CHAPTER

71

POWER PLANT

CHAPTER 71 - POWER PLANT
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EFFECTIVITY:

SPECIAL NOTE

WITHIN THIS MANUAL ALL REFERENCES TO LEFT AND RIGHT, CLOCKWISE AND COUNTERCLOCKWISE, FRONT AND REAR, ARE AS VIEWED FROM THE REAR OF THE AIRPLANE.

WITHIN THE ENGINE/PROPELLER MANUALS ALL SUCH REFERENCES ARE AS VIEWED FROM THE ACCESSORY GEARBOX/SPINNER BULKHEAD.

BECAUSE THE PIAGGIO P180 AVANTI IS CONFIGURED WITH "PUSHER" PROPELLERS, THE ENGINES ARE INSTALLED WITH THE ACCESSORY GEARBOX TOWARDS THE FRONT OF THE AIRPLANE; THEREFORE, IN THIS MANUAL ALL REFERENCES TO LEFT AND RIGHT, CLOCKWISE AND COUNTERCLOCKWISE, FRONT AND REAR (WHEN APPLIED TO ENGINE AND PROPELLER COMPONENTS) WILL BE THE OPPOSITE TO THE SAME REFERENCES IN THE ENGINE/ PROPELLER MANUALS.

FOR EXAMPLE, ACCORDING TO THIS MANUAL, THE ENGINE ACCESSORY GEARBOX IS AT THE FRONT OF THE ENGINE; THE ENGINE MANUALS CONSIDER THE ACCESSORY GEARBOX TO BE THE REAR OF THE ENGINE.

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POWER PLANT - DESCRIPTION AND OPERATION

1. General

A. The propulsive force for the P.180 Avanti is provided by a turboprop system consisting of two Pratt & Whitney Canada (P&WC) free turbine engines, each driving a Hartzell five-bladed, variable pitch propeller in "pusher" configuration.

B. For the purpose of this manual the term "power plant" refers to the complete engine change package, comprising the basic engine as supplied by P&WC, together with all accessories. For description and maintenance of the various airframe system related components, refer to the respective chapters in this manual.

C. Each power plant is mounted in a tubular titanium framework which is bolted to the top of the wing, and is enclosed within a streamlined nacelle.

D. The Engine Maintenance Manual (Engine MM) contains all necessary information relating to the basic engine and some general "power plant" details. The nacelles are dealt with in Chapter 54 of this manual and the propellers in Chapter 61. Each component for the Power Plant Builbing Up and Stripdown are described in the proper engine chapter in this Manual. The information covered by this Chapter 71 is as follows:

71-00-00	Power Plant - General Page Block 1 Description and Operation Page Block 401 Removal and Installation Page Block 501 Adjustment/Test
71-20-00	Engine Mounts Page Block 1 Description and Operation Page Block 201 Maintenance Practices
71-20-00	Firewalls Page Block 1 Description and Operation
71-50-00	Electrical Harness Page Block 1 Description and Operation
71-70-00	Engine Drains Page Block 1 Description and Operation

E. The associated systems of the power plant are dealt with in the following Chapters of this manual:

* 61 Propeller
* 70 Standard Practices - Engine
* 71 Power Plant
* 72 Engine
* 73 Engine Fuel and Control
* 74 Ignition
* 75 Air

* 76 Engine Controls
* 77 Engine Indicating
78 Exhaust
* 79 Oil
80 Starting

The chapters marked with an asterisk are also in the Engine MM but the information given applies only to the items which are part of the basic engine and the engine itself; the same chapters in this manual (the Airplane Maintenance Manual) gives the information relating the airframe-mounted items and the interfaces with the engine and engine-mounted items.
Note that if there is conflicting information in the Engine MM and the Airplane MM, the information in the Airplane MM is to be used; this is because the Engine MM deals with the power plant in general terms only, whereas the Airplane MM deals with the specific installation.

F. Although there is duplication of chapters in the Engine and Airplane Maintenance Manuals, duplication of information is kept to the minimum. For example, Chapter 72 of the Airplane MM consists only of a token page which refers to Chapter 72 of the Engine MM which contains all of the information relevant to the basic engine.

POWER PLANT - REMOVAL/INSTALLATION

1. General

A. This topic contains the information necessary for the safe removal and installation of the power plant, i. e. the engine complete with the build-up items.

B. For information on the engine not covered in this manual refer to the Engine Maintenance Manual.

C. Persons involved in the removal/installation of a power plant must be aware of the maintenance precautions to be taken before any work is done. Para. 2 lists the most important of these maintenance precautions; however, work must be done using good aeronautical standard maintenance practices.

2. Maintenance Precautions

A. WARNINGS

(1) OBEY THE HEALTH AND SAFETY PRECAUTIONS GIVEN IN CHAPTER 20-00-00.

(2) BE CAREFUL WHEN YOU WORK ON THE IGNITION SYSTEM

- DO NOT TOUCH THE HIGH TENSION LEADS OR THE IGNITER PLUGS FOR AT LEAST SIX MINUTES AFTER THE CIRCUIT BREAKER OF THE IGNITION SYSTEM IS OPEN.
- USE INSULATED TOOLS TO DISCONNECT THE IGNITER LEADS FROM THE IGNITION EXCITER UNIT.

(3) BE CAREFUL WHEN YOU WORK ON THE ENGINE FUEL SYSTEM

- DO NOT SMOKE OR USE AN OPEN FLAME.
- MAKE SURE THAT THERE IS ADEQUATE FIRE-FIGHTING EQUIPMENT IN THE NEAR VICINITY, AND THAT YOU KNOW HOW TO USE IT.
- USE ONLY EXPLOSION-PROOF ELECTRICAL EQUIPMENT AND AIR-DRIVEN TOOLS.
- WASH YOUR HANDS THOROUGHLY AFTER HANDLING THE FUEL AND CHANGE CONTAMINATED CLOTHING.
- WIPE UP ANY FUEL WHICH HAS SPILLED.

(4) BE CAREFUL WHEN YOU WORK ON THE ENGINE OIL SYSTEM

- WASH YOUR HANDS THOROUGHLY AFTER HANDLING THE OIL AND CHANGE CONTAMINATED CLOTHING.

(5) BE CAREFUL WHEN YOU WORK ON THE ENGINE AND PROPELLER CONTROL SYSTEMS

- PUT A NOTICE IN THE FLIGHT COMPARTMENT TO TELL PERSONS NOT TO MOVE THE CONTROLS.

(6) BE CAREFUL WHEN YOU WORK WITH SUSPENDED LOADS

- DO NOT STAND OR WALK UNDER A SUSPENDED LOAD.

B. CAUTIONS

(1) DO NOT LET ENGINE FUEL OR OIL FALL ONTO THE ENGINE OR ANY OTHER PART OF THE AIRPLANE
- REMOVE ANY OIL OR FUEL WHICH HAS FALLEN ONTO ANY PART OF THE AIRPLANE.

(2) TURN THE PROPELLER ONLY IN ITS NORMAL DIRECTION OF ROTATION. TURNING IN THE WRONG DIRECTION MAY CAUSE DAMAGE TO THE CARBON BRUSH OF THE BETA SYSTEM.

(3) DO NOT PUT OIL THAT HAS BEEN DRAINED FROM THE ENGINE BACK INTO THE OIL SYSTEM. DRAINED OIL CAN CONTAMINATE THE OIL SYSTEM.

(4) DO NOT PUT FUEL THAT HAS BEEN DRAINED FROM THE ENGINE BACK INTO THE FUEL SYSTEM. DRAINED FUEL CAN CONTAMINATE THE FUEL SYSTEM.

(5) DO NOT USE CADMIUM-PLATED TOOLS WHEN YOU WORK ON THE FUEL SYSTEM.

(6) USE EXTREME CARE TO PREVENT DIRT, HARDWARE, TOOLS OR OTHER FOREIGN OBJECTS FROM ENTERING, CONTAMINATING OR DAMAGING THE ENGINE AND ITS ASSOCIATED COMPONENTS AND PARTS.
- INSTALL CAP/COVERS OVER OPEN/DISCONNECTED LINES AND CONNECTORS (AS SOON AS POSSIBLE AFTER DISCONNECTION)
- DO NOT REMOVE CAPS/COVERS UNTIL IMMEDIATELY BEFORE INSTALLATION OF THE COMPONENT OR PART.
- MAKE SURE THAT THE COMPONENT OR PART IS THOROUGHLY CLEAN BEFORE INSTALLATION.

(7) BE CAREFUL WHEN YOU HANDLE FUEL AND OIL LINES
- DO NOT DENT OR KINK THE LINE
- DO NOT DAMAGE THE THREADS OF FITTINGS/COUPLING NUTS
- DO NOT TWIST HOSES.

(8) DO NOT REMOVE O-RINGS, SEALS AND GASKETS FROM THEIR STORAGE PACKING UNTIL NEEDED FOR ASSEMBLY/INSTALLATION. BEFORE INSTALLATION, INSPECT O-RINGS, SEALS AND GASKETS FOR CUTS, NICKS AND OTHER FLAWS. INSTALL ONLY PERFECT ITEMS.

(9) USE ONLY CLAMPS OF THE CORRECT SIZE AND TYPE WHEN SECURING HOSES, TUBING, WIRING HARNESSES AND CONDUITS TO THE ENGINE OR ENGINE BRACKETS. CLAMPS OF INSUFFICIENT SIZE MAY DAMAGE LINES BY CONSTRICTION/LIMITING THERMAL EXPANSION.

(10) MAKE SURE THAT THERE IS SUFFICIENT CLEARANCE BETWEEN LINES AND SURROUNDING PARTS. INSUFFICIENT CLEARANCE COULD CAUSE CHAFING AND RESULT IN FAILURE OF THE LINE/PART.

(11) MAKE SURE THAT ALL PARTS AND COMPONENTS ARE STILL WITHIN THEIR STORAGE (SHELF) LIFE LIMITS.

(12) BEFORE INSTALLATION OF A COMPONENT THAT IS NOT NEW, MAKE SURE THAT THE COMPONENT TBO HAS NOT EXPIRED.

(13) MAKE SURE THAT SUPPORT EQUIPMENT IS IN GOOD CONDITION.

(14) MAKE SURE THAT LIFTING EQUIPMENT IS ADEQUATE. CHECK THE SAFETY TAG FOR SAFE WORKING LOAD AND MAKE SURE THAT THE EQUIPMENT INSPECTION PERIOD IS STILL VALID.

3. Removal

NOTE: This removal procedure is applicable to both the left-hand and right-hand power plants. Data for the right-hand procedure is given between parentheses.

A. Fixtures, Test and Support Equipment

Nomenclature	Part No.	Qty	Remarks
(1) Hoisting Equipment	Not Specified	1	Capable of lifting 550 lbs (250 kg) minimum
(2) Lifting Sling	TBD	1	
(3) Engine Stand	TBD	1	
(4) Caps, Covers and Blanks	Not Specified	A/R	For covering and blanking all disconnected pipe ends, etc.
(5) Drip Tray	Not Specified	1	For oil and fuel spillage
(6) Access Platform	Not Specified	2	3ft (1m)
(7) Warning Notice	Not Specified	1	

B. Referenced Information

Maintenance Manual Chapter 24-30-00
Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 61-10-00
Maintenance Manual Chapter 71-00-01
Maintenance Manual Chapter 74-10-00
Maintenance Manual Chapter 79-20-00
Engine Maintenance Manual Chapter 72-00-00

C. Preparation

NOTE: Because the engine is removed from the airplane horizontally rearwards, it will be necessary to consider the position of the airplane in relation to the hoisting equipment.

(1) Make sure that the airplane wheels are chocked front and rear.
(2) Make sure that the airplane is statically grounded.
(3) Make sure that there is at least one serviceable fire extinguisher available in the vicinity of the airplane.
(4) Make sure that there is an adequate supply of caps, covers and blanks to seal off all disconnected fuel, oil and air lines, ducts, etc.
(5) Put a drip tray under the engine to catch fuel/oil spillage.
(6) Put the engine stand as close as practicable to the airplane; this will minimize the time that the removed engine is suspended.
(7) Put the access platforms in position.

(8) Check the position of controls and switches in the flight compartment as follows:
- POWER LEVERS - set to IDLE
- CONDITION LEVERS - set to CUT OFF
- Firewall fuel shut off valve L F/W VALVE (R F/W VALVE) set to CLOSED, and L F/W V CLSD (R F/W V CLSD) amber annunciator is on.

(9) Put a warning notice in the flight compartment to tell persons not to move the POWER or CONDITION LEVERS.

(10) Open, tag and safety these circuit breakers:

Pilot CB panel:	Copilot CB panel:
L BLEED AIR	
L FW SHUT OFF	R OIL COOLER
L TRQ	CHIP DET
L TURB TEMP	(if installed)
L PROP RPM	PROP SYNCPH
L TURB RPM	(if installed)
L FUEL FLOW	AUTO FTR
L OIL PRESS	R OIL TEMP
L OIL TEMP	R OIL PRESS
IGN SYS	R FUEL FLOW
L ENG START	R TURB RPM
R ENG START	R PROP RPM
L ENG ICE VANE	R TURB TEMP
L OIL COOLER	R TRQ
	R FW SHUT OFF
	R BLEED AIR
	R ENG ICE VANE

(11) If the engine is equipped with the optional fire extinguisher bottle, open, tag and safety the FIRE EXT circuit breaker on the panel in the baggage compartment.

D. Procedure

(1) Remove the propeller of the power plant to be removed. Refer to 61-10-00.

(2) Remove nacelle panels 410AT and 410AB (420AT and 442AB). Refer to 54-10-00.

NOTE: Nacelle panels 430AL and 430AR (440AL and 440AR) are removed during the propeller removal procedure.

(3) Put a protective cover around the engine air inlet screen.

(4) Remove the oil cooler. Refer to 79-20-00.

(5) Disconnect the oil hose from the elbow at the top of the engine oil tank and remove the hose.

(6) Disconnect the tie rods of the rear firewall as follows (Ref. Fig. 401):

(a) Remove the nut and screw which secure the tie rod to the rear frame in four places; move the tie rods aside as required to temporarily install the screws and nuts in their holes to prevent loss.

(b) Remove the cap screw and washers which secure the tie rod to the engine top and bottom mounting pads (four places total).

(c) Remove the screw which secures the rod to the splice bulkhead in two places; move the tie rods aside as required to temporarily install the screws in their holes to prevent loss.

(7) Loosen the clamps which secure the oil cooler outlet ducts to the rear firewall. Move the ducts forward to disconnect them from the firewall.

NOTE: To disconnect the oil cooler outlet ducts from the firewall it may be necessary to disconnect the ejector tubes from their supply tube.

(8) Disconnect the electrical bonding jumpers from each side of the lower part of the center frame. Temporarily install the attaching hardware to prevent loss.

(9) Disconnect the following electrical connectors:

– P125 (P124) at the bracket on the wing adjacent to the inboard strut of the engine mounting frame

– P127 (P126) at the rear face of the engine center frame, lower part, inboard side

– P137 (P138) at the shutoff valve of the air conditioning system (located inboard between the center and rear firewalls)

– P227 (P226) at the shutoff valve of the oil cooling ejector system (located centrally between the center and rear firewalls).

(10) Release the wires of connector P137 (P138) from the cable tie at the plenum apron.

(11) Temporarily secure the connectors P125 , P127, P137 and P227 (P124, P126, P138 and P226) and their wires to the engine so that they will not cause obstruction during engine removal.

(12) Disconnect the electrical connector P163 (P162) of the oil tank dipstick. Temporarily secure the connector and its wires to the engine.

(13) Remove the oil tank dipstick and put it in a safe place so that it does not become damaged. Install a blank at the oil tank filler neck.

(14) Remove the upper diaphragm as follows:

(a) Remove the bolt, washer and nut which secure the upper diaphragm to:

– the clamp (P-clip) on the cross tube of the mounting frame

– the top of the splice bulkhead

– the top of the center firewall.

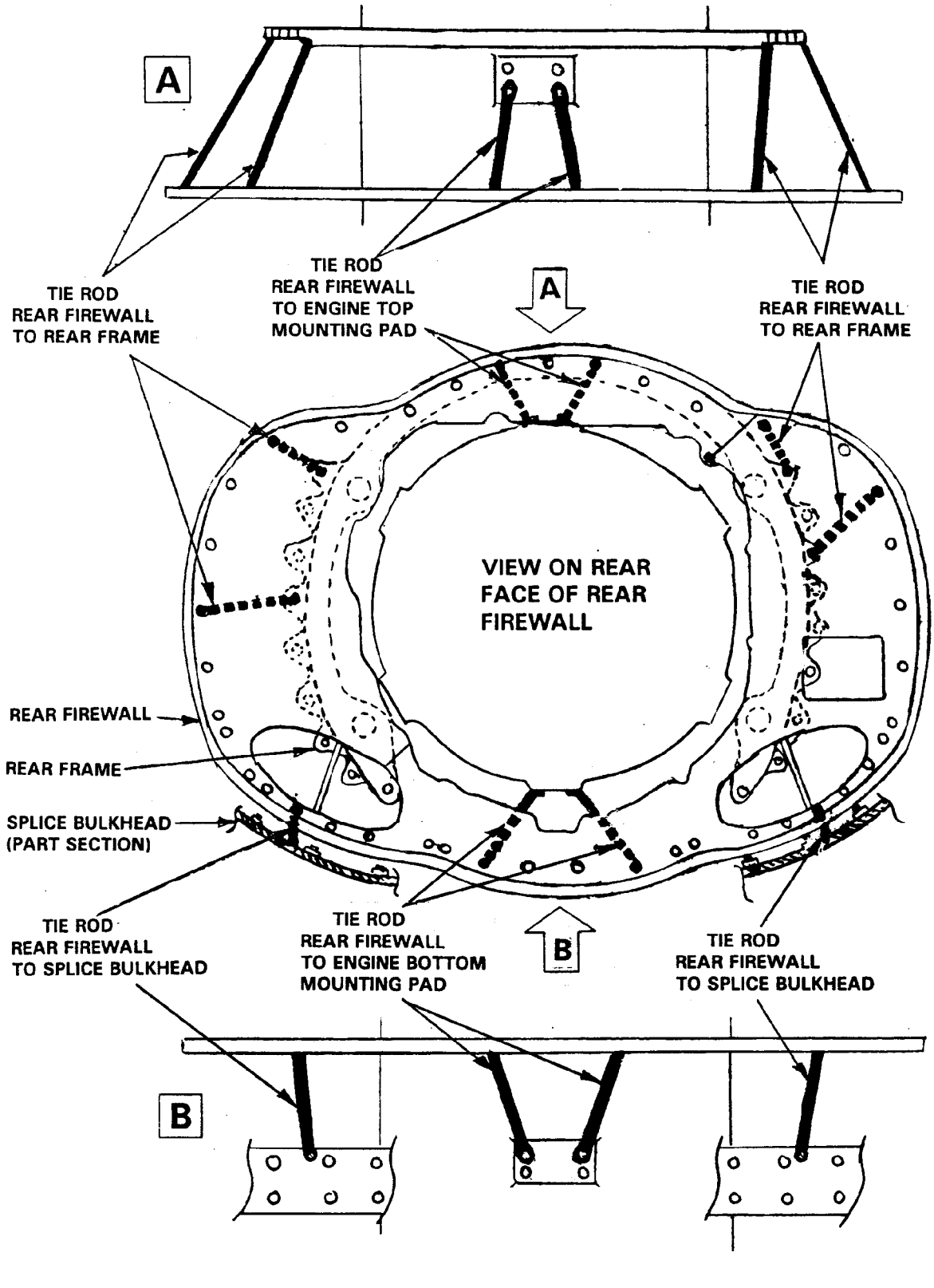

Fig. 401 - Tie Rods - Connection/Disconnection Details

(b) Remove the upper diaphragm complete with its support strut.

(c) Temporarily install the bolts, nuts and washers in their respective locations to prevent loss.

(15) Remove the lower diaphragms as follows:

(a) Remove the bolt and nut which secure the front lower diaphragm to the lower part of the center frame.

(b) Remove the bolt and three washers which secure the rear lower diaphragm to the bottom mounting pad of the engine at two of the four attachment holes.

NOTE: On the earliest production airplanes, the front lower diaphragm has support struts which must be removed to clear the engine removal line. To do this the support struts must be disconnected from the front diaphragm, and the oil cooler outlet ducts (to which the struts are riveted/welded) must be removed.

(c) Remove the lower diaphragms and temporarily install the bolts, nuts and washers in their respective locations to prevent loss.

(16) Disconnect the fuel inlet hose at the oil-to-fuel heater located at the bottom of the engine accessory gearbox below the fuel control unit.

(17) Disconnect the fuel return hose at the top of the engine fuel pump.

(18) Temporarily secure the collector (of the engine oil breather hose, and the hoses of the starter-generator and fuel pump drive drains) to the engine so that it will not cause obstruction during engine removal.

(19) Disconnect the power and condition control cables as follows:

(a) Disconnect the end of the power control cable at the lug on the sliding cam assembly.

(b) Disconnect the conduit of the power control cable at the bracket which is secured to the accessory gearbox.

(c) Disconnect the propeller/condition control input cable at the fork of the control mechanism.

(d) Disconnect the conduit of the propeller/condition control cable at the bracket which is secured to the accessory gearbox.

(e) Remove the eye-end and nuts from the ends of the cables and release the cables from the bracket.

(f) Temporarily install the loose items to prevent loss.

(20) Disconnect the precooler as follows (Ref. Fig. 402)

(a) Fully loosen the union nut (1) to disconnect the supply tube (11) from the bleed fitting (23).

(b) Fully loosen the union nut of the supply tube (20) to disconnect the tube from the bleed fitting (23).

(c) Remove the clamps (19) to disconnect the bleed fitting (23) from the inlet stub pipe (17).

(d) Remove the four nuts (4), washers (3) and bolts (2) which attach the bleed fitting (23) to the supply tube (8).

(e) Remove the four bolts (21) and washers (22) which attach the bleed fitting (23) to the engine.

(f) Remove the bleed fitting (23) complete with the packer (5) and put it in a safe place.

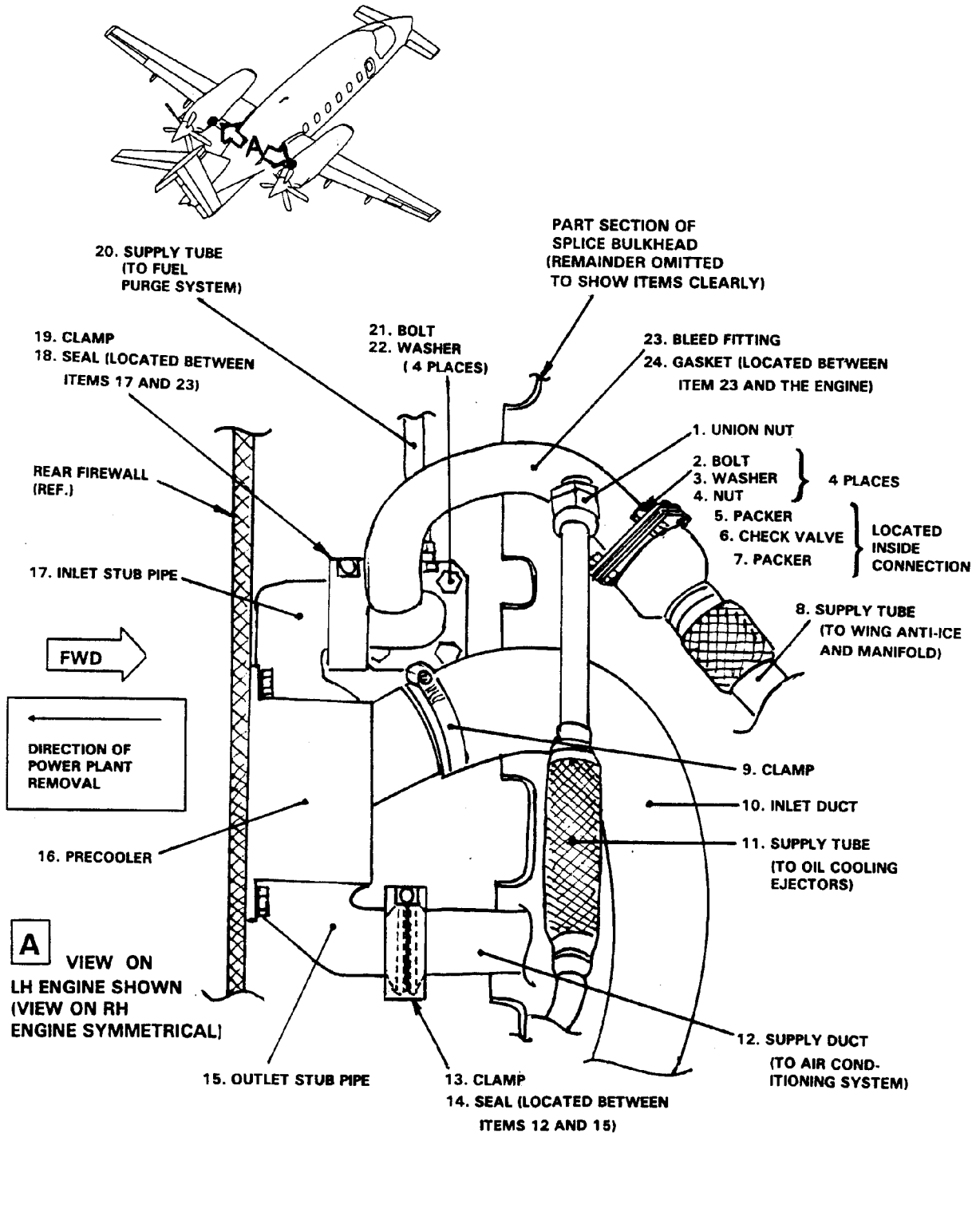

Fig. 402 - Precooler Connection/Disconnection Details

(g) Remove and discard the gasket (24) and the seal (18); make sure that the check valve (6) and packer (7) remain correctly installed in the supply tube (8).

(h) Remove the clamp (13) to disconnect the supply duct (12) from the outlet stub pipe (15); move the connection apart as required to remove the seal (14). Discard the seal.

(i) Remove the clamp (9) which secures the inlet duct (10) to the center stub pipe of the precooler (16) and pull the duct off the stub pipe.

(21) Remove the starter-generator (refer to 24-30-00).

NOTE: The engine can be removed with the starter-generator electrically disconnected but not removed. The reason for removing the starter-generator is to make the engine lighter at the accessory gearbox end; this helps to balance the engine because the lifting sling is (of necessity) installed at one end of the engine only.

(22) Remove the ignition unit (refer to 74-10-00).

NOTE: The ignition unit is part of the engine and remains with the engine when the engine is transported. The engine shipping container has a stowage bracket for the ignition unit.

(23) Temporarily secure the ignition cables to the engine so that they do not cause obstruction during engine removal.

(24) Make sure that all items which will remain attached to the engine during removal are disconnected from the airplane.

(25) Examine the engine lifting sling for condition and, if satisfactory, attach the sling to suitable hoisting equipment.

(26) Put the sling into position above the engine and attach the cables to the top mounting pad of the engine and to the lifting eye provided at the engine reduction gearbox.

