



T.O. NATO 1RF-G91-R4-1

FLIGHT MANUAL



G91-R4



20 MAY 1961
REVISED 20 JULY 1961

LIST OF EFFECTIVE PAGES

THIS PUBLICATION CONSIST OF THE FOLLOWING PAGES:

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FLIGHT HANDBOOK

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SECTION I

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AIRPLANE

The FIAT G 91 R/4 (fig. 1-1) is a lightweight strike reconnaissance fighter suitable for low altitude, high speed photographic reconnaissance or tactical missions and can also be employed in air-to-air combat.

The G 91 R/4 is a single-place, mono-jet reconnaissance aircraft with fully retractable tricycle landing gear, swept-back low wings and empennage. It is equipped with three VINTEN F95-MK 3 cameras installed in the nose and a REICHHALTER D-6B sound recorder.

The airplane is primarily designed for two types of photographic missions:

PRIMARY - High-speed, low-altitude daytime reconnaissance for perspective (photography (forward, port, and starboard)).

SECONDARY - Daytime reconnaissance for planimetric photography.

There are two pylons under each wing panel for external loads. The inner pylons can carry two auxiliary droppable fuel tanks (68.68 gals, 260 liters each) or, different combinations of weapons. The outer pylons can only carry weapons.

The airplane is powered by a BRISTOL SIDDELEY ORPHEUS MK. 80302 turbojet engine (fig. 1-2) which has a rated sea-level static thrust of 5000 pounds (2270 kgs).

Steel armor plates protect the cockpit and the most vital sections of the aircraft (fig. 1-3). The cockpit is air conditioned and pressurized and offers excellent visibility that aids in searching out and locating the targets.

The clamshell type canopy, embodying the radio compass sense aerial, can be jettisoned through the seat

THREE VIEWS

THE AIRPLANE

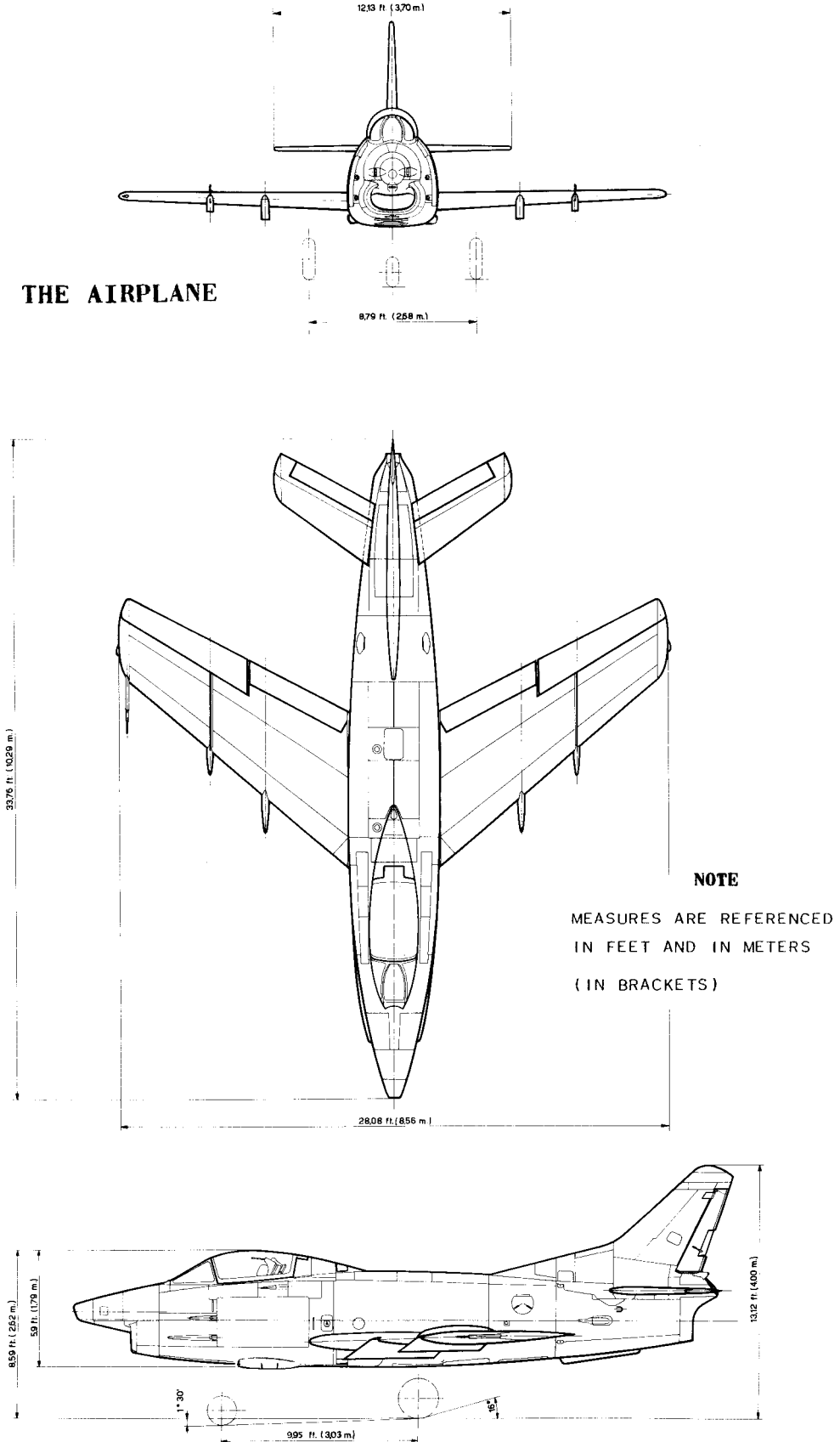


Figure 1-1

AIRCRAFT EXPLODED VIEW

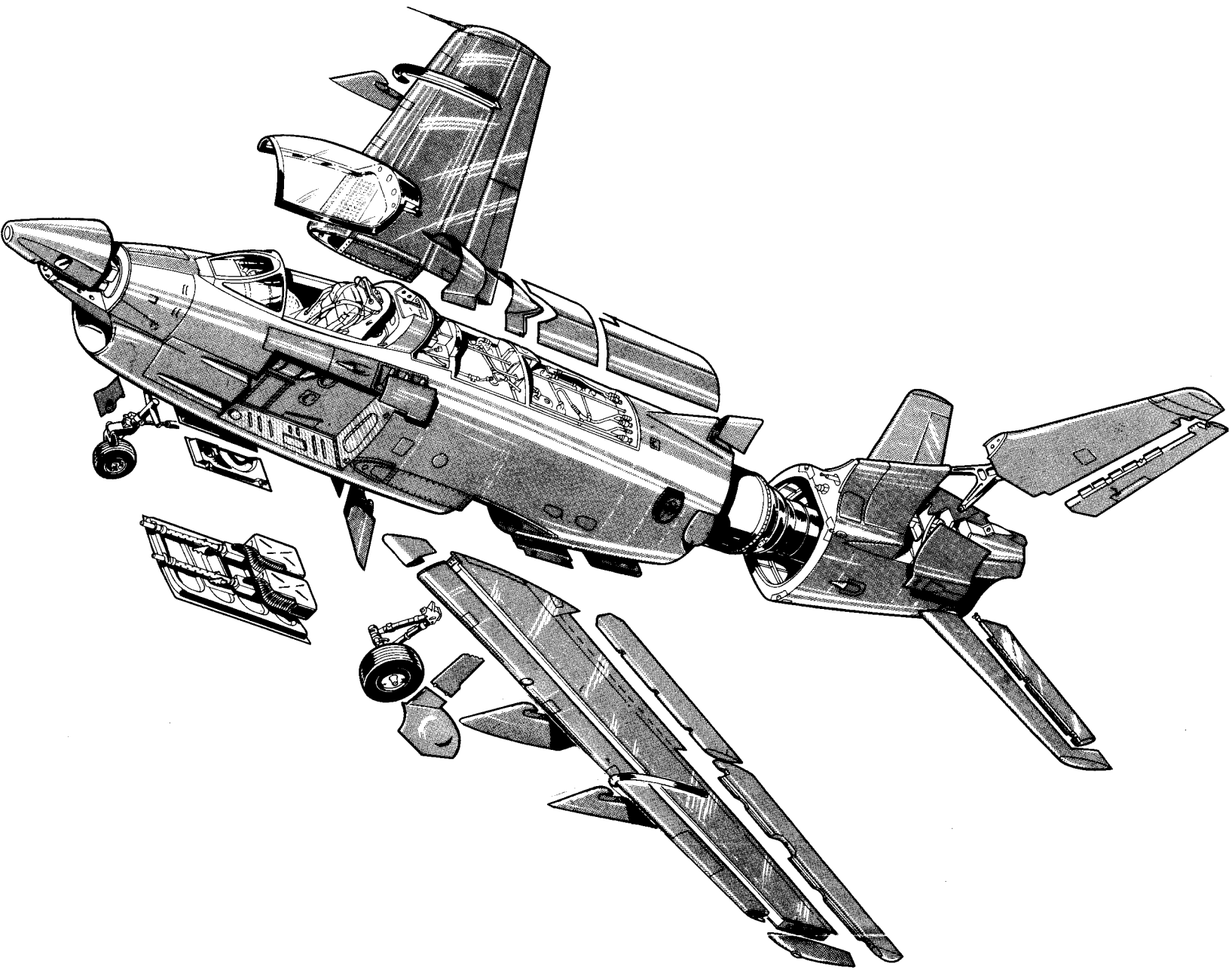
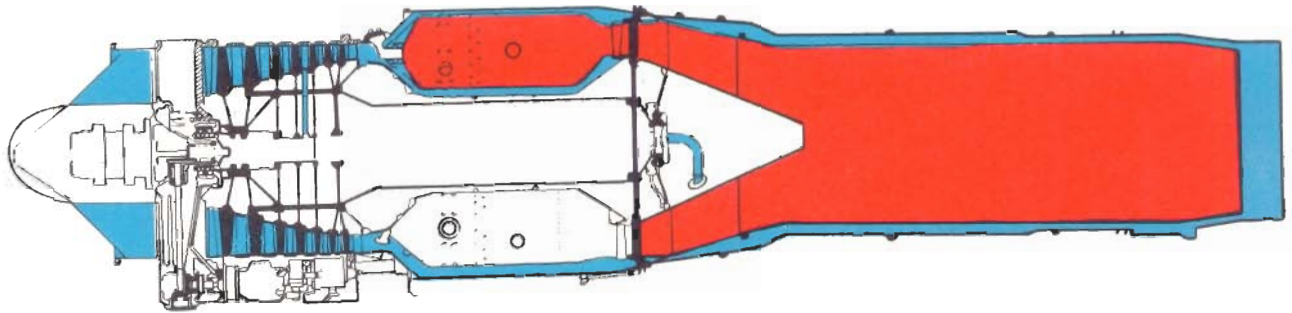


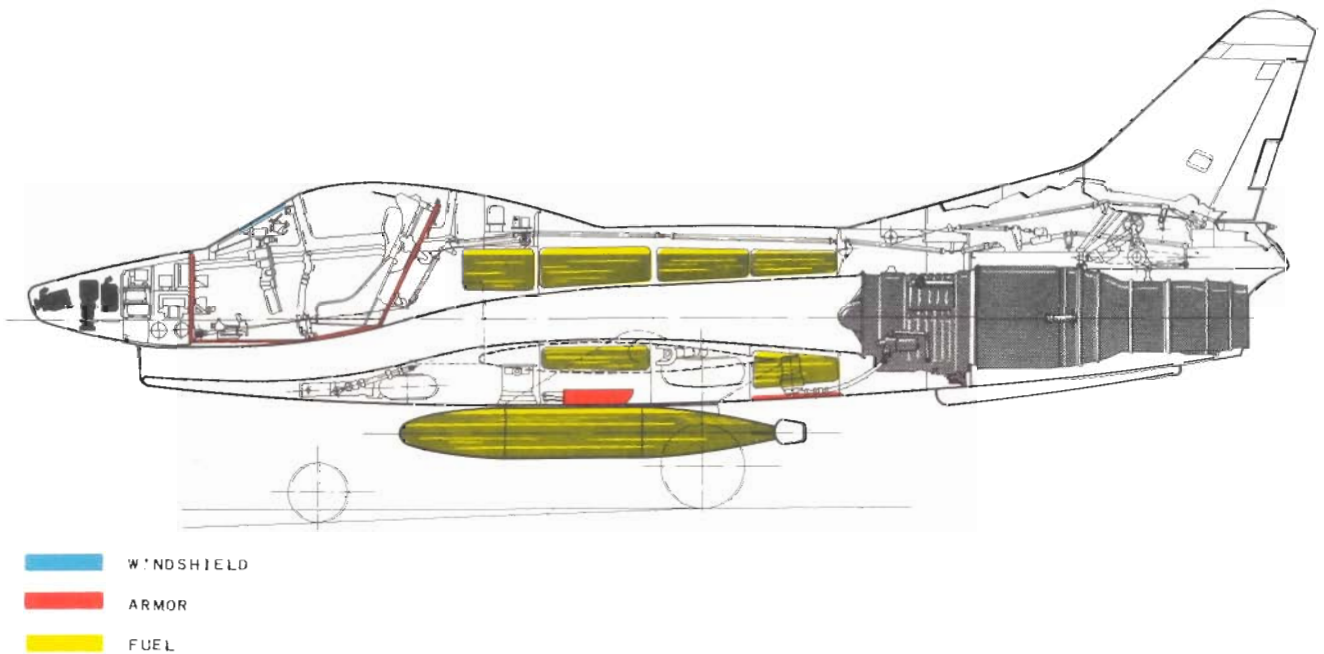
Figure 1-1/A



F-0000/A

Figure 1-2

AIRCRAFT SECTION



A-0001/B

Figure 1-3

ejection time-delay mechanism by pulling the seat firing handles or independently through a manual control.

The G91-R-4 is equipped with a Martin Baker MK-W4 ejection seat. The ejection seat has a time-delay release mechanism which makes ejection possible even at runway level.

The airplane is provided with a drag chute for additional braking on landings.

AIRPLANE DIMENSIONS

a) *Airplane*

— Length	33.76 ft	(10.29 m)
— Wing span	28.08 ft	(8.56 m)
— Height (to top of fin) . .	13.12 ft	(4.00 m)

b) *Wing*

— Wing span	28.08 ft	(8.56 m)
— Gross wing area	176.75 sq.ft	(16.42 m ²)
— Aspect ratio	4.46	
— Swept wing angle (at 25 % wing chord)	37° 13' 24"	
— Profile (normal to front spar)	NACA 65A 112 NACA 65A 111	
— Attachment thickness (normal to front spar)	12 %	
— Tip thickness (normal to front spar)	11 %	
— Angle of attack at wing attachment	+1°	
— Angle of attack at wing tip	—1°	
— Dihedral angle	+1° 30'	
— Wing twist	+2°	

c) *Ailerons*

— Gross aileron area	18.73 sq.ft	(1.74 m ²)
— Aileron chord (normal to front spar)	32 %	
— Aileron length/half wing span	0.465	
— Total rotation	±15°	

d) *Fuselage*

— Length	33.00 ft	(10.06 m)
--------------------	----------	-----------

— Height (without canopy and fin)	4.86 ft	(1.48 m)
— Width	4.59 ft	(1.40 m)

e) *Horizontal empennage*

— Span	12.14 ft	(3.70 m)
— Area	27.88 sq.ft	(2.59 m ²)
— Profile (normal to torque tube)	NACA 65A 010	
— Thickness (normal to torque tube)	10 %	
— Angle of attack	variable $\left\{ \begin{array}{l} +2^\circ \\ -5^\circ \end{array} \right.$	

f) *Vertical empennage*

— Empennage area (exclusive of fin)	18.73 sq.ft	(1.75 m ²)
— Rudder area	4.31 sq.ft	(0.40 m ²)
— Profile (normal to rear spar)	NACA 65A 010	
— Thickness (normal rear spar)	10 %	

g) *Wing flaps*

— Type	slotted	
— Gross flap area	18.69 sq.ft	(1.73 m ²)
— Width half wing span . .	1.18 ft	(0.36 m)
— Maximum travel	40°	

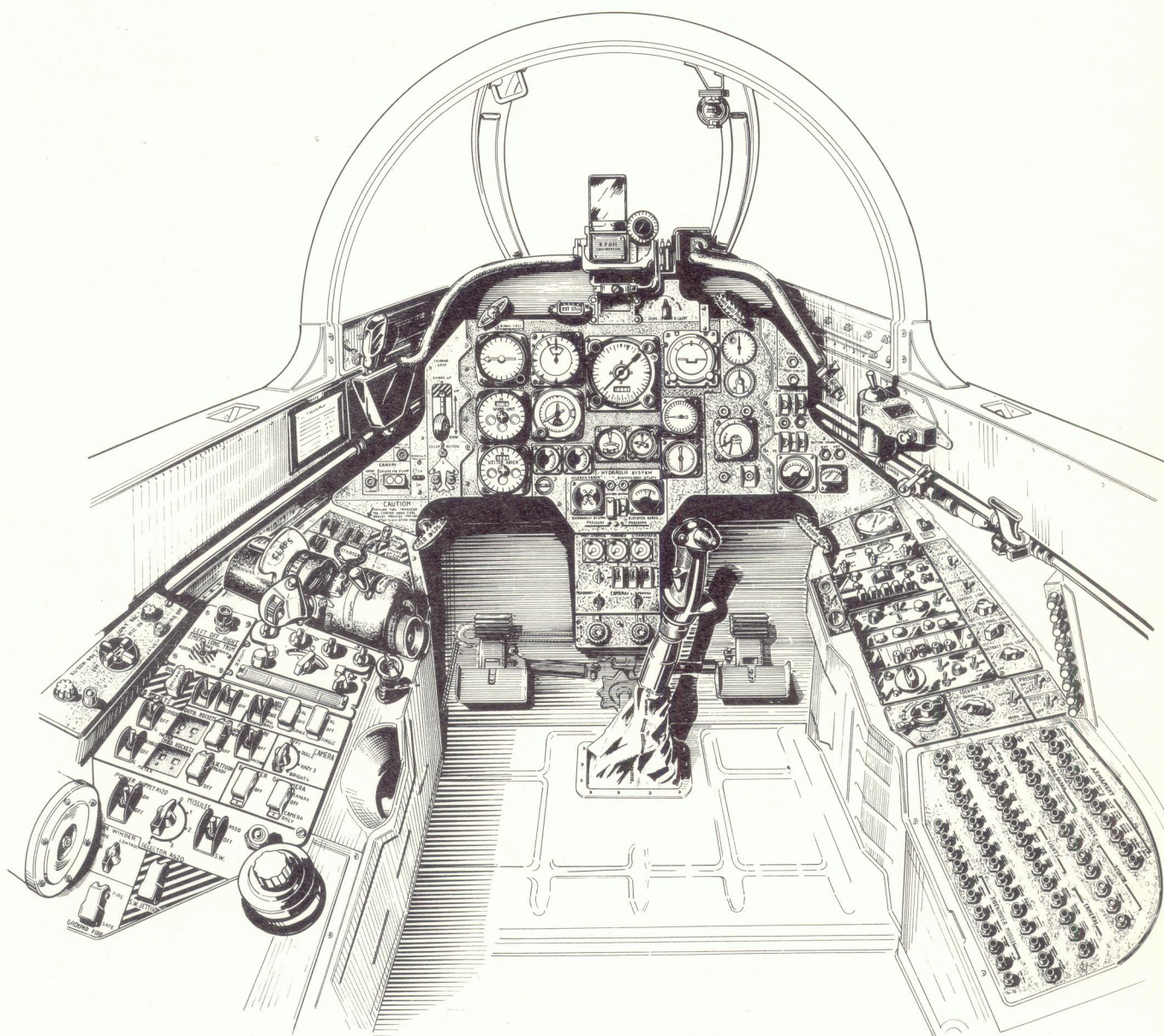
h) *Speed brakes*

— Gross speed brake area . .	7.53 sq.ft	(0.70 m ²)
— Maximum travel	50°	

i) *Landing gear*

— Main gear tread	8.79 ft	(2.68 m)
— Wheel base	9.95 ft	(3.03 m)
— Main gear		
Tire diameter	25.2 in	(0.64 m)
Tire width	9.45 in	(0.24 m)
Wheel axle travel	9.06 in	(0.23 m)
— Nose gear		
Tire diameter	16.93 in	(0.43 m)
Tire width	6.69 in	(0.17 m)
Wheel axle travel	7.87 in	(0.20 m)

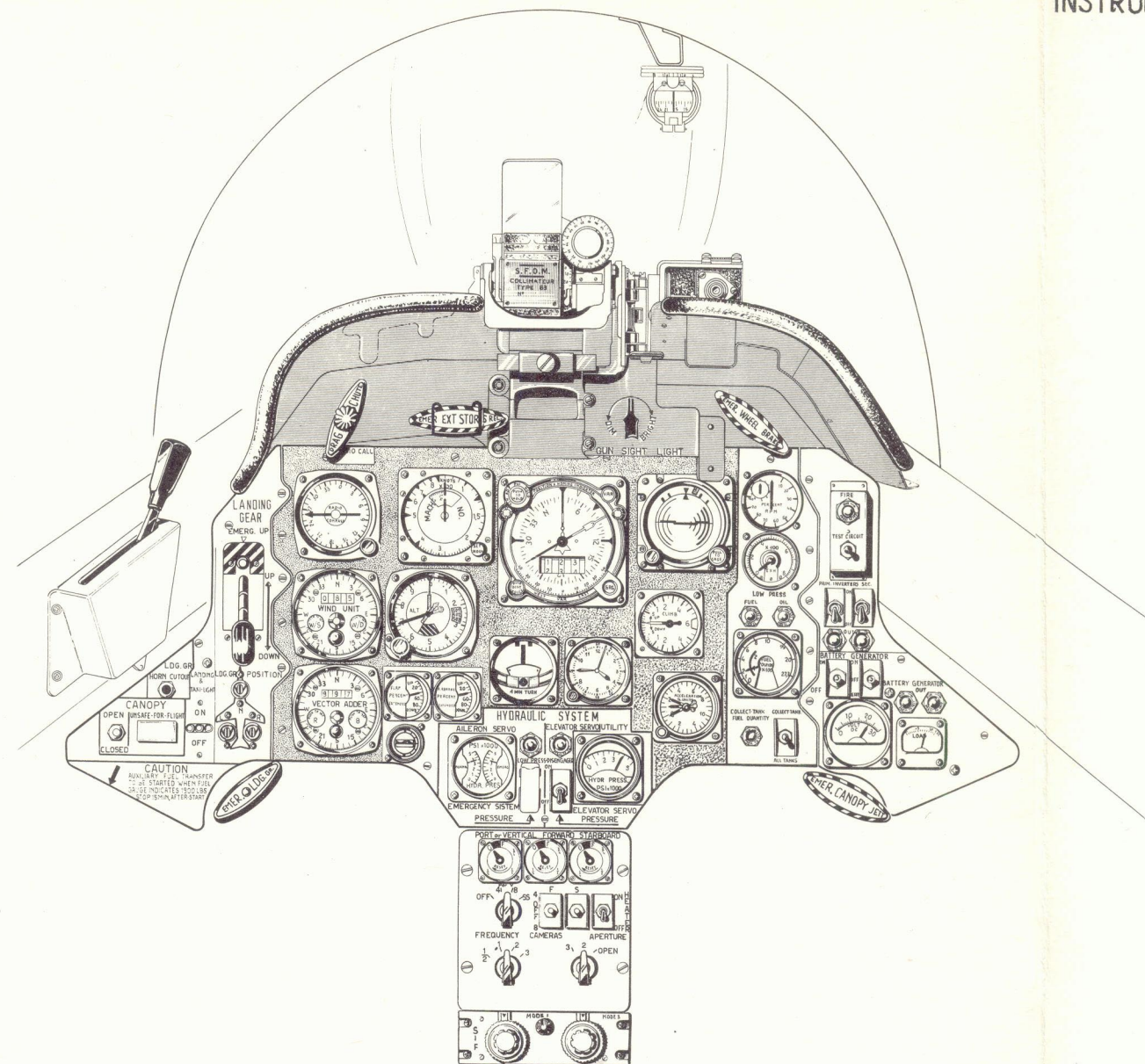
COCKPIT



A-0002/C

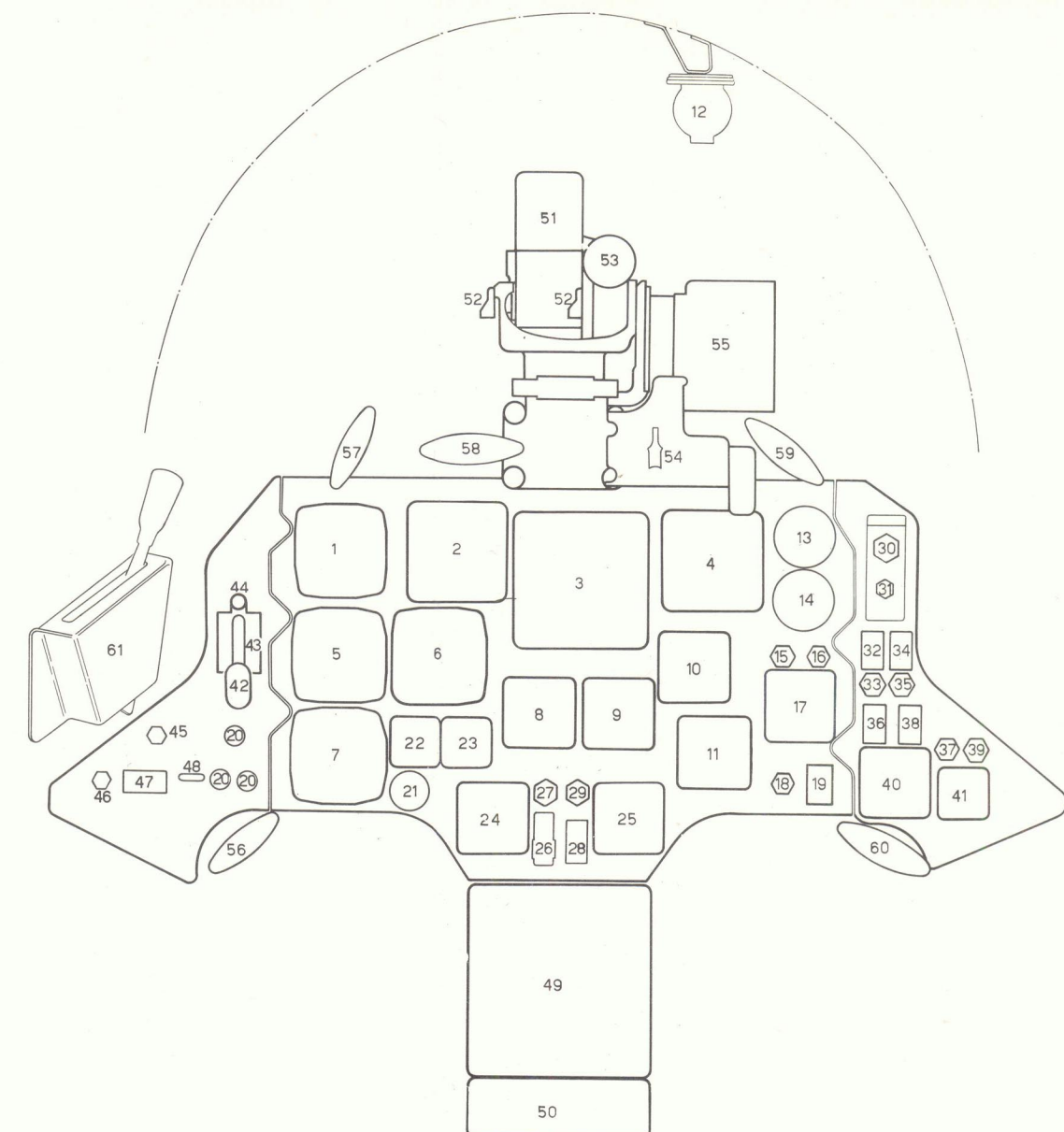
Figure 1-4

INSTRUMENT PANEL



1. RADIO COMPASS INDICATOR
2. MACH AND AIR SPEED INDICATOR
3. DIRECTIONAL INDICATOR TYPE PHI MK.3B
4. ARTIFICIAL HORIZON
5. WIND UNIT
6. ALTIMETER
7. VECTOR ADDER
8. TURN AND BANK INDICATOR
9. CLOCK
10. RATE OF CLIMB INDICATOR
11. ACCELEROMETER
12. MAGNETIC COMPASS
13. PERCENTAGE R.P.M. INDICATOR
14. EXHAUST GAS TEMPERATURE INDICATOR
15. FUEL LOW PRESSURE WARNING LIGHT
16. OIL LOW PRESSURE WARNING LIGHT
17. FUEL QUANTITY INDICATOR
18. COLLECT TANK FUEL QUANTITY WARNING LIGHT
19. FUEL QUANTITY SELECTOR SWITCH
20. LANDING GEAR POSITION INDICATOR
21. STABILIZER POSITION INDICATOR

22. WING FLAP POSITION INDICATOR
23. SPEED BRAKES POSITION INDICATOR
24. AILERON SERVO PRESSURE DUAL GAGE
25. UTILITY SYSTEM PRESSURE GAGE
26. AILERON SERVO EMERGENCY SYSTEM CONTROL SWITCH
27. AILERON SERVO NORMAL SYSTEM LOW PRESSURE WARNING LIGHT
28. ELEVATOR SERVO CONTROL SWITCH
29. ELEVATOR SERVO CONTROL DISENGAGED WARNING LIGHT
30. FIRE WARNING LIGHT
31. FIRE WARNING CIRCUIT TEST SWITCH
32. PRIMARY INVERTER CONTROL SWITCH
33. PRIMARY INVERTER OUT WARNING LIGHT
34. SECONDARY INVERTER CONTROL SWITCH
35. SECONDARY INVERTER OUT WARNING LIGHT
36. BATTERY CONTROL SWITCH
37. BATTERY OUT WARNING LIGHT
38. GENERATOR CONTROL SWITCH
39. GENERATOR OUT WARNING LIGHT
40. VOLTMETER
41. LOADMETER
42. LANDING GEAR UNLOCKED WARNING LIGHT



43. LANDING GEAR CONTROL HANDLE
44. LANDING GEAR EMERGENCY UP BUTTON
45. LANDING GEAR HORN CUTOUT BUTTON
46. CANOPY CONTROL SWITCH
47. CANOPY UNSAFE FOR FLIGHT WARNING LIGHT
48. LANDING AND TAXI LIGHT CONTROL SWITCH
49. CAMERA CONTROL PANEL
50. SIF CONTROL PANEL
51. GUN SIGHT
52. GUN SIGHT UNLOCK CONTROL FOR ELEVATION ADJUSTMENT
53. GUN SIGHT ELEVATION ADJUSTMENT KNOB
54. GUN SIGHT RECTICLE ILLUMINATION CONTROL RHEOSTAT
55. GUN CAMERA
56. LANDING GEAR EMERGENCY LOWERING HANDLE
57. DRAG CHUTE CONTROL HANDLE
58. EMERGENCY EXTERNAL STORES RELEASE HANDLE
59. EMERGENCY WHEEL BRAKE (PARKING) HANDLE
60. EMERGENCY CANOPY JETTISON HANDLE
61. CANOPY LOCK HANDLE

Figure 1-5

LEFT CONSOLE

G91 R/4
P

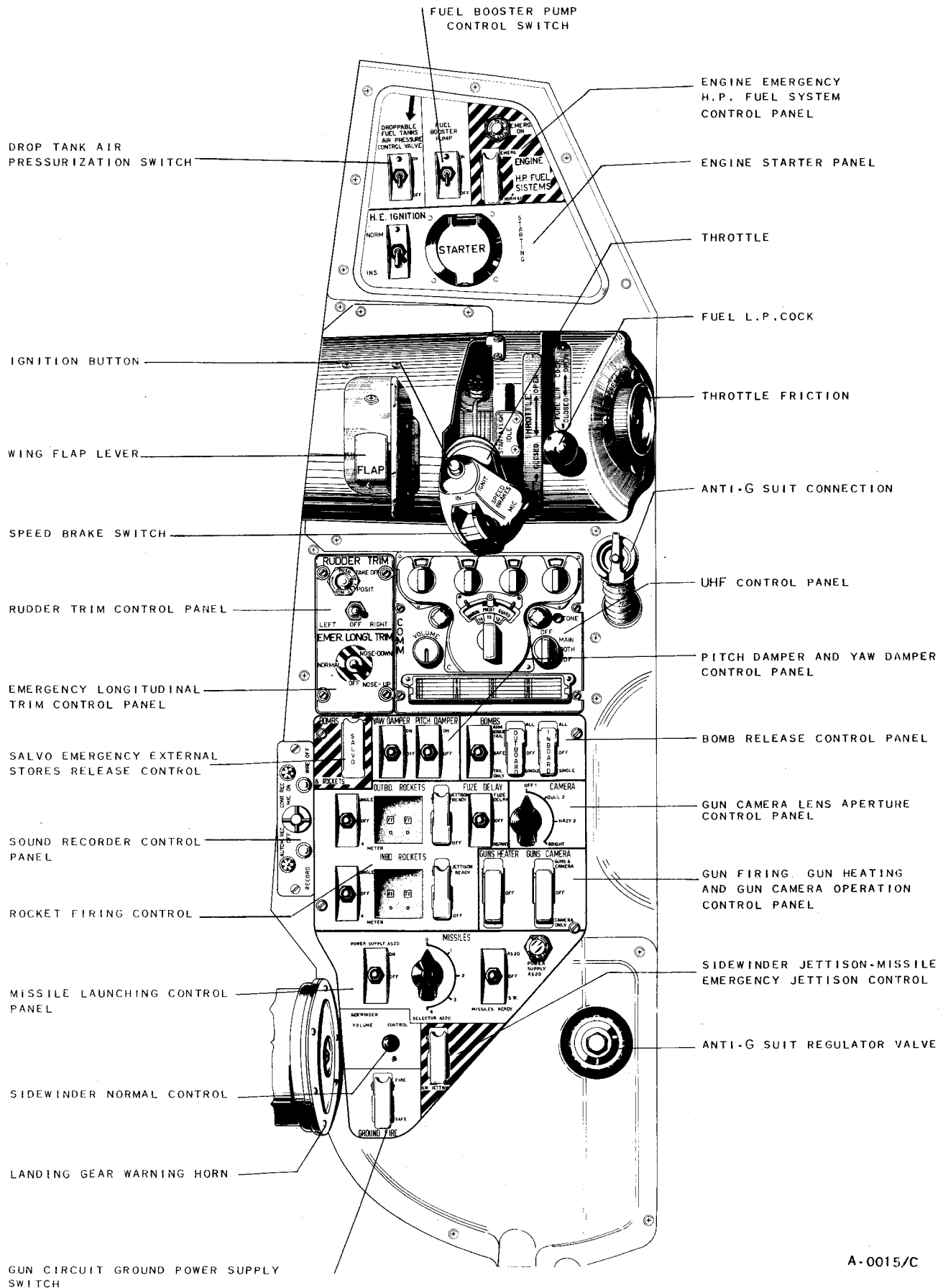


Figure 1-6

A-0015/C

RIGHT CONSOLE

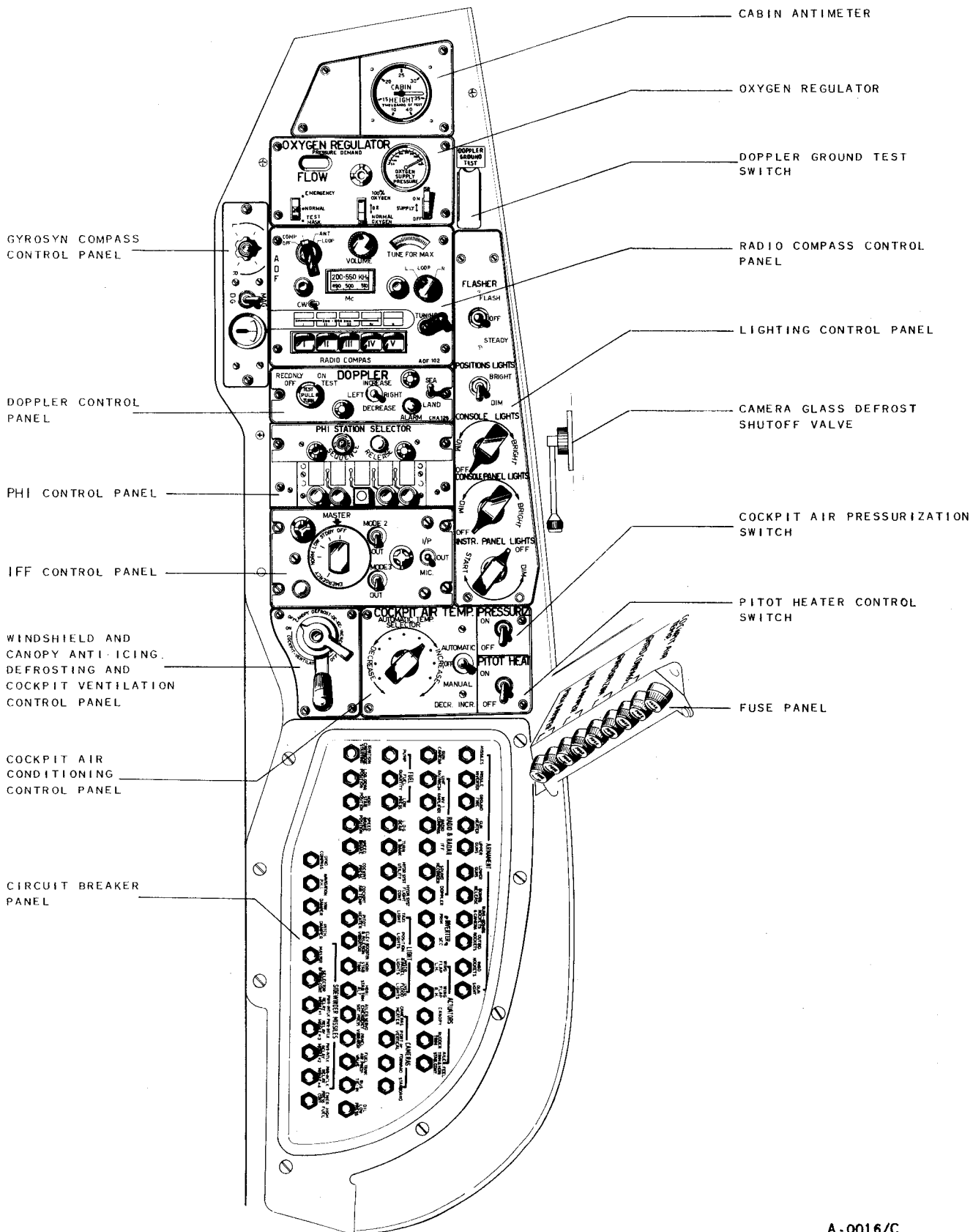


Figure 1-7

AIRPLANE WEIGHTS (provisional)a) *Reconnaissance configuration*

- Empty weight (with 2 pylons including mounts, feed belts and ammunition boxes for 4 guns (C.G. 39.01%). 6834 lbs (3100 kg)
- Take-off gross weight (including pilot, 3 cameras, 1 sound recorder, (1600 lbs) 2776 lbs of internal fuel and (520 lbs) 900 lbs of drop tanks fuel, 4 guns and 720 50 cal. rounds) (C.G. 21.24%) 11755 lbs (5332 kg)
- Landing weight with 253 lbs (115 Kgs) of fuel remaining, ammunition expended, and 2 empty drop tanks (C.G. 22.53%) 8243 lbs (3739 kg)

b) *Strike configuration with two 500-pound bombs*

- Empty weight (as item a) (C.G. 39.01%) 6834 lbs (3100 kg)
- Take-off gross weight (including pilot, (1600 lbs) 2776 lbs internal fuel, 2 500-pound bombs, 4 guns, and 1200 50 cal. rounds) (C.G. 21.54%) 11817 lbs (5360 kg)
- Landing weight with 253 lbs (115 kgs) of fuel remaining, ammunition expended (C.G. 23.52%) 8144 lbs (3694 kgs)

c) *Strike configuration with 12 3-inch rockets*

- Empty weight (as item a) (C.G. 39.01%) 6834 lbs (3100 kgs)
- Take-off gross weight (including, pilot, 2776 lbs (1600 lbs) of internal fuel, 2 rocket launchers, 12 3-inch rockets, guns and 1200 50 cal. rounds) (C.G. 23.47%) 11140 lbs (5053 kgs)
- Landing weight (with 253 lbs (115 kgs) of fuel remaining, 2 rocket launchers, and ammunition expended) (C.G. 23.47%) 8232 lbs (3734 kgs)

d) *Strike configuration with 4 250-pound bombs*

- Empty weight (with 4 pylons and including mounts, feed belts and ammunition boxes for 4 guns) (C.G. 39.21%) 6894 lbs (3127 kgs)
- Take-off gross weight (including pilot, 2776 lbs (1600 lbs) of internal fuel, 4 250-pound bombs, 4 guns and 1200 50 cal. rounds) (C.G. 23.23%) 11876 lbs (5387 kgs)
- Landing weight (ammunition expended and 253 lbs (115 kgs) of remaining fuel) (C.G. 23.77%) 8203 lbs (3721 kgs)

e) *Strike configuration with 4 AS-20 missiles*

- Empty weight (with 4 pylons and including mounts, feed belts and ammunition boxes for 2 guns) (C.G. 40.05%) 6843 lbs (3104 kgs)
- Take-off gross weight (including pilot, 2776 lbs (1600 lbs) of internal fuel, 4 missile pylons, 4 AS-20 missiles, 2 guns and 600 50 cal. rounds) (C.G. 23.47%) 12083 lbs (5481 kgs)
- Landing weight (ammunition expended, 4 missile pylons, and 253 lbs (115 kgs) of remaining fuel) (C.G. 26.10%) 8216 lbs (3727 kgs)

f) *Strike configuration with 4 SIDEWINDER missiles*

- Empty weight (as in item d) (C.G. 39.21%) 6894 lbs (3127 kgs)
- Take-off gross weight (including pilot, 2776 lbs (1600 lbs) of internal fuel, 4 type 3B pylons, 4 SIDEWINDER missiles, 4 guns, and 1200 50 cal. rounds) (C.G. 22.53%) 11700 lbs (5307 kgs)
- Landing weight (ammunition expended, 4 type 3B pylons and 253 lbs (115 kgs) of remaining fuel) (C.G. 23.62%) 8411 lbs (3815 kgs)

g) *Strike configuration with 100 2-inch rockets*

- Empty weight (as item d)
(C.G. 39.21 %) 6894 lbs (3127 kgs)
- Take-off gross weight (including pilot, 2776 lbs (1600 lbs) of internal fuel, 4 rocket launchers, 100 2-inch rockets, 4 guns, and 720 50 cal. rounds) (C.G. 21.02 %) 12039 lbs (5461 kgs)
- Landing weight (ammunition expended, 4 rocket launchers, and 253 lbs (115 kgs) of remaining fuel) (C.G. 25.11 %) 8686 lbs (3940 kgs)

h) *Strike configuration with 2 250-pound bombs and drop tanks (OVERLOADED)*

- Empty weight (as item d)
(C.G. 39.21 %) 6894 lbs (3127 kgs)
- Take-off gross weight (including pilot, 2776 lbs (1600 lbs) of internal fuel and 253 lbs (250 lbs) of auxiliary fuel, 2 250-pound bombs, 4 guns, and 720 50 cal. rounds) (C.G. 23.82 %) 12253 lbs (5558 kgs)
- Landing weight (ammunition expended, 2 empty drop tanks, and 253 lbs (115 kgs) of fuel remaining) (C.G. 24.42 %) 8241 lbs (3738 kgs)

i) *Strike configuration with 2 500-pound bombs and 2 AS-20 missiles (OVERLOADERD)*

- Empty weight (as item e)
(C.G. 40.05 %) 6843 lbs (3104 kgs)
- Take-off gross weight (including pilot, 2776 lbs (1600 lbs) of internal fuel, 2 500-pound bombs, 2 missile pylons, 2 AS-20 missiles, 2 guns, and 360 50 Cal. rounds) (C.G. 24.81 %) 12293 lbs (5576 kgs)
- Landing weight (ammunition expended, 2 missile pylons, and 253 lbs (115 kgs) of remaining fuel) (C.G. 26.05 %) 8089 lbs (3669 kgs)

TYPICAL RATIOS

Airplane configuration	Take-off wing load lbs/ft	Load-to-thrust ratio at take-off lb/lb
a) Reconnaissance	66.50	2.35
b) Strike with 2 500-pound bombs	66.85	2.36
c) Strike with 12 3-inch rockets	63.02	2.23
d) Strike with 4 250-pound bombs	67.19	2.37
e) Strike with 4 AS-20 missiles	68.36	2.42
f) Strike with 4 SIDEWINDER missiles	66.19	2.34
g) Strike with 100 2-inch rockets	68.11	2.41
h) Strike with 2 250-pound bombs and 2 AS-20 missiles (OVERLOADED)	69.32	2.45
i) Strike with 2 500-pound bombs and drop tanks (OVERLOADED)	69.55	2.46

RECONNAISSANCE CAMERA SYSTEM

The reconnaissance camera system of the G91-R/4 consists of three VINTEN F95 MK.3 cameras (fig. 4-18) located in the nose of the aircraft. The cameras are arranged:

- A forward perspective camera installed in the forward nose has its fixed optical axis inclined 15° down and forward to the longitudinal axis of the aircraft.

- Two lateral cameras (port and starboard) located behind the forward camera have their optical axes inclined 15° downward to the horizon and 90° to the airplane course.

The three cameras are used for the execution of primary missions while the port camera is used for secondary missions. This camera is located to serve for either lateral perspective photography or for high altitude or low altitude vertical planimetric photography. During vertical photography, an intervalometer is used with the camera to control the frequency of the pictures during camera operation.

The CAMERA control panel with a counter for each camera is located below the hydraulic system pressure gages on the instrument panel.

The camera sighting system consists of a sight for the forward camera and two recticles fitted to the canopy frame for the two lateral cameras. Camera operation is controlled by a button on the forward lower left side of the control stick grip (fig. 1-19).

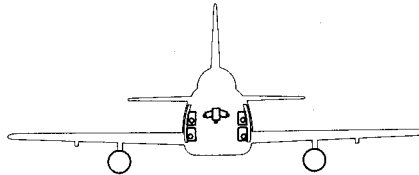
AIRPLANE CONFIGURATIONS

BASIC ARMAMENT

ADDITIONAL ARMAMENT

RECONNAISSANCE

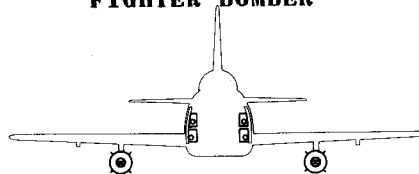
FOUR .50 CAL GUNS (720 ROUNDS)



TWO DROP TANKS (900 LBS OF FUEL)
THREE CAMERAS

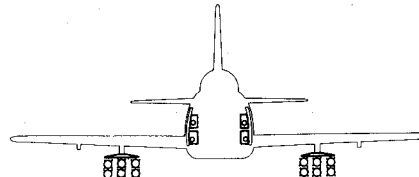
FIGHTER-BOMBER

FOUR .50 CAL GUNS (1200 ROUNDS)



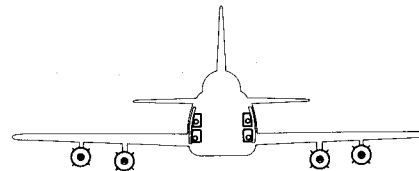
TWO 500-POUND BOMBS

FOUR .50 CAL GUNS (1200 ROUNDS)



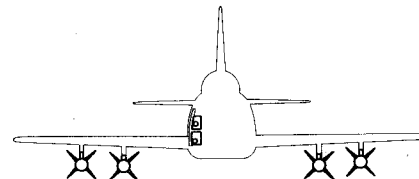
TWELVE 3-INCH ROCKETS

FOUR .50 CAL GUNS (1200 ROUNDS)



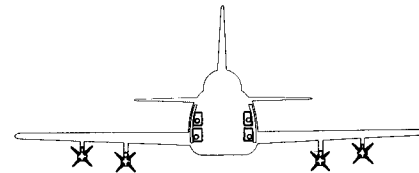
FOUR 250-POUND BOMBS

TWO .50 CAL GUNS (600 ROUNDS)



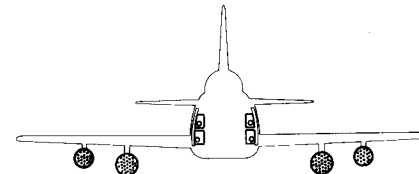
FOUR AS-20 MISSILES

FOUR .50 CAL GUNS (1200 ROUNDS)



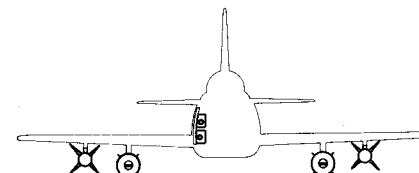
FOUR SIDEWINDER MISSILES

FOUR .50 CAL GUNS (720 ROUNDS)



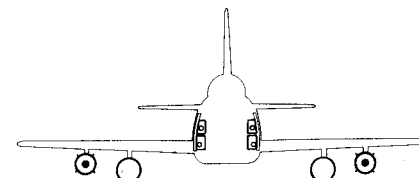
HUNDRED 2-INCH ROCKETS

TWO GUNS (360 ROUNDS)



TWO 500-POUND BOMBS
TWO AS-20 MISSILES (OVERLOADED)

FOUR GUNS (720 ROUNDS)



TWO DROP TANKS (900 LBS OF FUEL)
TWO 250-POUND BOMBS (OVERLOADED)

Figure 1-8

A REICHHALTER D-6B sound recorder permits the recording of comments during reconnaissance operation. The recorder control panel is located on the left cockpit console panel outboard of the armament controls. The sound recorder is operated by the throttle and control stick radio MIC buttons.

ARMAMENT

The armament of the G91-R/4 consists of the basic and additional armament (fig. 1-8).

BASIC ARMAMENT

The basic armament consists of four 300-round 50 cal. (12.7 mm) Browning Colt M3 guns mounted in two gun panels (two guns in each panel) on the fuselage sides forward of the wing attachments.

NOTE The left gun panel is replaced with an auxiliary panel when the AS-20 missile jettison and guidance system is used.

ADDITIONAL ARMAMENT

The following combination of weapons can be installed on the wing pylons (2 on each wing) as additional armament equipment:

<i>2 inner pylons</i>	<i>2 outer pylons</i>
2 500-pound bombs	—
12 3-inch rockets	—
2 250-pound bombs	2 250-pound bombs
2 AS-20 missiles	2 AS-20 mixsiles
2 SIDEWINDER missiles	2 SIDEWINDER missiles
62 2-inch rockets	38 2-inch rockets
2 500-pound bombs	2 SIDEWINDER missiles
(2 drop tanks)	2 250-pound bombs

GUN CAMERA

The BELL & HOWELL KB-3A gun camera is located next to the gun sight above the instrument panel. It is electrically powered and utilizes 16 mm films. The gun camera shoots thorough the armored windshield glass and can be used with or without firing the guns. It can operate at 16,32 or 64 frames per second.

GUN SIGHT

The SFOM type 83A reflection type gun sight is located in mid position on top of the instrument panel.

ENGINE

GENERAL

The Bristol Siddeley Orpheus MK 80302 is a straight flow turbojet engine with a seven-stage axial compressor driven by a single stage turbine. The maximum sea level static thrust rating is 5000 pounds (2270 kgs). Air is supplied to the compressor inlet through a duct from the air intake under the nose of the aircraft. There is no provision for anti-icing the engine or the intake.

The combustion system consists of seven separate flame tubes within an annular chamber. Each flame tube has a duplex burner fed from a flow distributor in the Combined Control Unit (C.C.U.) of the engine fuel system. The flow distributor receives high pressure fuel through a combined throttle valve and high pressure cock supplied by a Lucas D-size pump with a hydro-mechanical governor driven by the engine. The electric ignition system is a B.T.H. high energy system with two igniters in flame tubes No. 4 and No. 7 which are connected to the other five tubes by interconnector tubes.

The starter system comprise a B.T.H. cartridge starter with two cartridge breeches that are electrically selected and fired. Engine oil pressure prevents the starter jaw from being engaged when the engine is running or windmilling.

The engine oil tank is mounted on the engine and is equipped to provide an oil supply during short periods of negative «G». There is no oil cooler.

Two compressor bleeds from the compressor 7th stage are used for cockpit pressurization, air-conditioning, and fuel tank pressurization. The jet pipe and shroud are cantilever mounted directly on the engine. Two thermocouples and a single Lucas exhaust gas temperature limiter are installed in the tail pipe. The nozzle is fitted with trimmers.

Engine driven accessories are a 6 kw Labinal D.C. generator and a Messier hydraulic pump.

A fireproof bulkhead isolates the engine combustion system and hot parts from the cool zone that contains the engine fuel and oil systems and accessories. This airplane has a fire detector system but no fire extinguisher system.

ENGINE FUEL SUPPLY SYSTEM

Fuel is contained in nine pressurized fuel cells in the fuselage and in two pressurized droppable fuel tanks under the wings. Fuel flows through the hydraulically driven flow-proportioner, that maintains a constant center of gravity for the aircraft, into No. 5 cell. No. 5



F-0001/A

cell has a submerged electric booster-pump that incorporates an inverted flight device. This booster-pump delivers fuel (fig. 1-12) through a low-pressure cock (manually selected from the cockpit by the FUEL L.P. cock lever in the throttle group), and a low-pressure fuel filter to the engine driven high-pressure pump. A pressure switch is incorporated in the filter and when outlet pressure of the filter drops below 5 p.s.i. because the filter is clogged or because the booster-pump has failed, the switch closes an electric circuit and lights the FUEL LOW PRESSURE red warning light. This «push-to-test» type light is located on the left of the fuel quantity indicator on the instrument panel.

HIGH PRESSURE FUEL SYSTEM

THE THROTTLE

The pilot's only control of the engine is the throttle located on the left cockpit console (fig. 1-10). It is mechanically connected to the combined throttle valve and high pressure cock of the engine. Located on top of the throttle lever are the «SPEED BRAKE» selector switch, the «IGNIT» button for relight in flight and the «MIC» button.

The throttle quadrant marked «STOP», «CLOSED», «OPEN» has three detents for the throttle lever; one at STOP, giving high pressure cock shut off; one at «START AND FLIGHT IDLE», giving minimum r.p.m.; and the third at full forward for maximum thrust. Throttle friction can be regulated by means of «THR. FRICTION» adjuster by turning the hand-wheel clockwise to «INCREASE». Between the throttle lever and the friction adjuster is the fuel low-pressure cock (L.P. cock). Its two positions are CLOSED (back) and OPEN (forward).

THE ENGINE-DRIVEN FUEL PUMP

The engine-driven high pressure fuel pump is a variable stroke pump controlled by a servo-pressure system. The metered fuel flow is a function of servo pressure regulated by the components of the fuel control system.

THE COMBINED CONTROL UNIT (C.C.U.)

High pressure fuel is delivered to the *Combined Control Unit* (C.C.U.) which contains the *Throttle-Valve* (for the pilot to vary the engine r.p.m.) combined with the *High-Pressure Cock* (for stopping the engine) and is connected to the pilot's throttle lever. From the throttle valve, the fuel flows to the *Fuel Flow Distributor* and *Dump Valve* also contained in the C.C.U.

and then by the primary and secondary circuits, to the Duplex burners. The distributor and the Duplex burners ensure proper atomization of fuel at low and high flow rates. The dump valve is kept closed by primary pressure when the throttle valve is open and the engine is running or windmilling. When the engine is shut down by moving the throttle to STOP, pressure falls and a spring opens the dump valve which drains all fuel contained in the primary manifold overboard.

THE BAROMETRIC PRESSURE CONTROL (B.P.C.)

The C.C.U. contains the *Barometric Pressure Control* (B.P.C.) which, at any fixed setting of the throttle automatically controls fuel flow and r.p.m. during changes of air speed and altitude.

THE EGT LIMITER

The EGT limiter is installed in the tail pipe and by a pneumatic signal, via the Venturi tube connected to the B.P.C., overrides the B.P.C. and reduces fuel flow to prevent the E.G.T. from exceeding the maximum limit. During take-off and initial climb the r.p.m. is governed at 100% when it is necessary due to high ambient temperature. The EGT limiter is not effective during rapidly changing conditions of fuel flow such as rapid throttle opening. The controlled EGT increases with altitude and above 15,000 feet it might be necessary to retard the throttle to avoid exceeding the 730° C maximum limit.

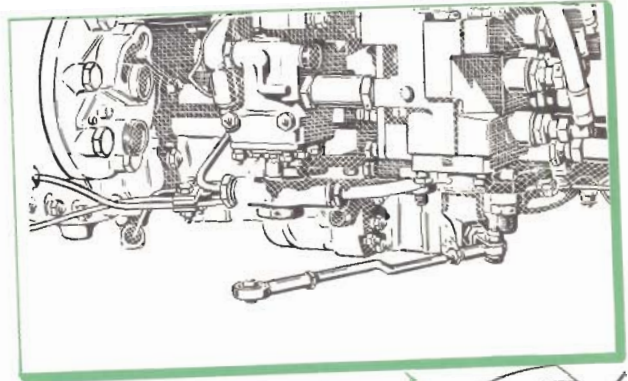
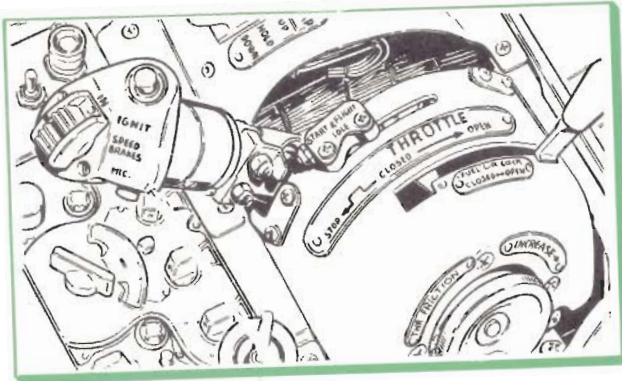
THE OVERSPEED GOVERNOR

Excessive r.p.m. at full throttle is prevented by an overspeed governor in the engine's fuel pump; this is set to 100% maximum on the ground. Governed r.p.m. do not vary much with a change in fuel density, but it increases with altitude and tend to diminish with an increase in air-speed. Maximum in flight is 101% and overspeed should not exceed 103% or last for more than 20 seconds.

THE AIR/FUEL RATIO CONTROL (AFRC) WITH p_2/P_0 SWITCH

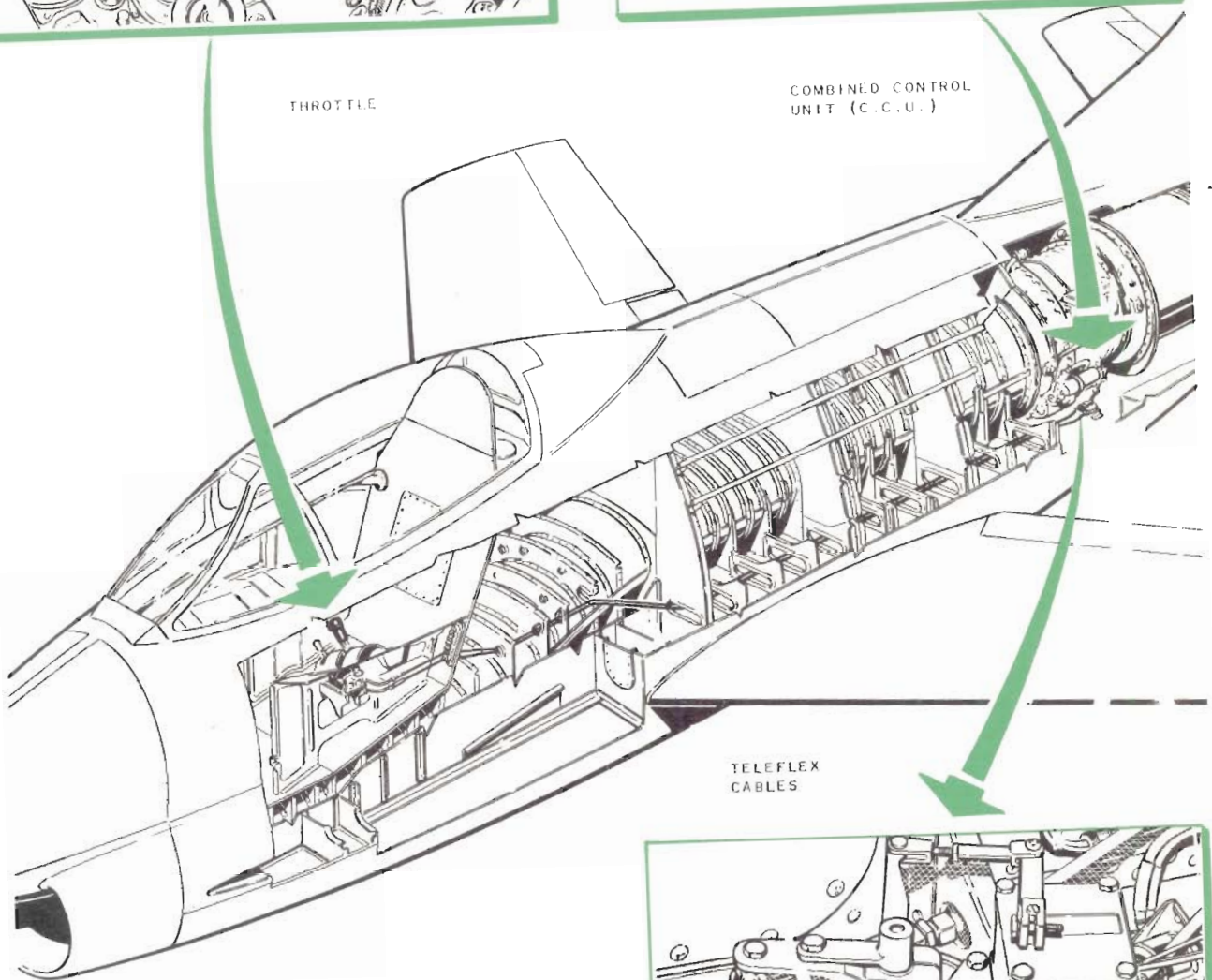
At all altitudes up to 30,000 feet, when the throttle is opened rapidly the rate of increase of fuel flow to the burners is limited by the A.F.R.C. to avoid compressor stall or excessive EGT. On the ground the A.F.R.C. is set to give acceleration from 40% r.p.m. to 2% less than the available maximum r.p.m. in five to eight seconds after a throttle slam to OPEN. Acceleration times vary directly with ambient temperatures.

