CHAPTER

61

PROPELLERS

CHAPTER 61 - PROPELLERS
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SPECIAL NOTE

WITHIN THIS MANUAL ALL REFERENCES TO LEFT AND RIGHT, CLOCKWISE AND COUNTER-CLOCKWISE, 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 BULK-HEAD.

BECAUSE THE PIAGGIO P180 AVANTI IS CON-FIGURED WITH "PUSHER" PROPELLERS, THE ENGINES ARE INSTALLED WITH THE ACCESSO-RY 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/PROPEL-LER 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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PROPELLERS - GENERAL

1. Introduction

A. The propulsive force of the Piaggio P.180 Avanti II is provided by two independent five-bladed propellers. Each propeller is driven by the power turbine of its associated engine through a reduction gearbox.

B. The engine reduction gearbox reduces power turbine speed (Nf) to 6.02% at the prop shaft, a ratio of 16.62:1. The nominal 100% Nf is 33,235 rpm, which equates to a propeller speed (Np) of 2000 rpm.

C. Each propeller system comprises:

- a rotating assembly consisting of a hub, five blades, a pitch change mechanism and a spinner
- a propeller (pitch-controlling) governor mounted on top of the engine reduction gearbox
- an overspeed governor located on the right-hand side of the reduction gearbox
- an autofeather system
- a propeller speed indication system.

2. Scope

A. This chapter gives information on the propellers and their associated components.

B. The chapter is divided into sections to simplify the arrangement of information as follows:

Section 61-10-00	gives detailed description, operation and maintenance practices for the propeller assembly; that is, the rotating portion of the propeller system.
Section 61-20-00	gives detailed description, operation and maintenance practices for the propeller pitch controlling portion of the system; that is, the propeller governor and the propeller overspeed governor.
Section 61-21-00	gives detailed description, operation and maintenance practices for the autofeather system.
Section 61-40-00	gives detailed description, operation and maintenance practices for the propeller speed indication system.

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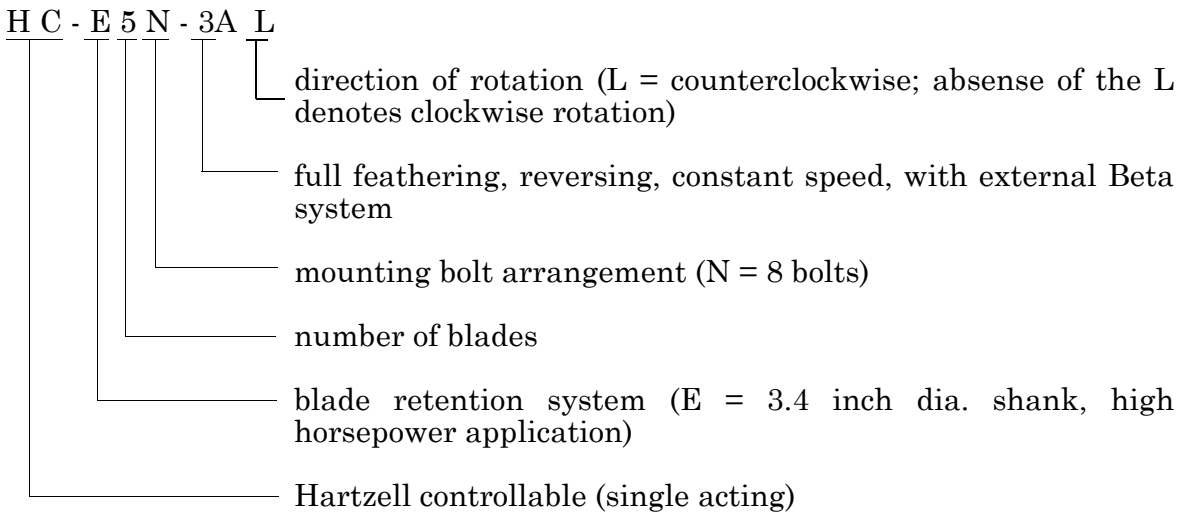
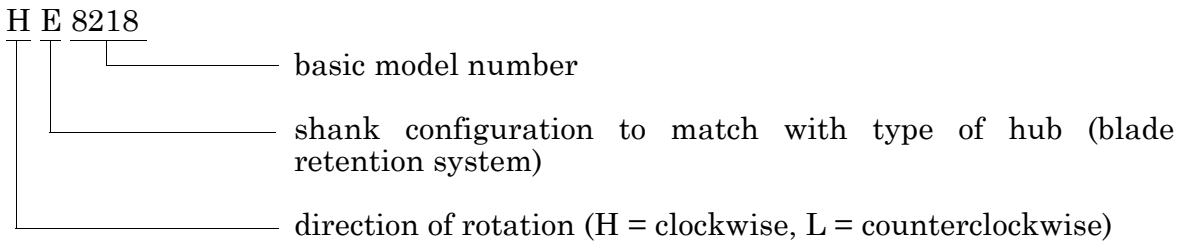
PROPELLER ASSEMBLY - DESCRIPTION AND OPERATION

1. General

A. This description and operation applies to both the left hand and right hand propellers; the only difference between the left and right propellers is the direction of rotation. Viewed from the rear of the airplane the left hand propeller rotates clockwise and the right hand propeller rotates counterclockwise.



The propeller blades are designated HE8218 (left engine) and LE8218 (right engine) explained as follows:



2. Description (Ref. Fig. 1)

A. The propeller is a Hartzell five-bladed, constant speed, single-acting, hydraulically actuated type with feathering and pitch-reversing capabilities. The propeller is configured to act as a "pusher" in that the engine is installed with the propeller shaft to the rear of the airplane. This configuration helps to improve airplane stability, reduces power plant noise within the passenger compartment and allows for a smoother airflow over the wing in the area of the nacelle.

B. The propeller comprises a lightweight hub assembly, five blades and a pitch change mechanism.

C. The hub assembly comprises front and rear halves bolted together, between which five pre-load plates and five ball bearings are clamped. A drive spigot protruding from the center of each pre-load plate locates in the hollow root of the blade, with a needle roller bearing interposed. The ball bearing locates around the blade root to retain the blade within the hub and take up the centrifugal force of the rotating blade.

D. Each blade turns on its bearings to change pitch. Drive from the hub is transmitted to the blades through the needle roller bearing via the spigots of the pre-load plates. Thrust from the blades is transmitted to the hub through the spigots of the pre-load plates via the needle roller bearings.

E. The propeller blades are aluminum alloy castings. The root of each blade has a blind hole to accept a needle roller bearing and the drive spigot of a pre-load plate. A cam follower device on the blade root protrudes into the hub to engage in the slot of a pitch change fork assembly. The cam follower is positioned so that forward and rearward movement of the fork assembly causes the blade to turn, thus changing pitch. A counterweight is attached to each blade near its root, when the propeller is rotating the centrifugal force acting on the counterweight is transferred to the blade as a force tending to turn the blade into coarse pitch. This force counteracts the natural Centrifugal Turning Moment (CTM) of the rotating propeller blade which tends to force the blade into fine pitch. The neutralizing of blade CTM simplifies blade pitch and actuation.

F. The pitch change mechanism comprises:

- a fixed cylinder
- a sliding piston
- a pitch change rod
- a fork assembly
- a feathering spring
- three Beta rods and nuts
- a Beta feedback ring

G. The cylinder is bolted to the rear of the rear hub half. The cylinder is sealed at its rear end by a reverse adjust plate which limits rearward movement of the piston.

H. The piston and the fork assembly are secured to the pitch change rod so that forward and rearward movement of the piston is transmitted directly to the fork assembly. Forward and rearward movement of the fork assembly is converted to rotary movement of the blades by the cam follower device on the root of each blade.

I. The pitch change rod is hollow and projects forwards into the prop shaft of the engine. The prop shaft acts as an oil supply/return line from/to the propeller governor. Holes in the pitch change rod allow oil to flow to and from the front of the piston. An O-ring sealed plug is installed in the rear end of the pitch change rod. The rear end of pitch change rod projects through the center of the reverse adjust plate. A feather adjustment nut and jam nut are installed (externally) near the rear end of the pitch change rod; the adjustment nut contacts the reverse adjust plate when the propeller is feathered.

J. The feathering spring is located within the cylinder front end and extends forward into the hub rear half. A retainer on the pitch change rod contacts the front end of the spring so that when the rod moves rearward the spring is compressed.

K. The Beta rods are located in, and extend from, the hub unit. At their forward end the three rods are attached to the Beta feedback ring. A Beta nut is located on each rod; the nuts act a low (fine) pitch stops because, when the propeller blades reach the full fine position, the pitch change fork contacts the nuts and cannot move further rearwards. The Beta nuts remain stationary because of their connection to the Beta feedback ring which is hydraulically and mechanically held in position by the Beta control valve and the reversing control linkage. The feedback ring can move only as a result of the selection of reverse (Beta range) pitch.

L. The Beta feedback ring is connected to the Beta control valve and to the reversing push pull control by a (reversing) lever. Forward and rearward movement of the rotating ring is transmitted to the lever by a carbon block assembly which is located in the ring groove.

3. Operation (Ref. Fig. 2 and 3)

A. Feather to Fine Pitch/Fine Pitch to Reverse Pitch

(1) Oil pressure (supplied from the engine oil system and boosted by a pump in the propeller governor) is directed to the front of the piston.

(2) The oil pressure overcomes the force of feathering spring and drives the piston rearwards within the cylinder. This rearward movement of the piston is transmitted to the pitch change fork assembly which, via the cam followers, turns the blades towards fine pitch.

(3) Full fine pitch is set by the position of the Beta nuts which limit the rearward movement of the pitch change fork assembly.

(4) Maximum reverse pitch is set by the position of the reverse adjust plate (in the rear end of the cylinder) which limits rearward movement of the piston.

B. Reverse Pitch to Fine Pitch/Fine Pitch to Feather

(1) When oil is allowed to return from the propeller pitch change mechanism and drain into the scavenge side of engine oil system, the feathering spring drives the pitch change fork assembly forwards. This forward movement of the fork assembly is transmitted to the blade cam followers which turn the blades towards fine pitch coarse pitch and feather.

(2) Feather position is set by an adjustment nut on the rear end of the pitch change rod. When the blades reach the full feather position, the adjustment nut contacts the reverse adjust plate to halt further movement.

C. Propeller pitch is controlled by a propeller governor. The governor controls the oil supply to and from the pitch change mechanism. Full details of the controlling aspect of the propeller is given in 61-20-00.

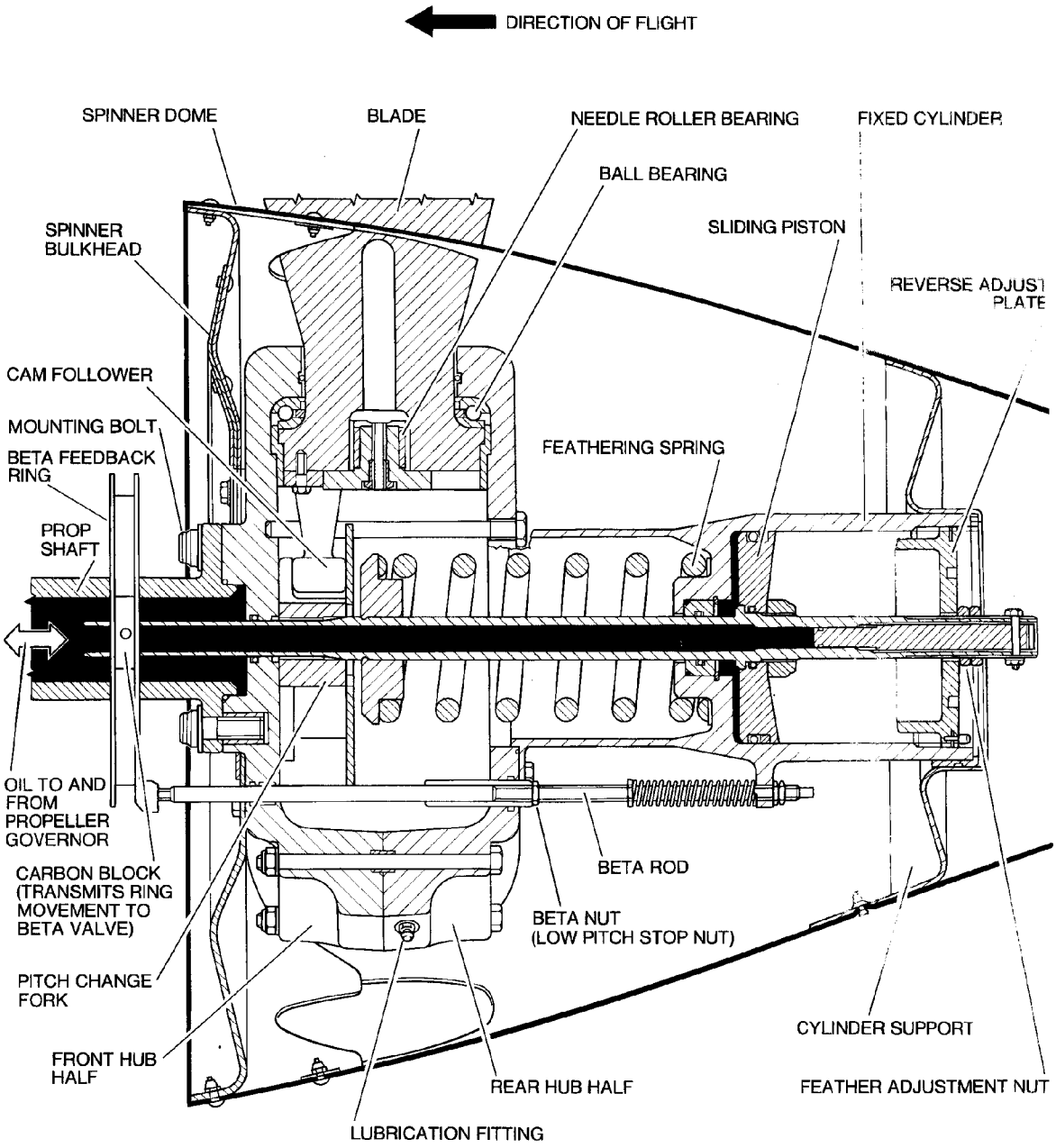


Fig. 1 - Propeller Components

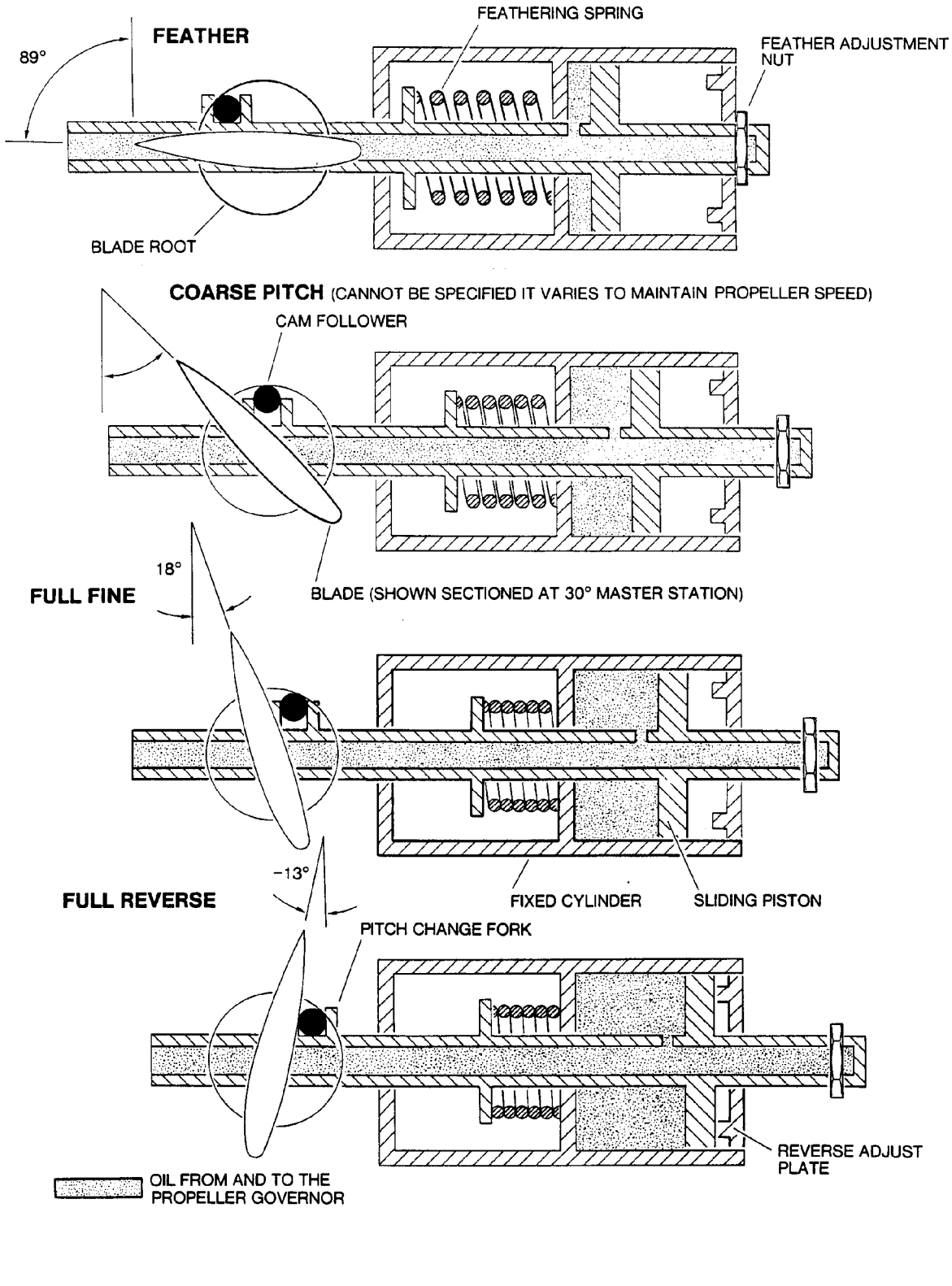


Fig. 2 - Propeller Pitch Positions - Schematics

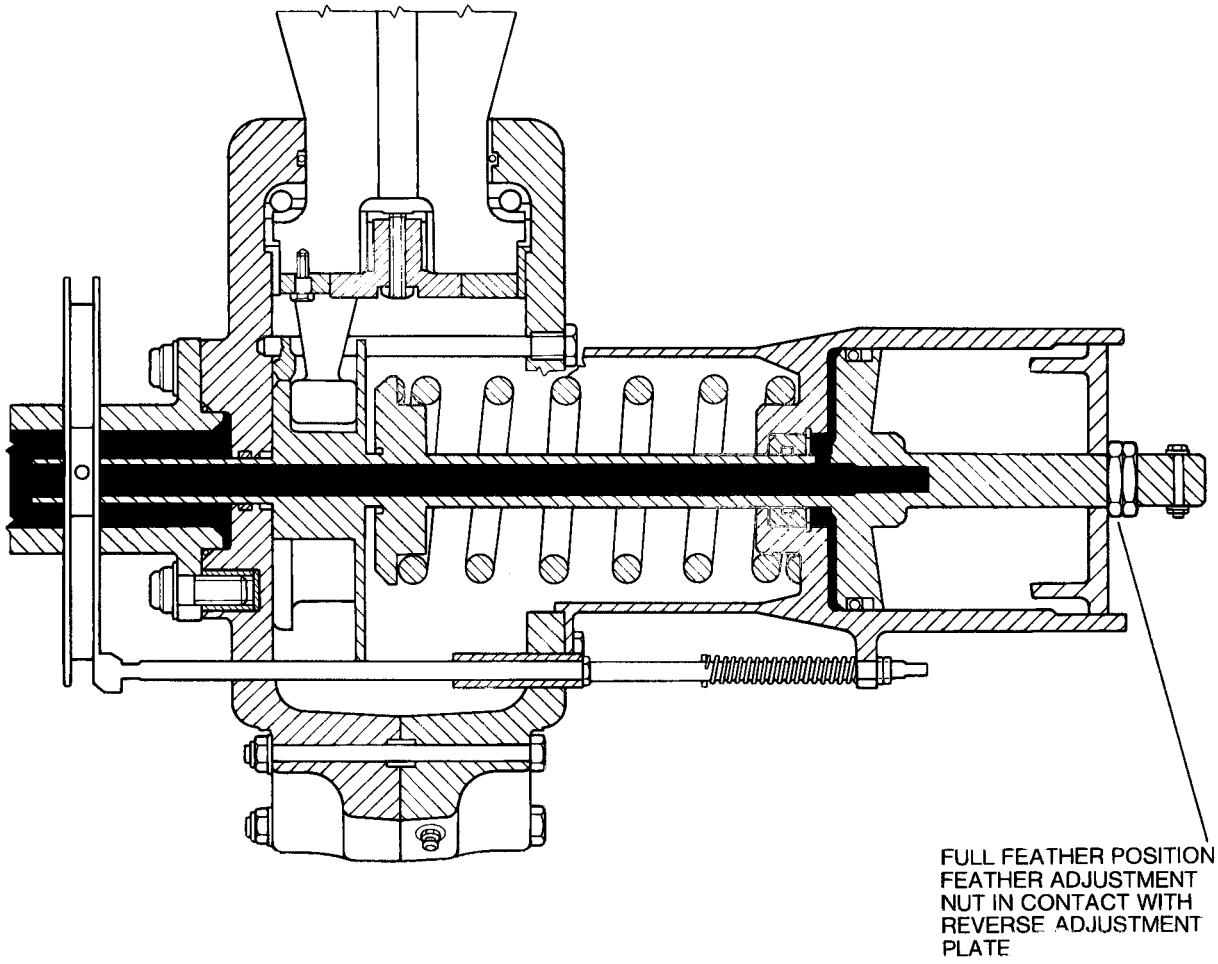


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Fig. 3 - Propeller Blade Full Pitch Positions (Sheet 1 of 3)