(27) Use the hoisting equipment as required to take up the full weight of the engine; make sure that the hoisting equipment is in line with the engine centerline and that both cables of the lifting sling are equally tight.

(28) Remove and discard the cotter pin from the nut and bolt combination at the two upper vibration isolators and remove the locking wire from the bolt at the two lower isolators.

(29) Remove the bolt and washer at the two lower isolators; attach tags to the bolts and washer to maintain identification with the associated isolator.

(30) Remove the bolt, nut and three washers (one under the bolthead and two under the nut) at the two upper isolators; adjust the hoisting equipment as required to relieve any strain on the bolts and make removal easier. Attach tags to the bolts, nuts and washers to maintain identification with the associated isolator.

(31) Slowly and carefully remove the engine from the airplane; check continuously that there are no obstructions or hang-ups and, where necessary, adjust the position of the engine to make sure it clears all parts of the airplane.

(32) Move the engine to the stand or shipping container, as applicable.

WARNING: DO NOT POSITION YOURSELF UNDER THE SUSPENDED ENGINE. IF THE ENGINE FALLS, INJURY TO PERSONS CAN OCCUR. LOWER THE ENGINE AS REQUIRED TO MAKE REMOVAL OF THE ISOLATORS POSSIBLE FROM EACH SIDE OF THE ENGINE.

(33) Attach tags to the vibration isolators to identify their respective locations on the engine. Remove the isolators and put each isolator and is associated bolts, etc. in a protective envelope; tie the envelopes to the engine.

(34) Install the engine in the stand or shipping container as detailed in the Engine Maintenance Manual, 72-00-00.

(35) If applicable do a strip-down of the engine as detailed in 71-00-01.

4. Installation

NOTE: This installation procedure is applicable to both the left-hand and right-hand power plants. Data for the right-hand installation is given between parentheses.

A. Fixtures, Test and Support Equipment

Nomenclature	Part No.	Qty	Remarks
(1) Hoisting Equipment	Not Specified	1	Capable of lifting 550 lbs (250 kg) minimum
(2) Lifting Sling	TBD	1	
(3) Engine Stand	TBD	1	
(4) Access Platform	Not Specified	2	3 ft (1 m)

B. Consumable Materials

Nomenclature	Ref. No.	Qty	Remarks
Lockwire	04-008	A/R	
Cable Ties	Not Specified	A/R	Various sizes

C. Expendable Parts

Nomenclature	Fig./Item	IPC-CSN	Qty	Remarks
Seal	402/14	211000 1-140	1	
Seal	402/18	211000 1-140	1	
Gasket	402/24	P&WC 723631 1-140	1	
Cotter Pin	403	712000 1-430	2	Upper vibration isolators
Vibration Isolator (Ref. Note following this list)	403	712000 1-460	4	(LH Engine only, Barry Controls P/N 95007-18)

Nomenclature	Fig./Item	IPC-CSN	Qty	Remarks
Vibration Isolator (Ref. Note following this list)	403	712000 1-470	4	(RH Engine only, Barry Controls P/N 95007-17)

D. Referenced Information

Maintenance Manual Chapter 70-00-01
Maintenance Manual Chapter 71-20-00
Engine Maintenance Manual Chapter 72-00-00
Maintenance Manual Chapter 74-10-00
Maintenance Manual Chapter 24-30-00
Maintenance Manual Chapter 79-20-00
Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 61-10-00
Maintenance Manual Chapter 76-10-00
Maintenance Manual Chapter 21-60-00

E. Preparation

(1) Make sure that the airplane wheels are chocked, front and rear.
(2) Make sure that the airplane is statically grounded.
(3) Make sure that there is at least one serviceable fire extinguisher available in the vicinity of the airplane.
(4) Put the engine stand, complete with the built-up power plant, as close as practicable to the airplane to minimize the time the engine will be suspended.
(5) Before installing the power plant, inspect the four main mounting bolt holes of the engine mounting frame as detailed in 71-20-00, Page Block 201.
(6) The ignition unit and a set of vibration isolators will be found tied to the engine (Ref. 71-00-01); remove these items and check that the isolators are correct for the engine being installed (LH or RH). Ref. Para. B. of this topic.
(7) Make sure as necessary that:
- the applicable circuit breakers are open, tagged and safetied
- the warning notice (telling persons not to move the POWER or CONDITION LEVERS) is in place in the flight compartment
- the POWER LEVERS are set to IDLE, the CONDITION LEVERS are set to CUT OFF and the firewall fuel shutoff valve is set to CLOSED.

F. Procedure

(1) Examine the engine lifting sling for condition and, if satisfactory, attach the sling to suitable hoisting equipment.
(2) Put the sling into position above the engine and attach the cables to the top mounting pad of the engine and to the lifting eye provided at the engine reduction gearbox.
(3) Remove the engine from the stand/shipping container as detailed in the Engine Maintenance Manual, 72-00-00.

WARNING: DO NOT POSITION YOURSELF UNDER THE SUSPENDED ENGINE. IF THE ENGINE FALLS, INJURY TO PERSONS CAN OCCUR. LOWER THE ENGINE AS REQUIRED TO MAKE INSTALLATION OF THE VIBRATION ISOLATORS POSSIBLE FROM EACH SIDE OF THE ENGINE.

(4) Install the four vibration isolators as follows (Ref. Fig. 403):

NOTE: A gasket and four attaching bolts and washers are supplied with each vibration isolator assembly.

(a) Install the gasket on the mounting pad at the 2 o'clock position on the engine gas generator case.

(b) Put the isolator into position on the pad so that the spigot engages in the hole in the gasket and the pad, and the four bolt holes are aligned.

(c) Install the four bolts, with a washer under each bolthead; make sure that the countersunk face of the washer hole is toward the bolthead.

(d) Torque-tighten the bolts evenly and progressively to between 275 and 300 lbf.in. (31.1 and 33.9 Nm).

(e) Safety the bolts together, in pairs, with lockwire.

(f) Do steps (a) thru (d) for the isolators at the 4, 8 and 10 o'clock positions.

(5) Put the engine into position behind the mounting frame.

(6) Slowly and carefully move the engine forward into position in the mounting frame; check continuously that there are no obstructions to installation and, where necessary, adjust the position of the engine to make sure it clears all parts of the airplane.

(7) Adjust the hoisting equipment as required to align the holes in the upper vibration isolators with the holes in the mounting frame.

(8) Secure the engine to the mounting frame as follows (Ref. Fig. 403):

(a) Install the two drilled-shank bolts, with a countersunk washer under each bolthead, through the frame holes and into the isolator holes; make sure that the countersunk face of the washer is against the bolthead.

NOTE: If countersunk washers are not supplied, you can install a plain washer under the bolthead. This applies only to the bolts which secure the isolators to the mounting frame.

(b) Install two plain washers and a castellated nut on the end of each bolt. Tighten the nut fingertight only at this time.

(c) Align the holes in the lower vibration isolators with the holes in the mounting frame.

(d) Install the two drilled-head bolts, with a countersunk washer under each bolthead (Ref. NOTE above) through the isolator holes and into the frame holes; make sure that the countersunk face of the washer is against the bolthead.

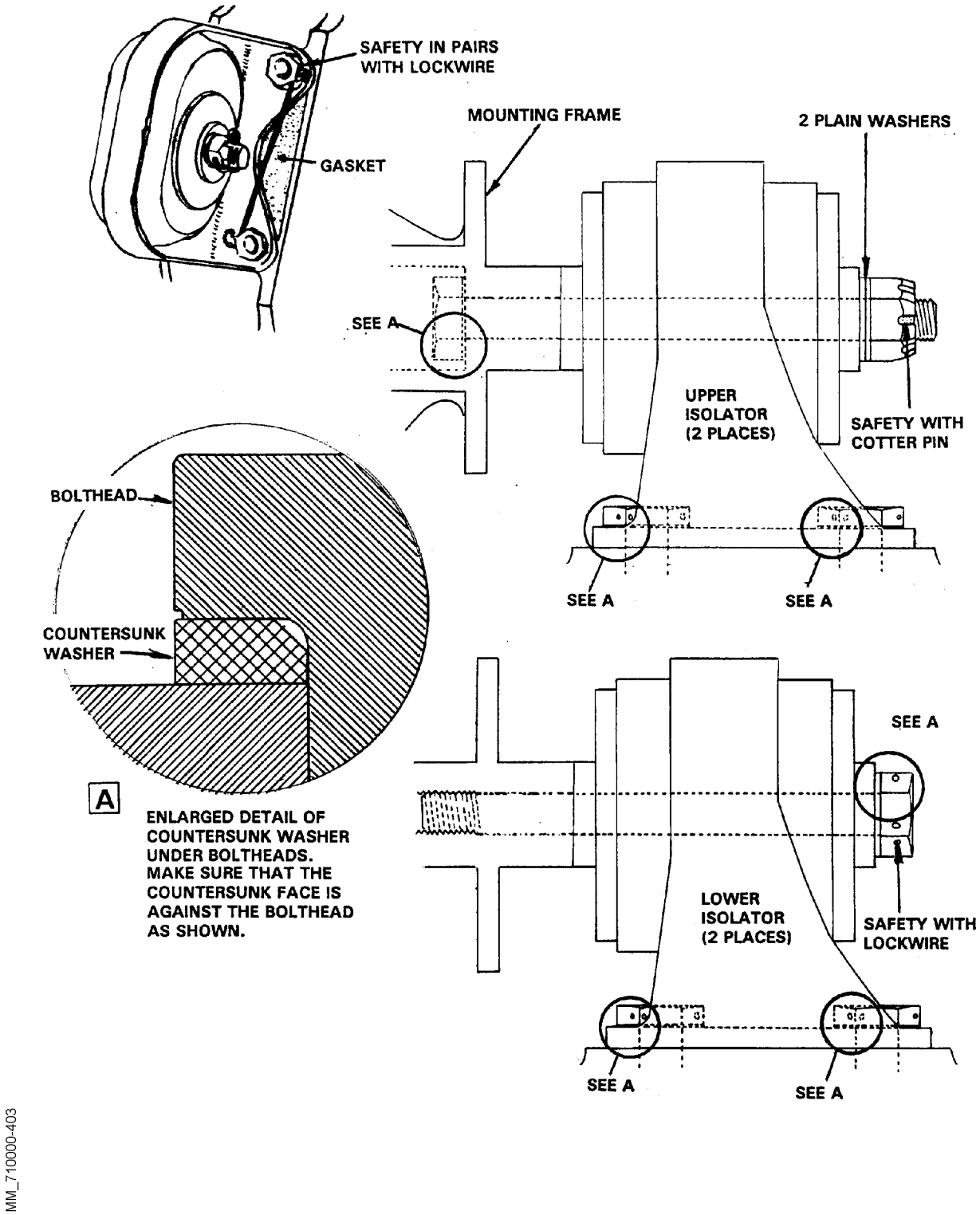

Fig. 403 - Vibration Isolators - Installation Details

(e) Engage the bolt threads with the threads of the mounting frame hole; make sure that the threads engage without misalignment and that the bolt can be turned without excessive force.

(f) Torque tighten the bolts and nuts at the upper isolators and the bolts at the lower isolators evenly and progressively to between 480 and 600 lbf.in. (54.2 and 67.8 Nm).

(g) Safety the nuts with new cotter pins and the (lower) bolts with lockwire.

(9) Install the ignition unit (Refer to 74-10-00).

(10) Install the starter-generator (Refer to 24-30-00).

(11) Connect the precooler as follows (Ref. Fig. 402):

(a) Remove the caps/covers from the line ends of the precooler, bleed fitting and associated items.

(b) Push the inlet duct (10) onto the center stub pipe of the precooler (16) and install the clamp (9) to secure the duct to the pipe.

(c) Install a new seal (14) between the ends of the supply duct (12) and the outlet stub pipe (15). Install the clamp (13) to secure the duct to the pipe.

(d) Make sure that the check valve (6) and packer (7) are correctly installed in the supply tube (8).

(e) Examine the packer (5) for damage and deterioration; if necessary, install a new packer.

(f) Put the bleed fitting (23) into position; install a new gasket (24), new seal (18) and the packer (5).

(g) Install the four bolts (21) and washers (22) to secure the bleed fitting (23) to the engine.

(h) Install the clamp (19) to secure the inlet stub pipe (17) to the bleed fitting (23); make sure that the seal (18) remains correctly in place.

(i) Install the four bolts (2), washers (3) and nuts (4) to secure the supply tube (8) to the bleed fitting (23); make sure that the check valve (6), packer (5) and packer (7) remains correctly in place.

(j) Connect the supply tubes (11) and (20) to the bleed fitting.

(k) Do a leak test of the precooler connections (Refer to 21-60-00).

(12) Remove the protective caps and connect the fuel return hose at the top of the engine fuel pump.

(13) Remove the protective caps and connect the fuel inlet hose at the oil-to-fuel heater located at the bottom of the engine accessory gearbox below the fuel control unit.

(14) Install the lower diaphragms as follows:

(a) Put the lower diaphragms into position between the center and rear firewalls and align the holes in the rear diaphragm with the two LH holes of the four holes in the bottom mounting pad.

(b) Install the bolt and three washers in each of the two holes to secure the rear diaphragm to the mounting pad.

(c) Align the hole in the front diaphragm with the hole in the lower part of the center frame.

(d) Install the bolt and nut to secure the front diaphragm to the center frame.

NOTE: On the earliest production airplanes, the front lower diaphragm has support struts which are welded/riveted to the oil cooler outlet ducts. To connect the struts to the diaphragm the oil cooler outlet ducts must be installed first.

(15) Install the upper diaphragm as follows:

(a) Put the upper diaphragm into position between the center and rear frames.

(b) Install the bolt, washer and nut to secure the upper diaphragm to:

– the top of the center firewall
– the top of the splice bulkhead
– the clamp (P-clip) on the cross tube of the mounting frame.

(16) Remove the blank from the filler neck of the engine oil tank and install the oil tank dipstick.

(17) Connect electrical connector P163 (P162) to the dipstick.

(18) Connect the following electrical connectors:

– P125 (P124) at the bracket on the wing adjacent to the inboard strut of the engine mounting frame
– P127 (P126) at the rear face of the engine center frame, lower part, inboard side
– P137 (P138) at the shutoff valve of the air conditioning system (located inboard between the center and rear firewalls).
– P227 (P226) at the shutoff valve of the oil cooling ejector system (located centrally between the center and rear firewalls).

(19) Use a cable tie to secure the wires of connector P137 (P138) to the plenum apron.

(20) Connect the two electrical bonding jumpers, one to each side of the center-frame lower-part.

(21) Install the ends of the oil cooler outlet ducts on the flanges of the rear firewall and secure each of the ducts to the firewall with a clamp.

NOTE: If, during removal of the power plant, it was necessary to disconnect the ejector tubes from their supply tube, the tubes must now be connected.

(22) Connect the tie rods of the rear firewall as follows (Ref. Fig. 401):

(a) Install the screw to secure the tie rod to the splice bulkhead in two places.

(b) Install the cap screw and three washers to secure the tie rods to the engine top and bottom mounting pads (four places total).

NOTE: At the bottom mounting pad one of the holes is used to secure the lower diaphragm and one of the tie rods. Use either the existing bolt or the cap screw at this location.

(c) Install the screw and nut to secure the tie rod to the rear frame in four places.

(23) Connect the oil hose to the elbow at the top of the engine oil tank.

(24) Install the oil cooler (Refer to 79-20-00).

(25) Install the propeller (Refer to 61-10-00), but do not install the nacelle panels at this time.

(26) Connect the power and condition control cables as follows:

(a) Remove the eye-end and nut from the propeller/condition control input cable, the two nuts from the power control cable, and the outer nut and washer from the two conduits (these items were temporarily installed after disconnection during the power plant removal procedure).

(b) Put the cables into position through the holes in the bracket which is secured to the accessory gearbox.

(c) Install the washer and nut on each of the two conduits and install one of the nuts at the end of the power control cable.

(d) Put the end of the power control cable into position in the lug of the sliding cam assembly.

(e) Tighten the nuts of the conduits so that the threaded part of the conduit is approximately central in the hole of the bracket.

(f) Install the nut on the end of the power control cable to secure the cable to the lug of the sliding cam.

(g) Install the nut and eye-end on the end of the propeller/condition control input cable.

(h) Connect the eye-end to the fork of the control mechanism.

(i) Adjust the power and propeller/condition control systems, as required, in accordance with the engine rigging procedures given in 76-10-00.

(27) Remove the cover from the engine air inlet screen.

(28) Perform a Generator Power Cable Routing Inspection. Refer to 24-30-00

(29) Install nacelle panels 410AB, 410AT, 430AL and 430AR (420AB, 420AT, 440AL, 440AR). Refer to 54-10-00.

(30) Remove the engine stand, access platforms and drip tray from the vicinity of the airplane.

(31) Remove the warning notice from the flight compartment.

(32) Remove the safety tags and close these circuit breakers:

Pilot CB panel:	Copilot CB panel:
L BLEED AIR	
L FW SHUT OFF	R OIL COOLER
L TRQ	CHIP DET
L TURB TEMP	(if installed)
L PROP RPM	PROP SYNCPH
L TURB RPM	(if installed)
L FUEL FLOW	AUTO FTR
L OIL PRESS	R OIL TEMP
L OIL TEMP	R OIL PRESS
IGN SYS	R FUEL FLOW
L ENG START	R TURB RPM

Pilot CB panel:	Copilot CB panel:
R ENG START	R PROP RPM
L ENG ICE VANE	R TURB TEMP
L OIL COOLER	R TRQ
	R FW SHUT OFF
	R BLEED AIR
	R ENG ICE VANE

(33) If the engine is equipped with the optional fire extinguisher, remove the safety tag and close the FIRE EXT circuit breaker on the panel in the baggage compartment.

(34) If a new/overhauled (zero-life) engine has been installed, depreserve the engine as detailed in 72-00-00 of the engine MM.

(35) Do an engine ground run and do the checks required "AFTER ENGINE INSTALLATION" as detailed in Page Block 501 of this section. Do also the checks required after engine controls rigging as detailed in 76-10-00.

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POWER PLANT - ADJUSTMENT/TEST
(ENGINE GROUND TESTING)

1. General

A. This topic gives the procedures and the information required for ground testing the engine and is to be used in conjunction with the Engine Maintenance Manual.

B. The procedures and information are given in the following order:

- Safety Precautions (refer to Para. 2)
- Engine and Propeller Limitations (refer to Para. 3)
- Engine Power Settings (refer to Para. 4)
- Emergency Procedures (refer to Para. 5)
- Starting Faults (refer to Para. 6)
- Preparation for Ground Run (refer to Para. 7)
- Dry Motoring Run (refer to Para. 8)
- Wet Motoring Run (refer to Para. 9)
- Close-Up (refer to Para. 10)
- Required Checks (refer to Para. 11)
- Engine Ground Run Checks (refer to Para. 12)

C. To prevent complication due to the many possible combinations of checks required during any one ground run, each check is given an individual check number and the instructions for doing the individual check are full and complete, including references to safety precautions, limitations, preparation and engine starting.

D. For the convenience of the operator a sample Ground Run Check Sheet is given at the end of this page block. The Check Sheet is intended to give the operator a sample of the suggested format; the operator may use the Check Sheet, or not, at his own discretion.

2. Safety Precautions

A. Engine ground running must be done only by persons who are fully qualified on the Pratt & Whitney engines as installed in the P180. Persons qualified to run the engines must be certificated by the applicable local authority as trained and competent in the use of fire fighting equipment, emergency procedures and all normal ground running procedures.

B. At least two persons should be used for the ground run - one in the flight compartment and one fire fighting attendant/observer. The fire fighting attendant(s)/observer(s) must wear ear defenders.

C. Ground running must be done with the airplane on hard, level around, and the ground must be clean (that means free from the dust, grit, sand, stones, rags and any spilled fluids).

D. The airplane must be positioned so that no persons, buildings, vehicles or other airplanes are subject to propeller and exhaust backwash. If one or both engines are to be run at high power settings, or if an acceleration check is required, the airplane must be positioned so that the area ahead is clear of any obstructions; aligning the airplane on the runway or the perimeter track is strongly recommended.

E. Appropriate fire fighting equipment, such as carbon dioxide (CO_2) or bromochlorodifluoromethane (BCF), must be positioned close to hand. The ground run attendant(s)/observer(s) must be fully trained in the use of the fire-fighting equipment.

F. The engine(s) must be shut down before any adjustments, or any other tasks, are done on the engine(s) or the airframe.

G. Refer to Fig. 501 for information on danger areas and the recommended location for equipment applicable to ground running.

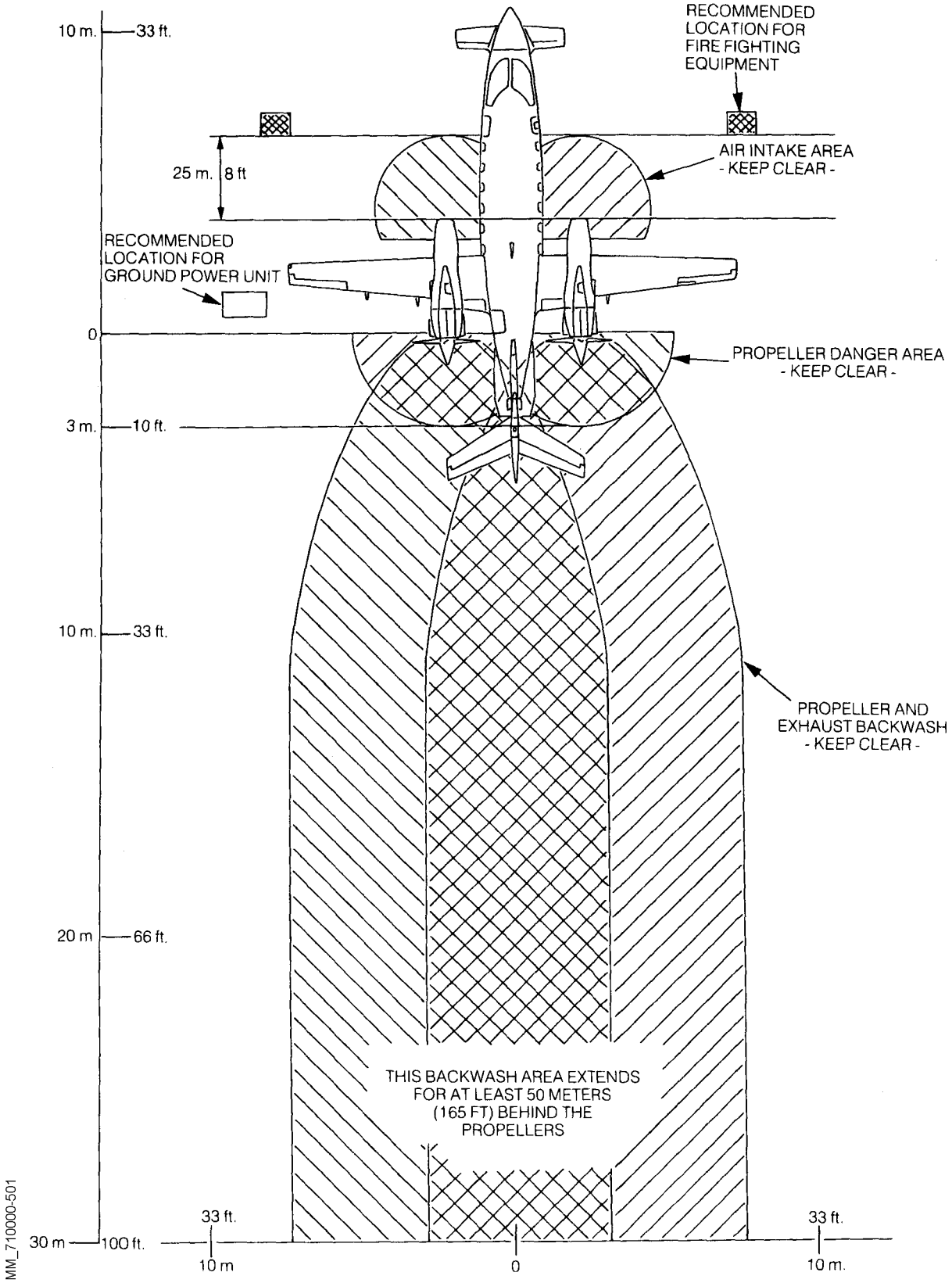

Fig. 501 - Danger Areas and Recommended Locations for Equipment

3. Engine, Propeller and Component Limitations

A. The following engine limitations apply to the Pratt & Whitney Canada (P&WC) engines as installed in the Piaggio P180 Avanti airplane. The limits are extracted from the P&WC Specific Operating Instructions..

POWER SETTING	TYPICAL ITT (°C)	OPERATING LIMITS					
		MAXIMUM OBSERVED ITT (°C)	TORQUE (%	Ng %	Np (RPM)	OIL PRESS. (PSIG)	OIL TEMP.
MAX PWR	785	830	2230 MAX	104 MAX	2000 MAX	90 to 135	0 to 104
IDLE	-	715	-	51 MIN	-	60 MIN	-40 to 110
STARTING	-	1000 (5 SECS. MAX)	-	-	-	200 MAX	-40 MIN
TRANSIENT	-	870 (20 SECS. MAX)	2750 (20 SECS. MAX)	104 MAX	2205 MAX	40 to 200	0 to 110
MAX REVERSE	-	760	-	-	1900 MAX	100 to 135	0 to 104

NOTE 1:The engine torque limits apply to propeller speeds between 1600 and 2000 rpm. Below 1600 rpm torque is limited to 49.3%.

NOTE 2: Normal oil pressure is 90 to 135 psig above 72% Ng at normal oil temperature (60 to 70 °C). Oil pressure below 60 psig is unsafe and requires that the engine be shut down immediately.

NOTE 3: For increased service life of engine oil, an oil temperature of between 74 to 80°C is recommended. A minimum oil temperature of 55°C is recommended for fuel heater operation at maximum power.
Oil temperature limits are -40°C to 104°C with limited periods of 10 minutes at 104 to 110°C.

NOTE 4: The maximum observed ITT at IDLE applies over an Ng range of 51 to 61%.

B. Fig. 502 and 503 give details of the action to be taken in the event of torque and/or ITT limits being exceeded. Record the details (including the duration) of any occurrence of overtorque/overtemperature and refer to Fig. 502/503 for further instructions.

