

CHAPTER

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BOEING 707

MAINTENANCE MANUAL

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CHAPTER 80

STARTING

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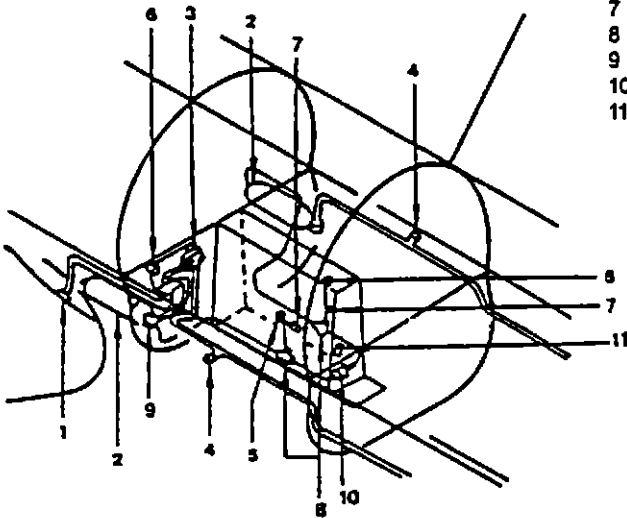
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STARTING SYSTEM - DESCRIPTION AND OPERATION

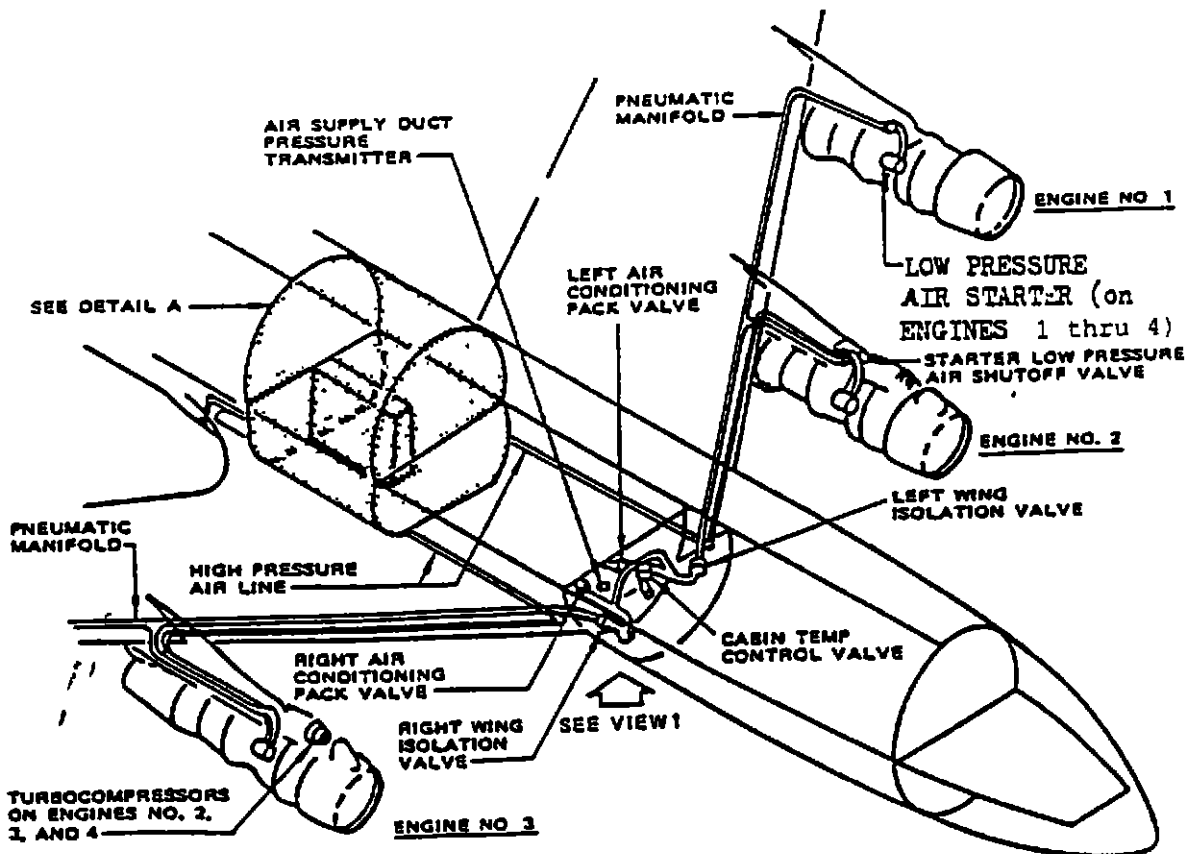
1. General

- A The starting system provides a means of rotating the N² engine compressor to an rpm range at which an engine start may be accomplished when fuel and ignition are supplied. The engines are fitted with pneumatic starters which are driven by low pressure air supplied from either an airplane self-contained source or from an external source. Each of the starters is geared to an N² engine compressor through an accessory drive gear case.
- B. The components comprising the starting system (figure 1) are
- (1) 4 low pressure air starters
 - (2) Item deleted
 - (3) Two starter air bottles (Not used)
 - (4) Two ground charging connections
 - (5) Two pressure transmitters (Not used)
 - (6) Low pressure air ground connections
 - (7) High pressure air relief valves (Not used)
 - (8) High pressure air gages (Not used)
 - (9) Valve which regulate and control the distribution of high and low pressure air and the associated plumbing (Not used)
- C All starters can be operated by low pressure air supplied through the pneumatic manifold from an operating turbocompressor, or from a low pressure air ground service cart. The cart connects to the manifold through an external pneumatic ground service connection on the right side of the fuselage forward of the wing. (See figure 1). Refer to Pneumatic System, Chapter 36, for information on turbocompressors and the pneumatic manifold. Either a low pressure or a high pressure ground start can be selected depending upon the availability of air supply at the time of a starting operation (See Figure 1) (SAB 707-80-210 Deletes high pressure starting)

- 1 HIGH PRESSURE AIR SUPPLY GROUND CONNECTION - NOT USED
- 2 STARTER AIR BOTTLE (DELETED BY SAB 707-80-210)
- 3 HIGH PRESSURE AIR REGULATING AND SHUTOFF VALVE - NOT USED
- 4 HIGH PRESSURE AIR RELIEF VALVE - NOT USED
- 5 STARTER AIR BOTTLE PRESSURE GAGE - NOT USED
- 6 HIGH PRESSURE AIR SUPPLY SOLENOID VALVE - NOT USED
- 7 STARTER AIR BOTTLE PRESSURE TRANSMITTER - NOT USED
- 8 STARTER AIR BOTTLE GROUND CHARGING VALVE - NOT USED
- 9 STARTER AIR BOTTLE ISOLATION VALVE - NOT USED
- 10 PRIORITY VALVE - NOT USED
- 11 STARTER AIR COMPRESSOR CONTROL VALVE - NOT USED

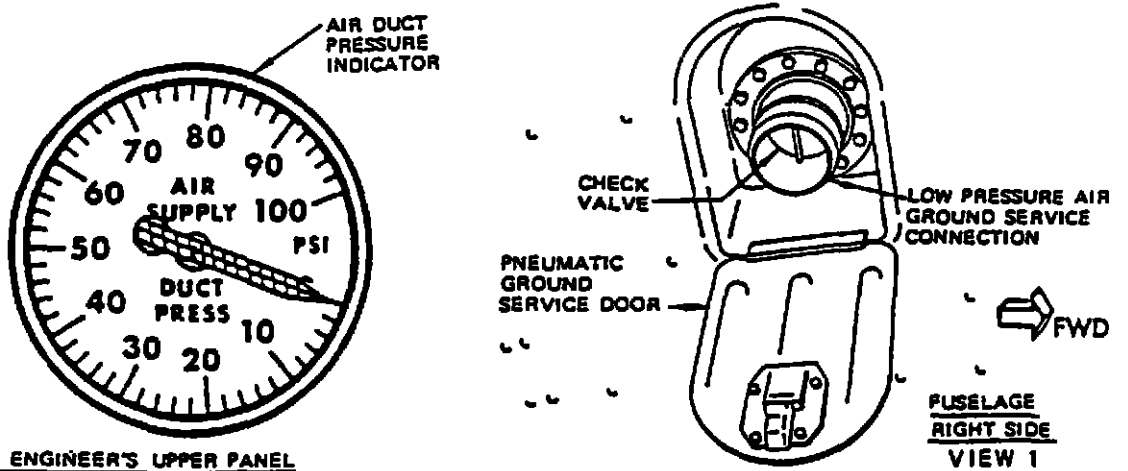
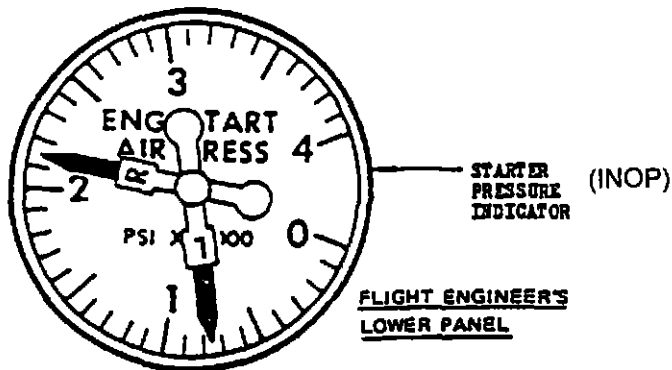
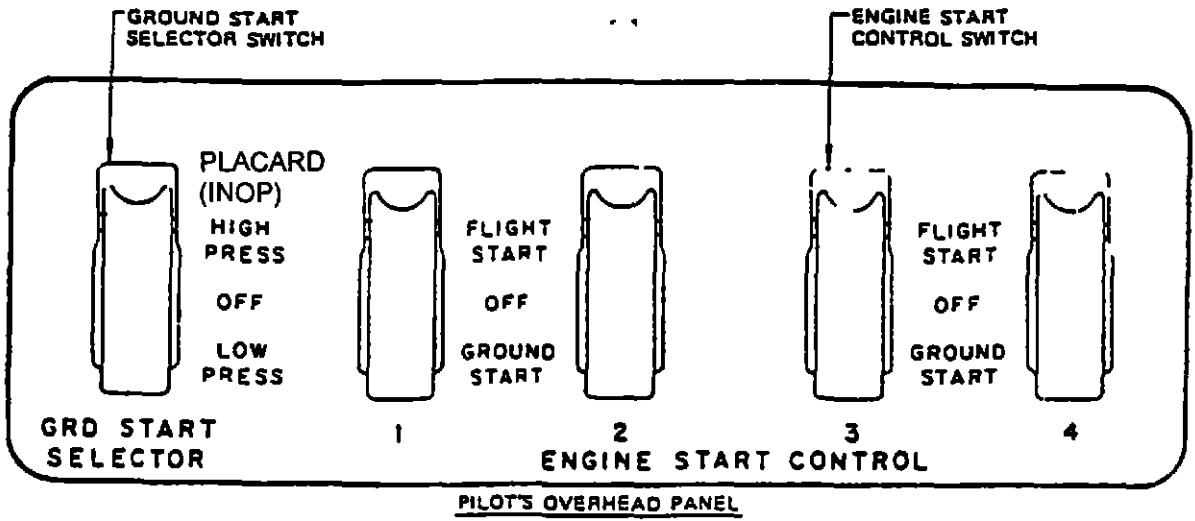


DETAIL A



Starting System Equipment Location
 Figure 1 (Sheet 1)

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2 Starter Description

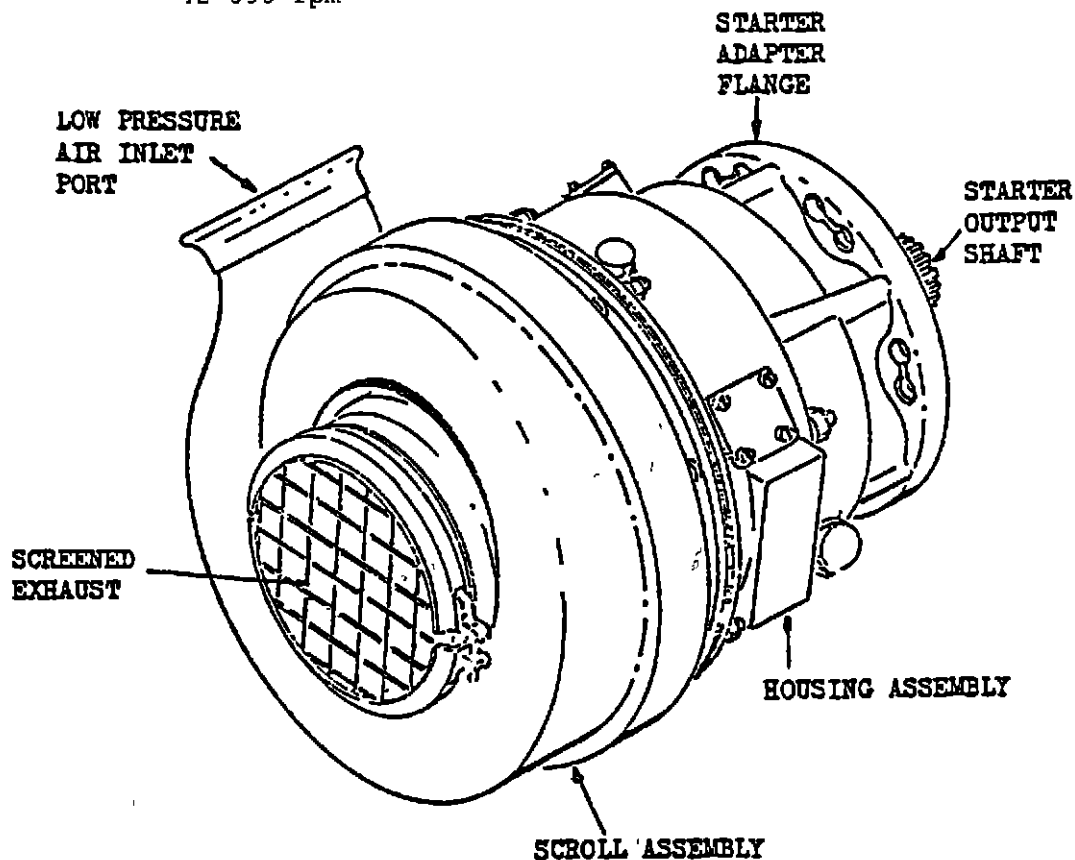
A Low Pressure Air Starter

(1) General

The pneumatic starter (figure 3A) is an air motor which converts the energy of compressed air into rotative mechanical force sufficient to accelerate the engine to starting speed. Low pressure air and electrical energy are required for starter operation. The starter accelerates the engine to starting speed and continues to assist the engine after light-off until the starter cutoff speed is attained. The starter is a lightweight, turbine-type air motor and consists of a turbine wheel assembly, a reduction gear assembly, a splined output shaft and an overrunning pawl and pawl drive engagement mechanism, all contained within scroll and housing assemblies.

(2) Reduction Gear Assembly

A reduction gear assembly contains an output shaft which serves as a shear section (See figure 3). The ratio of starter turbine and output shaft rpm's is 18.3 to 1, for example, the starter output shaft speed is 2300 rpm when the turbine is rotating at 42 090 rpm.



Typical Low Pressure Air Starter Engines N° 1 and 4

Figure 3A

STARTING
Starting System
Description and
Operation



(3) Engagement Mechanism

The engagement mechanism is a pawl and pawl drive combination which connects the reduction gear system to the starter output shaft for engine starting

(4) Deleted

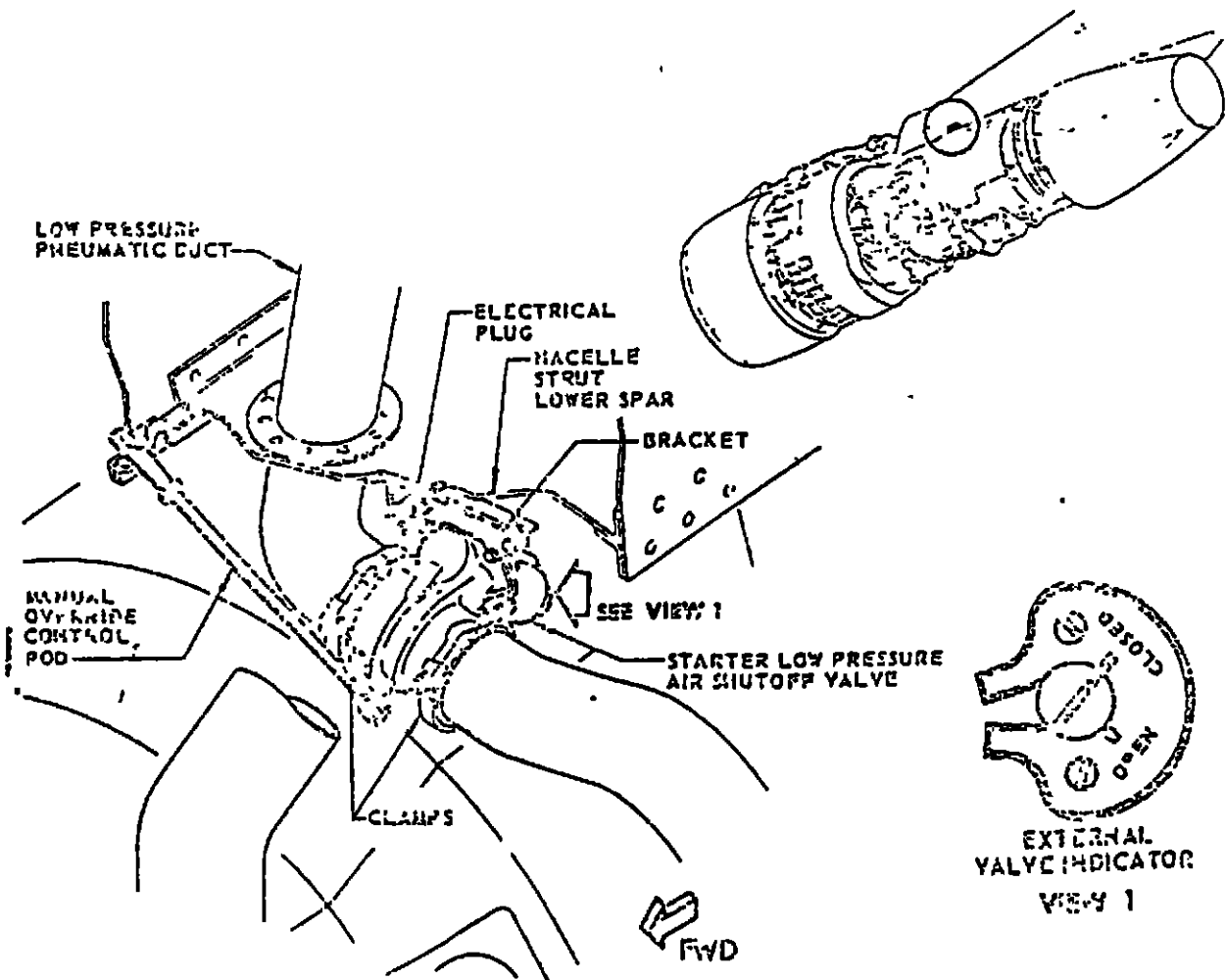
(5) Scroll Assembly

The scroll assembly encloses the turbine wheel portion of the rotating assembly, provides air inlet connection, a screened exhaust and incorporates self-contained turbine nozzle vanes. The scroll assembly is secured to the housing by means of eight bolts through a friction clamp. A heat barrier is installed between the flanges of the scroll assembly and the housing assembly. Shims placed between the heat barrier and the flange of the housing assembly provide a means for obtaining the correct clearance between the front face of the turbine wheel and the interior of the scroll assembly. The scroll assembly may be rotated about the axis of the starter to any position required to align the air inlet connection with the pneumatic duct by loosening the eight attaching nuts

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3 Starter Low Pressure Air Shutoff Valve

- A The starter low pressure air shutoff valve (figure 4) controls the air supply passing from the airplane pneumatic duct to the starter. The valve consists of a pneumatic actuator, a solenoid actuated valve control, a valve shutoff butterfly assembly, and a manual override control rod assembly.
- B The starter low pressure air shutoff valve relies on air pressure in the duct to keep it closed. When the pressure selector switch is placed to the "LOW PRESS" position and the engine start control switch to "GROUND START", the valve is held open by a solenoid. Low pressure air then passes through the valve to the starter. Should the valve fail to open electrically, the manual override is used to open the valve. A special tool is provided to operate the override control rod. The tool is strapped to the interior forward cargo door in the electrics compartment.
- C The valve is located on the underside of the nacelle strut. It is connected to the pneumatic ducts by quick release clamps.