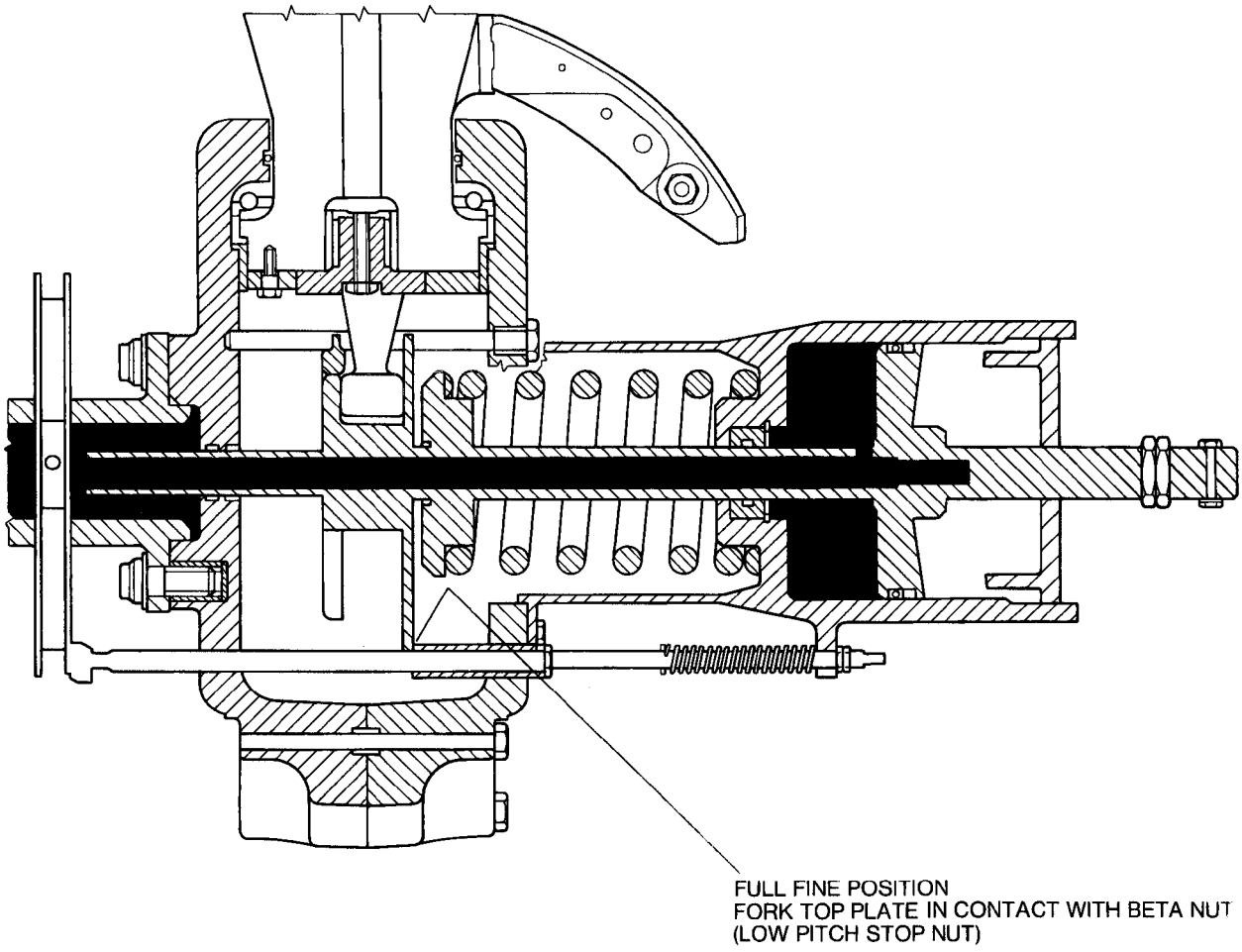

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Fig. 3 - Propeller Blade Full Pitch Positions (Sheet 2 of 3)

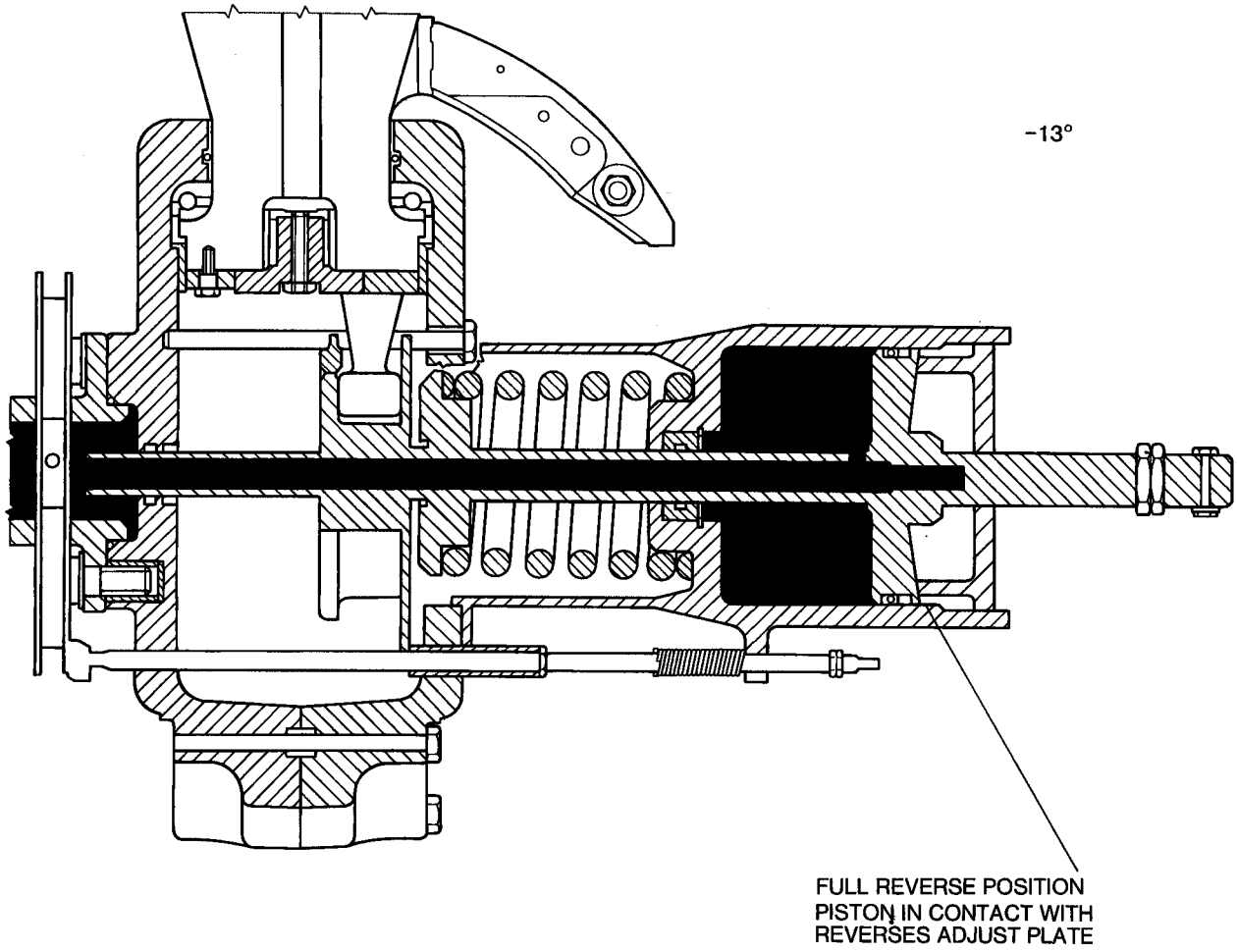

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Fig. 3 - Propeller Blade Full Pitch Positions (Sheet 3 of 3)

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PROPELLER ASSEMBLY - MAINTENANCE PRACTICES

1. General

A. This topic provides the following maintenance practices:

- Propeller Assembly, Inspection (refer to Para. 2)
- Propeller Assembly, Lubrication (refer to Para. 3)
- Propeller Assembly, Removal (refer to Para. 4)
- Propeller Assembly, Installation (refer to Para. 5)
- Propeller Blades, Minor Repairs (refer to Para. 6)

B. Other propeller system maintenance practices which are given elsewhere are listed below, together with the appropriate cross-references.

- Maximum Propeller Speed Check
- Feathering Check
- Autofeather Check
- Underspeed Fuel Governing Check
- Check for Interference between the Normal Governing and Overspeed Fuel Governing Functions of the Propeller Governor
- Overspeed Governor Check
  (refer to the Maintenance Manual, Chapter 71-00-00, Page Block 501 for the six checks listed above)
- Propeller Governor Removal and Installation
- Propeller Overspeed Governor Removal and Installation (refer to the Maintenance Manual, Chapter 61-20-00, Page Block 201 for the two items listed above)
- Propeller Tachometer Generator Removal and Installation
- Propeller Speed Indicator Removal and Installation
  (refer to the Maintenance Manual, Chapter 61-40-00, Page Block 201 for the two items listed above)
- Propeller Controls Rigging (refer to the Maintenance Manual, Chapter 76-10-00, Page Block 201)

2. Propeller Assembly - Inspection

A. Definitions of Damage

- Corrosion is a gradual wearing away or deterioration due to chemical action.
- Crack is an irregularly shaped separation within a material usually visible as a narrow opening at the surface.
- Depression is a surface area where the material has been compressed, but not removed, by contact with an object.
- Distortion is an alteration of the original shape or size of a component.
- Erosion is a gradual wearing away or deterioration due to action of the elements.
- Gouge is a small surface area where material has been removed by contact of a sharp object.
- Impact damage occurs when the propeller blade or hub assembly strikes or is struck by an object either in flight or on the ground.

– Nick is a sharp surface indentation caused by the impact of a foreign object.
– Pitting is a number of extremely small gouges caused by corrosion or wear.
– Scratch/cut is an elongated gouge.

B. 150-Hour Inspection (Both Propellers)

(1) Remove the screws and washers securing the spinner dome to the bulkhead and remove the spinner dome.
(2) Remove nacelle panels 430AL and 430AR (left engine) and 440AL and 440AR (right engine). Refer to 54-10-00.
(3) Inspect all visible propeller parts, including the spinner dome, for damage and wear. Any damage on a blade must be repaired before the next flight; refer to Para. 6 for minor repairs and acceptable damage limits. Perform the Beta System Check as described in this section Para. 9.
(4) Inspect for signs of oil leakage in the following areas:
  (a) At the seal between the pitch change rod and the reverse adjustment plate.
  (b) At the seal between the reverse adjustment plate and the cylinder.
  (c) At the seal between the engine flange and the propeller mounting flange.
(5) Investigate the source of any oil leak found and rectify as necessary.
(6) Inspect for signs of grease leakage in the following areas:
  (a) Between the blade socket and the hub.
  (b) At any of the ten lubrication fittings.
  (c) At the interface between the hub halves.
  (d) At the Beta rod exit from the engine-side hub half.
  (e) At the Beta rod exit from the cylinder-side hub half.
  (f) At the seal between the cylinder shoulder and the cylinder-side hub half.
(7) Replace any leaking lubrication fitting and ensure that all ten fittings have protective plastic caps fitted.

  NOTE: The only other potential source of grease leakage, regardless of the location of grease leak found, is one or more of the blade retention split-bearings.

(8) Replace the propeller if grease leakage is evident and all lubrication fittings are found to be serviceable.
(9) Inspect all attaching parts for proper fit.
(10) Install the spinner dome and secure the dome to the bulkhead with screws and washers.
(11) Install nacelle panels 430AL and 430AR (left engine) and 440AL and 440AR (right engine). Refer to 54-00-00.

3. Propeller Assembly - Lubrication

A. Tools

Lubricating Gun	Not Specified

B. Materials

Grease	03-011 (refer to the CAUTION below)

C. Procedure (Both Propellers)

(1) Remove the screws and washers securing the spinner dome to the bulkhead and remove the spinner dome.

WARNING: TO AVOID DISLODGING THE HUB O-RINGS DURING THE LUBRICATION PROCEDURE IT IS ESSENTIAL THAT THE LUBRICATION FITTINGS ON THE ENGINE-HALF OF THE HUB ARE COMPLETELY REMOVED AS DETAILED IN THE FOLLOWING STEP.

(2) Remove each of the five lubrication fittings on the engine-half of the hub-unit.

CAUTION: THE RECOMMENDED GREASE IS AEROSHELL 22 (REF. NO. 03-011). VERIFY WHICH GREASE HAS BEEN USED AND USE THE SAME. DO NOT MIX DIFFERENT BRANDS OR SPECIFICATIONS. THE CHEMICAL INTERACTION OF DIFFERENT GREASES COULD DAMAGE THE BLADE BEARINGS.
IF IT IS NECESSARY TO CHANGE FROM ONE GREASE SPECIFICATION TO ANOTHER, THE PROPELLER MUST BE REMOVED, DISASSEMBLED, CLEANED OF OLD CREASE, ASSEMBLED AND LUBRICATED WITH NEW GREASE.

(3) Add an equal number of pumps of lubricant through each of the five lubrication fittings on the cylinder-half of the hub-unit.

NOTE: Lubrication of each blade retention split-bearing is considered complete when grease emerges from the location of the removed lubrication fitting in a steady flow with no air pockets.

CAUTION: MAKE SURE THAT NO MORE THAN 1 FL. OZ OF GREASE ARE PUMPED INTO EACH CYLINDER-SIDE LUBRICATION FITTING. THIS GREASE AMOUNT INSURES THAT ALL FREE VOLUMES OF THE BEARING ARE PROPERLY FILLED IN. AS REPORTED IN THE HARTZELL OWNER'S MANUAL, 1 FL. OZ CORRESPONDS TO APPROXIMATELY 6 PUMPS WITH A HAND - OPERATED GREASING GUN.
IF THE OPERATOR DOESN'T VERIFY THAT THE GREASE IS EMERGING FROM THE OPPOSITE HOLE, AFTER 6 PUMPS, THIS MEANS THAT SOME PROBLEM IS PRESENT. ANY FURTHER QUANTITY OF GREASE INTRODUCED INTO THE SYSTEM COULD GENERATE PROPELLER UNBALANCE CONDITIONS AND CONSEQUENT VIBRATIONS.

(4) Install the five lubrication fittings on the engine-half of the hub-unit.

(5) Ensure that each of the ten lubrication fittings is fitted with a plastic protection cap.
(6) Clean off any excess grease.
(7) Install the spinner dome and secure the dome to the bulkhead with the screws (and washers, if applicable).

4. Propeller Assembly - Removal (Ref. Fig. 202)

A. Fixtures, Test and Support Equipment

Warning Notice	Not Specified
Access Platform	3 ft (1 m)
Cover, Engine Shaft	P & WC Part No. PK1841
Propeller Stand	TBA

B. Tools

Propeller Beta System Compression Tool	Hartzell CST-2834 or CST-2987
Propeller Lifting Sling	

C. Referenced Information

Maintenance Manual Chapter 54-00-00

D. 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.

(1) Put a Warning Notice in the flight compartment to tell persons not to move the power levers or the propeller levers.
(2) Open, tag and safety these circuit breakers:
Pilot CB Panel:
L ENG START
R ENG START
(3) Remove nacelle panels 430AL and 430AR (440AL and 440AR) (Refer to 54-00-00).
(4) Remove the spinner dome by removing screws and washers.
(5) Disconnect the Beta linkage by removing the Truarc snap ring and the carbon block assembly.
(6) Using the Beta system compression tool CST-2834 or CST-2987, pull the Beta ring away from the engine to expose the propeller mounting bolts.

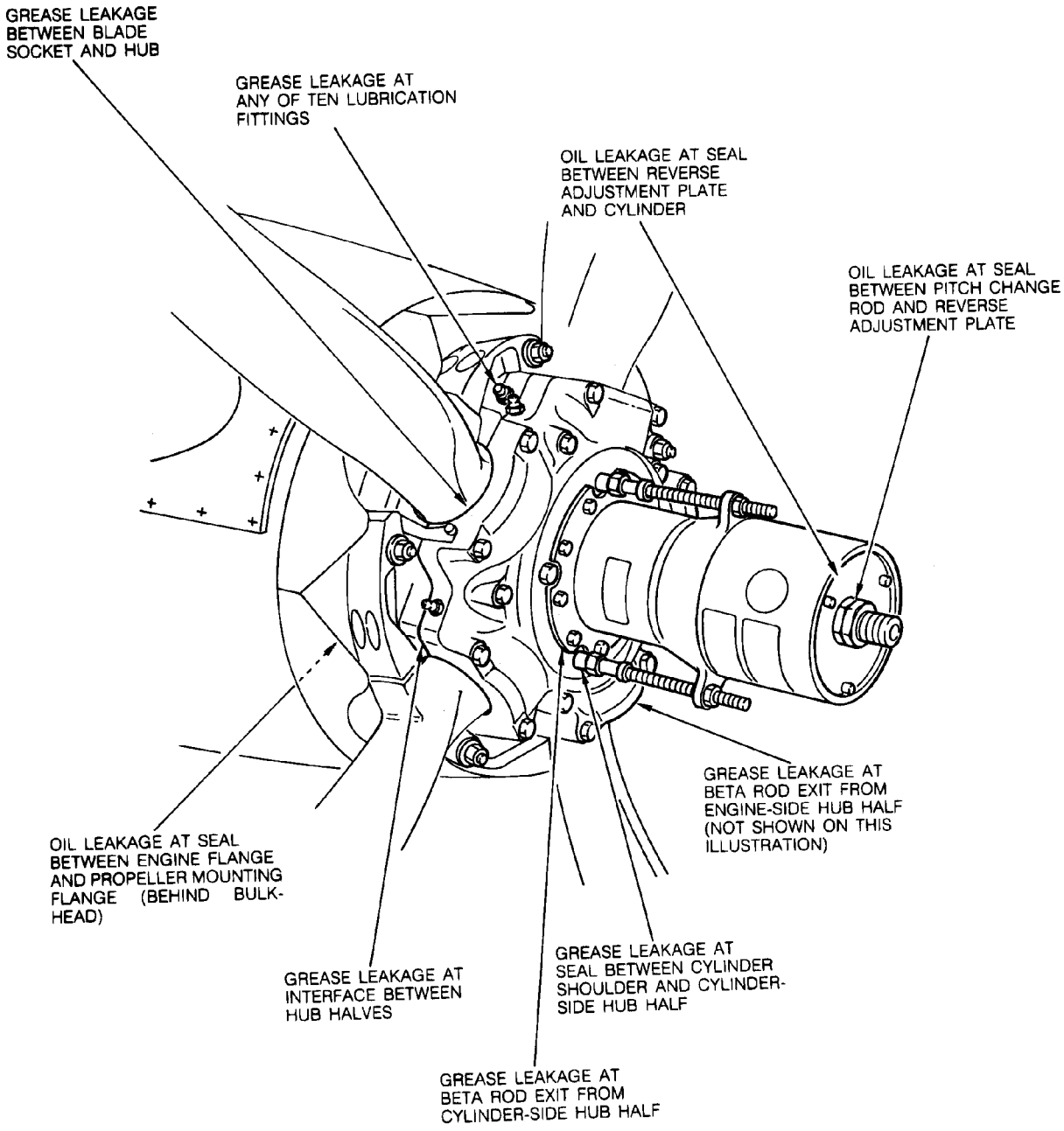

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Fig. 201 - Propeller Inspection Areas for Oil and Grease Leakage

(7) Install the lifting sling and, using a mobile hoist, take up the weight of the propeller.

WARNING: MAKE SURE THAT THE LIFTING EQUIPMENT IS CAPABLE OF SUPPORTING A LOAD OF AT LEAST 100 kg (220 lbs). THE PROPELLER WEIGHS 88.5 kg (195 lbs).

NOTE: If the propeller being removed is to be installed on the same engine, mark the engine shaft and the propeller bulkhead so that propeller/ shaft alignment and balance can be maintained.

(8) Remove the lockwire from the mounting bolts and remove the mounting bolts and washers.

(9) Make sure that the full weight of the propeller is taken up, then move the propeller away from the engine to clear the propeller shaft (engine flange) and install the propeller in its stand.

(10) Decompress and remove the Beta system compression tool.

(11) Remove and discard the propeller shaft O-ring.

(12) Install the engine shaft cover.

5. Propeller Assembly - Installation (Ref. Figs. 202, 203 and 204)

A. Tools

Propeller Lifting Sling	
Propeller Beta System Compression Tool	Hartzell CST-2834 or CST-2987
Special Torquing Adapter	Not Specified
Torque Wrench (for use with Special Torquing Adapter AST-2877)	Not Specified

B. Expendable Parts

O-ring, Engine Shaft	PRP-909-8

C. Materials

Anti-seize Compound (petrolated graphite)	03-001 or 03-002
Lockwire	04-008

D. Referenced Information

Maintenance Manual Chapter 54-00-00
Maintenance Manual Chapter 71-00-00

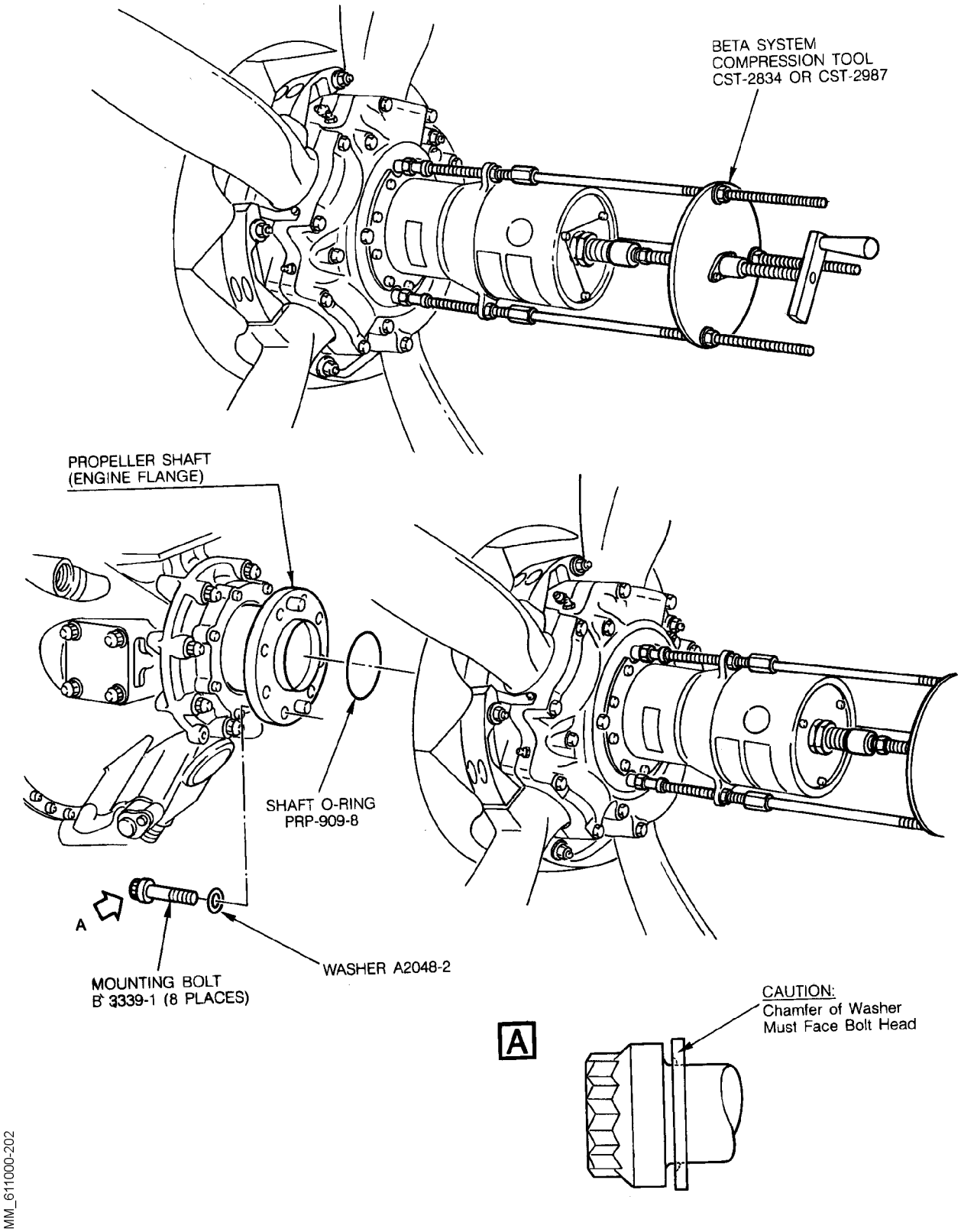
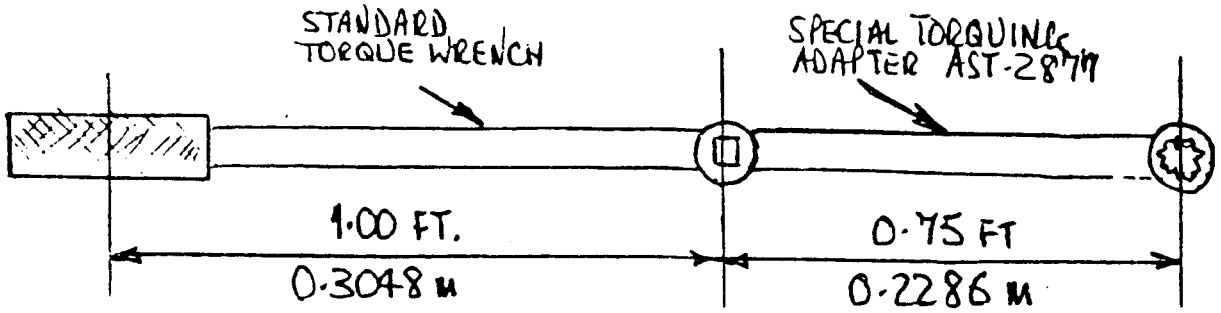