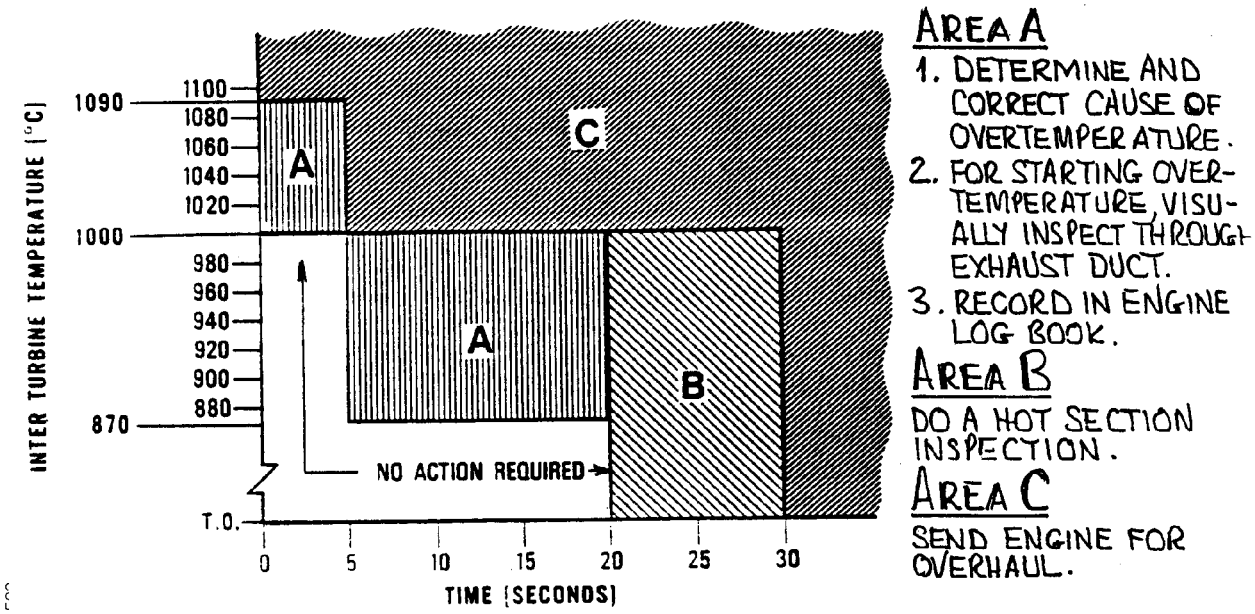

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Fig. 502 - Engine ITT Limits

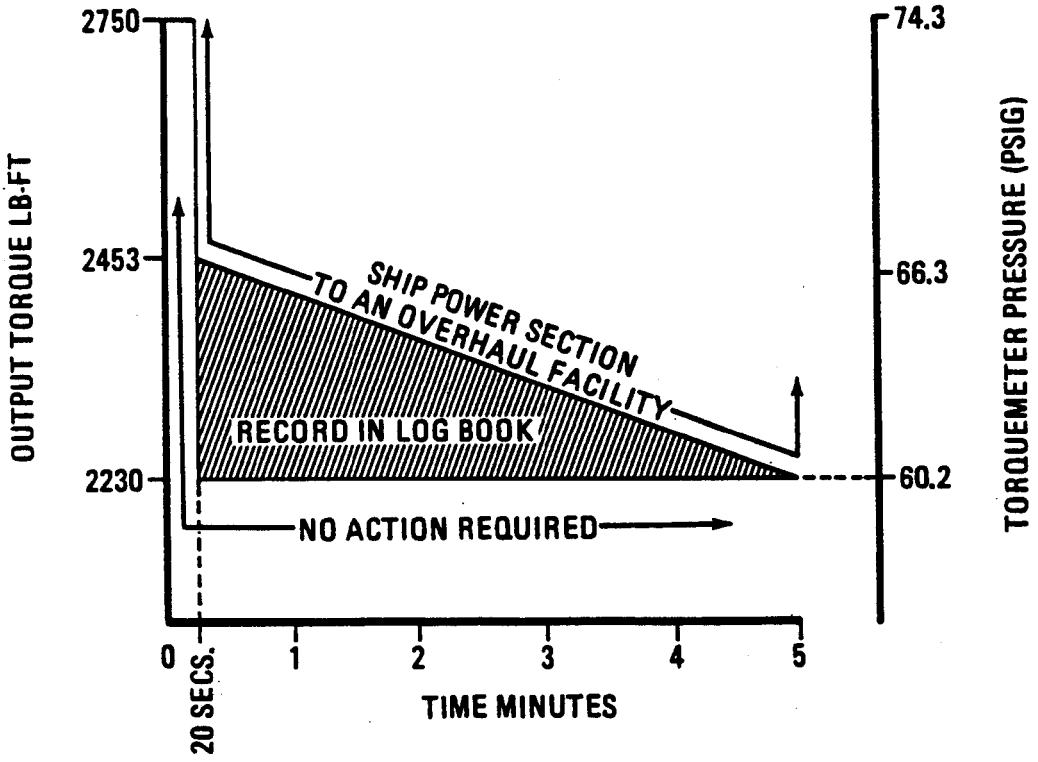

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Fig. 503 - Engine Torque Limits

C. The following limitations apply to the Hartzell HC-E5N-3(A) and HC-E5N-3(A)L propellers installed on the Piaggio P180 Avanti airplane.

(1) STABILIZED GROUND OPERATION OF AN UNFEATHERED PROPELLER BELOW 900 RPM AND BETWEEN 1300 AND 1600 RPM IS PROHIBITED.

(2) STABILIZED GROUND OPERATION OF A FEATHERED PROPELLER ABOVE 600 RPM IS PROHIBITED.

(3) REVERSE THRUST MAY BE INITIATED ONLY AFTER PROPELLER SPEED HAS DROPPED BELOW 1900 RPM.

(4) REVERSE THRUST MUST NOT BE SELECTED UNLESS THE ENGINE IS RUNNING. SELECTION OF REVERSE THRUST ON A STATIC ENGINE CAN DAMAGE THE MECHANICAL LINKAGE.

(5) GROUND OPERATION AT TORQUE SETTING

(6) GROUND OPERATION FOR MORE THAN 1 HOUR, IF TORQUE

D. The following limitations apply to the starter-generator during engine starting and motoring operations:

(1) A MAXIMUM OF 30 SECONDS ON, FOLLOWED BY AT LEAST 1 MINUTE OFF THEN, IF NECESSARY,

(2) A MAXIMUM OF 30 SECONDS ON, FOLLOWED BY AT LEAST 1 MINUTE OFF THEN, IF NECESSARY,

(3) A MAXIMUM OF 30 SECONDS ON FOLLOWED BY AT LEAST 30 MINUTES OFF BEFORE A FOURTH START ATTEMPT MAY BE MADE.

4. Engine Power Settings

A. The engine power settings which are placarded on the control lever quadrant are as follows:

(1) MAX PWR

This setting gives the maximum power permissible for safe engine operation and corresponds to 850 shaft horsepower (SHP) at an engine gas generator speed (Ng) of 104% and a propeller speed (Np) of 2000 rpm. Maximum power is available at sea level up to an ambient temperature of 69.4°C (157°F).

(2) FI

This flight idle setting is for use mainly when the airplane is in the descent and approach modes and is obtained by placing the power control lever in the IDLE position and the corresponding propeller control lever in the FI position. The setting corresponds to 71% Ng.

NOTE: The propeller control lever is also known as the condition lever because it "conditions" the engine fuel control unit to provide high (flight) or low (ground) idle power.

(3) GI

This ground idle setting is for use mainly to reduce noise levels (to comply with aviation regulations) during ground operations and is obtained by placing the power control lever in the IDLE position and the corresponding propeller control lever in the GI position. This setting corresponds to 54% Ng.

(4) MAX REV

This setting gives the maximum reverse pitch of the propeller and the engine power necessary for maximum efficiency when operating in the reverse mode. This setting corresponds to 86% Ng and is the maximum power available in the reverse mode.

B. Engine power in the forward thrust mode is established by setting the power control lever to the required position between IDLE and MAX PWR.

C. Engine power in the reverse thrust mode is established by setting the power control lever to the required position between IDLE and MAX REV.

NOTE: Inadvertent selection of reverse thrust is prevented by a detent, at the IDLE position, which requires that the power control lever be lifted before it can be moved rearward from IDLE.

5. Emergency Procedures

WARNING: ALL PERSONS INVOLVED WITH GROUND RUNNING MUST BE AWARE OF THE FOLLOWING EMERGENCY PROCEDURES. FAILURE TO TAKE IMMEDIATE AND APPROPRIATE ACTION COULD RESULT IN LOSS OF LIFE AND DESTRUCTION OF THE AIRPLANE.

A. If an engine fire occurs (L FIRE or R FIRE red annunciator on) take the following immediate action:

(1) Set both of the propeller control levers to CUT OFF.
(2) Set both of the firewall fuel shut off valves (L F/W VALVE and R F/W VALVE) to CLOSED.
(3) Set both of the fuel booster pumps switches (L PUMP and R PUMP) to OFF.
(4) Make sure that both of the ignition switches (L IGN and R IGN) are set to NORM.
(5) Press the appropriate engine fire extinguisher switch (L ENG FIRE EXT or R ENG FIRE EXT).
(6) Set the battery master switch (BAT) to OFF.
(7) Evacuate the airplane.
(8) If the fire is visible from outside the airplane give assistance to the fire fighting attendant in extinguishing the fire, using the fire- fighting equipment.

B. If an engine failure occurs or if any of the engine or propeller limits are exceeded, take the following immediate action:

(1) Set both of the propeller control levers to CUT OFF.

(2) Set both of the firewall fuel shut off valves (L F/W VALVE and R F/W VALVE) to CLOSED.
(3) Set both of the fuel booster pump switches (L PUMP and R PUMP) to OFF.
(4) Make sure that both of the ignition switches (L IGN and R IGN) are set to NORM.
(5) Set the battery master switch (BAT) to OFF.
(6) Evacuate the airplane.
(7) Wait for the failed engine to cool down then investigate the cause of the engine failure.

C. If an internal engine fire occurs during shutdown, take the following immediate action:

(1) Make sure that the power control lever is at the IDLE position.
(2) Make sure that the propeller control lever is at the CUT OFF position.
(3) Open the IGN SYS circuit breaker located on the pilot CB panel.
(4) Set the appropriate start switch (L START or R START) to the START position and, after a maximum of 30 seconds, return the start switch to OFF.
(5) If the fire continues, or is suspected of continuing:
(a) Set the firewall fuel shut off valve (L F/W VALVE or R F/W VALVE as applicable) to CLOSED.
(b) Set the battery master switch (BAT) to OFF.
(c) Evacuate the airplane.

6. Starting Faults

A. General

(1) Each unsatisfactory and/or unsuccessful attempt to start an engine must be investigated and the cause must be rectified.
The troubleshooting section of the engine maintenance manual 72-00-00, gives details of the procedures to be followed to find and rectify engine faults which may contribute to unsatisfactory/ unsuccessful starts.
(2) The following paragraphs give details of the more common starting faults and gives the necessary instructions for the immediate actions required for safe engine operation.

B. Engine Fails to Reach Satisfactory Stabilized Ng.

If the engine gas generator fails to reach its minimum stabilized speed of 13% Ng, when the start switch is set to START, abort the start and proceed as follows:

(1) Set the start switch to OFF.
(2) Set the propeller control lever to CUT OFF.
(3) Allow the engine to run down.
(4) Failure of the engine to reach satisfactory Ng under starter motor power indicates an inadequate power supply, so check the ground power unit or the aircraft battery as applicable.

(5) If the power supply to the starter is satisfactory, refer to the troubleshooting sections of Chapter 24-30-00 and the engine maintenance manual 72-00-00.

C. No Start/Wet Start

If the gas generator fails to light up within 10 seconds, (no rise in Ng above starter induced speed and no rise in ITT), abort the start and proceed as follows:

(1) Set the start switch to OFF.
(2) Set the propeller control lever to CUT OFF.
(3) Allow the engine to run down.
(4) Do a dry motoring run (refer to Para. 8).
(5) Do a test of the ignition system (refer to 74-00-00).
(6) Attempt another start. In the event of a further no start/wet start refer to the troubleshooting section of the engine maintenance manual 72-00-00.

D. Delayed Start

If engine lightup takes more than 10 seconds after setting the propeller control lever to GI (Ground Idle) abort the start and proceed as follows:

(1) Set the start switch to OFF.
(2) Set the propeller control lever to CUT-OFF.
(3) Allow the engine to run down.
(4) Do a dry motoring run (refer to Para. 8).
(5) Do a test of the ignition system (refer to 74-00-00).
(6) Attempt another start. In the event of a further delayed start refer to the troubleshooting section of the engine maintenance manual 72-00-00.

E. Hung or False Start

If the engine lights up but Ng remains less than 54% proceed as follows:

NOTE: A hung or false start is also indicated by an abnormal rise in ITT

(1) Set the propeller control lever to CUT OFF immediately a hung start becomes apparent.
(2) Listen, during engine rundown, for any abnormal engine noises.
(3) Allow the engine to run down then do a drymotoring run (refer to Para. 8).
(4) If motoring run is normal, attempt a successful start.
(5) If another hung or false start occurs refer to the troubleshooting section of the engine maintenance manual 72-00-00.

F. Impending Hot Start

If, after engine lightup, the ITT rises rapidly through 700°C, or rises normally but continues to rise towards 1000°C, the starting temperature limit of 1000°C for 5 seconds is liable to be exceeded and the start must be aborted.
Proceed as follows:

(1) Set the propeller control lever to CUT OFF immediately an impending hot start becomes apparent and at the same time observe the maximum ITT indication.
(2) Allow the engine to run down.

(3) If the ITT limit for starting is exceeded refer to Fig. 502 for the appropriate action to be taken.

(4) If the ITT limit for starting is not exceeded, do a dry motoring run (refer to Para. 8) then attempt another start.

(5) In the event of another Impending Hot Start refer to the troubleshooting section of the engine maintenance manual 72-00-00.

NOTE: An Impending Hot Start may be caused by a Delayed Start or a Hung Start

G. Hot Start

Failure to recognize an Impending Hot Start could result in a Hot Start, which is when the ITT limit for starting is exceeded.
If a Hot Start occurs proceed as follows:

(1) Set the propeller control lever to CUT OFF immediately the ITT starting limit of 1000°C for 5 seconds is exceeded.

(2) Make note of the full extent of the overtemperature and the duration, and refer to Fig. 502 for the appropriate action to be taken.

7. Preparation for Ground Running

A. Documentation Checks

(1) Check the airplane servicing documents for any outstanding maintenance tasks which may affect the ground running procedures.

(2) Obtain copies of Ground Run Check Sheets as required and complete the necessary details.

NOTE: A suggested format for a Ground Run Check Sheet is given at the end of this Page Block. In the absence of any other Check Sheet which the operator may have produced, remove the one at the end of this Page Block, obtain copies as required and return the Sheet to its original place.

(3) If a performance check is to be done obtain and record the ambient air temperature and atmospheric pressure. Apply the obtained figures to the Engine Performance Check Curves (Refer to Para. 12K.) and extract the ambient-corrected figures for:

- Torque Pressure (Tq) in foot pounds (%)
- Fuel Flow (Wf) in pounds per hour (PPH)
- Interturbine Temperature (ITT) in degrees Celsius (°C)
- Gas Generator Speed (Ng) in percent (%)

for a propeller speed (Np) of 2000 rpm.

B. External Checks

(1) Fixtures, Test and Support Equipment

(a) Fire-Fighting Equipment - CO_2 or BCF

(b) Ear Defenders - as required, not specified

(c) Ground Power Unit (GPU) - not specified

(d) Chocks - 4 required, not specified

(2) Make sure that the airplane fuel content is sufficient for the ground run. Replenish if required (Refer to 12-00-00).

(3) Check the engine oil level. Replenish if required (Refer to 12-00-00).

(4) Check the airplane tire pressures. Inflate if required (Refer to 12-00-00).

(5) Position the airplane, nose into wind.

(6) Apply the parking brake.

(7) Chock both of the main wheels, front and rear.

(8) Place the fire fighting equipment in position (Refer to Fig. 501).

(9) Place the GPU in position (Refer to Fig. 501) and connect the GPU to the airplane (Refer to 24-30-00).

NOTE: Use of a GPU is optional. However, it is recommended that one be used, especially if several engine starts are to be made, to conserve the life of the airplane battery.

(10) Remove the propeller restraints.

(11) Remove and stow all covers and blanks.

(12) Inspect the engine air intakes and make sure that the complete intake system is free from foreign objects.

(13) Inspect the nacelles and make sure that all fasteners are installed.

(14) Make sure that the ground run area is free from unnecessary ground equipment, etc.

C. Flight Compartment

(1) Remove the gust lock (Refer to 27-70-00).

(2) Make sure that the avionics switch is set to the OFF position (this is to make sure that no damage will be caused to the avionics by possible current surges from the ground power unit during starting).

8. Dry Motoring Run

A. General

(1) This procedure is used whenever it is thought necessary to remove internally trapped fuel or vapor or if there is evidence of a fire within the engine gas path.

(2) By running the engine, under starter power, without fuel or ignition, the air passing through the engine purges the fuel, vapour or fire from the combustion, turbine and exhaust sections of the engine.

B. Procedure

(1) Check the position of controls and switches in the flight compartment as follows:
- Ignition system circuit breaker, IGN SYS on the pilot CB panel - open
- Power control levers - set to IDLE
- Propeller control levers - set to CUT OFF
- Bleed air switches - set to OFF
- Firewall fuel shutoff valves, L F/W VALVE and R F/W VALVE set to CLOSED.
- Battery master switch - set to BAT
- Generator master switches, L and R GENERATOR set to OFF
- Fuel booster pumps L PUMP and R PUMP - set to OFF

(2) Check that the Ground Power Unit (GPU) is connected and supplying the airplane with electrical power.

NOTE: The engine(s) may be motored using the power of the airplane battery or a GPU. Use of a GPU is recommended.

(3) Obtain clearance from the fire fighting attendant/observer to motor the engine.

CAUTION: DO NOT MOTOR THE ENGINE FOR MORE THAN 30 SECONDS CONTINUOUSLY. STARTER LIMITS ARE: 30 SECONDS ON, 1 MINUTE OFF, 30 SECONDS ON, 1 MINUTE OFF, 30 SECONDS ON, 30 MINUTES OFF.

(4) Set the starter switch to START.

(5) If the engine is being motored to extinguish an internal fire:
- observe the ITT and continue motoring until ITT falls
- if ITT remains steady immediately:

(a) Propeller Control Lever: Check CUT OFF

(b) Firewall fuel shutoff valve: Check CLOSED

(c) Ignition System circuit breaker, IGN SYS, on the Pilot CB Panel: Check OPEN

(d) ITT: Continue motoring until drops, respecting motoring time

(6) Set the Starter Switch to OFF.

(7) After the engine has run down, set the fuel booster pump switches to OFF.

(8) Set the battery master switch to OFF.

(9) Close the ignition system circuit breaker.

9. Wet Motoring Run

A. General

(1) This procedure is used strictly for maintenance purposes and is not part of the normal engine starting procedure.

(2) After a wet motoring run, a dry motoring run must be done before an attempt is made to start the engine.

B. Procedure

(1) Check the position of controls and switches in the flight compartment as follows:
- Ignition system circuit breaker, IGN SYS on the pilot CB panel - open
- Power controls levers - set to IDLE
- Propeller control levers - set to CUTOFF
- Bleed air switches - set to OFF
- Firewall fuel shutoff valves, L F/W VALVE and R F/W VALVE set to OPEN
- Battery master switches set to BAT
- Generator master switches, L and R GENERATOR - set to OFF
- Fuel booster pumps L PUMP and R PUMP - Set to MAIN

(2) Check that the Ground Power Unit (GPU) is connected and supplying the airplane with electrical power.

NOTE: The engine(s) may be motored using the power of the airplane battery or a GPU. Use of a GPU is recommended.

(3) Obtain clearance from the fire fighting attendant/observer to motor the engine.

CAUTION: DO NOT MOTOR THE ENGINE FOR MORE THAN 30 SECONDS CONTINUOUSLY. STARTER LIMITS ARE: 30 SECONDS ON, 1 MINUTE OFF, 30 SECONDS ON, 1 MINUTE OFF, 30 SECONDS ON, 30 MINUTES OFF.

(4) Set the starter switch to START

(5) At Ng of 18.7% with an oil pressure of 30 psig or more, set the propeller control lever to GI for 10 seconds.

(6) Set the propeller control lever to CUT OFF.

(7) Set the starter switch to OFF.

(8) During engine rundown, check that the flow divider/purge valve and both gas generator case drain valves are functioning (Refer to the engine maintenance manual, 73-16-34 and 73-16-36 respectively).

(9) Set the fuel booster pump switches to OFF.

(10) Check oil lines, fuel lines and connections for leaks. No leaks are allowed.

(11) Do a dry motoring run (Refer to para. 8).

10. Close-Up

A. General

(1) After the required ground run checks have been done it is necessary to do final checks and tasks to make the airplane safe.

(2) The checks and tasks which make up the "close-up" procedure are to be done as soon as possible after the engines have run down and all shutdown and after-shutdown checks have been made.

B. Procedure

(1) Check the positions of controls and switches in the flight compartment as follows:
- Power control levers - set to IDLE
- Propeller control levers - set to CUT OFF
- Landing gear selector - set to DN
- Firewall fuel shutoff valves, L and R F/W VALVE - set to CLOSED
- Fuel booster pump switches, L and R PUMP - set to OFF
- Bleed air switches, L and R - set to OFF
- Ignition switches, L and R IGN - set to NORM
- Generator master switches, L and R GENERATOR - set to OFF
- Battery master switch - set to OFF

(2) Check that the GPU (if one was used) is switched off, and disconnected from the airplane and that the ground power receptacle access door 271 A is closed.

(3) Make sure that the flight compartment is clean and that all tools, equipment, etc. have been removed.

(4) Install the gust lock (Refer to 27-70-00).

(5) Inspect the engine air intakes and the propellers for damage and rectify any damage found.

(6) Install all covers and blanks which were removed and stowed during the preparation for ground run.

(7) Install the propeller restraints.

(8) Make sure that all necessary details are entered on the Ground Run Check Sheet(s) and that all necessary details are transferred to the engine and airplane log books.

11. Required Checks

A. General

(1) The list on the page opposite gives the occasions when an engine ground run is required and the checks to be done to satisfy the requirements of the run.

(2) The checks are numbered for ease of reference and each check number is permanently assigned to a specific check. For example, CHECK 11 is assigned to the Engine Performance check so CHECK 11, when referenced within this manual, will always be a reference to the Engine Performance check.

NOTE: Check numbers assigned within this manual do not correspond to the check numbers (paragraph reference numbers) assigned to the same checks within the engine maintenance manual (EMM). The format of this Chapter 71 differs from Chapter 71 in the EMM because this Chapter 71 deals with the Power Plant as a complete unit whereas the EMM deals only with the basic engine.

B. Complete List of Checks

(1) CHECK 1 - Engine Starting (Refer to Para 12.A)
(2) CHECK 2 - Idle Speed (Refer to Para 12.B)
(3) CHECK 3 - Generator (Refer to Para 12.C)
(4) CHECK 4 - Maximum Propeller Speed (Refer to Para 12.D)
(5) CHECK 5 - Feathering (Refer to Para 12.E)
(6) CHECK 6 - Autofeather (Refer to Para 12.F)
(7) CHECK 7 - Underspeed Fuel Governing (Refer to Para 12.G)
(8) CHECK 8 - Check for Interference between the Normal Governing and Overspeed Fuel Governing Functions of the Propeller Governor (Refer to Para. 12.H)
(9) CHECK 9 - Overspeed Governor (Refer to Para. 12.I)
(10) CHECK 10 - Oil Pressure (Refer to Para. 12.J)
(11) CHECK 11 - Engine Performance (Refer to Para. 12.K)
(12) CHECK 12 - Engine Shutdown and Rundown (Refer to Para. 12.L)
(13) CHECK 13 - After Shutdown (Refer to Para. 12.M)

REASON FOR GROUND RUN	CHECKS TO BE DONE												
	1	2	3	4	5	6	7	8	9	10	11	12	13
BEFORE 500/1500 HOURS INSPECTION	X	X	X	X	X	X	X	X	X	X	X	X	X
AFTER 500/1500 HOURS INSPECTION	X	X	X	X	X	X	X	X	X	X	X	X	X
AFTER ENGINE INSTALLATION (2)	X	X	X	X	X	X	X	X	X	X	X	X	X
AFTER LONG TERM STORAGE (2)	X	X	X	X	X	X	X	X	X	X	X	X	X
AFTER REPAIR, REPLACEMENT OR ADJUSTMENT OF THE FOLLOWING COMPONENTS:													
– PROPELLER OR PROP. GOVERNOR	X			X	X		X	X			X	X	X
– PROP. OVERSPEED GOVERNOR	X			X	X	X			X			X	X
– REVERSING LINKAGE	X			X			X	X				X	X
– DC GENERATION SYSTEM COMPONENTS	X		X									X	X
– FUEL CONTROL UNIT (3)	X	X									X	X	X
– FUEL PUMP (ENGINE) (3)	X	X									X	X	X
– FUEL LINES/FUEL MANIFOLD/ FUEL NOZZLES/FUEL FLOW DIVIDER AND PURGE VALVE/FUEL DRAIN VALVES (3)	X	X									X	X	X
– COMPRESSOR BLEED VALVE	X	X									X	X	X
– P3 (COMPRESSOR) AIR FILTER	X										X	X	X
– OIL FILTER, HOUSING AND CHECK VALVE	X									X	X	X	X
– OIL PRESSURE REGULATING VALVE	X									X	X	X	X
– OIL-TO-FUEL HEATER	X									X	X	X	X
– THERMOSTATIC BYPASS AND CHECKVALVE	X									X	X	X	X
– ANY OTHER PRESSURE OIL SYSTEM COMPONENT	X									X	X	X	X
– NO. 2 BEARING SCAVENGE OIL TUBE	X											X	X
– EXTERNAL SCAVENGE OIL TUBES	X											X	X
– TORQUE PRESSURE TRANSDUCER/ HIGH AND LOW TORQUE PRESSURE SWITCHES	X					X					X	X	X
– IGNITION SYSTEM COMPONENTS	X											X	X
– POWER/PROPELLER CONTROL SYSTEM COMPONENTS	X	X		X	X						X	X	X

(1) Only if rectification work has been done on the engine

(2) The engine Depreservation Procedure must be done before the ground run (Refer to the Engine Maintenance Manual 72-00-00.

(3) Do a wet motoring run before the ground run

12. Engine Ground Run Checks

A. CHECK 1 - Engine Starting

(1) Prestart checks.

(a) Check the positions of controls and switches in the flight compartment as follows:

- Required circuit breakers - closed
- Power control levers - set to IDLE
- Propeller control levers - set to CUT OFF
- Bleed air switches, L and R - set to OFF
- Ignition switches, L IGN and R IGN - set to NORM
- Firewall fuel shutoff valves, L F/W VALVE and R F/W VALVE - set to OPEN
- Battery master switch - set to BAT
- Generator master switches, L and R GENERATOR - set to OFF
- Fuel booster pumps, L PUMP and R PUMP - set to OFF
- Oil cooler switches, L and R OIL COOL - set to OFF
- Autofeather switch - set to OFF

(b) Check that the GPU is connected and supplying the airplane with electrical power.

NOTE: The first engine (left or right) may be started using the power of the airplane battery or a GPU. Use of a GPU is recommended.

(c) Check that the following annunciators are on:

- L OIL PRESS
- L FUEL PUMP
- L FUEL PRESS
- L GEN
- AUTOFEATHER
- R OIL PRESS
- R FUEL PUMP
- R FUEL PRESS
- R GEN
- EXT POWER

NOTE: There will be other annunciators on but only those listed above are applicable to the Ground Run Checks.