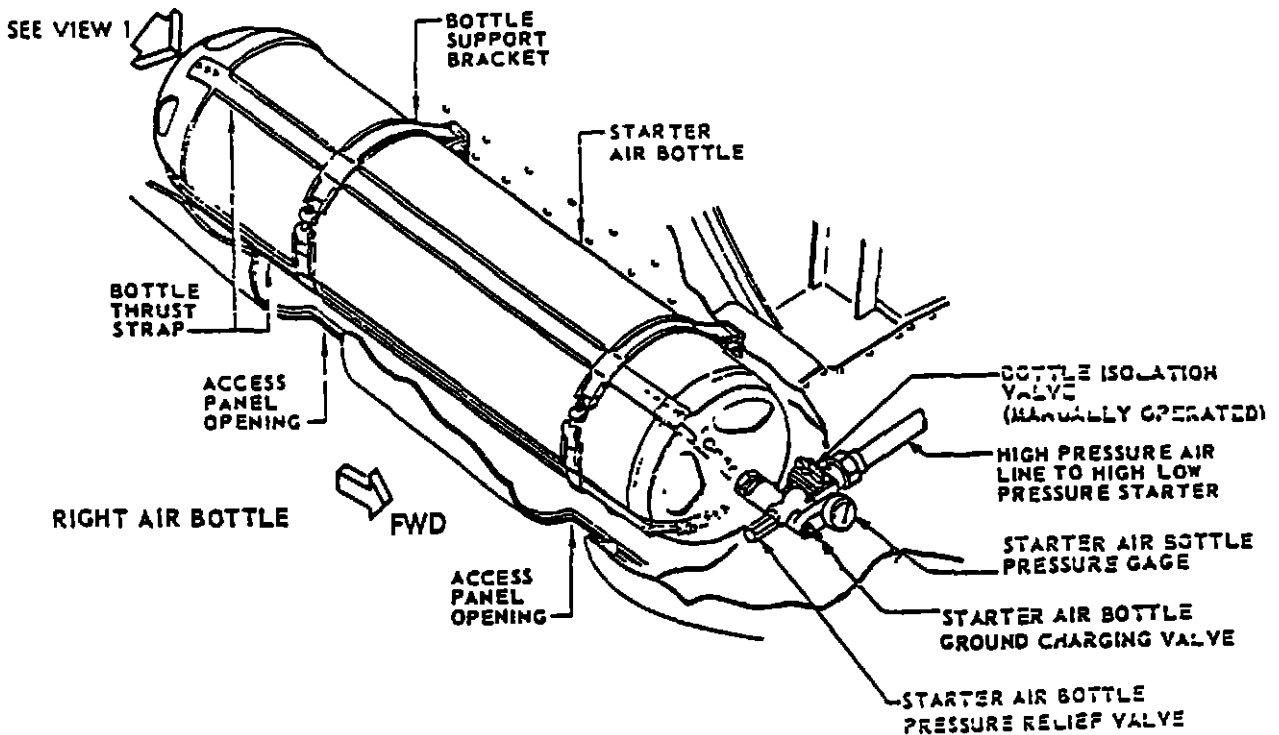
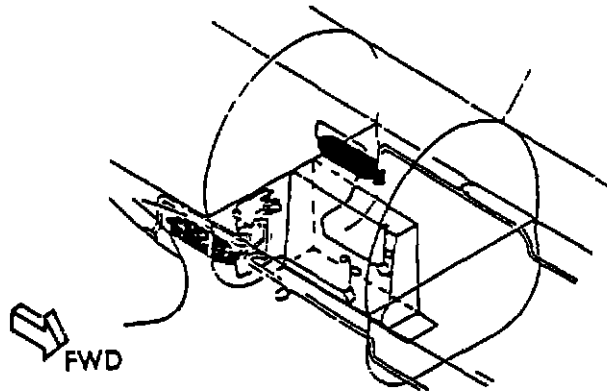
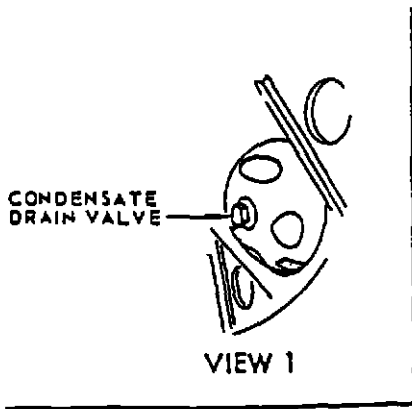


Starter Low Pressure Air Shutoff Valve
Figure 4

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4 Starter Air Bottle (NOT INSTALLED) "See SAB 707-80-210"

A Two starter air bottles are located in the main landing gear wheel well aft fairings (figure 5 and 6). The bottles are wire wrapped and are attached to the structure by forward and aft strap type clamps. The supporting clamps are provided with antichafting strips on their internal surfaces to prevent corrosion that can be caused by abrasion. The starter air bottles are charged to approximately 3100 psig through ground charging valves. Located on the aft end of each bottle is a condensate drain valve for periodic draining of accumulated moisture.





5 Starter Air Bottle Isolation Valve (Not used See SAB 707-80-210)

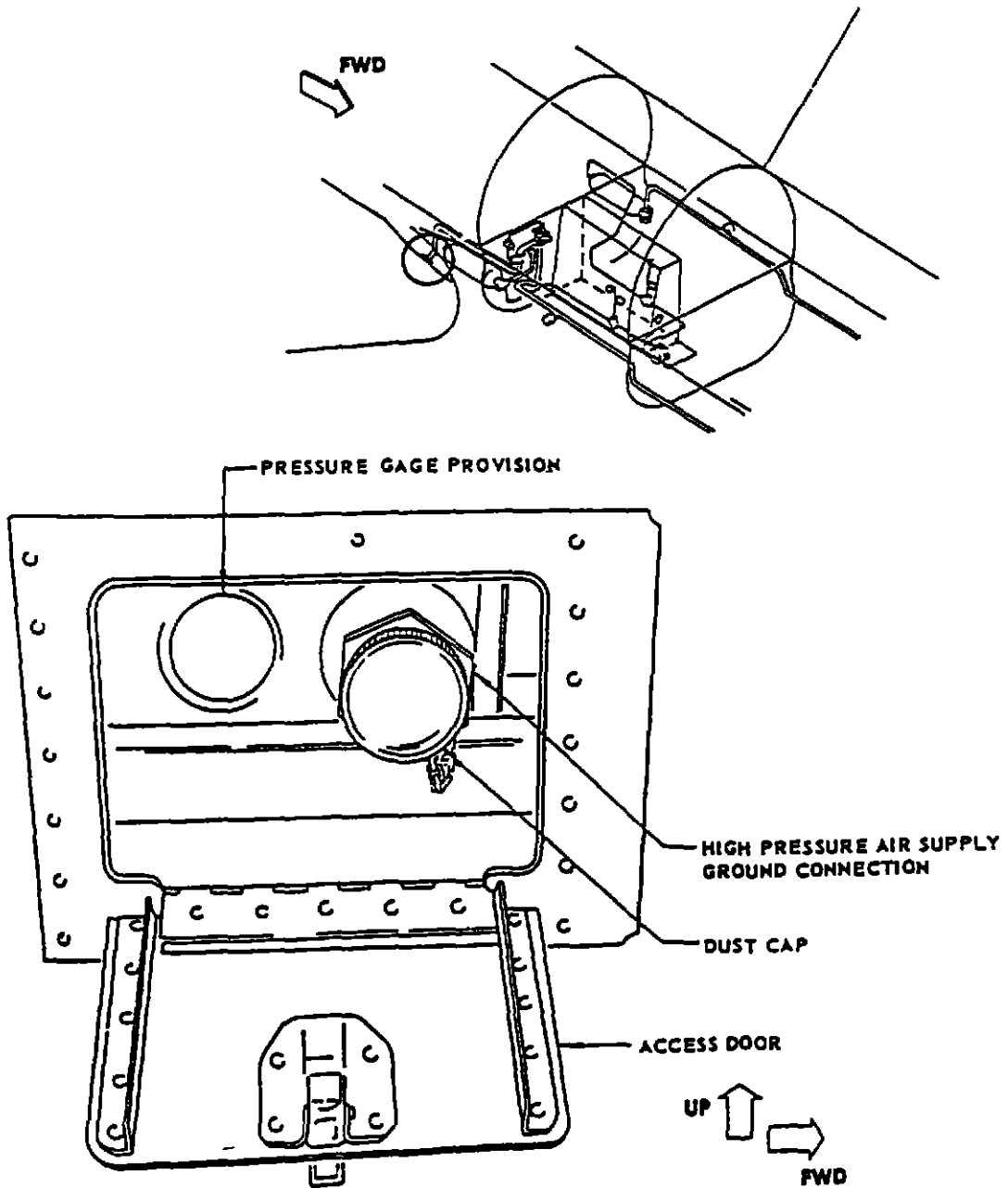
A The manually operated starter air bottle isolation valve (figure 5) is mounted on the high pressure starter air bottle in the landing gear wheel well aft fairing. With the valve in the closed position, the starter air bottle is isolated from the system and air is supplied from the high pressure air supply ground connection. In the open position, the valve incorporates the air bottle into the system. This condition allows high pressure air from a fully charged bottle to be used for high pressure starter operation.

6 Starter Air Bottle Pressure Relief Valve (Not used See SAB 707-80-210)

A Each starter air bottle is equipped with a high pressure relief valve (figure 5). The starter air bottle pressure relief valve is located on the starter air bottle isolation valve mounted on the starter high pressure air bottle. The relief valve prevents thermal build-up of excess pressure in each air bottle. The valve is set to relieve at 3450 (+/- 50) psig and to reseal at 3100 psig.

7 High Pressure Air Supply Ground Connection (Not used See SAB 707-80-210)

- A. A starter high pressure air supply ground connection (figure 7) is provided for attaching ground equipment to supply air for high pressure starting. The external high pressure air connection is located in the fuselage to fillet fairing aft section. Access to the connection is gained through a door in the fairing. A cap is provided to protect the connection when not in use.



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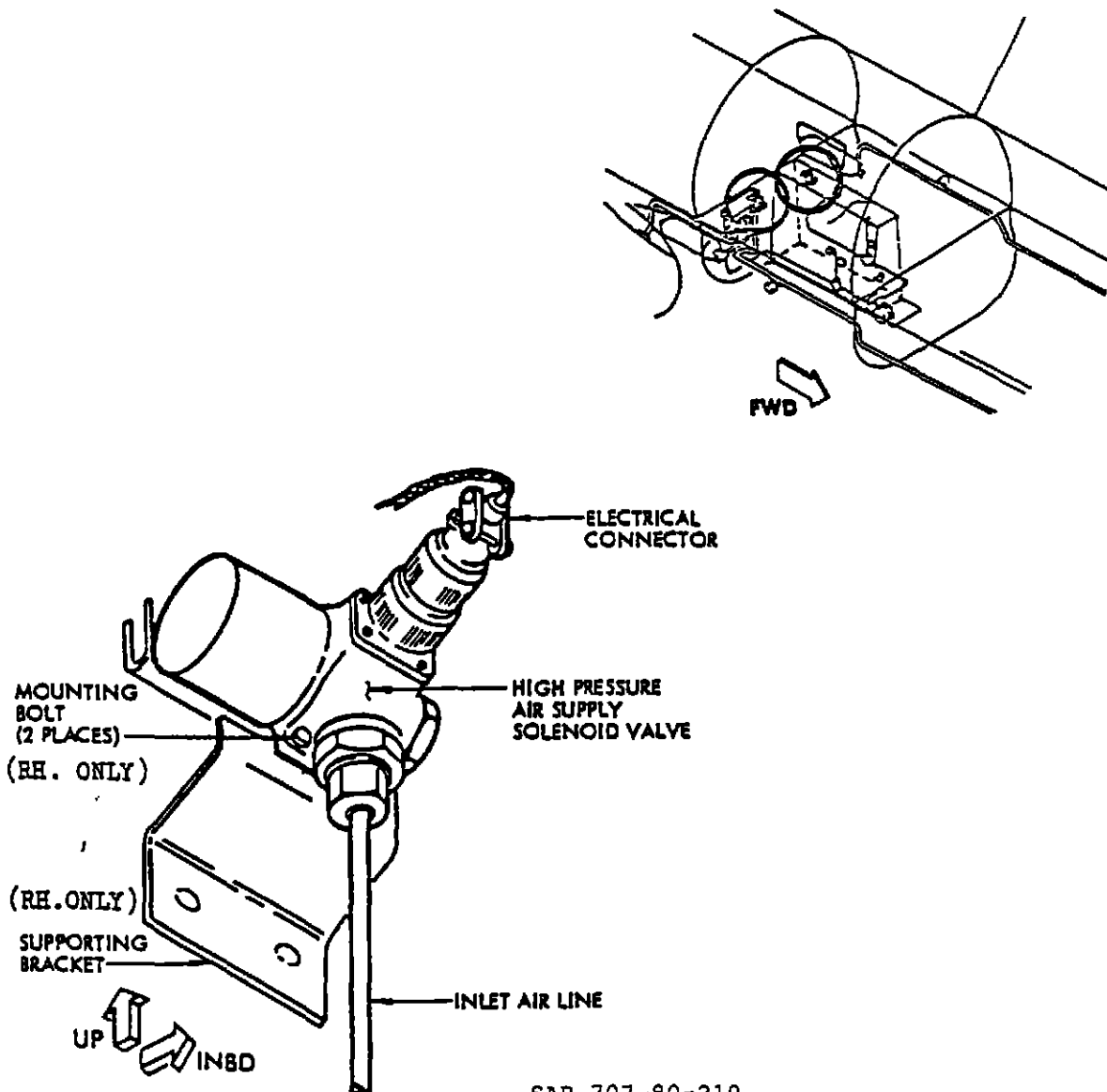
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High Pressure Air Supply Ground Connection
 Figure 7

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8 High Pressure Air Supply Solenoid Valve (Not used See SAB 707-80-210)

- A The high pressure air supply solenoid valve (figure 8) is a normally open valve that is utilized to prevent surging of the high pressure air regulating and shutoff valve when an external high pressure air source is connected. The valve is located on the main landing gear wheel well aft bulkhead and is installed in an air line connecting the piston actuator chamber of the pressure regulator to the high pressure line upstream of the regulator.
- B When a high pressure start has been selected and the engine start switch for engine N° 2 and 3 is in GROUND START the solenoid valve closes and allows the pressure regulating and shutoff valve to function properly.

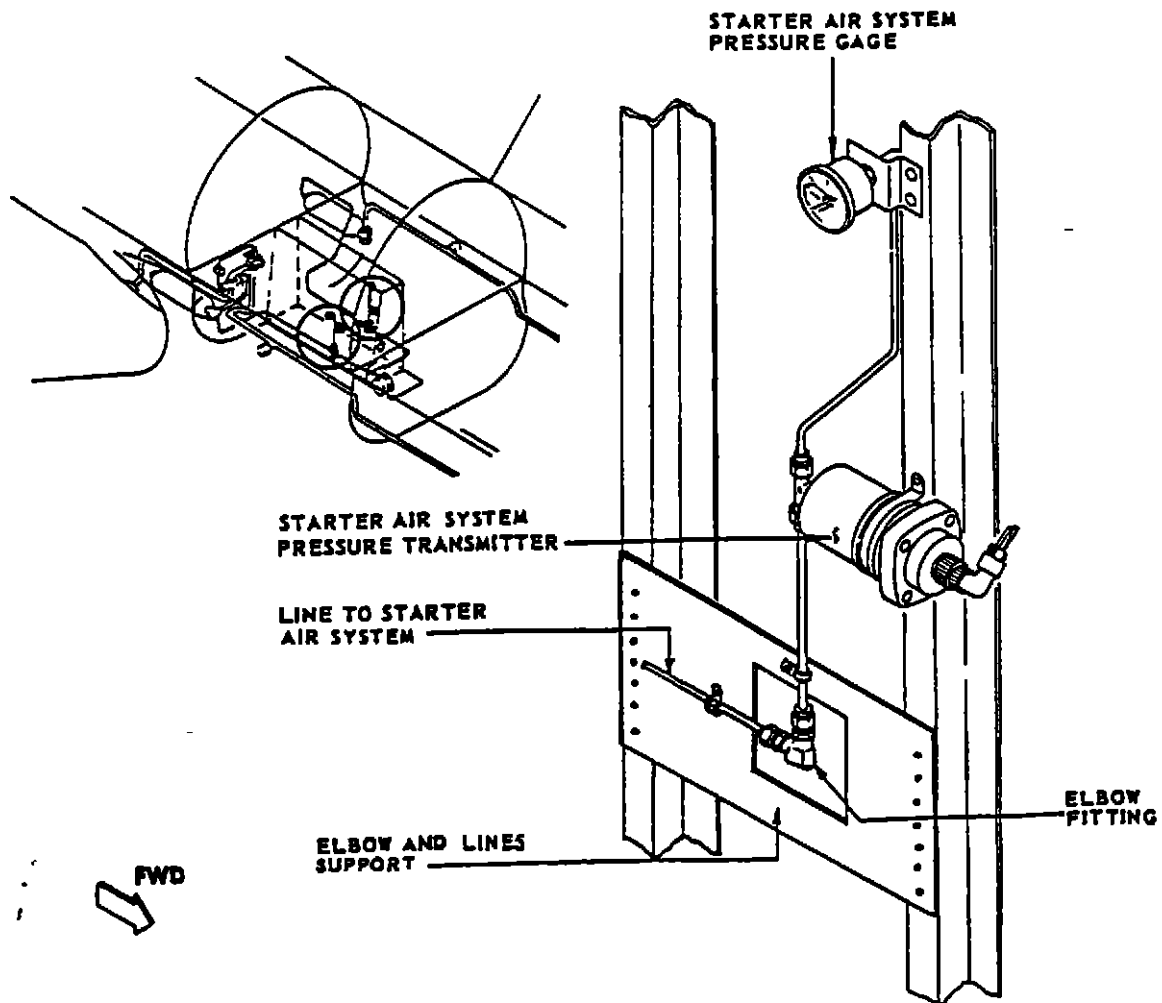


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High Pressure Air Supply Solenoid Valve
Figure 8

9 Starter Air Bottle Ground Charging Valve (Not used See SAB 707-80-210)

- A The starter air bottle ground charging connections are standard high pressure air charging valves. They are located on each cylinder head
- B Each starter air bottle ground charging valve consists of a stem, O-ring seals, and a body and nut assembly. The stem is protected from thread damage and against the entry of foreign matter by a cap. The ground charging valve is opened to admit outside source air pressure by turning the valve nut counterclockwise to a maximum of 2-1/4 turns. This unseats the valve.



