage nose.
Static ports are mounted on the left and right sides of the fuselage nose. Left and right side ports control respectively front and rear cockpit instruments.
The pitot tubes can be electrically heated to prevent ice formation through a PITOT ANTI-ICE switch mounted on the right front console.
Electrical power for the operation of the pitot anti-ice circuit is provided by the ESS BUS via PITOT A/I circuit breakers mounted on the right front and right rear consoles. (One for each pitot probe).

FLIGHT INSTRUMENTS

AIRSPEED MACH INDICATOR

The airspeed-mach indicator (see figure 1-28) provides simultaneous indications of airspeed, mach number and maximum allowable speed and mach number.
Differential pressure is applied to the indicated airspeed diaphragm which transmits its motion to the indicated airspeed index, this index sticks out from a disc rotating over a fixed dial.
Static pressure, applied within the case, acts on the aneroid diaphragm which moves a rotating subdial which is visible through a window on the indicated airspeed index disc.
The indication of the index disc on the subdial gives the mach number at which the aircraft is flying. The indication of maximum allowable speed is given by a warning pointer with respect to both the fixed dial and to the subdial.
The warning pointer is permanently connected to the mach number mechanism by means of a differential gearing system and accurately follows the movement of the mach number subdial except when a stop, which is attached to the case, hinders the movement to give the maximum allowable indicated speed.
The indicated airspeed index disc must never travel beyond the maximum allowable pointer.
The instrument is provided with an index marker actuated by a setting knob on the front of instrument and is integrally lighted.

ALTIMETERS

A standard differential pressure counter-pointer altimeters (see figure 1-28) is installed on the front and rear instrument panels, both connected to static air system. Each instrument is provided with a millibar barometric scale. Each altimeter includes a vibrator, which smoothes the pointer movement.
The altimeter on the front instrument panel includes the encoding equipment to supply altitude information to the ATC System.
A cabin altimeter, on the front cockpit, indicates cabin pressure in terms of pressure altitude from 0 to 50,000 feet (See ECS system)

VERTICAL SPEED INDICATORS

A vertical speed indicator (see figure 1-28), one on each instrument panel, indicates the aircraft vertical speed in feet per minutes. The indicator dial is calibrated from 0 to 6,000 ft/min both up and down. The indicators are connected to static air pressure system.

ACCELEROMETER

The accelerometer provides indication of 'normal" accelerations (loads along the vertical axis of the aircraft) expressed in g units.
In addition to the conventional main pointer, the instrument incorporates two recording pointers (one for the positive g and one for the negative g). The recording pointers remain in the maximum travel positions reached by the main pointer to give an indication of the greatest accelerations the aircraft has undergone.
The recording pointers can be reset to normal (1 g) position by pressing the knob on the lower left side of the instrument.

CLOCK

A clock is mounted on both instrument panels. A knurled knob in the lower left corner is used to wind the clock, when in the normal position, whilst in the pulled position it sets the clock hands. The instrument contains an elapsed time mechanism using two hands, one for the minutes and one for the seconds.
A knob on the upper right of the instrument is used to start, stop and return the elapsed time mechanism to the initial position (chronometer function).

MAGNETIC COMPASS (STBY)

The standby magnetic compass is mounted on a support above the right auxiliary console in the front cockpit. The magnetic compass provides a visual indication of the aircraft heading in relation to the magnetic north.

ATTITUDE INDICATOR

The attitude indicator AI-297 (see figure 1-29) is a five inches integrally lit instrument, composed of an attitude indicator and by a turn and slip indicator, which provide pitch and roll information and turn and slip indications. The attitude display consists of a servo driven sphere, miniature aircraft, a bank-angle dial, bank angle index, power off flag and a pitch trim knob.

PITOT STATIC SYSTEM SCHEMATIC

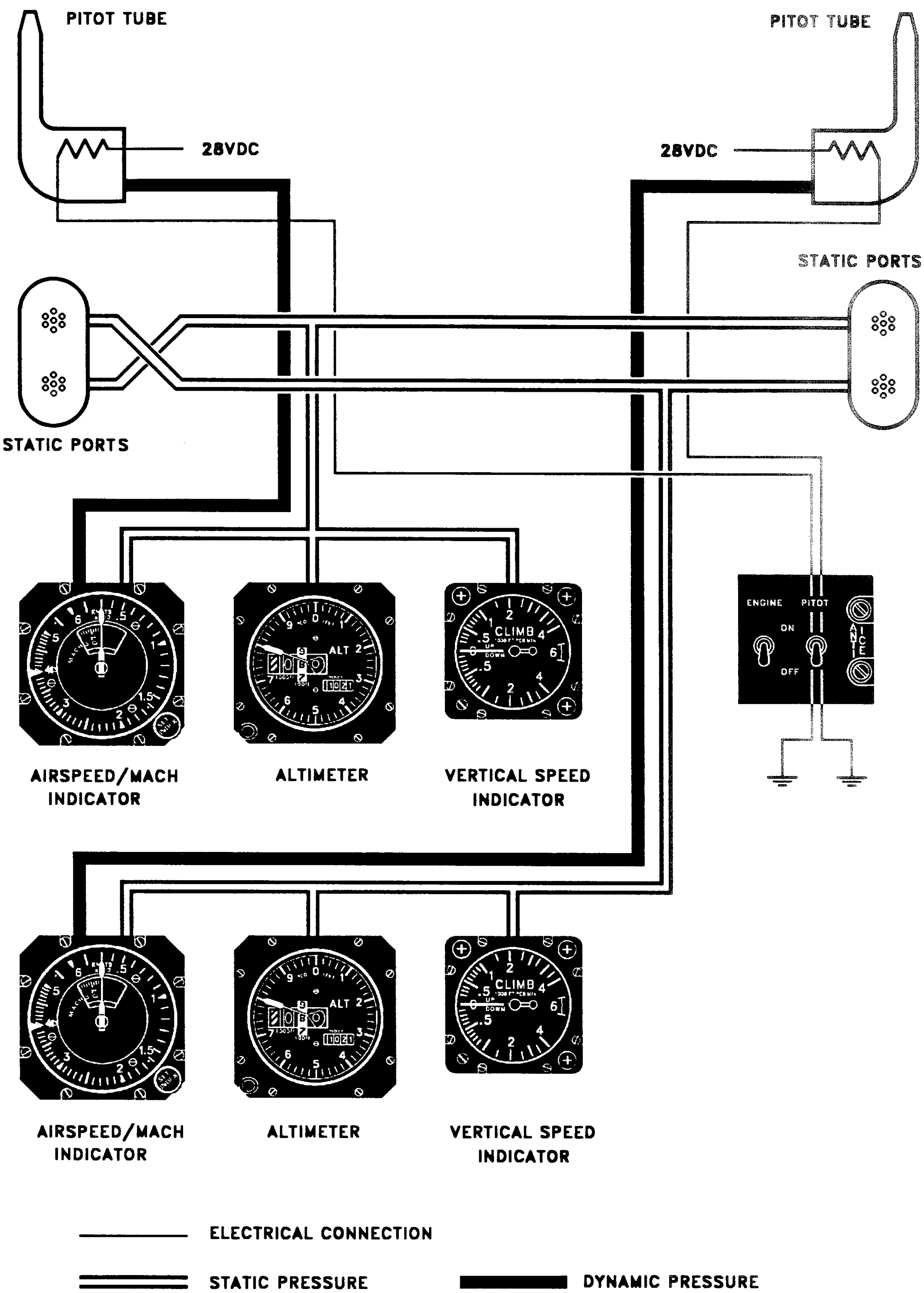


Figure 1-27.

FLIGHT INSTRUMENTS

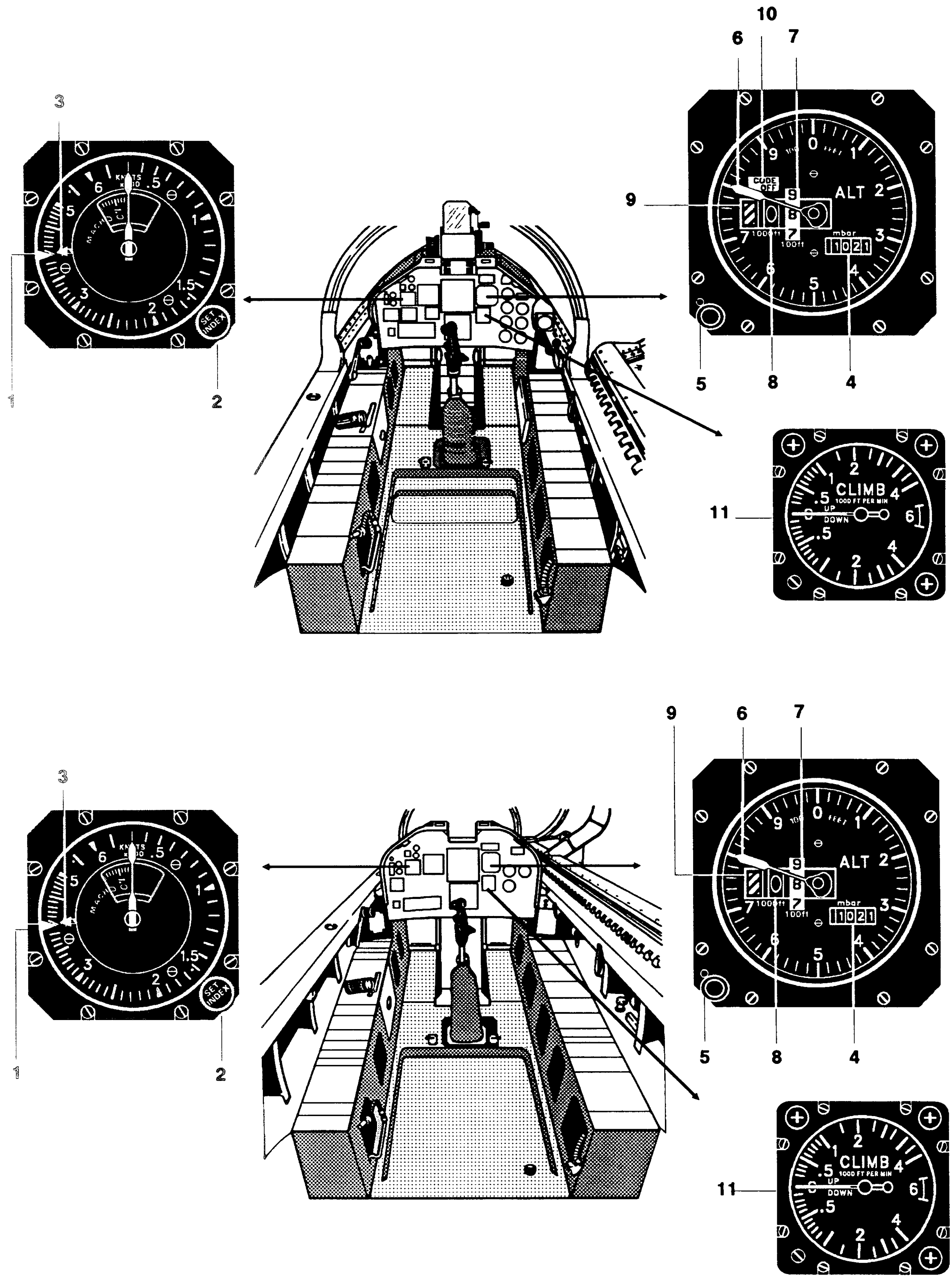


Figure 1-28. (Sheet 2)

FLIGHT INSTRUMENTS

DESCRIPTION			FUNCTION
1.	Setting pointer	-	Selects by means of the set index knob (2) a desired airspeed value
2.	SET INDEX knob	-	Sets the setting pointer (1) to the desired airspeed value.
3.	Maximum Allowable Airspeed-Mach pointer	-	Indicates maximum allowable airspeed/mach No.
4.	Barometric scale readout	-	Shows barometric pressure as selected by the barometric pressure set knob.
5.	Barometric pressure set knob	Rotated	Selects required barometric pressure.
6.	100 foot pointer	-	Indicates hundreds of feet altitude in 20 foot increments.
7.	100 foot counter	-	Indicates hundreds of feet altitude. The drum counter is graduated from 0 to 9 and rotates simultaneously with movement of the 100 foot pointer.
8.	1,000 foot counter	-	Indicates thousands of feet altitude.
9.	10,000 foot counter	-	Indicates tens of thousand of feet altitude.
10.	Encoder flag	CODE OFF	Encoder altimeter not associated to ATC transponder.
		Flag not in view	The encoder altimeter transmits coded altitude information through the ATC transponder.
11.	Rate of climb indicator	-	Displays vertical velocity.

Figure 1-28. (Sheet 2)

The servo driven sphere has full freedom about two axes and indicates the roll and pitch attitudes with respect to the miniature aircraft.
The artificial horizon on sphere is referenced to the earth's horizon by signals from vertical gyroscope of the AHRS system. A pitch trim knob, on the lower right side of the indicator face, allows zeroing indicator relatively to the pitch attitude.
The power off warning flag is visible at lower left side of display any time the indicator has insufficient power to operate.
Turn and slip indications are displayed by a turn needle and an inclinometer. Turn needle rate information is obtained from gyroscope of the AHRS system.
The attitude indicator is powered by 115 VAC bus bar via AI circuit breaker.

Operation

Operation of the attitude indicator is provided by the vertical gyro of the AHRS system.
The aircraft attitude is shown accurately through ±90 degrees of roll and ±82 degrees of pitch. Pitch and roll attitudes are shown by the circular motion of a sphere displayed as background for the fixed miniature reference aircraft.
The horizon is represented on the sphere by a solid line, the sky by a light gray area and the earth by a dull black area.
Horizontal markings with 5 degrees increments on the face of the sphere show accurate aircraft attitudes up to 82 degrees of climb or dive.
Bank angles are read with 10 degrees increments on a semicircular bank scale on the upper half of the instrument.
The adjustment knob electrically rotates the sphere in relation to the fixed miniature reference aircraft to correct the pitch attitude changes.
The window in the lower left corner of the instruments shows "OFF" whenever the instrument is not operating or the vertical gyro is out. The "OFF" flag will be in view for about 1 minute during warm-up of the vertical gyro and during fast erection.
Normal erection of the gyroscope occurs automatically while fast erection can only be attained by pushing the "FAST ERECT" switch on the Compass Controller.

CAUTION

In case of high gyroscope misalignement, several "FAST ERECT" cycles may be required to obtain a correct attitude indicators alignment.

STDBY ATTITUDE INDICATOR

The AG-5 attitude indicator (see figure 1-29) provides an independent alternate attitude information in case of malfunction or failure of the Attitude Indicator.
The indicator, powered by the 28VDC Essential Bus through the STBY A/IND circuit breaker, provides accurate aircraft attitude through ±90 degrees of roll and pitch.
The indicator consists of a gyroscope connected to a sphere which carries a horizon line, etched pitch graduation and a roll index.
The sphere is divided into a grey (sky) and a black (earth) sector. A horizon line is provided in the centre where the two colors meet. Dive and climb angles are marked on the sphere at 5 degrees intervals.
The angle of roll is shown by the position of the index with respect to a scale fixed to the frame of the indicator.
The miniature aircraft, gives an immediate and countinous indication of the flight attitude with reference to a plane parallel to the sphere.
The small knob on the lower right side of the dial is used for centering the gyroscope; centering is performed by means of the PULL TO CAGE knob in the front of the instrument.
The instrument is fitted with an alarm flag (OFF) that is brought into view in case of malfunction or any time the indicator has insufficient power to operate or the pilot operates the caging knob.
Pitch angle reference may be varied by rotating the caging knob. The reference mark are spaced 5 degrees in dive and climb from the zero position.
Following loss of electrical power, attitude indicator information remain available for about 1 minute depending on flight manoeuvers the aircraft is performing.

FATIGUEMETER SYSTEM (Only on ACFT S/N 053 and 054)

The fatiguemeter, installed on the bottom of fuselage structure (between frame FS 5821 and FS 6160) is provided to monitor the acceleration vertical to the flight path and to record the number of times each of the selected acceleration is exceeded.
The system is powered by the External Essential bus through a circuit breaker installed on the External Breaker and Bite Panel.

WARNING /CAUTION SYSTEMS

The system (see figure 1-30) consists of warning and caution lights which enable the pilot to monitor the condition of the aircraft systems and components.
All lights, grouped on the caution panels, may be tested together by means of a three position WARN TEST switch, spring loaded to center position, on the right side of the instrument panel in each cockpit.
The caution and warning light intensity can be adjusted by means of a potentiometer labeled WARN PUSH BUT on the INT LTS control panels.

NOTE

During day flight and for testing procedures the WARN PUSH BUT potentiometer should be set in the BRT position (maximum brightness).

WARNING LIGHTS

The red warning lights come on to indicate a dangerous condition requiring immediate corrective action.
The warning lights are as follows:
- CANOPY
- CAB PRESS
- OXY LOW
- BATT HOT
- FIRE

All lights are on the caution panel, excepts the FIRE warning lights, which are on the right side of the front and rear glareshields. A warning light, combined with an audible signal fed into the headset, is also incorporated in the landing gear lever grip.
For warning lights description and function refer to the relevant systems and to figure 3-7. "EMERGENCY PROCEDURES".

CAUTION LIGHTS

The yellow caution lights, on the caution panel, come on to indicate a defective condition requiring pilot's attention but not necessarily immediate corrective action.
The malfunction indicated by a caution light does not affect the aircraft safety and, in some instances, can be eliminated in flight by the pilot. The caution light will however remain on until the problem is corrected. The caution lights are powered by the 28 VDC essential bus via INT LTS circuit breaker and dimming devices. For caution light description and function refer to relevant system or to figure 3-8. "EMERGENCY PROCEDURES".

MASTER CAUTION LIGHT

Two MASTER CAUTION lights, one in each cockpit, come on whenever a warning or caution light , in the associated caution panel, is on.
Resetting of the system is obtained by pressing the MASTER CAUTION light: the MASTER CAUTION light goes out and is ready to detect other system failures, while the warning/caution light, on the caution panel remains on, if the failure persists, or goes out if the failure was only due to a momentary fault.

CAUTION TONE GENERATOR SYSTEM

The system consists of an audio tone control unit

AI AND STBY ATTITUDE INDICATORS

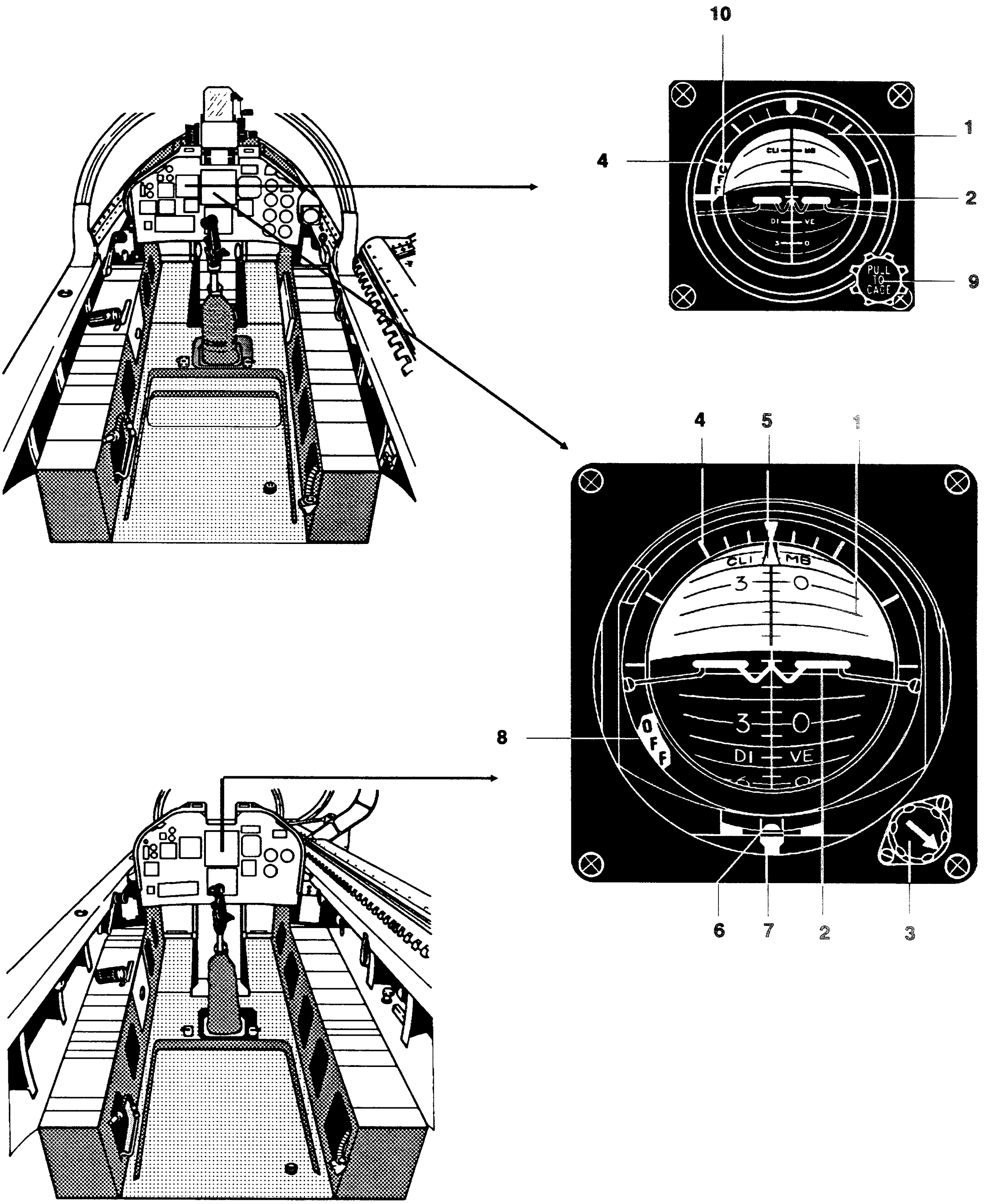


Figure 1-29. (Sheet 1 of 2)

AI AND STBY ATTITUDE INDICATORS

DESCRIPTION			FUNCTION
1.	Sphere	-	Used together with the miniature aircraft to indicate the aircraft attitude with respect to the horizon bar.
2.	Miniature aircraft	-	Used together with the sphere to indicate the aircraft attitude with respect to the horizon.
3.	Pitch trim knob	-	Adjust in pitch the position of the horizon line on the instrument.
4.	Bank angle dial and scale	-	Provides an indication of the bank angle of the aircraft. (Bank scale: 10-20-30-60-90 degrees).
5.	Bank index	-	Indicates the bank angle on the bank scale.
6.	Slip indicator	-	Indicates, when the ball is not centered, that the aircraft manoeuver is not correctly coordinated (yaw or side slip).
7.	Rate of turn indicator	-	Indicates the rate of turn of the aircraft around the vertical axis.
8.	OFF flag	In view	Indicates that the AI is unreliable due to failure, or momentarily, because an erection cycle is taking place.
9.	PULL TO CAGE knob	Rotated	Adjust in pitch the position of the miniature aircraft against the horizon line.
		Pulled	Permits fast erection of the gyro to restore the level flight indication.
10.	OFF flag	In view	Indicates that STBYattitude indicator is unreliable due to failure or lack of power supply.
11.	Horizon Bar	-	Indicates the azimuth attitude of the aircraft against the fixed aircraft symbol.
12.	Heading Indicator	-	Indicates the aircraft heading against the lubber line.

Figure 1-29. (Sheet 2)

connected to the landing gear/throttle position circuit, which provides an audible tone, in the headsets, to warn the pilots of a peculiar flight condition.
The system may be tested by means of the TONE TEST spring loaded switch installed on the right side of the front auxiliary console.

ACCESS TO COCKPIT

Normal access to front and rear cockpit is gained by means of an access step provided on the left side of the fuselage (see figure 1-31).

CANOPY

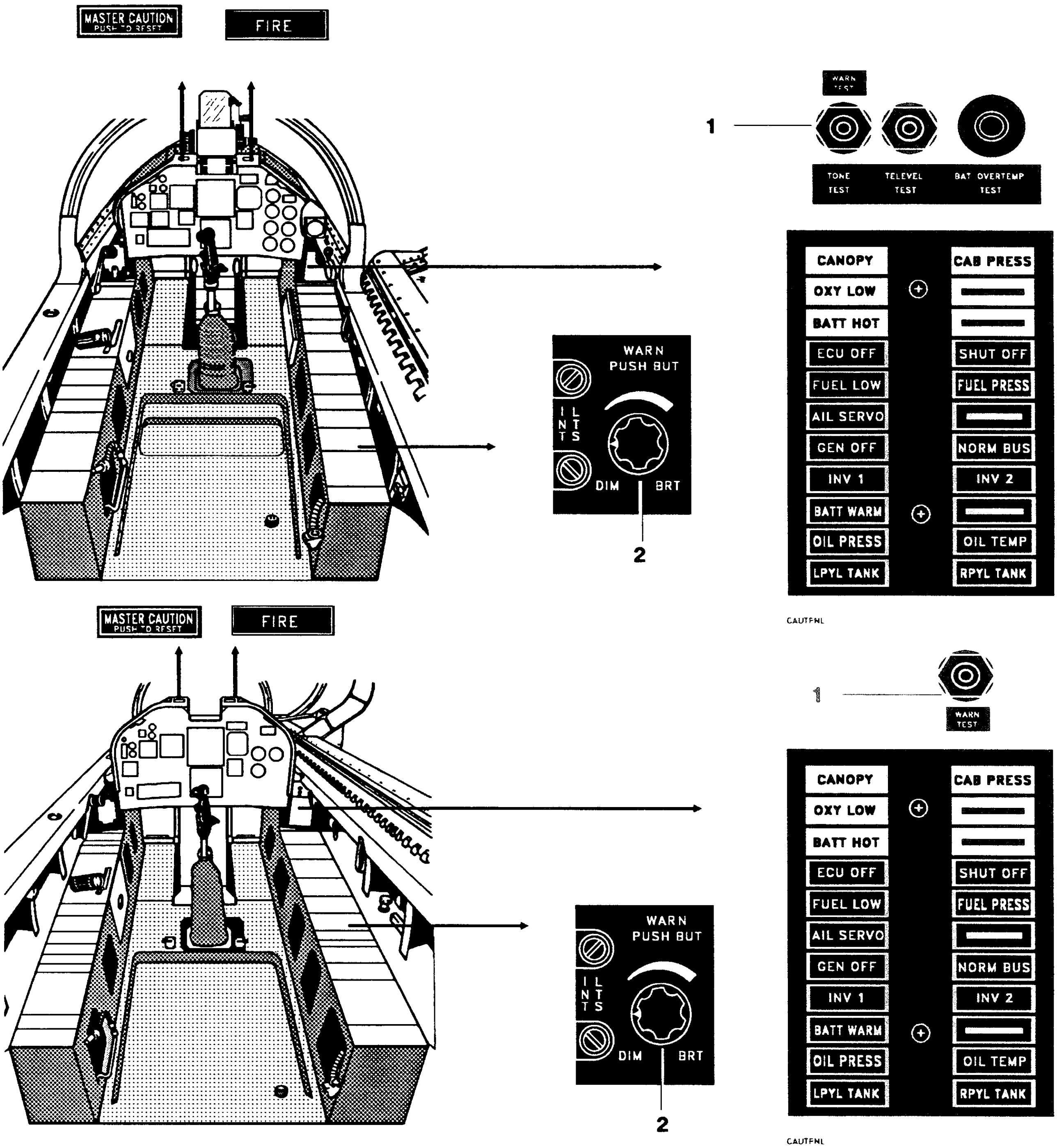
The canopy consists of a transparent enclosure covering the pilot's stations, which is hinged at the cabin right side.
The canopy is balanced by a jack and is operated manually. When the canopy is opened, the same jack provides the opening travel limit.
To ensure cabin airtightness, the canopy is fitted, all along its perimeter, with a pneumatic seal.
For canopy seal operation refer to CABIN SEALING paragraph.
A CANOPY warning light, on the caution panel, comes on when the canopy is not closed and locked.
The canopy is divided in two parts by a second windshield which isolates the two pilot's cockpits.
The two sections of the enclosure can be cut along their periphery by an explosive cord that must be detonated, only on the ground, by either pilot or by the ground crew whenever canopy opening by normal means is prevented.
The canopy normal controls are described and illustrated in figure 1-31.

CANOPY OPERATION

Unlocking and Opening from the Outside

To open the canopy from the outside rotate dow-

WARNING AND CAUTION LIGHTS



	DESCRIPTION		FUNCTION
1.	*WARN TEST TONE TEST* switch	*WARN TEST*	Provides a self test of the warning and caution lights and associated circuit.
		TONE TEST	Provides a self test of the tone generation circuit.
2.	*WARN PUSH BUT* potentiometer	*DIM*	Warning and caution lights operating in dim light.
		BRT	Warning and caution lights operating in bright light.
		Pulled (switched on)	Causes bright illumination of warning and caution lights (the potentiometer is cut-out).

Figure 1-30.

CANOPY CONTROLS LOCATION

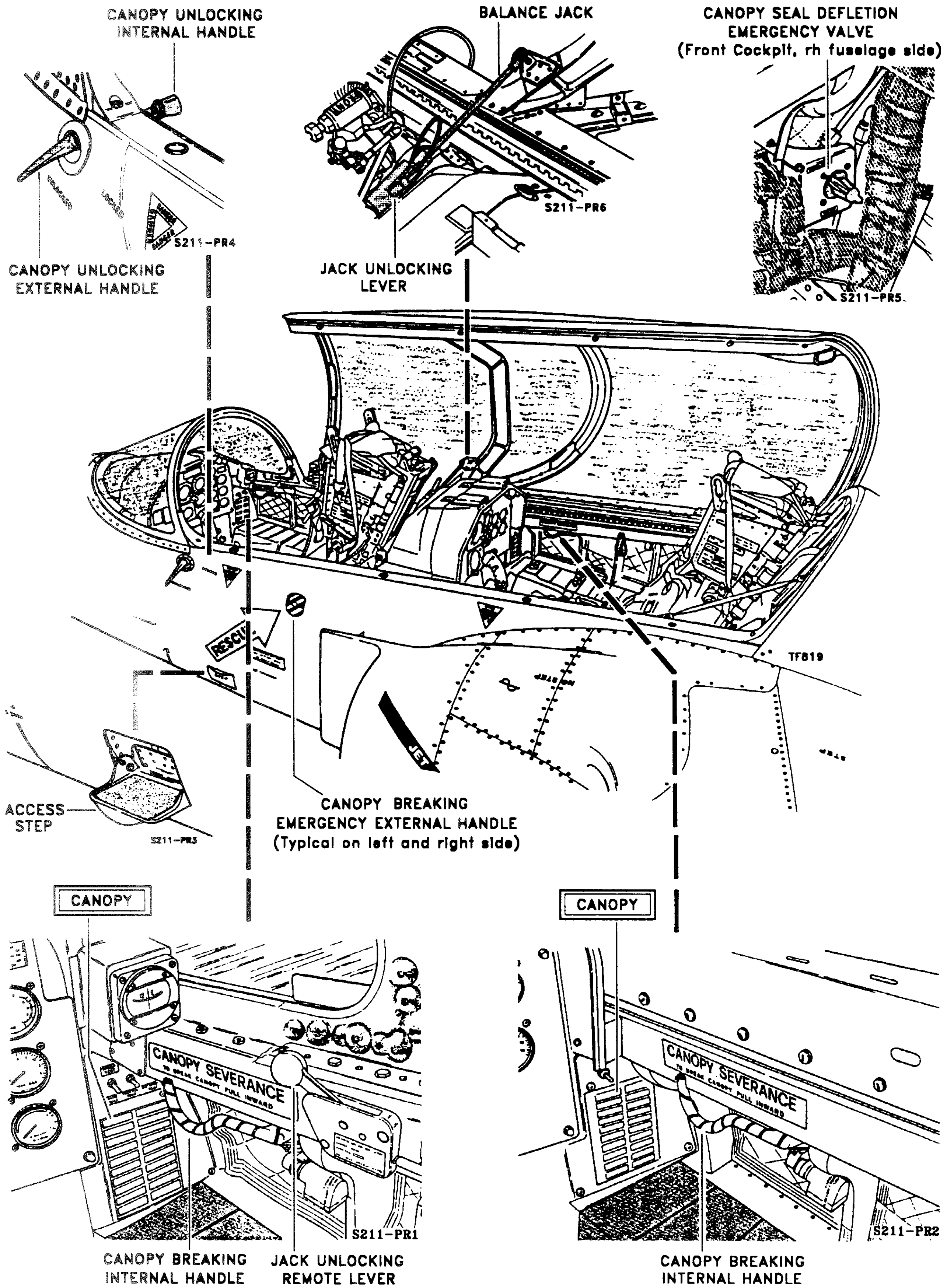


Figure 1-31.

nward the canopy external handle. This action releases the four canopy latches and the canopy can be pushed upwards and taken to the full open position. The canopy will then be locked in the open position by the balance jack.

Unlocking and Opening from the Inside

Pull the canopy internal handle rearward. Grasp the canopy fixed internal handle and open the canopy by taking it to the full open position.

Closing and Locking from the Outside

Release the canopy from its open position by directly pulling the jack unlocking remote lever in the front cockpit or pushing the jack unlocking lever on the balance jack. Lower the canopy and lock it by rotating upward the canopy external handle.

Closing and Locking from the Inside

Pull the jack unlocking remote lever and close the canopy by means of the fixed internal handle.
When the canopy lean against the sill, close the canopy internal handle. Locking occurs in the last portion of the travel.
When the canopy is locked, the CANOPY warning light will go out to advise that the canopy is properly closed and locked.

TRANSPARENCY BREAKING ON THE GROUND

Breaking of the canopy transparent from inside the cabin is obtained by pulling either one of two CANOPY SEVERANCE safety wired handles located on the right canopy frame of each cockpit.
This operation initiates and detonates the explosive cord, which cuts the transparency of both canopy sections.
Canopy breaking can also be obtained by the ground personnel by opening one of the two doors located on the fuselage sides and by pulling the cable handle attached to each door.

CAUTION

Both interior handles, secured with a safety wire, must be pulled only in emergency conditions on the ground, when the canopy cannot be unlocked and opened by the normal controls. These handles must not be pulled in flight.

MK IT10LA EJECTION SEAT

Both cockpits are provided with a Martin Baker type IT10LA ejection seat.
The seat is a lightweight fully automatic, cartridge-operated, rocket-assisted ejection seat providing safe escape for various combination of aircraft altitude, speed, flight path and flight attitude within the envelope of zero altitude at zero speed in substantially level altitude at speed up to 600 knots IAS between zero altitude and 50,000 ft.
The seat is ejected through the canopy transparency which is fractured by two breakers mounted on the top of the seat.
Man/seat separation and parachute deployment are fully automatic.

SEAT DESCRIPTION

The seat (See figure 1-32) consists of three main components: the ejection gun, the seat structure and the seat pan.
The ejection gun provides the initial power for seat ejection and the means of attachment of the seat to the aircraft structure.
The seat structure is the frame to which any other seat component is attached and it slides during ejection on the guide rails fitted to the ejection gun. This structure is locked in position on the gun by a latch assembly which unlocks automatically only at time of ejection.
A shaped pack contains the man-carrying parachute and a drogue assembly is secured to the upper part of the structure to form the pilot's headrest and includes the seat harness.
A Harness Retraction Unit is attached to the structure and can be unlocked for forward movement by the occupant. The same unit serves to bring the occupant in the correct pre-ejection posture at the time of ejection.
A Drogue Gun extracts the drogue assembly subsequent to ejection, whilst the automatic sequence for deployment of the main parachute and the separation of the occupant from the seat is ensured by a Barostatic Time Release Unit.
The seat pan accommodating the Personal Survival Pack, is attached to sliding members on the seat structure and its height from the aircraft floor can be adjusted by means of an electrically-powered actuator.
Attached to the underside of the seat pan is a Rocket Pack incorporating two pair of efflux nozzles of different bore to impart divergent trajectory to seats (to left on the front seat, to right on the rear seat) in order to avoid any risk of collision in case of concurrent ejection of the two seats.
A Manual Separation Handle for emergency harness release, is connected to a firing unit which will operate the harness release sequence when fired.
An Emergency Oxygen Cylinder, mounted on the left rear side of the seat pan, is automatically tripped on ejection providing sufficient oxygen to the seat occupant during ejection and before separation from the seat.
Provision is made for manual operation of the emergency oxygen supply, to deliver oxygen for ten minu-

EJECTION SEAT DESCRIPTION

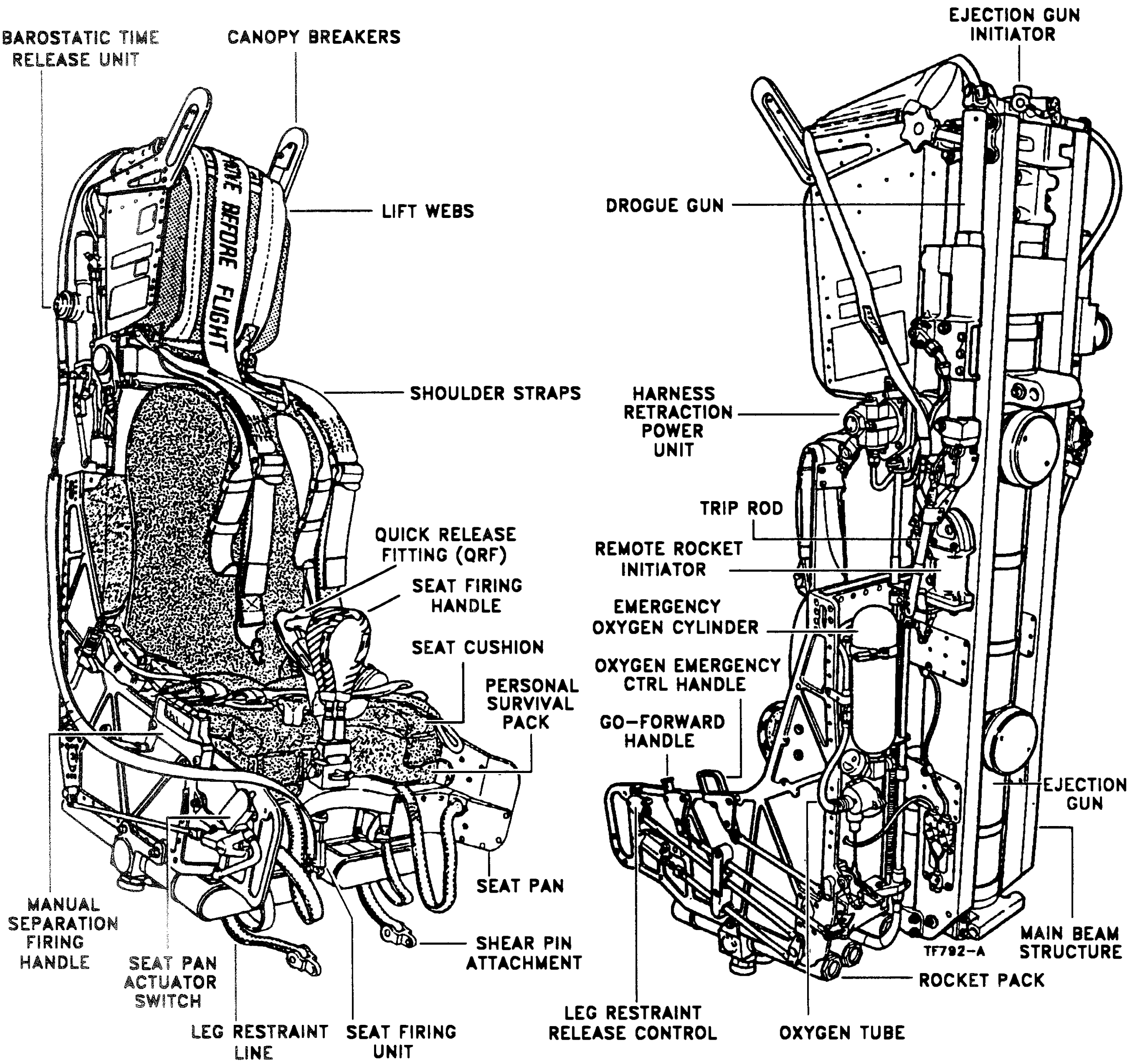


Figure 1-32.

tes, should the aircraft main oxygen system fail.
An automatic leg restraint system is fitted to the seat pan to draw back and restrain the occupant's legs.
Typical peak accelerations experienced by the air-crew during ejection are 19.5 instantaneous "g" at the main gun stroke, and 14.5 sustained "g" following rockets ignition.
For ejection seat controls description and operation see figure 1-33.

SEAT SAFETY PINS

The ejection seat safety pins (see figure 1-34), handled by the ground crew, are six and are located in the firing sears of the following components:
- Seat Firing Unit.
- Seat Firing Handle.
- Remote Rocket Initiator.
- Manual Separation Firing unit.
- Drogue Gun.
- Barostatic Time-Release Unit.

The safety pins, interconnected by a red streamer, are to be removed by the ground crew prior to flight.
The only safety pin handled by the pilots is the ejection seat firing handle pin. Prior to flight, the pilot will remove the pin from the seat and insert it in the special housing located in proximity of the canopy fixed handle.
For removal and insertion of this pin, press the push-button incorporated in the T shaped grip.

EJECTION SEAT OPERATION

Ejection is initiated by pulling the Seat Firing Handle located between the pilot's thighs, on the front of the Seat Pan.
The operation of the handle fires the cartridge of the firing unit, the gas from which is piped to the Ballistic Manifold and then to the Harness Retraction Unit and Ejection Gun Initiator.
The gas piped to Harness Retraction Unit breech fires the cartridge to operate the harness retraction unit drawing the occupant back to the correct posture for ejection.
At the same time the gas reaches the Ejection Gun Initiator where it operates the firing unit which fires the Ejection Gun Primary Cartridge thus ejecting the seat.
The gas pressure developed by the primary cartridge causes the inner and intermediate pistons of the ejection gun to rise releasing the top latch.
The secondary cartridges are fired progressively as the rising pistons expose them to the heat and pressure of the primary cartridge gas.
As the seat ascends the guide rails:
* The canopy breakers shatter the canopy
* The trip rods withdraw the sears from the Drogue Gun and Barostatic Time Release Unit
* The emergency oxygen is tripped
* The main oxygen is disconnected.
* The leg restraint lines tighten to draw back and restrain the occupant's legs. When these lines become taut, the shear rivets in the lower attachment shear and the lines are freed from the floor brackets, the legs being restraint by the snubbing units.

As the ejection seat continues to rise, the static line of the Remote Rocket Initiator becomes taut and withdraws the sear to fire the cartridge as the ejection gun nears the end of its stroke. This fires the cartridge in the rocket pack which ignites the propellant and the rocket pack sustains the upward thrust of the ejection gun. Withdrawal of the drogue gun sear allows the mechanism to function and, after the delay mechanism has operated, the firing pin is released and the cartridge is fired ejecting the piston. The ejected piston withdraws the closure pin securing the outer closure flaps of the parachute pack and deploys the drogue. The drogue, when fully developed, stabilizes and retards the seat and occupant.
On removal of the time-release unit sear and when conditions of height (15,000 FT) and speed are such that the Barostatic or Barostatic controlled g-switch are no longer restraining the mechanism, the unit commences to function. After the time delay has elapsed, the firing pin is released and the cartridge is fired. Gas from the cartridge operates the drogue shackle link piston to free the drogue shackle link and at the same time operates the parachute mechanical lock piston which releases the parachute withdrawal line tie and operates the upper harness locks through the connecting link and lever. Gas also passes to the manual separation breech where it fires the manual separation to operate the lower harness release mechanism releasing the lower harness lugs, negative-g strap and leg restraint lines. The occupant is momentarily held in the seat by the sticker straps. The drogue shackle link piston housing withdraws the parachute from the pack. The parachute, when developed, lifts the occupant and survival pack from the seat pulling the sticker straps and PSP lowering line lugs from their clips. This arrangement ensures that there is no possibility of collision between seat and occupant after separation.
A normal parachute descent follows.
On man/seat separation the survival pack lanyard, being attached to the flying clothing, enables the survival pack to be lowered by operating the plug release connector (Refer to Section III, Emergency Procedure, Para. After Ejection Over Water). On lowering, the pack opens, the liferaft and survival aids withdraws and the empty shall being allowed to fall away.

MANUAL SEPARATION

In case of failure of automatic separation mode, pilot/seat separation can be manually obtained by operating the manual separation firing handle. (Refer to Section III, EMERGENCY PROCEDURES, Para. Manual Separation).

EJECTION SEAT CONTROLS

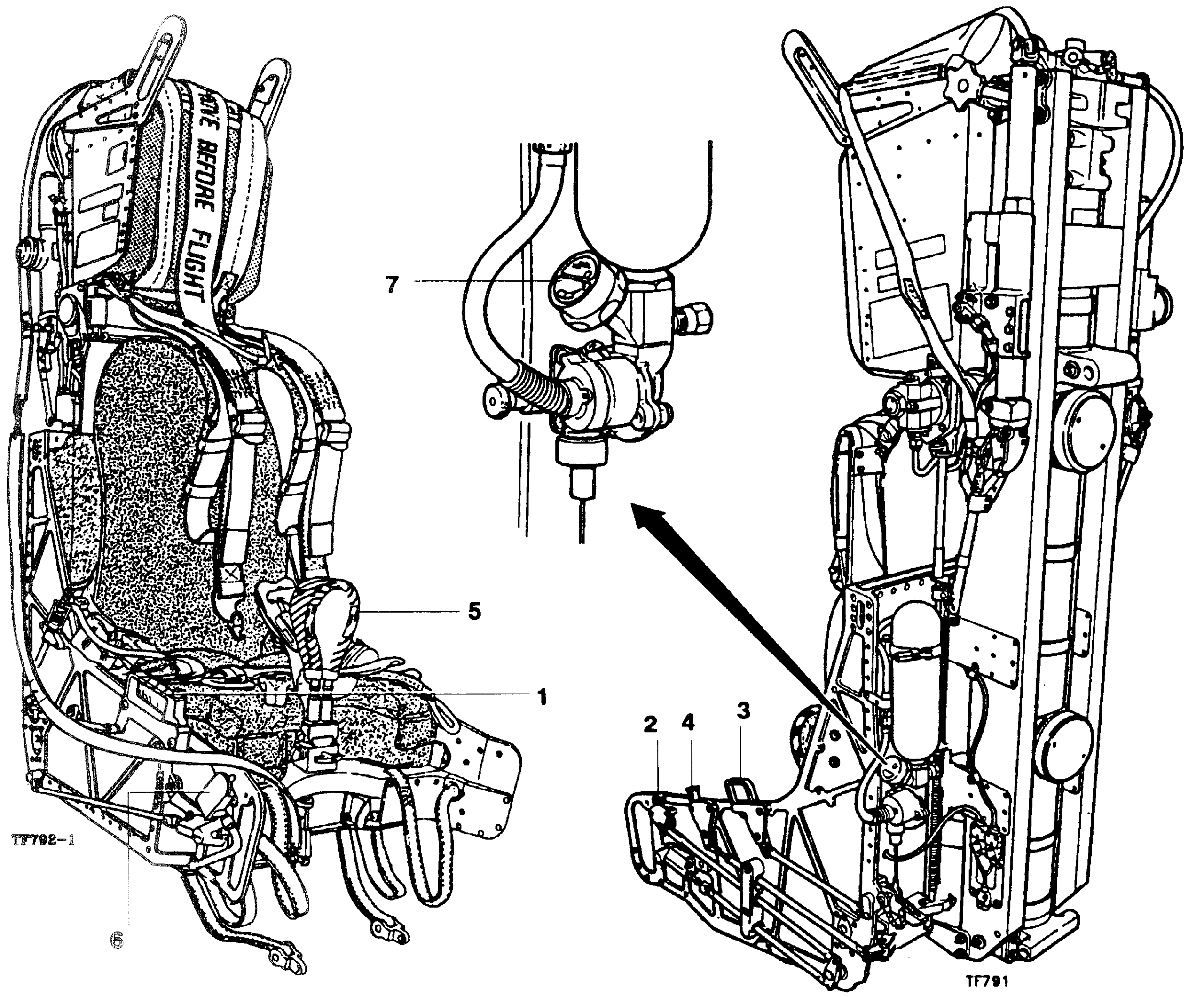


Figure 1-33. (Sheet 1 of 2)

EJECTION SEAT CONTROLS

	DESCRIPTION		FUNCTION
1.	Manual separ. firing handle	Raised after pressing the push button	Permits manual separation of the pilot from seat. **CAUTION** With the seat firing handle in its housing, the separation handle is mechanically locked in rest position. Operation of the separation handle is possible only after actuation of the seat firing handle.
2.	Leg restraint release lever	Pulled aft	Releases the two leg restraint lines from the seat.
3.	Emergency oxygen manual control	Pulled	Fractures the break-off tube in the emergency oxygen cylinder. Oxygen is supplied to the pilot's mask.
4.	Go-forward control handle	Forward	Allows the shoulder harness to slide in both directions. The pilot can lean forward.
		Rearward	Allows the shoulder harness to slide backward only. Once the pilot returns to the rearward position, he cannot lean forward. **NOTE** The handle has two positions and can be moved only after pulling upwards to disengage.
5.	Seat firing handle	Pulled	Causes ejection of the seat.
6.	Seat vertical adjustment switch	UP	Raises the seat pan to provide height adjustment of the pilot's position.
		DOWN	Lowers the seat pan to provide height adjustment of the pilot's position. When released, the switch automatically returns to center, locking the seat in the selected position. **CAUTION** To avoid actuator motor overheating, do not operate it for more than one minute, allowing intervals of at least five minutes.
7.	Emergency Oxygen content gauge	-	Indicates the oxygen quantity contained in the emergency oxygen cylinder.

Figure 1-33. (Sheet 2)

EJECTION SEAT SAFETY PINS LOCATION

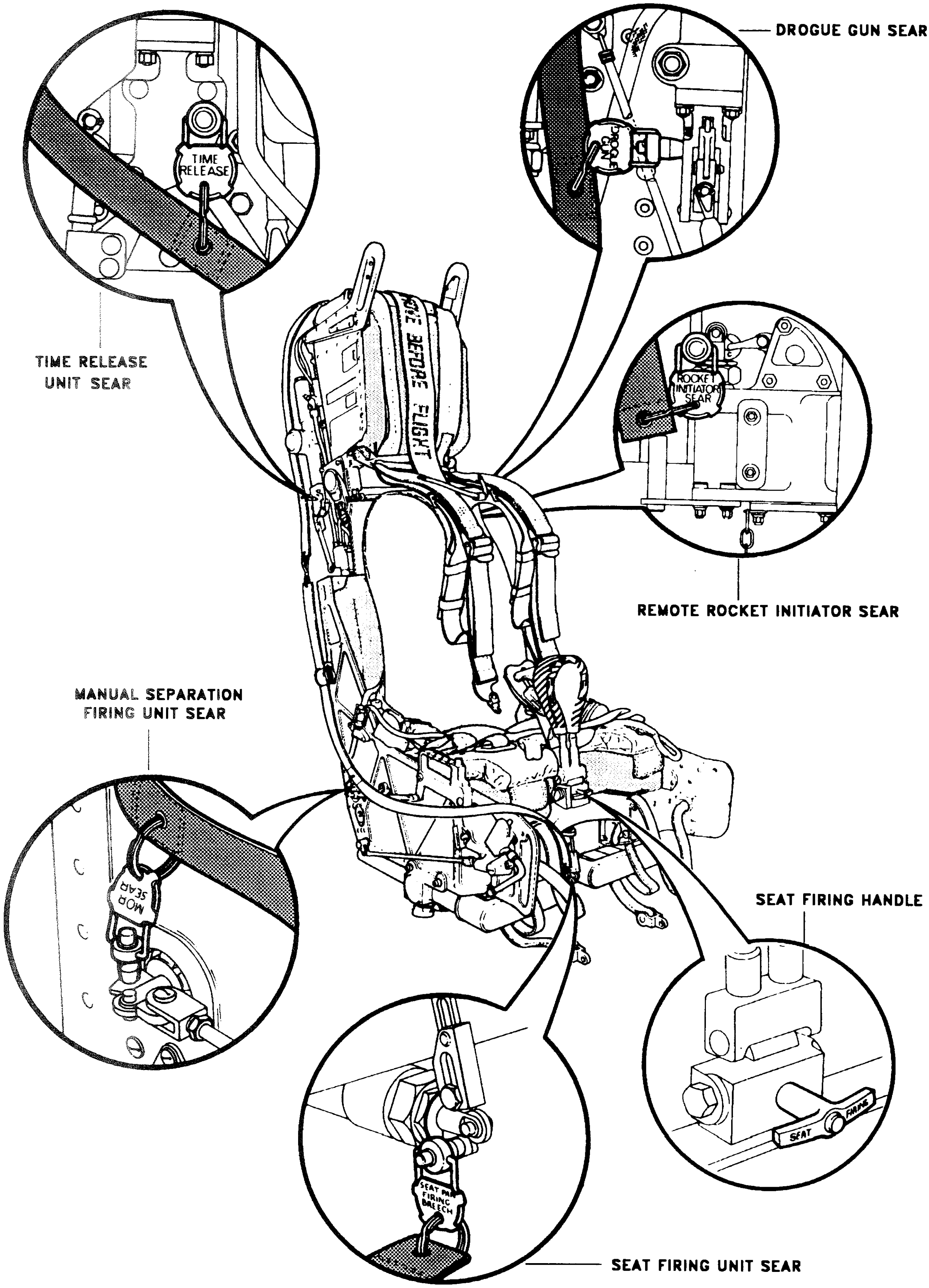


Figure 1-34.

CONDITIONING & PRESSURIZATION SYSTEM

The air conditioning and pressurization system (see figure 1-35) provides temperature controlled and pressure regulated air for cabin heating, ventilating, windshield demisting, canopy sealing and cockpit pressurization.
The charge of hot air for cockpit conditioning and pressurization is obtained directly from the engine compressor.
The temperature of the air delivered into the cockpit is governed by a conditioning package which use refrigerant freon R-12 to cool bleed air and to condition cockpit recirculation air.

AIR-CONDITIONING SYSTEM

The air-conditioning system (See figure 1-35 sheet 1) consists mainly of:
- The conditioning package, on the upper side of the fuselage central section.
- The electronic regulator mounted on the base of the conditioning package which provides automatic temperature control.
- The ECS control panel in the front cockpit to control the system operation.

The system has different mode of operation depending if the aircraft is on ground or definetly airborne.

Ground Operation

Conditioning system, while the aircraft is on ground and with engine at IDLE, is activated by setting the ECS switch to ON. The 28VDC power signal is directly supplied to operate the fans, in the distribution and recirculation duct and, via shock strut microswitch, jet pump cut-off switch and bleed air shut-off switch to open the bleed air and jet pump shut-off valves.
The 28 Vdc power signal is also supplied via freon maximum pressure switch to the electronic regulator which starts to control the temperature of the air delivered into the cockpit.
During ground operation, the charge of hot bleed air is supplied through the bleed air shut-off valve, into the pre-cooler of the conditioning package.
A jet pump in the exhaust duct, operated by bleed air delivered through the jet pump shut-off valve, provides cooling of the bleed air passing through the pre-cooler, by conveying fresh ram air over the freon condenser and pre-cooler.
The jet pump shut-off valve closes when the engine is set to operate above 80% NL. In this conditions, the 28 Vdc power signal to the jet pump is removed by the jet pump cut-off switch mechanically actuated by the HMU lever.
A bleed air shut-off switch, on the precooled air line downstream the pre-cooler, cut-off the bleed air shut-off valve when the temperature of the pre-cooled air is higher then 250°C.
The flow of pre-cooled air is then supplied either to the motorized modulating valve and, through a flow limiter and check valve toward the freon evaporator. At this point, the pre-cooled air, mixed with air exhausted from the cockpit, is drawn over the freon evaporator and supplied into the cockpit by the action of the fans in the distribution duct.
The temperature of the air entering into the cockpit is controlled by the electronic regulator which, through the cabin temperature sensors, compares the temperatures of the air at cabin inlet and outlet and provides output signals to operate the freon circuit or the motorized modulating valve to decrease or increase the temperature of the air delivered into the cockpit depending on the position of AUTO/MAN switch on ECS panel.
Automatic temperature control by the electronic regulator occurs only with the AUTO/MAN switch, on ECS panel, set to AUTO. In this condition, the electronic regulator automatically control the operation of the freon circuit and the motorized modulating valve.
When conditioning air, as sensed in the distribution duct, requires a further cooling, a power signal is supplied to the shut-off valve of the freon hydraulic motor which operates the freon compressor and activates the freon circuit. When activated, gaseous freon, from the compressor, is delivered to the freon condenser where is being cooled and liquifies by the action of the ram air drawn over the condenser by the jet pump operation. Liquid freon is then supplied, through the accumulator and expansion valve, to the freon evaporator where evaporates by substracting heat from the conditioning air passing through the evaporator. The freon circuit remains activated until condition or cooling is no more required.
On the contrary, automatic activation of the motorized modulating valve by the electronic regulator occurs when additional warm air is requested downstream the freon evaporator to increase the temperature of the conditioned air being supplied into the cockpit. In this condition the freon circuit is de-activated.
Manual temperature control of the conditioning air delivered into the cockpit is obtained by setting and retaining the AUTO/MAN switch to COLD or HOT position. This action allows the pilot to take control of the electronic regulator by activating the freon circuit or operating the motorized modulating valve as required to obtained the desired cockpit temperature.