(2) Starting - First Engine (Left or Right)

WARNING: ENGINE STARTING MUST NOT BE ATTEMPTED BEFORE:

- ALL SAFETY PRECAUTIONS HAVE BEEN COMPLIED WITH
- ALL PREPARATIONS FOR GROUND RUN AND ALL PRESTART CHECKS ARE DONE.

WARNING: PERSONS INVOLVED IN THE GROUND RUN MUST:

- BE AWARE OF THE POSSIBLE STARTING FAULTS WHICH MAY OCCUR AND THE SUBSEQUENT PROCEDURES (REFER TO PARA.6)
- BE AWARE OF THE ACTIONS TO BE TAKEN IN THE EVENT OF AN EMERGENCY (REFER TO PARA.5).

(a) Set the fuel booster pump switches L PUMP and R PUMP to STBY and check that the L FUEL PRESS and R FUEL PRESS annunciators go off.

(b) Set the fuel booster pump switches to MAIN and check that L FUEL PRESS and R FUEL PRESS annunciators remain off and that the L FUEL PUMP and R FUEL PUMP annunciators go off.

(c) Obtain clearance from the fire fighting attendant/observer to start the engine.

(d) Set the starter switch to START. Check for a rise in Ng and oil pressure.

(e) At 13% Ng, set the propeller control lever to G.I. Be prepared to abort the start by setting the propeller control lever to CUT OFF in the event of an Impending Hot Start.

(f) Check that Ng accelerates to ground idle speed (54%) and that the ITT limit of 1000°C for 5 seconds is not exceeded. Make a note of the MAX ITT reading.

NOTE: At about 40% Ng the starter switch should automatically return to the OFF position.

(g) At stabilized ground idle speed check the following:

- ITT: 715°C max.
- Oil Pressure: 60 psig min.
- Oil Temperature: 110°C max.
- Ng: 54% min.
- Np: 900 rpm min.

(h) If this is the first start of the ground run, feather and unfeather the propeller at least twice to purge the propeller control system of air and to circulate warm oil through the system.

(i) Record on the Ground Run Check Sheet the maximum ITT reading noted during the starting procedure.

(j) Set the propeller control lever to F.I.

WARNING: TAKE EXTREME CARE WHEN CONNECTING/ DISCONNECTING THE GPU WHILE THE ENGINES ARE RUNNING. AVOID ENTERING THE DANGER ZONES DESIGNATED FOR THE AIR INTAKES AND PROPELLER (REFER TO FIG. 501). DEATH OR INJURY TO PERSONS CAN OCCUR.

(k) Unless it is needed for starting the second engine, disconnect the GPU (Refer to 24-30-00) and check that the EXT POWER annunciator goes off.

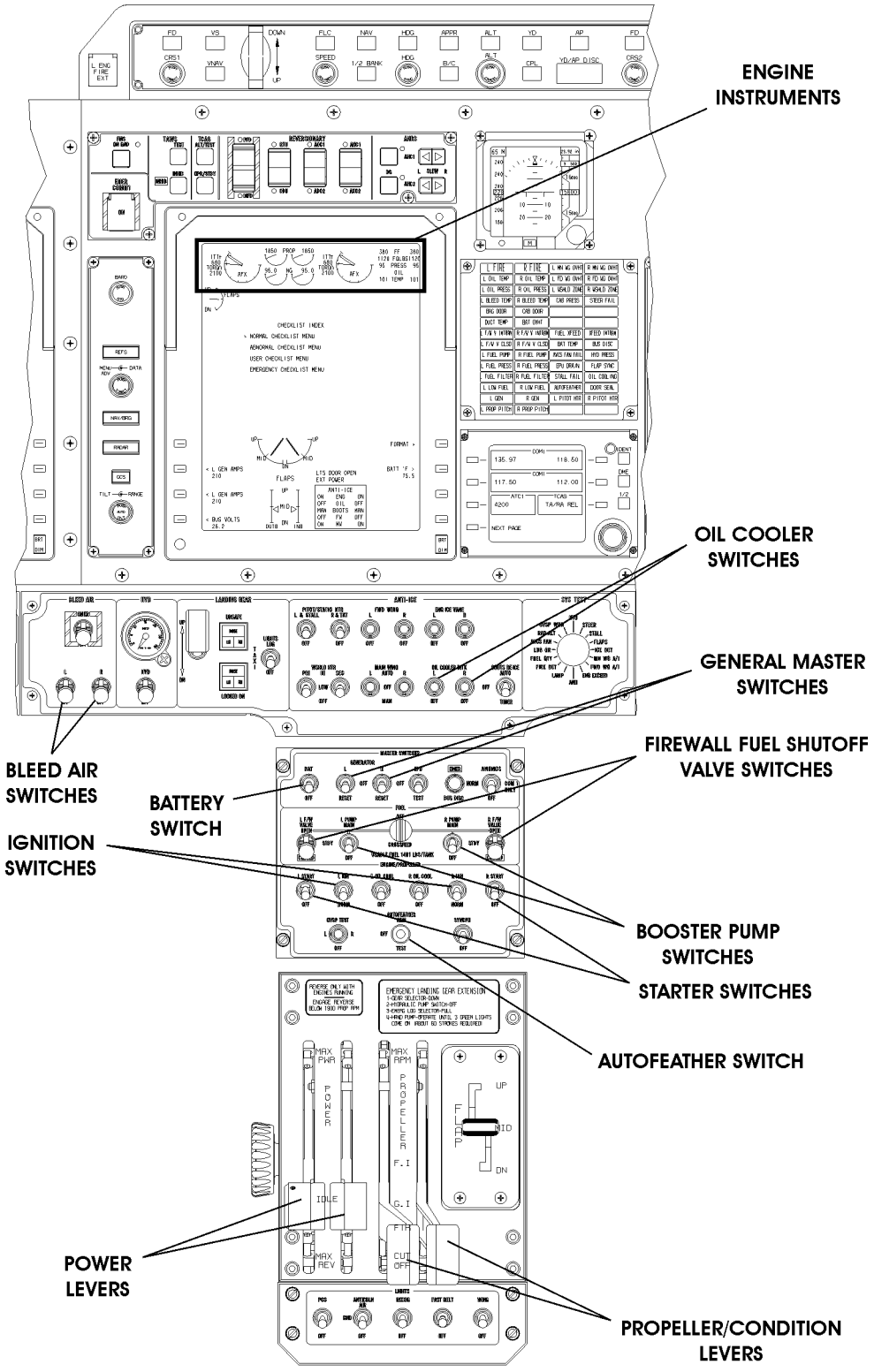

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Fig. 504 - Controls and Switches for Engine Ground Run

(l) If a GPU has not been used or if the GPU is disconnected, set the generator switch of the running engine to ON and check that:
- the corresponding GEN annunciator goes off
- there is a positive reading on the ammeter
- the voltmeter reading is 27.5 to 28 volts

NOTE: The values of the checks above are displayed onthe Multi Function Display (MFD) Sistem Page.

(3) Starting - Second Engine

NOTE: Starting of the second engine can be done using the power from the generator of the operating engine (cross start procedure) or the power from the GPU.

(a) If the cross start procedure is to be used, check as follows:
- the propeller control lever of the operating engine is at flight idle (FI)
- the ammeter indication on the MFD is less than 160 amps.

(b) Obtain clearance from the fire fighting attendant/observer to start the second engine.

NOTE: All references to controls, switches and indicator readings in the following steps apply to the second engine only.

(c) Set the starter switch to START. Check for a rise in Ng and oil pressure.

(d) At 13% Ng, set the propeller control lever to GI. Be prepared to abort the start by setting the propeller control lever to CUT OFF in the event of an Impending Hot Start.

(e) Check that Ng accelerates to ground idle speed (54%) and that the ITT limit of 1000°C for 5 seconds is not exceeded. Make a note of the MAX ITT reading.

NOTE: At about 40% Ng the starter switch should automatically return to the OFF position.

(f) At stabilized ground idle speed check the following:
- ITT: 715°C max.
- Oil pressure: 60 psig min.
- Oil temperature: 110°C max.
- Ng: 54%
- Np: 900 rpm min.

(g) If this is the first start (second engine) of the ground run, feather and unfeather the propeller at least twice to purge the propeller control system of air and to circulate warm oil through the system.

(h) Record on the Ground Run Check Sheet the maximum ITT indication noted during the starting procedure.

(i) Set the propeller control lever of the first engine to the GI position.

WARNING: TAKE EXTREME CARE WHEN CONNECTING/ DISCONNECTING THE GPU WHILE THE ENGINES ARE RUNNING. AVOID ENTERING THE DANGER ZONES DESIGNATED FOR THE AIR INTAKES AND PROPELLER (REFER TO FIG. 501). DEATH OR INJURY TO PERSONS CAN OCCUR.

(j) If a GPU has been used for starting the second engine, disconnect the GPU from the airplane (Refer to 24-30-00) and check that the EXT POWER annunciator goes off.

B. CHECK 2 - Engine Idle Speed

(1) General

(a) At an ambient temperature of 25°C (77°F), the optimum ground idle (G.I.) speed is 54% Ng and flight idle speed is 71%. These are the nominal idle speeds (with a tolerance of ±0.5%), but different ambient temperatures will change the idle speeds. For example, at an ambient temperature of 15°C (59°F), the optimum ground idle speed is 55% Ng and flight idle speed is 72% Ng.

(b) Immediately before the ground run, find out what the ambient temperature is. Apply the figure, in degrees Celsius (°C), to the graphs on Fig. 505 to find the optimum ground idle and flight idle speeds for the ambient temperature.

(c) If it is necessary to adjust an idle speed it is best to adjust to get as close as possible to the optimum speed rather than just within the tolerance; this will prolong the time between adjustment and reduce maintenance.

(2) Check Procedure

NOTE: This procedure is applicable to both the left hand and right hand installations. Data for the right hand procedure is given between parentheses.

(a) Start the engine. Refer to Para. A. (CHECK 1).

(b) With the propeller control lever at G.I., set the power control lever to get approximately 70% Ng.

(c) Set the generator master switch to L (R).

(d) Set the bleed air switch to L (R).

(e) Set the oil cooler switch to L (R).

(f) Set the power control lever to IDLE.

(g) Allow time for the ground idle speed to stabilize.

(h) Make sure that the oil pressure is 60 psig or more and that oil temperature is 60°C or more.

(i) Check the ground idle speed (Ng%).

(j) If the ground idle speed is within the tolerance band for the ambient temperature, record the Ng% reading on the Ground Run Check Sheet.

(k) If the ground idle speed is not within the tolerance, make a note of the Ng% reading.

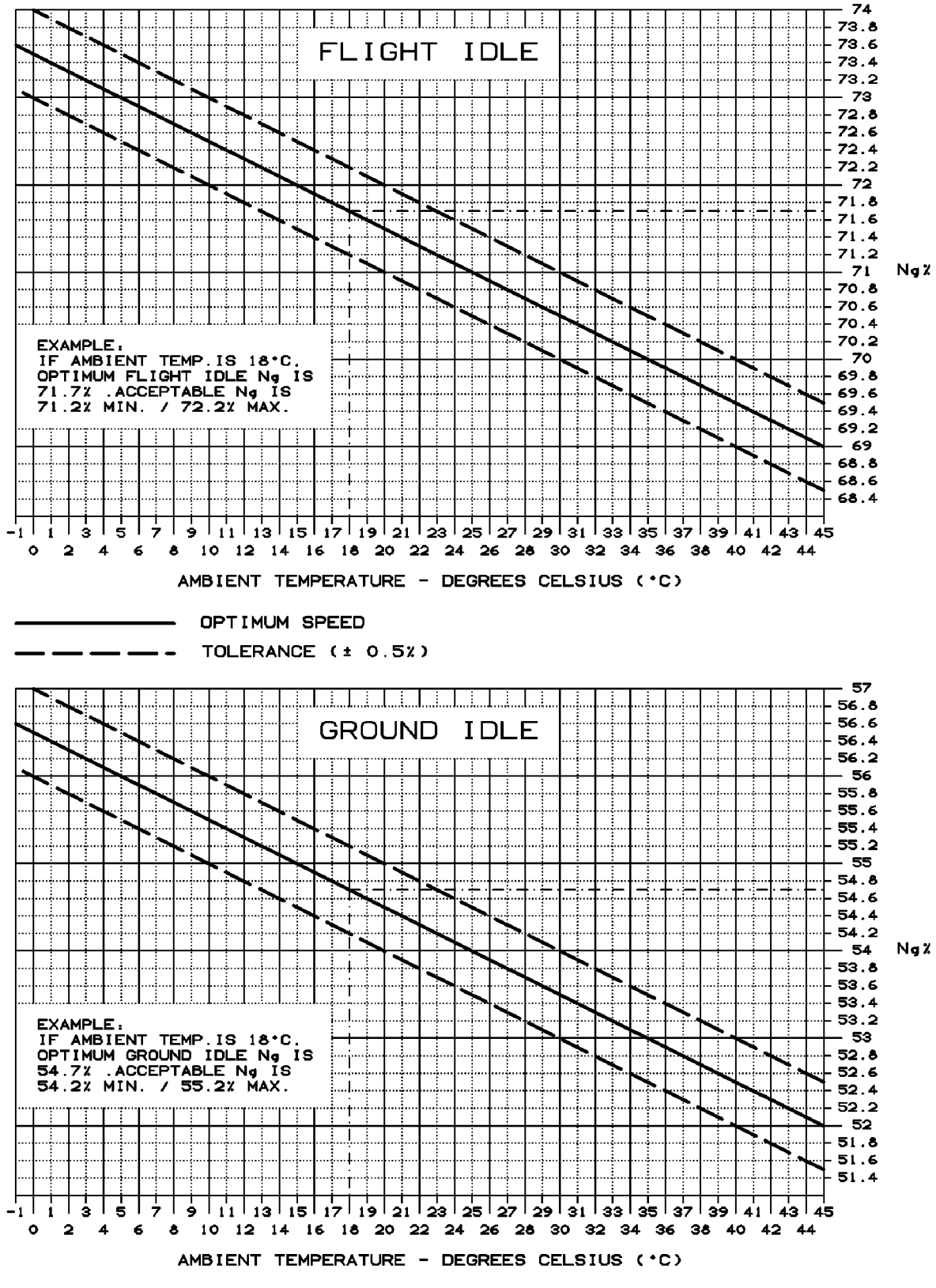

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Fig. 505 - Idle Speed/Ambient Temperature Correlation Graphs

NOTE: Adjust the ground idle speed after you check the flight idle speed; this is so that, if the flight idle speed also needs adjustment, the two adjustments can be done as a single procedure.

(l) Set the propeller control lever to F.I.
(m) Set the power control lever to get approximately 80% Ng.
(n) Set the oil cooler switch to OFF.
(o) Return the power control lever to IDLE.
(p) Allow time for the flight idle speed to stabilize.
(q) Check the flight idle speed (Ng%).
(r) If the flight idle speed is within the tolerance band for the ambient temperature, record the Ng% reading on the Ground Run Check Sheet.
(s) If the flight idle speed is not within the tolerance, make a note of the Ng% indication.
(t) Shut the engine down. Refer to Para. L. (CHECK 12).
(u) Adjust the ground and/or flight idle speed if applicable. Refer to para. (3) following.
(v) Do the idle speed checks again as necessary after adjustment.

(3) Adjustment Procedure (Ref. Fig. 506)

(a) Fixtures, Test and Support Equipment

Access Platform	3 ft (1 m)
Warning Notice	Not Specified

(b) Tools

Torque Wrench 32-45 lb in (3.6-5.1 Nm)
56-70 lb in (6.3-7.9 Nm)

(c) Materials

Lockwire	MS20995C32

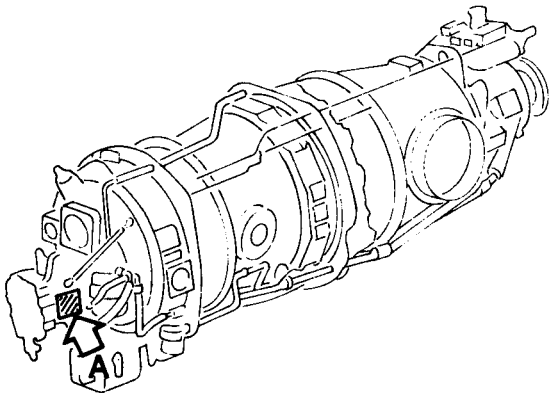
(d) Referenced Information

Maintenance Manual Chapter 54-00-00

Maintenance Manual Chapter 76-10-00

(e) Preparation

1) Put a warning notice in the flight compartment to tell persons not to move the power or propeller controls.
2) Put the access platform in position.
3) Remove nacelle panel 410AT (420AT). Refer to 54-00-00.
4) Make sure that the engine power control system is correctly rigged before you adjust the idle Ng at the fuel control unit (fcu). Refer to 76-10-00.



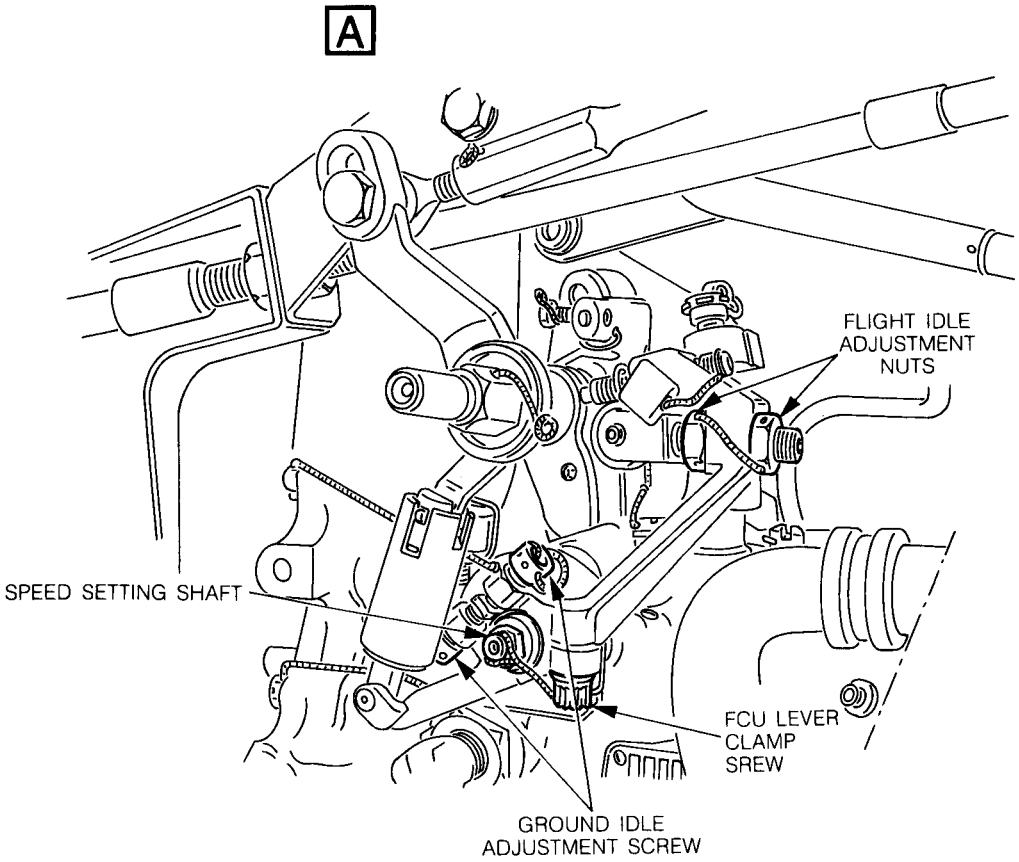


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Fig. 506 - Engine Idle Speed Adjustment

(f) Procedure - Ground Idle Adjustment

1) Remove the lockwire securing the fcu lever clamp screw to the speed setting shaft.
2) Loosen the clamp screw, but not more than necessary to allow adjustment.
3) Remove the lockwire securing the upper and lower ground idle adjustment screws to each other.

NOTE: One - sixth of a turn (one 'flat') of the screws will change Ng by 2% approximately.

4) Loosen the upper (to increase Ng) or lower (to decrease Ng) adjustment screw, and tighten the opposing screw an equal amount, to change ground idle Ng as required to get the optimum idle Ng for the ambient temperature (Ref. Fig. 505). For example, if the optimum ground idle Ng is 54.2% and the Ng noted on the ground run is 57.2%, then loosening the lower screw (and tightening the upper screw) one quarter of a turn will reduce Ng by the required 3% (approximately).

NOTE: The tab of the speed setting shaft must be held firmly between the two adjustment screws.

5) Safety the two adjustment screws, to each other, with lockwire.
6) Torque the fcu lever clamp screw to between 32 and 45 lb.in. (3.6 and 5.1 Nm).
7) Safety the fcu lever clamp screw to the speed setting shaft with lockwire.

(g) Procedure - Flight Idle Adjustment

1) Remove the lockwire securing the two cam follower adjustment nuts to each other.

NOTE: One complete turn of the adjustment nuts will change Ng by 1.5% approximately.

2) Loosen the adjustment nut nearest the propeller (to increase Ng) or the other adjustment nut (to decrease Ng), and tighten the opposing nut an equal amount, to change flight idle Ng as required to get the optimum idle Ng for the ambient temperature (Ref. Fig. 505). For example, if the optimum flight idle Ng is 71.2% and the Ng noted on the ground run is 73.2%, then loosening the adjustment nut furthest from the propeller (and tightening the other nut) one complete turn plus one third of a turn (two flats) will reduce Ng by the required 2% (approximately).
3) Torque the adjustment nuts to between 56 and 70 lb. in. (6.3 and 7.9 Nm).
4) Safety the adjustment nuts to each other with lockwire.

(h) Procedure - After Adjustment

1) Make sure that the work area is clean and that all tools etc. have been removed.
2) Install nacelle panel 410AT (420AT). Refer to 54-00-00.
3) Remove the access platform from the area.
4) Remove the warning notice from the flight compartment.
5) Do the engine idle speed check again until satisfactory.

C. CHECK 3 - Generator

(1) Start both engines. Refer to Para. A. (CHECK 1).
(2) Before you start the generator check, make sure that:
(a) The GPU is disconnected from the airplane.
(b) The EXT POWER annunciator is OFF.
(c) The power control levers are set at IDLE.
(d) The propeller control levers are set at G.I.
(e) The generator master switches are set to OFF.
(f) The L GEN and R GEN annunciators are on
(3) Do the generator check

Action	Result
(a) Set the left GENERATOR switch to L	The L GEN annunciator goes off. (If the annunciator stays on, set the left propeller control lever to FI - the annunciator should go off before engine Ng reaches 60%).
(b) On the Multi-Function Display (MFD) System Page, check the BUS VOLTS	The voltage reading should be between 27.5 and 28
(c)	
(d) On the MFD, check the L GEN amperes.	There should be a positive reading (amperes).
(e)	
(f) Set the left generator switch to OFF.	The L GEN annunciator comes on
(g)	
(h) Set the right generator switch to R	The R GEN annunciator goes off. (If the annunciator stays on, set the left propeller control lever to FI - the annunciator should go off before engine Ng reaches 60%).
(i) On the MFD, System Page, check the BUS VOLTS	The voltage reading should be between 27.5 and 28
(j)	
(k) On the MFD, check the R GEN amperes.	There should be a positive reading (amperes).

Action	Result
(l) Set the right generator switch to OFF	The R GEN annunciator comes on.
(m) Set the left and right generator switches to L and R respectively.	The L GEN and R GEN annunciators go off
(n) On the MFD, check the L GEN amperes.	There should be a positive reading (amperes), note the reading.
(o) On the MFD, check the R GEN amperes.	There should be a positive reading (amperes).Difference between readings in steps (j) and (k) should be within ± 40A (amperes).

(4) Do any electrical checks/tests that may be required

NOTE: The full generator output rating of 400 Amps is available at an engine speed (Ng) of approximately 60%. For safety, before you apply a major load, set the propeller control lever(s) to FI.

(5) Shut the engines down. Refer to Para. L. (CHECK 12).

D. CHECK 4 - Maximum Propeller Speed

NOTE: This procedure is applicable to both the left hand and right hand installations. Data for the right hand installation is given between parentheses.

(1) Check Procedure

(a) Start the engine. Refer to Para. A. (CHECK 1).

WARNING: OBEY THE PROPELLER LIMITATIONS GIVEN IN PARA. 3 OF THIS PAGE BLOCK.

(b) Set the propeller control lever to MAX RPM.

(c) Move the power control lever forward slowly until the propeller enters the constant speed range (no further increase in propeller speed (Np).

(d) Check that Np is 2000 ±10 rpm.

(e) If Np is within the tolerance, record the Np RPM reading on the Ground Run Check Sheet.

(f) If Np is not within the tolerance, make a note of the Np RPM reading.

(g) Shut the engine down. Refer to Para. L. (CHECK 12).

(h) Adjust the maximum propeller speed if applicable. Refer to para (2) following.

(i) Do the maximum propeller speed check again as necessary after adjustment.