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E. Low Pressure Start Using Airplane Air Source

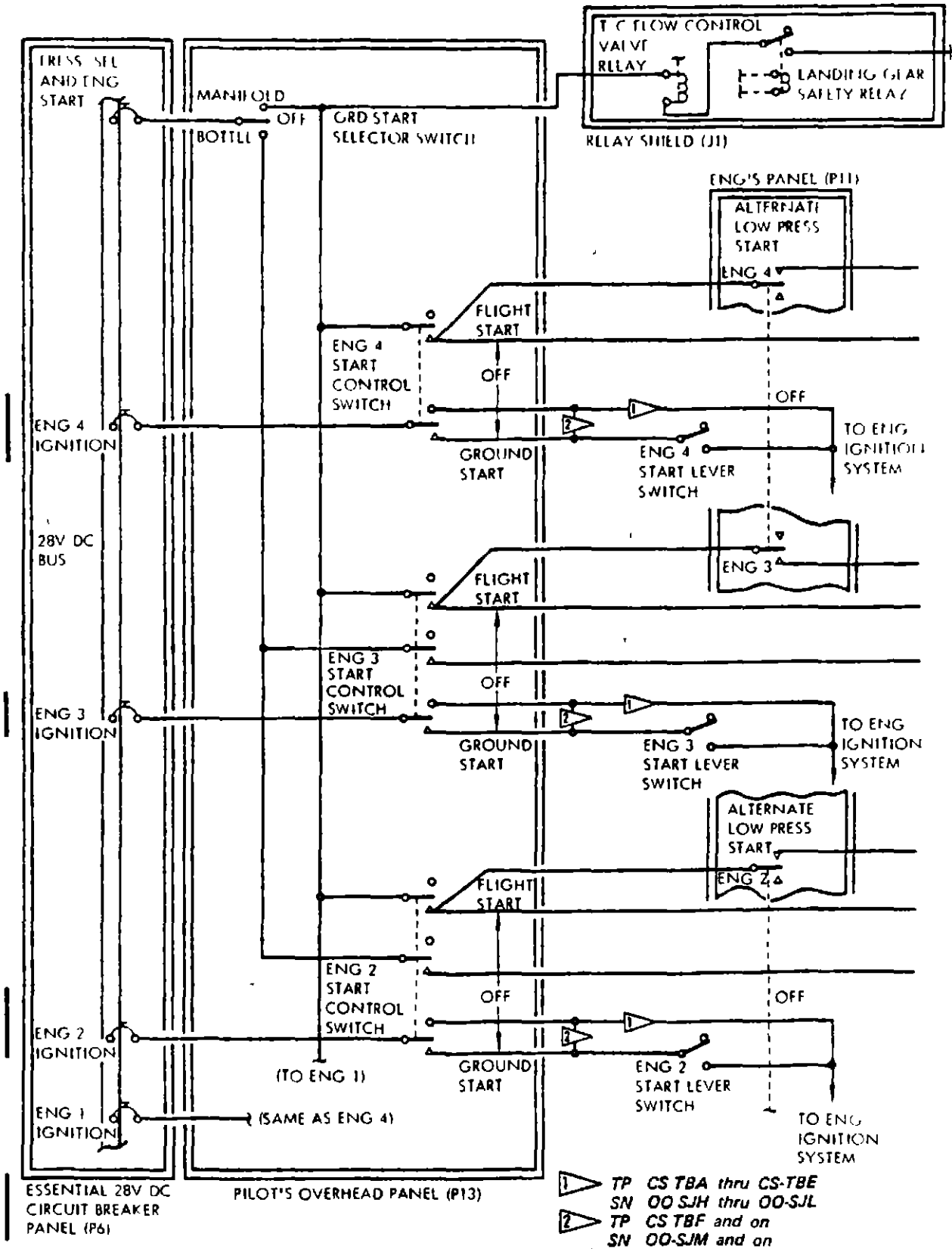
- (1) This method of starter operation is applicable to all engines, and may be accomplished in either of the two ways:
 - (a) Start using turbocompressor output requires that either engine No. 2, 3, or 4 be operating so that turbocompressor air output from the operating engine can be directed into the pneumatic manifold. To ensure an adequate supply of compressed air for cross-starting an engine, the turbocompressor will operate at a higher output when the ground start selector switch is in the "LOW PRESS" position.
 - (b) The low pressure engine bleed can also be used for cross starting engines. However, this is undesirable because a 90-95% N2 rpm is required on operating engines to develop adequate pressure for starting another engine.
- (2) Control and operation are the same as for a low pressure start using external air source

F. High Pressure Start Using External Air Source

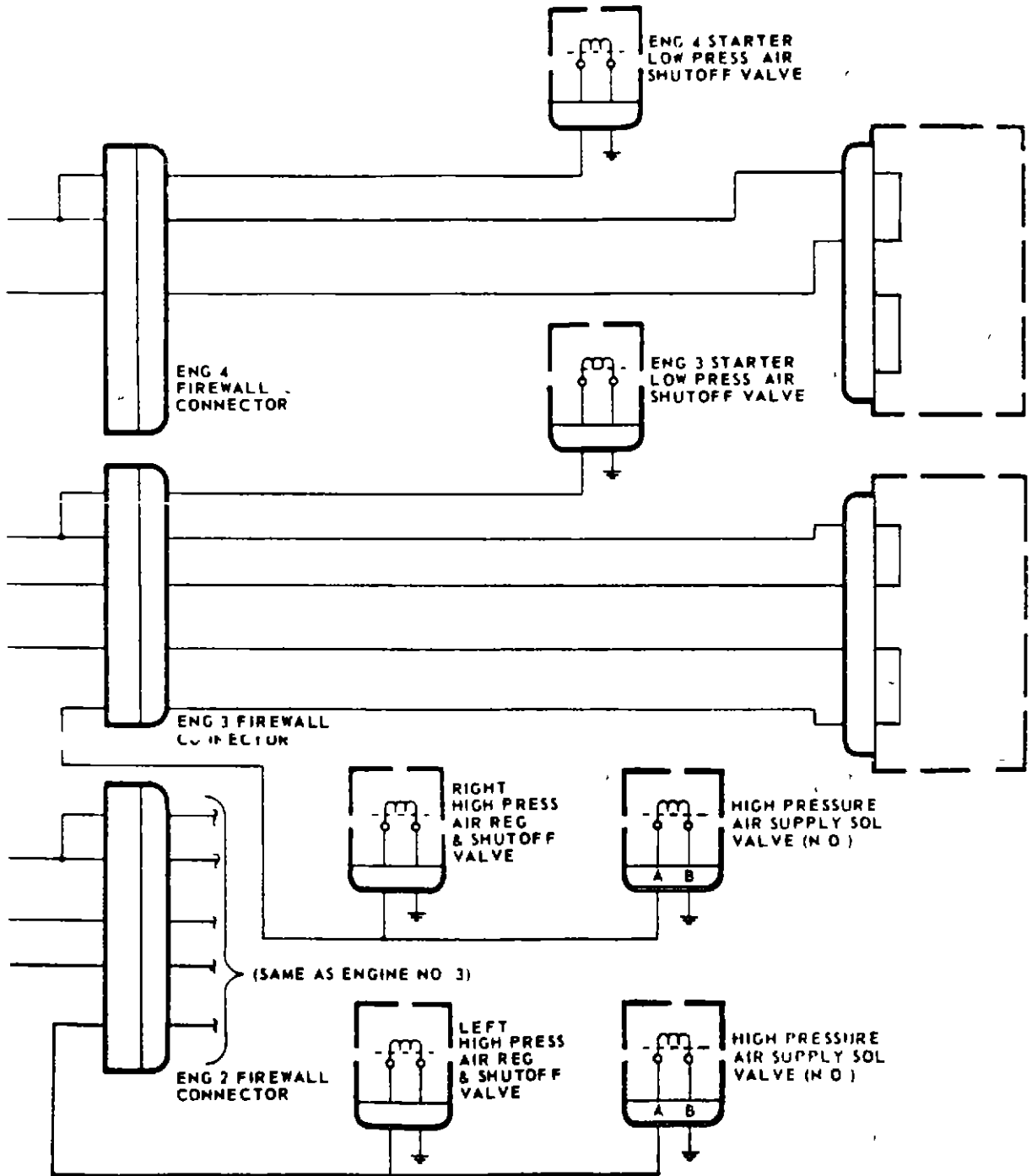
- (1) This method of starter operation is applicable only to engine No. 3, and is dependent upon having a 3000 psig air supply connected to the high pressure air supply ground connection. The starter air bottle isolation valve must be maintained in the closed position. (See figure 15.)
- (2) With engine No. 3 start control switch positioned to "GROUND START" and the ground start selector switch in the "HIGH PRESS" position, 28-volt d-c power is provided to actuate the high pressure air regulating and shutoff valve and to close the high pressure air supply solenoid valve. The proper operation of these components causes high pressure air to be directed to the high pressure scroll of the high/low pressure air starter.
- (3) When the starter output shaft reaches 2300 to 2500 rpm (33 to 37% N2 rpm), the "GROUND START" switch should be released to "OFF" position, cutting off power to the high pressure air supply solenoid valve and the high pressure air regulating and shutoff valve, terminating the action of these components and thus the starting operation. (See figure 14).

CAUTION: ENGINE N2 RPM SHOULD BE MONITORED CLOSELY TO PREVENT OVERSPEEDING THE STARTER WHICH CAN SEVERELY DAMAGE THE UNIT.

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Starting System Circuit
Figure 14 (Sheet 1)



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Starting System Circuit
 Figure 14 (Sheet 2)



STARTER LOW PRESSURE AIR SHUTOFF VALVE WITH MANUAL OVERRIDE

HIGH PRESSURE AIR REGULATING AND SHUTOFF VALVE

HIGH PRESSURE AIR RELIEF VALVE

MOTOR DRIVEN SHUTOFF VALVE

STARTER AIR BOTTLE GROUND CHARGING VALVE



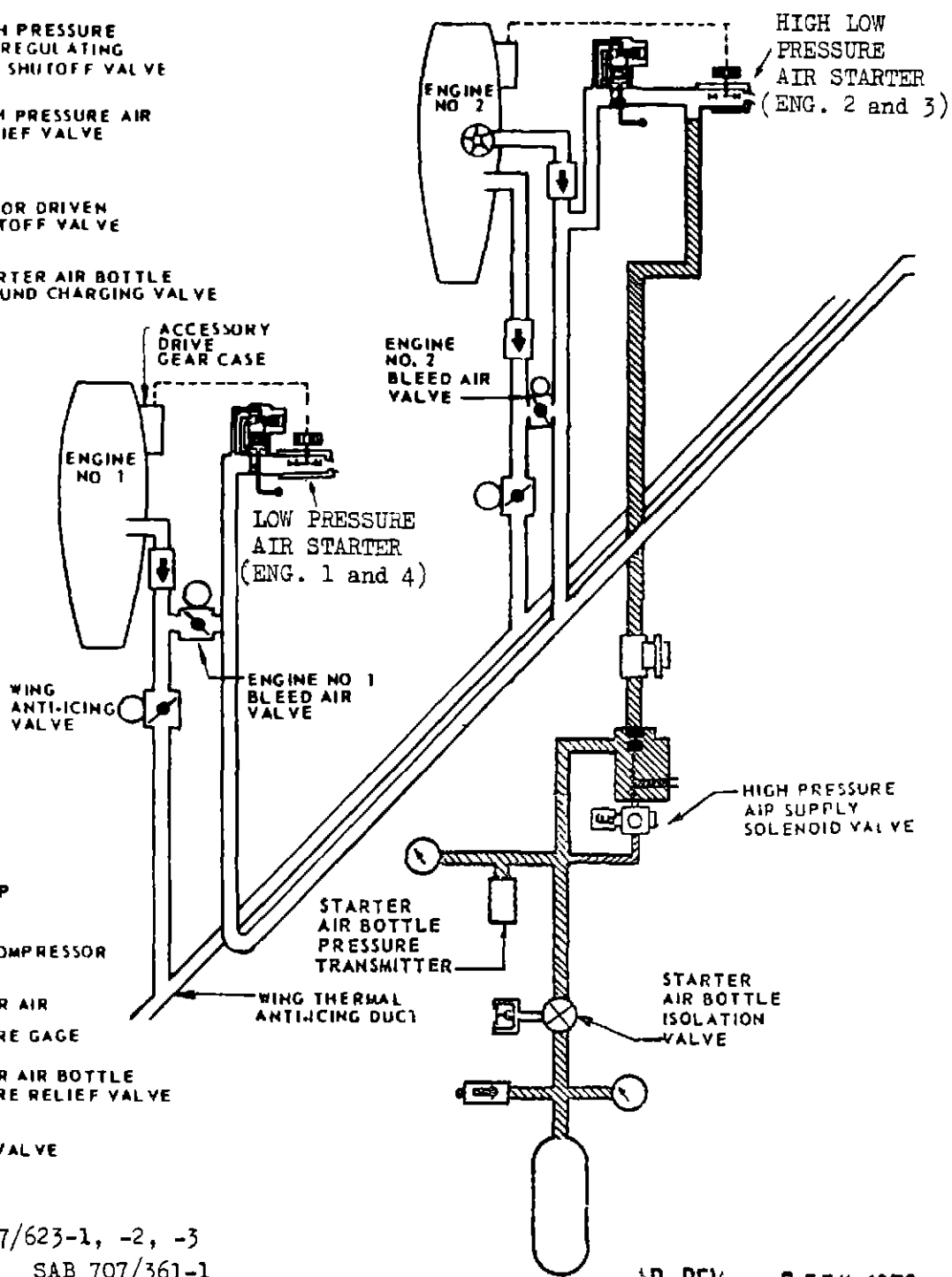
LINE CAP

TURBOCOMPRESSOR

STARTER AIR BOTTLE PRESSURE GAGE

STARTER AIR BOTTLE PRESSURE RELIEF VALVE

CHECK VALVE

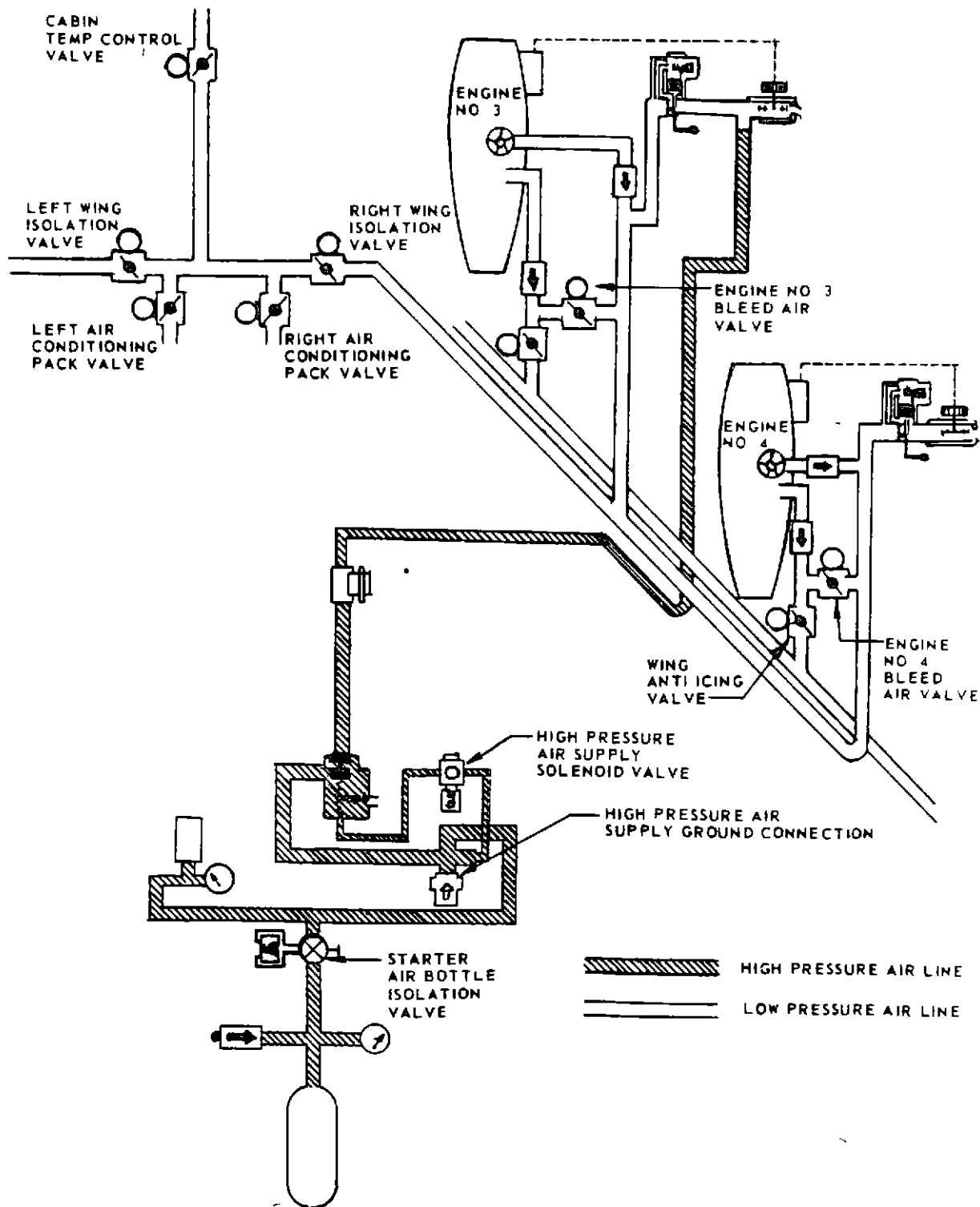


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Starting System Flow Diagram
 Figure 15 (Sheet 1)

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Starting System Flow Diagram
 Figure 15 (Sheet 2)

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G. High Pressure Start Using Airplane-Contained Air Source

- (1) This method of starter operation is applicable to engines No. 2 and 3, and is dependent upon having the starter air bottles charged to 3000 psig. The left bottle supplies air to the starter on engine No. 2, and the right bottle supplies air to the starter on engine No. 3. The starter air bottle isolation valve must be in the open position when starting engine.
- (2) Control and operation are the same as for the high pressure start using external air source.



TURBOFAN



STARTING SYSTEM - TROUBLE SHOOTING

1. Trouble Shooting Low Pressure (Manifold) Start

A. General

- (1) The ability of an air starter to successfully start an engine is dependent upon the airplane pneumatic system being properly pressurized, the external electrical power connected to the airplane, and the engines serviced and in good operating condition. Other procedures preparatory to the initiation of a normal engine start must also be observed.

B. Pneumatic System

- (1) A sufficient flow of air must be available from either a low pressure air ground service cart or from an engine driven turbocompressor. To pressurize the pneumatic manifold, the air supplied to the starter must meet the following conditions:

Maximum Air Temperature	475°F
Air Pressure Limits	22 to 46 psig
Minimum Air Delivery at 22 psig	90 lbs/min

- (2) The left and right air conditioning pack shutoff valves must be closed. (See Chapter 21, "Air Conditioning.")
- (3) The left and right wing isolation valves must be open. (See Chapter 36, "Pneumatic System.")

NOTE: Before attempting an engine start, sufficient time should be allowed for movement of the isolation and pack valves to be completed.

C. Electrical

- (1) External electrical power, 115/200 volt, 3-phase, ac, should be supplied to the airplane.
- (2) The applicable circuit breakers must be closed. Refer to 80-1-0, "Adjustment/Test Starting System."

D. Engine

- (1) The engine inlet must be clear of ice and the engine compressors must be free to rotate.
- (2) The engine fuel and ignition systems must be operating properly.
- (3) The N2 tachometer and other engine indicating instruments must be operating correctly.

2 Low Pressure Starting System Trouble Shooting Chart

With adequate low pressure air supplied, (See 81-1-0) attempt a low pressure start.* IF -

N₂ COMPRESSOR DOES NOT ATTAIN 10% RPM WITHIN 8 TO 14 SECONDS

*** WARNING.**

Observe starter for exhaust air and low pressure air shutoff valve position.

IF RPM'S EXCEED 38% ON THE N₂ TACHOMETER DURING THESE TESTS, SHUT DOWN THE STARTER AIR SUPPLY IMMEDIATELY.

VALVE IS CLOSED (NO AIR FLOW) - Remove electrical connector and test for 28V D-C voltage drop from pin A to pin B (B is grounded). IF -

28V DC VOLTAGE DROP EXISTS. Replace valve.

28V DC DROP DOES NOT EXIST. Check the circuit segments and repair as necessary.

VALVE OPEN AND STARTER OPERATES BUT FAILS TO ROTATE N₂ COMPRESSOR

VALVE OPEN (AIR FLOWS FROM EXHAUST) BUT N₂ COMPRESSOR ROTATES TOO SLOWLY - Check for foreign material in scroll assembly and turbine that may be causing binding. IF -

NOT OK - Remove foreign material.

OK - Replace starter. If N₂ compressor still rotates too slowly, check engine per Chapter 72.

Check for failed starter drive shaft. IF -

NOT OK - Replace starter drive shaft.

OK - Replace starter.

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CONTINUED FROM
PRECEDING PAGE

N₂ COMPRESSOR ATTAINS
12% RPM BUT ENGINE DOES
NOT "LIGHT UP" WITHIN
20 SECONDS AFTER
ATTAINMENT

Make audible check of
ignitors per chapter 74.
IF -

IGNITION NOT OK
Troubleshoot ignition
system per chapter 74
and repair as necessary.

IGNITION OK - Trouble-
shoot fuel system per
chapter 73 and repair
as necessary.

STARTER FAILS TO SHUT
DOWN AFTER COMPLETING
A NORMAL STARTING
OPERATION. (STARTER
EXHAUST CONTINUES)*

Check electrical cir-
cuitry. IF -

NOT OK - Repair or re-
place faulty components,
and replace starter.

OK - Check starter air
shutoff valve for proper
operation. IF -

NOT OK - Replace valve

OK - Replace starter.

***CAUTION:** THE STARTER MUST BE REPLACED WHEN THIS CONDITION
EXISTS, FOR IT IS POSSIBLE THAT THE STARTER TURBINE
HAS BEEN STRUCTURALLY DAMAGED BY EXCESSIVE ROTATIONAL
SPEED.