Fig. 202 - Propeller Removal and Installation



$$\frac{\text{ACTUAL TORQUE REQUIRED X TORQUE WRENCH LENGTH}}{\text{TORQUE WRENCH LENGTH + LENGTH OF ADAPTER}} = \text{TORQUE WRENCH READING TO ACHIEVE ACTUAL TORQUE REQUIRED}$$

EXAMPLE - FOR AN "ACTUAL TORQUE REQUIRED"
OF 100 LB.FT. (136 Nm) USING A 9-INCH ADAPTER:

$$\frac{\text{100 LB.FT. (136 Nm) x FT. (0.3048 m)}}{\text{1 FT. (0.3048 m) + 0.75 FT. (0.2286 m)}} = \text{57.1 LB.FT. (77.8 Nm)} = \text{READING ON TORQUE WRENCH FOR ACTUAL TORQUE OF 100 LB.FT. (136 Nm)}$$

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Fig. 203 - Torque Wrench Adapter/Reading Details

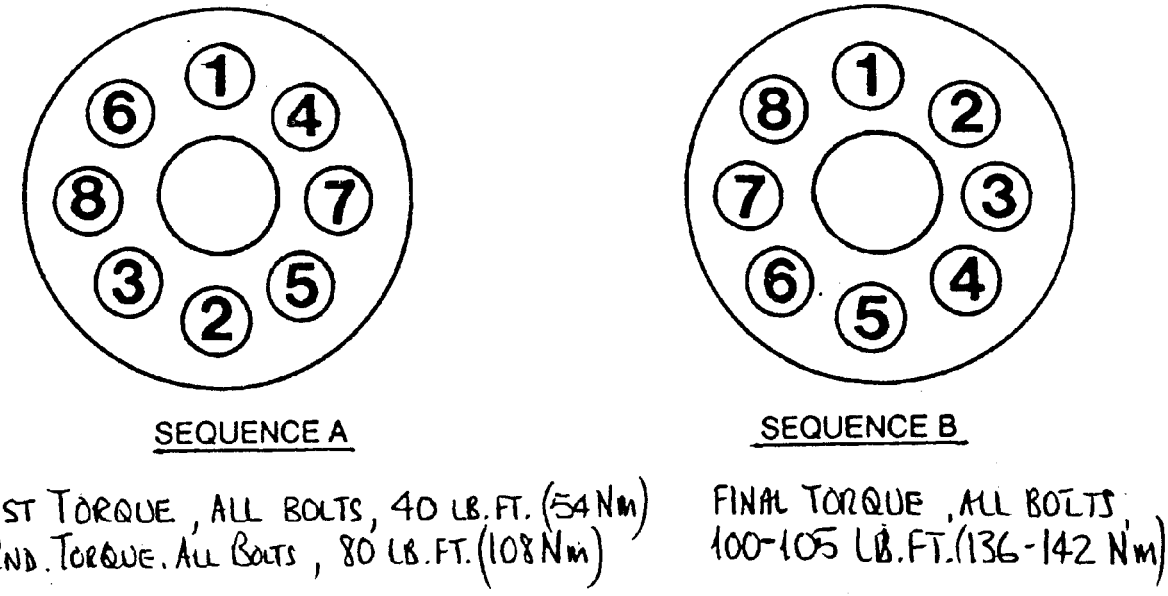

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Fig. 204 - Mounting Bolt Tightening Sequences

E. Procedure

CAUTION: MAKE SURE THAT THE PROPELLER BEING INSTALLED IS THE CORRECT ONE FOR THE ENGINE. INSTALLATION OF THE WRONG PROPELLER COULD CAUSE DAMAGE TO THE ENGINE AND PROPELLER.

THE CORRECT PROPELLER/ENGINE COMBINATIONS ARE:

LEFT ENGINE
P & WC PART NO. 3037000, BUILD SPEC. 677
LEFT PROPELLER
HARTZELL PART NO. HC-E5N-3A (WITH HE 8218 BLADES)
AND
HARTZELL PART NO. HC-E5N-3/3A

RIGHT ENGINE
P & WC PART NO. 3037000, BUILD SPEC, 676
RIGHT PROPELLER
HARTZELL PART NO. HC-E5N-3AL (WITH LE 8218 BLADES)
AND
HARTZELL PART NO. HC-E5N-3L/3AL

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

(1) Make sure that:
- The Warning Notice is in position
- The L ENG START and R ENG START circuit breakers are open, tagged and safetied
- Access is available.
  (Refer to the removal procedure)

(2) Remove the engine shaft cover.

(3) Make sure that the propeller and engine mounting flange mating faces are clean and undamaged.

(4) Lightly lubricate a new engine shaft O-ring using engine oil, and install the O-ring onto the shaft.

(5) Compress the Beta system of the propeller assembly using the compression tool.

WARNING: MAKE SURE THAT THE LIFTING EQUIPMENT IS CAPABLE OF SUPPORTING A LOAD OF AT LEAST 100 kg (220 lbs). THE PROPELLER WEIGHS 88.5 kg (195 lbs).

(6) Install the lifting sling and, using a mobile hoist, lift the propeller assembly into position adjacent to the engine shaft.

(7) Rotate the engine shaft as necessary to align the location dowels on the engine shaft flange with the dowel holes in the propeller hub flange.

(8) Position the propeller assembly carefully onto the engine shaft.

WARNING: USE ONLY PROPELLER MOUNTING BOLTS PART NUMBER B-3339-1. BOLTS WITHOUT THIS PART NUMBER ARE INCORRECT AND MUST NOT BE USED.

CAUTION: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER HUB FLANGE AND THE ENGINE FLANGE.

CAUTION: REPLACE ALL PROPELLER MOUNTING BOLTS AND WASHERS AT OVERHAUL. USE MOUNTING BOLTS AND WASHERS AGAIN ONLY WHEN THE PROPELLER IS BEING INSTALLED AFTER REMOVAL BETWEEN OVERHAULS.

(9) Apply anti-seize compound (petrolated graphite) to the threads of the eight mounting bolts.

(10) Install a washer (part no. A2048-2) on each bolt, with the chamfered (beveled) side of the washer hole toward the bolt head.

(11) Refer to Fig. 203 and determine the torque readings required for the actual torque figures of 40 lb.ft. (54 Nm), 80 lb.ft. (108 Nm) and 100 - 105 lb.ft. (136 - 142 Nm) according to the length of the adapter and the torque wrench to be used.

NOTE: If the 9-inch torque adapter AST-2877 is used in conjunction with a standard torque wrench of 12-inch effective length, the required torque readings are:
23 lb.ft. (31 Nm) - actual torque 40 lb.ft. (54 Nm)
46 lb.ft (62 Nm) - actual torque 80 lb.ft. (108 Nm)
57 - 60 lb.ft. (78 - 81 Nm) - actual torque 100 - 105 lb.ft. (136 - 142 Nm)

(12) Install the eight mounting bolts and washers and torque the bolts to 40 lb.ft. (54 Nm) in sequence A as shown on Fig. 204.

(13) Torque the bolts, also in sequence A, to 80 lb.ft. (108 Nm).

(14) Finally torque the bolts in sequence B to 100 - 105 lb.ft. (136 - 142 Nm).

(15) Safety the bolts, in pairs, with lockwire.

(16) Release and remove the lifting equipment and sling.

(17) Decompress the Beta system compression tool and install the Beta linkage.

(18) Remove the compression tool.

(19) Check the carbon block assembly for good condition and install the block into the groove of the Beta ring.

(20) Check the side clearance between the carbon block and the Beta ring flange. The clearance should be 0.001 inch (0.03 mm) to 0.002 inch (0.05 mm) for new installations, and a maximum worn clearance of 0.010 inch (0.25 mm).

(21) Safety the Beta linkage with lockwire.

(22) Install the spinner dome and secure the dome to the bulkhead with screws and washers.

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

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

Pilot CB Panel:

L ENG START
R ENG START

(25) Remove the Warning Notice from the flight compartment.

(26) Ground run the engine (refer to 71-00-00) as specified for propeller replacement.

(27) After the ground run inspect the propeller for oil and grease leaks.

6. Propeller Blades - Minor Repairs (Ref. Fig. 205 and 206)

WARNING: ANY BLADE DAMAGE, HOWEVER MINOR, MAY PRODUCE A CONDITION IN WHICH FATIGUE CRACKS WILL START AND BLADE FAILURE WILL OCCUR. DAMAGE MUST BE REPAIRED, OR THE PROPELLER REPLACED, BEFORE THE NEXT FLIGHT.

A. General

Small nicks, gouges, scratches, etc. on the blade leading and trailing edges and on both blade surfaces may be repaired by blending out the damage, providing that repair tolerances are not exceeded. Several repairs may be made to a blade, providing that they do not form a continuous depression across the blade.
Larger nicks, gouges, scratches and cracks which may affect the structural strength, balance or efficient operation of the propeller must be referred to an approved overhaul facility.

B. Repair Tolerances

NOTE: The given limits of damage repair are the known safe limits which do not require the specific approval of the propeller or airplane manufacturer; but blade damage that is outside the repair limit does not necessarily mean that the blade cannot be repaired in the field. If there is minor damage which is outside the given repair limits, refer to the propeller manufacturer (Hartzell) or the airplane manufacturer (Piaggio) for specific instructions.

Fig. 205 shows the minimum allowable blade width, after repair, at eight stations, and the minimum allowable thickness, after repair, at the thickest point of the balde at each of the stations. These figures must be used as a basis for calculationg repair tolerances at any point of the blade.
To calculate maximum permitted depth of repair to leading or trailing edge damage (Ref. Example A, Fig. 205) the following formula may be used:

$$\text{Maximum permitted depth or repair } v = \frac{y - x}{y} \times w$$

where y = actual width of blade at nearest station

z = minimum allowable width at the station (extracted from the table at the right of the illustration)

and w = actual width of blade at point of damage

For example A on the illustration, the 36 inch (914,4 mm) station is nearest, so typical figures may be:

$$v \text{ (in inches)} = \frac{8.244 - 7.622}{8.244} \times 8.204 = 0.619 \text{ in}$$

$$v \text{ (in millimeters)} = \frac{209.4 - 193.6}{209.4} \times 208.4 = 15.7 \text{ mm}$$

To calculate maximum permitted depth of repair to blade face damage (Ref. Example B, Fig. 205) the following formula may be used:

$$\text{Maximum permitted depth of repair } a = \frac{b - c}{b} \times d$$

where b = actual thickness at thickest point of blade at nearest station
c = minimum allowable blade thickness at the station (extracted from the table)
and d = actual thickness of blade at point of damage

For example B on the illustration, the 18 inch (457.2 mm) station is nearest so typical figures may be:

$$a \text{ (in inches)} = \frac{0.752 - 0.720}{0.752} \times 0.617 = 0.026 \text{ in}$$

$$a \text{ (in millimeters)} = \frac{19.09 - 18.29}{19.09} \times 15.67 = 0.66 \text{ mm}$$

Calculations should be done prior to repair and the depth of repair checked after completion of the repair.

C. Tools and Equipment

Precision Measuring Equipment (micrometer, vernier calipers, wire feeler gages, etc.)	Not Specified
Fine Cut Round and Half-round Files and/or	Not Specified
Power Tool with Fine Grinding and Polishing Attachments	Not Specified
Emery Cloth	Not Specified
Crocus Paper	Not Specified
X10 Magnifying Glass	Not Specified
Dye Penetrant	Not Specified
Alodine or Hartzell Polane Paint	Available from Hartzell

D. Referenced Information

Maintenance Manual Chapter 71-00-00

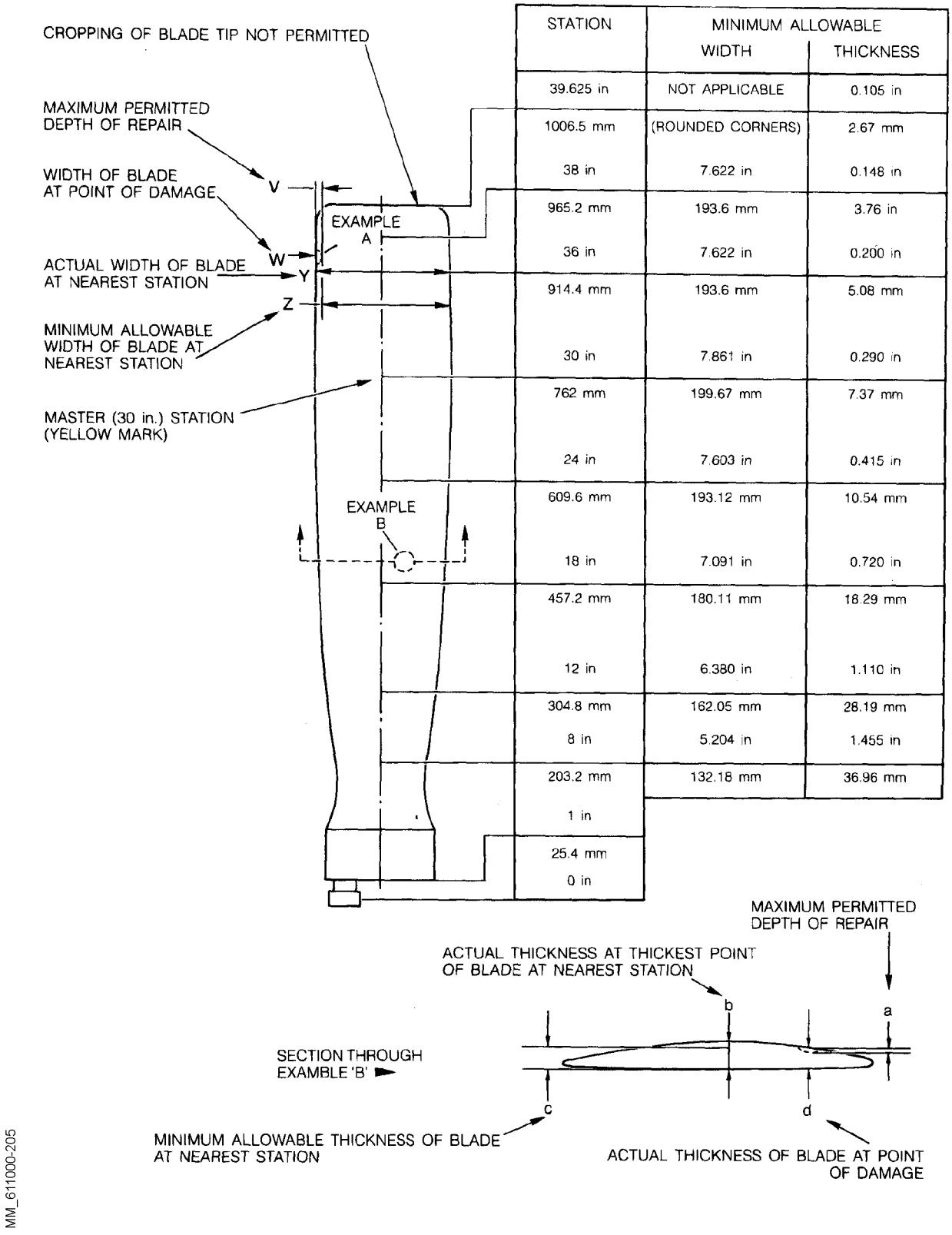
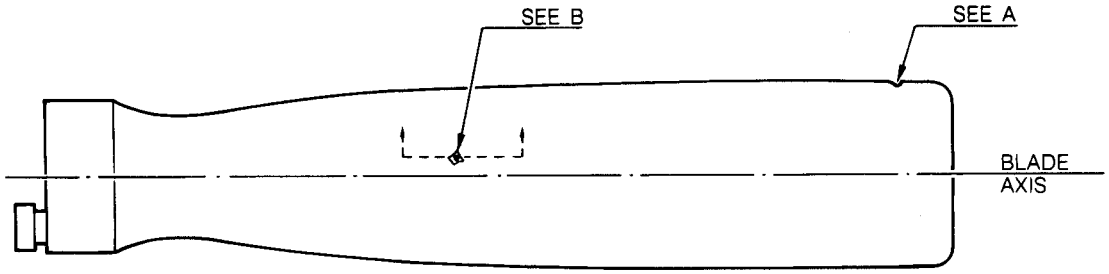


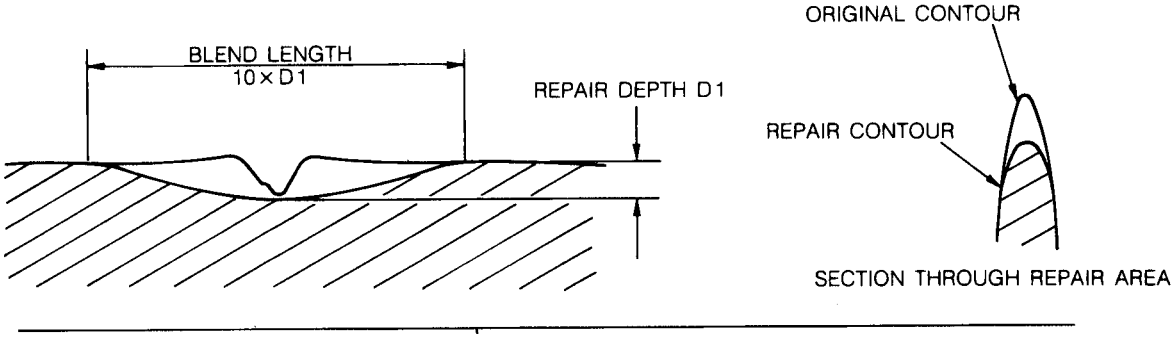
Fig. 205 - Blade Repair Tolerances



A · EDGE DAMAGE REPAIR

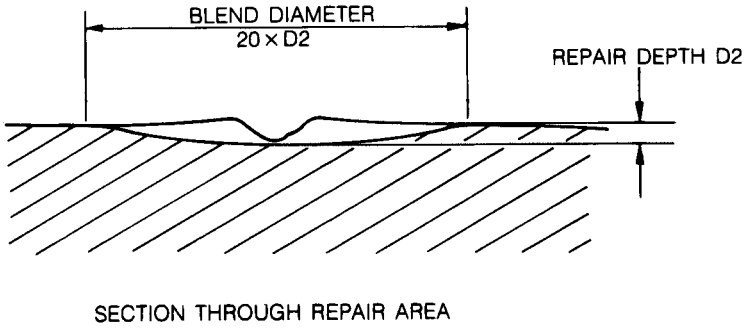
CAUTION:
FILING, RUBBING AND ALL SUCH REPAIR WORK INVOLVING LINEAR MOTION SHOULD BE DONE PARALLEL TO THE BLADE AXIS TO MINIMIZE THE POSSIBILITY OF STRESS CRACKS.

EXAMPLE:
FOR A REPAIR DEPTH OF 0.25 INCH (6.35 mm) THE BLEND LENGTH WOULD BE 2.5 INCHES (63.5 mm)



B · FACE DAMAGE REPAIR

EXAMPLE:
FOR A REPAIR DEPTH OF 0.125 INCH (3.2 mm) THE BLEND DIAMETER WOULD BE 2.5 INCHES (63.5 mm)



MM_611000-206

Fig. 206 - Blade Repairs

E. Repair Procedure - Blade Edges (Ref. Fig. 206, Detail A)

(1) Calculate the depth of the required repair and check that the repair can be made within the repair tolerances detailed in Para. B.

(2) File or grind the material to the depth of damage (D1) producing a smooth blended depression 10 x D1 long. Shape the edge to maintain the original contour.

(3) Check that the permitted repair depth has not been exceeded.

(4) Smooth off the file marks with emery cloth and polish the repair area with crocus paper.

(5) Examine the repair area (using a X10 magnifying glass) for any remaining indications of damage.

(6) Check for cracks in the repair area using the dye penetrant method.

(7) On completion of the repair, protect the repaired area by painting with alodine or Hartzell Polane paint.

(8) Ground run the engine (Refer to 71-00-00) to check for vibration. Dynamically balance the propeller if vibration is evident.

F. Repair Procedure - Blade Faces (Ref. Fig. 206, Detail B)

(1) Calculate the depth of the required repair and check that the repair can be made within the repair tolerances detailed in Para. B.

(2) File or grind the material to the depth of damage (D2), producing a smooth blended depression 20 x D2 across.

(3) Check that the permitted repair depth has not been exceeded.

(4) Smooth off the file marks with emery cloth and polish the repair area with crocus paper.

(5) Examine the repair area (using a X10 magnifying glass) for any remaining indications of damage.

(6) Check for cracks in the repair area using the dye penetrant method.

(7) On completion of the repair, protect the repaired area by painting with alodine or Hartzell Polane paint.

(8) Ground run the engine (Refer to 71-00-00) to check for vibration. Dynamically balance the propeller if vibration is evident.

G. Repair Procedure - Blade Tip

(1) Minor damage at blade tips may be repaired as detailed for blade edges (Refer to Para. E).

(2) Blade cropping (shortening) to repair a damaged tip is permitted provided that all five blades are cropped by the same amount and that the propeller diameter is not less than 84.5 inches.

7. Blade Surface - Cleaning Procedure

Refer to Chapter 12-10-06.

8. Blade Surface Erosion/Corrosion - Inspection and Repair

A. Procedure

NOTE: Refer to HARTZELL Service Bulletin No. 181 for inspection and repair of propeller blade surface erosion/corrosion.
In this Service Bulletin also instructions for the re-painting of the blades are comprised.

9. Beta System Check

A. Procedure

(1) Refer to Chapter 54-10-00, Page Blocks 205-206 of this manual and remove right rear nacelle panels 430AR (left engine) and 440AR (right engine).

(2) Using precision blocks or other suitable means, measure the width of the Beta ring groove in at least three different circumferential positions: the average value must not exceed 0.510 inches. If this condition is not satisfied, the Beta ring must be replaced according to Para. 8. "Beta Ring Replacement" of this Sub-Chapter.

(3) Using a feeler gage, measure the side clearance between carbon block and the Beta ring (in at least three different circumferential positions of the Beta ring): The average value must not exceed 0.010 inches. If this condition is not satisfied, and the Beta ring groove width is within the limit of 0.51 inches, the carbon block must be replaced according to Para. 7. "Carbon Block Replacement" of this Sub-Chapter.

NOTE: This check will be performed when the propeller is feathered and the Beta ring at the corresponding position.

(4) At the end of the inspection and whenever a part is replaced, fully compress by hand the low pitch switch plunger (Refer to IPC Chapter 61-42-00, item 90) and measure - with a feeler gage - the clearance between the plunger end and the Beta lever end. The minimum clearance should be 0.06 inches, provided the requirements of Chapter 76-10-00, Page Blocks 222-223 of this manual, are satisfied.

CAUTION: A PLUNGER THAT IS FULLY COMPRESSED BY THE BETA LEVER WILL ACCELERATE CARBON BLOCK AND BETA RING WEAR.

(5) If both checks (2) and (3) are positive, install the rear nacelle panels 430AR and 440AR (Refer to Chapter 54-10-00, Page Blocks 205-206 of this manual).

(6) If the requirement of point (4) is not satisfied, a review of Beta system rigging and/or Beta ring installation is recommended.

10. Carbon Block Replacement

A. Procedure

(1) Refer to Chapter 54-10-00, Page Blocks 205-206 of this manual and remove right rear nacelle panels 430AR (left engine) and 440AR (right engine).
(2) Refer to Chapter 61-10-00, Page Blocks 205-207 of this manual and remove the carbon block from the Beta ring groove.
(3) Refer to Chapter 61-10-00, Page Block 209 of this manual and install the new carbon block.
(4) Refer to Chapter 54-10-00, Page Blocks 205-206 of this manual and install nacelle panels 430AR and 440AR.