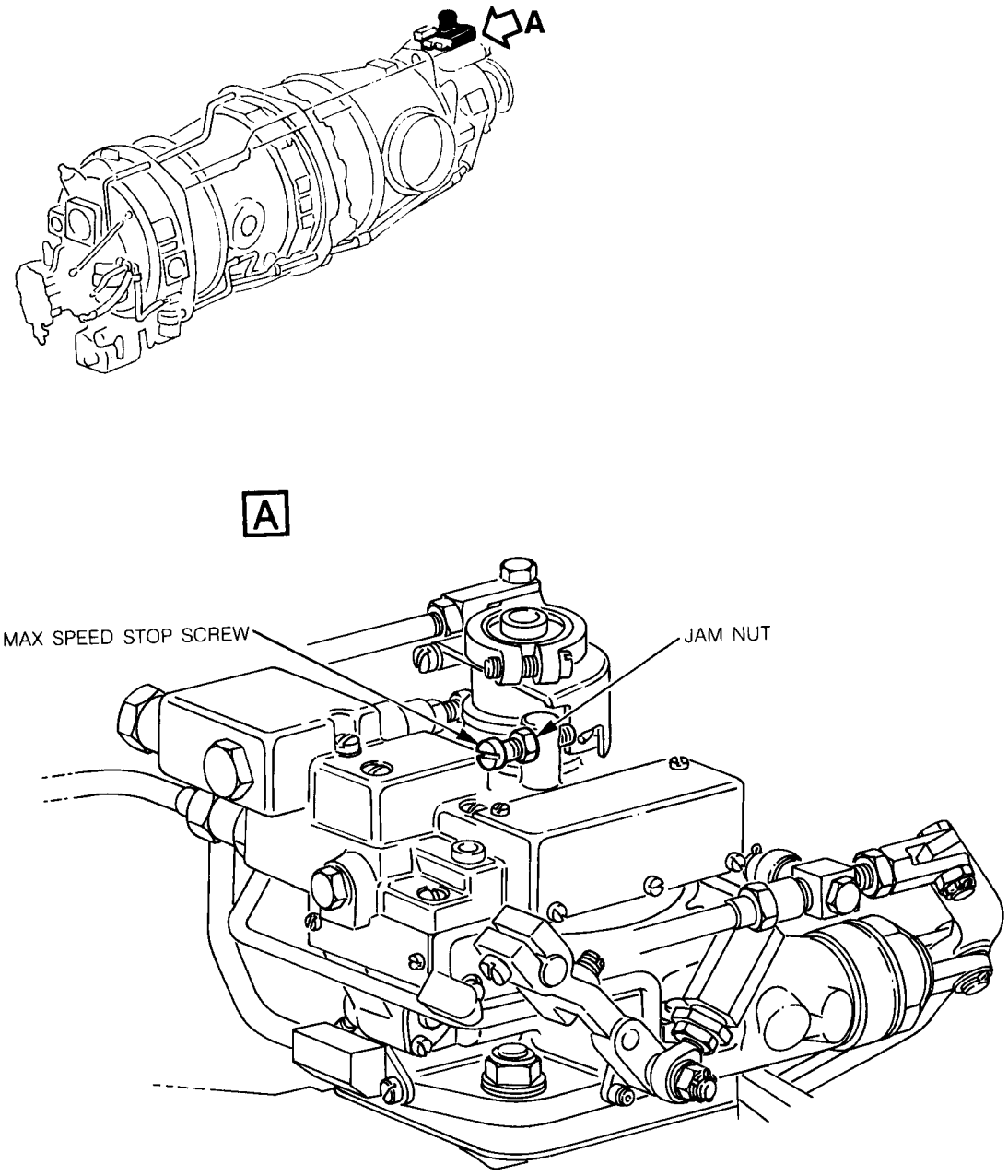

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Fig. 507 - Maximum Propeller Speed Adjustment

(2) Adjustment procedure (Ref. Fig. 507)

(a) Fixtures, Test and Support Equipment

Access Platform	3 ft (1 m)
Warning Notice	Not Specified

(b) Materials

Lockwire	04-008

(c) Referenced Information

Maintenance Manual Chapter 54-00-00
Maintenance Manual Chapter 76-10-00

(d) Preparation

1) Put a Warning notice in the flight compartment to tell persons not to move the power or propeller controls.
2) Put the access platform in position.
3) Remove nacelle panels 430AL and 430AR (440AL and 440AR). Refer to 54-00-00.
4) Make sure that the propeller control system is correctly rigged before you adjust at the propeller governor. Refer to 76-10-00. With the propeller lever at the MAX RPM position, the stop plate should contact the max speed stop screw.

(e) Procedure - Maximum Propeller Speed Adjustment

1) Remove the lockwire from the max speed stop screw.
2) Hold the stop screw and loosen the jam nut.

NOTE: One turn of the stop screw will change the maximum propeller speed by 20 rpm approximately.

3) Turn the stop screw (in to decrease rpm, out to increase rpm) as required to get 2000 rpm. For example, if the maximum Np noted on the ground run is 1970, then turning the stop screw out one and one half turns will increase the max Np rpm by the required 30 rpm (approximately).
4) Hold the stop screw and tighten the jam nut.

(f) Procedure - After Adjustment

1) Remove the access platform from the area.

NOTE: The ground run for checking the max. propeller speed after adjustment can be done with nacelle panels 430AL and 430AR (440AL and 440AR) removed.

2) Remove the nacelle panels from the area. Make sure that no damage to the panels can occur.
3) Remove the warning notice from the flight compartment.
4) Do the check procedure again until satisfactory.
5) On satisfactory completion of the check, safety the stop screw with lockwire.
6) Install nacelle panels 430 AL and 430 AR (440 AL and 440 AR).

E. CHECK 5 - Feathering

NOTE: This procedure is applicable to both the left hand and right hand engines.

(1) Start the engine. Refer to Para. A (CHECK 1).
(2) With the power control lever set to IDLE and the propeller control lever set to G.I., allow time for the engine to stabilize at ground idle speed.
(3) Make a note of the Ng digital reading.
(4) Set the propeller control lever to the FTR position.
(5) Check that the propeller feathers.
(6) Make a note of the Ng digital reading.
(7) Set the propeller control lever to the G.I. position and check that the propeller unfeathers.
(8) Shut the engine down. Refer to Para. L (CHECK 12).
(9) Feathering operation is satisfactory if the difference between the Ng readings noted at steps (3) and (6) is 0.3% or less.
(10) If the Ng readings are different by more than 0.3%, replace the propeller governor.

F. CHECK 6 - Autofeather(Ref. Fig. 513)

(1) Start both engines Refer to Para.A. (CHECK 1).
(2) Before you start the autofeather check make sure that:
  (a) Both engines are at the IDLE power setting with both propeller control levers set to MAX RPM.
  (b) The autofeather switch (on the panel to the rear of the propeller control levers) is set to OFF.
  (c) The AUTOFEATHER amber annunciator is on.
(3) Do the autofeather check

Action	Result
(a) Move both power control levers forward to get a torque reading of 33.6 % (750 ft. lbs.) (approximately) for both engines.	The AUTOFEATHER amber annunciator stays on.
(b) Set the autofeather switch to ARM.	The AUTOFEATHER amber annunciator goes off.
(c) Set the autofeather switch to OFF.	The AUTOFEATHER amber annunciator comes on.

Action	Result
(d) Set and hold the autofeather switch to TEST.	The AUTOFEATHER amber annunciator goes off and, after a delay of approximately two seconds, the L.AFX and R AFX indication on the Multi Funcion Display (MFD) System Page are displayed.
(e) With the autofeather switch held to the TEST position, move the left power control lever slowly back to IDLE; at the same time, watch the left engine torque reading and the R AFX and L AFX green indication on the MFD.	From 30.5 to 21.5% (680 to 480 ft. lbs.) torque on the left engine, the R AFX green indication goes off. From 21.1 to 13% (470 to 290 ft. lbs.) torque on the left engine, the L AFX green indication goes off and the left propeller feathers.
(f) Release the autofeather switch and move the left power control lever forward to get a torque reading of 33.6 % (750 ft. lbs.) approximately.	The AUTOFEATHER amber annunciator comes on.
(g) Set and hold the autofeather switch to TEST.	The AUTOFEATHER amber annunciator goes off and, after a delay of approximately two seconds, the L AFX and R AFX green indication come on.
(h) With the autofeather switch held to the TEST position, move the right power control lever slowly back to IDLE; at the same time, watch the right engine torque reading and the L AFX and R AFX green annunciators	From 30.5 to 21.5% (680 to 480 ft. lbs.) torque on the right engine, the L AFX green indication goes off. From 21.1 to 13% (470 to 290 ft. lbs.)torque on the right engine, the R AFX green indication goes off and the right propeller feathers.
(i) Release the autofeather switch and move the right power control lever forward to get a torque reading of 33.6 % (750 ft. lbs.) approximately.	The AUTOFEATHER amber annunciator comes on.
(j) Set and hold the autofeather switch to TEST and move bothpower control levers (at the same time) back to IDLE.	The AUTOFEATHER amber annunciator goes off. The L AFX and R AFX green indication remain off and neither of the propellers go to feather.

Action	Result
(k) Release the autofeather switch.	The AUTOFEATHER amber annunciator comes on.

NOTE: Minimum difference between high and low press switch indications on the opposite engines (i.e. LH engine high torque vs. RH low torque and vice versa) is 3.1% If a lower value is observed, check Torque Indicating System. If a degradation in engine performance or abnormal oil consumption is present, have a maintenance check on engine bearing no. 3 air seal.

G. CHECK 7 - Underspeed Fuel Governing (Ref. Fig. 508)

NOTE: These procedures are applicable to both the left hand and right hand installations. Data for the right hand installation is given between parentheses.

(1) Fixtures, Test and Support Equipment

Access Platform	3 ft (1 m)
Warning Notice	Not Specified

(2) Tools

Torque Wrench 12-18 lb.in. (1.4 - 2.0 Nm)	Not Specified

(3) Expendable Parts

Cotter Pin	MS9245-23

(4) Referenced Information
Maintenance Manual Chapter 54-00-00

(5) Preparation
(a) Put a Warning notice in the flight compartment to tell persons not to move the power and/or propeller control levers.
(b) Put the access platform in position.
(c) Remove nacelle panels 430AL and 430AR (440AL and 440AR). Refer to 54-00-00.
(d) Remove and discard the cotter pin that secures the bolt and nut which attach the propeller governor reset lever to the interconnect rod (refer to Fig. 508).
(e) Remove the nut and bolt; take care to catch the washer which is located between the reset lever and the interconnect rod.
(f) For safety, temporarily install the bolt, nut and washer in either the lever or the rod end.
(g) Use a temporary tie to hold the reset lever against its minimum stop (towards the reduction gearbox/exhaust duct flange).
(h) Use a temporary tie to secure the interconnect rod to the push/pull control assembly.

NOTE: The ground run for the underspeed fuel governing check can be done with nacelle panels 430AL and 440AR (440AL and 440AR) removed.

(i) Remove the nacelle panels from the area. Make sure that no damage to the panels can occur.

(j) Remove the access platform from the area.

(k) Remove the warning notice from the flight compartment.

(6) Check Procedure

(a) Start the engine. Refer to Para. A. (CHECK 1).

CAUTION: OBEY THE PROPELLER LIMITATIONS GIVEN IN PARA. 3 OF THIS PAGE BLOCK.

(b) With the power control lever set at IDLE, set the propeller control lever to MAX RPM.

(c) Slowly move the power control lever towards MAX PWR until the propeller speed (Np) stops increasing.

(d) Check that the Np reading is 1900 ±20 rpm.

(e) If Np is within the tolerance, record the Np rpm reading on the Ground Run Check Sheet.

(f) If Np is not within the tolerance make a note of the Np rpm reading.

(g) Shut the engine down. Refer to Para. L. (CHECK 12).

(h) If the check is satisfactory (propeller underspeed is within the tolerance) go to step (8) Procedure After Satisfactory Check.

(i) If the propeller underspeed is not within the tolerance, adjustment of the underspeed fuel governing eccentric is required. Refer to step (7) which follows.

(7) Adjustment Procedure

(a) Put a warning notice in the flight compartment to tell persons not to move the power and/or propeller control levers.

(b) Put the access platform in position.

NOTE: Because the underspeed eccentric is a very sensitive device, its adjustment cannot be estimated in terms of number of turns versus a certain amount of increase/decrease in propeller underspeed rpm. The maximum amount of adjustment at any one time is 1/16 of a turn. After adjustment, do the Check Procedure again until you get a satisfactory result.

(c) Adjust the underspeed eccentric clockwise (to decrease rpm) or counterclockwise (to increase rpm) no more than 1/16 of a turn.

(d) Remove the access platform from the area.

(e) Remove the warning notice from the flight compartment.

(f) Do the Check Procedure again.

(8) Procedure After Satisfactory Check

(a) Put a warning notice in the flight compartment to tell persons not to move the power and/or propeller control levers.

(b) Put the access platform in position.
(c) Remove the temporary ties from the reset lever and the interconnect rod.
(d) Remove the bolt, nut and washer which was temporarily installed in the lever or the rod end.
(e) Install the bolt and nut (as shown in Fig. 508) with the washer located between the reset lever and the interconnect rod.
(f) Torque the nut to between 12 and 18 lb. in (1.4 and 2.0 Nm).
(g) Install a new cotter pin.
(h) Install nacelle panels 430AL and 430AR (440AL and 440AR). Refer to 54-00-00.
(i) Remove the access platform from the area.
(j) Remove the warning notice from the flight compartment.

H. CHECK 8 - Interference between the Normal Governing and Overspeed Fuel Governing Functions of the Propeller Governor

NOTE: This procedure is applicable to both the left hand and right hand installations. Data for the right hand installation is given between parentheses.

(1) Fixtures, Test and Support Equipment

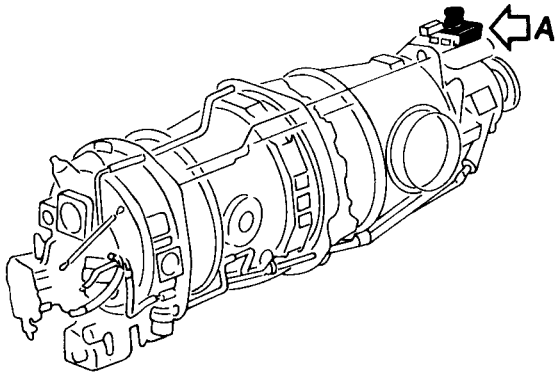
Access Platform	3 ft (1 m)
Warning Notice	Not Specified

(2) Referenced Information
Maintenance Manual Chapter 54-00-00

(3) Preparation
(a) Put a warning notice in the flight compartment to tell persons not to move the power and/or propeller control levers.
(b) Put the access platform in position.
(c) Remove nacelle panels 430 AL and 430 AR (440 AL and 440 AR). Refer to 54-00-00.
(d) Make sure that the reset lever of the propeller governor is touching the maximum stop. Ref. Fig. 509.
(e) Make sure that there is a gap of between 0.90 and 0.110 inch (2.3 and 2.8 mm) between the internal and external adjusters of the interconnect rod (Ref. Fig. 509).

NOTE: The ground run for this check can be done with nacelle panels 430 AL and 430 AR (440 AL and 440 AR) removed.

(f) Remove the nacelle panels from the area. Make sure that no damage to the panels can occur.
(g) Remove the access platform from the area.
(h) Remove the warning notice from the flight compartment.



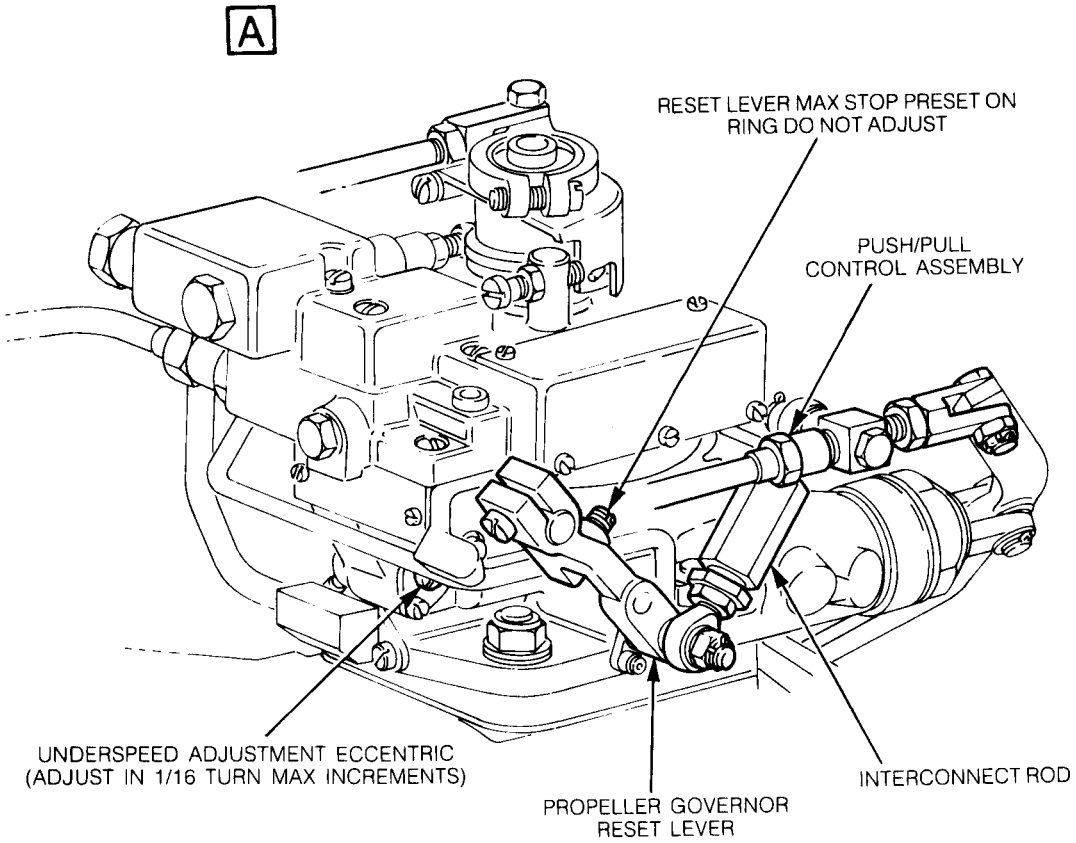


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Fig. 508 - Underspeed Fuel Governing Check and Adjustment Details

(4) Check Procedure

(a) Start the engine. Refer to Para. A. (CHECK 1)

CAUTION: OBEY THE PROPELLER LIMITATIONS GIVEN IN PARA. 3 OF THIS PAGE BLOCK.

(b) With the power control lever set at IDLE, set the propeller control lever to MAX RPM.

(c) Slowly move the power control lever towards MAX PWR until the torque reading is 67.3%.

(d) Make a note of the Ng reading.

(e) Make a temporary mark to indicate the position of the power control lever at a torque reading of 67.3%; this is to prepare for a check after the ground run.

(f) Set and held the propeller overspeed test switch to LEFT (RIGHT).

NOTE: The propeller speed should decrease by approximately 150 RPM.

(g) Make a note of the Ng reading.

(h) Release the propeller overspeed test switch; the switch should automatically return to the OFF position.

(i) If the Ng reading noted at step (g), is more than 0.4% higher than the Ng noted at step (d), replace the propeller governor.

(j) If the Ng noted at step (g) is the same as, less than, or up to 0.4% higher than, the Ng noted at step (d) the check is satisfactory.

(k) Shut the engine down. Refer to Para. L. (CHECK 12).

(l) Set the power control lever to the position marked at step (e).

(m) Make sure that the reset lever of the propeller governor is touching the maximum stop. Ref. Fig. 509.

(n) Set the power control lever to IDLE and remove the temporary marking.

(o) Put the access platform in position.

(p) Install nacelle panels 430AL and 430AR (440AL and 440AR). Refer to 54-00-00.

(q) Remove the access platform from the area.

I. CHECK 9 - Overspeed Governor

(1) General

(a) This check of the propeller overspeed governor is done after replacement of the governor, after engine installation, after long term storage, and as part of the before-and after - the "B" or "C" inspection or HSI ground run.

(b) The check is done by reducing the tension of the overspeed governor spring through the operation of the overspeed test solenoid. This reduction in spring tension causes the governor to coarsen propeller blade pitch and thereby restrict maximum propeller speed (Np) to approximately 1840 rpm (92% of normal max Np).

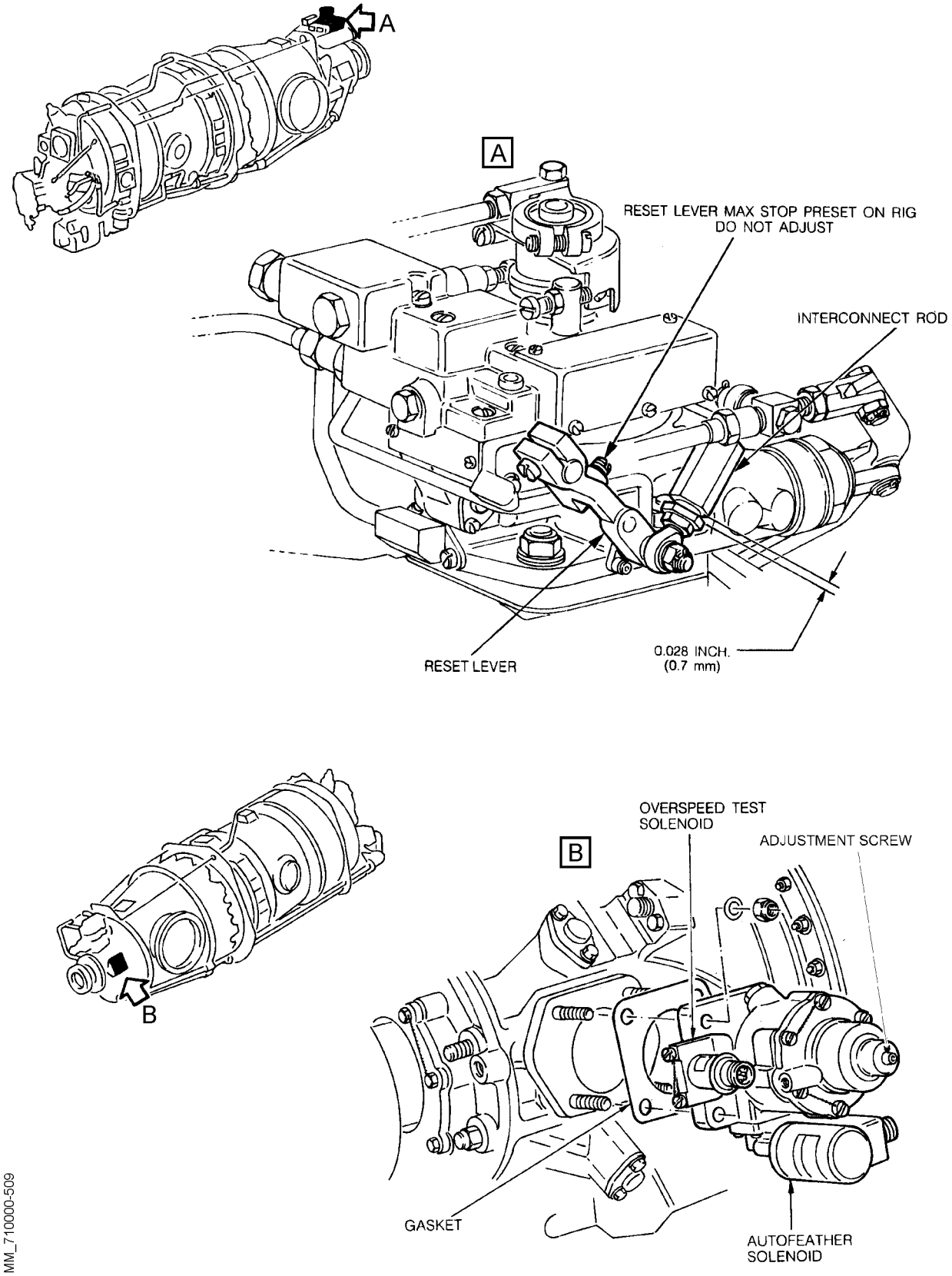

Fig. 509 - Prop.Governor Interconnect Rod and Overspeed Governor Adjustment Screw

(c) If the overspeed governor does not meet the requirements of this check (i.e. no NP drop observed), do a test of the wiring to make sure that the fault is within the governor; if a speed drop is observed but the value is outside the required range, then adjust in accordance with the applicable procedure ((3) Adjustment).

(2) Procedure

(a) Fixtures, Test and Support Equipment

Access Platform	3 ft (1 m)
Warning notice	not specified
Allen wrench	not specified
SP-954 sealant or Loctite 222	

(b) Referenced Information
Maintenance Manual Chapter 61-20-00

NOTE: This procedure applies to both the left hand and right hand installations. Data for the right hand installation is given between parentheses.

(c) Start the engine. Refer to Para. A. (CHECK 1).
(d) Set the propeller control lever to MAX RPM.
(e) Move the power control lever forward until the propeller enters the constant speed range (no further increase in propeller speed).
(f) Make sure that propeller speed is between 1990 and 2010 rpm.
(g) Set and hold the propeller overspeed test switch (located directly forward of the propeller control levers) to LEFT (RIGHT).
(h) Make sure that propeller speed (Np) decreases and stabilizes between 1820 and 1860 rpm: this value will be recorded as [A].
(i) If [A] is within 1820 and 1860 then perform steps (l) and (m).
(j) If [A] is within 1720 and 1820 or 1860 and 1960 then perform steps (l) and (m) and adjust the overspeed governor as per the applicable procedure.
(k) If [A] is below 1720 or above 1960 then perform steps (l) and (m) and replace the overspeed governor as per AMM 61-20-00.
(l) Release the propeller overspeed test switch; the switch should automatically return to the OFF position.
(m) Shut the engine down. Refer to Para. L. (CHECK 12).

(3) Adjustment

(a) On the top of the overspeed, locate the adjustment screw. Ref. Fig. 509.

(b) Turning counter-clockwise the adjusting screw causes the RPM to decrease, while turning clockwise causes the RPM to increase.

(c) Unscrew or tighten (depending by the overspeed governor test result - [A]) the adjusting screw by one face (1/6 of full rotation).

NOTE: Since the effectiveness of the regulation may be different (from 50 to 100 rpm per 1/6 of rotation), the steps below are necessary to evaluate the entity of the adjusting action on the overspeed governor.

(d) Run the engine and repeat the overspeed governor test (refer to the step (2) Procedure). Record the RPM got during the test [B].

(e) Calculate the variation actually corresponding to a one face rotation:

variation = A - B (if the screw is unscrewed)

variation = B - A (if the screw is tightened)

(f) If still necessary, adjust again in accordance with the variation calculated above. Once the test requirements are met, lock the screw applying some sealant SP-954 or Loctite 222 or equivalent on it.

J. CHECK 10 - Oil Pressure

(1) Check Procedure

(a) Start the engine. Refer to Para. A. (CHECK 1).

(b) Set the propeller control lever to MAX RPM.

(c) Set the power control lever to get an Ng reading of 72% minimum.

(d) Allow time for the engine oil temperature and oil pressure to stabilize.

(e) Make sure that the oil temperature is within the normal range of 60 to 70°C.

(f) Make sure that, at normal temperature, the oil pressure is between 90 and 135 psig.

(g) Shut the engine down. Refer to Para. L. (CHECK 12).

(h) If the oil pressure is not within the limits given is step (f), adjust the pressure as detailed in the following Adjustment Procedure.