Flight Operation

Operation of the conditioning system with the aircraft airborne is the same as per ground operation with the only exception that the jet pump shut-off valve is closed, and pre-cooling of conditioning air and freon condenser operation is provided by the ram air entering through the ram air scoop.
During landing gear extension/retraction transient maneuvers the freon circuit becomes inoperative. In this condition the power signal eventually delivered by

ECS SYSTEM SCHEMATIC - CONDITIONING

The system is shown in the following conditions:
- Aircraft on ground
- Bleed air and jet pump shut-off opened
- NL below 80%
- Demist shut-off closed
- Canopy seal shut-off closed

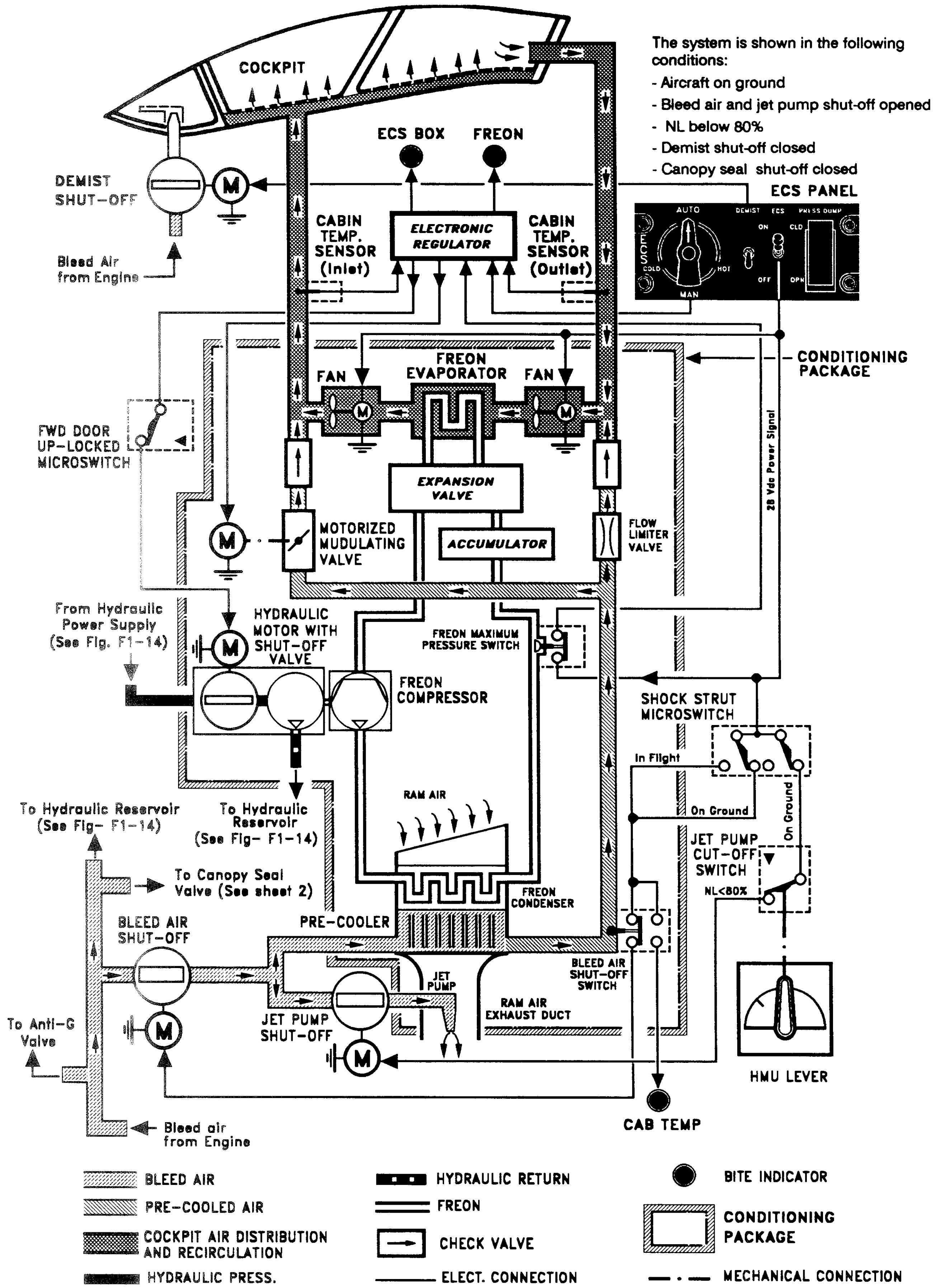


Figure 1-35. (Sheet 1 of 2)

ECS SYSTEM SCHEMATIC - PRESSURIZATION

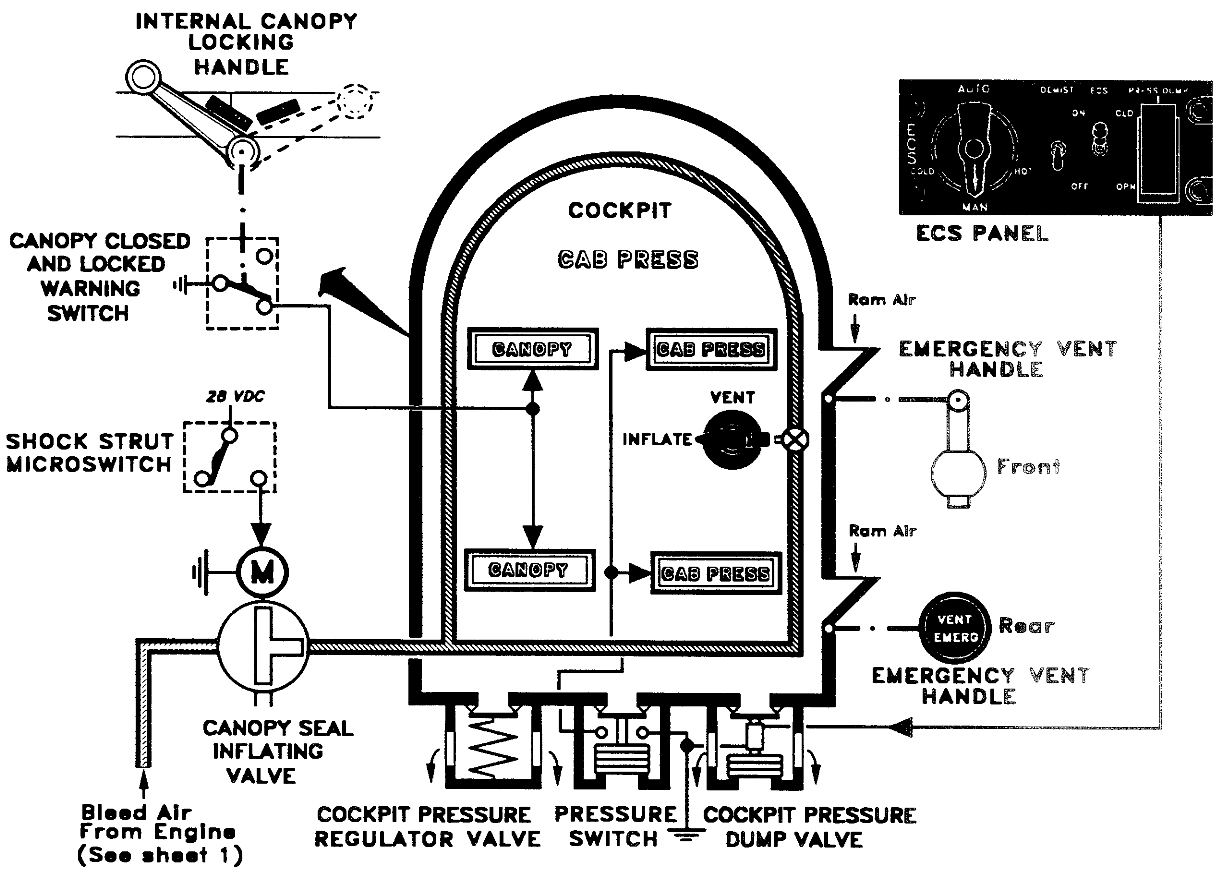


Figure 1-35. (Sheet 2)

the electronic regulator to the shut-off valve of the hydraulic motor is removed by the fwd door up-locked microswitch to prevent excessive drop of hydraulic power in the landing gear circuit.

AIR CONDITIONING FAULT INDICATION

The air conditioning system has a fault indication circuit consisting of bite indicators grouped on the External Breakers and Bite Panel. The ECS BOX, CAB TEMP and FREON bite indicators are operated by signal supplied respectively by the electronic regulator, bleed air shut-off switch and freon maximum pressure switch (see figure 1-35, sheet 1).
A BITE RESET push button on the external breakers and bite panel is provided to reset the circuits when activated by fault signals (momentary or permanent) from the monitored circuits. For bites functional description refer to figure 1-37.

CANOPY AND WINDSHIELD DEMISTING

The air used to conditioning the cabin enters through outlets suitably arranged at the base of the canopy. This will prevent moist formation resulting from cooling of the transparent due to outside temperature decrease with altitude.
Demisting of the windshield (see figure 1-35, sheet 1) is provided by hot engine bleed air through suitable outlets arranged around the base of the windshield. The system consists of a demist shut-off valve, in the upper side of the aft fuselage, controlled by the pilot through the DEMIST switch on the ECS panel.

CABIN EMERGENCY VENTILATION

A cabin emergency ventilation system (see figure 1-35, sheet 2) is provided to ensure cabin ventilation in case the air bled from the engine compressor becomes contaminated.
The system consists of two ram air scoops (one for each pilot station) manually controlled by means of emergency ventilation handles on the right side of the console. The front ram air scoop has mechanical control and is located on the right side of the fuselage above the air intake. The aft ram air scoop is installed on the lower side of the fuselage and is controlled by the pilot via flexible cable.

CANOPY SEALING

Canopy sealing is provided by a seal on the canopy

frame, which is automatically inflated, with pressurized bleed air, as soon as the main gear shock struts are released from the aircraft weight.
The system consists of a canopy seal inflating valve (see figure 1-35, sheet 2) on the aft pressurized bulkhead and of shock strut microswitches which control the operation of the valve.
A VENT/INFLATE selector, at the right fuselage side of front cockpit, provides a means to manually deflate the canopy seal if automatic deflating fails. For normal operation, the VENT/INFLATE selector must to be set to the INFLATE position.
A CANOPY warning light, on both front and rear caution panel, operated by the canopy closed and locked microswitches below the canopy sill, warns the pilot when the Internal Canopy Locking Handle is not closed and locked.

PRESSURIZATION SYSTEM

Pressurization of the cockpit is provided by the pressurization system which consists of the Cockpit Pressure Regulating Valve, Pressure Switch and Cockpit Pressure Dump Valve on the aft pressurized bulkhead.
The cockpit pressure regulating valve regulates the flow of air from the cockpit to maintain the designed cockpit pressure over the full operational range of the aircraft. At altitudes below 8,000 feet, the valve opens to permit free circulation of the air in and out of the cockpit.
At altitude above 8,000 feet, the air flowing out the valve decreases until a preset differential pressure of 3.5 psi between the cockpit and ambient air has been established.
A Cabin Altimeter provides the pilot with an indication of the fictitious altitude corresponding to the pressure existing in the cockpit. With a correct system operation, indication should be in accordance with cockpit pressurization schedule of figure 1-36.
The cockpit pressure dump valve provides control of cockpit to atmosphere differential pressure in the event of failure of the cockpit pressure regulating

COCKPIT PRESSURE SCHEDULE

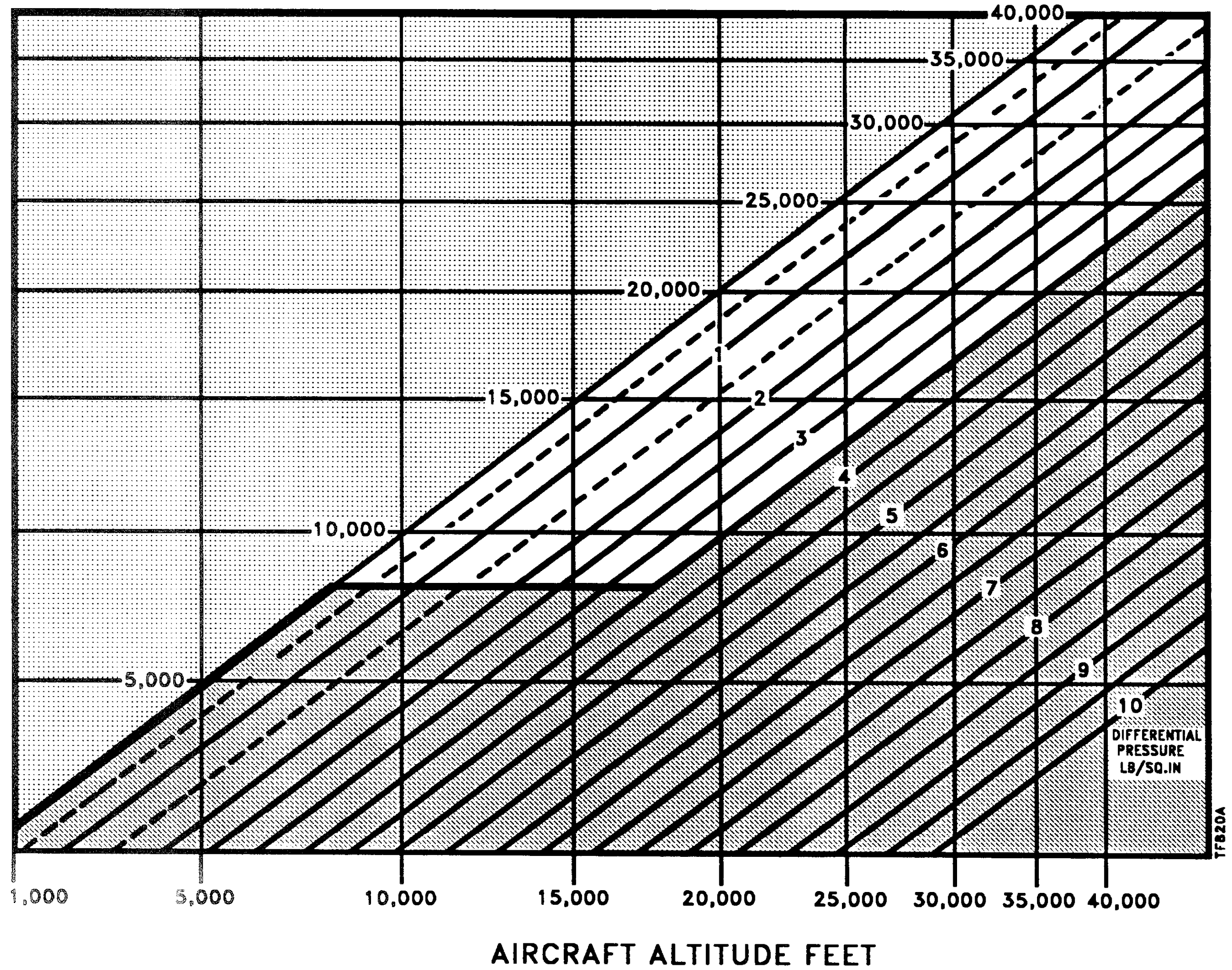


Figure 1-36.

valve. The cockpit pressure dump valve opens automatically when differential pressure exceeds 3.85 + 0.15 psi to relief excess pressure in either direction. The cockpit pressure dump valve may be electrically controlled through the PRESS DUMP switch on the ECS panel.
The cabin pressure switch causes the CABIN PRESS warning lights to come on should cockpit internal pressure exceed 3.85 + 0.15 psi.

ECS SYSTEM CONTROLS

The controls of the air conditioning and pressurization system are illustrated in figure 1-37.

ECS SYTEM CONTROLS			
DESCRIPTION			FUNCTION
1.	PRESS DUMP switch	OPN	Operates cabin pressure dump relief valve allowing a quick cabin pressure overboard discharge.
		CLD	Cabin pressure dump relief valve opens when differential pressure is higher or equal to 3.85 PSI.
2.	ECS switch	ON	E.C.S. system and electrofans are activated.
		OFF	E.C.S. system and electrofans are disactivated.
3.	DEMIST switch	ON	The demist shut-off valve is open allowing windshield defogging.
		OFF	The demist shut-off valve is closed.
4.	AUTO/MAN selector	-	When rotated permits automatic or manual selection of the cabin temperature.
		AUTO	Engages the automatic system to maintain cabin temperature at the selected temperature.
		MANUAL	Permits cabin temperature to be manually adjusted in case of failure of the automatic system.
5.	CABIN ALT indicator	-	Indicates the cabin pressure altitude in thousands of feet.
6.	Ram air scoop handle (front cockpit)	-	The ram air scoop opens by pulling rearward the handle to provide fresh ventilating air to the cabin.
7.	Ram air scoop knob (rear cockpit)	-	When pulled provides opening of the rear cockpit ram air scoop.
8.	FREON Bite *	White	Indicates that freon pressure switch has been operated due to an increase of the internal pressure.
		Black	Indicates that the freon circuit has correctly operated.
9.	ECS BOX Bite *	White	Indicates that the electronic regulator has experienced a momentary or a permanent fault.
		Black	Indicates that the electronic regulator has correctly operated.
10.	CAB TEMP Bite *	White	Indicates that an overtemperature condition has been sensed by the Bleed Air Shut-off Valve switch.
		Black	Normal operating condition.
11.	BITE RESET switch*	Pressed	Reset any bite fault indications only if the bite change-over has been caused by a momentary fault.
12.	CABIN PRESS warning light	On	Indicates that cabin pressure is above the maximum permitted value (Cabin Pressure Regulator at fault).
13.	Canopy seal selector	VENT	The canopy seal inflating system valve is vented to the atmosphere.
		INFLATE	The canopy seal inflating system is ready to operate.

* On external breakers and bite panel

Figure 1-37. (Sheet 1 of 2)

ECS SYSTEM CONTROLS

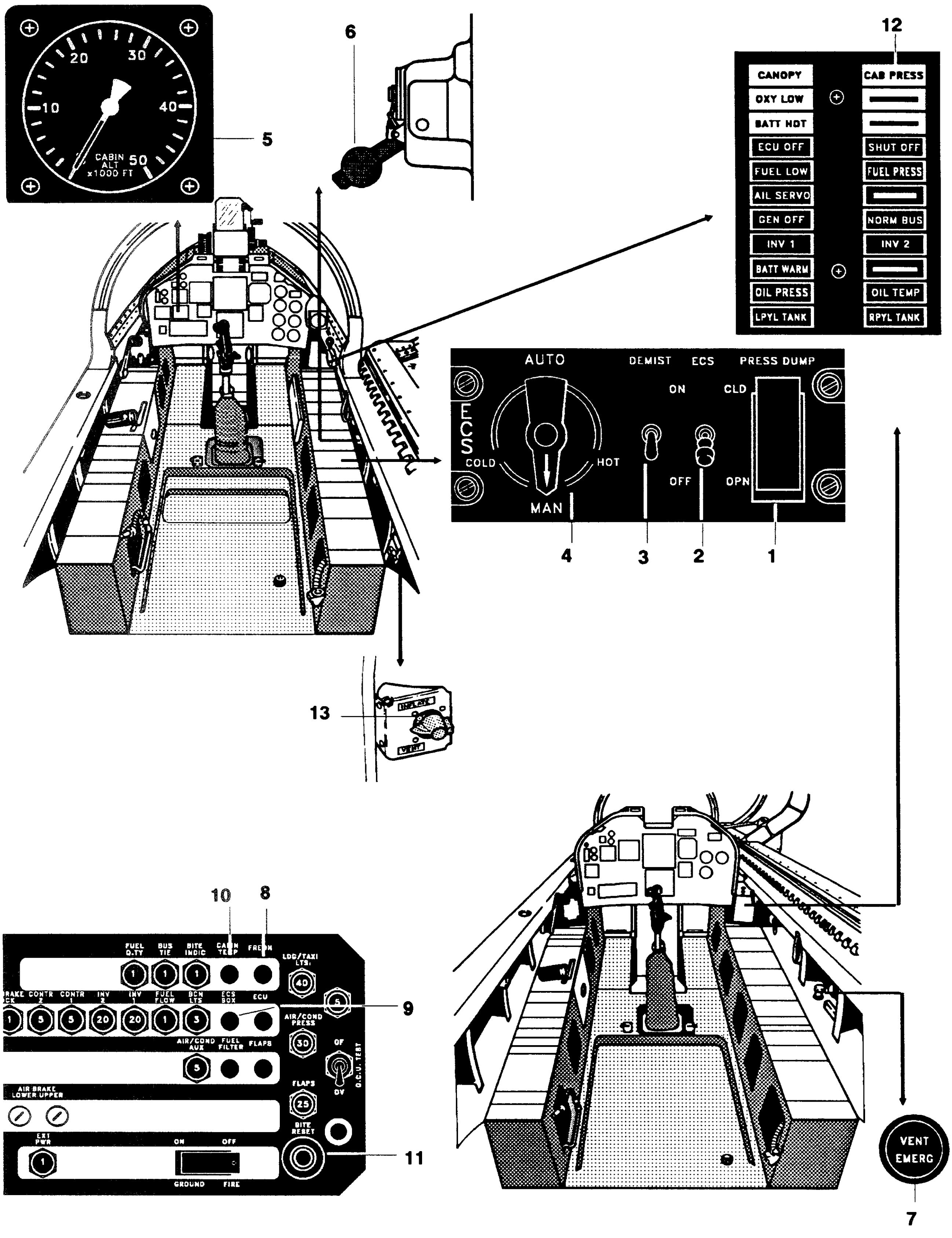


Figure 1-37. (Sheet 2)

ANTI-G SUIT SYSTEM

Both pilots have the possibility to connect the anti-g connector of the anti-g suit to a coupling located near the left console in the cockpit. The anti-g coupling is connected to a pressure regulating valve which receives pressurized air from the engine compressor. Positive acceleration causes the valve to open, inflating the anti-g suit. The air pressure injected in the anti-g suit increases with the vertical acceleration (g) applied. A button on top of the valve can be manually pressed to check the system operation. A plug is provided to close the rear anti-g valve connector to prevent pressure discharge during solo flight.

OXYGEN SYSTEM

The aircraft is equipped with a gaseous high pressure, demand type oxygen system (See figure 1-38) consisting of two Control Panels, one Pressure Reducer Valve and two interconnected high pressure gaseous storage cylinders in the nose section.
The system has an operating pressure (up-stream the pressure reducing valve) of 151,6 bar (2,200 psi) and a total gas capacity (at 20° C) of 2,520 liters; the refilling is made through a single filler valve accessible through an access door on the left side of the nose section. The approximate duration of the oxygen supply is given in Table 1-1.
An OXY LOW red warning light, on front and rear caution panel, comes on when the pressure downstream the reducing valve drops below 3 ± 0.3 bar (43 ± 5 psi).
An emergency oxygen supply is available from a bottle mounted on each ejection seat.
The oxygen system controls are described and illustrated in figure 1-39.

OXYGEN SYSTEM OPERATION

For normal oxygen system operation proceed as follows:

1. SUPPLY lever - ON.
2. OXYGEN Diluter lever - NORMAL.

In this position, the regulator mixes air with oxygen in varying quantities according to the altitudes and supplies the mixture every time the pilot inhales. Above 25,000 ft altitude, the regulator supplies pure oxygen.

3. FLOW indicator (blinker).It alternately displays a yellow cruciform marker corresponding to the breathing cycle.
4. Observe the pressure gauge to check the duration of the oxygen supply.

NOTE

A rapid oxygen pressure drop during climbing to high altitudes (with low temperatures) can cause an unnecessary alarm to the pilot. A rapid drop of oxygen pressure while the aircraft is in level flight, or while it is descending, is not ordinarily due to temperature drop. When this happens, leakage or loss of oxygen must be suspected. Should the aircraft main oxygen system fails, the pilot may use oxygen from the emergency oxygen cylinder by pulling the emergency oxygen handle on the left side of the ejection seat. In this condition, the pilot may be provided with oxygen for about ten minutes.

Table 1-1.

OXYGEN DURATION CHART

CABIN ALT. (FT)	OXYGEN	PRESSURE INDICATOR					
		4/4	3/4	1/2	1/4	1/8	1/16
25,000	100%	4 : 01	3 :01	1 : 58	0 : 58	0 : 29	0 : 14
	N	4 : 01	3 :01	1 : 58	0 : 58	0 : 29	0 : 14
20,000	100%	3 : 08	2 : 21	1 : 32	0 : 45	0 : 22	0 : 11
	N	5 : 38	4 : 13	2 : 47	1 : 21	0 : 42	0 : 19
15,000	100%	2 : 28	1 : 51	1 : 19	0 : 86	0 : 18	0 : 08
	N	6 : 45	5 : 03	3 : 20	1 : 37	0 : 51	0 : 23
10,000	100%	1 : 59	1 : 29	0 : 58	0 : 29	0 : 14	0 : 07
	N	5 : 37	4 : 13	2 : 47	1 : 21	0 : 42	0 : 19
5,000	100%	1 : 37	1 : 13	0 : 47	0 : 23	0 : 12	0 : 06
	N	4 : 43	3 : 32	2 : 20	1 : 08	0 : 35	0 : 16
0	100%	1 : 19	1 : 00	0 : 39	0 : 19	0 : 12	0 : 04
	N	3 : 56	2 : 57	1 : 57	0 : 57	0 : 30	0 : 19

NOTE : Durations are expressed in hours and minutes and referred to a two pilots crew.

OXYGEN SYSTEM SCHEMATIC

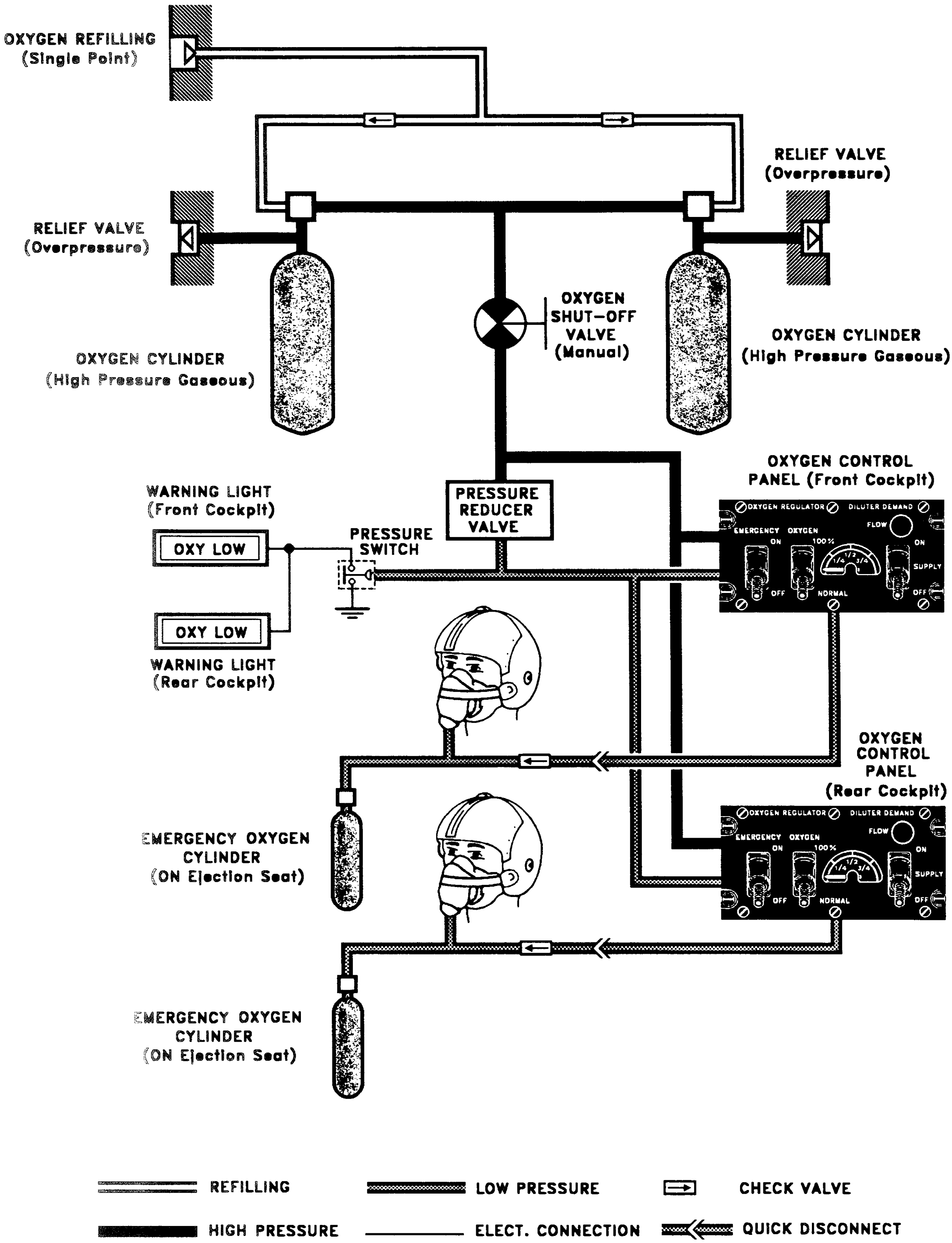
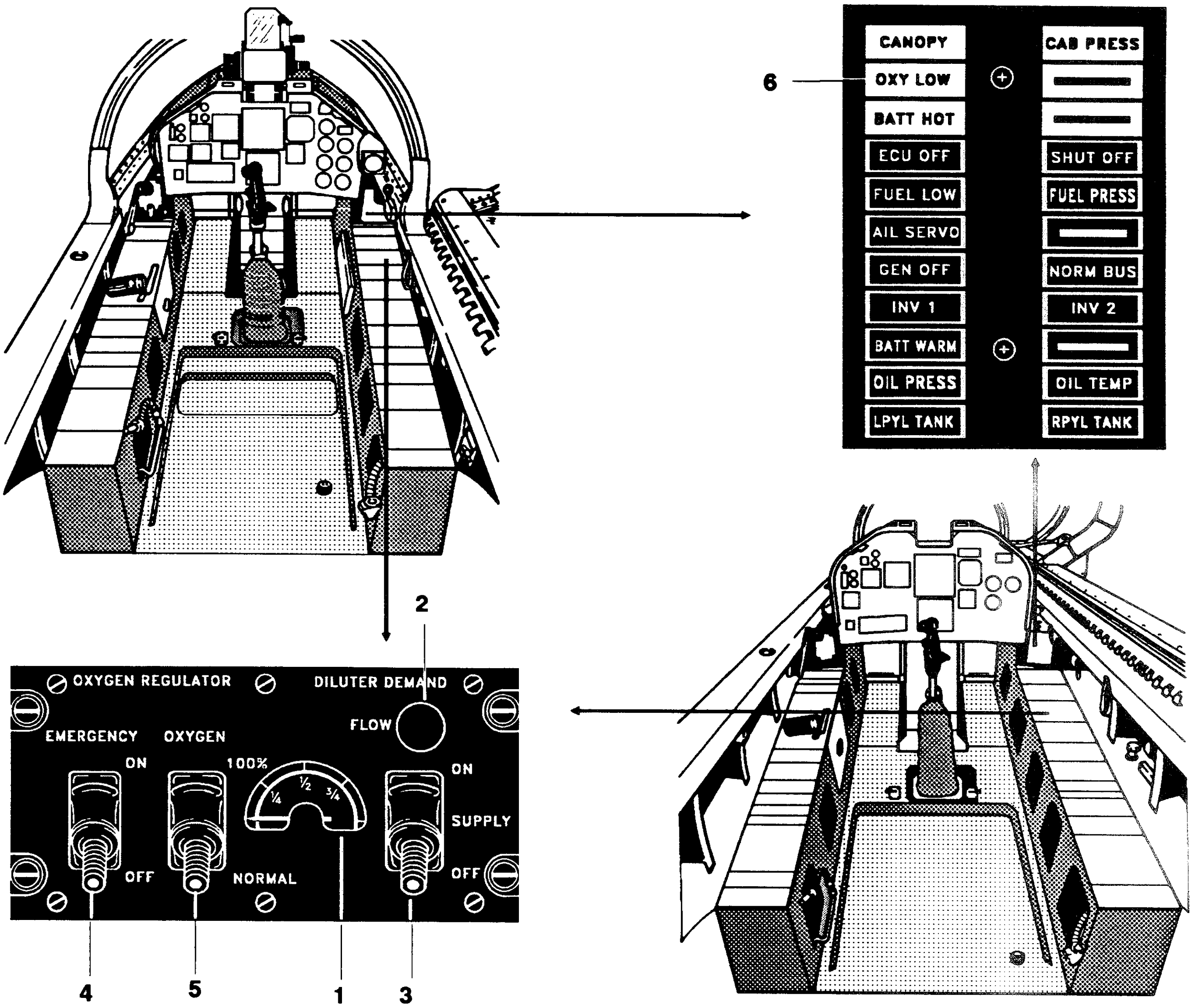


Figure 1-38.

OXYGEN SYSTEM CONTROLS



DESCRIPTION			FUNCTION
1.	Pressure gauge	-	Indicates the oxygen pressure into cylinders (scale: 0-1/4- 1/2-3/4- Full)
2.	FLOW indicator	-	Provides alternate yellow cruciform signals during the pilot's breathing cycle, to indicate regular oxygen flow.
3.	SUPPLY lever	ON	Oxygen supply provided.
		OFF	Oxygen supply is interrupted.
4.	Emergency lever	ON	Continuously delivers 100% pure oxygen to the mask.
5.	OXYGEN Diluter lever	NORMAL	Provides regulated mixture of cockpit air and oxygen as a function of the cabin altitude.
		100%	Provides a regulated supply of 100% oxygen.
6.	OXY LOW pressure warning light	ON	When pressure downstream the pressure reducing valve drops below 3 bar (43 ± 5 psi).

Figure 1-39.

COMMUNICATION & NAVIGATION

The communication and navigation systems of the S211 aircraft are described in figure 1-40.
Antenna locations are also shown on the same figure.
COMM and NAV system components are in the nose compartment and in the aft upper side of the fuselage.
The nose radio compartment contains the Displacement Gyro Assembly, Electronic Control Amplifier (AHRS system) and DME transceiver (DME 40).
The aft radio compartment contains the VHF COMM1 and 2 transceiver (RT1300/ARC186 (V) and AN/ARC175 (V) (ACFT C only)), a VHF NAV receiver (VIR 31A), ATC Transponder (TDR 90) and ADF receiver (ADF 60A).
The aft radio compartment is adequately ventilated (through three ventilating grids located on the left and right side of the radio compartment) to prevent overheating of the radio compartment.

COMMUNICATION SYSTEM

These paragraphs provide description and operation of the communication systems of the aircraft.

COMM/NAV DUAL CONTROL SYSTEM (ACFT A & B)

The COMM/NAV dual control system provides the pilots with a means of selecting, operating and controlling the communication and navigation systems of the aircraft from both front and rear cockpit.
The COMM/NAV dual control shift operates according to the following logic:
front COMM/NAV CONTROL SHIFT indicating light (s) illuminated - relevant COMM/NAV associated systems controlled from the front cockpit and viceversa.
This means that, should 28 VDC power fail (ex. circuit breaker out), the communication and navigation controls and selection functions remain switched to the to the previously selected take control line switches.
The dual control system consists of two COMM/NAV CONTROL SHIFT panels installed on the left front and left rear consoles and of two switching boxes mounted on the left and right rear consoles.
Each control shift panel incorporates four push button switches, (labelled VHF1, VHF2, VOR-ILS, ADF).
Two dimmable lights, in each control shift panel, provide (when pressed) illumination of the push button switches and control panel identification markings.
For COMM/NAV CONTROL SHIFT controls description and operation see figure 1-41. sheet 1.

COMM DUAL CONTROL SYSTEM (ACFT C)

The COMM (left side) and NAV (right side) dual control system provides the pilots with a means of selecting, operating and controlling the communication and navigation system of the aircraft from both front and rear cockpit. The COMM dual control shift operates according to the following logic:
front COMM 1 control shift indicating light (s) illuminated - relevant COMM associated systems controlled from the front cockpit and viceversa.
This means that, should 28 VDC power fail (ex. circuit-breaker out), the communication controls and selection functions remain switched to the to the previously selected take control line switches.
The dual control system consists of two COMM CONTROL SHIFT panels installed on the left front and left rear consoles and of two switching boxes mounted on the left and right rear consoles.
Each control shift panel incorporates two push button switches, (labelled COMM1, COMM2).
Two dimmable lights, in each control shift panel, provide (when pressed) illumination of the push button switches and control panel identification markings.
For COMM and NAV CONTROL SHIFT controls description and operation see figure 1-41. sheet 2.

ICS SYSTEM

The ICS system is an audio control center composed of two self-contained audio control panels, two jack connectors for pilots headsets and microphones, ICS/MUTE push-button switches, installed on the control stick hand-grips and MIC push-button switches on the engine throttles.
The ICS system provides a means of controlling communication and navigation audio information being received or transmitted.
The ICS system also controls communication between the crew and between the crew and ground maintenance personnel.
For ICS system controls description and operation see figure 1-42.

AUDIO SYSTEM OPERATION

Set the controls on the ICS control panel as follows:
1. Set the transmission selector knob to VHF1.
2. Pull-out VHF1, VHF2, ADF, VOR,DME receiver switches to select associated COMM and NAV reception circuits.
3. Globally adjust the audio level of the receivers by means of the VOL control knob.
4. Should transmission be required, depress the MIC switch(es) on the engine throttle lever.

INTERPHONE SYSTEM OPERATION

To communicate with the other pilot proceed as follows:
1. With the HOT MIC rotary knob pushed-in the intercommunication between the pilots is performed by pushing the ICS/MUTE switch (es), on the control stick hand-grips without cutting off all external communications (VHF COMM and VHF NAV signals).
2. Pulling the HOT MIC switch the intercommunica-

COMMUNICATION & NAVIGATION EQUIPMENT

TYPE	DESIGN-ATION	OPERATION	CONTROL LOCATION	ACFT CODE
COMMUNICATION				
Intercomm system (ICS)	Gemelli AG07-1(A)1	Intercommunications, receiver signal monitoring, selection of transmission set	Control panel on both left front and left rear console. MIC switch on throttle lever. ICS switch on control stick grips	A-B-C
VHF COMM 1 System	Collins AN/ARC 186(V)	Two-way voice communication	Control panel on front and rear instrument panel	A-B-C
VHF COMM 2 System	Collins AN/ARC 175(V)	Two-way voice communication	Control panel on both left front and left rear console.	C
NAVIGATION				
AHRS SYSTEM	Lear Siegler 6000-T-2	Provides a source for roll, pitch, heading angular displacement and turn rate data.	Controller on forward central pedestal.	A-B
AHRS SYSTEM	Litton Italia LISA 2000A	Provides a source for roll, pitch, heading angular displacement and turn rate data	Controller on forward central pedestal.	C
VHF NAV System	Collins VIR 31A	Reception of manual and automatic VOR and ILS signal approach for localizer and glide slope information displayed on the HSI.	Control panel on left front and left rear console	A-B-C
ADF System	Collins ADF60A	Relative bearing from a selected ground station displayed on HSI single bar pointer.	Control Panel on right front and right rear console.	A-B-C
DME System	Collins DME 40	Distance information from a selected ground station displayed on HSI window	-	A-B-C
ATC Transponder	Collins TDR 90	Aircraft identification and altitude reporting to a ground station	Control panel right console	A-B-C

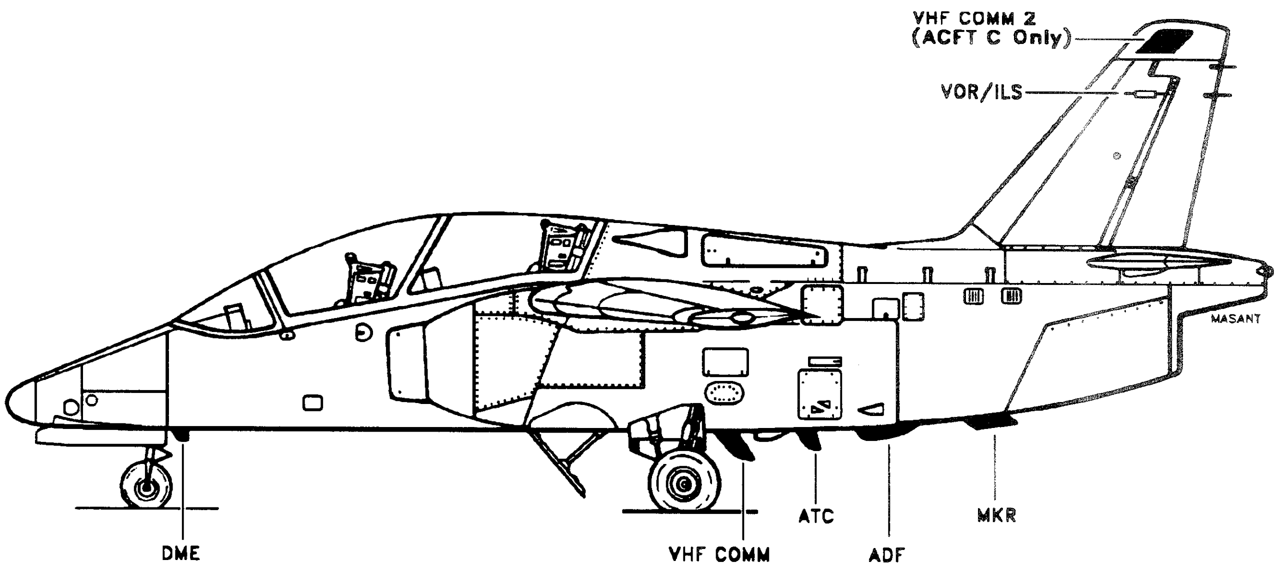
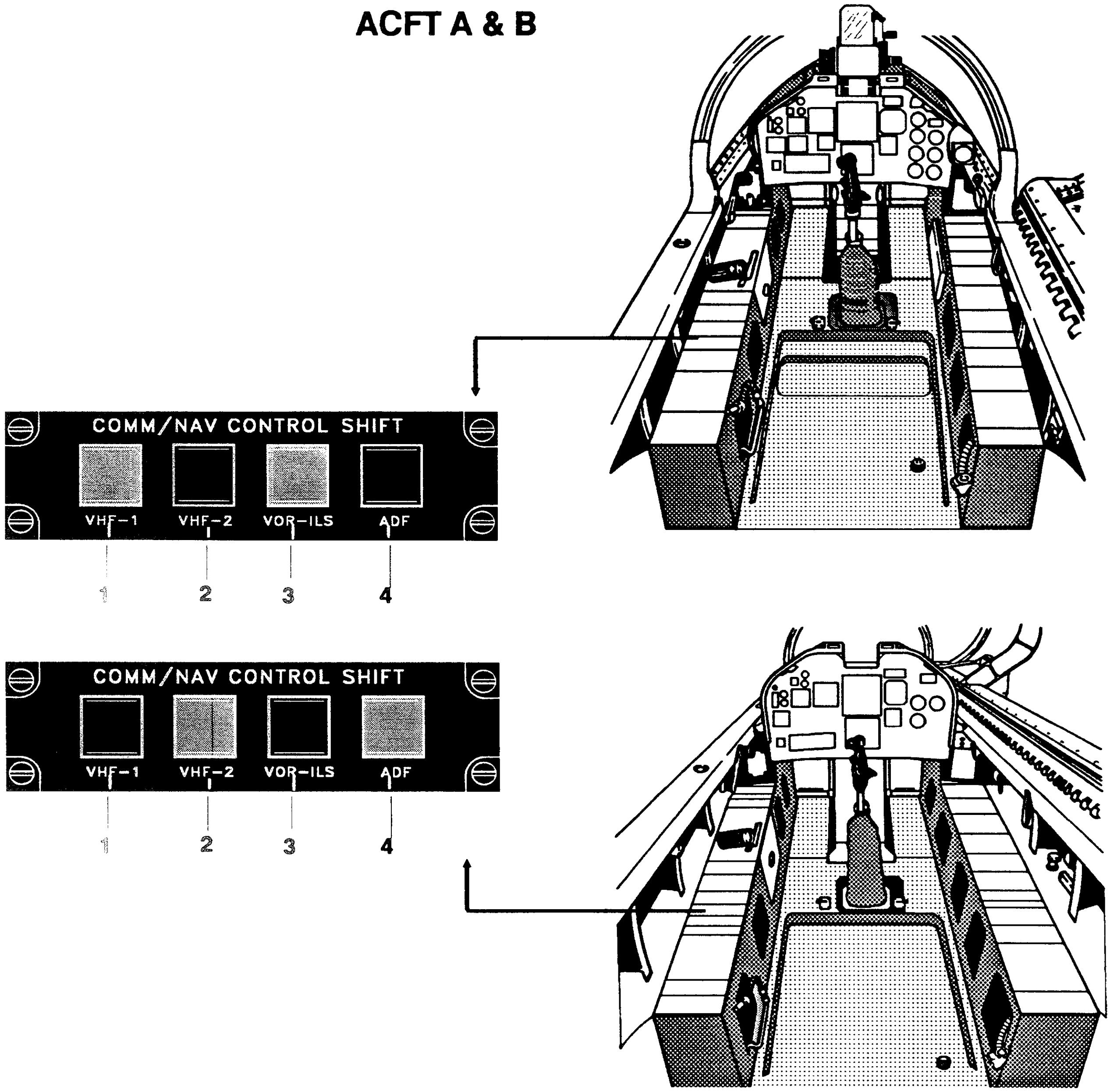


Figure 1-40.

COMM/NAV DUAL CONTROL SHIFT CONTROLS

ACFT A & B

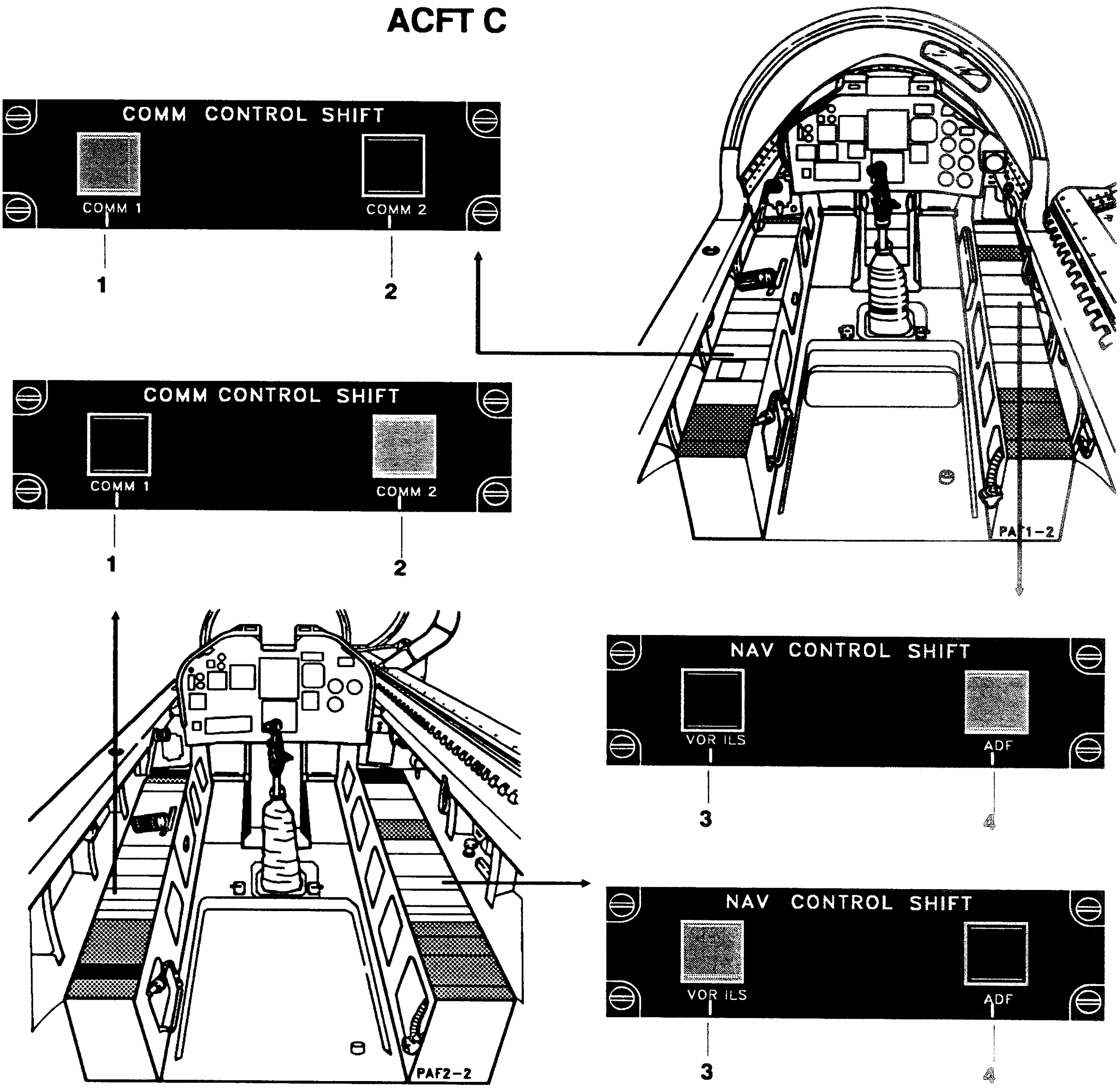


DESCRIPTION		FUNCTION
1. VHF-1 take control line switch and indicating light	-	When pushed (either from front or rear) enables or disable the operation of front or rear VHF-1 controller according to the illumination logic of the green indicating light.
2. VHF-2 take control line switch and indicating light	-	When pushed (either from front or rear) enables or disable the operation of front or rear VHF-2 controller according to the illumination logic of the green indicating light.
3. VOR-ILS take control line switch and indicating light	-	When pushed (either from front or rear) enables or disable the operation of front or rear VHF NAV controller according to the illumination logic of the green indicating light.
4. ADF take control line switch and indicating light	-	When pushed (either from front or rear) enables or disable the operation of front or rear ADFcontroller according to the illumination logic of the green indicating light.

Figure 1-41. (Sheet 1 of 2)

COMM/NAV DUAL CONTROL SHIFT CONTROLS

ACFT C



DESCRIPTION		FUNCTION
1. COMM 1 take control line switch and indicating light	-	When pushed (either from front or rear) enables or disable the operation of front or rear COMM 1 controller according to the illumination logic of the green indicating light.
2. COMM 2 take control line switch and indicating light	-	When pushed (either from front or rear) enables or disable the operation of front or rear COMM 2 controller according to the illumination logic of the green indicating light.
3. VOR-ILS take control line switch and indicating light	-	When pushed (either from front or rear) enables or disable the operation of front or rear VHF NAV controller according to the illumination logic of the green indicating light.
4. ADF take control line switch and indicating light	-	When pushed (either from front or rear) enables or disable the operation of front or rear ADFcontroller according to the illumination logic of the green indicating light.

Figure 1-41. (Sheet 2)

ICS SYSTEM CONTROLS

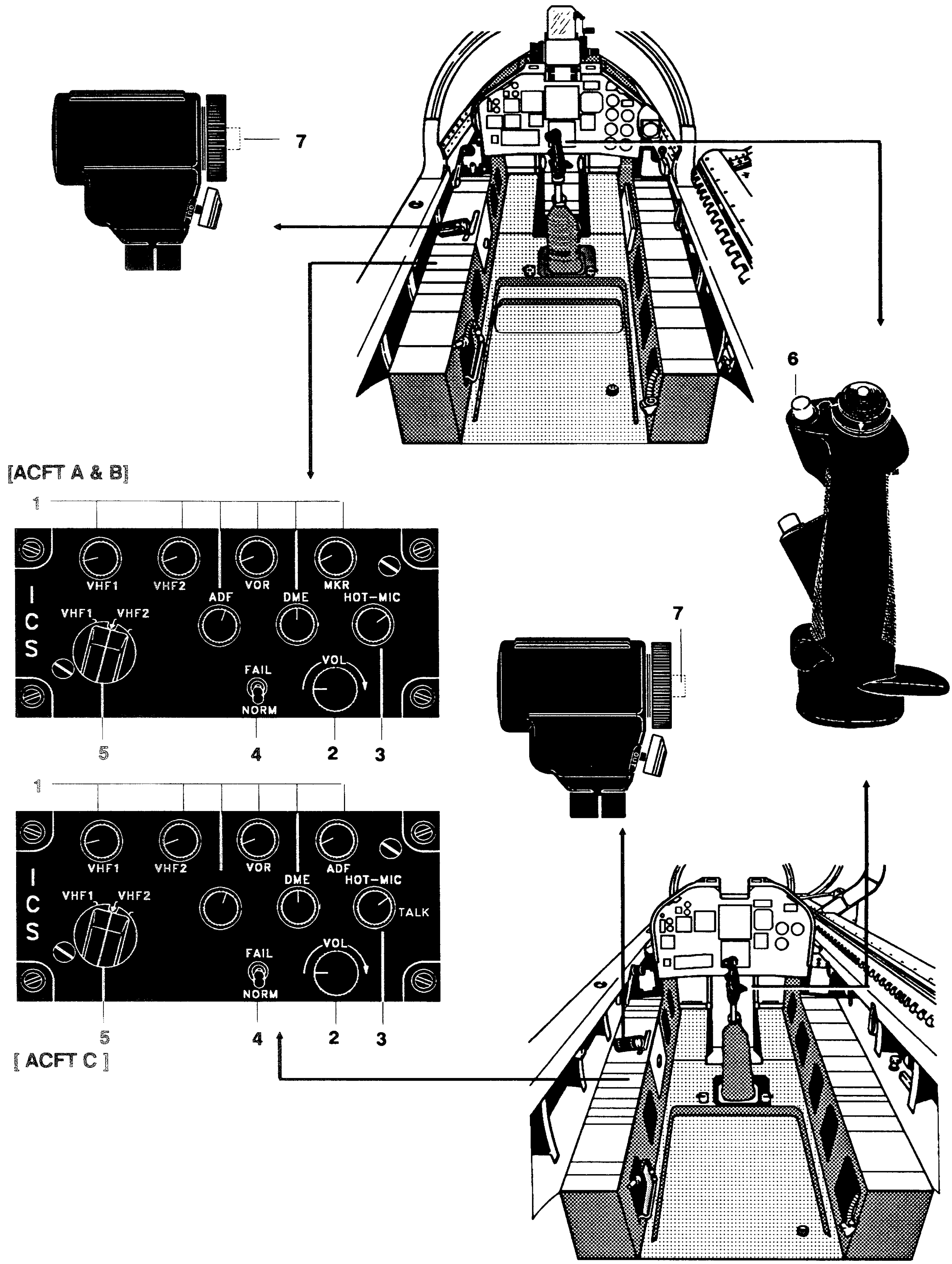


Figure 1-42.

ICS CONTROLS

DESCRIPTION			FUNCTION
1.	Receiver switches	Pushed-in	Off position.
		Pulled-out	Provides selection of audio signals from receivers.
2.	VOL knob	Rotated	Collectively adjusts the level of audio signals.
3.	HOT-MIC knob	Pulled out	Enables immediate intercommunication between crew without pushing the interphone push-button.
		Rotated	Adjust the interphone audio level.
		Pushed-in	The interphone communications are enabled by pressing the interphone push-button.
4.	FAIL switch	FAIL	In case of headset amplifier failure, permits reception of one receiver at a time with priority from left to right.
		NORM	Normal operation.
5.	Transmitter selector knob	VHF 1 VHF 2	Selects VHF 1 COMM transceiver. Selects VHF 2 COMM transceiver. (ACFT C only)
6.	ICS/MUTE push-button	Pushed	Allows interphone communications to the other pilots when operating in "Cold Mike" mode. In " Hot Mike" mode provides a muting facility cutting off all external communications (VHF COMM/NAV and ADF) to enhance internal communications.
7.	MIC push-button	Pushed	Allows transmission through the selected VHF COMM transceiver.

Figure 1-42. (Sheet 2)

tion between the pilots is performed without depressing the ICS/MUTE switch(es) (hand-free intercommunication). While, pushing the ICS/MUTE switch(es), the ICS MUTE function provides a muting facility, cutting off all external communications (VHF COMM/NAV and ADF) to enhance communications between the pilots.
The ICS system is powered by the 28 VDC ESS BUS bar through ICS circuit breaker.

VHF COMM 1 SYSTEM DESCRIPTION

The Collins AN/ARC186 (V) VHF system consists of a RT 1300/ARC 186 (V) remote transceiver unit in the nose radio compartment, two Controllers on the left side of the front and rear console and associated Sensor System VHF-AM/FM Wide Band Antenna on the bottom side of the aircraft.
The system provides full 10 WATTS emitted power for two way voice communication: AM in the 116.000 to 151.975 MHz band and FM in the 30.000 to 87.975 MHz band. Voice reception only, is available in 108.000 to 115.975 MHz band.
The system has also provision for FM homing operation in the 30.000 to 87.975 MHz FM band, which is not used in this configuration. Channel spacing in all frequency band is 25 KHz increments. Frequency channels can be manually selected using the four rotary selector switches, or preset memory (20 channels), by means of the channel selector on the radio control set.
The AN/ARC 186 (V) VHFsystem provides voice reception and transmission in the pre-stored guard frequency between 116.000 and 151.975 MHz (121.500 MHz factory adjusted) in the EMER AM mode, as well as voice reception and transmission on a pre-stored guard frequency between 30.000 and 87.975 MHz (40.500 MHz factory adjusted) in the EMER FM mode.
A tone of approximately 1000 Hz may be transmitted as long as the TONE/SQ DIS switch is held in TONE position and a squelch disable capability is also provided by pushing and retaining the above switch in the SQ DIS position.
A SENSOR SYSTEM wide band antenna is used in both AM and FM mode, in conjunction with the VHF 186 AM/FM system, for transmitter receiver operating purpose.
The VHF system is powered by the ESS BUS Bar and can be controlled either from the front or rear cockpit, through the respective COMM/NAV Control Shift as far as VHF system management, operating mode selection, frequency selection, audio level regulation etc. With the system ON, any operating limitation is removed and the system may operate from both front and rear cockpits, as far as the voice transmission and reception is concerned, through the respective Audio Control Panel (ICS) and Push-To-Talk switch on engine throttle lever.
For VHF controls description and illustration see figure 1-43.

VHF Manual Operation

Perform VHF system manual operation as follows:

1. Select forward or aft VHF radio control set by means of COMM/NAV CONTROL SHIFT.
2. Through the Mode Selector Switch, select TR position.
3. Select MAN position by means of frequency control-emergency selector switch.
4. By means of the four frequency selector knob, select desired frequency.

NOTE

The frequency selector knobs provide frequency increasing (starting from left or right) in 10.0 MHz, 1.0 MHz, 0.1 MHz and 0.025 MHz (Frequency selector knob clockwise rotation increases frequency).

5. Turn the volume control knob to the maximum clockwise position
6. On audio control panel (ICS) regulate, VOLUME by means of VHF combined potentiometer push/pull switch and select, through the transmitter rotary switch, VHF function.
7. On the VHF Controller:
   a. Select SQ DISABLE function and check that noise is heard in the headset.
   b. Select TONE function and check that a TONE of approximately 1,000 Hz is heard in the headset.
   c. To transmit depress the MIC switch on engine throttle.

Presetting

Perform VHF channel presetting as follows:

1. Select front or rear VHF radio control set by means of COMM/NAV CONTROL SHIFT.
2. Through the Mode Selector switch, select TR position.
3. Select MAN position by means of frequency control/emergency selector switch.
4. By means of the four frequency selector knob, select desired frequency to be stored in memory.
5. On the VHF controller, rotate PRESET channel selector until desired Channel appears in the window. (The system may store up to a maximum of 20 preset channels).
6. Momentarily depress the LOAD switch.

Preset Channel Operation

1. Rotate the frequency control/emergency select switch to the PRE position and select the desired channel by means of PRESET channel selector.
2. Turn the Volume control knob to the maximum clockwise position.
3. On Audio Control Panel (ICS) regulate, VOLUME by means of VHF combined potentiometer/push pull switch and select the transmitter, rotating the function selector to the VHF position.
4. On the VHF Controller:
   a. Select SQ DISABLE function and check that noise is heard in the headset.
   b. Select TONE function and check that a TONE of approximately 1,000 Hz is heard in the headset.
   c. To transmit depress the MIC switch on engine throttle.

Emergency Operation

For emergency operation, rotate the Frequency Control/Emergency select switch in either AM or FM emergency frequency as required. The transceiver is ready to operate in pre-stored guard frequency (121.500 MHz in AM mode and 40.500 MHz in FM mode).

NOTE

The maximum allowed duty cycle is one minutes in continuous transmission operating mode and five minutes only in continuous reception operating mode.

VHF/COMM 2 SYSTEM DESCRIPTION (ACFT C)

The Collins AN/ARC 175 VHF COMM2 system consist of a remote transceiver unit in the aft radio compartment, two Controllers on the left side of the front and rear console and associated VHF/COMM 2 Antenna on the tail of the aircraft.
The VHF system provides two way voice communication from 116.000 to 151.975 MHz band.
Frequency channels can be manually selected using the two rotary switches on the radio control set.
The VHF/COMM 2 systems can be controlled either from the front or rear cockpit through the respective COMM Control Shift panel as far as VHF system management, operating mode selection, frequency selection and audio level regulation.
With the system on, any operating limtation is removed and the system may operate through the respective Audio Control Panel (ICS) and Push-to Talk switch on engine throttle lever.
The VHF COMM2 systems are powered by the NORM BUS through VHF2 circuit breaker on circuit breaker panel of the front cockpit
For VHF/COMM2 control description and operation see figure 1-44.

VHF COMM2 Operation

To operate the VHF COMM2 system proceed as follows:

1. Select front or rear VHF2 radio control set by means of COMM CONTROL SHIFT.
2. Set power switch to PWR.
3. Select desired frequency by means of frequency selector knobs.