ENGINE CONTROL UNIT



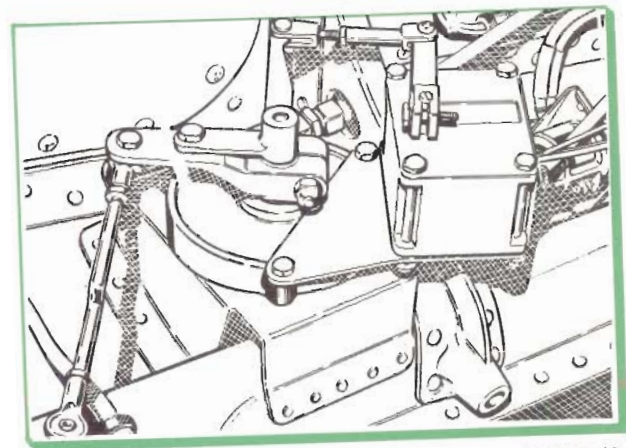
THROTTLE

COMBINED CONTROL UNIT (C.C.U.)



TELEFLEX CABLES

TELEFLEX BOX TO THROTTLE VALVE CONTROL LEVER CONNECTING ROD



F-0005/C

Figure 1-10

THE PRESSURE-RATIO LIMITER (PRL)

This automatic control in the engine's fuel system prevents the compressor pressure-ratio from becoming excessive at full throttle. It reduces the maximum flow of fuel permitted by the B.P.C. to limit the ratio of compressor r.p.m. and relative temperature to a safe value. Above 30,000 feet the maximum available engine r.p.m. at full throttle may be limited to around 90% at conditions of low Mach No. and ambient temperature. When the P.R.L. is active, engine r.p.m. at full throttle will be limited to below 100% and varies directly with ambient temperature and Mach No.

ENGINE EMERGENCY FUEL SYSTEM

An emergency fuel system, controlled by a warning light and a switch located in the left console of the cockpit, may be installed in this aircraft. Description of system will be issued as soon as data is available.

IGNITION SYSTEM

During ground starts, ignition is provided by moving the H.E. Ignition switch to «NORM» and pressing the «STARTER» button. The two H.E. coil groups are supplied with 28V D.C. and a starter cartridge is fired. The booster coils supply current to the two igniter plugs mounted in Nos. 4 and 7 flame-tubes. The ignition of the fuel in these two flame-tubes progresses through the interconnectors to the remaining tubes. A time switch is provided to cut ignition 30 secs. after the «STARTER» button has been pressed.

For a relight in flight with the engine windmilling, the H.E. ignition switch is moved to «NORM» and the «IGNIT» button on top of the throttle grip is pressed. (Refer to air start procedure in Section III). This avoids firing a starting cartridge.

WARNING Make sure that the H.E. IGNITION button is at NORM.

The IGNIT button may be depressed for 15 seconds, which is maximum throttle open time in case of an unsuccessful relight, and should be released when the engine r.p.m. has reached 40% after a successful relight.

TURBOSTARTER

The engine has a cartridge turbostarter located at the front of the engine inside the air intake bullet. The turbostarter has a single-stage turbine driven by the expansion of the cartridge combustion gases which are

fed to the starter through two stainless steel lines from the cartridge breeches. Each breech has a safety valve which opens at 1200 p.s.i. (84.5 kg/cm²). The turbine exhausts to atmosphere through a duct.

The starter turbine transmits power to the engine compressor shaft by means of a toothed jaw which is automatically disengaged by rising engine oil pressure. Low oil pressure during engine operation or windmilling might permit the jaw to engage and become damaged.

Depressing the STARTER button electrically ignites one cartridge through the breech selector, and the time switch prevents the second cartridge from being selected of fired until 30 seconds have elapsed.

CAUTION Precautions before loading and reloading starter breeches are given in Section II.

ENGINE OIL SYSTEM

The engine bearings and accessory drives are lubricated by oil contained in a tank mounted on the left side of the engine compressor.

NOTE Only the oils specified in Section V may be used.

Oil tank capacity is 22.8 pints (10.79 lt) of which 8.39 pints (3.97 lt) are usable. Engine oil consumption at maximum r.p.m. is 2.4 pints (1.14 lt) per hour maximum and 1.8 pints (0.85 lt) per hour minimum.

WARNING The maximum permissible consumption is 2.4 pints (1.14 lt) per hour which limits the duration of level flight to 3 hours 15 minutes. Oil limitations are given in Section V.

From the tank, oil is routed to the main pump which sends it under pressure through a non-return valve to two lines. One line routes the oil through a filter to the engine front bearing, and then by means of an auxiliary pump, filter, and scavenge pump, oil is returned to the tank. The other line routes oil through a filter to a metering pump with two lines. The first line supplies oil to the accessory drives before returning to the oil supply tank through a filter and the scavenge pump. The second line supplies oil to the rear bearing through a non-return valve and this oil is lost through the tail pipe.

Incorporated in the main oil pump and alongside the non-return valve is a pressure relief valve that limits maximum pressure in the system to 55 p.s.i.

Normal oil pressure is 45 p.s.i. The oil low pressure warning light comes on. When the operating pressure is below 25 ± 2 p.s.i. light comes on. The light should normally be out at 40% r.p.m. and above.

WARNING The oil low pressure warning light should be out during the entire operating range of the engine. With the engine hot and running at low r.p.m. the warning light may come on. If on the ground, immediately shut down the engine and have oil system pressure checked. If airborne, proceed as specified under « OIL SYSTEM FAILURE » in Section III.

ENGINE INSTRUMENTS AND INDICATORS

The **tachometer** is calibrated from 0% to 100% r.p.m. and has two pointers. The large dial pointer indicates tens from 0 to 100, and the small dial pointer indicates units from 0 to 9.

The **exhaust gas temperature indicator** is calibrated from 0° C to 800° C in 20° increments.

The **fuel quantity indicator** has two scales: one graduated from 0 to 2730 lbs with intermediate grad-

Oil low pressure warning light illuminates when the engine oil pressure drops below 25 ± 2 p.s.i.

The **fire warning light** comes on when the temperature around any one of the ten fire detectors rises above 274° C.

FUEL SYSTEM

The fuel system (fig. 1-12) consists of 11 fuel tanks: nine fuel cells in the fuselage and two 68.9 gal. (260-liter) droppable fuel tanks under the wings.

The fuselage cells, consisting of two interconnected cell groups (forward and aft) and a manifold cell (No. 5), are serviced through the filler nozzles of cells 2RH and 3RH where fuel drains into the remaining cells. The drop tanks are refueled through their respective filler necks.

NOTE Only fuels specified in Section V may be used.

The following table illustrates fuel distribution in the airplane:

Cell group	Cell No.	lt	kg	Imp. gall.	U.S. gall.	lbs
Forward . . .	1-2LH-2RH-4	790	620	174	209	1367
Aft	3LH-3RH-3 ¹ LH-3 ¹ RH	650	510	143	172	1124
Manifold . .	5	160	126	35	42	277
Auxiliary . .	6L-6R5	520	409	114	137	900
	Total	2120	1665	466	560	3668

uations for the indication of total quantity of fuel; the second one is graduated from 0 to 250 lbs for the indication of collect tank fuel quantity.

A warning light COLLECT TANK FUEL QUANTITY ON and a switch are installed below the instrument. The switch has two positions « COLLECT TANK » and « ALL TANKS ».

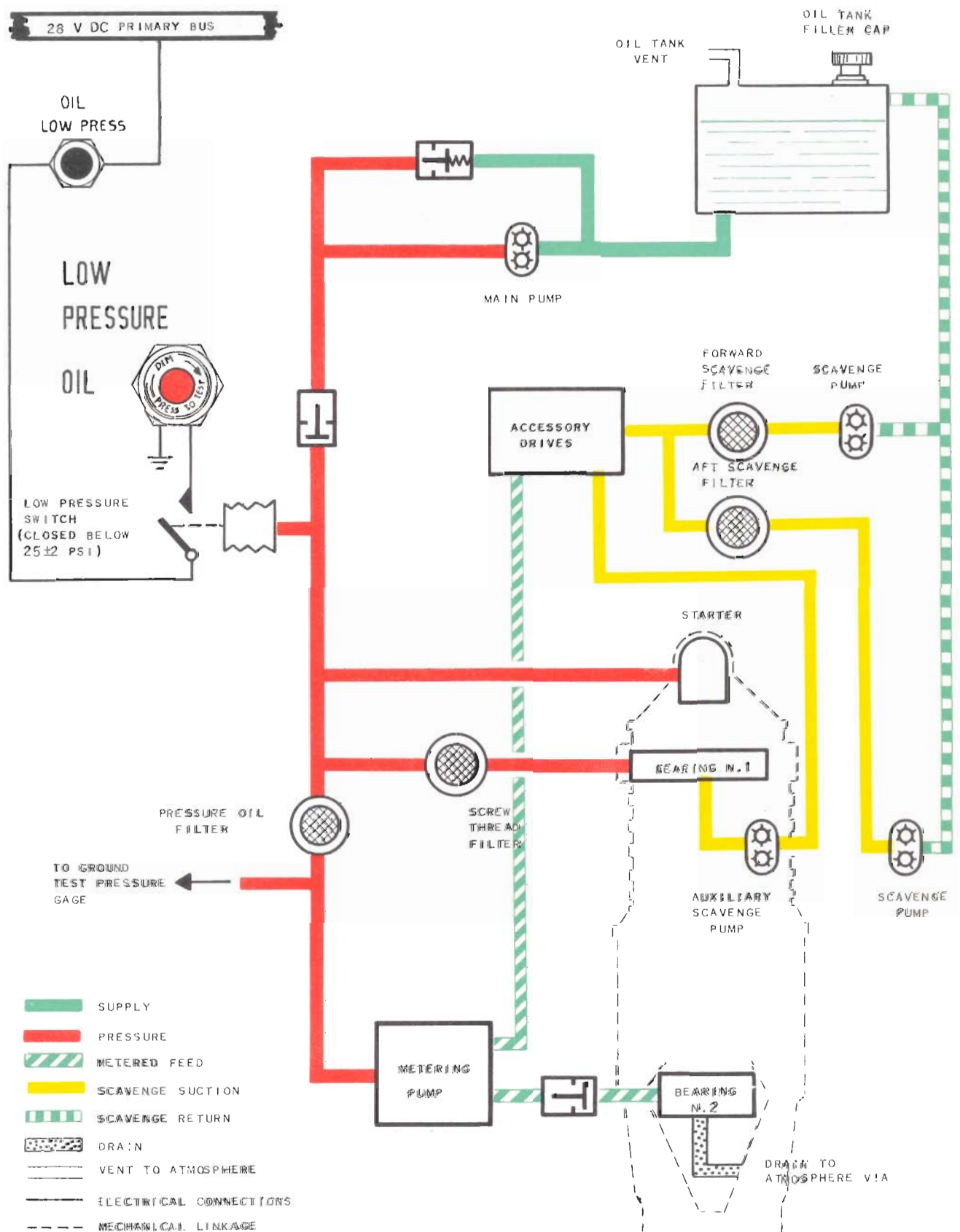
If the switch is turned to « COLLECT TANK » position the warning light goes ON and the lower scale will display readings of collect tank fuel quantity. If it is turned to « ALL TANKS » position the warning light goes OFF and the upper scale will display readings of total quantity of fuel in the aircraft.

The **fuel low pressure warning light** comes on when the fuel pressure drops below 5 ± 0.5 p.s.i.

Two fuel lines from the drop tanks run through two check valves and connect in the fuselage to form a single line which is again split into two lines to deliver fuel to cells 2RH and 3LH through two float valves. To transfer fuel, the drop tanks are pressurized with 8 p.s.i. air taken from the engine compressor 7th stage. The « DROPPABLE FUEL TANK AIR PRESSURE CONTROL VALVE » switch controls drop tank pressurization.

WARNING The « DROPPABLE FUEL TANK AIR PRESSURE CONTROL VALVE » switch must be turned ON only when the fuel quantity indicator reads 1900 lbs. This switch must be turned OFF 15 minutes after fuel begins to transfer.

ENGINE OIL SYSTEM



G91 R/3
R/4
P

Figure 1-11

FUEL SYSTEM

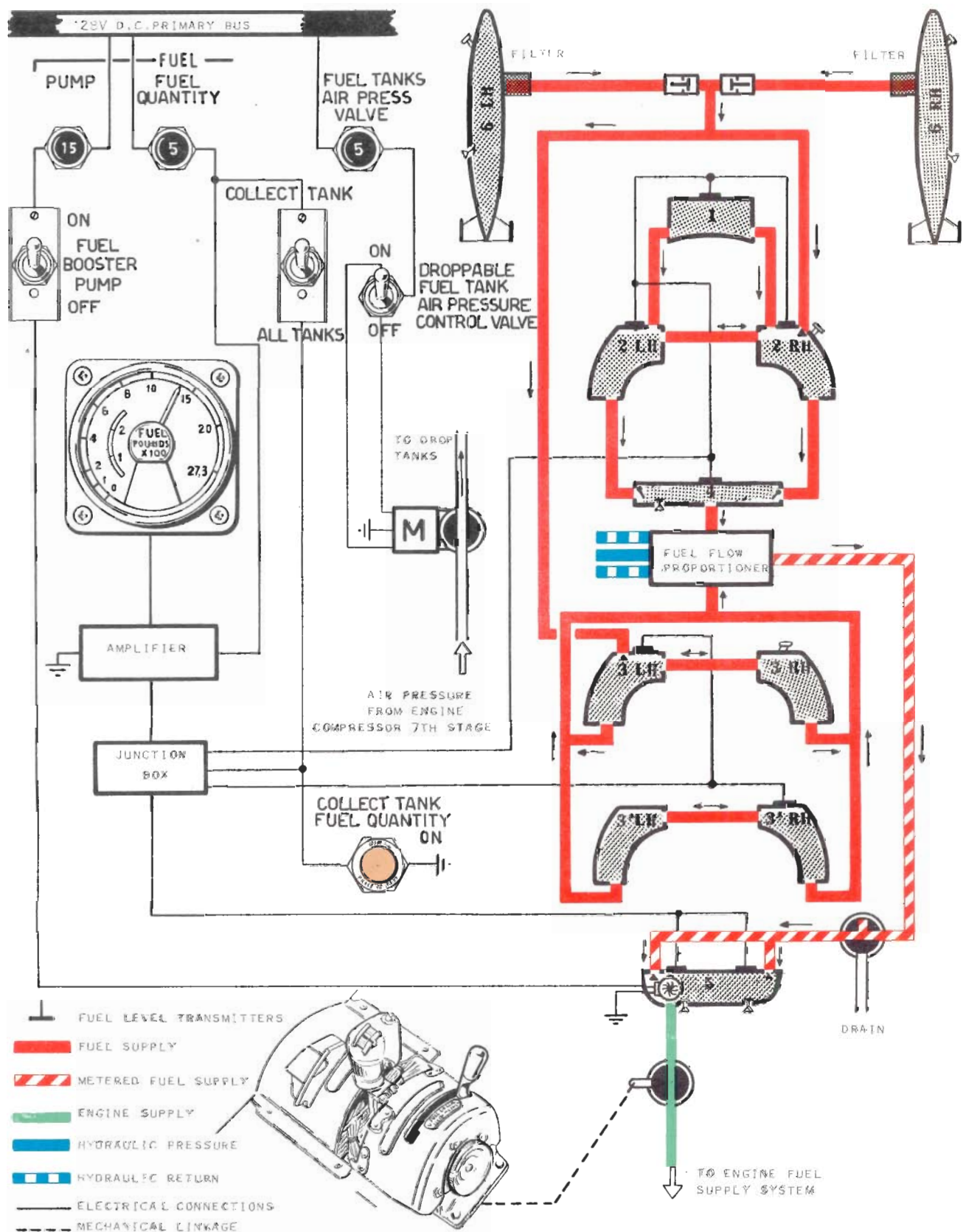


Figure 1-12

From the two fuselage cell groups fuel flows to the hydraulically driven flow proportioner which directs fuel through two float valves to cell No. 5. The fuel system dump valve is located between the fuel flow proportioner and the No. 5 cell float valves. To drain the fuel cells there are nine drain cocks; one in cell No. 4, two in cell No. 5, three in each drop tank.

A submerged electric booster pump incorporating an inverted flight device delivers fuel through a low pressure cock and low-pressure fuel filter to the engine-driven pump.

The fuselage cells are pressurized at 3 p.s.i. and cell No. 5 is pressurized at 1 p.s.i. by air from the seventh stage of the engine compressor. All fuel drains to cell No. 5 by gravity feed or pressure differential.

Three sets of Waymouth fuel level transmitters are wired to a single junction box where a single coaxial cable extends to an amplifier connected to the fuel quantity indicator in the cockpit. The transmitters are:

- 1st set (forward group) comprising 4 level transmitters
- 2nd set (aft group) comprising 2 level transmitters
- 3rd set (cell No. 5) comprising 2 level transmitters.

FUEL FLOW PROPORTIONER

The hydraulically driven fuel flow proportioner simultaneously transfers fuel from the two groups of fuel cells to No. 5 cell to maintain a constant center of gravity.

SUBMERGED ELECTRIC FUEL BOOSTER PUMP

This pump incorporates an inverted flight device and, supplies fuel from cell No. 5 to the engine driven pump. It prevents the fuel pressure at the engine driven pump inlet from falling below 5 ± 0.5 p.s.i. provided the fuel filter is not clogged.

FUEL LOW PRESS RED WARNING LIGHT

Is located at the bottom left of the instrument panel. When illuminated it indicates that the filter outlet pressure is below 5 ± 0.5 p.s.i. because the booster pump has failed or the filter is clogged.

ELECTRICAL POWER SUPPLY SYSTEM

Electrical power is supplied by a 6 Kw engine-driven Labinal generator and a 24-volt, 36 ampere-hours

battery. The generator can supply a full electrical load within the entire operational speed range of the engine. The system powers all the electrical equipment, controls and indicators.

ELECTRICALLY OPERATED EQUIPMENT

See figures 1-13 and 1-14.

D.C. ELECTRICAL POWER DISTRIBUTION

The D.C. electrical power necessary for operation of the electrical units in the airplane is distributed by a group of three busses: a battery bus, a primary bus and a secondary bus.

The battery bus is hot at all times when the battery is connected so that the emergency equipment is always operable.

The primary bus is powered from the generator and supplies power to all essential equipment for normal flight. In case of generator failure, the primary bus will be powered from the battery bus when the « BATTERY » switch is in the « ON » position.

CAUTION If the electrical equipment is to be ground operated, do not exceed 30 minutes unless the access panels covering the electrical equipment are removed. Heat generated in the electrical compartments will cause failure or a serious reduction in equipment life.

The secondary bus is powered from the primary bus and supplies power to all equipment that is not essential for a normal flight. In case of generator failure, a relay automatically disconnects the primary bus from the secondary bus.

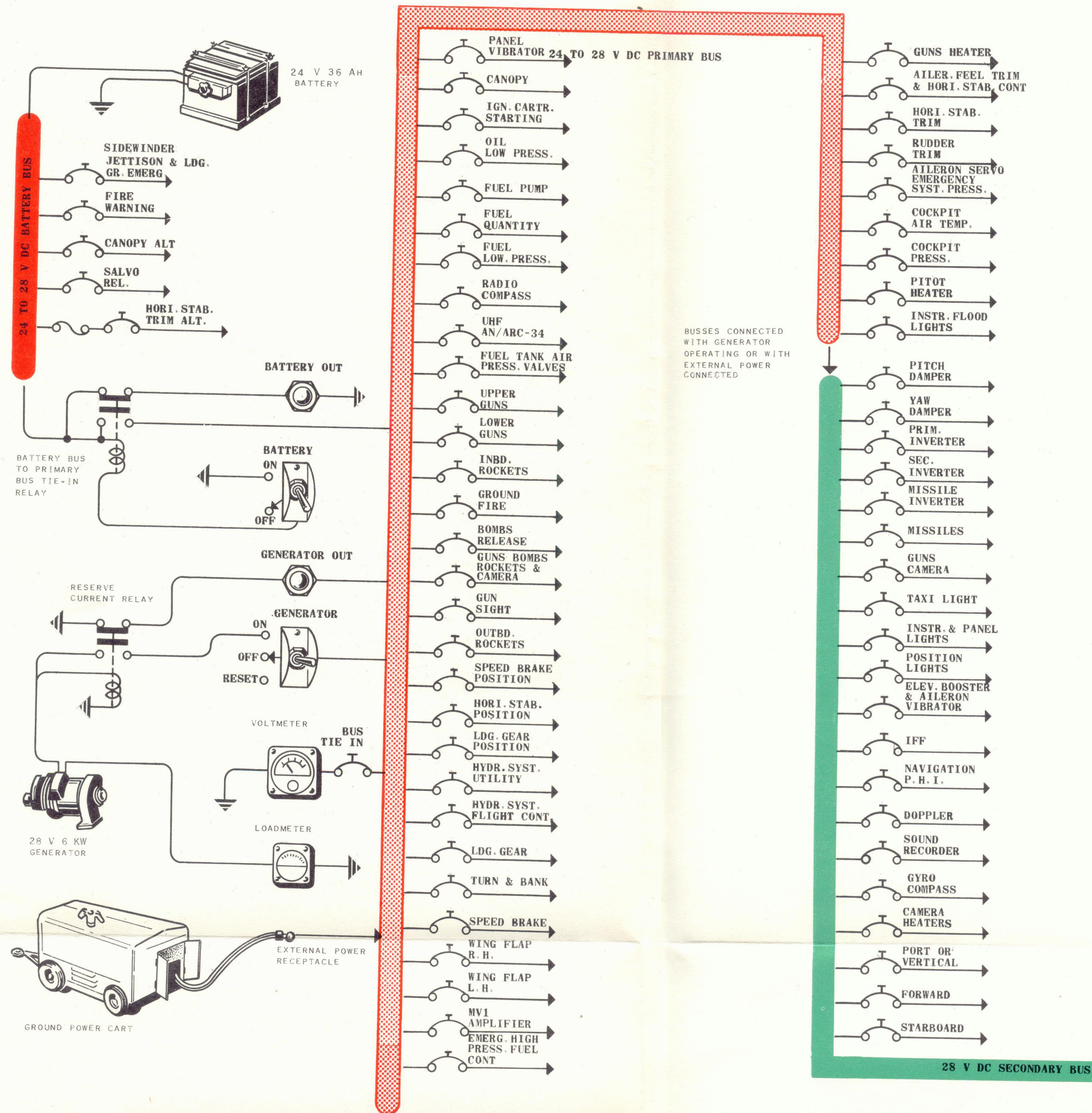
EXTERNAL POWER RECEPTACLE

The external power receptacle is located on the right lower side of the airplane just aft of the wing trailing edge. When an external power unit is connected current is supplied to the primary bus and to the secondary bus. If the primary bus tie-in relay is closed, power is also supplied to the battery bus. A 24V D.C., 200 amp ground power unit must be used.

GROUNDING RECEPTACLES

There are three grounding receptacles on the right side of the fuselage. Two are just forward and below the fuel filler caps; one is located below the wing leading edge.

DC ELECTRICAL SYSTEM



SWITCH POSITIONS AND OPERATING CONDITIONS	COLORS BUSSES ARE POWERED BUSSES
BATTERY SWITCH "ON"	[Red bar]
GENERATOR SWITCH "ON"	[Red checkered bar]
GENERATOR OPERATIVE	[Green bar]
BATTERY SWITCH "ON"	[Red bar]
GENERATOR INOPERATIVE	[Red checkered bar]
	SECONDARY BUS
BATTERY SWITCH "ON"	[Red bar]
GENERATOR INOPERATIVE	PRIMARY BUS
	SECONDARY BUS

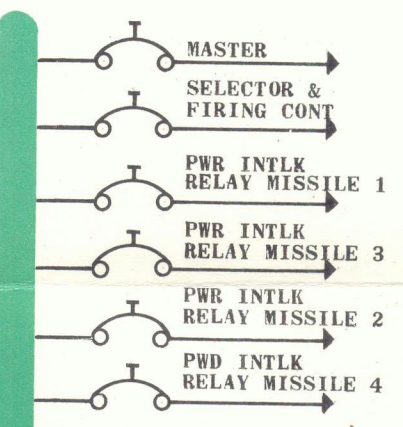
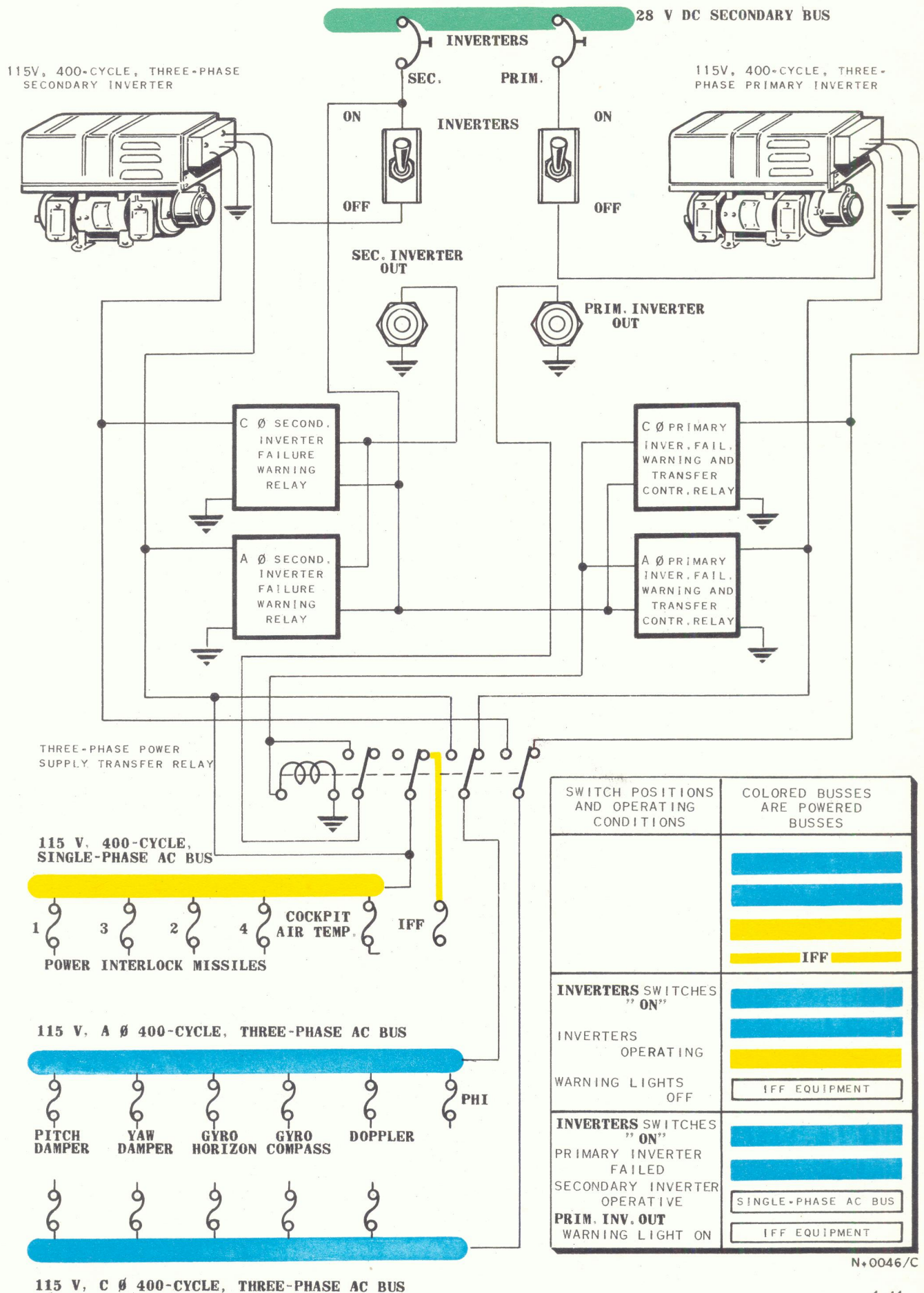


Figure 1-13

AC ELECTRICAL SYSTEM



N+0046/C

Figure 1 - 14

CIRCUIT BREAKERS

The D.C. electrical circuits are protected by push-pull circuit breakers mounted on a panel at the aft end of the right console (fig. 1-15) and in the circuit breaker bay aft of the RH gun door.

The following circuit breakers are located aft of the armament bay on the right side of the fuselage: «CANOPY ALT» (battery bus), «SALVO RELEASE» (bomb safe and external load emergency jettison), «EXT. STORES JETTISON & LDG. GR. EMERGENCY» (SIDEWINDER missile emergency jettison and landing gear ground safe), «FIRE WARNING» (fire detector circuit), «FIELD GEN» and «FIELD RELAY» (generator field circuit control). Access is through an air-loc access door.

BATTERY SWITCH

The battery switch located on the right side of the instrument panel has two positions, ON and OFF. This switch connects the battery bus to the primary bus through the primary bus tie-in relay when the battery is connected and the switch is on.

GENERATOR SWITCH

The generator switch is located on the right side of the instrument panel. It has three positions, ON, OFF, RESET, and it is spring-loaded from RESET to OFF. Placing this switch at ON connects the generator to the primary bus. If generator voltage becomes excessive, the generator field circuit is automatically opened by means of an over voltage relay and the generator is disconnected from the primary bus. The RESET position is used to bring the generator back into the circuit. Moving the switch to ON will connect the generator to the primary bus. With the switch in the OFF position, the generator is disconnected from the primary bus.

A.C. ELECTRICAL POWER DISTRIBUTION

The A.C. electrical power is distributed to the A.C. electrical equipment by the 115 volt, 400 cycle single-phase and three-phase A.C. busses. The A.C. busses are powered by the primary inverter and the secondary inverter which are powered by the secondary bus.

PRIMARY INVERTER

The primary inverter converts 28-Volt D.C. secondary bus power into 115 Volt, 400-cycle A.C. power and supplies three-phase A.C. power to the gyro horizon, yaw damper, pitch damper, and gyrosyn

compass, single-phase A.C. power to the PHI and DOPPLER equipment.

SECONDARY INVERTER

The secondary inverter converts 28 Volt D.C. secondary bus power into 115 Volt, 400-cycle, three-phase A.C. power. Under normal conditions, single-phase A.C. power is supplied to the cockpit air conditioning system, air temperature regulator, AN/APX-25 IFF equipment and to the SIDEWINDER MISSILE SYSTEM.

In case of primary inverter failure, a group of relays connects the three-phase busses to the secondary inverter which will be used as three-phase. These relays automatically disconnect the IFF equipment to avoid overloading the inverter.

In case of secondary inverter failure the cockpit air conditioning temperature regulator and IFF equipment will be inoperative.

FUSES

The A.C. electrical circuits, powered by the secondary bus, are protected by two groups of fuses installed on the right console above the circuit breakers panel (see fig. 1-15).

The first group of fuses, located forward in a vertical position, protects the following electrical units:

COCKPIT AIR TEMP., GYRO-COMPASS, GYRO-HORIZON, YAW DAMPER and PITCH DAMPER.

The second group protects:

PHI, IFF, DOPPLER and SIDEWINDER MISSILE system.

ELECTRICAL SYSTEM INSTRUMENTS AND INDICATORS

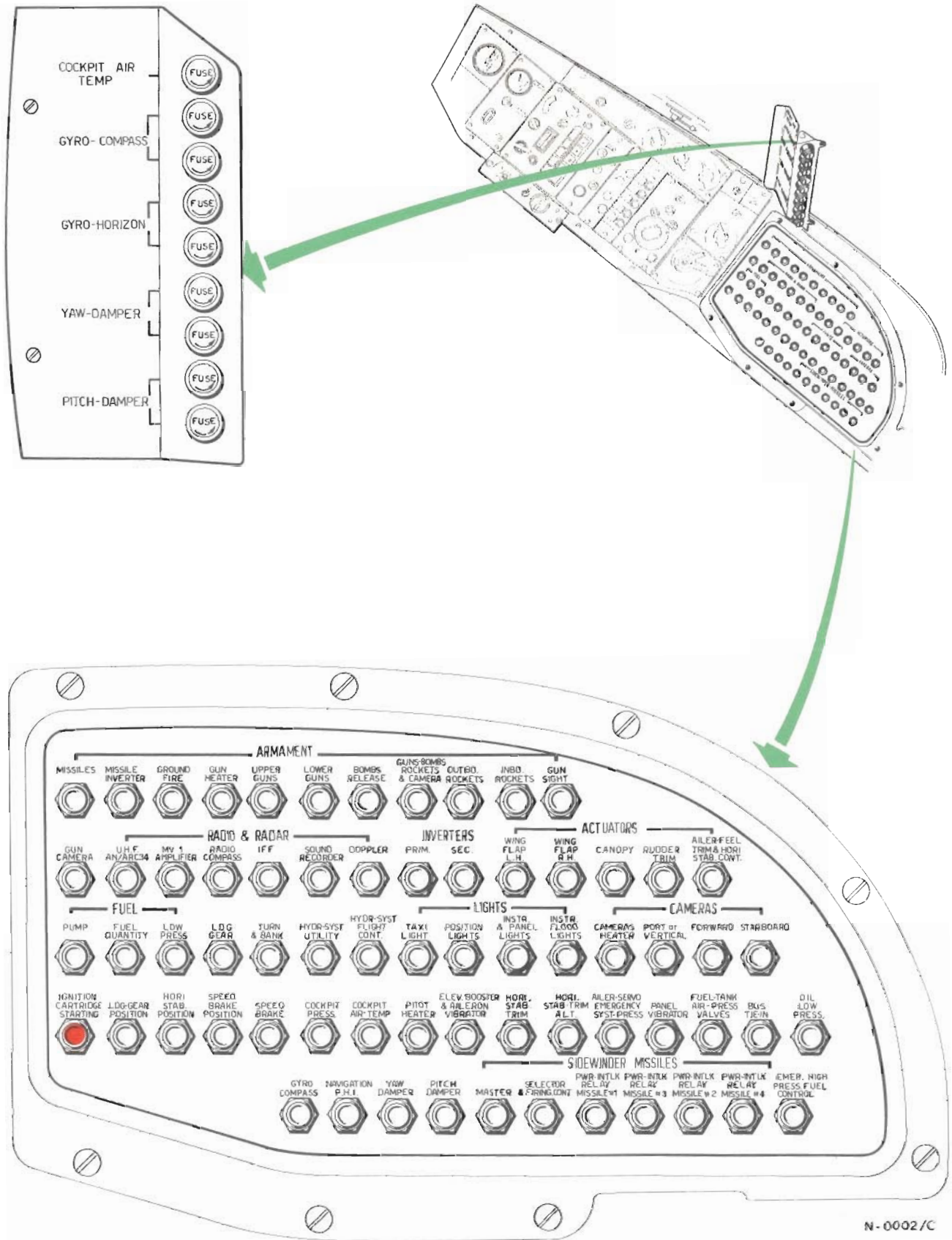
BATTERY OUT WARNING LIGHT

When illuminated, this red light indicates that the battery bus is disconnected from the primary bus. It is located on the bottom right side of the instrument panel.

GENERATOR OUT WARNING LIGHT

The red GENERATOR OUT warning light is located on the bottom right side of the instrument panel. This light comes on when the generator does not power the primary bus. In this case, the secondary bus is cut off while the primary bus is powered by the battery bus provided the tie-in relay is closed and the battery is connected.

COCKPIT FUSE AND CIRCUIT BREAKER PANELS



N-0002/C

Figure 1-15

VOLTMETER

The voltmeter is mounted on the bottom right side of the instrument panel and reads primary bus voltage. This instrument provides a visual indication of battery voltage when the battery switch is ON and the GENERATOR switch is OFF, regardless of engine operation. It indicates the generator voltage when the BATTERY switch is OFF and the GENERATOR switch is ON with the engine running. With both switches ON and with the engine running, this instrument indicates the voltage of either battery or generator, whichever is greater.

LOADMETER

The loadmeter is mounted beside the voltmeter on the right lower side of the instrument panel. This instrument indicates percent of amperage absorbed by powered units and reads «1» when this current is 200 amperes.

The «**PRIM. INVERTER OUT**» warning light is an amber light located below the primary INVERTER switch on the right side of the instrument panel. Illumination of the PRIM. INVERTER OUT warning light indicates that the primary inverter has failed or has been disconnected and that all A.C. equipment except the IFF is powered from the secondary inverter.

The «**SEC INVERTER OUT**» warning light is an amber light located beside the PRIM. INVERTER OUT warning light; illumination indicates that the secondary inverter has failed or has been disconnected. In this case, the cockpit air temperature regulator and IFF equipment are inoperative.

UTILITY HYDRAULIC POWER SUPPLY SYSTEM

The airplane hydraulic power supply system consists of a 5.02 gal. (19 liters) hydraulic fluid reservoir, a self-regulating engine driven pump, an accumulator, a pressure snubber, and a pressure transmitter connected to a gage in the cockpit. This system supplies power for operation of the landing gear, speed brakes, fuel flow proportioner, flight control system, and wheel brakes.

Hydraulic fluid is directed through a filter to the engine-driven pump which diverts it under pressure through a second filter to the accumulator. The self-regulating pump has an independent return line to the hydraulic fluid reservoir.

From the accumulator, fluid under pressure flows to the utility equipment (see figs. 1-16, 1-23 and 1-17).

UTILITY HYDRAULIC SYSTEM INDICATORS

UTILITY HYDRAULIC SYSTEM PRESSURE GAGE

Downstream of the accumulator a pressure snubber and an electric pressure transmitter are connected to the «UTILITY» gage located on the «HYDRAULIC SYSTEM» panel in the cockpit.

FLIGHT CONTROL SYSTEM

The flight control system incorporates aileron and elevator servo controls.

Lateral (roll) control of the airplane is achieved through irreversible hydraulic servo controls located before each aileron. The rigid mechanical linkage between the control stick and the servo controls is connected to a spring-loaded artificial feel system that provides stick feel to the pilot. A vibrator eliminates break out forces.

Control surface trim tabs are not provided for the ailerons. Lateral trim is obtained by moving the stick from its neutral position through the control stick trim switch and trim actuator.

Longitudinal (pitch) control of the airplane is achieved by the elevator through a hydraulic irreversible power control actuator. In the event of hydraulic system failure, automatic change-over to mechanical operation occurs. Stick forces are transmitted to the pilot by an artificial feel system (spring-loaded bungees and a bobweight) built into the control system.

No control surface trim tabs are required on the elevator since the horizontal stabilizer is moved by an electric actuator controlled by the control stick trim switch or the EMERG. LONG'L TRIM switch.

Directional (yaw) control of the airplane is provided by the rudder through the rudder pedals. The rudder incorporates a trim tab that is positioned by an electric actuator controlled by the RUDDER TRIM switch located on the left console panel.

NOTE In case of hydraulic system failure automatic change-over to mechanical operation occurs.

ARTIFICIAL FEEL SYSTEM

The spring-loaded bungee, artificial feel system (fig. 1-17) is connected to the mechanical linkage

UTILITY HYDRAULIC POWER SYSTEM

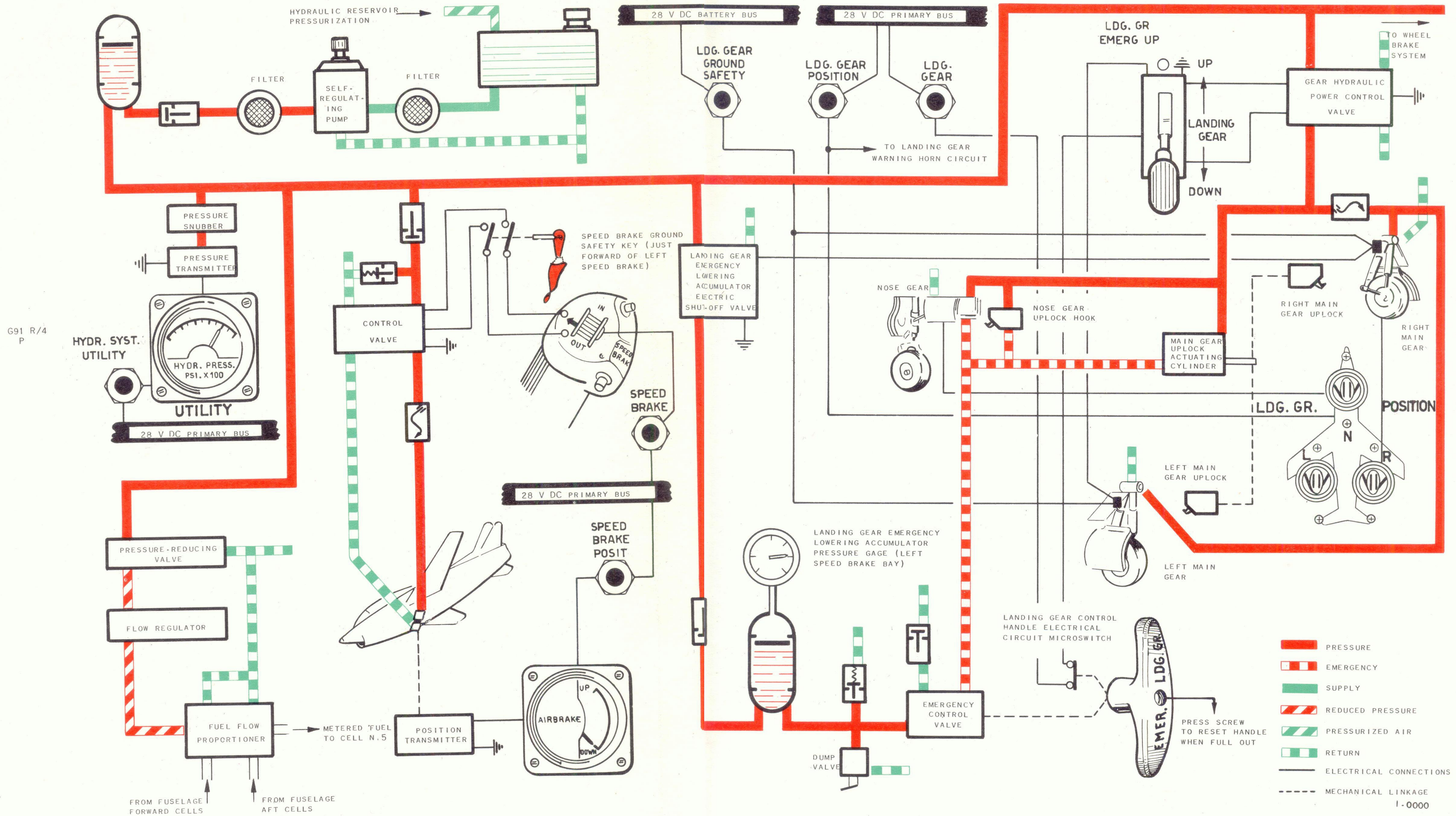
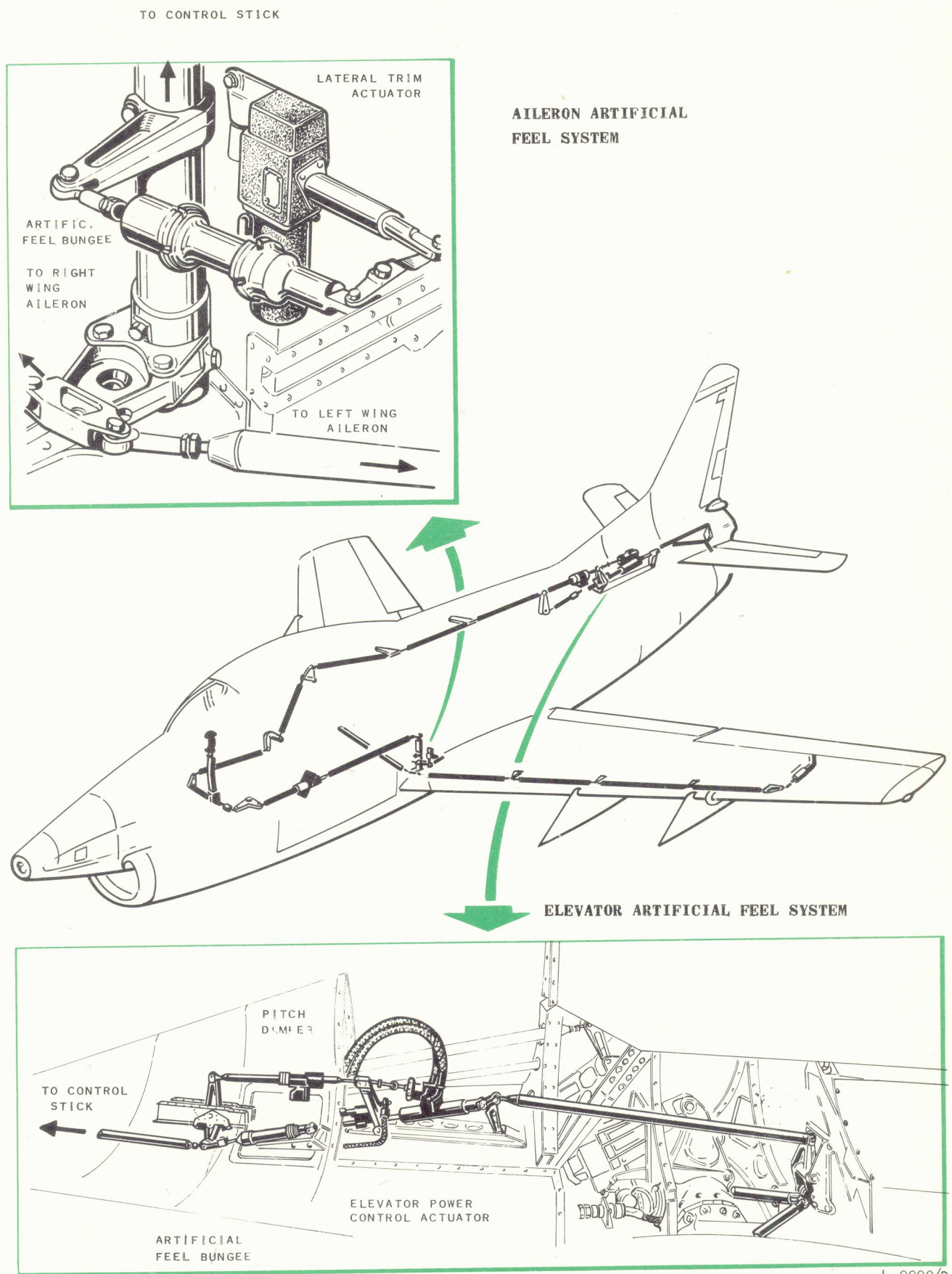


Figure 1-16

ARTIFICIAL FEEL SYSTEMS



L-0000/B

Figure 1-17

between the control stick and the ailerons. It is located behind the left armament bay. A motor connected to the mechanical linkage attachment moves the no-load position of the control stick and functions as lateral trim. There is a similar unit for the elevator.

PITCH DAMPER

The pitch damper increases the longitudinal stability of the airplane by sensing the pitch movement of the airplane and varying the length of the elevator power control actuator control rod to dampen out the movement. The pitch damper can be engaged whenever there is a need for reducing longitudinal oscillations.

PITCH DAMPER MAGNETIC SWITCH

The pitch damper magnetic switch is located on the armament panel of the left console and has two positions, ON and OFF. This switch controls the opening of the hydraulic actuating cylinder hydraulic pressure shutoff valve through a control valve controlled by the rate gyro, which plots the angular speed of the airplane with respect to the horizon.

The **pitch damper release switch** is located on the control stick just below the stick grip. Depressing this switch will disengage the pitch damper causing the magnetic PITCH DAMPER switch to return to OFF.

YAW DAMPER

A yaw damper (fig. 1-18) increases the directional stability of the airplane by sensing the rate of directional change and electrically varying (through an electric servo control) the rudder position to dampen out the change. The yaw damper should be on at any time that oscillations must be reduced.

“YAW DAMPER” SWITCH

The YAW DAMPER switch on the armament control panel of the left console, controls the yaw damper. It has two positions: «ON» and «OFF».

FLIGHT CONTROLS AND INDICATORS

CONTROL STICK GRIP

The type B-8 a control stick grip (fig. 1-19) has the aileron and horizontal stabilizer trim switch, a camera and gun firing trigger, a microphone button, a bomb release and rocket firing button, and a camera button.

RUDDER PEDALS

The rudder pedals (fig. 1-20) can be adjusted fore and aft by rotating the toothed handwheel located inboard of the pedals.

CONTROL LOCK

The control surfaces can be locked (fig. 1-21) by a lever located forward of the control stick. When this lever is mated to the lug on the control column and the spring-loaded pin is inserted, the control stick locks. At the same time, a pin engages and locks the pedals in the center position and the throttle is locked in the «STOP» position by a teleflex cable.

NORMAL TRIM SWITCH

Normal trim is controlled by a four-position spring-loaded switch on top of the control stick grip (see fig. 1-19).

The center position is neutral. Holding the normal trim switch forward or aft changes the position of the horizontal stabilizer leading edge and trims the aircraft nose down or up. Holding the normal trim switch to either side changes the control stick neutral position through the artificial feel system and causes the corresponding wing to be trimmed down.

ALTERNATE LONGITUDINAL TRIM SWITCH

The four position «EMERG. LONG'L TRIM» switch, on the left console trim control panel (fig. 1-22) provides an alternate circuit for the horizontal stabilizer. The switch positions are NORMAL, NOSE DOWN, OFF, and NOSE UP. The EMERG. LONG'L TRIM switch must be NORMAL to provide power for normal trim. In case of normal trim failure, use of this switch provides longitudinal trim at the same speed obtained by use of the normal trim switch. Moving the alternate longitudinal trim switch to OFF disconnects the normal trim circuit.

HORIZONTAL STABILIZER POSITION INDICATOR

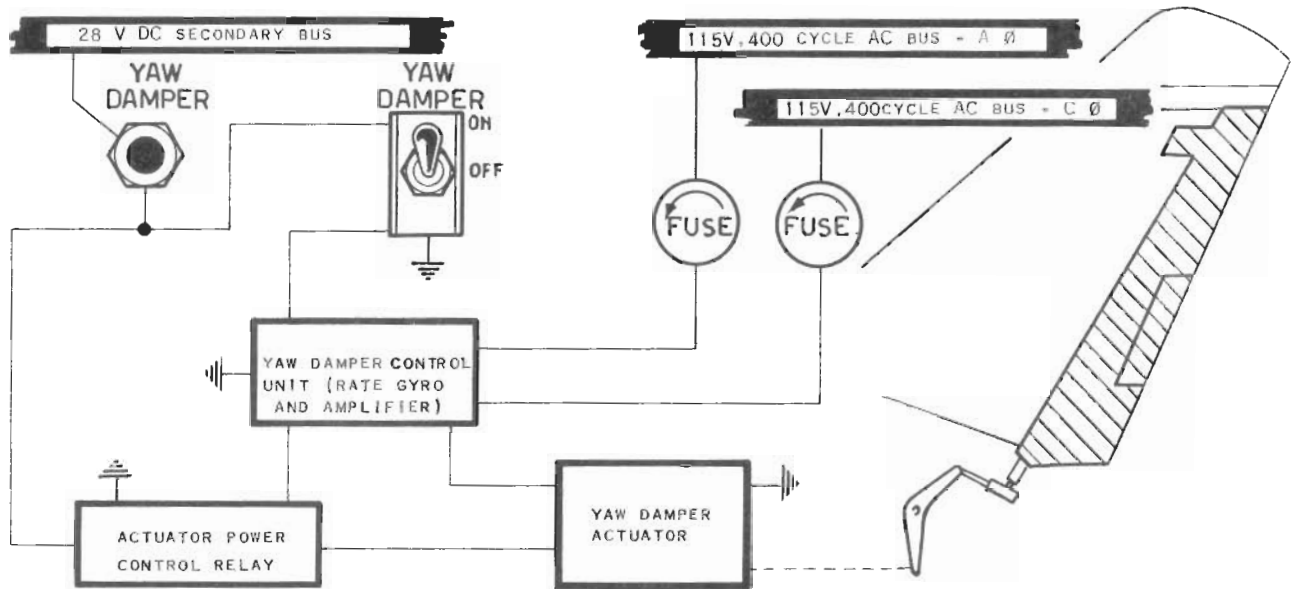
The horizontal stabilizer position indicator is mounted left of the AILERON SERVO pressure gage on the instrument panel. Its scale ranges from «NOSE UP» to «NOSE DOWN» and has a red mark for take-off position. The stabilizer can travel $+5^\circ$ to -2° with a tolerance of $\pm 15' - 0'$ in both directions.