11. Beta Ring Replacement

A. Procedure

(1) Remove the screws and washers securing the spinner dome to the bulkhead and remove the spinner dome.
(2) Refer to Chapter 54-10-00, Page Blocks 205-206 of this manual and remove right rear nacelle panels 430AR and 440AR.
(3) Refer to Chapter 61-10-00, Page Blocks 205-207 of this manual and remove the propeller assembly from the engine.
(4) Refer to Hartzell Instruction Manual no. 158, Chap. 4, page 4.4 and disengage the Beta ring from the Beta rods.
(5) Refer to Hartzell Instruction Manual no. 158, Chap. 7, pages 7.18 - 7.19 and install the new Beta ring.
(6) Using a feeler gage, measure the side clearance between the carbon block and the Beta ring (in at least three different circumferential positions of the Beta ring), and verify that the value of 0.010 in. is not exceeded.

NOTE: The nominal clearance of a completely new installation (Beta ring & carbon block) should be .001 to .002 in.

(7) Refer to Chapter 61-10-00, Page Blocks 207-211 of this manual and install the propeller assembly on the engine.

12. Propeller Dynamic Balancing

A. Fixtures, Test and Support Equipment

Digital Balancer Analyser	"Vibrex 2000"
Vibration Velocity Transducer	P/N 7310
Vibration Velocity Transducer bracket	P/N 3383-1
Vibration Velocity Transducer cable	Not Specified
Propeller Speed Optical Transducer	P/N 12900
Propeller Speed Optical Transducer bracket	P/N 10423-1

Digital Balancer Analyser	"Vibrex 2000"
Propeller Speed Optical Transducer cable	Not Specified
Reflecting Tape	P/N 10444
Balance weight	Not Specified
Scale	Not Specified

B. Referenced Information

Hartzell Propeller Owner's Manual no.149, sect. 61-00-39
Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 61-10-00
Maintenance Manual Chapter 61-40-00

C. Propeller Balance Setup

(1) Refer to AMM sect. 54-10-00 and remove the engine nacelle rear panels
(2) Refer to Hartzell Propeller Owner's Manual no.149, sect. 61-00-49 and remove the Spinner Dome.
(3) Record the position and mass of the balance weight already existing of the Propeller

NOTE: Only in case that the Spinner Bulkhead is not provided with self-locking nuts for balance weight attachment (Refer to Hartzell Propeller Service Letter HC-SL-61-292).

(4) Refer to AMM sect. 61-40-00 and remove the lower forward bolt used to fix the Propeller Speed Transducer on the Engine
(5) Install the Vibration Velocity Transducer p/n 7310, using Bracket p/n 3383-1, on the Propeller Speed Transducer flange, using the same bolt previously removed.

NOTE: The Vibration Transducer axis shall be oriented vertically

(6) Remove the upper bolt from the oil drain plug in the lower side of the Engine Gearbox case and, using the same bolt, install the Propeller Speed Optical Transducer p/n 12900, using Bracket p/n 10423-1
(7) On the Engine-side face on the Propeller Bulkhead, attach a Reflecting Tape (p/n 10444), in correspondence of point on blade no.1 the Optical Speed Transducer
(8) Indicate with A this point on polar chart
(9) Indicate on polar chart, the other points with letters as illustrated in FIG.
(10) Run the Vibration Transducer cable and the Speed Sensor Cable towards the front of the nacelle and then along the wing and fuselage up to a position safe for the operator. Momentarily clamp the cables to the Engine existing cables

D. Vibrex 2000 Settings

(17) Turn on the Digital Balancer / Analyser "Vibrex 2000"
- Push ON/OFF button

(18) Erase old data on memory
- Push context key REVIEW button
- Push context key STATUS button and than START
- Push context key CLEAR RUNS and than START
- Push context key CLEAR SPECTRA and than START
- Push GO BACK

(19) To begin a propeller balance operation, press the context key next to the Main Menu screen option PROPELLER BALANCE. The Vibrex 2000 displays the first of two Propeller Balance Setup screens. This set of screens allows you to enter basic balance setup information

(20) Entering aircraft Ids

NOTE: The Vibrex 2000 asks for an aircraft tail number or serial number (aircraft ID). You may use both alpha and numeric keys for this data entry, as well as the available punctuation keys.
You may use up to six places for this entry

- Press the AIRCRAFT ID context key (next to the AIRCRAFT ID label)

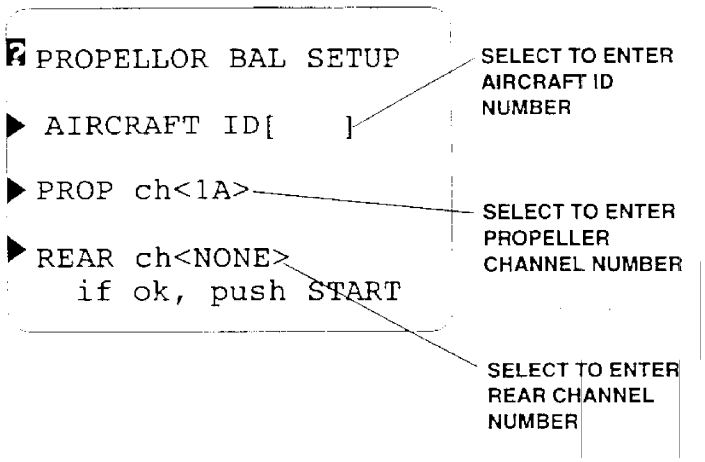


Fig. 207 -

- Edit Aircraft ID screen displays (see below)

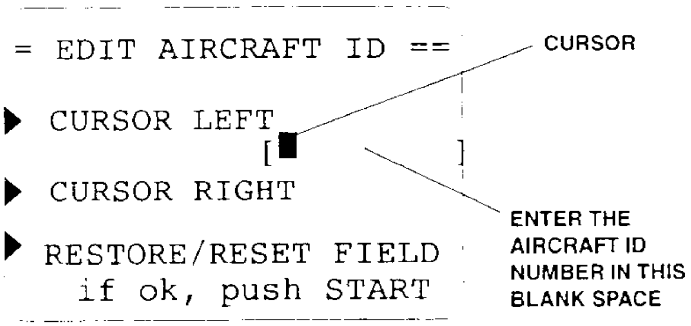


Fig. 208 -

– From this screen, select the places to be filled by pressing the CURSOR LEFT or CURSOR RIGHT context key

NOTE: when you are printing, this aircraft ID entry prints out on the hard copy for the appropriate aircraft.
This ID also labels data when you are reviewing propeller balance measurement

– If you make a mistake, press the RESTORE/RESET FIELD context key to start over.
– After you have entered the aircraft S/N, press START to return to the first Propeller Balance Setup screen
– You may press GO BACK to cancel or undo any edits. This action also returns you to the previous screen

(21) Selecting channels

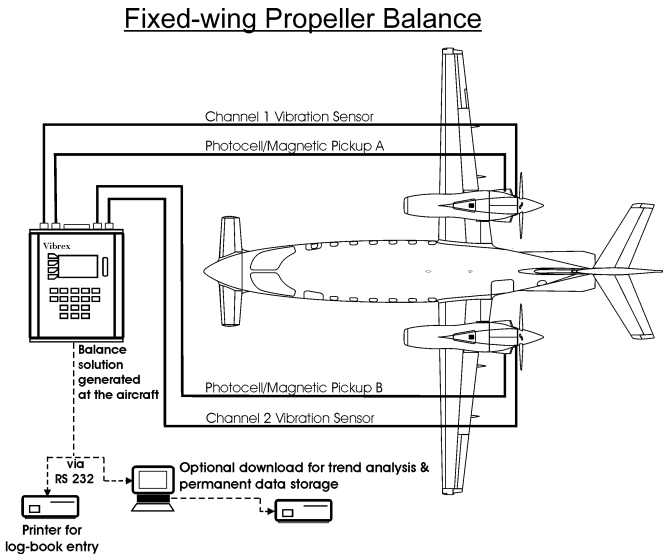


Fig. 209 -

(22) Entering HorsePower (451-600 HP for Piaggio P.180) using the HP ENGINE context key to set the Vibrex 2000 for the propeller being balanced. Enter this information using the second Propeller Balance screen, as shown below:

- The default settings for HP ENGINE is 0-100
- Set HP ENGINE to 451-600
- After you have entered the correct horsepower, note the sensitivity number displayed beneath the SET SENSITIVITY line
- Repeated key presses of the next context key scroll through the available horsepower ranges and their attendant sensitivities
- The Vibrex 2000 learns the response to the first weight change and corrects the sensitivity to one that is appropriate to the propeller being balanced.

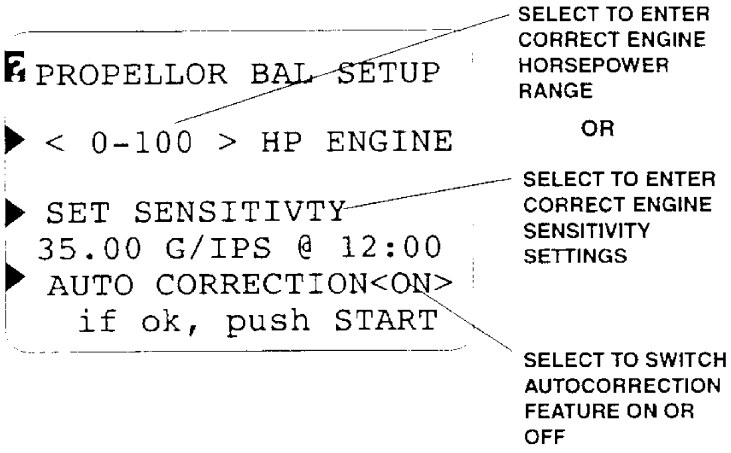


Fig. 210 -

NOTE: Since high horsepower engines necessarily require bigger and heavier propellers, this method works well for settings weight sensitivity

Changing Weights - The weight required to move the balance point 1.0 IPS (equivalent to the distance between 0 IPS and the 1.0 IPS ring on a polar chart) displays under the SET SENSITIVITY line. Note that, as the horsepower reading changes, the weight value goes up as well.

(23) Setting Sensivity using the Set Sensitivity screen. Access this display screen by pressing the SET SENSITIVITY context key from the second Propeller Balance Setup screen

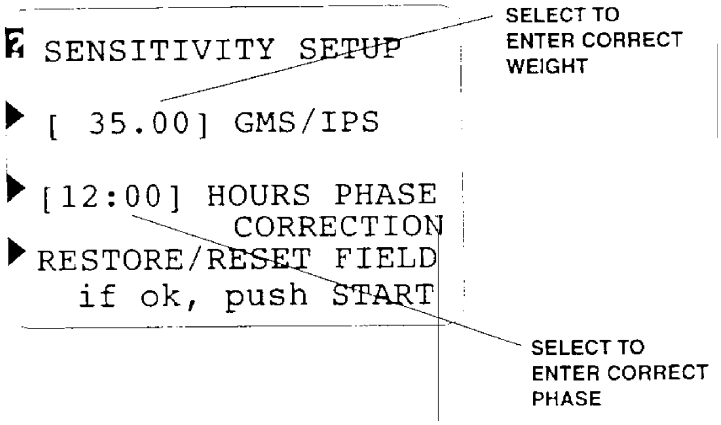


Fig. 211 -

NOTE: Automatic calibration only occurs if you have set the Autocorrection to <ON>.

E. Acquiring Balance Readings

(24) Perform a normal engine start and allow the engine to warm up, then
- On constant-speed propellers, cycle the propeller twice to be sure the air is purged from the propeller hub.
- On fixed-piths propellers, run the propeller at the maximum static RPM.

(25) Operate the propeller at the desired RPM (shown live on the Vibrex 2000's display screen).

(26) Press START. The Vibrex 2000 collects IPS reading and clock-angle data/ measurement. During this process, a temporary Data Collection screen displays

NOTE: If, at any time, you want to stop collecting data, press the GO BACK key while the Data Collection screen displays.

(27) Vibrex 2000 then displays a Measurements screen that reads out the acquired balance measurements (see below)

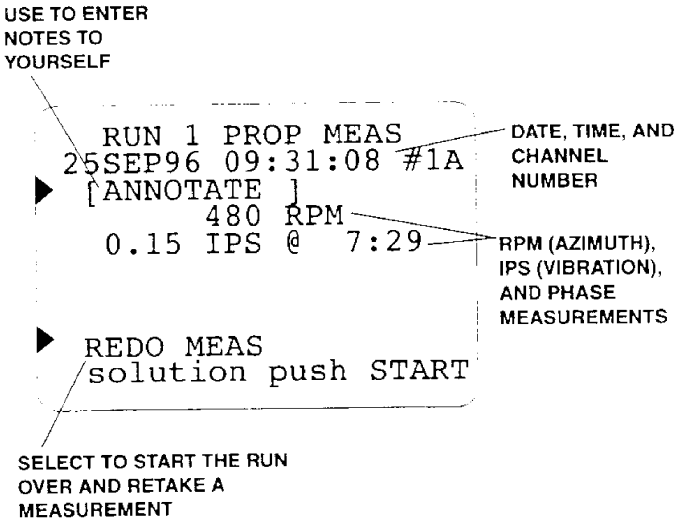


Fig. 212 -

(28) If one or more readings become suspect for any reason, you may retake a reading by pressing the REDO MEAS context key. This action automatically erases the former reading.

CAUTION: PRESSING GO BACK CANCELS (UNDOES OR ERASES) THE MEASUREMENT

(29) If the current reading is correct, press START to advance to the next screen

NOTE: If the reading is correct and you wish to make a special annotation, press the ANNOTATE context key. These entry may be any kind of note to yourself, for example, that this is a before-balancing run or the last balancing run.
Make any entry you wish here, then press START to enter the note and to advance you to the next screen

NOTE: Vibrex 2000 gives you a balance quality graph, allowing you to read out how well you have achieved balance on a given propeller. This graph displays on a screen that contains a horizontal bar labeled BETTER on the left end of the bar and WORSE on the right as shown below

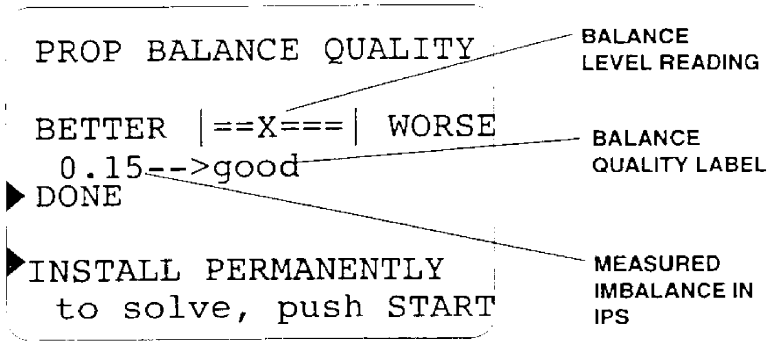


Fig. 213 -

(30) After the balance reading displays and you press the START key, the Vibrex 2000 presents it's recommended weight change solution (in grams) at a specific clock angle.
The illustration below shows an example of typical Vibrex 2000 Solution screen

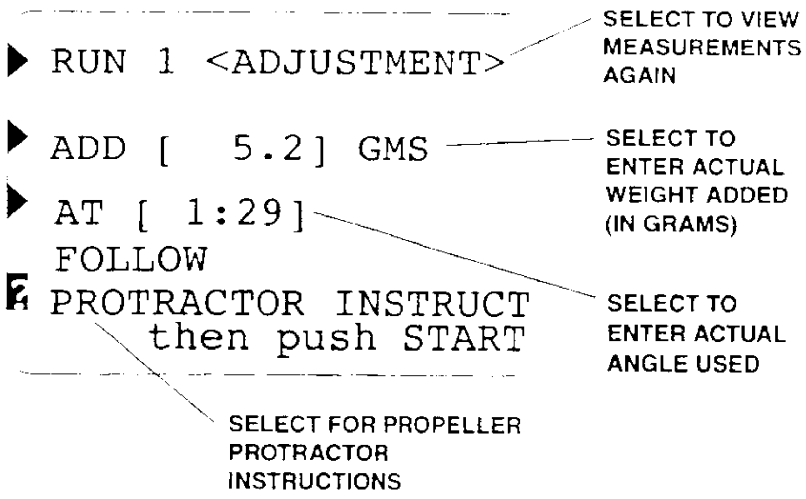


Fig. 214 -

F. Applying Balance Solutions

(31) To find the correct location on the propeller for applying the balance weights, use the Propellers Protractor, as follows:

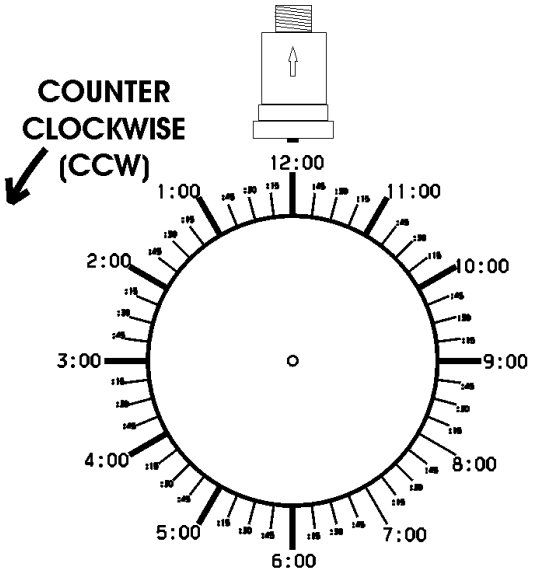


Fig. 215 -

– Rotate the retro-reflective target on the propeller or spinner so it is aligned with the beam of the photocell

WARNING: USE CAUTION WHEN WORKING AROUND THE PROPELLER. TREAT THE PROPELLER AS THOUGH THE ENGINE COULD FIRE, AND WORK AROUND THE PROPELLER ONLY IF YOU ARE CERTAIN THE ENGINE CANNOT FIRE

– Using the Propeller Protractor side with the same direction of rotation as the propeller, hold the Propeller Protractor against the center of the propeller or propeller spinner. Make sure the velocimeter on the protractor is parallel and in the same orientation as the velocimeter mounted on the engine
– Locate the clock angle from the Vibrex 2000 solution on the propeller
– Place the weight from the solution at the location delivered from using the Propeller Protractor

– If you place the weight from the solution ad the location other than specified by the Vibrex 2000, make a note of the clock angle of the weight and change the appropriate WEIGHT ENTERED solution in the Vibrex 2000

(32) It is recommended to use stainless steel washers (e.g. AN970-3) as balance weight, and to fix them with stainless steel bolts (e.g. NAS 6403A-x, where "x" depends on the number of washer required)

CAUTION: DO NOT EXCEED A TOTAL WEIGHT OF 25.5 GRAMS PER POSITION (EQUIVALENT TO 6 WASHERS)

NOTE: Balance weight screws attached to the spinner bulkheads must protrude through the self-locking nuts a minimum of one thread ad a maximum of four threads

(33) If unable to use the azimuth of the balance weight, for clearance or other reasons, or the weight may be too much for a single-weight addition point (more than 25.5 grams). In these cases do the following procedures:

– Press the context key labelled AT [XX:XX]
– Press the SPLIT WEIGHT context key
– Enter the angle or angles available for weight addition so the Vibrex 2000 calculates the required weight on each point

CAUTION: YOU MUST ENTER TWO WEIGHT POINTS ON EITHER SIDE OF THE SINGLE-WEIGHT LOCATION IN ORDER FOR THE SOLUTION TO RESULTING THE SAME IPS READING.

(34) Do a final run to verify that you have installed the permanent weights correctly. Then press DONE

(35) Start engine again, stabilize as soon as practical to the minimum power setting to maintain NP as set before

(36) It is recommended to check the effectiveness of balancing by recording the vibration values at Max Power.

(37) When dynamic balancing is completed, place a decal p/n A-2803 (supplied by Hartzell) on the Propeller Cylinder (see fig. 5). This will alert repair station personnel that the existing balance weight configuration may not be correct for static balance

(38) Record the number and mass of the balancing weights on the Propeller Logbook.

CONTROLLING - DESCRIPTION AND OPERATION

1. General

A. This description and operation applies to both propeller controlling systems. Although the propellers rotate in opposite directions the controlling components are identical for each propeller.

B. The controlling components for each propeller are a (main) propeller governor and a propeller overspeed governor.

C. During operation, the propeller governor sets up a propeller blade pitch angle to provide a propeller speed of 2,000 rpm and, within normal operating conditions, maintain that speed by continually adjusting blade pitch angle to compensate for changes in flight conditions and engine power output.

D. Propeller control from the flight compartment is provided by two levers (one for each propeller), each connected by a push/pull cable assembly to the speed control lever of its associated propeller governor. The lever is designated propeller control lever, but is also known as the condition lever because it "conditions" the engine fuel control unit to provide high (flight) and low (ground) idle power.

2. Description - Propeller Governor

A. The propeller governor is mounted on top of the engine reduction gearbox and is driven from the prop shaft through an accessory drive gearshaft.

B. The governor comprises:

- a preset speed selector spring, a speed selector shaft and a speed control lever
- rotating flyweights, shaft-driven from a bevel gear on the engine propeller shaft; the centrifugal force exerted on the rotating flyweights is directly proportional to propeller speed, and opposes the force of the speed selector spring
- an oil control valve, operated by the flyweights, which controls oil flow to and from the propeller pitch change mechanism
- a gear-type oil pump on the same drive as the flyweights; the oil pump boosts engine oil pressure to a pressure sufficient to operate the pitch change mechanism
- a Beta control valve for reverse pitch operation
- an Nf (free turbine speed) governor section
- an oil pressure relief valve set at 26.5 bar (385 psi).

C. The oil control valve has three positions:

- down: opens an oilway to direct propeller governor oil pump output to the front of the pitch change piston causing the piston to move rearward and forcing the blades into finer pitch
- up: allows oil to drain from the propeller pitch change mechanism into the engine reduction gearbox via the hollow drive shaft; in this condition the propeller feathering spring forces the blades into coarser pitch or, if feather is selected, into the fully feathered position
- mid: closes off the oilway to and from the propeller; in this condition the propeller pitch change mechanism is held in a hydraulic lock.

D. When the oil control valve is in the up or mid position (no oil flow to the propeller pitch change mechanism), the oil pressure relief valve opens to allow excess pressure oil to circulate through the relief valve and back to the inlet side of the governor oil pump.

E. The oil control valve is positioned by the interaction of the speed selector spring force and the centrifugal force of the rotating flyweights. The speed control spring is located above the oil control valve and exerts a force tending to move the valve down. The flyweights exert a force tending to move the valve up. When the propeller is rotating at 2,000 rpm, the opposing forces are equal, the flyweights are upright and the oil control valve is in the mid position.

F. Propeller speeds above 2,000 rpm cause flyweight centrifugal force to overcome spring force and move the oil control valve up; speeds below 2,000 rpm cause control spring force to overcome flyweight centrifugal force and move the valve down. Oil control valve movement results in a change of propeller blade pitch to restore propeller speeds to 2,000 rpm. This speed maintaining functions of the governor is detailed in Para. 4, Operation.

G. The Nf governor section of the propeller comprises a lever controlling a Py (engine fuel governing air pressure) valve. If propeller speed reaches 106% of the selected propeller speed, the flyweights will operate the lever, open the Py valve and reduce engine fuel flow. This reduces engine power and prevents any further increase in propeller speed.