VHF COMM 1 SYSTEM CONTROLS

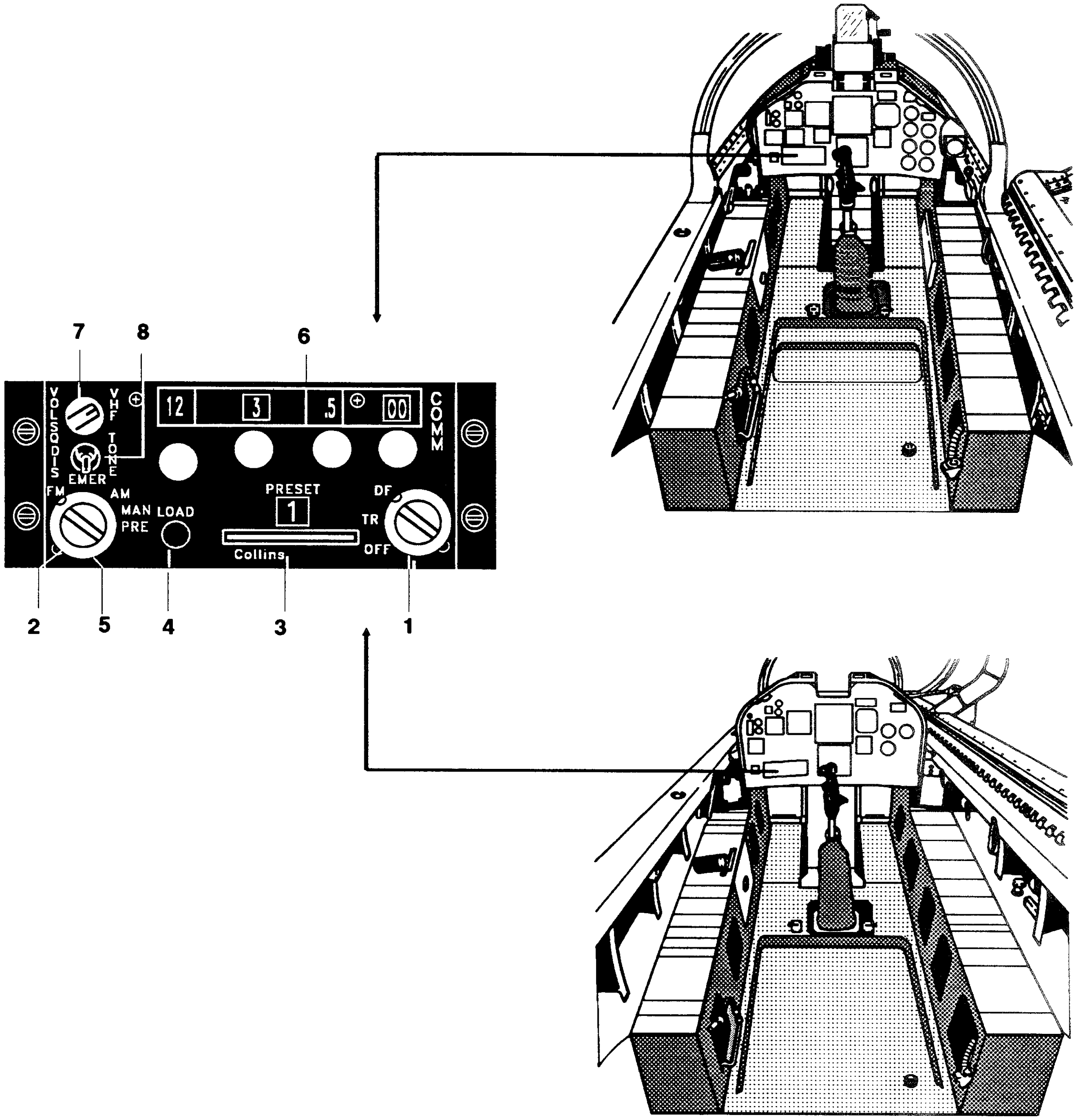


Figure 1-43. (Sheet 1 of 2)

VHF COMM 1 SYSTEM CONTROLS

DESCRIPTION			FUNCTION
1.	Mode selector switch	OFF	Removes power from radio set.
		TR	Provides normal two-way communication.
		DF	Not in use.
2.	Frequency mode select.	PRE	Frequency selected by manual frequency controls.
		EMERG FM	Provides EMERGENCY communication in FM band (40.500 MHz).
		EMERG AM	Provides EMERGENCY communication in AM band (121.500 MHz).
3.	PRESET channel	-	When frequency mode selector switch is set to PRE position, the PRESET channel control is used to select a preset channel freqency as stored in memory.
4.	LOAD switch	-	Used to load memory with PRESET channel selector.
5.	Manual frequency controls	-	Used to select operating frequency mode selector within MAN position. The manual frequency controls allow selection of any one of 4080 channels available.
6.	Frequency display	-	Display frequency information as selected by manual frequency controls.
7.	VOL control	-	Controls volume of audio output from radio set control.
8.	TONE/SQ DIS switch	TONE	A 1000 Hz tone will be transmitted as long as the switch is kept in this position.
		SQ DIS	Momentary retained on SQ position, disables receiver squelch.

Figure 1-43. (Sheet 2)

NOTE

The frequency selector knobs provide frequency increasing (from left to right) 1.0 MHz and 0.025 MHz (Frequency selector knob clockwise rotation increases frequency).

4. On Audio Control Panel (ICS) regulate volume by means of VHF1 and VHF2 combined potentiometer push/pull switches and select VHF1 or VHF2 function through the trasmitter rotary switch.

5. On VHF Controller:
   a. Select OFF function and check that noise is heard in the headset.
   b. To transmit, depress MIC switch on throttle lever.

NAVIGATION SYSTEM

The following paragraphs provide description and operation of the navigation systems of the aircraft.

ATTITUDE AND HEADING REFERENCE SYSTEM (AHRS) LEAR SIEGLER 6000-T (ACFT A and B)

The attitude and heading reference system consists of a 7901F Displacement Gyro Assembly (DGA), an Electronic Controller Amplifier (ECA) 6504Y1in the nose radio compartment, a 3853A3 Compass System Controller (CSC) in the front cockpit central pedestal and a ML1 Magnetic Azimuth Detector (MAD), on the right wing tip.

The system provides pitch, roll and turn rate informattion to the attittude indicators (AI), azimuth information to the HSI's and VOR/ILS receiver for the automatic VOR function.

The AHRS is an all attitude source of roll, pitch, heading angular displacement and turn rate data.

Roll output information is continuous throughout ±180° and is valid for all aircraft attitudes.

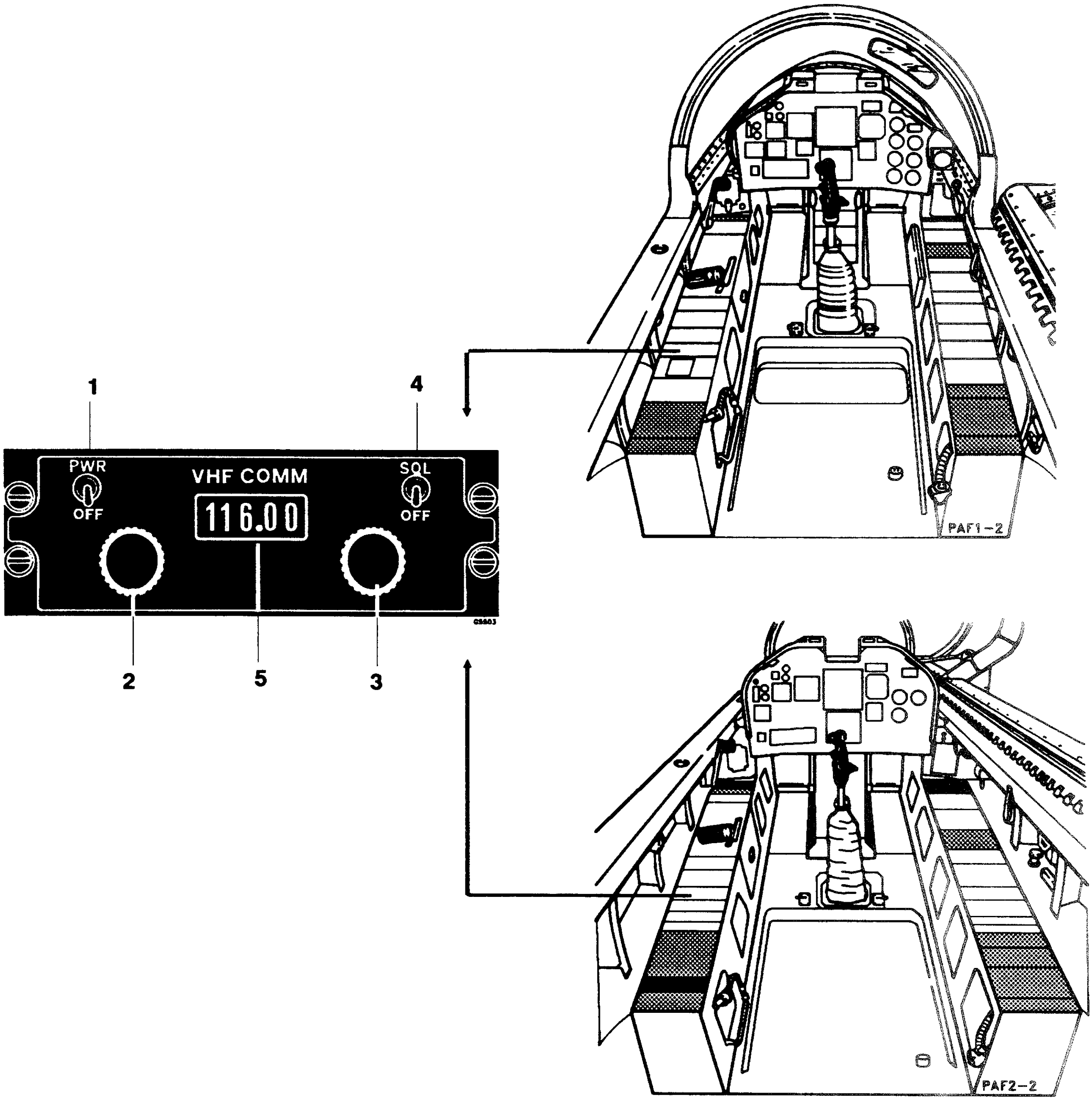
Pitch output information is continuous throughout ± 90° and is valid for all aircraft attitudes.

Heading output information is continuous throughout 360° and is valid for all aircraft attitudes.

There is no stops or controlled precession points in the attitude or heading axes of the AHRS.

Vertical erection is compensated for earth rate.

VHF COMM 2 SYSTEM CONTROLS [ACFT C]



DESCRIPTION		FUNCTION
1. Mode selector switch	OFF PWR	Removes power from radio set. Provides normal two-way communication
2. MHz Frequency Mode selector	Rotated	Select frequency in 1 MHz increments.
3. KHz Frequency Mode selector	Rotated	Select frequency in 25 KHz increments.
4. SQL/OFF switch	OFF SQL	Squelch is disabled. Enables main receiver squelch.
5. Frequency display	-	Display frequency as selected through the manual frequency controls.

Figure 1-44.

In flight, vertical accuracy is improved by roll or pitch erection cut-off, respectively during turns or longitudinal accelerations.
Heading data is available in three modes.
In the DG mode the heading data is derived from the directional gyro which is compensated for earth rate and mean drift.
In the SLAVED mode DG data is slaved to the earth's magnetic field as sensed by the MAD.
In the COMPASS mode, the output of the flux detector is repeated with electronic damping.
The AHRS is powered by 115 VAC BUSand 26 VAC BUS thru breakers as shown in figure 1-10.
For AHRS system controls description and operation see figure 1-45 sheet 1.

AHRS OPERATION

The AHRS can operate in three major modes: directional gyro (DG), slaved (SLV) and COMP. These modes are selected using the mode select switch on the compass system controller (CSC).
In the DG mode, the heading output represents the earth-rate corrected, free directional gyro azimuth angle. The sync/heading set control on the CSC is used to align the heading output to the desired reference. This mode is normally used only in areas where the magnetic meridians are weak and distorted.
In the SLV mode the AHRS provides gyro-stabilized magnetic heading outputs using the long term accuracy of the magnetic azimuth detector (MAD) and the short term response of the gyro.
The directional gyro is slaved by the heading error to produce the correct magnetic heading output; a PUSH TO SYNC knob is used to syncronize magnetic heading.
When the aircraft longitudinal acceleration exceeds 0.085 g or the turn rate exceeds 8°/minutes, the slaving signal is removed to eliminate slaving of the heading signal to acceleration induced errors of the magnetic azimuth detector.
In the COMPASS mode the AHRS provides magnetic heading information based on magnetic azimuth detector information without the benefit of gyro stabilization. This is an emergency mode used only in the event of a failure of the displacement gyroscope assembly. Output signals to attitude indicators are not provided in this mode and the AHRS provides a warning signal (OFF Flag) to Attitude Indicators.

ATTITUDE AND HEADING REFERENCE SYSTEM (AHRS) LITTON ITALIA LISA 2000A (ACFT C)

The attitude and heading reference system (installed on ACFT C) consists of a Gyro Electronic Unit (GEU), a Compass Adjustment Unit (CAU) in the nose radio compartment, a Compass System Controller (CSC) on the central pedestal of the front cockpit and a Magnetic Azimuth Detector (MAD) on the right wing tip.
The system provides pitch, roll and turn rate information to the atittitude indicators (AI), azimuth information to the HSI's and VOR/ILS receiver for the automatic VOR function.
The AHRS is an all attitude source of roll, pitch, heading angular displacement and turn rate data.
Roll output information is continuous throughout ±180° and is valid for all aircraft attitudes.
Pitch output information is continuous throughout ± 90° and is valid for all aircraft attitudes.
Heading output information is continuous throughout 360° and is valid for all aircraft attitudes.
There is no stops or controlled precession points in the attitude or heading axes of the AHRS.
Vertical erection is compensated for earth rate.
In flight, vertical accuracy is improved by roll or pitch erection cut-off, respectively during turns or longitudinal accelerations.
Heading data is available in two modes: DG and Slaved
In the DG mode the heading data is derived from the directional gyro which is compensated for earth rate and mean drift.
In the SLAVED mode DG data is slaved to the earth's magnetic field as sensed by the MAD.
The AHRS is powered by 28 VDC ESS BUS and 28VDC FWD BATT BUS.
For AHRS system controls description and operation see figure 1-45 sheet 2.

AHRS OPERATION

CAUTION

During engine starting, the AHRS system must be set to OFF. (AHRS switch OFF).

1. After engine light up set AHRS switch to ON.
2. Check illumination of ALIGN (amber) indicating light.

NOTE

After 25 seconds from ALIGN light illumination check that HSI warning flag goes out and after 20 seconds check that the indicating light goes out.

3. Check that the emisphere selector switch is set to the correct emisphere (N or S) and that the latitude correction control is set to the local latitude.

CAUTION

Be sure that the aircraft is static and levelled within ± 10 °.

4. Select DG or SLAVED operating mode.

NOTE

In the slaved mode, the heading output is slaved to the MAD, therefore to the earth magnetic field. Any misalignment indication between the Gyro Electronic Unit and the MAD is shown on the synchro indicator. Synchronization may be obtained by means of one of the following methods:

a. Perform unaccelerated level flight.
 1. Misalignment errors comprised within 10° will be corrected within 2 minutes.
 2. Misalignment errors comprised above 10° will be corrected immediately.
b. Rotate the HDG set knob until the synchro indicating pointer is being zeroed.
c. Set Mode Selector Switch to DG and then back to SLAVED.

NOTE

The heading output obtained is referred to true magnetic north.

DG Mode of Operation

NOTE

This mode of operation is used when flying in the vicinity of magnetic pole or during aerobatic flight. Positioning the Mode Selector Switch to DG, the heading output is not referred to magnetic north but to the heading previously selected. In this mode of operation, HDG SET knob rotation will cause a change in the heading information displayed on the HSI's.

In Flight AHRS System Synchronization

After aerobatics, with the Mode Selector Switch set to SLAVED perform AHRS system synchronization as follows:

a. Flying in levelled-unaccelerated flight, press the PRESS TO SYNC switch and wait for a few seconds until ALIGN indicating light goes out.

In Flight Synchronization After Loss of DC Power

a. Should loss of DC power be lower than 59 milliseconds the system will automatically synchronize within two seconds.

b. Should interruption of DC power be higher than 50 milliseconds, the system will go off. When 28 DC power is being re-applied the system turn on but the heading output information will be reliable only if the aircraft is in levelled (± 10°) unaccelerated flight. In case that the above values were not observed proceed as follows:
 a. Set Mode Selector Switch to DG and then to SLAVED (or viceversa if the Mode Selector Switch is set to DG position).

VHF NAV and DME SYSTEM

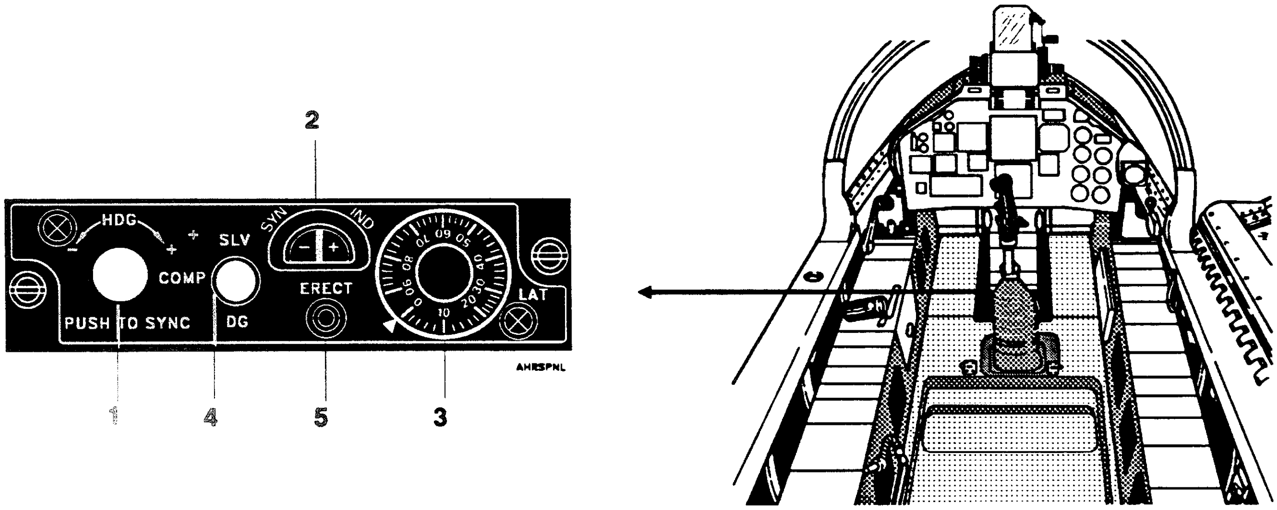
The VHF NAV system VIR 31A receives and process VOR, localizer, glide slope and marker beacon signals to provide VOR bearing, VOR course deviation, VOR to-from, localizer and glide slope deviation, high and low level flag signals, marker beacon flag signals and VOR, localizer and marker beacon audio signals.
The system consists of two VOR ILS controllers mounted on the right side of front and rear console, a receiver unit VIR 31A, installed in the upper fuselage radio compartment, two HSI mounted on front and rear instrument panel and VOR ILS and MKR antennas.
The receiver consists of three major sections:
-VOR/LOC
-Glide slope (GS) section
-Marker beacon (MKR receiver).
•The VOR/LOC receiver tunes and process VOR (112.00 to 117.95 MHz) and LOC (108.00 to 111.95 MHz) signals to display either magnetic bearing to or from a ground VOR station, or the deviation (in the azimuth plane) from the runway centerline during an ILS approach. VOR information is displayed in the automatic mode on N°.1 pointer of the horizontal situation indicator (HSI).
•The GS receiver tunes and processes the signals transmitted by the GS transmitter of ILS and displays the deviation (in the elevation plane) from the standard glide path. The GS frequency are paired to LOC channels and are therefore selected by a single set of controls.
Deviation information is displayed on the HSI.
The VHF/NAV system is powered by the 28VDC NORM BUS through the VOR ILS circuit breakers and by 26 VAC Bus Bar through VOR ILS circuit breaker.
•The MKR receiver is tuned at a fixed frequency of 75 MHz and provides selective aural and visual information when overflying the marker beacon.
The VOR ILS controller can be tuned to any one of the 252 DME channels in the frequency range of 962 to 1213 MHz; the DME frequency is paired to the VHF NAV frequency and therefore no specific selector is needed. The system processes the signal and dispays (on the HSI) slant distance between aircraft and ground facility.
The DME system is powered by the 28 VDC NORM BUS via DME circuit breaker installed on the circuit breaker panel of front cockpit central pedestal.
For VHF NAV controls and indicators description and operation see figure 1-46.

VHF NAV SYSTEM OPERATION

VOR/ILS and MKR Operation

a. On COMM/NAV CONTROL SHIFT select front or rear VOR ILS control set.
b. On the selected VOR ILS control panel :
 1. Set power switch to PWR.
 2. Select operating frequency by means of fre-

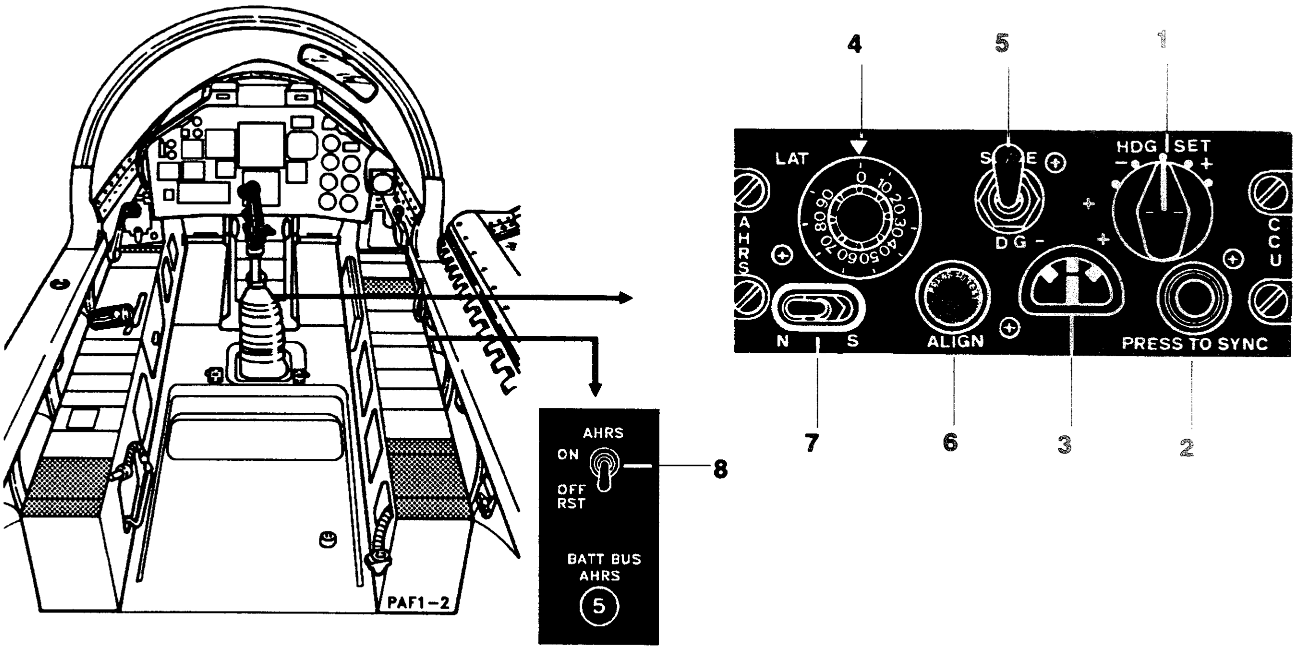
AHRS SYSTEM CONTROLS [ACFT A AND B]



DESCRIPTION		FUNCTION
1. SYNC/heading set control	-	The sync/heading controll is a push-to turn control which serves two purposes dependent upon the AHRS operating mode. In SLV mode, pushing in the control command provides automatic magnetic synchronization. In the DG mode, pushing in and turning the control provides a means to align the heading output to the desired heading.
2. SYN IND	-	With the AHRS in the slaved mode, the SYNC indicator provides an indication of system magnetic alignment. When the needle is centered, the heading output is aligned to the earth's magnetic field as detected by the magnetic azimuth detector.
3. Latitude correction control	-	The latitude correction control is set to the local latitude to compensate for earth rate and Coriolis acceleration.
4. Mode selector switch	DG	The heading output represents the earth rate corrected, free directional gyro azimuth angle. The sync/heading control set to CSC provides alignment of the heading output to the desired reference. This mode is normally used in areas where the magnetic meridians are weak and distorted or when operating in a tactical grid system.
	SLV	In the slaved mode, the AHRS provides gyro-stabilized magnetic heading ouputs using the long term accuracy of the magnetic azimuth detector and the short term response of the gyro. The directional gyro is slaved by the heading error to produce the correct magnetic heading output. When the aircraft longitudinal acceleration exceeds 0.085 g or the turn rate exceeds 8°/min, the slaving signal is removed to eliminate slaving of the heading signal to acceleration induced errors of the magnetic azimuth detector.
	COMP	The AHRS provides magnetic azimuth detector information without the benefit of gyro stabilization. This is an emergency mode used only in the event of a failure of the dispacement gyroscope assembly. Output signals to attitude indicators are not provided in this mode and the AHRS provides a warning signal (OFF flag) to attitude indicators and horizontal situation indicators.
5. Erect switch	Pushed	Applies fast erection to the vertical gyro until the button is released or the gyro erects to within 0.5°from vertical. The switch overrides longitudinal acceleration cut out but will not apply fast erection cut out by turn rate.

Figure 1-45. (Sheet 1 of 2) [ACFT A & B]

AHRS SYSTEM CONTROLS [ACFT C]



	DESCRIPTION		FUNCTION
1.	HDG SET Knob	Left or right	With Mode Selector Switch (5) set to SLAVE position, the HDG SET knob allows AHRS system manual synchronization. With Mode Selector Switch (5) set to DG position, the HDG SET knob allows to select a desired heading.
2.	PRESS TO SYNC Push Button	Pressed	With the Mode Selector Switch (5) set to SLAVE position, provides automatic magnetic synchronization.
3.	Synchro Indicator	-	With the AHRS in the SLAVE mode, the SYNC indicator gives indication of magnetic alignment. When the needle is centered, the heading output is aligned with the earth's magnetic field as detected by the magnetic azimuth detector (MAD)
4.	Latitude Correction Control	-	The latitude control is set to the local latitude to compensate for earth rate and Coriolis acceleration.
5.	Mode Selector Switch	DG	The heading output represents the earth-rate corrected, free directional gyro azimuth angle. This mode is normally used in area where the magnetic meridians are weak and distorted or when operating in a tactical grid system.
		SLAVE	In the slaved mode, the AHRS provides gyro-stabilized magnetic heading output using the long term accuracy of the magnetic azimuth detector and the short term response of the gyro. The directional gyro is slaved by the heading error to produce the correct magnetic heading output
6.	ALIGN Indicator Light	-	Comes on during system light-up and goes out when the system is ready to operate. The indicator light intensity is adjusted by means of the INSTR potentiometer on INT LTS control panel.
7.	Emisphere Selector Switch	-	Used to select the emisphere in which the aircraft is being operating.
8.	AHRS power switch	OFF/RST	AHRS system inoperative.
		ON	AHRS system powered by 28 VDC ESS BUS and BATT Bus.

Figure 1-45. (Sheet 2) [ACFT C]

VHF/NAV CONTROLS AND INDICATORS

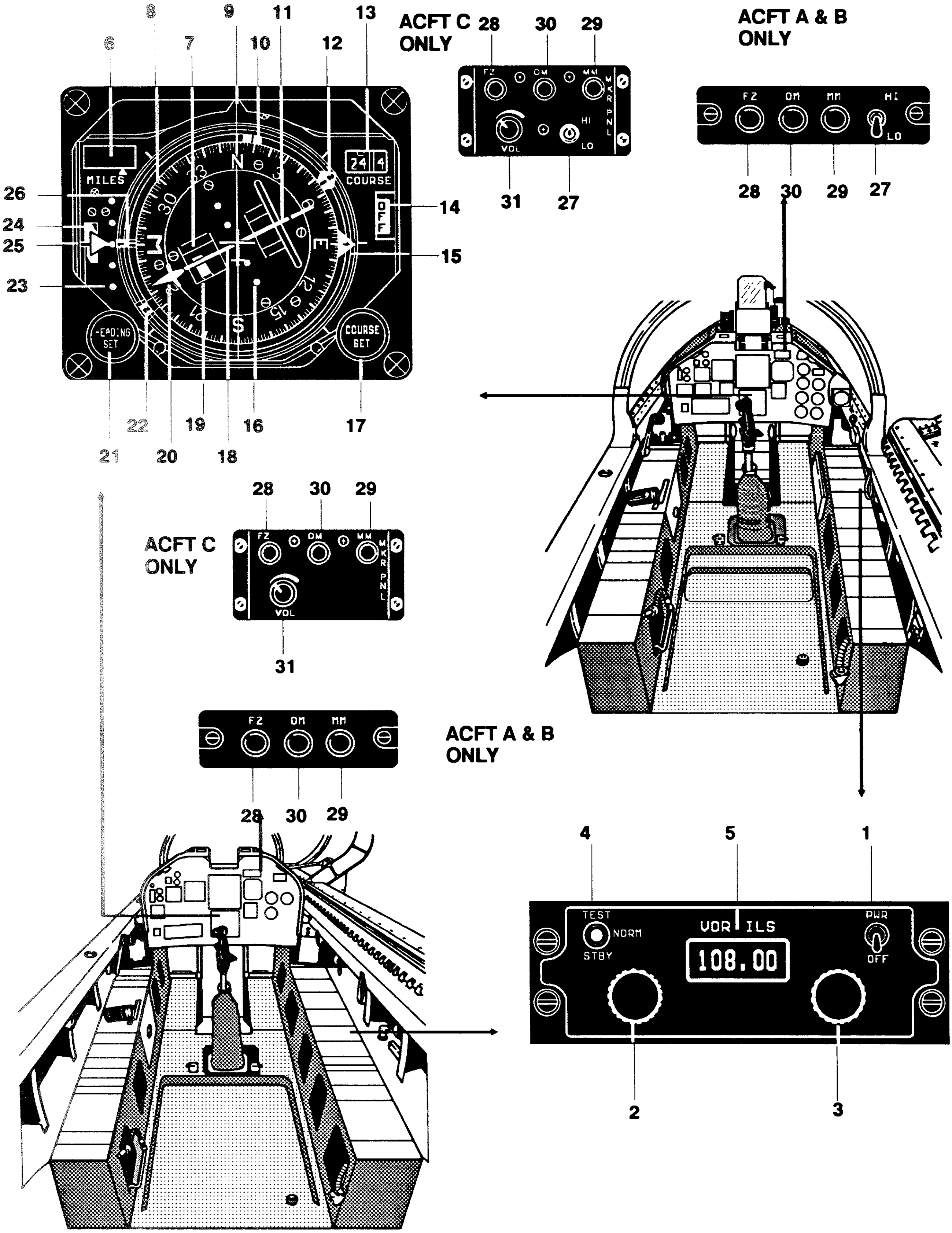


Figure 1-46. (Sheet 1 of 3)

VHF/NAV CONTROLS AND INDICATORS

DESCRIPTION			FUNCTION
VHF NAV Control Panel Description			
1.	Power switch	OFF PWR	The VOR ILS and DME system are de-energized. Applies power to VOR ILS and DME systems.
2.	MHz freq. selector	Rotated	Selects operating frequency in 1 MHz increments.
3.	KHz freq. selector	Rotated	Select operating frequency in 50 KHz increments.
4.	Mode selector switch	NORM TEST	VOR ILS and DME operates normally. During test check for the following (VOR station tuned and course arrow positions between 0÷5°): The VOR/LOC flag goes out of view after 3 seconds, the deviation bar will center, TO-FROM indicator indicates TO, the bearing pointer N°1 shall be within 0÷5°, the marker lights flick and an audio tone of 30 Hz must be heard in the headset, the DME range display on the HSI shows 0.0 or 0.1. Then, set the mode selector switch to NORM and check for: - The VOR flag comes in view after one second than goes out of view for five seconds, the bearing pointer N°1 of the HSI will park at 90° within one second. Select a LOC frequency, set Mode Selector switch to TEST and check that VOR/LOC goes out of view after ~3 seconds, the Glide Slope flags goes out of view after ~ 1.5 seconds, the course deviation bar shall indicate a right deflection of approximately one dot, the glide slope pointer will indicate a down deflection of one dot, the marker lights shall flick and a tone of 30 Hz shall be heard in the headset. Set the Mode Selector switch to NORM and check that VOR/LOC and glide slope flags come in view after one second.
		STBY	DME receiver in standby operation while VOR/ILS operates normally.
5.	Channel display	-	Displays the selected operating frequency .
HSI Description			
6.	MILES distance indicator	-	Indicates the aircraft distance, in nautical miles, from the selected VOR/DME station.
7.	TO-FROM indicator	-	Indicates whether the aircraft is moving TO or FROM selected station.
8.	Compass card	-	Indicates aircraft heading in degrees at the fixed lubber line.
9.	Fixed lubber line	-	Permits reading of the aircraft magnetic heading.
10.	Selected heading reference	-	Selected by the HEADING SET knob.
11.	Course deviation bar	-	When in VOR mode, bar lateral displacement indicates amount and direction of deviation from selected course.
12.	Bearing pointer N°2 (head)	-	Indicates the bearing of the NDB station.
13.	Course window	-	Displays the value of course selected by the COURSE SET knob.
14.	OFF flag	In view	Indicates that the instrument is de-energized.
15.	Bearing pointer No. 1 (head)	-	Indicates the bearing of the VOR station.
16.	Course deviation scale		When in VOR mode, allows the deviation bar to indicate the amount of deviation from the deviation course. Every dot represents a 5° deviation. When in ILS mode allows the deviation bar to indicate the amount of deviation from the LOC. Each dot indicated 1/4° deviation.
17.	COURSE set knob	-	Permits to select desired course. Relevant information appears in the COURSE window and is indicated by the course arrow.
18.	Miniature aircraft	-	Point of reference to compair HSI readings with aircraft heading.

Figure 1-46. (Sheet 2)

VHF/NAV CONTROLS AND INDICATORS

DESCRIPTION			FUNCTION
19.	Deviation bar flag	In view	The course bar indication is unreliable.
20.	Course arrow (head)	-	Indicates the course selected with the COURSE SET knob.
21.	HEADING SET knob	-	Sets the heading reference.
22.	Bearing pointer No.2 (tail)	-	Indicates the NDB station radial.
23.	Glide slope scale		Permits to indicate the amount of deviation from the glide slope beam. Each dot represents approximately 1/4°.
24.	Glide slope flag		Indicates that glide slope input signal is unreliable.
25.	Glide slope indicator		Indicates the position of the glide slope with respect to the aircraft.
26.	Bearing pointer 1 (tail)		Indicates the VOR station radial.
Marker Control Panel Description			
27.	MKR sensivity	HI LO	High sensivity to receive airway marker signals. Low sensitivity to receive ILS marker signals.
28.	FZ light (white)	On	Indicates that aircraft is flying over an airway marker. The aural signal of 3000 Hz is heard in the headsets.
29.	MM light (amber)	On	Indicates that aircraft is flying over an ILS middle marker. The aural signal of 1300 Hz is heard in the headsets.
30.	OM light (blue)	On	Indicates that aircraft is flying over an ILS outer marker. The aural signal of 400 Hz is heard in the headsets.
31.	VOL knob	Rotated	Adjust the level of MKR signals.

Figure 1-46. (Sheet 3)

quency selector knob.

c. On ICS panel:

a. Set MKR and VOR switch to on.

b. Volume knob as required.

DME Operation

a. On VOR ILS control panel:

1. Set mode selector switch to STBY. (VOR ILS section still powered. DME powered for warm-up only).

NOTE

The warming time is approximately two minutes.

2. Set mode selector knob to NORM (Both VOR ILS and DME section powered).

3. Select operating frequency by means of frequency selector knob.

b. On ICS panel:

1. Set DME switch to On.

2. Volume knob as required.

HORIZONTAL SITUATION INDICATOR (HSI)

The horizontal situation indicator allows to define the aircraft position in relation to the selected VOR or DME station.

The magnetic heading is indicated by a rotating compass card read against a fixed lubber line on the instrument dial face. The compass card is operated by the Attitude and Heading Reference System.

The HEADING SET knob , in the lower left corner of the instrument, permits to set a double heading marker to the desired heading. This marker rotates in synchronism with the azimuth ring after selection. The heading value selected must be read on the compass card.

The selected VOR radial is set by means of the COURSE SET knob mounted in the lower right corner of the instrument and is indicated by the arrow located in the central section of the dial face. This value must be read against the compass card.

The course value is also indicated by a three digit indicator installed in the upper right corner of the instrument dial.

A lateral drift (left or right from the center portion of the course arrow) indicates an opposite deviation of the aircraft from the selected course. The inner dot indicates five degrees deviation from the selected course ; the outer dot indicates ten degrees deviation. When used with the ILS, each dot indicates a 1-1/4 degree deviation from the LOC.

A red alarm flag will appears in a display window under

the head portion of the arrow to indicate an invalid deviation reading.
The instrument incorporates a glide slope function which displays the deviation (in the elevation plane) from the standard glide path.
A small pointer (TO-FROM) appears under the front or the rear part of the course arrow. When the TO-FROM indicator appears, it indicates that the course selected is correctly intercepted and flown.
The magnetic bearing of the station is indicated by pointers No. 1 and No. 2 located on the outer periphery of the compass card. The tails of the same pointers indicate the selected radials.
A red warning flag marked OFF appears, in a display window below the numerical indicator, to indicate lack of AC power to the instrument.
The front and rear HSI are interlocked in order to slave the COURSE SEL knob to the VOR ILS controller selected on the COMM NAV CONTROL SHIFT panel.
The distance from the VOR station to the aircraft in nautical miles is indicated by four digit indicator in the upper left corner of the dial face in accordance with the signal fed from the DME unit. If the system is not operating or is in search condition, dashes will appwear in the DME display.
The horizontal situation indicators are powered by the 115 VAC BUS via HSI circuit breakers installed on the central pedestal and on the circuit breaker panel of right console in the rear cockpit.

ADF SYSTEM DESCRIPTION

The ADF navigation system consists of an ADF 60A Remote Receiver Unit, installed in the aft radio compartment, two G-4881-03 ADF Controllers mounted on the right front and rear console and an ANT 60A integrated antenna, mounted on the lower fuselage side.
The ADF receiver is a low frequency band (190÷1749.5 KHz frequency range) which provides bearing output to the bearing pointer N° 2 of the HSI's.
The ADF system is powered by the 28 VDC NORM BUS [ACFT A & B] and 28 VDC ESS BUS [ACFT C] through the ADF circuit breaker and by the 26 VAC BUS through the ADF circuit breaker for ADF synchro-output. The ADF system may be controlled either from the front or rear cockpit through the respective front and rear COMM/NAV CONTROL SHIFT panel.
The ADF control panels allow ADF system management, operating mode selection, frequencies selection, audio level regulation, etc. With the system ON and operating frequency already selected, the system may be used from both cockpits, as far as the identification audio (ICS) and ADF bearing displayed on HSI's bearing pointer N°2 are concerned.
For ADF system control description and operation see figure 1-47.

ADF SYSTEM OPERATION

1. Select forward or aft ADF radio control set by means of COMM/NAV CONTROL SHIFT.
2. Switch ON the ADF receiver by setting the Mode Selector switch to ANT position.
3. Set Transfer Switch (TFR) leftward.
4. By means of the left Frequency Selector concentric knobs, select desired operating frequency. Check that operating frequency be displayed on the upper left side window.
5. Set Transfer Switch (TFR) rightward and if desired select a second operating frequency by means of the right Frequency Selector concentric knobs. Check that operating frequency be displayed on the upper right window.

NOTE

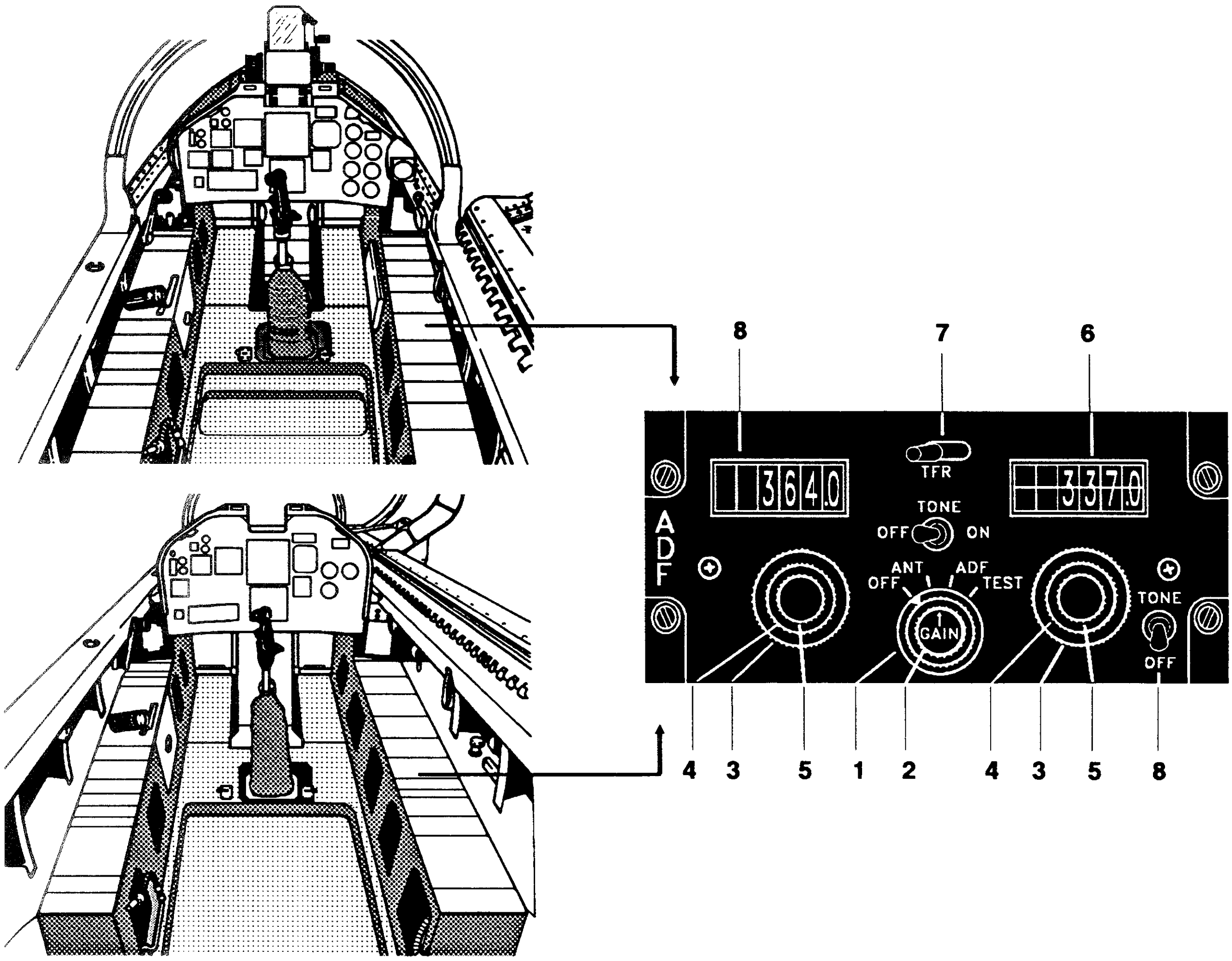
The HSI's single bar pointer are parked horizontally.

6. Adjust the GAIN control concentric knobs with the Mode Selector to the maximum clockwise position.
7. On Audio Control Panel (ICS) pull and regulate volume control by means of ADF combined potentiometer/push pull switch and listen to the audio identification from ADF ground station. (Should the ground station be on A1 type, set TONE-OFF switch to TONE position).
8. Through the Mode Selector knobs, select ADF position. The bearing pointer of the HSI's indicator should move and point the relative bearing to the ground station.
9. With the receiver tuned to a station frequency record the bearing indicator as a reference. Activate the self-test circuit, the pointer should rotate 90° from reference and return to the reference when self-test switch is released.

ATC TRANSPONDER SYSTEM

The ATC (Air Traffic Control) transponder system consists of the Transponder Unit TDR90 in the aft upper avionic compartment, the control panel on the right console of the front cockpit and the associated antenna on bottom side of the fuselage.
The system provides identification and transmission of coded altitude informatione when interrogated by a SSR (Secondary Surveilance Radar) ground station. The transponder receives and decodes interrogation from the ground station (at 1030 MHz) and transmits a coded reply (at 1090 MHz).
The system is powered by the 28VDC ESS BUS via ATC circuit breaker installed on the circuit breaker panel on the central pedestal (front cockpit).
For ATC system control description and illustration see figure 1-48.
For altimeter encoder description and operation see figure 1-28.

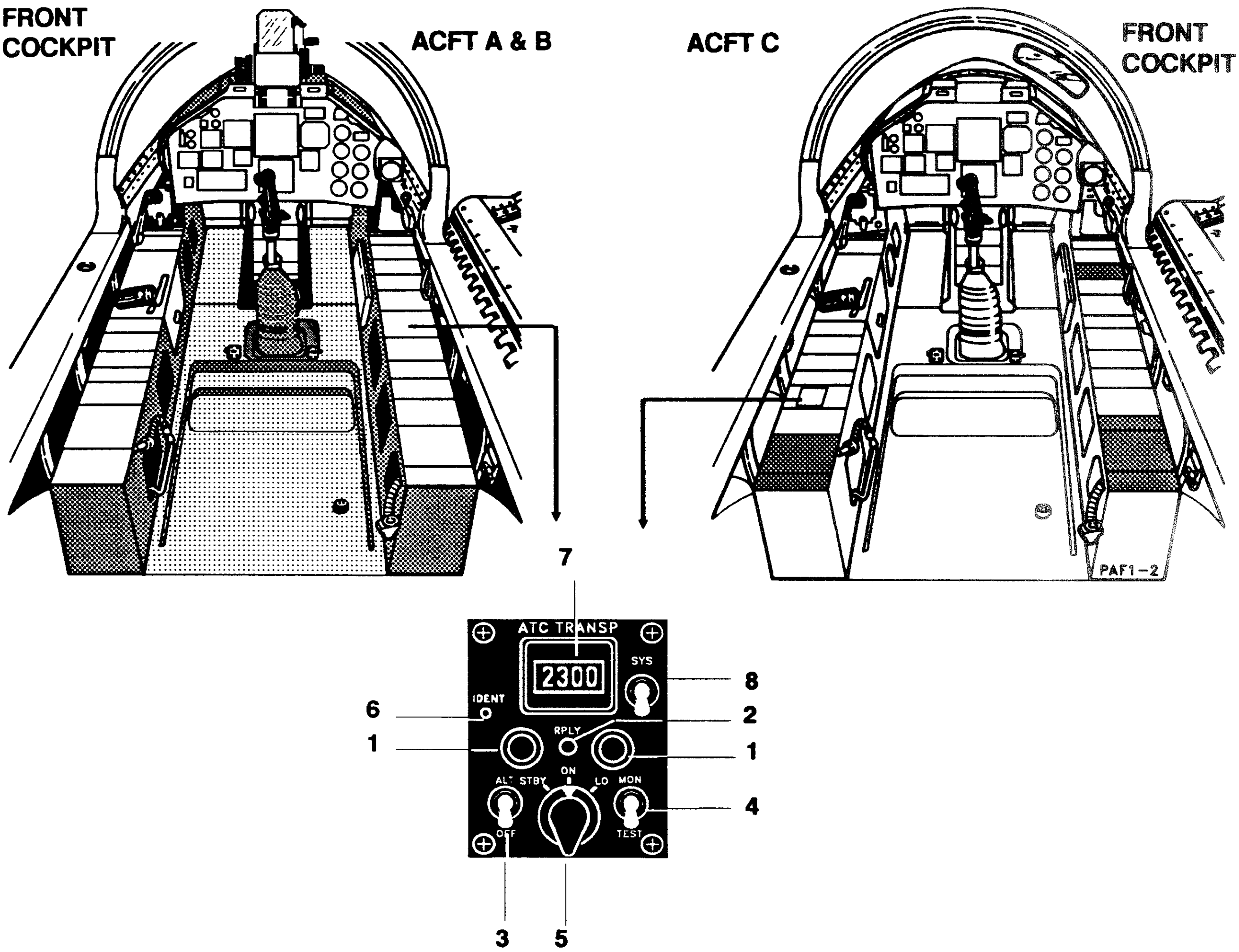
ADF SYSTEM CONTROLS



	DESCRIPTION		FUNCTION
1.	Mode selector knob	OFF	De-energized position.
		ANT	ADF receiver operates as an aural receiver providing only an aural output of the received signal.
		ADF	The system operates as an automatic direction finder receiver. Relative bearing to the station is represented to the HSI single bar pointer and provides audio output of the received signal.
		TEST	The HSI bar pointer No. 2 will rotate 90° counterclockwise from previous valid indication.
2.	GAIN control knob	Rotated	Controls the audio level from the ADF controls.
3.	Frequency selector	Rotated	Selects frequencies in 100 KHz increments.
4.	Frequency selector	Rotated	Selects frequencies in 10 KHz increments.
5.	Frequency selector	Rotated	Selects frequencies in 1 KHz increments.
6.	Frequency indicator	-	Indicates selected frequency in KHz of the associated receiver.
7.	TFR switch	Left or right	Selects one of two preset frequency. A white bar appears in the window of frequency not selected. Only used frequency illuminated.
8.	TONE switch	OFF	Tone mode is cut-out.
		TONE	Provides an aural output tone of 1000 Hz when receiving a signal to identify a keyed CW signals.

Figure 1-47.

ATC TRANSPONDER SYSTEM CONTROLS



	DESCRIPTION		FUNCTION
1.	Code selector knobs	-	Used to select the reply code. The selected code will appear in the code window.
2.	RPLY light (green)	Flashing On	Indicates that transponder is replying to interrogation. During self-test to indicate correct system operation.
3.	Mode switch	ALT OFF	The unit transmits coded altitude information on mode C. The unit transmits a normal mode C without coded altitude information.
4.	Test switch	MON Center TEST	Allows the reply lamp to operate when the transponder replies to an interrogation. RPLY lamp inoperative. Activates the transponder self-test circuitry.
5.	Mode selector	STBY ON LO	Primary power applied for system warm-up only. System normal operation. Selects the low sensitivity mode of operation.
6.	IDENT push-button	Pressed (momentarely)	Initiates the transmission of a discrete identification pulse.
7.	Code window	-	Displays the reply code selected by the code selector knobs.
8.	SYS switch	-	Not in use.

Figure 1-48.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

The exterior lighting installation consists of three navigation lights, which incorporate strobe lights and two landing and taxi lights.

∘The navigation lights comprise two wing tip lights (red on the left, green on the right and one white light on the tail fairing). The navigation lights may operate in steady, flashing and dim or bright modes, according to the position of the NAV LTS rotary switch installed on the EXT LTS panel.

∘The strobe lights, at the wing tips are controlled by the BCN switch on the EXT LTS panel.

The system comprises a strobe light power supply in a compartment on the left air intake cover.

∘The landing and taxi lights are on the leading edge of the LH and RH wing and are both controlled by a three position switch on the left side of the instrument panel (front cockpit).

The navigation lights are powered by the 28 VDC essential bus bar via NAV LTS circuit breaker.

The strobe, landing and taxi lights are powered by the 28 VDC normal bus via BCN LT; LDG LTS and TAXI LTS are powered by circuit breakers having corresponding names.

The exterior lighting system controls are described and illustrated in figure 1-49.

INTERIOR LIGHTING

The interior lighting system comprises warning and push button lights, instrument lights, controllers lights and emergency lights.

Warning and push-button lights provides illumination of caution panel and push-buttons and are controlled by the relevant potentiometer installed on the INT LTS control panel. The instruments are integrally illuminated and the light intensity is controlled by the relevant potentiometer installed on the INT LTS control panel.

Controller lights provide the illumination of all control panels and are powered by the relevant potentiometer installed on the INT LTS control panel.

Emergency lights, directly connected to the battery system, provide cockpit illumination in case of electrical failure and are powered through a EM LTS three position switch.

For emergency lights location refer to figure 1-49.

SERVICING

The servicing diagram is illustrated in figure 1-50.

ARMAMENT SYSTEM [ACFT A]

The aircraft (see figure 1-51) has provision for the installation of four underwing pylons to carry and fire/release several combination of external stores as illustrated in Section V of this Manual.

External stores selection and control is accomplished from the front cockpit only, through the armament control panel on the right console.

In the rear cockpit only the indication of the functions selected are displayed through an External Store Selection Indicator Panel.

The aircraft has also provisions for the installation of the Gun Sights above the front and rear instrument panel.

Firing and releasing controls are on both front and rear control stick grip.

Electrical power for the operation of the armament circuits is provided by the 28 VDC NORM BUS through the ARMT circuit breaker and MASTER switch in the front cockpit.

A MASTER OVRD switch is provided, on the rear instrument panel, to cut-out the electrical power from the armament circuit to prevent or interrupt the firing sequence carried out from the front cockpit.

Operation of the firing circuit, while the aircraft is on the ground, is prevented by a safety switch (MLG down switch). The switch maintains the firing circuit open until the aircraft weight is on the wheels. However, operation of the firing circuit on the ground may be accomplished by means of a Ground Fire switch on the External Breakers and Bite Panel. The switch, when set to ON, closes the circuit between the trigger switch and the armament control panel by-passing the main gear down-lock circuit.

A SALVO switch on the front and rear instrument panel is provided for emergency external store Jettison. The switches, directly powered by the battery can operate either with the aircraft on ground or in flight. Therefore, to prevent inadvertent operation both SALVO push button switches are protected by a lockwired safety guard.

ARMAMENT SYSTEM CONTROLS

For armament system controls description, operation and location see figure 1-52.

SIGHTING SYSTEM [ACFT A]

The S211 (see figure 1-53) installs an optical sighting system type ISIS D211.

The ISIS D 211 system is a lead computing optical sight for air-to-air attacks with guns and air-to-ground attack with guns, rockets and bombs.

Provision is made on the sighthead for mounting a camera recorder.

The ISIS D 211 optical sighting system provides a sightline for guns in air-to-air attacks and guns, rockets and bombs in air-to-ground attacks. In each mode of attack, the gyro controlled aiming mark is so

LIGHTING SYSTEM CONTROLS

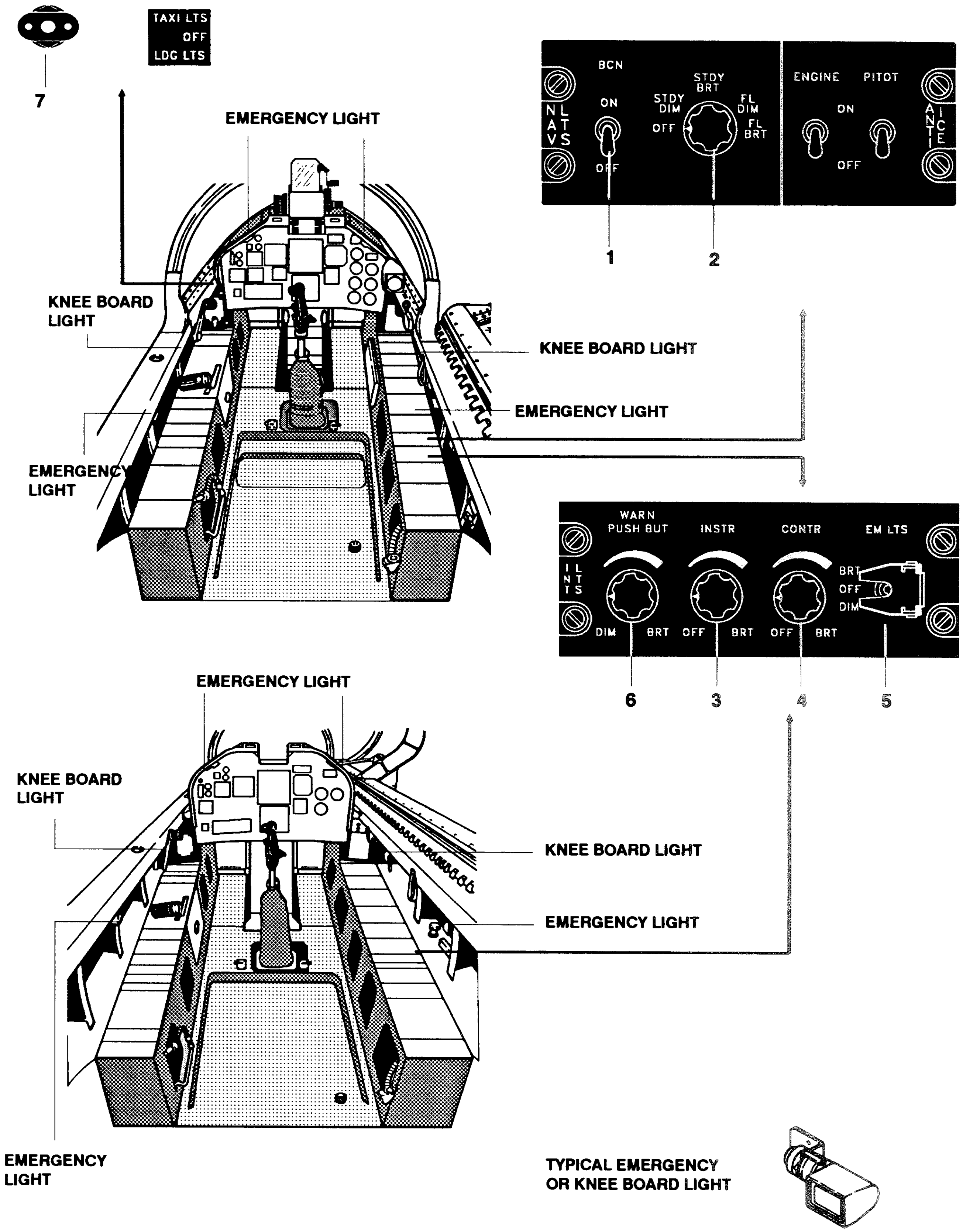


Figure 1-49. (Sheet 1 of 2)

LIGHTING SYSTEM CONTROLS

DESCRIPTION			FUNCTION
1.	BCN strobe lights sw	OFF	Turns off the stobe lights.
		ON	Turns on the strobe lights.
2.	Nav lights potentiometer	OFF	The navigation lights are off.
		STDY DIM	The navigation lights operate in steady dim light.
		STDY BRT	The navigation lights operate in steady bright light.
		FL DIM	The navigation lights operate in flashing dim light.
		FL BRT	The navigation lights operate in flashing bright light.
3.	INSTR potentiometer	OFF	The instrument lights are off.
		INTERMEDIATE	Provides instrument lights medium illumination.
		BRT	Provides instrument lights bright illumination.
		Pulled (Switched-on)	Provides instrument lights bright illumination.
4.	CONTR potentiometer	OFF	De-energized position.
		INTERMEDIATE	Provides medium illumination of control panels and knee-board lights
		BRT	Provides bright illumination of control panels and knee-board lights .
		Pulled (Switch-on)	Provides bright illumination of control panels and knee-board lights in case of potentiometer failure.
5.	EM LTS switch	BRT	Provides emergency lights bright illumination.
		OFF	De-energized position.
		DIM	Provides emergency lights dim illumination.
6.	WARN PUSH BUT potent.	DIM	Provides warning and caution lights dim illumination.
		BRT	Provides warning and caution lights bright illumination.
		Pulled (Switch-on)	Provides bright illumination of warning and caution lights in case of potentiometer failure.
7.	TAXI LTS/LDG LTS	OFF	De-energized position.
		TAXI LTS	Taxi lights illuminated.
		LDG LTS	Taxi lights illuminated.