RUDDER TRIM TAB CONTROL SWITCH

The three-position «RUDDER TRIM» switch is located on the trim control panel (fig. 1-22). Its posi-

PITCH & YAW DAMPER SYSTEMS

YAW DAMPER SYSTEM



PITCH DAMPER SYSTEM

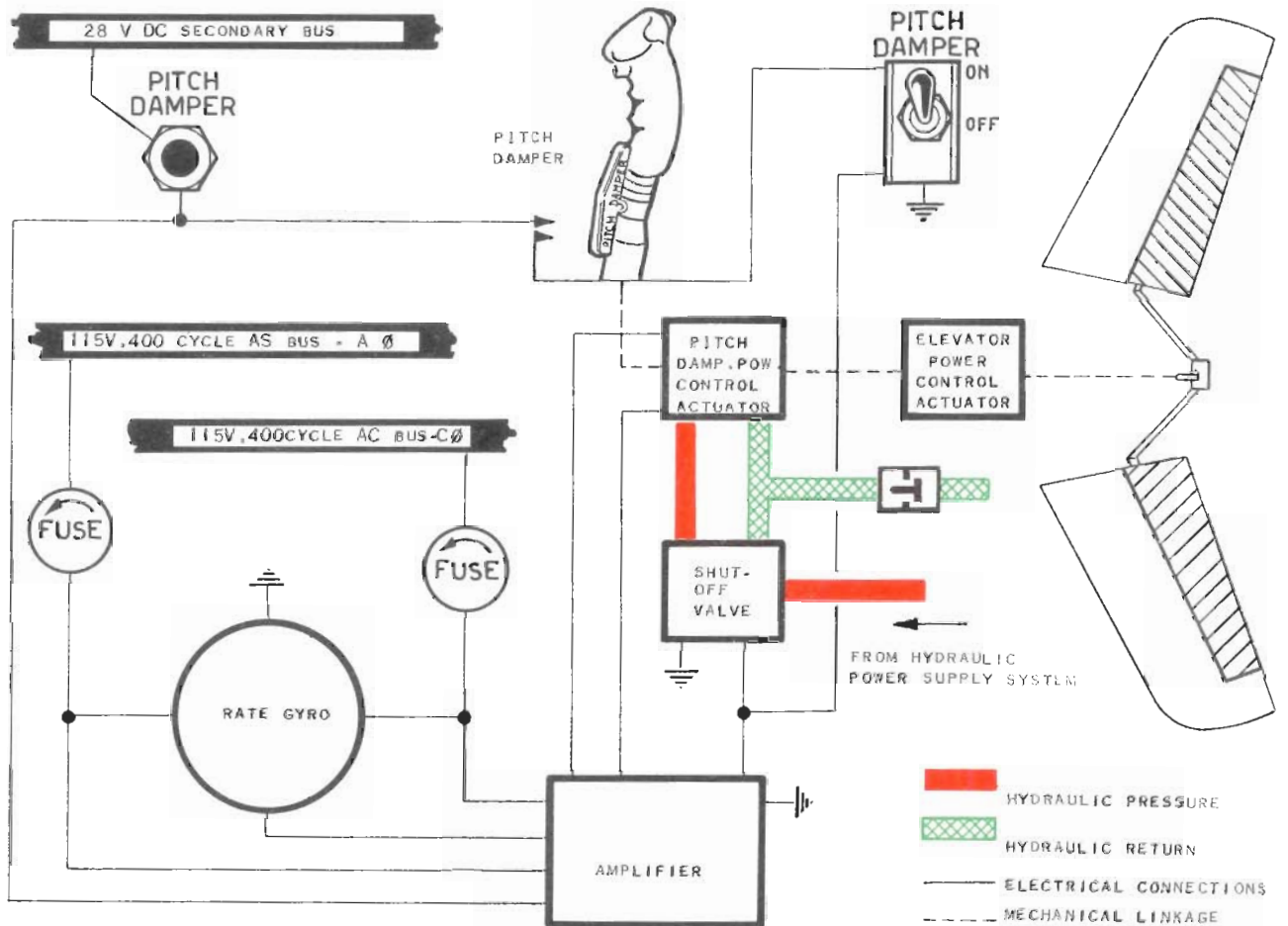


Figure 1-18

CONTROL STICK GRIP

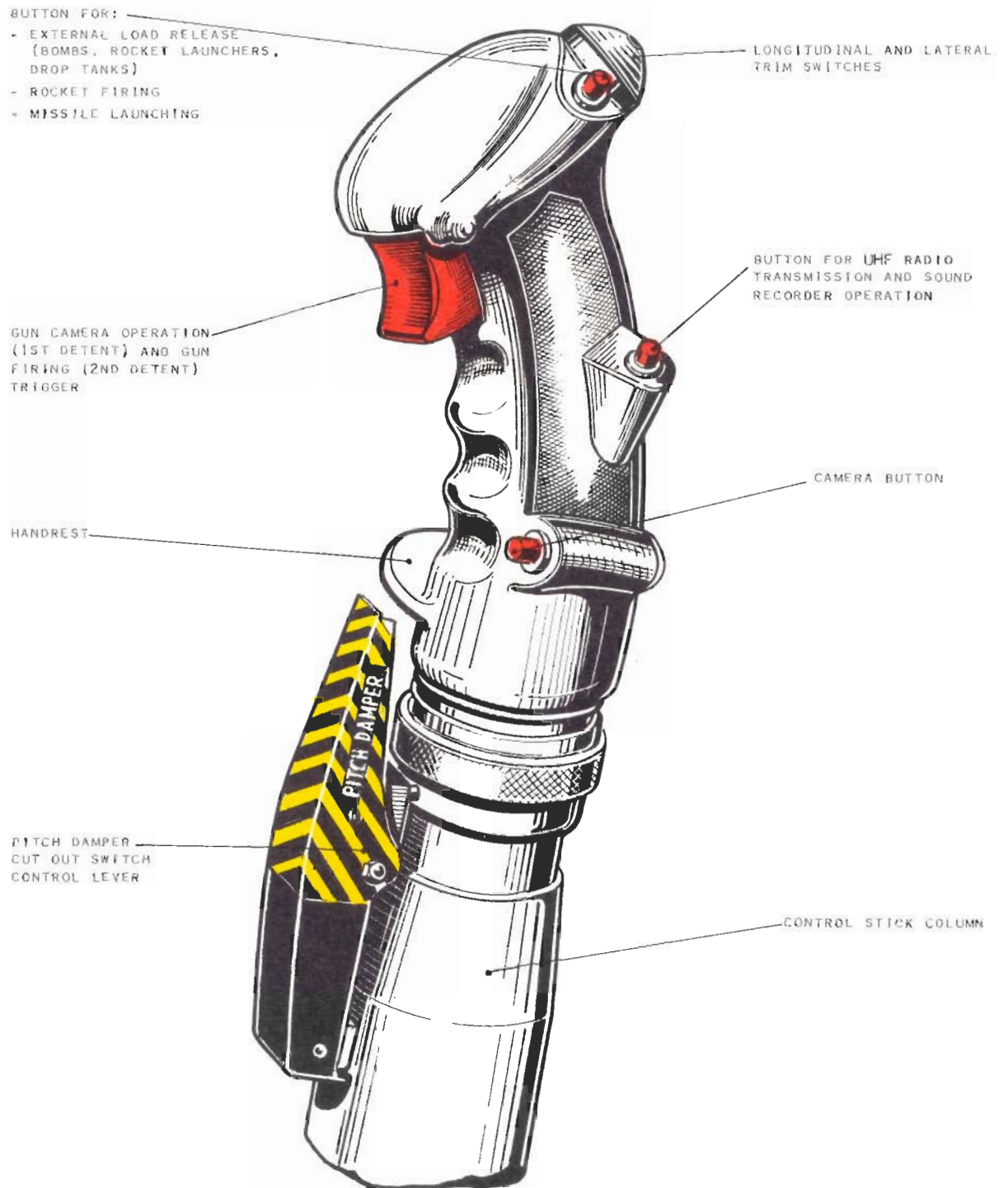
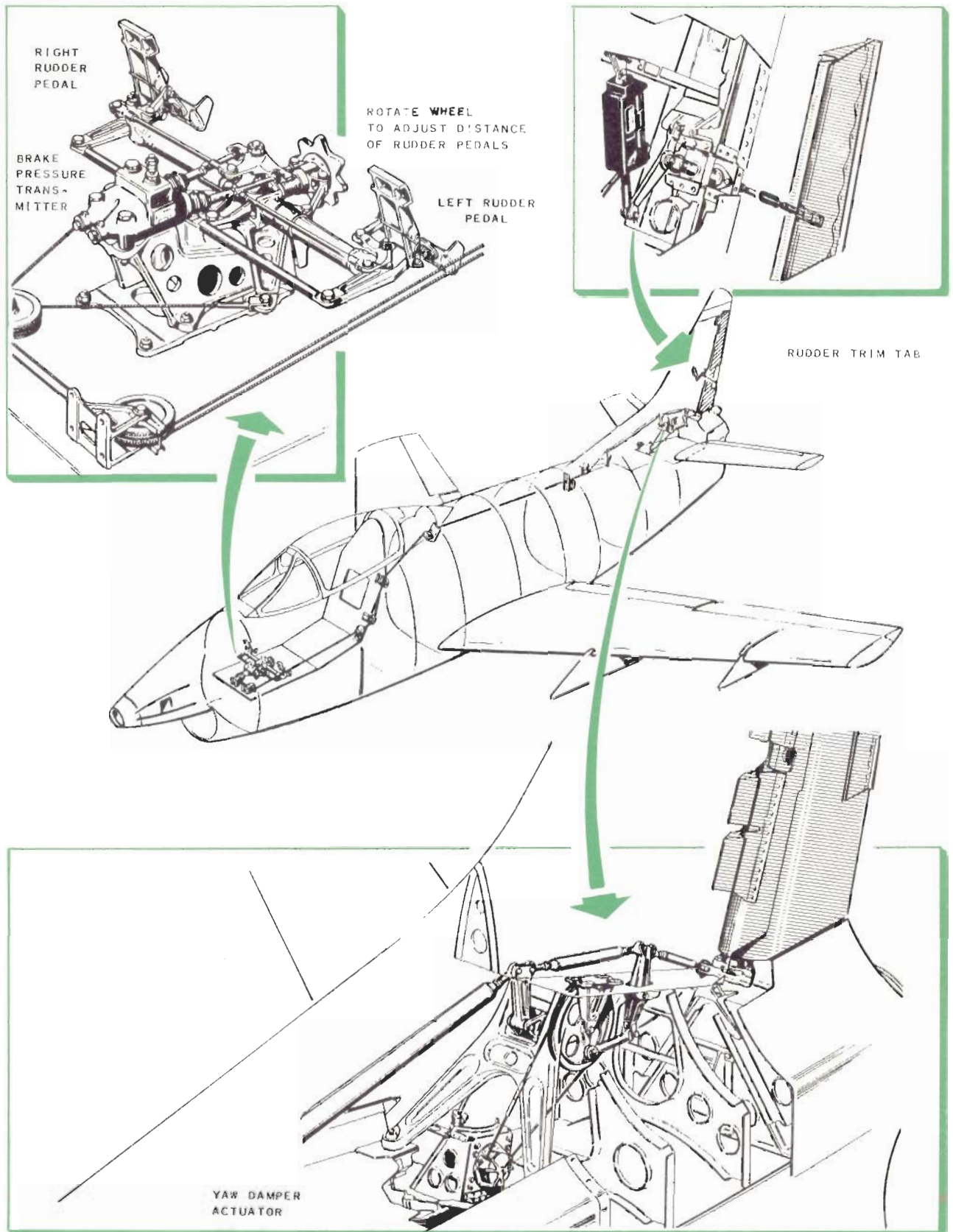


Figure 1-19

RUDDER SYSTEM

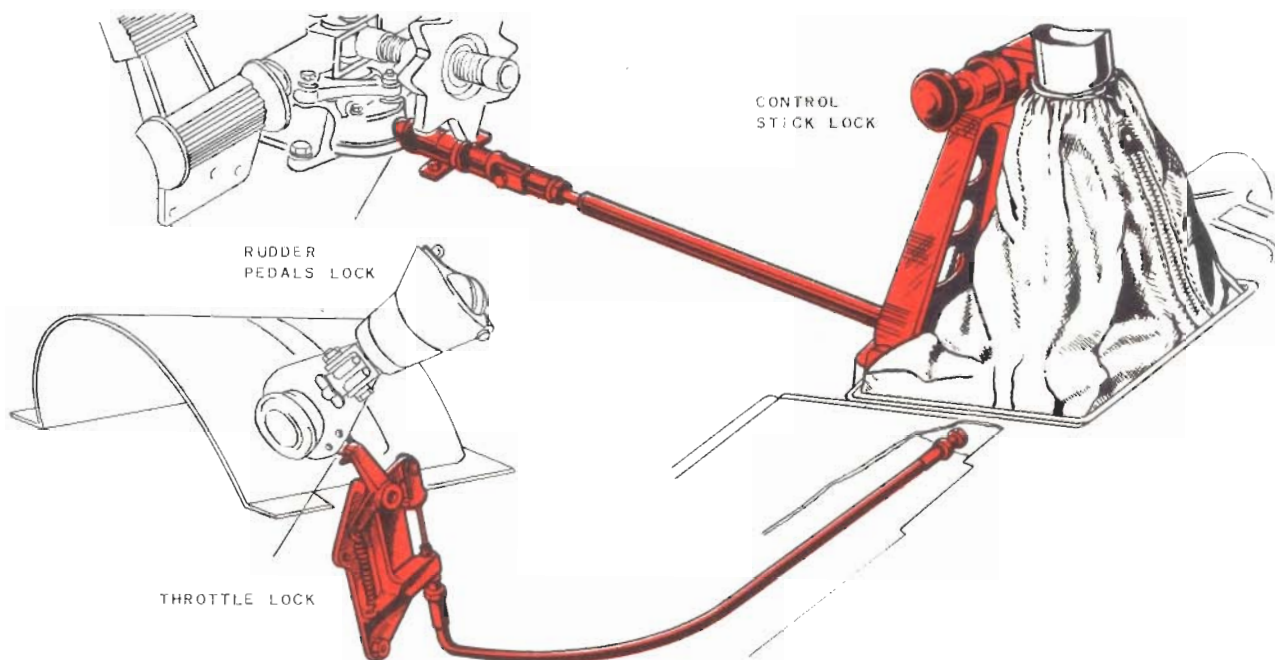
RUDDER TRIM TAB ACTUATOR



L-0002/C

Figure 1-20

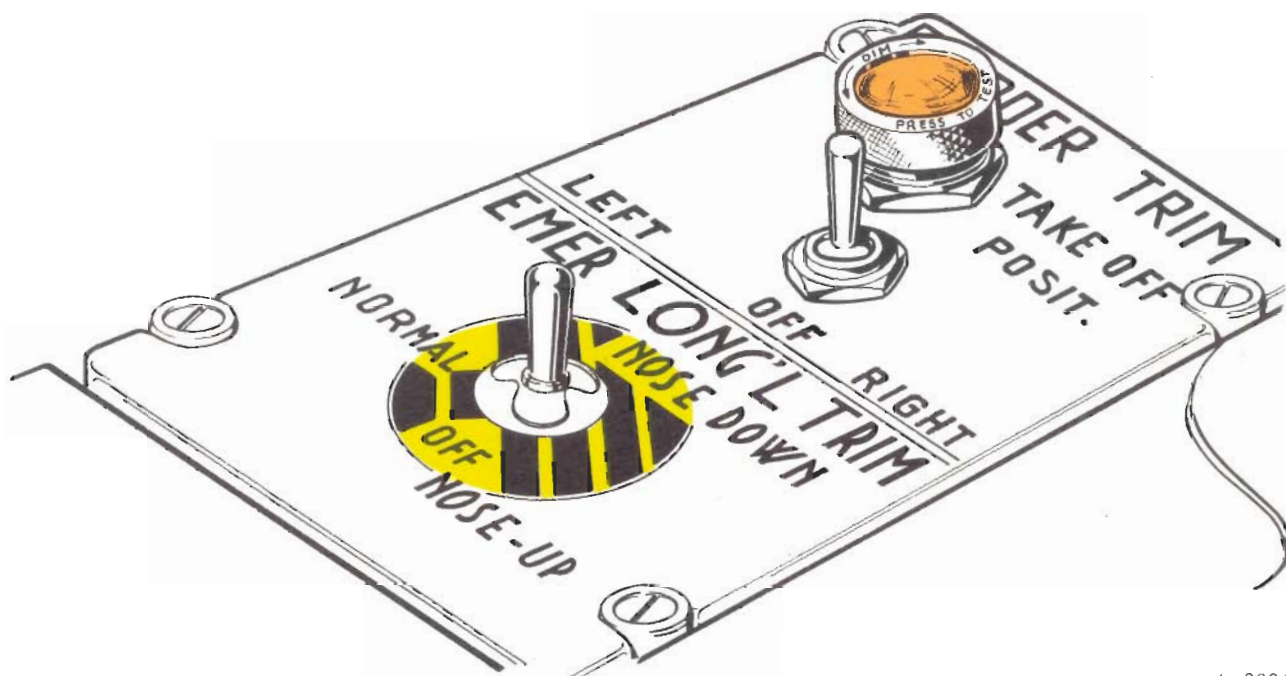
FLIGHT CONTROL LOCKS



L-0003

Figure 1-21

TRIM CONTROL PANEL



L-0004

Figure 1-22

tions are « LEFT », « OFF » and « RIGHT ». The switch must be held LEFT or RIGHT for corresponding rudder trim.

TAKE OFF TRIM POSITION INDICATOR LIGHT

The « TAKE-OFF POSIT » warning light, located on the trim control panel (fig. 1-22) will illuminate whenever the rudder trim tab is trimmed to take-off position and will go out when the switch is released.

FLIGHT CONTROL HYDRAULIC SYSTEM

The flight control hydraulic system (fig. 1-23) is powered by the utility hydraulic system and has an independent return line to the hydraulic fluid reservoir. The flight control hydraulic system comprises the aileron normal system, aileron emergency system, and elevator system. Each system has an accumulator which has a check valve and a 4000 p.s.i. pressure relief valve. A pressure reducing valve is provided for the emergency system supply line to reduce fluid pressure from 3550 p.s.i. to 2850 p.s.i.

AILERON SERVO SYSTEM PRESSURE GAGE

The « AILERON SERVO » dual gage is located on the « HYDRAULIC SYSTEM » control panel. It has two pointers, « NORMAL » and « EMERG. », that indicate system pressure of the flight control normal and emergency systems. Two pressure snubbers (one for each circuit) installed before the pressure transmitter, protect the instrument from abrupt pressure changes.

The **aileron servo switch** labeled « AILERON SERVO NORMAL SYSTEM PRESSURE », has two positions, « ON » and « OFF » and is protected by a red cover that holds it in the OFF position. Raising the cover and turning the switch ON supplies alternate accumulator pressure to the aileron servo controls through an independent circuit.

NORMAL SYSTEM LOW PRESSURE WARNING LIGHT

The normal system LOW PRESS red warning light is calibrated at 2630 ± 107 p.s.i. This light illuminates whenever the normal system pressure drops below this value, indicating that automatic transfer to the flight control mechanical system will occur as soon as residual accumulator pressure is used.

The **elevator servo switch** is on the lower center instrument panel. It is labeled elevator servo PRES-

SURE and has two positions, « ON » and « OFF » that are used to engage or disengage the elevator.

The **elevator servo disengage** amber warning light is located above the elevator servo control switch and illuminates when the switch is « OFF » and the stick is mechanically connected to the elevator.

WING FLAP SYSTEM

Each flap is operated by an individual electric actuator mechanically interconnected by a flexible shaft that synchronizes flap travel. In case of power failure of one actuator, the other will drive both flaps (at a reduced speed) through the synchronizing shaft. The actuators are the mechanically irreversible jack-screw type.

WING FLAP LEVER

The wing flap lever, located outboard of the throttle and marked « FLAP », moves on a quadrant marked « UP », « HOLD » and « DOWN ».

Placing the lever to « UP » or « DOWN », supplies power to the retraction or extension side of the actuator. Power to the actuators is automatically shut off by limit switches when the flaps reach the maximum travel. For any intermediate flap position move the flap lever to « HOLD » when the flaps have reached the desired position.

WING FLAP POSITION INDICATOR

The « FLAP » indicator, located below the altimeter, indicates percentage of « UP » or « DOWN » travel of the wing flaps, and is powered by the left flap actuator. In case the right flap actuator is inoperative and the synchronizing cable is connected, the indicator will still function properly.

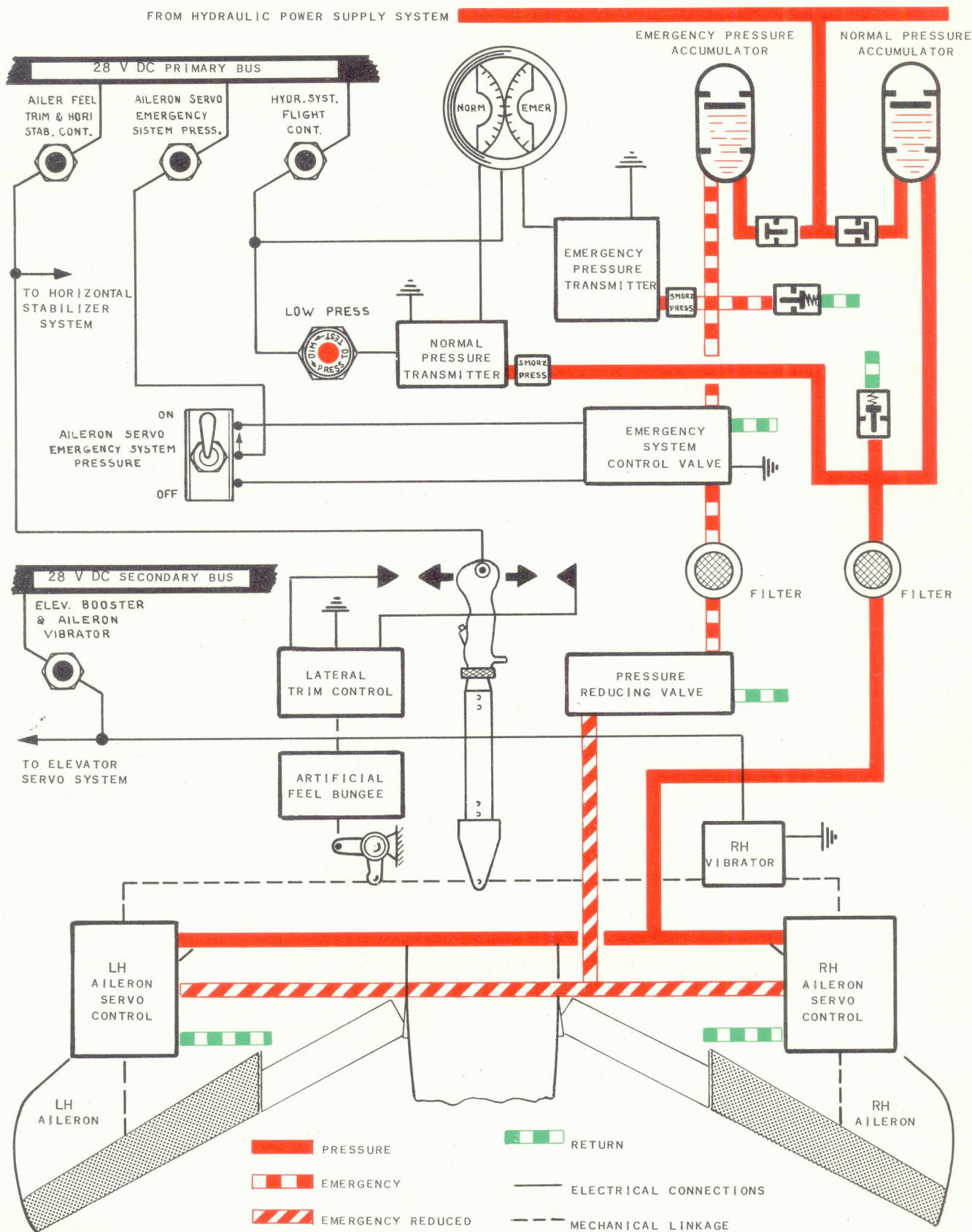
SPEED BRAKE SYSTEM

The speed brakes consist of two interconnected panels under the fuselage and a single electrically controlled hydraulic actuating cylinder (fig. 1-16) located in the lower portion of the fuselage.

SPEED BRAKE SWITCH

The speed brake switch mounted on top of the throttle grip, is labeled « SPEED BRAKES » and has

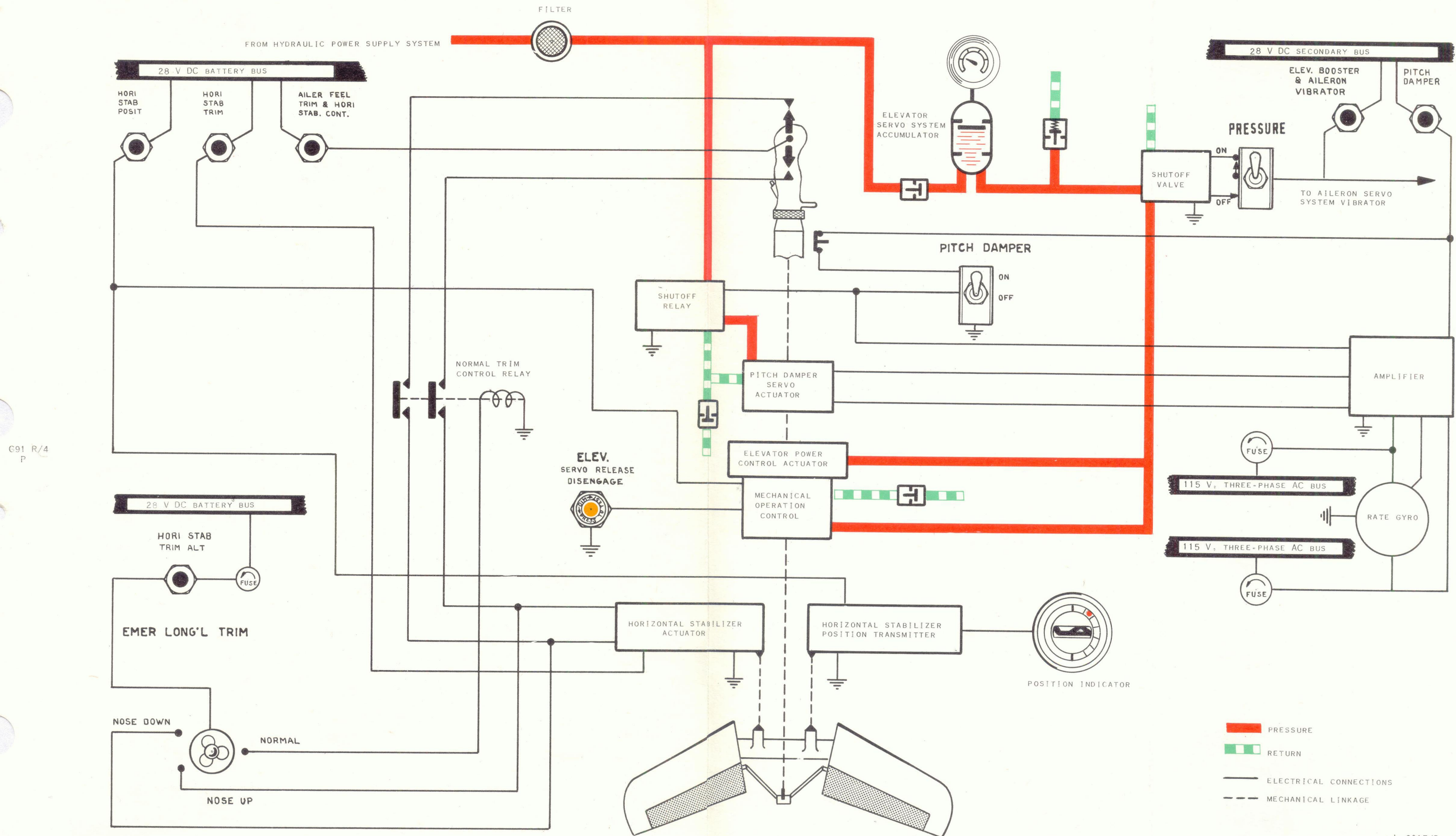
FLIGHT CONTROL SYSTEM-AILERON SERVO SYSTEM



L-0017/B

Figure 1-23/1

FLIGHT CONTROL HYDRAULIC SYSTEM - ELEVATOR SERVO SYSTEM - HORIZONTAL STABILIZER SYSTEM - PITCH DAMPER SYSTEM



L-0017/B

Figure 1-23/2

three positions «IN» «OUT», and neutral. The speed brakes can be stopped in any desired position by movement of the switch to neutral.

The speed brake ground safety switch prevents accidental speed brake closing when the airplane is on the ground. The switch opens the circuit of the system control valve and is controlled by inserting a pin into a hole located on the left side just forward of the speed brakes. The key must be pushed full in and rotated until the stop «click» is heard.

Speed brake position indicator is mounted next to the wing flap position indicator on the instrument panel. The pointer travels from «IN» to «OUT» and has intermediate positions corresponding to percent of actual speed brake travel.

LANDING GEAR SYSTEM

The landing gear and landing gear doors are hydraulically actuated (fig. 1-16) by 3550 p.s.i. from a variable output engine driven self-regulating pump.

An accumulator supplies pressure to the nose gear actuating cylinder for emergency lowering of the nose gear. Once the uplock hooks are opened during emergency operation, the main gear extends by gravity and can be downlocked by abrupt yawing of the aircraft.

NOSE GEAR GROUND SAFETY LOCK

While the airplane is parked, or is being towed on the ground, a mechanical ground safety lock should be installed to prevent inadvertent retraction of the nose gear. A red streamer is attached so that installation of the lock is apparent (fig. 1-24).

LANDING GEAR HANDLE

The landing gear handle located on the left side of the instrument panel (fig. 1-25) has two positions, «UP» and «DOWN» and receives power from the primary bus.

When the gear is down and locked and the weight of the airplane is on the gear, a ground safety switch prevents movement of the gear lever from «DOWN» to «UP».

LANDING GEAR EMERGENCY RETRACT BUTTON

If it is necessary to retract the gear during take-off or landing, the landing gear ground safety switch can

be overridden by use of the LDG. GR. EMERG. UP button (fig. 1-25). This button unlocks the landing gear handle and permits movement to «UP».

LANDING GEAR EMERGENCY RELEASE HANDLE

This handle located below the instrument panel, on the left (fig. 1-25), actuates a microswitch that cuts-off electrical power to the landing gear handle, unlocks the gear uplocks, and opens the emergency system accumulator line to the down side of the nose gear actuating cylinder. This handle is labeled «EMERG. LDG. GR.».

The main gear extends by gravity.

Landing gear position indicators (fig. 1-25) provide a visual indication of the landing gear position. An unsafe warning light is located in the landing gear control handle.

There are three indicators. Each indicator shows:

«UP» - If the gear is up and locked.

«BARBER POLE» - If the related gear is in an unlocked condition. (This indication will also appear if the gear is locked but the electrical system is inoperative).

«A MINIATURE WHEEL» - If the gear is down and locked.

A gear unsafe warning light is located in the landing gear control handle. The light goes on when any gear is not locked up or down regardless of throttle position or when any gear is not locked down when the throttle is retarded below 50 % r.p.m.

The light is out when the landing gear is up or when the gear is locked down when the throttle is retarded below 50 % r.p.m.

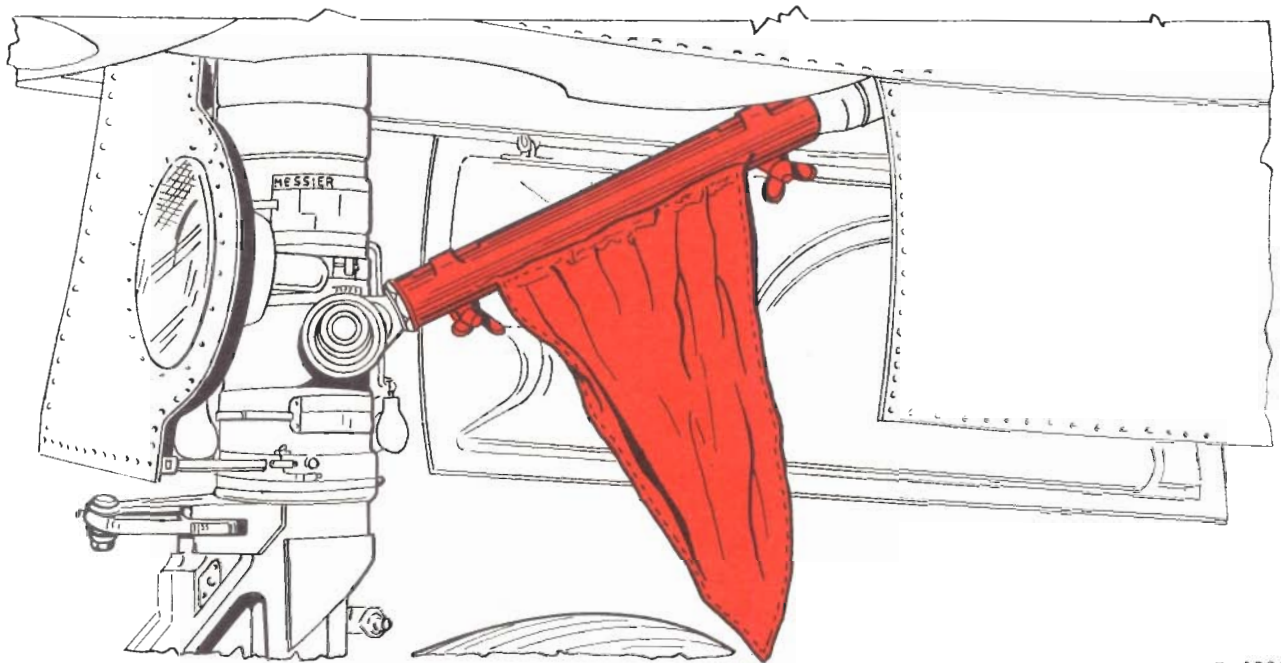
GEAR UNLOCKED WARNING HORN

A warning horn on the rear left side of the cockpit sounds when the gear is in any position other than down and locked and the throttle is at less than 50 % r.p.m. Advancing the throttle over 50 % r.p.m. silences the horn, regardless of gear position.

WARNING HORN CUTOFF BUTTON

The «LDG. GR. HORN CUT OUT» button is located on the left lower side of the instrument panel. Depressing it cuts power to the horn circuit. Advancing the throttle resets the horn circuit.

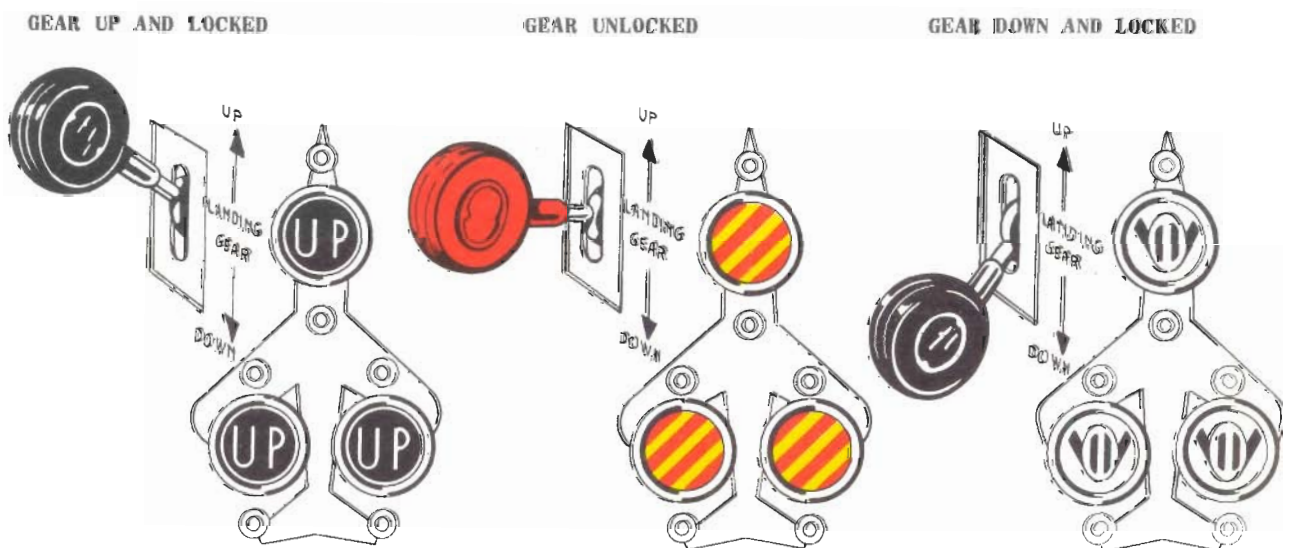
NOSE GEAR GROUND SAFETY LOCK



E. 0000

Figure 1-24

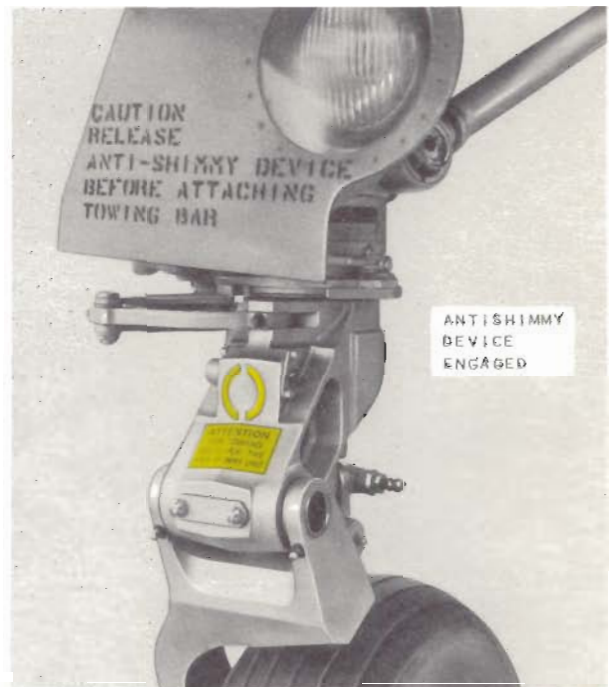
LANDING GEAR POSITION INDICATOR



F. 0001

Figure 1-25

ANTISHIMMY DEVICE



1 0002

Figure 1-26

ANTISHIMMY UNIT

A shimmy damper unit is installed on the nose gear strut (fig. 1-26). This unit is a hydraulically operated system that includes an expansion accumulator and two actuating cylinders. A piston protrudes 3/16" to 9/16" from the accumulator and should be checked prior to each flight. Maximum nose gear travel with this unit engaged is 35 ± 1 degrees, and 55 degrees with the unit disengaged.

WARNING Before the airplane is towed, the antishimmy unit must be disengaged by pulling out the pin that connects the lever to the control connecting rod. The antishimmy should be engaged prior to flight.

WHEEL BRAKE SYSTEM

The wheel brakes system consists of a static fluid circuit actuated by the rudder pedals, a boost control valve and the braking units.

The force applied to the pedals is transmitted by the static fluid circuit to the boost control valve. This valve reduces the pressure of the utility system from 3550 p.s.i. to a value variable from 0 p.s.i. (neutral position of the pedals) to a maximum of 1520 ± 150 p.s.i. (maximum braking action).

The braking units consist of self-compensating rotor plates applied to the main landing gear wheels, and actuated by power control hydraulic actuating cylinders.

The actuating cylinders are operated by the reduced pressure furnished by the boost control valve.

The braking action of each unit is proportional to the force applied to the pedals.

EMERGENCY AND PARKING BRAKE

In case of failure of the normal brake system, braking is accomplished by using hydraulic pressure stored in the emergency wheel brake system accumulator.

In this case, braking control is metered by the emergency brake handle located to the right and above the instrument panel. It is marked «EMERG. WHEEL BRAKE». Pulling this handle supplies pressure to the braking units with the same braking effect as if action was applied through the pedals. This braking action will be proportional to handle extension. When released, the handle will return to its normal position.

For parking, the wheels should be locked; once the handle is pulled out, rotating it 90 degrees will lock it in that position.

DRAG CHUTE SYSTEM

A drag chute is provided to reduce landing distances (fig. 1-28). The ring-slot type drag chute, packaged in a deployment bag, has a spring-loaded drogue. It is stowed in a compartment located below the rudder and above the exhaust nozzle.

The drag chute is manually controlled from the cockpit through a teleflex cable.

CAUTION The drag chute is for operation after touchdown has been made and the speed is 150 knots IAS or below.

DRAG CHUTE HANDLE

The drag chute handle, marked «DRAG CHUTE», is located above the upper left corner of the instrument panel. Pulling this handle releases the compartment door allowing the pilot chute to be deployed, which in turn opens the drag chute. Pushing it back in releases the locking assembly and allows the chute to be jettisoned.

FLIGHT AND NAVIGATION INSTRUMENTS

ADF INDICATOR

Refer to «ADF-102 RADIO COMPASS SYSTEM» in section IV.

WIND UNIT

Refer to «PHI MARK III B NAVIGATION EQUIPMENT» in section IV.

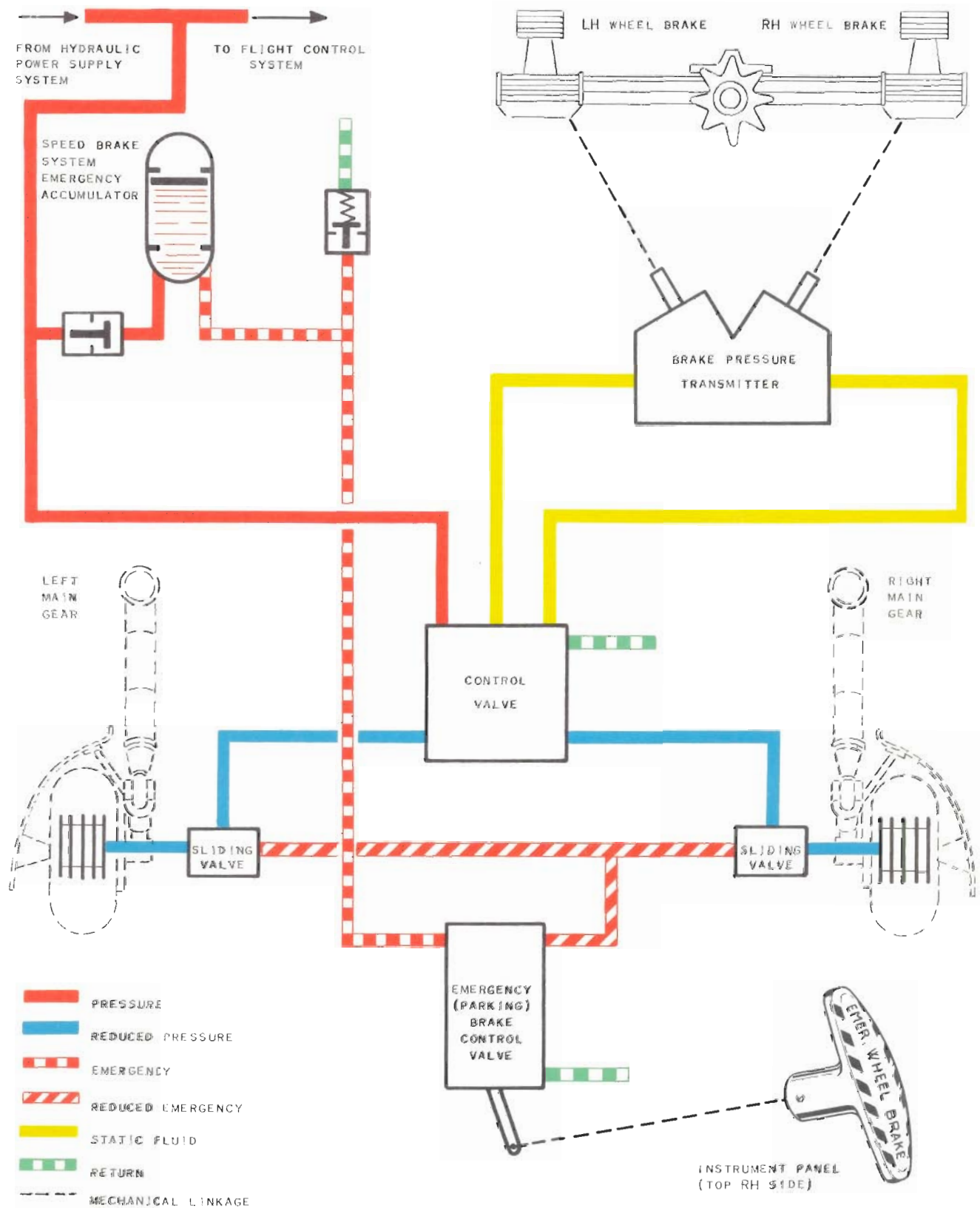
VECTOR ADDER

Refer to «PHI MARK III B NAVIGATION EQUIPMENT» in section IV.

The airspeed and mach number indicator is essentially a conventional airspeed indicator with the addition of a pointer which indicates the Mach number. A movable arrow on the rim of the indicator may be set for in-flight speed references; i.e., cruise or landing approach.

The altimeter is located on the flight instrument panel and has three pointers for indicating hundreds,

WHEEL BRAKE SYSTEM



1-0001

Figure 1-27

thousand and ten thousand foot intervals. The altimeter provides altitude readings from 1,000 to 50,000 feet with 20-foot intervals. Field altimeter setting may be set in the atmospheric pressure window to give correct landing and in-flight altitudes. Below 15,000 feet a yellow and red «Barber Pole» is displayed to assist the pilot during letdowns.

The cabin altimeter is the barometric type and is located on the right console in the cockpit. It provides altitude readings from 0 to 50,000 feet with 1,000-foot intervals.

PHI INDICATOR

Refer to «PHI MARK III B NAVIGATION EQUIPMENT» in section IV.

The turn-and-bank indicator is a conventional instrument powered by the 28-volt D.C. primary bus. A single needle displacement will provide a 360 degree turn in four minutes.

The gyro horizon indicator is powered by the three-phase A.C. busses. It indicates the attitude of the airplane in relation to the horizon. Erection of the gyro requires approximately 2 1/2 minutes.

An «OFF» power failure flag will appear in case of A.C. three phase power failure or internal instrument failure.

Since the level-flight angle of attack of the airplane varies with different loadings and speeds, a pitch trim knob is provided on the indicator for the pilot to center the horizon bar after the airplane has been trimmed for level flight.

The rate-of-climb indicator is a conventional instrument providing 0 to 6,000 ft/min readings in either diving or climbing attitudes. The indicator scale is the differential type to provide more accurate readings near zero rate of altitude change.

The clock is the eight day stopwatch type that has a full sweep second hand and luminescent dial.

The accelerometer indicates instantaneous acceleration and maximum G (positive and negative) encountered by the aircraft during flight. It has three pointers that indicate maximum positive G, maximum negative G, and instantaneous accelerations. A knurled control knob resets the instrument to zero when pushed in.

The stand-by compass is a conventional magnetic compass mounted to the right of the instrument panel

on the windshield bow and is furnished for navigation in the event of slaved gyro magnetic compass failure.

EMERGENCY EQUIPMENT

ENGINE FIRE-WARNING SYSTEM

The engine fire-warning system consists of a set of 274° C fire detectors radially mounted around the engine compressor and a warning light located on the right upper side of the instrument panel (fig. 1-29). When a fire condition is sensed by the fire detectors, the light circuit is closed and the FIRE warning light goes on.

Operation of the circuit can be checked by moving the spring-loaded «TEST CIRCUIT» toggle switch (below the warning light). If the circuit is inoperative, the warning light will not illuminate. This check does not test the thermocouples but only tests the electrical circuitry of the system.

CANOPY SYSTEM

The electrically actuated canopy (fig. 1-30) opens and closes by rotating about a hinge point at the rear. The canopy is locked mechanically by means of the canopy lock handle located on the upper left side of the cockpit.

When the canopy is locked, the canopy seal is automatically inflated when the cockpit pressurization switch is on.

CANOPY SWITCH

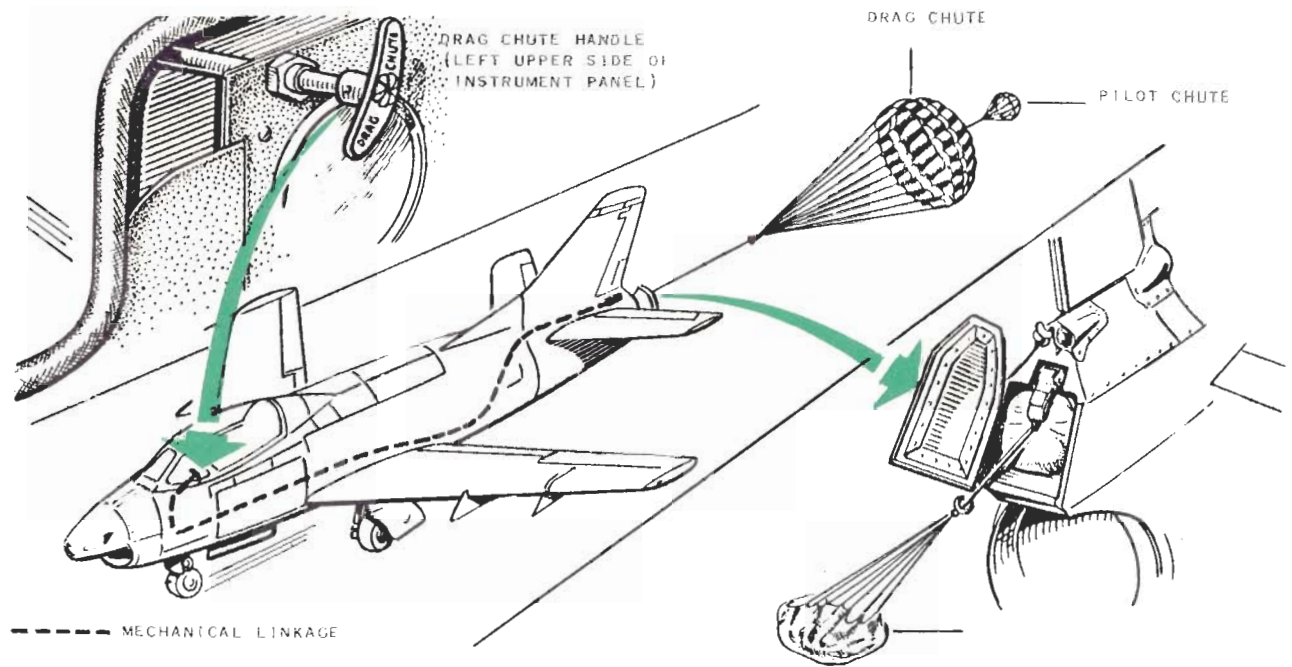
The canopy switch located on the left lower side of the instrument panel has two operating positions, «OPEN» and «CLOSED», and is spring-loaded to the center neutral position. This switch controls the opening and closing of the canopy. The canopy can be left partially open by releasing the canopy switch when the canopy has reached the desired position.

CANOPY UNSAFE WARNING LIGHTS

Two canopy unsafe warning lights (wired in parallel) are mounted just next to the canopy switch on the left lower side of the instrument panel.

These lights, which are covered by a single red cover glass, will illuminate and remain on as long as the canopy latches are unlocked.

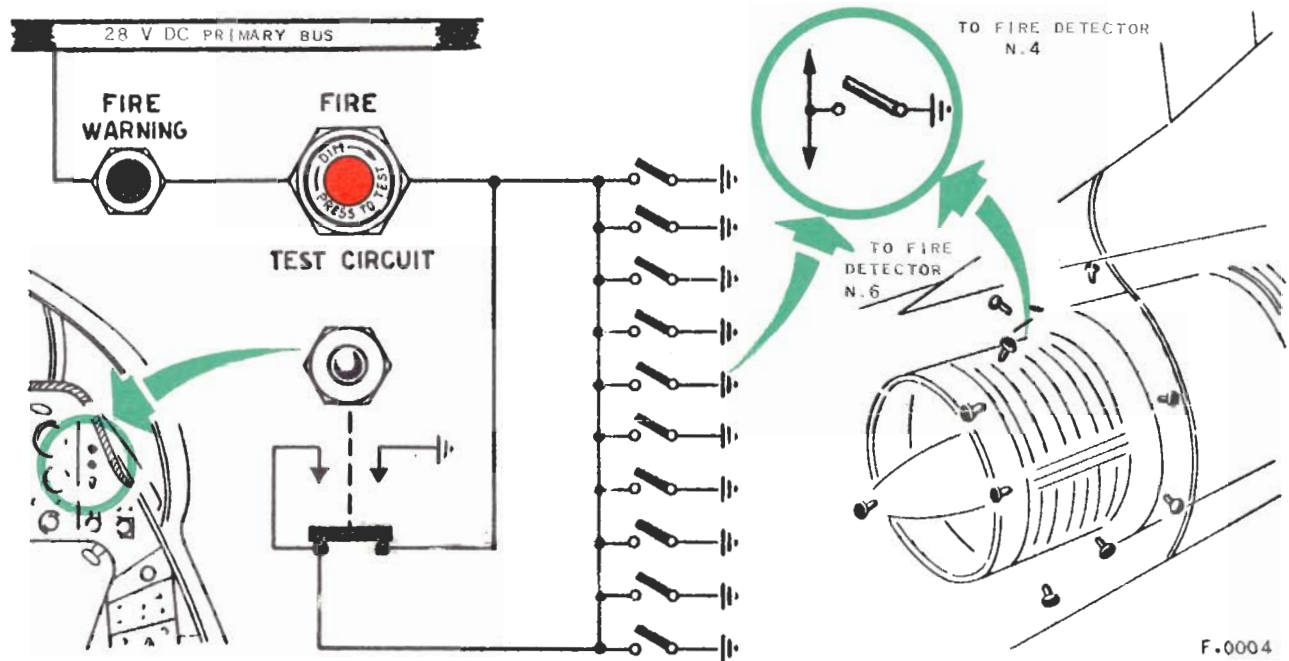
DRAG CHUTE SYSTEM



B-0000

Figure 1-28

FIRE DETECTOR SYSTEM



F.0004

Figure 1-29

CANOPY SYSTEM

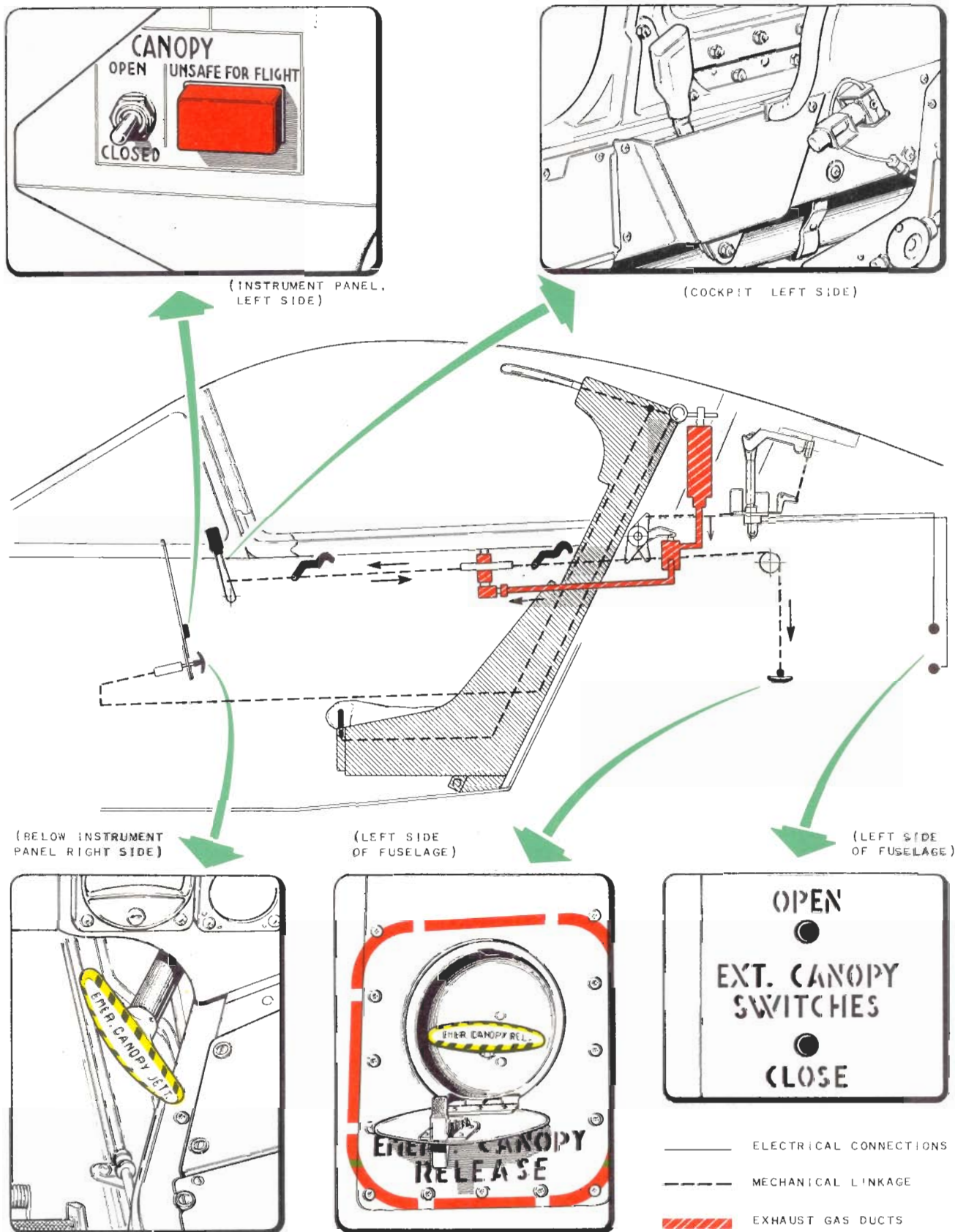


Figure 1-30

EXTERNAL CANOPY SWITCHES

The canopy is operated externally through two electrical, spring-loaded push buttons on the left side of the fuselage. These switches are aft of the gun panel and are marked «EXT CANOPY SWITCHES». One button is marked «OPEN», the other «CLOSE».

Functionally, there is no difference between the canopy switch in the cockpit and the external canopy switches, except that the external switches operate off the battery bus and do not require external power or the battery switch on.

CANOPY JETTISON HANDLE

This handle is located below the instrument panel and is marked «EMERG. CANOPY JETT.». Pulling this handle will jettison the canopy independent of seat ejection.

EXTERNAL CANOPY EMERGENCY RELEASE HANDLE

The external canopy emergency release handle is mounted in the left side of the fuselage aft of the gun panel and is covered by a door labeled «EMERG. CANOPY RELEASE». When pulled it unlatches and releases the canopy from its hinge point.

CANOPY LOCK HANDLE

A canopy lock handle, located on the left side of the cockpit, above the throttle, locks the canopy in the down position. When the canopy is locked, the canopy unsafe warning light circuit opens and air under pressure is supplied to the canopy seal when the cockpit pressurization switch is on.

CANOPY GROUND SAFETY PIN

The canopy ejection ground safety pin is installed in the right upper side of the ejection seat. This safety pin locks the firing pin to prevent accidental firing of the canopy ejection cartridge.

EJECTION SEAT

The Martin-Baker fully automatic type MK-W4 ejection seat (figs. 1-31 and 1-32) is designed to provide safe escape at all altitudes and speeds and, after ejection,

to separate the pilot from the seat and deploy the parachute automatically. If an ejection is made at high altitude, a barostatic control attached to the seat delays the opening of the main parachute and subsequent separation of the pilot from the seat until a more tolerable altitude is reached where the automatic mechanism operates. The seat incorporates a main stabilizer drogue and a controller drogue, stowed in the headrest.

Firing of the ejection charges is a completely manual operation. Height adjustment of seat and locking of belts are also manually controlled operations.

The personal parachute and its controller drogue are stowed in a «horseshoe» wedge shaped pack behind the pilot's shoulder and gives a high degree of comfort to the pilot.

FACE BLIND FIRING HANDLE

The face blind firing handle (yellow and black bands) projects from the headrest. Pulling the handle down will extract the face blind that serves to cover the pilot's face and initiate the ejection seat firing sequence.

ALTERNATE FIRING HANDLE

The alternate firing handle is located in the leading edge of the seatpan, between the pilot's legs. It has the same function as the normal firing handle and is used when, due to high G, the arms cannot be raised over the head.

If ejection is made by the alternate firing handle, the face will not be protected therefore, the pilot should sit erect with head and back firm against the seat.

TIME DELAY FIRING MECHANISM

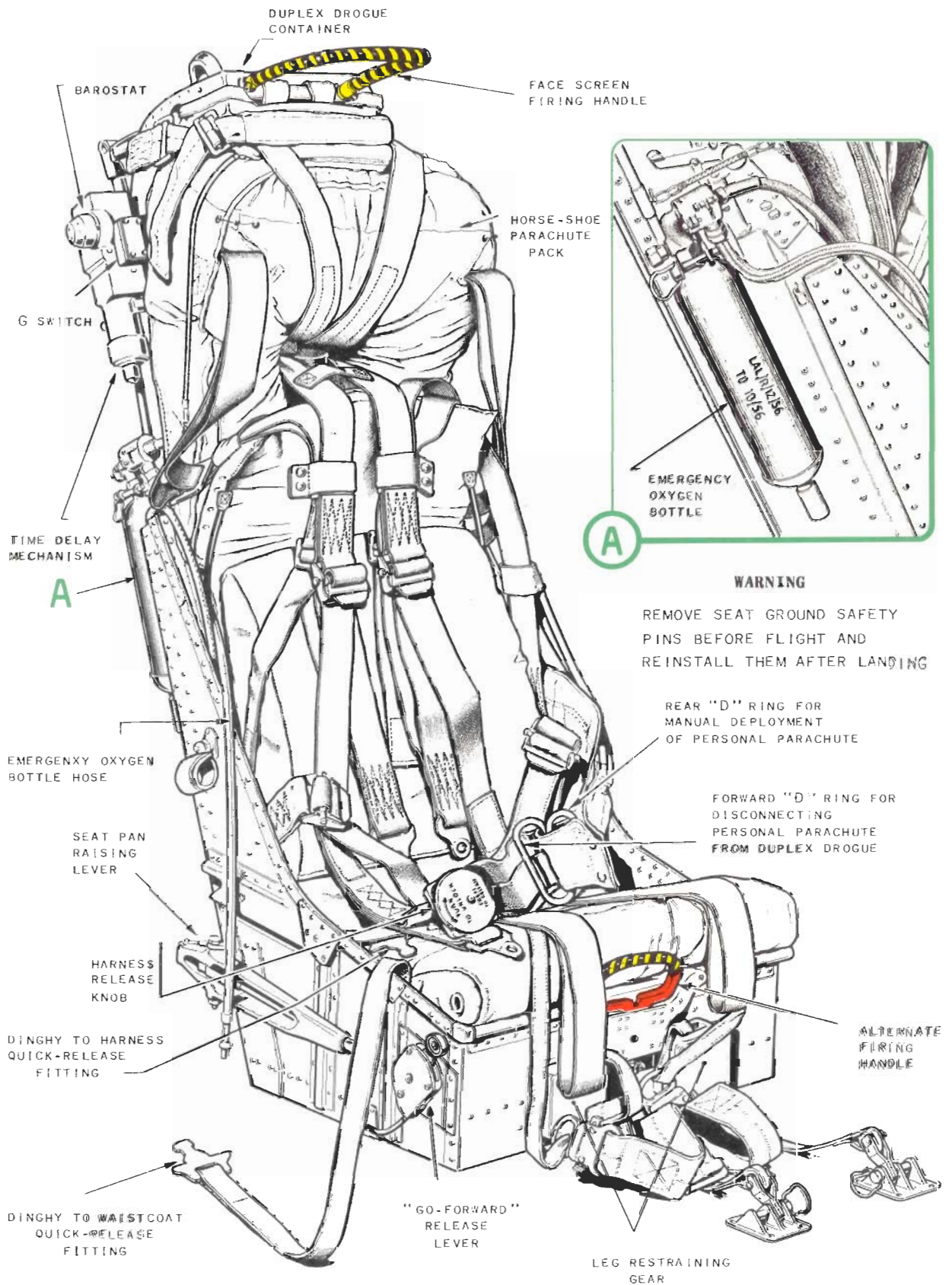
Pulling either firing handle will operate this mechanism, which regulates the sequence of the following operations during seat ejection: canopy release, canopy jettison, and seat ejection.

GROUND SAFETY PINS

Three ground safety pins are used to prevent accidental firing of the seat. One safety pin locks the face blind firing handle and is installed in the top of the headrest; another safety pin locks the alternate firing handle and is inserted in the leading edge of the seat pan.

The third safety pin is inserted into the hole of the seat ejection gun sear.

MARTIN BAKER MK-W4 EJECTION SEAT

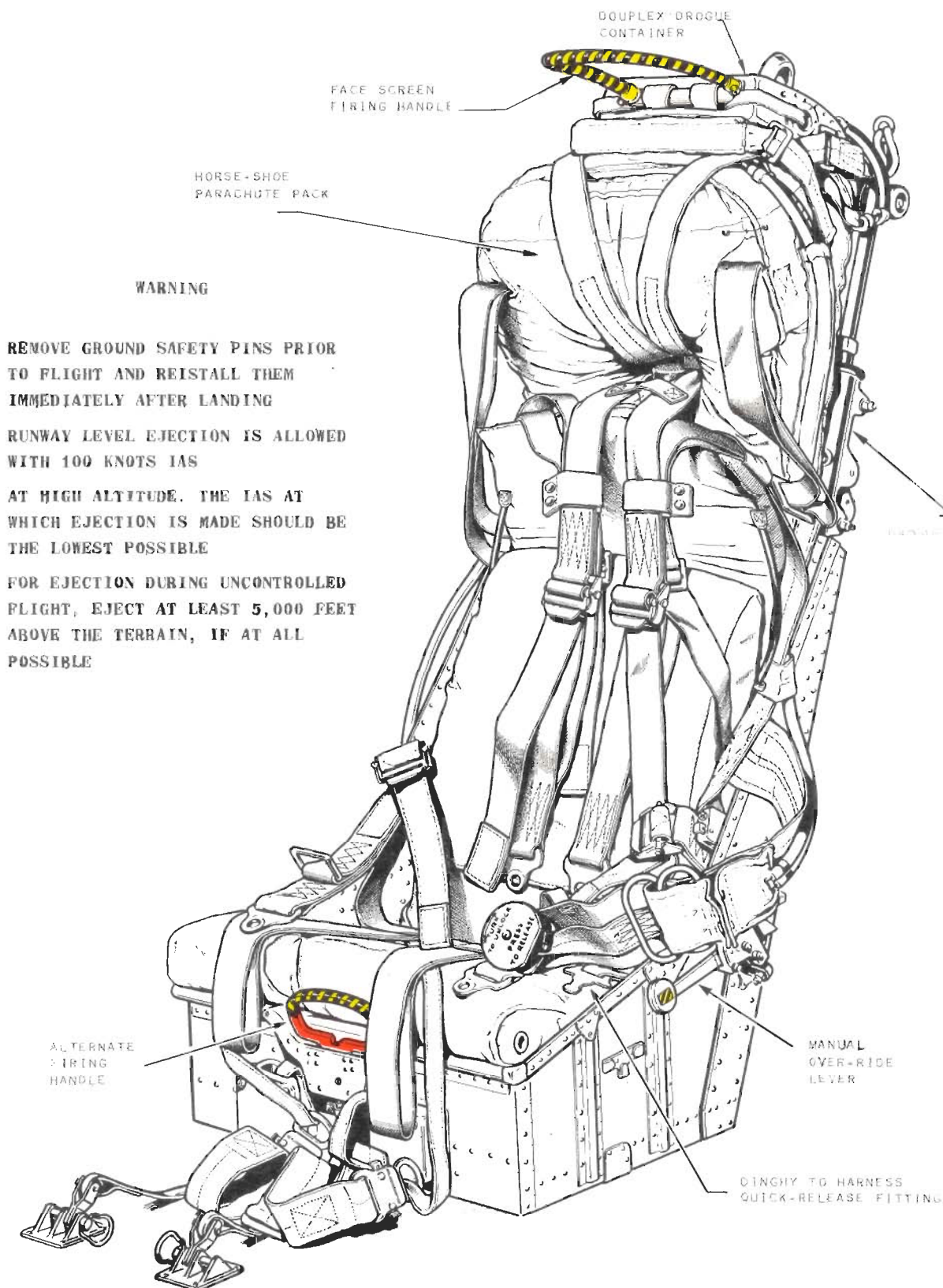


G91 R/4

Figure 1-31

R-0026

MARTIN BAKER MK-W4 EJECTION SEAT



R-0027

Figure 1-32

SEAT VERTICAL ADJUSTMENT LEVER

Vertical seat adjustment is mechanically operated by the seat vertical adjustment lever, on the right side of the ejection seat. Maximum seat up and down travel is approximately 6 inches (15 cm).