H. The plunger-type Beta control valve is located within the governor. One end of the plunger extends outside the governor and connects to the reverse push/pull control. Inside the governor the plunger is located in two oil lines - the oil supply line from the governor oil pump to the oil control valve and the oil line from the pressure relief valve to the pump inlet.

3. Description - Propeller Overspeed Governor

A. The propeller overspeed governor is mounted on the engine reduction gearbox, right-hand side, and comprises a pre-set control spring, rotating flyweights (driven from a bevel gear on the propeller shaft) and an oil valve. An autofeather solenoid valve and a test solenoid valve are installed on the outside of the governor casing.

B. The control spring is set to maintain the oil valve in the closed position up to a propeller speed of 2,120 rpm (106% of normal governed speed); if the propeller speed tends to rise above 2,120 rpm, the centrifugal force of the flyweights will increase, overcome the force of the control propeller, and propeller blade pitch will increase (coarsen) to bring speed back to 2,120 rpm and close off the oil valve.

C. Propeller overspeed can occur only if the (main) propeller governor malfunctions in which case the overspeed governor will control the overspeed at 106%.

D. The autofeather solenoid operates a spool-type valve located between the propeller oil pressure and drain oilways within the front overspeed governor. When the solenoid is energized, the valve moves to interconnect the oilways and allow propeller oil to drain from the front of the pitch change piston through the overspeed governor into the engine reduction gearbox. The feathering spring then moves the piston and, consequently, the blades into the feathered position. Refer to 61-21-00 for more details of the autofeather system.

E. A test solenoid valve is provided on the overspeed governor. The solenoid valve, when operated, reduces control spring force and restricts propeller speed to approx. 1,840 rpm (below propeller governor operation). This test facility enables an operational check of the unit to be done during engine ground test.

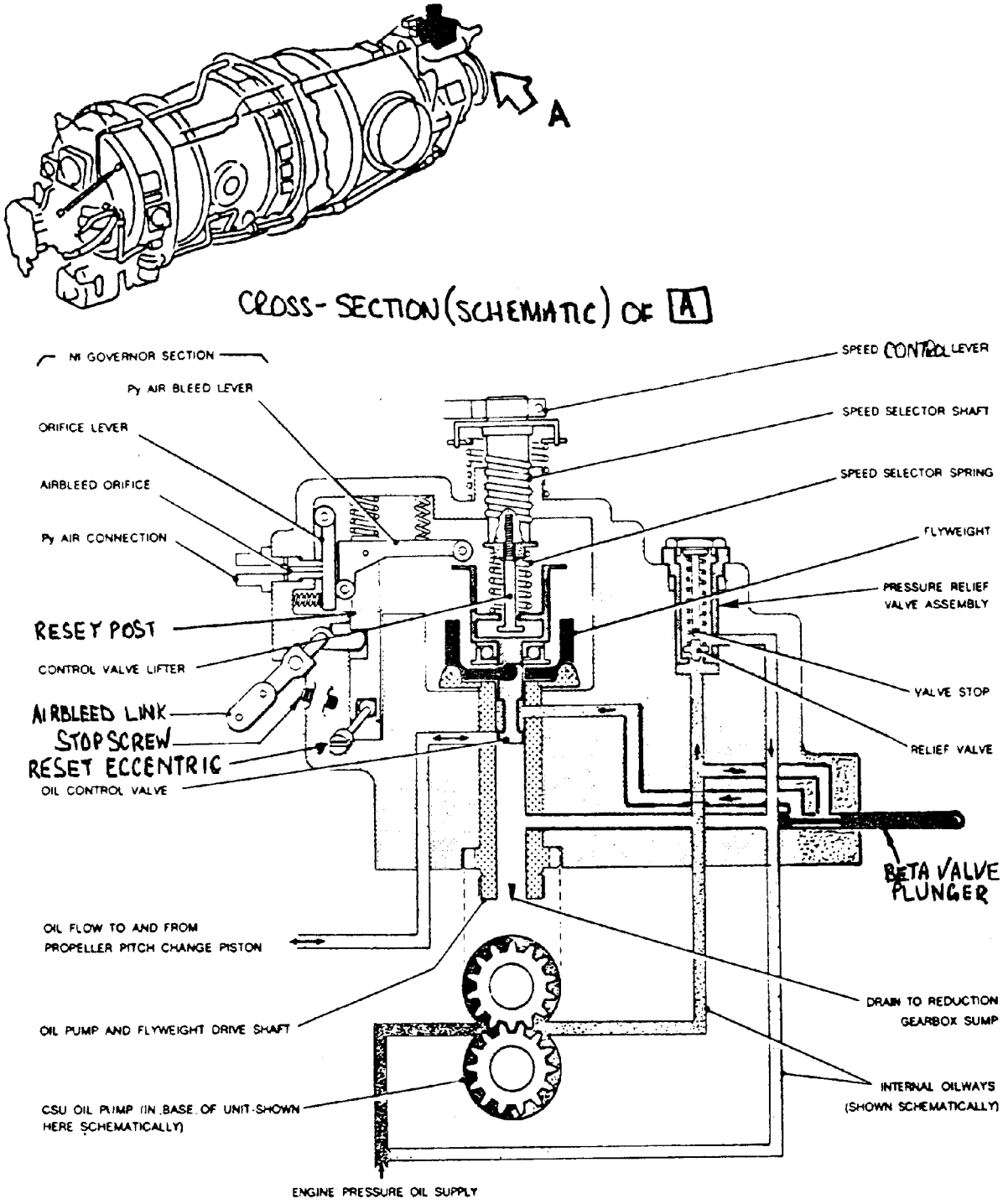


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Fig. 1 - Propeller Governor - Schematic Cross-Section

CONTROLLING - MAINTENANCE PRACTICES

1. General

A. This topics covers the removal and installation of the propeller pitch controlling governors.

B. The propeller governor (constant speed unit) is supplied with the engine, and its removal from and installation on the engine is dealt with in the engine maintenance manual. This topic gives the necessary power plant interfaces to prepare the governor for removal and to finalize the installation procedure.

C. The overspeed governor is supplied by the airframe manufacturer, and its removal and installation is dealt with totally within this topic.

2. Propeller Governor - Removal (Ref. Fig. 201)

A. Fixtures, Test and Support Equipment

Warning Notice	Not specified
Access Platform	3 ft.(1 m)

B. Referenced Information

Maintenance Manual Chapter 54-00-00
Engine Maintenance Manual (P&WC Part No. 3036122) Chapter 61-26-31

C. 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.

(1) Put a Warning Notice in the flight compartment to tell persons not to move the power levers or the propeller levers.
(2) Open, tag and safety these circuit breakers:

Pilots CB Panel

L ENG START
R ENG START

(3) Remove nacelle panels 430 AL and 430 AR (440 AL and 440 AR) (Refer to 54-00-00).
(4) Remove the nut, two washers and bolt securing the propeller control cable rod end to the speed control lever of the propeller governor.
(5) Temporarily install the bolt, washers and nut in the cable rod end and tie the rod end away from the line of removal of the governor.
(6) Remove the governor as detailed in Chapter 61-26-31 of the engine maintenance manual.

NOTE: The reference in 61-26-31 to an electrical connector is valid only for those airplanes with synchrophasing which is an option.

3. Propeller Governor - Installation (Ref. Fig. 201)

A. Referenced Information

Maintenance Manual Chapter 54-00-00
Maintenance Manual Chapter 71-00-00
Maintenance Manual Chapter 76-10-00
Engine Maintenance Manual (P&WC Part No. 3036122) Chapter 61-26-31

B. Procedure

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

(1) Make sure that:
- the Warning Notice is in position
- the L ENG START and R ENG START circuit breakers are open tagged and safetied
- access is available (Refer to the removal procedure).

(2) Verify that the governor has been installed as detailed in 61-26-31 of the engine maintenance manual.

(3) Connect the propeller control cable rod end to the speed control lever of the propeller governor (Ref. Fig. 201).

NOTE: The attaching bolt, washers and nut should be found temporarily attached to the rod end.

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

Pilot CB Panel

L ENG START
R ENG START

(5) Remove the Warning Notice from the flight compartment.

(6) Ground run the engine (Refer to 71-00-00) as specified for propeller governor replacement. If adjustment of the control cable is required refer to 76-10-00 for rigging details.

(7) On satisfactory completion of the ground run inspect the governor for oil leaks and rectify as necessary.

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

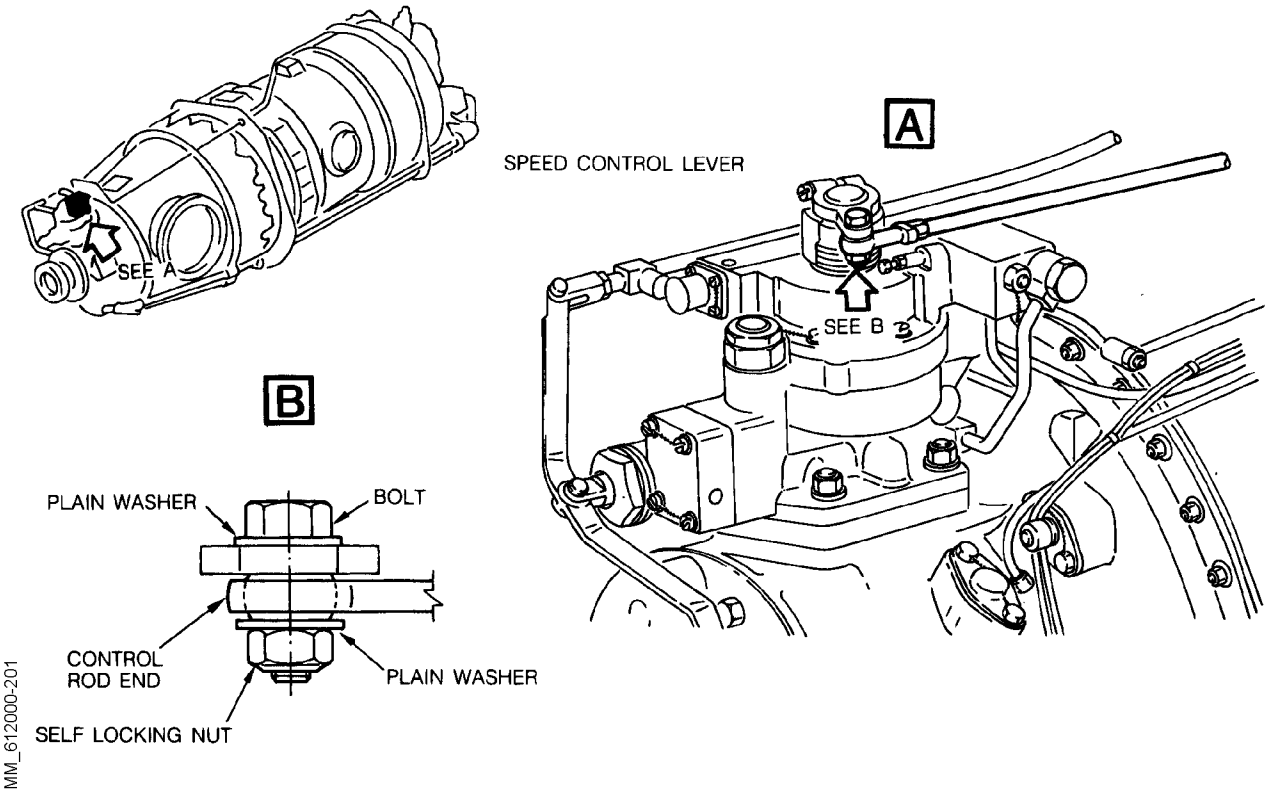

Fig. 201 - Propeller Control Cable Attachament

4. Overspeed Governor - Removal (Ref. Fig. 202)

A. Fixtures, Test and Support Equipment

Cover, engine pad	P&WC PK 269
Access platform	3 ft.(1 m)

B. Referenced Information

Maintenance Manual Chapter 54-00-00

C. 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.

(1) Open, tag and safety this circuit breaker:

Pilot CB Panel

L ENG START
(R ENG START)

(2) Remove nacelle panels 430AL and 430AR (440AL and 440AR) (Refer to 54-00-00).

(3) Remove the lockwire and disconnect the electrical connectors from the autofeather and test solenoids of the overspeed governor.
(4) Remove the four nuts and washers securing the overspeed governor to its mounting pad.
(5) Remove the overspeed governor from the engine taking care to avoid damaging the splines of the drive shaft.
(6) Remove and discard the gasket.
(7) Install a cover on the mounting pad.

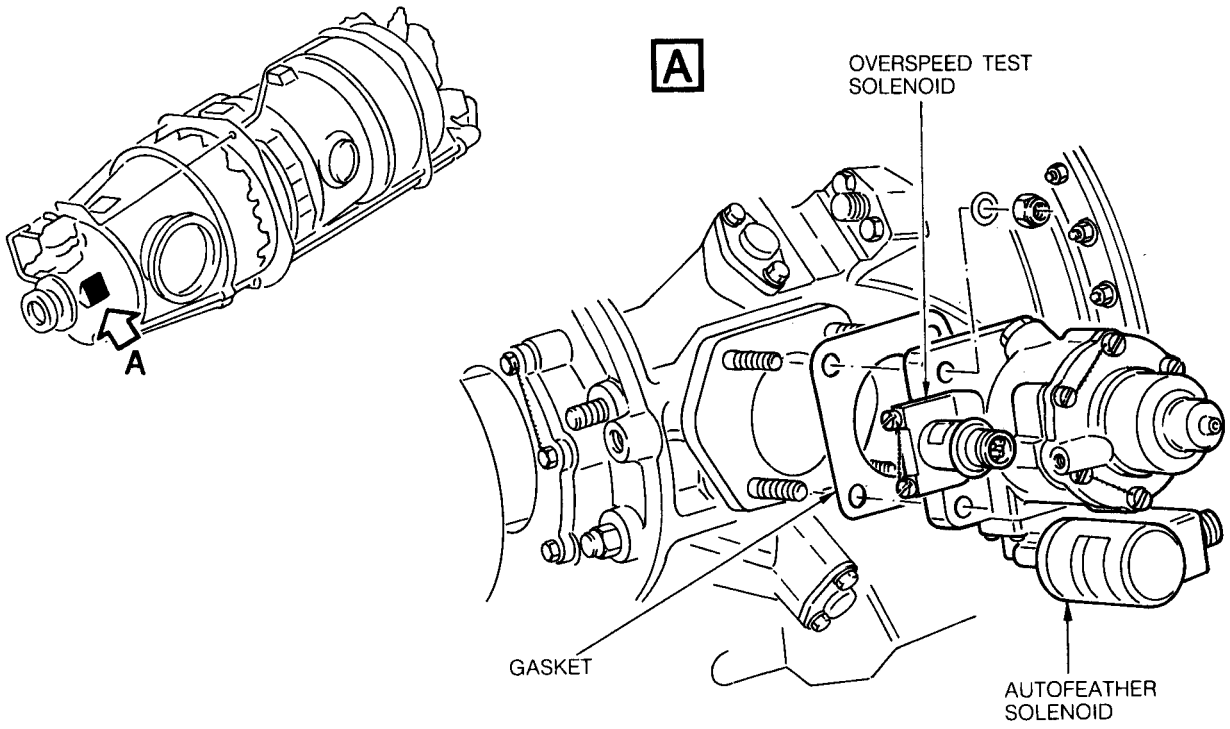

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Fig. 202 - Propeller Control Cable Attachament

5. Overspeed Governor - Installation (Ref. Fig. 202)

A. Tools

Torque Wrench 170-190 lb in. (19.2-21.5 Nm)	Not specified

B. Expendable Parts

Gasket	P&WC 3010818

C. Materials

Lockwire	04-008

D. Referenced Information

Maintenance Manual Chapter 54-00-00
Maintenance Manual Chapter 71-00-00

E. Procedure

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

(1) Make sure that:
- the L ENG START (R ENG START) circuit breaker is open, tagged and safetied
- access is available

(2) Make sure that the overspeed governor base, its drive shaft and oilways are clean and free from damage.

(3) Remove the cover from the mounting pad and make sure that the pad, the internal drive and oilways are clean and free from damage.

(4) Install a new gasket on the pad. Check that the oilways in the mounting pad are not obstructed.

(5) Install the overspeed governor on the pad taking care to avoid damaging the splines of the drive shaft.

(6) Secure the governor to the pad with the four nuts and washers. Torque tighten the nuts, progressively and diametrically, to between 170 and 190 lb in. (19.2 and 21.5 Nm) plus the run-down torque applicable to each nut.

(7) Connect the electrical connectors to the receptacles of the overspeed test solenoid and the autofeather solenoid.

(8) Safety the connectors with lockwire.

(9) Remove the safety tags and close this circuit breaker:

Pilot CB Panel

L ENG START
(R ENG START)

(10) Ground run the engine (Refer to 71-00-00) as specified for propeller overspeed governor replacement.

(11) On satisfactory completion of the ground run inspect the overspeed governor for oil leaks and rectify as necessary.

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

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AUTOFEATHER SYSTEM - DESCRIPTION AND OPERATION

1. General

A. The autofeather (automatic feathering) system is incorporated to provide a means of immediately dumping oil from the propeller pitch control mechanism and thereby enable the feathering spring to feather the propeller blades as soon as engine torque pressure falls below a nominal value of 17.5 % at a power setting of 87.3% Ng or more. Such a reduction in torque pressure would almost certainly be the result of engine failure.

B. Without autofeather, the propeller of a failed engine would feather as a result of loss of engine oil pressure, but the process would not be immediate. This means that the propeller would be "disking" and causing substantial drag for the short but significant period between engine failure and propeller feathering. During takeoff and landing, propeller drag would cause an excessive yawing moment and give the pilot an extra workload which could be hazardous. The autofeather system is designed to be used only during the critical flight modes of takeoff and landing.

C. At airspeeds in excess of 127 KIAS the autofeather system is neither required or desired so, just after takeoff, when the airplane airspeed is more than 127 KIAS, the pilot disarms the system, usually in conjunction with retraction of the landing gear.

2. Description(Ref. Fig 2)

A. The autofeather system comprises:

- a feathering (oil dump) solenoid valve located on the propeller overspeed governor of each engine
- a high torque pressure switch and a low torque pressure switch located adjacent to the torque pressure transducer on the inboard side of each engine immediately behind the rear firewall

NOTE: Due to hysteresis (the slight delay between cause and effect), the pressure switches operate at different pressures depending on whether the pressure is increasing or decreasing. To prevent confusion, within this text and on the block diagram, the high and low torque pressure switches are allocated nominal operating values (with pressure decreasing) from 30.5 to 21.5 % and from 21.1 to 13 % respectively. In fact, the switches are calibrated to operate as follows:

High Pressure Switch	Low Pressure Switch
30.9 % , with pressure increasing	21.5 %, with pressure increasing
26.5 %, with pressure decreasing	17.5 %., with pressure decreasing

NOTE: A separation of 3.1 % must be verified between high torque and low torque pressure switch indication on opposite engines (i.e. LH high torque vs. RH low torque and vice versa).

- an autofeather ARM/TEST switch located on the ENGINE/PROPELLER panel on the control pedestal.
- a circuit breaker, placarded AUTO FTR, located on the copilot CB panel
- a control relay and an "arm light out" relay for each engine, located in the main junction box in the baggage compartment
- an autofeather system relay which is connected to the ARM/TEST switch and the landing gear down switch
- two "arming" switch located in the control pedestal and set to be operated by the power control levers at approximately 87.3% Ng
- an AUTOFEATHER amber caution light on the annunciator panel, and a green"AFX" legend onthe MFD (Multi Funcion Display) System Page.

3. Operation (Ref. Fig. 1)

A. The autofeather system becomes operational when the autofeather ARM/TEST switch is set to ARM, but the system will only operate when:

- both power control levers are set at a position which would normally give 87.3% Ng approximately or more; at this power control lever setting both "arming" microswitches are closed.
- the torque pressure on either of the engines decreases to less than the nominal value of 17.5 %.

B. When the autofeather switch is set to ARM and the power control levers are set to 87.3% Ng or more:

- A green AFX legend shall be displayed in the lower center of the ITT/TORQ gauge (On the Multi Function Display, System Page) when the respective engine's autofeather discrete is received by a DCU (Data Concentration Unit), to tell the pilot that the autofeather system is armed.
- the circuits to the high and low torque pressure switches are completed.

C. When the system is armed:

- if the torque pressure of either the engines decreases to less than the nominal value of 26.5 %, the high torque pressure switch of the affected engine operates to arm the control relay of the affected engine and disarm the system of the opposite engine; this disarming of the opposite engine is indicated by its green advisory annunciator going off.
- if the torque pressure of the affected engine continues to decrease, at the nominal value of 17.5 % the low torque pressure switch operates to complete the circuit (through the control relay) to energize the autofeather solenoid.
- if the autofeather solenoid valve is energized, it dumps the propeller governing oil and the propeller blades are immediately turned (by the un-opposed force of the feathering spring) to the feathered position.

D. A simple two-second delay circuit is incorporated so that the system does not inadvertently operate due to the slight delay (less than two seconds) between slam accelerations and Ng response.

E. The system can be tested during a ground run by setting the autofeather switch to TEST; this test setting completes a circuit to bypass the "arming" microswitches and enable the system to be checked using the power control levers to simulate engine failure (decreasing torque). The autofeather system test is included in the Engine Ground Testing part of Chapter 71.