Figure 1-49. (Sheet 2)

SERVICING DIAGRAM

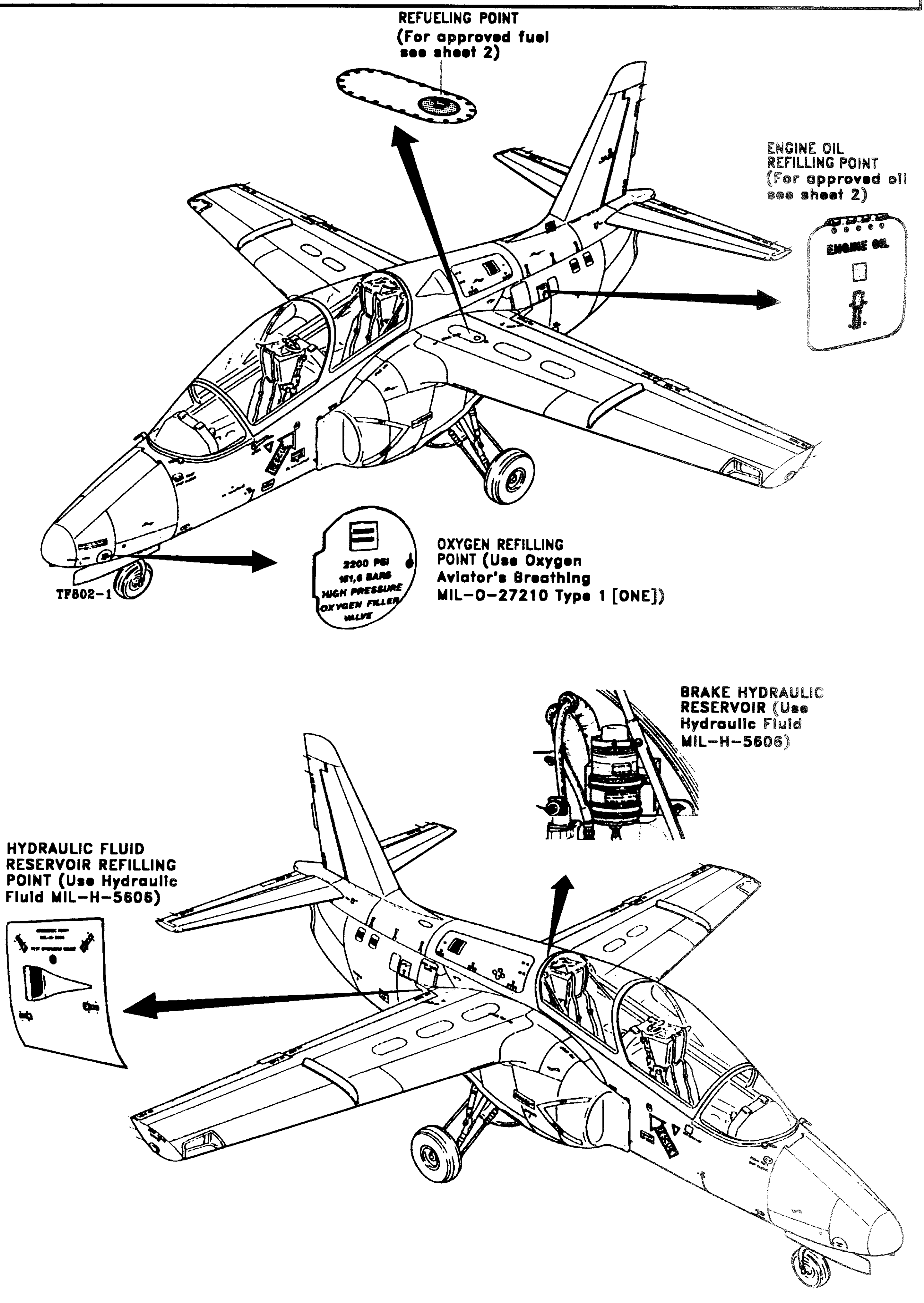


Figure 1-50. (Sheet 1 of 2)

SERVICING DIAGRAM

FUEL

NOTE

The fuel used in the aircraft shall have an anti-icing additive.
Commercial fuel may not contain icing inhibitor; in this case icing inhibitor MIL-I-27686E (commercial name PRIST) shall be added during aircraft refueling in concentrations of 0.10 - 0.15 maximum percent by volume

CAUTION

Lack of fuel system icing inhibitor (FSII) may cause fuel filter or line icing and consequently engine flame-out.

PRIMARY FUEL

FUEL TYPE	SPECIFICATION			NATO CODE	JOINT SERVICE DESIGNATION
	ASTM	U.S. MILITARY	BRITISH		
Aviation turbine fuel kerosine type (freezing point -58°)	D1655 JET B	MIL-T-5624 JP4	DERD 2452	F-40	AVTAG
Aviation turbine fuel kerosine type (freezing point -47°)	-	MIL-T-83133 JP8	DERD 2453	F-34	AVTUR
Aviation turbine fuel kerosine type (freezing point -47°)	D1655 JET A-1	-	DERD 2494	F-35	AVTUR
Aviation turbine fuel kerosine type (freezing point -46°)	-	MIL-T-5624 JP5	DERD 2452	F-44	AVCAT

EMERGENCY FUEL

FUEL TYPE	ASTM	U.S. MILITARY	BRITISH	NATO CODE	JOINT SERVICE DESIGNATION
Aviation Gasoline Grade 100/130 (Freezing point -60°) (See limitations in the Engine Maintenance Manual and S.B. No. 7144)	-	MIL-G-5572	DERD 2485	F-18	100/130 AVGAS 115/145 AVGAS

ENGINE LUBRICATING OIL

DEFINITION	SPECIFICATION		NATO CODE	COMMERCIAL DESIGNATION
	U.S. MILITARY	BRITISH		
Synthetic lubricating oil for aircraft gas turbines	MIL-L-23699	-	O-156	Mobil Jet 2 Shell Asto 500 500 Exxon 2380

For additional information refer to PW S.B. 7001.

OXYGEN

DEFINITION	U.S. MILITARY
Oxygen aviator's breathing (Gas)	MIL-O-27210 Type 1 (ONE)

Figure 1-50. (Sheet 2)

ARMAMENT SYSTEM SCHEMATIC

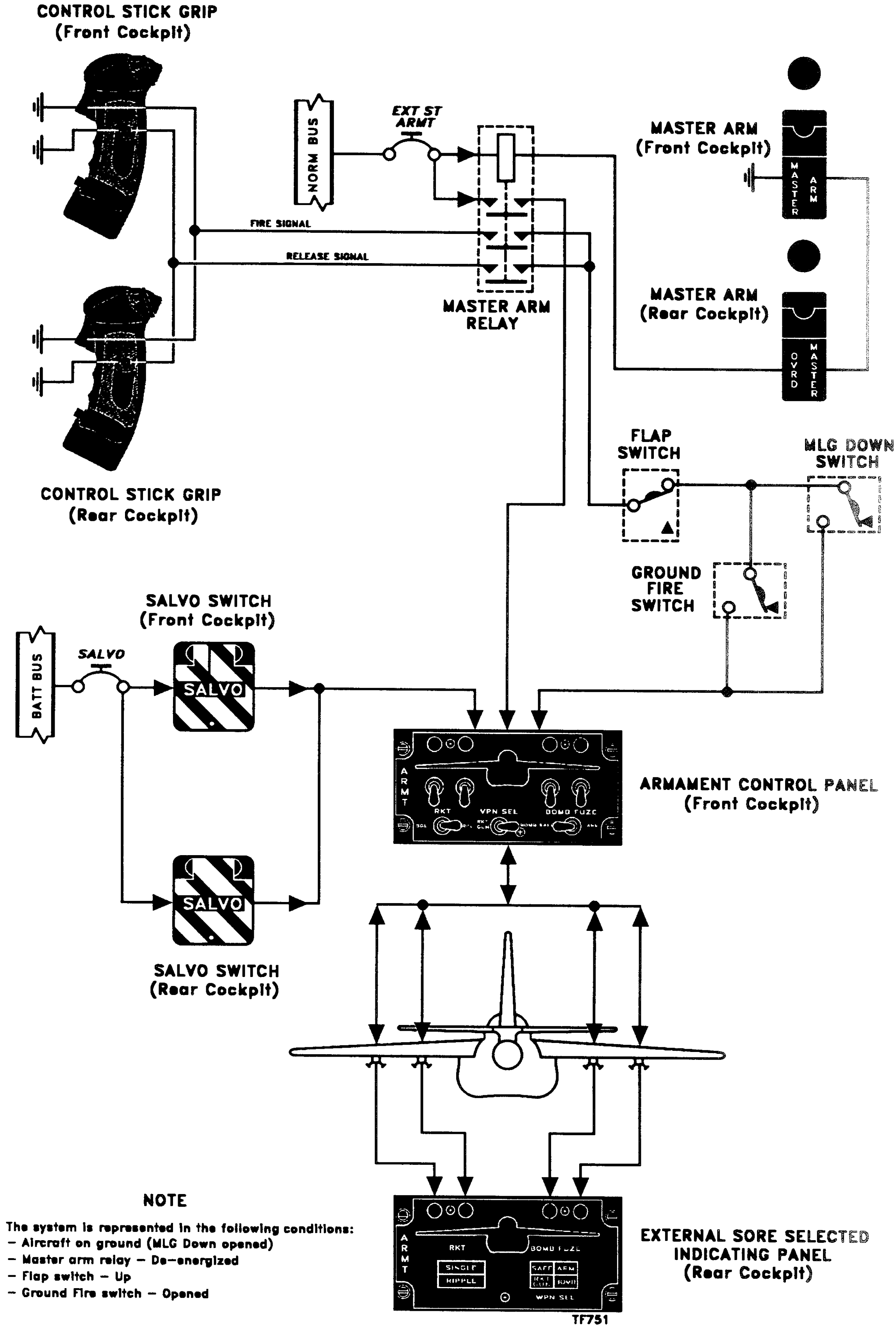


Figure 1-51.

ARMAMENT SYSTEM CONTROLS

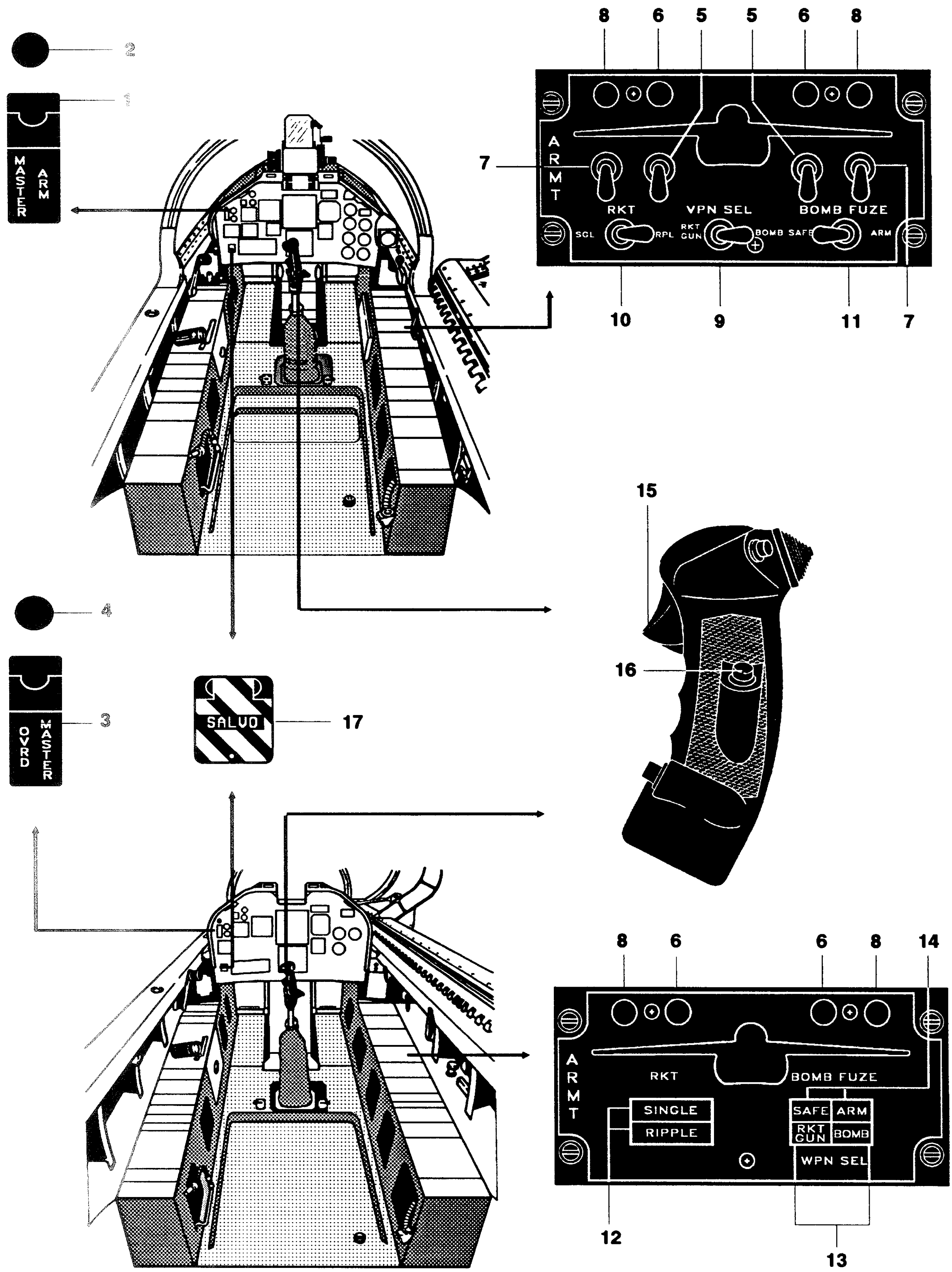


Figure 1-52. (Sheet 1 of 2) [ACFT A]

ARMAMENT SYSTEM CONTROLS

DESCRIPTION		FUNCTION
1. MASTER ARM switch	Off (Guard down)	The armament circuit is de-energized
	On (Guard up)	The armament circuit is operative.
2. MASTER ARM warning light	Out	The armament circuit is de-energized
	On	Indicates that the switch (1) is set to on and that the armament circuit ready to operate.
3. MASTER ARM OVRD switch (Rear cockpit)	On (Guard down)	Supplies 28 VDC power to armament circuit provided that the MASTER ARM switch (1) is set to on.
	Off (Guard up)	Removes or prevents 28 VDC power supply to the armament circuit.
4. MASTER ARM warning light (Rear cockpit)	Out	The armament circuit is de-energized. MASTER ARM switch (1) set to Off.
	On	Indicates that the switch (1) is set to on and that the armament circuit ready to operate.
5. Inboard pylon switches	Off (Down)	Inboard pylons armament circuit de-energized.
	On (Up)	The inboard pylons armament circuit energized if MASTER ARM switch (1) is set to on.
6. Inboard pylon warn lights	Out	Indicates that the inboard pylons armament circuit is de-energized.
	On	Indicates that the inboard pylons armament circuit is energized (switch 1and 5 set to on).
7. Outboard pylon switches	Off (Down)	Outboard pylons armament circuit de-energized.
	On (Up)	The outboard pylons armament circuit energized if MASTER ARM switch (1) is set to on.
8. Outboard pylon warn lights	Out	Indicates that the outboard pylons armament circuit is de-energized.
	On	Indicates that the outboard pylons armament circuit is energized (switch 1and 5 set to on).
9. WPN SEL switch	RKT GUN	Selects the rocket and gun circuit of armament system to allow gun firing and/or rocket launching.
	BOMB	Selects the bomb circuit of armament system to allow releasing of bombs.
10. RKT switch	SGL	Allows firing of one rocket at a time.
	RPL	Allows firing of rockets in ripple mode as selected on the sequence switch of the rocket launcher.
11. BOMB FUZE switch	SAFE	The bomb fuzes are unarmed.
12. RKT advisory lights	SINGLE/RIPPLE	SINGLE or RIPPLE light on according to RKT switch (10) selection.
13. WPN SEL advisory lights	RKT GUN/BOMB	RKT GUN or BOMB light on according to WPN SEL switch (9) selection.
14. BOMB FUZE advisory lights	SAFE/ARM	SAFE or ARM light comes on according to the position of BOMB FUZE switch (11).
15. Trigger switch	Squeezed to the second detent	Fires the guns or the rockets carried under the wing pylons.
16. Bomb release switch	Pressed	Permits bomb releasing from wing pylons or from BRDs.
17. SALVO switch	Guard up and switch pressed	Permits external stores releasing from wing pylons independently from the armament switches position.

Figure 1-52. (Sheet 2) [ACFT A]

ISIS D211 SIGHTING SYSTEM SCHEMATIC

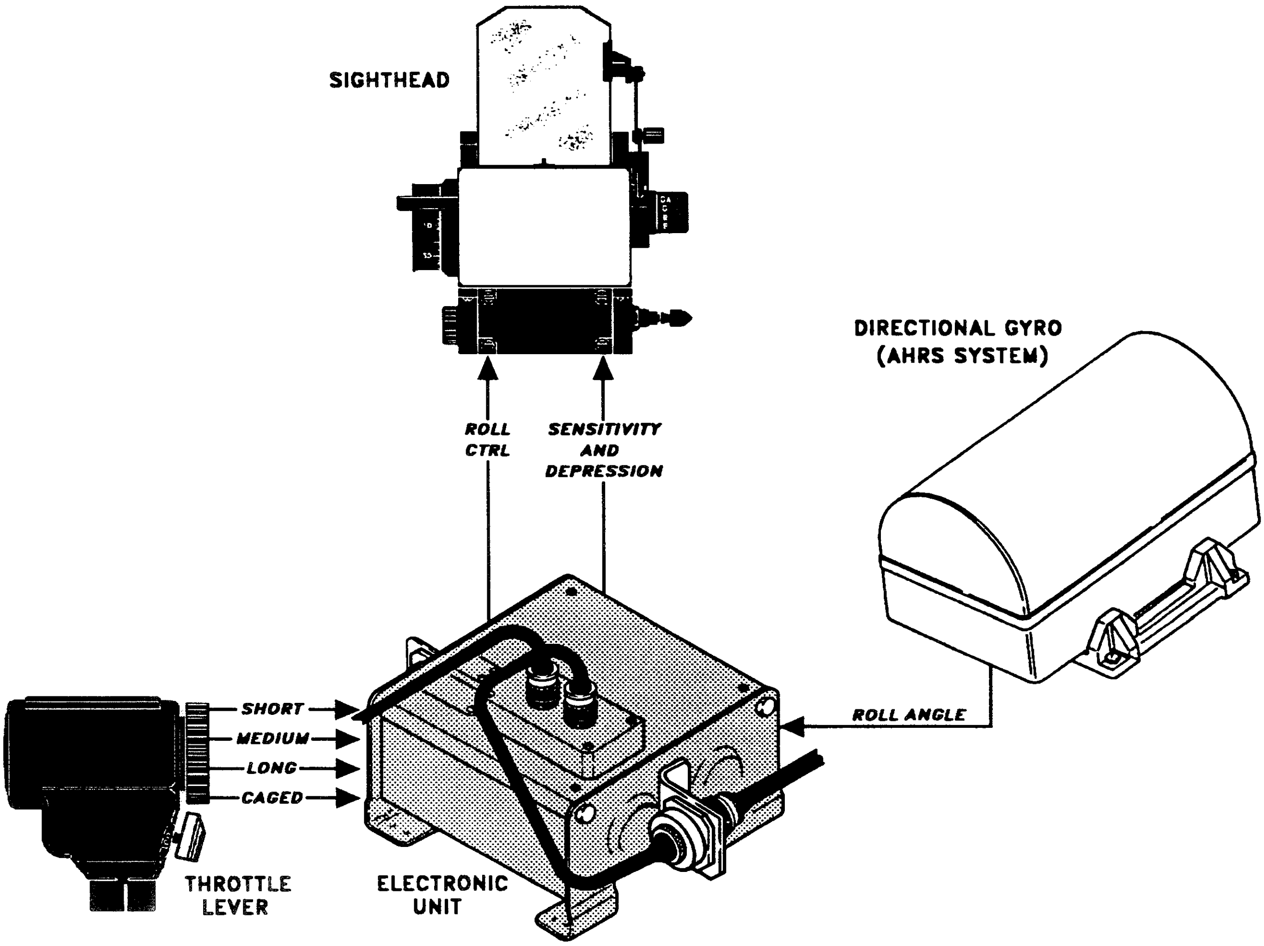


Figure 1-53. [ACFT A]

positioned with respect to the airframe that, provided the pilot tracks the target steadily for a sufficient time before releasing the weapon at the appropriate range, a successful attack will be made.

The system consists mainly of the following components:

- Sighthead in front cockpit only above the instrument panel.
- Electronic Unit (EU) in the front cockpit before the instrument panel.
- Range Selector Switch on throttle lever.
- Displacement Gyro Assembly (for roll information from AHRS system) in the nose radio compartment.

Electrical power for system operation is supplied by the NORM BUS through the GUN SIGHT DC circuit breaker and by the 115 VAC BUS through GUN SIGHT AC circuit breaker.

SIGHTHEAD

The sighthead type D11 carries the following controls:

a. Combining glass
b. Mode selector switch
c. OFF/ON/REV switch
Roll test switch
e. Lamp changeover switch (Mechanical)
f. Dimmer control
g. Depression control

The sighthead contains the gyro assembly and the associated optical system.

The gyro assembly allows the correct positioning of the sightline for each mode of operation by using a rate-measuring gyro. The rotor of the gyro can be displaced in both the azimuth and elevation axes of the aircraft, from its central position, by means of static biases and by angles which depend on the rate of turn of the aircraft. The gyro rotor has a mirror mounted at one end, which, as it is diplaced, deflects the projected and collimated image of an aiming mark which form the sightline.

The optical system (see figure 1-54) consists of two collimated aiming marks, one moving and one fixed. These marks are the images of two illuminated reticles, reflected on a partially reflected combining glass. The moving reticle image consists of 2 mr diameter centre spot with 10 mr extending arms situated 10 mr from the centre spot. The extending arms are surrounded by a quartered 50 mr diameter circle. In the

RETICLE PATTERN OF SIGHTHEAD TYPE D11

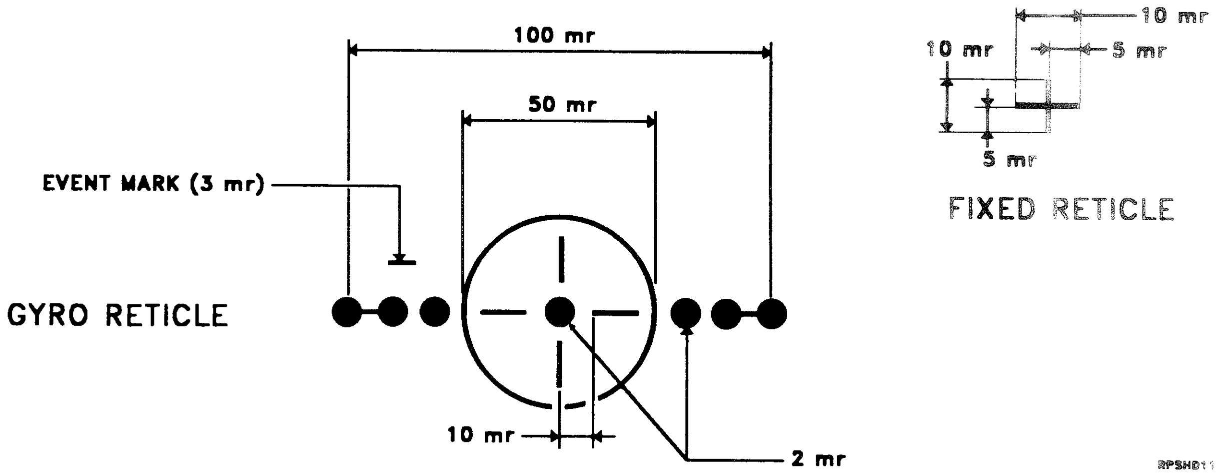


Figure 1-54. [ACFT A]

azimuth plane, there are 2 mr diameter spots at 30 mr, 40 mr and 50 mr on either side of the centre spot, the spots at 40 mr and 50 mr being joined by a straight line. The reticle image also has an event marker which appears on the port side of the aiming mark, 40 mr from the centre spot. The event marker consists of a short bar above the 40 mr spot. All line widths are 1.0 mrad.
The fixed reticle is a cross measuring 10 mr in each direction.
A Mode Selector Switch on the sight head provides the following modes:

- GA Guns air-to-air
- G Guns air-to-ground
- R Rockets
- B Bombs
- S Manually depressed sight line

Variable resistors located in the sight head permit pre-flight adjustment of sensitivity from 0.25 to 1.25 sec. to be set in all modes and depression biases from 0 to 75 mrad in all modes except "S" where the pilot, using the depression control, can set in from 0 to 200 mrad depression.
In each mode with the OFF/ON/REV switch on the sight head set to ON, the depression angles willl be roll stabilsed around the Longitudinal Fuselage Datum/Armament Datum Line therefore the component of the Vertical depression from the LFD/ADL will be in the true vertical.
In the event of roll information becoming suspect, setting the OFF/ON/REV switch to REV will simulate zero roll within the system and all depressions will be relative to the aircraft axis.
The serviceabilty of the roll stabilization circuit within the system can be checked by pressing the Roll Test Switch on the underside of the sighthead. With a depression set in, the sightline should deflect up to the left simulating a 60° bank to port.

The two reticles are illuminated by a 28 v quartz iodine lamp mounted behind a diffuser to guarantee even illumination. A primary lamp and a standby lamp are mounted on a mechanical changeover switch in case the primary lamp should fail.
When not in use the combining glass may be lowered into the "STOWED" position.

Electronic Unit

The Electronic Unit Type 11 contains the sensitivity, depression and roll stabilizing circuits and receives roll signals from the AHRS and then modifies the input to the gyro to maintain a true vertical position of the aiming mark during the attack.

Range Selector Switch

The Range Selector Switch is a four position rotary switch which in the GA mode can be selected by the pilot for short, medium and long ranges, providing signals to the gyroscopic sensitivity and depression circuits within the system.
The fourth position (fully forward) switches in a "CAGED" gyroscopic sensitivity current for use in the initial tracking phase of a rocket attack.
With the switch in the short range position the event marker in the sight head will be unmasked.
Range selected are as follows:

- Caged (Fully Forward)
- Long 2000 ft
- Medium 1500 ft
- Short 1000 ft

OPERATION

There are five modes of attack which can be selected at the sighthead of the ISIS D 211 system.
1. Guns, air-to-air GA

2. Guns, air-to-ground G
3. Rockets, air-to-ground R
4. Bombs B
5. Manually Depressible Sightline S

In each mode, except the S mode, the aiming mark will have a preset sensitivity and a preset angle from a line parallel to the Longitudinal Fuselage Datum (LFD). In the S mode, the sensitivity is preset and the required depression dialled in on the sighthead depression control.
The preset depression and sensitivity are as follows:

Mode	Range Selector	Depression (± 2 mrad)	Sensitivity	Event Mark
GA	Long	6	1.08	masked
GA	Medium	5	0.45	masked
GA	Short	4	0.27	unmasked
G	-	10	0.60	masked
R	-	17	1.15	masked
G	Cage	17	0.33	masked
B	-	37	0.33	masked
S	-	0 ÷ 200	0.33	masked

NOTE

The depression and sensitivity values are those set by the manufacturer and may be changed to suit the weapon and attack parameters.

In each mode, with the OFF/ON/REV switch on the sighthead set to ON, the depression angle will be roll stabilized around the Sight Zero Datum (SZD) which is parallel to the LFD. The component of the depression from SZD will therefore be in the true vertical.
In the event that the roll information to the system is suspect, setting the ON/OFF/REV switch to REV will simulate zero roll within the system and all depressions and azimuth deflections will be relative to the aircraft axis. The serviceability of the roll stabilization circuits within the ISIS system may be checked by selecting S mode on the Mode Selector Switch, dialling in approximately 60 mr depression on the Depression Control and pressing the Roll Test switch on the underside of the sighthead. The sightline should deflect up to the left simulating a bank angle of 60° to port. The fixed cross indicates the gun line in the azimuth and elevation and is parallel to LFD and can, in the event of failure of the sighthead gyro, be used to complete an air-to-air attack.

AIR TO AIR ATTACKS

Gun, Air-to-Air (GA) Mode

With the OFF/ON/REV switch set to ON and Mode selector switch to GA select, with Range Selector switch on the Throttle unit, the required firing range and turn the aircraft to bring the aiming mark on the target. Track the target for a minimum period of 1.5 seconds while closing on the target. Fire when the target is within the range selected as estimated by comparison of the target size with the aiming mark display.
When required to press home the attack, the Range Selector switch must be set to a shorter range and again open fire when the target is within range.
In the early stage of the attack, the rate of turn of the aircraft may cause the gyro to deflect to its mechanical limits which, will be indicated by a controlled bounce of the aiming mark. Temporarely reducing the rate of turn and/or selecting a shorter range on the Range Selector switch, will reduce the gyro deflection until further into the tracking phase where, the rate will automatically be reduced and the Range Selector switch can be reset to the required range.
For Range Selector switch function selection refer to figure 1-55.

AIR-TO-GROUND ATTACKS

Gun, Air-to-Ground (G) Mode

For Gun air-to-ground mode of operation the OFF/ON/REV switch must be set to ON and the Mode Selector switch to G. The pilot must set the aiming mark just short of the target and allows it to approach the target as range decreases. Then hold the aiming mark on the target for the shortest possible time before firing at the pre-determined range, airspeed and dive angle.Range is determined by comparing the target size with the aiming mark size.

Rockets, Air-to-Ground (R) Mode

The method of attack is the same as for Air-to-ground Guns. The Mode Selector switch must be set to R and the Range Selector switch to CAGED until tracking is established. When the Mode Selector switch is set to any range position, the sensitivity is then set to a pre-determined value and the gyro is UNCAGED.

Bombs (B) Mode

The method of attack is the same as for Guns Air-to-ground and Mode Selector switch must be set to B.

Manual Depression Sight Line (S) Mode

Selection of the S mode on Mode Selector switch selects the same sensitivity as for in the R mode (CAGED), but the sightline is manually depressed up to 200 mr from LFD by the depression control of the sighthead.
This facility is normally used when more than one type of bomb is carried. One attack can be carried out with B mode selected and the other attacks with S mode and the required depressions set in on the depression control. This facility can also be used when the ordnance to be delivered and the attack to be made require a different depression from the ones presetted in G, R or B mode.

ISIS D211 SIGHTING SYSTEM CONTROLS

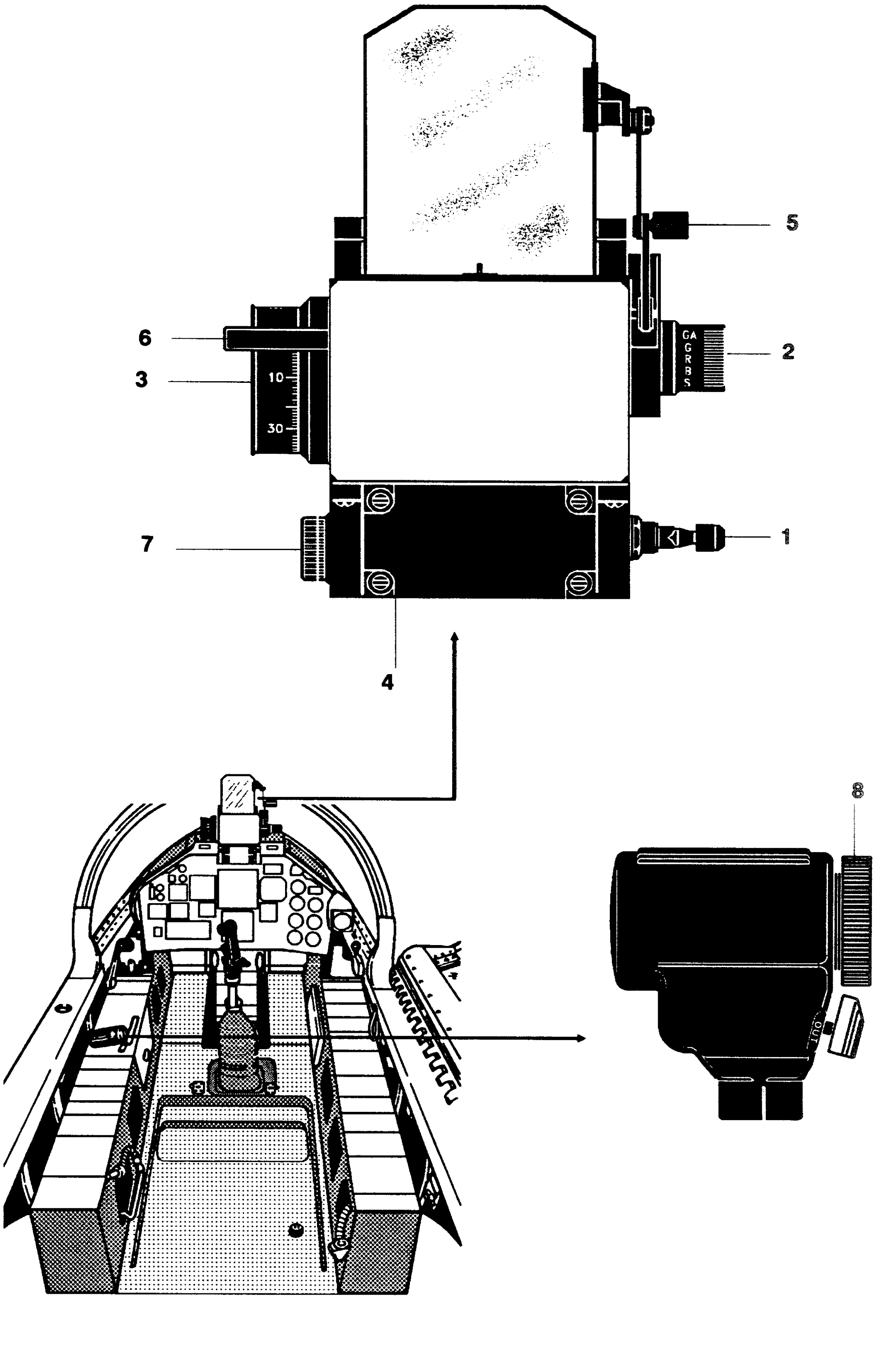


Figure 1-55. (Sheet 1 of 2) [ACFT A]

ISIS D211 SIGHTING SYSTEM CONTROLS

DESCRIPTION			FUNCTION
1.	OFF/ON/REV switch	OFF	De-energized position.
		ON	Applies power to the sighting system.
		REV	Simulates zero roll within the system and all depressions and azimuth deflections are relative to the aircraft axis.
2.	Mode Selector switch	GA	Selects the Guns air-to-air attack operating mode.
		G	Selects the Guns air-to-ground attack operating mode.
		R	Selects the Rockets air-to-ground attack operating mode.
		B	Selects the Bombs operating mode.
		S	Sightline sensitivity same as in R mode, but the sightline can be only depressed manually up to a max of 200 mr from LFD.
3.	Depression Control	-	Used to select the sightline depression for the required mission
4.	Roll Test switch	Pressed	Checks the roll stabilization circuits of the system provided the Mode Selector switch is set to S and a manuall depression of approximately 60 mr has been selected on the Depression Control. The sightline should deflect up to the left simulating a bank angle of 60° to port.
5.	Combining Glass Folding Mechanism	-	Allows lowering of the combining glass into the stowed position.
6.	Lamp Changeover switch (Mechanical)	-	Pushing full rearward or leftward, allows lamp changeover in case the primary lamp should fail.
7.	Dimmer Control		Adjusts the light intensity of reticle illuminating lamp.
8.	Range Selector switch (Four position)	CAGED (Fully fwd)	Sets the sensitivity to a preset value to give a caged gyro during the initial tracking stage of a rockets attack.
		LONG (2000 ft)	Sets the sightline sensitivity and depression to values preset by variable resistors in the system.
		MEDIUM (1500 ft)	Sets the sensitivity and depression to values preset by variable resistors in the system.
		SHORT (Fully aft 1000 ft)	Sets the sensitivity and depression to values preset by variable resistors in the system and unmasks the event marker displayed on the left hand side of gyro reticle.

Figure 1-55. (Sheet 2) [ACFT A]

SECTION 2
NORMAL PROCEDURES

TABLE OF CONTENTS

PREPARATION FOR FLIGHT

FLIGHT RESTRICTIONS

Refer to Section V for the Operating Limitations imposed to the aircraft.

FLIGHT PLANNING

Refer to 1T-S211-1-1 Performance Data Manual for computation of all performance data.

TAKE-OFF AND LANDING DATA

To complete the take-off and landing data card included in the check list, refer to 1T-S211-1-1 Performance Data Manual.

PROCEDURES

The procedures described in this section are given in detail , where possible.
The same procedures are contained in the pilot's Check List in an abbreviated form.The rear seat crew member should go through the same checks complying where applicable.

INITIAL CHECKS

Approaching the aircraft, check it is chocked in suitable position for starting, cleared of ground equipment and that fire extinguisher is available.

PRE-FLIGHT CHECKS

BEFORE EXTERIOR INSPECTION

1. Check log forms for aircraft serviceability.
2. All electric switches - OFF.
3. MASTER ARM and all pylons switches - OFF.
4. Landing Gear Control lever - Check DOWN.
   During strange field operation only:
   EMER LDG CR handle - Pull to allow inspect main landing gear bay forward section then IN.
5. Flaps - Check DOWN.

EXTERIOR INSPECTION

The exterior inspection procedures are based on the assumption that all pre-flight and post flight actions specified in the applicable technical publications have been accomplished by maintenance personnel. During walk-around all surfaces should be checked for cracks, distortion or loose or missing fasteners. Attention should be directed to surfaces for oil, fuel and hydraulic leaks.
In addition the following specific checks should be accomplished with reference to figure 2-1.

1. LEFT FORWARD FUSELAGE

- Air intake - Clear.
- Static ports - Unobstructed.

EXTERIOR INSPECTION

1.	LEFT FORWARD FUSELAGE	6.	RIGHT AFT FUSELAGE
2.	NOSE LANDING GEAR	7.	TAIL
3.	RIGHT FORWARD FUSELAGE	8.	LEFT AFT FUSELAGE
4.	RIGHT MAIN LANDING GEAR	9.	LEFT WING
5.	RIGHT WING	10.	LEFT MAIN LANDING GEAR

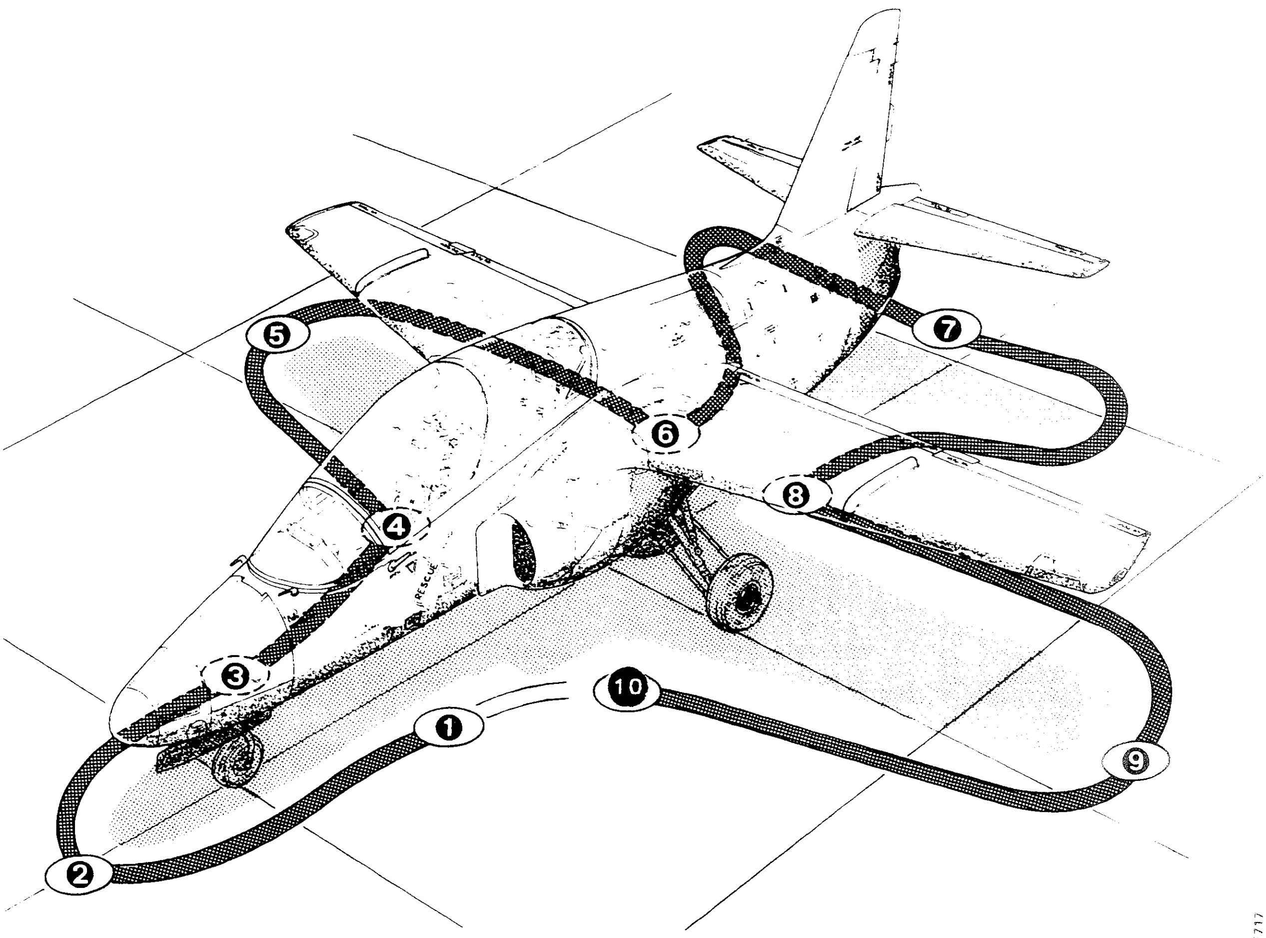


Figure 2-1.

- Pitot head - Unobstructed.
- Draining ports Push to drain (additional check to be added for strange field operation).
- Oxygen discharge indicator - Conditions.

2. NOSE LANDING GEAR

- Strut - Check extension.
- Tire - Check conditions, creep mark and inflation.
- Torque link pin - Inserted for taxy.
- Nose wheel bay - General conditions.
- Doors - Check free play.

3. RIGHT FORWARD FUSELAGE

- Oxygen discharge indicator - Conditions..
- Draining ports - Push to drain (Additional checks to be added for strange field operation).
- Pitot head - Unobstructed.
- Static ports - Unobstructed.
- Forward and rear ram air scoops - Closed.
- Canopy - Integrity and transparency.
- Air intake - Clear.

4. RIGHT MAIN LANDING GEAR

- Wheel chock - In place.
- Strut - Extension, no leak.
- Hydraulic and brake lines - Check for leaks or damages.
- Tire - Check conditions, creep mark and inflation.
- Brake pad linings - Check wear indicator (still visible when pushed in with parking brake on).
- Main gear bay - Check for leaks and general

conditions.
- Door - Check free play
- Forward main gear bay - Check for leaks and push closed. (Additional check to be added for strange field operation)
- Breakers and bites panel - IN and BLACK, access door closed and locked. (Additional check to be added for strange field operation).

5. RIGHT WING

- Undersurface, leading edge and fence - check conditions.
- External lights - Check conditions.
- Static dischargers-Check for integrity and fixing.
- Aileron - Check for movement and general conditions.
- Upper wing surface - Check conditions.
- Flap - Check for a slight free-play, roller and track.

6. RIGHT AFT FUSELAGE

- Access doors - Closed and locked.
- Ram air outlet (Air Conditioning) - Unobstructed.
- Antennas - Check conditions.

7. TAIL

- Jet pipe and turbine - Inspect for cracks, distortion, hot strakes, signs of damage.
- Control surfaces - Movement and conditions.
- Fuel venting outlet - Unobstructed.
- Static discharger - Check for integrity and fixing.
- Tail navigation light - Check conditions.

8.LEFT AFT FUSELAGE

- Ground cable - Disconnected.
- Engine oil filler cap - Closed.
- Battery connectors - Fastened and secured.(Additional check to be added for strange field operation).
- Access doors - Closed and locked.

9. LEFT WING

- Upper wing surface - Conditions.
- Fuel tank filler cap - Closed.
- Flap-Check for a slight free-play, roller and track.
- Aileron - Check for movement and general conditions.
- Static Dischargers - Check for integrity and fixing.
- External lights-Check integrity and transparency.
- Undersurface, leading edge and fence - General conditions.
- Ram Air Inlet (Air Conditioning) - Unobstructed.

10.LEFT MAIN LANDING GEAR

- Wheel chock - In place.
- Strut - Extension, no leaks.
- Hydraulic and brake lines - Check for leaks and damages.
- Tire-Check conditions, creep mark and inflation.
- Brake pad linings - Check wear indicator (should still be visible when pushed in, with parking brake on).
- Main gear bay - Check for leaks and general conditions
- Door - Check free play
- Forward main gear bay - Check for leaks and push closed. (Additional check to be added for strange field operation).

11. FUSELAGE UNDERSIDE

- Antennas - Check for security and general conditions.
- Generator ram air scoop - Unobstructed.
- Speed brake - Check for oil leaks, security and general conditions.

REAR COCKPIT CHECKS FOR "SOLO" FLIGHTS

1. Check to ascertain that the survival pack, seat belt and harness, helmet radio cable connector normal and emergency oxygen hoses, are fastened by means of the appropriate apron.

CAUTION

If an apron is not available, it is permitted, for ferry flights only, to fasten the parachute and survival pack by means of the seat belts or other fastening devices. The pilot will be responsible of ascertaining that fastening is secure.

WARNING

Aerobatics are forbidden when the cover assembly is not installed in the rear seat.

2. Anti-G connector - Plugged
3. Left hand circuit breakers - All push-button IN.
4. AIL SERVO switch - ON (guard down).
5. FUEL SHUT OFF switch - OPEN and safetied. (guard down).
6. IGNITION switch - AUTO (guard down).
7. VHF COMM - TR and set frequency.
8. OVRD MASTER ARM switch-OFF (guard down).
9. Stand-by attitude indicator - Uncage.
10. BATTERY switch - AUTO (guard down).
11. Internal lights - OFF.
12. Right hand circuit breakers - All push-buttons IN; except CAUT PNL circuit breaker.
13. VENT EMERG - Closed.
14. Internal canopy breaking handle -Check in place and secured.

EJECTION SEAT CHECKS

COCKPIT ENTRY

Entry to the cockpit is gained from the left side by using the retractable foot-step on the left side of the fuselage after manually opening the canopy which is hinged on the right side (see figure 1-31, Section I) or by use of an external echelon.

EJECTION SEAT CHECKS

1. Seat Safety pin - In position.
2. Emergency oxygen - Check content.
3. Remote rocket initiator safety pin - Removed.
4. Drogue gun - Trip rod connected, safety pin removed.
5. Drogue withdrawal line - Secured to the drogue gun piston.
6. Seat latch - Center pin & plunger flush with housing.
7. Ejection gun initiator connector - Secure & retaining pin in place.
8. Barostatic time-release unit - Trip rod connected, safety pin removed.
9. Emergency oxygen hose - Connected.
10. All harness connections - Secured.
11. Survival pack release connectors - Connected on the parachute harness.
12. Leg restraint lines - Correctly attached to the aircraft floor connections.

STRAP-IN

After sitting in the seat, proceed as follows:

1. Parking brake - On and press pedals.
2. Adjust the rudder pedal length by means of the PEDAL ADJ knob.
3. Connect the anti-G hose.
4. Connect the quick-release connector provided on the life vest to the arrow head portion of the personal survival pack (P.S.P.) lowering line lug, routing the lowering line outside the left leg.
5. Route the starboard leg restraint line around the front of the right leg, through the rings from inboard to outboard an,d plug the taper plug into the leg restraint line lock inside the starboard leg guard. Similarly route the port leg restraint line around the left leg. Adjust the leg restraint lines in the snubbing units to permit full leg movement.
6. Ensure that the go-forward control lever is in the locked position and bring down the shoulder straps.
7. Bring the harness quick-release fitting (Q.R.F.) mounted on the negative-g restraint strap up between the legs ensuring that the strap is routed behind and not through the seat firing handle.

NOTE

To fit lug into Q.R.F. raise forward the T shaped front plate depressing the release button on its top.

8. Move the go-forward control lever forward and check for freedom to move forward. Return the go-forward control lever to the aft position.
9. Connect oxygen hose MIC/TEL lead.

INTERIOR INSPECTION

AFTER STRAP-IN

1. External electrical power - Plugged IN.(if available). Ensure that power is trimmed to indicate 28V.

CAUTION

The external power supply should not exceed 1000 A and should not be less than 800A.

2. BATTERY switch - ON - Check voltage (minimum 24 V) then OFF (leave ON if external electrical power is not available).

NOTE

For internal battery starts, BATTERY switch must be set to ON. This selection will disconnect external power eventually plugged in.

3. Intercom - Check.
4. GEN switch - OFF.
5. A/C POWER switch - Select INV1 (odd date) or INV2 (even date).
6. N/BUS switch - ON. (NORM BUS caution light out).
7. Adjust the seat height by means of the switch on the seat RH side.
8. Shoulder harness - Readjust as required.

LEFT RIGHT CHECKS

Left Console

1. Left circuit breakers panels - All push-buttons IN.

1A. [ACFT C] ATC Controller - Function selector OFF, preset mode and code.

2. COMM/NAV CONTROL SHIFT panel - Press the concerned buttons and check lights on.

2A. [ACFT C] VHF COMM control panel - Set frequency.

3. ICS panel:
   a. TR/RX selector - VHF.
   b. Reception switches - As required.
   c. HOT-MIC/TALK switch - As required.

d. VOL knob - Midway.
e. NORM/FAIL - Set NORM.

4. AILERON SERVO switch - ON (guard down).
5. Flaps lever - DOWN, and compare with the position on the flap indicator.
6. THROTTLE - Check for free movement, adjust friction, and set to STOP.
7. Relight button - Test.
8. FUEL SHUT OFF switch - Check OPEN (Guard down and wire locked). SHUT OFF Light - OFF.
9. AUX PUMP switch - OFF.
10. ECU switch - ON (guard down).
11. IGNITION switch - Check continuous ignition then AUTO (guard down).
12. STARTER switch - NORM.
13. External fuel control and indicating panel -Check contents (if applicable).

Left Quarter Panel

1. Landing Gear control panel:
   a. Control lever - L.G. DOWN and RED light off.
   b. Position indicators - 3 green lights.
2. TAXI LTS and LDG LTS switch - OFF.

Instrument Panel

1. MASTER ARM switch - OFF (guard down).
2. CLOCK - Check.
3. SALVO switch - Guard down.
4. Flaps, Speed Brake, trim indicators - Check for proper indications.
5. Rudder trim green light - On.
6. Accelerometer - Check and reset.
7. Cabin Altimeter - Check field elevation.
8. VHF COMM control panel - Set frequency.
9. Mach-airspeed indicator Check and set outer index for the desired value.
10. Stand-by attitude indicator - Caged.
11. Attitude Indicator (AI) - Check conditions.
12. HSI - Check conditions.
13. Emergency landing gear handle - Check in.
14. Central pedestal circuit breaker panels - All push button IN.
15. Compass System Controller -Mode Selector to SLV, indicator aligned: check HSI ndications for consistency with standby compass indication. Set latitude.
16. FIRE warning light - Push to test.
17. Encoder altimeter - Set field elevation.
18. Vertical speed indicator - Check for zero indication.
19. Weapon mode selec. - As required (if applicable)
20. Voltammeter - Check voltage.
21. Engine instruments - Check for zero indication and conditions.
22. Fuel flow indicator - Check for zero indication and conditions.
23. Fuel quantity indicator - Consistent with the known quantity of fuel.
24. Hydraulic pressure indicator - Check for zero indication and conditions.

Right Quarter Panel

1. WARN/TONE TEST switch - Select to WARN TEST then release; check all lights on the warning panel (not already ON) and the MASTER CAUTION light flashing. Push MASTER CAUTION to reset.
   Select TONE TEST then release; check audible warning signal in the headset. (Two seconds then silent).
2. TELEVEL TEST switch - Select TEST then release; check the pointer movement to zero, back to full scale and then to the initial value, without momentary stop(s) in any intermediate position.
3. BAT OVERTEMP TEST push-button switch - Press and check illumination of the BATT WARM and BATT HOT warning lights.

Right Console

1. Oxygen Regulator:
   a. Supply lever - ON.
   b. Pressure gauge - Check pressure.
   c. Flow indicator - Check alternate cruciform yellow signal while breathing.
   d. Diluter lever - Test 100% then normal or as required.
   e. Emergency lever - ON, check pressure delivery, then OFF.
2. CANOPY SEVERANGE handle - In place and secured.
3. ARMT Control Panel - Pylon switches all OFF.(if applicable).
4. VOR controller - Function selector OFF.
5. ADF Controller - Function Selector knob: OFF, preset frequency.
6. [ACFT A and B]ATC Controller - Function selector OFF, preset mode and code.
7. ECS control panel:
   a. AUTO/MAN selector - Set at 11 o'clock.
   b. DEMIST switch - OFF.
   c. ECS switch - OFF.
   d. PRESS DUMP switch-CLOSED (guard down).
8. Emergency ventilation - Closed

8A. [ACFT C] AHRS switch - OFF
AHRS BATT c/b - In

9. Navigation lights control panel:
   a. BCN switch - ON.
   b. Light mode selector - As required.
10. ENGINE anti-ice switch - OFF.
11. PITOT anti-ice switch - OFF.
12. Internal Lights control panel:
   a. Light intensity - As required.
   b. EM LTS switch - ON for check ; then OFF
13. Right hand circuit breakers panels - All push buttons IN.
14. Canopy seal valve selector knob - Check INFLATE position.

DANGER AREAS

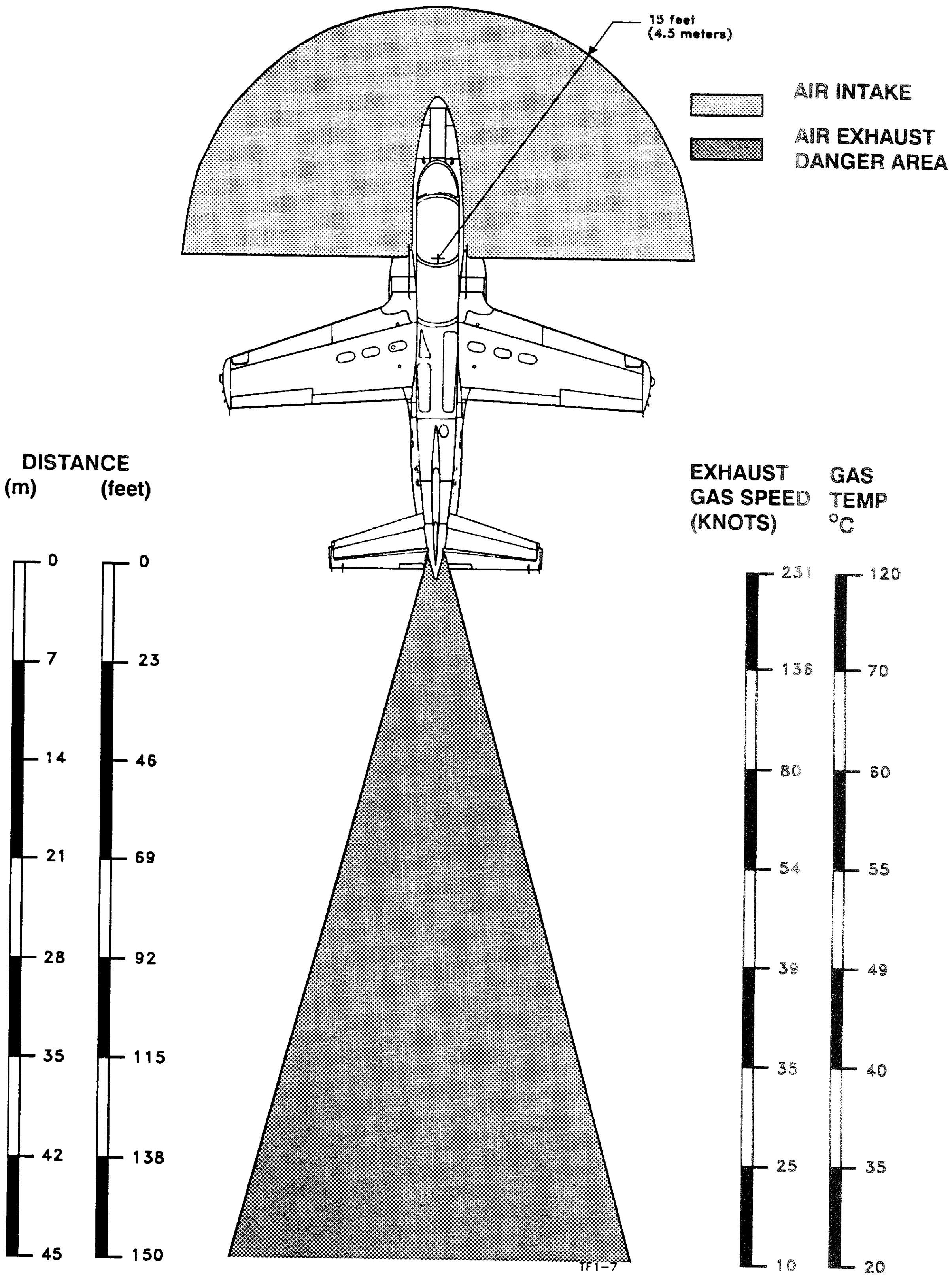


Figure 2-2.

PRE-START CHECKS

1. Ensure the aircraft is headed into the wind.

CAUTION

A strong tail wind may cause a jet pipe temperature increase and aggravate an incipient fire conditions.

2. Refer to figure 2-2, Danger Areas, for the extent of the engine intake and exhaust hazard areas.
3. Check engine intake areas are clear.

ENGINE STARTING

STARTING ENGINE ON INTERNAL BATTERY

NOTE

Engine starting shall normally be performed on internal battery. However, starting with an approved external power source should be performed for engine ground run.

1. Switch off unnecessary electrical loads.
2. BATTERY switch - ON. Check for 24 Volt minimum
3. FUEL SHUT-OFF switch - Check OPEN (Guard down).
4. AUX PUMP - ON . Check FUEL PRESS caution light goes OUT.
5. STARTER switch - ON and release and simultaneously start the clock;
   S/GEN caution light will go out.
6. THROTTLE - At 10% NH select IDLE.

CAUTION

If the engine does not light up within 10 seconds from IDLE selection:

- THROTTLE - STOP. Continue the motoring for additional 10 seconds to eliminate trapped fuel and vapor. STARTER switch - STOP and release.

NOTE

Should START switch (front and/or rear) fail to disconnect the starter/generator, proceed as follows:
- BATTERY switch - OFF
- When external power source used for starting, switch off the external power source.

CAUTION

When the GPU is supplying power to the starter, do not try to disconnect the plug from the external power receptacle.

CAUTION

Before attempting another start pay particular attention to duty cycle limitation (Refer to Section V for starter cooling). If the engine does not start after second attempt, investigate the reasons. However any other start attempt following the second one shall be performed in accordance with starter generator duty cycle limitations (see Section V).

7. Engine Speed - Check normal acceleration. At NH 40% stop the clock and check that time is less then 30 seconds.
   GEN OFF caution light will start blinking at NH 40% ± 4 and will become steady by pressing the MASTER CAUTION light.
8. ITT - Check for normal increase (Max 500° C).

CAUTION

If ITT rises too quickly and approaches 500°C, retard the throttle to STOP immediately. Report the temperature attained and the overtemperature period for subsequent investigation.

9. Oil pressure - Check for normal increase.

CAUTION

If there is no sign of oil pressure increase within 30 seconds, or if the IDLE stabilized value is below 35 psi shut down immediately selecting throttle to STOP.

10. Hydraulic pressure - Check for normal increase

CAUTION

If there is no indication of hydraulic pressure after engine light up, shut down the engine.

11. FIRE warning light - Check off.
12. Lights on caution panel - Check all lights off except CANOPY and GEN OFF.
13. RPM - NH-Check 49÷50% (sea level)
14. ITT - Check not exceeding 580°C.
15. Hydraulic pressure indicator - Check within limits.

NOTE

The AIL SERVO caution light will go out with some delay after hydraulic pressure exceeds 1000 psi.

16. GEN switch - ON, check GEN OFF caution light goes out.
17. Inverter switch - Change over.
18. Voltammeter - Check normal indications. (27÷29 Volts).
19. Canopy - Closed and locked, check CANOPY warning light goes out.

20. Seat handle safety pin - Stowed in the special housing on the canopy frame, check helmet clearance (minimum one fist).
21. ECS - ON.

STARTING ENGINE ON EXT. POWER SUPPLY

1. Switch off unnecessary electrical loads.
2. Check BATTERY switch is set to OFF.
3. Proceed as prescribe in "Starting engine on internal battery" from step 3 thru 15.
4. BATTERY switch - ON.
5. GEN switch - ON, check GEN OFF caution light goes out.
6. External power - Disconnect.
7. Inverter switch - Change over.
8. Voltammeter - Check normal indications (27 ÷ 29 Volts).
9. Canopy - Closed and locked, check CANOPY warning light goes out.
10. Seat handle safety pin - Stowed in the special housing on the canopy frame, check helmet clearance (minimum one fist).
21. ECS - ON.