MANUAL OVER-RIDE LEVER

Pulling this lever up will release the pilot's harness, leg restraining straps, and parachute from the seat for manual bail-out.

“GO FORWARD” RELEASE LEVER

The go-forward release lever is located on the right side of the seat pan. Pushing this lever forward will

unlock the shoulder harness, permitting the pilot freedom of forward movement in the seat. When the lever is released, the shoulder harness locks.

AUTOMATIC LEG RESTRAINT

The automatic leg restraining gear is designed to hold the pilot's legs against the forward edge of the seat pan during ejection.

Two reinforced nylon cords pass through the rings of the leg strap quick-disconnects. One end of each cord is connected to the back of the seat. The other end of each cord is passed through snubbing units fixed to the forward face of the seat pan and then connected to the cockpit floor by a special roller bracket designed to break away at the load required to hold the legs against the seat pan.

SECTION II

NORMAL PROCEDURES

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GENERAL

Before each mission, the pilot will perform a number of checks as outlined in the following paragraphs.

EXTERIOR INSPECTION

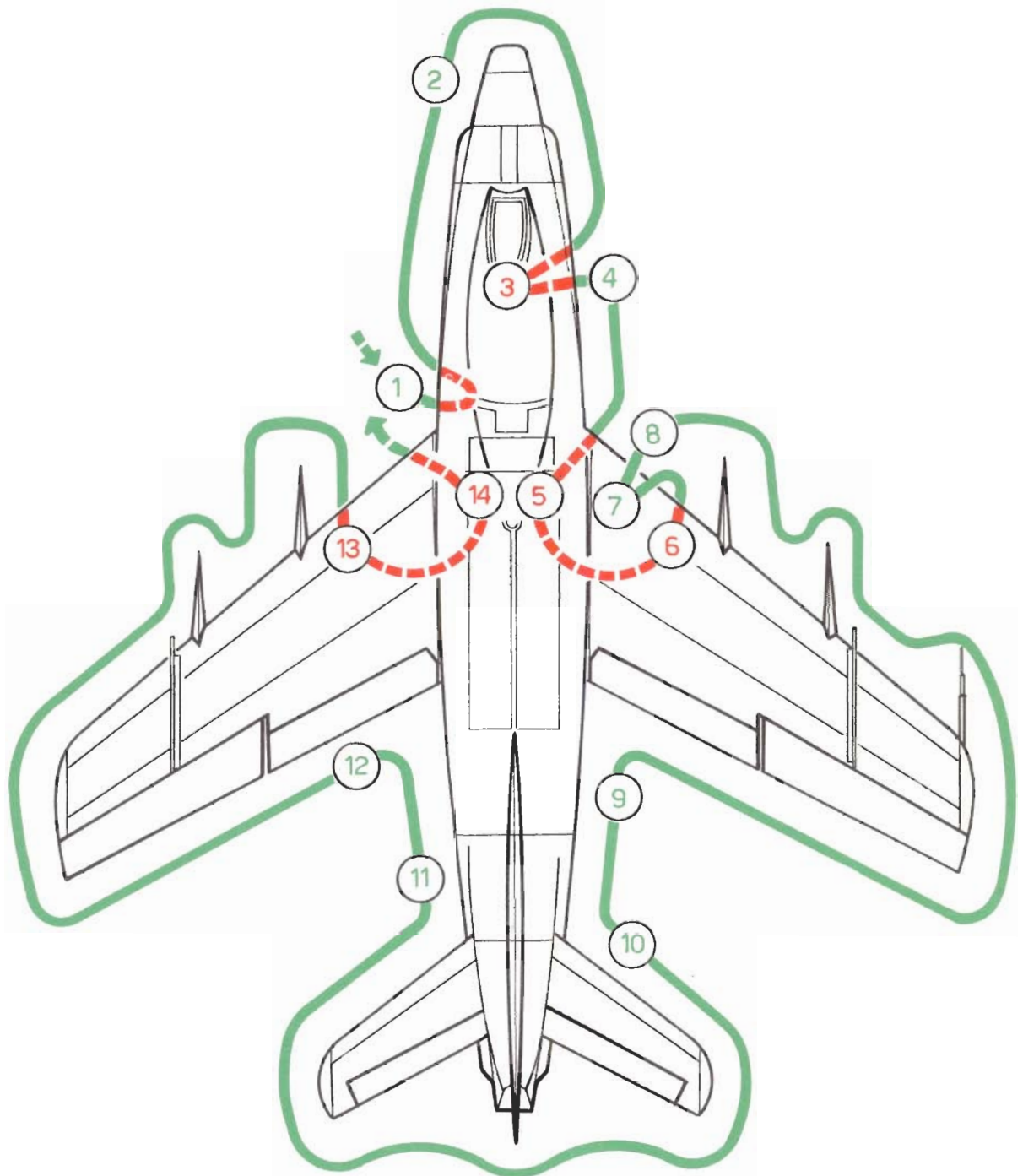
Perform exterior inspection as outlined in figure 2-1, starting from the left side of the airplane just forward of the wing leading edge and going clockwise around the airplane.

The pilot should check the airplane log book for the engineering status of the airplane and then ensure that the aircraft is properly loaded and equipped for the flight and mission.

The crew-chief will assist the pilot during this inspection. In case of a gunnery mission, the armament specialist will also assist the pilot.

WARNING Make sure the airplane has:
 a) Main wheels chocked. If the ground slopes rearwards, the main wheels should also be chocked at the rear.

EXTERIOR INSPECTION



1. FUSELAGE - FORWARD LH SIDE
2. NOSE
3. NOSE GEAR
4. FUSELAGE - FORWARD RH SIDE
5. RH SPEED BRAKE
6. RH MAIN GEAR
7. FUSELAGE - TOP RH SIDE

8. RH WING PANEL
9. FUSELAGE - AFT RH SIDE
10. EMPEWAGE AND TAIL
11. FUSELAGE - AFT LH SIDE
12. LH WING PANEL
13. LH MAIN GEAR
14. LH SPEED BRAKE

S-0000/C

Figure 2-1

- b) Speed brakes open and speed brake ground safety pin inserted.
- c) Antishimmy engaged.
- d) Canopy open.
- e) Air intake duct and tail pipe plugs removed.
- f) Pitot covers removed.
- g) Gun ports covered.
- h) Flight controls unlocked.
- i) Wing flaps down.
- j) Ejection seat and canopy ground safety pins installed.
- k) Engine bay side and lower inspection doors open.

Then proceed to the following checks:

FORWARD FUSELAGE - LH SIDE

- a) Check battery access door closed and secure.

CAUTION If the airplane is not at its home base, remove door and check the battery. Make sure it is connected.

- b) Check left side of canopy and windshield for general condition, cracks, and frosted areas.
- c) Check LH gun panel secure and gun ports covered.

CAUTION Before a gunnery mission, check gun plugs removed and expended ammunition compartment clear of links and cases.

- d) Check all doors closed and secure (camera comp.).
- e) Check all air inlets and outlets clear.

NOSE

- a) Check nose secured and camera glasses clean.
- b) Engine air intake duct cover removed.
- c) Check air intake duct for foreign objects such as tools and rags, and for popped rivets, distortion, etc.
- d) Check left side of camera compartment.

NOSE GEAR AND WELL

- a) Check for hydraulic leaks.
- b) Check nose gear microswitch for operation.
- c) Check springs and hooks for condition and operation.

- d) Check side doors for general condition and hinges.
- e) Check nose gear ground safety lock removed.
- f) Check nose gear fairing door and taxi light.
- g) Check antishimmy device engaged.
- h) Check shock strut extension for 2.9 inches (75 mm) without external loads, 2.7 inches (69 mm) with external loads.
- i) Check nose gear wheel and tire for general condition, slippage, inflation, etc.

FORWARD FUSELAGE - RH SIDE

- a) Check right side of canopy for general condition, cracks, and signs of splintering.
- b) Check RH gun panel secure and gun muzzles covered.

CAUTION Before a gunnery mission, check gun plugs removed and expended ammunition compartment clear of links and cases.

- c) Check all doors closed and secure.
- d) Check all air inlets and outlets clear.
- e) Check battery bus circuit breakers.

RH SPEED BRAKE

- a) Check for hydraulic leakage.
- b) Check speed brake for general condition (twists or breaks).
- c) Check speed brake position transmitter for general condition.

RIGHT WHEEL WELL AND MAIN GEAR

- a) Check for hydraulic leaks and fuel leaks.
- b) Check main gear fairing door.
- c) Check springs and hooks for general condition and operation.
- d) Check landing gear uplock cocked.
- e) Check main gear door microswitch for operation.
- f) Check hydraulic line to wheel brake assembly. Check brake for condition.
- g) Check shock strut extension for 1.5 inches (37 mm) without external loads, 1.1 inches (27 mm) with external loads.
- h) Check wheel and tire for general condition, slippage, inflation, etc.

- i) Check airplane ground rod.
- j) Check wheel chocked.
- k) Check main gear door, strut, fairing, and attachments for general condition.

FUSELAGE - RH TOP SIDE

Climb on top of right wing and check:

- a) Fore and aft fuel filler caps secure.
- b) Doors and fairings (RH side and top) closed and secure.
- c) Position light and canopy glass for condition.
- d) Wing upper skin for scratches, dents, etc.

RIGHT WING PANEL

- a) Check leading edge and fence.
- b) Check inner pylon and drop tank (drop tank filler cap closed).
- c) Check outer pylon and load.
- d) Pitot cover removed and pitot tube checked, static ports clean.
- e) Check wing tip and position light.
- f) Check aileron for general condition, looseness, twists, hydraulic leakage, and binding.
- g) Check flap for general condition, looseness, binding and grounding cables secure.

AFT FUSELAGE SECTION - RH SIDE

- a) Through right engine bay access door, check for hydraulic or engine oil and fuel leaks, broken or burned wires. Check cartridge breeches locked. Close and secure door.
- b) Check all fairings and doors closed. Check for fuel leakage from cell No. 5.
- c) Check all air inlets, outlets, and drains clear.

EMPENNAGE AND TAIL

- a) Check elevator servo accumulator gage for 1422 (± 57) p.s.i. reading.
- b) Check all fairings and doors closed.
- c) Check horizontal stabilizer for looseness, gap with fuselage, and general condition.
- d) Check elevator for general condition and looseness.
- e) Check rudder, trim tab and rudder control rod for general condition.

- f) Check navigation lights.
- g) Check drag chute compartment door securely latched. Remove retaining pin and hand to crew chief.
- h) Tail pipe plug removed.
- i) Check tail pipe, thermocouples, and exhaust gas temperature limiter for general condition, breaks, cracks, or distortion.
- j) Check turbine for missing, burnt or distorted buckets.

AFT FUSELAGE SECTION - LH SIDE

- a) Through engine bay LH access door, check for hydraulic and engine oil leaks, broken or burnt cables, secure oil tank cap and dip stick. Close access door.
- b) Through engine bay lower access door, check for hydraulic, fuel, or engine, oil leaks. Close access door.
- c) Check all fairings and doors secure.

CAUTION If at other than home base, check hydraulic fluid level and oil level.

- d) Check all drains and vents clear.
- e) Check for fuel leaks from cell No. 5 left access door.

LEFT WING PANEL

- a) Check flap for general condition, looseness, twists, binding, and grounding cables secure.
- b) Check aileron for general condition, looseness, twists, hydraulic leaks, and binding.
- c) Check wing tip and position light.
- d) Check outer pylon and load.
- e) Check inner pylon and drop tank for security (check tank filler cap securely closed).
- f) Check leading edge and fence.
- g) Check emergency canopy release handle in and safetied, door secure.

LEFT MAIN GEAR AND WHEEL WELL

- a) Check door, strut, wheel fairing, and attachments for general condition and operation.
- b) Check wheel chocked.
- c) Check wheel and tire for general condition, slippage, inflation, etc.
- d) Check shock strut extension for 1.5 inches (37 mm) without external loads, 1.1 inches (27 mm) with external loads.

- e) Check hydraulic line to wheel brake assembly and check brake linings for condition.
- f) Check left main gear microswitch for operation.
- g) Check springs and hooks for condition and operation.
- h) Check main gear fairing door.
- i) Check for hydraulic leaks and fuel leaks from fuel flow proportioner.
- j) Check fuel system drain valve closed and safetied.

LH SPEED BRAKE

- a) Check for hydraulic and fuel leaks.
- b) Check landing gear emergency lowering accumulator gage for 1422 (± 57) p.s.i. reading.
- c) Check forward drain valve for leak.
- d) Check landing gear emergency system dump valve closed and safetied.
- e) Check landing gear emergency system control valve spring for condition.
- f) Check speed brake for general condition, twists, or breaks.
- g) Remove speed brake ground safety key.

INTERIOR INSPECTION

Use the cockpit entrance ladder (fig. 2-2) to enter the cockpit for the interior check.

BEFORE ENTERING THE COCKPIT, PROCEED AS FOLLOWS:

- a) Visually check loose objects, tools, etc.
- b) Check LATITUDE switch on PHI JUNCTION BOX at specified setting.
- c) Then check:
 - ejection seat harness secure and in good condition;
 - bail-out oxygen bottle installed on seat and break away cable connected;
 - normal firing handle face blind in place;
 - ejection seat and canopy ground safety pins (three on seat headrest and one in alternate firing handle) installed;
- d) Check EMERG. EXT. STORES REL handle safe.

ENTER THE COCKPIT:

- a) Connect:
 - leg restraining straps;
 - dinghy;
 - shoulder harness and thigh straps;
 - anti-G suit hose;
 - oxygen lines (normal and emergency).
- b) Check left and right consoles and instrument panel, starting from left to right.

LEFT CONSOLE

- a) ARMAMENT PANEL SWITCHES - OFF.
- b) SOUND RECORDER MASTER SWITCH - OFF.
- c) YAW DAMPER and PITCH DAMPER - OFF.
- d) EMERG. LONG'L TRIM - NORMAL.
- e) UHF - OFF.
- f) FLAPS - HOLD.
- g) SPEED BRAKES - NEUTRAL.
- h) THROTTLE - STOP (with friction adjusted as desired).
- i) FUEL L.P. COCK - OPEN.
- j) H.E. IGNITION - NORM.
- k) DROPPABLE FUEL TANK AIR PRESSURE CONTROL VALVE - OFF.
- l) FUEL BOOSTER PUMP - OFF.
- m) EMERGENCY FUEL SWITCH - NORMAL.

INSTRUMENT PANEL

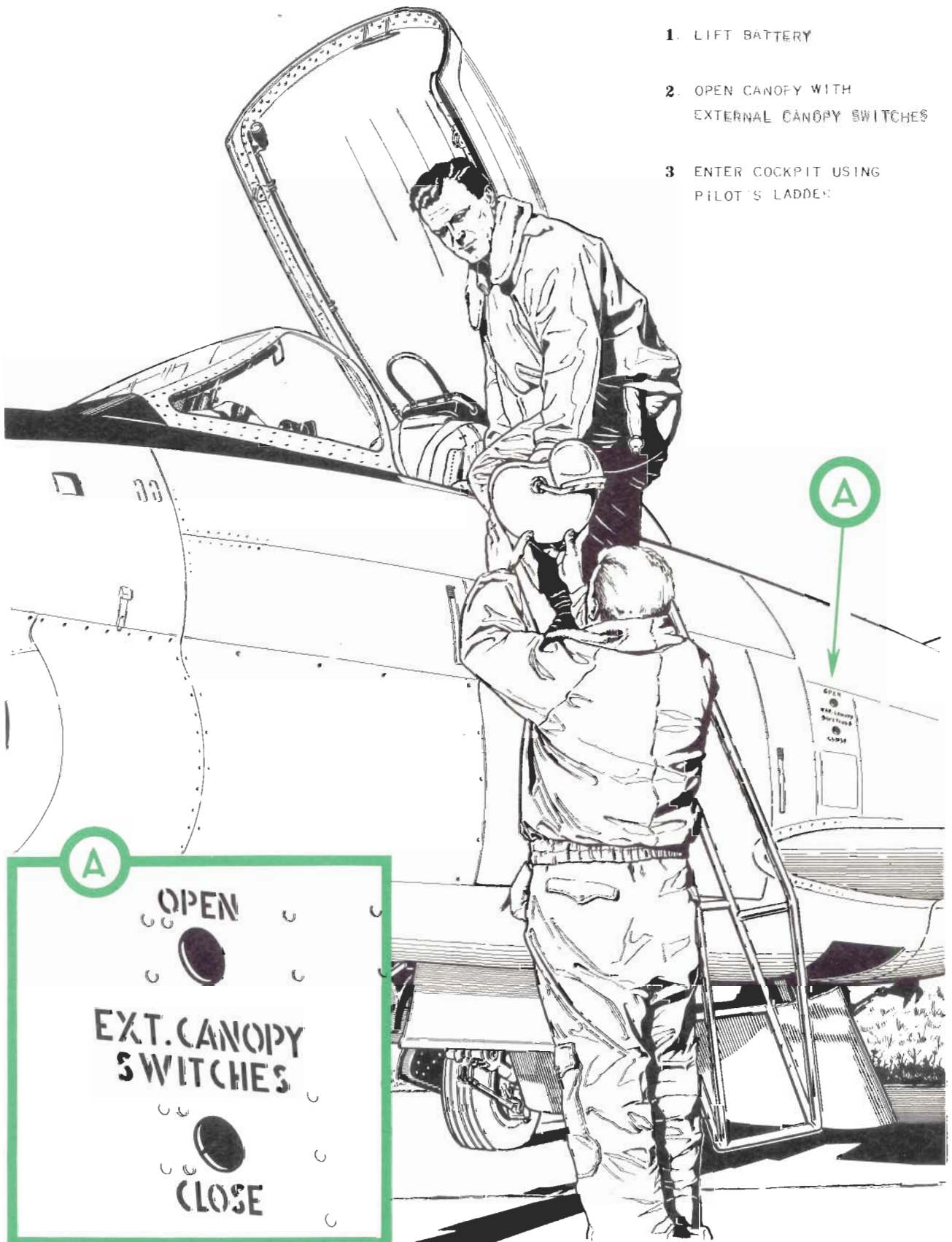
- a) EMERG. LDG. GR. handle - IN.
- b) LANDING & TAXI LIGHT - OFF.
- c) LANDING GEAR CONTROL HANDLE - DOWN (« barber pole » indication).

NOTE Red light may be checked by depressing LDG. GR. horn cutout button.

- d) DRAG CHUTE handle - IN.
- e) EMERG. EXT. STORES REL. handle - IN (Safe).
- f) GUN SIGHT LIGHT - Rheostat to DIM.
- g) EMERG. WHEEL BRAKE handle - OUT.
- h) AIRSPEED INDICATOR - Adjusted.
- i) ALTIMETER - Adjusted.
- j) AILERON SERVO EMERGENCY SYSTEM PRESSURE - OFF.

ENTERING COCKPIT

1. LIFT BATTERY
2. OPEN CANOPY WITH EXTERNAL CANOPY SWITCHES
3. ENTER COCKPIT USING PILOT'S LADDER



S-0001/1

Figure 2-2

- k) ELEVATOR SERVO PRESSURE - OFF.
- l) CLOCK - Set.
- m) ACCELEROMETER - Zeroed by depressing button.
- n) CAMERAS control panel - Check three film indicators for full indication. Check all switches OFF.
- o) SIF panel - As desired.
- p) INVERTERS - OFF.
- q) BATTERY - OFF (BATTERY OUT warning light on).
- r) GENERATOR - OFF.
- s) EMERG. CANOPY JETT handle - IN.

RIGHT CONSOLE

- a) OXYGEN REGULATOR - 400 p.s.i. pressure - Red lever NORMAL - White lever NORMAL OXYGEN - Green lever ON.
- b) ADF - OFF.
- c) GYROSYN CONTROL PANEL - MAG.
- d) DOPPLER - OFF.
- e) PHI - Station selector preset.
- f) IFF - OFF.
- g) CANOPY DEFROST-DEICE - OFF.
- h) EMERG. COCKPIT VENTILATION - OFF.
- i) COCKPIT AIR TEMP. - AUTOMATIC and set at 11.00 o'clock.
- j) COCKPIT PRESSURIZ - OFF.
- k) PITOT HEAT - OFF.
- l) LIGHTING CONTROL PANEL - OFF.
- m) CAMERA DEFROSTING lever - CLOSED.
- n) CIRCUIT BREAKERS - IN.
- o) FUSES - IN.
- p) IGNITION CARTRIDGE STARTING C/B - OUT.

On completion of these power-off checks, the pilot will perform the « Before-starting » checks.

BEFORE STARTING

- a) BATTERY OR EXTERNAL - ON (BATTERY OUT warning light off if battery switch is ON).
- b) GENERATOR - ON (GENERATOR OUT warning light on).
- c) INVERTERS - ON.
- d) FIRE WARNING - Test warning light by moving TEST CIRCUIT switch ON.

- e) FUEL LOW PRESS - Warning light on.
- f) OIL LOW PRESS - Warning light on.
- g) ELEVATOR SERVO DISENGAGE - Warning light on.
- h) FUEL QUANTITY INDICATOR - 2730 lbs.
- i) COLLECT TANK SWITCH AND LIGHT (MODIFIED A/C) - ON.
- j) CANOPY UNSAFE FOR FLIGHT - Warning lights on.
- k) LANDING GEAR POSITION INDICATORS - LD. GR. down.
- l) FLAP HANDLE - Down.
- m) FLAPS position indicator - Down.
- n) SPEED BRAKES SWITCH - OUT.
- o) SPEED BRAKES position indicator - Down.
- p) IGNITION & CARTRIDGE STARTING C/B - IN.
- q) IGNIT button - Depress and listen for ignitors.
- r) SEAT AND CANOPY EJECTION PINS (four) - Removed.

After making these checks and ensuring that the danger areas (fig. 2-3) are clear, the pilot may start the engine.

STARTING ENGINE

NOTE Refer to Section V for emergency fuel specifications.

NORMAL STARTING PROCEDURE

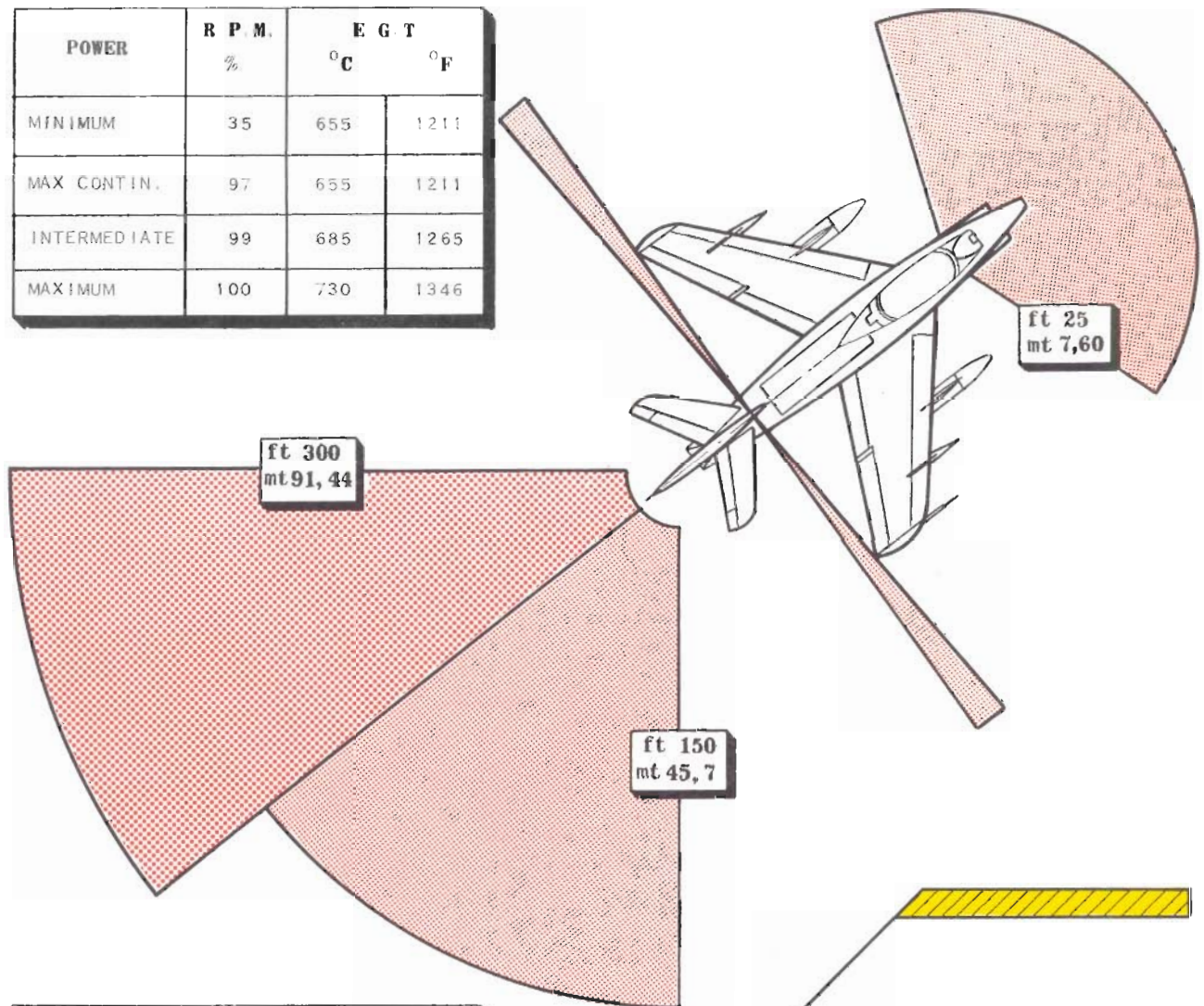
- a) H.E. IGNITION - NORM.
- b) FUEL BOOSTER PUMP - ON (FUEL LOW PRESS warning light out).
- c) EMERGENCY FUEL SWITCH - NORMAL.
- d) THROTTLE - START & FLIGHT IDLE.
- e) STARTER - Button depressed for 2 seconds.

WARNING Depressing the STARTER button will immediately energize the engine ignition circuit. The button is automatically held depressed for 30 seconds by a time switch controlled solenoid which prevents simultaneous selection of the two cartridges that would damage the starter turbine.

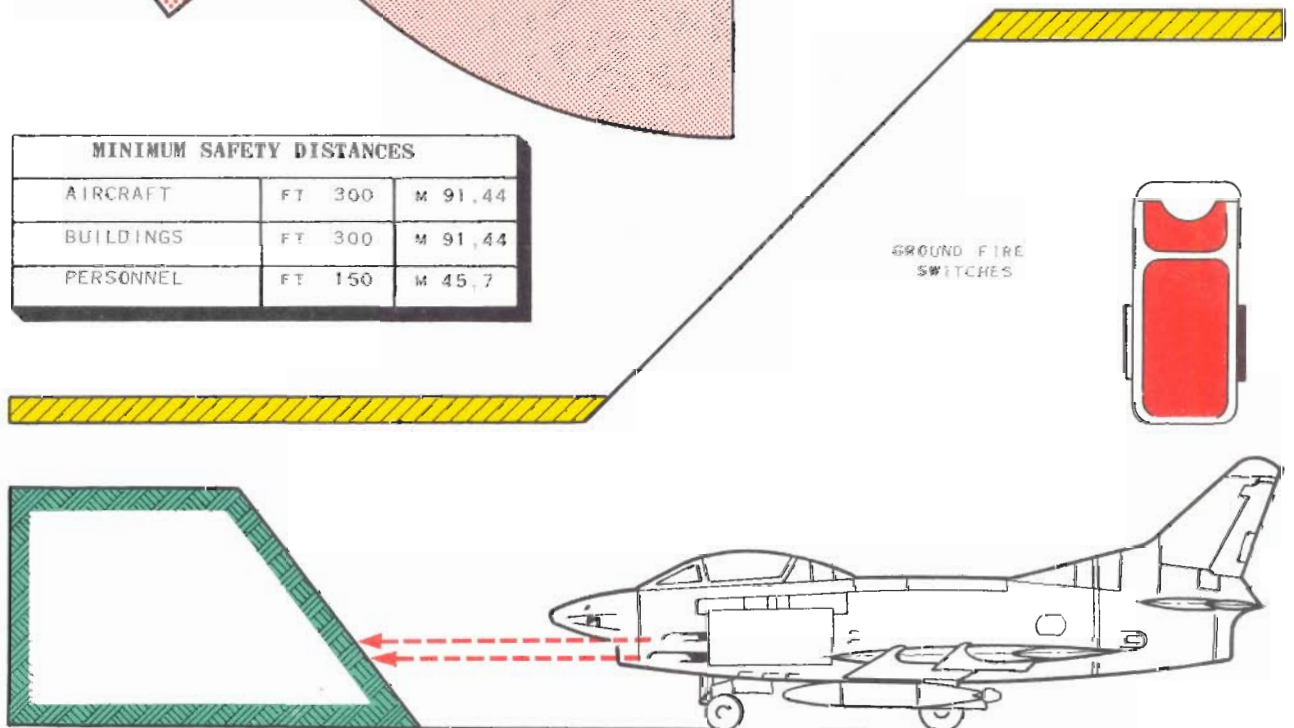
WARNING If ignition does not occur within 5 seconds abort start sequence and investigate cause before selecting the second cartridge.

DANGER AREAS

POWER	R P M. %	E G T	
		°C	°F
MINIMUM	35	655	1211
MAX CONTIN.	97	655	1211
INTERMEDIATE	99	685	1265
MAXIMUM	100	730	1346



MINIMUM SAFETY DISTANCES			
AIRCRAFT	FT 300	M 91.44	
BUILDINGS	FT 300	M 91.44	
PERSONNEL	FT 150	M 45.7	



f) EGT and RPM - The EGT should begin to rise at approximately 15% r.p.m. within 3 seconds after pressing the button. EGT should increase to less than 650° C and RPM should rise to 35 (+0.5, 0)% within 13 seconds.

WARNING If the exhaust gas temperature rises too quickly and exceeds 700° C during the starting cycle, immediately chop throttle to STOP and shut down engine to investigate cause before attempting a restart. Record temperatures above 730° C. If the engine and oil are colder than -26° C (-5° C with emergency oil), do not attempt a start.

AFTER STARTING

Increase engine r.p.m. to 45% and check:

- a) FIRE WARNING LIGHT - OUT.
- b) OIL LOW PRESS LIGHT - OUT.

WARNING In very cold weather, if the OIL LOW PRESS warning light comes on, retard the throttle until the light goes out; then gradually increase the r.p.m. If the light remains on, shut down the engine and investigate cause.

- c) FUEL LOW PRESS LIGHT - OUT.

WARNING Retard the throttle to STOP if the FUEL LOW PRESS warning light comes on during a start. Investigate cause.

- d) GENERATOR LIGHT - OUT.
- e) BATTERY LIGHT - OUT.
- f) INVERTER LIGHTS - OUT push to test.
- g) VOLTMETER - 28 volts.
- h) LOADMETER - 0.3 to 0.5 amperes.
- i) HYDRAULIC SYSTEM pressure gages - 3450 to 3750 p.s.i.
- j) AILERON SERVO LOW PRESS LIGHT - OUT push to test.
- k) AILERON SERVO EMERGENCY SYSTEM PRESSURE - ON & LIGHT OUT.
- l) LIGHTING PANEL - As desired.

ENGINE FAILS TO START

If the EGT does not rise within 5 to 6 seconds after pressing the starter button, retard the throttle to STOP and investigate.

Ensure that excess fuel is drained from the jet pipe. Then perform a dry cycle as follows:

- a) THROTTLE - STOP.
- b) FUEL L.P. COCK - OPEN.
- c) FUEL BOOSTER PUMP - ON.
- d) H.E. IGNITION - INS.
- e) STARTER - Press button for 2 seconds.
- f) Allow engine to run down.
- g) Reload starter breeches.

CAUTION Before making another start move the airplane to avoid risk of fire from fuel on the ground.

PRECAUTIONS BEFORE LOADING AND UNLOADING STARTER BREECHES

- a) BATTERY - OFF (BATTERY OUT warning light on).
- b) H.E. IGNITION - INS.
- c) After firing one breech or firing both allow breech to cool for one minute before reloading.
- d) After firing three cartridges in succession, allow the starter system to cool for 15 minutes before reloading and firing again.

WARNING Do not reload a hot breech.

BEFORE TAXIING

CANOPY

- Check entrance ladder removed.
- Move canopy switch to CLOSED and hold until the canopy closes fully.
- Move canopy lock handle forward and check CANOPY UNSAFE FOR FLIGHT warning lights out.
- INVERTERS - ON; GENERATOR - ON; BALLERY - ON.
- LOADMETER checked.

ELEVATOR SERVO CONTROL

- Move PRESS switch to ON and check that DISENGAGE warning light goes out. An abrupt jerk on the control stick should be noticed when the elevator power control actuator is engaged.

CAUTION If this does not happen, move the control stick full forward and full aft until the above conditions are met.

EMERG. LONG'L TRIM

— Move EMERG. LONG'L TRIM switch to NOSE DOWN and then to NOSE UP for complete travel (check on indicator). Then move to Take Off position. Place switch in normal.

NORMAL LONG'L TRIM

— Move TRIM switch forward and aft through complete travel (check indicator). Then move to Take Off position.

LATERAL TRIM

— Move TRIM switch left and right and then return to center position. Check control stick in center position. Check ailerons and control stick travel during trim actuation.

RUDDER TRIM

— Move rudder trim switch LEFT and RIGHT for complete travel, and then to take-off position. Check TAKE OFF POSIT warning light on. (Light should go out when switch is released). Use mirror or ground crew to visually check rudder tab position.

FLIGHT CONTROLS

Operate control stick and rudder pedals to full travel in all directions. Check freedom of movement and automatic return to center position. Observe hydraulic system fluctuation and return to normal pressure.

SPEED BRAKES

Move SPEED BRAKE switch to IN until the speed brakes close fully. Check speed brake movement on speed brake position indicator. Observe hydraulic system pressure.

FLAPS

Move flap lever UP to completely retract the wing flaps, and then full DOWN. Check flap travel on flap position indicator. Move flap lever to HOLD.

UHF

Move UHF control switch to BOTH, select desired channel, adjust volume, and contact control tower for taxi instructions.

OXYGEN REGULATOR

Move red lever to TEST MASK and check oxygen flow and operation of FLOW indicator. Then release and check that lever returns to NORMAL.

Move white lever to 100% OXYGEN if taxiing behind other airplanes. Otherwise leave at NORMAL OXYGEN.

ADF

Turn control switch to ANT position and allow several minutes for warm up. For a preselected station, move control switch to ANT position and depress the button of the desired station. Place control switch to COMP and check indicator pointer for movement in the direction of the selected station. For a station that is not preselected, move control switch to «ANT», tune to the desired station and move the control switch to «COMP». Check indicator pointer for movement in the direction of the selected station.

PHI AND DOPPLER (to conserve fuel check with GPU prior to start)

a) Press HOME station selector button.

b) Switch mode selector knob to HOLD position. Adjust DIST knob to zero distance counter. Then move mode selector switch to PHI position. SEQUENCE (amber) light should go on for about 10 seconds. Distance indicator should not display more than 1 1/2 miles.

CAUTION Wait until light goes off before checking further.

c) Switch DOPPLER control knob to RECVR ONLY position and wait for equipment to warm up. After about one minute, switch knob to TEST position.

CAUTION Wait until red warning light on DOPPLER control panel goes off to signal that Doppler circuit gives proper output reading.

d) Rotate VAR knob until variation index on indicator is on 0°. Grivation index must be $20^{\circ} \pm 2^{\circ}$ to the left of reference lubber line.

e) Switch mode selector knob on PHI indicator to HOLD position, zero distance counter and start stop watch. Switch mode selector to PHI position and wait until SEQUENCE warning light goes off.

f) After 5 minutes, the distance counter on the indicator should show 50 ± 2 miles and bearing pointer should be at $180^\circ \pm 2$ to grivation index.

g) Switch DOPPLER control knob to RECVR ONLY position. Check that the warning light on the DOPPLER control panel goes on after 15 seconds and the grivation index shows $0^\circ \pm 2$.

On completion of check, switch Doppler control knob OFF.

h) Switch mode selector to HOLD position and reset distance counter. Switch selector to PHI position and wait for SEQUENCE warning light to go off.

i) Press station selector buttons 2, 3, 4, and 5 in succession. The PHI indicator should display calibration of buttons with a ± 2 miles tolerance for range and a $\pm 2^\circ$ tolerance for bearing.

j) Press button No. 1. Rotate VAR knob on PHI indicator until 10° EAST is displayed on variation scale.

Grivation index should move $10^\circ \pm 1^\circ$ right of lubber line.

Repeat procedure rotating VAR knob to read 10° WEST. Grivation index should move $10^\circ \pm 1^\circ$ left of lubber line.

k) To set wind information, rotate W/S and W/D buttons until required display is given on speed counter and direction index.

NOTE SEQUENCE warning light on station selector should go on just after W/S and W/D buttons are depressed. After wind vector has been set into wind unit, wait for SEQUENCE warning light to go off before proceeding further.

l) Adjust VARIATION to desired setting.

m) Switch mode selector knob to HOLD position and zero distance counter by using DIST knob.

n) Switch mode selector knob to PHI position.

o) J-8 caged and released.

p) Anti-G suit checked.

After these checks ensure that ground safety pins are removed from the headrest and the alternate firing handle in front of the seat pan.

Also ensure that wheel chocks are removed.

TAXIING

a) Depress and hold brakes and release parking brake.

b) Advance throttle, release brakes and reduce

RPM to taxi power dependent upon ambient temperature and airfield altitude.

WARNING The wheel brakes are very efficient. Care should be used in applying brakes to prevent overheating. Avoid using brakes accidentally due to the position of the brake pedals.

c) Flight instruments - Check.

d) Airspeed indicator - 30-35 knots.

PHI - Correct heading.

Attitude indicator - Adjusted for ITO/cruise.

Turn and slip indicator - Operating.

Vertical speed - Zero.

Standby compass - Checked.

Navigation equipment - As required.

BEFORE TAKE-OFF

a) Align nose wheel with runway center line.

b) Apply brakes.

c) TRIM

— Elevator - Take-off position.

— Aileron - Control stick centered aileron checked.

— Rudder - TAKE-OFF POSIT light checked.

d) SPEED BRAKES - UP.

e) FLAPS - Full down and flap lever at HOLD.

f) CANOPY - closed and locked; CANOPY UNSAFE FOR FLIGHT warning lights out.

g) AILERON SERVO EMERGENCY SYSTEM. PRESSURE - OFF.

h) FLIGHT INSTRUMENTS - Checked.

i) OXYGEN REGULATOR - White lever 100% OXYGEN.

j) FLIGHT CONTROLS - Check for freedom of movement.

k) PRESSURIZATION - ON.

l) HARNESS AND THIGH STRAPS - tightened and locked pins removed.

m) THROTTLE - Check engine throttle SLAM. 40 % RPM slam to 100 % (6 seconds acceleration time); retard and at 70 % reslam for stall (fig. 5-1).

n) ENGINE INSTRUMENTS - Checked.

o) FUEL QUANTITY - Checked.

p) PITOT HEAT - As required.

q) NAVIGATION LIGHTS and COCKPIT LIGHTS - As required.

TAKE-OFF

To take off, proceed as follows (fig. 2-4).

After aligning aircraft with runway and applying brakes:

a) Advance throttle smoothly to 100% r.p.m. and allow r.p.m. and EGT to stabilize (730° C maximum).

NOTE — At ambient temperatures below 59° F (15° C), the r.p.m. should reach 100% and the EGT should be below 720° C.

— At ambient temperatures above 59° F (15° C), the EGT limiter should control EGT at 720° C to 725° C and the r.p.m. will be below 100%.

— In very hot weather, it might be necessary to retard the throttle to avoid exceeding 730° C before the EGT limiter has taken control.

CAUTION At maximum r.p.m. the wheels may slip on the ground with the brakes on. In this case, release the brakes and continue to advance the throttle during initial take-off.

b) Release brakes and begin take-off roll, using the brakes to maintain directional control. Rudder control becomes effective at 50 knots IAS.

c) At 95 knots IAS, lift nose wheel (full aft stick).

d) As speed reaches 125 knots IAS with no external load or 130 knots IAS (with external loads), the aircraft should fly off the ground.

NOTE Due to poor elevator response at low airspeeds full aft movement of the control stick is required during the initial take-off roll.

MINIMUM RUN TAKE-OFF

Minimum run take-off with external loads at altitude 0 and standard air conditions is 2,671 feet (814 m).

CROSS WIND TAKE-OFF

Tests are being performed. Information will be issued upon availability of data.

AFTER TAKE-OFF (CLIMB)

a) Tap brakes to free wheels of mud, snow etc, and retract the gear before reaching 185 knots IAS. Check gear indicators for «UP» indication.

b) Raise flaps at 140 to 185 knots IAS. Trim longitudinally as required. Move FLAP lever to HOLD.

c) RPM - 100% (should not exceed 101%).

d) EGT - 730° C max.

e) Accelerate to 360 knots IAS.

f) Climb at 360 knots IAS until Mach. 0.7 is reached and continue at Mach 0.7.

5000 FOOT TERRAIN CHECK

a) OXYGEN REGULATOR - white lever at NORMAL OXYGEN.

b) SIF - Checked.

CAUTION — In full throttle climb, the r.p.m. will rise to 101% by the time 5000 feet is reached and normally the EGT temperature will be below 720° C; in high ambient temperatures, the EGT limiter will restrict r.p.m. to less than 101% up to 15,000 feet.

— Above 15,000 feet, the throttle may have to be retarded to avoid exceeding the 730° C EGT limit. Above 30,000 feet, the Pressure Ratio Limiter will limit the r.p.m. at full throttle and the EGT should be below 730° C.

— Report EGT above 720° C when below 15,000 feet and check the limiter.

— In reduced power climb, retard the throttle to 97% r.p.m. or to 685° C EGT.

CRUISE

Altimeter - Reset to 29.92" hg.

Canopy defrosters - As required.

DROP TANKS

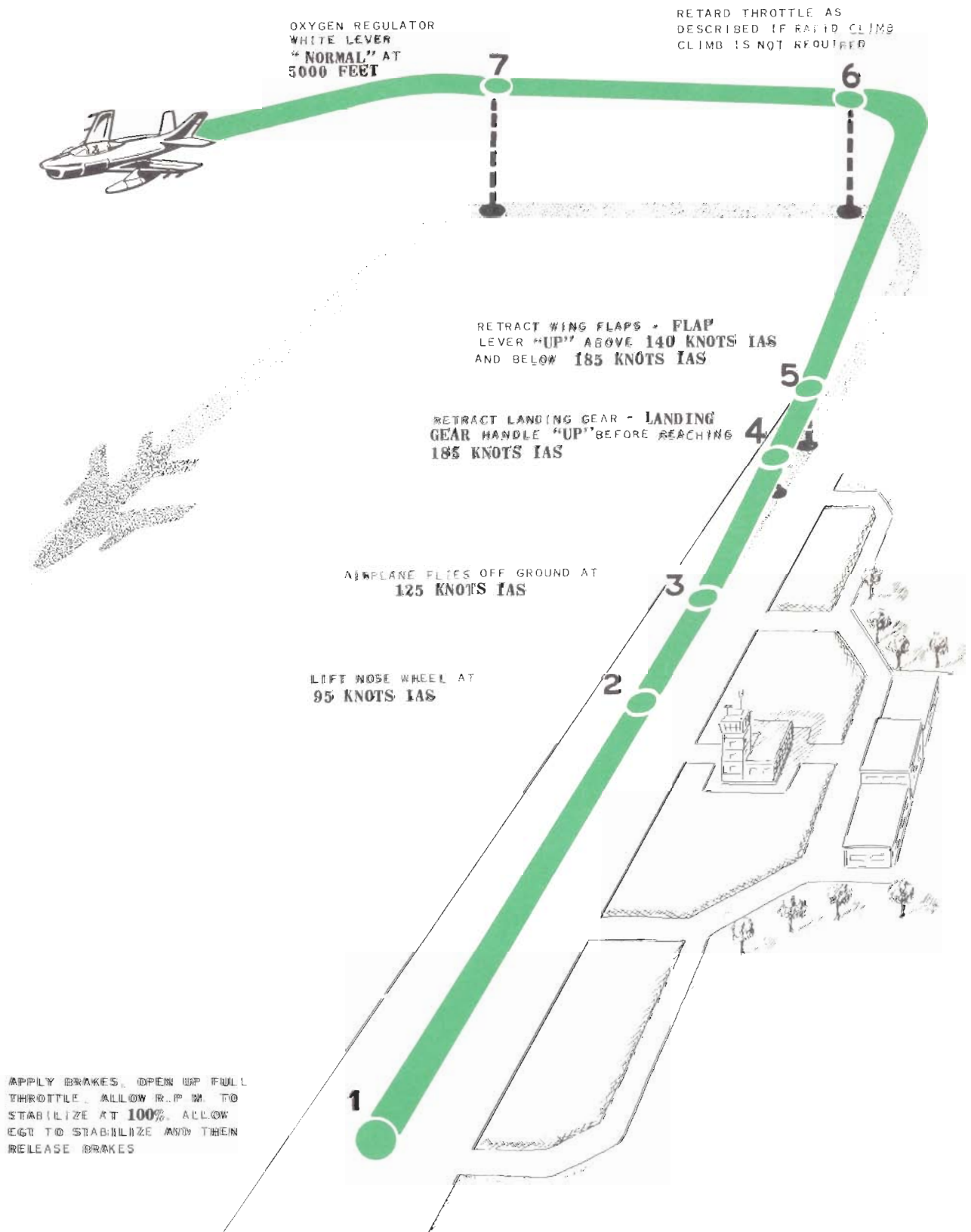
a) Turn pressurization control switch on when the fuel quantity indicator has dropped to 1900 pounds.

b) Turn pressurization switch OFF after 15 minutes or when fuel quantity indicator shows a reduction in fuel load.

FLIGHT CHARACTERISTICS

Refer to Section VI.

TAKE-OFF



SYSTEMS OPERATION

Refer to Section VII.

DESCENT

- a) SPEED BRAKES - As required.
- b) THROTTLE - RPM not under 40 %.
- c) CANOPY DEFROSTER - ON.
- d) PITOT HEAT - As required.
- e) Check EGT - 200° C minimum.
- f) ALTIMETER - Checked and set to station pressure.

5000 FOOT TERRAIN CHECK

- a) ARMAMENT PANEL - All switches OFF.
- b) FUEL QUANTITY - Check.
- c) OXYGEN REGULATOR - White lever at 100 % OXYGEN.
- d) INSTRUMENTS and NAVIGATION EQUIPMENT - Checked.
- e) HARNESS - Checked.

BEFORE LANDING

- a) Fly traffic pattern at 1500 to 1700 feet above field elevation at 260 knots IAS.

INITIAL APPROACH

- a) FUEL QUANTITY - Check.
- b) HYDRAULIC PRESSURE - Check.
- c) SPEED BRAKE - IN.
- d) AIR SPEED - 260 knots IAS.
- e) THROTTLE - 75 % (40 % minimum).

180° TURN TO DOWNWIND LEG (PITCH OUT)

At a point near the end of the runway, the exact location of which will be determined by traffic density and headwind conditions, begin a 180° level turn to the downwind leg by rolling slowly and smoothly into a bank of approximately 60°. Fly the aircraft around the turn to the downwind leg. This turn to

the downwind leg is a smooth, steep turn and not a hard « break ».

- a) SPEED BRAKE - Out.
- b) THROTTLE - Retard to 60 % r.p.m.

DOWNWIND LEG.

Roll out on the downwind leg, fly straight and level, maintaining altitude while reducing airspeed to a minimum of 160 knots.

- a) LANDING GEAR LEVER - Down. Check gear indicators and hydraulic pressure.
- b) SPEED BRAKES - As required.
- c) BRAKES - Check pedal pressure.

180° TURN TO FINAL APPROACH

Roll into the 180° turn to final approach at a minimum of 160 knots using a medium bank descending turn. Do not allow airspeed to drop below 160 knots while in the turn.

- a) FLAPS - DOWN.
- b) THROTTLE - 60 % or as required.
- c) LANDING GEAR LEVER - Recheck down and locked.

FINAL APPROACH

The roll out onto the final approach shall be completed at not less than 160 knots, 500 feet altitude above the terrain and approximately 3/4 nautical mile from the end of the runway.

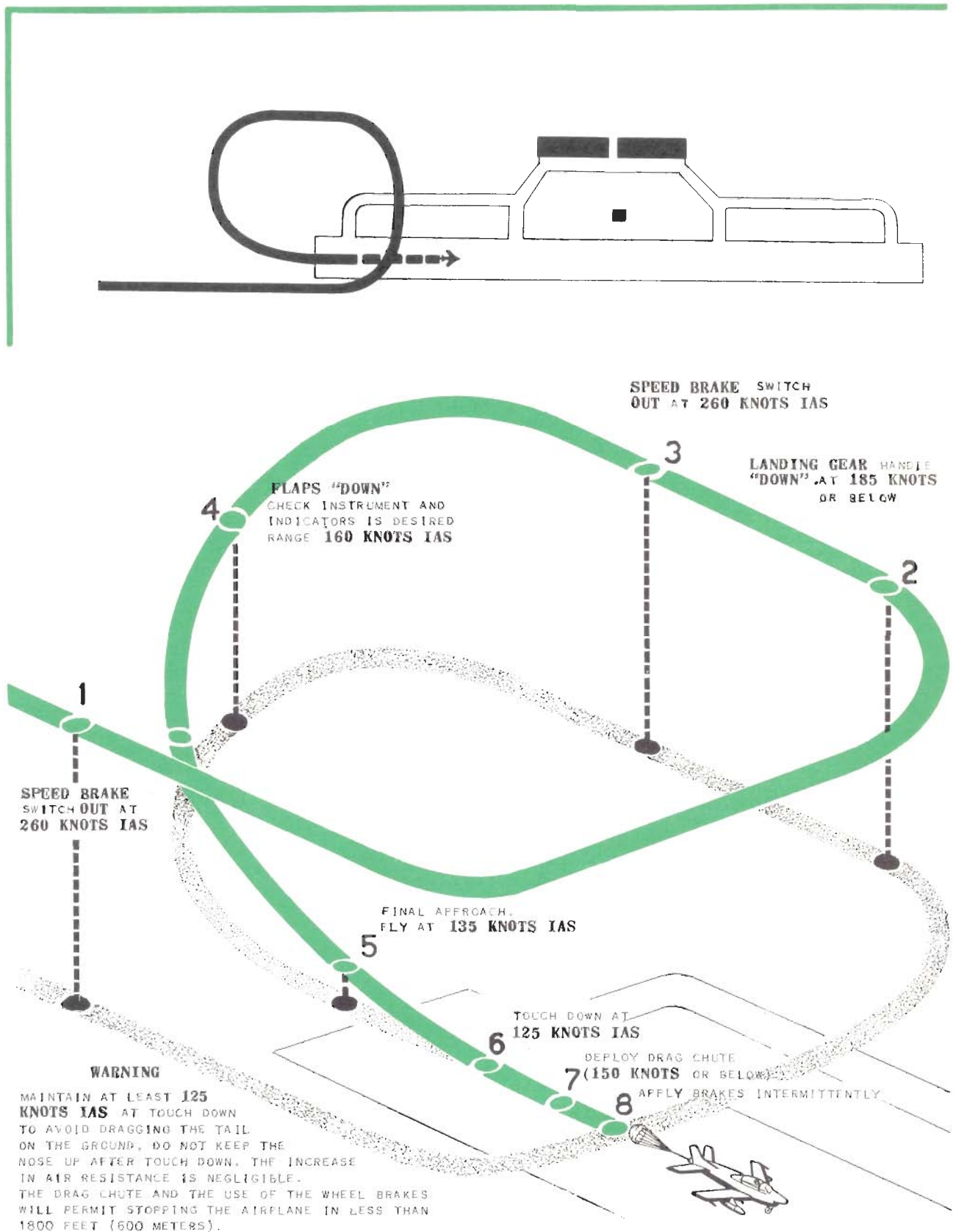
- a) THROTTLE - As required.
- b) AIRSPEED - maintain a minimum of 135 knots IAS.
- c) TOUCH DOWN - 125 knots.
- d) LOWER NOSE WHEEL and DEPLOY DRAG CHUTE.

NOTE — With the exception of gust correction factors or flight control difficulties, the final approach speed should not exceed 150 knots.

— The final approach, flare and touchdown speeds that are discussed here are based on 150 gallons of fuel.

The flare-out for landing should be gradual, with speed reduced to a minimum of 135 knots before landing. Touchdown must be at least 125 knots IAS to prevent a nose high attitude and tailpipe damage.

NORMAL LANDING



CROSSWIND LANDING

The crosswind landing procedure is the same as for normal landings with the exception of drift correction. It is recommended that the upwind wing-low (slip) method of drift correction be used. In very strong crosswinds a combination of the wing-low and crab method for counteracting drift may be used. Under these conditions a landing should be made in the center of the runway.

WET OR ICY RUNWAY LANDINGS

For landing on wet or icy runways, normal procedures may be used due to the short landing distance of this aircraft.

GO-AROUND

If you make a decision to go around (fig. 2-6), proceed as follows:

- a) **THROTTLE** - Advance smoothly to maximum power.
- b) **SPEED BRAKES** - closed (UP).
- c) **LANDING GEAR** - UP below 185 knots IAS.
- d) **FLAPS** - UP above 140 knots IAS and below 185 knots IAS.

WARNING When the speed brakes are open, the gear may not retract fully. Close the speed brakes before retracting the gear.

AFTER LANDING

- a) **DEPLOY DRAG CHUTE.**

NOTE The limiting drag chute deployment speed is 150 knots IAS. Pull out the **DRAG CHUTE** handle immediately after touchdown. Do not deploy the drag chute in flight. The drag chute can be deployed during cross-wind landings on a dry runway provided the cross-wind speed is not greater than 20 to 25 knots.

- b) **APPLY BRAKES INTERMITTENTLY.**
- c) **FLAPS UP** (flap lever at HOLD).
- d) **SPEED BRAKES** - (IN).

e) Jettison the drag chute as soon as possible after leaving the runway to avoid excessive use of brakes to maintain directional control of the airplane in a crosswind.

AFTER CLEARING THE RUNWAY

- a) **CANOPY** - As required.
- b) If the airplane is returning from a firing mission, the armament mechanics should disarm the guns and disconnect the unexpended rocket or missile connectors as soon as the airplane leaves the runway.
- c) **OXYGEN** - As required.
- d) **TRIM** - TAKE OFF.
- e) **CANOPY DEFROSTER** - OFF.
- f) **NAVIGATION EQUIPMENT** - OFF.
- g) **PITOT HEAT** - OFF.

SHUTDOWN ENGINE

- a) **CANOPY** - OPEN.
- b) **WHEELS** - Chocked.

CAUTION Do not use the parking brake when the wheel brakes are hot.

- c) **THROTTLE** 55-60 % RPM. Allow temperature to stabilize and then throttle to STOP.
- d) **LOWER FLAPS** and place flap lever at HOLD.
- e) **SPEED BRAKES** - Down.
- f) Move **FUEL BOOSTER PUMP** switch OFF after engine shutdown.
- g) **TURN OFF ALL SWITCHES TO DISCONNECT ALL EQUIPMENT.**
- h) Move **BATTERY** switch OFF (BATTERY OUT warning light on).
- i) **IGNITION C/B** « OUT ».
- j) Install four seat and canopy ground safety pins.
- k) Have speed brake ground safety key inserted.

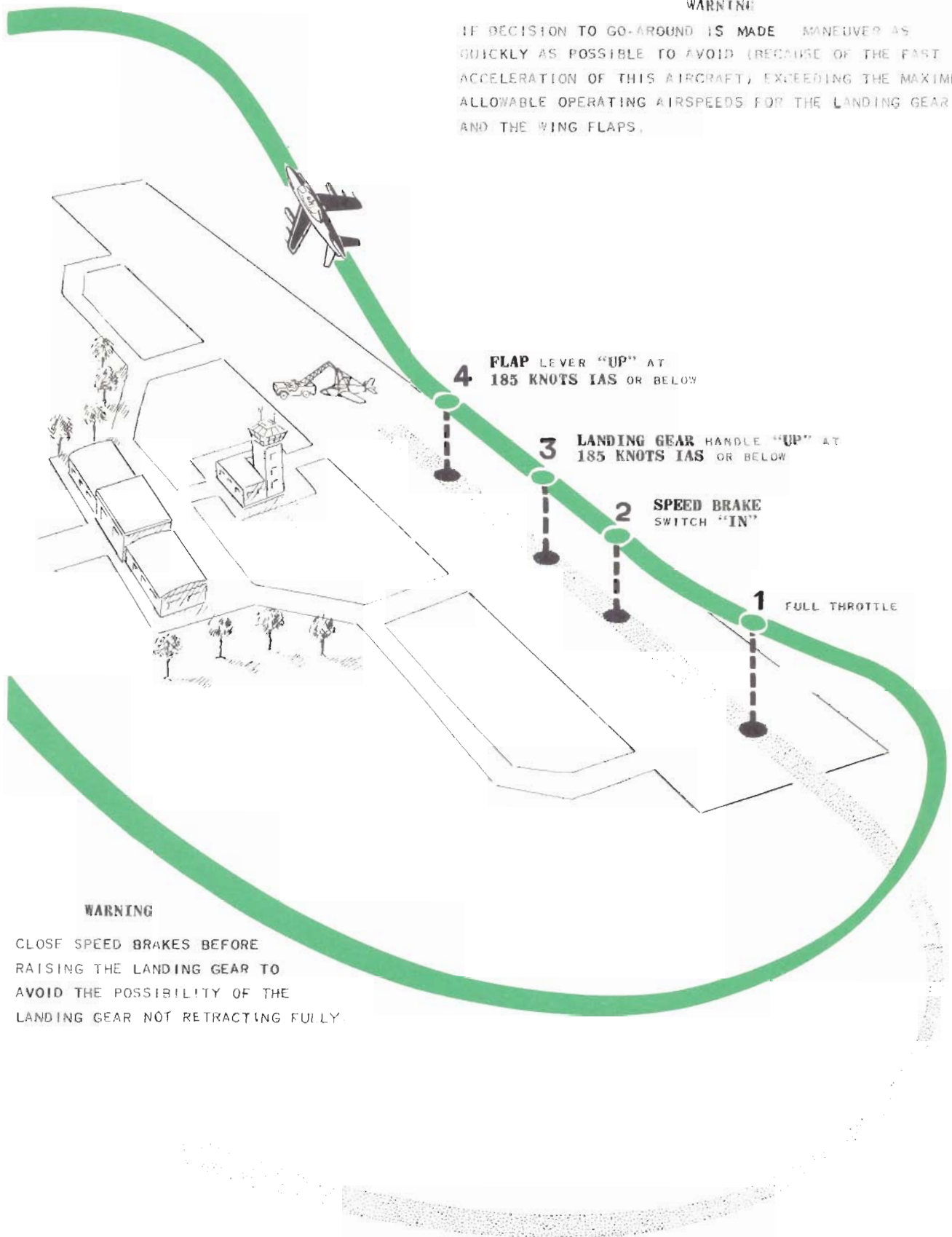
BEFORE LEAVING AIRPLANE

- a) **COMPLETE AIRPLANE LOG BOOK.**
- b) **OXYGEN LEVER** - NORMAL.
- c) **AIRCRAFT CONTROLS LOCKED.**
- d) **CHOCKS IN PLACE, BRAKES OFF.**

GO-AROUND

WARNING

IF DECISION TO GO-AROUND IS MADE, MANEUVER AS QUICKLY AS POSSIBLE TO AVOID (BECAUSE OF THE FAST ACCELERATION OF THIS AIRCRAFT) EXCEEDING THE MAXIMUM ALLOWABLE OPERATING AIRSPEEDS FOR THE LANDING GEAR AND THE WING FLAPS.



WARNING

CLOSE SPEED BRAKES BEFORE RAISING THE LANDING GEAR TO AVOID THE POSSIBILITY OF THE LANDING GEAR NOT RETRACTING FULLY.

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Figure 2-6

SECTION III

EMERGENCY PROCEDURES

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ENGINE FAILURE

FLAME-OUT

If a flame-out occurs, an air start may be attempted. Air starts should never be attempted, however, if engine failure can be attributed to some obvious mechanical failure.

Flame-outs are indicated by loss of engine r.p.m. and drop in engine oil pressure. When the engine oil pressure drops below 20 p.s.i., the starter is geared to the engine by the action of an opposing spring which engages the starter teeth that are normally uncoupled by oil pressures above 20 p.s.i.

NOTE Starter noises due to starter engagement during flame-outs are completely normal.

SYMPTOMS

- a) Loss of thrust.
- b) Loss of r.p.m.
- c) EGT falling below 200° C.