STARTING SYSTEM - MAINTENANCE PRACTICES1. Unit Servicing Starting System

A. General

- (1) Servicing of the installed starters is limited to draining and refilling, or adding oil to the lubricating oil sumps.

B. Service Starter

- (1) Equipment and Materials

- (a) Lubricating Oil, MIL-L-23699

- (2) Drain and refill starter lubricating oil sump.

- (a) Remove oil fill plug and oil drain plug and allow oil to drain completely. (See figure 2.)

WARNING: PROLONGED CONTACT OF LUBRICATING OIL WITH THE SKIN CAN CAUSE DERMATITIS, THE OIL WILL STAIN CLOTHING AND CAN SOFTEN PAINT. SKIN MUST BE THOROUGHLY WASHED AFTER CONTACT AND SATURATED CLOTHING MUST BE REMOVED IMMEDIATELY. PAINTED SURFACES ON WHICH OIL HAS BEEN SPILLED SHOULD BE CLEANED IMMEDIATELY.

- (b) Install oil drain plug and fill starter oil sump to the bottom thread of the fill port with maximum 350 cubic centimeters of lubricating oil. Install oil fill plug.

- (3) Add oil to starter lubricating oil sump.

- (a) Drain and fill starter oil sump as indicated in paragraph B.(2), using clean lubricating oil removed from starter and adding a sufficient quantity of new recommended oil to make up the total specified amount.

CAUTION: DO NOT USE DRAINED OIL IF CONTAMINATED WITH FOREIGN MATERIAL OR METAL PARTICLES.

SOME OILS ARE NOT COMPATIBLE WHEN MIXED. UNLESS COMPATIBILITY IS ASSURED, DO NOT MIX BRAND NAME OILS.

NOTE. The drained oil may be reused prior to oil change time if it is free of foreign material and metal particles.

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2. Adjustment/Test Starting System

A. General

- (1) Testing the starting system consists of testing the low pressure air starters, the high/low pressure air starters, and low pressure air shutoff valves using low pressure air; then testing the high/low pressure air starter and the associated high pressure air components using high pressure air.

B. Equipment and Materials

- (1) Ground Low Pressure Source, Boeing Turbine Compressor Model 502-11B or equivalent. The following output limits shall apply:

Maximum Air Outlet Temperature	475°F
Maximum Air Outlet Pressure	46 psig
Minimum Delivery at 22 psig	90 lbs/min

- (2) High pressure air source (3000 psig)
- (3) Ground electrical power 115/200 volt, 3-phase ac

C. Test Low Pressure and High/Low Pressure Air Starter Using Low Pressure Air

- (1) Ground airplane to an approved grounding lug. Refer to Chapter 13, "Static Grounding."
- (2) On airplanes fitted with rotary type start control switches, check that switches are off.
- (3) Connect electrical power to external power receptacle, and connect pneumatic ground cart to ground service connection.
- (4) Check that "PRESS SELECTOR & ENG START" circuit breaker and applicable engine "IGNITION" and "ENGINE IGNITORS" circuit breakers on circuit breaker panel P6 are closed.
- (5) Check that air conditioning pack shutoff valves and engine bleed air valves are closed, and that left and right wing isolation valves are open. Refer to Chapter 21, "Air Conditioning," and Chapter 36, "Pneumatic System."
- (6) With pneumatic ground cart operating and ground start selector switch in "LOW PRESS" position, place engine start control switch in "GROUND START" position. Starter low pressure air shutoff valve shall open and starter shall motor engine.
- (7) Continue with normal start procedure. Refer to Chapter 71, "Power Plant - General."
- (8) At 33 to 37% N2 rpm, the "GROUND START" switch must be released to "OFF" position, causing starter low pressure air shutoff valve to close and terminate starting operation.

CAUTION: ENGINE N2 RPM SHOULD BE MONITORED CLOSELY TO PREVENT
OVERSPEEDING THE STARTER WHICH CAN SEVERELY DAMAGE
THE UNIT.



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- (9) Place engine start control switch to "OFF" position
- (10) Shut down engine Refer to Chapter 71, "Power Plant - General"
- (11) Test other starters in same manner
- (12) Determine whether there is any further need for electrical power and/or low pressure air on airplane, if not, remove external power and/or pneumatic ground cart

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E Test Low Pressure Air Shutoff Valve Manual Override (when fitted)

- (1) Ground airplane to an approved grounding lug Refer to Chapter 13, "STATIC GROUNDING"
- (2) Connect pneumatic ground cart to ground service connection
- (3) Pull applicable engine "IGNITION" circuit breaker on circuit breaker panel P6
- (4) Check that air conditioning pack shutoff valves and engine bleed air valves are closed, and that left and right wing isolation valves are open Refer to Chapter 21, "Air Conditioning", and Chapter 36 "Pneumatic System"
- (5) With pneumatic ground cart operating, actuate low pressure air shutoff valve override linkage with manual override operating tool

NOTE Pressure must be maintained on override tool to hold valve open against closing force supplied by valve actuator

- (6) Observe that engine rotation reaches at least 10% N2 rpm

CAUTION · OBSERVE STARTER MOTORING DUTY CYCLE OF 2 MINUTES (MAXIMUM) ON, 5 MINUTES OFF.

- (7) Discontinue motoring by slowly relaxing pressure on manual override tool (Permit valve to close)
- (8) Close applicable engine "IGNITION" circuit breaker
- (9) Test other low pressure air shutoff valves in same manner
- (10) Determine whether there is any further need for low pressure air on airplane, if not, remove pneumatic ground cart



MAINTENANCE MANUAL

F. Test High/Low Pressure Air Starter Using High Pressure Air (Engines No. 2 and 3)

- (1) Ground airplane to an approved grounding lug. Refer to Chapter 13, Static Grounding.
- (2) Connect external electrical power to airplane.
- (3) On airplanes fitted with rotary type start control switches, check that the switches are OFF
- (4) Check that PRESS SELECTOR & ENG START circuit breaker and applicable engine IGNITION and ENG IGNITORS circuit breakers on circuit breaker panel P6 are closed.
- (5) Connect high pressure air supply to high pressure air supply ground connection (engine No. 3 only), or use high pressure air from starter air bottle.

NOTE: A fully charged starter air bottle must be used for checking starter performance.

Starter air bottle isolation valve must be in closed position when external air supply is used; isolation valve must be in open position when starter air bottle is used.

- (6) With ground start selector switch in HIGH PRESS position, place engine start control switch to GROUND START position.
- (7) Continue with normal start procedure. Refer to Chapter 71, Power Plant
- (8) At 33 to 37% N2 rpm, the "GROUND START" switch must be released to "OFF" position, causing high pressure air regulating and shutoff valve to close and terminate starting operation.

CAUTION: ENGINE N2 RPM SHOULD BE MONITORED CLOSELY TO PREVENT OVERSPEEDING THE STARTER WHICH CAN SEVERELY DAMAGE THE UNIT.

- (9) Place engine start control switch to "OFF" position.
- (10) Shut down engine. Refer to Chapter 71, Power Plant.
- (11) Determine whether there is any further need for electrical power on airplane, if not, remove external power.



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STARTER LOW PRESSURE AIR SHUTOFF VALVE -
MAINTENANCE PRACTICES

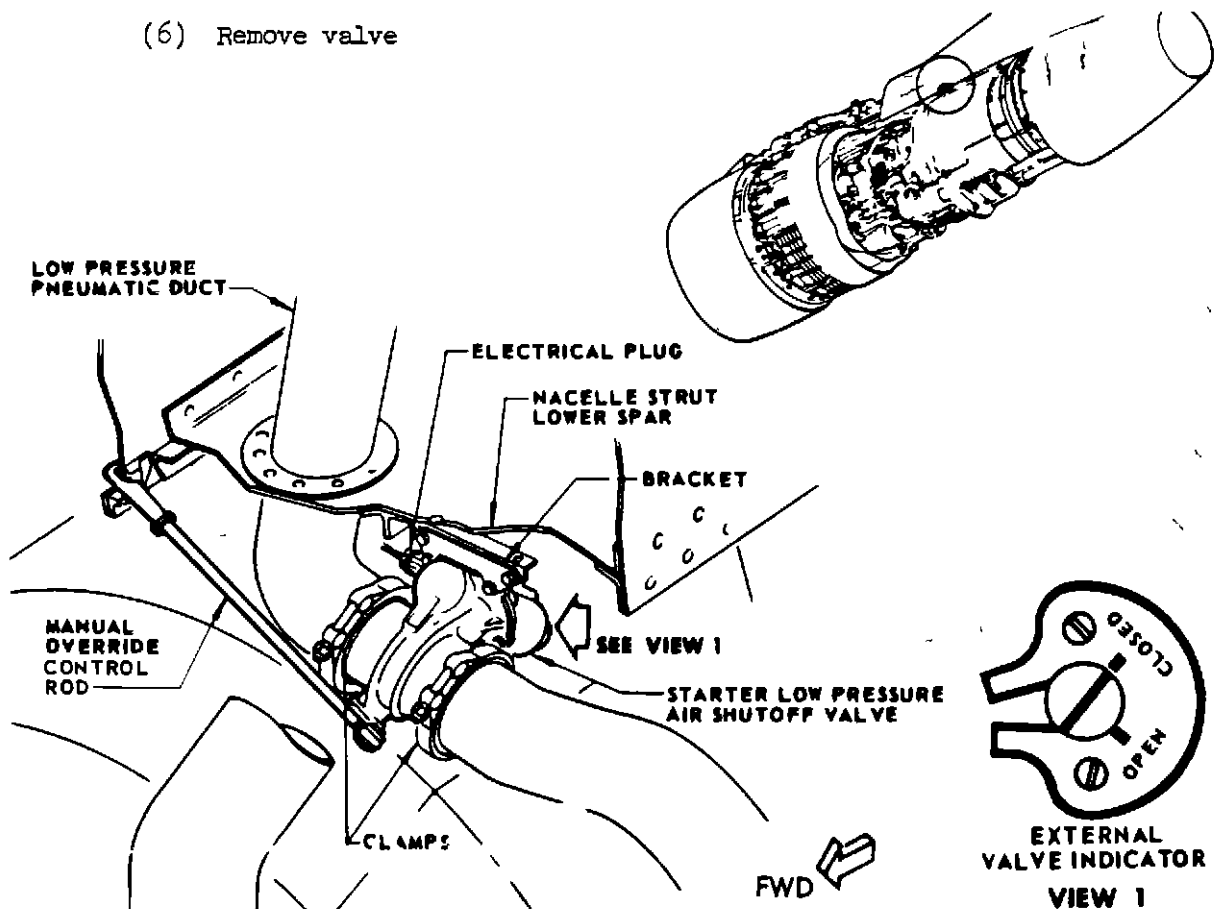
EFFECTIVITY

TURBOFAN

1. Removal/Installation Starter Low Pressure Air Shutoff Valve

A. Remove Starter Low Pressure Air Shutoff Valve (See figure 201.)

- (1) Open left side cowl panel
- (2) Disconnect electrical plug.
- (3) Disconnect and remove manual override control rod from valve body.
- (4) Remove upper two bolts freeing the valve from the nacelle strut bracket.
- (5) Open clamps holding starter low pressure air shutoff valve to low pressure pneumatic duct.
- (6) Remove valve



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MAINTENANCE MANUAL

B. Install Starter Low Pressure Air Shutoff Valve (See figure 201.)

- (1) Prior to valve installation check that valve butterfly is in the closed position.
- (2) With valve bolt holes aligned with support bracket holes, connect valve to low pressure pneumatic duct with clamps, but do not tighten clamps.
- (3) Install bolts that hold air shutoff valve to nacelle strut bracket and tighten clamps.
- (4) Connect manual override control rod to low pressure air shutoff valve.
- (5) Connect electrical plug to electrical receptacle on starter low pressure air shutoff valve.
- (6) Check external valve indicator to ensure that valve is in closed position.
- (7) Close left side cowl panel.

EFFECTIVITY

TURBOFAN



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LOW PRESSURE AIR STARTER - MAINTENANCE PRACTICES

1. Unit Servicing Low Pressure Air Starter

A. General

- (1) After removal from the airplane, the low pressure air starter must be preserved for shipment or storage. It is necessary also, to depreserve a replacement starter prior to installation.

B. Equipment and Materials

- (1) Lubricating Oil, MIL-L-7808, or P&WA Specification No. 521 (See P&WA Service Bulletin No. 238.)
- (2) Corrosion Preventive Compound, MIL-C-8188, Grade A

C. Preservation of Low Pressure Air Starter

- (1) Drain all lubricating oil from the starter oil sump by removing the oil fill and drain plugs and allowing starter oil sump to drain completely. (See figure 202.)
- (2) Install oil drain plug and refill starter oil sump using approximately 150 cubic centimeters of corrosion preventive compound, MIL-C-8188, Grade A. Install oil fill plug.
- (3) Rotate the starter slowly in all directions so that all internal surfaces are thoroughly coated with corrosion preventive compound. Manually turn the starter output shaft several revolutions in both directions.
- (4) Drain all corrosion preventive compound from the starter by removing the oil fill and drain plugs.
- (5) Install starter oil fill and drain plugs.
- (6) Cover all openings and connections on the unit with protective plugs or covers and wipe all oil, grease, or dirt from all external surfaces.

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D. Depreservation of Low Pressure Air Starter

CAUTION A REPLACEMENT STARTER MUST BE DEPRESERVED BEFORE BEING PLACED IN OPERATION.

- (1) Remove oil fill plug and fill starter sump with lubricating oil. (See figure 202.)

WARNING: Prolonged contact of MIL L-7808 oil with the skin may cause dermatitis, the oil will stain clothing and may soften paint. Skin must be thoroughly washed after contact and saturated clothing must be removed immediately. Painted surfaces on which oil has been spilled should be cleaned immediately.

- (2) Install oil fill plug and rotate starter in all directions so that all internal surfaces are thoroughly coated with oil.
- (3) Remove oil fill and drain plugs and allow starter oil sump to drain completely. Starter must be held in horizontal position with drain hole down for complete draining.
- (4) Install oil drain plug.
- (5) Fill starter oil sump with 350 cubic centimeters of lubricating oil.

CAUTION: UNLESS COMPATIBILITY IS ASSURED, DO NOT MIX BRAND NAME OILS. DO NOT REFILL STARTER OIL SUMP WITH OIL USED TO FLUSH OUT THE CORROSION PREVENTIVE COMPOUND.

- (6) Install oil fill plug.

2. Removal/Installation Low Pressure Air Starter

A. Equipment and Materials

- (1) Lubricating Grease, MIL-L-3545

B. Remove Low Pressure Air Starter (See figure 202.)

- (1) Open engine cowl side panels.

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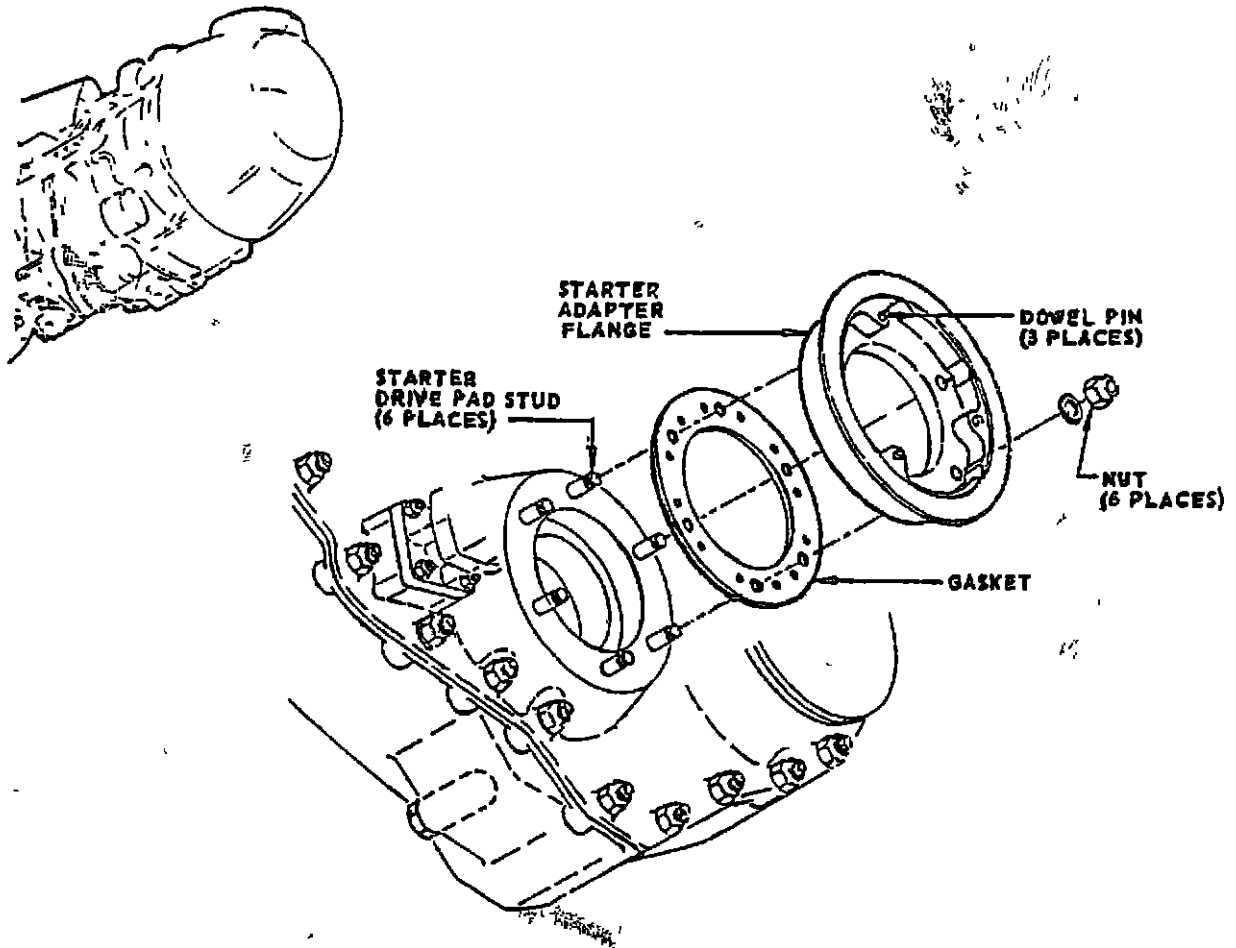
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- (2) Loosen clamp connecting low pressure air inlet port to low pressure pneumatic duct.
- (3) Open clamp attaching starter to starter adapter flange and remove starter from engine accessory drive gear case.
- (4) If adapter flange is to be removed from the accessory drive gear case, remove six mounting nuts and washers holding adapter flange to gear case. (See figure 201.)