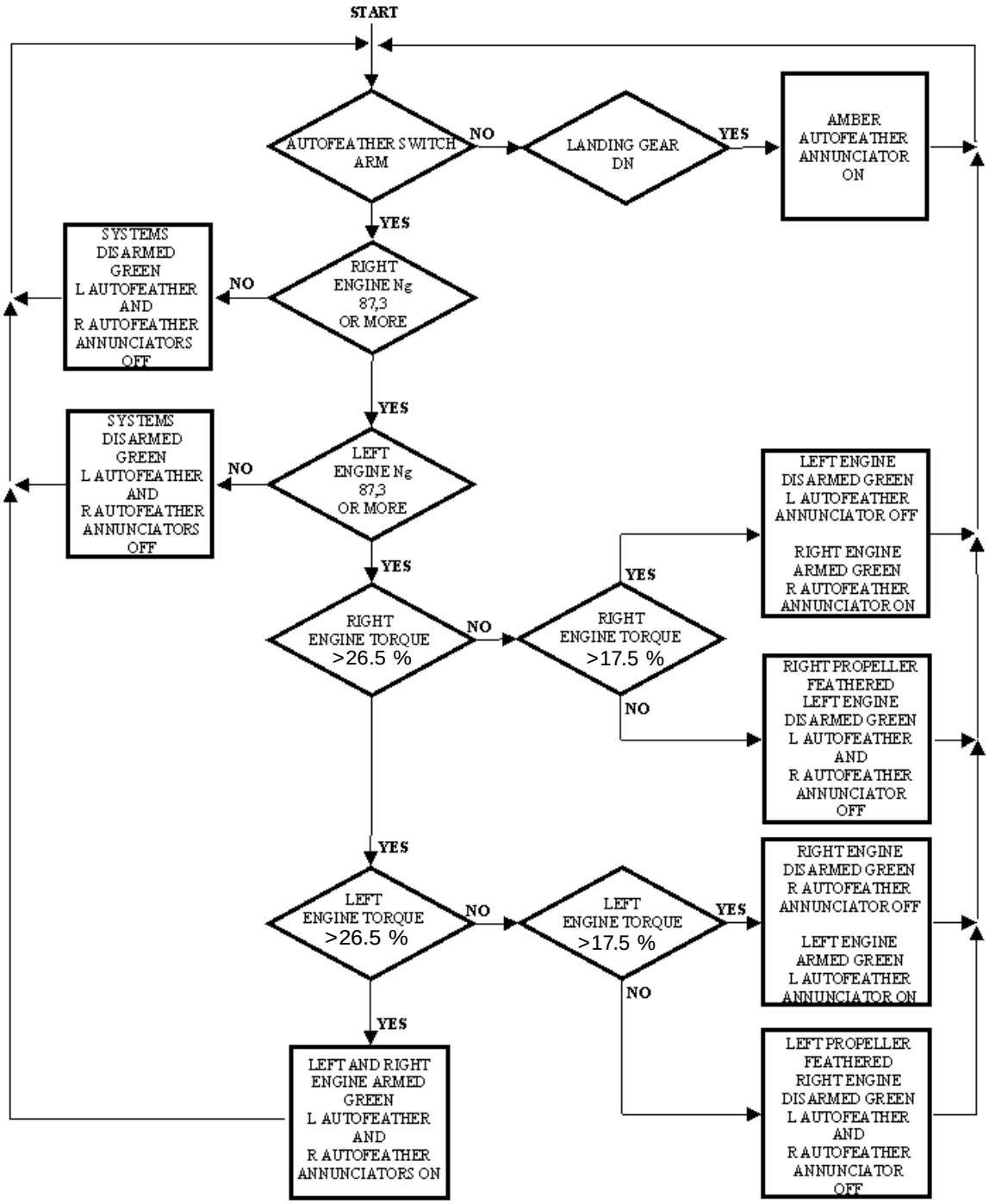

Fig. 1 - Autofeather System Block Diagram

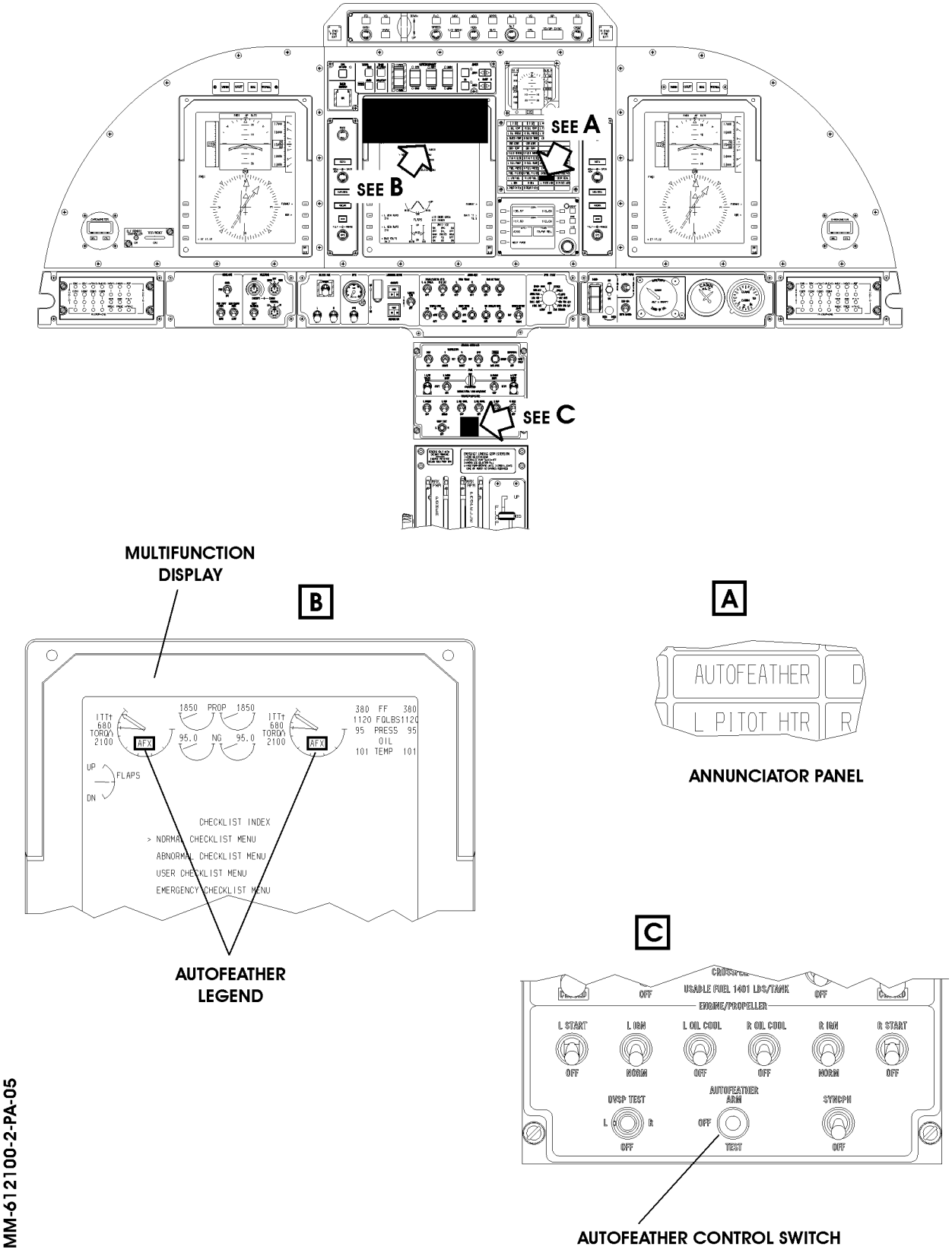

Fig. 2 - Autofeather System - Components Location

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AUTOFEATHER SYSTEM - MAINTENANCE PRACTICIES

1. General

   A. This topic cover the removal and installation of the autofeather system components.

   B. The autofeather High and Low Torque Pressure Switch are installed on the rear nacelle firewall, toward wing outer.

   C. The autofeather High and Low Torque Pressure Switch is supplied by R DUAL FEED BUS through a circuit breaker labeled AUTOFEATHER.

2. Autofeather High and Low Pressure Switch Removal(Ref. Fig.201)

   A. Fixtures, Test and Support Equipment

Lint Free Cloth	Not specified
Cap	Not specified

   B. Reference Information

   Maintenance Manual Chapter 06-00-00

   C. Procedure

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

   NOTE: The Autofeather High and Low Torque Pressure Switches removal procedure are identical.

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

   Copilot CB panel

   AUTOFEATHER

WARNING: DO NOT TOUCH THE ENGINE COMPONENTS UNTIL THEY ARE COOL. THE TEMPERATURE STAYS HIGH AFTER THE ENGINE STOPS. HIGH TEMPERATURES CAN CAUSE INJURY TO PERSONS.

   (2) Remove the nacelle panels 410AB, 430AL, 430AR and 410AT (420AB, 440AL, 440AR and 420AT) (Refer to 06-00-00).

   NOTE: The switches are installed close together, on the same support.

   (3) Remove the electrical connector (1) from the switch (2).
   (4) Remove the lockwire(3) from the switch (2).

NOTE: If is necessary remove both the switches, mark each switch body and the its own position on the support.

(5) Unscrew the switch from the support (4).
(6) Remove the switch (2).
(7) Cap the switch seat on the support to avoid oil outflow.
(8) Place a lint free cloth under the support (4).

3. Autofeather High and Low Pressure Switch Installation (Ref. Fig. 201)

A. Reference Information

Maintenance Manual Chapter 06-00-00

Maintenance Manual Chapter 71-00-00

B. Procedure

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

NOTE: The Autofeather High and Low Torque Pressure Switches installation procedure are identical.

(1) Remove the protection cap and screw the Torque Pressure Switch (2) in its own seat on the support (4).If both switches has been removal, take care to the marks taken previously.
(2) Tighten the switch to the support.
(3) Install the lockwire.
(4) Connect the electrical connector.
(5) Remove a lint free cloth.
(6) Install the nacelle panels 410AB, 430AL, 430AR and 410AT (420AB, 440AL, 440AR and 420AT) (Refer to 06-00-00).
(7) Remove the safety tag and close the AUTOFEATHER circuit breaker on Copilot Circuit Breakers Panel.
(8) Do a test (Refer to 71-00-00).

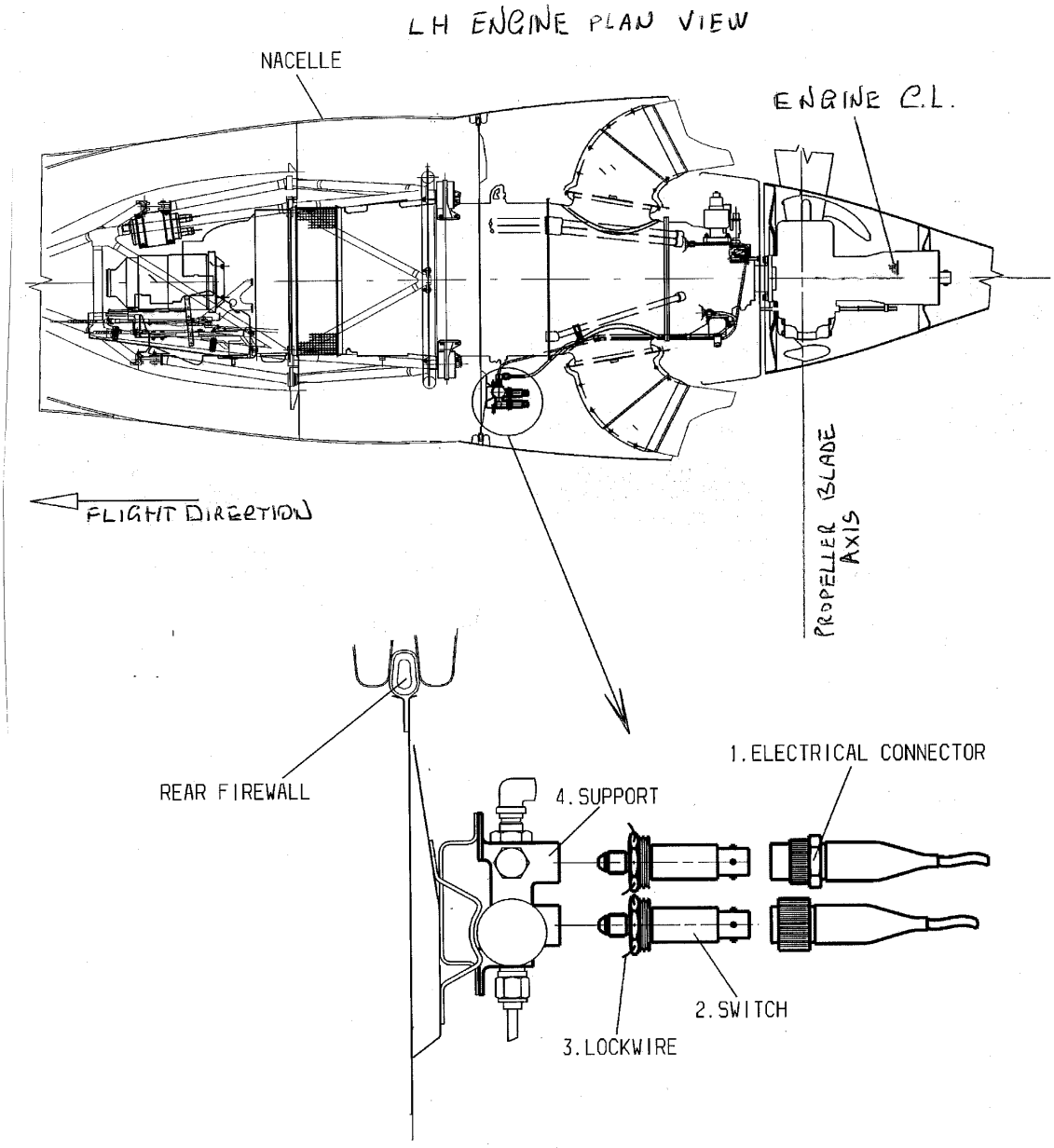


Fig. 201 - Autofeather High & Low Pressure Switch - RemovalI/Installation

4. Autofeather High and Low Differential Pressure Switches - Removal (Ref. to Fig. 202)

A. Fixtures, Test and Support Equipment

Lint Free Cloth	Not specified
Cap	Not specified

B. Reference Information

Maintenance Manual Chapter 06-00-00

C. Procedure

NOTE: This procedure is applicable to both left-hand and right-hand installations.

NOTE: The Autofeather High and Low Differential Pressure Switches removal procedure are identical.

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

Copilot CB panel

AUTOFEATHER

WARNING: DO NOT TOUCH THE ENGINE COMPONENTS UNTIL THEY ARE COOL. THE TEMPERATURE STAYS HIGH AFTER THE ENGINE STOPS. HIGH TEMPERATURES CAN CAUSE INJURY TO PERSONS.

(2) Remove the nacelle panels 420AB, 440AL, 440AR and 420AT (Refer to 06-00-00).
(3) Remove the lockwires (3, 4, 6).
(4) Disconnect the electrical connector (1).
(5) Unscrew completely the nut (2).
(6) Loosen the lock nut (5).
(7) Remove the Autofeather High Differential Pressure Switch.
(8) Cap the switch seat on the manifold and the tube end (8) to avoid oil outflow.
(9) Place a lint free cloth under the manifold (7).

5. Autofeather High and Low Differential Pressure Switches - Installation (Ref. Fig. 202)

A. Reference Information

Maintenance Manual Chapter 06-00-00

Maintenance Manual Chapter 71-00-00

B. Procedure

NOTE: This procedure is applicable to both left-hand and right-hand installations.

NOTE: The Autofeather High and Low Differential Pressure Switches installation procedure are identical.

(1) Remove the protection cap and screw the Autofeather High Differential Pressure Switch in its own seat on the manifold (7).
(2) Tighten the switch to the manifold (7).
(3) Connect the tube (8) to the switch with the nut (2).
(4) Connect the electrical connector (1).
(5) Install the lockwires (3, 4, 6).
(6) Remove a lint free cloth.
(7) Install the nacelle panels 420AB, 440AL, 440AR and 420AT) (Refer to 06-00-00).
(8) Do a test (Refer to 71-00-00)
(9) Remove the safety tag and close the AUTOFEATHER circuit breaker on Copilot Circuit Breakers Panel.

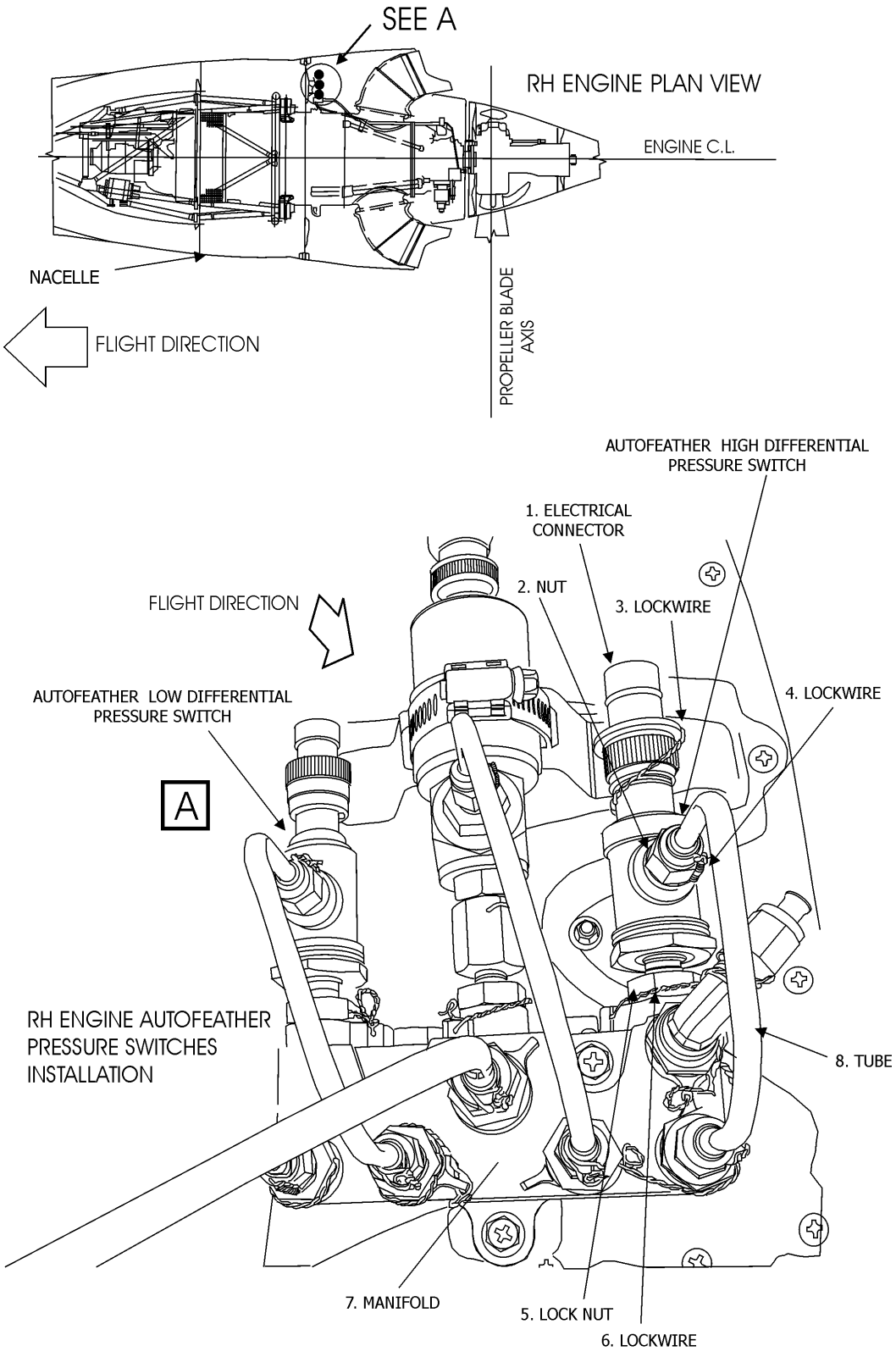


Fig. 202 - High and Low Differential Pressure Switches - Removal / Installation

AUTOFEATHER SYSTEM - ADJUSTMENT/TEST

1. General

A. This topic gives the procedures and the information required for the Autofeather Pressure Switches Functional Test.

B. The procedures provided in this section are defined to cover all the possible configurations of the autofeather pressure switches installation.

2. Autofeather High and Low Pressure Switch - Functional Test (ref.to fig.501)

WARNING: DO NOT DISCONNECT THE OIL PRESSURE REFERENCE TUBE UNTIL THE ENGINE REACHES AN ADEQUATELY LOW TEMPERATURE.
THE TEMPERATURE REMAINS HIGH AFTER THE ENGINE SHUTDOWN.
HIGH TEMPERATURE CAN CAUSE INJURY TO PERSONS.

WARNING: OIL CAN CAUSE INJURIES TO YOUR SKIN OR YOUR EYES.
PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.
IF THE OIL GETS ON YOUR SKIN OR IN YOUR EYES, GET IMMEDIATE MEDICAL HELP.

A. Fixtures, Test and Support Equipment

A/F Switch Test Bench	TEM-612000-002
Lint-free cloth	Not Specified
Multimeter	TEM-230000-004

B. Referenced Information

Maintenance Manual Chapter 61-21-00
Maintenance Manual Chapter 54-10-00

C. Procedure

(1) Verify the battery switch is in the OFF position.
(2) Verify the Avionics Master Switch is in the OFF position.
(3) Open, tag and safety the following circuit breakers:
- L ENG START
- R ENG START
- L TRQ
- R TRQ
- AUTOFEATHER

(4) Remove the rear nacelle panels as per AMM 54-10-00
(5) Remove the electrical connectors from the top of both the switches.
(6) Disconnect the oil pressure reference tube from the manifold.

(7) Connect the A/F Switch Test Bench air pressure line to the manifold oil pressure port.

(8) Test the High Pressure Switch as follows:

(a) Connect the pins A and B with the multimeter and verify the circuit is closed (continuity between pins A and B).

(b) With the A/F Switch Test Bench, slightly increase the pressure up to 18.5 psig. Verify the circuit is open (discontinuity between pins A and B).

NOTE: If not, replace the high pressure switch as per AMM 61-21-00 and repeat the procedure from the step 8 on the new one.

NOTE: While performing the following step, do not exceed 60 psig.

(c) Increase air pressure up to 60 psig and verify the switch remains open (discontinuity between pins A and B)

NOTE: Verify the switch remains always open between 18.5 and 60 psig. Any continuity (even if temporary) between pins A and B is not allowed.

(d) Slightly release the pressure and verify the circuit is closed (continuity between pins A and B) when the pressure value is within the range 16 ± 0.5 psig.

NOTE: If not, replace the high pressure switch as per AMM 61-21-00 and repeat the procedure from the step 8 on the new one.

(e) Slightly release the pressure until 0 psig and verify the circuit remains closed (continuity between pins A and B).

(f) Connect the pins B and C with the multimeter and verify the circuit is open (discontinuity between pins B and C).

(g) With the A/F Switch Test Bench, slightly increase the pressure up to 18.5 psig. Verify the circuit is closed (continuity between pins B and C).

NOTE: If not, replace the high pressure switch as per AMM 61-21-00 and repeat the procedure from the step 8 on the new one.

NOTE: While performing the following step, do not exceed 60 psig.

(h) Increase air pressure up to 60 psig and verify the switch remains closed (continuity between pins B and C)

NOTE: 8erify the switch remains always closed between 18.5 and 60 psig. Any discontinuity (even if temporary) between pins B and C is not allowed.

(i) Slightly release the pressure and verify the circuit open (discontinuity between pins B and C) when the pressure value is within the range 16 ± 0.5 psig.

NOTE: If not, replace the high pressure switch as per AMM 61-21-00 and repeat the procedure from the step 8 on the new one.

(j) Slightly release the pressure until 0 psig and verify the circuit remains open (discontinuity between pins B and C).

(9) Test the Low Pressure Switch as follows:

(a) Connect the pins A and B with the multimeter and verify the circuit is closed (continuity between pins A and B).

(b) With the A/F Switch Test Bench, slightly increase the pressure up to 13 psig. Verify the circuit is open (discontinuity between pins A and B).

NOTE: If not, replace the low pressure switch as per AMM 61-21-00 and repeat the procedure from the step 9 on the new one.

NOTE: While performing the following step, do not exceed 60 psig.

(c) Increase air pressure up to 60 psig and verify the switch remains open (discontinuity between pins A and B)

NOTE: Verify the switch remains always open between 13 and 60 psig. Any continuity (even if temporary) between pins A and B is not allowed.

(d) Slightly release the pressure and verify the circuit is closed (continuity between pins A and B) when the pressure value is within the range 10.5 ± 0.5 psig.

NOTE: If not, replace the low pressure switch as per AMM 61-21-00 and repeat the procedure from the step 9 on the new one.

(e) Slightly release the pressure until 0 psig and verify the circuit remains closed (continuity between pins A and B).

(f) Connect the pins B and C with the multimeter and verify the circuit is open (discontinuity between pins B and C).

(g) With the A/F Switch Test Bench, slightly increase the pressure up to 13 psig. Verify the circuit is closed (continuity between pins B and C).

NOTE: If not, replace the low pressure switch as per AMM 61-21-00 and repeat the procedure from the step 9 on the new one.

NOTE: While performing the following step, do not exceed 60 psig.

(h) Increase air pressure up to 60 psig and verify the switch remains closed (continuity between pins B and C)

NOTE: Verify the switch remains always closed between 13 and 60 psig. Any discontinuity (even if temporary) between pins B and C is not allowed.

(i) Slightly release the pressure and verify the circuit open (discontinuity between pins B and C) when the pressure value is within the range 10.5 ± 0.5 psig.

NOTE: If not, replace the low pressure switch as per AMM 61-21-00 and repeat the procedure from the step 9 on the new one.

(j) Slightly release the pressure until 0 psig and verify the circuit remains

open (discontinuity between pins B and C).

(10) Disconnect the A/F Switch Test Bench air pressure line from the manifold oil pressure port and connect the oil pressure reference tube.