CAUSES

- a) Loss of fuel to the engine (FUEL LOW PRESS warning light on) due to:
 - 1) All fuel expended.
 - 2) FUEL L.P. COCK closed.
 - 3) Fuel filter clogged.
 - 4) Fuel supply line broken between fuel booster pump and engine-driven fuel pump.
- b) Compressor stall at low IAS during acceleration, caused by:

- 1) Slam throttle opening above 30,000 feet.
- 2) Defective A.F.R.C. below 30,000 feet.
- c) Compressor stall at high r.p.m. above 25,000 feet, indicated by r.p.m. above 90% and a deep pulsating noise and vibration, caused by:
 - 1) Defective pressure ratio limiter.
 - d) Mechanical failure of the engine.

MECHANICAL FAILURE

SYMPTOMS

- a) Severe fluctuation of r.p.m. along with severe roughness and vibration.
- b) Abnormal noises continuing after the cockpit is depressurized.
- c) Large loss of r.p.m., possibly flame-out, no banging or vibration, and the FUEL LOW PRESS warning light out.

REMEDY

If mechanical failure of the engine is suspected the engine should be shut down (Throttle to STOP and FUEL L.P. COCK to CLOSED).

WARNING In case of mechanical failure, do NOT attempt to restart due to the risk of fire.

AIR START

WARNING See warnings under emergency fuel specification in Section V.

a) Air start with a hot engine

The chances of a successful air start are best below 30,000 feet regardless of airspeed and r.p.m.

- 1) IGNIT - Immediately press and hold depressed and throttle to flight idle.
- 2) EGT-RPM - A simultaneous rise will indicate a successful air start.
- 3) IGNIT - Release when r.p.m. has increased above 40%.
- 4) THROTTLE - Advance to the required r.p.m.

b) Unsuccessful airstart with engine hot

If an airstart does not occur, or if the engine relights and the EGT rises rapidly above 700°C, proceed as follows:

— above 30,000 feet:

- 1) IGNIT - Release button.
- 2) THROTTLE - Retard to STOP.
- 3) FUEL BOOSTER PUMP - Switch OFF.
- 4) Descend to 30,000 feet or below.
- 5) Attempt cold engine airstart procedure.

— at 30,000 feet or below:

- 1) IGNIT - Release button.
- 2) Throttle - Retard to STOP.
- 3) IAS - Reduce to 150 knots.
- 4) Wait 20 seconds and use cold engine airstart procedure.

WARNING Before attempting an airstart raise nose of airplane; with throttle at STOP, drain tail pipe of residual fuel.

c) Airstart of a cold engine

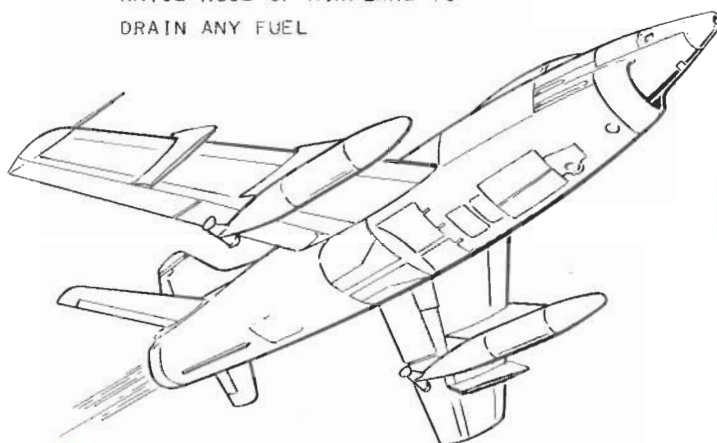
To airstart a cold engine, proceed as follows (fig. 3-1):

- 1) THROTTLE - Retard to STOP.
- 2) FUEL L.P. COCK - OPEN.
- 3) ALTITUDE - At high altitudes, descend to 30,000 feet or below.
- 4) TAIL PIPE - Raise nose of airplane to drain any fuel.
- 5) MAXIMUM AIRSPEED - 150 knots (or not more than 15% wind-milling r.p.m. for altitudes between 30,000 feet and 25,000 feet) - 190 knots below 25,000 feet.
- 6) BATTERY - ON and check that the BATTERY OUT warning light is off.
- 7) All engine and fuel circuit breakers - IN.
- 8) FUEL BOOSTER PUMP - ON and check that FUEL LOW PRESS warning light is out.
- 9) H.E. IGNITION - NORMAL.
- 10) IGNIT - Press button for 2 to 3 seconds then hold depressed while slowly advancing the throttle to START & FLIGHT IDLE.
- 11) THROTTLE - START & FLIGHT IDLE.
- 12) EGT-RPM - a simultaneous rise will indicate a successful airstart.
- 13) IGNIT - Release button at 40% r.p.m.
- 14) THROTTLE - Advance to required r.p.m.

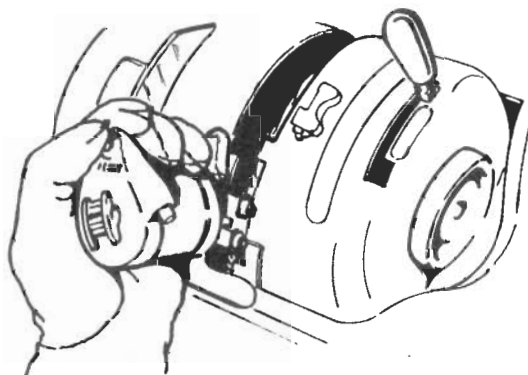
WARNING If there is play in the mechanical linkage between the throttle lever and the engine, it may be necessary to continue pressing the button and slowly open the throttle up to one inch beyond START & FLIGHT IDLE.

ENGINE AIR START PROCEDURE ENGINE COLD

- 1 - THROTTLE "STOP"
- FUEL BOOSTER PUMP SWITCH "OFF"
- FUEL L.P. COCK LEVER "OPEN"
- RAISE NOSE OF AIRPLANE TO DRAIN ANY FUEL



- 3 - CHECK BATTERY OUT WARNING LIGHT OFF; IF LIGHT IS ON, TURN BATTERY SWITCH "ON"
- ENGINE AND FUEL CIRCUIT BREAKERS - IN
- CHECK H.E. IGNITION SWITCH "NORM"
- FUEL BOOSTER PUMP SWITCH "ON"
- CHECK FUEL LOW PRESS WARNING LIGHT OFF



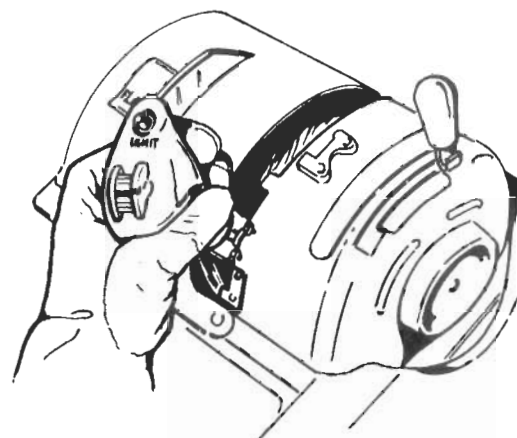
- 5 - A RISE OF EGT AND RPM WILL INDICATE A SUCCESSFUL AIRSTART

NOTE

IF THERE IS MUCH PLAY IN THE MECHANICAL LINKAGE BETWEEN THE THROTTLE LEVER AND THE ENGINE IT MAY BE NECESSARY TO ADVANCE THE THROTTLE 1 INCH BEYOND THE START & FLIGHT IDLE POSITION WHILE HOLDING THE IGNIT BUTTON DEPRESSED

WARNING

DO NOT OPEN THE THROTTLE MORE THAN 1 INCH BEYOND START & FLIGHT IDLE IF THE ENGINE IS NOT RUNNING SMOOTHLY AT 40% RPM OR ABOVE



- 2 AT HIGH ALTITUDES, DESCEND TO 30,000 FEET OR BELOW

NOTE

FLY THE AIRPLANE AT THESE AIRSPEEDS:

- A) 150 KNOT IAS (OR NOT MORE THAN 15% WINDMILLING RPM) FOR ALTITUDES BETWEEN 30,000 FEET AND 25,000 FEET
- B) 190 KNOTS IAS BELOW 25,000 FEET

- 4 - WITH THROTTLE AT "STOP", DEPRESS IGNIT BUTTON FOR 2 TO 3 SECONDS TO CLEAN IGNITER PLUGS
- WITH IGNIT BUTTON HELD DEPRESSED, ADVANCE THROTTLE TO "START & FLIGHT IDLE"
- RELEASE IGNIT BUTTON WHEN RPM HAVE INCREASED ABOVE 40%



WARNING Do not open the throttle more than one inch beyond **START & FLIGHT IDLE** until the engine has relit and is running smoothly.

Use precautions described in « Unsuccessful airstart ».

d) *Unsuccessful airstart with engine cold*

If an airstart does not occur within 15 seconds, or if the engine starts and the EGT rises rapidly above 700° C, proceed as follows:

- 1) **IGNIT** - Release **IGNIT** button.
- 2) **THROTTLE** - Retard to **STOP**.
- 3) **FUEL BOOSTER PUMP** - **OFF**.
- 4) Wait 20 seconds and apply cold airstart procedure again.

WARNING If there was not an airstart it may have been due to failure of the **IGNIT** circuit. With the throttle at **STOP**, the **IGNIT** button should be pressed for 2 seconds for an audible check of sparking with the UHF switched on. If no sparking is heard in the headphones, **IGNIT** failure is confirmed.

In this case apply the following airstart procedure, using the **STARTER** button.

c) *Airstart with **STARTER** Button*

Proceed as follows:

- 1) **THROTTLE** - Retard to **STOP**.
- 2) **FUEL L.P. COCK** - **OPEN**.
- 3) **ALTITUDE** - At high altitudes, descend to 30,000 feet or less.
- 4) **TAIL PIPE** - Raise nose of aircraft to drain any fuel.
- 5) **AIRSPPEED** - 150 knots and not more than 15 % windmilling r.p.m. for altitudes between 30,000 feet and 25,000 feet - 190 knots below 25,000 feet.
- 6) **BATTERY** - **ON** and check that the **BATTERY OUT** warning light is out.
- 7) **ENGINE AND FUEL CIRCUIT BREAKERS** - **IN**.
- 8) **FUEL BOOSTER PUMP** - Switch **ON** and check that the **FUEL LOW PRESS** warning light is out.
- 9) **H.E. IGNITION** - **NORMAL**.
- 10) **STARTER** - Depress **STARTER** button.
- 11) **THROTTLE** - Slowly advance to **START & FLIGHT IDLE**.
- 12) **EGT-RPM** - a simultaneous rise will indicate a successful airstart.
- 13) **THROTTLE** - Advance to required r.p.m.

ENGINE FAILURE DURING TAKE-OFF

a) *Before airborne*

If engine failure occurs before leaving ground, proceed as follows:

- 1) **THROTTLE** - Retard to **STOP**.
- 2) **DRAG CHUTE** - Deploy drag chute and apply brakes as necessary.

If runway is equipped with a runway barrier and there is insufficient remaining runway, proceed as follows:

- 3) **EXTERNAL STORES** - Release as soon as possible by using **SALVO** switch or by pulling the **EMERG. EXT. STORES REL.** handle.

If runway is not equipped with a runway barrier and there is insufficient remaining runway, proceed as follows:

- 4) **CANOPY** - Jettison by pulling **EMERG. CANOPY JETT** handle.
- 5) **LANDING GEAR** - Depress **LDG GR. EMERG. UP** button and move landing gear control handle **UP**.
- 6) **BATTERY** and **GENERATOR** - Switch **OFF**.
- 7) Abandon airplane as soon as possible after forward motion has stopped.

b) *After airborne*

If terrain beyond end of runway is rough, eject.

WARNING The **MARTIN BAKER MK-4** ejection seat equipped with **G-** switch permits ejecting from runway level with at least 100 knots **IAS**.

If terrain allows a forced landing, proceed as follows:

- 1) **THROTTLE** - Retard to **STOP**.
- 2) **EXTERNAL STORES** - Release by using **SALVO** switch or **EMERG. EXT. STORES REL.** handle.
- 3) **CANOPY** - Jettison by pulling **EMERG. CANOPY JETT** handle.
- 4) **LANDING GEAR** - **DOWN**, if already retracted.
- 5) **FLAPS** - **DOWN**, if already raised.
- 6) **BATTERY** and **GENERATOR** - Switch **OFF**.
- 7) Land straight ahead, changing course only enough to clear obstacles.
- 8) **DRAG CHUTE** - **DEPLOY AT TOUCH-DOWN**.

ENGINE FAILURE DURING FLIGHT

If a mechanical failure occurs along with severe roughness and vibration, abnormal noises, or rapid

loss of r.p.m. and flame-out, do not attempt to restart in flight; proceed as follows:

- 1) **THROTTLE** - Retard to **STOP**.
- 2) **FUEL BOOSTER PUMP** - OFF.
- 3) **FUEL L.P. COCK** - CLOSED.
- 4) **BATTERY** and **GENERATOR** - OFF.
- 5) Glide at best aerodynamic efficiency.

GLIDE WITH ENGINE DEAD

NO EXTERNAL LOAD

To obtain best glide distance (fig. 3-2), follow this procedure:

- 1) **LANDING GEAR** - UP.
- 2) **FLAPS** - UP.
- 3) **SPEED BRAKES** - CLOSED.
- 4) IAS approximately 180 knots.
- 5) **PREPARE FOR A FORCED LANDING** (see fig. 3-3) OR **FOR EJECTION** (fig. 3-6), remembering that seat ejection at runway level is possible with at least 100 knots IAS.

FORCED LANDING WITH DEAD ENGINE

Descend as follows:

- 1) **High** key point (over end of runway).
 - 7000 feet above terrain.
 - 180 knots IAS.
 - Landing gear down.
 - Wing flaps down.
 - Speed brakes closed
- 2) **Intermediate** key point.
 - 5000 feet above terrain.
 - 165 knots IAS.
- 3) **Low** key point.
 - 3500 feet above terrain.
 - 165 knots IAS.
- 4) **Base** key point (90° from runway).
 - 2500 feet above terrain.
 - 165 knots IAS.
- 5) **Final**
 - 150 knots IAS.

NOTE If necessary:

- Jettison external load.
- Jettison canopy when turning final if landing on an unprepared area.

WARNING If terrain is unknown, eject.

SIMULATED FORCED LANDING

When training on simulated forced landings, compensate idle thrust by opening the speed brake 70% and proceed as described in the preceding paragraph.

FIRE

FIRE WARNING LIGHT ON

This airplane is not equipped with a fire-extinguishing system. If an overheat condition is sensed by any one of the fire detectors, the **FIRE** warning light will go on. If the existence of a fire is confirmed, proceed as follows:

- 1) **THROTTLE** - Retard to **STOP**.
- 2) **FUEL BOOSTER PUMP** switch - OFF.
- 3) **FUEL L.P. COCK** - CLOSED.
- 4) **BATTERY** and **GENERATOR** switches - OFF.

ENGINE STARTING

- 1) **FUEL BOOSTER PUMP SWITCH** - OFF.
- 2) **THROTTLE** - STOP.
- 3) **FUEL LOW PRESSURE COCK** - CLOSED.
- 4) **BATTERY SWITCH** - On - all other electrical switches OFF.
- 5) **STARTER SELECTOR SWITCH** - Isolate (INS).
- 6) **STARTER BUTTON** - Depress and battery switch off.

Allow engine to dry rotate and thereby extinguish fire in engine intake, compressor section, or tail pipe. If warning light remains on, abandon aircraft.

GROUND ROLL

Deploy drag chute and apply brakes. Proceed as follows:

- 1) **THROTTLE** - STOP.
- 2) **FUEL BOOSTER PUMP** - OFF.
- 3) **FUEL LOW PRESSURE COCK** - CLOSED.
- 4) **ALL BATTERY AND GENERATOR SWITCHES** - OFF.

Abandon cockpit after aircraft is stopped.

FLIGHT

THROTTLE - STOP or minimum practicable RPM consistent with flight conditions and altitude.
FUEL BOOSTER PUMP SWITCH - OFF.

GLIDE DISTANCES WITH DEAD ENGINE NO EXTERNAL LOAD

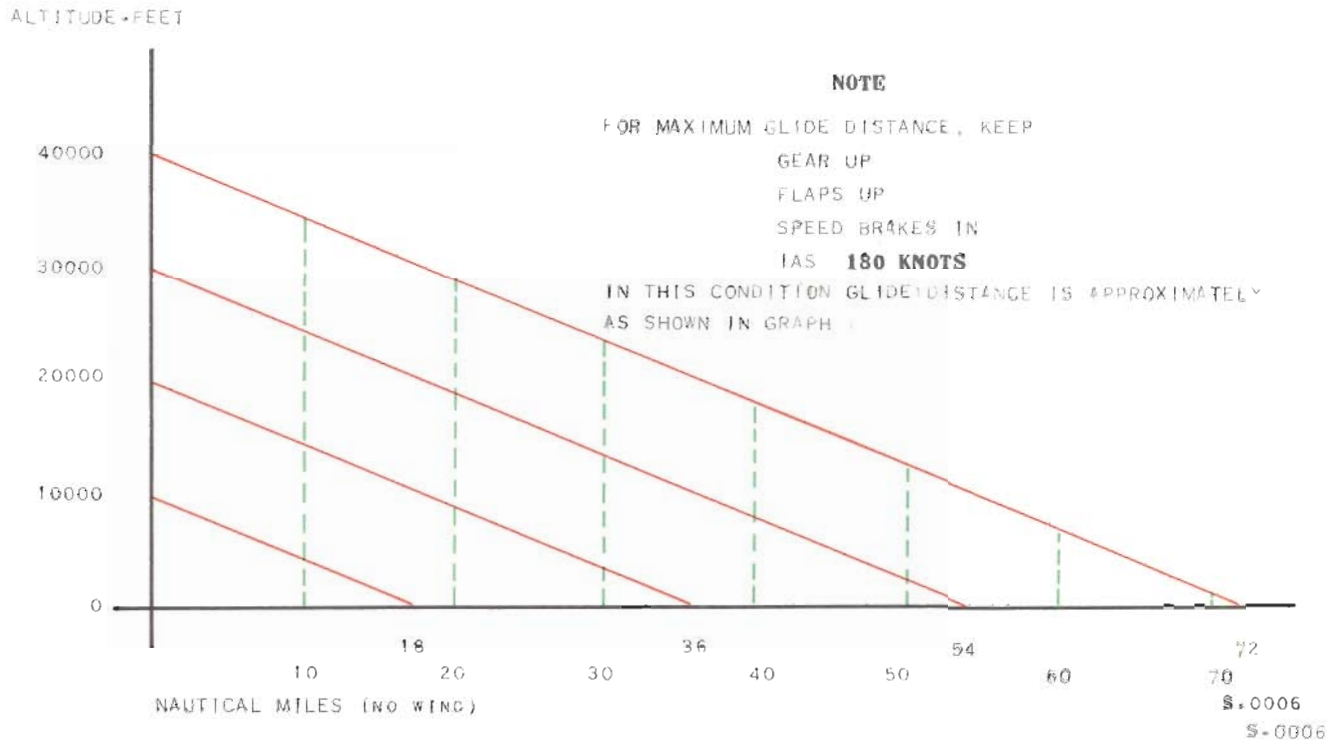


Figure 3-2

FORCED LANDING DEAD ENGINE

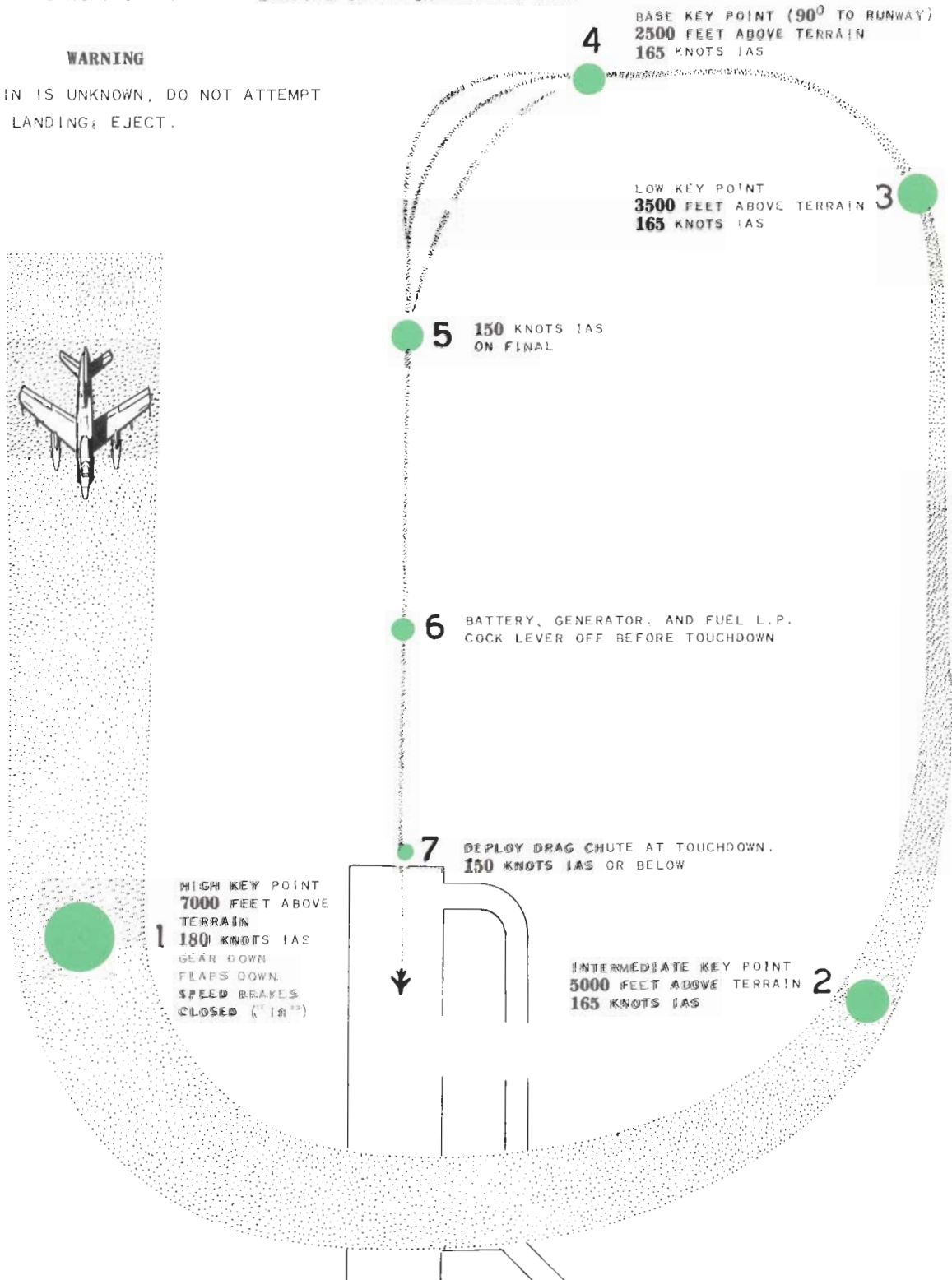
NOTE

IF NECESSARY:

- A) JETTISON EXTERNAL LOAD BY USING **SALVO SWITCH** OR **EMERG. EXT. STORES REL. HANDLE**
- B) JETTISON CANOPY ON FINAL LANDING ON AN UNPREPARED AREA

WARNING

IF TERRAIN IS UNKNOWN, DO NOT ATTEMPT
A FORCED LANDING; EJECT.



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Figure 3-3

BATTERY SWITCH - OFF.
 FUEL LOW PRESSURE COCK - CLOSED.
 If warning light remains on abandon aircraft.

ENGINE SHUT DOWN

THROTTLE - STOP.
 FUEL BOOSTER PUMP SWITCH - OFF.
 FUEL LOW PRESSURE COCK - CLOSED.
 GENERATOR SWITCH - OFF.
 STARTER SELECTOR SWITCH - Isolate.
 STARTER BUTTON - Depress.

If engine RPM is below 10% allow engine to dry rotate, and thereby extinguish engine intake, compressor section, or tail pipe fires; battery switch off.

If warning light remains on abandon aircraft.

NOTE For extinguishing ground fires, refer to figure 3-4.

OIL SYSTEM FAILURE

OIL LOW PRESS WARNING LIGHT ILLUMINATED

a) *Engine running at 95% r.p.m. and positive «G»*

Illumination of the OIL LOW PRESS warning light indicates oil system failure. Immediately retard the throttle to IDLE.

b) *Engine running at stabilized r.p.m. below 94.5% or during throttle retardation.*

Illumination of the OIL LOW PRESS warning light indicates insufficient oil supply. If the light goes out when the throttle is slowly advanced to 95%, the flight can be continued at a suitable power to keep the light off. The light may come on again during descent when the throttle is retarded.

c) *Engine operating at any r.p.m. and negative «G»*

The light may go on if the oil level is low or at the end of a flight. Oil pressure must be restored by returning to positive «G».

NOTE When the engine is running at low oil pressure, the turbostarter engine coupling may be engaged and damage the engine or starter.

FUEL SYSTEM FAILURE

FUEL LOW PRESS WARNING LIGHT

Illumination of the FUEL LOW PRESS warning light indicates failure of the fuel low pressure system. Failure can be attributed to any of the following:

a) *Submerged fuel booster pump*

— Up to 25,000 feet there will be no loss of thrust since fuel cell pressurization and gravity flow will supply fuel to the engine, except in tropical conditions when specification AVTAG fuel is used. Use the throttle with caution and continue the flight.

— Above 25,000 feet loss of thrust may result. If necessary, descend below 25,000 feet and continue the flight.

b) *Fuel filter clogged*

— A loss of thrust will result at any altitude. Do not vary the position of the throttle and land as soon as possible.

c) *Fuel low pressure cock closed*

— A rapid loss of thrust will result and flame-out will occur. Immediately place the FUEL L.P. COCK lever OPEN and, if flame-out has occurred, USE applicable airstart procedure.

d) *Leakage from fuel lines between fuel booster pump and engine-driven pump*

The greater the leak the greater the loss of thrust and a visible trail of unburned fuel will result. Check the FIRE warning light continuously, close the throttle and make a decision whether to attempt a forced landing or eject.

e) *All fuel expended*

The fuel quantity indicator will read zero. Recheck wing tanks empty. If fuel remains, attempt an airstart and land immediately. Prepare for a forced landing or ejection.

FUEL HIGH PRESSURE FAILURE

The Emergency fuel procedure will be issued as soon as the Emergency Fuel System data is available.

AUXILIARY FUEL TANKS NOT TRANSFERRING FUEL

It is possible to land with either or both wing tanks full without encountering difficulty. After attempting to transfer fuel several times, rocking wings and changing altitude rapidly, adjust your flight according to the remaining fuel.

EXTINGUISHING GROUND FIRES

NOTE : NO FIRE EXTINGUISHING EQUIPMENT IS INSTALLED IN THE AIRPLANE.

WARNING : IN CASE OF FIRE, IMMEDIATELY RETARD THROTTLE TO "STOP", FUEL L.P. COCK LEVER TO "CLOSED" AND TURN BOOSTER PUMP AND BATTERY SWITCHES OFF. ABANDON COCKPIT



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TAIL PIPE FIRE

TURN H.E. IGNITION SWITCH TO "ISOL" AND BATTERY SWITCH "ON". DEPRESS STARTER BUTTON AND TURN BATTERY SWITCH "OFF" AS SOON AS THE ENGINE IS STARTED. IF THE AIR FLOW IS NOT ENOUGH TO EXTINGUISH THE FIRE, INTRODUCE EXTINGUISHING AGENT INTO THE TAIL PIPE

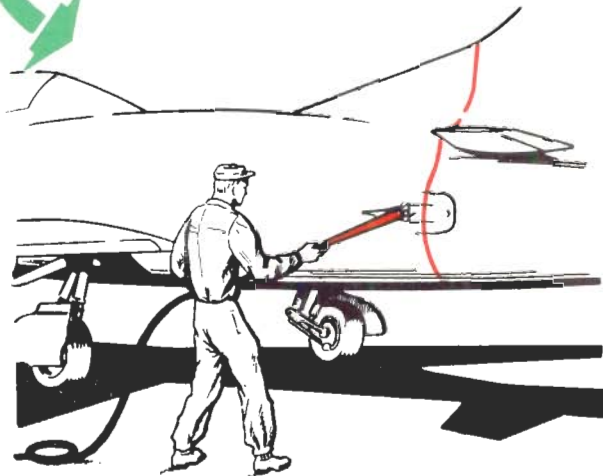


COMPRESSOR COMPARTMENT FIRE

OPEN ENGINE (RIGHT HAND ACCESS DOORS) AND INTRODUCE EXTINGUISHING AGENT

AFT FUSELAGE FIRE

INTRODUCE EXTINGUISHING AGENT INTO TAIL PIPE VENTILATION PORT. IF THIS IS NOT SUFFICIENT TO BLOW OUT THE FIRE, INTRODUCE AGENT BETWEEN THE TAIL PIPE AND THE AIRPLANE SKIN



POSTFIRE PROCEDURE

1. BLOW OFF EXTINGUISHING AGENT WITH COMPRESSED AIR
2. WASH ALL AFFECTED STRUCTURE WITH A FINE SPRAY OF WATER
3. WASH THE AFFECTED STRUCTURE WITH A 5 PERCENT CHROMIC ACID SOLUTION, THEN RINSE WITH CLEAR WATER
4. IF EXTINGUISHING AGENT HAS PENETRATED INTO ENGINE, THE ENGINE WILL REQUIRE A THOROUGH OVERHAUL

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ELECTRICAL SYSTEM FAILURE

ELECTRICAL FIRE

A fire due to an electrical short is very unlikely to occur since all electrical circuits are protected by fuses or circuit breakers. However, if a fire does occur in flight, turn off the generator and the battery, check for smoke and/or fire and land as soon as possible. If fire continues, proceed with an emergency landing or eject.

GENERATOR FAILURE

If the **GENERATOR-OUT** warning light illuminates, indicating that the generator has failed or has been disconnected because of overvoltage, equipment powered by the secondary bus and the single-phase and three-phase A.C. busses will be automatically cut off. The primary bus can still be powered by the battery bus for about 20 minutes maximum. Attempt to bring the generator back into the circuit by placing the **GENERATOR** switch to **RESET** and releasing, checking the voltmeter for a 28-volt reading. Then return the switch to **ON**.

If the warning light goes out, the generator has been brought back into the circuit and was disconnected because of overvoltage.

If the light remains on, it indicates generator or voltage regulator failure and a landing must be made as soon as possible. Do not attempt to reset the generator.

If it is necessary to continue the flight, turn off all primary bus powered equipment unnecessary for flight to prolong battery life.

WARNING Radio and navigation equipment absorbs more electrical power than any other equipment. Therefore, use of this equipment should be restricted to minimum essential.

PRIMARY INVERTER FAILURE

Primary inverter failure is indicated by illumination of the **PRIM INVERTER OUT** warning light. The three-phase busses will be automatically connected to the secondary inverter while the **AN/APX-25 IFF** equipment will be out.

SECONDARY INVERTER FAILURE

Failure of the secondary inverter is indicated by the illumination of the **SEC. INVERTER OUT** warning

light. The following equipment will be automatically disconnected: **MARK 3 B PHI**, **AN/APX-25 IFF**, and the electronic cockpit air temperature regulator. To regulate cockpit air temperature, the air temperature regulator **MANUAL control switch** should be moved to either **DECR** or **INCR position** and then returned to **OFF**.

NORMAL LONG'L TRIM FAILURE

In case of normal trim control failure, trimming action is accomplished through the **EMERG. LONG'L TRIM** switch located on the left cockpit console.

WARNING If both trim controls fail and the horizontal stabilizer remains locked in either an up or down position, reduce the speed of the aircraft. At moderate speed, flight can be continued.

HYDRAULIC POWER SUPPLY SYSTEM FAILURE

HYDRAULIC PUMP FAILURE

If failure of the engine driven hydraulic pump or rupture of the lines connected to the pump occurs, pressure will not be supplied to the utility hydraulic system or flight control system. An alternate hydraulic pump is not provided in this airplane, and the only emergency system consists of accumulators set in series in the different airplane systems.

WARNING In case of a hydraulic line rupture inside the engine compartment, a fire may occur due to the low flash temperature of hydraulic fluid (93.3°C). Check the **FIRE** warning light continuously. If this light goes on, use the «**FIRE**» procedures.

FUEL FLOW PROPORTIONER

If the fuel flow proportioner should fail, fuel can flow through the proportioner without restricting the fuel flow to the engine. However, the fuel flow will not be proportioned and the airplane center of gravity will be subject to change. In this case, trimming action through use of the longitudinal trim switch will be required.

SPEED BRAKES

If the utility hydraulic system fails, the speed brakes cannot be opened. Should failure occur while the speed brakes are open, they can be closed partially or completely by the air load, provided the speed brake switch is moved IN.

WHEEL BRAKES

An accumulator and an emergency system (with a manually operated control valve) permit emergency braking in case of utility hydraulic system failure. Emergency braking control is not applied through the brake pedals but through the «EMERG. WHEEL BRAKE» handle located on the upper right side of the instrument panel. Braking action on both wheels will be proportional to the force applied at the handle.

LANDING GEAR

a) In case of utility hydraulic system failure the landing gear cannot be retracted. However, the landing gear can be lowered by following this procedure (fig. 3-5):

- 1) Reduce airspeed to below 185 knots IAS.
- 2) Landing gear handle DOWN.
- 3) Pull out EMERG. LDG. GR. handle (left bottom side of instrument panel). Hold handle extended until gear position indicators show nose gear down and locked and main gear unlocked.
- 4) Yaw airplane (rudder and aileron) to lock main gear.

CAUTION After an emergency landing gear extension push EMERG. LDG. GR. handle IN to reset the landing gear control handle electrical circuit. To do this, press the screw in the middle of the handle.

b) Landing gear emergency retraction

If it is necessary to retract the landing gear during take-off or after landing, depress the LDG. GR. EMERG. UP button and move the landing gear handle UP.

c) Landing gear fails to retract

If landing gear fails to retract maintain an airspeed below 185 knots IAS and check landing gear circuit breakers in. Attempt to extend and retract landing gear several times. If gear fails to retract fully and indicate UP with gear warning light out extend gear and land as soon as possible.

AILERONS

In case of flight control hydraulic system failure, reserve accumulator pressure will be used in the normal flight control hydraulic system before automatic transfer to mechanical linkage operation occurs.

An alternate flight control hydraulic system receives hydraulic pressure from an emergency accumulator and permits aileron operation at a reduced rate. The alternate hydraulic system is controlled by the AILERON SERVO EMERGENCY SYSTEM PRESSURE switch. Use the alternate system during the final stage of landing to provide adequate control during normal flight control failure.

ELEVATOR

If the normal flight control hydraulic system fails, hydraulic operation of the elevator is provided by an accumulator in the elevator system as long as accumulator pressure is available. Then automatic transfer to mechanical operation occurs. The elevator system does not include an alternate hydraulic system for emergency operation.

EXTERNAL STORES JETTISON

For external stores emergency release proceed as follows:

a) Salvo release switch

If the battery bus functions properly, turn SALVO switch (located on the upper left side of the armament panel) to «ON» position. All external stores are electrically jettisoned.

b) Emergency external stores release handle

If the battery bus becomes inoperative, pull EMER. EXT. STORES REL. handle located on the instrument panel, above the airspeed indicator. All external stores are mechanically released. In both cases bombs and rockets are released safe.

c) When there is a need of releasing specific loads (e.g. wing tanks), and the electrical system functions properly, proceed as follows:

a) Turn OUTBOARD or INBOARD switch, whichever is applicable, to «ALL» position.

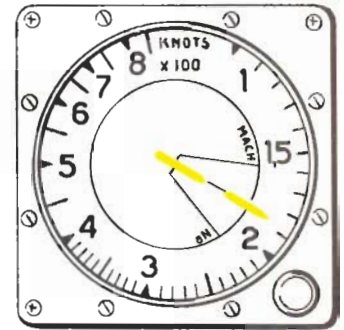
b) Push external load release button on the control stick.

WING FLAPS MALFUNCTION

No particular system is installed in this aircraft to prevent or correct malfunctioning of flaps. In case of

LANDING GEAR EMERGENCY EXTENSION

- 1 REDUCE AIRSPEED TO LESS THAN **185 KNOTS IAS**

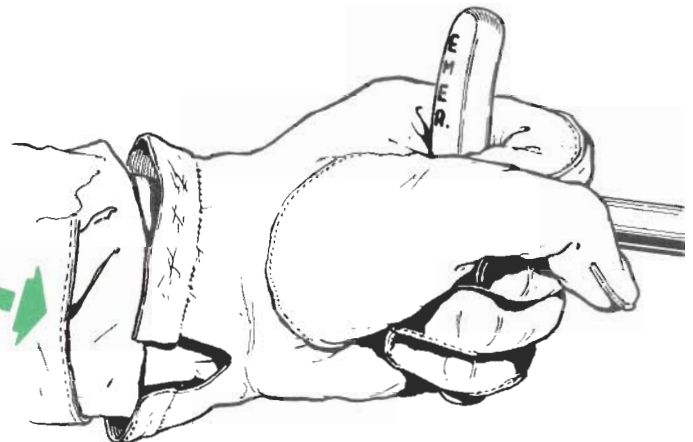


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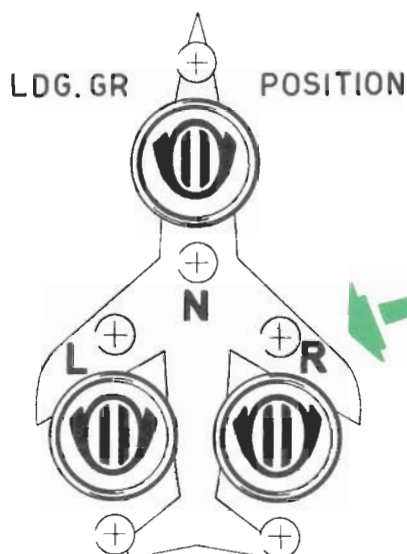
LANDING GEAR HANDLE "DOWN"

NOTE

THIS STEP IS NOT ABSOLUTELY ESSENTIAL FOR EMERGENCY LOWERING OF THE LANDING GEAR, AS LANDING GEAR LOWERING IS INDEPENDENT OF THE POSITION OF THE **LANDING GEAR** CONTROL HANDLE



- 3 **EMERG. LDG GR. HANDLE** (LOWER LEFT SIDE OF INSTRUMENT PANEL) FULLY EXTENDED AND HOLD



- 4

CHECK GEAR POSITION INDICATOR FOR NOSE GEAR DOWN-AND-LOCKED AND MAIN GEAR UNLOCKED OR DOWN AND LOCKED INDICATION. THEN RELEASE EMERGENCY RELEASE HANDLE

WARNING

THE MAIN GEAR WILL FALL BY GRAVITY. IF NECESSARY, YAW AIRPLANE TO LOCK MAIN GEAR

wing flaps malfunction check the flaps circuit breaker. If breaker is out push in and proceed as usual. If flaps do not retract, do not exceed 185 Knots speed and land immediately.

If flaps do not come down or come down partially, make the final approach for landing without flaps.

COCKPIT AIR CONDITIONING AND PRESSURIZATION

AIR CONDITIONING FAILURE

If automatic temperature control system becomes inoperative:

Move **AUTOMATIC** switch (located on the **COCKPIT AIR TEMP.** panel) to either «**MANUAL DEC** or **MANUAL INC**» position until the desired cockpit temperature is reached.

NOTE In case above operation is unsuccessful, proceed as follows:

- a) Descend below 12,000 feet.
- b) Turn **PRESSURIZ** switch «**OFF**» to obtain depressurization of the cockpit.
- c) Move **EMERG. COCKPIT VENTILATION** lever «**ON**», as desired.

PRESSURIZATION FAILURE

Comparison of cabin altimeter reading with airplane altimeter readings may show failure of cockpit pressurization.

- 1) In case of lack of pressurization above 12,000 feet.
 - a) Descend below 12,000 feet.
 - b) Turn **PRESSURIZ** switch «**OFF**».
 - c) Move **EMERG. COCKPIT VENTILATION** lever towards «**ON**», as desired.
- 2) In case of excessive pressurization above 12,000 feet:
 - a) Descend below 12,000 feet.
 - b) Turn **PRESSURIZ** switch «**OFF**».
 - c) Move **EMERG. COCKPIT VENTILATION** lever towards «**ON**», as desired.

Below 12,000 feet, perform only steps b) and c) indicated above.

LANDING EMERGENCIES

GEAR UP LANDING

If a gear up landing is unavoidable, proceed as follows:

AIRPLANE WITHOUT EXTERNAL LOAD OR WITH DROP TANKS EMPTY

- 1) Expend excess fuel if possible.
- 2) Make normal approach with flaps down and speed brakes open. Shoulder harness locked.
- 3) On final approach, turn **GENERATOR** and **BATTERY** switches **OFF** and jettison canopy by pulling **EMERG. CANOPY JETT** handle.
- 4) Just before touchdown, retard Throttle to **STOP**, Fuel Booster pump **OFF**, close **FUEL L.P. COCK** lever and touch down in normal landing attitude.
- 5) Deploy drag chute immediately after touchdown.
- 6) Abandon airplane immediately after it stops.

AIRPLANE WITH EXTERNAL LOAD

Jettison external load (bombs, rocket launchers with or without rockets, Napalm containers, missiles) and wing droptanks if they contain fuel that cannot be expended. Then proceed as described in the preceding paragraph.

ANY ONE GEAR UP OR UNLOCKED

If landing is to be made on other than smooth ground or runway, retract landing gear and make a wheels up landing.

If landing is to be made on smooth ground or runway, proceed as follows:

- 1) Jettison external load (weapons or drop tanks if they contain fuel).
- 2) Expend excess fuel.
- 3) Make normal approach with wing flaps down and speed brakes open. Shoulder harness locked.
- 4) On final approach, turn **GENERATOR AND BATTERY** switches **OFF** and jettison canopy by pulling **EMERG. CANOPY JETT** handle.
- 5) Just before touchdown, retard **THROTTLE** to **STOP**, **FUEL BOOSTER PUMP OFF**, **FUEL LOW PRESSURE** cock lever «**CLOSE**». Check **BATTERY** and **GENERATOR** switches **OFF**. Plan approach to touch down as near end of runway as possible.
- 6) Deploy drag chute immediately after touchdown.

7) Keep unsafe wheel up as long as possible. Do not use brakes if you can stop without them.

8) Abandon airplane immediately after it stops.

LOSS OF CANOPY

If the canopy should accidentally be lost during the take-off roll and there is insufficient runway remaining to abort the take-off, it is recommended that the take-off be completed. It should be remembered that if a landing is made immediately after take-off, the airplane weight will be higher than normal and, consequently, the approach and touchdown speeds will be 15 to 20 knots higher.

Because of the turbulence of air in the cockpit, it is recommended that the airplane be flown at reduced speed if flight must be continued.

EMERGENCY ENTRANCE

See figure 3-6.

ESCAPE PROCEDURE

Escape from the airplane in flight should be made with the ejection seat (fig. 3-7). This is the only safe way of escaping at both low and high speed at all altitudes.

EJECTION

If the airplane must be abandoned:

1) Grasp face blind firing handle (on top of seat headrest) with both hands and hold firmly.

2) Pull handle firmly downwards to the fullest extent to extract the face blind completely. Hold face blind tight against face and keep elbows as close together as possible against the body. Sit erect, head firm against the headrest.

WARNING An alternate firing handle is provided on the leading edge of the seat pan (between the pilot's legs) in the event the pilot can not raise his arms to reach the normal blind firing handle.

Pulling either handle fires the canopy ejection cartridge and, after one second, the seat ejection cartridge. Ejection is automatic and occurs in the following sequence (fig. 3-8):

- 1) Opening of emergency oxygen bottle.
- 2) Retracting of pilot's legs against seat.
- 3) Jettisoning of drogue gun piston.
- 4) Pilot's release from seat at altitude preset by barostatic control.
- e) Opening of pilot's personal chute.

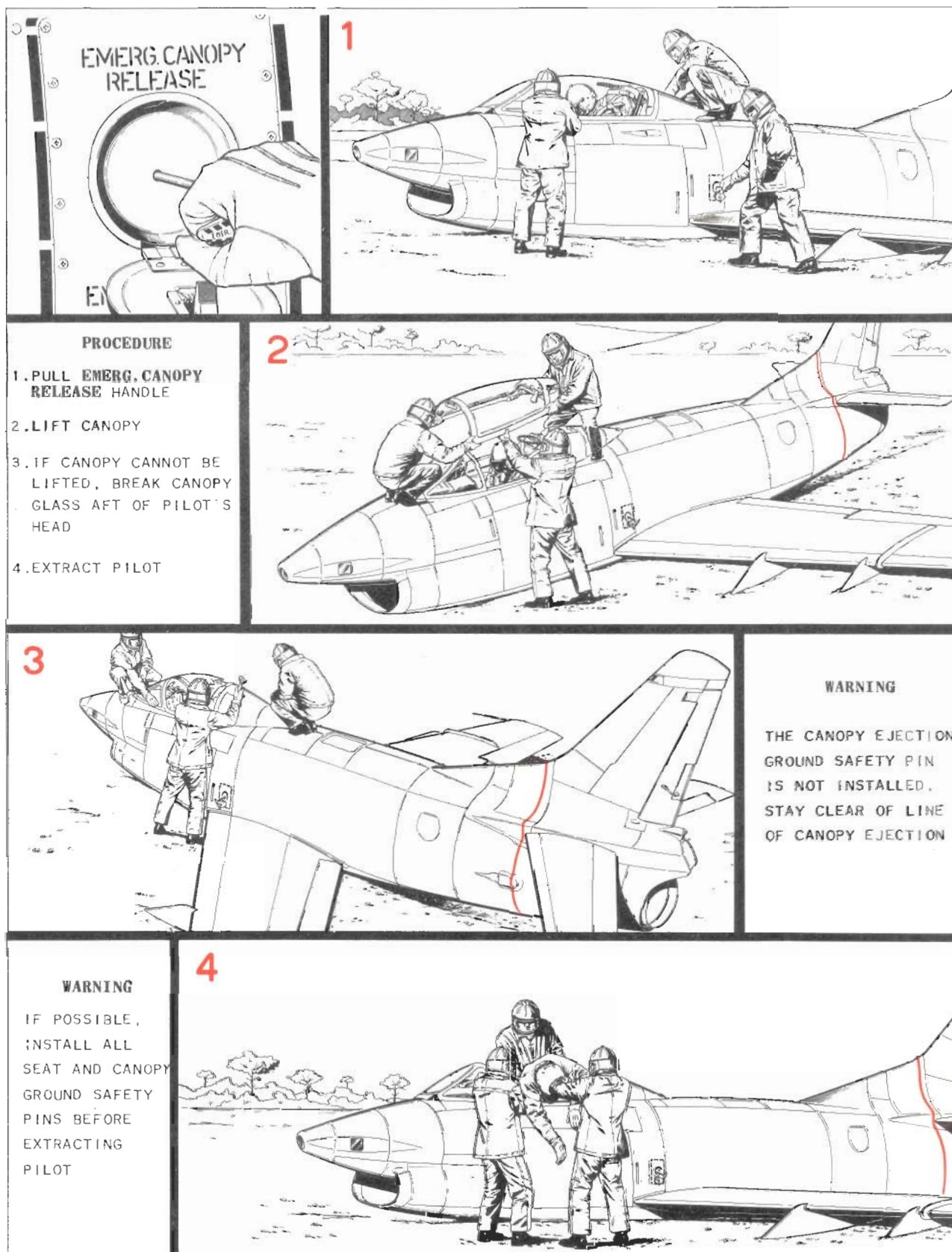
WARNING If, due to some failure in the canopy ejection mechanism, the canopy fails to leave the airplane, the ejection seat can be ejected through the canopy as a last resort. Therefore, seat adjustment is necessary before starting a flight to make sure the helmet does not project over the top of the seat headrest to prevent the helmet from hitting the canopy.

DINGHY DRILL

The following procedure should be used if ejection has taken place over water:

- 1) Discard oxygen mask.
- 2) When about 100 ft. above the water rotate the disc knob of the quick release fitting on the parachute harness to the unlock position; this does not release the harness (fig. 3-10, Detail A).
- 3) Release the two side dinghy attachments. *Leave the lanyard attached to the life vest* (fig. 3-10, Detail B). The dinghy will fall away to the full extent of the attaching line.
- 4) When about 6 ft. above the water, after taking a deep breath hold nose and keep elbows well into the sides.
- 5) As soon as the feet touch the water *and not before*, remove safety clip (fig. 3-10, Detail C) and strike the harness disc knob with the free hand to release the parachute and harness from the body (fig. 3-10, phase 2).
- 6) Upon surfacing, inflate the life vest. Secure the vest close to the chest.
- 7) Draw the survival pack towards the body by means of the lowering line and grasp the handle on the underside of the pack. Pull the handle to release the pack closure pins and operate the CO₂ cylinder that inflates the dinghy (fig. 3-10, Detail D).
Shake the dinghy during inflation.
Hold the cylinder under water to prevent freezing of the inlet valve; this is particularly important in cold weather conditions.

COCKPIT EMERGENCY ENTRANCE

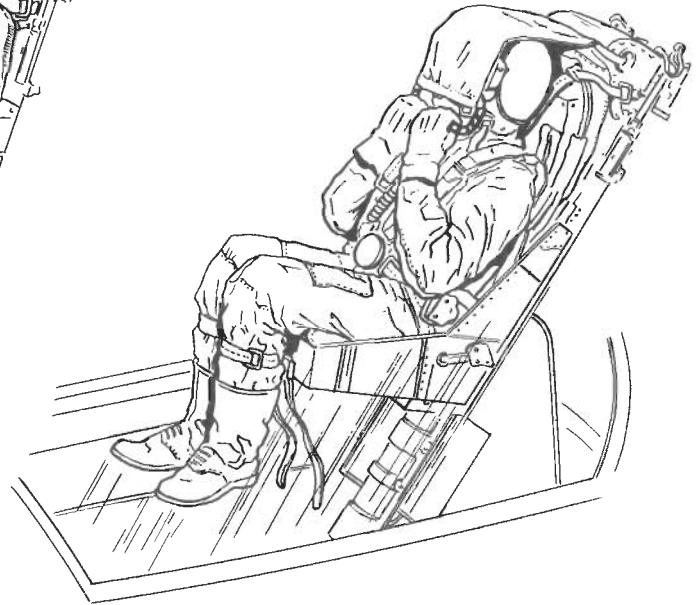
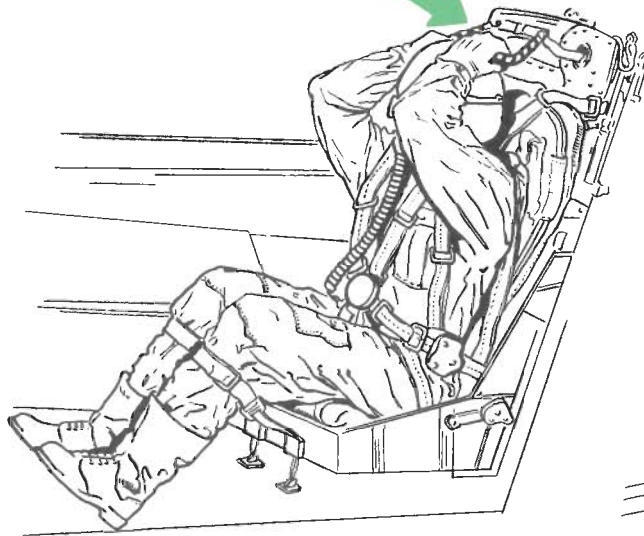


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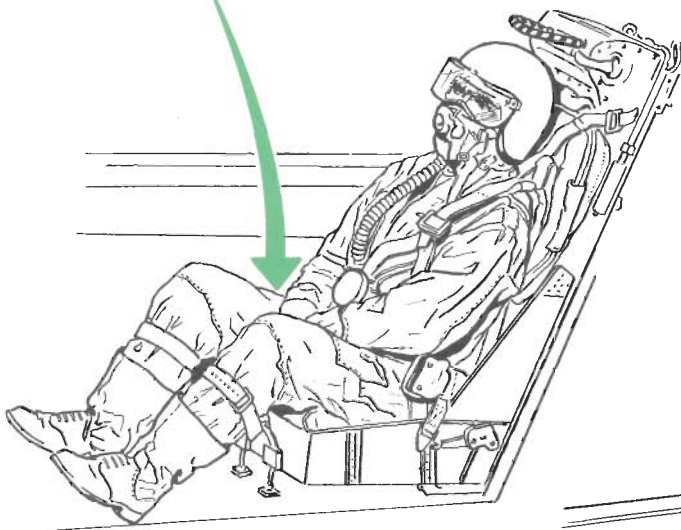
Figure 3-6

SEAT EJECTION

EJECTION BY MEANS OF FACE
BLIND FIRING HANDLE



EJECTION BY MEANS OF
ALTERNATE FIRING HANDLE



R-0003

Figure 3-7

EJECTION SEQUENCE

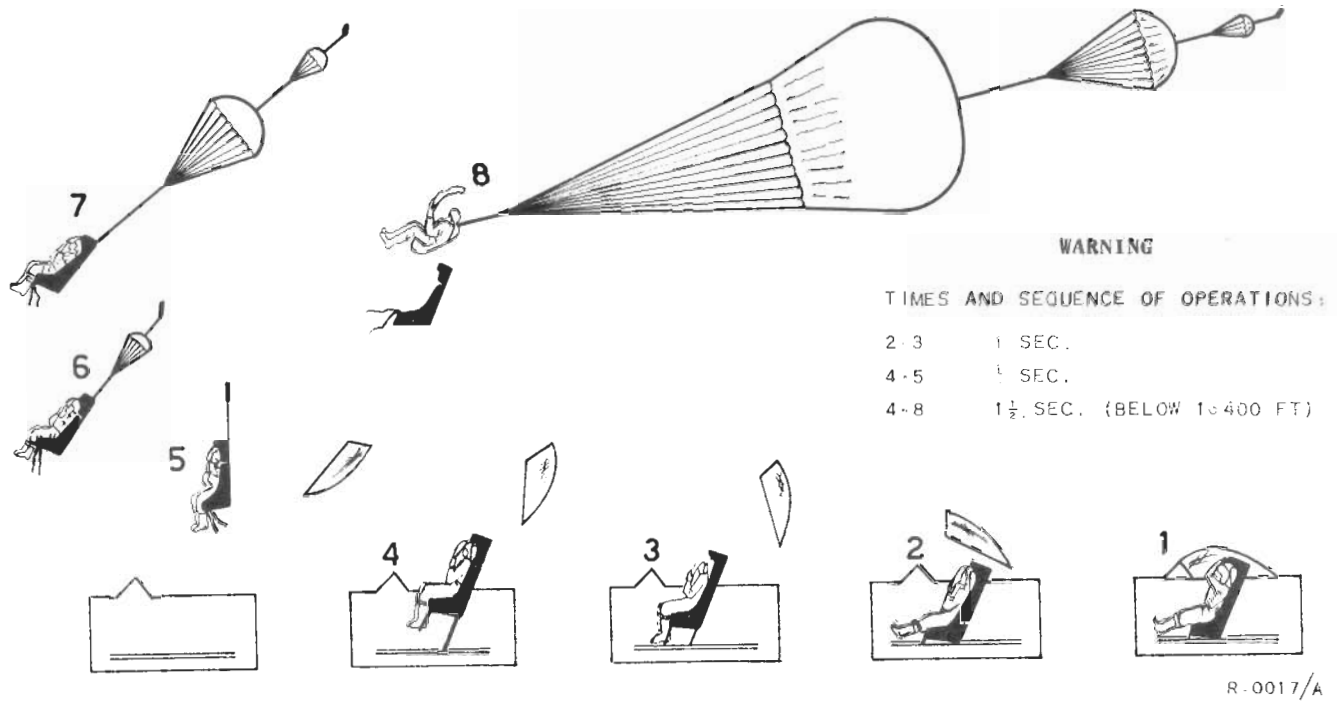
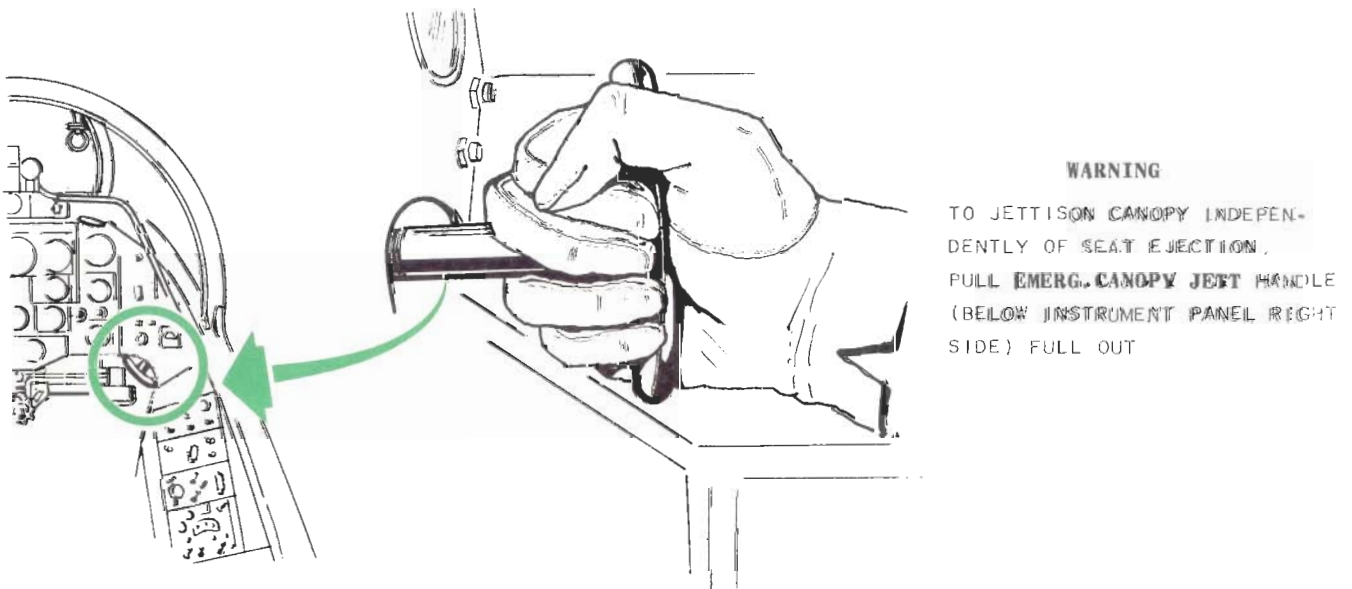


Figure 3-8

CANOPY EJECTION



R-0005

Figure 3-9

8) The correct method of boarding the dinghy is to grasp the two handling loops on top of the narrow or bow end, pull the body upwards over the buoyancy chamber, at the same time kicking vigorously with the legs to assist the upward and forward pull of the arms. When balanced over the bow end of the dinghy, transfer the hands to the two loops nearer the stern and haul the body inboard (fig. 3-10, phase 3). If the stern tends to rise while boarding, push the dinghy forward to fill the water - ballast pocket and try again.

Once in the dinghy, turn over and sit upright.

NOTE Another method of boarding may be used.

Using this method it is necessary to turn over on the back, grasp the two handling loops at the bow and thrust the dinghy downwards underneath the body, hauling in on the two loops near the stern as soon as the body is well over the dinghy. This method would be difficult to use with a fully inflated dinghy and is not recommended except with a partially inflated dinghy.

9) Having boarded the dinghy, the occupant should settle down, connect the inflator to the topping-off valve. Draw in the equipment tray, examine buoyancy chamber for leaks and plug any which are found with the leak stoppers provided. Remove the drogue from its stowage in the water ballast pocket to keep the stern into the wind. Bail out as much water as possible from the dinghy, using the container and sponge; using the inflator, pump air into the buoyancy chamber until the dinghy is fully inflated.

DITCHING

Owing to the possibility of low altitude ejection with at least 100 knots IAS, ditch only as a last resort.

However, if ditching is unavoidable:

- 1) Follow radio distress procedure.
- 2) Disconnect dinghy quick-disconnect fittings, anti-G suit and radio leads.
- 3) Lock shoulder harness and tighten seat and parachute straps.
- 4) Set oxygen regulator white lever at 100% OXYGEN.
- 5) Check landing gear up.
- 6) Check speed brakes closed.
- 7) Wing flap lever DOWN.
- 8) Jettison canopy immediately before ditching.
- 9) Retard throttle to STOP.

10) Turn BOOSTER PUMP, GENERATOR, and BATTERY switches OFF.

11) Close FUEL L.P. COCK.

12) Unless wind is high or sea is rough, try to touch down along wave crest. If wind is high or sea is rough, the best procedure is to approach into the wind.

13) Make normal approach and flare out to normal landing attitude, being careful to keep the nose high.

AFTER DITCHING

a) After the aircraft has settled on the water, rotate and strike the disc knob of the quick release fitting on the parachute harness.

b) Release the two dinghy attachments and leg restraint garters.

c) Step out of the cockpit.

d) Lift the dinghy pack out of the aircraft by means of the lowering line attached to the life-vest.