Starter Adapter Flange
Figure 201

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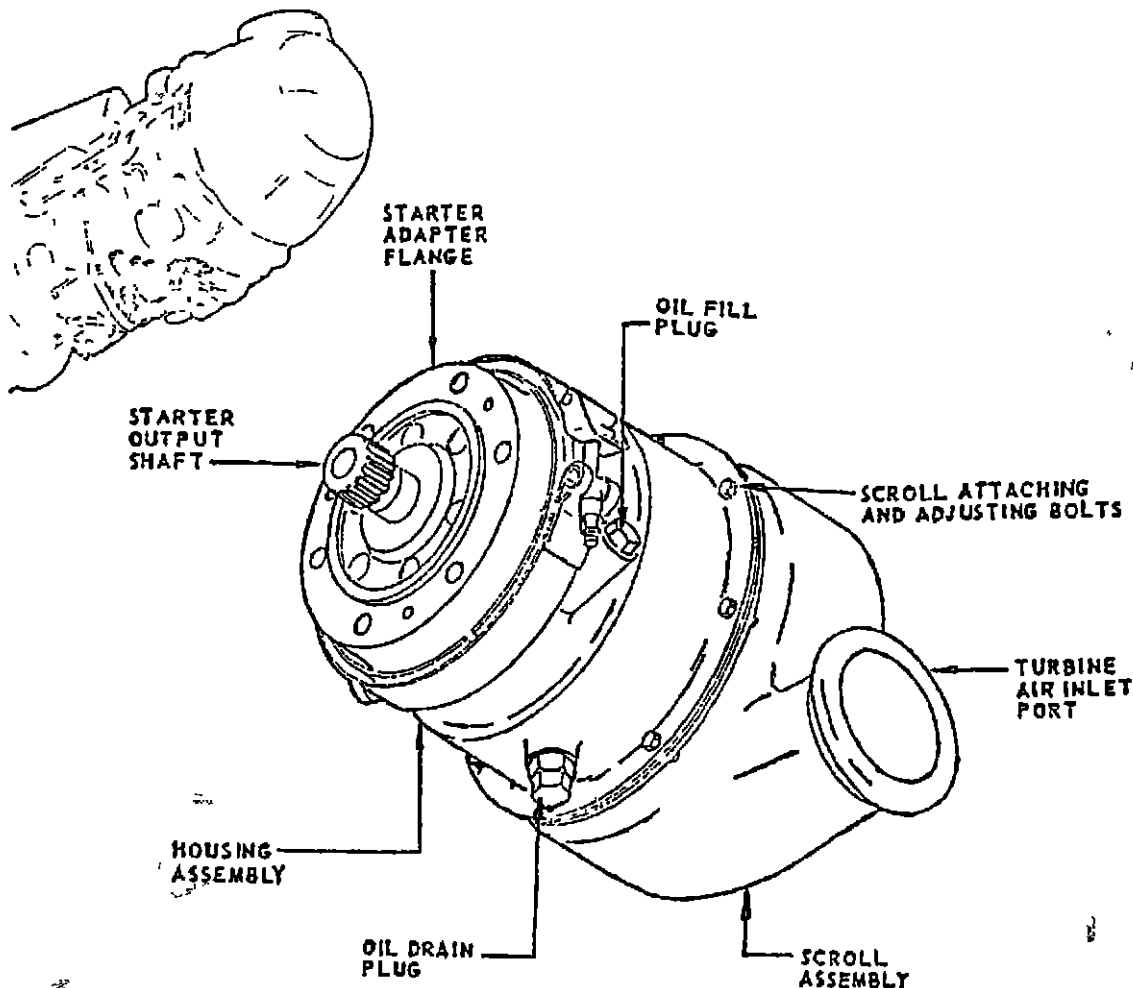
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C. Install Low Pressure Air Starter (See figures 201 and 202.)

- (1) Depreserve starter and remove all shipping plugs, covers and caps from starter.
- (2) Install gasket on engine starter drive pad of accessory drive gear case before attaching starter adapter flange. (See figure 201.)
- (3) Position starter adapter flange on drive pad studs so that one dowel pin is located in six o'clock position. Attach flange to drive pad with six nuts and washers and tighten securely.
- (4) Place starter in a position relative to engine drive gear case which will result in positioning oil drain plug at lowest possible point and still provide accessibility to either of the two oil fill plugs. (See figure 202.)



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Pneumatic Starter Installation

Figure 202

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EFFECTIVITY

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- (5) Ascertain whether starter scroll assembly should be repositioned on housing assembly to align starter scroll inlet with pneumatic duct.

NOTE: The scroll assembly may be rotated about the axis of the starter to any position necessary to facilitate connection to the pneumatic duct.

- (6) If necessary to reposition scroll assembly, loosen eight nuts securing scroll clamping flange to starter housing assembly, rotate scroll assembly as necessary and tighten nuts to a torque of 35 to 45 pound-inches. (See figure 2, 80-0.)
- (7) Coat starter output shaft splines with lubricant MIL-L-3545 and attach starter to flange using starter mounting clamp (6, figure 202). Tighten nut to torque of 40 to 50 pound-inches.

CAUTION: MAKE CERTAIN THAT SPLINES OF STARTER OUTPUT SHAFT ARE PROPERLY ENGAGED WITH COUPLING ON ENGINE DRIVE PAD.

- (8) Clamp low pressure pneumatic duct to low pressure air inlet port.
- (9) Test operation of installed starter. Refer to " Test Low Pressure and High/Low Pressure Air Starter, " 80-1-0.
- (10) Close engine cowl side panels.

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HIGH/LOW PRESSURE AIR STARTER - MAINTENANCE PRACTICES1 Unit Servicing High/Low Pressure Air Starter

A. General

- (1) After removal from the airplane, the high/low pressure air starter must be preserved for shipment or storage. It is necessary also, to deprime a replacement starter prior to installation.

B. Equipment and Materials

- (1) Lubricating Oil, MIL-L-7808, or P&WA Specification No 521 (See P&WA Service Bulletin No 238.)
- (2) Corrosion Preventive Compound, MIL-C-8188, Grade A

C. Preservation of High/Low Pressure Air Starter

- (1) Drain all lubricating oil from the starter oil sump by removing the oil fill and drain plugs and allowing starter oil sump to drain completely. (See figure 202.)
- (2) Install oil drain plug and refill starter oil sump using approximately 150 cubic centimeters of corrosion preventive compound, MIL-C-8188, Grade A. Install oil fill plug.
- (3) Rotate the starter slowly in all directions so that all internal surfaces are thoroughly coated with corrosion preventive compound. Manually turn the starter output shaft several revolutions in both directions.
- (4) Drain all corrosion preventive compound from the starter by removing the oil fill and drain plugs.
- (5) Install starter oil fill and drain plugs.
- (6) Cover all openings and connections on the unit with protective plugs or covers and wipe all oil, grease, or dirt from all external surfaces.

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D. Depreservation of High/Low Pressure Air Starter

CAUTION: A REPLACEMENT STARTER MUST BE DEPRESERVED BEFORE BEING PLACED IN OPERATION.

- (1) Remove oil fill plug and fill starter sump with approximately 350 cubic centimeters of lubricating oil. (See figure 202.)

WARNING: PROLONGED CONTACT OF LUBRICATING OIL WITH THE SKIN CAN CAUSE DERMATITIS, THE OIL WILL STAIN CLOTHING AND CAN SOFTEN PAINT. SKIN MUST BE THOROUGHLY WASHED AFTER CONTACT AND SATURATED CLOTHING MUST BE REMOVED IMMEDIATELY. PAINTED SURFACES ON WHICH OIL HAS BEEN SPILLED SHOULD BE CLEANED IMMEDIATELY.

- (2) Install oil fill plug and rotate starter in all directions so that all internal surfaces are thoroughly coated with oil.
- (3) Remove oil fill and drain plugs and allow starter oil sump to drain completely. Starter must be held in horizontal position with drain hole down for complete draining.
- (4) Install oil drain plug.
- (5) Fill starter oil sump with 350 cubic centimeters of lubricating oil.

CAUTION: UNLESS COMPATIBILITY IS ASSURED, DO NOT MIX BRAND NAME OILS. DO NOT REFILL STARTER OIL SUMP WITH OIL USED TO FLUSH OUT THE CORROSION PREVENTIVE COMPOUND.

- (6) Install oil fill plug.

2. Removal/Installation High/Low Pressure Air Starter

A. Equipment and Materials

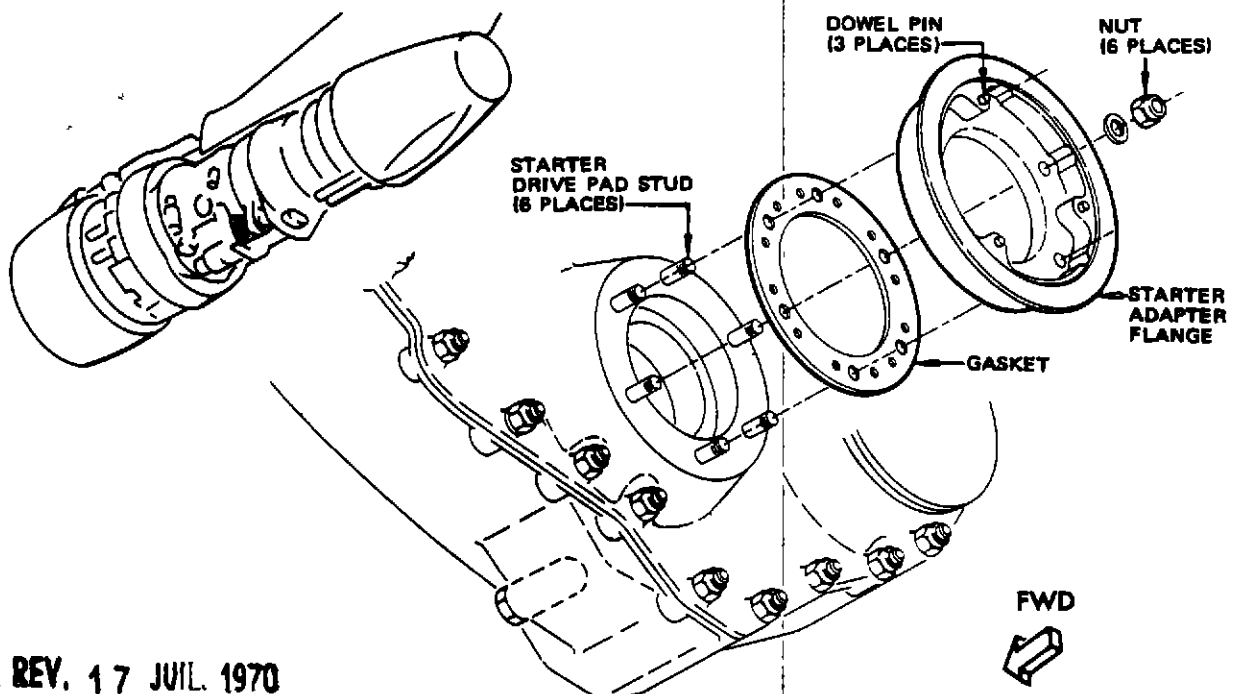
- (1) Lubricating Grease, MIL-G-3545

B. Remove High/Low Pressure Air Starter (See figure 202.)

- (1) Open engine cowl side panels.
- (2) Disconnect starter electrical plug from starter.

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- (3) Disconnect high pressure air inlet line
 - (4) Loosen clamp connecting low pressure air inlet port to low pressure pneumatic duct.
 - (5) Open clamp attaching starter to starter adapter flange and remove starter from engine accessory drive gear case.
 - (6) If adapter flange is to be removed from the accessory drive gear case, remove six mounting nuts and washers holding adapter flange to gear case. (See figure 201.)
- C. Install High/Low Pressure Air Starter (See figures 201 and 202)
- (1) Depreserve starter and remove all shipping plugs, covers, and caps from starter.
 - (2) Install gasket on engine starter pad of the accessory drive gear case before attaching starter adapter flange. (See figure 201)
 - (3) Position the starter adapter flange with one of the dowel pins between the bottom two studs and attach flange to accessory drive gear case with six nuts and washers and tighten securely. (See figure 201.)



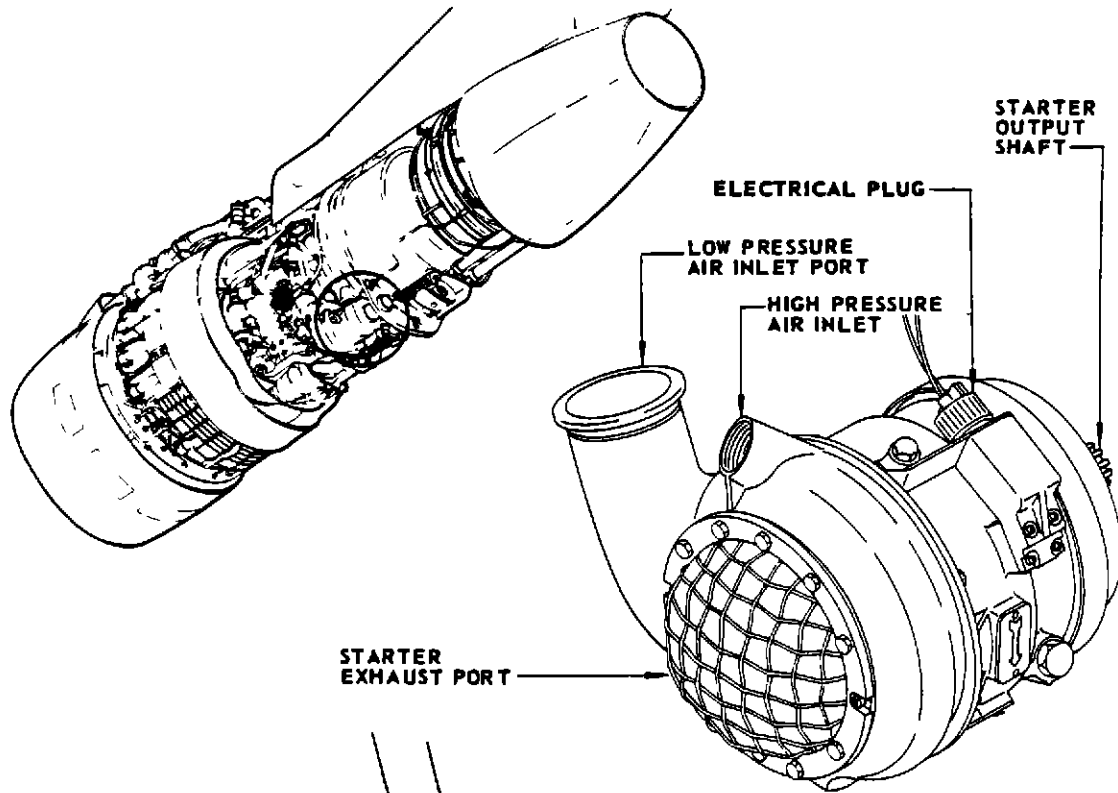
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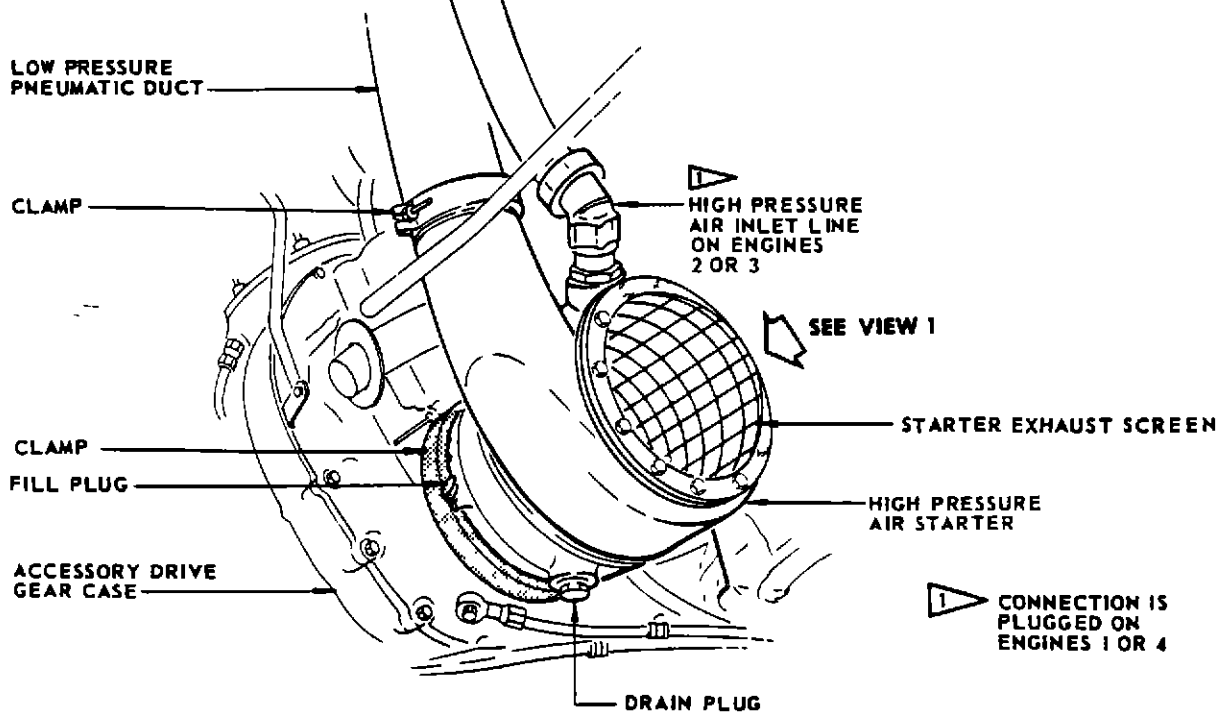
Starter Adapter Flange Installation
 Figure 201

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VIEW 1



**High Pressure Air Starter Installation
 Figure 202**



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(4) Determine a position for the starter in relation to the engine drive gear case, which will position the oil drain plug at the lowest possible point and still provide accessibility to the electrical connections and either of the two oil fill plugs. (See figure 202.)

(5) Coat starter output shaft splines with lubricant, MIL-G-3545 and attach starter to the adapter flange using starter mounting clamp. Tighten nut to torque of 40-50 pound-inches.

CAUTION: MAKE CERTAIN THAT SPLINES OF THE STARTER OUTPUT SHAFT ARE PROPERLY ENGAGED WITH THE COUPLING IN THE ENGINE ACCESSORY DRIVE GEAR CASE.

(6) Clamp low pressure pneumatic duct to low pressure air inlet port.

(7) Connect air line to high pressure air inlet.

(8) Connect electrical plug on starter unit.

(9) Test operation of high pressure air starter. Refer to Test High/Low Pressure Air Starter, 80-1-0.

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MAINTENANCE MANUAL

STARTER AIR BOTTLE - MAINTENANCE PRACTICES

EFFECTIVITY

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1. Unit Servicing Starter Air Bottle

WARNING. HIGH PRESSURE AIR TRAPPED IN THE SYSTEM, EVEN IN A SHORT LINE, CAN BE FATAL IF EXPELLED RAPIDLY.

A. General

- (1) Servicing of the starter air bottle is limited to the periodic draining of accumulated moisture.

B. Drain Starter Air Bottle

- (1) Remove access panel R1162 or L1162 in aft wing fuselage fairing. Refer to Chapter 12, Access Doors and Panels.
- (2) Slowly open drain valve by turning counterclockwise to a maximum of two turns.

WARNING: DO NOT LOOSEN DRAIN FITTING VALVE MORE THAN TWO TURNS. VALVE MAY BE BLOWN FROM BOTTLE.

KEEP FACE AND HANDS FROM VALVE OPENING. AIR AND WATER ARE EXPELLED WITH CONSIDERABLE FORCE.

- (3) After water has been drained, close valve and tighten nut to a torque of 80 pound-inches.
- (4) Install access panel.

2. Removal/Installation Starter Air Bottles

WARNING: HIGH PRESSURE AIR TRAPPED IN THE SYSTEM, EVEN IN A SHORT LINE, CAN BE FATAL IF EXPELLED RAPIDLY.

A. Equipment and Materials

- (1) Downlock, Main Landing Gear Door - F71127 or equivalent

B. Remove Starter Air Bottle (See figure 201)

- (1) Open main landing gear wheel well door and place door ground release handle in down and latched position.



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- (2) Install main landing gear door downlock.
- (3) Remove starter air bottle fitting access panel 842. Refer to Chapter 12, Access Doors and Panels
- (4) Close manually starter air bottle isolation valve.
- (5) Let high pressure air escape by actuating the high pressure starting system.
- (6) Disconnect high pressure air line from starter air bottle isolation valve.
- (7) Remove air bottle support access panels R1160, R1161 and R1162. Refer to Chapter 12, Access Doors and Panels.
- (8) Loosen the two bottle support clamps and remove bottle through forward access opening.
- (9) Plug air line unless a new bottle is to be immediately installed.

C. Install Starter Air Bottle (See figure 201)

- (1) Slip starter air bottle into the two bottle support clamps and position air bottle so that ports on valves and fittings line up with air lines.