(2) Adjustment Procedure (Ref. Fig. 510)

(a) Fixtures, Test and Support Equipment

Access Platform	3 ft (1 m)

(b) Tools

Torque Wrench 36-40 lb.in. (4.1-4.5 Nm)

(c) Expendable Parts

NOMENCLATURE	IPC CSN
Preformed Packing	P&WC 72-66-31 5-260

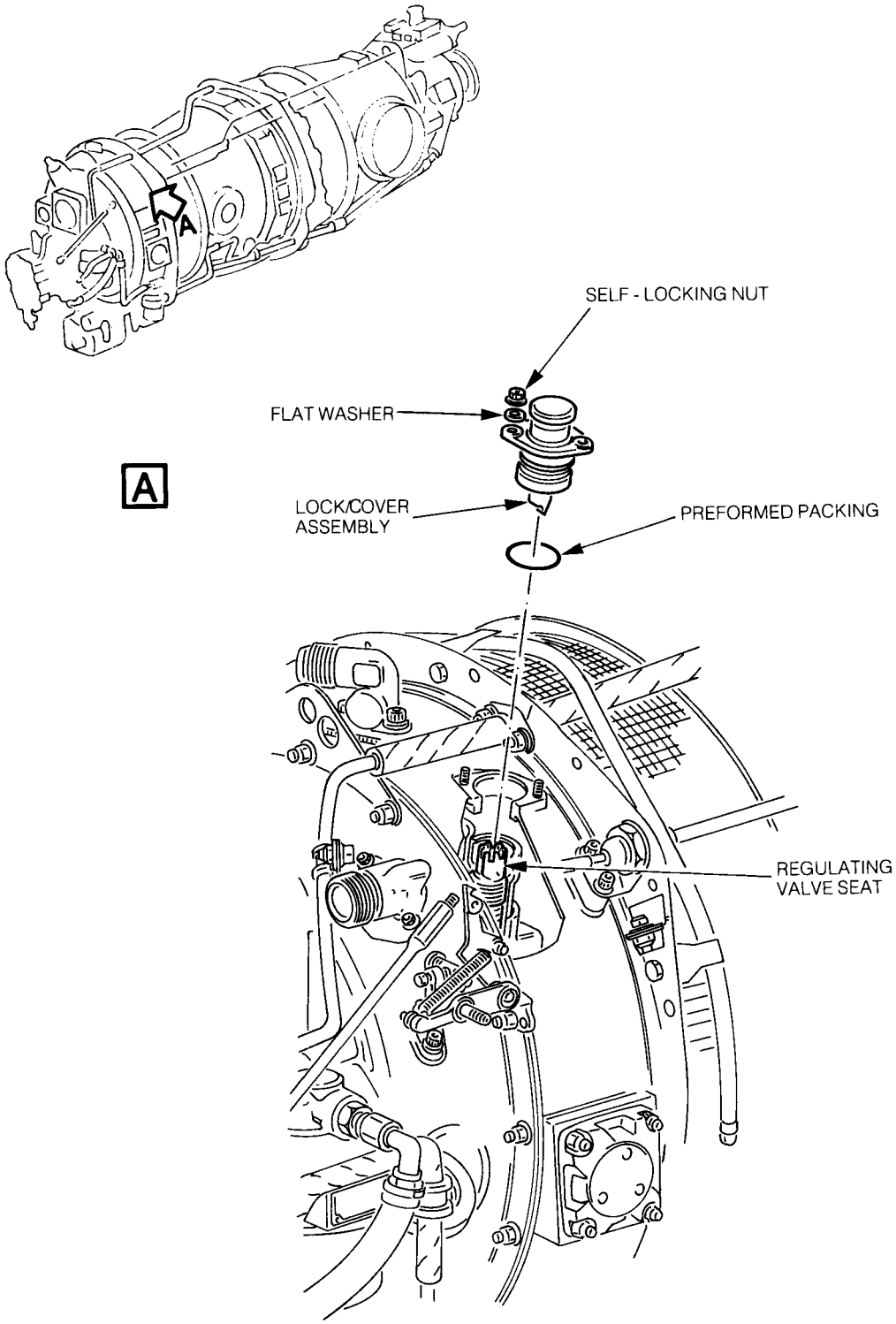

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Fig. 510 - Engine Oil Pressure Adjustment

(d) Referenced Information
Maintenance Manual Chapter 54-00-00

(e) Preparation
1) Put the access platform in position.
2) Remove nacelle panel 410AT (420AT). Refer to 54-00-00.

(f) Remove the two self-locking nuts and flat washers which secure the lock/cover assembly to the compressor inlet case.
1) Remove the lock/cover assembly and the preformed packing. Discard the packing.
2) Using a suitably shaped tool, turn the regulating valve seat (clockwise to increase oil pressure, counterclockwise to decrease).
3) Lightly lubricate a new preformed packing with engine oil and install the packing onto the lock/cover assembly.
4) Make sure that the lock will engage with one of the slots in the regulating valve seat. If necessary, turn the seat a little to align the slot with the lock.
5) Install the lock/cover assembly and secure it to the compressor inlet case with the two flat washers and self-locking nuts.
6) Torque the two nuts to between 36 and 40 lb.in. (4.1 and 4.5 Nm).

(g) Procedure - After Adjustment
1) Install nacelle panel 410AT (420AT). Refer to 54-00-00.
2) Remove the access platform from the area.
3) Do the oil pressure check again until satisfactory.

K. CHECK 11 - Engine Performance

(1) General

(a) An engine performance check is done:
– before and after the airplane 500 and 1500 hour inspections and the engine hot section inspection (HSI)
– after engine installation
– after long term storage
– after repair, replacement or adjustment of any component which could affect performance (refer to Para. 11 of this topic for the full list of applicable components)
– at regular intervals at the discretion of the operator.

(b) The engine performance check consists of:
– Recording the engine gas generator speed (Ng), interturbine temperature (ITT) and fuel flow (Wf) at a specific target torque (Tq) setting
– Checking that the recorded values of Ng, ITT and Wf are within the limits given in the Engine Performance Checking Curves (Ref. Fig. 511)
– Comparing the recorded values with the norms established on previous engine performance checks done on that particular engine.

NOTE: The norms are the normal characteristic values for a particular engine. Comparisons between engines serves no useful purpose; the performance of each engine is best checked against its own history. The target Tq setting and the maximum permitted values for Ng, ITT and Wf (corrected for the prevailing ambient conditions) are extracted from the Engine Performance Check Curves (Ref. Fig. 511).

(c) It is to be expected that the recorded values will gradually more closer to the maximum limits as engine operating hours build up; however, a sudden change from previously established norms should be considered as early warning of impending problems.

NOTE: The cause of any sudden change from the norm must be investigated as detailed in the troubleshooting section of the engine maintenance manual (Ref. 72-00-00).

(d) The results of the engine performance checks are recorded in the engine log book; the norms for a particular engine are established over the first few checks.

(e) All forms of engine deterioration are accompanied by an increase in ITT and Wf at a specific power setting. Compressor deterioration is, in most cases, due to dirt deposits and causes an increase in Ng at a specific power setting; this form of deterioration can be remedied by field cleaning as detailed in the power plant cleaning section of the engine maintenance manual (Ref. 71-06-30).

(f) Each engine performance check is done with no pneumatic or electrical loads on the engine, i.e. the bleed air and generator switches are set to the OFF position; this makes sure that check results can be compared to previous check results without the inaccuracies that differing loads could cause Pressure Unit Conversion Figures

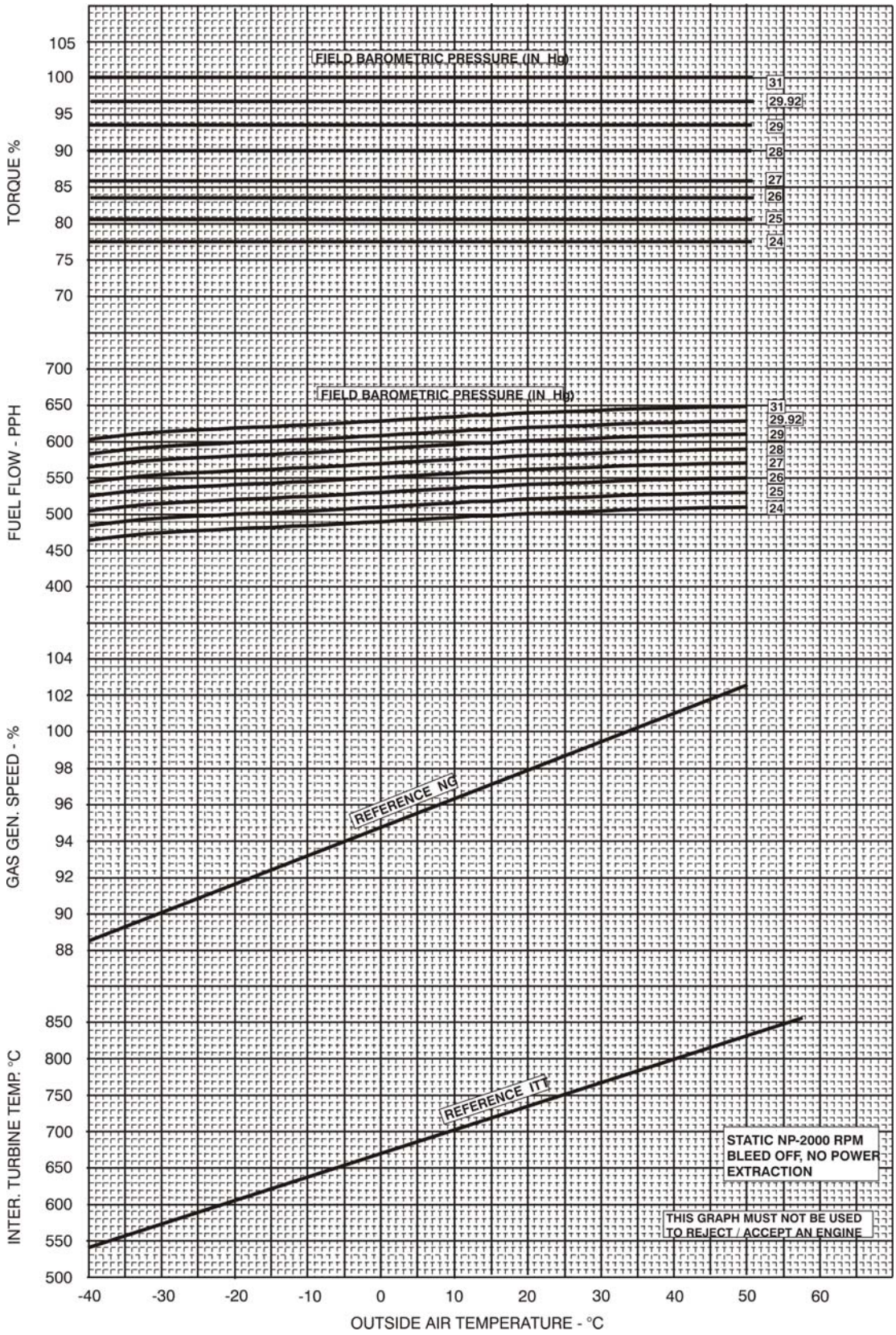


Fig. 511 - Engine Performance Check Curves

mbr	mmHg	in.Hg	PSI	mbr	mmHg	in.Hg	PSI	mbr	mmHg	in.Hg	PSI
700	525	20.67	10.15	835	626	24.66	12.11	970	727	28.64	14.07
705	529	20.82	10.22	840	630	24.81	12.18	975	731	28.79	14.14
710	533	20.97	10.30	845	634	24.95	12.25	980	735	28.94	14.21
715	536	21.11	10.37	850	638	25.10	12.33	985	739	29.09	14.28
720	540	21.26	10.44	855	641	25.25	12.40	990	742	29.23	14.36
725	544	21.41	10.51	860	645	25.40	12.47	995	746	29.38	14.43
730	548	21.56	10.59	865	649	25.54	12.54	1000	750	29.53	14.50
735	551	21.70	10.66	870	653	25.69	12.62	1005	754	29.68	14.57
740	555	21.85	10.73	875	656	25.84	12.69	1010	758	29.83	14.65
745	559	22.00	10.80	880	660	25.99	12.76	1015	761	29.97	14.72
750	563	22.15	10.88	885	664	26.13	12.83	1020	765	30.12	14.79
755	566	22.30	10.95	890	668	26.28	12.91	1025	769	30.27	14.86
760	570	22.44	11.02	895	671	26.43	12.98	1030	773	30.42	14.94
765	574	22.59	11.09	900	675	26.58	13.05	1035	776	30.56	15.01
770	578	22.74	11.17	905	679	26.72	13.12	1040	780	30.71	15.08
775	581	22.89	11.24	910	682	26.87	13.20	1045	784	30.86	15.15
780	585	23.03	11.31	915	686	27.02	13.27	1050	788	31.01	15.23
785	589	23.18	11.38	920	690	27.17	13.34	1055	791	31.15	15.30
790	593	23.33	11.46	925	694	27.32	13.41	1060	795	31.30	15.37
795	596	23.48	11.53	930	697	27.46	13.49	1065	799	31.45	15.44
800	600	23.62	11.60	935	701	27.61	13.56	1070	803	31.60	15.52
805	604	23.77	11.67	940	705	27.76	13.63	1075	806	31.74	15.59
810	608	23.92	11.75	945	709	27.91	13.70	1080	810	31.89	15.66
815	611	24.07	11.82	950	712	28.05	13.78	1085	814	32.04	15.73
820	615	24.21	11.89	955	716	28.20	13.85	1090	818	32.19	15.81
825	619	24.36	11.96	960	720	28.35	13.92	1095	821	32.34	15.88
830	623	24.51	12.04	965	724	28.50	13.99	1100	825	32.48	15.95

The columns above give the direct conversions of common pressures and units

To convert a unit in the left hand column into a unit in the top line, multiply by the figure at the co-ordinate.
NOTE: THE PROCESS IS NOT REVERSIBLE

	PSI	kg/cm^2	in. Hg	mm. Hg	millibar	Bar	Atmos.	kPa
PSI	-	0.07031	2.036	51.7147	68.9	0.0689	0.06804	6.896
kg/cm^2	14.223	-	29.96	735.5	980	0.98	0.9678	98.08
in. Hg	0.49116	0.03453	-	25.4	33.864	0.033	0.3342	3.387
mm. Hg	0.019337	0.00136	0.03937	-	1.333	0.001333	0.0013	0.133322
millibar	0.0145	0.0010197	0.2953	0.75	-	1000	0.00099	0.1
Bar	14.504	1.0197	29.53	750	0.001	-	0.9869	100
Atmos.	14.696	1.0332	29.921	760	1013.3	1.0133	-	101.334
kPa	0.145	101.97	0.29529	7.5	0.00001	0.01	0.00987	-

(g) If, after comparing the results of the most recent check with previous check results, there is any doubt about the condition of an engine, do a compressor wash and repeat the Engine Performance Check.

(2) Preparation

(a) Obtain and record the ambient air temperature (in degrees Celsius) and atmospheric pressure (in millibars). Refer to Fig. f for conversion details if ambient is obtained in units other than millibars.

(b) Apply the figures to the Engine Performance Check Curves (Ref. Fig. 511) and extract the required ambient-corrected values for target Tq, and the limits for ITT, Ng and Wf.

(c) Record the values on the Ground Run Check Sheet.

(3) Procedure

(a) Start the engine. Refer to Para. A. (CHECK 1).

(b) Set the generator switch to OFF.

(c) Set the bleed air switch to OFF.

(d) With the power control lever set at IDLE and the propeller control lever set at G.I., allow time for the engine operating temperature to stabilize.

(e) Set the propeller control lever to MAX RPM and slowly move the power control lever forward to the Tq setting previously determined from the Engine Performance Checking Curves.

(f) Allow time for the engine to stabilize; adjust the setting as required to maintain stabilized target Tq, making sure that the limits for ITT, Ng and Wf are not exceeded.

(g) Record the indicated ITT, Ng and Wf.

(h) Shut the engine down. Refer to Para. L. (CHECK 12).

(i) Compare the values of ITT, Ng and Wf recorded in step (g) above with the values extracted from the Engine Performance Check Curves.

(j) If the limits were not exceeded, proceed to step (l).

(k) If any of the limits were exceeded, refer to the troubleshooting section of the engine maintenance manual (Ref. 72-00-00).

(l) Record the results of this check (indicated Tq, ITT Ng and Wf) in the engine log book.

(m) Compare the results of this check with the results of previous checks; make sure that any change from the norm can be considered as normal engine deterioration, i.e. minor changes only.

L. CHECK 12 - Engine Shutdown and Rundown

(1) General

(a) Make sure that the fire fighting attendant/observer is aware:

– of the increased possibility of a fire during shutdown.

– that he must listen for abnormal or extraneous noises during engine rundown.

(b) A persistent below-normal rundown time and/or the presence of abnormal/ extraneous noises during rundown indicates a fault. Investigation procedures, such as filter and chip detector inspections and the progressive replacement of driven accessories should be done to isolate and rectify the fault.

(2) Tools

Stopwatch	Not Specified

(3) Procedure

(a) Set the power control lever to IDLE.
(b) Set the battery switch to BAT.
(c) Set the generator switch to OFF.
(d) Set the bleed air switch to OFF.
(e) Set the propeller control lever to G.I.
(f) Allow at least two minutes for the engine to stabilize at the lowest attainable ITT.

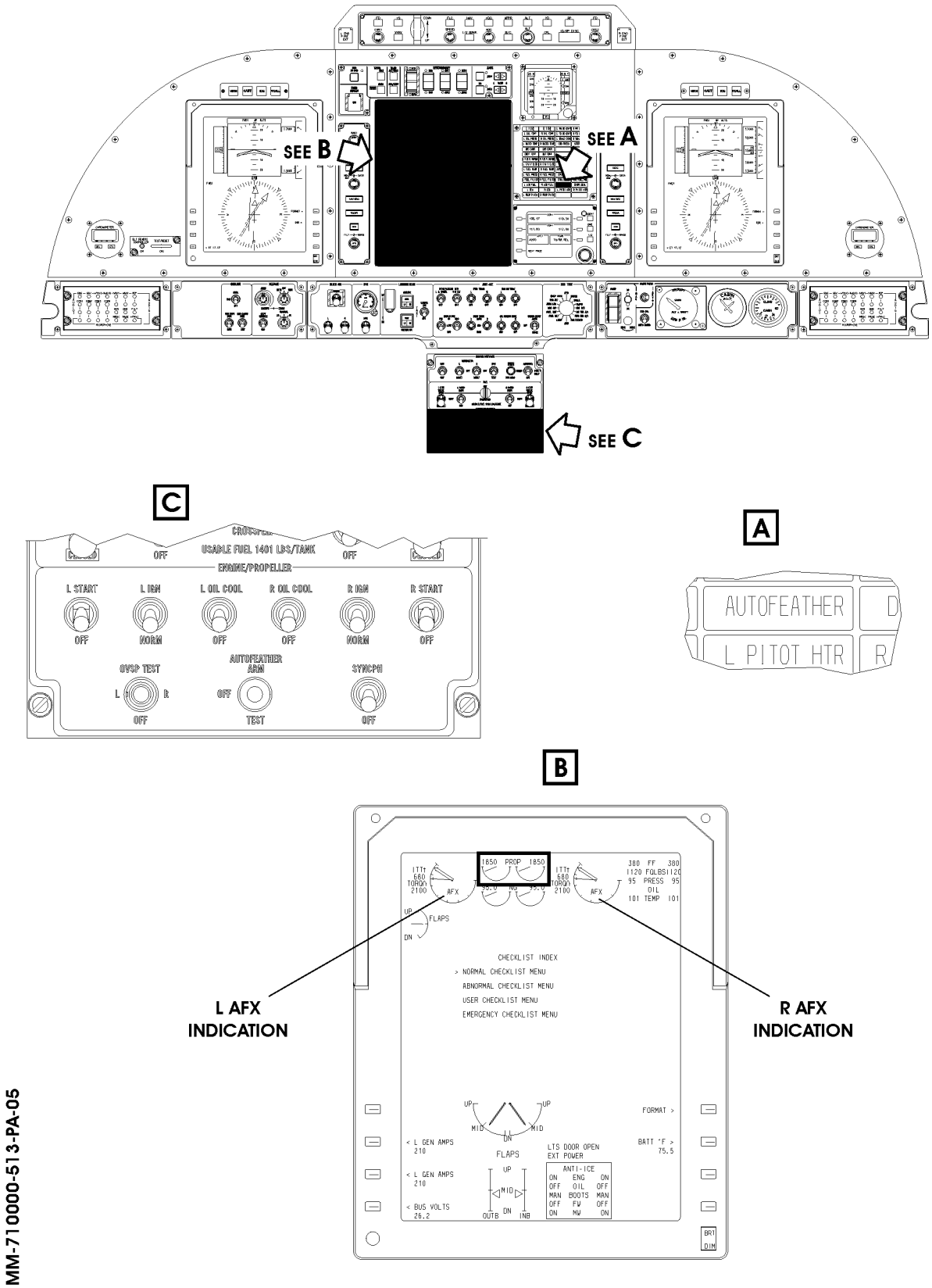
WARNING: BE PREPARED TO TAKE APPROPRIATE ACTION IN THE EVENT OF A FIRE WITHIN THE ENGINE AFTER SHUTDOWN. REFER TO PARA. 5.

(g) At the same time:
- start the stopwatch
- set the propeller control lever to CUT-OFF.

(h) Make sure that the propeller feathers immediately (less than one second).
(i) Watch the ITT and Ng indicators. Make sure that ITT decreases as the engine runs down.
(j) Stop the stopwatch as soon as the Ng indicator shows a zero reading.
(k) Record the rundown time on the Ground Run Check Sheet. The minimum acceptable rundown time is 20 seconds.
(l) Set the fuel booster pump switches to OFF.
(m) Set the firewall fuel shutoff valves to CLOSED.
(n) Set the battery switch to OFF.
(o) Do the after - shutdown check. Refer to Para. M (CHECK 13).

M. CHECK 13 - After Shutdown

(1) Check the engine nacelle area for signs of fuel and oil leaks. Except for the normal oil drains, there should be no oil leakage; investigate and rectify the cause of any oil or fuel leak.
(2) Within ten minutes of engine shutdown, check the engine oil level and replenish as necessary. Refer to 12-00-00.
(3) Do the close-up procedure. Refer to Para. 10 of this topic.



MM-710000-513-PA-05

Fig. 512 - Autofeather Check - Components Location

P.180 AVANTI ENGINE GROUND RUN CHECK SHEET

Airplane Serial No:_____ Reg. No:_____ Flying Hrs:_____

LH Engine Ser. No:_____ Operating Hrs. TT:_____ TSO_____

RH Engine Ser. No:_____ Operating Hrs. TT:_____ TSO_____

LH Propeller Ser. No:_____ Operating Hrs. TT:_____ TSO_____

RH Propeller Ser. No:_____ Operating Hrs. TT:_____ TSO_____

Amb. Temp:_____ Barom. Press:_____ Date:_____ Time_____

Test Engineer 1:_____ Test Engineer 2:_____

Reason for Ground Run:_____

Checks required (delete checks not required):

Check No: 1 2 3 4 5 6 7 8 9 10 11 12 13

Check No.	Check		Required	Observed Left	Observed Right
1	ENGINE START	ITT	1000°C max (5 sec. limit)		
2	IDLE SPEED CHECK (Required values from Fig. 505)	Ground Idle Flight Idle	_____ % Ng _____ % Ng		
3	GENERATOR CHECK	On Line Output Bus Volts	Before 60% Ng Positive Reading 27.5 to 28		
4	MAX. PROP. SPEED CHECK	Np	2000 ± 10		
5	FEATHERING CHECK	(difference in readings) Ng	0.3% or less		
6	AUTOFEATHER CHECK	(write yes or no under observed)	Correct function		
7	UNDERSPEED FUEL GOVERNING CHECK	Np	1900 ± 20 rpm		
8	CHECK FOR INTERFERENCE BETWEEN NORMAL GOVERNING AND OVERSPEED FUEL GOVERNING FUNCTIONS OF THE PROPELLER GOVERNOR	Tq Ng (reading difference)	67.3 % No more than 0,4 % higher		
9	OVERSPEED GOVERNOR CHECK	Governed Np	1840 ± 20 rpm		
10	OIL PRESSURE CHECK		90-135 psig		
11	ENGINE PERFORMANCE CHECK (Required values from Fig. 511)	Target Tq Max ITT Max Ng Max Wf	_____ lb. ft. _____ °C _____ % _____ PPH		
12	ENGINE SHUTDOWN AND RUNDOWN CHECK	Rundown Time	20 secs. min.		
13	AFTER SHUTDOWN CHECK		No leaks		

TT = Total Time TSO = Time Since Overhaul

SPECIAL NOTE

This page contains no technical information because it is the back-up page of the suggested Ground Run Check Sheet. Do not write on this sheet or mark it in any way. As required, remove this sheet from the binder, copy the Ground Run Check Sheet and return this sheet to its proper place within its binder.

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ENGINE MOUNTS - DESCRIPTION AND OPERATION

1. Description

NOTE: This description applies to both the left hand and right hand engine mounts.

A. The engine is installed in a cradle-type mounting frame. The mounting frame comprises:

- front and rear sections made from titanium tubes which are welded to fittings to form a cradle. The tubes are formed from titanium sheet, rolled to form a tube and welded at the seam.
- two struts, also made from titanium tube, with attachment fittings welded to the tube ends.
- center and rear frames, of inverted U-shape, manufactured from titanium.
- four engine vibration isolators.

B. The front section of the mounting frame is bolted to three titanium brackets which are bolted to the wing spars - one to the front spar and two to the rear spar.
The struts are bolted to, and extend rearward from, the two titanium brackets at the wing rear spar.
The rear section is bolted to the front section and the struts, with the center frame located and held between the two sections. The rear frame and the four vibration isolators are bolted to the rear of the rear section.

C. The center and rear frames are so called because they align with, and form part of, the center and rear firewalls of the engine, respectively. These frames are utilized for attachment of the engine nacelle panels. The rear edges of the upper and lower nacelle panels and the front edges of the rear nacelle panels abut at, and are attached to, a splice bulkhead which is bolted to the rear frame. The upper and lower nacelle panels are also attached directly to the center frame.

D. Laminated shims are used at the attachment locations of the mount to the brackets on the wing spars so that there are no gaps between the mount forks and the bracket eye extension. This makes sure that when the attaching nuts and bolts are tightened there is minimum stress on the fork ends.
Laminated shims are also used where the tubular frame sections and struts are attached to the center and rear frames. This makes sure that the four main mounting bolt holes at the rear of the rear section, and the frames themselves, are correctly located for alignment with other items.

E. The engine vibration isolators are used to attach the engine to the mounting frame. Each isolator consists of two elastomer cores permanently bonded to steel end plates, two metal bushings and a nylon bumper tube assembled together in a sandwich manner, and mounted in a steel body. The base of the body is secured to the gas generator case of the engine by four bolts, and the four isolators are located at the 2, 4, 8 and 10 o'clock positions around the case. Each isolator is attached to the mounting frame with one bolt through the bushings and bumper tube. The vibration isolators are manufactured with the centers offset to compensate for power plant torque moment. Because the propellers rotate in opposite directions the centers of the four isolators of the left engine are offset in the opposite direction to those of the right engine; so left and right isolators are not interchangeable.

2. Operation

A. The propulsive force of the propeller is transmitted to the engine through the thrust bearing in the reduction gearbox. Propulsive forces from the engine are transmitted from the isolator bodies which are attached to the engine, through the elastomer cores and onto the bushings. The mounting bolts, located through the bushings, complete the transmission of forces to the mounting frame which is bolted to the wing spars.

B. Propeller/power plant shock and vibration are reduced by the controlled spring rate and damping properties of the elastomer cores. While transmitting the propulsive forces to the airframe there is no direct metal-to-metal contact between the engine and the mounting frame, and engine vibration is absorbed and isolated from the airframe.