WARNING Ejection is possible from under-water. However, tests to determine the amount of injury possible to a pilot have not been conducted.

e) Inflate the life vest immediately.

f) Carry out the dinghy drill and inflate as described previously.

EJECTION SEAT FAILS TO EJECT

If the airplane must be abandoned and the ejection mechanism fails:

1) Jettison canopy by using the EMERG CANOPY JETTISON handle. If canopy fails to jettison, unlock and open it. Keep head down and forward to prevent being hit by the canopy while it breaks away from the aircraft.

2) Pull outer «D» ring to disconnect parachute pack from main stabilizer drogue.

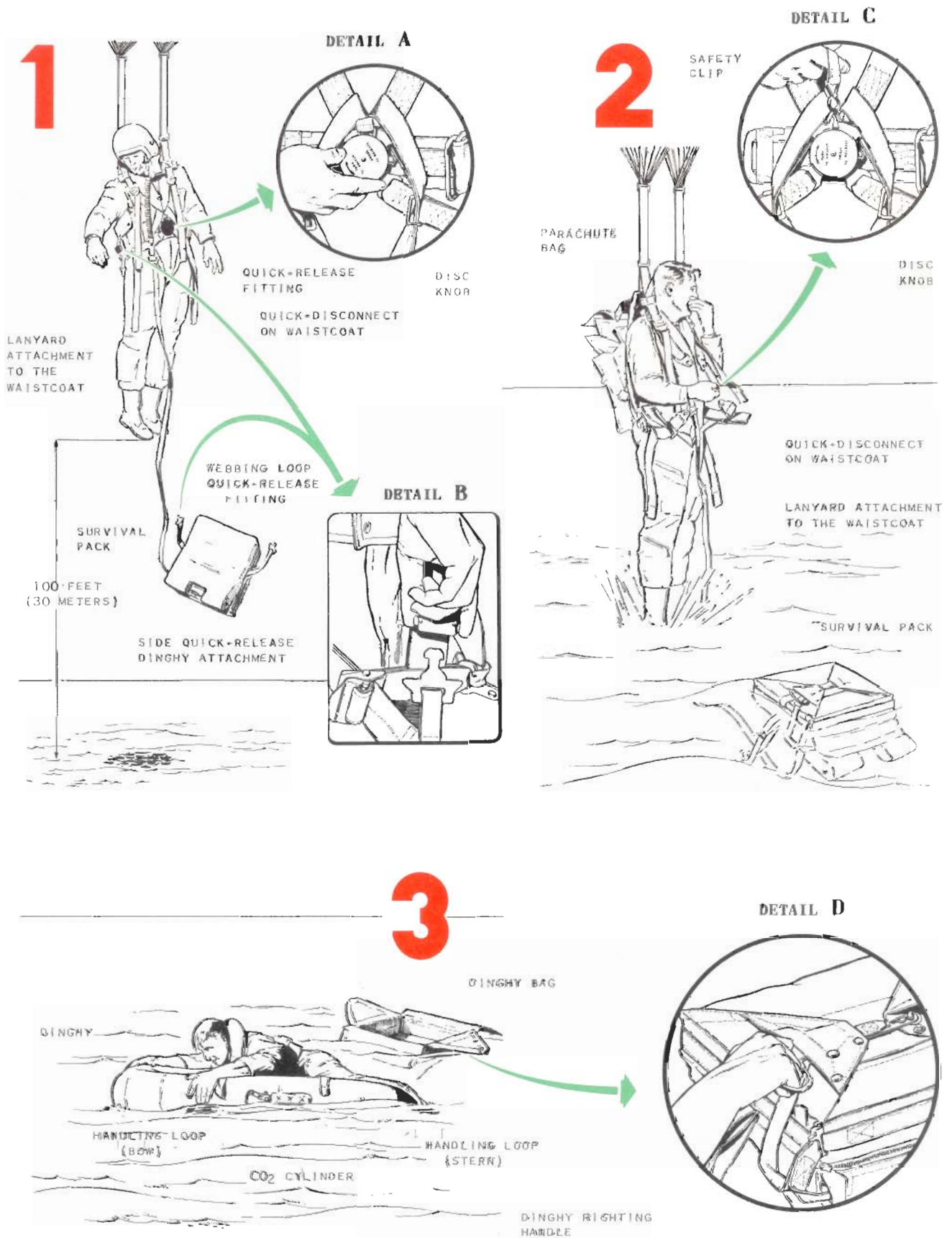
3) Pull up manual over-ride lever on port side of seat to unlock seat harness and disconnect parachute pack from seat.

4) Abandon airplane.

5) Pull the inner «D» ring which is just below the outer «D» ring to deploy the parachute.

WARNING Steps 2), 3) and 5) are to also be accomplished in the event that the time-delay mechanism fails after ejection.

DINGHY DRILL



R-0131

Figure 3-10

SPIN RECOVERY

SPIN RECOVERY PROCEDURE

Wind tunnel tests conducted on the G.91 have revealed that the best spin recovery procedure is:

rudder: applied opposite to direction of spin;

ailerons: neutral;

elevators: neutral or very slightly nose down.

OBSERVATIONS

It has been found that the ailerons are the most effective controls during spin and spin recovery. The more opposite the ailerons are, the rougher a spin will be. If the ailerons are « with » the spin, the recovery

is quicker but is much more oscillatory (pitch). However there is the danger of entering an inverted spin.

The rudder cannot alone control a spin or a spin recovery. However, rudder against the spin decreases the amplitude of lateral oscillations and speeds up recovery. The horizontal empennage has no noticeable effect upon spin characteristics.

Spin rotation should stop after one to three turns. Assuming that spin recovery would take three turns, that the airplane attitude is 45° on spin recovery and that the pilot makes a 2G pull-out after accelerating up to a speed 1.5 times as much as the stall speed, the total loss of altitude from beginning of spin recovery to effective recovery and level flight is approximately 4200 ft from 9000 ft and 5100 ft from 18,000 feet (1400 m from 3000 m and 1700 m from 6000 m).

If, at recovery, the airplane is in a vertical attitude, the loss of altitude would be increased approximately 1800 ft from 9000 ft (600 meters from 3000 m).

SECTION IV

DESCRIPTION AND OPERATION OF AUXILIARY EQUIPMENT

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REICHHALTER D-6B SOUND RECORDER	4-31
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COCKPIT AIR CONDITIONING, PRESSURIZATION AND VEN- TILATION SYSTEM

This system (fig. 4-1) is designed to supply air from the engine compressor seventh stage for pressurization and conditioning of the cockpit. Part of this hot air is passed through an air-cooling unit and then is mixed with the warm air that flows directly to the mixer. This mixed air then enters the cockpit through the air outlets provided in the left side of the cockpit (adjustable) and just above the rudder brake pedals (fixed).

A pressure regulator (fig. 4-2) maintains the correct cockpit pressure.

The cockpit pressurization control panel (fig. 4-3) is on the right console.

WARNING The cabin altimeter, mounted on the left side of the instrument panel, provides a means of checking operation of the cockpit pressurization system by comparing cabin altimeter readings with airplane altimeter readings.

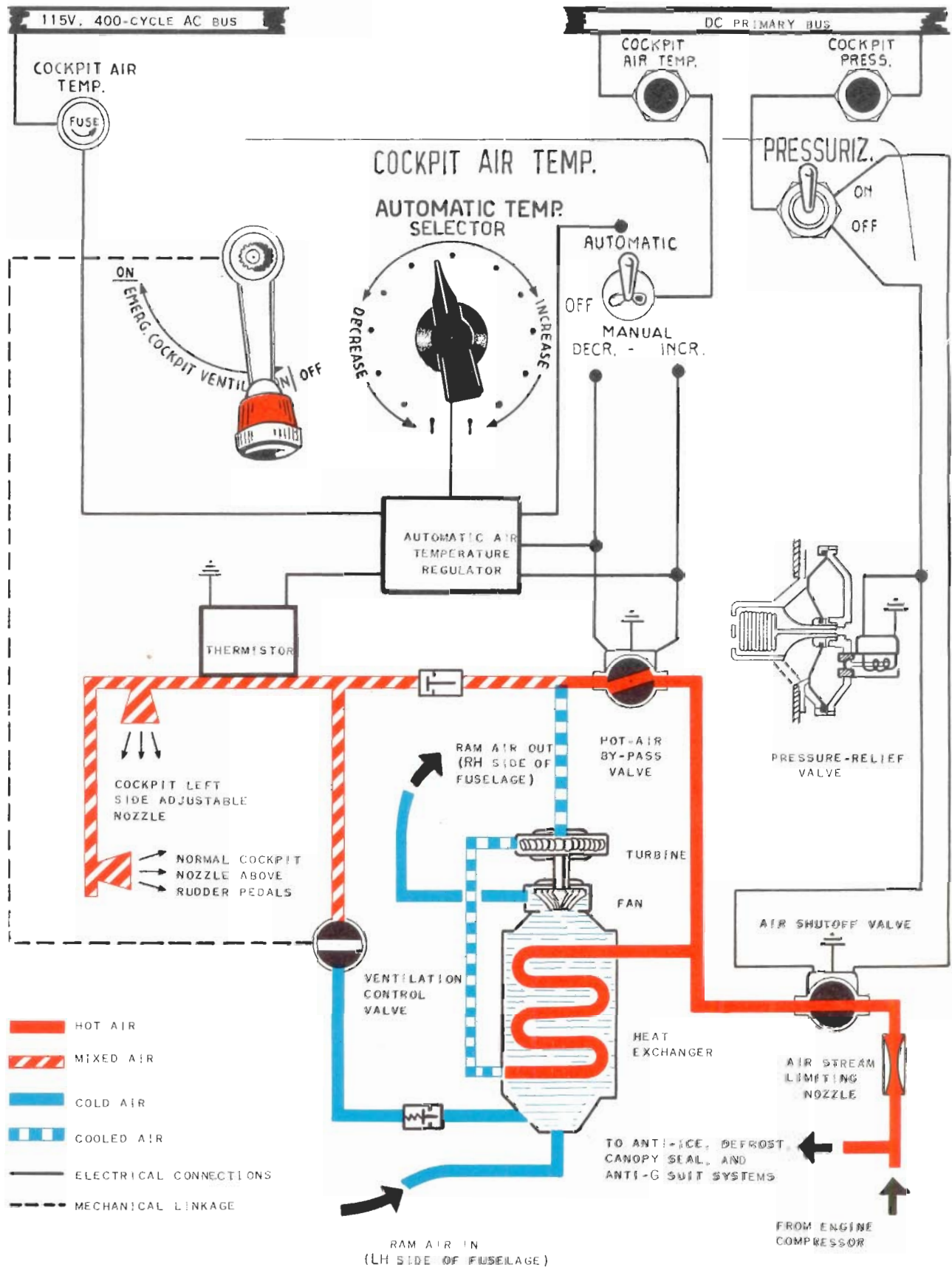
EMERG. COCKPIT VENTILATION LEVER

The cockpit emergency ventilation lever opens and closes the self-regulating dump valve by manual selection. This valve is located on the right console behind the APX-25 control panel.

COCKPIT PRESSURIZ SWITCH

Cockpit air pressurization is controlled by the cockpit pressurization two position (ON and OFF) switch.

COCKPIT AIR CONDITIONING, PRESSURIZATION AND VENTILATION SYSTEM



M-0000/A

Figure 4-1

COCKPIT PRESSURE SCHEDULE

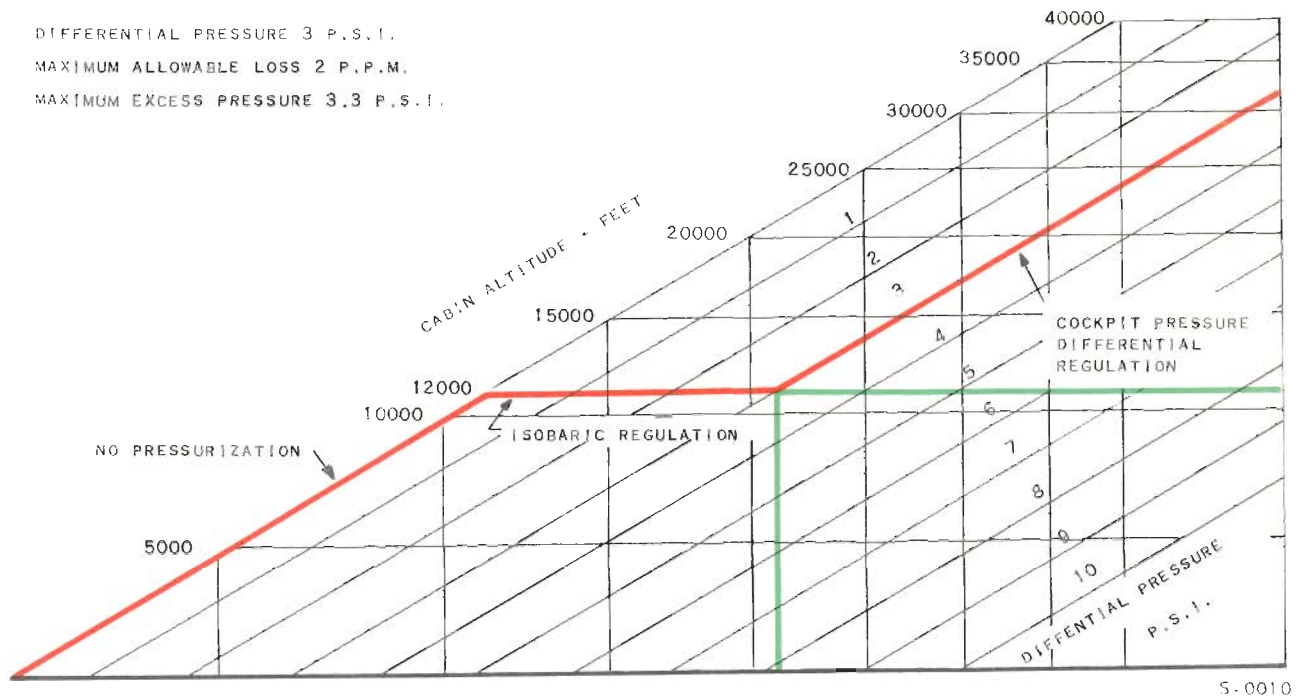


Figure 4-2

COCKPIT AIR CONDITIONING, VENTILATION, AND PRESSURIZATION CONTROL PANEL

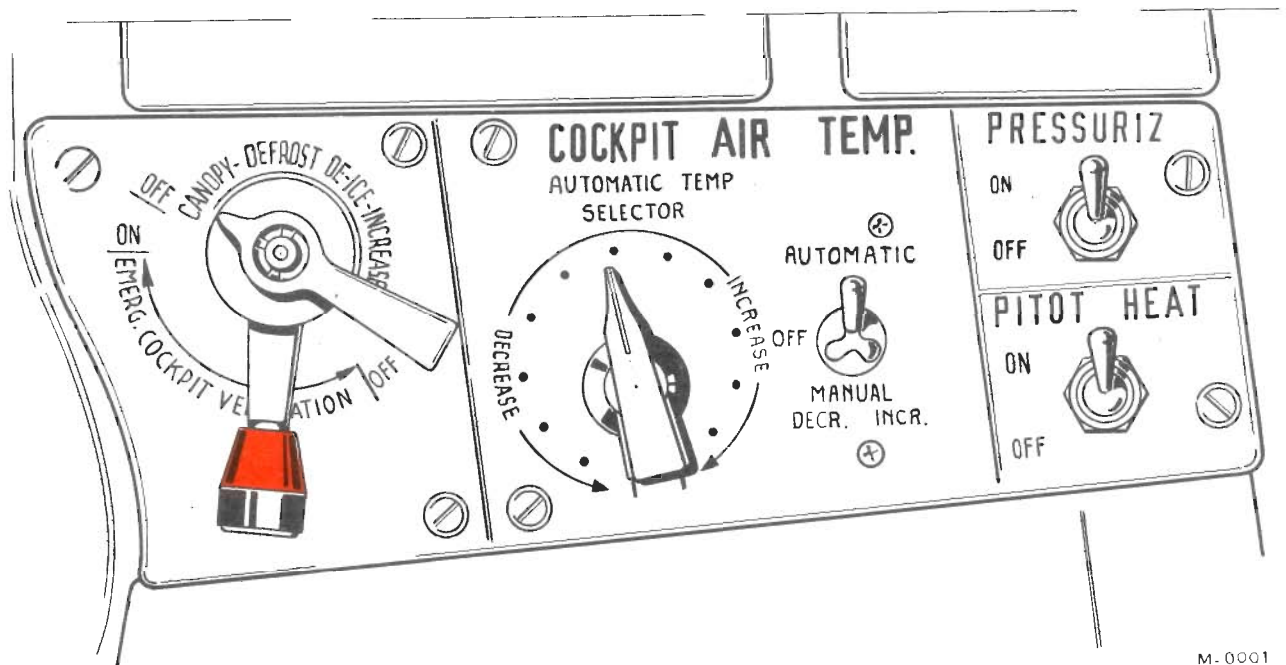


Figure 4-3

AUTOMATIC TEMP. SELECTOR RHEOSTAT

Cockpit air temperature is selected by an adjustment toward INCREASE or DECREASE of the cockpit air temperature rheostat.

COCKPIT AIR TEMPERATURE AUTOMATIC SWITCH

This switch has four positions, AUTOMATIC, MANUAL INC, MANUAL DEC., and a center OFF position. With the switch in the AUTOMATIC position, air temperature is automatically maintained at the temperature selected on the cockpit air temperature rheostat.

In case the cockpit air temperature automatic electronic control system fails, the switch may be moved to either MANUAL DEC. or MANUAL INC until the desired cockpit temperature is reached.

ANTI-ICING AND DEFROSTING SYSTEM

This system (fig. 4-4) is designed to supply hot air from the engine compressor to the inside and outside of the windshield, to the inner surface of the canopy and to the nose camera glasses (forward, lower, port and starboard).

The system comprises two circuits, one for the canopy and windshield, controlled by the CANOPY DEFROST DE-ICE knob on the right console, and one for the nose glasses, controlled by the CAMERA DEFROSTING lever on the right side of the cockpit.

ANTI-ICING AND DEFROSTING SYSTEM CONTROLS

Canopy defrost DE-ICE control knob can be rotated clockwise from the OFF position. When moved toward increase, it progressively uncovers the duct apertures in the defrosting and anti-icing air ducts and hot air is directed to the windshield and canopy.

CAMERA DEFROSTING LEVER

Moving the lever to OPEN directs hot air through duct apertures along the nose glasses (forward, lower, port and starboard). When the CAMERA DEFROSTING lever is in the vertical position, the system air pressure shutoff valve is closed.

RADIO AND RADAR EQUIPMENT**COMMUNICATION**

AN/ARC-34 UHF command radio equipment.

NAVIGATION

Navigation independent of ground stations is possible with MARK 3 B PHI automatic course, distance indicator and DRA-12A DOPPLER.

ADF-102 radio compass indicator.

IDENTIFICATION

AN/APX-25 IFF identification radar set.

SOUND RECORDING

Reichhalter D-6B sound recorder set.

UHF COMMAND RADIO-AN/ARC-34

The UHF command radio equipment consists of a receiver-transmitter, a control panel (fig. 4-5), an antenna (fig. 4-6), a relay and two MIC buttons.

The AN/ARC-34 command radio equipment provides two-way radio-telephone communication (air-to-air and air-to-ground) on 1750 different frequencies in the radio frequency range of 225.0 through 399.9 megacycles, on frequencies spaced 0.1 megacycle apart.

The receiver-transmitter comprises a transmitter and two receivers; main and guard. The transmitter and main receiver are pretuned to the same operating frequency. The guard receiver is tuned to the guard frequency. All the controls are grouped in a single control panel. In the radio set, any 20 of the 1750 possible frequencies can be preset in any order. The operator can select any of the 20 channels by the large knob on the control panel. The number of the selected channel will appear in a small window above the selector knob. In addition, four knobs are provided so additional operating frequencies can be set up manually by the pilot.

The mode of operation of the main receiver and the transmitter is preset by the MANUAL-PRESET-GUARD selector knob located near the large center knob. Depending on the type of operation, only the

ANTI-ICING AND DEFROSTING SYSTEM

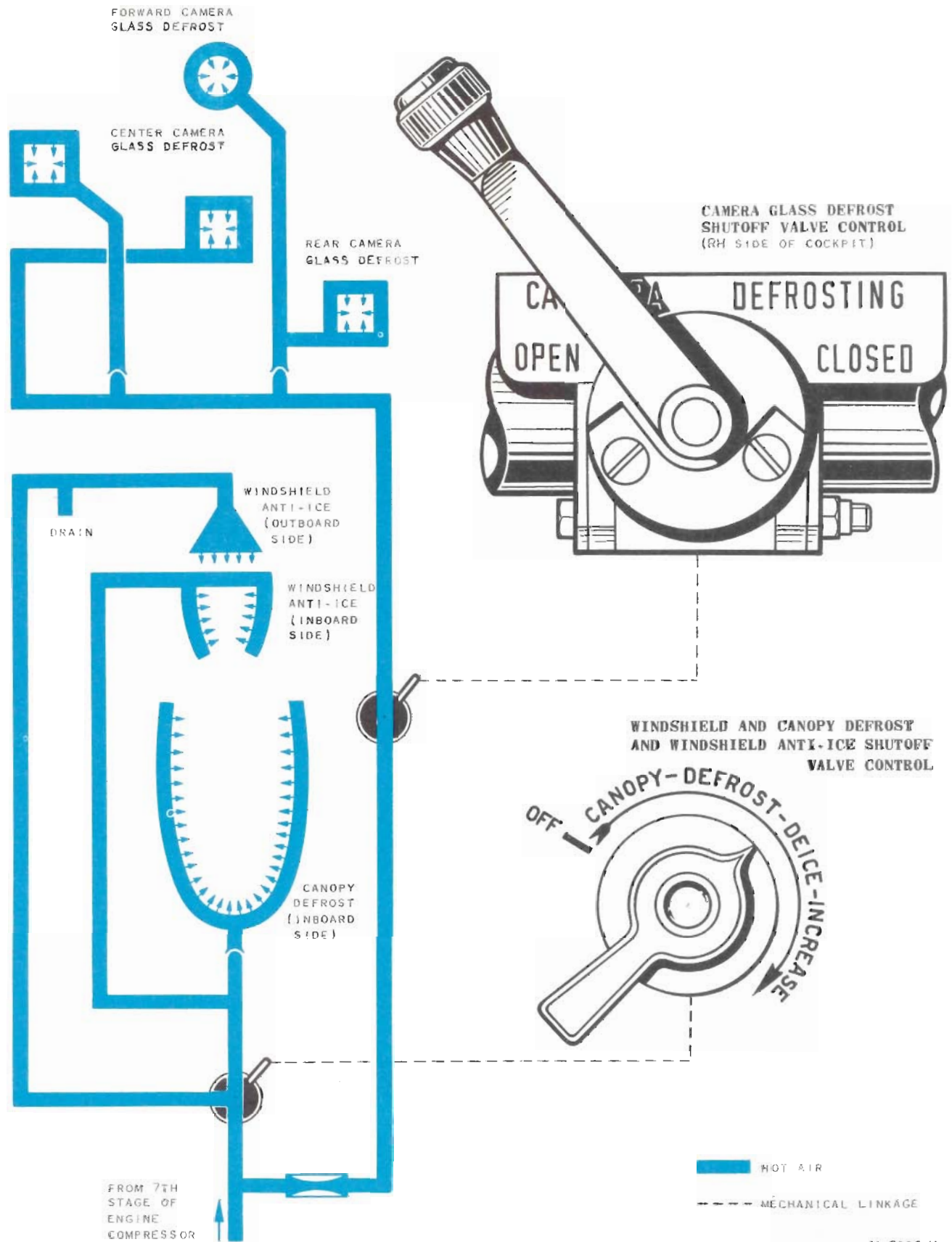
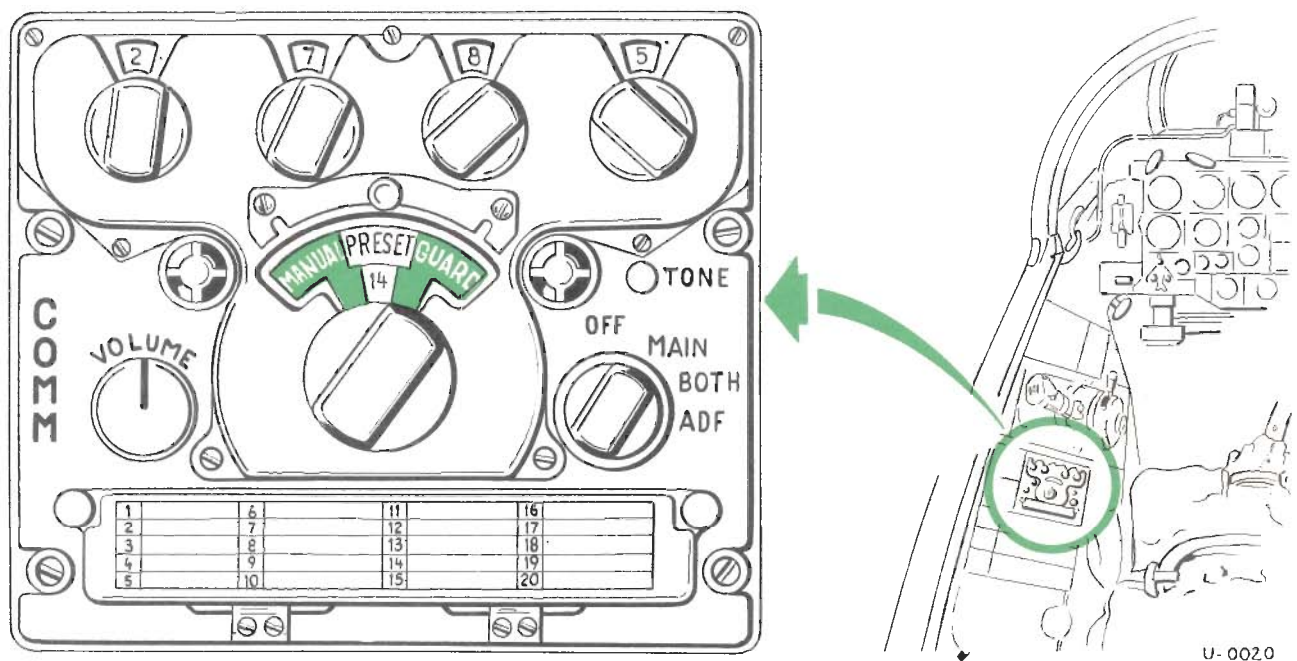


Figure 4-4

AN/ARC-34 UHF CONTROL PANEL



C91 R/4
P

Figure 4-5

UHF ANTENNA LOCATION DIAGRAM

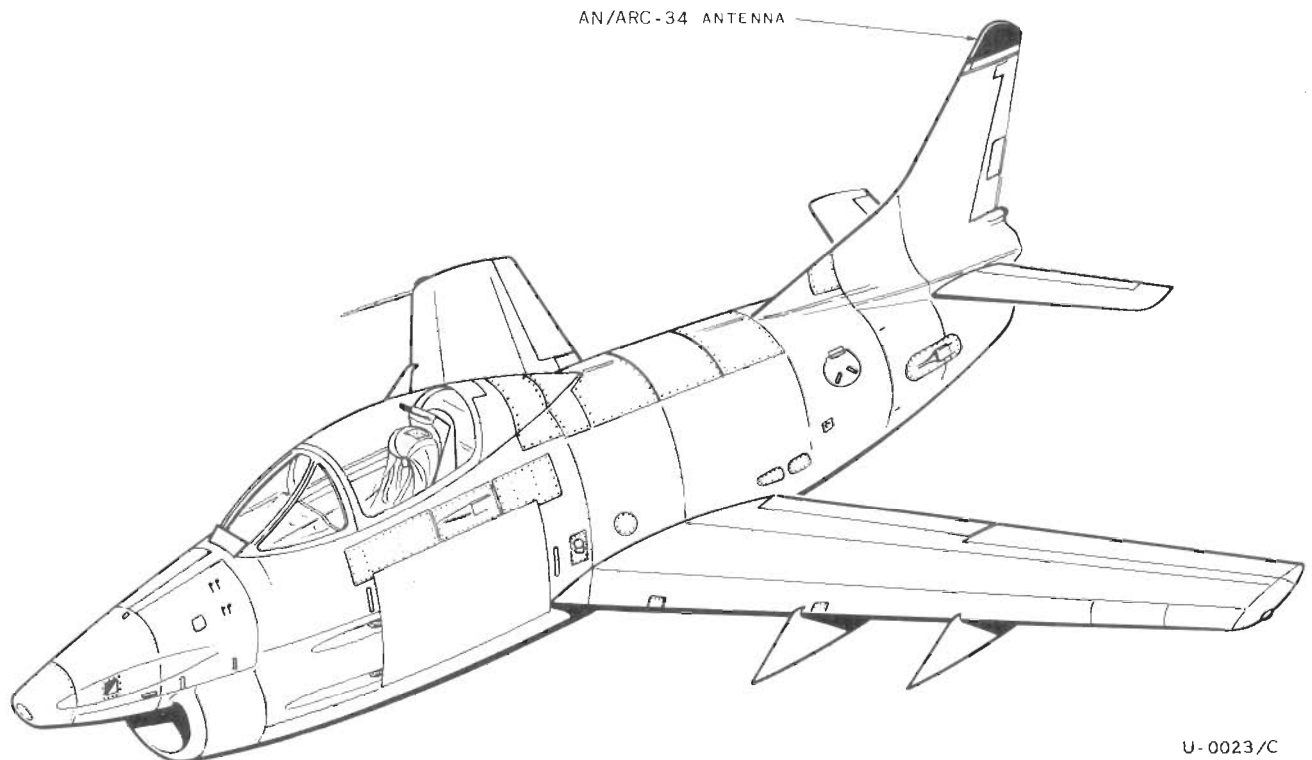


Figure 4-6

main receiver and the transmitter can be employed, or both receivers (main and guard) and the transmitter. These combinations are preset by the OFF-MAIN-BOTH-ADF switch. The ADF position is inoperative in this installation.

The transmitter may be tone-modulated (A-2) for emergency or direction finder purposes by pressing the TONE button which operates the transmitter on an audio oscillation. The volume is regulated by the VOLUME knob.

Two MIC buttons are located on top of the throttle (fig. 1-10) and in the control stick grip (fig. 1-19), respectively. They permit switching from reception to transmission by connecting the antenna to the transmitting part of the equipment through a relay. When the MIC buttons are released, the antenna is reconnected to the receiving part of the unit.

NOTE When the sound recorder master switch is placed in the MIC ON position, the antenna relay circuit is opened and transmission is not possible.

The antenna, located on top of the vertical stabilizer, is used for both reception and transmission.

The UHF system is powered by the primary bus. The control panel is on the left console.

OPERATION OF COMMAND RADIO (AN/ARC-34)

- 1) Rotate main control switch to « BOTH » position and allow approximately one minute for warm-up of main and guard receiver units.
- 2) Place « MANUAL-PRESET-GUARD » switch in the « PRESET » position.
- 3) Place channel selector control to desired channel.
- 4) Adjust volume control to desired audio level.
- 5) Manual selection of a frequency not preset is made by moving the « MANUAL-PRESET-GUARD » control to « MANUAL » position. Rotate the four frequency selector knobs for selection of the desired frequency. The main control switch must be in either « MAIN » or « BOTH » position for manual operation.
- 6) Reception on the guard frequency is made by moving the « MANUAL-PRESET-GUARD » selector to « GUARD ». This tunes the receiver and transmitter to the guard frequency and cuts out the main units.
- 7) To turn set off, rotate main control switch to « OFF ».

MARK III B PHI NAVIGATION EQUIPMENT

The PHI Mark III B is a dead reckoning navigation system which does not require the support of any ground transmitting stations to continuously preset the course and distance of the aircraft to any of five predetermined points. Optional additional points can be preset by the pilot through the Vector Adder unit.

The operating range of the system using only one station selector magazine is 2,000 nautical miles. However, the pilot can add additional vectors to the operating range at any time during flight through use of the Vector Adder, thus increasing the maximum range to 3,000 miles.

COMPONENTS OF PHI SYSTEM

PHI CONTROL PANEL

The PHI system control panel (detail D, fig. 4-7), located on the right console, allows the pilot to properly select any one of the five predetermined stations for flight, by means of related buttons. Button 1 always corresponds to the calibration station to which the other four points are correlated. The station selector magazine, which is located in the PHI control panel, is readily removed by using the RELEASE button.

WARNING When any one of the five buttons on PHI control panel is pressed, the SEQUENCE warning light comes on for about 7 seconds. When light is on, no PHI controls should be adjusted as this will jeopardize correct reading of PHI indicator. No readings should be taken at this time.

VECTOR ADDER

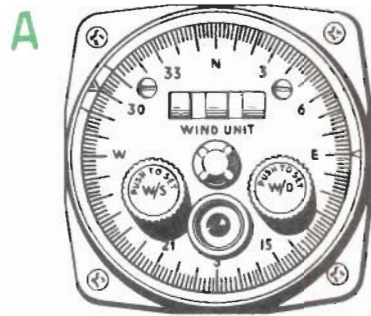
The Vector Adder (detail C, fig. 4-7) allows addition of any supplementary vector (not more than 500 miles) selected by the pilot and referenced to one of the five predetermined stations. Vector additions can be cancelled and replaced at any time.

PUSH TO SET - « R » knob is used to rotate three digit counters for vector length. PUSH TO SET - « O » knob is used to rotate bearing pointer referenced to an azimuth scale.

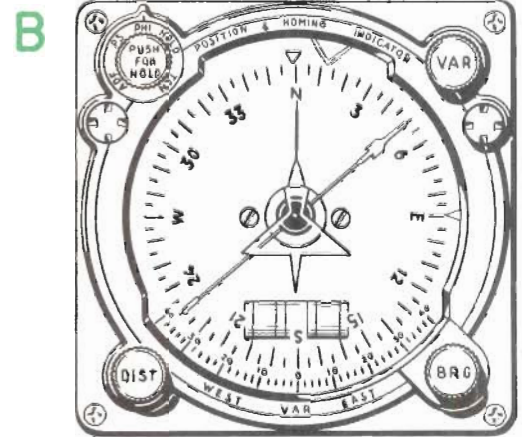
NOTE Press knobs before turning.

In addition to an instrument light the Vector Adder also has a warning light that comes on when a vector is added and goes off when a vector is cancelled.

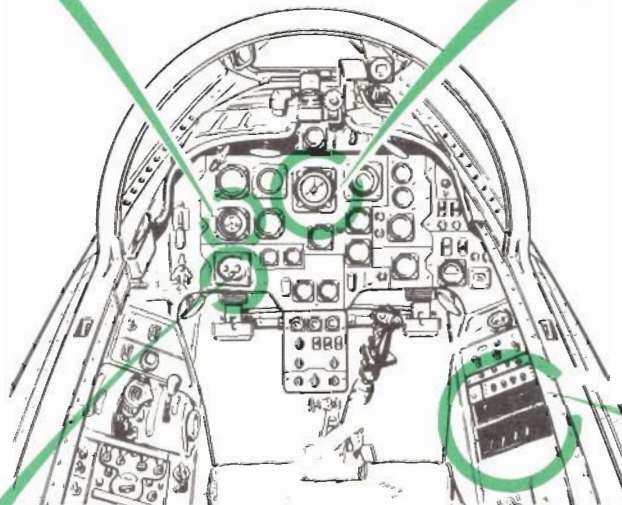
PHI CONTROL PANEL AND INDICATORS



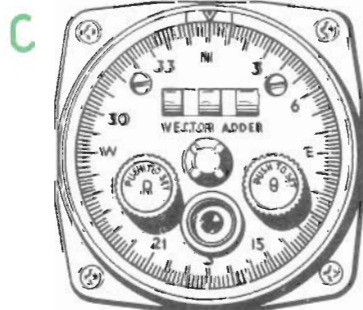
WIND UNIT



PHI INDICATOR



DOPPLER CONTROL PANEL



VECTOR ADDER

PHI CONTROL PANEL



P-0048/B

Figure 4-7

DOPPLER SYSTEM

The DOPPLER system automatically provides highly accurate and continuous information on ground speed and drift angle without reference to ground installations.

The system consists of:

A receiver-transmitter, two antennas, a computer, vertical gyroscope and a control panel.

a) *The receiver-transmitter* is located in the radio equipment bay. It gives out four beams of signals modulated at 8,800 megacycles through the two antennas located on the bottom of the front fuselage. The signals are reflected by the ground, received by the antennas and the receiver section of the receiver-transmitter and fed to the computer located in the radio equipment bay. The computer calculates information referenced to the ground speed and drift angle and feeds it to the PHI system.

b) *The gyroscope unit* is located aft of the cockpit rear bulkhead. It corrects errors caused by slight variations of longitudinal (pitch) and transversal (aileron) trim of the airplane. In cases of great variation the DOPPLER system is cut out and the PHI system uses information from the true airspeed transmitter and wind unit.

c) *The control panel* located on the right hand console (detail D, fig. 4-7) controls the system in flight and during ground tests and consists of:

— *Main 4 position switch*: OFF (system de-energized), RECVR ONLY, (receiver energized for pre-heating and stand-by condition), ON (receiver and transmitter energized), TEST (only for testing system).

— *4 position switch*: INCREASE - DECREASE - RIGHT - LEFT (used for ground tests as a simulated control of computers).

— *2 position switch*: SEA - LAND (used in flight to change sensitivity of system for sea or land flights).

— *Warning light*: ALARM (indicates DOPPLER system cut off from PHI system).

WIND UNIT (ALTERNATE TO DOPPLER)

The wind unit (detail A, fig. 4-7) is located on the left side of the main instrument panel. It is used to feed wind information (speed and direction) into the PHI system on the ground and in flight. PUSH TO SET-W/S knob is used to set wind speed data indicated by a three digit counter. PUSH TO SET-W/D knob is used to rotate wind direction pointer.

NOTE Press knobs before turning.

In addition to an instrument light the wind unit also has a SEQUENCE warning light which goes on during computation. Wait until light goes off before reading or using PHI system control.

PHI POSITION & HOMING INDICATOR

The PHI indicator (detail B, fig. 4-7) is located in the center of the main instrument panel. It gives continuous indication of:

— Bearing and distance from a selected station.

— Magnetic heading shown by airplane heading indicator (fixed and placed over azimuth scale).

The following knobs are located on the four corners of the indicator:

a) VAR: to move lower outer dial pointer (grivation setting).

b) BRG: to adjust center pointer (bearing pointer).

c) DIST: to adjust distance counter.

d) Mode Selector: 5 positions.

— HOLD: to cut in memory.

— PHI: to cut in PHI indicator.

— PS: (pilot setting) to cut out operation as PHI system. In this case indicator only gives magnetic heading and bearing pointer can be rotated with BRG knob to any position.

— ADF: Not set for operation - Do not use.

— TCN: Not set for operation - Do not use.

NOTE Distance counter operates when the airplane flies faster than 175 knots.

AIRSPPEED INTEGRATOR RESOLVER

The airspeed integrator resolver is located in the radio equipment bay and consists of a ball disc integrator and a ball resolver to compute data on true airspeed distance and bearing.

JUNCTION BOX

The junction box is located in the cockpit above the rudder pedals. The LATITUDE knob on the box is used to set latitude information and must be checked prior to each flight. The junction box is also used as the terminal center for the entire PHI system.

ADDITIONAL EQUIPMENT

Besides the equipment described above, the PHI system also includes the following equipment used to

automatically supply information needed for system operation:

TRUE AIRSPEED INDICATOR TRANSMITTER

The true airspeed transmitter is connected to the Pitot static system and the temperature detector. The airspeed transmitter, therefore, gives a signal proportional to true airspeed of the airplane.

TEMPERATURE DETECTOR

Furnishes to the true airspeed transmitter with air temperature data necessary to correct airspeed and obtain true airspeed.

GYROSYN COMPASS

The gyrosyn compass is a directional gyro slaved to magnetic North through an amplifier and a flux valve installed in the left wing outer panel. Heading is indicated by the center pointer of the PHI indicator.

The compass control panel is located on the cockpit right hand console. The panel has a MAG and DG two position switch, a manual slaving control and an indicator to show alignment of compass to magnetic North. When the switch is turned to MAG the compass is slaved magnetically. When the switch is turned to DG the compass operates as a directional gyro. Manual slaving control allows rapid alignment of the compass to magnetic North when the compass is energized or when there alignment error. The indicator shows synchronization of the compass or compass error to magnetic North. It is used as a guide for manual slaving and as an indication of correct operation of system.

NORMAL USE OF PHI SYSTEM

The technician must set the information on the station selector on station 2, 3, 4 and 5, referenced to station 1 (used as the calibration station) then install the station selector unit on station selector receptacle.

Pilot will perform the following operations:

- 1) Before entering the cockpit check setting of LATITUDE index on the junction box to the home base latitude.
- 2) Press button No. 1 on PHI station selector for departing station (calibration station in this case).
- 3) Turn PHI indicator mode selector to HOLD position.
- 4) «Zero» PHI indicator distance counter with DIST knob.
- 5) Turn mode selector to PHI. The SEQUENCE light will come ON. After the sequence light goes

OFF, set wind speed and direction on the wind unit according to the meteorological wind information. To set, press and rotate the W/D and W/S knobs. The SEQUENCE light will come ON and will remain ON while adjustments are being made. The light will go OFF approximately 7 seconds after both knobs have been released.

6) Press consecutively buttons 2, 3, 4, 5 on control panel to check proper setting of destination fixes on the indicator.

7) With PHI indicator VAR knob set lower outer pointer to obtain indication of magnetic variation for area where flight is to be accomplished.

NOTE For flights to be accomplished in areas with noticeable magnetic variation instead of setting total average value, divide flight into subsequent sections and set relative average value into each section.

In the PHI mode of operation, the Indicator will display range and bearing data in relation to preselected stations. According to button pressed (1-2-3-4-5), the distance counter gives the distance in miles the airplane is from the preselected station, and the movable pointer gives bearing of that station to centerline of airplane.

To fly towards a destination, pilot must fly the aircraft to align movable bearing pointer with grivation index pointer. When over the station, the distance counter will read «000» and the bearing pointer will rotate 180 degrees.

Once over the station, the distance counter will display miles flown from the station, and the bearing pointer will display bearing of the station to the centerline of the airplane.

CORRECTION OF INDICATOR

It is possible to check the range and bearing displayed on the indicator by comparing indicated data with data taken from the map or received from a ground station.

If the range and bearing displayed in the PHI mode does not correspond to the information received from the ground station, perform following operations:

- 1) Turn the mode selector to the HOLD position.
- 2) Press DIST Knob, rotate DIST Knob and/or BRG Knob until the indicator displays new data.

NOTE Whenever range or bearing adjustments are made on the PHI indicator, the mode selector must be in the HOLD position.

On the HOLD position the normal operational changes in range and bearing display do not occur since the display is held to permit adjustment. However computations for range and bearing are still being performed by the system and stored in the memory circuits.

When the mode selector is turned to the PHI position, the information stored in the memory circuits becomes available and will be displayed on the indicator.

WARNING Do not keep the mode selector in the HOLD position for more than 10-15 minutes to avoid wrong display of data on the indicator.

3) After adjustments of range and bearing have been performed, return the mode selector to the PHI position.

The amber SEQUENCE light on the PHI Control panel will go ON. Approximately 7 seconds after the reset operation the light will go OFF.

WARNING No PHI adjustments should be made during the period when the SEQUENCE light is ON.

4) After the SEQUENCE light goes OFF, the stored information will be released and displayed on the indicator.

5) Check the variation setting by observing the variation scale index located in the lower part of the indicator below the azimuth scale. The index should be set to the average value of the variation for the flight plan.

WIND SET

If there is no change in the meteorological wind information, no adjustment to the Wind Unit is necessary. If the wind information received in flight differs from that set in at take-off, then a wind set operation must be performed in the following manner:

1) Turn mode selector to PHI position.

2) Press and rotate W/S and W/D buttons on the Wind Unit and set in the wind speed and wind direction to conform with to the new wind information received. Observe that the SEQUENCE light on the PHI control panel goes ON. Approximately 7 seconds after the reset operation the light will go OFF.

NOTE Although Doppler is the primary input to the PHI System, it is advantageous to keep wind information as correct and up to date as possible since the Doppler System may become inactive periodically.

WIND FIND

To correct errors in the wind display, if the position of the aircraft is incorrect and a new « fix » is established, an automatic wind find operation should be performed as follows:

1) Turn mode selector to the HOLD position.

2) Adjust the range and bearing displayed on the Indicator to agree with « fix » data.

3) Press the W/S or W/D buttons on the Wind Unit.

4) Observe that the amber light of the Wind Unit comes ON and that the Wind Unit direction index and/or speed counter display new wind data.

NOTE If the wind data displayed on the Wind Unit, after performing a wind find operation, is known to be incorrect, *before turning mode selector to PHI position*, reset the W/S and W/D buttons to their initial settings after the amber light on the Wind Unit goes OFF.

5) Turn mode selector to PHI position when the amber light of the Wind Unit goes OFF.

WARNING At least 10 minutes of « air data » flight is required before making a Wind Find operation and/or between each successive wind find operation.

ADDITION OF A VECTOR (USING VECTOR ADDER)

The addition of a vector by using Vector Adder is performed as follows:

1) Check Station selector button to which vector is referred.

2) Press and rotate PUSH TO SET-R knob of the Vector Adder to display on the three digit counter the miles corresponding to the new Vector.

The amber light on the Vector adder will come ON indicating that the new data, in addition to the Station Selector data, is being fed to the PHI computer circuitry.

3) Press and rotate the PUSH TO SET-θ Knob to obtain new bearing.

The PHI indicator will then display the bearing to reach station and distance of airplane from that point.

To cancel added vector:

1) Press any other button, on the Station Selector for a station not selected in that moment.

2) Wait until SEQUENCE light on PHI control panel goes OFF.

3) Press button (on PHI control panel) relative to the station previously selected.

4) The amber light of the Vector Adder will go OFF and the PHI indicator will display bearing and distance as before addition of the vector.

NOTE Range and bearing settings can be performed on the Vector Adder either before flight or during flight.

ADF 102 RADIO COMPASS SYSTEM

The ADF 102 is a completely transistorized system using etched circuitry which gives automatic indication of airplane bearing to a station to which the ADF-102 is tuned. In addition, the system incorporates the functions of both automatic and manual directional finding and audio reception of modulated and non-modulated radio signals. Reception ranges from 200 to 1600 kilocycles, divided into two bands, one from 200 to 550 kilocycles and the other from 550 to 1600 kilocycles.

The system consists of a receiver, an indicator, a control unit (fig. 4-8) a sense antenna, a fixed loop antenna (fig. 4-9) and an automatic goniometer. The controls are mounted in the control panel located on the right console.

The system operates on power from the primary bus.

CONTROLS

All operating controls are mounted on the front panel of the control unit.

MAIN SWITCH

The main switch has four positions:

a) OFF - System is cut off from power supply.

CAUTION Instrument lighting system is independent from main switch. Lighting of control panel does not mean the system is operating.

b) COMP - System is energized and operates as an automatic direction finder using both antennas.

c) ANT - System is energized and operates only as a receiver using sense antenna.

d) LOOP - System is energized and operates as a manual direction finder by rotating loop antenna in

either direction at a slow or fast speed with the 4 position LOOP knob.

VOLUME CONTROL KNOB

The volume control knob is used for adjusting audio output.

CW SWITCH

The CW switch is normally OFF. It is turned to CW when a weak or very distant station cannot be heard distinctly, this energizes the BF oscillator in the system. The set is then tuned for sonic null. A-I type stations require the use of the CW switch.

LOOP-L-R Control knob is used to rotate compass left (L) or right (R) when main switch is on LOOP position. Direction and speed of rotation are controlled by the direction and displacement of the control. When released, the control should return to neutral position.

TUNING handle is used for easy and precise tuning of the desired frequency on the indicator in the center of the panel.

BUTTONS FOR PRESELECTED STATIONS

When one of the five buttons are pressed a preselected frequency can be tuned instead of using the TUNING control handle.

The first 4 buttons are used for frequencies on the first wave band and the fifth is used for a frequency on the second wave band. Kilocycles related to preselected frequencies can be read in windows above each button.

INDICATOR

The indicator is located on the upper left side of the instrument panel.

The needle of the indicator points to the bearing from which radio signals are being received.

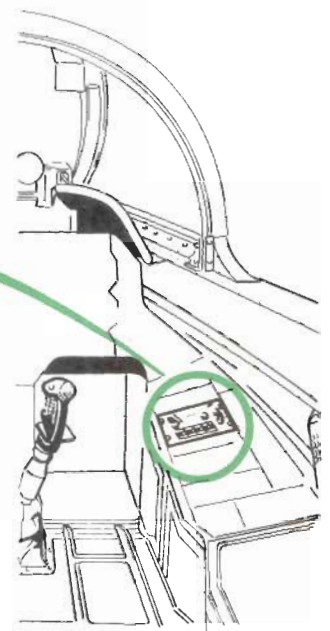
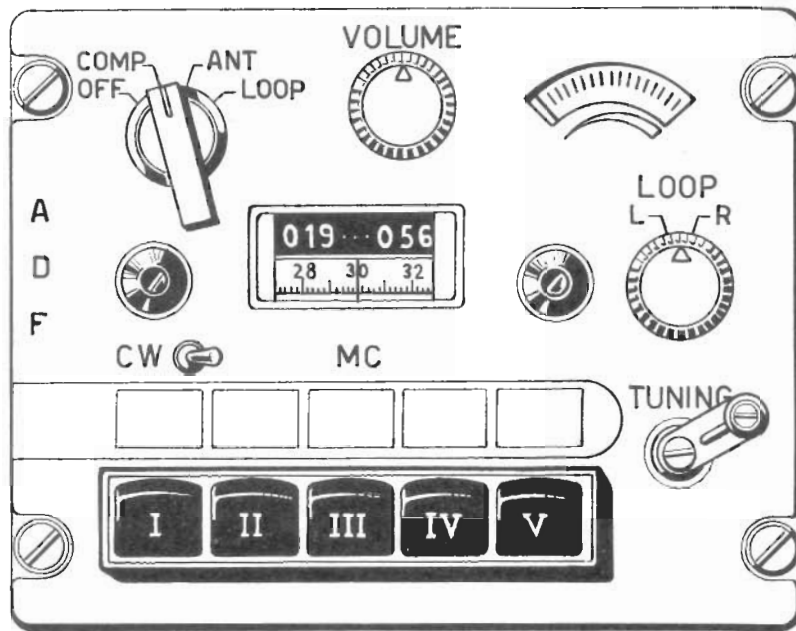
The azimuth scale of the indicator may be rotated to convert (mechanically) the bearings to true or magnetic bearings.

ANTENNAS

The system has two antennas:

The *fixed loop Antenna* located in the upper side of the fuselage behind the canopy picks-up the signals from a radio station.

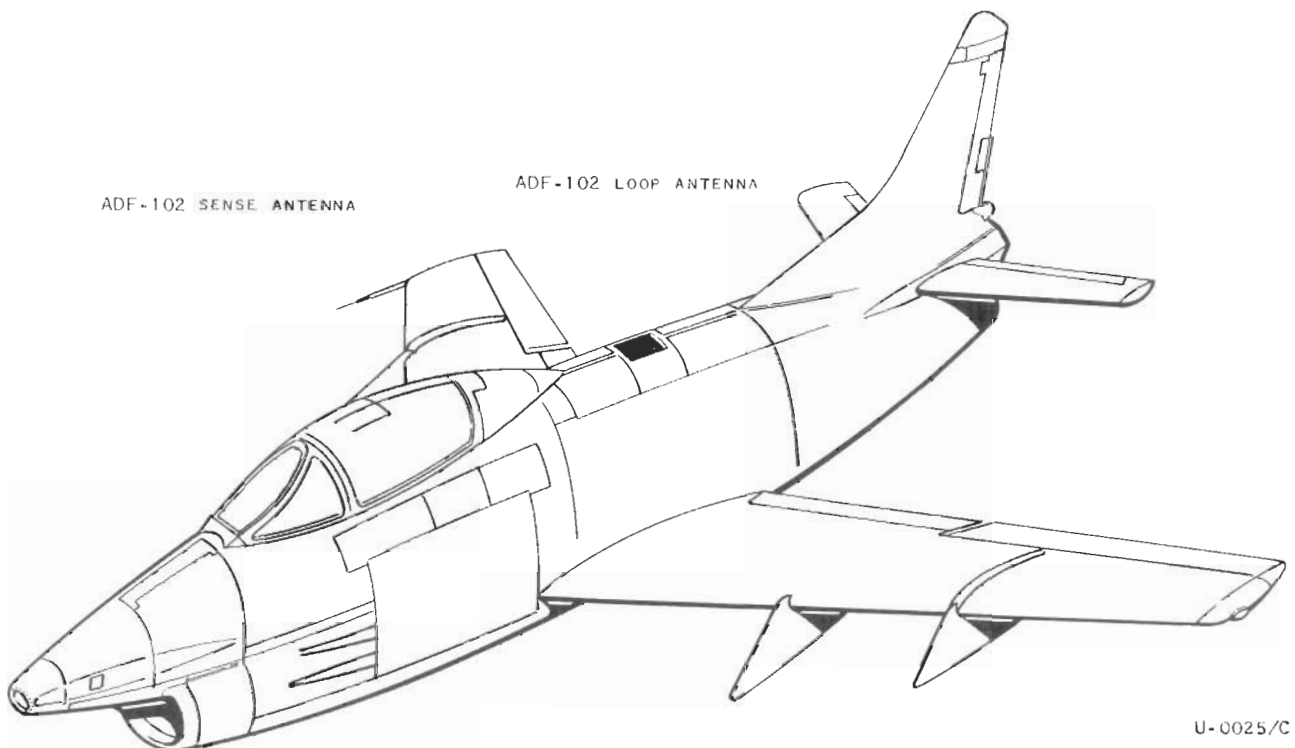
ADF-102 RADIO COMPASS CONTROL PANEL



U-0022/B

Figure 4-8

RADIO COMPASS ANTENNA LOCATION DIAGRAM



U-0025/C

Figure 4-9

The *sense antenna* located in the canopy glass indicates the direction of the radio station from which signals have been received.

The *receiver* located on the radio equipment bay, receives the signals picked-up by the fixed loop antenna, amplifies and compares them with the signals picked-up by the sense antenna and feeds the automatic goniometer.

AUTOMATIC GONIOMETER

Located on the upper side of the aft fuselage behind the loop antenna it automatically searches the aural null.

OPERATION OF SYSTEM

The radiocompass system can accomplish one of the following functions:

- 1) Operate as a radio compass to determine course of airplane in relation to destination.
- 2) Operate as a receiver with the sense antenna.

OPERATION AS A COURSE INDICATOR

- 1) Turn main switch to ANT.
- 2) Tune to station using control or pressing related button of a preselected frequency.
- 3) Turn main switch to comp.
- 4) Indicator on instrument panel will give position of station.
- 5) Turn main switch OFF to cut off system.

OPERATION AS A RECEIVER

- 1) Turn main switch to ANT.
- 2) Turn CW switch to CW when tuning A-I stations.
- 3) Tune to required frequency with TUNING control.
- 4) Adjust volume with control knob.

CAUTION For better definition of radio range stations adjust headset volume to minimum signal strength. Continue reducing volume as A and N signal intensity increases.

- 5) Turn main switch OFF to cut system OFF.

AN/APX-25 IFF AND SIF RADAR

The AN/APX-25 is an airborne pulse-type transponder which enables the aircraft to identify itself whenever it is challenged by either Mark X (AN/APX-6) or

Selective Identification Feature (SIF) interrogating systems. The set does not operate simultaneously in both SIF and normal Mark X systems. This provision is included to permit continual operation during a transitional period while the expanding network of SIF installations are replacing the older Mark X stations. A preset adjustment of the S-103 switch within the receiver-transmitter enables operation in either one or the other system. This switch cannot be set during flight, therefore the pilot should know which system is selected by the switch.

The SIF permits the aircraft to not only reveal itself as friendly when interrogated, but also identify itself with regard to serial number, flight number, mission or any other method previously arranged. The system is usually operated in conjunction with search radar which automatically actuates the transmission of a coded reply which is received and portrayed on a planned position indicator or letter symbol indicator which enables specific identification and location of the aircraft.

The C-1158/APX-25 control panel permits turning the equipment on and selecting the various modes of operation. When the S-103 switch located within the receiver transmitter in the nose section is in the NORM position the set responds only to Mark X interrogations.

MARK X RADAR IDENTIFICATION

The purpose of Mark X radar identification is to enable the aircraft to identify itself automatically as friendly whenever it is challenged by Mark X interrogation signals from other appropriate radar recognition equipment located at land bases, aboard ships or in other aircraft. Two supplementary purposes of the equipment are:

- a) To enable specific friendly aircraft to identify themselves apart from numerous other friendly aircraft.
- b) To provide means for the transmission of a special coded signal known as the emergency reply.

C-1158/APX-25 CONTROL PANEL (fig. 4-10)

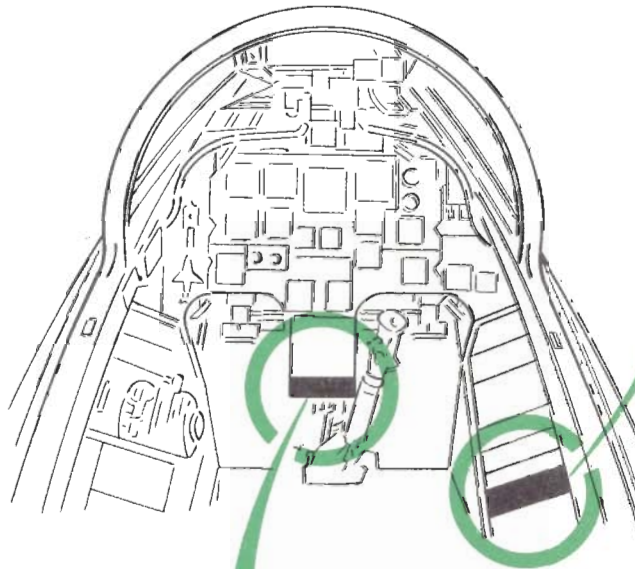
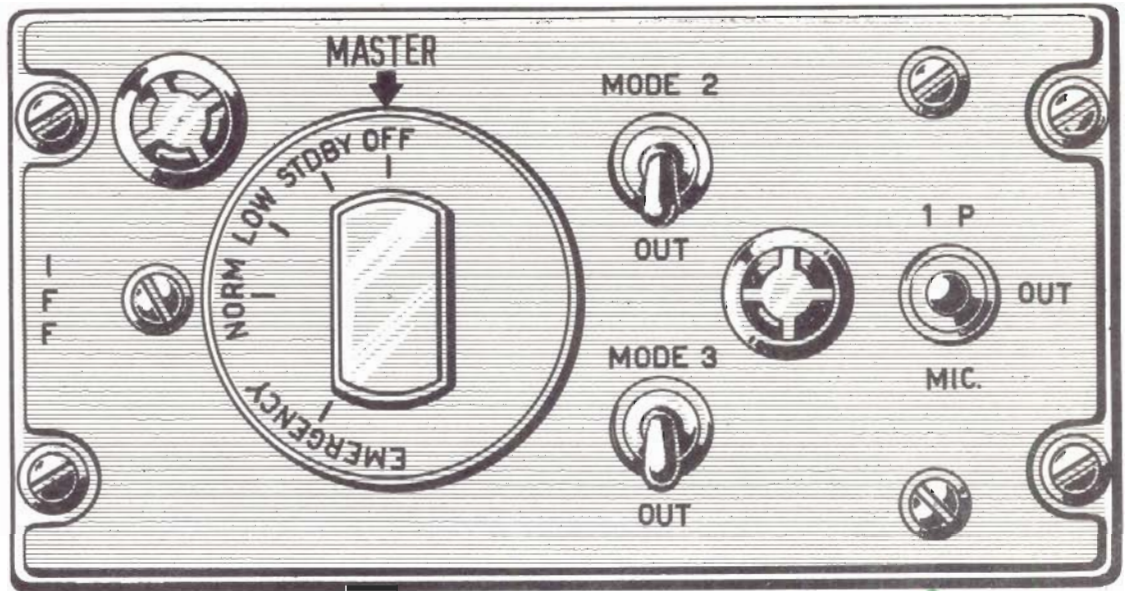
The C-1158/APX-25 control panel is located in the cockpit on the right hand console. The panel has the following controls:

EMERGENCY DIAL STOP

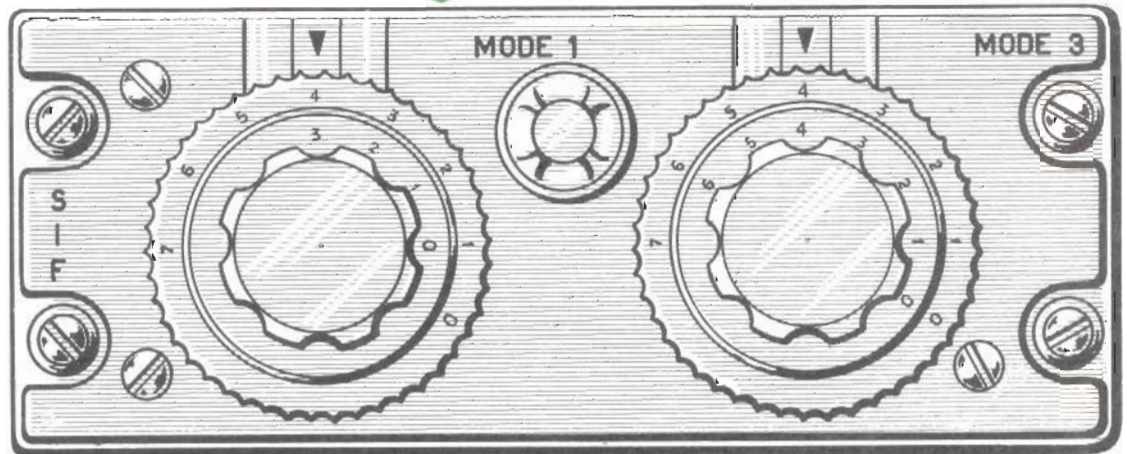
The emergency dial stop must be pressed in order to rotate the master switch from NORM to the EMERGENCY position.