AFTER START CHECKS

1. Anti-G valve - Press to test.
2. Rudder trim switch: left and right, then set to neutral as indicated by the illumination of the RUD TRIM NEUTRAL light.
3. Speed brake - Retracted: Check the indicator and await for the crew chief to confirm speed brake position.
4. Wing flaps - Check operation, then T/O. Check indicator and await for the crew chief to confirm flap position.
5. AUX PUMP - OFF, (FUEL PRESS caution light remains OFF).
6. Pylon tanks- PUMPS switches: ON (if applicable).
7. VHF Controller mode selector switch - T/R.
8. Stick trim button : press in the four directions and check indicators movements, than set to neutral for take off.
9. Control stick: left/right, aft/forward for full and free movement.
10. Stand-by Attitude Indicator - Uncage and set gull wing.
11. [ACFT C] AHRS BAT circuit breaker - In.
12. [ACFT C] AHRS switch - ON.
13. AI - Check that OFF flag is out of sight, the attitude indicator is aligned; adjust pitch trim to 0°.

NOTE

With aircraft static on the ground and two pilots on board, the miniature aircraft shall display a 0 degree pitch attitude. Alignment of the instrument horizon line with the actual horizon takes approximately 90 seconds then the flag moves out of view.

14. HSI - Compare compass card reading with standby compass reading. Adjust, if required, the alignment indicator of the COMP control panel .
15. VOR controller - Mode selector PWR.
16. ADF controller - Mode selector to ADF and check operation.
17. ATC controller - Function selector to STBY.
18. Chocks removed by ground crew.
19. Radio call - Set QNH.

TAXIING

1. Have the wheel chocks removed.
2. PARKING BRAKE handle - Release.
3. Wheel Brakes - Check.
4. Move the aircraft at 65 ÷ 70% NL. Taxi at the lowest practical RPM. Once the aircraft is moving, it can be taxied with the throttle in the IDLE position on a hard surface.

CAUTION

Check that the area behind the aircraft is clear of obstacles, personnel or other aircraft. Maintain a minimum distance of 150 feet from the exhaust blast of any other aircraft that is operating at maximum thrust to prevent damage to the canopy.

5. Wheel brakes - Check operation.
6. Steer the aircraft using rudder pedals, avoiding differential braking.
7. Oxygen diluter lever - As required.

CAUTION

If the aircraft is to be operated on the ground under possible conditions of carbon monoxide contamination (such as when taxiing directly behind another jet aircraft or during operation with the tail pointed into the wind), use oxygen with the diluter lever at 100%.

8. Flight instruments - Check the turn and bank indicator and the magnetic heading on the HSI for correct indications during turns while taxiing.
9. Navigation aids - Check operation.

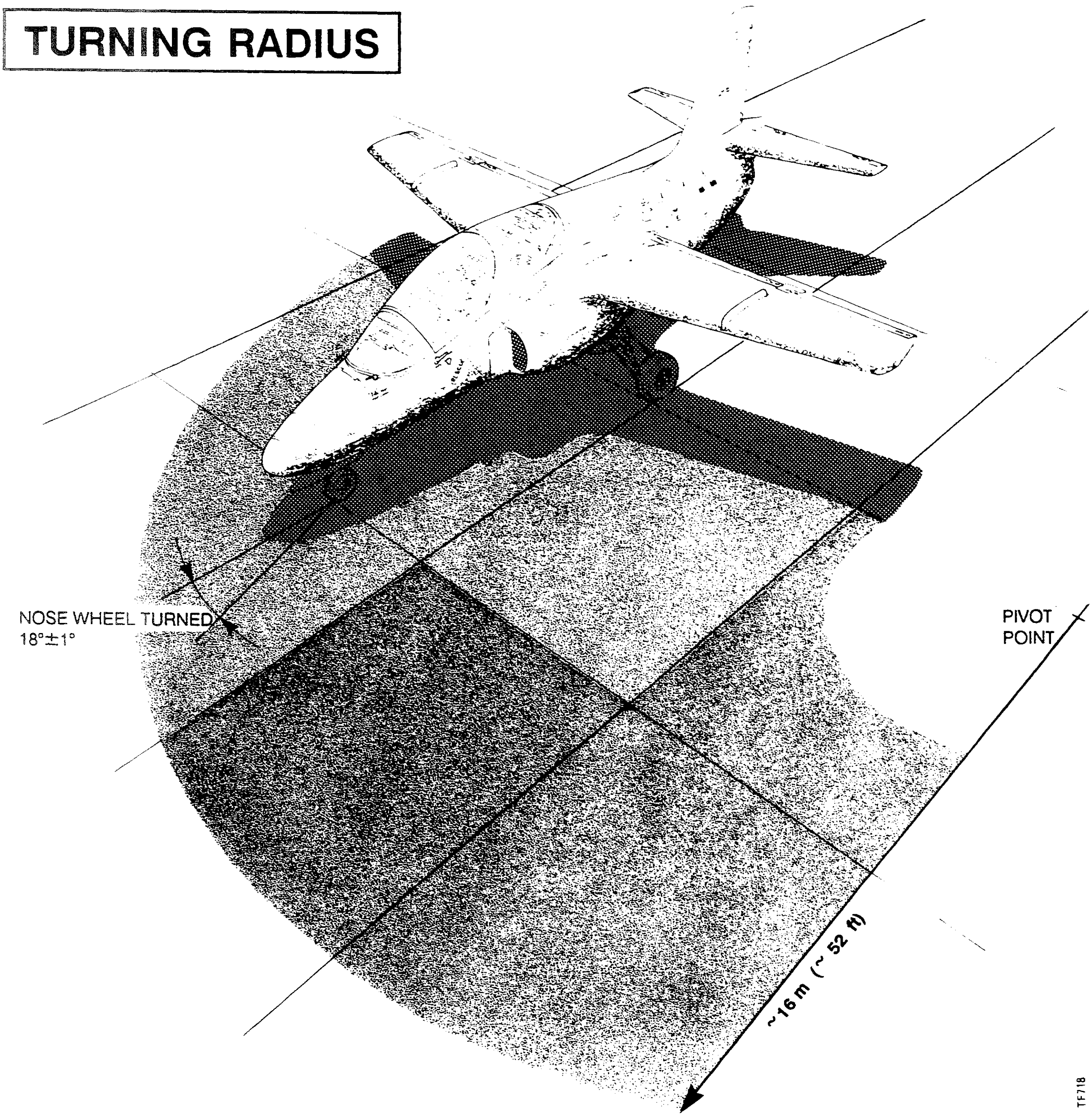
BEFORE TAKE-OFF CHECKS

(RUN-UP AREA)

ENGINE CHECKS

1. Record OAT and get targets for Max NL with ECU

TURNING RADIUS



GROUND CLEARANCE

NOTE:
All vertical ground clearance are centimeters.
The dimensions in brackets are inches.

A = 60 (23.6)
B = 140 (55)
C =410 (161)

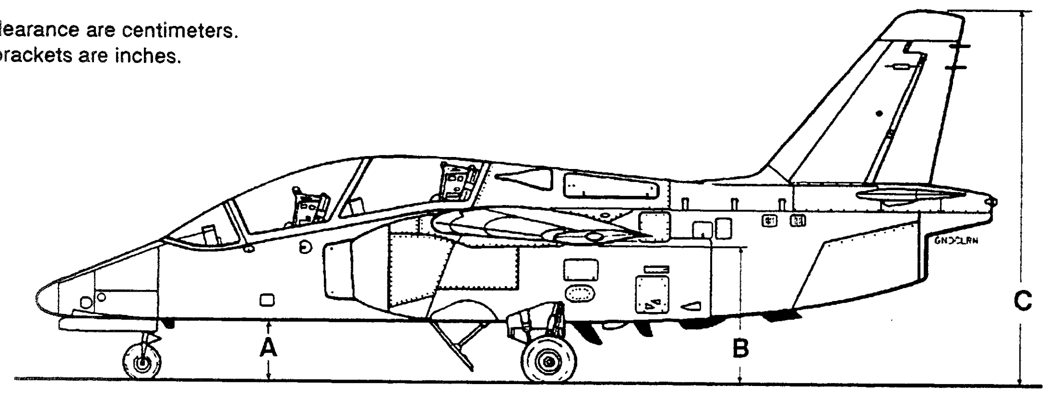


Figure 2-3.

ON and ECU OFF.
2. Engine anti-ice and DEMIST - Check OFF.
3. Set power to MAX; when engine runs steady check:
   - NH ⇒ MAX 97%
   - NL ⇒ Target value within limits
   - ITT ⇒ Within limits
   - Oil pressure ⇒ Normal range
   - Hydraulic pressure ⇒ Within limits.
4. ECU; set OFF (only for the first flight of the day) and check:
   - ECU light ⇒ ON, reset MASTER CAUTION
   - NL ⇒ target value within limits
5. Reduce to IDLE; ECU ON.
6. AUX PUMP switch - ON.

PRE LINE UP CHECKS

1. SPEED BRAKE - Select OUT.
2. Have final external check performed by ground crew. During this operation pilot keeps hands over head.
3. SPEED BRAKE - IN when ground crew signals final external checks completed.
4. FLAPS - Check T/O.
5. Trim indicators - Check neutral position.
6. Flight instruments - Check OFF flags out of sight, attitude indicators erected and compass syncronized.
7. Fuel system; Check:
   - Fuel quantity
   - Pylon fuel PUMPS switches - ON (if applicable).
   - R/L PYLON TANK lights OFF (if applicable).
8. Oxygen; check pressure, oxygen flow indicator, blinker operation.
9. ATC controller - Mode Selector ON - ALT ON.
10. PITOT ANTI-ICE switch - ON, check indication on ammeter.
11. NAV lights - Set as required.
12. Canopy -Check closed and locked; CANOPY light- OFF.
13. Shoulder harness - Check locked, PSP and leg restraint cords -Connected, safety pin - stored, chin strap - tight and visor down.
14. Safety pin - Check stored in the housing.
15. Warning/caution lights - Check all OFF.
16. Flight controls - Recheck full and free movement.
17. Have take off emergency briefing completed.

TAKE-OFF

LINE UP CHECKS

1. Align the aircraft on the runway and check heading.
2. THROTTLE MAX holding the brakes. Check engine acceleration.
3. Check engine parameters within limits.
4. All warning and caution lights OFF.
5. Release the brakes.
6. At VR (95 KIAS or 1.1 Vs) establish T/O attitude (~ 10°).
7. Allow the aircraft to flight-off the ground.

Normal Take-off (Refer to figure 2-4)

Before starting ground run, view (if applicable) the point on the runway (established during flight planning) beyond which take-off cannot be aborted. Refer to Performance Data Manual 1T-S211-1-1 for the take-off distances and speeds.

CROSS-WIND TAKE-OFF

Refer to cross-wind take-off and landing chart in Performance Data Manual 1T-S211-1-1 for the effect of varying cross-winds. During a cross-wind take-off, use the same procedures as for normal take-offs. It is however recommended that the control stick be moved upwind and the nose wheel lifted off at the speed recommended in the Performance Data Manual 1T-S211--1 to improve aircraft controllability. During ground run the aircraft tends to take a upwind nose attitude. Be prepared to apply rudder against wind after nose wheel lift-off to keep the take-off roll straight down the run-way until the aircraft is airborne. Once airborne, be prepared to counteract the aircraft drift.

AFTER TAKE-OFF

When the aircraft is definitely airborne, proceed as follows:
1. Wheel brakes - Apply and release.
2. Landing gear lever - UP. Check the landing gear indicator red lights out. Retraction of the landing gear requires about 6 seconds.

CAUTION

If the landing gear is retracted above limit airseed, the excessive air loads may damage the landing gear doors, preventing their subsequent correct operation.

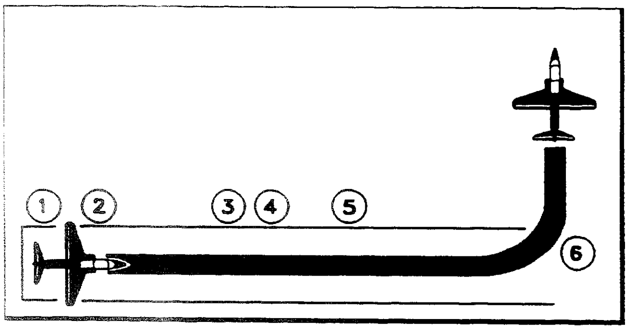
3. Wing flaps lever - UP above 200 feet and between 120 and 140 KIAS. The trim change is negligible.

CAUTION

In order not to overstress structures raise flaps below limit airspeed being aware of the slow flap motion in the T/O-UP range.

4. Engine RPM - Check within limits.
5. ITT - Check 700°C MAX.

TAKE-OFF



* BASED ON TAKE-OFF GROSS WEIGHT OF 2,650 Kg - 5,840 lbs.
* REFER TO "PERFORMANCE DATA MANUAL" FOR TAKE-OFF DISTANCE AND SPEED AT OTHER GROSS WEIGHTS (V_R = ROTATION SPEED SHOULD BE 1.1 STALLING SPEED).

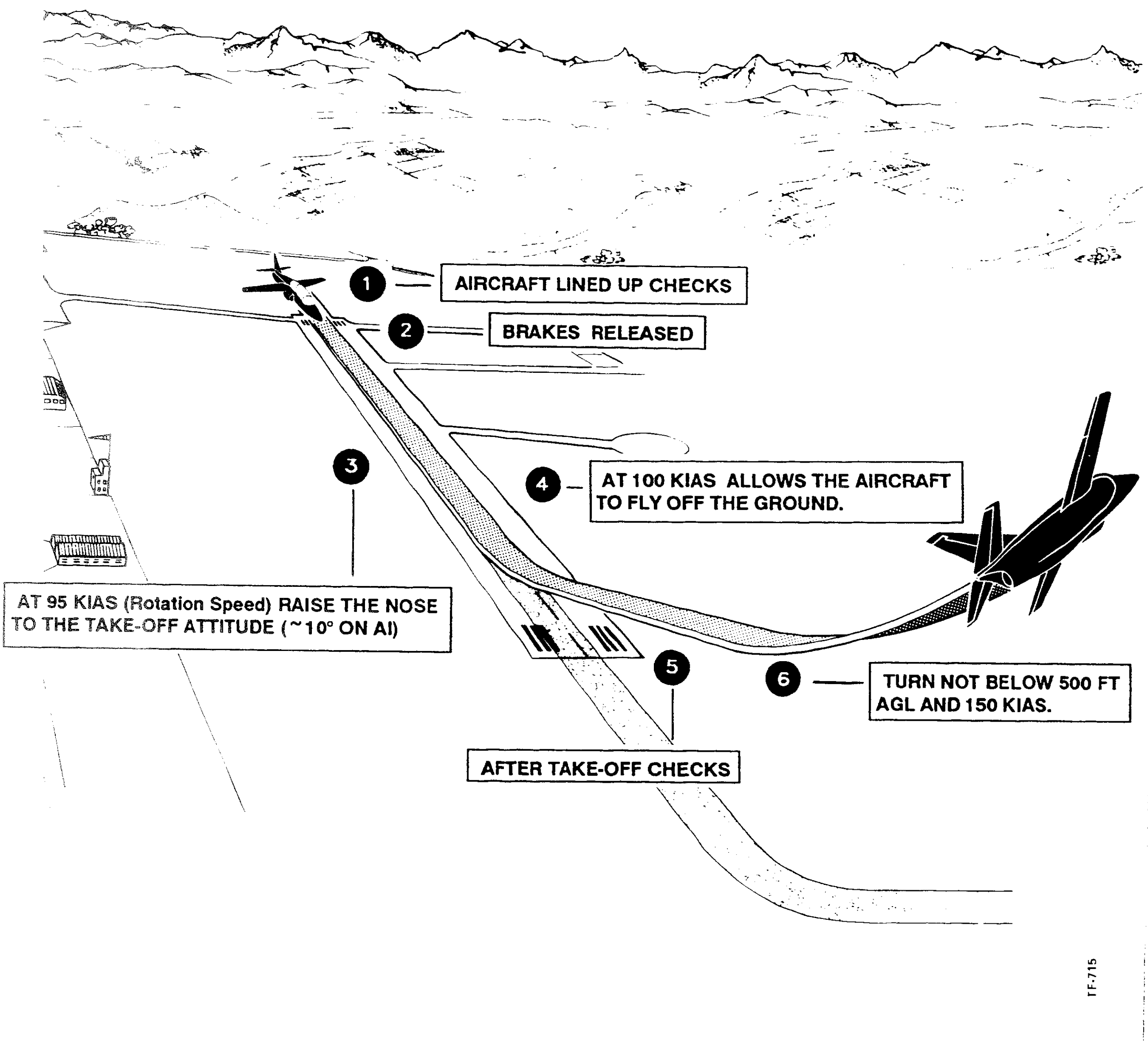


Figure 2-4.

CLIMB AND 10 MINUTE CHECKS

Refer to Performance Data Manual 1T-S211-1-1 for climbing speed, distance travelled in climb, time to climb and fuel consumption. For operative climb maintain constant IAS/Mach Number; for best performance climb maintain best climb speed schedule; maintain the best climb speed for minimum time to altitude.

1. Fuel - Check quantity and flow, AUX PUMP switch - OFF above 5,000 ft.
2. Oxygen:
   a. Pressure - Check.
   b. OXY FLOW indicator - Check operation.
3. Cabin altitude: Check the cabin altimeter above 8000 ft (see figure 1-34). Typical pressurization system check can be carried out as follows:
   a. From 8,000 to 17,500 ft (true altitude), the cabin altimeter reading should remain constant at 8,000 feet.
   b. At 20,000 feet true altitude the cabin altimeter should indicate 9,500± 500 feet.
   c. At 30,000 feet true altitude the cabin altimeter should indicate 16,500± 500 feet.
4. Check that permissible limits are not exceeded for following parameters:
   - NH and NL
   - ITT
   - Oil pressure
   - Hydraulic pressure
   - Voltammeter.
5. Location - Within operating area.

NOTE

To prevent possible canopy frosting at high altitude, when climb above 25,000 ft is planned, set the ECS cabin temperature selector towards the AUTO HOT position. If required, it is possible to further increase the cabin air temperature by selecting MAN HOT position for a maximum of 20 seconds. Exceeding the time limit may cause an overtemperature condition which would automatically close the ECS shut-off valve resulting in progressive loss of cabin pressurization. ECS and pressurization may be restored to normal operation as follows:

a. Select the AUTO position
b. Reset the ECs ON/OFF switch.

6. Pylon Fuel Tanks PUMPS - OFF when empty (If applicable).

CRUISE

For cruise data, refer to Performance Data Manual 1T-S211-1-1. 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 are kept to minimum.

PRE AEROBATICS CHECKS

1. Height - Sufficient to recover by :
   -5,000 feet dual
   -8,000 feet solo
   -15,000 feet for spin entry.
2. Flaps and landing gear up, speed-brake test.
3. Harness locked and tight. No loose articles.
4. Engine instruments - Check normal readings.
5. Location - Check clear airspace, within training area.
6. Lookout- Check clear of clouds and other aircraft.

DESCENT/REJOIN CHECKS

Refer to the Performance Data Manual 1T-S211-1-1 for the recommended descent speeds, time required, fuel consumed and distance travelled in descent. Refer to Section VI for the chart of the recovery altitudes after dive.

1. Fuel - Check quantity and set AUX PUMP switch ON.
2. Instrument - Check AIs, compasses syncronized, NAV aid tuned and identified.
3. Radio - Check frequency.
4. Harness - Locked and tight.
5. Altimeter - Set QNH.
6. DEMIST - As required.

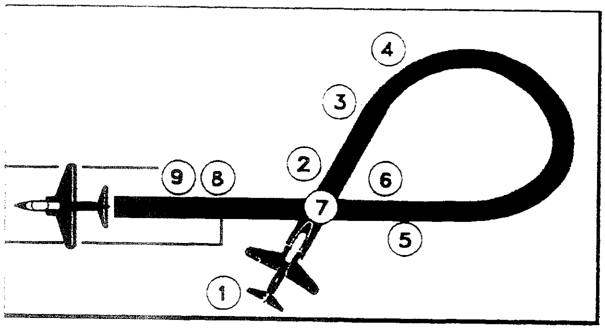
NOTE

To prevent the formation of mist on the windshield and canopy interior surfaces during rapid descents from high altitudes, adjust the cabin heat to high temperature few minutes prior to descend.

APPROACH AND LANDING

PRE-LANDING CHECKS

1. Shoulder straps - Locked.
2. Armament controls - Off. (If applicable).
3. AUX PUMP switch - Check ON.
4. Hydraulic press - Check within limits.
5. Landing lights - As required.
6. Check fuel quantity and compute approach speeds.



INSTRUMENT APPROACH

* BASED ON LANDING WEIGHT OF 2,500 Kg - 5,550 lbs. (Two Pilots - 1,000 lbs of fuel)
* FOR OTHER WEIGHTS:
  - FINAL APPROACH SPEED SHALL BE 1.3 STALL SPEED.
  - THRESHOLD SPEED SHALL BE 1.2 STALL SPEED.
* FOR STALL SPEED REFER TO FIGURE 6-1.
* IN PRESENCE OF GUSTY WIND, ADD HALF THE VALUE OF THE MUST GUST TO FINAL APPROACH SPEED.

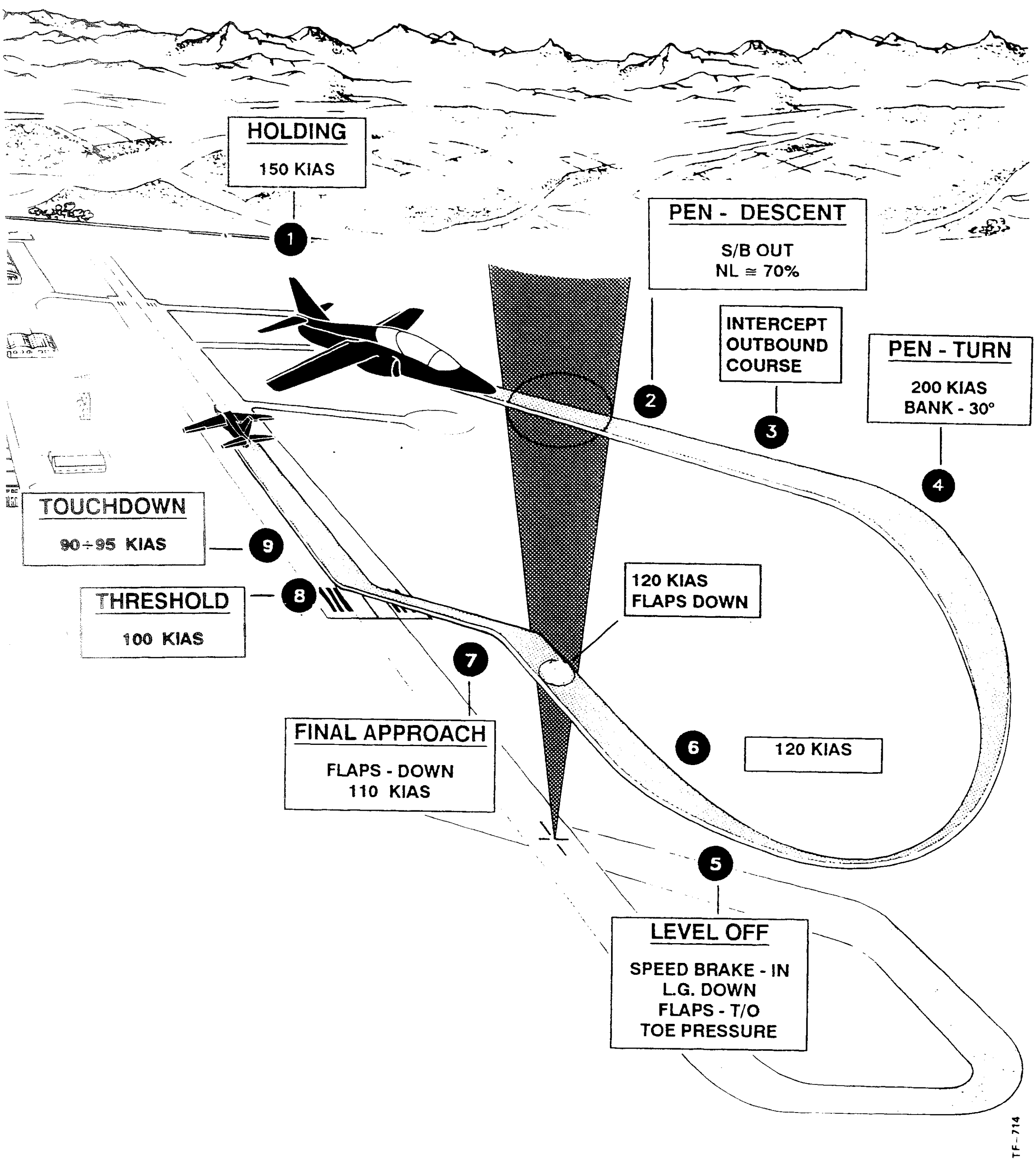
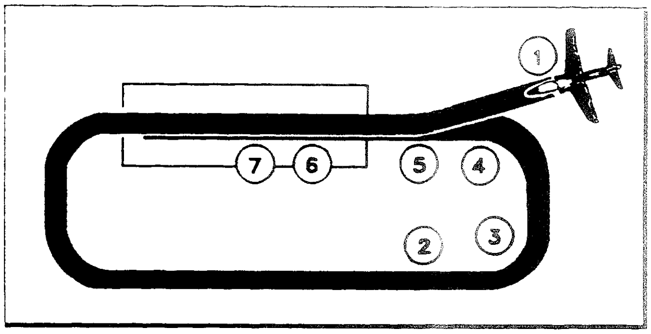


Figure 2-5.

RADAR APPROACH

* BASED ON LANDING WEIGHT OF 2,500 Kg - 5,550 lbs. (Two Pilots - 1,000 lbs of fuel)
* FOR OTHER WEIGHTS:
  - FINAL APPROACH SPEED SHALL BE 1.3 STALL SPEED.
  - THRESHOLD SPEED SHALL BE 1.2 STALL SPEED.
* FOR STALL SPEED REFER TO FIGURE 6-1.
* IN PRESENCE OF GUSTY WIND, ADD HALF THE VALUE OF THE MUST GUST TO FINAL APPROACH SPEED.



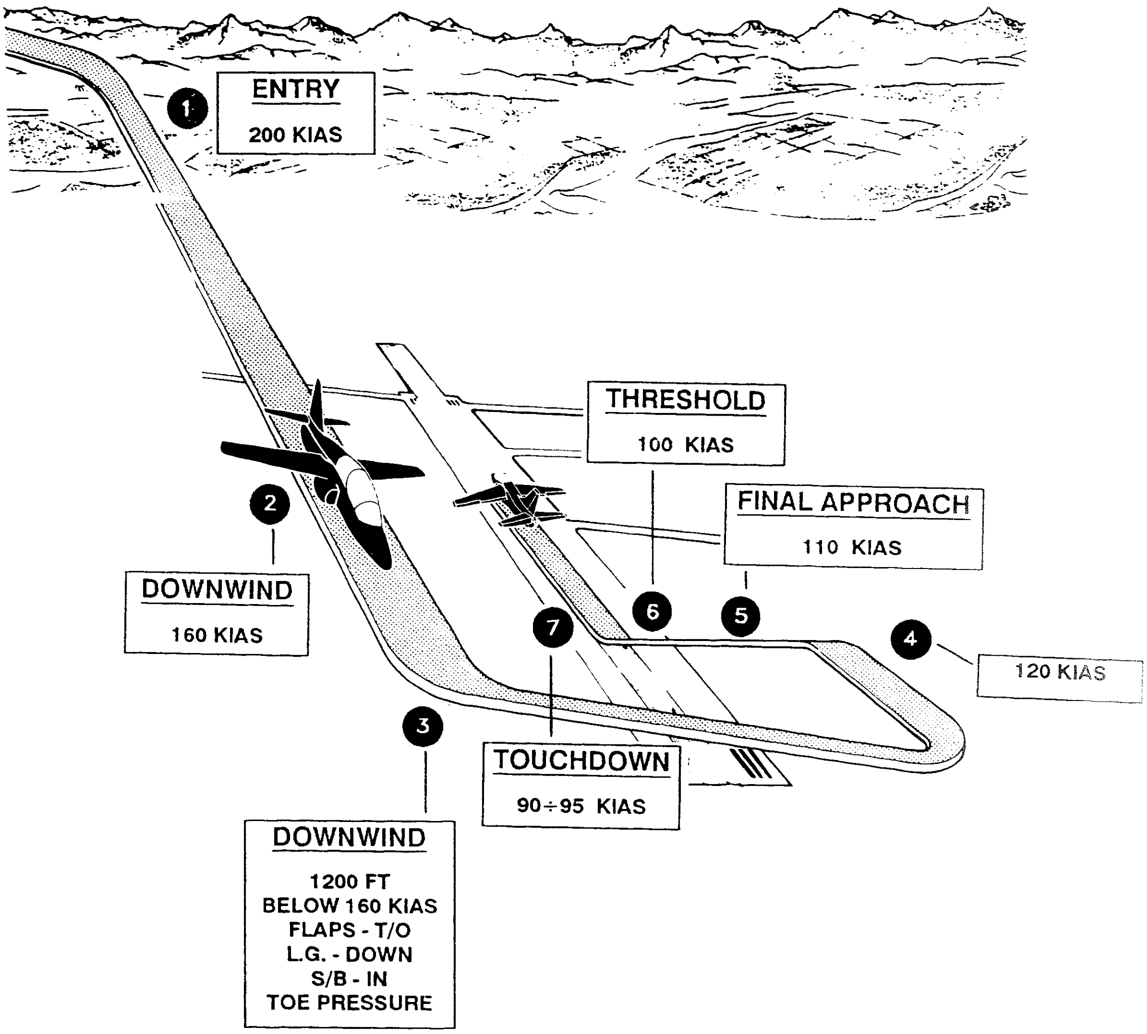
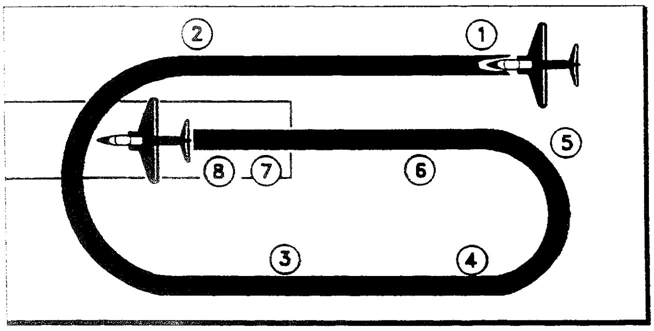


Figure 2-6.

LANDING PATTERN



* BASED ON LANDING WEIGHT OF 2,500 Kg - 5,550 lbs. (Two Pilots - 1,000 lbs of fuel)
* FOR OTHER WEIGHTS:
  - FINAL APPROACH SPEED SHALL BE 1.3 STALL SPEED.
  - THRESHOLD SPEED SHALL BE 1.2 STALL SPEED.
* FOR STALL SPEED REFER TO FIGURE 6-1.
* IN PRESENCE OF GUSTY WIND, ADD HALF THE VALUE OF THE MUST GUST TO FINAL APPROACH SPEED.

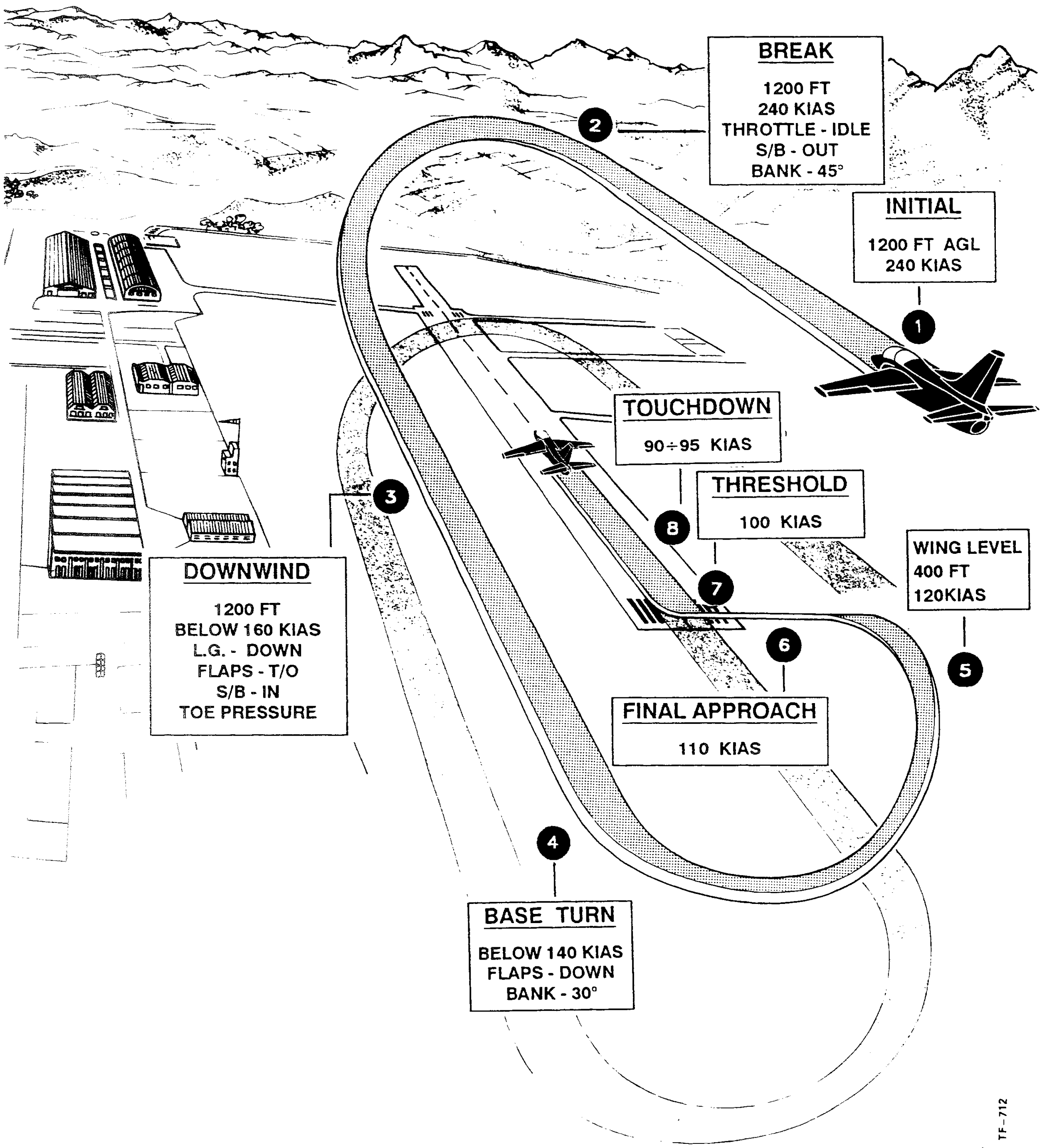


Figure 2-7.

NORMAL LANDING

For standard instrument approach (ADF, VOR/ILS) from high altitude refer to figure 2-5.
For radar (GCA) approach refer to figure 2-6.
For normal landing procedures refer to figure 2-7.
For the vertical speed limits at touchdown refer to Section V; for the landing airspeeds and ground rolls, refer to the Performance Data Manual IT-S211-1-1.
If the runway length and conditions permit, an aerodynamic braking is advisable to avoid brake and tire wear.
To perform an aerodynamic braking, increase the aircraft nose-up attitude after touchdown until the aircraft nose is in line with the horizon. The control stick should be gradually pulled to the full aft position. Gently lower the aircraft nose and bring the nose wheel in contact with the runway before the elevator becomes ineffective. Maintain directional control during the landing roll by use of rudder and nose wheel steering.
Before braking, it is advisable to move the wing flaps to UP and maintain full aft stick. This maneuver will put more weight on the main wheels, thus allowing a more efficient braking of the aircraft.

CROSS-WIND LANDING

Cross-wind landings may be easily performed by using the normal landing procedures. However, while using normal approach speeds, counteract drift either by a crab or by the upwind wing down method or by a combination or both to keep the aircraft track aligned with the runway. Anyway, just before touchdown, aircraft should be aligned with the runway.
After touch-down, keep the control stick upwind and lower the nose wheel smoothly to the runway as soon as practical, maintaining a centerline track by use of rudder pedals. Check pedals centralized before lowering the nose.

NOTE

Refer to cross-wind take-off and landing chart in the Performance Data Manual 1T-S211-1-1 for effect of varying cross-winds.

LANDING IN HIGH LOAD CONDITIONS

When landing in high load conditions bear in mind that the maximum permissible sinking speed (see Figure 5-8), decreases remarkably with the increase in weight. It is therefore recommended that a flat landing be made at the air speed specified in the Performance Data Manual 1T-S211-1-1 by controlling the sinking speed with the engine. Flare should be gradual and touch-down smoth. A stall prior to touch-down could result in a abrupt and incontrollable increase of the sinking speed above limits.

CAUTION

The vertical speed indicator readings are subject to a remarkable lag; therefore they are reliable during an approach under sufficiently steady conditions but not in the transient such as flare and contact.

USE OF WHEEL BRAKES

To minimize brake overheating and wear, the brakes should be used as little and lightly as possible. Care should be exercised to take full advantage of the length of runway during landing or aborted take-off. Use of brakes for turning the aircraft on the ground should be avoided. Nose wheel steering will be used for this purpose. Heavy brake pressure immediately after touch down is likely to cause tire skidding on the run-way, due to wing lift still produced by speed.
A wheel, once locked, will remain locked if the same or greater brake pressure is maintained, even though weight on the wheels increases as lift decreases. Optimum braking occurs when the wheel is in an incipient skid, i.e. the wheel is still rotating but only a slight increase in brake pressure would cause a complete skid. A complete skid decreases the braking action because of a decrease in the coefficient of friction between the sliding tire and the runway surface; the scuffing action produces small bits of rubber acting as rollers under the tire and, as skidding continues, the heat generated starts to melt the rubber and the molten rubber acts as lubricant. Further application of brake pressure could increase the tendency to skid, the possible final result being a blown tire and a tendency for the aircraft to turn in the direction of the affected wheel.

CAUTION

If brakes overheating is ascertained when the aircraft is stopped, it is advisable to wait for the brakes to cool down before flying again or before setting the parking brake.

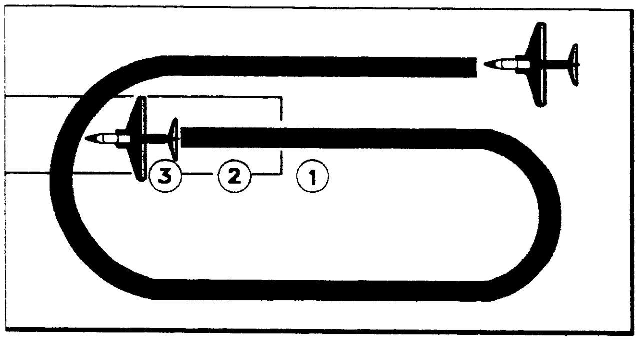
Optimum Braking Action

Retract flaps and apply brakes in a single, smooth application with constantly increasing pedal pressure. If skidding occurs, momentarily release brake pressure and immediately reapply brakes. This procedure will provide the shortest stopping distance possible from wheel braking action. If runway length is insufficient to completely stop the aircraft prepare for barrier engagement.

Brake Operation at High Speed

Extreme care should be used in applying brakes at high speed to prevent skidding of the tire. As discussed above, very little pressure is required to develop a skid while considerable lift is on the wing.

GO-AROUND



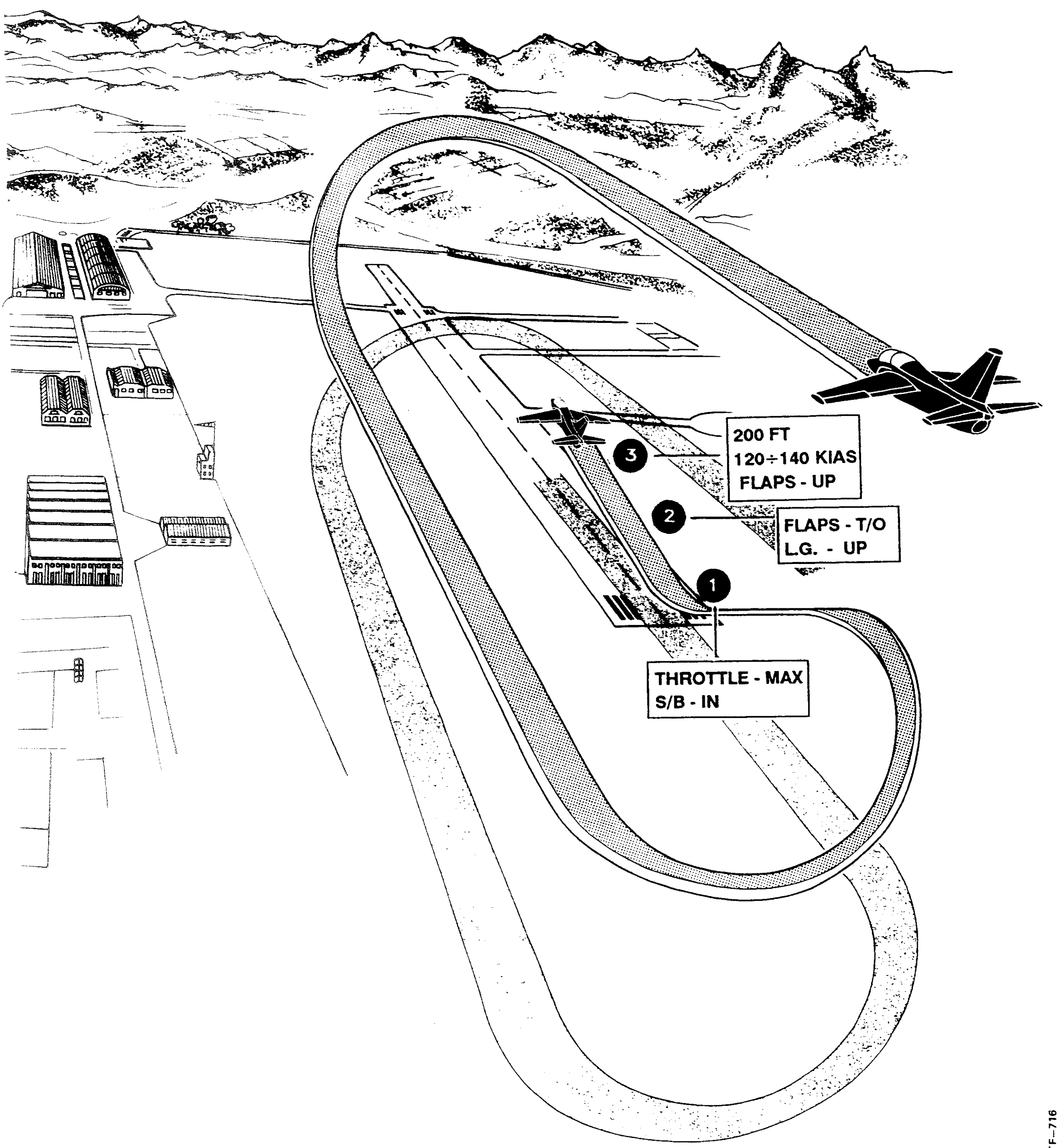


Figure 2-8.

If skidding is occurring, momentarily release pressure and again gradually apply increasing brake pressure. Lift may be reduced by lowering the nose as soon as possible and retracting the flaps.

GO-AROUND (figure 2-8)

Make the decision to go-around as early as possible.

1. THROTTLE Lever - MAX.
2. Speed Brake - IN.
3. Establish Take-off attitude.
4. With positive rate of climb:
   - Flap - T/O.
   - Landing gear lever UP.
5. Wing Flap UP above 200 feet and between 120÷140 KIAS.

TOUCH-AND-GO LANDING

The following procedure is to be adopted when a normal landing has been attempted, the landing wheels are in contact with the runway and it is found necessary to take-off again immediately, before allowing the aircraft to come to a stop:

1. Advance throttle to MAX.
2. Speed brake - IN.
3. Leave the flaps in the position as previously selected for landing.
4. Accelerate to take-off speed, then establish take-off attitude and allow the aircraft to fly-off the ground.
5. Apply the wheel brakes when the aircraft is definitely airborne.
6. With positive rate of climb;
   - Flap - T/O.
   - Landing gear lever - UP.
7. Flap control - UP between 120 and 140 KIAS and above 200 ft.

NOTE

The warning horn will blow when ldg gear is retracted as long as flaps are in DOWN position.

8. Longitudinal trim as required.
9. Check the landing gear, speed brake and flap position indicators.

CAUTION

Touch-and-go landings include all aspects of the landing and take-off procedures in a relatively short time span. Be constantly alert for possible aircraft malfunctions and/or procedure misapplication during these two critical flight phases which may result in unsafe conditions.

AFTER LANDING CHECKS

After the landing roll and when clear of the runway:

1. Landing light - OFF.
2. Taxi light - As required.
3. Seat safety pin - Fit in the firing handle.
4. Wing flaps - UP. Check the indicator.
5. Speed brake - IN. Check the indicator.
6. AUX PUMP switch - OFF.
7. Trims - In neutral position.
8. VOR Control panel - OFF.
9. ADF control panel - OFF.
10. ATC control panel - SBY.
11. DEMIST switch - OFF.
12. ANTI-ICE PITOT switch - OFF.
13. ENGINE ANTI-ICE switch - Check OFF.
14. Navigation lights - OFF.

ENGINE SHUT-DOWN

1. Parking brake - Applied.

WARNING

Avoid applying the parking brake if the brakes are overheated.

2. Throttle - Stabilize at IDLE for one minute.
3. Speed brake - OUT.
4. Flaps - DOWN.
5. VHF - OFF.
6. Standby Attitude Indicator - Caged.
7. ECS switch - OFF.
8. BEACON light - OFF.
9. Throttle - STOP.
10. Canopy - Open.
11. ECU switch - OFF
12. IGNITION switch - OFF.
13. N/BUS switch - OFF/RST.
14. A/C PWR switch - OFF.
15. GEN switch - OFF.
16. BATTERY switch - OFF. (After engine stop).

BEFORE LEAVING AIRCRAFT

1. Disconnect the following:

   a. Anti-G hose
   b. PSP connector.
   c. Leg restrain chord.
   d. Oxygen hose MIC/TEL Lead.

2. Wheel chocks - In place.

3. PARKING BRAKE handle - Released.

Final Aircraft External Inspections

After a solo flight, check in the rear cockpit:

1. VHF COMM - OFF.
2. Standby Attitude Indicator - Cage.

   Enter any discovered discrepancies and limitations that may have been exceeded in flight in the aircraft log book.

CAUTION

Keep clear of the tail pipe and do not move the aircraft into a hangar for at least 15 minutes after shutdown because of the possibility of explosion from fuel vapour accumulation.

SECTION III
EMERGENCY PROCEDURES

TABLES OF CONTENTS

INTRODUCTION

This section contains procedures to be followed in emergency conditions to ensure maximum safety for the crew and/or aircraft. Thourough knowledge of these procedures will enable the aircrew to better cope with an emergency. The steps should be performed in the listed sequence. However, the procedures do not restrict the aircrew from taking any additional action necessary to deal with the emergency.
The procedures contain items classified as critical or non critical. The critical items are actions that must be performed immediately to avoid aggravating the emergency and causing personal injury, loss of life, loss or damage to the aircraft. Critical items are presented in capital letters and must be committed to memory. Non critical items are considered to be less urgent and must be accomplished by direct reference to the check list. In any emergency situation, contact should be established with ground station as soon as possible after completing the initial corrective action. Include position, altitude, heading, speed, nature of the emergency and pilot's intentions in the first tran-

smission. Thereafter the ground station should be kept informed of the progress of the flight and of any changes or developments in the emergency.
Three basic rules apply to most emergencies and should be observed by each crew member :

1. Maintain aircraft control.
2. Analyze the situation and take proper action.
3. Land as soon as possible or as soon as practicable.

The meaning of land as soon as possible and land as soon as practicable, as used in this section, is as follows:

Land As Soon As Possible (ASAP)

Emergency conditions are urgent and require an immediate landing at the nearest suitable airfield.

Land As Soon As Practicable

Emergency conditions are less urgent and, in the aircrew's judgement, the flight may be safely continued to an airfield where more adequate facilities are available.

WARNING

The canopy should be retained during all emergencies which could result in crash, fire, crash landing, aborted takeoff. The risk of becoming trapped due to a canopy malfunction or overturn of the aircraft is outweighed by the protection given to the aircrew by the canopy.

GROUND EMERGENCIES

EMERGENCY GROUND EGRESS

Depending on the severity of the situation the aircrew must decide to abandon the aircraft through manual egress or by ejection. If necessary:

1. EJECT

WARNING

Canopy must be closed and locked.

Otherwise: (figure 3-1, sheet 1)

1. If time permits, make the ejection seat safe by inserting the safety pin in the handle of the seat pan.
2. LEG RESTRAINT LEVER - RELEASE
3. SURVIVAL PACK LANYARD - DISCONNECT
4. OXYGEN MASK HOSE AND RADIO PLUG -DISCONNECT.
5. QRF - RELEASE
6. CANOPY - OPEN (manually or activating the M.D.C. pulling either front or rear canopy breaking handles).

WARNING

The manual separation handle of the ejection seat must not be used during a ground egress.

PILOT RESCUE BY GROUND PERSONNEL (Two Rescuers) (Figure 3-1, sheet 2).

If the pilot of the crashed aircraft is physically incapacited to take direct action to abandon the air-craft, two persons are required to perform the following tasks:

1. Unlock and open the canopy. (manually or activating the M.D.C. external handle).
2. EJECTION SEAT - Safe by inserting the safety pin in the handle on the seat pan.
3. OXYGEN MASK HOSE, RADIO PLUG -DISCONNECT.
4. PULL THE LEG RESTRAINT LINES RELEASE LEVER on the seat port side.
5. DISCONNECT SURVIVAL PACK LANYARDS.
6. UNLOCK THE HARNESS QUICK RELEASE FITTING.
7. After climbing into the cockpit, one of the two rescuers will LIFT THE PILOT BY THE SHOULDERS AND WILL LAY HIM DOWN OVER THE BACK OF THE OTHER RESCUER that is waiting on the ground.

ENGINE FIRE DURING START

If there is evidence of a fire within the engine during start as indicated by sustained turbine temperature or detected by a ground crew or by illumination of the fire warning light, in order to purge fire from the combustion section, proceed as follows:

1. THROTTLE - STOP
2. IGNITION SWITCH - OFF
3. AUX PUMP SWITCH - OFF
4. FUEL SHUT-OFF SWITCH - CLOSED (guard and lever up).
5. Electrical power (external or battery) - OFF
6. Abandon the aircraft following the EMERGENCY GROUND EGRESS procedure.

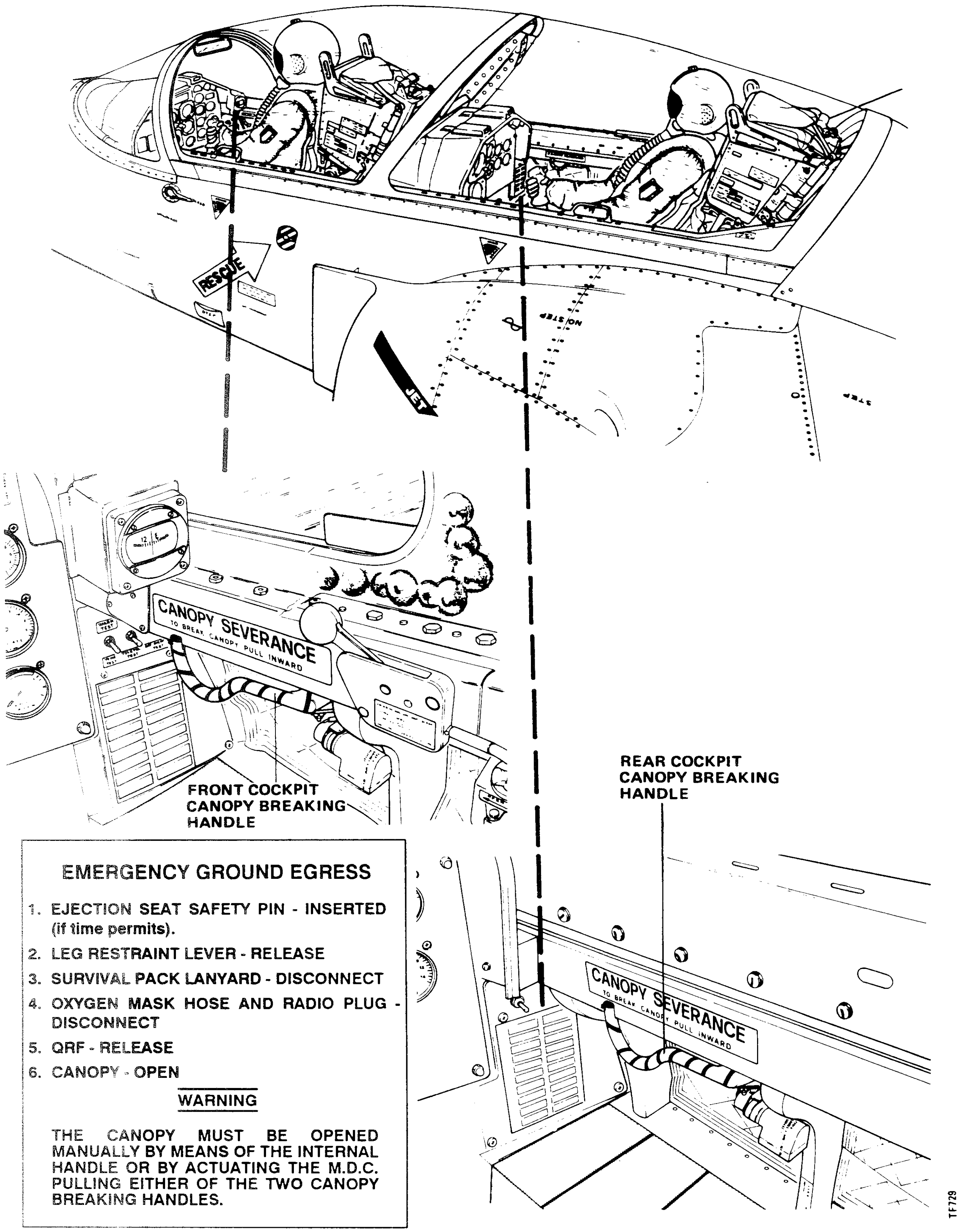
ENGINE FIRE ON THE GROUND

If the FIRE warning light illuminates or there are other indications of fire from outside proceed as follows:

1. THROTTLE - STOP
2. FUEL SHUT-OFF SWITCH - CLOSED
3. BATTERY SWITCH - OFF
4. Leave the aircraft as quickly as possible following the EMERGENCY GROUND EGRESS procedure.

EMERGENCY GROUND EGRESS

PILOT PROCEDURE



EMERGENCY GROUND EGRESS

1. EJECTION SEAT SAFETY PIN - INSERTED (if time permits).
2. LEG RESTRAINT LEVER - RELEASE
3. SURVIVAL PACK LANYARD - DISCONNECT
4. OXYGEN MASK HOSE AND RADIO PLUG - DISCONNECT
5. QRF - RELEASE
6. CANOPY - OPEN

WARNING

THE CANOPY MUST BE OPENED MANUALLY BY MEANS OF THE INTERNAL HANDLE OR BY ACTUATING THE M.D.C. PULLING EITHER OF THE TWO CANOPY BREAKING HANDLES.

Figure 3-1. (Sheet 1 of 2)

EMERGENCY GROUND EGRESS

PILOT RESCUE BY GROUND PERSONNEL (TWO RESCUERS)

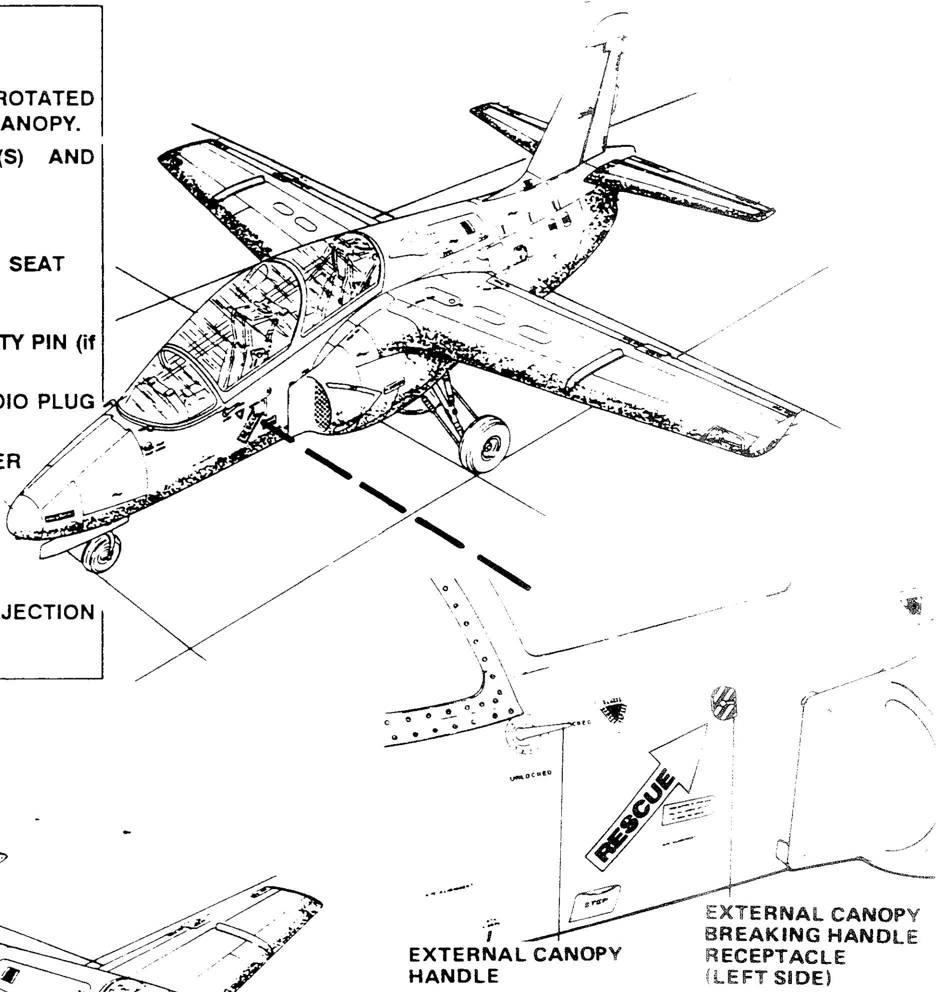
NORMAL ENTRY

1. EXTERNAL CANOPY HANDLE - ROTATED FULLY DOWN AND RAISE THE CANOPY.
2. GAIN ACCES TO COCKPIT(S) AND REMOVE PILOT FACE MASK.

WARNING

DO NOT ACTUATE EJECTION SEAT FIRING HANDLE.

3. INSTALL EJECTION SEAT SAFETY PIN (if time permits).
4. OXYGEN MASK HOSE AND RADIO PLUG - DISCONNECTED.
5. LEG RESTRAINT RELEASE LEVER - RELEASE.
6. SURVIVAL PACK LANYARD - DISCONNECT.
7. QRF - RELEASE.
8. REMOVE PILOT(S) FROM EJECTION SEAT(S).



EMERGENCY ENTRY

1. EXTERNAL CANOPY BRAKING HANDLE RECEPTACLE - PUSH BUTTON TO OPEN DOOR.
2. PULL THE HANDLE OUT 10 ft.
3. REMOVE CANOPY TRANSPARENT.
4. GAIN ACCES TO COCKPIT(S) AND IF TIME WILL PERMIT INSTALL EJECTION SEAT SAFETY PIN.

WARNING

DO NOT ACTUATE EJECTION SEAT FIRING HANDLE.

5. OXYGEN MASK HOSE AND RADIO PLUG - DISCONNECTED.
6. LEG RESTRAINT RELEASE LEVER - RELEASE.
7. SURVIVAL PACK LANYARD - DISCONNECT.
8. QRF - RELEASE.
9. REMOVE PILOT(S) FROM EJECTION SEAT(S).