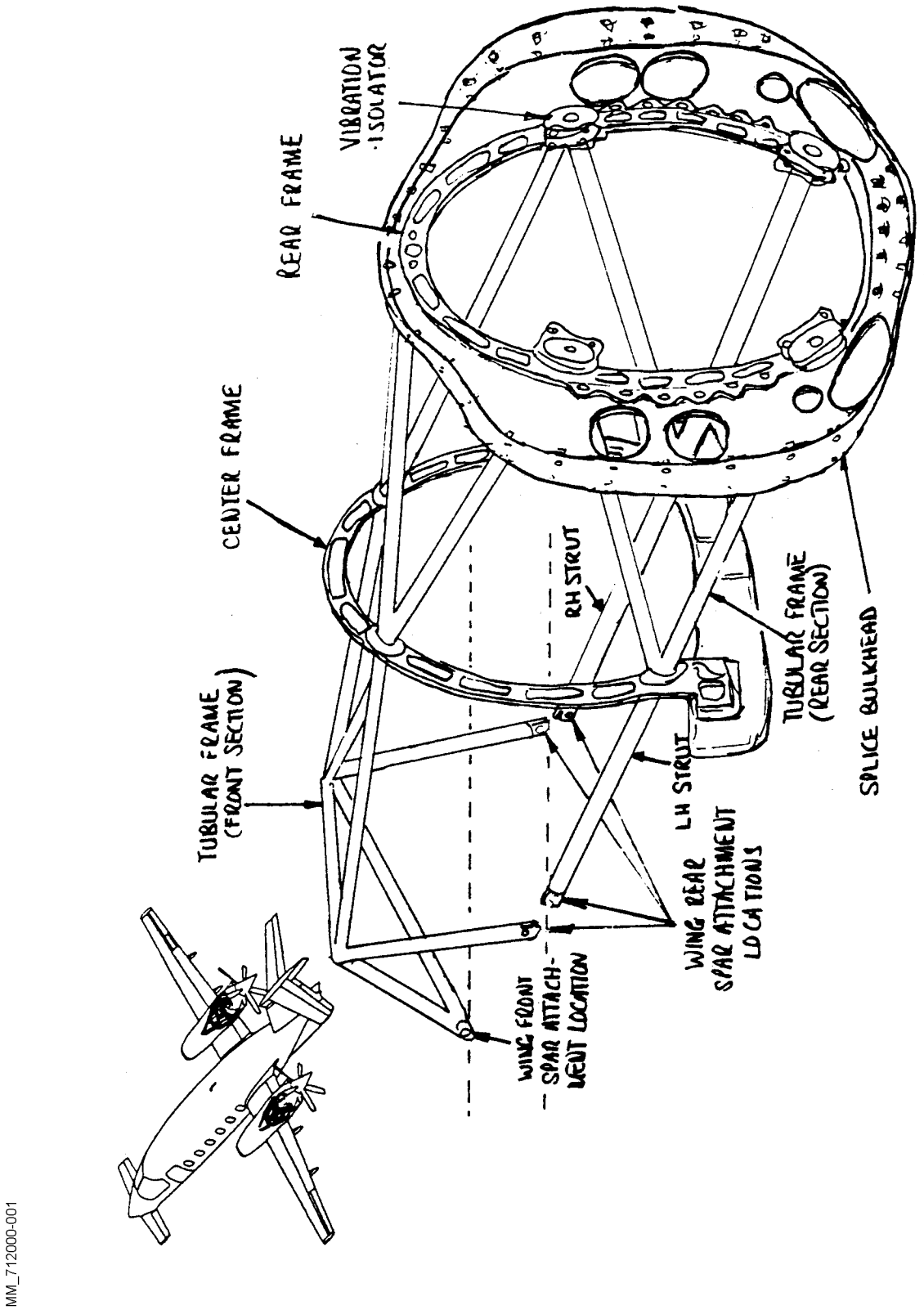
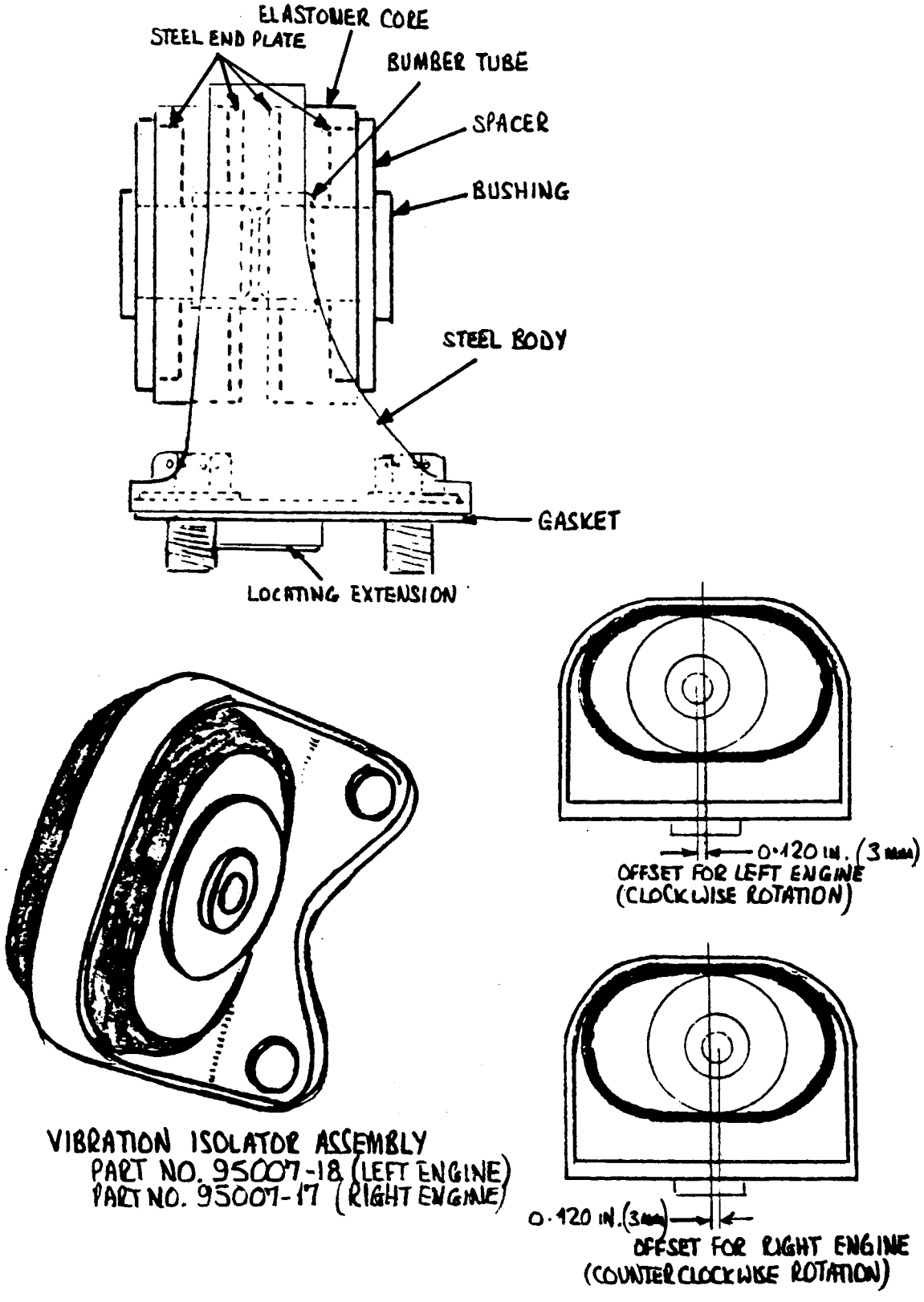


Fig. 1 - Engine Mount Details



MM_712000-002

Fig. 2 - Engine Vibration Isolator Details

ENGINE MOUNTS - MAINTENANCE PRACTICES

1. General

A. This topic gives the following maintenance practices for the engine mounts:

- Inspection with Engine Installed (Refer to Para. 2)
- Inspection with Engine Removed (Refer to Para. 3)
- Removal (Refer to Para. 4)
- Installation (Refer to Para. 5)
- Disassembly (Refer to Para. 6)
- Assembly (Refer to Para. 7)

B. The inspection instructions and information includes the vibration isolators, but the removal and installation procedures exclude the isolators; removal and installation of the isolators is part of the power plant stripdown/buildup (Chapter 71-00-01). The procedure for connecting/disconnecting the isolators to/from the mounting framework is part of the power plant installation/removal procedures (Chapter 71-00-00.

C. The engine mounts are life-limited with the airframe.

D. Refer to Chapter 05-10-00, 05-20-00 and 05-50-00 for Vibration Isolators life-limit and periodic inspection.

E. The extent of inspection depends on whether or not the power plant is installed, so this topic gives the information and instructions necessary for both instances.

2. Inspection with Engine Installed

NOTE: This inspection information applies to both the left hand and right hand engine mounts. Data for the right hand engine mount is given between parentheses.

NOTE: This procedure gives the information and instructions necessary for the visual inspection of the engine mounts.

A. Fixtures, Test and Support Equipment

Access platform (3 ft./1 meter)	Not specified
Inspection Mirror	Not specified
Magnifying glass (x10 minimum)	Not specified
Strong light source	Not specified
Straight edge (6-inch steel rule or similar)	Not specified

B. Materials

Methyl-Ethyl-Ketone (MEK)	02-009
Lint-free cloth	04-013

C. Referenced Information

Maintenance Manual Chapter 54-00-00
Maintenance Manual Chapter 51-10-00

D. Preparation

(1) Remove nacelle panels 410AT, 410AB, 430AL and 430AR (420AT, 420AB, 440AL and 440AR). Refer to 54-00-00.

(2) Put the access platform in position.

WARNING: BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

CAUTION: DO NOT LET THE MEK COME INTO CONTACT WITH THE ELASTOMER CORES OF THE VIBRATION ISOLATORS OR ANY OTHER NON-METALLIC ITEMS. THE CORES AND OTHER NON-METALLIC ITEMS CAN BE DAMAGED BY PROLONGED CONTACT WITH MEK.

(3) If required, clean the engine mounts using a lint-free cloth moistened with MEK.

E. Procedure

(1) Inspect the tubular sections as far as possible without moving or removing items. Use a strong light source, an inspection mirror where necessary, and a magnifying glass and inspect for:
- damage
- cracks
- corrosion at the interface areas between the tubular sections and the frames.

(2) If damage or cracks are found refer to the airplane manufacturer for repair instructions.

(3) If corrosion is found:
(a) Remove the mount (Refer to Para. 4).
(b) Disassemble the tubular sections from the frames to gain access to the affected areas (Refer to Para. 6).
(c) Repair the affected areas (Refer to).
(d) Assemble the tubular sections to the frames (Refer to Para. 7).
(e) Install the mount (Refer to Para. 5).

(4) Inspect the front tubular section and struts for security of attachment to the wing brackets. Make sure that the bolts/nuts are tight.

(5) Inspect the tubular sections and struts for security of attachment to the frames. Make sure that the attachment bolts/nuts are tight.

(6) Use the straight edge to check the tubular sections and the struts for distortion. If there is any distortion refer to the airplane manufacturer for instructions.

CAUTION: DO NOT PROBE BONDED AREAS WITH A SHARP OBJECT. THIS CAN RESULT IN DAMAGE TO THE BOND.

(7) Inspect the vibration isolators (four on each engine) for:
- separation of the elastomer cores from their end plates
- general condition
- damage to the body
- tightness of mounting bolts

(8) Replace any isolator with separation of the elastomer core from its end plate or with damage that could affect the strength of the isolator.

(9) Perform a Generator Power Cable Inspection. Refer to 24-30-00

F. After-inspection Procedure

(1) Install nacelle panels 410AT, 410AB, 430AL and 430AR (420AT, 420AB, 440AL and 440AR). Refer to 54-00-00.

(2) Remove the access platform from the area.

3. Inspection with Engine Removed

NOTE: This inspection information applies to both the left hand and right hand engine mounts. Data for the right hand engine mount is given between parentheses.

NOTE: This procedure gives the information and instructions necessary for the detailed inspection of the engine mounts. The check for elongation of the four main mounting bolt holes (at the rear of the rear section of the tubular frame) should also be done whenever the engine is removed.

NOTE: Instruction for engine removal is not given in this procedure. It is assumed that the engine has been removed.

A. Fixtures, Test and Support Equipment

Access platform (3 ft/1 meter)	Not specified
Inspection mirror	Not specified
Magnifying glass (x10 minimum)	Not specified
Strong light source	Not specified
Straight edge (6-inch steel rule or similar)	Not specified
Endoscope	Not specified
Thread gauge	Not specified
Dye penetrant inspection kit	Not specified

B. Materials

Methyl-Ethyl-Ketone (MEK)	02-009
Lint-free cloth	04-013

C. Expendable Parts

Cable ties (Ty-raps)	SST2S

D. Referenced Information

Maintenance Manual Chapter 51-13-00
Maintenance Manual Chapter 51-90-00

E. Preparation

(1) Put the access platform in position.
(2) Make a note of the exact location of all item which are attached to the engine mounts. This is to make sure that the items can be attached in the same locations after inspection of the mounts.
(3) Remove the ignition unit (Refer to 74-20-00).
(4) Remove the bracket which secures the solenoid valve of the engine inlet de-icing system to the front section of the tubular frame. Retain all attaching items.
(5) Remove the brackets which secure the fuel filter assembly to the front section of the tubular frame. Retain all attaching items.
(6) Cut and discard the cable ties (Ty-raps) which secure electrical cables and other items to the tubular frame.
(7) Make sure that the frame is free from all attachments.

WARNING: BE CAREFUL WHEN YOU USE THE MEK. OBEY THE HEALTH AND SAFETY INSTRUCTIONS GIVEN IN CHAPTER 20-00-00.

CAUTION: DO NOT LET THE MEK COME INTO CONTACT WITH NON-METALLIC ITEMS, AS THESE ITEMS CAN BE DAMAGED BY PROLONGED CONTACT WITH MEK.

(8) Clean the engine mounts using a lint-free cloth moistened with MEK.

F. Procedure

(1) Do a dye penetrant inspection of the complete engine mount (Refer to 51-90-00). Use an inspection mirror to inspect areas not visible directly, and use an endoscope to inspect the areas inside the four main mounting bolt holes at the rear of the rear tubular section,
(2) If any cracks are found, refer to the airplane manufacturer for repair instructions.
(3) Inspect the four main mounting bolt holes for wear and ovality. The two lower threaded holes can be checked with a thread gauge. Refer to Fig. 201 for hole dimension/thread size details.

(4) Inspect the four main mounting bolts and the nuts of the two upper bolts for corrosion and damage, especially at the threads. Replace any damaged or corroded bolt or nut.

(5) Do a dye pentrant inspection of the four bolts and two nuts (Refer to 51-90-00). Replace any bolt or nut that has a crack, no matter what size the crack is or its location.

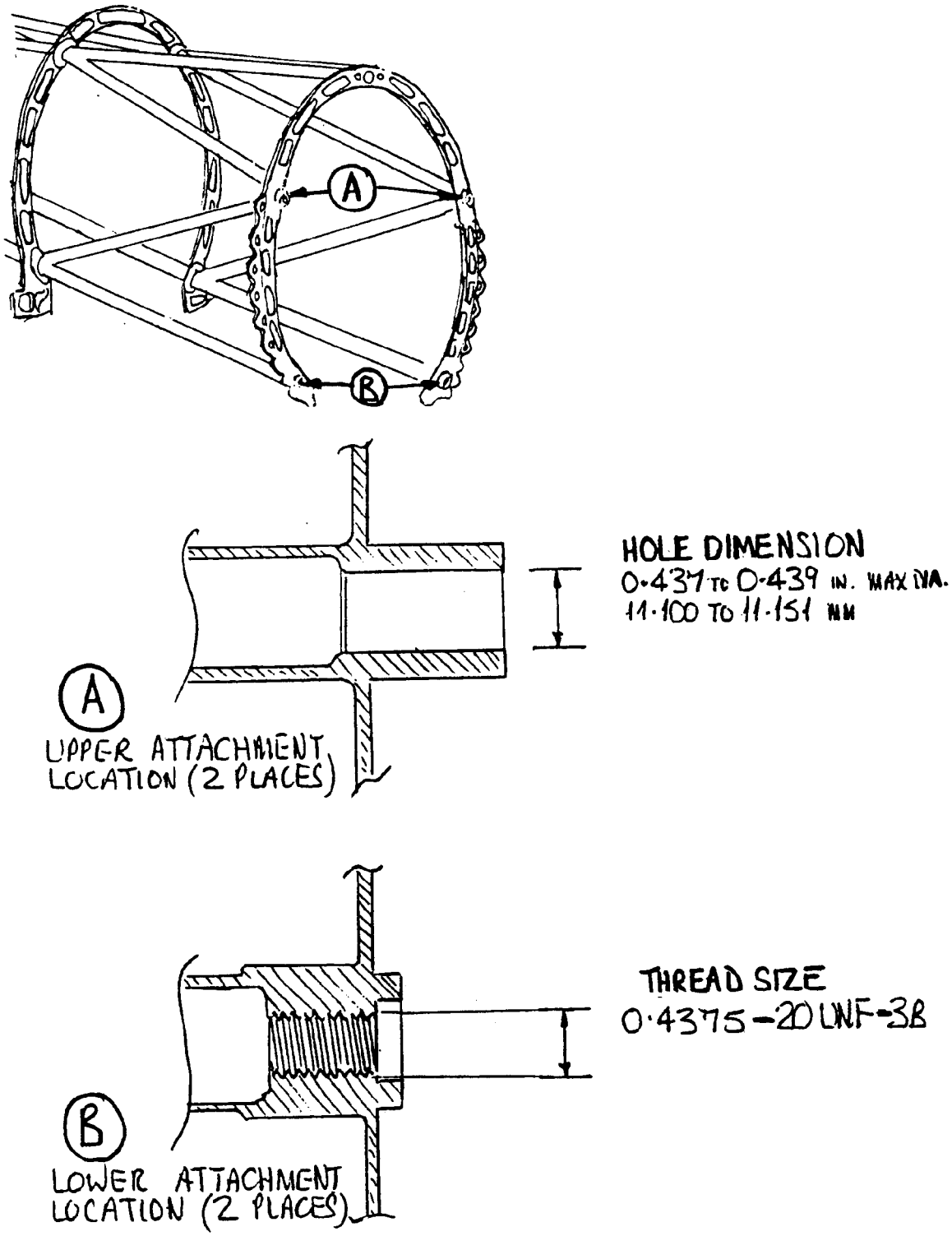


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Fig. 201 - Mounting Bolt Hole Details

FIREWALL - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 1 thru 3)

   A. The nacelle area is divided into four separate zones by three firewalls. The firewalls are named front, center and rear, and are located as follows:

   – the front firewall is at NACS -2377.33 which is in line with the wing front spar at FS 6000
   – the center firewall is at NACS -1412.12 which is in line with the wing third spar at FS 6965.21
   – the rear firewall is at NACS -885.71 which is in line with FS 7491.62.

   B. The front firewall consists of three fireproof blankets which divide the air intake section of the nacelle between, and on each side of, the two air intake passages. The blanket between the air intake passages is used for mounting the actuator of the inertial separation system. The upper wing surface in the nacelle compartment behind the front firewall (the wing fuel tank area between the front and rear wing spars) is protected from fire by fireshields (flameproof plates), covers and shrouds, as shown in Fig. 1.

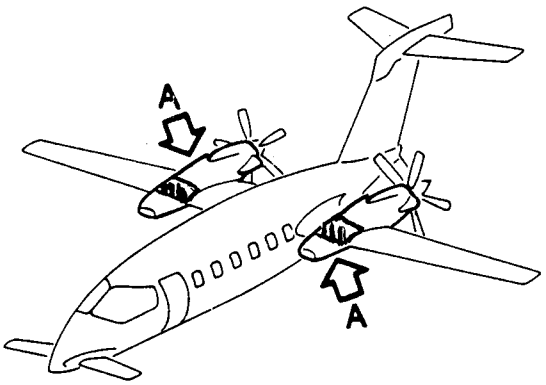
   C. The center firewall separates the air inlet section of the engine from the cold (accessories) section. This firewall consists of upper and lower sections, a gasket and a gasket retainer. The lower section is bolted to the lower part of the center frame assembly and the upper section is bolted to the upper part of the center frame assembly. The upper part of the center frame is made from titanium (which is fireproof) but because the lower part is light alloy, a fireshield is attached to the front face of the lower part to complete the firewall. The engine incorporates a fireseal ring, secured to the compressor inlet case immediately in front of the air inlet screen, for mounting of the gasket and its retainer.

   NOTE: The engine manufacturer (Pratt & Whitney) refers to the fireseal ring at this location as the rear fireseal ring: this is because Pratt & Whitney consider the accessory gearbox to be the rear of the engine. When the engine is installed in the nacelle of the P.180 Avanti, the accessory gearbox is to the front and the "rear" fireseal is located in the approximate center of the nacelle. Similarly what Pratt & Whitney call the center fireseal ring is located in the rear section of the nacelle and provides mounting for the rear firewall.

   When the engine is installed in the nacelle the gasket is in contact with the upper and lower sections of the firewall and the complete assembly forms a firesproof seal as shown in Fig. 2.

D. The rear firewall separates the air inlet section of the engine from the hot (combustion and exhaust) section. This firewall consists of two firewall halves and a gasket. When installed, the two halves are bolted to each other and to a fireseal ring which is secured to the gas generator case of the engine immediately in front of the fuel manifold. The gasket is bolted to the outer edge of the firewall. When the rear nacelle panels are in place, the gasket locates in a preformed groove on the inner surface of the panels to form a complete fireproof seal.

E. As required, the firewalls incorporate holes for the passage of control and electrical cables, tubing, ducting, etc. Fireproof sealant is used at these locations to complete the fireproof seal. The firewalls are also used, as required, for the mounting of components, such as the precooler of the air conditioning system which is bolted to the inboard side of the rear firewall.



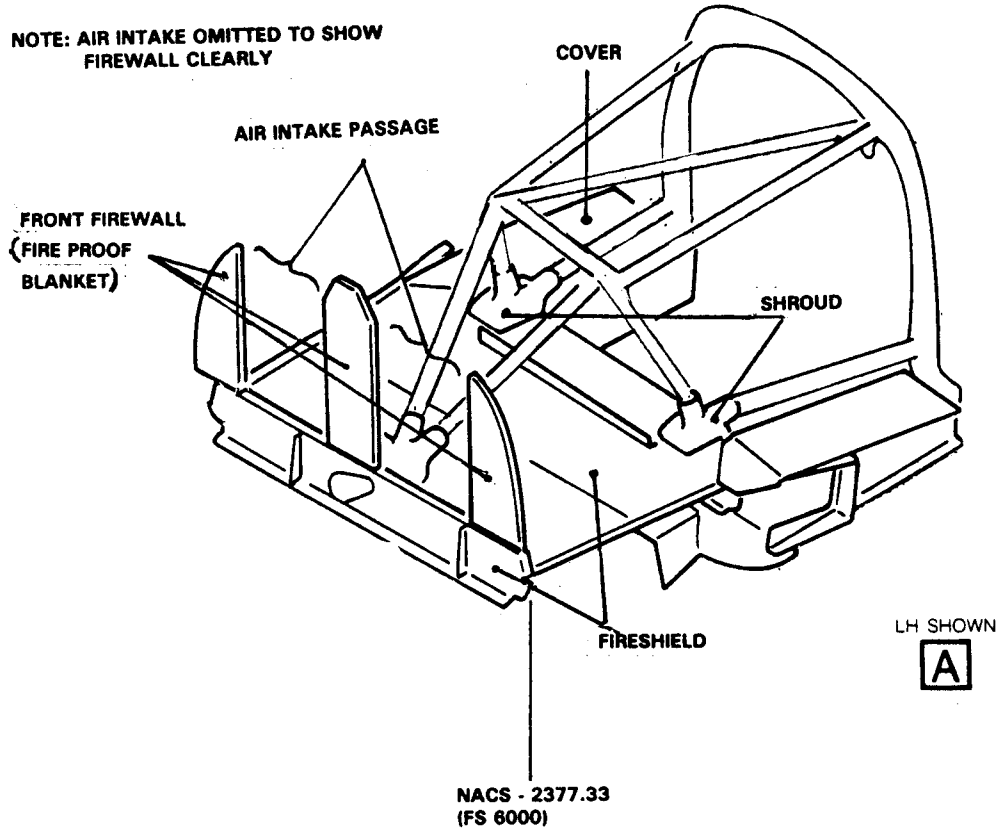


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Fig. 1 - Front Firewall Location Details