AN/APX-25 RADAR CONTROL PANELS

C1158/APX-25 CONTROL PANEL



C1128/APX-25
CONTROL PANEL



U-00217C

Figure 4-10

MASTER SWITCH

The master switch is a five position rotary switch permitting selection of the following operational conditions as positioned:

OFF - The OFF position deenergizes the set.

STDBY - In the STDBY position, all primary power is turned on, tubes are heated and ready for immediate operation. However, the transponder receiver is not sensitized, thus no replies can be transmitted.

LOW - In the LOW position, the transponder receiver operates the same as in the NORM position but at reduced sensitivity and replies will be transmitted upon receipt of strong interrogation signals, ordinarily from nearby interrogation-responders.

NORM - In the NORM position, the transponder receiver is placed in Mode 1 operation, but is fully sensitized and operated with maximum performance. Transmittal power from the transponder is the same for both the LOW and NORM positions.

EMERGENCY - In the EMERGENCY position a distinctive emergency reply is transmitted upon receipt of any interrogation signal regardless of the mode of interrogation or the settings of the mode switches.

MODE SWITCHES

The mode switches provide separate control of transponder performance in Modes 2 and 3. They are effective only when the adjacent master switch is in NORM or LOW. The performance controlled by the Mode switches is independent of the performance controlled by the other and both are independent of transponder performance in Mode 1. Thus by setting the switches in MODE 1 and MODE 2 positions, the set is rendered operative in all three modes at once. The transponder is automatically placed in Mode 1 operation whenever the master switch is in NORM or LOW. Therefore no Mode 1 switch is provided. The OUT position prevents the reception and transmission of that particular switches' mode of operation.

I/P OUT-MIC SWITCH

The I/P-OUT-MIC switch is a 3 position switch with a momentary I/P position (up) and OUT position (center) and a MIC position (down) as follows:

I/P - The spring loaded I/P position must be held up for an operator's reply to a Mode 2 response when the Mode 2 switch is in the OUT position. When released the switch returns to the OUT position and continues to reply to Mode 2 interrogations for 30 seconds.

OUT - In the OUT position no Mode 2 interrogations are accepted; hence no replies are transmitted.

MIC - The MIC position causes the transponder to reply to Mode 2 interrogations only when the aircraft command radio transmitter is being operated by the pilot.

SELECTIVE IDENTIFICATION FEATURE (SIF) (fig. 4-11)

When the S-103 switch in the receiver-transmitter is in the MOD position the set responds to SIF interrogations according to the position of the controls as follows:

EMERGENCY DIAL STOP

Refer to C-1158/APX-25 control panel (fig. 4-10).

MASTER SWITCH

The master switch has the same positions as for Mark X operation except that the NORM and EMERGENCY positions have slightly different functions as follows:

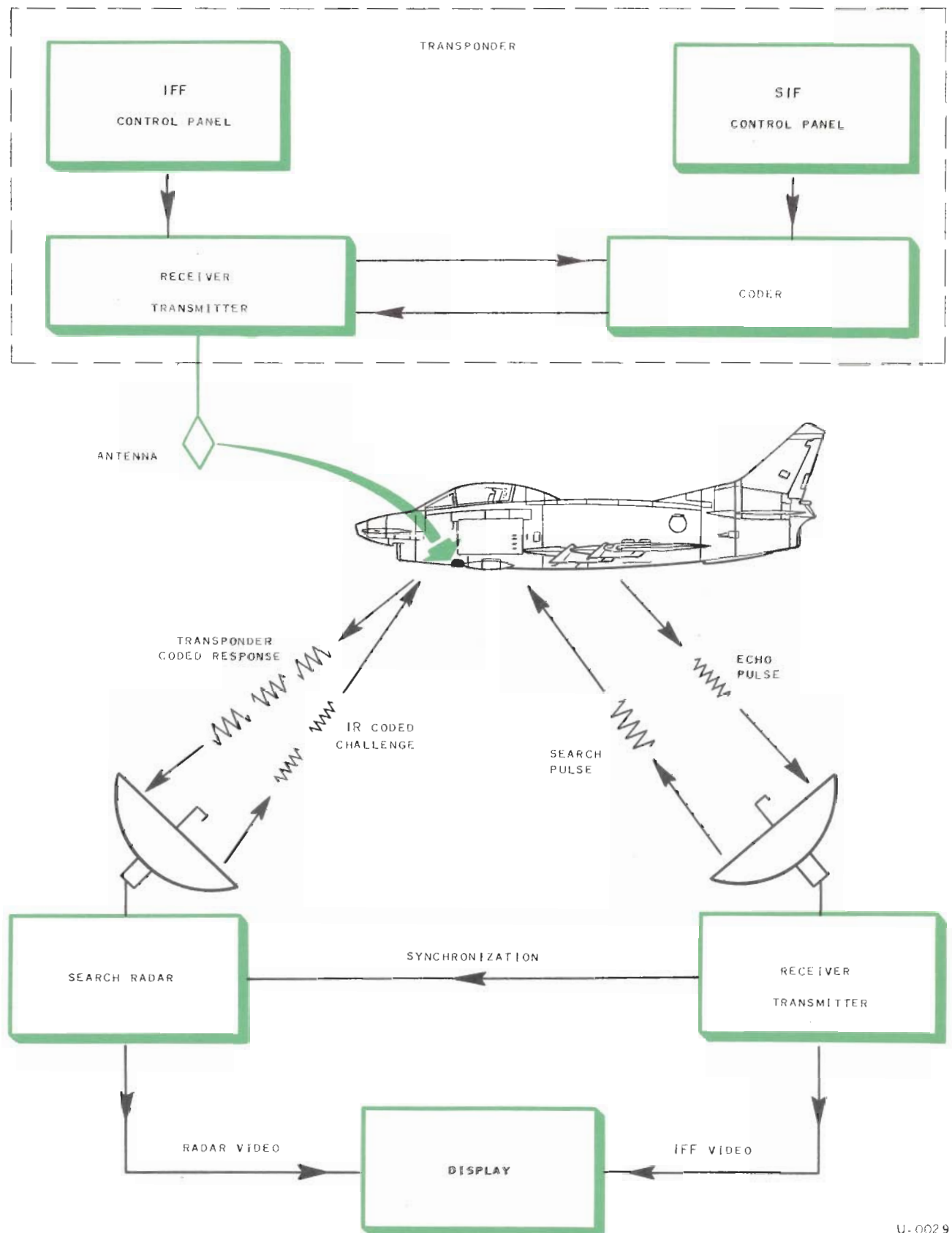
NORM - In the NORM position, the transponder receiver is operated in any of the 32 Mode 1 codes as selected by the Mode 1 control dial on the C-1128/APX-25 control panel. The set is fully sensitized and operates with maximum performance. Transmittal power from the transponder is the same for both the LOW and NORM positions.

EMERGENCY - In the EMERGENCY position a distinctive emergency reply is transmitted upon response to either Mode 1 or both Mode 1 and Mode 3 interrogations (depending upon the type of coder installed (KY-95 or KY-95A). If KY-95A is used, the operation may be either Mode 1 or Mode 3. Mode 3, if selected, permits quicker positive identification of the aircraft in distress. The reply is in four successive groups of code trains. The set may be wired so that during ejection, an auxiliary switch closes which automatically starts emergency operation.

MODE 2 SWITCH

The Mode 2 switch has two positions, OUT and MODE 2 (Up). In the MODE 2 position (provided the master switch is in LOW OR NORM) there are 400 possible reply codes available. The number and interval of these codes must be pre-set on the coder (KY-95 or KY-95A whichever is installed) prior to flight.

IFF OPERATING DIAGRAM SIF OPERATION



U-0029

Figure 4-11

MODE 3 SWITCH

The Mode 3 switch has two positions, OUT and MODE 3 (up). In the MODE 3 position (provided the master switch is in LOW or NORM) there are 64 possible reply codes available to the pilot as selected by the MODE 3 dial on the C-1128/APX-25 control panel.

I/P-OUT-MIC SWITCH

The I/P-PUT-MIC switch operates in SIF as follows:

I/P - Holding the switch in the I/P spring loaded position (UP) causes a double Mode 1 code train to be transmitted in response to each Mode 1 interrogation. This response will continue for 30 seconds after the switch is released to OUT from the I/P position. If the KY-95A coder is installed, I/P operation may be extended to Mode 3 just as in emergency operation.

MIC - Placing the switch in the MIC position (down) produces the same results as the I/P position except that the response occurs only when the microphone button on the throttle is pressed.

C-1128/APX-25 CONTROL PANEL (fig. 4-10)

The C-1128/APX-25 control panel located on the sub instrument panel is used to select the codes in both Mode 1 and Mode 3 transponder operation. The panel contains two coaxial dial labeled MODE 1 and MODE 3. Their description and operation is as follows:

MODE 1 DIAL

The Mode 1 dial consists of two coaxial knobs, the outer knob of which bears the numbers 0 through 7, the inner knob from 0 through 3, making possible 32 different selected responses for Mode 1 operation. The set will respond to Mode 1 interrogations according to the code set on the Mode 1 dial whenever the master switch is in the NORM or LOW positions. Mode 1 operation, as selected, will operate independent of or concurrently with Modes 2 and 3 operation.

MODE 3 DIAL

The Mode 3 dial also consists of two coaxial knobs. Both the outer and inner dials are placarded from 0 through 7, making possible 64 different selected responses for Mode 3 operation. The set will respond to Mode 3 interrogations according to the code set on the Mode 3 dial, provided the master switch is in the NORM or LOW position and the Mode 3 switch on the C-1128/APX-25 control panel is in the Mode 3 position.

Mode 3 operation, as selected, will operate independently of or concurrently with Modes 1 and 2 operation.

REICHHALTER D-6B MAGNETIC RECORDER SYSTEM

The recorder is a magnetic wire type installed in the radio equipment bay. The control panel (fig. 4-12) is located on the left console near the armament control panel.

SYSTEM CONTROLS**MAIN SWITCH**

The four position main switch which is located on the center of the control panel has the following functions:

- a) **OFF** - System is off.
- b) **AUTOM. REC** - The system is energized and automatically records each reception and transmission audio signal from the radio receiver-transmitter.
- c) **CONT REC** - The system is energized and automatically records each reception and transmission. The set operates continuously and recording is spasmodic. Actual recording of sound takes place only when there is sound. The recorder will operate continuously for one hour in this setting.
- d) **MIC ON** - The system is energized and only records transmission when one of the MIC buttons are pressed (on control stick grip or throttle).

RECORD WARNING LIGHT

This light is green and comes on whenever system operates and wire is feeding.

WIRE OFF WARNING LIGHT

This light is amber and comes on when wire is nearly exhausted. It remains on until system is turned off.

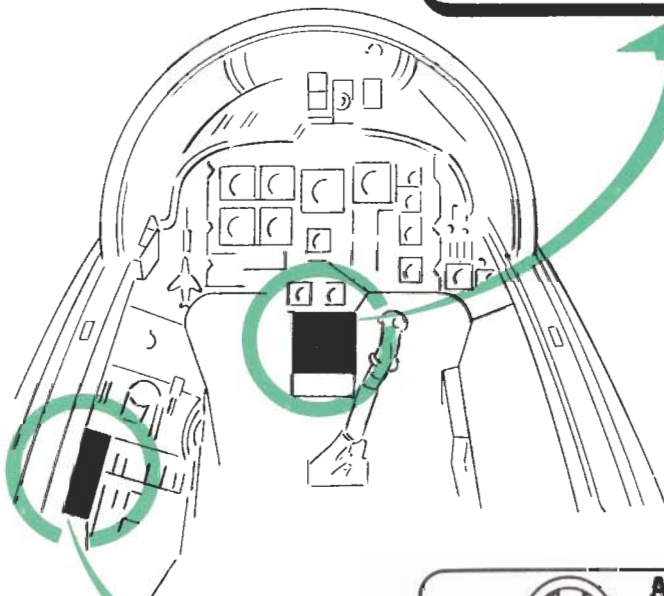
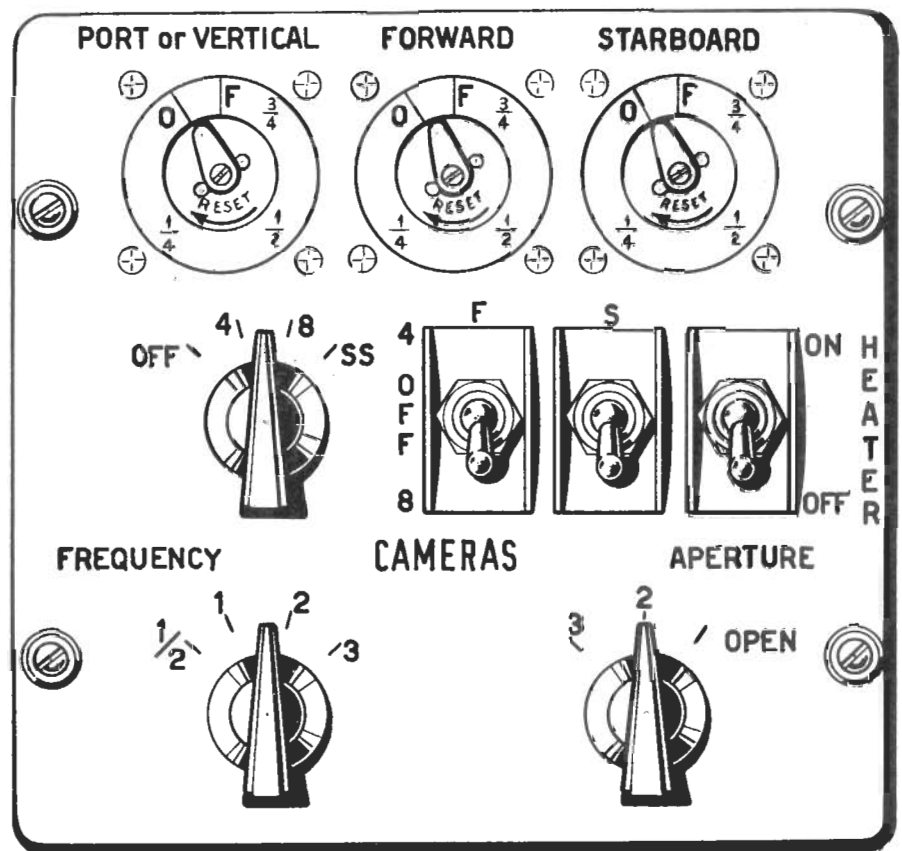
LIGHTING SYSTEM**EXTERNAL LIGHTING**

The external lighting consists of wing tip lights, tail lights, fuselage lights and taxi light.

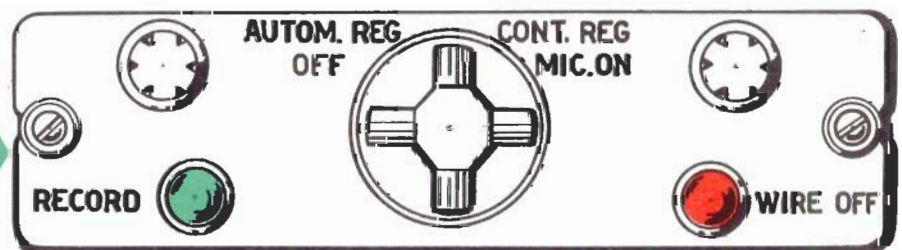
All external lights operate on 28V D.C. power from the secondary bus.

CAMERA AND SOUND RECORDER CONTROL PANEL

CAMERA CONTROL PANEL



SOUND RECORDER CONTROL PANEL



V-0000/C

Figure 4-12

The position light control panel is located on the right console (fig. 4-13) while the taxi light control switch is located on the lower part of the left hand side of the main instrument panel.

FLASHER CONTROL

Has three positions FLASH-OFF-STEADY. When this control is turned from OFF to STEADY, position lights come ON and remain ON. When it is turned to FLASH lights go on and off intermittently. The flasher control unit is located in the communications bay on the left side of the nose of the aircraft.

POSITION LIGHTS INTENSITY CONTROL

Has two positions: BRIGHT and DIM. It is located on the lighting control panel.

TAXI LIGHT SWITCH

Has two positions: ON and OFF. It is located on the lower left hand side of the main instrument panel.

INTERNAL LIGHTING

Internal lighting consists of two types of lights: incandescent lights powered by the secondary bus for lighting consoles, horizon gyro and oxygen, UHF, IFF, PHI, and DOPPLER panels. Ultraviolet lights powered by the primary bus are for main instrument panel lighting.

Control rheostats are located on the right hand console.

CONSOLE LIGHTS RHEOSTAT

Has two positions: « CONSOLE LIGHTS and OFF and can be rotated from DIM to BRIGHT.

OXYGEN-UHF-IFF-PHI DOPPLER CONTROL PANEL LIGHT RHEOSTAT

Has two positions: CONSOLE PANEL LIGHTS and OFF and can be rotated from DIM to BRIGHT.

INSTR. PANEL LIGHTS ULTRAVIOLET LIGHT RHEOSTAT

To switch on ultraviolet lights turn rheostat from

OFF through DIM to START. Keep it at START until lights go on. Turn toward DIM to reach desired intensity.

ANTI-G SUIT SYSTEM

A hose connection located on the left console connects the pilot's anti-G suit to the air pressure regulator valve located on the panel (fig. 4-14).

The valve is preadjusted and pressurizes the suit when « G » load is more than 1.5 G. Pressure in the « G » suit is 1.4 p.s.i. for each « G ».

With the engine running system operation can be checked out by de-pressing the button on top of the valve head.

OXYGEN SYSTEM

The airplane is equipped with a low pressure oxygen system (fig. 4-15) with two Type D-2 cylinders. An emergency oxygen bottle is located on the right side of the ejection seat and is connected directly to the oxygen mask hose. For safety of operation, especially during combat, pressure lines from the cylinders to demand type oxygen regulator (fig. 4-16) are independent and have check valves installed. The MD-1 regulator mixes air and oxygen in proper proportion for flight altitude. It has a pressure gage for the oxygen system, a flow meter, a bulb for lighting dials and system controls.

WARNING For long range missions (drop tanks installed), observe following limitations:

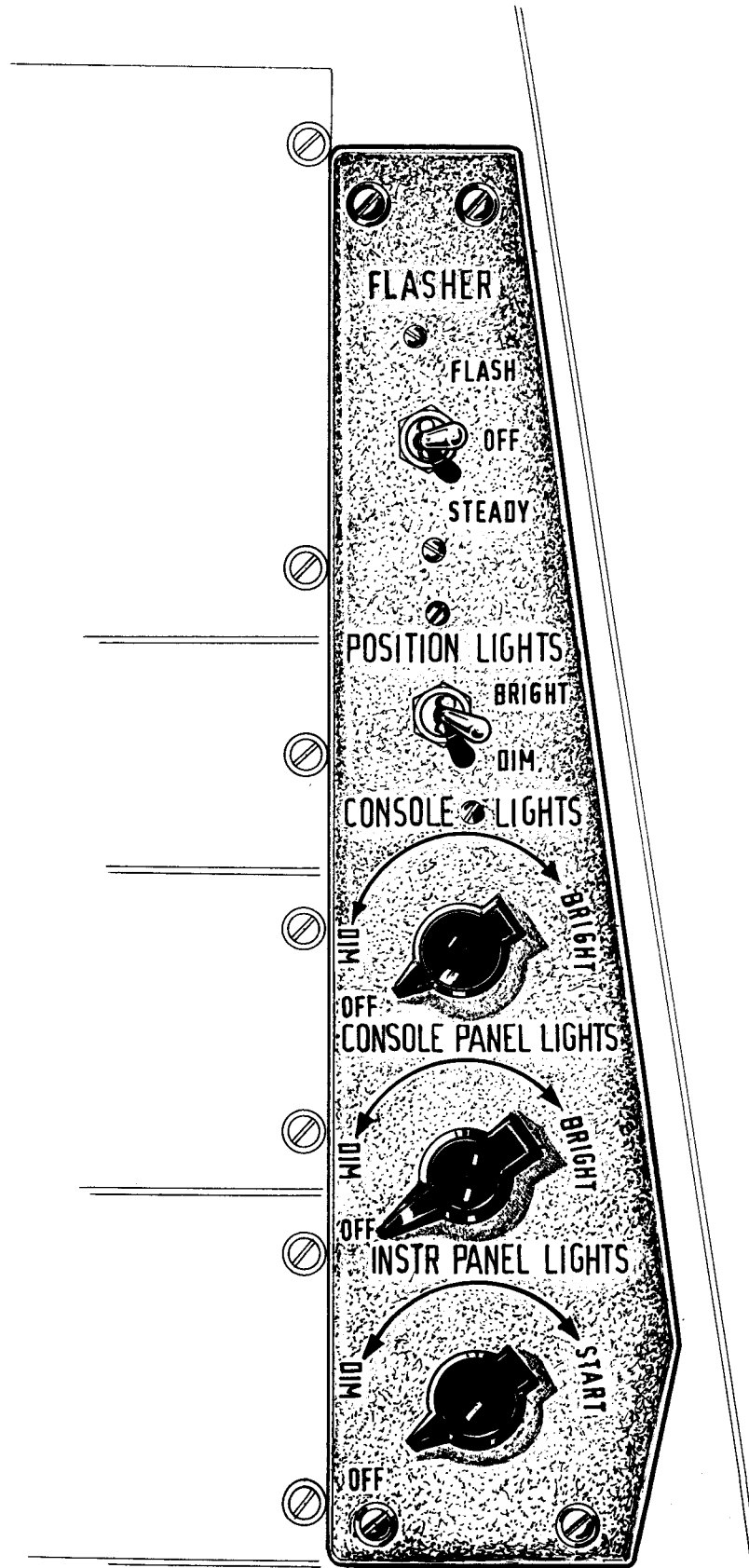
a) *Normal low altitude missions*

No limitations as oxygen range is adequate.

b) *Special high altitude missions*

Oxygen may not be adequate to cover duration of flight. Flight plan must be drawn up following table 4-1.

LIGHTING CONTROL PANEL



N-0003/B

Figure 4-13

ANTI-G SUIT SYSTEM

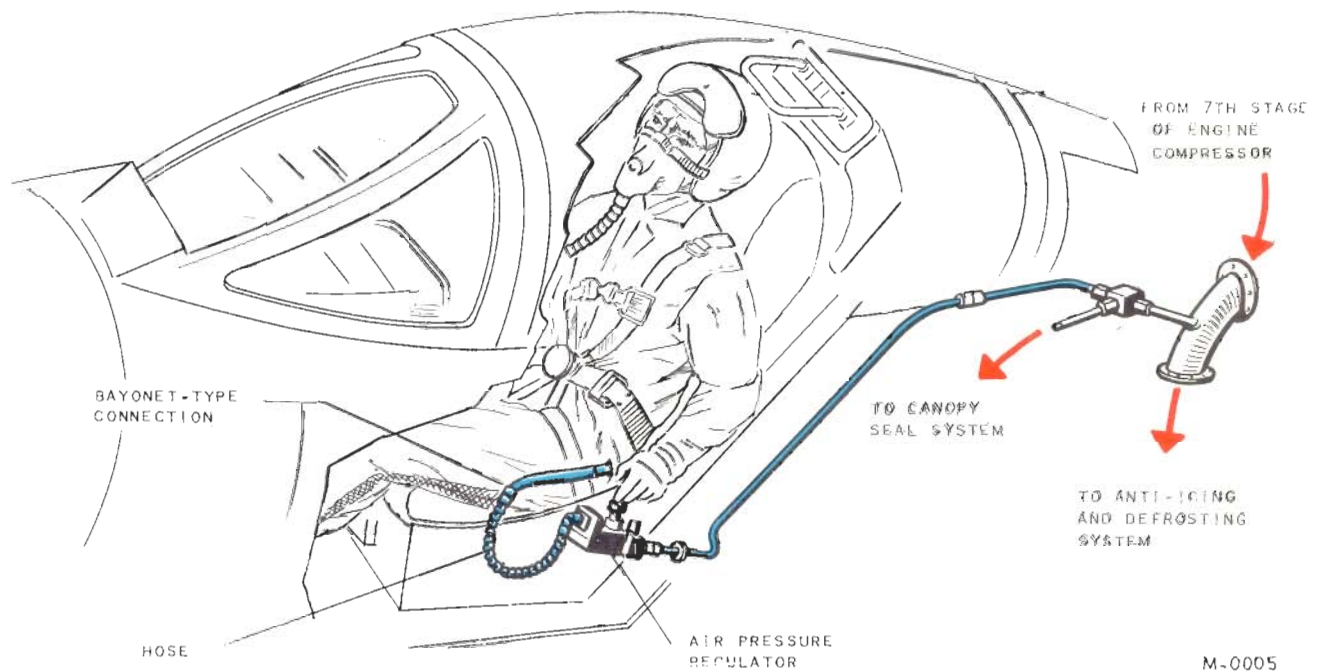


Figure 4-14

OXYGEN SYSTEM

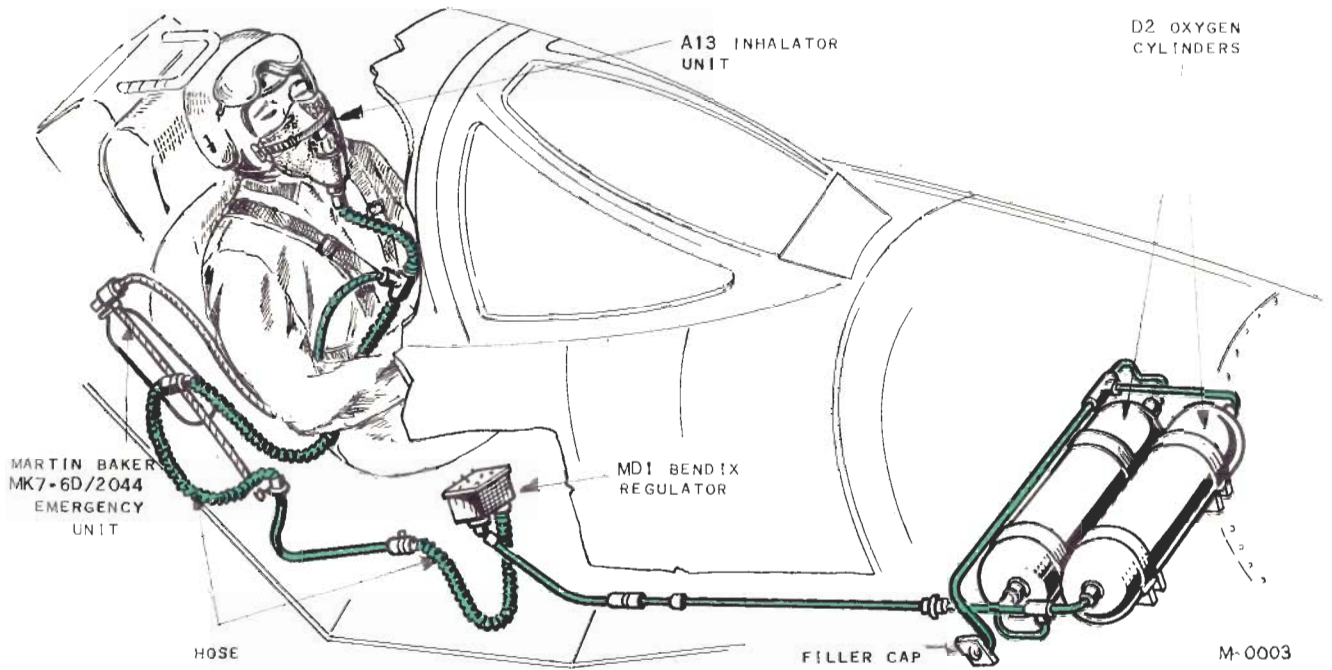


Figure 4-15

OXYGEN REGULATOR

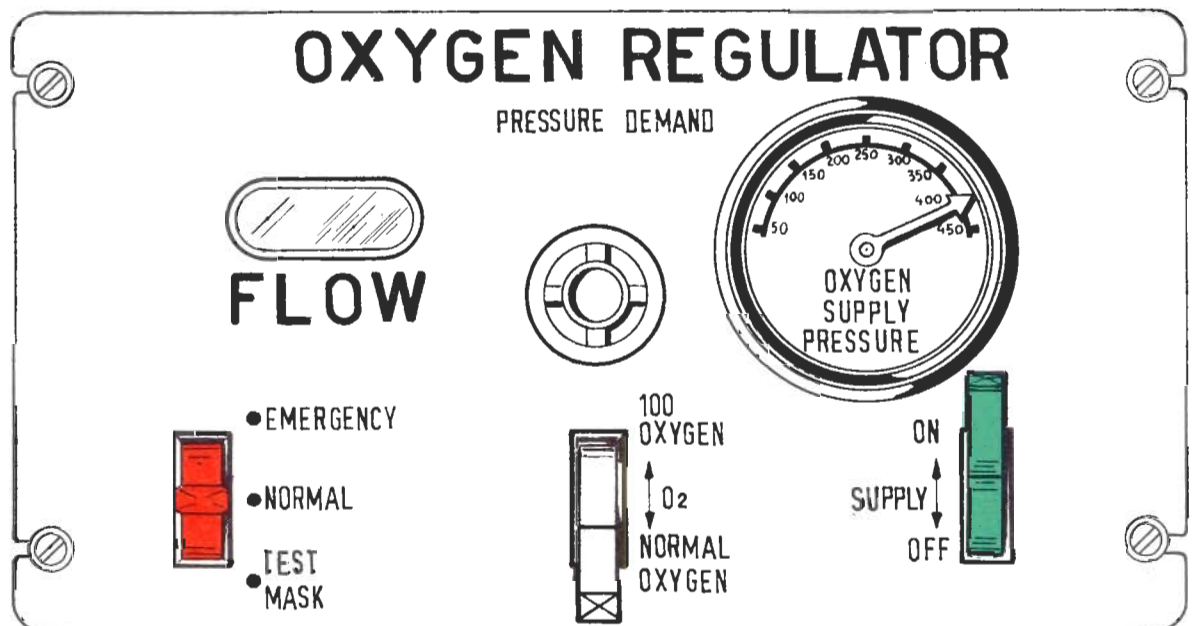


Figure 4-16

CALCULATED DURATION OF OXYGEN - Numbers out of brackets represent flow in hours with white lever on NORMAL OXYGEN 2 Type D-2 cylinders - Numbers in brackets represent flow in hours with white lever on 100% OXYGEN							
Cockpit alt. in ft.	Indicated pressure in p.s.i.						
	400	350	300	250	200	150	100
30,000	2.1 (2.1)	1.8 (1.8)	1.5 (1.5)	1.2 (1.2)	0.9 (0.9)	0.6 (0.6)	0.4 (0.4)
25,000	1.9 (1.5)	1.6 (1.3)	1.4 (1.1)	1.1 (0.9)	0.8 (0.7)	0.6 (0.5)	0.4 (0.3)
20,000	2.2 (1.1)	1.9 (0.9)	1.6 (0.8)	1.3 (0.6)	1.0 (0.4)	0.7 (0.3)	0.4 (0.2)
15,000	2.7 (0.9)	2.3 (0.7)	2.0 (0.6)	1.6 (0.5)	1.2 (0.4)	0.9 (0.3)	0.6 (0.2)
10,000	3.6 (0.7)	3.1 (0.6)	2.7 (0.5)	2.2 (0.4)	1.7 (0.3)	1.2 (0.2)	0.8 (0.1)
When indicated pressure is less than 100 p.s.i. descend to altitude where use of oxygen is not necessary.							

TABLE 4-1

SYSTEM CONTROLS

DELIVERY CONTROL

Delivery to the regulator is controlled by a green lever marked SUPPLY. Lever has two positions; ON and OFF.

DILUTER LEVER

System is adjusted by a two position «100% OXYGEN» and «NORMAL OXYGEN» white lever. When lever is moved to NORMAL OXYGEN an air-oxygen mixture is established by the regulator for the altitude at which the airplane is flying. When lever is moved to 100% OXYGEN, pure oxygen is delivered.

EMERGENCY LEVER

This three position lever (EMERGENCY-NORMAL-TEST MASK) is kept on NORMAL during normal operation. When the lever is moved to TEST MASK, a steady flow of oxygen under pressure is provided. When released the lever will return to NORMAL. When the lever is placed on EMERGENCY, the lever remains in position and provides continuous positive pressure to the mask regardless of any other regulator setting.

NORMAL OPERATION

1) Check charge of cylinder on gage, it should be 400 p.s.i.; otherwise charge the system.

2) Delivery control ON.

3) Diluter lever to NORMAL OXYGEN.

4) Emergency control on NORMAL.

NOTE Above 30,000 feet, a vibration or wheezing sound may sometimes be noticed in the mask. This noise is a normal characteristic of regulator operation and may be overlooked.

EMERGENCY OPERATION

If pilot experiences anoxia due to improper operation of regulator move white lever to 100% OXYGEN. If this is insufficient cut out regulator by moving red lever to EMERGENCY.

PHOTOGRAPHIC SYSTEM

The system includes three Vinten F 95 MK3 cameras with related control panel and a D6B magnetic recorder with a control panel. The magnetic recorder has been described in a previous section.

CAMERA SYSTEM

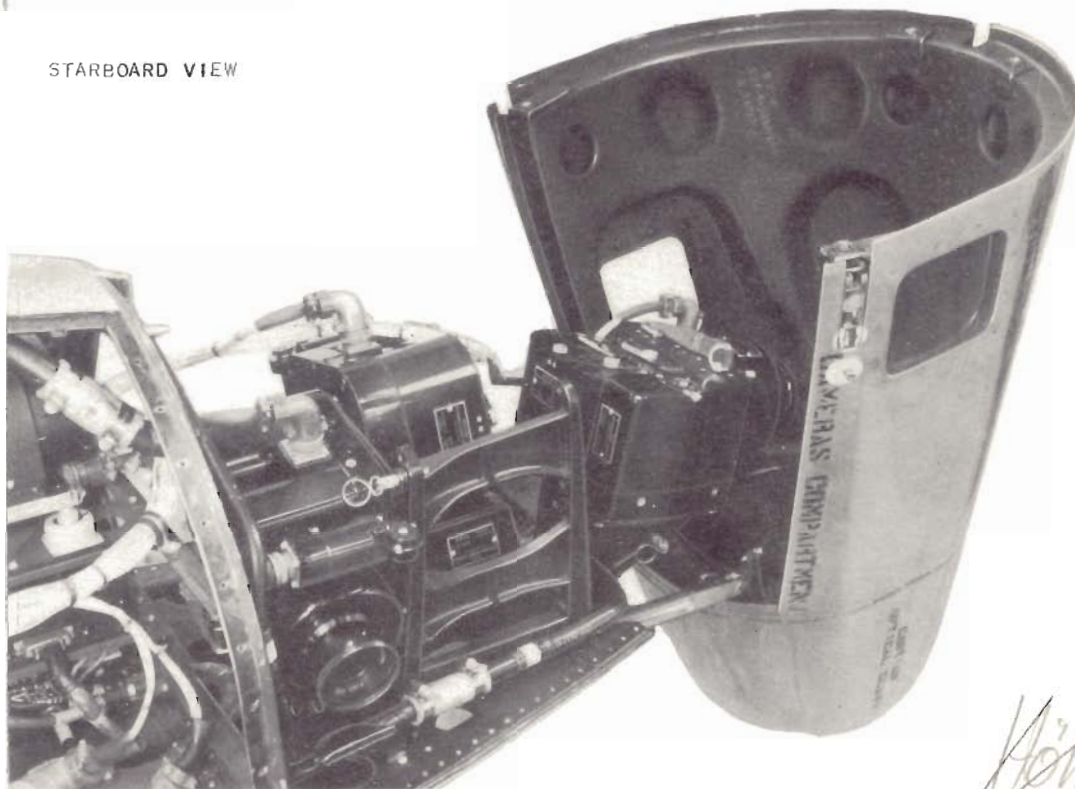
The cameras are located in the airplane nose (fig. 4-17) one behind the other and have these functions:

5174 S.7

CAMERA INSTALLATION

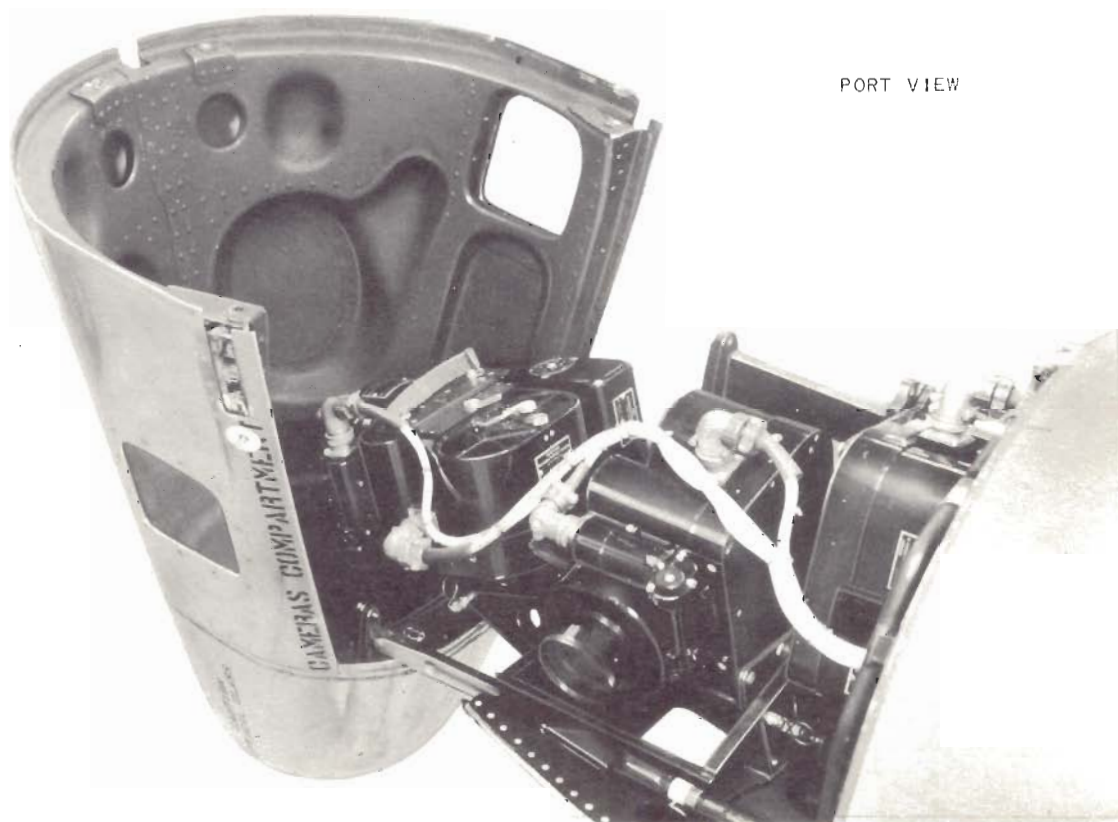
59 mm

STARBOARD VIEW



Heide

PORT VIEW



✓ 50 20

Figure 4-17

ARCHIV
A. W. Krüger

PLEASE RETURN
Soonest possible

W-0001
4-45

— The first (front) fixed camera with optical axis at 15° to the airplane centerline is used for front perspective photography.

— The central camera is a two position installation with the axis vertical to or at 15° to the centerline. According to its position, it can be used for planimetric or left lateral perspective photography.

— The rear camera, with optical axis at 15° to the centerline is used for right perspective photography.

The cameras can operate simultaneously or individually according to the position of the control panel (fig. 4-12) switches located on the center instrument panel. A control button is located on the stick grip (fig. 1-19) on the left lower side. The control panel includes:

FILM COUNTER

There are three counters, one for each camera, marked PORT or VERTICAL, FORWARD, STARBOARD and indicate the quantity of film remaining through positions F (full) to 0 (empty) with intermediate position $\frac{3}{4}$, $\frac{1}{2}$ and $\frac{1}{4}$.

SELECTOR SWITCHES

There are three selector switches marked P or V, F, S. They are used to pre-set power supply for the camera and to select the camera film speed.

The P or V rotary switch for center camera has the following positions: OFF (power off), 4 (power on, 4 frames per second), 8 (power on, 8 frames per second) and S.S. (power on and one frame at a time).

F and S toggle switches for front and rear cameras respectively have three positions: OFF (power off), 4 (power on, 4 frames per second), 8 (power on, 8 frames per second).

CAMERA HEATER SWITCH

This switch is marked HEATER. It has two positions ON and OFF.

FREQUENCY SWITCH

Selects the interval between each exposure when the Port or Vertical camera is in the planimetric position and the P or V switch is on S.S. There are four positions: $\frac{1}{2}$, 1, 2 and 3 to give intervals of $\frac{1}{2}$, 1, 2 or 3 seconds respectively.

APERTURE SWITCH

Selects the diaphragm aperture, and has three positions, 3, 2 and OPEN. Aperture is selected or changed

according to light conditions. Apertures corresponding to each position of the switch are pre-set before flight.

CAMERA OPERATION

PERSPECTIVE PHOTOGRAPHY

1) Push in the following circuit breakers:

- CAMERAS HEATER
- SOUND RECORDER
- CAMERAS - PORT OR VERTICAL
 - » - FORWARD
 - » - STARBOARD

2) Turn HEATER switch ON (as required below 40° F (10° C).

3) Select speed of cameras by placing P or V, F and S switches on 4 or 8. Select cameras to be used for particular mission.

4) Select diaphragm aperture according to light conditions, placing APERTURE switch on 3, 2 or OPEN.

5) Press button on control stick grip, observe that cameras operate.

After shooting turn selector switches OFF.

If remarks and a record are to be made during photographic mission:

1) Turn recorder switch to MIC ON (if only pilot transmissions are to be recorded).

2) Press one of the MIC buttons and talk to record.

After recording turn switch OFF.

CAUTION If all transmission and receptions are to be recorded, turn switch to CONT. REC or AUTOM REC., according to whether interval between communications is to be recorded or not.

PLANIMETRIC PHOTOGRAPHY

NOTE For planimetric shooting the PORT OR VERTICAL camera must be preset on ground.

1) Push in the following circuit breakers:

- CAMERAS HEATER
- SOUND RECORDER
- CAMERAS - PORT OR VERTICAL

2) Turn HEATER switch ON as required below 40° F (10° C).

3) Turn P or V switch to 4 or 8 for shooting at 4 or 8 frames per second (operation similar to perspective

cameras) or to S.S. (single shot). In this case select interval between each frame with FREQUENCY switch.

4) Adjust diaphragm aperture with APERTURE switch.

5) Press control button, observe camera operation.

NOTE If P or V switch is turned to SS, single shooting can be performed by turning FREQUENCY switch to 3 and releasing button after pressing it.

If recording is required together with planimetric shooting, use procedure set forth in preceding paragraph. After testing turn P or V and HEATER switches OFF.

ARMAMENT SYSTEM

GENERAL

The armament system consists of a control panel, firing, launching and release controls, missile control, sight, gun camera basic armament, and additional armament on inboard and outboard pylons.

CONTROL PANEL

Located on the left console (fig. 4-18), it consists of the following switches and indicators:

BOMB SWITCH

This three position switch has the following functions:

a) **ARM NOSE & TAIL** - Bomb nose and tail arming wires are pulled by the solenoids. Bombs are armed.

b) **SAFE** - Bombs are released safe with arming wires attached.

c) **TAIL ONLY** - Tail arming wire is pulled and bombs are dropped with nose fuse safetied.

BOMB SELECTORS

Two bomb selectors, one for the outboard wing racks and the other for the inboard wing racks, have three positions, and function as follows:

a) **ALL** - All bombs are released when the control button is pressed.

b) **OFF** - Bomb circuit is cut off.

c) **SINGLE** - Bombs are released separately when the bomb release button is pressed. Sequence is left-right for outboard bombs and Right-left for inboard bombs. This is to maintain stability of the airplane.

CAMERA SWITCH (KB-3A GUN CAMERA)

This four position switch has the following functions:

a) **OFF** - System is deenergized.

b) **DULL 2** - System is energized. Lens aperture is set for dull light conditions.

c) **HAZY 3** - System is energized. Lens aperture is set for hazy conditions.

d) **BRIGHT 4** - System is energized. Lens aperture is set for bright light.

ROCKET SELECTORS

There are two rocket selector switches, one for outboard rockets and the other for inboard rockets. They have three positions with the following functions:

a) **SINGLE** - One rocket is fired, alternately left and right, whenever the trigger button is pressed.

b) **AUTO** - Rockets are fired until the trigger button is released, alternately left and right.

c) **4** - Four left and four right rockets are launched whenever button is pressed.

ROCKET COUNTER

There are two double counters, one for the outboard racks and the other for the inboard racks that show unused rockets on each launcher.

ROCKET LAUNCHING PRESET SWITCHES

There are two switches, one for outboard rockets and one for inboard rockets that have two positions: JETTISON READY and OFF and are used to preset power supply to the rocket launching system.

FUZE DELAY ROCKETS SWITCH (5 INCH ROCKETS ONLY)

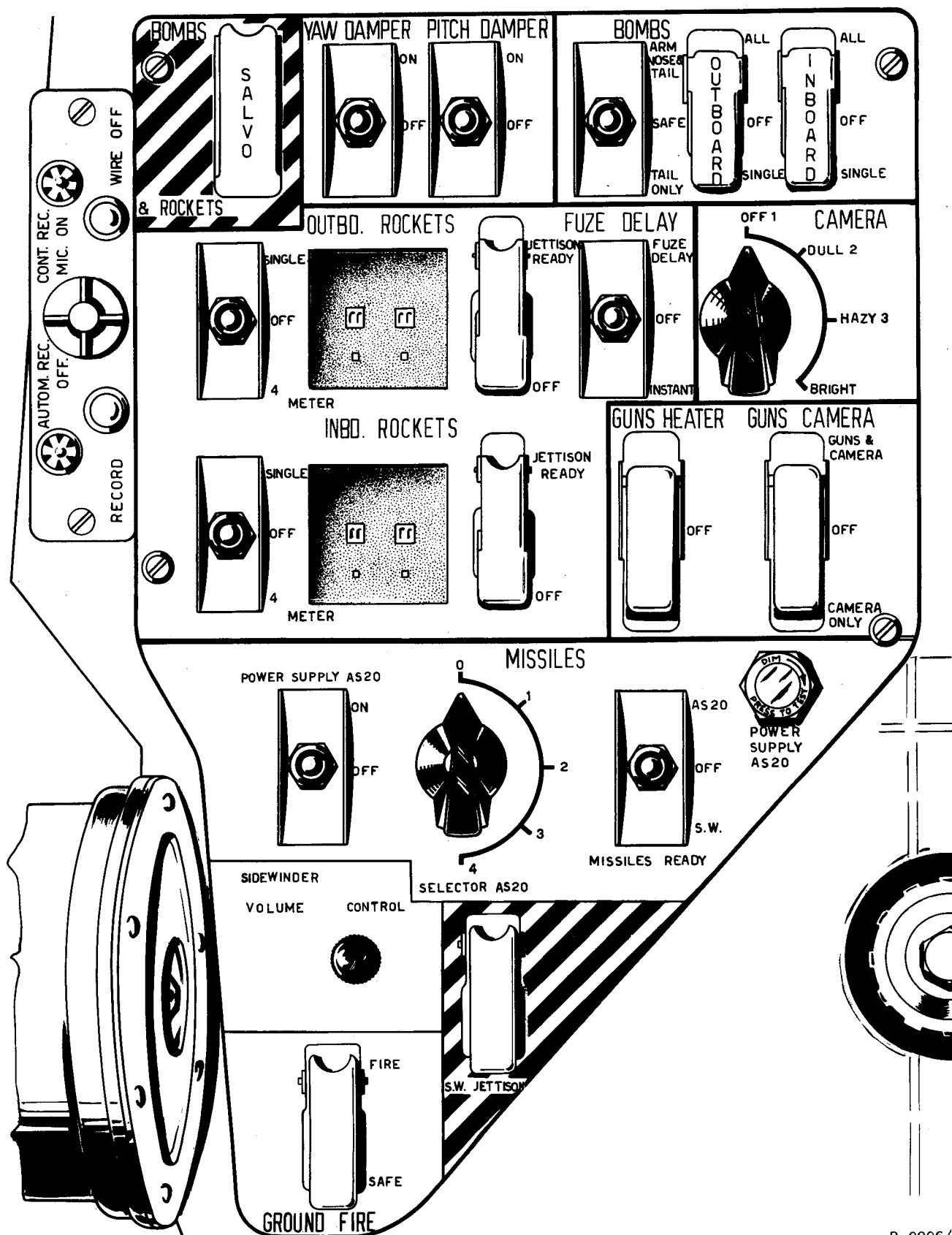
Has three positions with the following functions:

a) **FUZE DELAY** - Rockets will explode after a time delay from impact.

b) **OFF** - Rockets explode with a fuze delay. Pilot must select «Instant» for explosion on impact.

c) **INSTANT** - Rocket explodes on impact.

ARMAMENT CONTROL PANEL



R-0006/C

Figure 4-18

GUN HEATER SWITCH

Has two positions with the following functions:

- a) **GUNS HEATER** - Gun heaters are energized.
- b) **OFF** - System is cut off.

GUNS & CAMERA CONTROL SWITCH

Three positions, GUNS and CAMERA-OFF-CAMERA ONLY with the following functions:

- a) **GUNS & CAMERA** - Gun camera will operate when control stick trigger is depressed to the first stop and machine guns will fire when trigger is completely depressed.
- b) **OFF** - System is cut off.
- c) **CAMERA ONLY** - Only gun camera operates. Guns do not fire.

POWER SUPPLY AS20 SWITCH

Has two positions with the following functions:

- a) **ON** - AS20 missile control circuit is energized and POWER SUPPLY AS20 warning light comes on.
- b) **OFF** - AS20 missile control circuit is cut off.

AS20 SELECTOR SWITCH

Has five positions: 0, 1, 2, 3 and 4. Positions 1, 2, 3 and 4 correspond to selection for launching an AS20 missile with 1 = outboard left; 2 = outboard right; 3 = inboard left; 4 = inboard right. Position 0 cuts off power supply.

MISSILES READY SWITCH

Has three positions: AS20, OFF, SW. It is used for presetting launching of AS20 or SIDEWINDER missiles.

POWER SUPPLY AS20 WARNING LIGHT

Is an amber colored light which comes on when AS20 missile control circuit is energized.

GROUND FIRE SWITCH

Is used for ground operation of machine guns, AS20 missile launching, and rocket firing control circuits. The GROUND FIRE switch operates the GROUND SAFETY relay when the left main landing gear strut is not extended.

RELEASE, LAUNCHING AND FIRING CONTROLS

Normal controls consist of a trigger and a press button located on the control stick grip (fig. 1-19).

Emergency controls consist of SALVO & SW JETTISON switches, located on the armament control panel, and EMER. EXT. STORES REL. handle above the main instrument panel.

TRIGGER

The trigger is on the front of the control stick grip and is used to control machine gun firing and gun camera operation. When trigger is pressed to first position only the gun camera is operated. At the fully depressed position the guns and gun camera operate.

LAUNCHING AND RELEASE CONTROL BUTTON

Is located on the top left hand side of the control stick grip. According to setting of armament control panel switches it is used to launch rockets and missiles, to release bombs, napalm containers or drop tanks.

SALVO SWITCH

The SALVO switch is located on the armament control panel. It is used for simultaneous jettison of external stores at any position of sequence switches. Rockets, missiles and bombs are released safe.

SW JETTISON SWITCH

It is located on the armament control panel and is used for simultaneous jettison of SIDEWINDER missiles in safe condition at any position of sequence switches.

EMER. EXT. STORES REL. HANDLE

This handle is located above the instrument panel. It is used for manual jettison of external stores at any position of control panel switches.

MISSILE PATH CONTROL LEVER

The missile path control lever is located on the upper right hand side of the cockpit and consists of a control box which controls the missile through radio signals to correct its trajectory. To ease the pilot during missile path control, the lever is provided with an adjustable armrest.

POWER SUPPLY ON WARNING LIGHT

This green warning light is located on the missile path control lever support. It comes on about 20 seconds after the POWER SUPPLY switch is turned ON, to indicate the system is energized.

SFOM 83A SIGHT

The SFOM 83A sight is a reflective type fixed reticle sight. With vertical adjustment the pilot can adjust for any type of ground attack.

AIM SIGHT GLASSES

Day - Semi-transparent glass.

Night - Colorless glass.

NOTE Unused aim sight glass is kept in a container attached to the glare shield.

LOCKING LEVERS

There are two locking levers. One is on the left side of the sight and the other on the left side of the graduated drum. Loosen both to provide vertical adjustment of sight.

ELEVATION CONTROL KNOB

A knurled knob with a graduated dial that through rotation gives slight variations in elevation; one complete turn corresponds to 10° elevation. For greater variations of elevation pull knob out and rotate.

RETICLE LIGHTING RHEOSTAT

Adjusts brightness of sight reticle and is located on the top of the main instrument panel, just below the sight, marked GUN SIGHT LIGHT. Adjustment is obtained by rotating from DIM to BRIGHT.

KB-3A GUN CAMERA

The KB-3A gun camera is located on the main instrument panel to the right of the sight. It is controlled electrically by the trigger located on the control stick grip and the GUN and CAMERA control switch. First position of trigger controls gun camera operation.

Camera motor is energized if GUNS & CAMERA switches is moved from OFF position.

BASIC ARMAMENT

On each fuselage side panel there is a bay for the installation of quick removable machine gun panels.

Each gun panel carries two machine guns and two readily replaceable ammunition boxes (one for each gun).

The machine guns are recharged automatically by gasses caused by firing of ammunition. They fire 50 caliber bullets at a rate of 1200 rounds per minute. Each ammunition box can hold 300 rounds. The magazines and links are collected below the armament bay, from which they are removed through a quick opening access door.

Guns installed on the airplane are charged before flight by means of an armament cable and handle. Each gun is provided with a heater controlled by the GUNS HEATER switch located on the armament control panel. The guns are protected from dust and humidity by special plugs, which are removed before each firing mission.

Gun firing is controlled by pressing the trigger on the control stick grip to the second position.

ADDITIONAL ARMAMENT

Four pylons are mounted under the wings-two ON each wing.

Each pylon contains an MA-4A bomb rack for external armament. Bomb release, rocket and missile launching is controlled by the button located on the control stick grip.

CAUTION When AS20 missiles are installed remove left gun door and replace with special panel for guidance control equipment.

INBOARD PYLONS

Each pylon has provision for an auxiliary fuel tank or:

- a) 500 lb. bomb.
- b) 250 lb. bomb.
- c) Rocket post with 6 3" rockets.
- d) Container with 31 2" rockets.
- e) AS20 missile.
- f) SIDEWINDER missile.

OUTBOARD PYLONS

Each can carry:

- a) 250 lb bomb.
- b) Rocket pod with 6 3" rockets.
- c) Container with 19 2" rockets.
- d) AS20 missiles.
- e) SIDEWINDER missile.

NOTE Outboard pylons are not equipped to carry auxilliary fuel tanks.

SECTION V

OPERATING LIMITATIONS

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ENGINE OPERATING LIMITATIONS

Operating conditions	Time limit each flight	R.P.M. %	EGT °C	Thrust (pounds)
Take - off and operational necessity	15 min	101	730	5000
Intermediate	30 min	99	685	4570
Maximum continuous	Unrestricted	97	655	4200
Descent and approach	Unrestricted	40 min.	655 200 min	—
Ground idle	Unrestricted	35 min.	655	—
Overspeed	20 sec.	103	—	—

GROUND CHECKS

OVERSPEED GOVERNOR

The overspeed governor is set to give 100 % r.p.m. on the ground for maximum thrust at take-off. It may be necessary to retard the throttle during climb at full power in order to avoid exceeding 101 % r.p.m.

EXHAUST GAS TEMPERATURE LIMITER

The exhaust gas temperature limiter is set at 715° C to 720° C on the exhaust temperature indicator to

allow for temperature creep with altitude. With most engines, the maximum available r.p.m. will be below 100 % at full throttle when the ambient temperature is 15° C or above. Exhaust gas temperature below 665° C on the ground, is abnormal with throttle fully opened.

AIR-FUEL RATIO CONTROL

The A.F.R.C. acceleration times from 40 % r.p.m. to 2 % less than the available maximum r.p.m. after a throttle slam to open are dependent on ambient temperature (see fig. 5-1). With the A.F.R.C. properly set, it is possible to rapidly retard the throttle from full open to flight idle and as the r.p.m. falls past 70 %, to re-slam the throttle to full open without engine surging or stalling. (This is a ground check only).

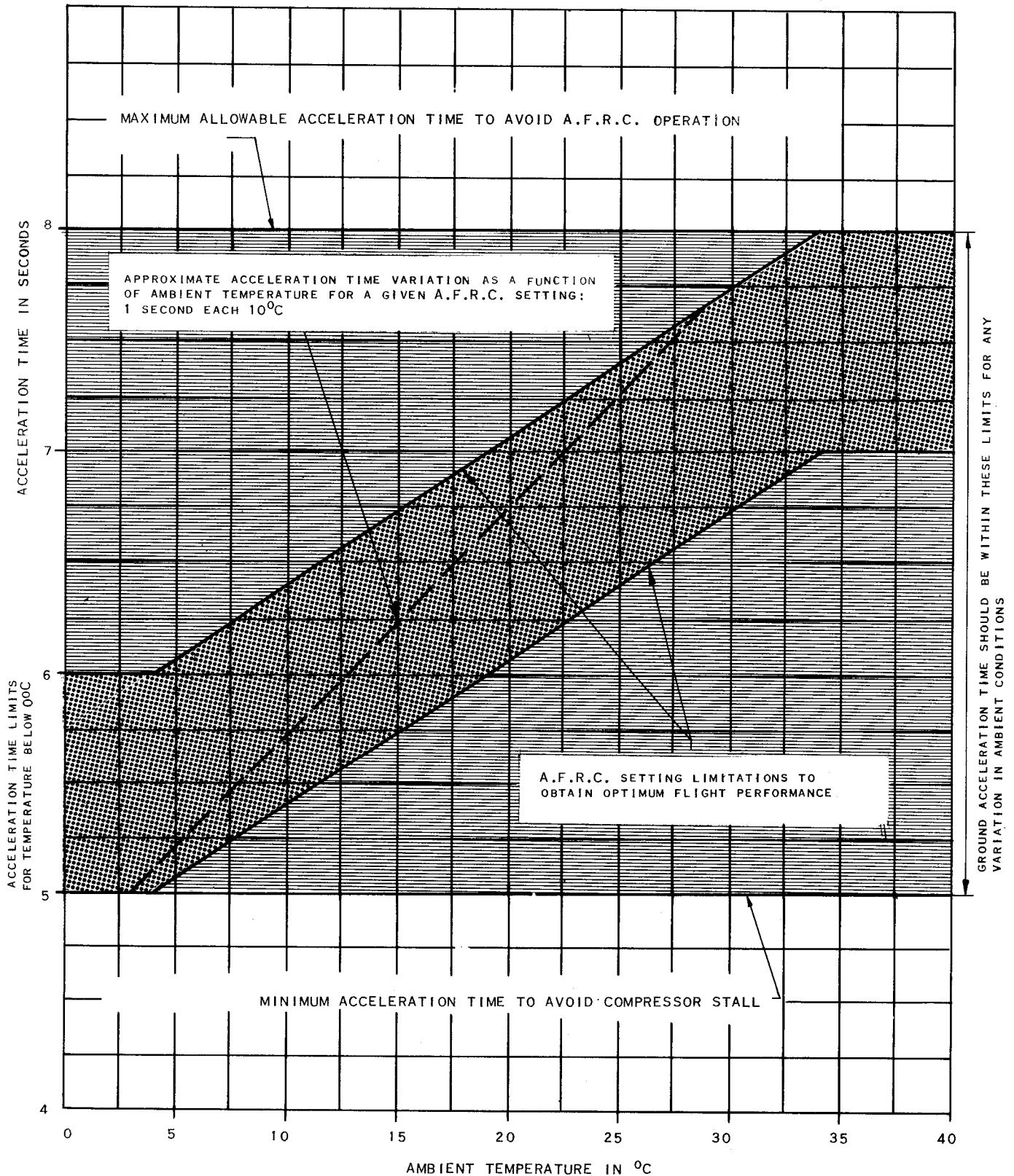
WARNING In flight, slam acceleration should always be avoided.

GROUND IDLE R.P.M.