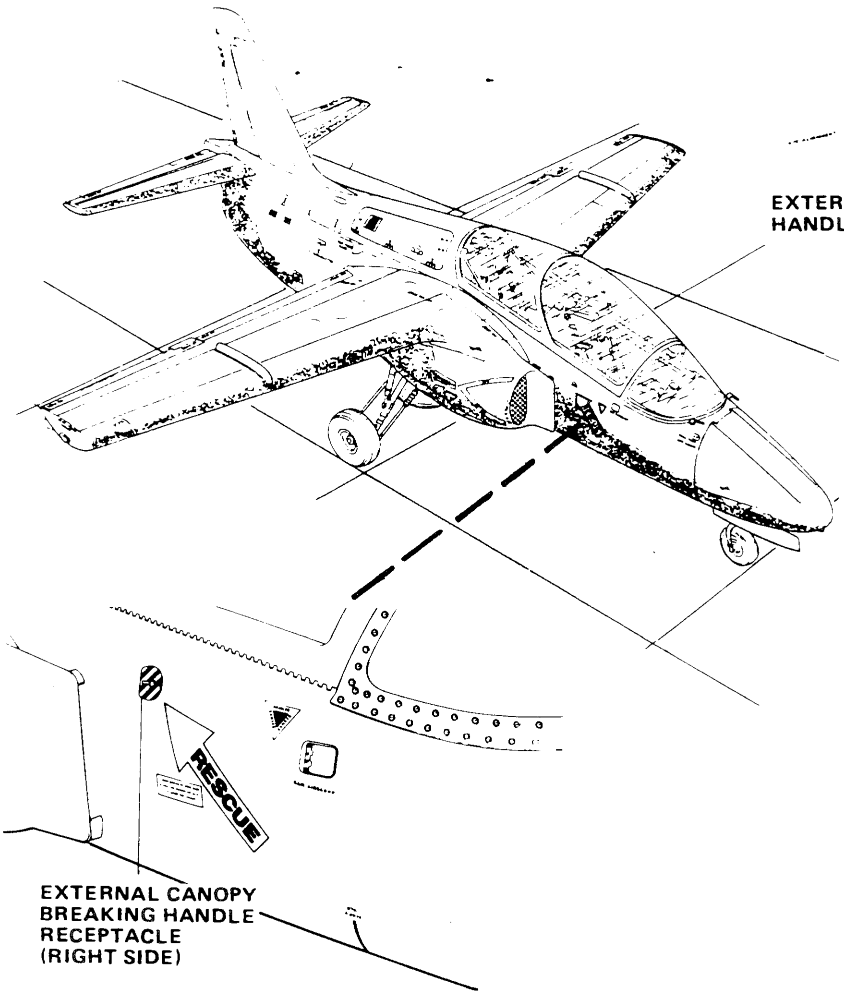


Figure 3-1. (Sheet 2)

TAKE OFF EMERGENCIES

ABORT - OVERRUN BARRIER ENGAGEMENT

If an emergency occurs during take off the aircrew has to decide whether to continue take-off or to abort.
If the decision to stop is made, proceed as follows:

1. THROTTLE - IDLE
2. BRAKES - APPLY AS NECESSARY

CAUTION

The heat generated in the brake during an aborted take-off continues to build-up during the subsequent 10 to 20 minutes. This heat is transmitted to the wheel and into the tire itself, and may cause melting of the wheel hub fuse with consequent tire deflation.

If an overrun barrier engagement is necessary , accomplish as much of the following as possible:

3. Call BARRIER, BARRIER, BARRIER if required.
4. THROTTLE - STOP.
5. FUEL SHUT-OFF SWITCH - CLOSED
6. BATTERY SWITCH - OFF.
7. Keep braking.

CAUTION

Brakes must be apllied moderately to prevent possible loss of directional control from tire blow-out.

8. Keep the canopy closed and the nose wheel in contact with the ground.
9. Engage the overrun barrier in center and at 90° .
10. If time permits, insert the seat safety pin.
11. Abandon the aircraft as soon as possible.

LANDING GEAR EMERGENCY RETRACTION

WARNING

Ground retraction of the landing gear is to be carried out only when absolutely required, since one main gear leg will probably fold before the other, and severe structural damages and possible pilot injury may result. LG emergency retraction from the back seat is not possible without electrical power.

If the action of the brakes appears to be insufficient to prevent the impact against other aircraft, building, etc. and overrun barrier is not available:

1. SPEED BRAKE - IN.
2. THROTTLE - STOP
3. DOWN-LOCK OVERRIDE button - PUSH, and raise the LG LEVER.
4. FUEL SHUT-OFF switch - CLOSED (Guard up).
5. BATTERY - OFF.

WARNING

The LG lever must be raised immediately after setting the THROTTLE to STOP in order to have as high residual RPM as possible. This to enable the hydraulic pump to deliver hydraulic power sufficient for LDG emergency retraction

6. When the aircraft stops - Abandon the aircraft.

ENGINE FAILURE DURING TAKE-OFF

Aircraft on the Ground

If the engine fails while the airplane is in the take-off roll with sufficient stopping distance left:

1. ABORT

If conditions do not allow a safe ABORT:

2. EJECT

NOTE

For procedure refer to paragraph Ejection During Take Off.

Aircraft Airborne

If engine failure occurs on take-off after the aircraft is airborne, prepare for an emergency landing, accomplishing as much of the following as time permits:

1. THROTTLE - STOP.
2. SALVO JETTISON PUSH-BUTTON - PRESS (if external stores are carried).
3. EMER LDG CR handle - PULL OUT, TURN 90° CLOCKWISE AND CONFIRM THE WHEELS LOCKED IN THE DOWN POSITION.

WARNING

If down-locking of the wheels does not occur: EJECT.

4. Flap control lever - As required.
5. ATTEMPT ENGINE RELIGHT;
   If unsuccessful:
6. FUEL SHUT-OFF SWITCH - CLOSED (guard and lever up).
7. BATTERY switch - OFF.
8. Land straight ahead. Change direction only as sufficient to avoid possible obstacles.

WARNING

If landing is judged dangerous: EJECT.

FLAT OR BLOWN TIRE DURING TAKE-OFF

Main Landing Gear Tire Blow Out

a. If aircraft speed and runway left allow a safe stopping:

1. Throttle - IDLE.
2. Maintain directional control by the nose wheel steering.
3. Try to maintain the wings level by full lateral deflection of the control stick to the side opposite the blown tire.
4. In case of failure to stay on the runway:
   - THROTTLE - STOP.
   - SALVO JETTISON - Pressed.
   - FUEL SHUT-OFF - CLOSED (Guard and lever up).
   - BATTERY - OFF.

b. If the take-off is continued:

1. Do not retract the landing gear.
2. Consume fuel down to a residual quantity of 170 lbs.
3. Land on the side of the runway opposite the blown tire.
4. Use the aileron to reduce the weight on the wheel with the blown tire.
5. After touchdown, proceed as per step a.

Nose Landing Gear Tire Blow Out

a. If the aircraft speed and runway left allow a safe stopping:

1. THROTTLE - STOP
2. Maintain directional control as required, preferably by use of the nose wheel steering.
3. Maintain full aft stick.
4. In case of failure to stay on the runway:
   - SALVO JETTISON - Pressed.
   - FUEL SHUT-OFF - CLOSED (Guard & lever up).
   - BATTERY - OFF.

b. If the take-off is continued:

1. Do not retract the landing gear.
2. Consume fuel down to a residual quantity of 170 lbs.
3. After touch-down, reduce weight on the nose wheel as much as possible by holding a full nose-up deflection of the stick and lower the nose wheel gently.
4. If the runway length allows it, use the brakes moderately in order not to increase the load on the nose wheel.

FIRE DURING TAKE-OFF

The procedure to be followed will vary with the circumstances, depending upon airspeed, length of remaining runway, possibility to continue the take-off run, location of populated areas, etc. The pilot should take these factors into account and follow as far as possible the typical procedure listed below.

Aircraft on Ground

If the FIRE warning light illuminates during ground run and there is still sufficient runway to allow an aborted take-off even with the engagement of the runway overrun barrier:

1. ABORT

If the FIRE warning light illuminates when just airborne with the landing gear still down and there is sufficient runway to allow a landing:

1. Land on the remaining runway.

If the take-off cannot be aborted due to insufficient runway left and over-run barrier not available, continue the take-off and, when airborne, proceed as detailed here-after.

Aircraft Airborne

If the FIRE warning light illuminates after the aircraft is definitely airborne and take-off cannot be safely aborted, proceed as follows:

1. Landing Gear - UP.
2. SALVO JETTISON PUSH-BUTTON - PRESS (if external stores are carried).
3. THROTTLE - MAINTAIN TAKE-OFF POWER and immediately start climb.

   If there is a sign of fire: EJECT
   otherwise:
4. ATTAIN A SAFE ALTITUDE of at least 1,500 ft AGL.
5. ENGINE THROTTLE - REDUCE RPM. Move to IDLE if altitude is higher than the minimum safe altitude or adjust for minimum practical power to maintain a safe altitude.
6. WARNING LIGHT - CHECK:

   a. If the warning light goes out, continue the flight at reduced power and land as soon as possible. Occasionally check the serviceability of the fire and over-heat warning circuit by pressing the FIRE warning light. If this action does not bring the light on, follow the procedure described in following step b.

   b. If the light remains on, check for positive indications of fire, such as smoke trails following a turn, reports from the ground or from another aircraft, abnormal engine instrument readings (RPM, ITT oil pressure), unusual engine noise or vibration, fumes, heat., smoke in the cockpit.

7. IF FIRE IS NOT CONFIRMED, CONTINUE THE FLIGHT AT REDUCED POWER AND LAND AS SOON AS POSSIBLE.
8. IF FIRE IS CONFIRMED - EJECT.

EJECTION DURING TAKE-OFF

The Mk IT-10LA ejection seat allows aircrew ejection at all speeds and altitudes, even during the take-off run. Follow the same Ejection Procedure as described in paragraph "In flight Ejection" in this section.

UNLOCKED CANOPY DURING TAKE-OFF

Should the canopy be unlocked during take-off, or should it open when the aircraft is already airborne and there is not sufficient runway left to abort the take-off, proceed as follows:

1. REDUCE SPEED TO 120 KIAS, prevent yawing and do not attempt to lock the canopy.
2. LAND AS SOON AS POSSIBLE by carrying out a straight-in approach.

BIRD INGESTION

If the aircraft should encounter a flock of small birds and one or more birds are ingested by the engine, the throttle must not be moved after the ingestion until the aircraft has reached a safe altitude, since difficulty in engine control may be experienced. Prepare immediately for landing by selecting the required engine speeds with slow and progressive movements of the throttle.

IN-FLIGHT EMERGENCIES

ENGINE FLAME-OUT

The symptoms of engine flame-out are a drop in turbine temperature and a reduction in engine speed. This may occur due to lack of fuel supply (broken line, or fuel starvation due to prolonged inverted flight, or running out of fuel, or possibly may be caused by unstable engine operation.
The following considerations are provided to assist the pilot to interpret the situation when a flame-out is experienced.

a. The low rotor (NL) is a free shaft, therefore the windmilling effect will always provide a positive indication by the NL gage, if electrical power supply is available.

   Steady state windmilling values are approximately:
   NL = 17% at 130 KIAS and
   NL = 23% at 200 KIAS.

   Much lower NL indications or zero are a clear symptom of a mechanical damage preventing free rotation of the low rotor shaft.
   Under these conditions an attempt to restart the engine will most probably be unsuccessful.

b. The high rotor (NH) is insensitive to windmilling effects. In addition it is dragged by the gearbox because it is loaded by the engine high pressure fuel pump, by the electric generator (until it disconnects automatically at about NH = 40% and by the hydraulic pump.
   Therefore NH will drop to zero within 30 seconds to 1 minute depending upon the conditions when the flame-out occures (primarily the initial value of NH).
   A very fast NH drop to zero indicates jamming in the high rotor shaft and any attempt to restart will be most probably unsuccessful.

c. After a flame-out the ITT rate of drop will depend only upon the amount of ventilation of the turbines; therefore it is related primarily to NH and to the aircraft speed.
   An engine flame-out from IDLE at 15,000 ft and 130 KIAS will typically produce an ITT drop from 450°C to 220°C in 10 seconds, but it will take 20 more seconds to drop below 200°C.

RELIGHTING IN FLIGHT

If the engine flame-out is not due to a steady mulfunction, a relight may always be safely and successfully attempted.
An immediate relight procedure shall be carried out when time and altitude are critical in the pilot judgement, otherwise the air start procedure with more complete checks should be preferred.

Immediate Hot Relight

When engine flame-out is immediately realized **and NH is still above 50%**, proceed as follows:

WARNING

Performing this procedure with NH below 50% will have progressively higher probabilities of engine overtemperature and severe hot section damage and should never be attempted unless as the last resort before ejection (i.e. low speed/low altitude).

1. RETARD THROTTLE TO IDLE.
2. PRESS THE RELIGHT PUSH BUTTON.

The simultaneous rise of ITT and NH/NL RPM will indicate successful relight.

3. Release the RELIGHT button when engine stabilizes at IDLE RPM.

4. Check OIL PRESS to be within limits, then advance the throttle as required.

CAUTION

If no relight occurs within 10 seconds, or if the engine relights but the ITT rapidly rises above 500°C with a clear tendency to exceed 700°C. RETARD THE THROTTLE TO STOP.

WARNING

If time, altitude and speed are not sufficient to attempt an air start, prepare for a forced landing or for ejection.

Engine Air Start

When engine flame-out is realized **and NH has already dropped below 50%**, proceed as follows:

1. RETARD THE THROTTLE TO STOP.

NOTE

The most favourable condition for an air-start are found at altitudes below 20,000 ft and speeds below 250 KIAS.

CAUTION

In a flame-out condition the only electrical power source is the internal battery; therefore electrical power drain must be reduced to the minimum as soon as possible.

2. If time and altitude permits:

a. Let ITT drop below 200°C.

NOTE

The maximum ITT during air starting is directly related to the residual ITT .

b. Check or select:
- FUEL SHUT-OFF - OPEN
- AUX PUMP switch - ON.
- BATTERY switch - ON.
- N/BUS switch - OFF.

NOTE

Switching off the normal bus is aimed to reduce all electrical loads to the minimum with one action.

3. PRESS THE STARTER SWITCH.

NOTE

If releasing the switch a starter disengagement occurs, press and hold the starter switch until the sequence is completed. (Idle stabilized).

4. WITH NH ABOVE 10%, ADVANCE THE THROTTLE TO IDLE AND PRESS THE RELIGHT PUSH BUTTON.

NOTE

Pushing the relight button is aimed to provide the ignition even if NH is above 40% when the starting sequence (and the ignition) is automatically cut-off.

The simultaneous rise of ITT and NH/NL rpm will indicate successful relight.

5. Release the RELIGHT BUTTON when engine stabilizes at IDLE RPM.

6. Check OIL PRESS to be within limits, then advance the throttle as required.

CAUTION

If no relight occurs within 10 seconds, or the engine relights but the ITT rapidly rises above 500°C with a clear tendency to exceed 700°C:

- RETARD THE THROTTLE TO STOP.
- STARTER SWITCH - STOP.

CAUTION

If the starter sequence is not stopped manually, the starter will continue to motor the engine and will very rapidly drain the battery.

WARNING

If time, altitude and speed are not sufficient to attempt a second engine air-start, prepare for a forced landing or for ejection.

7. N/BUS switch - ON to restore full operation of aircraft systems.

ENGINE MECHANICAL FAILURE

Mechanical failure is normally indicated by rough engine operation and abnormal noises with or without thrust losses.
If these symptoms are experienced proceed as follows:

a. If the ITT, RPM and fuel flow gauges show that the engine has not flamed out, do not close the throttle. Use the engine to land the aircraft as soon as possible with the minimum possible throttle movement.

b. If a flame-out has occured but the engine is windmilling normally, an immediate relight can be attempted and if successful, use the engine to assist in landing the aircraft as soon as possible, with the minimum of throttle movement.

c. If the engine RPM drop to zero, i.e. engine seized, a relight must not be attempted. Proceed as follows:

(1) THROTTLE LEVER - STOP
(2) FUEL SHUT-OFF SWITCH - CLOSED
(3) All non-essential electrical Equipment - OFF.

d. Where the mechanical failure has resulted in the engine continuing to run but with symptoms of failure still present, be prepared to stop the engine immediately if the symptoms become severe.

Proceed as follows:

(1) THROTTLE LEVER - STOP
(2) FUEL SHUT-OFF SWITCH - CLOSED
(3) All non-essential electrical equipment - OFF.

ECU FAILURE

ECU failure is indicated by the ECU OFF caution light and a reduction in engine thrust. Under this condition, fuel management authority is assured by the HMU with a decrease of maximum power (ranging from 88 % to 93 % NL) depending on flight conditions (speed, altitude ambient temperature). With ECU off, engine thrust gives sufficient performance to safely fly the aircraft within its entire flight envelope, however engine response to throttle movements becomes very slow and degrades at lower airspeed.

WARNING

At low airspeeds, acceleration time with ECU off from IDLE to max attainable NL may be in the 20 ÷ 40 seconds range. Therefore if an ECU failure occurs while at IDLE, advance throttle above 65 % NL where engine response is faster.

In the event of ECU caution light flashing proceed as follows:

1. Press to reset the MASTER CAUTION button.

If ECU resumes operation (light off), no further action is required.

If ECU remains faulty (caution light steady):

2. ECU switch OFF then ON. If caution light remains steady.
3. ECU switch - OFF.
4. From the front cockpit: Engine Throttle Extra-stroke Control Lever - Pulled
5. Throttle - As required . Proceed flight monitoring engine speed and ITT.
6. Land as soon as practicable.

WARNING

During approach for landing with ECU off do not retard the throttle below 65 % NL to maintain an acceptable engine acceleration capability. Reduce throttle to idle only when sure to have the runway made.

COMPRESSOR STALL

Compressor stall may be experienced only at high altitude under high angles of attack while the engine is accelerating.
Compressor stall is recognized by abnormal engine noises which may range in intensity from a rumbling to a sharp bang or bangs.
Any compressor stall investigated during flight tests and the few cases experienced in S211 operation have all been self recovering and did not require any action by the pilot.
However, should a non-self-recovering stall ever occur (increase in ITT and decrease or hang-up in NL/NH) the corrective action consists in retarding the throttle.

NOTE

Compressor stalls do not cause any mechanical damage which could be prejudicial to safe engine operation.

ENGINE FUEL LOW PRESSURE

If the FUEL PRESS caution light comes on with engine running, assume a deficiency in the fuel supply system and proceed as follows:

1. Fuel AUX PUMP switch - ON.
2. Reset MASTER CAUTION push button.

If the FUEL PRESS caution light remains on, proceed as follows:

3. THROTTLE - reduce NL as low as possible.
4. Land as soon as possible avoiding negative g.

CAUTION

Operation of the engine with the fuel LOW PRESS warning light ON should be recorded and reported after flight.

5. If following steps 1and 2 the FUEL PRESS caution light extinguishes, land as soon as practicable.

ENGINE OIL LOW PRESSURE

If the OIL PRESS caution light illuminates to indicate a deficiency in the engine oil supply, proceed as follows:

1. Throttle - Set to about 85 % NL .
2. If pressure remains above the minimum land as soon as practicable avoiding negative "g".
3. If the minimum pressure value cannot be maintained, land as soon as possible.

ENGINE OIL HIGH TEMPERATURE

The OIL TEMP caution light illuminates to indicate the oil temperature is above limits.
If the OIL TEMP light ON is concurrent with the illumination of OIL PRESS caution light:

1. Throttle - Set 85 % NL.
2. Land as soon as possible.

If the OIL PRESS caution light is Out:

3. Throttle - Set to about 90% NL to have oil cooling from fuel flow.
4. Land as soon as practicable.

FIRE DURING FLIGHT

If the FIRE warning light illuminates during flight, proceed as follows:

1. THROTTLE - REDUCE RPM. Retard to IDLE if above safe altitude or adjust to minimum practical power to maintain safe altitude.
2. WARNING LIGHT - CHECK:

   a. If light goes out, continue flight at reduced power and land as soon as possible.
   Occasionally check the serviceability of the detector circuit by pressing the FIRE warning light.

   b. If the light remains on, check for positive indications of fire such as smoke trails following a turn, reports from ground or from another aircraft, abnormal engine instrument readings (RPM, ITT, oil pressure), unusual engine noise or vibration, fumes, heat, smoke in the cockpit.

3. IF NO FIRE IS APPARENT, CONTINUE FLIGHT AT REDUCED POWER AND LAND AS SOON AS POSSIBLE.

4. IF FIRE IS CONFIRMED - EJECT.

LOSS OF CONTROL

For recovery procedures from departures, stalls and spins refer to Section VI Flight Characteristics.

IN-FLIGHT EJECTION

BEFORE EJECTION

When time and conditions permit, carry out the following operations before leaving the aircraft:
1. Head the aircraft towards a clear area.
2. ATC Controller - Select Emergency code.
3. Reduce airspeed below 250 KIAS and fly in straight and level or climbing flight.
4. Lower the helmet visor.
5. Warn other occupant.
6. THROTTLE - STOP.

CAUTION

With two pilots on board the first to eject should be, when possible, the rear occupant.

NOTE

See Figure 3-2 for minimum ejection altitude above ground.

EJECTION PROCEDURE

1. GRASP THE SEAT FIRING HANDLE WITH BOTH HANDS WHEN POSSIBLE.
2. STRETCH THE LEGS OUT FORWARD OF THE SEAT.
3. KEEP THE BACK AS STRAIGHT AS POSSIBLE.
4. PRESS THE HEAD AGAINST THE HEADREST.
5. PULL THE HANDLE SMARTLY UPWARDS TO ITS FULL EXTENT.
6. RETAIN THE GRIP UNTIL THE HARNESS RELEASE MECHANISM OPERATES.

MANUAL SEPARATION

After ejection at altitudes lower than 10,000 feet, the drogue gun should fire and deploy the drogue parachute followed after a short delay by deployment of the personal parachute and automatic separation from the seat.
If at any stage it is obvious that the seat is not functioning correctly, the occupant should pull the manual separation handle located on the right side of the seat and obtain normal completion of the sequence.

WARNING

Do not operate the manual separation handle if the Firing Handle has been pulled and seat failed to fire.

AFTER EJECTION

Over Water (fig. 3-4).

1. Check PSP lanyard connected to life jacket.

MINIMUM EJECTION ALTITUDE ABOVE GROUND

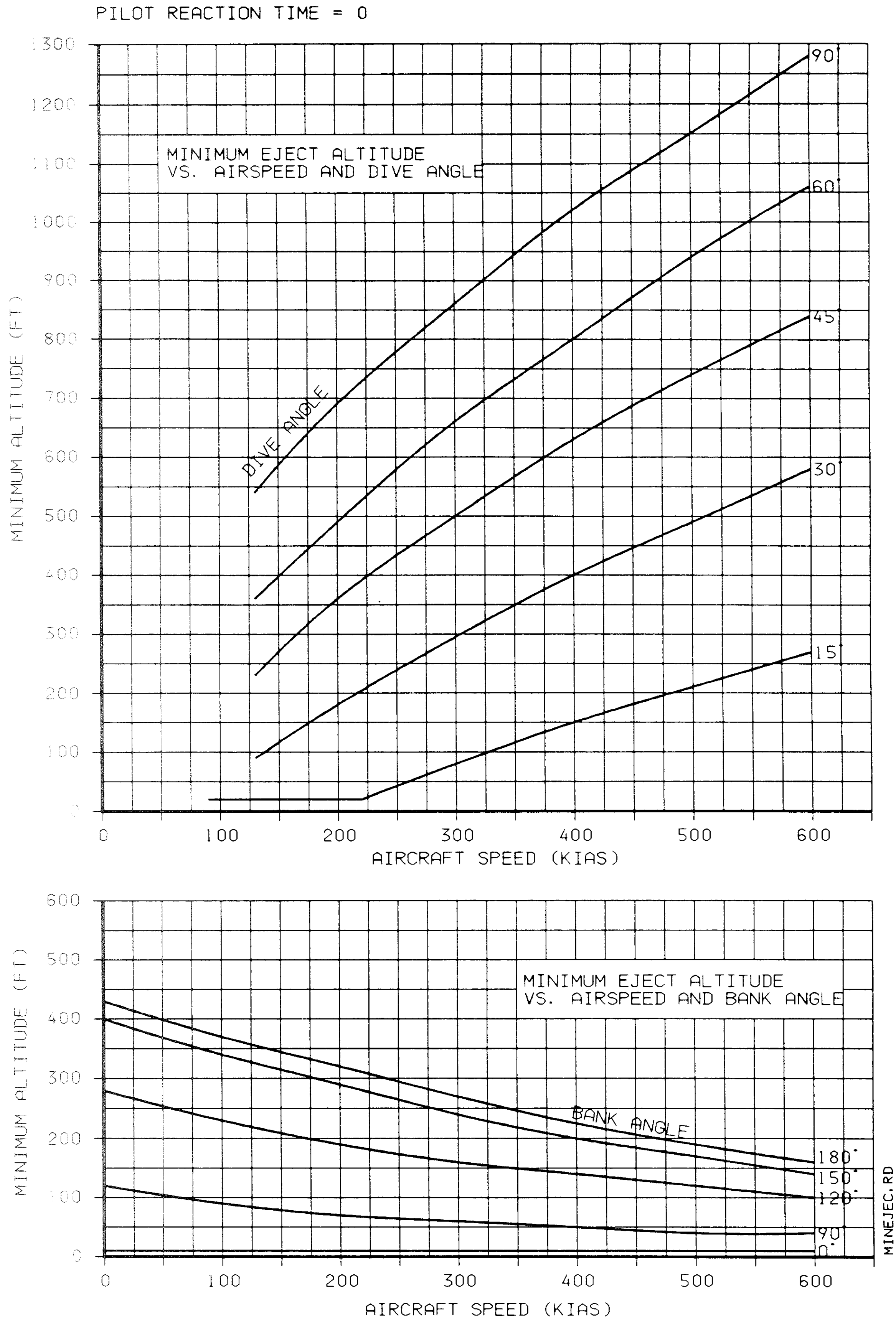
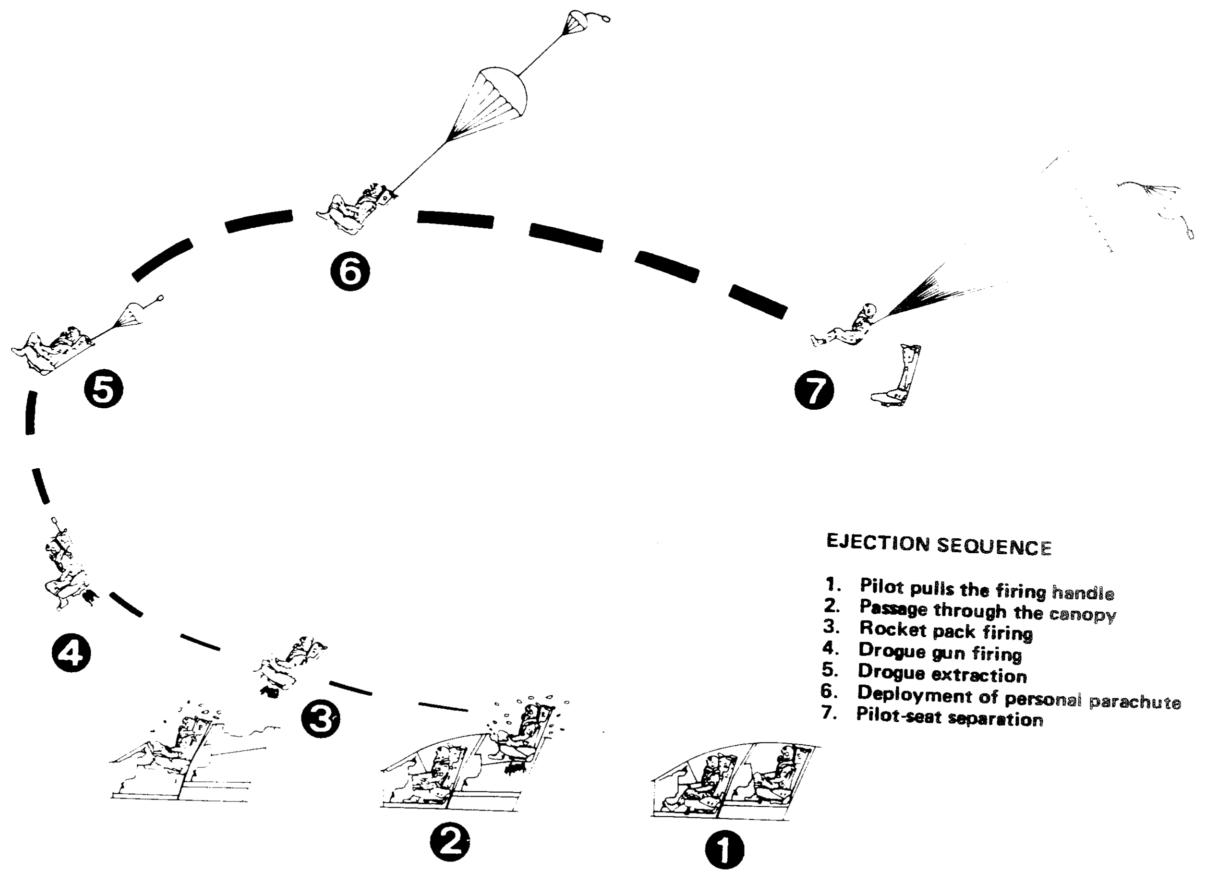


Figure 3-2.

MKIT10 (L) SEAT EJECTION SEQUENCE



EJECTION SEQUENCE

1. Pilot pulls the firing handle
2. Passage through the canopy
3. Rocket pack firing
4. Drogue gun firing
5. Drogue extraction
6. Deployment of personal parachute
7. Pilot-seat separation

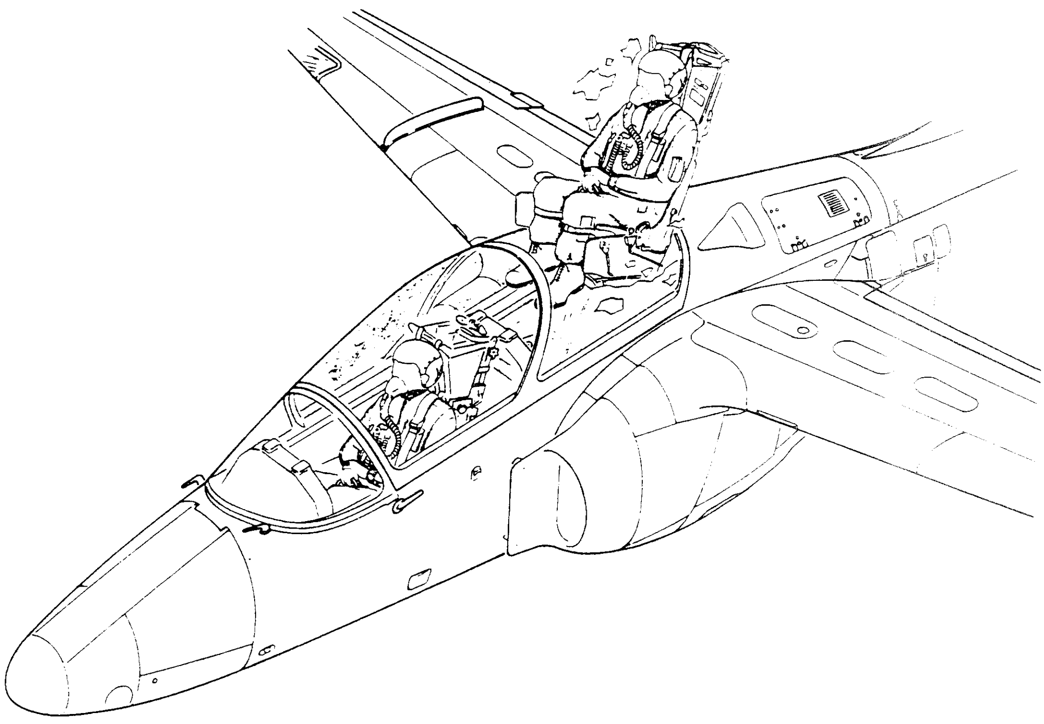


Figure 3-3.

AFTER EJECTION OVER WATER

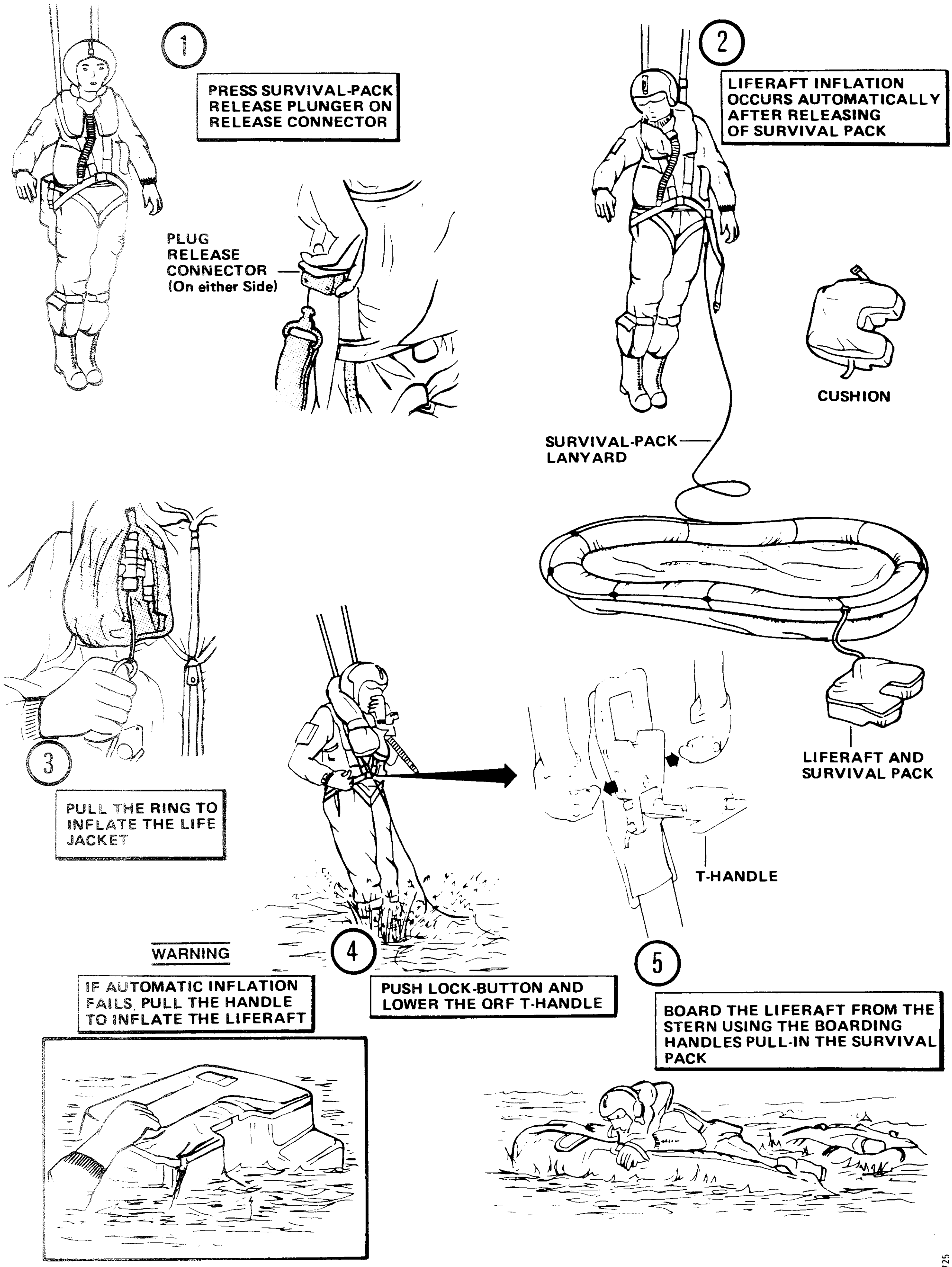


Figure 3-4.

2. At an altitude of approximately 1000 ft, release one of the two plug release connectors which secure the survival pack to the harness, leaving the liferaft attached to the life jacket. The survival pack will fall away to the full extent of the lowering line (approximately 18 ft). The liferaft will inflate automatically.
3. Disconnect the oxygen mask.
4. Ensure that the harness shoulder straps pass under the life jacket, and inflate the life jacket.
5. As soon as the survival pack touches the water operate the quick-release fitting to free the body from the parachute and harness.
6. Adjust the lifejacket to provide correct flotation angle and trace the lowering line to recover the survival pack and the liferaft. Pull the handle to inflate the liferaft in case of failure of the automatic system.
7. Board the liferaft from the stern ; once boarded, recover the survival pack pulling the lowering line.

Over Land

1. Examine the nature of the terrain prior to releasing the survival pack. If trees, buildings or rocks are present, it is recommended that the survival pack be left connected to the parachute harness for better body protection.
   It is also recommended that the oxygen mask be left in place for face protection.
2. Upon contact with the ground, operate the quick release fitting to free the body from the parachute harness.

ECS FAILURES

OVERPRESSURIZATION (CABIN PRESS warning light ON)

Illumination of the CABIN PRESS warning light on the warning panel indicates a cabin differential pressure in excess of 4 +0.5/-0 psi, due to pressure regulator and safety valve failures in the cabin pressurization system.
Under this condition proceed as follows:

1. REDUCE AIRSPEED BELOW 250 KIAS IN ORDER TO MAINTAIN COCKPIT HABITABILITY SHOULD THE CANOPY BE LOST.
2. ECS SWITCH - OFF.
3. DEMIST SWITCH - OFF.
4. OXYGEN system - Check for correct operation.
5. Reduce altitude below 25,000 feet.
6. Cross check cabin and flight altimeters; when the two readings equalize:

   - PRESS DUMP SWITCH - OPEN.
   - EMER VENT - OPEN.
7. Restore ECS and DEMIST as required.
8. Land as soon as practical.

LOSS OF CABIN PRESSURE (High Cabin Altitude)

If the cabin altitude reading is abnormally high a failure of the pressurization system must be suspected.

1. Check:
   - Emergency ventilation - Closed.
   - PRESS DUMP switch - Closed.
   - ECS switch - ON.
   - VENT/INFLATE knob - INFLATE.

If the setting is correct :

2. OXYGEN system - Check for correct operation.
3. Altitude - descend below 25,000 ft.
4. Land as soon as practicable.

CABIN TEMPERATURE CONTROL FAILURE

The cabin temperature control is automatically carried out with the ECS rotary selector in the AUTO range.
If the cabin temperature is not consistent with the selected value:

1. TURN THE ECS ROTARY SELECTOR IN THE MANUAL RANGE AND KEEP THE SELECTOR IN HOT OR COLD POSITION UNTIL DESIRED EFFECT IS ATTAINED.

If the cabin temperature is not consistent with the MANUAL selection:

2. ECS switch - OFF.
3. Oxygen system - Check for correct operation.
4. Descend below 25,000 feet.
   a. If necessary to control excessive high temperatures, cross check cabin and flight altimeters; when the two readings equalize:

   - PRESS DUMP SWITCH - OPEN.
   - EMER VENT - OPEN.

b. If necessary to control excessive low temperature use DEMIST intermittently.

VAPOURS OR SMOKE IN THE COCKPIT

Condensation Vapors.

1. ECS rotary selector - HOT.
2. DEMIST switch - ON.

Smoke

Smoke in the cockpit may be the first indication of an electrical fire or may be caused by hot oil being emitted from the engine, due to a bearing failure, entering through the air conditioning system.

1. OXYGEN diluter lever - 100%.
2. Mask - tighten.
3. If fumes are suspected to come from the air conditioning system :

   a. ECS switch - OFF.
   b. DEMIST switch - OFF.
   c. Cross check cabin and flight altimeters; when the two readings equalize:
   - PRESS DUMP SWITCH - OPEN.
   - EMER VENT - OPEN.

4. If the smoke is suspected to be produced by an electrical fire, switch all non essential electrical equipments OFF.
   If smoke persists switch OFF BATTERY and GENERATOR.

CAUTION

This will cut-off all flight instruments. Before carrying-out this action actual flying condition should be evaluated. Refer to "Complete Electrical Failure" conditions.

5. Land - As soon as possible.

OXYGEN FAILURES

If the OXY LOW caution light comes on or suspected hypoxia, resistance to breathing, abnormal smelling are experienced, an oxygen system failure/contamination must be suspected.

1. OXYGEN DILUTER LEVER - 100%

If the above step do not restore a normal situation:

2. EMERGENCY OXYGEN LEVER - EMERGENCY.
3. MASK SEALS AND CONNECTIONS - CHECK FOR TIGHTNESS.

If the above steps do not restore a normal situation:

4. EMERGENCY OXYGEN HANDLE ON THE SEAT - PULL.
5. OXYGEN diluter lever - OFF.
6. DESCEND AS SOON AS POSSIBLE BELOW 10,000 ft.
7. LAND AS SOON AS PRACTICABLE.

EMERGENCY DESCENT

The aircraft is capable of performing an emergency descent from any altitude, with speed brake open and engine idling, at the maximum allowed Mach Number and IAS. Misting of canopy and windshield should be expected, particularly in hot and humid areas. Set ECS and DEMIST as required.

ELECTRICAL SYSTEM FAILURES

GENERATOR FAILURE

The failure of the generator is indicated by the GEN OFF caution light illumination.

1. Ensure that the GEN switch is ON.
2. Check the loadmeter to ensure that the failure is real and the caution light is not giving a false indication (if the loadmeter reads with a value greater than zero, the generator is operative).
3. Select the GEN switch to RESET and then back to ON. If the caution light still remains on, the generator has failed, and all electrical utilities are powered by the battery.
4. Switch all unnecessary electrical equipment OFF.

NOTE

Assuming a normal battery charge (not lower than 80 %) the electrical loads necessary to sustain flight in adverse conditions (night, cold) can be supported for approximately 25 minutes.

5. Land as soon as possible.

INVERTER FAILURE

Single Inverter Failure.

The INV1 or INV2 warning light illumination indicates the corresponding inverter is at fault.

1. Switch to the serviceable inverter.
2. If this causes the failure of the newly selected inverter, a shorted AC utility must be suspected.

   a. Disconnect all AC utilities by pulling out relevant circuit breakers.

   b. Reset the MASTER CAUTION.

   c. If this results in either INV caution light to go out, select such inverter and by inserting one at the time the AC circuit breakers identify the faulty equipment which must be left OFF for the remaining of the flight. Land as soon as practicable should be considered.

   d. If following step b above, both INV caution lights stay ON, proceed as per Double Inverter Failure.

3. If the newly selected inverter remains serviceable, meaning that all AC utilities are maintained, landing as soon as practicable is advised.

Double Inverter Failure

If both INV1 and INV2 caution lights illuminate, all AC utilities will be lost.

1. INV SWITCH - OFF.
2. Land as soon as practicable.

NORMAL BUS FAILURE

Illumination of NORMAL BUS caution light indicates that the normal bus is disconnected.

1. NORM BUS switch - RESET then to ON
2. If not succesful land ASAP bearing in mind the system not operating (Flaps power, fuel flow, DME, etc.)

BATTERY OVERTEMPERATURE

Illumination of the BATT WARM caution light indicates the battery internal temperature has reached 55°C, and the battery has automatically disconnected from the ESSENTIAL BUS, and will not be continually charged. LAND AS SOON AS PRACTICABLE.

NOTE

The battery will be automatically reconnected to the ESSENTIAL BUS should a generator failure occur. Under these circumstances nominal residual life of the battery is not assured.

HOT BATTERY

Illumination of the BATT HOT warning light indicates the battery internal temperature exceeds 65°C, with the battery still connected to the ESS BUS.

1. BATTERY SWITCH - IMMEDIATELY OFF

NOTE

In this case the only electrical power source available in the aircraft is the generator.

2. LAND ASAP.

COMPLETE ELECTRICAL FAILURE

In case of disconnect/failure of both electrical power sources (battery and generator) a complete electrical power failure will occur and will be indicated in the cockpit by no reading in all instruments except: airspeed indicators, altimeters, vertical speed indicator, stand by compass, G-meter, slip indicator, clock.

CAUTION

All caution/warning lights and all internal lights will be inoperative.

1. GENERATOR switch - RST then ON.
2. If electrical power is restored land as soon as possible.
3. If electrical power is still not restored land as soon as possible or eject depending on the particular flight conditions considering that:

- ECU will be inoperative
- All COMM and NAV equipment is not available
- Remaining flight endurance can only be guessed upon the last fuel reading and the elapsed time.
- Pylon tanks fuel will not be available
- Trims, speed brake and flaps cannot be operated.
- The landing gear can be lowered with the emergency system only and there will be no light indications of landing gear down and locked.

LANDING EMERGENCIES

FLAME-OUT LANDING

Because of the many variables encountered, the final decision whether to attempt a flame-out landing or to eject must remain with the pilot. It is impossible to establish a predetermined set of rules and instructions which would provide a ready-made decision applicable to all emergencies of this nature. The basic conditions listed, combined with the pilot's analysis of the condition of the aircraft, type of emergency and his proficiency, are of prime importance in determining whether to attempt a flame-out landing or to eject. These variables make a quick and accurate decision difficult. If the decision is made to eject, before ejection the pilot should attempt to turn the aircraft toward an area where injury or damage to persons or property on the ground or water is least likely to occur. Before a decision is made to attempt a flame-out landing, the following basic conditions should exist.

- A suitable runway must be available.
- Weather and terrain conditions must be favourable. Cloud cover, ceiling, visibility, turbulence, surface wind, etc. may hamper the establishment of a proper flame-out pattern.
- Flame-out landings should only be attempted when either a satisfactory High Key or Low Key position can be achieved.

WARNING

If, at any time during the flame-out approach, conditions do not appear ideal for successful completion of the landing, ejection should be accomplished.

In case a decision to attempt a flame-out landing is made, follow the procedure outlined below and illustrated in figure 3-5.

1. Landing gear, flaps and speed brakes -retracted.
2. Airspeed 130 KIAS.

NOTE

For optimum glide performances refer to figure 3-6.

3. Glide towards the field while accomplishing the following operations.
   a. SALVO jettison push button-press (if required).
   b. Check that the throttle is set at STOP.
   c. FUEL SHUT OFF switch - CLOSED (guard and lever up).

CAUTION

If gliding flight is expected to last more than 15 minutes, disconnect all unnecessary electrical loads, including ECS, to ensure adequate battery endurance.

4. High Key point: 3,000 ft above the ground.
   a Extend the landing gear in accordance with the LG Emergency Lowering procedure.
   b. Aispeed - 130 KIAS.
5. Low key point(downwind): 2,000 feet.
   a. Wing flaps - T/O
   b. Airspeed - 130 KIAS
6. Final low key point: 1,000 feet.
   a. Wing flaps - As required
   b. Airspeed - 130 KIAS.

WARNING

If landing is considered unsafe, EJECT. Decision to eject must be made by 1000 ft AGL minimum.

7. Battery switch - OFF.
8. Touchdown at 90 to 95 KIAS.

NOTE

For Practice Forced Landing (PFL) purposes, select IDLE and speed brake out to simulate dead engine conditions.

HYDRAULIC SYSTEM FAILURES

Abnormal hydraulic readings indicate a probable system failure.

a. Pressure in excess of 3,400 psi indicates an abnormal hydraulic pump operation, if pressure exceeds 3,850 psi indicates a stuck pressure relief valve also. Under these conditions, all hydraulic services operate normally, but it is recommended to pull out HYD c/b and before LDG extension insert HYD c/b.
   LAND AS SOON AS PRACTICABLE.

b. Pressure readings steadily below 2,700 psi indicate abnormal hydraulic pump operation.

Under these conditions, land as soon as possible, bearing in mind that, depending on the residual hydraulic pressure available, the following circumstances may occur:

- Inability to operate the speed brake.

CAUTION

Do not operate the speed brake in order to conserve to the maximum extent residual hydraulic system capability.

- Inability to operate the landing gear by the normal system.

CAUTION

In this case follow the Landing Gear Emergency Lowering procedure.

- Release to the open position of the safety locks on the rear doors of the main landing gear (at pressure below 1,500 psi).
  The LG handle red warning light will come ON.

CAUTION

In this condition avoid airspeed in excess of 200 KIAS.

- Loss of aileron servo operation (The AIL SERVO caution light will come ON). Select AIL SERVO OFF to preclude surge in hydraulic pressure which may cause control problem.

CAUTION

Reduce speed below 200 KIAS. Be aware of the high lateral stick forces which reduce at slower speeds.

- Loss of the freon compressor hydraulic motor (No cockpit cooling available).

CAUTION

If possible, set the ECS switch to OFF.

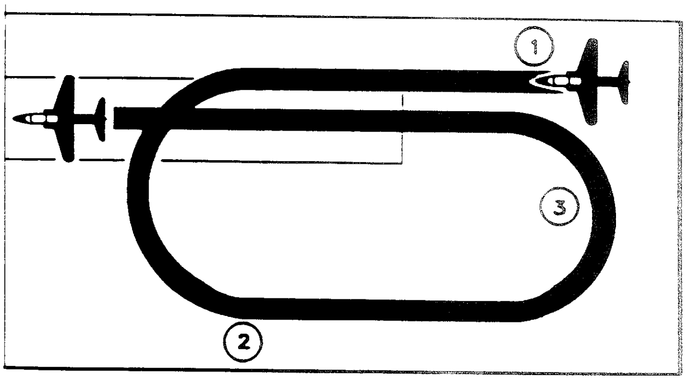
FLIGHT CONTROL FAILURES

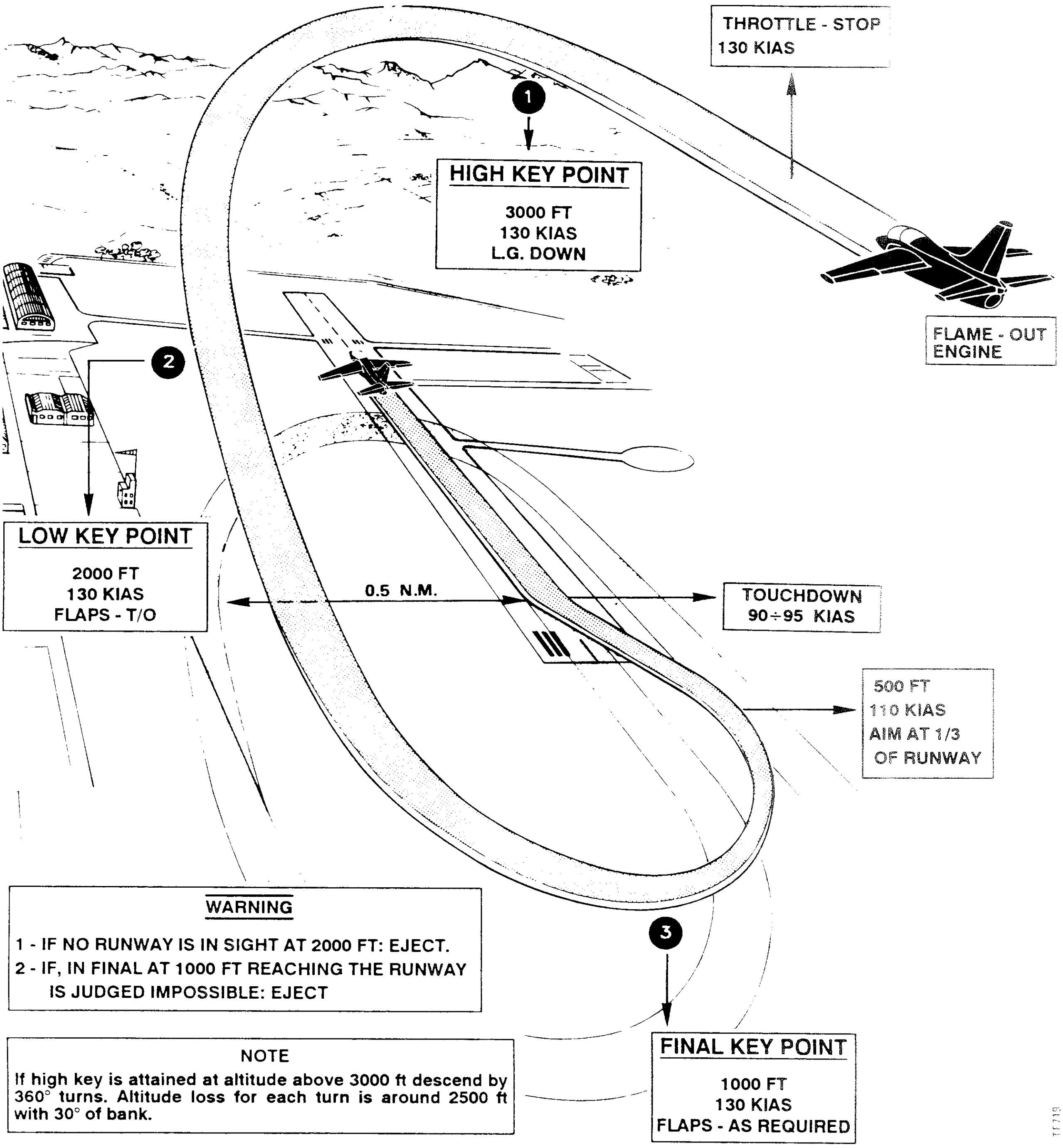
Electrical Failure of Stabilizer Trim Circuit

If the trim starts moving by itself (trim run-away), push

FLAME-OUT LANDING

NOTE: FOR PRACTICE FORCED LANDING (PFL) PURPOSES, SELECT IDLE, SPEED BRAKE AND AIL BOOST - OFF TO SIMULATE DEAD ENGINE CONDITION.





WARNING

1 - IF NO RUNWAY IS IN SIGHT AT 2000 FT: EJECT.

2 - IF, IN FINAL AT 1000 FT REACHING THE RUNWAY IS JUDGED IMPOSSIBLE: EJECT

NOTE

If high key is attained at altitude above 3000 ft descend by 360° turns. Altitude loss for each turn is around 2500 ft with 30° of bank.

Figure 3-5.

MAXIMUM GLIDE

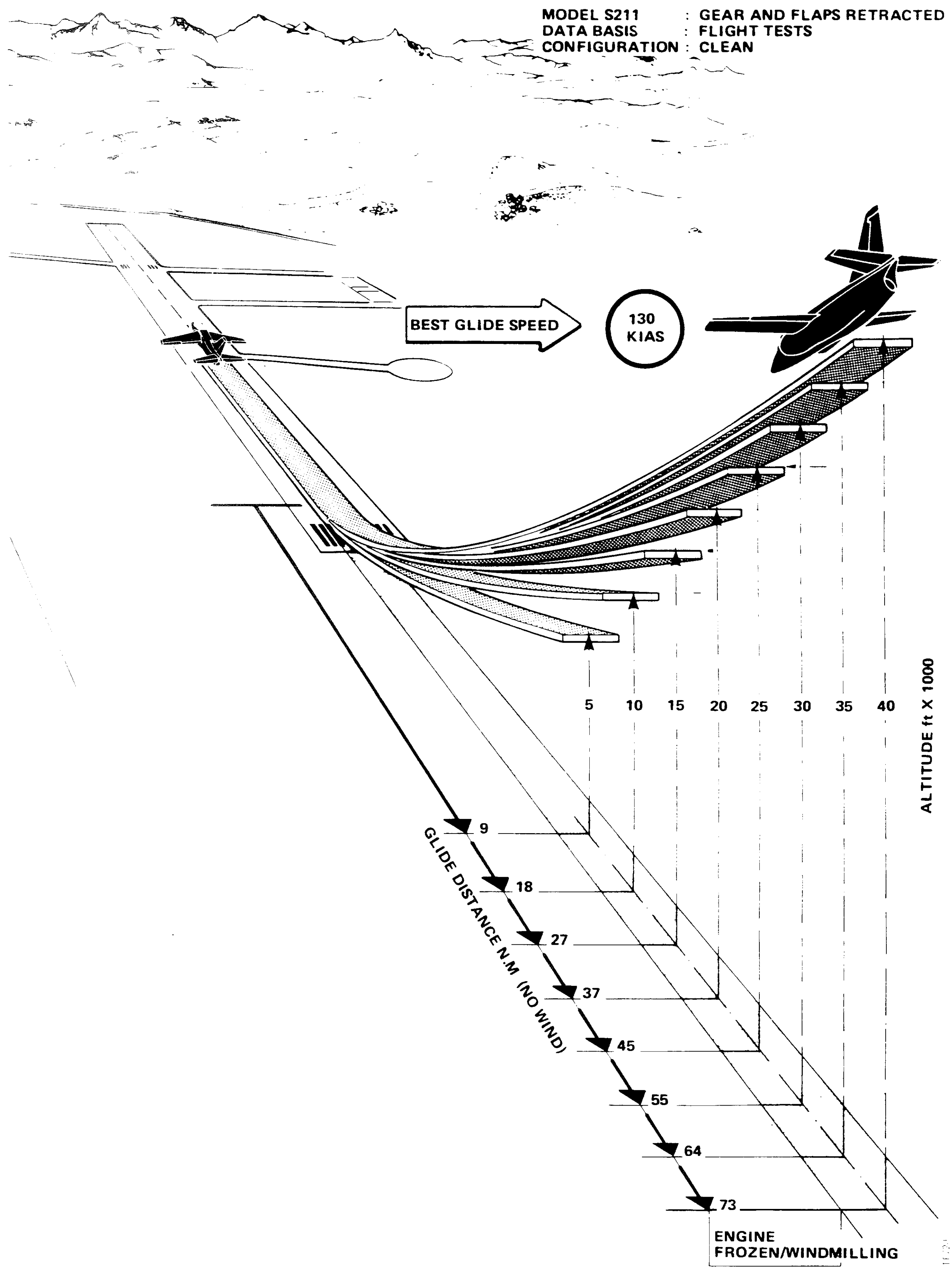


Figure 3-6.

WARNING LIGHTS

WARNING LIGHTS	CONDITION	CORRECTIVE ACTION
FIRE	Overtemperature or fire in the engine compartment.	Refer to procedures outlined in this section.
CANOPY	Canopy not locked in the closed position.	In flight: - Reduce below 120 KIAS - Do not attemp to lock the canopy - Land ASAP.
CAB PRESS	Cabin differential pressure exceeds 4 + 0.5/-0 psi.	Descend below 25,000 ft, reduce airspeed and refer to ECS failure.
BAT HOT	Battery internal temperature exceeds 65° and battery still connected to ESSENTIAL BUS.	Battery switch - OFF. LAND ASAP.
OXY LOW	Oxygen pressure downstream the pressure reducer valve dropped below 3 Bar (43±5 psi).	Descend below 10,000 feet.

Figure 3-7.

CAUTION LIGHTS

CAUTION LIGHTS	CONDITION	CORRECTIVE ACTION
ECU OFF	ECU disconnected or at fault - Slower engine acceleration. Engine in manual control may exceed limits.	Cycle ECU switch OFF/ON to reset. IF unsuccessful, monitor engine limits and refer to ECU failure. Maintain NL above 65% for adequate engine acceleration. Monitor engine limits.
SHUT-OFF	Fuel Shut-off Valve is closed.	Fuel Shut - off - OPEN.
FUEL LOW	Fuselage fuel is below 170 ± 15 lbs.	Land ASAP.
FUEL PRESS	Fuel pressure at engine pump inlet is below the minimum required for normal engine operation.	AUX PUMP switch-ON and refer to procedures of this section.

Figure 3-8. (Sheet 1 of 2)

CAUTION LIGHTS

CAUTION LIGHTS	CONDITION	CORRECTIVE ACTION
AIL SERVO	Loss of hydraulic power in the circuit.	Reduce airspeed below 200 KIAS, select AIL SERVO-OFF.
GEN OFF	Generator at fault or disconnected.	GEN switch RST/ON to RESET. If not successful, refer to generator failure.
NORM BUS	Normal Bus is disconnected.	NORM BUS OFF/RST then ON to reset. If not successful, land ASAP.
INV 1 INV 2	Corresponding inverter is at fault.	Select the serviceable inverter and refer to A. C. failure.
BATT WARM	Battery internal temperature has reached 55° and the battery has automatically disconnected from the ESSENTIAL BUS.	Land as soon as practicable.
OIL PRESS	Pressure at engine oil pump outlet is below minimum	Throttle to about 85% NL; land ASAP.
OIL TEMP	Oil temperature is above limits	If lit, together with OIL PRESS, see above. If OIL PRESS not lighted, advance throttle and land as soon as practicable.
L.PYL TANK R.PYL TANK	Low fuel press in the left or right transfer line: a) Transfer completed b) System malfunction: Fuel is not being pumped off the LH or RH pylon tank.	 Set the rilevant external pump switch to OFF. Reconsider mission planning for reduced range and endurance.