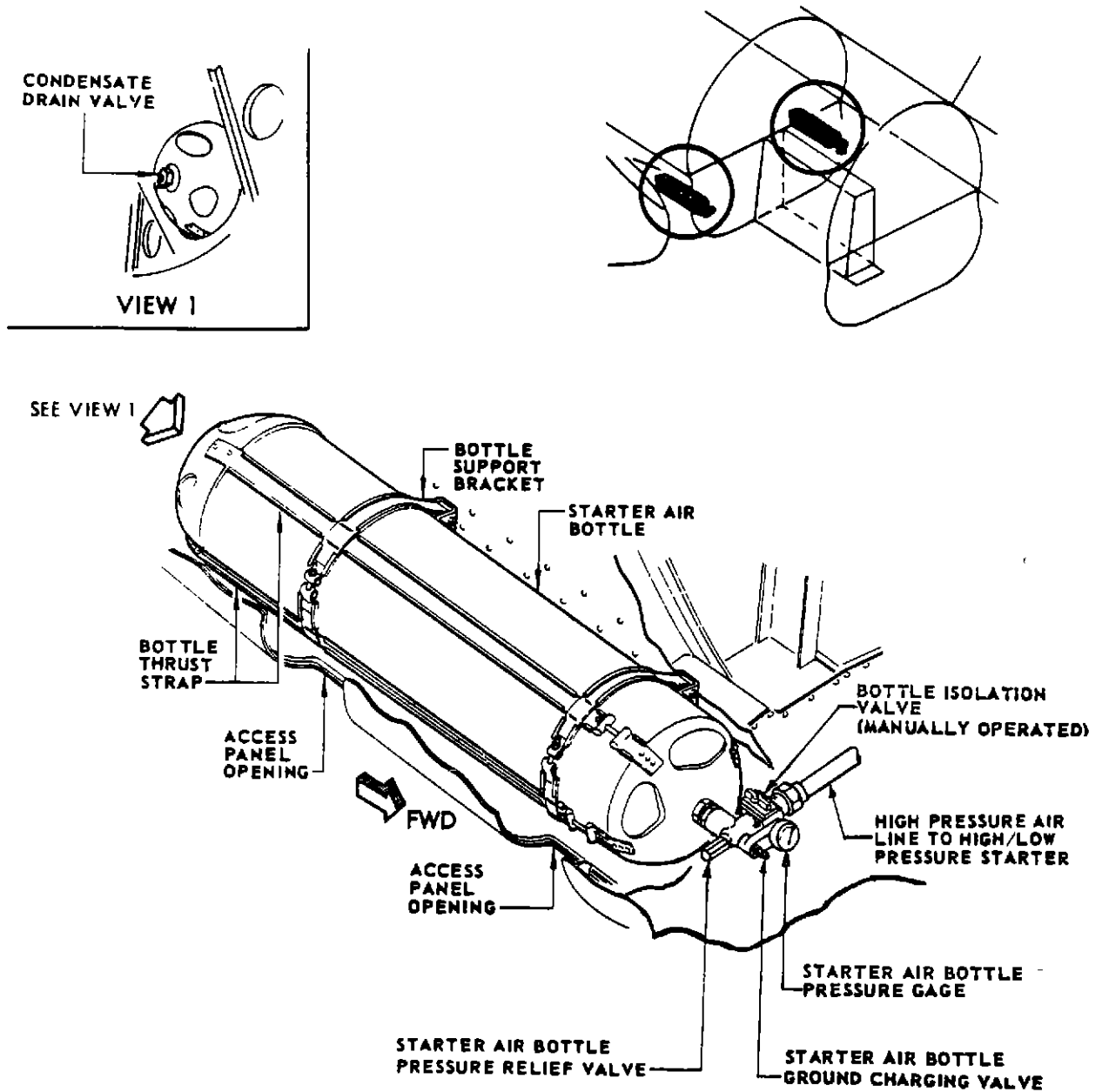
- (2) Tighten support clamps until bottle is held in position.

NOTE Do not apply final torque on clamp bolts. Bottle may have to be repositioned.

- (3) Remove plug from air line and connect high pressure air line to starter air bottle isolation valve.
- (4) Tighten bottle support clamp bolts and torque nuts from 20 to 30 pound-inches.

NOTE: On a full bottle charged to 3000 psig the support clamp should be torqued from 50 to 70 pound-inches.

- (5) Recharge starter air bottle. Refer to Chapter 12, Air and Nitrogen Servicing
- (6) Check lines for leaks under pressure.
- (7) Remove main landing gear door downlock.
- (8) Close right main landing gear wheel well door and install access panels 842, R1160, R1161 and R1162.



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Starter Air Bottle Installation
 Figure 201

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MAINTENANCE MANUAL

HIGH PRESSURE AIR REGULATING AND SHUTOFF VALVE - "NOT USED"

MAINTENANCE PRACTICES

EFFECTIVITY

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1 Removal/Installation High Pressure Air Regulating and Shutoff Valve (NOT USED)

WARNING · HIGH PRESSURE AIR TRAPPED IN THE SYSTEM, EVEN IN A SHORT LINE, CAN BE FATAL IF EXPELLED RAPIDLY.

A Equipment and Materials

- (1) Downlock, Main Landing Gear Door - F71127 or equivalent

B Remove High Pressure Air Regulating and Shutoff Valve (See figure 201)

- (1) Open main landing gear wheel well door and place door ground release handle in down and latched position.
- (2) Install main landing gear door downlock
- (3) Close manually starter air bottle isolation valve
- (3a) Let high pressure air escape by actuating the high pressure starting system
- (4) Open HIGH PRESS REG VALVE HTR circuit breaker on 115 volt ac bus N° 2 panel (P2) if airplane ac electrical system is in operation

CAUTION BEFORE REMOVING VALVE ASCERTAIN VALVE IS NOT TOO HOT TO HANDLE

- (5) Disconnect electrical plug
- (6) Disconnect high pressure air outlet line
- (7) On right valve disconnect pressure equalizing line on upper side of valve
- (8) Disconnect heater strip electrical leads, unbolt heater clamp, and remove heater strip from valve.

CAUTION IF HEATER STRIP IS REMOVED FROM VALVE WITHOUT DISCONNECTING ELECTRICAL LEADS, APPLICATION OF ELECTRICAL POWER CAN RESULT IN BURNING OUT HEATER STRIP HEATER STRIP CONTAINS RESISTANCE WIRES HANDLE WITH CARE, AND AVOID UNNECESSARY BENDING AND FLEXING

- (9) Disconnect high pressure air inlet line.

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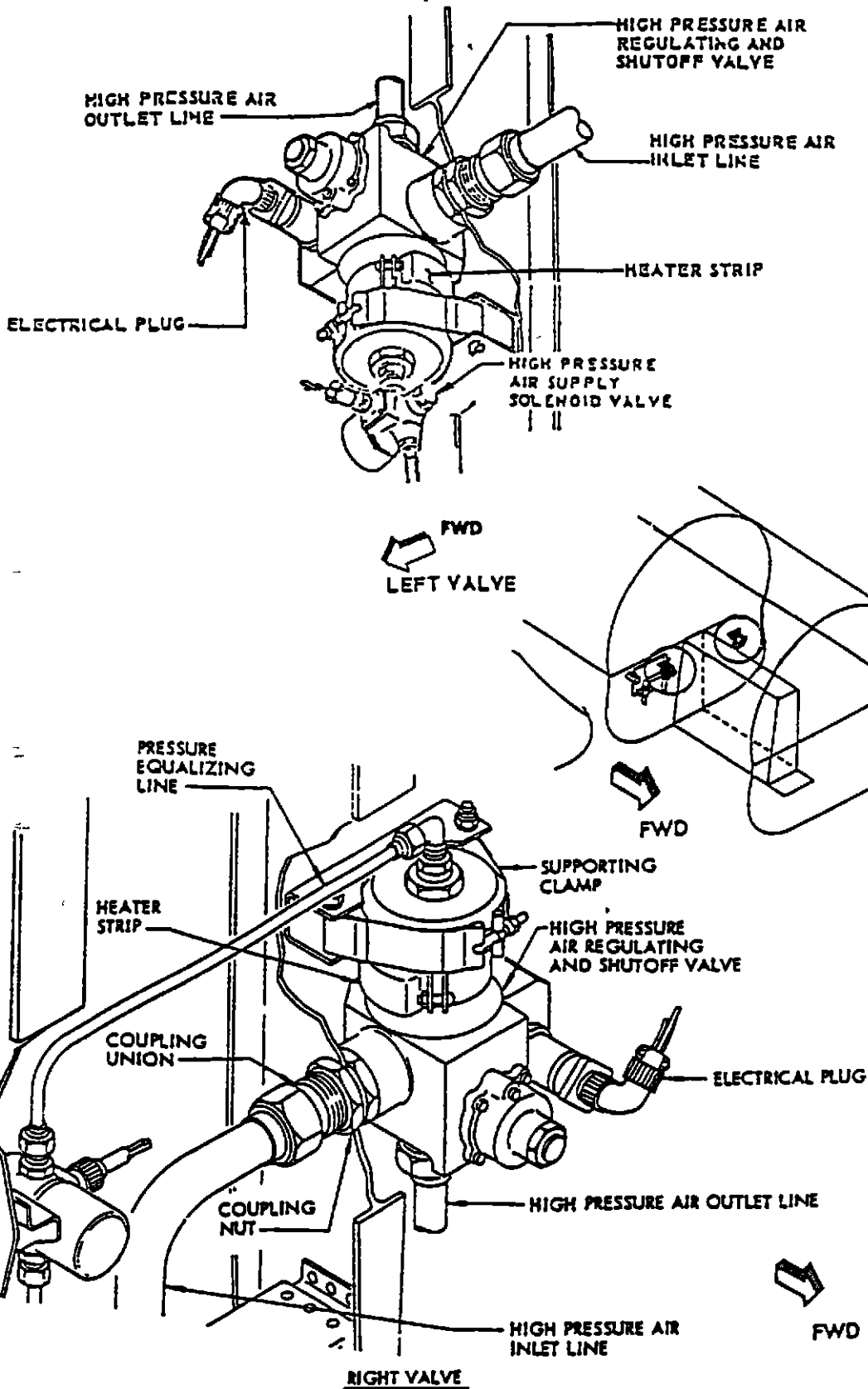
- (10) Loosen clamp holding valve to bulkhead
 - (11) Remove coupling nut, and remove valve from structure
- C Install High Pressure Air Regulating and Shutoff Valve (See figure 201) (NOT USED)
- (1) Insert coupling union of valve through opening in supporting structure, and install coupling nut
 - (2) Fasten valve body to bulkhead using clamp
 - (3) Connect high pressure air inlet line
 - (4) Clamp heater strip to valve and connect electrical leads
 - (5) Connect pressure equalizing line to valve
 - (6) Connect high pressure air outlet line
 - (7) Connect electrical plug
 - (8) Open starter air bottle isolation valve
 - (9) Check lines for leaks under pressure and close starter air bottle isolation valve
 - (10) Close HIGH PRESS REG VALVE HTR circuit breaker on 115 olt ac bus N° 2 panel (P2)
 - (11) With electrical power applied to 115 volt ac bus N° 2 panel (P2) and HIGH PRESS REG VALVE HTR circuit breaker closed, to ensure that heater strip is operative, check that the heater strip is warm to the touch if ambient temperature is below 100°F
 - (12) Remove main landing gear door downlock.
 - (13) Close main landing gear wheel well door

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High Pressure Air Regulating and Shutoff Valve Installation

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HIGH PRESSURE AIR RELIEF VALVE - REMOVAL/INSTALLATION "NOT USED"

1 Equipment and Materials

A Downlock, Main Landing Gear Door - F71127 or equivalent

2 Prepare High Pressure Air Relief Valve for Removal "NOT USED"

WARNING · ASCERTAIN THAT PRESSURE SELECTOR SWITCH ON OVERHEAD PANEL IS IN GUARDED OFF POSITION

A Open main landing gear wheel well door and place door ground release handle in down and latched position

B. Install main landing gear door downlock

3 Remove High Pressure Air Relief Valve "NOT USED"

WARNING HIGH PRESSURE AIR TRAPPED IN THE SYSTEM, EVEN IN A SHORT LINE, CAN BE FATAL IF EXPELLED RAPIDLY

A Disconnect inlet and outlet high pressure air lines from pressure relief valve (See figure 401)

B Remove screws attaching skin-patch to wing-body fairing to obtain access to coupling nut.

C Unscrew coupling nut from pressure relief valve assembly

D Remove the clamp(s) supporting the pressure relief valve assembly

E Remove pressure relief valve assembly from seal pan

4 Install High Pressure Air Relief Valve

A Position pressure relief valve assembly on mounting bracket and seal pan

B. Install clamp(s) securing valve assembly to structure with self-locking nuts and washers.

NOTE Do not tighten nuts until air lines have been connected

C. Connect coupling nut to pressure relief valve assembly and apply final torque of 700-900 pound-inches

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STARTER AIR BOTTLE PRESSURE RELIEF VALVE - REMOVAL/INSTALLATION "NOT USED"

1 Equipment and Materials

A Downlock, Main Landing Gear Door - F71127 or equivalent

2 Prepare for Removal "NOT USED"

- A Open main landing gear wheel well door and place door ground release handle in down and latched position
- B Install main landing gear door downlock
- C Discharge high pressure air from starter air bottle by removing cap from ground charging valve and slowly turning hexnut counterclockwise, a maximum of two turns
- D Remove starter air bottle fitting access panel 842 or 846 Refer to Interior Access Doors and Panels, Chapter 12,

3 Remove Starter Bottle Pressure Relief Valve (See figure 401) "NOT USED"

WARNING HIGH PRESSURE AIR TRAPPED IN THE SYSTEM, EVEN IN A SHORT LINE, CAN BE FATAL IF EXPELLED RAPIDLY

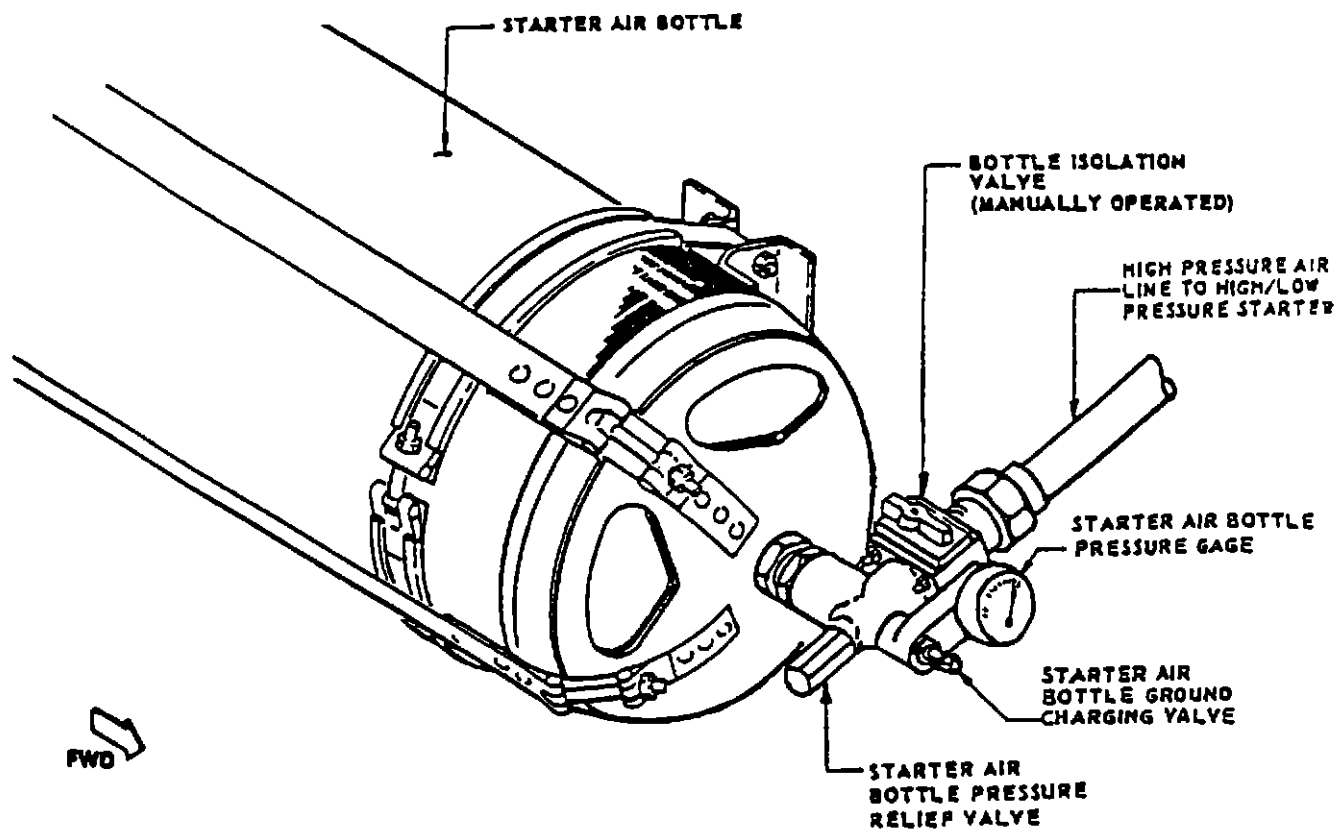
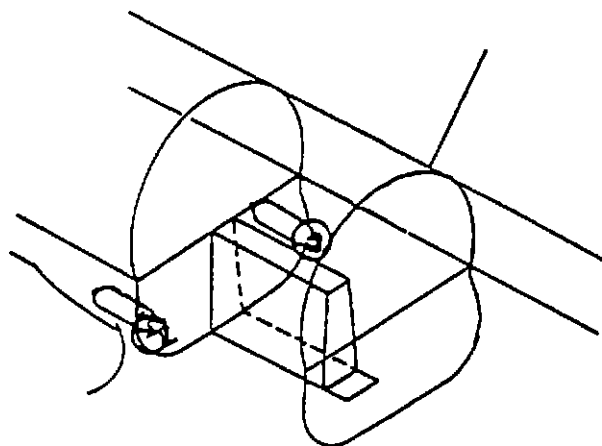
A Remove pressure relief valve by turning counterclockwise until valve separates from fitting

4 Install Starter Air Bottle Pressure Relief Valve "NOT USED"

- A Install new O-ring and backup ring on fitting end.
- B Install pressure relief valve in fitting and tighten
- C Recharge starter air bottle. Refer to Air and Nitrogen Servicing, Chapter 12.
- D. Check lines and connections for leaks under pressure

5 Restore Airplane to Normal "NOT USED"

- A Replace starter air bottle fitting access panel
- B Remove main landing gear door downlock
- C Close main landing gear wheel well door



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Starter Air Bottle Pressure Relief Valve Installation
 Figure 401

STARTER AIR BOTTLE GROUND CHARGING VALVE - REMOVAL/INSTALLATION1. Equipment and Materials

- A. Downlock, Main Landing Gear Door - F71127 or equivalent

2. Prepare for Removal

- A. Open main landing gear wheel well door and place door ground release handle in down and latched position.
- B. Install main landing gear door downlock.
- C. Discharge high pressure air from starter air bottle by removing cap from ground charging valve and slowly turning hexnut counterclockwise, a maximum of two turns.

3. Remove Starter Air Bottle Ground Charging Valve

WARNING: HIGH PRESSURE AIR TRAPPED IN THE SYSTEM, EVEN IN A SHORT LINE, CAN BE FATAL IF EXPELLED RAPIDLY.

- A. Remove lockwire and remove ground charging valve by turning counterclockwise until valve separates from adapter.

4. Install Starter Air Bottle Ground Charging Valve

- A. Install new O-ring on adapter end.
- B. Install ground charging valve in adapter and tighten; lockwire.
- C. Recharge starter air bottle. Refer to Air and Nitrogen Servicing, Chapter 12.
- D. Check lines and connections for leaks under pressure.

5. Restore Airplane to Normal

- A. Remove main landing gear door downlock.
- B. Close main landing gear wheel well door.