The minimum r.p.m. on the ground is given as a function of barometric pressure in the following table:

Barometric pressure in inches of mercury	% R.P.M.
29.9	35.0
29.0	36.0
28.0	37.5
27.0	38.5
26.0	40.0
25.0	41.0

ACCELERATION TIME LIMITS AS A FUNCTION OF AMBIENT TEMPERATURE VARIATIONS



G91 R/4
P

STARTING EXHAUST GAS TEMPERATURE

The starting EGT should be 700° C maximum. If a temperature of 800° C is reached, the engine should be removed.

MINIMUM AMBIENT TEMPERATURE FOR STARTING AND THROTTLE OPENING

The minimum temperature for starting and opening up to power is —26° C if the engine and the oil are not at a higher temperature than —26° C. The minimum temperature is —5° C on emergency oil.

ICING CONDITIONS AND FOGGY WEATHER

The engine has no anti-icing. Operating in icing conditions must be avoided.

LUBRICATING OIL**MINIMUM OIL PRESSURE**

The minimum oil pressure is 25 ± 2 p.s.i. When the oil pressure is below this figure, the OIL LOW PRESS warning light comes on and should normally be out at 40 % r.p.m. and above.

NEGATIVE «G»

If the OIL LOW PRESS warning light comes on during a negative «G», maneuver restore positive «G» immediately. For acrobatics at negative «G», use the following duration limitations on oil consumption:

Flying time since take-off	Maximum duration for each maneuver
During the 1st hour	60 seconds
From 60 min. to 90 min.	52 seconds
90 to 120	37 seconds
120-150	22 seconds

OIL CONSUMPTION

At maximum continuous r.p.m., oil consumption is:

- approximately 1.8 pints (0.85 liters) per hour minimum
- approximately 2.4 pints (1.14 liters) per hour maximum.

FUEL PRESSURE

The FUEL LOW PRESSURE warning light comes on when the pressure falls below 5 ± 0.5 p.s.i. This light should always be out when the engine is running and the fuel booster pump is switched on (FUEL BOOSTER PUMP switch «ON»).

FUEL SPECIFICATIONS**FUELS FOR NORMAL USE**

Specification			
U.S.	British	Interservice	NA-TO
	DERD 2494	AVTUR 50	F-34
MIL-F-5616 JP-4	DERD 2482	AVTUR 40	F-30
MIL-F-5624-C Grade JP-4	DERD 2486	AVTAG	F-40

FUELS FOR EMERGENCY USE

NOTE Operation on emergency fuels is limited to 10 hours maximum between each engine overhaul.

Specification			
U.S.	British	Interservice	NA-TO
	DERD 2485 Grade 73	73 LAVGAS	F-13
MIL-F-5572 A Grade 80	DERD 2485 Grade 80	80 LAVGAS	F-14
MIL-F-5572 A Grade 91/96	DERD 2485 Grade 91/96	91/96 LAVGAS	F-15
MIL-F-5572 A Grade 100/130	DERD 2485	100/130 LAVGAS	F-18
MIL-G-3056 A	DEF 2401 A 80 N.O.	80 MIGAS	F-46
MIL-G-3056 AMI Type C		80/Z MATGAS	F-48
	DEF 2401 A 70 N.O.	MATGAS	F-50

WARNING — With those volatile fuels, the engine must not be operated with the fuel booster pump OFF.

— All operation with the FUEL LOW PRESS warning light on must be reported.

— Engine fuel pump life is affected if the fuel pressure is below 10 p.s.i. The aircraft ceiling is also limited by this factor.

WARNING — With those volatile fuels, a dry motoring cycle must be made before attempting to start a hot engine.

— An immediate airstart in flight must not be attempted.

Specification			
U.S.	British	Interservice	NA-TO
MIL-F-896 Class 2	DEF 2402	47/0 DIESO	F-78
MIL-F-896 Class 2		47/20 DIESO	F-79

WARNING — Normal starting procedures apply, but an airstart in flight is not guaranteed.

— Flight tests have not been made with diesel fuel.

— Engines not incorporating Orpheus Mod. OT. 147 (Nimonic 105 turbine blades) must not be operated on these fuels..

— It is not possible to operate below -10°C with F-78 and below 0°C with F-79.

PRECAUTIONS WHEN CHANGING FUEL GRADES

When fuel is changed from one grade to another, there is an accompanying change in fuel density which will alter the control characteristics of the fuel pump governor and of the A.F.R.C. Therefore before flight check:

- a) Governor setting and reset as necessary.
- b) A.F.R.C. setting for slam acceleration and reset as necessary.

Both settings should be in accordance with operating limitations in this section.

OIL SPECIFICATIONS

OIL FOR NORMAL USE

Specification				
U.S.	British	Inter-service	NATO	Supplier & Ref. No.
—	DERD 2487	OX-38	0-149	ESSO (British) EATO 35
				ESSO (U.S.) ETO 35
MIL-L-7808 C	—	—	0-148	ESSO ESSO turbo oil 15
				Caltex/Texaco Syntet. Aviation turbo oil 15

WARNING — Oils Spec. 0-149 and 0-148 *must not be mixed.*

— ESSO (British) EATO 35 may be mixed with ESSO (U.S.) ETO 35.

— ESSO turbo oil 15 may be mixed with Caltex/ Texaco Synthetic Aviation turbo oil 15.

— Minimum oil temperature for starting on normal oils is -14.8°F (-26°C).

— Minimum oil temperature for opening up (with engine running and OIL PRESS warning light out) on normal oils is -14.8°F (-26°C).

OILS FOR EMERGENCY USE

Specification			
U.S.	British	Interservice	NATO
—	DERD 2479/1	OEP-71	—

WARNING — Emergency oils must not be mixed with normal oils.

— Minimum oil temperature for starting on emergency oils is $+23^{\circ}\text{F}$ (-5°C).

— Minimum oil temperature for opening up (engine running and OIL LOW PRESS warning light out) on emergency oils is $+23^{\circ}\text{F}$ (-5°C).

STARTING CARTRIDGE SPECIFICATION

Starter cartridge specification is 600-gram, I.C.I. type No. 17/419A.

AIRSPEED LIMITATIONS

Units	Type of maneuver	Altitude (ft)	Max IAS (knots)	Max Mach No.
Airplane with no external loads.	Level flight with moderate maneuvers.	0-1500 1500-20000	580 —	0.88-0.895 0.895-0.95
Airplane with external loads (type I) *	Level flight with moderate maneuvers.	0-5000 above 5000	520 —	0.79-0.85 0.85
Airplane with external loads (type II) *	Level flight with moderate maneuvers.	0-13500 above 13500	450 —	0.68-0.85 0.85
Speed brakes	Opening	—	550	0.92
Landing gear	Lowering and retraction	—	185	—
Flaps	Lowering and retraction	—	185	—
Drag chute	Deployment	—	150	—
Canopy	Opening (also partial)	taxiing	50	—

* External loads: Type I - bombs, rocket launcher, drop tanks (from empty to half full), rocket containers, missiles.

Type II - drop tanks (from half full to full), Napalm containers.

SPEED BRAKE EXTENSION

The limiting airspeed for lowering the speed brakes is 550 knots IAS and Mach 0.92.

LANDING GEAR EXTENSION SPEED

Limiting airspeed with the landing gear lowered is 185 knots IAS.

If the landing gear is lowered, or kept lowered at speeds above 185 knots IAS, the air loads may damage the fairing doors, or operating mechanism.

WING FLAP OPERATING SPEED

The limiting airspeed with the wing flaps lowered is 185 knots IAS.

If the wing flaps are lowered, or kept lowered, above this limiting airspeed, the flaps or operating mechanism may be damaged.

MINIMUM LANDING AIRSPEED

The minimum touchdown speed at landing is a function of the weight and load factors of the airplane and with the wing flaps and landing gear lowered is given in figure 5-2.

DRAG CHUTE DEPLOYMENT SPEED

The limiting airspeed for drag chute deployment is 150 knots IAS.

If deployed at speeds above 150 knots IAS, the drag chute is automatically released from the airplane by the breakway fitting.

CANOPY OPENING SPEED

The canopy is not to be opened in flight. On the ground, while taxiing, the canopy may be operated at

airspeeds not exceeding 50 knots IAS. If canopy is operated at airspeeds above this value, damage to the canopy and canopy operating mechanism will result.

MANEUVER LIMITATIONS

AIRPLANE WITHOUT EXTERNAL LOADS

Symmetrical maneuvers are allowed up to a load factor of +7 G and -3 G, or up to the first g-stall symptoms in the speed range below:

- 550 knots CAS below 5,000 feet.
- Mach 0.90 between 5,000 and 20,000 feet.

Moderate maneuvers with a low G-load factor are allowed in the speed range below:

- 580 knots CAS below 1,500 feet.
- Mach 0.895 at 1,500 feet and Mach 0.95 at 20,000 feet with a 0.003 Mach linear increase for each 1000 feet of altitude.

AIRPLANE WITH EXTERNAL LOADS (TYPES I AND II)

Partial or moderate maneuvers are allowed throughout the entire speed range of this configuration (See AIRSPEED LIMITATIONS).

ALTITUDE MANEUVERS

Maneuvers at altitude are allowed up to 20,000 feet, within the above specified limits.

Maneuvering above 20,000 feet and up to 35,000 feet must be restricted to climb tests and navigation.

ACROBATICS

Acrobatics are allowed within the specifications and time limitations imposed on the airplane. Only engine oil consumption which might impair the lubrication of the engine restricts the aircraft for acrobatics.

PROHIBITED MANEUVERS

INVERTED FLIGHT

Prolonged inverted flight is prohibited.

Inverted flight restrictions are imposed by two factors:

- Oil system operation.
- Fuel system operation.

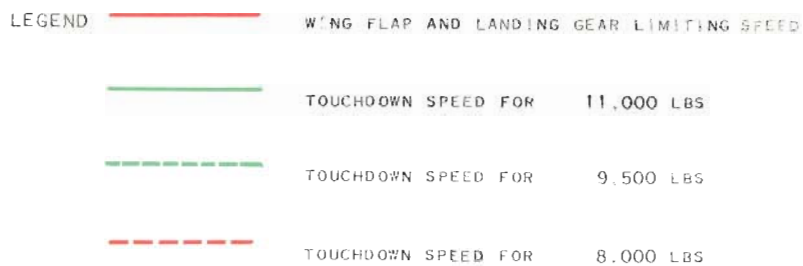
For oil system operation, comply with instructions given in this section (P 5-2).

For fuel system operation, fuel supply is ensured for 2 to 3 minutes with engine at full power. However, it is not advisable to *prolong inverted flight over 20 second duration*, since the fuel flow proportioner would run dry and might be damaged.

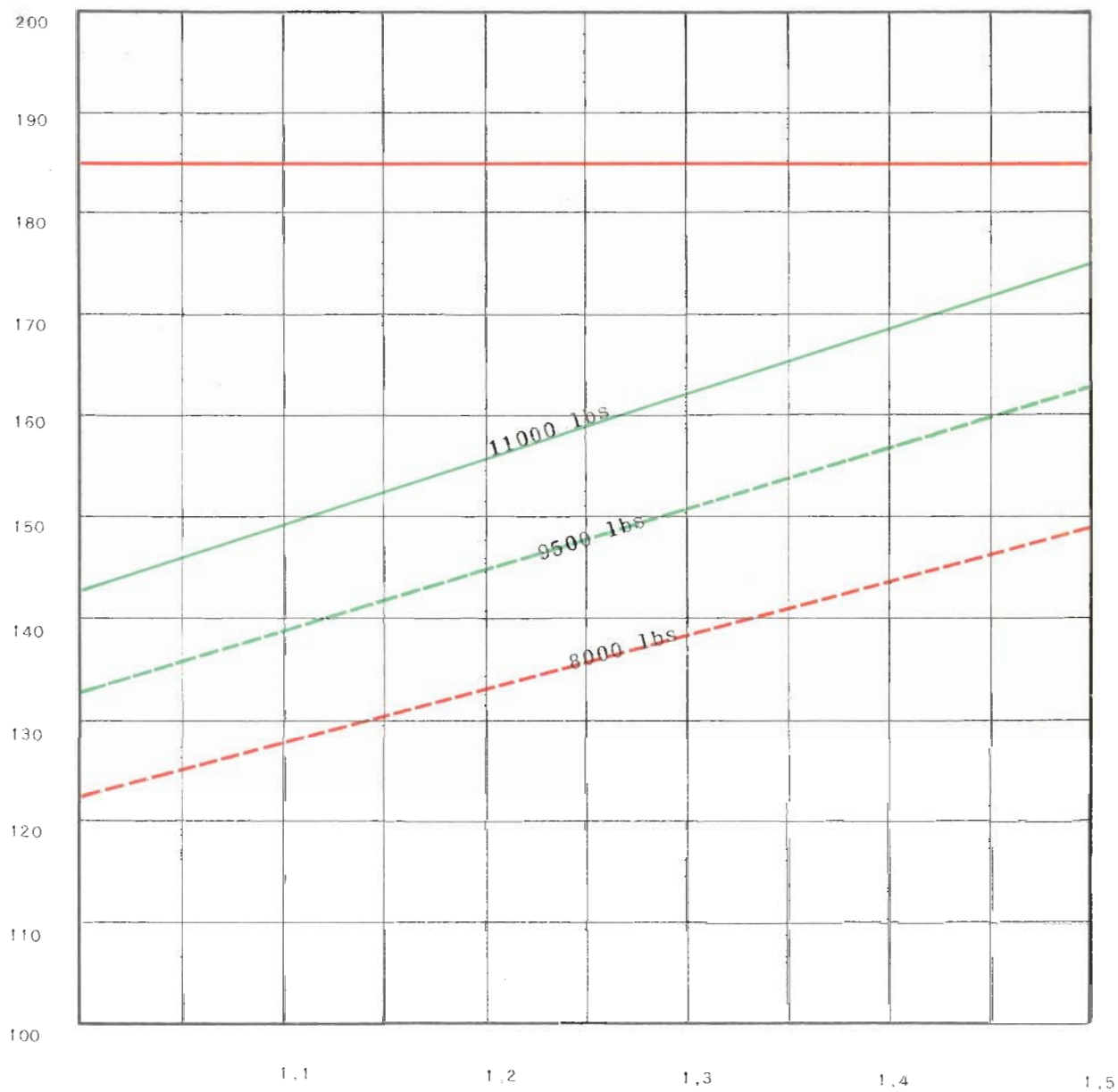
INTENTIONAL SPINS

Intentional spins are prohibited. In case of accidental spins, proceed according to prescribed spin recovery procedure.

TOUCHDOWN SPEED AT LANDING FLAPS AND LANDING GEAR DOWN



IAS IN KNOTS



LOAD FACTORS
S-6015

Figure 5-2

SECTION VI

FLIGHT CHARACTERISTICS

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SPINS	6-3
FLIGHT CONTROLS	6-4
MACH NUMBER	6-5
MANEUVERING FLIGHT CHARACTERISTICS	6-6
CLIMBS	6-7
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TAKE-OFF

No difficulties are encountered with this aircraft during take-off.

The airplane does not tend to yaw during the take-off roll. Therefore, if the nose gear has been properly aligned the aircraft will roll straight. Proper direction is easily maintained at the beginning of the take-off by operating the brakes, as necessary; however, the rudder becomes efficient almost immediately (70 knots).

Take-off is obtained by pulling the stick lightly and progressively.

At approx. 80 knots IAS the nose gear starts to be freed from the aircraft weight and at approx. 100 knots IAS it lifts off. At approx. 125-130 knots IAS the airplane takes-off. Do not take-off at lower speeds in order to maintain better control of the aircraft and to avoid touching the ground with the tail. No noticeable attitude variation is encountered when retracting landing gear and flaps. However forward stick pressure and nose down trim must be exerted during flap «up» travel.

STALLS

Stall characteristics of the airplane are typical for swept-wing aircraft.

a) CRUISE CONFIGURATION

As the airplane approaches 150 knots IAS there will be a light airframe buffet which will increase as the speed decreases.

At approx. 130 knots IAS the aircraft slightly tends to yaw and to drop a wing. This effect can be easily controlled through moderate use of the pedals. A false sensation of pitch-up is also felt by the pilot, but it is merely due to the lightening of the pressure on the stick. The stick can be pulled to «full-back». At approx. 115 knots IAS (depending upon the aircraft load) the aircraft starts to sink and drop the nose. The stick and the pedals can easily control the aircraft.

b) LANDING CONFIGURATION

At approx. 135-130 knots IAS the tendency to drop a wing and to oscillate increases. The stick can, however, be pulled to «full back». As the stall minimum speed is reached (approx. 105 knots, depending upon the aircraft load) the aircraft continues to descend in a stalled glide, at a speed slightly higher than the stall speed.

By maintaining the stick full back it will be noted that the aircraft, after reaching the stall speed, drops the nose and the speed tends to increase.

Then, due to the increased efficiency of the flight controls, the aircraft lifts the nose and further stalls again and continues on, smoothly oscillating without troubles.

A heavy buffet and lightening of pressure on the stick are the warning of a « G » Stall. Therefore, turning or pull out stalls are never sudden. While turning, the aircraft may tend to roll inward or outward from turn depending upon the aircraft attitude.

Stall recovery and correction of the aircraft attitude for a straight stall, turning stall, and pull-out stall *is made by slightly applying forward stick.*

SPINS

The aircraft, as all other airplanes of the same category, is hard to spin unless it is so forced by the pilot. Instead, it tends to enter into a tight spiral.

The flight control which most influences aircraft behavior during spins is the aileron

Therefore, *NEVER USE* aileron against the spin rotation. To recover from a spin neutralize the controls. Slightly apply opposite rudder to stop rotation and, if not sufficient, slightly use aileron (approx. half-way) with the spin. Immediately after, neutralize rudder and aileron to avoid a spin in the opposite direction. It is advisable not to push the stick forward abruptly to avoid entering into an inverted spin. If that happens, use opposite procedures to those followed to recover from a normal spin. Be aware that in an inverted spin the « G » applied are negative « G ». *Intentional spins are prohibited.*

FLIGHT CONTROLS

Elevator

The elevator is controlled by the pilot through a hydraulic actuator, Fairey type, and the feel is transmitted to the pilot by a spring-loaded bungee and a bobweight. The spring-loaded bungee system transmits a feel to the pilot which is proportional to the elevator travel and therefore the force applied by the pilot is proportional to the pitching speed.

However, the valve spring is also compressed, and the travel of the valve is proportional to the elevator travel speed and to the acceleration at which the aircraft longitudinal attitude varies.

Therefore, the feel of the pilot is also due to the Fairey valve travel, which will transmit an artificial feel proportional to the pitch acceleration. Since the bobweight is balanced by a spring calibrated to 1 G,

as the G increases, the pilot will receive a feel proportional to the number of G applied. The elevator is very efficient at all speeds. The efficiency slightly decreases at high Mach number and particularly during a dive.

The elevator also has a manual control

At high speed and high Mach number, the pilot will have to apply a remarkable amount of force to control the aircraft with the manual control, while, at low speed, the difference between the manual and the powered control is not noticeable. Therefore, in case of failure of the servo control, it is necessary to reduce the speed to maintain good control of the aircraft. It is pointed out, however, that manual pull-outs at sonic speed have been made with this aircraft.

Ailerons

The aileron control is hydraulically powered and the feel is a spring-type feel proportional to the aileron angle and the rate of roll.

Obviously the rate of roll slightly decreases at low and high speed. The aileron control is always very efficient and generates high rolling speed. The pilot should be careful in using the ailerons especially at high speed and very high altitude, to avoid dangerous attitudes of the aircraft. The ailerons can also be operated manually, but it should be borne in mind that they are also very hard to actuate because of the friction of the actuator. For the above reasons, it is suggested that light rudder be applied to help turn; thus causing small yaw angles. Due to the remarkable dihedral effect of the swept-wing, the aircraft will bank as with the use of the ailerons. However, it is imperative when approaching or landing with wind, to switch on the emergency hydraulic pressure accumulator.

Rudder

The rudder is controlled directly by the pedals. The only thing to note, is that, when the speed increases, there is a tendency of the directional stability to decrease as it happens for airplanes of this category. A yaw which will cause movement of the turn and bank indicator ball to the left, will then be noticed. The pilot can easily trim the aircraft to correct this effect.

Speed brakes

Opening the speed brakes causes a nose-up moment and closing them causes a nose-down moment. Both are easily controllable with the stick and easily trimmable.

As this aircraft is smaller than other airplanes and the dimensions unusual for a fighter, the absorption of the vibrations is lower. The pilot will than feel, with the speed brakes open, vibrations which will not cause any trouble. At high speed the opening of the speed brakes is easily controlled by the pilot because the speed brakes do not fully come out at once, but gradually as the speed decreases. This, reduces the nose-up moment.

MACH NUMBER

At high speed, approx. around Mach .9, a light buffet is noted if the aircraft has no external loads. The buffet increases above Mach .9. At approximately Mach .95 a light wing drop occurs, accompanied by a light yaw to left, that can easily be controlled by the pilot through the ailerons. No remarkable variations of the longitudinal stability occur and once above Mach .92 the aircraft flies at normal handling characteristics. Just a light kick on the pedals is received by increasing the speed above Mach .98. To minimize yawing effect, vortex generators have been installed on both sides of the rear fuselage.

MANEUVERING FLIGHT CHARACTERISTICS

All acrobatics can be performed at speeds typical for this type of aircraft. A roll may be initiated at 350 knots IAS, a loop and an Immelmann turn at approx. 450 knots IAS.

Turns and other acrobatics may be performed at intermediate speeds.

The controls of this aircraft are comfortable and well harmonized

A light pre-load of the feel springs (artificial feel) provides self balancing of the aircraft.

As any other aircraft, the G.91 has to be continuously trimmed.

The trim is very efficient and its efficiency increases as the speed increases. After take-off large angle varia-

tions are required to trim the aircraft. While at high speed the angle variations will be limited to a very small value.

CLIMBS

During climbs, control and handling of the aircraft is easy.

A light porpoising, due to the critical coupling of the controls and feel system frequency with the natural frequency of the aircraft, will be noticed. The two frequencies are very narrow; therefore if the aircraft oscillates, the control system will start to oscillate and vibrate. If the pilot applies force to the stick and releases it, these vibrations will disappear.

LANDING

The aircraft lands easily. It is suggested not to touch down at too low a speed in order to maintain better control of the aircraft to avoid touching the ground with the tail. Since the drag chute causes rapid deceleration, a reduced landing speed of 5 to 10 knots, will not reduce the landing distance significantly. The pilot should bear in mind that the aircraft will sink very rapidly with the speed brakes open and the landing gear down.

FERRY MISSIONS

At high altitude the aircraft has to be handled gently to avoid stalling. In a turn the stability slightly decreases, but handling of the aircraft will still be easy and comfortable. For a ferry mission, if flying at altitude between 30,000 and 35,000 feet, the aircraft will be easy and pleasant to handle. The use of external loads, i.e. bombs, rockets and droppable tanks, does not appreciably affect the flight characteristics. The pilot will notice a slight lengthening of the take off distance and a decrease of the general performances. The pilot will just have to observe the limitations imposed for flight with external loads.

SECTION VII

SYSTEMS OPERATION

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FUEL FLOW PROPORTIONER	7-2

ENGINE HANDLING PRECAUTIONS

EXHAUST TEMPERATURE INDICATOR

The exhaust temperature limits are critical and special attention is required during starting and airstart because the E.G.T. limiter will not prevent a very rapid increase in exhaust gas temperature.

Take-off at high ambient temperatures and climb at full power above 15,000 feet also require attention. Retard the throttle whenever E.G.T. is rising too rapidly or is excessive. Always report the occurrence and duration of E.G.T. above 730° C. Engine overhaul life and safety are affected.

THROTTLE HANDLING

Rapid throttle handling above 30,000 feet should always be avoided, except in an emergency. The engine life will be prolonged and its performance maintained if throttle movements are smooth and if great changes in power settings are kept to a minimum. However if the A.F.R.C. has been set wrong or if it has become defective, and the throttle is opened quickly the engine may possibly stall, causing the E.G.T. to rise above 730° C. Retard the throttle quickly to FLIGHT IDLE and try again gently; should the E.G.T. remain high or increase without R.P.M. increasing while the throttle is being opened, increase the I.A.S. until normal response of E.G.T./R.P.M. is obtained.

COMPRESSOR STALL

At low airspeed, if a compressor stall should occur during rapid acceleration, a deep pulsating noise may

be heard and may be followed by other symptoms such as the E.G.T. rising rapidly without the r.p.m. increasing.

These conditions can be overcome by quickly retarding the throttle to START & FLIGHT IDLE and allowing the IAS to increase. Then the throttle should be opened gently and there will be a normal increase of r.p.m. and E.G.T.

Compressor stall conditions must not be allowed to persist or damage to the engine will result. Compressor stall can cause engine flame-out. Sometimes this is indicated by a loud bang during a rapid acceleration, loss of thrust occurs and the r.p.m. and E.G.T. fall very rapidly. An air start is required. (See Section III).

ENGINE NOISES AND ROUGH RUNNING

During flight, unusual noises due to thermal expansion or to pressure surge in the cabin pressurizing system may occur. When an unusual noise is heard, depressurize the cockpit for a few minutes. If the noise persists, it can be assumed to come from the engine which should be checked after landing.

Usually, noises can be eliminated by varying the r.p.m., but if they occur at all heights and at all engine speeds, it points to some mechanical failure. (See Section III).

ENGINE ICING

In clouds at indicated temperatures below +1° C, a loss of thrust, abnormally high E.G.T. and a loss of r.p.m., indicates engine icing. Flying into clear air conditions warmer than +1° C will overcome these symptoms, although they may persist for some time.

These symptoms and their duration must be reported since engine overhal life and safety are affected.

FUEL FLOW PROPORTIONER

The fuel flow proportioner consists of two hydraulic pressure-driven pumps. By draining fuel from the two

groups of cells simultaneously it prevents shifting of the airplane center of gravity.

For this reason, the two bucket pumps are disaligned to the casing in which they rotate, so that the delivery capacity of each pump is proportional to the capacity of its respective group of cells. In case of mechanical or hydraulic failure of the fuel flow proportioner, fuel will flow freely through the proportioner without affecting the fuel supply to the engine. However, a shift in the airplane center of gravity will occur and require constant trimming.

SECTION VIII
CREW DUTIES

Not applicable.

SECTION IX

ALL WEATHER OPERATION

To be published as soon as data will be available.

APPENDIX I

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DISCUSSION OF CHARTS

A series of charts on the following pages present estimated performance of the aircraft.

All charts except take-off and landing Charts are based on operation in NACA standard atmosphere.

TAKE-OFF DISTANCES

Figures A-1 through A-4 provide ground run distances and total distances to clear a 50 foot obstacle with maximum thrust, at various altitudes and temperatures.

A dry hard surface runway with 0,15 and 30 knot head winds are considered.

The charted distances are estimated, assuming normal take-off technique.

CLIMB

From the climb chart (fig. A-5) the best climb speed, fuel consumed, time to climb, distance covered and rate of climb for maximum thrust can be determined.

A fuel allowance for warm-up and take off is listed at sea level. Fuel requirements at other altitudes include this allowance plus the fuel needed to climb from sea level.

Time and distance covered during an in-flight climb may be obtained in the same manner.

DESCENT

The descent chart (fig. A-6) is based on the use of speed brakes to provide a high rate of descent. The airspeeds selected correspond to approximately .64 Mach at 30,000 feet, then decrease to approximately .38 Mach at sea level.

To minimize fuel consumption, idle RPM is used.

LANDING DISTANCES

Figure A-7 shows landing distances, both ground-run and total to clear a 50 foot obstacle, for landing at various altitudes with drag chute deployed.

A dry hard surface runway and 0,15 and 30 knot head winds are considered.

MAXIMUM LEVEL SPEED

The maximum level speed diagram (fig. A-8) shows the maximum level-flight Mach number capability of a clean aircraft, from sea level to 22,000 feet.

FLIGHT OPERATION INSTRUCTION CHARTS

The Flight Operation instruction charts (fig. A-9 through A-11) are provided to facilitate flight planning.

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They show the range of the airplane at maximum-range airspeed and the procedure required to obtain this range.

Columns are provided in the charts for each 5000 feet increase in altitude up to 30,000 feet. On the line opposite available fuel in the upper half of the chart, ranges are shown for each initial altitude. In general, two range values are quoted for each altitude and fuel quantity. One is for continued flight at the initial altitude, and the other is for the maximum range obtainable by climbing to a higher altitude. The charted ranges do not include fuel consumed and distance covered during warm-up, take-off, and initial climb at the start of a flight. However, fuel used and distance covered during letdown or during in-flight climb to an optimum altitude are taken into account. The lower half of each chart presents the operating procedure to obtain the ranges quoted in the upper half. When altitude is changed, operating instructions in the column with the new altitude must be used if the ranges listed are to be obtained.

Under different wind conditions, ranges (in ground miles) are varied by the effect of wind on ground speed.

Recommended CAS also may change in order to maintain the most favorable ground miles per pound. To facilitate range computation under wind conditions,

the operating procedure in the lower half of each chart contains instructions for various winds at each altitude listed. To obtain ground miles in a wind, chart air miles are multiplied by the range factor found opposite the effective wind at the cruising altitude. Thus, range factors may be used to determine the best altitude for cruising when there is a known wind difference at different altitudes.

Although a wind may be from any direction with respect to the course of the airplane, it may be expressed as an effective wind. An effective wind has the same effect on the ground speed of the airplane as if it were a straight head wind or tail wind. In other words, the wind component in the direction of the airplane heading is the effective wind. For example, a 100-knot wind at 30 degrees to the course is an effective head wind of approximately 85 knots. If the true airspeed of the airplane is 485 knots, the true ground speed is approximately 400 knots.

The approximate power settings quoted on any one chart are based on the gross weight equal to the high limit of the chart weight band. If the recommended CAS values are maintained, the power settings will decrease slightly as the gross weight decreases. No allowances are made for navigational errors, combat, formation flight, landing, or other contingencies. Such allowances must be made as required.

D. A.
D. P. V.

TAKE-OFF DISTANCES
FEET

E. 0766/1
F. 1/6

A/C CLEAN

Wt = 4900 kg C.G. = 22.6% m.a.c.

ALTITUDE			0 ft						1000 ft						2000 ft					
Temperature Fahrenheit			140	120	100	80	60	40	140	120	100	80	60	40	140	120	100	80	60	40
HEADWIND (Kts)	0	Ground roll	3675	3050	2560	2185	1985	1820	4055	3380	2805	2395	2165	1985	4560	3775	3100	2660	2345	2100
		Clear 50'	5400	4580	3940	3460	3020	2660	5875	5020	4265	3725	3415	3180	6200	5530	4645	4070	3675	3345
	15	Ground roll	2940	2430	2020	1725	1545	1405	3235	2725	2250	1890	1690	1535	3660	3035	2495	2100	1870	1660
		Clear 50'	4465	3775	3235	2840	2610	2460	4875	4170	3545	3085	2805	2605	5445	4595	3855	3365	3020	2750
	30	Ground roll	2265	1870	1545	1300	1150	1035	2510	2100	1725	1430	1280	1160	2870	2365	1935	1610	1410	1260
		Clear 50'	3625	3050	2625	2300	2070	1890	3955	3395	2855	2495	2250	2070	4445	3760	3135	2725	2445	2235

DATA AS OF: 13 MAY 1961

Fig. A-1

BASED ON: ESTIMATED DATA

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D. A.
D. P. V.**TAKE-OFF DISTANCES**
FEETE. 0766/1
F. 2/6**A/C CLEAN**

Wt = 4900 kg C.G. = 22.6% m.a.c.

ALTITUDE			3000 ft						4000 ft						5000 ft					
Temperature Fahrenheit			140	120	100	80	60	40	140	120	100	80	60	40	140	120	100	80	60	40
HEADWIND (Kts)	0	Ground roll	5215	4215	3445	2955	2575	2275	5940	4710	3840	3280	2825	2450	6760	5250	4265	3610	3085	2625
		Clear 50'	7380	6105	5085	4430	3970	3570	8400	6725	5610	4855	4300	3825	9595	7415	6170	5300	4660	4065
	15	Ground roll	4170	3395	2755	2345	2050	1780	4790	3790	3070	2610	2265	1990	5510	4235	3445	2905	2510	2180
		Clear 50'	6135	5055	4215	3675	3250	2915	7020	5595	4645	4020	3545	3120	8105	6185	5135	4415	3855	3350
	30	Ground roll	3330	2660	2150	1805	1560	1385	3840	2985	2395	2020	1740	1505	4430	3365	2725	2265	1920	1660
		Clear 50'	5070	4170	3430	2970	2660	2420	5840	4625	3805	3280	2890	2580	6740	5170	4235	3625	3150	2770

DATA AS OF: 13 MAY 1961

Fig. A-2

BASED ON: ESTIMATED DATA

D. A.
D. P. V.**TAKE-OFF DISTANCES**
FEETE. 0766/1
F. 4/6**A/C 2 TANKS**

Wt = 5350 kg C.G. = 22% m.a.c.

ALTITUDE			0 ft						1000 ft						2000 ft					
Temperature Fahrenheit			140	120	100	80	60	40	140	120	100	80	60	40	140	120	100	80	60	40
HEADWIND (Kts)	0	Ground roll	4580	3775	3120	2690	2445	2260	5070	4200	3445	2955	2660	2415	5675	4690	3840	3280	2920	2630
		Clear 50'	6560	5510	4710	4120	3775	3570	7200	6050	5100	4460	4035	3800	8005	6710	5595	4855	4365	4065
	15	Ground roll	3690	3020	2530	2150	1920	1725	4100	3380	2790	2365	2100	1900	4610	3805	3100	2625	2315	2070
		Clear 50'	5465	4610	3920	3415	3100	2870	6005	5070	4250	3710	3380	3115	6725	5625	4660	4055	3645	3280
	30	Ground roll	2890	2365	1955	1595	1460	1350	3235	2660	2185	1805	1610	1470	3675	3005	2445	2035	1775	1580
		Clear 50'	4495	3740	3185	2755	2495	2290	4940	4150	3495	3005	2725	2465	5580	4645	3840	3300	2955	2665

DATA AS OF: 13 MAY 1961

Fig. A-3

BASED ON: ESTIMATED DATA

Appendix I

T.O. NATO 1RF-G91-R4-1

D. A. **TAKE-OFF DISTANCES** E. 0766/1
D. P. V. **FEET** F. 5/6
A/C 2 TANKS Wt = 5350 kg C.G. = 22% m.a.c.

ALTITUDE			3000 ft						4000 ft						5000 ft					
Temperature Fahrenheit			140	120	100	80	60	40	140	120	100	80	60	40	140	120	100	80	60	40
HEADWIND (Kts)	0	Ground roll	6430	5250	4265	3610	3200	2870	7335	5875	4760	4035	3510	3065	8365	6530	5315	4465	3840	3270
		Clear 50'	9120	7450	6150	5315	4725	4375	10595	8270	6790	5840	5150	4740	12595	9170	7515	6415	5595	5080
	15	Ground roll	5265	4265	3460	2940	2560	2265	6035	4805	3870	3280	2825	2455	6940	5380	4330	3645	3120	2665
		Clear 50'	7710	6265	5150	4445	3955	3520	9040	6970	5710	4890	4315	3760	10890	7775	6330	5365	4690	4060
	30	Ground roll	4215	3400	2710	2280	1985	1750	4855	3840	3035	2560	2200	1930	5625	4315	3430	2890	2445	2110
		Clear 50'	6430	5170	4215	3625	3215	2870	7645	5760	4660	4005	3510	3090	9350	6445	5200	4430	3840	3325

DATA AS OF: 13 MAY 1961

Fig. A-4

BASED ON: ESTIMATED DATA

D. A. **CLIMB CHART** E. 0936
D. P. V. **STANDARD AIR** F. 1/1

A/C CLEAN Wt = 4900 kg C.G. = 22.6% m.a.c. **A/C TWO TANKS** Wt = 5350 kg C.G. = 22% m.a.c.

Rate of climb ft/min	Distance n.m.	Time min.	Fuel lbs	Vc Kts	Mach	HT ft	Mach	Vc Kts	Fuel lbs	Time min.	Distance n.m.	Rate of climb ft/min.
7500	0	0,00	180*	420	0.64	Sea level	0.54	360	200*	0,00	0	6900
7000	15	2.20	245	410	0.67	5000	0.57	350	250	2.23	14	6300
6400	19	3.00	310	380	0.68	10000	0.59	330	305	3.08	17	5700
5700	25	3.78	360	350	0.69	15000	0.61	310	365	4.03	23	5000
5000	31	4.67	415	325	0.70	20000	0.63	290	425	5.17	30	4300
4250	39	5.75	470	300	0.72	25000	0.65	270	500	6.33	38	3500
3400	49	7.17	525	270	0.72	30000	0.67	250	575	8.00	48	2750

* Allowance for start, taxi, take-off and acceleration to climb speed.

DATA AS OF: 6 JUN 1961

Fig. A-5

BASED ON: ESTIMATED DATA

T.O. NATO 1RF-G91-R4-1

D. A.
D. P. V.

DESCENT CHART
(Over Letdown Point)
STANDARD AIR

E. 0935
F. 1/1

A/C CLEAN and A/C TWO TANKS

HT ft	V Kts	Mach	Fuel lbs	Time min.	Rate of descent ft/min.	Distance naut. miles
30000	240	0.64	37	4.75	7400	16.0
25000	240	0.58	32	4.00	7000	13.0
20000	240	0.53	27	3.33	6650	10.5
15000	250	0.49	15	2.50	6350	8.0
10000	250	0.45	7	1.67	6100	5.5
5000	250	0.41	3	0.83	5950	2.5
Seal level	250	0.38	0	0	5850	0

DATA AS OF: 30 MAY 1961

Fig. A-6

BASED ON: ESTIMATED DATA

D. A.
D. P. V.

LANDING DISTANCES
FEET

E. 0776
F. 1/1

$$W_t = 3800 \text{ kg}$$

ALTITUDE			0 ft					2500 ft					5000 ft				
Temperature Fahrenheit			120	100	80	60	40	120	100	80	60	40	120	100	80	60	40
HEADWIND (Kts)	0	Ground roll	1840	1770	1710	1640	1575	2005	1935	1870	1805	1740	2215	2135	2050	1985	1905
		Clear 50'	2885	2804	2725	2625	2560	3100	3020	2935	2840	2755	3345	3265	3165	3070	2970
	15	Ground roll	1490	1445	1380	1330	1280	1660	1590	1525	1460	1410	1820	1755	1690	1625	1560
		Clear 50'	2410	2345	2265	2200	2115	2625	2545	2460	2380	2300	2855	2770	2675	2575	2495
	30	Ground roll	1245	1200	1150	1100	1050	1380	1330	1280	1215	1165	1540	1475	1430	1360	1295
		Clear 50'	2035	1970	1905	1840	1775	2230	2165	2085	2000	1935	2445	2360	2280	2200	2115

DATA AS OF: 7 FEB 1961

Fig. A-7

BASED ON: ESTIMATED DATA

MAXIMUM LEVEL SPEED
AIRCRAFT CLEAN

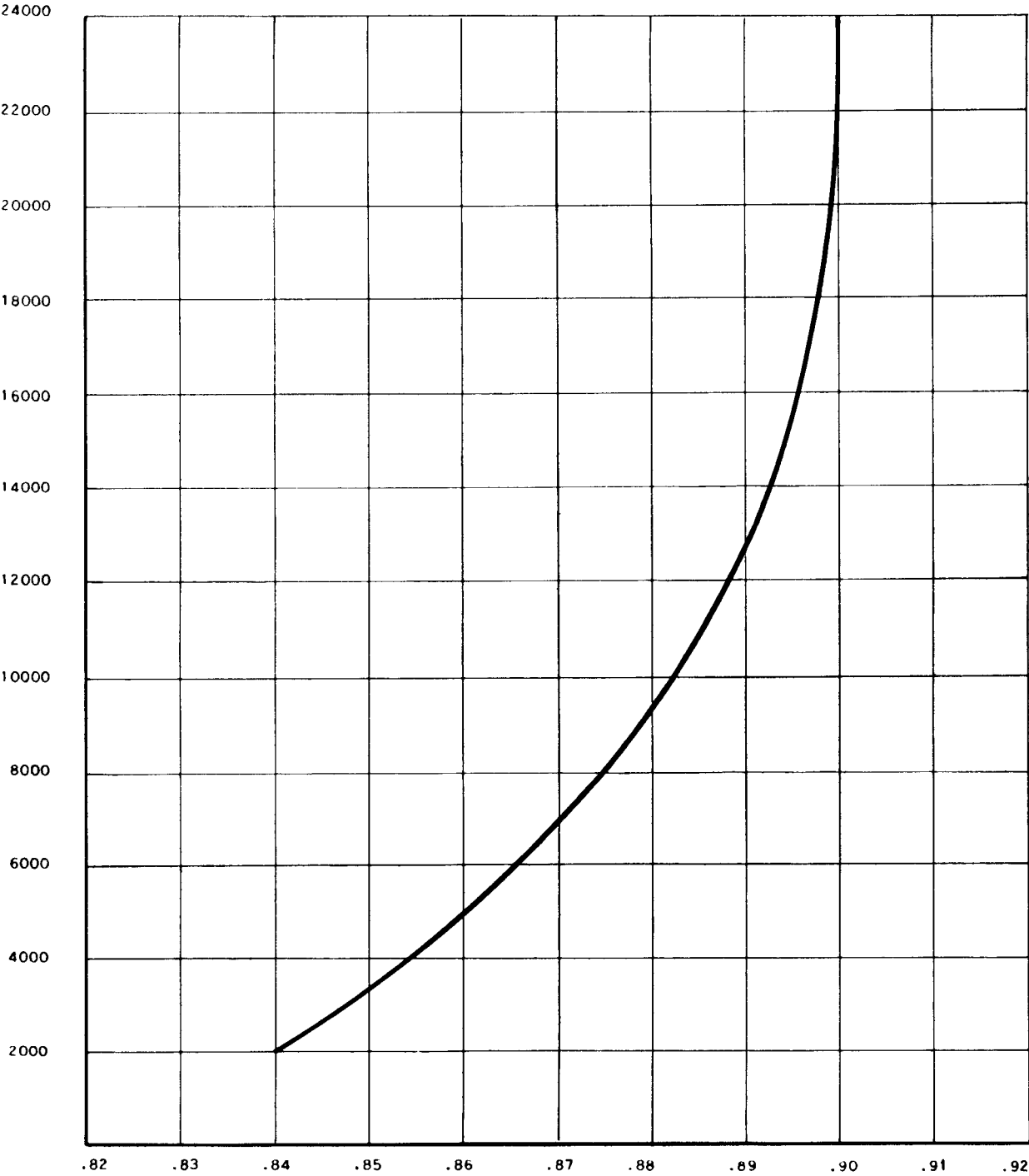


Fig. A-8

AIRPLANE MODEL (S)												FLIGHT OPERATION INSTRUCTION CHART												EXTERNAL LOAD ITEMS																			
FIAT G 91												CHART WEIGHT LIMITS:												NONE																			
ENGINE (S) BRISTOL ORPHEUS 803																								NUMBER OF ENGINES OPERATING: 1																			
INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT - Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowances for reserve, combat, navigational errors, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING - From initial fuel on board subtract fuel required for take off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.																		NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight change), it is necessary to observe the optimum cruising altitude on each chart, i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for fuel. Climb distance and fuel are included where climbs are indicated.																									
DATA BELOW CONTAINS 165 POUNDS FUEL RESERVE AFTER LANDING.																																											
IF YOU ARE AT S.L.						FUEL LBS.	IF YOU ARE AT 5000'						IF YOU ARE AT 10 000'						IF YOU ARE AT 15 000'						IF YOU ARE AT 20 000'						IF YOU ARE AT 25 000'						FUEL LBS.	IF YOU ARE AT 30 000'					
Range in naut. miles (Zero wind)					By cruising AT OPT. ALT.		Range in naut. miles (Zero wind)					By cruising AT OPT. ALT.	Range in naut. miles (Zero wind)					By cruising AT OPT. ALT.	Range in naut. miles (Zero wind)					By cruising AT OPT. ALT.	Range in naut. miles (Zero wind)					By cruising AT OPT. ALT.													
By cruising At S.L.	OPT. ALT. (1000 FT)						By cruising AT 5000'	OPT. ALT. (1000 FT)					By cruising AT 10 000'	OPT. ALT. (1000 FT)					By cruising AT 15 000'	OPT. ALT. (1000 FT)					By cruising AT 20 000'	OPT. ALT. (1000 FT)					By cruising AT 25 000'	OPT. ALT. (1000 FT)				By cruising AT 30 000'		OPT. ALT. (1000 FT)					
295	30				610	2500	—	—				—	—				—	—				—	—				—	—				2500	—	—									
225	30				455	2000	270	30				485	315	30				500	360	30				505	410	30				510	465	30				515	2000	520	30				
165	30				305	1500	195	30				335	225	30				350	260	30				355	295	30				360	330	30				365	1500	370	30				
100	30				155	1000	115	30				185	135	30				200	155	30				205	175	30				210	200	30				215	1000	220	30				
CRUSING AT S.L.						Effective wind	CRUISING AT 5000'						CRUISING AT 10 000'						CRUISING AT 15 000'						CRUISING AT 20 000'						CRUISING AT 25 000'						Effective wind	CRUISING AT 30 000'					
C.A.S.	APPROXIMATE						C.A.S.	APPROXIMATE					C.A.S.	APPROXIMATE					C.A.S.	APPROXIMATE					C.A.S.	APPROXIMATE					C.A.S.	APPROXIMATE						C.A.S.	APPROXIMATE				
	% RPM	LB/HR	G.S.	Range Factor	Letdown dist.			% RPM	LB/HR	G.S.	Range factor	Letdown dist.		% RPM	LB/HR	G.S.	Range factor	Letdown dist.		% RPM	LB/HR	G.S.	Range factor	Letdown dist.		% RPM	LB/HR	G.S.	Range factor	Letdown dist.		% RPM	LB/HR	G.S.	Range factor	Letdown dist.			% RPM	LB/HR	G.S.	Range factor	Letdown dist.
370	83	2930	250	0.67	—	120 H.W.	350	83	2500	255	0.68	—	335	83	2190	265	0.68	—	325	83	1960	280	0.69	—	315	84	1810	300	0.70	—	300	84	1630	310	0.71	—	120 H.W.	285	85	1500	325	0.72	—
360	82	2830	280	0.77	—	80 H.W.	340	82	2410	285	0.78	—	325	82	2120	295	0.78	—	315	83	1900	310	0.79	—	305	83	1730	325	0.80	—	290	84	1580	340	0.81	—	80 H.W.	275	85	1440	350	0.81	—
350	82	2740	310	0.88	—	40 H.W.	330	82	2340	315	0.89	—	315	82	2020	320	0.89	—	305	82	1850	340	0.90	—	295	83	1680	355	0.90	—	280	83	1520	365	0.90	—	40 H.W.	265	84	1380	375	0.90	—
345	82	2700	345	1.00	—	0	325	82	2300	350	1.00	—	310	82	2000	355	1.00	—	300	82	1880	370	1.00	—	290	83	1640	385	1.00	—	275	83	1500	400	1.00	—	0	260	84	1370	410	1.00	—
340	82	2660	380	1.12	—	40 T.W.	320	82	2270	385	1.11	—	305	82	1970	390	1.11	—	295	82	1770	405	1.11	—	285	83	1620	420	1.10	—	270	83	1460	430	1.10	—	40 T.W.	255	84	1330	440	1.10	—
330	81	2600	410	1.23	—	80 T.W.	310	82	2180	410	1.23	—	295	82	1920	420	1.23	—	285	81	1730	435	1.22	—	275	82	1580	450	1.21	—	260	82	1430	460	1.20	—	80 T.W.	245	83	1290	465	1.20	—
320	81	2540	440	1.35	—	120 T.W.	300	81	2130	440	1.35	—	285	81	1870	450	1.35	—	275	81	1670	460	1.33	—	265	82	1540	475	1.32	—	250	82	1390	485	1.31	—	120 T.W.	235	83	1250	490	1.30	—
1) Climb at max RPM. 2) Multiply nautical units by 1.15 to obtain statute units. 3) Read lower half of chart opposite effective wind only. 4) Make additional allowances for landing, navigational errors, combat, formation flight etc. as required. 5) Chart weight limits based on fuel density of 6.34 LBS/GAL.. Fuel flow based on fuel density of 6.34 LBS/GAL.												EXAMPLE If you are at 10000 feet with 2000 lbs of available fuel, you can fly 315 nautical air miles by holding 310MPH CAS. However, you can fly 500 nautical air miles by immediately climbing to 30000 feet using max RPM. At 30000 feet cruise at 260 MPH CAS and start letdown - nautical air miles from destination. With a 80 MPH headwind the range at 30000 feet with be 500 × 0.78 or 390 nautical air miles. Cruise at 275MPH CAS with this wind and start letdown - nautical air miles from destination.												LEGEND EFFECTIVE WIND - HW, HEADWIND; TW. TAILWIND RANGE FACTOR = $\frac{\text{GROUND DISTANCE (Effective Wind)}}{\text{RANGE IN NAUT. MILES (Zero Wind)}}$ G. S. - GROUND SPEED IN NAUTICAL MILES PER HR LB/HR - TOTAL FUEL CONSUMPTION - POUNDS PER HR BASED ON JP/4 FUEL																			
DATA AS OF: 13 MAY 1961 BASED ON: ESTIMATED DATA																																											

Fig. A-9

AIRPLANE MODEL (S)										FLIGHT OPERATION INSTRUCTION CHART															EXTERNAL LOAD ITEMS									
FIAT G 91										CHART WEIGHT LIMITS:															TWO 69 GAL TANKS									
ENGINE (S) BRISTOL ORPHEUS 803																									NUMBER OF ENGINES OPERATING: 1									
INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT - Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowances for reserve, combat, navigational errors, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING - From initial fuel on board subtract fuel required for take off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.															NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight change), it is necessary to observe the optimum cruising altitude on each chart, i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for fuel. Climb distance and fuel are included where climbs are indicated.																			
DATA BELOW CONTAINS 165 POUNDS FUEL RESERVE AFTER LANDING.																																		
IF YOU ARE AT S.L.			FUEL LBS.	IF YOU ARE AT 5000'			IF YOU ARE AT 10 000'			IF YOU ARE AT 15 000'			IF YOU ARE AT 20 000'			IF YOU ARE AT 25 000'			FUEL LBS.	IF YOU ARE AT 30 000'														
Range in naut. miles (Zero wind)				Range in naut. miles (Zero wind)			Range in naut. miles (Zero wind)			Range in naut. miles (Zero wind)			Range in naut. miles (Zero wind)			Range in naut. miles (Zero wind)				Range in naut. miles (Zero wind)														
By cruising AT S.L.	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.		By cruising AT 5000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.	By cruising AT 10 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.	By cruising AT 15 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.	By cruising AT 20 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.	By cruising AT 25 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.		By cruising AT 30 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.												
340	30	795	3350	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3350	—	—	—												
295	30	690	3000	360	30	705	435	30	715	505	30	725	585	30	735	665	30	745	3000	760	30	—												
245	30	555	2500	300	30	570	355	30	575	415	30	585	480	30	595	545	30	605	2500	620	30	—												
190	30	415	2000	230	30	430	275	30	440	320	30	445	375	30	455	425	30	465	2000	480	30	—												
135	30	275	1500	165	30	290	200	30	300	230	30	310	265	30	315	300	30	330	1500	340	30	—												
80	30	135	1000	100	30	150	120	30	160	140	30	170	160	30	180	180	30	190	1000	205	30	—												
CRUISING AT S.L.			Effective wind	CRUISING AT 5000'			CRUISING AT 10 000'			CRUISING AT 15 000'			CRUISING AT 20 000'			CRUISING AT 25 000'			Effective wind	CRUISING AT 30 000'														
C.A.S.	APPROXIMATE					C.A.S.	APPROXIMATE					C.A.S.	APPROXIMATE					C.A.S.		APPROXIMATE					C.A.S.	APPROXIMATE								
	% RPM	LB/HR		G.S.	Range factor		Letdown dist.	% RPM	LB/HR	G.S.	Range factor		Letdown dist.	% RPM	LB/HR	G.S.	Range factor			Letdown dist.	% RPM	LB/HR	G.S.	Range factor		Letdown dist.	% RPM	LB/HR	G.S.	Range factor	Letdown dist.			
—	—	—	—	—	—	120 H.W.	—	—	—	—	—	—	—	—	—	—	—	—	120 H.W.	260	86	1500	290	0.70	—									
—	—	—	—	—	—	80 H.W.	—	—	—	—	—	—	—	—	—	—	—	—	80 H.W.	255	86	1470	320	0.80	—									
345	83	3260	305	0.85	—	40 H.W.	325	83	2690	310	0.85	—	305	83	2240	310	0.90	—	40 H.W.	245	85	1420	350	0.90	—									
340	83	3180	340	1.00	—	0	320	83	2630	345	1.00	—	280	85	1770	375	1.00	—	0	240	85	1370	380	1.00	—									
335	83	3130	375	1.10	—	40 T.W.	315	83	2590	380	1.10	—	275	85	1730	405	1.10	—	40 T.W.	235	85	1340	410	1.10	—									
—	—	—	—	—	—	80 T.W.	—	—	—	—	—	—	270	84	1710	440	1.20	—	80 T.W.	230	84	1320	445	1.20	—									
—	—	—	—	—	—	120 T.W.	—	—	—	—	—	—	265	84	1690	475	1.35	—	120 T.W.	225	84	1310	480	1.30	—									
1) Climb at max RPM. 2) Multiply nautical units by 1.15 to obtain statute units. 3) Read lower half of chart opposite effective wind only. 4) Make additional allowances for landing, navigational errors, combat, formation flight etc. as required. 5) Chart weight limits based on fuel density of 6.34 LBS/GAL. Fuel flow based on fuel density of 6.34 LBS/GAL.							EXAMPLE If you are at 10 000 feet with 2000 lbs of available fuel, you can fly 275 nautical air miles by holding 300MPH CAS. However, you can fly 440 nautical air miles by immediately climbing to 30 000 feet using max RPM. At 30 000 feet cruise at 240 MPH CAS and start letdown - nautical air miles from destination. With a 80 MPH headwind the range at 30 000 feet will be 440 × 0.8 or 350 nautical air miles. Cruise at 250MPH CAS with this wind and start letdown - nautical air miles from destination.							LEGEND EFFECTIVE WIND - HW, HEADWIND; TW, TAILWIND RANGE FACTOR = $\frac{\text{GROUND DISTANCE (Effective Wind)}}{\text{RANGE IN NAUT. MILES (Zero Wind)}}$ G. S. - GROUND SPEED IN NAUTICAL MILES PER HR LB/HR - TOTAL FUEL CONSUMPTION - POUNDS PER HR BASED ON JP-4 FUEL																				
DATA AS OF: 12 APR 1961 BASED ON: ESTIMATED DATA																																		

Fig. A-10

AIRPLANE MODEL (S)										FLIGHT OPERATION INSTRUCTION CHART										EXTERNAL LOAD ITEMS																								
FIAT G 91										CHART WEIGHT LIMITS:										11 800 TO 10 200 POUNDS										TWO 500 POUNDS BOMBS														
ENGINE (S) BRISTOL ORPHEUS 803																														NUMBER OF ENGINES OPERATING: 1														
INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT - Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowances, for reserve, combat, navigational errors, formation flight, etc.). Move horizontally right of left to section according to present altitude and read total range available (no wind) by crusing at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING - From initial fuel on board subtract fuel required for take off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.															NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight change), it is necessary to observe the optimum cruising altitude on each chart, i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for fuel. Climb distance and fuel are included where climbs are indicated.																													
DATA BELOW CONTAINS 165 POUNDS FUEL RESERVE AFTER LANDING																																												
IF YOU ARE AT S.L.			FUEL LBS.	IF YOU ARE AT 5000'			IF YOU ARE AT 10 000'			IF YOU ARE AT 15 000'			IF YOU ARE AT 20 000'			IF YOU ARE AT 25 000'			FUEL LBS.	IF YOU ARE AT 30 000'																								
Range in naut. miles (Zero wind)				Range in naut. miles (Zero wind)			Range in naut. miles (Zero wind)			Range in naut. miles (Zero wind)			Range in naut. miles (Zero wind)			Range in naut. miles (Zero wind)				Range in naut. miles (Zero wind)																								
By cruising At S.L.	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.		By cruising AT 5000'	OT. ALT. (1000 FT)	By cruising AT OPT. ALT.	By cruising AT 10 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.	By cruising AT 15 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.	By cruising AT 20 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.	By cruising AT 25 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.		By cruising AT 30 000'	OPT. ALT. (1000 FT)	By cruising AT OPT. ALT.																						
240	30	555	2500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2500	—	—	—																						
190	30	415	2000	230	30	430	275	30	440	320	30	450	375	30	455	425	30	470	2000	480	30	—																						
135	30	275	1500	165	30	290	200	30	305	230	30	310	265	30	320	300	30	330	1500	340	30	—																						
80	30	135	1000	100	30	150	120	30	165	140	30	170	160	30	180	180	30	190	1000	205	30	—																						
CRUISING AT S.L.				CRUISING AT 5000'			CRUISING AT 10 000'			CRUISING AT 15 000'			CRUISING AT 20 000'			CRUISING AT 25 000'				CRUISING AT 30 000'																								
C.A.S.	APPROXIMATE					Effective wind	C.A.S.	APPROXIMATE					C.A.S.	APPROXIMATE					C.A.S.	APPROXIMATE					Effective wind	C.A.S.	APPROXIMATE																	
	% RPM	LB/HR	G.S.	Range factor	Letdown dist.			% RPM	LB/HR	G.S.	Range factor	Letdown dist.		% RPM	LB/HR	G.S.	Range factor	Letdown dist.		% RPM	LB/HR	G.S.	Range factor	Letdown dist.			% RPM	LB/HR	G.S.	Range factor	Letdown dist.													
—	—	—	—	—	—	120 H.W.	—	—	—	—	—	—	310	84	2300	235	0.65	—	—	305	85	2100	260	0.70	—	300	86	1910	280	0.70	—	285	86	1720	290	0.70	—	120 H.W.	260	86	1500	290	0.70	—
—	—	—	—	—	—	80 H.W.	—	—	—	—	—	—	305	84	2240	270	0.75	—	—	300	85	2040	290	0.80	—	295	86	1870	310	0.80	—	275	86	1670	320	0.80	—	80 H.W.	255	86	1470	320	0.80	—
345	83	3260	305	0.85	—	40 H.W.	325	83	2690	310	0.85	—	305	83	2240	310	0.90	—	—	295	84	2000	325	0.90	—	285	85	1810	340	0.90	—	265	85	1630	350	0.90	—	40 H.W.	245	85	1420	350	0.90	—
340	83	3180	340	1.00	—	0	320	83	2630	345	1.00	—	300	83	2200	345	1.00	—	—	290	84	1970	360	1.00	—	280	85	1770	375	1.00	—	260	85	1560	380	1.00	—	0	240	85	1370	380	1.00	—
335	83	3130	375	1.10	—	40 T.W.	315	83	2590	380	1.10	—	295	83	2160	380	1.10	—	—	285	84	1940	395	1.10	—	275	85	1730	405	1.10	—	255	85	1530	410	1.10	—	40 T.W.	235	85	1340	410	1.10	—
—	—	—	—	—	—	80 T.W.	—	—	—	—	—	—	290	82	2130	415	1.25	—	—	280	83	1920	430	1.20	—	270	84	1710	440	1.20	—	250	84	1510	445	1.20	—	80 T.W.	230	84	1320	445	1.20	—
—	—	—	—	—	—	120 T.W.	—	—	—	—	—	—	285	82	2100	445	1.35	—	—	275	83	1880	460	1.35	—	265	84	1690	475	1.35	—	245	84	1490	480	1.30	—	120 T.W.	225	84	1310	480	1.30	—
1) Climb at max RPM. 2) Multiply nautical units by 1.15 to obtain statute units. 3) Read lower half of chart opposite effective wind only. 4) Make additional allowances for landing, navigational errors, combat, formation flight etc. as required. 5) Chart weight limits based on fuel density of 6.34 LBS/GAL. Fuel flow based on fuel density of 6.34 LBS/GAL.							EXAMPLE If you are at 10000 feet with 2000 lbs of available fuel, you can fly 275 nautical air miles by holding 300 MPH CAS. However, you can fly 440 nautical air miles by immediately climbing to 30000 feet using max RPM. At 30000 feet cruise at 240 MPH CAS and start letdown - nautical air miles from destination. With a 80 MPH headwind the range at 30000 feet with be 440 × 0,8 or 350 nautical air miles. Cruise at 255 MPH CAS with this wind and start letdown - nautical air miles from destination.															LEGEND EFFECTIVE WIND - HW, HEADWIND; TW, TAILWIND RANGE FACTOR = $\frac{\text{GROUND DISTANCE (Effective Wind)}}{\text{RANGE IN NAUT. MILES (Zero Wind)}}$ G. S. - GROUND SPEED IN NAUTICAL MILES PER HR LB/HR - TOTAL FUEL CONSUMPTION - POUNDS PER HR BASED ON JP/4 FUEL																						
DATA AS OF: 12 APR 1961 BASED ON: ESTIMATED DATA																																												

Fig. A-11

ALPHABETICAL INDEX

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