(11) Connect and secure the electrical connectors on the top of both the switches (ref. to fig.501).

(12) Install the rear nacelle panels as per AMM 54-10-00

(13) Close the following circuit breakers:

- L ENG START
- R ENG START
- L TRQ
- R TRQ
- AUTOFEATHER

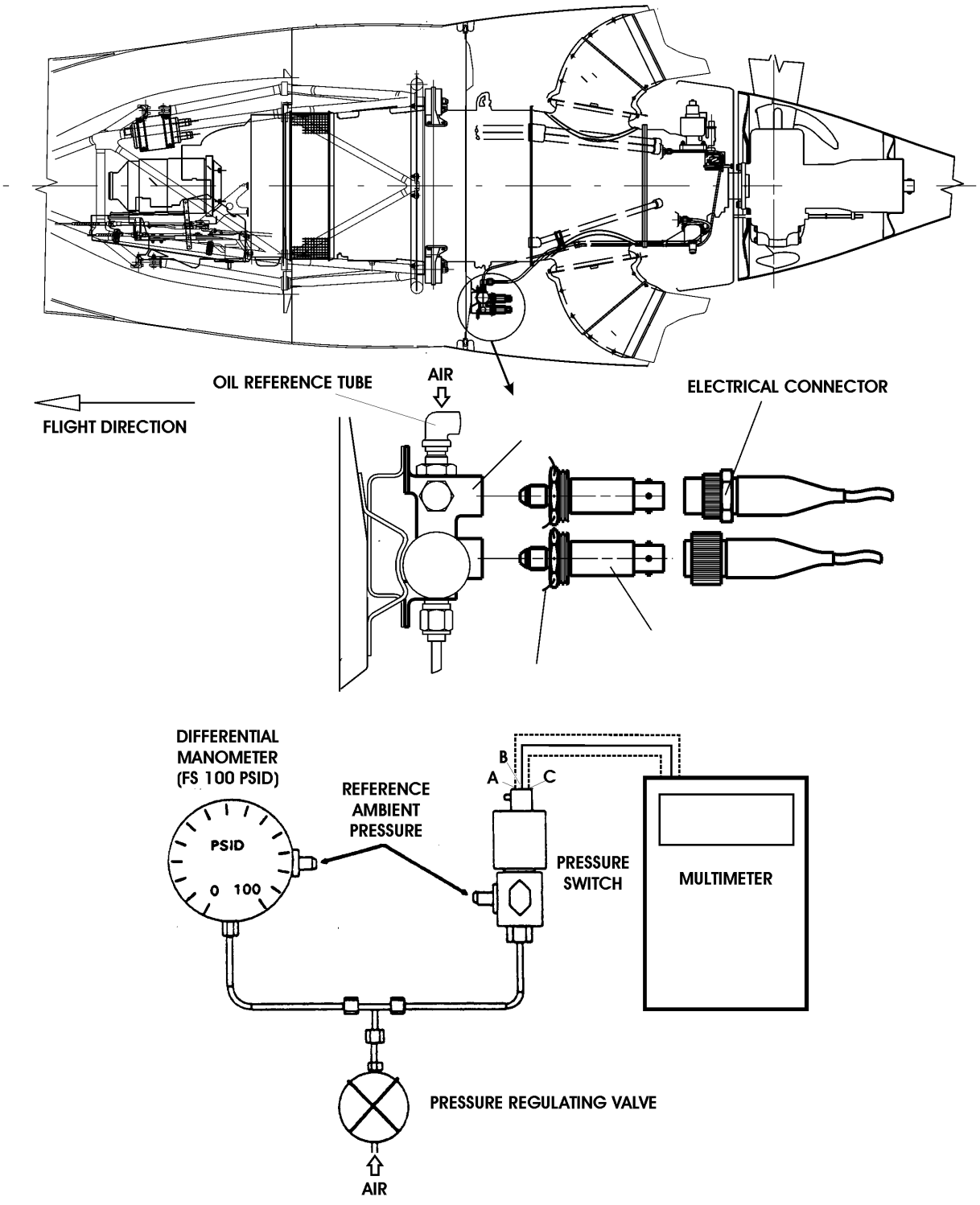


Fig. 501 - Autofeather High and Low Pressure Switch - Functional Test (Sheet 1 of 2)

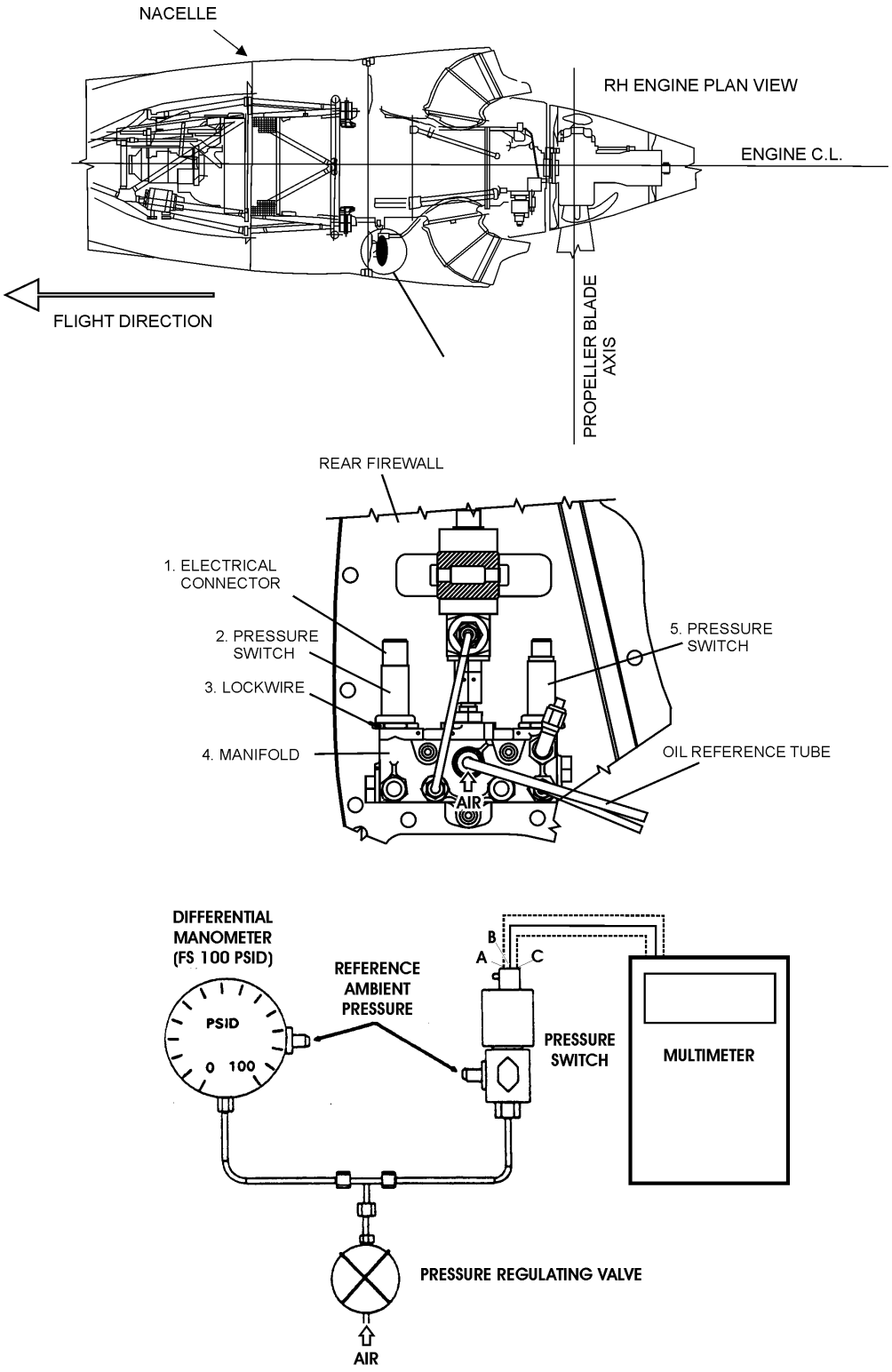


Fig. 501 - Autofeather High and Low Pressure Switch - Functional Test (Sheet 2 of 2)

3. Autofeather High and Low Differential Pressure Switch - Functional Test (ref.to fig.502)

WARNING: DO NOT DISCONNECT THE OIL PRESSURE REFERENCE TUBE UNTIL THE ENGINE REACHES AN ADEQUATELY LOW TEMPERATURE.
THE TEMPERATURE REMAINS HIGH AFTER THE ENGINE SHUTDOWN.
HIGH TEMPERATURE CAN CAUSE INJURY TO PERSONS.

WARNING: OIL CAN CAUSE INJURIES TO YOUR SKIN OR YOUR EYES.
PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.
IF THE OIL GETS ON YOUR SKIN OR IN YOUR EYES, GET IMMEDIATE MEDICAL HELP.

A. Fixtures, Test and Support Equipment

A/F Switch Test Bench	TEM-612000-002
Lint-free cloth	Not Specified
Multimeter	TEM-230000-004

B. Referenced Information

Maintenance Manual Chapter 61-21-00
Maintenance Manual Chapter 54-10-00

C. Procedure

(1) Verify the battery switch is in the OFF position.
(2) Verify the Avionics Master Switch is in the OFF position.
(3) Open, tag and safety the following circuit breakers:
- L ENG START
- R ENG START
- L TRQ
- R TRQ
- AUTOFEATHER

(4) Remove the rear nacelle panels as per AMM 54-10-00
(5) Remove the electrical connectors from the top of both the switches.
(6) Disconnect the oil pressure reference tube from the manifold.
(7) Connect the A/F Switch Test Bench air pressure line to the manifold oil pressure port.
(8) Test the High Differential Pressure Switch as follows:
(a) Connect the pins A and B with the multimeter and verify the circuit is closed (continuity between pins A and B).
(b) With the A/F Switch Test Bench, slightly increase the pressure up to 18.5 psig. Verify the circuit is open (discontinuity between pins A and B).

NOTE: If not, replace the high pressure switch as per AMM 61-21-00 and repeat the procedure from the step 8 on the new one.

NOTE: While performing the following step, do not exceed 60 psig.

(c) Increase air pressure up to 60 psig and verify the switch remains open (discontinuity between pins A and B)

NOTE: Verify the switch remains always open between 18.5 and 60 psig. Any continuity (even if temporary) between pins A and B is not allowed.

(d) Slightly release the pressure and verify the circuit is closed (continuity between pins A and B) when the pressure value is within the range 16 ± 0.5 psig.

NOTE: If not, replace the high pressure switch as per AMM 61-21-00 and repeat the procedure from the step 8 on the new one.

(e) Slightly release the pressure until 0 psig and verify the circuit remains closed (continuity between pins A and B).

(f) Connect the pins B and C with the multimeter and verify the circuit is open (discontinuity between pins B and C).

(g) With the A/F Switch Test Bench, slightly increase the pressure up to 18.5 psig. Verify the circuit is closed (continuity between pins B and C).

NOTE: If not, replace the high pressure switch as per AMM 61-21-00 and repeat the procedure from the step 8 on the new one.

NOTE: While performing the following step, do not exceed 60 psig.

(h) Increase air pressure up to 60 psig and verify the switch remains closed (continuity between pins B and C)

NOTE: Verify the switch remains always closed between 18.5 and 60 psig. Any discontinuity (even if temporary) between pins B and C is not allowed.

(i) Slightly release the pressure and verify the circuit open (discontinuity between pins B and C) when the pressure value is within the range 16 ± 0.5 psig.

NOTE: If not, replace the high pressure switch as per AMM 61-21-00 and repeat the procedure from the step 8 on the new one.

(j) Slightly release the pressure until 0 psig and verify the circuit remains open (discontinuity between pins B and C).

(9) Test the Low Differential Pressure Switch as follows:

(a) Connect the pins A and B with the multimeter and verify the circuit is closed (continuity between pins A and B).

(b) With the A/F Switch Test Bench, slightly increase the pressure up to 13 psig. Verify the circuit is open (discontinuity between pins A and B).

NOTE: If not, replace the low pressure switch as per AMM 61-21-00 and repeat the procedure from the step 9 on the new one.

NOTE: While performing the following step, do not exceed 60 psig.

(c) Increase air pressure up to 60 psig and verify the switch remains open (discontinuity between pins A and B)

NOTE: Verify the switch remains always open between 13 and 60 psig. Any continuity (even if temporary) between pins A and B is not allowed.

(d) Slightly release the pressure and verify the circuit is closed (continuity between pins A and B) when the pressure value is within the range 10.5 ± 0.5 psig.

NOTE: If not, replace the low pressure switch as per AMM 61-21-00 and repeat the procedure from the step 9 on the new one.

(e) Slightly release the pressure until 0 psig and verify the circuit remains closed (continuity between pins A and B).

(f) Connect the pins B and C with the multimeter and verify the circuit is open (discontinuity between pins B and C).

(g) With the A/F Switch Test Bench, slightly increase the pressure up to 13 psig. Verify the circuit is closed (continuity between pins B and C).

NOTE: If not, replace the low pressure switch as per AMM 61-21-00 and repeat the procedure from the step 9 on the new one.

NOTE: While performing the following step, do not exceed 60 psig.

(h) Increase air pressure up to 60 psig and verify the switch remains closed (continuity between pins B and C)

NOTE: Verify the switch remains always closed between 13 and 60 psig. Any discontinuity (even if temporary) between pins B and C is not allowed.

(i) Slightly release the pressure and verify the circuit open (discontinuity between pins B and C) when the pressure value is within the range 10.5 ± 0.5 psig.

NOTE: If not, replace the low pressure switch as per AMM 61-21-00 and repeat the procedure from the step 9 on the new one.

(j) Slightly release the pressure until 0 psig and verify the circuit remains open (discontinuity between pins B and C).

(10) Disconnect the A/F Switch Test Bench air pressure line from the manifold oil pressure port and connect the oil pressure reference tube.

(11) Connect and secure the electrical connectors on the top of both the switches (ref. to fig.502).

(12) Install the rear nacelle panels as per AMM 54-10-00

(13) Close the following circuit breakers:

- L ENG START
- R ENG START
- L TRQ
- R TRQ
- AUTOFEATHER

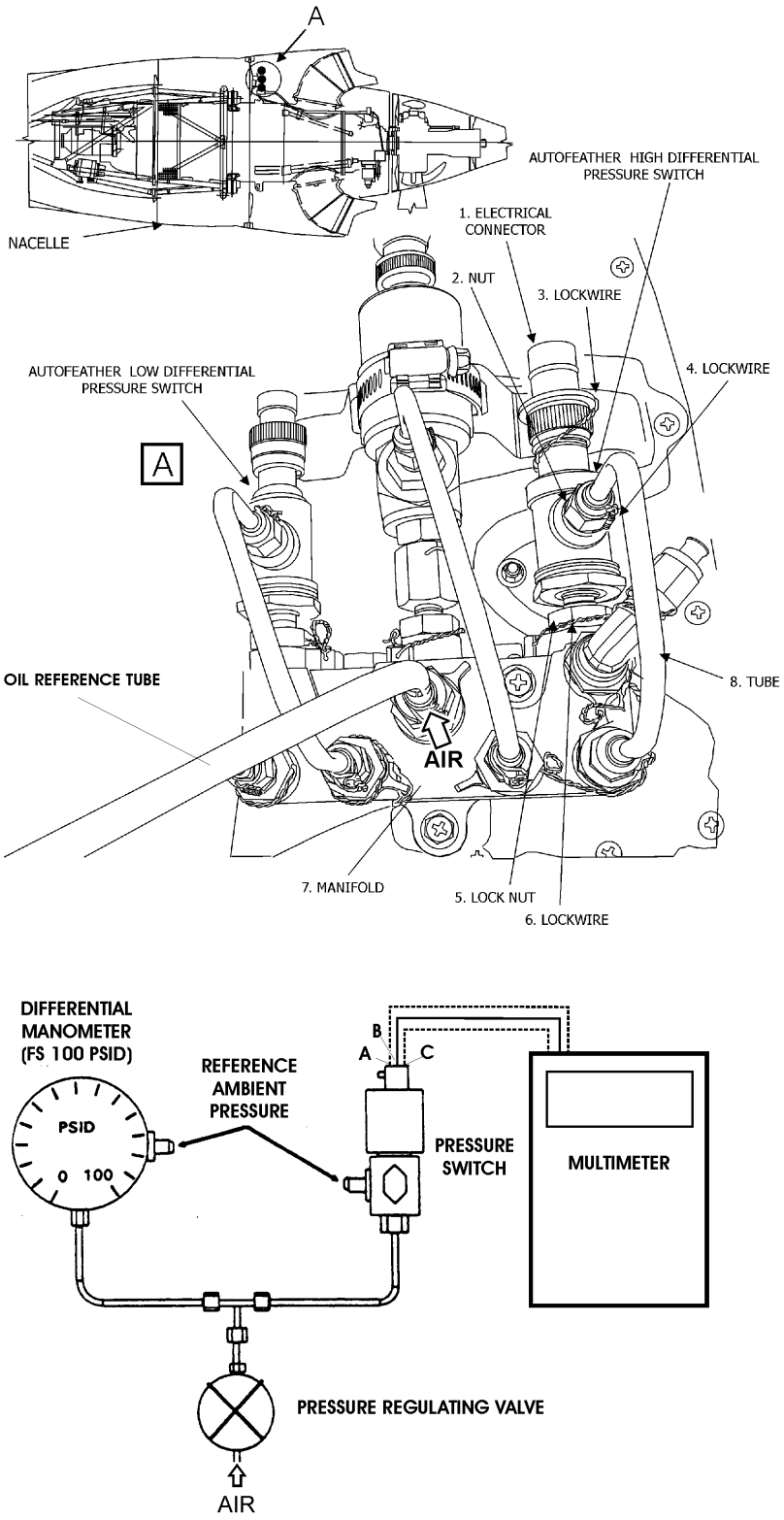


Fig. 502 - Autofeather High and Low Differential Pressure Switch - Functional Test

PROPELLER SYNCHROPHASER SYSTEM - DESCRIPTION AND OPERATION

1. General

A. The WOODWARD TYPE II FIXED PHASE Synchrophaser System allows the synchronization of the propeller, operating continuously on the propeller pitch to maintain a pre-defined propeller-phase relationship: the result is the reduction of the noise level in the cabin.

2. Description

A. The Synchrophaser System comprises:

- a control box
- a magnetic pick-up
- a rotating propeller target
- a SYNCPH/OFF switch located on the control pedestal immediately behind the propeller control levers
- a circuit breaker, placarded PROP SYNCPH, located on the copilot CB panel.

3. Operation (Ref. Fig. 1)

The system operates on electronic impulses generated by a rotating target passing each magnetic pick-up, and sensed by the control box.
The control box compares the LH and RH signals and then sends voltage signals to the magnetic coils in the propeller governors to maintain a fixed phase relationship between them: the faster propeller increases slightly the blades pitch to slow down the rotational speed while the slower propeller decreases slightly the blades pitch to increase the speed.

In operation, the system slightly increases both propellers speed setting and from that point adjusts speed up or down, as required, to maintain the pre-defined propeller phase relationship.

Before engaging the synchrophaser, it is necessary to match the propeller RPM within 10 RPM or less: this must be done by ear, since attempting to match the propeller levers or tachometers may not be sufficient.

Setting the SYNCPH switch, on the PROPELLER panel, to SYNCPH position, will engage the system when the relative position of the blades has drifted to within ±30 rotational degrees of the preset internal phase setting.

The time required by the two propellers to drift within the phasing range before the system senses and corrects the phase relationship electronically, could be as long as 30 seconds.

If the RPM difference between the two propellers should exceed the holding range of the synchrophaser system (approximately 25 RPM), the system will disable its outputs and both propeller RPM will return to the original manual setting.

To reset the system, the SYNCPH switch must be turned to OFF, the propeller RPM must be re-adjusted to within 10 RPM or less, then the switch must be turned to SYNCPH position. Yet the re-engagement may occur without resetting the switch, provided the phase error is small.

If the synchrophaser system is engaged during an in-flight engine shutdown or a propeller feathering, the system will quickly detect an out of range condition and disengage automatically.

Whenever an in-flight engine shutdown occurs, or during approach and landing the synchrophaser must be turned OFF.