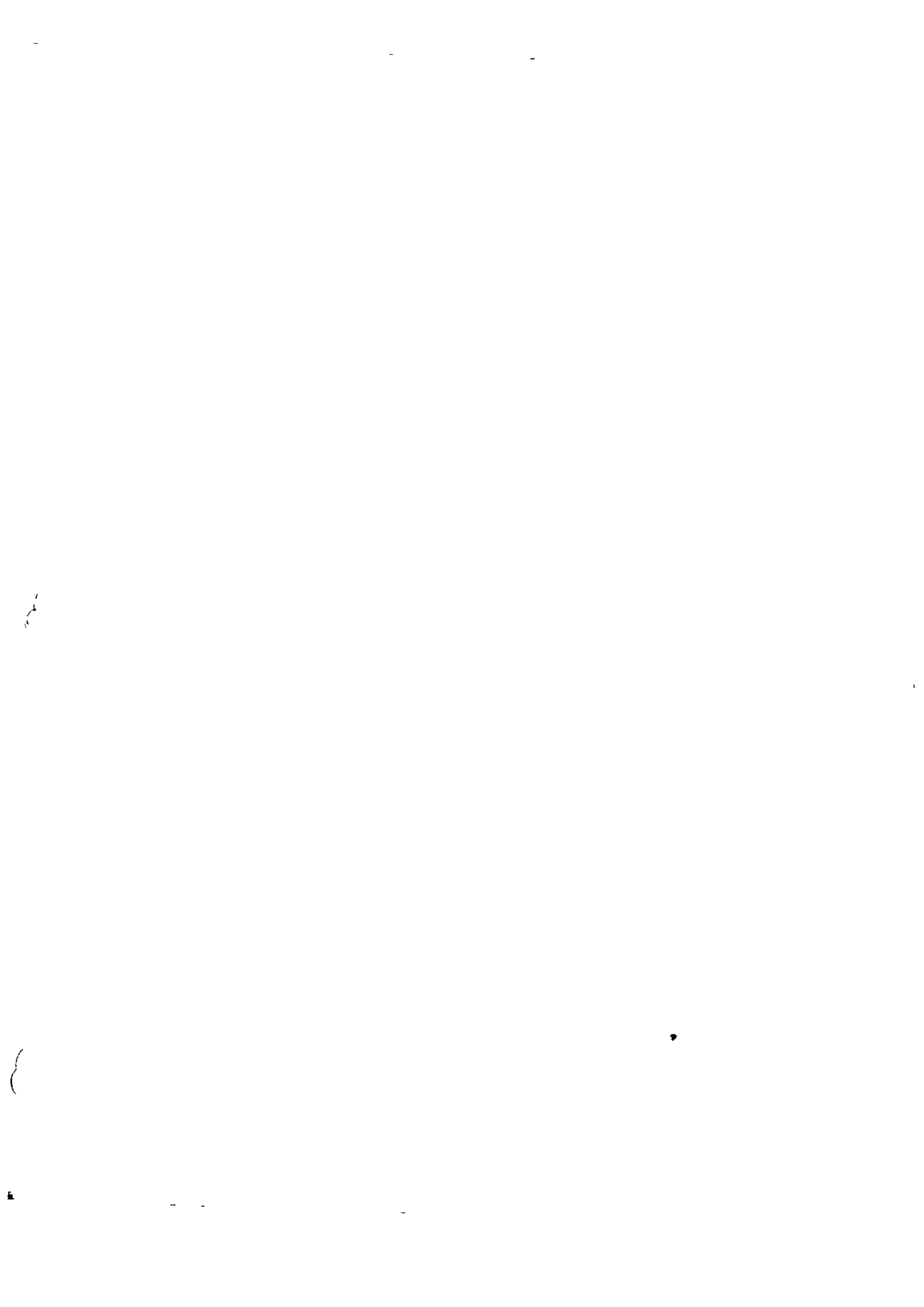
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STARTER AIR BOTTLE ISOLATION VALVE - MAINTENANCE PRACTICES1. Removal/Installation Starter Air Bottle Isolation Valve

WARNING: HIGH PRESSURE AIR TRAPPED IN THE SYSTEM, EVEN IN A SHORT LINE, CAN BE FATAL IF EXPELLED RAPIDLY.

A. Equipment and Materials

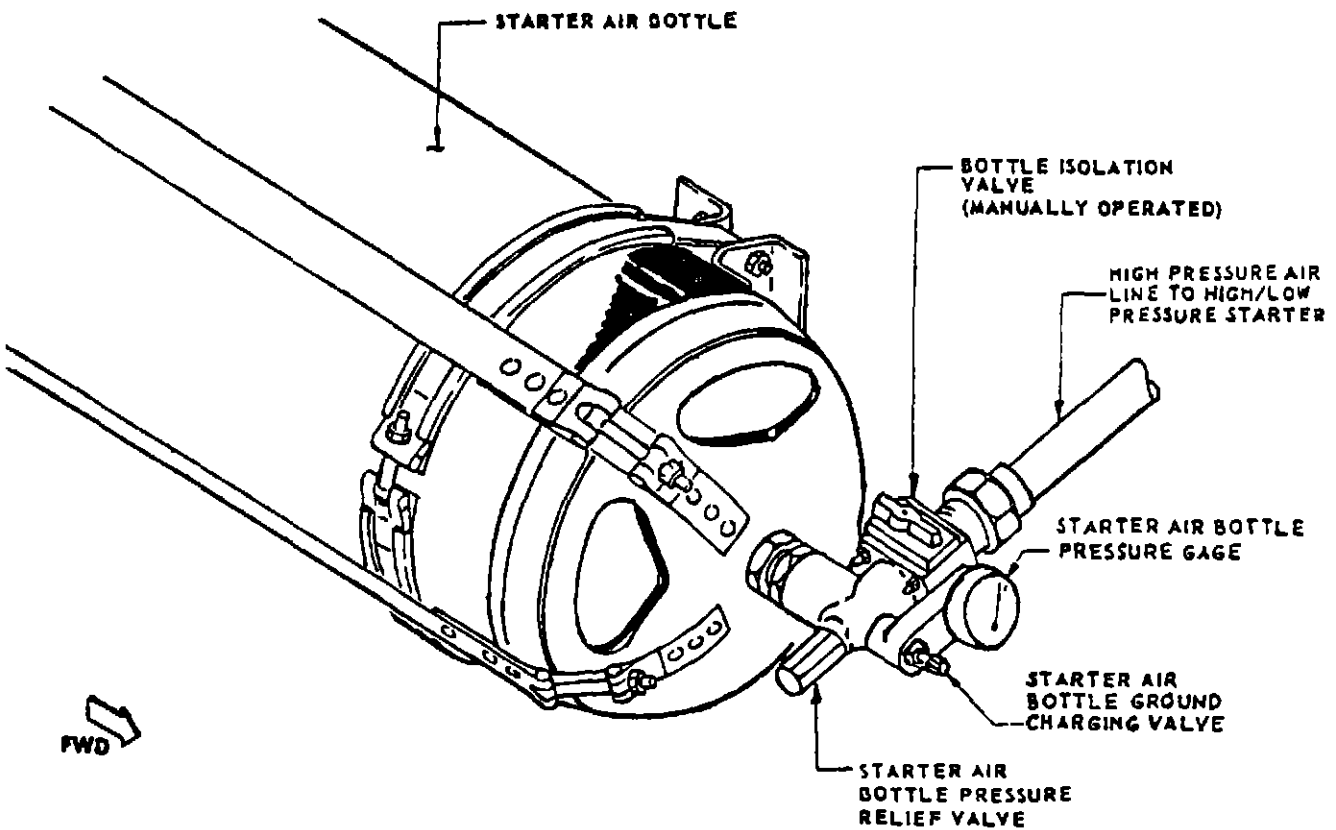
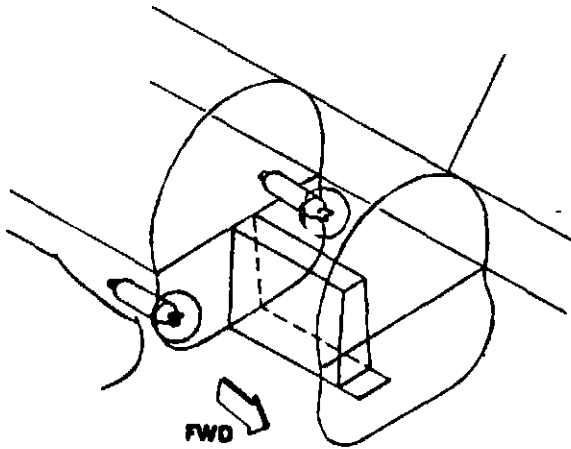
- (1) Downlock, main landing gear door F71127 or equivalent.

B. Remove Starter Air Bottle Isolation Valve (See figure 201.)

- (1) Open right main landing gear wheel well door and place door ground release handle in down and latched position.
- (2) Install main landing gear door downlock.
- (3) Discharge high pressure air from starter air bottle by removing cap from ground charging valve and slowly turning hexnut counterclockwise a maximum of two turns.
- (4) Remove starter air bottle fitting access panel 842. Refer to Interior Access Doors and Panels, Chapter 12.
- (5) Disconnect high pressure air line
- (6) Loosen 1-inch nut on coupling at valve inlet.
- (7) Remove isolation valve by turning coupling nut until valve separates from air bottle fitting.

C. Install Starter Air Bottle Isolation Valve (See figure 201.)

- (1) Replace O-rings and thread coupling nut onto air bottle fitting.
- (2) Tighten 1-inch coupling nut.
- (3) Connect high pressure air outlet line.
- (4) Recharge starter air bottle. Refer to Chapter 12, Air and Nitrogen Servicing.
- (5) Check lines for leaks under pressure.
- (6) Replace starter air bottle fitting access panel.
- (7) Remove main landing gear door downlock.
- (8) Close right main landing gear wheel well door.



Starter Air Bottle Isolation Valve Installation
Figure 201



MAINTENANCE MANUAL

HIGH PRESSURE AIR SUPPLY SOLENOID VALVE - MAINTENANCE PRACTICES "NOT USED"

1 Removal/Installation High Pressure Air Supply Solenoid Valve "NOT USED"

WARNING HIGH PRESSURE AIR TRAPPED IN THE SYSTEM, EVEN IN A SHORT LINE, CAN BE FATAL IF EXPELLED RAPIDLY

A Equipment and Materials

- (1) Downlock, Main Landing Gear Door - F71127 or equivalent

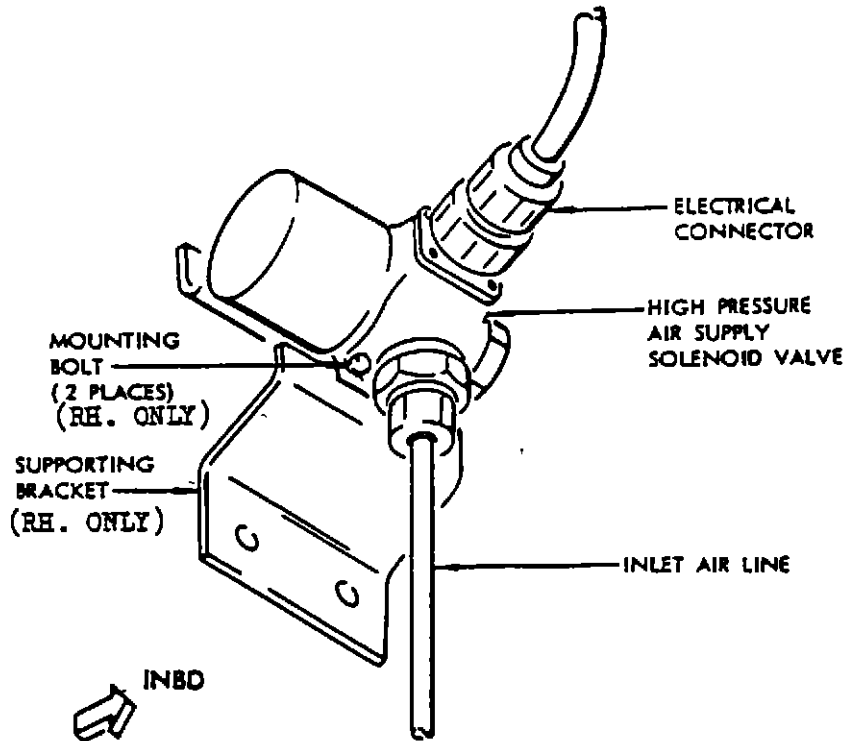
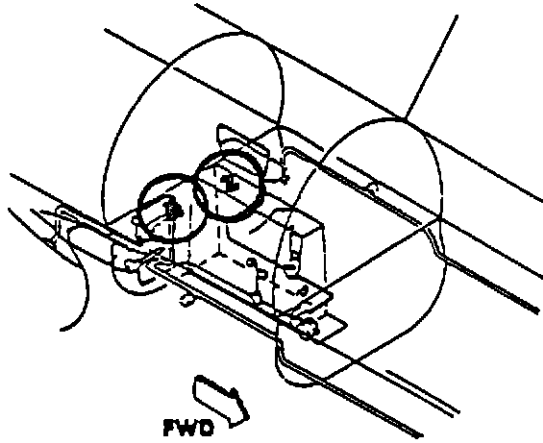
B Remove High Pressure Air Supply Solenoid Valve (See figure 201)

- (1) Open main landing gear wheel well doors and place door ground release handle in down and latched position
- (2) Install main landing gear door downlocks.
- (3) Discharge high pressure air from starter air bottle by removing cap from ground charging valve and slowly turning hexnut counterclockwise a maximum of two turns
- (4) Remove wheel well noise suppressing fairing, panel 840 Refer to Interior Access Doors and Panels, Chapter 12.
- (5) Disconnect electrical plug from solenoid valve
- (6) In right main landing gear wheel well, disconnect 1/4-inch inlet and outlet air lines at fitting on valve
- (7) Remove 2 machine screws and nuts fastening valve body to support plate and remove valve
- (8) In left main landing gear wheel well disconnect valve from high pressure air regulating and shutoff valve

C Install High Pressure Air Supply Solenoid Valve (See figure 201)

- (1) In right main landing gear wheel well, position valve and fasten to support plate with 2 machine screws and nuts
- (2) Connect 1/4-inch outlet air line to fitting on upper side of valve and 1/4-inch inlet air line to fitting on lower side of valve
- (3) In left main landing gear wheel well connect valve to high pressure air regulating and connect high pressure air inlet line
- (4) Connect electrical plug to solenoid valve
- (5) Recharge starter air bottle. Refer to Chapter 12, Air and Nitrogen Servicing.
- (6) Check lines for leaks under pressure.
- (7) Replace wheel well noise suppressing fairing, panel 840 Refer to Interior Access Doors and Panels, Chapter 12
- (8) Remove main landing gear door downlocks
- (9) Close main landing gear wheel well doors

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High Pressure Air Supply Solenoid Valve Installation
 Figure 201



MAINTENANCE MANUAL

STARTER AIR BOTTLE PRESSURE INDICATING SYSTEM- DESCRIPTION AND OPERATION "NOT USED"

EFFECTIVITY

Turbofan

1 General

- A The starter air bottle pressure indicating system consists of two direct reading pressure gages and an electrical pressure-indicating system

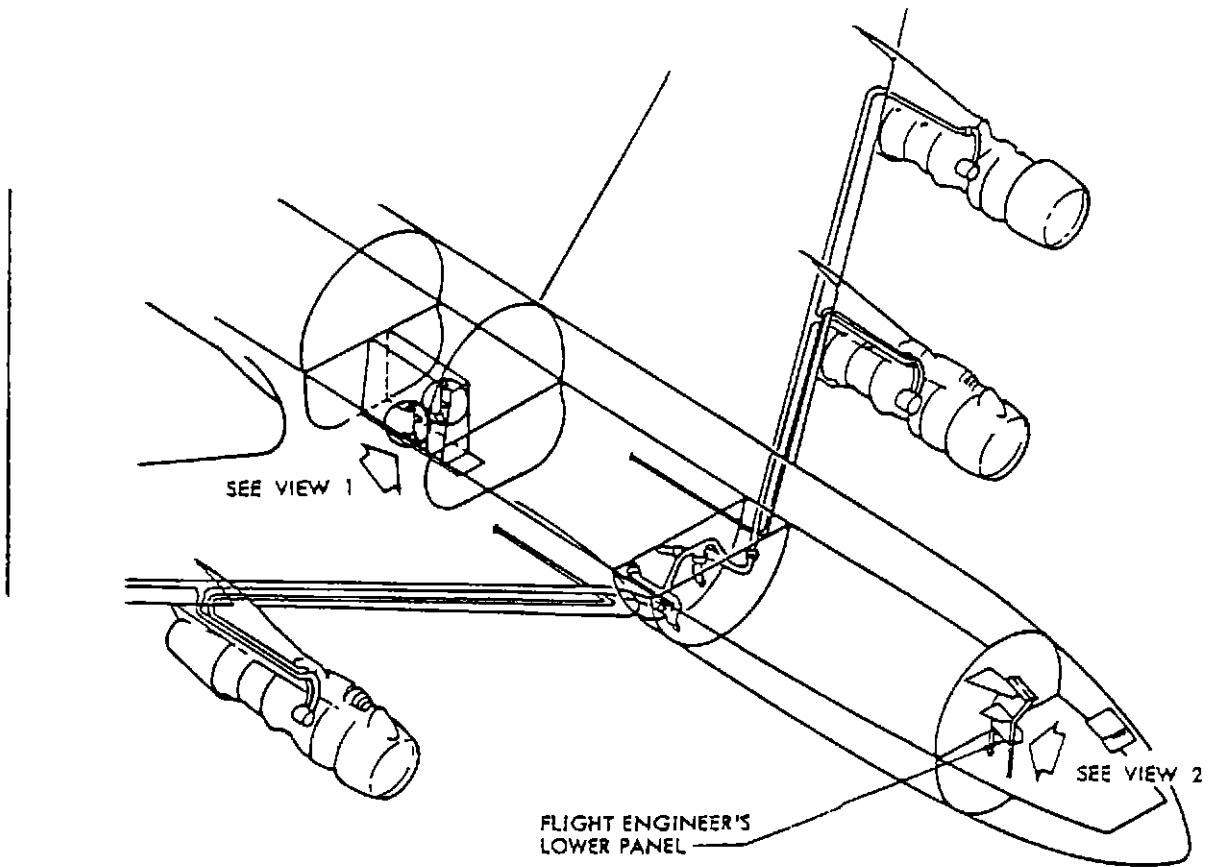
2 Starter Air Bottle Pressure Gages

- A A direct reading starter air bottle pressure gage is located on each bottle head. This provides a constant air bottle pressure reading on the gage for use by the ground crew

3 Starter Air System Electrical Pressure-Indicating System

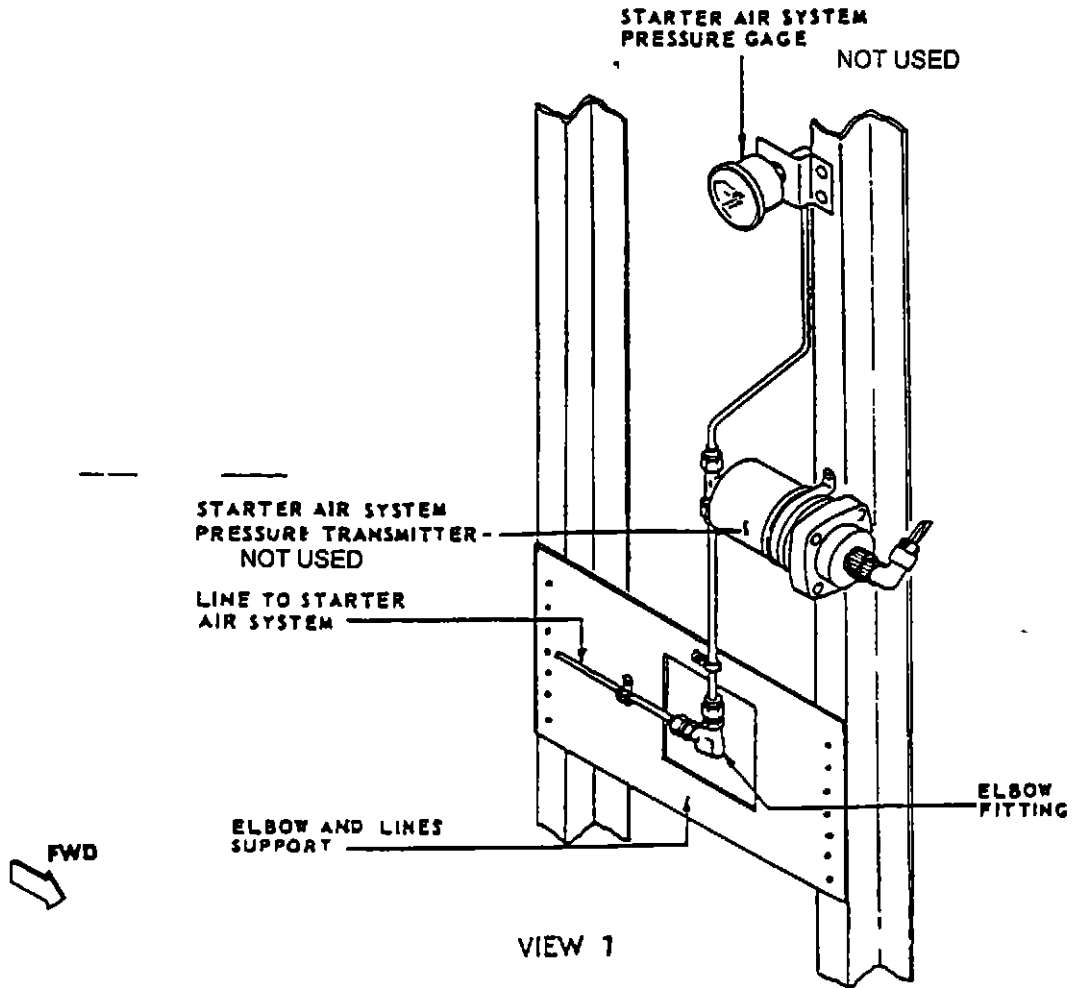
- A The starter air system electrical pressure-indicating system consists of two pressure transmitters and a dual pressure indicator (See figure 1). The pressure transmitters are of the electrically operated synchronous-type and are located, one above each ground charging valve on the inboard side of the main gear wheel wells on either side of the keel beam tank. Each transmitter is attached to the structure by a clamp
- B The dual pressure indicator receives signals from the pressure transmitters and indicates the starter bottle pressures in pounds per square inch. The pressure indicator is located on the flight engineer's lower panel
- C The starter air system electrical pressure-indicating system is supplied 28 volt 400 cycle ac through a circuit breaker on the 28 volt ac circuit breaker panel (P7). (See figure 2)