Figure 3-8. (Sheet 2)

the STAB TRIM DISENGAGE push button located on the stick grip. The trim movement shall stop immediately and the trim switch shall become inoperative.
If the stabilizer trim is locked in either maximum travel limit position, proceed as follows according to the two possible cases:

a. Full Nose-down Trim.
   1. Reduce engine power as required to decelerate.
   2. Select speed brake OUT to counteract the nose-down moment and to obtain a more rapid deceleration.
   3. Perform a landing from a long final without using flaps.

b. Full Nose-up Trim.
   1. Reduce engine RPM to idling.
   2. Bank the aircraft to reduce the control force , while maintaining altitude, down to a speed which allows longitudinal control to be maintained without excessive control forces on the stick.
   3. Perform a landing from a long final without using speed brake.

NOTE

An attempt can always be made to restore the trim operation by cycling the STAB TRIM breaker OFF and ON once.

Aileron Servo Control Failure

The illumination of the AIL SERVO caution light indicates that pressure in the servo circuit is insufficient.
1. Check hydraulic pressure.
2. Reduce airspeed below 200 KIAS.
3. AIL SERVO switch - OFF.

CAUTION

The stick force for aileron manual operation increases with the increase of speed, thus reducing maneuvrability.

4. Land as soon as practicable.

FUEL TRANSFER FAILURE FROM UNDERWING TANKS

Failure to transfer fuel from one or both external tanks can be detected by steady indications on the two external fuel quantity gauges together with decreasing internal fuel quantity.

1. Check PYL TANK PUMPS switches - ON.
2. Check PYL TANK RH/LH circuit breakers - IN

There is no alternate fuel transfer procedure, and the reduced range and endurance should be promptly determined. Faulty transfer from one external tank affects the aircraft controllability. Refer to asymmetric load landing procedure in this section.
For emergency jettison of the auxiliary fuel tanks refer to Section V.

LANDING ON UNPREPARED SURFACE

WARNING

Eject rather than attempt a landing on unprepared surface.

Landings on unprepared surfaces are not recommended. However, if an emergency landing on an unprepared surface is unavoidable, it should be made, whenever possible, with the landing gear extended. Experience has revealed that landings made on unprepared surfaces with the landing gear down have resulted in less pilot injury and less damage to the aircraft than those made with the landing gear up.

1. SALVO push-button - Press (if external stores are carried).
2.. ATC - Select Emergency code.
3. Burn fuel to the lowest possible level.
4. Make a normal approach with:

   • landing gear - DOWN
   • flaps - DOWN
   • speed brake - IN.

5. When landing is assured, select throttle to STOP.
6. FUEL SHUT OFF switch - Closed.
7. Just before touch-down BATTERY switch - OFF.
8. Touch down in normal landing attitude.
9. Leave the aircraft immediately after it stops.

WARNING

Advise ground personnel approaching to the aircraft that the ejection seats are not safe and to install safety pins prior to any other action.

LANDING GEAR EMERGENCY LOWERING

If the landing gear fails to lower or to lock in the DOWN position (one or more green lights OFF), attempt a re-cycle.

If recycling is unsuccessfull.

1. AIRSPEED - 140 KIAS.
2. Landing gear handle - Check down.
3. EMER LDG GR handle - pull fully OUT and ROTATE 90° clockwise.
4. Ensure that the landing gear position indicator lights give confirmation, (three green lights ON) that the landing gear is down and locked. The red warning light in the landing gear handle will remain illuminated.

NOTE

* The DOWN locking of the gears is favourably affected by positive load factor and aerody-namic pressure.

* Should any of the legs fail to lock in the down position, increase airspeed as much as necessary to help mechanical down lock by air pressure.

5. Restore EMER LDG CR handle - IN

NOTE

After the landing gear emergency lowering the air conditioning cooling operation will be normally interrupted. Under this condition proceed as follows:

a. DEMIST - as required .
b. PRESS DUMP switch and Emergency Ventilation - "OPEN" if required .

SIMULATED LANDING GEAR EMERGENCY LOWERING PROCEDURE

System Lowering Procedure

For practice Landing Gear Emergency Lowering Procedure proceed as follows:

1. Reduce airspeed at 140 KIAS.
2. Flaps - T/O.
3. HYD c/b - out.

NOTE

Drop of one MLG may occasionally happen and is not an indication of malfunction. Continue the procedure.

4. Hydraulic pressure indicator - Zero indication.
5. LG handle red light - Steady ON.
6. LG control handle - Down position (No change).
7. EMER LDG CR - Pull and lock.
8. Check illumination of three green LG down lock indication lights.

System Reset Procedure

To reset the landing gear after a simulated LG emergency lowering proceed as follows:

1. LG control handle - Check down.

CAUTION

Reset procedure with LG control handle UP will cause damage to LG doors.

2. EMER LDG CR - IN.
3. HYD c/b - IN.
4. LG handle red light - OUT.
5. Hydraulic pressure indicator - Within limits.
6. Flaps - UP.
7. LG control handle - UP.

LANDING GEAR EMERGENCY LANDING

For Landing Gear emergency landing see figure 3-9.

FLAPLESS LANDING

In case the extension of the wing flaps is precluded, carry out a flapless landing according to the following procedure (based on a weight of 2500 kg):

1. Fly a pattern slightly wider than normal with a longer downwind leg.
2. Extend the landing gear.
3. Make a power-on final approach longer than usual at a speed of 120 KIAS.
4. Maintain a speed of approx 110 KIAS at runway threshold.
5. Touch down in a nose-up attitude and maintain the aircraft in this attitude as long as possible to take advantage of aerodynamic braking.
6. When the nose wheel touches the ground, apply the wheel brakes as required.

NOTE

The same procedure applies when landing with flaps in the take-off position except for threshold speed that should be 105 KIAS.

EJECTION DURING LANDING

The Mk IT-10LA seat allows pilot's ejection at any speed and altitude, landing run included. Carry out the same ejection procedure as set forth in paragraph In-flight Ejection in this section.
See figure 3-2 for minimum ejection altitude.

LANDING WITH ASYMMETRIC LOAD

In the event the asymmetry results from inability to release a particular store or from a failure in auxiliary tank fuel transfer, determine, at a safe altitude, the speed at which full aileron travel is required to keep the aircraft in level flight with landing gear down and flaps in the take-off position.

WARNING

If at any time during flight near the minimum control speed permitted by the ailerons, insufficient aileron control is available to prevent a roll in the direction of the heavy wing, or if stall is experienced, recovery can only be accomplished by decreasing the aircraft pitch attitude and adding power to increase airspeed above

LANDING GEAR EMERGENCY LANDING

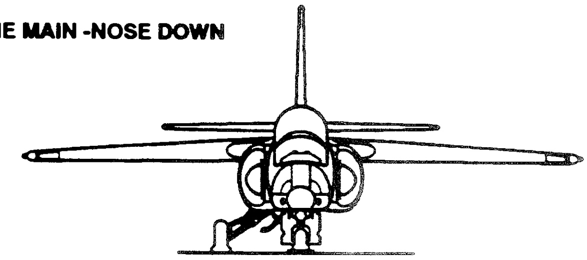
BEFORE ATTEMPTING LANDING CONSIDER:
* AIRFIELD FACILITIES
* CROSSWIND
* RUNWAY AND OVERRUN CONDITIONS

BEFORE LANDING -
1. JETTISON EXTERNAL STORES EXCEPT EMPTY WING TANKS
2. BURN FUEL DOWN TO 170 Lbs
3. RETRACT SPEED BRAKES
4. FLAPS DOWN
5. FLY NORMAL APPROACH
6. THROTTLE STOP
7. FUEL SHUT OFF CLOSED
8. BATTERY OFF

PROCEED AS FOR APPLICABLE CONFIGURATION BELOW

IF CONSIDERATIONS NOT FAVORABLE - EJECT

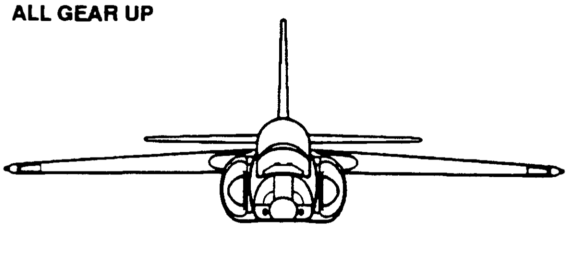
ONE MAIN -NOSE DOWN



LANDING NOT ADVISABLE, ATTEMPT SHOULD BE MADE TO RAISE COMPLETELY THE GEAR FOR A BELLY LANDING

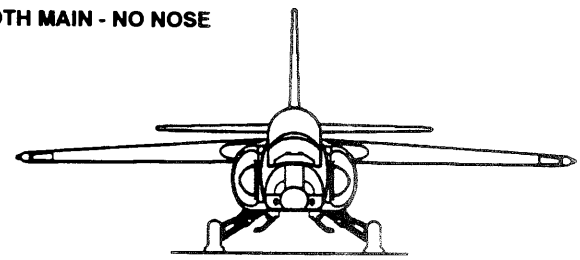
1. TOUCH DOWN ON THE SIDE OF THE DOWN - LOCKED GEAR AND WITH LOCKED GEAR OPPOSITE TO WIND DIRECTION.
2. HOLD AS LONG AS POSSIBLE THE OPPOSITE WING OFF THE GROUND USING THE AILERON.
3. WHEN WING TOUCHES THE GROUND TRY TO KEEP DIRECTION BY NOSE STEERING AND USING THE ONLY WHEEL BRAKE AVAILABLE.

ALL GEAR UP



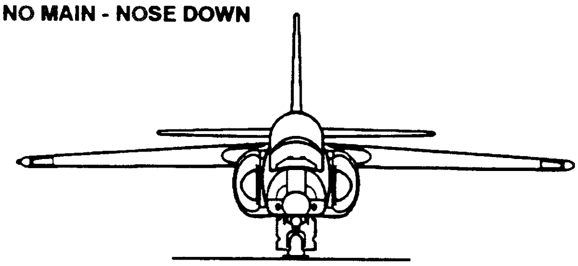
1. CONTACT RUNWAY IN AN ATTITUDE PARALLEL TO GROUND.
2. LEAVE THE AIRPLANE IMMEDIATELY AFTER IT STOPS.

BOTH MAIN - NO NOSE



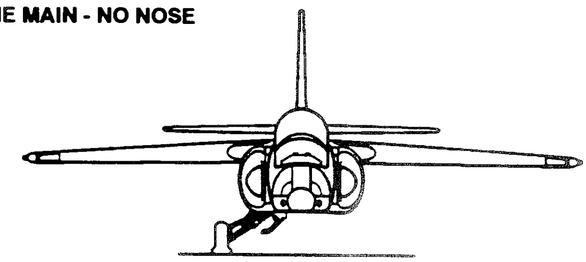
1. LOWER NOSE GENTLY TO THE GROUND BEFORE ELEVATOR CONTROL IS LOST.
2. WHEN NOSE TOUCHES THE GROUND APPLY BRAKES SMOOTLY AND STEADLY UNTIL THE AIRCRAFT COMES TO A STOP.

NO MAIN - NOSE DOWN



1. CONTACT RUNWAY IN AN ATTITUDE PARALLEL TO GROUND.
2. LEAVE THE AIRPLANE IMMEDIATELY AFTER IT STOPS.

ONE MAIN - NO NOSE



LANDING NOT ADVISABLE, ATTEMPT SHOULD BE MADE TO RAISE COMPLETELY THE GEAR FOR A BELLY LANDING.

1. IF GEAR WILL NOT RETRACT, EJECTION IS RECOMMENDED.

WARNING **ADVISE GROUND PERSONNEL ASSIGNED TO THE HANDLING OF THE AIRCRAFT THAT THE EJECTION SEATS ARE NOT SAFE, SO THAT SAFETY PINS CAN BE INSTALLED AS SOON AS POSSIBLE, PRIOR TO ANY OTHER ACTION.**

Figure 3-9.

minimum aileron control speed.

Proceed as follow according to the result of the low speed check:

a. If the minimum aileron control speed is above 140 KIAS:

   - Maintain higher airspeeds.
   - Direct towards a clear area .
   - EJECT.

b. If the minimum aileron control speed is below 140 KIAS:

   - Select flaps in the TAKE-OFF position.
   - Approach speed must be 10 KIAS higher than the minimum aileron control speed.
   - Touch down speed must be higher than the minimum aileron control speed.

For event b. it is recommended that the pilot, at a safe altitude, performs a simulated landing approach at the planned airspeed to become familiar with the aircraft flight characteristics under asymmetric loading configuration. A very flat, power on, straight-in approach, with very little flare, should be made to accomplish a smooth touch down.

WARNING

Under asymmetric condition abrupt thrust variations will result in undesirable yawing moments, while increased load factors will result in a roll toward the heavier wing.

The approach and landing should be carefully planned and executed, considering the runway length and the increased approach and touchdown speed. Consideration should be given to pilot's experience, runway width and surface conditions, weather conditions, visibility, crosswind, gusts, etc. Landing should be accomplished on the side of the runway away from the load, preferably with cross-wind from the load side.
A considerable help in roll control may be obtained by use of rudder.
After touch-down, the control stick should be held fully opposite to the load during the entire landing run.

LANDING WITH OTHER PILOT EJECTED

Following unintentional ejection of the front/rear pilot, the aircraft can be brought to a landing by an experienced pilot provided the steps below are followed:

1. Decrease airspeed to reduce aerodynamic vortex effect.
2. Climb to a safe altitude.
3. Perform a low speed handling check under typical landing conditions.

CAUTION

With the back seat occupant only, expect very low longitudinal stability due to the center of gravity being beyond the maximum allowed aft position.

4. If flying qualities are acceptable for an emergency landing, land as soon as possible, from a straight in approach.

5. If flying qualities are not acceptable, or deteriorate during the approach, EJECT.

SECTION IV
CREW DUTIES

NOT APPLICABLE

SECTION V
OPERATING LIMITATIONS

TABLE OF CONTENTS

INTRODUCTION

This section includes the limitations that must be observed during normal operation of the aircraft.
Limitations are derived from actual flight testing. Limitations connected with particular operational procedures are given in other section of this manual.
The flight and engine instrument markings giving the operating limitations are shown in figure 5-1.
These limitations are not necessarily repeated in the text. Whenever any limitation specified in this section is exceeded, proper inspection must be carried out prior to further activity.

SOLO FLYING

Solo flying must be performed from the front seat only. However, should the front cockpit occupant eject unintentionally in flight, the aircraft may be brought to landing from the rear seat according to the procedure outlined in Section III.

ENGINE LIMITATIONS

Engine operation limits are shown in figure 5-2.
The nominal NL value scheduled by ECU at full throttle as a function of ambient conditions is shown in figure 5-3. Engine performance shall be considered acceptable for take-off if the indicated NL does not exceed 104% and is within -0,5, +1,5% from the nominal NL corrected for the TRIM class and all other parameters are within limits.

ENGINE ACCELERATION LIMITS

On the ground, in response to a slam opening of the throttle, the engine must accelerate smoothly from IDLE (NH = 49 %) to MAX NL (refer to figure 5-3) in no more than 6 sec.

IGNITION LIMITATIONS

The engine igniters have no time limitation, but continuous operation will shorten their operating life.

STARTER DUTY CYCLE

The starter generator duty cycle strongly recommended to be used is as follows:

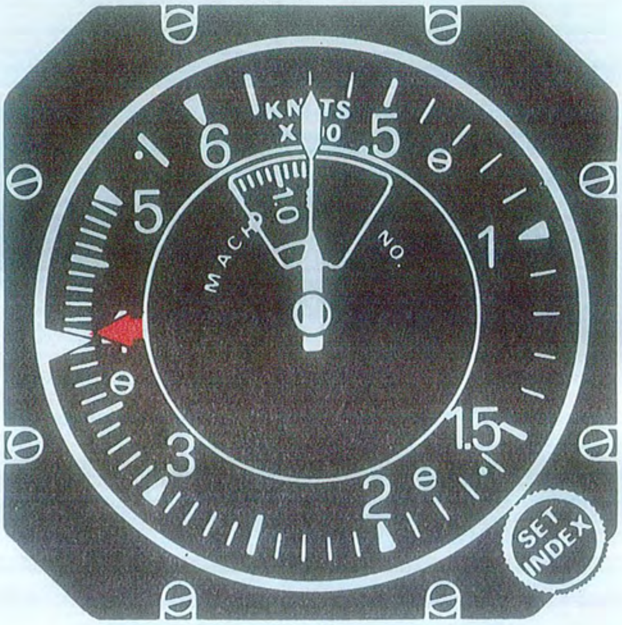
a. 20 seconds ON
   60 seconds OFF.
b. 20 seconds ON
   5 minutes OFF.
c. 20 seconds ON
   60 minutes OFF.

HYDRAULIC PRESSURE LIMITATIONS

ZERO "g' HYDRAULIC PRESSURE DROP

During aerobatic maneuvers the hydraulic pressure may drop to near zero values.

INSTRUMENT MARKINGS



MACH/AIRSPEED INDICATOR

400 KTS MAXIMUM PERMISSIBLE
0.8 MACH MAXIMUM PERMISSIBLE
(WHICHEVER IS LOWER)
CLEAN CONFIGURATION

NOTE
For other configurations refer to External Store Limitations in this section

I.T.T. INDICATOR

700 °C MAXIMUM PERMISSIBLE

680 ° TO 700 °C PERMISSIBLE FOR FIVE MINUTES

300 ° TO 680 °C CONTINOUS OPERATION

ENGINE RPM INDICATOR

97% NH MAXIMUM PERMISSIBLE
(Red Arrow Mark)

106 TO 108% NL TRANSIENT 15 SECONDS

108% NL MAXIMUM PERMISSIBLE
(Red Bar Mark)

NOTE
* Digital Display shows NL.
* Bar Pointer shows NL.
* Arrow Pointer shows NH.

Figure 5-1. (Sheet 1 of 2)

INSTRUMENT MARKINGS

ENGINE OIL PRESSURE INDICATOR

0 PSI FOR 5 SECONDS MAXIMUM

35 PSI MINIMUM TO COMPLETE FLIGHT

35 TO 70 PSI INDICATES MALFUNCTION OF ENGIN
LUBRICATION SYSTEM (UNLESS NH < 60%)

70 TO 95 PSI NORMAL OPERATION (FOR NH > 60%

95 PSI MAXIMUM

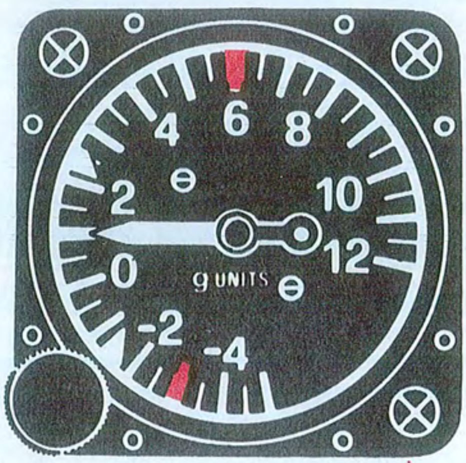
NOTE
For transient and aerobatic manoeuvres refer to Engine Operating Limitations in this section.

HYDRAULIC PRESSURE GAUGE

2700 TO 3400 PSI NORMAL

3400 PSI MAXIMUM

NOTE
Pressure below 2700 psi indicates system malfunction and is unsafe for LG up locks.



ACCELEROMETER

+6g MAXIMUM POSITIVE
(UP TO 2500 Kg - 5511 Lbs)

- 3g MAXIMUM NEGATIVE
(Up TO 2500 Kg - 5511 Lbs)

NOTE
For different weight and conditions refer to acceleration limitation in this section.

Figure 5-1. (Sheet 2 of 2)

ENGINE OPERATION LIMITATIONS

CONDITION	TIME LIMIT	MAX OBSERVED ITT (°C)	NL (% RPM)	NH (% RPM)	OIL PRESSURE (See below)(psig)
MAXIMUM	5 min	700	106	97	70÷95
MAX CONT.	Continuous	680	106	97	70÷95
IDLE	Continuous	580	-	49 min	35 minimum
STARTING	-	500	-	-	-
TRANSIENT		-	108 for 15 sec.	-	-

OIL PRESSURE:

a. Normal Flight : Normal oil pressure is 70 ÷ 95 psig at NH speeds above 60%.
Oil pressure below 70 psig is undesirable and should be tolerated only for the completion of the flight, preferably at reduced power setting.
Oil pressure below 35 psig is unsafe and requires that a landing be made as soon as possible, using the minimum power required to sustain flight.

b. Aerobatic Maneuvers: During certain maneuvers as prolonged 0 g flying, or 90° nose down, or 90° bank, oil pressure below 70 psig is possible but pressure below 25 psig is unsafe and normal flight attitude should be resumed as soon as possible.

NOTE

Whenever a prescribed engine limit is exceeded, the incident must be reported as an engine discrepancy in the aircraft Flight Report. It is particularly important to record the maximum value registered by the instrument and the duration of the incident.

Figure 5-2.

CAUTION

During certain maneuvers as prolonged zero "G" flying, or 90° nose down, 90° bank, temporarily hydraulic pressure fluctuations or drops may occur. Normal flight attitude should be resumed as soon as possible to restore normal hydraulic pressure.

NOTE

Whenever an hydraulic pressure drop below allowed limit is experienced, the incident must be reported as discrepancy in the aircraft flight report. Recording of value indicated by the instrument and time duration of incident is particularly important.

AIRSPEED & MACH LIMITATIONS

For the airspeed and Mach limitations refer to figure 5-4 and 5-5.

FLIGHT MANEUVERING LIMITATION

MANEUVERING ENVELOPE (See fig. 5-5)

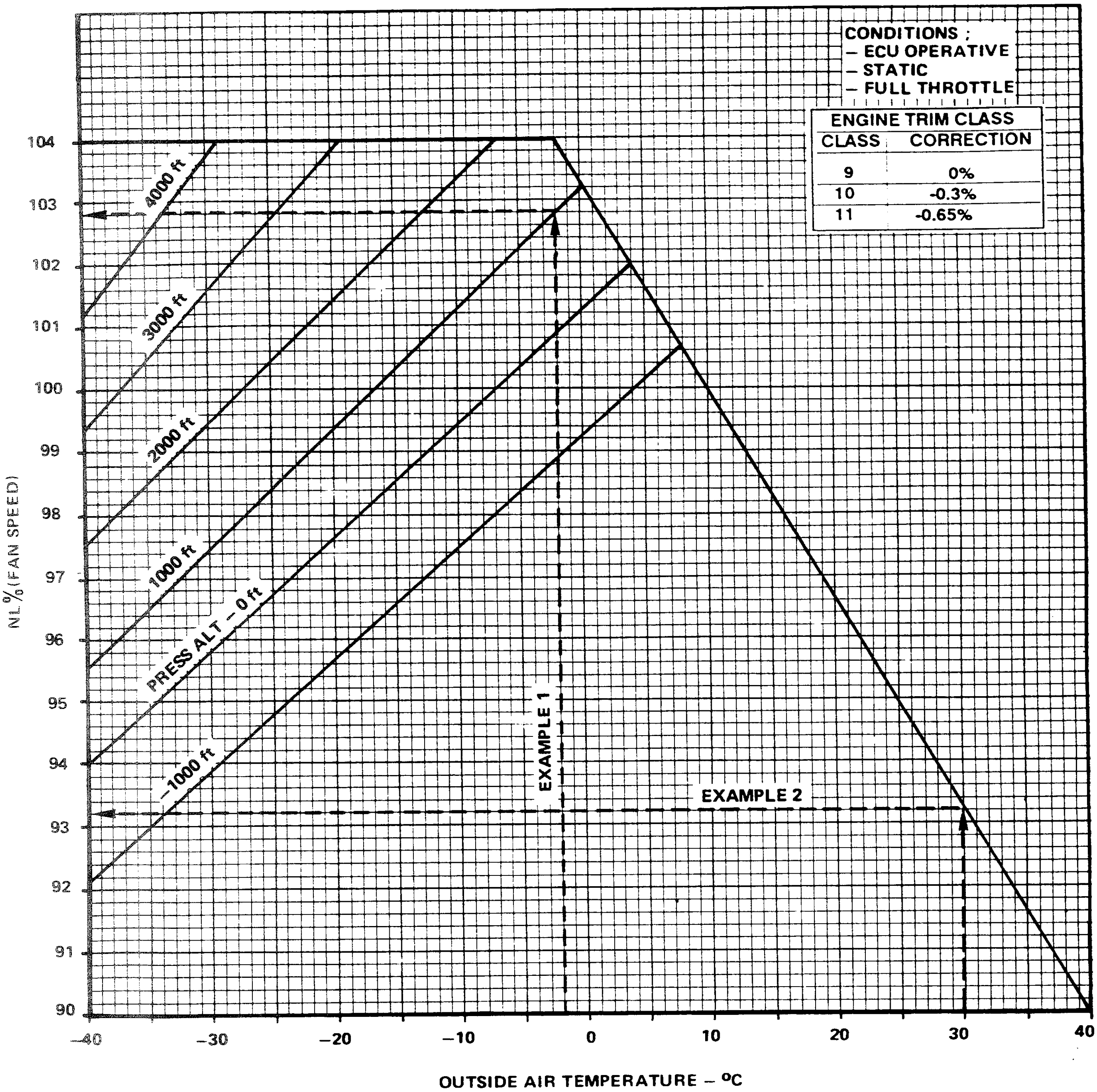
INVERTED FLIGHT LIMITATIONS

Inverted flight or any maneuver resulting in negative g is allowed up to 30 seconds at full throttle due to fuel system limitations. Fuel supply will last proportionally longer at reduced engine settings.

PROHIBITED MANEUVERS

a. Inverted or negative-g flight with FUEL LOW light ON.
b. Inverted Spins.
c. Spin entries with engine setting above IDLE
d. Spin with external stores other than smoke producers.

NOMINAL NL AT FULL THROTTLE - ECU ON



NOTE

Indicated NL at full throttle must be within -0.5, +1.5% from the nominal value, but never exceed the limit of 104% NL.

Example 1

-Ambient conditions: OAT = - 2°C

-Pressure altitude = 1000 ft.

The nominal NL value is 102.9 for engine trim class 9.

In this case acceptable indicated NL is comprised between 102.4 and 104% (red line).

Example 2

-Ambient conditions: OAT = 30°C

-Pressure altitude = 0 ft.

The nominal NL value is 93.2 - 0.3 = 92.9 for engine trim class 10.

In this case acceptable indicated NL is comprised between 92.4 and 94.4.

Figure 5-3. (Sheet 1 of 2)

NOMINAL NL AT FULL THROTTLE - ECU OFF

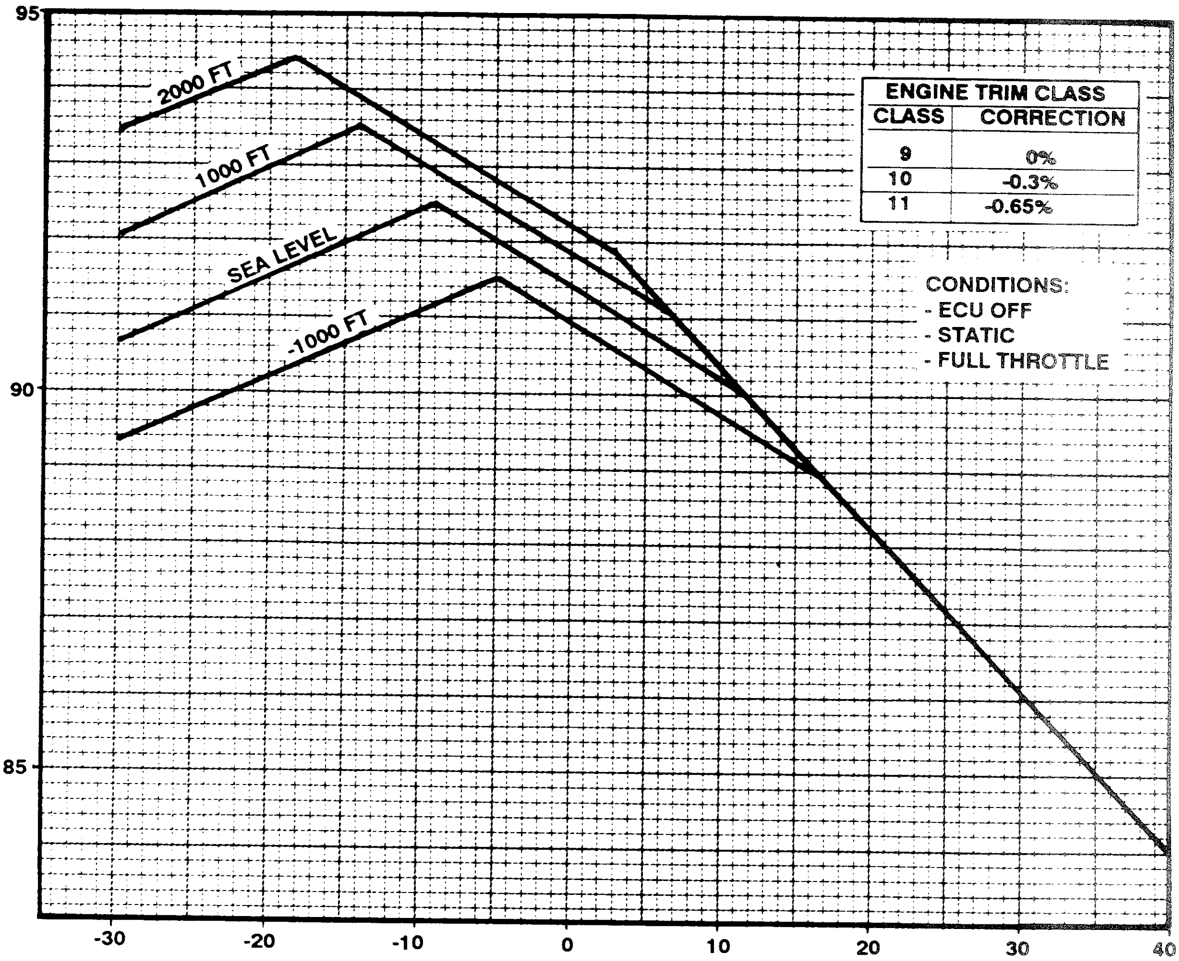


Figure 5-3. (Sheet 2)

AIRSPEED AND MACH LIMITATIONS

CONDITION	AIRSPEED	REMARKS
Aircraft - Clean	400 KIAS or 0.8 Mach	Whichever is lower
Aircraft - With external stores [ACFT A]	See figure 5-12	-
Landing gear - Extension and retraction	160 KIAS	Maintain load factor between 0 g and 2.0 g
Flaps - Extension and retraction: -TAKE-OFF Position -DOWN Position	 160 KIAS 140 KIAS	Maintain load factor between 0 g and 2.0 g
Speed brake - Extension and retraction	Unlimited	Expect pitch up tendency during extension at high speed
Tires - Ground roll	120 kts	Ground speed
Brakes - Aborted TAKE-OFF	104 kts	Ground speed

Figure 5-4.

MANEUVERING ENVELOPE

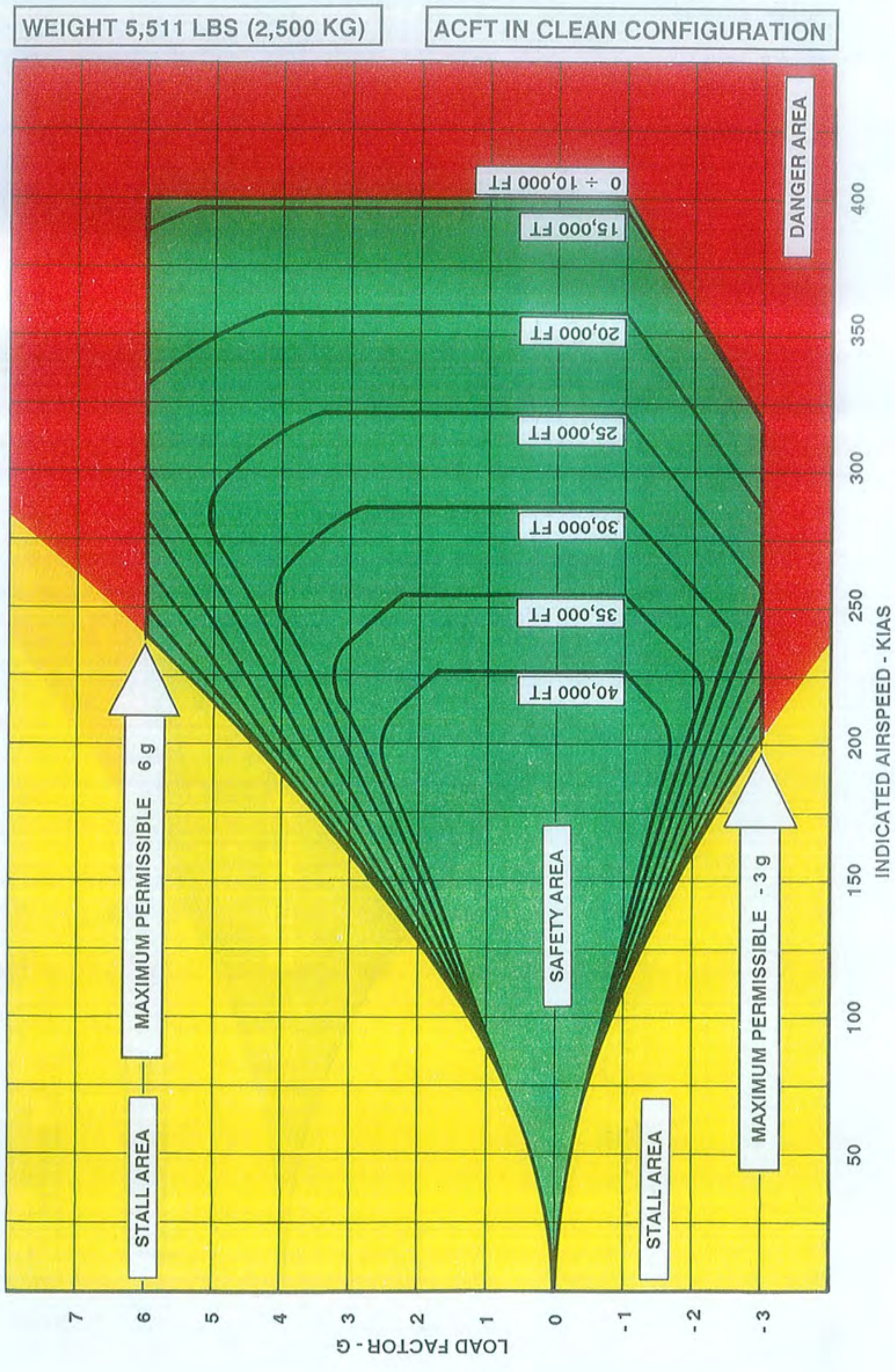


Figure 5-5. (Sheet 1 of 4)

MANEUVERING ENVELOPE

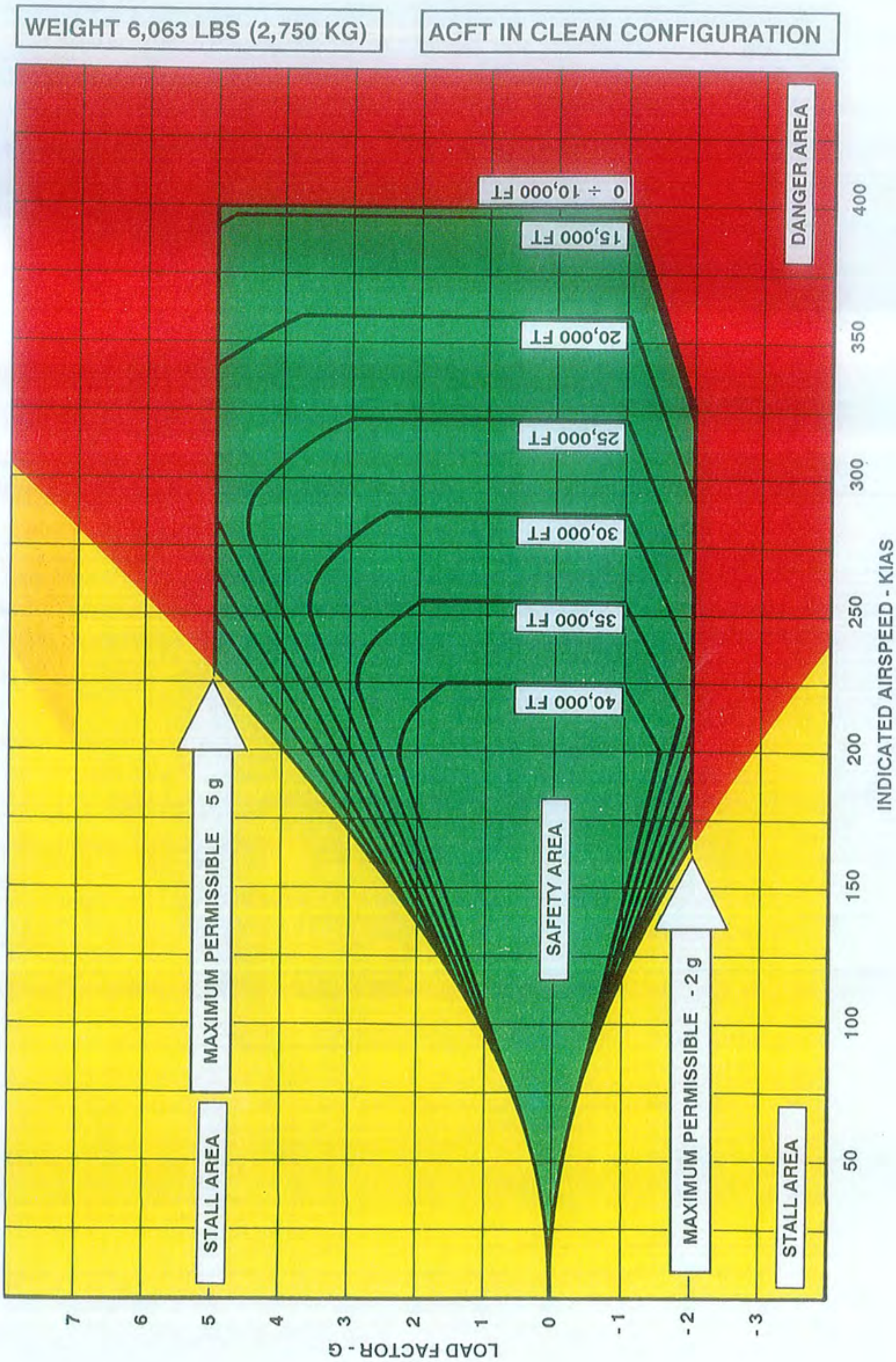


Figure 5-5. (Sheet 2)

MANEUVERING ENVELOPE

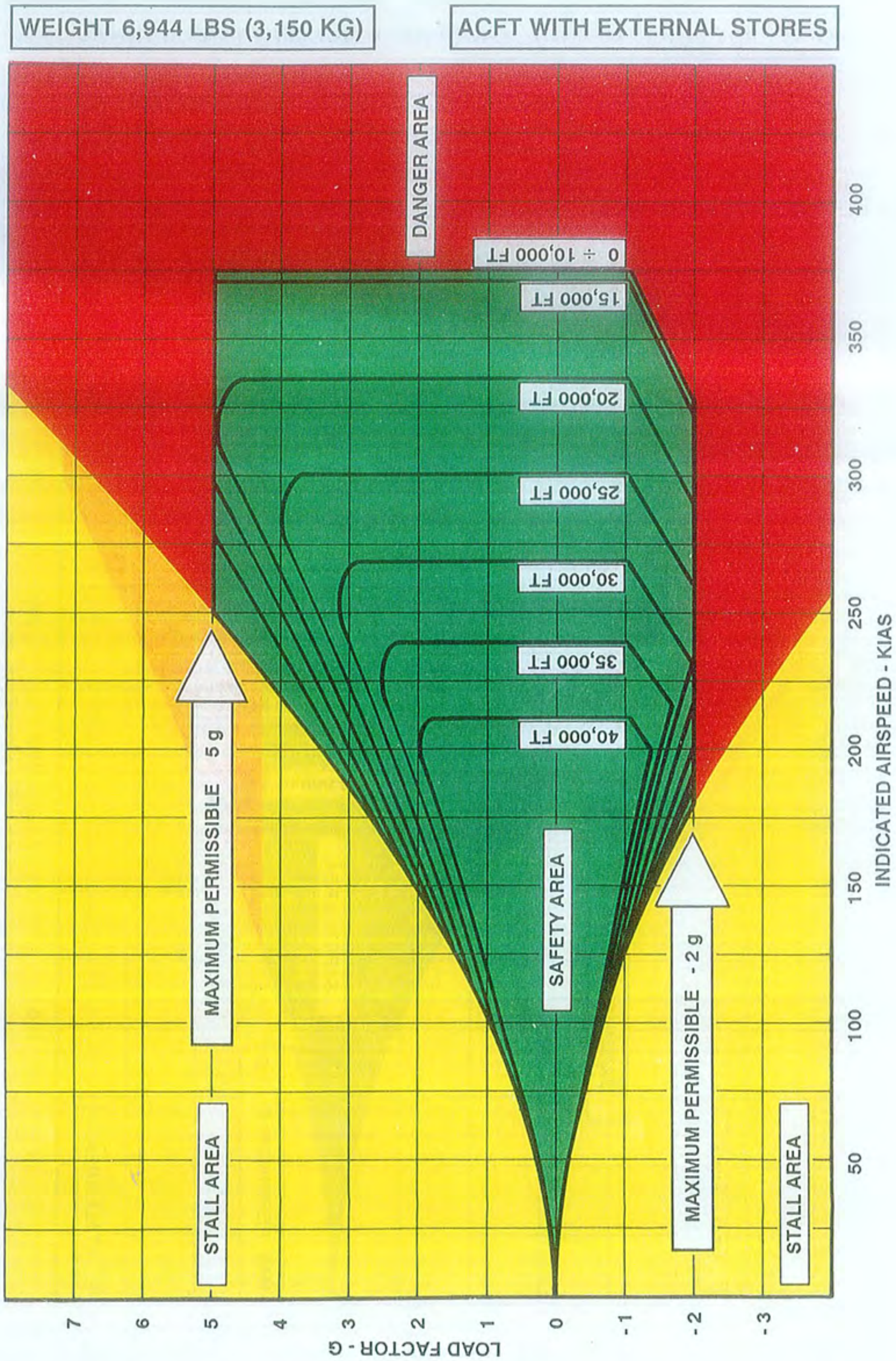


Figure 5-5. (Sheet 3)

MANEUVERING ENVELOPE

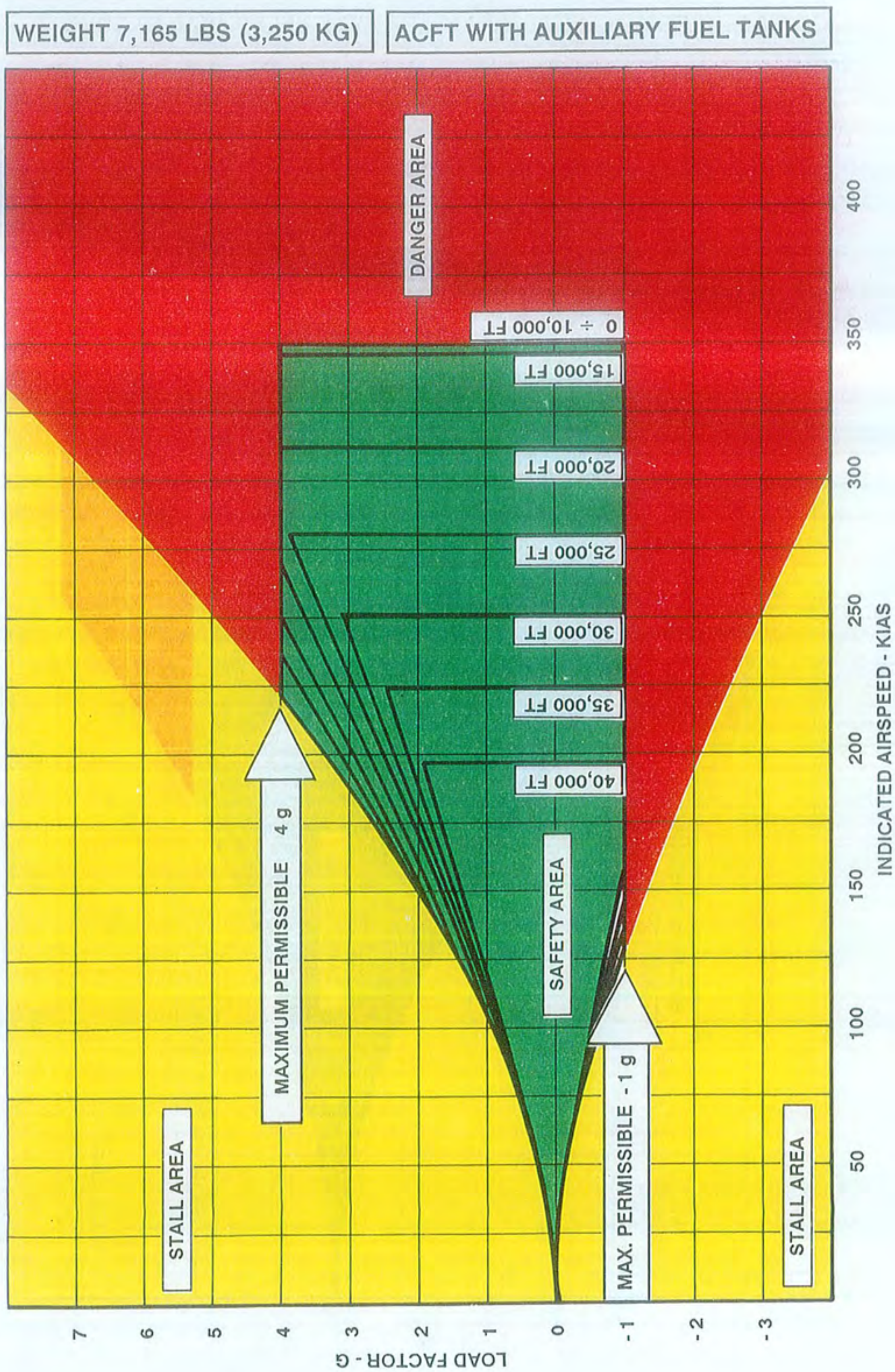


Figure 5-5. (Sheet 4)

ACCELERATION LIMITATIONS

For the maximum approved accelerations during symmetrical and asymmetrical maneuvers (rolling pull-outs) see figure 5-6.

ZERO G LIMITATIONS

No specific limitations are prescribed, but the flight under zero g conditions requires a close check and monitoring of the engine oil pressure, hydraulic system pressure and caution lights, particularly when these conditions are sustained for a long time.

CG LIMITATIONS

The CG limitations in relation to different aircraft configurations are shown in figure 5-7.

WEIGHT LIMITATIONS.

The maximum take-off weight is:

- 2750 kg (6063 lbs) in clean configuration
- 3150 kg (6944 lbs) with external stores [ACFT A]
- 3250 kg (7165 lbs) with aux. fuel tanks [ACFT A]

The maximum approved landing weight is:

- 3100 kg (6834 lbs) [ACFT A]

LANDING LIMITATIONS

The maximum allowable sinking speed during landing versus aircraft weight is indicated in figure 5-8.
The sinking speed values shown on the charts are intended at the touch-down.
The indications of the vertical velocity indicator are not reliable as they are not instantaneous being affected by a remarkable lag.

MISCELLANEOUS LIMITATIONS.

CROSS WIND

The crosswind limit for take-off and landing is 25 Kts.

NOTE

At 25 kts crosswind, the lateral aileron control will be reduced by approximately 1/3 of lateral stick travel.

The chart to resolve the crosswind components is reported in the Performance Data Manual.

LANDING/TAXI LIGHTS

The duty cycle for landing and taxy lights operation is:

- 10 minutes ON
- 20 minutes OFF.

SEAT ADJUST

The duty cycle for seat adjusting actuator operation is:

- 1 minute ON
- 8 minutes OFF.

EXTERNAL STORE LIMITATIONS [ACFT A]

LOAD ASYMMETRY LIMITS

The maximum allowable asymmetric moments are:

- For intentional take-off and landing is 350 kgm. (Aircraft laterally trimmable for airspeeds above 95 KIAS).

- For higher asymmetric loads refer to "Landing with asymmetric loads" in Section III.

Refer to chart of figure 5-9 to determine the asymmetric moment caused by stores of different weight (installed under the wing pylons) or by partial or complete fuel transfer failure of an auxiliary fuel tank. This chart permits to determine, in function of asymmetric loading:

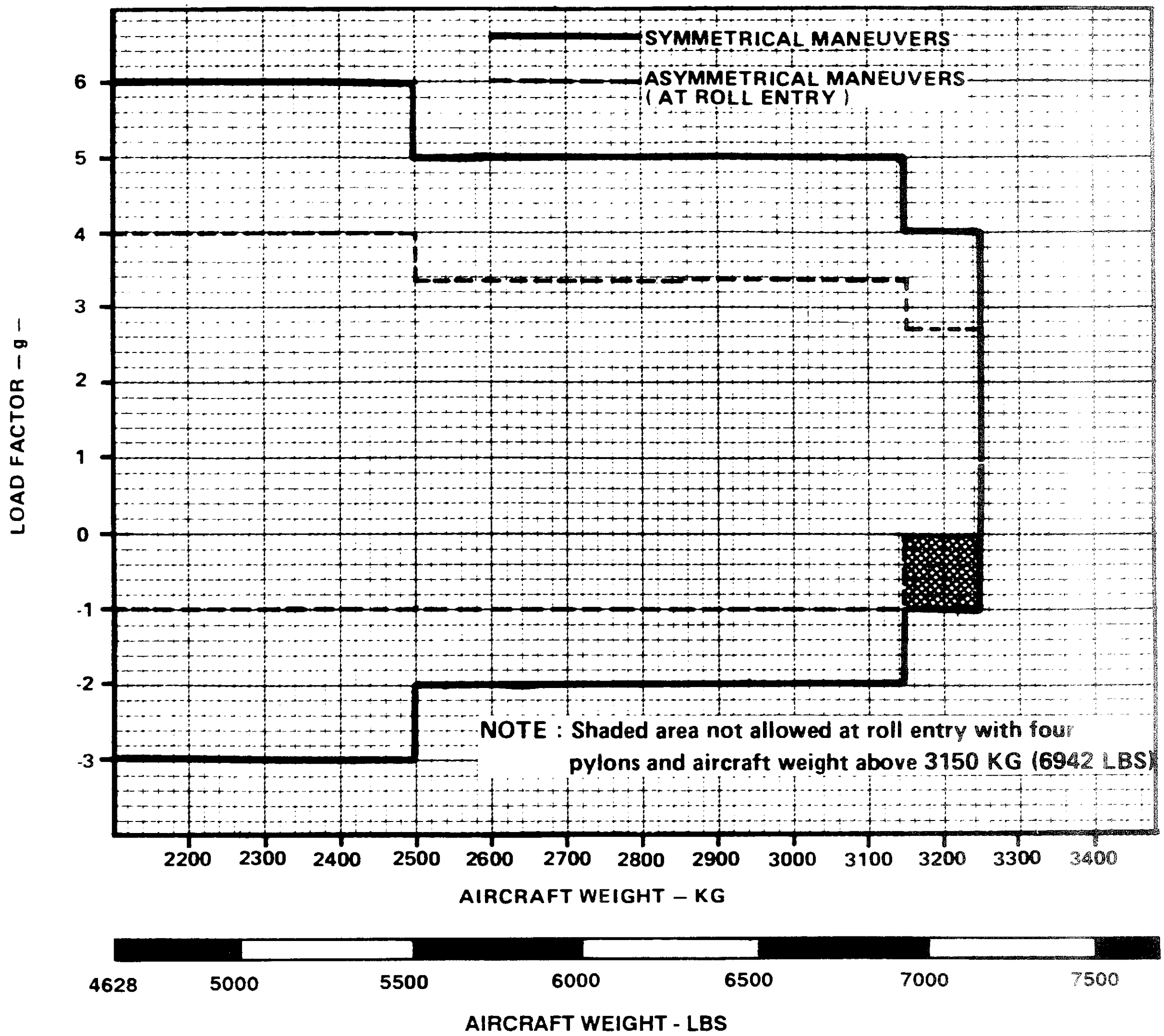
- The minimum speeds at which the aircraft can be laterally trimmed.

- The aileron control travel remaining for each speed.

CAUTION

The lateral control with asymmetric load chart does not account for turbolence, gusts, cross wind and load factor. Under maneuver flight the moment of asymmetry must be multiplied by the load factor.

MAXIMUM PERMISSIBLE LOAD FACTORS

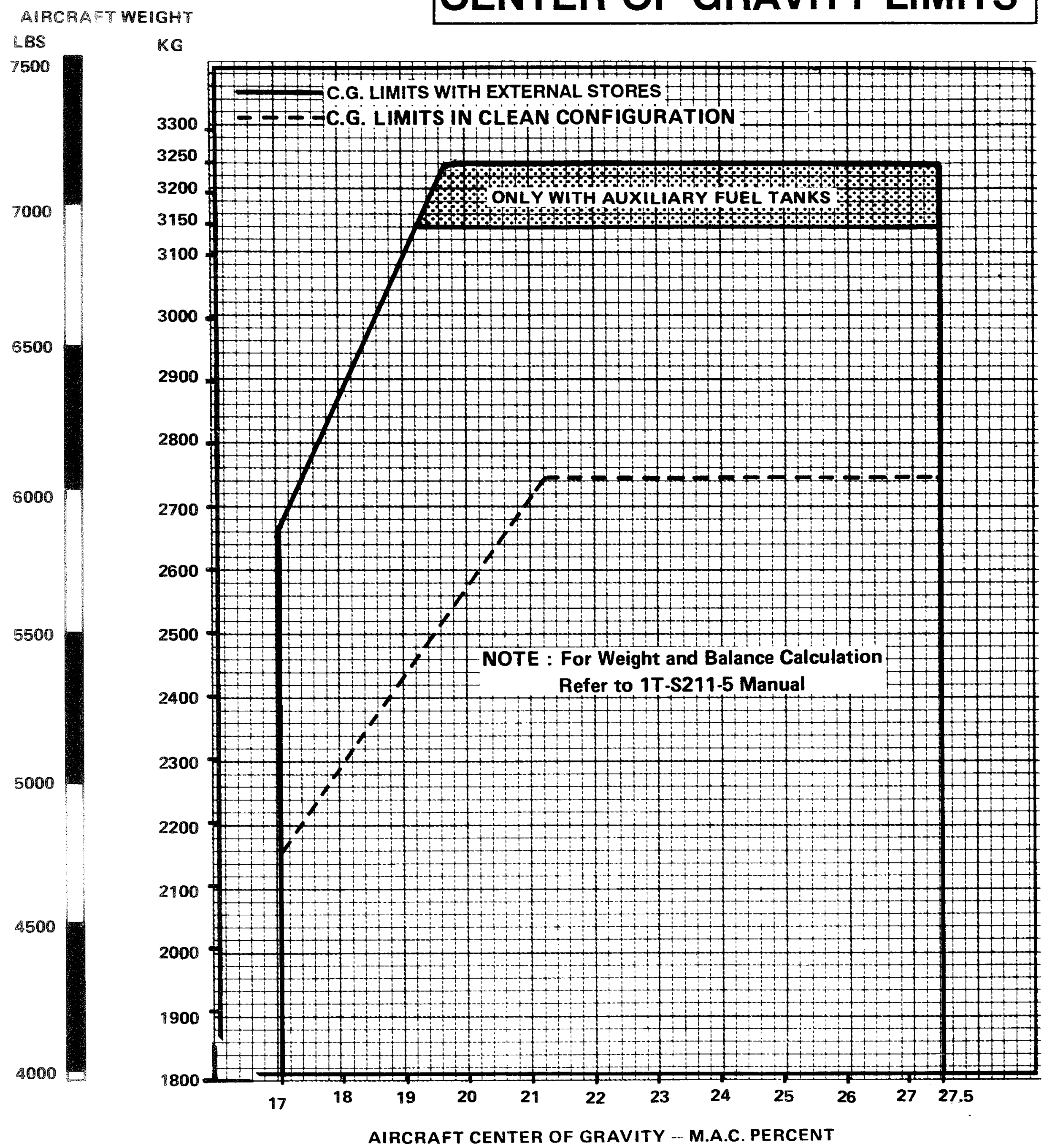


[ACFT A]

	AIRCRAFT WEIGHT	SYMMETRICAL MANEUVERS POSITIVE	SYMMETRICAL MANEUVERS NEGATIVE	SYMMETRICAL MANEUVERS NOTE	ASYMMETRICAL MANEUVERS (Limits apply for any lateral stick input) POSITIVE	ASYMMETRICAL MANEUVERS NEGATIVE	ASYMMETRICAL MANEUVERS NOTE
CLEAN	UP TO 2500 KG (5511 LBS)	+6	–3	For combined speed/load factor limitations see figure 5-5.	+4	–1	MAX ENTRY SPEED 400 KIAS OR .80 Mach
	UP TO 2750 KG (6063 LBS)	+5	–2		+3.33	–1	
EXTERNAL STORES	UP TO 3150 KG (6944 LBS) Two Pylons	+5	–2		+3.33	–1	MAX ENTRY SPEED 350 KIAS OR .70 Mach
	UP TO 3150 KG (6944 LBS) Four Pylons				+3.33	0	
	UP TO 3250 KG (7165 LBS) Two Pylons	+4	–1		+2.66	–1	

Figure 5-6.

CENTER OF GRAVITY LIMITS



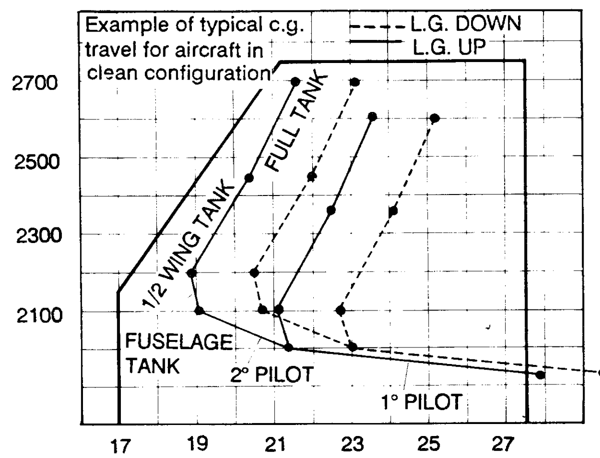


Figure 5-7.