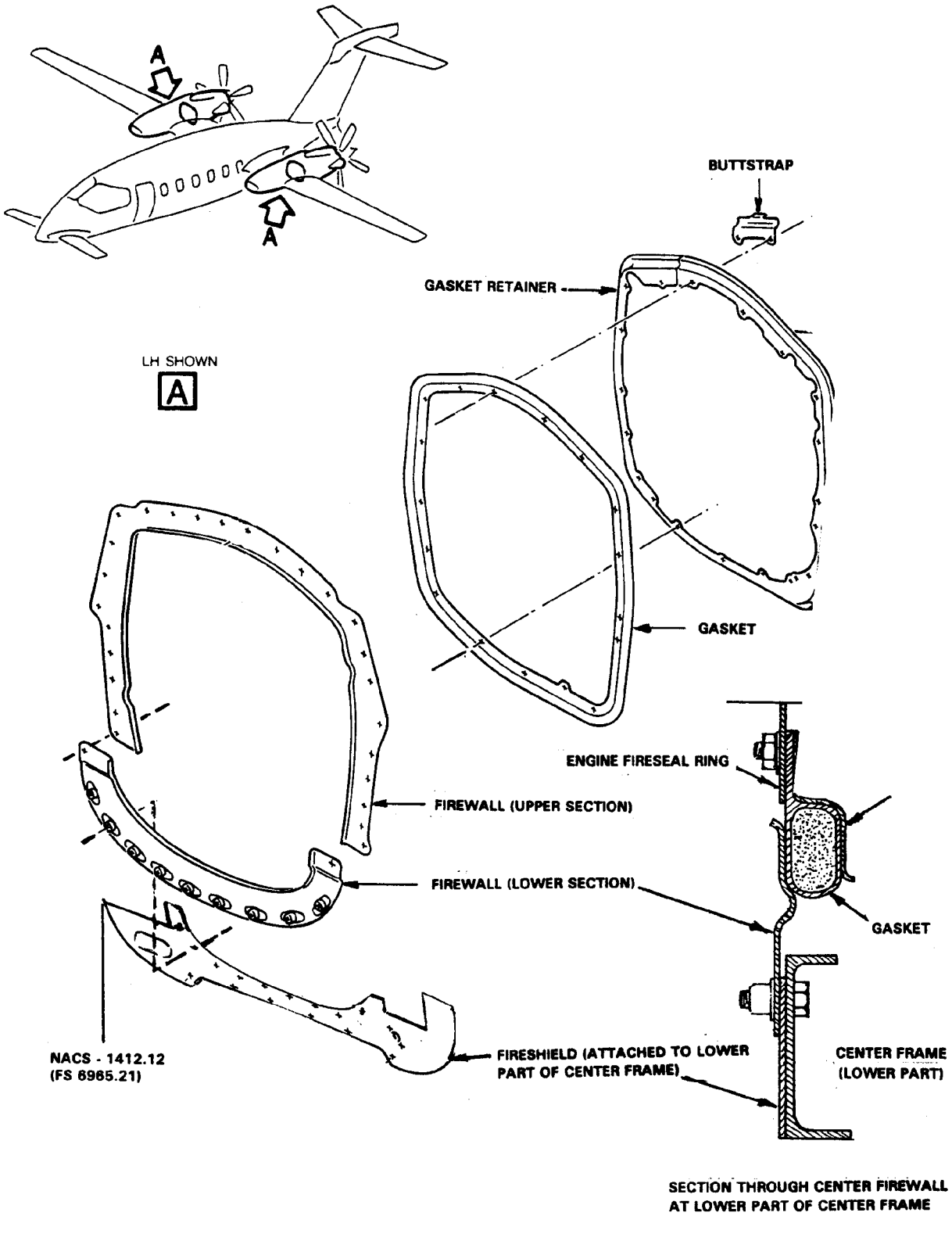

Fig. 2 - Center Firewall Location Details

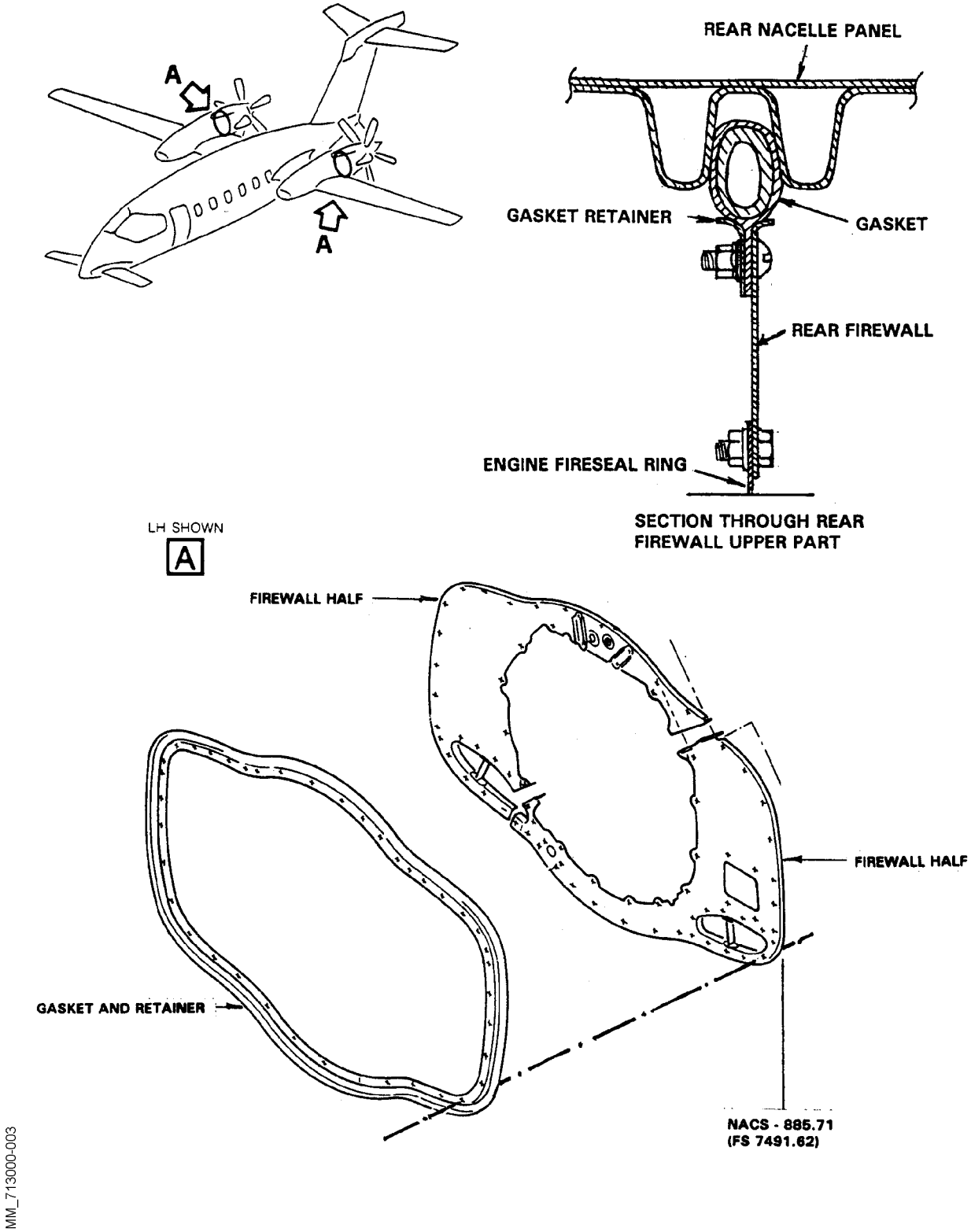

Fig. 3 - Rear Firewall Location Details

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ELECTRICAL HARNESS - DESCRIPTION AND OPERATION

1. General

A. Each of the two power plants has two electrical wiring harnesses, one located in the forward zone of the engine and one in the rear zone. The rear zone, which is separated from the forward zone by the center frame and firewall, extends from the engine air inlet screen to the reduction gearbox. The forward zone is where the accessory gearbox is located.

B. The connections of the wiring harness in the forward zone of the LH engine (Ref. Fig. 1) are:

P125, which connects to J125 at a bracket on the wing adjacent to the inboard strut of the LH engine mounting frame

NOTE: For removal of the LH engine, connector P125 must be disconnected and temporarily secured to the engine to prevent damage.

P51, which connects to the engine fire detector E13
P57, which connects to the oil temperature bulb MT11
P59, which connects to the oil pressure transducer MT13
P61, which connects to the oil low pressure switch S103
P67, which connects to the fuel flow transmitter MT29
P97, which connects to the Ng tachometer generator MT45
P163, which connects to the oil tank dipstick switch S111

C. The connections of the wiring harness in the rear zone of the LH engine (Ref. Fig. 2) are:

P127, which connects to J127 at the rear face of the engine center frame, lower part, inboard side.
P137, which connects to the shutoff valve L5 of the air conditioning system
P227, which connects to the shutoff valve L27 of the oil cooling ejector system

NOTE: For removal of the LH engine, connectors P127, P137 and P227 must be disconnected, and the connectors and wires must be temporarily secured to the engine to prevent damage. In addition, the wires of P137 must be released from the cable tie at the plenum apron.

P85, which connects to the torque pressure transducer MT37
P89, which connects the test solenoid valve L15 on the propeller overspeed governor
P91, which connects to the Np tachometer generator MT41
P217, which connects to the high torque pressure switch S155
P219, which connects to the low torque pressure switch S157
P221, which connects to the dump valve L23 on the propeller governor

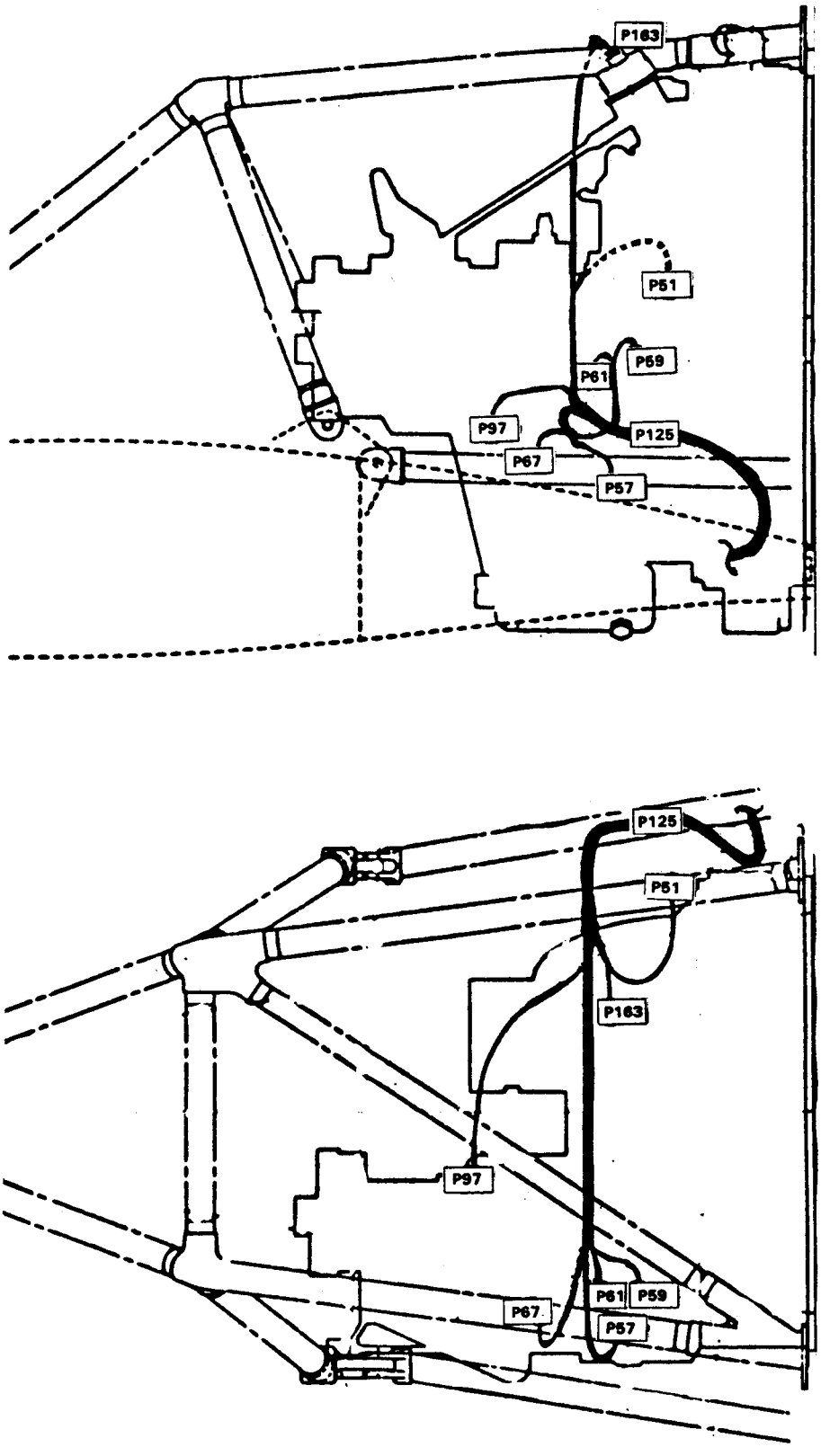

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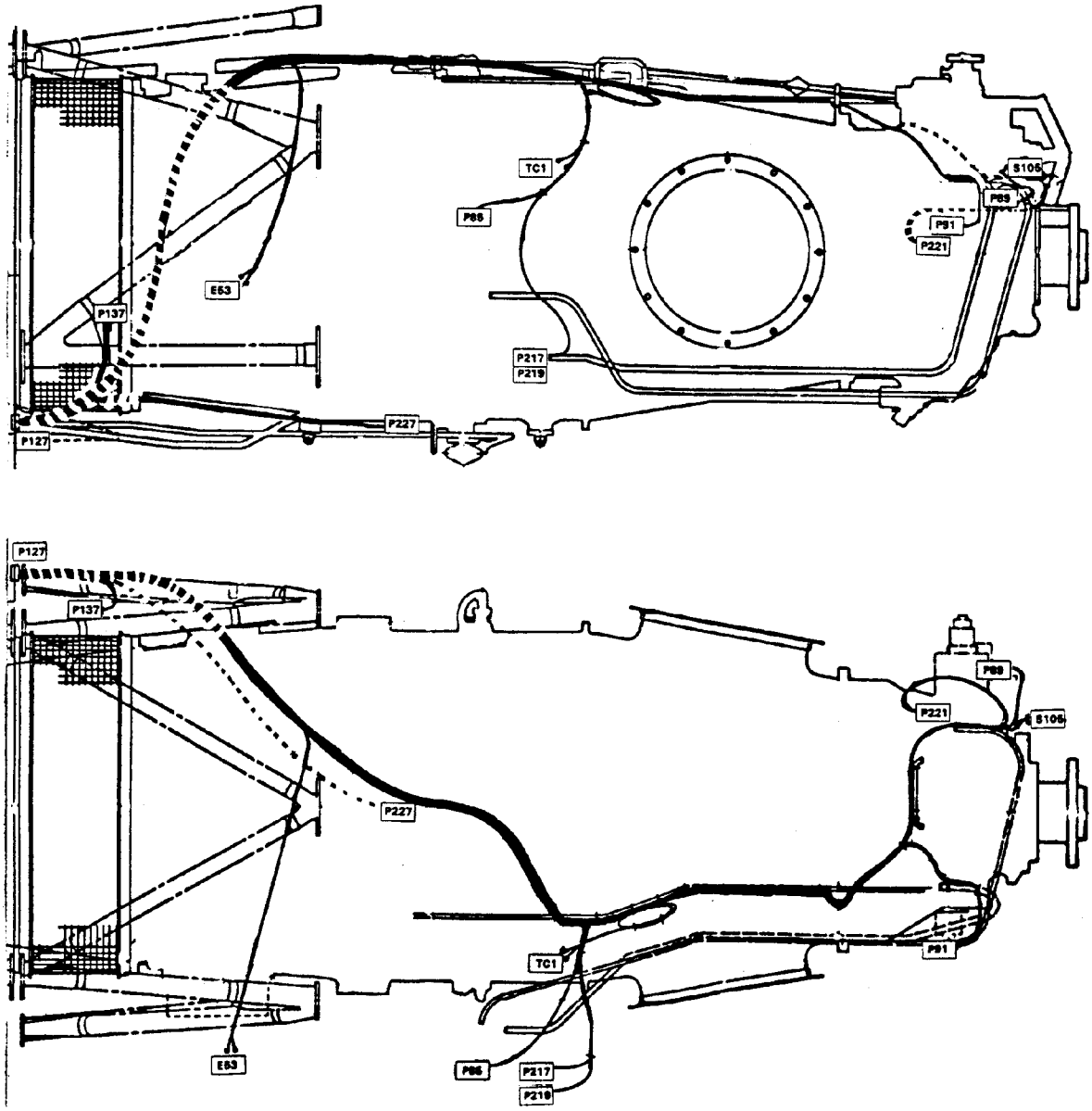
Fig. 1 - Wiring Harness - LH Engine Forward Zone



MM_715000-002

Fig. 2 - Wiring Harness - LH Engine Rear Zone

This wiring harness also incorporates wires with spade ends for connection to:

- the propeller low pitch switch S105
- the terminal block of the engine ITT harness TC1
- the fire extinguisher bottle E53 (optional)

If the airplane is equipped with the optional propeller synchrophasing system, there will also be a connector P223 which connects to the synchrophasing valve L25 on the propeller governor, and eires with spade ends for connection to the phase pickup MT55.

D. The connections of the wiring harness in the forward zone of the RH engine (Ref. Fig. 3) are:

P124, which connects to J124 at a bracket on the wing adjacent to the inboard strut of the RH engine mounting frame

NOTE: For removal of the RH engine, connector P124 must be disconnected and temporarily secured to the engine to prevent damage.

P50, which connects to the engine fire detector E14
P58, which connects to the oil temperature bulb MT10
P60, which connects to the oil pressure transducer MT12
P62, which connects to the oil low pressure switch S104
P68, which connects to the fuel flow transmitter MT28
P96, which connects to the Ng tachometer generator MT46
P162, which connects to the oil tank dipstick switch S110

E. The connections of the wiring harness in the rear zone of the RH engine (Ref. Fig. 4) are:

P126, which connects to J126 at the rear face of the engine center frame, lower part, inboard side.
P138, which connects to the shutoff valve L6 of the air conditioning system
P226, which connects to the shutoff valve L28 of the oil cooling ejector system

NOTE: For removal of the RH engine, connectors P126, P138 and P226 must be disconnected, and the connectors and wires must be temporarily secured to the engine to prevent damage. In addition, the wires of P138 must be released from the cable tie at the plenum apron.

P84, which connects to the torque pressure transducer MT38
P88, which connects the test solenoid valve L14 on the propeller overspeed governor
P90, which connects to the Np tachometer generator MT42
P216, which connects to the high torque pressure switch S154
P218, which connects to the low torque pressure switch S156
P220, which connects to the dump valve L24 on the propeller governor

This wiring harness also incorporates wires with spade ends for connection to:

– the propeller low pitch switch S106
– the terminal block of the engine ITT harness TC2
– the fire extinguisher bottle E52 (optional)

If the airplane is equipped with the optional propeller synchrophasing system, there will also be a connector P224 which connects to the synchrophasing valve L26 on the propeller governor, and wires with spade ends for connection to the phase pickup MT54.

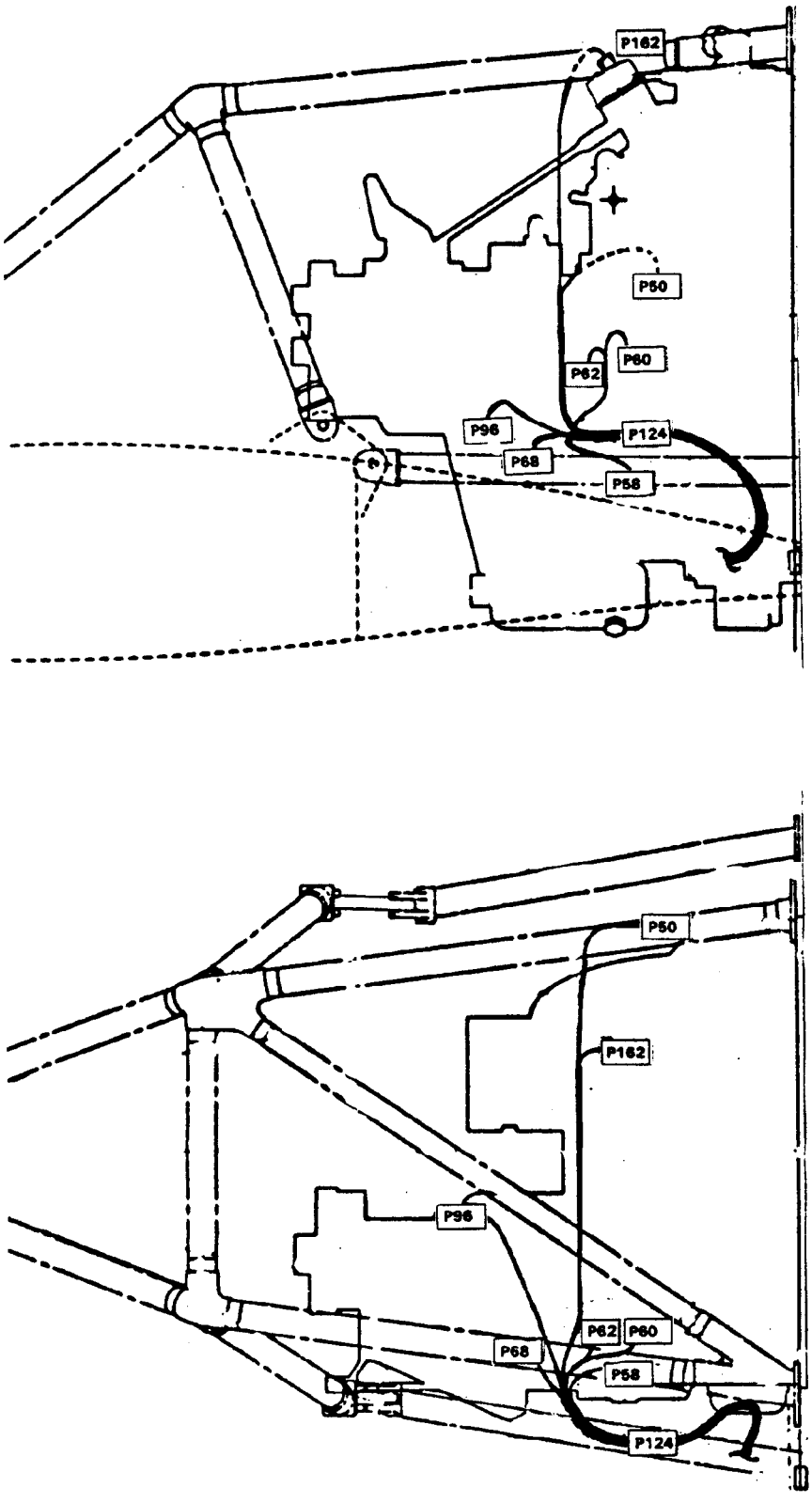


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Fig. 3 - Wiring Harness - RH Engine Forward Zone

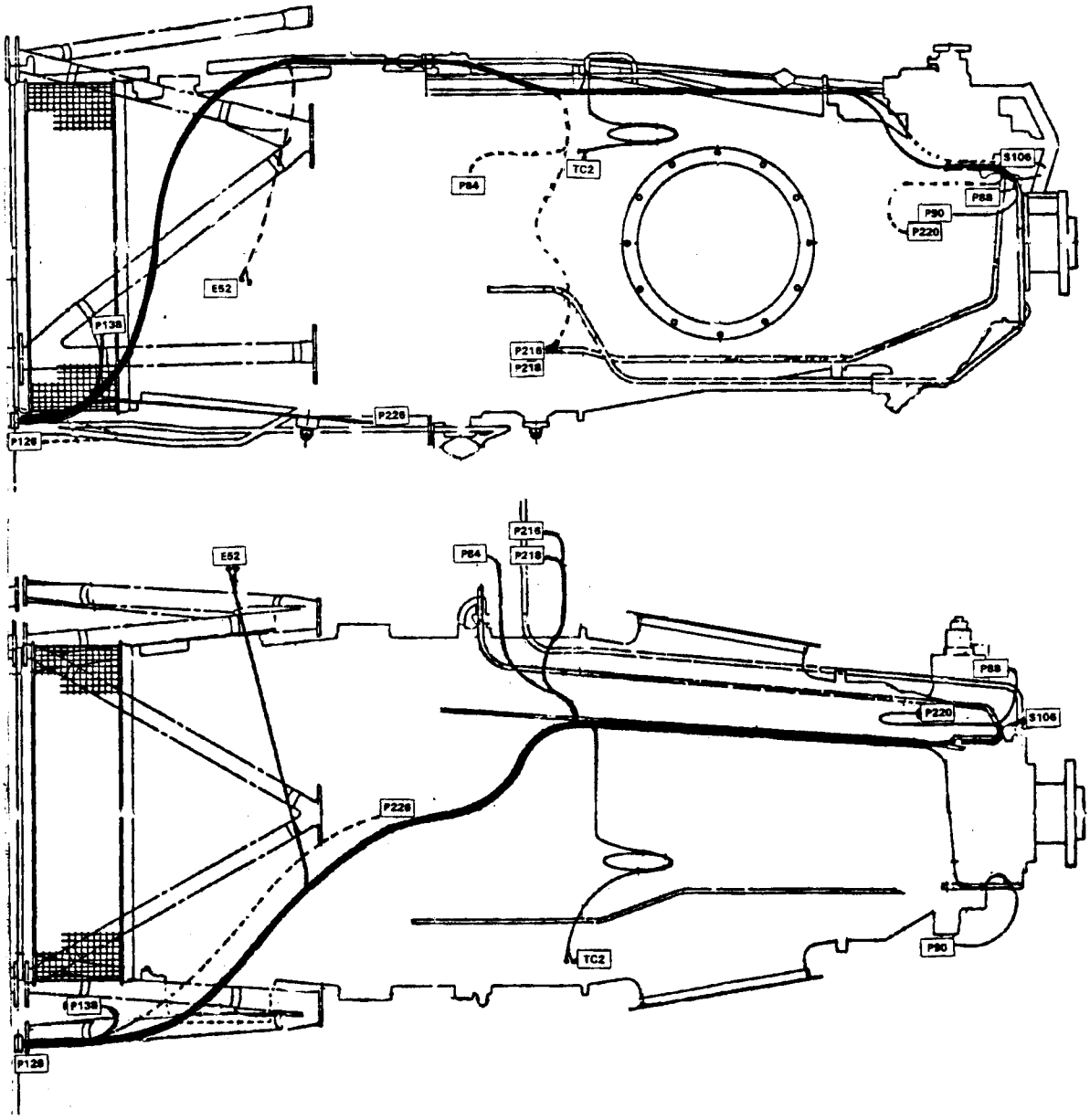

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Fig. 4 - Wiring Harness - RH Engine Rear Zone

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ENGINE DRAINS - DESCRIPTION AND OPERATION

1. General

A. The engine drain system is installed to vent normal leaking of fuel and oil overboard. The drain system is the same for both engines and comprises:

- the prop-shaft oil-seal cavity drain
- the combustion chamber fuel drain
- the starter-generator drive oil drain
- the fuel pump drive oil drain

B. The prop-shaft oil-seal cavity drain and the combustion chamber fuel drain are connected to atmosphere by metal tubes which protrude from a hole formed by two cut-outs in the rear nacelle panels directly below the combustion chamber fuel drain location. The tube of the prop-shaft oil-seal cavity drain extends forward from the bottom of the propeller thrust-bearing cover to the hole in the rear nacelle panels, and is secured to the pressure oil tube on the lower right side of the engine by two P-clips at two locations.

C. The starter-generator drive and the fuel pump drive oil drains are connected to atmosphere by rubber hoses which extends downward from the drains and are clamped to a collector which is secured to the lower nacelle panel.

D. Maintenance Practices for the drains consists of making sure that the tubes and hoses remain clear of obstructions.

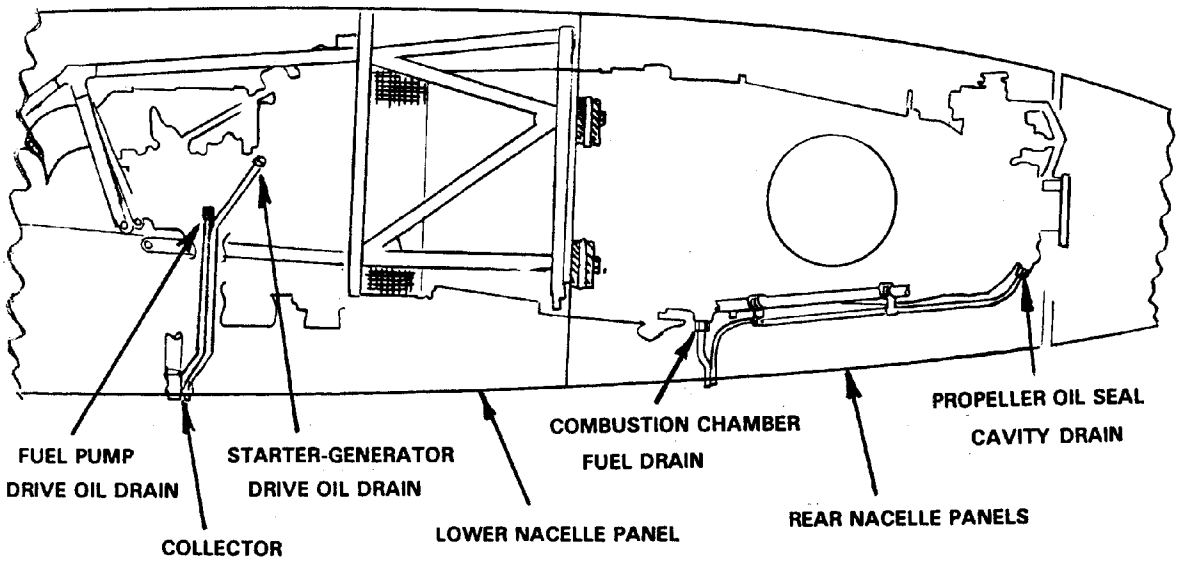

Fig. 1 - Engine Drains - Location Details

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