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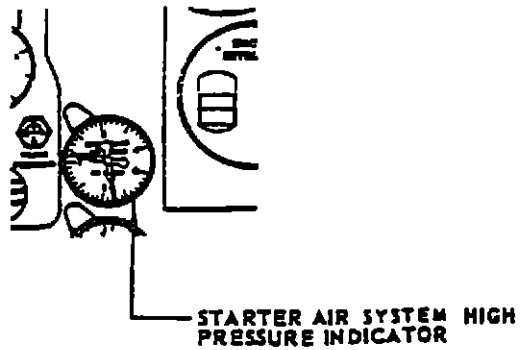


Starter Air Bottle Pressure Indicating System Equipment Location
Figure 1 (Sheet 1)

MAINTENANCE MANUAL



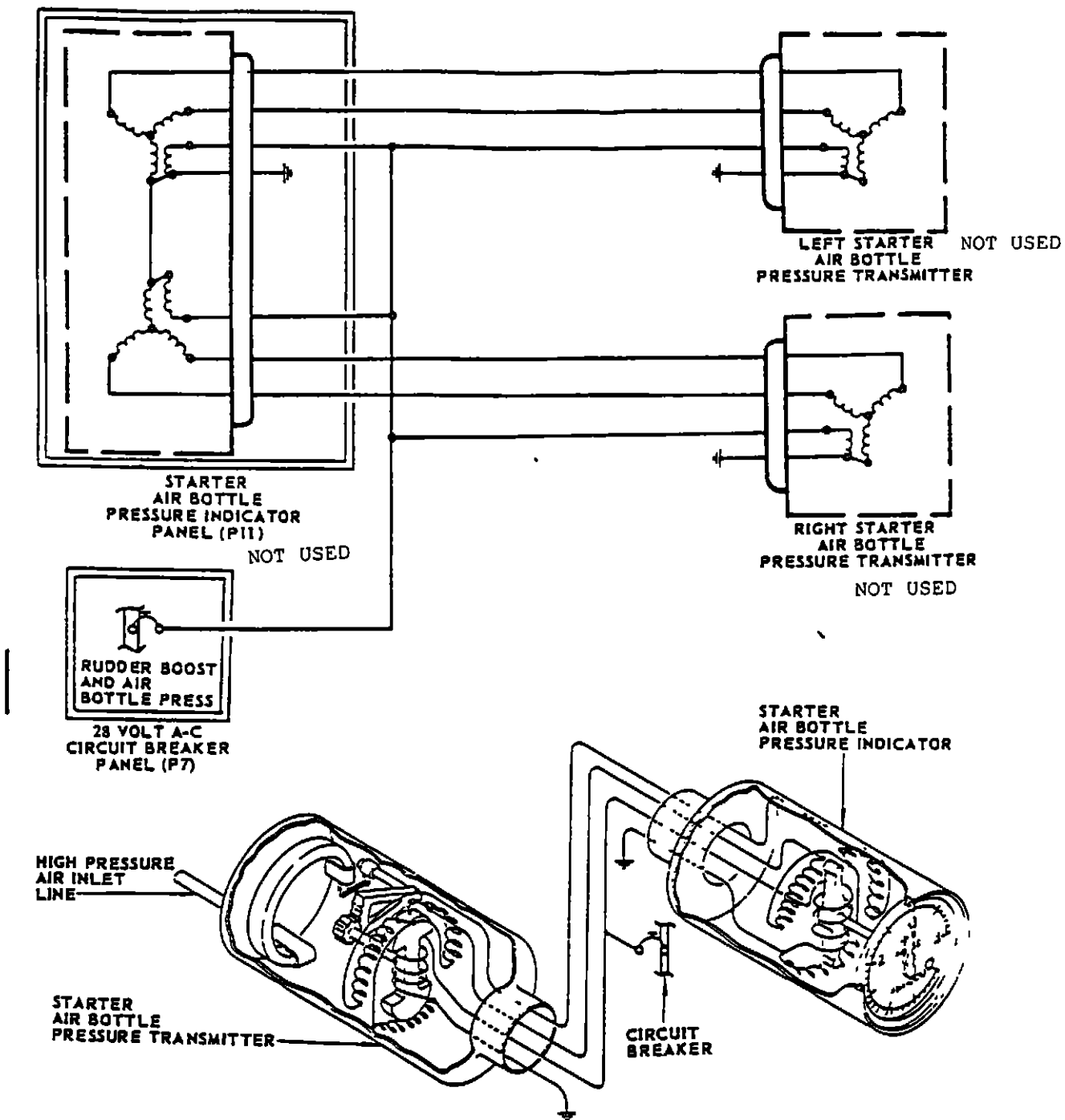
VIEW 1



FLIGHT ENGINEER'S LOWER PANEL

VIEW 2

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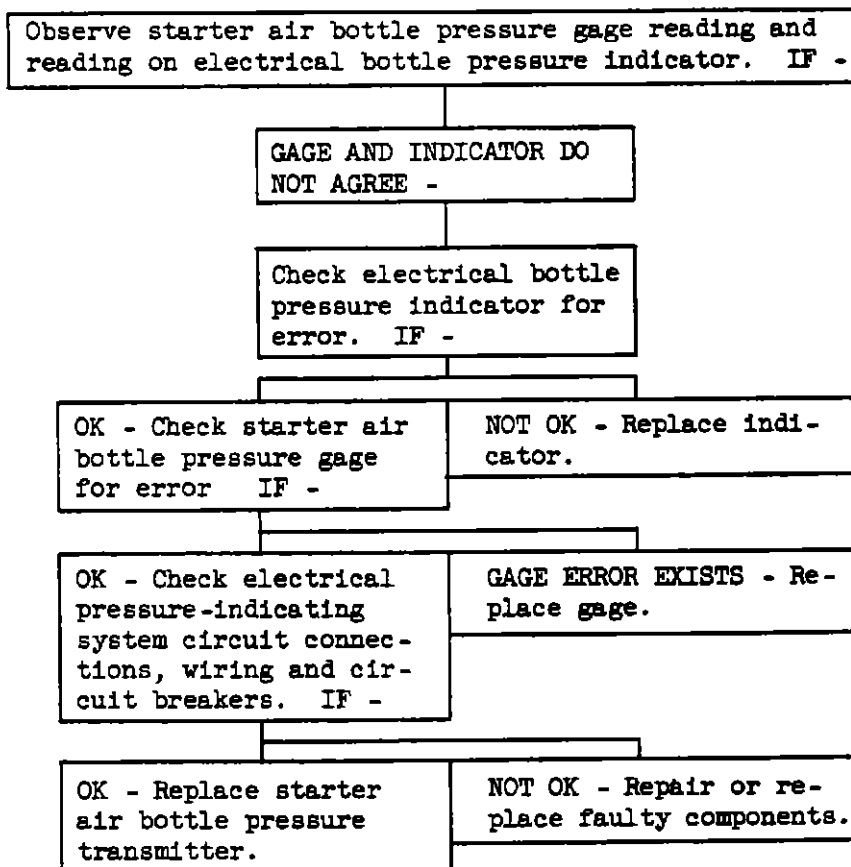
Starter Air Bottle Electrical Pressure Indicating System Schematic

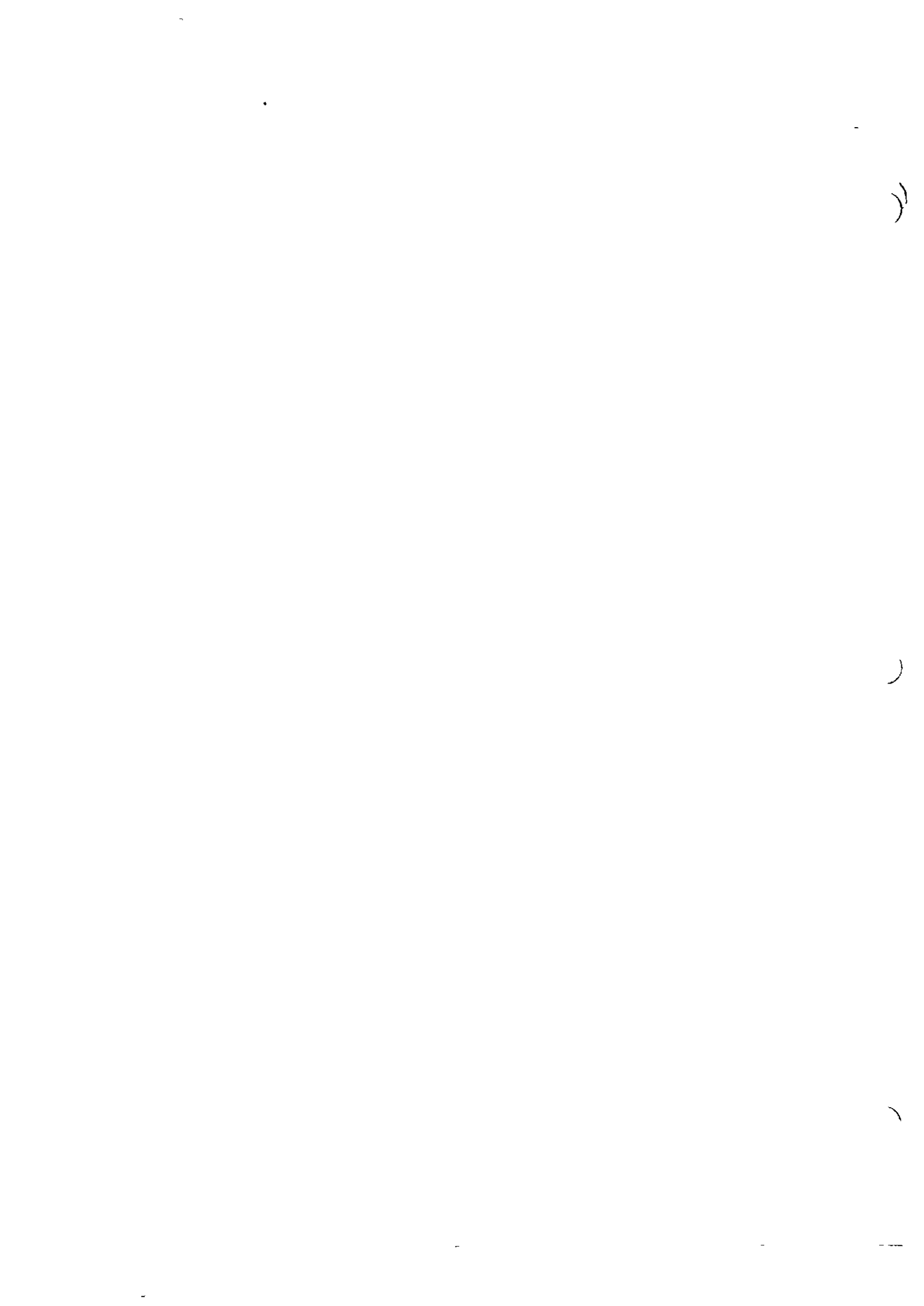
STARTER AIR BOTTLE PRESSURE-INDICATING SYSTEM -
TROUBLE SHOOTING

EFFECTIVITY

TURBOFAN

1 Starter Air Bottle Pressure-Indicating System - Trouble Shooting Chart







MAINTENANCE MANUAL
STARTER AIR SYSTEM PRESSURE TRANSMITTER - MAINTENANCE PRACTICES

EFFECTIVITY

TURBOFAN

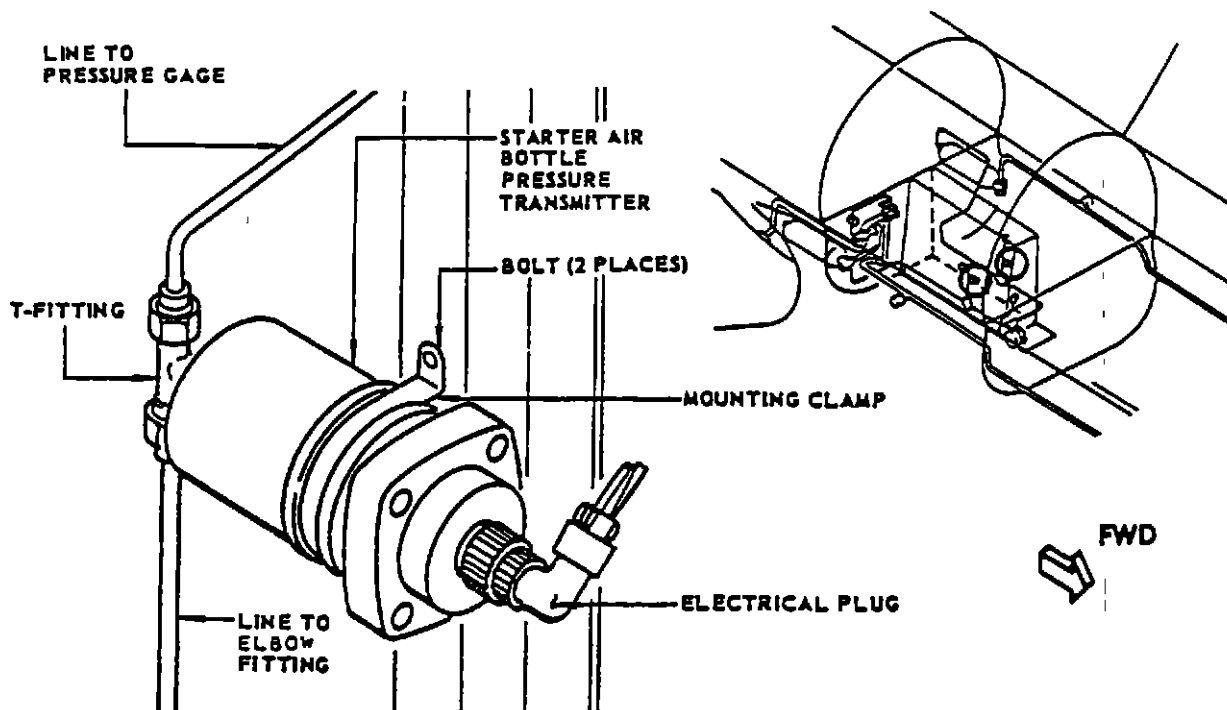
1 Removal/Installation Starter Air System Pressure Transmitter "NOT USED"

A Equipment and Materials

- (1) Down Lock, Main Landing Gear Door - F71127 or equivalent

B Remove Starter Air System Pressure Transmitter (See figure 201)

- (1) Open main landing gear wheel well door and place door release handle in down and latched position
- (2) Install main landing gear door down lock
- (3) Disconnect electrical power to air bottle pressure transmitter by opening "AIR BOTTLE PRESS" circuit breaker on the 28-volt a-c circuit breaker panel (F7).
- (4) Remove electrical plug from transmitter
- (5) Close manually starter air bottle isolation valve
- (5a) Let high pressure air escape by actuating the high pressure starting system



Starter Air System Pressure Transmitter Installation
Figure 401

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MAINTENANCE MANUAL

- (6) Disconnect high pressure air lines from T-fitting on aft side of starter air bottle pressure transmitter

NOTE If new transmitter is going to be installed, remove T-fitting from old transmitter and save for reuse

- (7) Remove mounting clamp securing transmitter to support bracket

C Install Starter Air System Pressure Transmitter (See figure 201) "NOT USED"

- (1) Install union and O-ring in pressure port of transmitter
- (2) Attach starter air bottle pressure transmitter to its supporting bracket with two screws, two nuts, and clamp Electrical connection on transmitter faces forward

NOTE Do not tighten clamp completely so that transmitter may be rotated to position T-Fitting

- (3) Connect air pressure lines to T-fitting
- (4) Tighten transmitter mounting clamp by tightening two screws and nuts on attaching bracket
- (5) Connect electrical plug to transmitter
- (6) Open starter air bottle isolation valve
- (7) Check lines and fittings for leaks under pressure
- (8) Remove main landing gear door down lock
- (9) Close main landing gear wheel well door.

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STARTER AIR SYSTEM PRESSURE GAGE - MAINTENANCE PRACTICES

EFFECTIVITY

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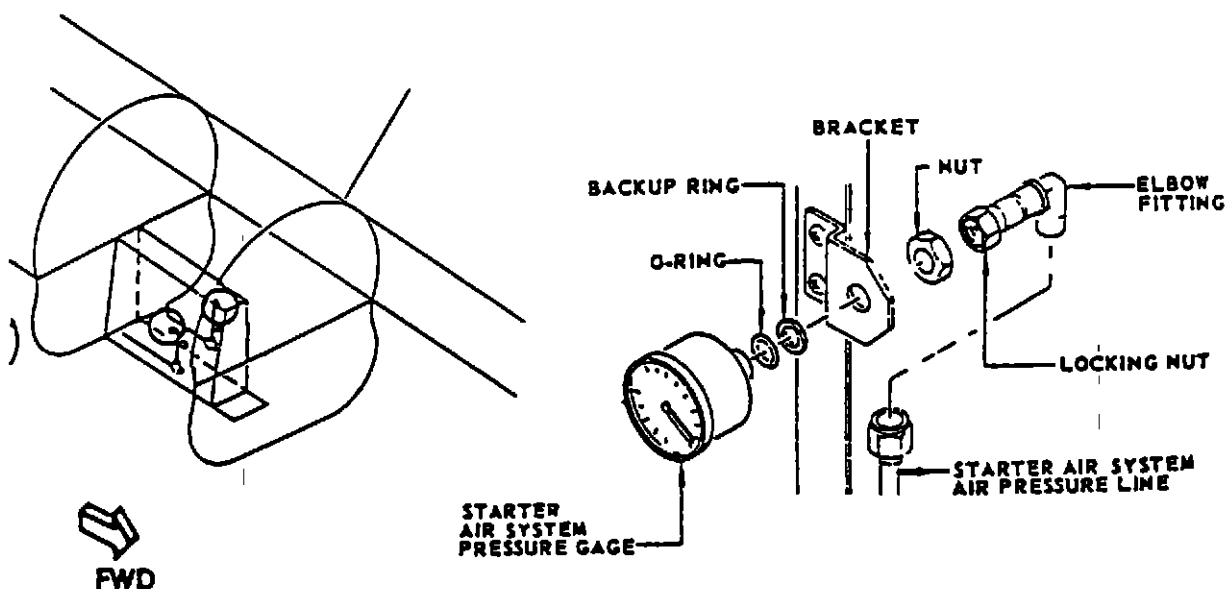
1 Removal/Installation Starter Air System Pressure Gage "NOT USED"

A Equipment and Materials

- (1) Down Lock, Main Landing Gear Door - F71127 or equivalent

B Remove Starter Air System Pressure Gage (See figure 201) "NOT USED"

- (1) Open main landing gear wheel well doors and place door ground release handle in down and latched position
- (2) Install main landing gear door down lock
- (3) Close manually starter air bottle isolation valve
- (4) Let high pressure air escape by actuating the high pressure starting system
- (5) Remove gage by first loosening two nuts on backside of gage attaching bracket and then rotating gage counterclockwise to remove from fitting. Save nut or screw it into elbow fitting for reuse during installation



Starter Air System Pressure Gage Installation
Figure 401



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C Install Starter Air System Pressure Gage (See figure 201) "NOT USED"

- (1) Install both nuts on elbow fitting and thread nuts past recess in fitting
- (2) Insert fitting into hole in attaching bracket and work backup ring and O-ring into recess of elbow fitting

CAUTION BE CAREFUL NOT TO DAMAGE O-RING ON FITTING THREADS

- (3) Thread gage boss into elbow fitting until gage boss just passes recess in elbow fitting Make sure gage is in upright reading position
- (4) Hold gage from turning and turn nut until a sudden increase in torque is felt indicating contact of O-ring with gage boss Turn nut down tightly against gage attaching bracket This tightening will hold gage against bracket and also will seal gage against a pressure leak by forcing O-ring seal into gage boss counterbore Tighten locking nut down on first nut to prevent loosening
- (5) Open starter air bottle isolation valve
- (6) Check lines for leaks under pressure
- (7) Remove main landing gear door down lock
- (8) Close main landing gear wheel well door

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