CONTACT SINKING SPEED

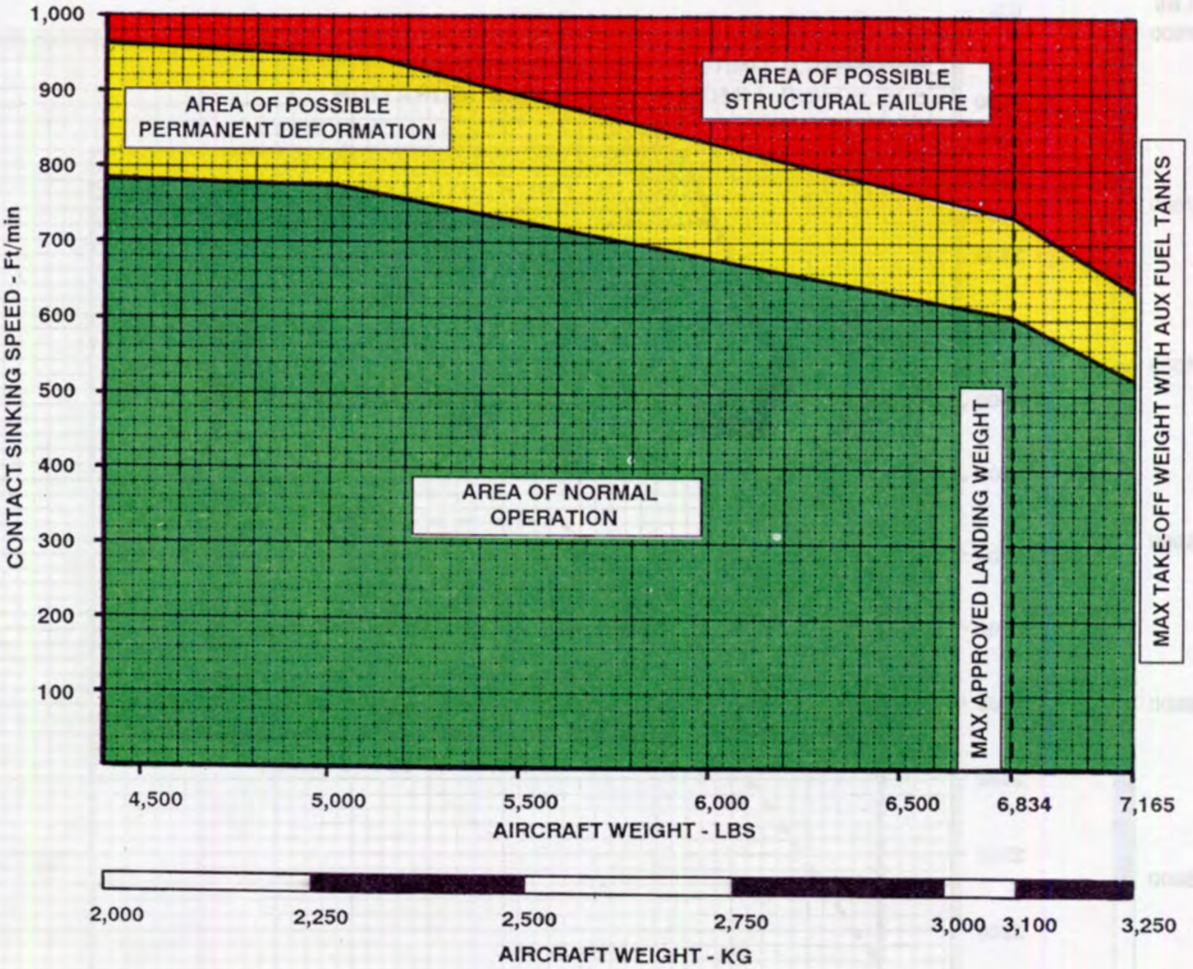


Figure 5-8.

AUXILIARY FUEL TANKS OPERATING LIMITATIONS

When installing Auxiliary Fuel Tanks (Model without fins MCC 310-367/368/381/383, observe the following limitations:

- SPEED . . . . 350 KIAS
- MACH NUMBER . 0.70
- LOAD FACTORS: . positive +5g
  negative -2g (TRANSIENT)
- ALTITUDE . . . . . . 40,000 FT
- EMERGENCY JETTISON . . . . . . FULL
  Speed range 120 to 200 kts
  Cruise configuration

NOTE

Slight positive load factor is supposed to help tanks separation.. Tanks release in close proximity of the ground should always be avoided.

CAUTION

DROPPING OF **EMPTY** TANKS AND **50% FULL** TANKS IS NOT RECOMMENDED AS IT WILL MOST PROBABLY RESULT IN COLLISION OF TANK BODY WITH THE AIRCRAFT FUSELAGE.

APPROVED STORE CONFIGURATION AND APPLICABLE LIMITS.

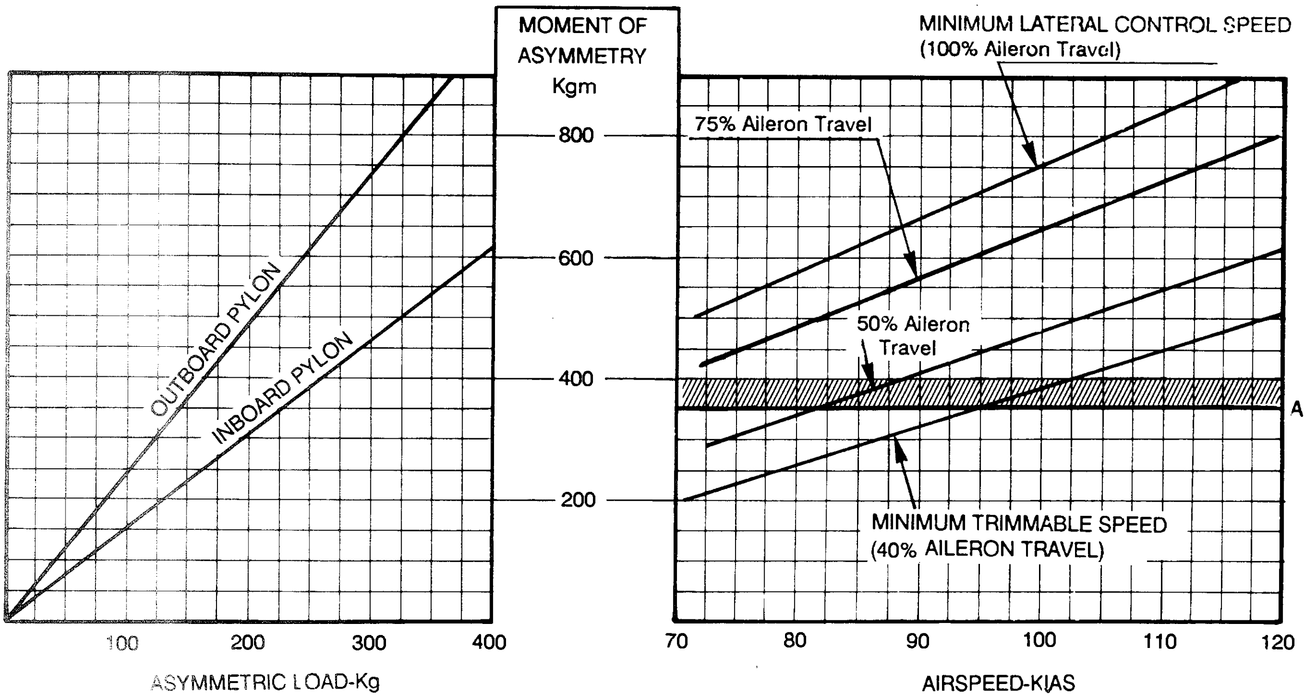
Figure 5-10 provides the symbols used to indicate the type of external stores. An external store index is provided in figure 5-11. The tables of Figure 5-12 provide the approved store configurations and the speed and load factor limits for each configuration. For pilot convenience they report also the drag index and weight , of the specific configuration based on the same data reported in 1T-S211-1-1 and in 1T-S211-5 Manuals.

CAUTION

Only the store configurations shown in figure 5-12, are allowed for operation. However, carriage of empty pylons is allowed in addition to any two-loaded-pylons configuration, provided that additional weight and drag are accounted for.

MINIMUM SPEED FOR TRIMMABILITY AND LATERAL CONTROL WITH ASYMMETRIC LOAD

- SPEED DO NOT HAVE MARGIN TO ACCOUNT FOR TURBOLENCE, GUSTS AND CROSSWIND.
- FOR MULTIPLE LOADS, THE MOMENT OF ASYMMETRY IS THE SUM OF THE MOMENT OF ASYMMETRY AT EACH PYLON STATION.
- TO FIND LATERAL CONTROL MARGINS DURING MANEUVERS, THE MOMENT OF ASYMMETRY MUST BE MULTIPLIED BY THE LOAD FACTOR.
- MAXIMUM MOMENT FOR INTENTIONAL ASYMMETRIC (REF A) TAKE-OFF AND LANDING = 350 Kgm.



Example 1:

DATA: One Auxiliary Fuel Tank (Inboard Pylon) does not transfer fuel.

FIND: - Moment of asymmetry
- Minimum lateral Control Speed
- Minimum Trimmable Speed.

PROCEDURE:

a. Enter the diagram with asymmetric load = 210 Kg.
b. Intercept the line corresponding to the inboard pylon.
c. Move horizzontally to read the value of the moment of asymmetry = 325 Kgm.
d. Intercept the minimum lateral control speed line.
e. Read the minimum lateral control speed (Below 75 KIAS extrapolated; value would be 51 KIAS).
f. Intercept the minimum trimmable speed line.
g. Read the minimum trimmable speed = 90 KIAS.

Example 2:

DATA: Aircraft loaded asymmetrically at inboard pylons with one BRD and one 7.62 Gun Pod.

FIND: - Moment of asymmetry
- Minimum lateral Control Speed
- Minimum Trimmable Speed.

PROCEDURE:

a. Load asymmetry = (118 - 43) Kg = 75 Kg.
b. Intercept the line corresponding to the inboard pylon.
c. Moment of asymmetry = 115 Kgm.
d. Intercept the minimum lateral control speed line.
e. The aircraft has full lateral controllabilty and trimmability until speed well below the stall speed at n = 1.

NOTE

Under load factor n = 5 the moment of asymmetry becomes 115 x 5 = 575 Kgm and the minimum lateral control speed is 80 KIAS. Under these conditions, the moment of asymmetry can be balanced with aileron travel ≤ 50% at speed ≥ 114 KIAS.

Figure 5-9.

SYMBOLS USED IN THE EXTERNAL STORE CONFIGURATION TABLES

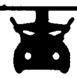
	WING PYLON WITHOUT SWAY BRACES		WING PYLON AND BRD
	WING PYLON WITH SWAY BRACES		WING PYLON AND AUX. FUEL TANK
	WING PYLON AND GUN POD		WING PYLON AND SMOKE PRODUCER
	WING PYLON AND RKT LAUNCHER		WING PYLON AND BOMB

Figure 5-10. [ACFT A]

Aircraft with empty pylons.

Limitations for the aircraft operating with empty pylons are the same as the clean aircraft.
The weight and the drag index of the pylons must be accounted for mission planning.

General Restrictions

The restrictions contained in this paragraph are applicable to store configurations of figure 5-12 with regard to transport, launch and to normal and emergency release.

1. The limits for mixed store configuration are provided for each type of store. The most restrictive limits must be met as long as the limiting store is carried.

2. The acceleration limits given in figure 5-12 are applicable only to symmetrical maneuvers. The entry acceleration limits for rolling pullout are 2/3 of the permissible limit for symmetrical maneuvers. (e.g.: If the acceleration limit for a symmetrical maneuver is equal to 5 g, the acceleration limit for the rolling pullout maneuver is 3.7 g.)

Store Configurations (See figure 5-12)

Approved two-pylons single-type-store configurations are reported in Tables 1 thru 5.

Approved four-pylons single-type-store configurations are reported in Tables 6 thru 10.

Approved mixed asymmetrical store configurations are reported in Tables 11 thru 15.

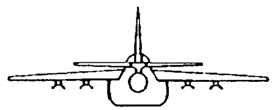
Approved mixed store configurations (symmetrical) are reported in Tables 16 thru 30.

EXTERNAL STORE CONFIGURATION INDEX

STORES	SINGLE STORES										MIXED STORES																			
	TWO PYLONS					FOUR PYLONS					ASYMMETRICAL					SYMMETRICAL														
TABLE N°	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
WING PYLON WITHOUT SWAY BRACE	•					•																								
WING PYLON WITH SWAY BRACE	•					•																								
GUN POD SIAI (7.62 mm)	•					•					•					•														
ROCKET LAUNCHER MATRA F2	•					•					•					•														
BRD AEREA 4-268	•										•																			
AUXILIARY FUEL TANK	•										•																			
SMOKE PRODUCER	•																													
GUN POD HMP.50 (12.7 mm)		•									•					•														
GUN POD GIAT (20 mm)		•																												
ROCKET LAUNCHER LAU 32		•				•					•					•														
ROCKET LAUNCHER LAU 68		•				•					•					•														
BOMB AAGP/LD		•				•										•														
BOMB MK 82		•																												

Figure 5-11. [ACFT A]

EXTERNAL STORE LIMITATIONS



EXTERNAL STORES	WING STATIONS 1	2	3	4	MAXIMUM SPEED (KIAS IMN) TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	LOAD FACTOR (g) SYMMETRICAL MANEUVER TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	MAX FIRING ANGLE (Including Pylons)	DRAG INDEX (Including Pylons)	TOTAL STORES WEIGHT (lbs) LOADED (UNLOADED) (Including Pylons)	NOTE
WING PYLON WITHOUT SWAY BRACE					400 0.80	N.A.	N.A.	N.A.	Fig. 5-5	N.A.	N.A.	N.A.	N.A.	24	66	-
WING PYLON WITH SWAY BRACE					400 0.80	N.A.	N.A.	N.A.	Fig. 5-5	N.A.	N.A.	N.A.	N.A.	28	73	-
GUN POD SIAI (7.62 mm)					375 0.75	350 0.70	N.A.	120 - 280 level flight cruise conf.	+5.0 -2.0	0/+3	N.A.	+0.5 +1.5	N.A.	56	267 (201)	500 rounds each
ROCKET LAUNCHER MATRA F2					375 0.75	350 0.70	N.A.	120 - 280 level flight cruise conf.	+5.0 -2.0	+0.5 +1.5	N.A.	+0.5 +1.5	45°	50 (66)	373 (198)	-
BOMB ROCKET DISPENCER AEREA 4.268					375 0.75	350 0.70	350 0.70	120 - 250 level flight cruise conf.	+5.0 -2.0	+0.5 +1.5	+0.5 +1.5	+0.5 +1.5	RKT (45°) MK76 (45°) MK106 (15°)	116 (130)	691 (448) 545 (448)	with 2 rockets and 4 bombs MK76 each. with 2 rockets and 4 bombs MK106 each.
AUXILIARY FUEL TANKS					350 .70	N.A.	N.A.	120-140 (1) 120-160 (2) 120-220(3) level flight cruise conf.	Fig 5-5	N.A.	N.A.	+1.0 +2.0	N.A.	80	1153 (223)	Empty weight includes undrainable fuel.
SMOKE PRODUCER					375 0.75	N.A.	N.A.	120 - 280 level flight	+5.0 -2 .0	N.A.	N.A.	+0.5 +1.5	N.A.	56	276 (106)	-

NOTE 1: Auxiliary fuel tank EMPTY NOTE 2: Auxiliary fuel tank 1/2 NOTE 3: Auxiliary fuel tank FULL

Figure 5-12. (Table 1) [ACFT A]

EXTERNAL STORE LIMITATIONS

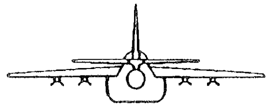
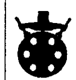
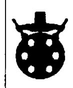
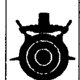
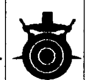
EXTERNAL STORES	WING STATIONS 				MAXIMUM SPEED (KIAS IMN)				LOAD FACTOR (g) SYMMETRICAL MANEUVER				MAX FIRING ANGLE	DRAG INDEX	TOTAL STORES WEIGHT (lbs) LOADED (UNLOADED)	NOTE
	1	2	3	4	TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	Including Pylon			
GUN POD HMP .50 (12.7 mm)					375 .75	350 .70	N.A.	Not Cleared	+5.0 -2.0	0/+3	N.A.	Not Cleared	N.A.	94	584 (437)	-
GUN POD GIAT (20 mm)					375 .75	350 .70	N.A.	Not Cleared	+5.0 -2.0	0/+3	N.A.	Not Cleared	N.A.	60	836 (575)	Maximum one second raffle
ROCKET LAUNCHER LAU 32 (2.75)					375 .75	350 .70	N.A.	Not Cleared	+5.0 -2.0	+0.5 +1.5	N.A.	Not Cleared	45°	66 (80)	500 (209)	-
ROCKET LAUNCHER LAU 68 (2.75)					375 .75	350 .70	N.A.	Not Cleared	+5.0 -2.0	+0.5 +1.5	N.A.	Not Cleared	45°	66 (80)	508 (207)	Nose fairing not allowed for firing.
BOMB AAGP/LD (125 kg)					375 .75	N.A.	350 .70	350 .70	+5.0 -2.0	N.A.	+0.5 +1.5	+0.5 +1.5	45°	46 (28)	593 (73)	-
BOMB MK82 (500 lbs)					375 .75	N.A.	350 .70	350 .70	+5.0 -2.0	N.A.	+0.5 +1.5	+0.5 +1.5	45°	74 (28)	1135 (73)	-

Figure 5-12. (Table 2) [ACFT A]

EXTERNAL STORE LIMITATIONS

EXTERNAL STORES	WING STATIONS 1	2	3	4	MAXIMUM SPEED (KIAS IMN) TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	LOAD FACTOR (g) SYMMETRICAL MANEUVER TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	MAX FIRING ANGLE	DRAG INDEX (Including Pylon)	TOTAL STORES WEIGHT (lbs) LOADED (UNLOADED) (Including Pylon)	NOTE
WING PYLON WITHOUT SWAY BRACE					400 0.80	N.A.	N.A.	N.A.	Fig. 5-5	N.A.	N.A.	N.A.	N.A.	48	132	-
WING PYLON WITH SWAY BRACE					400 0.80	N.A.	N.A.	N.A.	Fig. 5-5	N.A.	N.A.	N.A.	N.A.	56	146	-
GUN POD SIAI (7.62 mm)					350 0.75	350 0.70	N.A.	120 - 280 level flight cruise conf.	+5.0 -2.0	0/+3	N.A.	+0.5 +1.5	N.A.	112	537 (404)	-
ROCKET LAUNCHER MATRA F2					350 0.75	350 0.70	N.A.	120 - 280 level flight cruise conf.	+5.0 -2.0	+0.5 +1.5	N.A.	+0.5 +1.5	45°	100 (132)	746 (399)	-
ROCKET LAUNCHER LAU 32 (2.75)					350 .75	350 0.70	N.A.	Not Cleared	+5.0 -2.0	+0.5 +1.5	N.A.	Not Cleared	45°	132 (160)	1004 (422)	-
ROCKET LAUNCHER LAU 68 (2.75)					350 .75	350 0.70	N.A.	Not Cleared	+5.0 -2.0	+0.5 +1.5	N.A.	Not Cleared	45°	132 (160)	1019 (417)	Nose fairing not allowed for firing
BOMB AAGP/LD (125 kg)					350 .75	N.A.	350 .70	350 .70	+5.0 -2.0	N.A.	+0.5 +1.5	+0.5 +1.5	45°	92 (56)	1186 (73)	-

Figure 5-12. (Table 6) [ACFT A]

EXTERNAL STORE LIMITATIONS

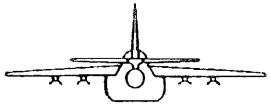
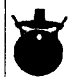
EXTERNAL STORES	 WING STATIONS				MAXIMUM SPEED (KIAS IMN)				LOAD FACTOR (g) SYMMETRICAL MANEUVER				MAXIMUM FIRING ANGLE	DRAG INDEX	TOTAL STORES WEIGHT (lbs) LOADED (UNLOADED)	NOTE
	1	2	3	4	TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	Including Pylon			
GUN POD SIAI (7.62 mm) and ROCKET LAUNCHER MATRA F2					375 0.75	350 0.70	N.A.	120 - 280 level flight cruise conf.	+5.0 -2.0	GUN 0/+3 RKT +0.5/+1.5	N.A.	+0.5 +1.5	RKT (45°)	53 (68)	320 (199)	-
GUN POD SIAI (7.62 mm)and BRD AEREA 4.268					375 0.75	350 0.70	350 0.70	120 - 250 level flight cruise conf.	+5.0 -2.0	GUN 0/+3 RKT +0.5/+1.5	+0.5 +1.5	+0.5 +1.5	RKT (45°) MK76 (45°) MK106 (15°)	86 (93)	479 (324) 406 (324)	With 2 rockets and 4 bombs MK76. With 2 rockets and 4 bombs MK106.
GUN POD HMP.50 (12.7 mm) and ROCKET LAUNCHER LAU 32 (2.75)					375 0.75	350 0.70	N.A.	Not Cleared	+5.0 -2.0	GUN 0/+3 RKT +0.5/+1.5	N.A.	Not Cleared	Gun 30° Rocket 45°	80 (87)	542 (322)	
GUN POD HMP .50 (12.7 mm)and ROCKET LAUNCHER LAU 68 (2.75)					375 0.75	350 0.70	N.A.	Not Cleared	+5.0 -2.0	GUN 0/+3 RKT +0.5/+1.5	N.A.	Not Cleared	Gun 30° Rocket 45°	80 (87)	546 (323)	Nose fairing not allowed for firing.
GUN POD HMP .50 (12.7 mm) and AUXILIARY FUEL TANK					350 .70	350 0.70	N.A.	Not Cleared	+5.0 -2.0	0/+3	N.A.	Not Cleared	Gun 30°	87	869 (330)	

Figure 5-12. (Table 11) [ACFT A]

EXTERNAL STORE LIMITATIONS

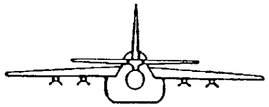
EXTERNAL STORES	WING STATIONS				MAXIMUM SPEED (KIAS IMN)				LOAD FACTOR (g) SYMMETRICAL MANEUVER				MAXIMUM FIRING ANGLE	DRAG INDEX	TOTAL STORES WEIGHT (lbs) LOADED (UNLOADED)	NOTE
	 1	2	3	4	TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	TRANS PORT	RKT/ GUN FIRING	BOMB RELEASE	SALVO	Including Pylons			
TWO GUN PODS SIAI (7.62 mm) and TWO ROCKET LAUNCHERS MATRA F2					350 0.75	350 0.70	N.A.	120 - 280 level flight cruise conf.	+5.0 -2.0	GUN 0/+3 RKT 0/+1.5	N.A.	+0.5 +1.5	RKT 45°	106 (122)	640 (398)	-
TWO GUN PODS HMP .50 (12.7 mm) and TWO ROCKET LAUNCHERS LAU 32 (2.75)					350 0.75	350 0.70	N.A.	Not Cleared	+5.0 -2.0	GUN 0/+3 RKT 0/+1.5	N.A.	Not Cleared	Gun 30° RKT 45°	160 (174)	1088 (650)	-
TWO GUN PODS HMP .50 (12.7 mm) and TWO ROCKET LAUNCHERS LAU 68 (2.75)					350 0.75	350 0.70	N.A.	Not Cleared	+5.0 -2.0	GUN 0/+3 RKT 0/+1.5	N.A.	Not Cleared	Gun 30° RKT 45°	160 (174)	1095 (647)	Nose fairing not allowed for firing.
TWO GUN PODS HMP.50 (12.7 mm) and TWO BOMBS AAGP/LD (125 kg)					350 0.75	350 0.70	350 0.70	Not cleared	+5.0 -2.0	0/+3	0/+1.5	Not Cleared	Gun 30° Bomb 45°	140 (122)	1180 (513)	-

Figure 5-12. (Table 16) [ACFT A]

SECTION VI
FLIGHT CHARACTERISTICS

TABLE OF CONTENTS

GENERAL

The aircraft has positive longitudinal stability in all configurations, within the permissible centre of gravity excursion range. Longitudinal control forces gradient may drop to friction band range values in landing configuration, at full aft C.G. This will not adversely affect the landing qualities during approach and landing. Lateral dynamic stability (spiral) is neutral, which is quite normal for an airplane of this class and does not require any special flying technique. Controllability is very good around three axes in all combinations of configuration and speed.

TAXIING

A mechanical nose wheel steering system provides positive directional control on the ground by simply displacing the rudder pedals. A very short turning radius can be obtained, at reasonably slow taxiing speeds, with full rudder pedals travel. Do not use differential braking in an attempt to tighten a turn, in order to avoid overstressing the mechanical linkage. Wheel brakes must only be used symmetrically to slow down and/or stop taxiing. For the same reason, do not attempt to move the rudder pedals when the aircraft is not moving.

STALLING

The stalling speeds under different conditions are presented in figure 6-1.

Stall characteristics are good and safe in all configurations, both in level flight and under load factor.
Stall is characterized by a slight pitch-down coupled sometimes with moderate wing drops.
In clean configuration a moderate stall warning (buffeting) occurs about 3÷4 knots above stalling speed. The warning is stronger in accelerated stalls where the aircraft has the same behaviour as in 1g stalls.
With gear and flaps extended, the warning take place shortly before the stall and it may be partially masked by natural airframe buffeting.
Aileron and rudder are effective in controlling yaw and roll motion up to the stall.
In deep stall the aircraft shows moderate oscillations in pitch, roll and slight oscillations in yaw and rudder is the best to control both yawing and lateral motions.
The aircraft never shows any tendency to pitch up and/or to sudden and ample wing drops.
Recovery from stalls is easily accomplished by easing the stick forward to about neutral position. Application of power will help to reduce altitude loss that is, usually, around 700-800 ft. Recovery from accelerated stalls is achieved by releasing back pressure on the stick.
In inverted stalls the aircraft gets the end of longitudinal control around 120 Kias and maintaining the control full forward, the speed decreases to around 90 Kias where the aircraft shows a stall characterized by a strong buffeting with a tendency to moderate wing drops.

SPINNING

The aircraft has no spontaneous tendency to spin. However for practice it can be forced into a spin, starting from 10 Kts above stalling condition, by pul-

STALL SPEED CHART

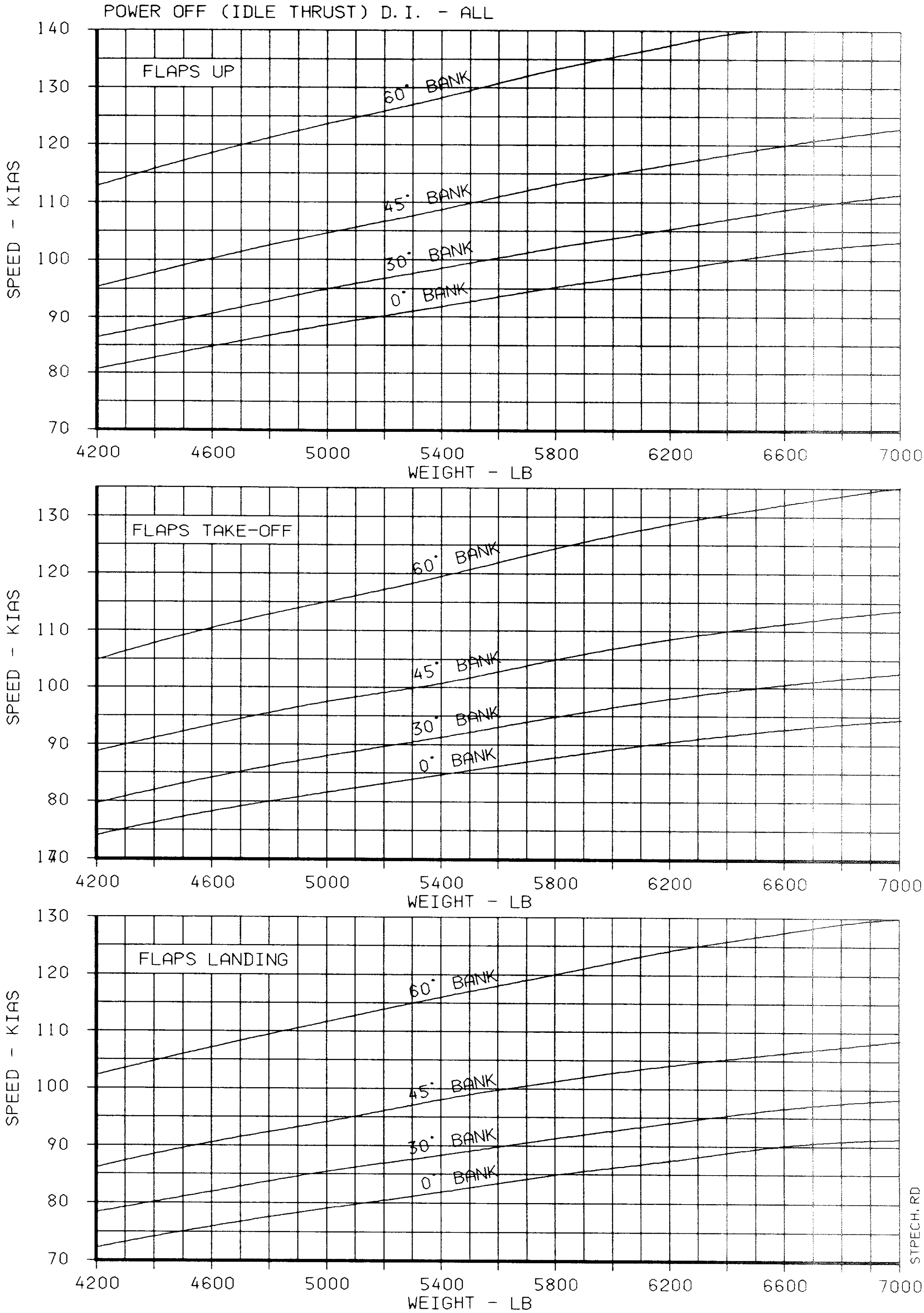


Figure 6-1.

DIVE RECOVERY CHART

MODEL	:	S211
DATA BASIS	:	FLIGHT TEST
ENGINE	:	P & WC JT15D-4C
FUEL GRADE	:	JP4
FUEL DENSITY	:	6.5 LBS/US GAL

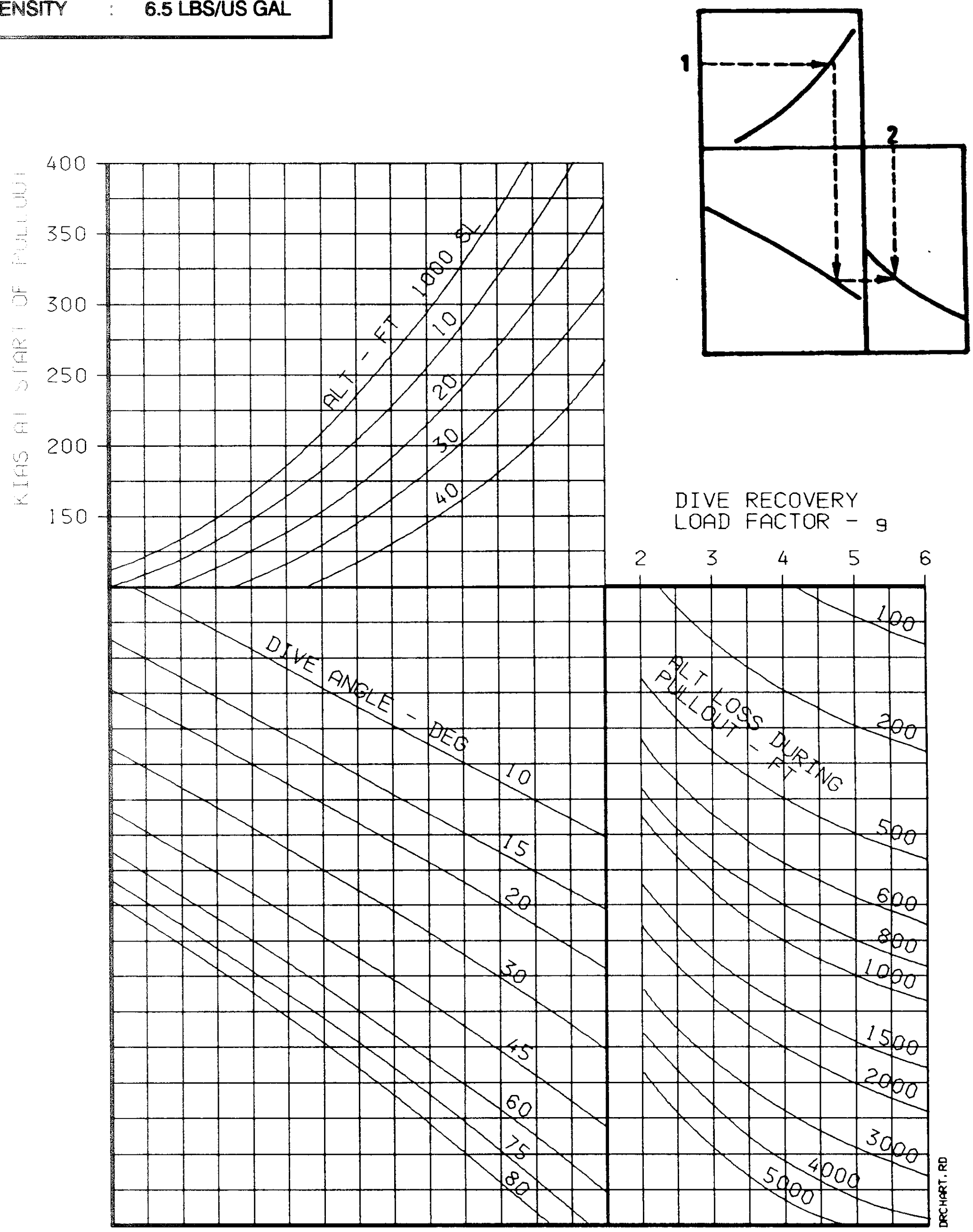


Figure 6-2.

ling the stick to the fully aft centered position and applying full prospin rudder.
The spinning has not constant characteristics depending from: speed of entry, direction of rotation, center of gravity position etc.
It may be characterized by a fairly constant steep nose-down attitude with slight variations in rate of yaw and roll or it may develop in a more irregular way with rates of yaw and roll varying from very slow to very fast within a turn and with moderate variations in pitch.
Usually, after the first turn, the aircraft shows an hesitation to continue the spin with moderate rudder aspiration. This hesitation may last for 1÷2 seconds.
After three turns the aircraft has a more steady state spinning that remains, anyway, always characterized by moderate oscillations in all three axes.
Normally during the first three turns the aircraft looses 1500÷2000 ft; after the third turn the altitude loss is 900 ÷ 1000 ft per turn, indicated speed is 155÷160 increasing, time per turn is around 2÷3 sec, incidence around 25°÷35°, pitch angle is around 80° below the horizon.
Recovery from the spin is always very quick and safe by applying rudder opposite to the yaw motion and releasing the stick forward to the neutral position. Rotation will stop after about 1/4 of turn. Recovery is safe even releasing all the controls. In this case, rotation will stop after about half turn.
Loss of altitude during a normal recovery is around 1500 ft.
All controls should be centered as soon as the rotation stops and power should be re-applied after the aircraft is brought back to a level attitude.

EFFECT OF FLIGHT CONTROLS ON SPINNING

Elevator

Releasing the stick toward the central position during a stabilized spin, the spinning becomes less oscillatory, the roll rate increases considerably and the nose down attitude may reach 80÷85° below horizon. The IAS may increase rapidly and the spin turns to a spiral mode. The loss of altitude increases and a fast normal recovery must be carried-out.

Ailerons

The aircraft in spinning shows a high sensitivity to ailerons control. Inspin ailerons make spin less oscillatory but the aircraft shows an increase in pitch attitude and roll rate. Outspin ailerons increase pitch and roll rate, while average incidence decreases. Even in this case, anyway, no conditions of disorientation for pilot are induced.

Rudder

Decreasing the displacement of rudder from full deflection the aircraft exhibites a higher nose down attitude. Rotation rate becomes slower and the aircraft shows a high reluctance to stay in the spin and may turn to a spiral mode.

Air Brake

Speed brake extension does not affect, in appreciable way, spin characteristics and recovery. It is advisable, anyway, to keep air brake IN, in order to minimize altitude loss during recovery.

EFFECT OF EXTERNAL STORES ON SPINNING [ACFT A]

External stores don't generally affect spin characteristics; the aircraft is still enough resistant to entry a spin in case of control misapplication. If entered, the aircraft exhibites slightly higher pitch rate.

WARNING

Intentional erected and inverted spins with external stores are prohibited. Jettison of stores in spin is not allowed.

INVERTED SPINS

The aircraft is very resistant to enter inverted spin. The inverted spin is anyway characterized by a violent departure both in roll and yaw with strong and fast changes of longitudinal attitude. The incidence increases continuously (up to 60 degrees) while airspeed decreases rapidly; time for one turn is around 4÷5 sec. The maneuver is very disorienting and pilot may have difficulties in recognizing the direction of yaw.
Should the aircraft enter unintentionally inverted spin, immediate recovery shall be accomplished by centralizing the controls; force required to neutralize rudder may be very high. Overshooting the rudder beyond the neutral position may bring the aircraft into erect spin with pilot disorientation and will delay the recovery.
Should the pilot get full disorientated, it is advisable to bring controls to neutral position.

WARNING

Intentional inverted spins are prohibited. Should the aircraft enter an inverted spin and the recovery has not been achieved above 5000 ft AGL, the aircraft should be abandoned.

UNUSUAL ATTITUDES

Recovery from unusual attitudes is easily accomplished by normal use of aircraft and engine controls. To recover from steep nose down attitudes, reduce power as needed (normally to idle), roll wings level and raise the nose to the horizon.
To minimize loss of altitude, the speed brake should be extended in addition to power reduction. Refer to figure 6-2 "dive recovery chart" for altitude loss data.
Recovery from extremely nose high attitudes is normally accomplished by rolling the aircraft and pulling it inverted toward the nearest horizon.
Full power should be applied in case the airspeed has dropped low values. Roll the aircraft level after the nose reaches the horizon, or slightly below.
The aircraft has no tendency to spin or to depart from controllable flight regime in any case. If an autorotation should develop out of unusual attitude, especially at high pitch and low speed, it will be normally due to misplaced flight controls.
Recovery will normally take place by simply neutralizing all flight controls, or by their gentle application against the rotation.

WARNING

> If unusual attitude is characterized by low speed and near vertical nose down attitude (i.e. recovering from a tail slade), rapid control movements in pitch and roll may cause transitory departures of the aircraft. If departure happens, controls should be immediately centralized, waiting for speed increasing. (Above 150 KIAS).

MANEUVERING FLIGHT

Longitudinal stick force versus load factor gradient during manoeuvring flight is adequate to reduce the possibility of inadequately overstressing the aircraft during pitching manoeuvers.
Suggested indicated airspeeds to initiate typical aerobatic maneuvers at medium altitudes are the following:
- loop 270 KTS.
- roll 240 KTS.
- immelman 280 KTS.

SIDESLIPS

The aircraft can be put into a sideslip in either direction, in all configurations. Rudder and aileron forces will increase progessively with the angle of sideslip, with lower values in the landing configuration.
Flying the aircraft in a sideslip is helpful to correct for cross wind when approaching to land, using the "wing low" method. When reaching high values of sideslip angles, a warning buffet will develop on the airframe. At this moment the sideslip angle should not be increased any further in order to maintain optimum flight controls effectiveness and to avoid rotations due to excessive cross-control, especially at low airspeed. Recovery from excessive sideslip is promptly accomplished by reducing cross-control.

FLIGHT CONTROLS EFFECTIVENESS

Elevator, ailerons and rudder are effective throughout the flight envelope of the aircraft. Full ailerons deflection at medium/high speeds will produce fairly high rates of roll (120 ÷ 150°).
Speed brake is obviously more effective at high speed. Speed brake extension will produce a pitch-up, which can be easily counteracted by applying push force on the stick as necessary. This force can be rapidly trimmed out.
At normal C.G. position, the aircraft is longitudinally trimmable in every possible combination of configurations and speeds.

FLIGHT WITH EXTERNAL STORES

Flight with external stores does not require any special technique as their influence on the aircraft, apart from drag, is relatively negligible.
Flight with external stores involves a penalty in climb and cruise performance (See "Performance Data " Manual), but there is no sensible negative effect on the aircraft flying characteristics.
The external stores produce a small reduction in the maximum rolling speed (100°/sec).
The stalling speeds and characteristics are the same as in clean configuration.
The external stores produce a stall warning aerodynamic buffeting (both airframe and stick) higher than in clean configuration, but the warning margin is about the same.
The recovery from stall is immediate by centering the stick.

FLIGHT WITH ASYMMETRIC LOAD

Within the permitted asymmetric load limits (See Sec-

tion V, Fig. 5-9) and under special operating conditions, planning mission in asymmetric external store configurations is allowed. Asymmetric loading involves a deterioration of both lateral and directional controls.
The rolling moment due to the mass of the asymmetric load must be counteracted by aileron trim to prevent rolling in the direction of the heavy wing. This aileron deflection increases with decreasing speed and increasing load factor. Rudder control may also be used to help in rolling control. Moreover, in case of asymmetric external stores, an unbalanced drag effect results in a yaw moment which can be easily counteracted by application of rudder pedals. Directional trimming is easily obtained for any asymmetric load configuration.

LATERAL TRIMMING AND MINIMUM CONTROL SPEED WITH ASYMMETRIC LOAD

Flight with asymmetric load imposes a requirement for aileron and rudder trimming or for the pilot to apply continuous control forces to hold the aircraft straight and level. As airspeed changes, the aerodynamic effectiveness of the control surfaces also changes, and so changes the deflection of the aileron control and rudder pedals in order to balance the load asymmetry.
When the aileron control has reached the full trimming deflection, this corresponds to the minimum speed for the lateral trim (See figure 5-9). A further speed reduction will oblige the pilot to hold a continuous lateral control force on the stick to increase aileron angle in order to maintain wings-level flight.
The speed at which full aileron deflection is required, is the minimum obtainable aileron control speed (See figure 5-9). A further reduction of speed below this value would result in an uncontrollable roll in the direction of the heavy wing, and prompt action is required by the pilot to return speed above the minimum value.

FLIGHT CHARACTERISTICS WITH ASYMMETRIC LOAD

Take-Off

In every take-off with asymmetric load, rotation and take-off speeds should never be less than the minimum trimmable control speed (See figure 5-9). Take-offs with asymmetric load may require large rudder application during the take-off run. It is recommended that 50% of the available aileron trim be set before take-off for imbalance up to 200 kgm and further increments of 10% of trim for every 40 kgm of additional imbalance be used. The pilot should promptly act on the stick in the lift-off phase to maintain the wings level and subsequently use lateral trim as sufficient to remove the force on the stick.

Flight

Small aileron and rudder trim applications are sufficient to maintain wings-level flight within the maximum permissible asymmetry limit at all speeds. Whenever stores are individually dropped, aileron inputs may be required, which may even be large depending upon airspeed. This requirement is to be borne in mind in all flights with external stores during which a condition of asymmetric load (inadvertent release of store) could accidentally result. In asymmetric flight conditions, all turns should be made, if possible, on the side away from the heavy wing, especially when flying at low speed.
Besides, it must be borne in mind that, under asymmetric load conditions, a lateral center-of-gravity displacement toward the heavier wing will result. As a consequence, the longitudinal acceleration along the a/c axis, such as those caused by the engine thrust or by the use of the speed brake, will introduce a yawing moment; to every thrust variation or extension of the speed brake there will correspond a yaw (on the load side when the engine throttle is advanced, on the opposite side when the engine throttle is retarded or the speed brake extended).
Load factor should be always minimized: during manoeuvers the moment of asymmetry due to asymmetric load is multiplied by the load factor and the rolling moment which must be counteracted by aileron increases of the same amount. Particularly at low/medium speed, at which the aileron travel required for lateral control may be a consistent fraction of full aileron deflection, a sudden and strong increase of load factor can produce a lateral uncontrollable departure.

Landing

A straight-in approach to the runway is recommended; this procedure allows a continous control of the sideslip angle to be maintained and, since large throttle movements are not required, it does not enhance the yawing effect of thrust variations. On the contrary, the overhead pattern which requires large turns at low speed, may prevent the pilot from noticing the building-up of large sideslip angle, thus resulting in a possible loss of control.
Thrust variations and speed brake extension, producing acceleration along the aircraft axis, can result, under asymmetric load conditions, in large yaw moments which at low speed can drive the aircraft into excessive sideslip angles: great care should therefore be taken to avoid strong and abrout thrust variations into approach to landing or in a possible go-around.
Besides, with asymmetric load, accelerations along the vertical axis create a rolling moment on the load side; this must be borne in mind since a rolling moment hardly counteractable by use of the ailerons could arise on landing from load factor application.
Landing should be made with flaps at take-off, on the

runway side away from the load, preferably with crosswind, if any, from the load side.
After ground contact, the aircraft remains directionally fully controllable down to very low speeds. A lateral deflection of the stick is however necessary to maintain the wings level. When braking, bear in mind that the center-of-gravity lateral displacement always results in a yawing moment on the side opposite the load. The aircraft lateral bank at speed lower than the aileron effectiveness speed is moderate and permits normal taxiing. Bank may increase to remarkable values slightly above 5° in presence of large asymmetries only at very low speeds.
It is recommended that turns in the taxi roll be made on the side of the heavy wing to relieve the weight on the corresponding wheel.

VIBRATIONS

The S211 aircraft sometimes exhibits a vibration of low frequency and moderate level, which is felt by the pilots in the rudder pedals, control stick and seat. Cause of the vibration is attributed to the splitter plate of the engine air intake duct and to internal aerodynamic conditions which are most likely to appear in a speed range of 200÷240 KIAS and an engine NL between 70 and 80%, more frequently at low altitude.
The phenomenon is not severe nor dangerous for the aircraft.

EFFECTS OF GUSTS

The gust load imposed to the aircraft increases with speed. At speed higher than 200 KIAS in extremely turbulent air, gust loads may exceed the limit load factor of the aircraft. Therefore, if it is necessary to fly in turbulent air, in order not to overstress the aircraft, reduce airspeed below 200 KIAS and avoid manoeuvers involving high load factors or large and abrupt attitude changes.

COMPRESSIBILITY EFFECTS

During diving maneuvers up to Mach Number limit of 0.8 (400 KIAS) stability and controllability of the aircraft will remain satisfactory.
At speed higher than 0.75/350 KIAS the aircraft may present a tendency to yaw: tendency that can be easily controlled by rudder trim. Usually at Mach number above 0.77 a light buffeting will appear.

SECTION VII
ALL WEATHER OPERATION

TABLE OF CONTENTS

INTRODUCTION

This section contains discussions, explanations, operational peculiarities and procedures which affect operation of the aircraft in extreme weather and climatic conditions. Normal instrument flight procedures are covered in Section II.

ICE AND RAIN

ICING CONDITIONS

On the ground

During ground running icing can occur with ambient temperatures less than 6°C, and relative humidity greater than 50%. The most severe icing conditions will occur when operating in fog with visibility less than 500 metres. If the above ground operating conditions exist, the ENGINE/ ANTI-ICE switch must be selected ON to have the engine cowl heated by compressor hot air.

In flight

Icing conditions which may be encountered are light, moderate and severe. Moderate and severe icing, particularly, can cause rapid buildup of ice on aircraft surfaces, greatly affecting performance. Short duration climbs and descents may be made thru light icing conditions.

WARNING

The aircraft should not be flown in moderate or severe icing conditions. If any icing is encountered, leave the area of icing condition as soon as possible.

Ice accumulation on the engine intake duct lips may cause engine damage. The entry of ice into an engine may cause jar, vibrations or noise in the engine and damage the fan and compressor blades. Instrument indications may remain normal even though damage has occured.

CAUTION

* If flight in icing conditions results in ice accumulation on the aircraft, enter this fact in the "Service and Discrepancy Book". Engine must be inspected for ice ingestion damage when this occurs.

* When snow or ice conditions exist, approach ends of runway are usually more slippery than any other areas due to the melting and refreezing of ice and snow at this location.

When icing conditions are suspected proceed as follows:

1. ANTI-ICE/PITOT switch - ON.
2. ANTI-ICE/ENGINE switch - ON.
3. IGNITION switch - CONT.
4. AUX PUMP switch - ON.
5. DEMIST switch - ON.

RAIN

When flying in rain conditions, forward vision may be reduced by drops of water or mist on the windshield, especially in low altitude, low speed flight. The situation can be improved by operating the windshield demist (DEMIST switch to ON).
In heavy rain select ignition switch - CONT.

WET OR SLIPPERY RUNWAY LANDING

Normal landing procedures should be used. Landing ground roll distances are significantly increased on a wet or slippery runway. Should crosswind be a factor, lower the nosewheel to the runway immediately after touch-down maintaining directional control with rud-

der and nose wheel steering as necessary. If cross-wind is not a factor, hold the nose as high as possible after touchdown without becoming airborne to obtain maximum aerodynamic braking, and hold this attitude until speed is reduced as much as possible.
After nosewheel is lowered, apply brakes carefully, avoiding to lock them. Hydroplaning and/or tire skidding on a wet or icy runway will increase stopping distance and easily result in loss of directional control. Make every effort to remain in the center of the runway if barrier engagement should become necessary. Taxy carefully, as nose wheel steering can be relatively ineffective on a wet or slippery runway.

NOTE

Hydroplanning takes place above a certain speed which is only function of tire pressure.

CAUTION

Painted areas on runways, taxiways and ramps are significantly more slippery, than unpainted areas. When painted areas are wet, the coefficient of friction may be negligible. Also painted areas may serve as condensation surfaces and it is possible to have wet, frosty, or icy conditions in these areas when the overall weather conditions are dry.

TURBULENCE & THUNDERSTORMS

Flight in turbulent air, hailstorms, and thunder storms should be avoided because of the increased danger of engine flameout and high probability of damage to airframe and components from impact with ice, hail and lightning.
If entry into adverse weather cannot be avoided, turn ON engine anti-ice, windshield defrost, and pitot heat prior to penetration. Monitor ITT and engine tachometer indicators continuously to allow for timely corrective action.
The following may cause engine flameouts:

a. Penetration of cumulus buildups with associated high liquid content.
b. Icing of either engine air intake duct lips or engine inlet guide vanes.
c. Turbolence can result in a very rapid change of angle of attack.

TURBULENT AIR PENETRATION PROCEDURES

CAUTION

Flight throught thunderstorms or extreme turbulence must be avoided whenever possible. Maximum use of weather forecast and radar facilities to help avoiding thunderstorms and turbulence is essential.

If flight thru these areas cannot be avoided, proceed as follows:

1. ENGINE ANTI ICE - ON.
2. PITOT ANTI ICE - ON.
3. AUX PUMP - ON.
4. IGNITION - CONT.
5. Airspeed - Establish 200 KIAS and trim for level flight. Severe turbulence will cause large and rapid variations in airspeed. Do not change thrust except for extreme airspeed variations.
6. Attitude - Attitude is the primary reference in extreme turbulence. Pitch and bank should be controlled by reference to the attitude indicator Do not change trim. Maintain controls as near neutral as possible to avoid overcontrolling. Do not use sudden or extreme control inputs. Extreme gusts will cause large attitude changes, but smooth and moderate use of the flight controls will reestablish the desired attitude.
7. Altitude - Severe vertical gusts may cause appreciable altitude variations. Allow altitude to vary maintaining attitude. Do not chase altitude and vertical velocity indications.

PENETRATION SPEED

If flight thru turbulent air is unavoidable, the recommended "best penetration speed" is 200 KIAS.

WARNING

If inadvertent flight in turbulence and thunderstorms is experienced, do not exceed 200 KIAS.

CAUTION

Flying in turbulence or hail may result in engine intake duct airflow distortion which can result in engine surge and possible flameout. However, normal air starts may be accomplished.

NIGHT FLYING

The aircraft has a complete fully adjustable lighting equipment.
During flight, the cabin brightness intensity should be maintained towards dim values in order to avoid annoying reflected light on the canopy.
Flying in presence of thunder-storm formation and "lightning" the cabin brightness intensity should be maintained bright in order to reduce pilot's dazzling.

To prevent disorientation, the strobe beacon light should be turned off in the vicinity of clouds before entering a cloud formation.
Same measure has to be taken by the leader aircraft during formation flight.
Frequent reference to flight instruments should be made during night flight due to the reduction of exterior visual references.

COLD WEATHER OPERATION

Most cold weather operation difficulties are encountered on the ground.
The following instructions are to be used with the normal procedures in Section II when cold weather aircraft operation is necessary.

BEFORE ENTERING AIRCRAFT

Remove protective covers:
check that surfaces, ducts struts, drains and vents are free of snow, ice, and frost.
Brush off light snow and frost. Remove ice and encrusted snow, either by a direct flow of air from a portable ground heater or by using deicing fluid. Remove light frost from the windshield and canopy, with a clean soft rag.

WARNING

Take-off distance and climb performance can be seriously degraded by snow and ice accumulation. The roughness and distribution of the ice and snow can vary stall speeds and characteristcs dangerously. Ensure that water does not accumulate in control hinge areas or other critical areas where refreezing may cause damage or binding.

CAUTION

To avoid damage to aircraft surfaces, do not permit ice to be chipped or scraped away. Inspect aircraft carefully for fuel and hydraulic leaks caused by contraction of fittings or by shrinkage of packings. Inspect area behind aircraft to ensure that water or snow will not be blown onto personnel and equipment during engine start.

ENTERING AIRCRAFT

WARNING

Keep oxygen mask well clear of face until after engine starts and cockpit warms up. Even so, the exhalation valve may have frozen and could require strong warm breath to free the stuck valve.

ENGINE START

Use external power for starting to conserve the battery. No preheat or special starting procedures are required. The engine can be started with ground temperatures as low as -40 °C (-40°F).
Turn on cockpit heat and canopy demist system as required immediately after engine start.

TAXIING

Nosewheel steering effectiveness is reduced when taxiing on ice and hard packed snow.
A combination of nose-wheel steering and wheel braking should be used for directional control.
The nosewheel will skid side-ways easily, increasing the possibility of tire damage. Maintain the engine at higher rpm to provide more heat for the cockpit and for canopy and windshield defrosting. However, reduced speeds will generally be necessary when taxiing over the uneven snow and ice covered surfaces typical of low temperature environments. Increase the normal interval between aircraft, both to ensure a safe stopping distance and to prevent icing of aircraft surfaces from melted snow and ice caused by the jet blast of the preceding aircraft. If bare spots exist thru the snow, skidding onto them should be avoided.

WARNING

Make sure all instruments have warmed up sufficiently to ensure normal operation. Check for sluggish instruments while taxiing.

TAKE-OFF

Use normal throttle procedures during take-off. Take-off should not be attempted with ice and snow on the wings and empennage or any other surfaces which might affect performances.

LANDING

Use minimum run landing techniques. When landing on runways that have patches of dry surface, avoid locking the wheels. If the aircraft starts to skid, release brakes until recovery from skid is accomplished.

CAUTION

After touchdown prepare for tendency of the aircraft to turn toward either side of runway. In cold environment, main landing gear struts may not compress equal amounts, causing aircraft to track to the lower strut side. Noseweel steering will be ineffective during high-speed portion of landing roll on icy runway.

ENGINE SHUTDOWN

Use normal engine shutdown procedure.

BEFORE LEAVING AIRCRAFT

The canopy should be fully closed on aircraft parked outdoors to prevent the entry of blowing snow caused by operation of other aircraft or from natural conditions.

HOT WEATHER AND DESERT OPERATION

Operation in hot weather and desert requires that precautions be taken to protect the aircraft from damage caused by high temperatures, dust and sand. Care must be taken to prevent the entrance of sand into aircraft parts and systems such as the engine, fuel system, pitot-static systems, etc. All filters should be checked more frequently than under normal operations. Plastic and rubber segments of the aircraft should be protected both from high temperatures and from blowing sand.
Canopy covers should be left off to prevent sand from accumulating between the cover and the canopy and acting as an abrasive on the plastic canopy. With a canopy closed, cockpit damage may result when ambient temperature is above 45°C.
Canopy should be opened in advance of flight to reduce cockpit temperature for comfort. Desert and hot weather operation requires that, in addition to normal procedures, the following precautions be observed.

ENTERING AIRCRAFT

During preflight inspection and on entering aircraft, it is recommended that light flying gloves be worn since aircraft surfaces are extremely hot in high ambient temperatures.

TAKE-OFF

Very hot temperatures decrease considerably engine thrust. Have Performance Manual carefully checked for take-off distances.
Use normal take-off technique.
Be alert for gusts and wind shears near the ground.

APPROACH AND LANDING

Monitor airspeed closely to ensure that recommended approach and touch-down airspeeds are maintained; high ambient temperatures cause speed relative to the ground to be higher than normal.
Anticipate a long landing roll due to higher ground speed at touchdown.

GLOSSARY

ABBREVIATION	DEFINITION
A	
A/A	Air to Air
AC	Alternate Current
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADJ	Adjustment
AFT	After word
AGL	Above Ground Level
AHRS	Attitude and Heading Ref Sys
AIL	Aileron
ALT	Altitude
AM	Amplitude Modulation
ANT	Antenna
ARMT	Armament
ATT IND	Attitude Indicator
AUTO	Automatic
AUX	Auxiliary
B	
BATT	Battery
BCN	Beacon
BITE	Built-in-Test Equipment
BRD	Bomb Rocket Dispenser
BRG	Bearing
BRT	Bright
C	
CAL	Caliber
CAM	Camera
CAS	Calibrated Airspeed
CCW	Counterclockwise
CG cg	Center of Gravity
CHAN	Channel
CONT'D	Continued
CRS	Course
CW	Clockwise
D	
DC dc	Direct Current
DEMIST	Demisting
DEV	Deviation
DG	Directional Gyro
DIST	Distance
DME	Distance Measuring Equipment
E	
E	East
EMER	Emergency
ENG	Engine
E (Cont'd)	
ESS	Essential
ETA	Estimated Time of Arrival
EXT	External
ECU	Electronic Control Unit
F	
FLAPS	Flaps
FLT	Flight
FREQ	Frequency
FSII	Fuel System Icing-inhibitor
FWD	Forward
FF	Fuel Flow
G	
G	Gravity (load factor)
GAL	Gallon
GC	Gyro Compass
GCA	Ground Controlled Approach
GCU	Generator Control Unit
GD	Guard
GEN	Generator
GS	Ground speed (knots)
GPU	Ground Power Unit
H	
HDG	Heading
HSI	Horizontal Situation Indicator
HTR	Heater
HYD	Hydraulic
HMU	Hydro-mechanical Unit
I	
IAS	Indicated Air Speed
IDENT	Identification
IFF	Instrument Friend/Foe
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMN	Indicated Mach Number
IN in	Inch(es)
INBD	Inboard
IND	Indicator
INTERCOM	Intercommunication(s)
INV	Inverter
ITT	Intermediate Turbine Temperature
ISA	International Standard Atmoshere
J	
JETT	Jettison

K

KCAS ...... Knots Calibrated Airspeed
KEAS ...... Knots Equivalent Airspeed
kHz .... Kilohertz
KIAS ...... Knots Indicated Airspeed
KT .... Knot(s)
KTAS ...... Knots True Airspeed

L

L .... Left
LAT .... Latitude
LB .... Pound
LB/HR ..... Pounds per hour
LDG .... Landing
LDG LT .... Landing Light
LG, LDG GR Landing Gear
LON .... Longitude

M

MAC ...... Mean Aerodynamic Chord
MAG ...... Magnetic
MAN ...... Manual
MEM ...... Memory
MHz .... Megahertz
MIC .... Microphone
MKR ...... Marker

N

N .... North
NAV .... Navigation
NH .... High Turbine RPM
NL .... Low Turbine RPM
NM nm .... Nautical Miles
NORM ..... Normal

O

OAT .... Outside Air Temperature
OBS .... Obstacle
OUTBD .... Outboard
OXY .... Oxygen

P

PLA .... Power Lever Angle
PNL ...... Panel
POS IND ... Position Indicator
PPH .... Pounds per hour
PRE .... Pre-selection
PRESS .... Pressure
PWR ...... Power
PYL .... Pylon

Q

QTY .... Quantity

R

R .... Right
REC ...... Receiver
REF .... Reference
RKT .... Rocket
RPM ...... Revolution per Minute
RNG ...... Range
RNG/BRG .. Range/Bearing
RPL .... Ripple
RUD ...... Rudder

S

S .... South
SEC ...... Secondary
SEL .... Selector
SGL ...... Single
SL .... Sea Level
SQL ...... Squelch
STBY ..... Standby
STD ...... Standard
SW .... Switch
SYS ...... System(s)

T

T/O .... Take off
T/R .... Transmitter Receiver
TAS ...... True Airspeed
TCN ...... Tactical Air Navigation
TEMP ..... Temperature
TGT ...... Target
TMN ...... True Mach Number
T1 .... Low Pressure Compressor Temp.
T6 .... Exhaust Temperature

U

UHF ...... Ultra High Frequency

V

VAC vac ... Volts Alternating Current
VDC vdc .. Volts Direct Current
VHF ...... Very High Frequency
VOL ...... Volume
VOR ...... Very High Frequency

W

W .... West
WARN ..... Warning
WPN ...... Weapon
WT .... Weight

X

XMTR .... Transmitter

Y Z

ALPHABETICAL INDEX

E

F

G

H

Q

R

S

T

U

V

W

X

Y

Z