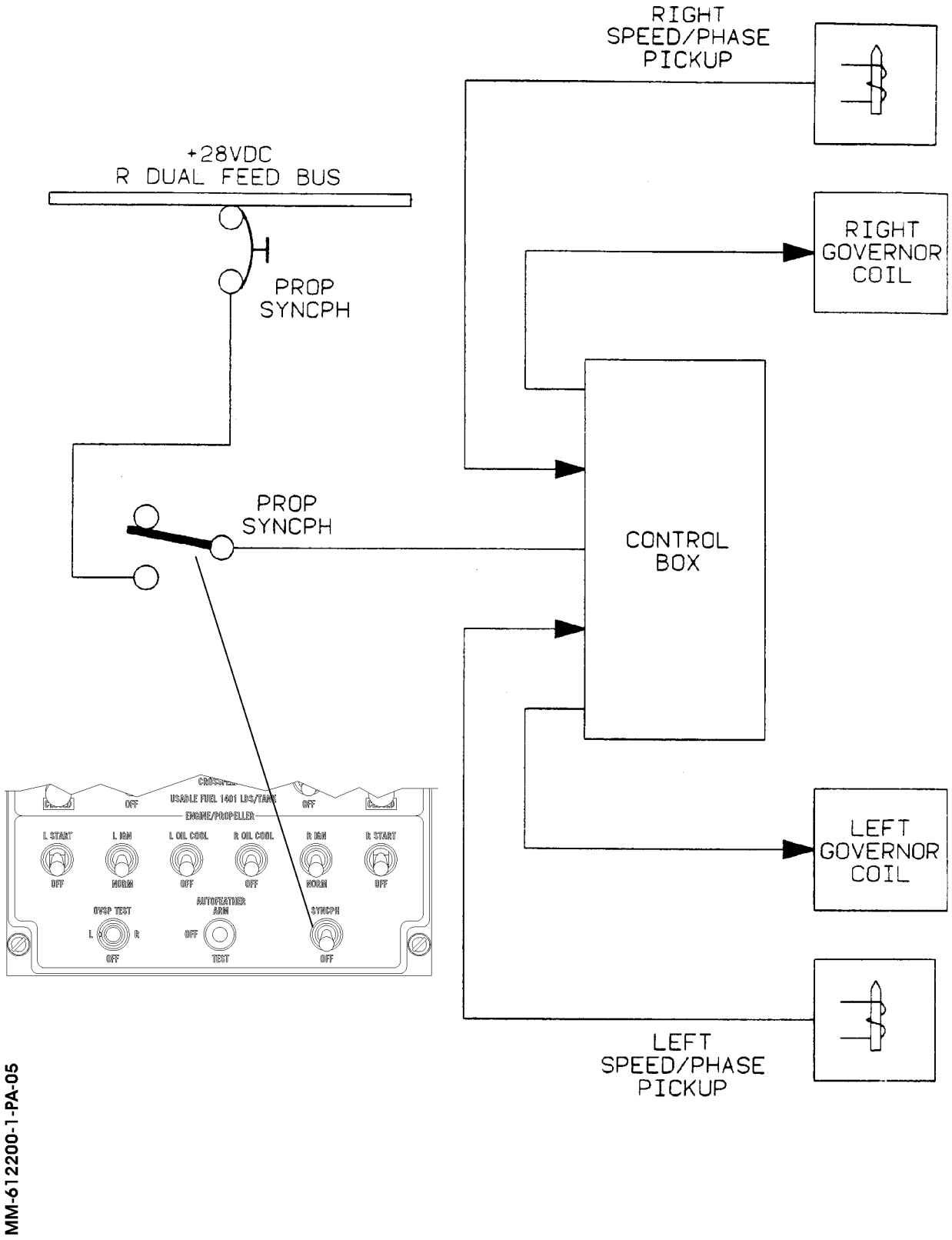


Fig. 1 - Propeller Synchrophaser - Block Diagram

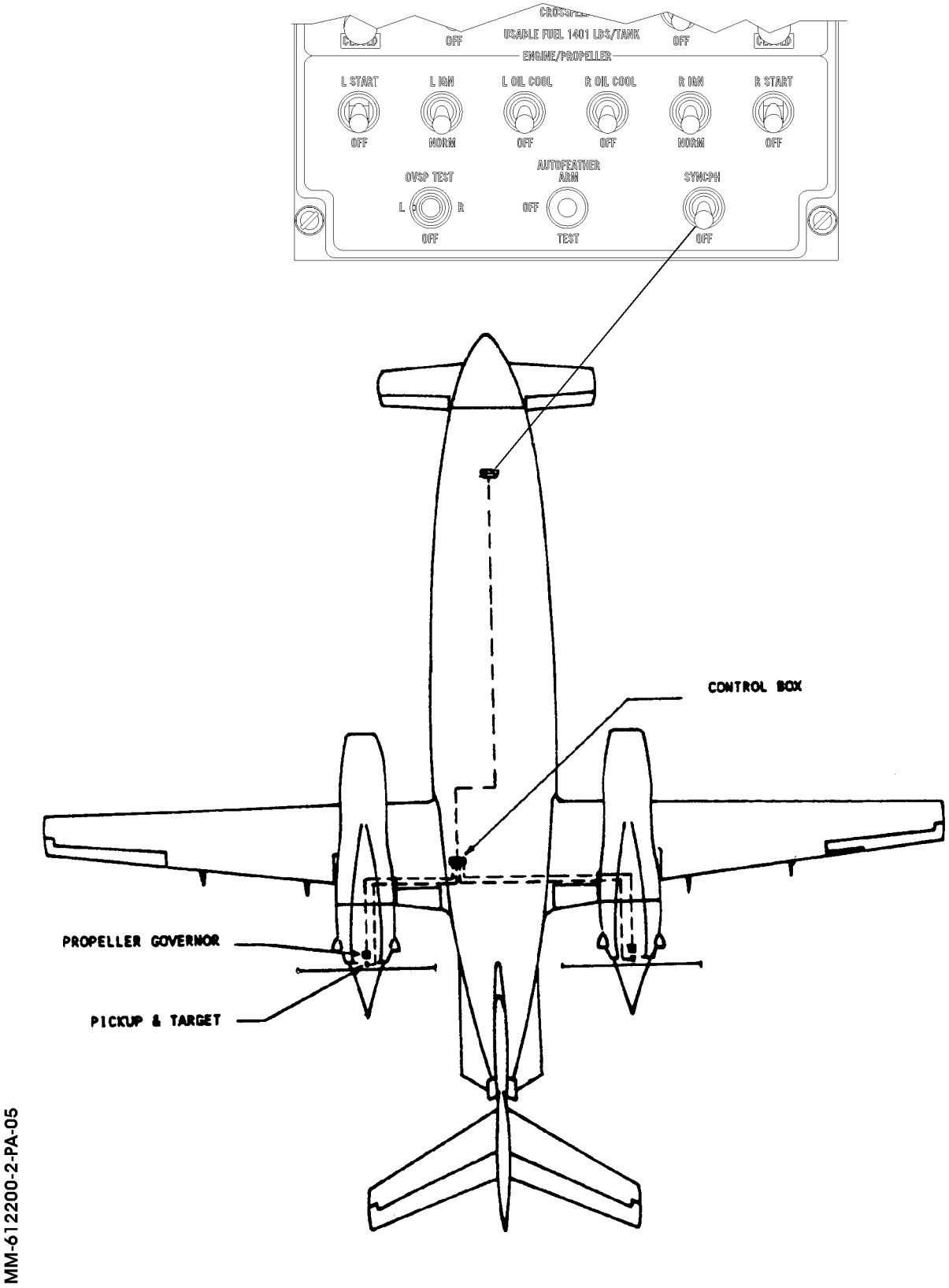


Fig. 2 - Propeller Synchrophaser System

PROPELLER SYNCHROPHASER SYSTEM - MAINTENANCE PRACTICES

1. General

A. This topic covers the removal and installation of the synchrophaser system components.

B. The control box is installed in the baggage compartment on four antivibration mounts. The rotating targets and magnetic pickups are installed on the propeller bulkheads and on the engines reduction gearboxes, respectively; the clearance must not exceed the maximum allowed by the manufacturer (2.5 mm.). The pickups wires are properly shielded and routed as to avoid electromagnetic interferences.

C. The synchrophaser control box, which is supplied with 28 VDC power through a circuit breaker labeled PROP SYNCPH on the pilot circuit breaker panel, is located in the left wall of the baggage comparment at the 6965.21 FS.

2. Synchrophaser Pickup - Removal (Ref. Fig. 201)

A. Fixtures, Test and Support Equipment

Warning Notice	Not Specified

B. Referenced Information

Maintenance Manual Chapter 54-00-00

C. Procedure

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

(1) Put a Warning Notice in the flight compartment to tell persons not to move the power levers or the propeller levers.

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

Pilot CB panel:	Copilot CB panel:
L ENG START	PROP SYNCPH
R ENG START	

(3) Remove the nacelle panels 430AL and 430AR (440AL and 440AR) (Refer to 54-00-00).

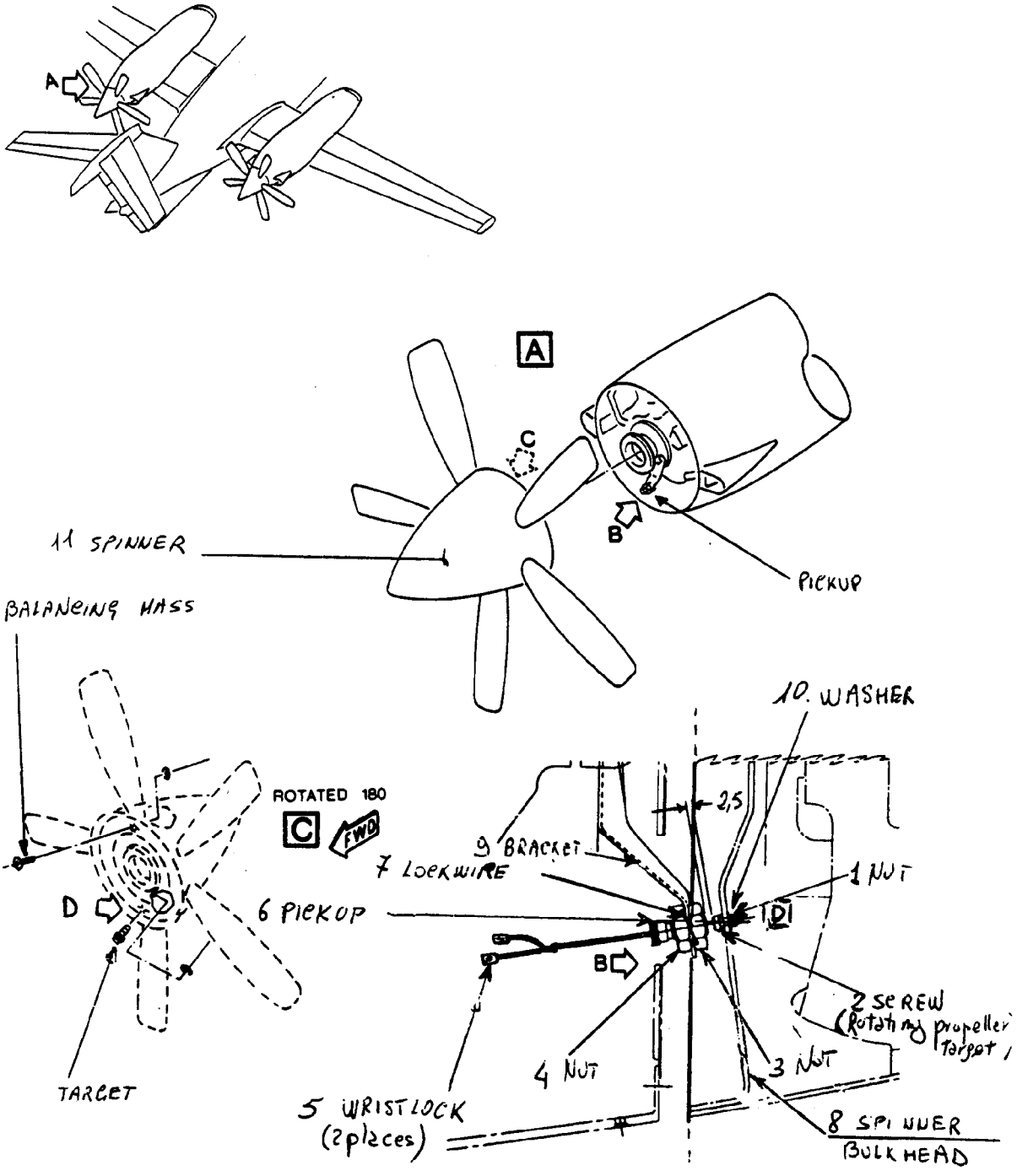
(4) Remove the lockwire (7).

(5) Disconnect the pickup wristlocks (5).

(6) Loosen the nuts (4) and (3).

(7) Completely unscrew the nut (3).

(8) Remove the pickup (6) and the nut (4),



MM_612200-201

Fig. 201 - Propeller Synchrophaser Pickup - Removal/Installation

3. Synchrophaser Pickup - Installation (Ref. Fig. 201)

A. Materials

Lockwire	04-008

B. Referenced Information

Maintenance Manual Chapter 54-00-00

C. Procedure

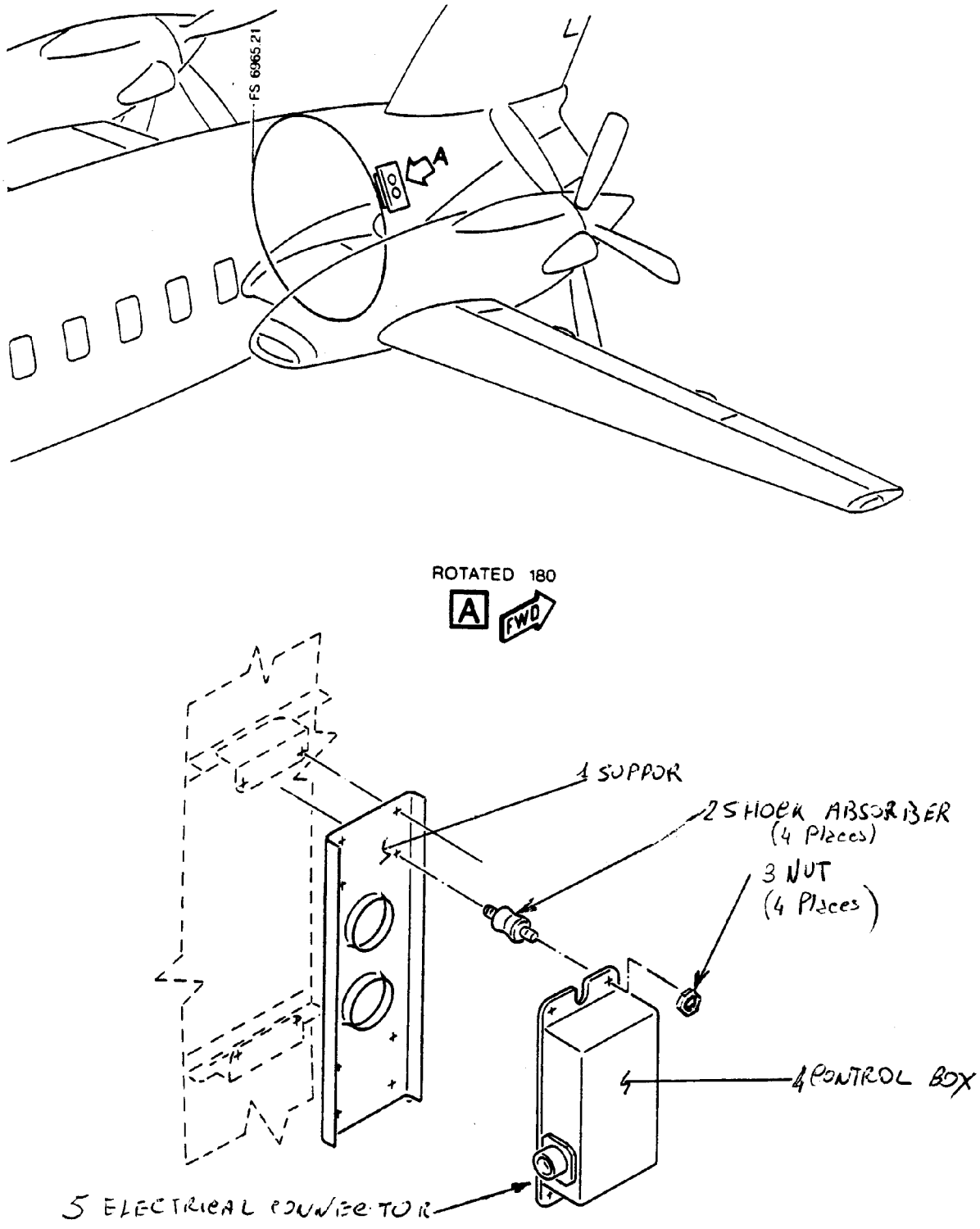
NOTE: This procedure is applicable to both left-hand and right-hand installations. Data for the right-hand installation procedure is given between parentheses.

(1) Make sure that:
- The Warning Notice is in position
- The L ENG START and R ENG START circuit breakers are open, tagged and safetied
- Access is available (Refer to the Removal Procedure).

(2) Place the pickup (6) with the nut (4) on the bracket (9).
(3) Install the nut (3) on the pickup (6).
(4) Adjust the bolts (3) and (4) until the clearance between the pickup (6) and the target (2) is 2.5 mm (0.1 in).
(5) Tighten the bolts (3) and (4) and safety with lockwire (7).
(6) Connect the pickup wristlocks (5).
(7) Remove the safety tags and close these circuit breakers:

Pilot CB panel:	Copilot CB panel:
L ENG START	PROP SYNCPH
R ENG START	

(8) Remove the Warning Notice from the flight compartment.
(9) Do a test of the synchrophaser system as described in this section.
(10) Install the nacelle panels 430AL and 430AR (440AL and 440AR) (Refer to 54-00-00).



MM_612200-202

Fig. 202 - Control Box Synchrophaser - Removal/Installation

4. Synchrophaser Target - Removal (Ref. Fig. 201)

A. Fixtures, Test and Support Equipment

Warning Notice	Not Specified

B. Procedure

NOTE: This procedure is applicable to both left-hand and right-hand installations.

(1) Put a Warning Notice in the flight compartment to tell persons not to move the power levers or the propeller levers.
(2) Open, tag and safety these circuit breakers:

Pilot CB panel:	Copilot CB panel:
L ENG START	PROP SYNCPH
R ENG START	

(3) Remove the spinner (11).
(4) Remove the nut (1), washer (10) and the screw (2) from the spinner bulkhead (8).

5. Synchrophaser Target - Installation (Ref. Fig. 201)

A. Procedure

NOTE: This procedure is applicable to both left-hand and right-hand installations.

(1) Make sure that:
- The Warning Notice is in position
- The L ENG START and R ENG START circuit breakers are open, tagged and safetied.

(2) Place the target (2) on the spinner bulkhead (8).
(3) Secure the target (2) to the spinner bulkhead with washer (10) and nut (1).
(4) Install the spinner (11).
(5) Check that the clearance between the pickup (6) and the target (2) is 2.5 mm (0.1 in).
(6) Remove the safety tags and close these circuit breakers:

Pilot CB panel:	Copilot CB panel:
L ENG START	PROP SYNCPH
R ENG START	

(7) Do a test of the synchrophaser system as described in this section.
(8) Remove the Warning Notice from the flight compartment.

6. Synchrophaser Control Box - Removal (Ref. Fig. 202)

A. Procedure

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

Pilot CB panel:	Copilot CB panel:
L ENG START	PROP SYNCPH
R ENG START	

(2) Disconnect the electrical connector (5).
(3) Remove the nut (3) from the shock absorber (2).
(4) Remove the control box (4).

7. Synchrophaser Control Box - Installation (Ref. Fig. 202)

A. Procedure

(1) Place the control box (4) on the shock absorbers (2).
(2) Install the nut (3).
(3) Connect the electrical connector (5).
(4) Remove the safety tags and close these circuit breakers:

Pilot CB panel:	Copilot CB panel:
L ENG START	PROP SYNCPH
R ENG START	

(5) Do a test of the synchrophaser system as described in this section.

PROPELLER SYNCHROPHASER SYSTEM - ADJUSTMENT/TEST

1. GeneralA.This topic gives the procedures and the information required for testing the synchrophaser system.

   B. The procedures and information are given in the following order:
   - Wiring Test
   - Input Signal Amplitude Test
   - Supply Voltage Test
   - Governor Trim Coil Test
   - Synchrophaser System - Troubleshooting.

2. Synchrophaser System - Wiring Test (Ref. Fig. 501)

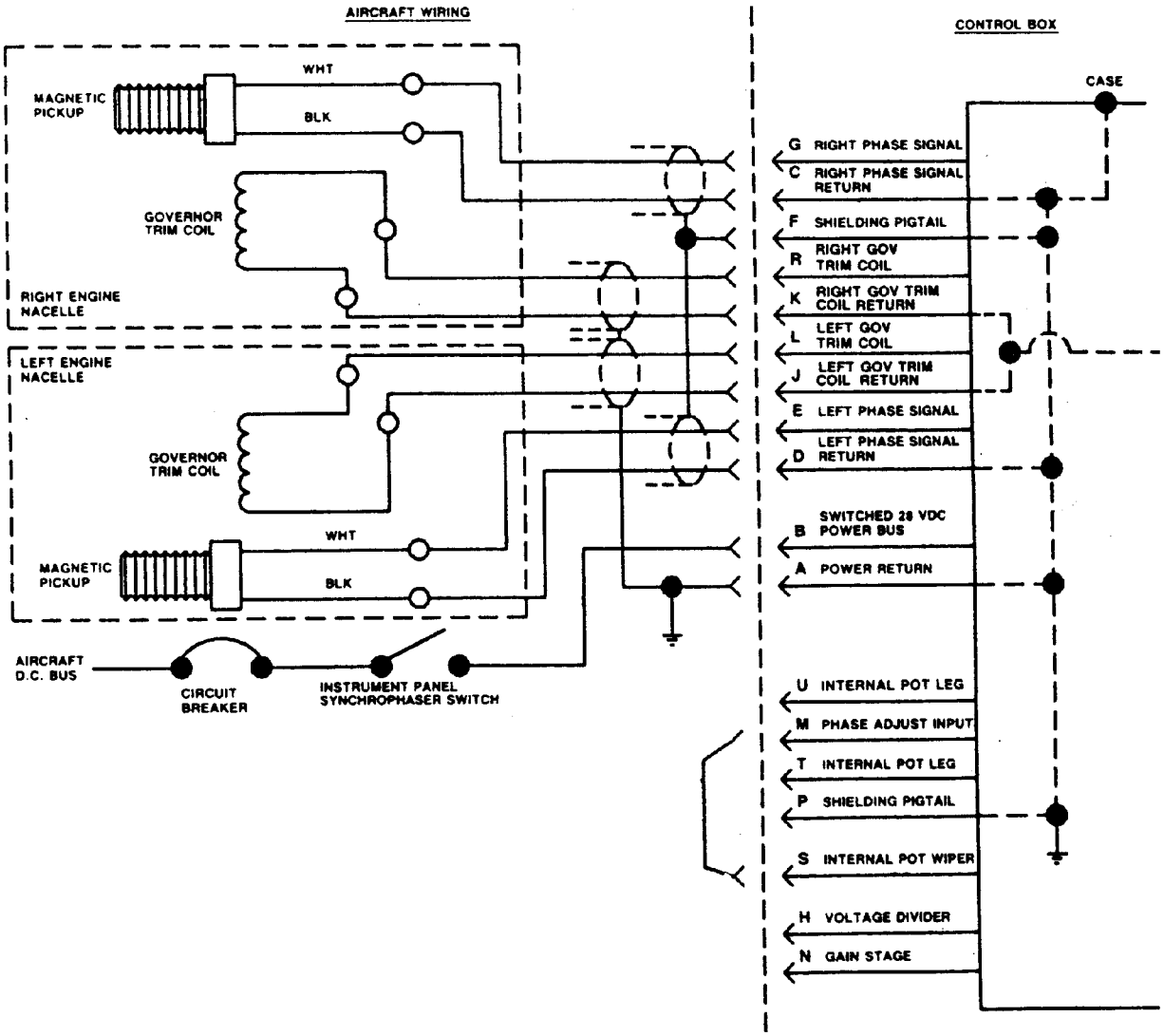
   A. Procedure

   (1) When checking wiring resistances and continuity, the synchrophaser circuit breaker should be open (OFF) and the aircraft master switch turned OFF. Resistance and continuity checks are made at the aircraft wiring connector that attaches to the control box. Unplug the control box and probe the aircraft wiring connector to verify resistances given in Table 501. If any discrepancies are found in the following checks, they must be corrected before continuing. Figure 501 illustrates a typical aircraft wiring schematic.

   NOTE: If coils are checked immediately after engine shutdown, they may be read as much as 20% higher due to heatsoak.

Table 501 - Continuity and Resistance Values

TEST POINT	COMPONENT OR FUNCTION	RESISTANCE
D to E	Left Pickup	52 to 68 Ohms
C to G	Right Pickup	52 to 68 Ohms
A to R	Right Coil	Open
A to L	Left Coil	Open
A to K	Coil Common	Open
A to J	Coil Common	Open
A to Ground	(Airframe)	0 Ohms
A to B	28 Vdc Bus	Open
M to S	Jumper	0 Ohms
J to L	Left Coil	
K to R	Right Coil	



MM_612200-501

Fig. 501 - Synchrophaser System - Electrical Schematic

3. Synchrophaser System - Input Signal Amplitude Test (Ref. Fig. 502)

A. Procedure

CAUTION: IF AN OSCILLOSCOPE IS USED TO VIEW THE OUTPUTS OF THE CONTROL BOX, ATTACH THE GROUND SIDE OSCILLOSCOPE INPUT TO PIN A AND THE OTHER SIDE TO PIN L OR R. DO NOT CONNECT TEST EQUIPMENT TO J OR K. A GROUND TO THESE POINTS WITH A CONTROL BOX IN OPERATION WILL DAMAGE THE CONTROL BOX.

The peak-to-peak amplitude of the input signals is racommended to be 2.4 volts peak-to-peak minimum at minimum cruise RPM. The clearance between the rotating target and the magnetic pickup is the primary factor affecting output amplitude. Before performing aircraft maintenance affecting target gap, it is advisable to first meansure the existing clearance and tag the pickup before distrubing the clearance. If propellers are exchanged or brush blocks moved, always return the clearance setting to the original measurement. The only time a new setting is required is when a magnetic pickup is replaced.

NOTE: When replacing the magnetic pickup or making clearance adjustments do not overtorque the pickup. Disconnect pickup wires before making any clearance adjustments. Do not twist pickup wires.

When magnetic pickup replacement is necessary, use the same clearance as a starting point. Measure the amplitude at minimum cruise RPM using an oscilloscope. An ordinary voltmeter will not provide a usable output reading as the signal is present for only a very small portion of the signal cycle. The waveform should comply with Figure 502. An inverted signal (negative pulse before positive) indicates magnetic pickup leads are reversed (this will normally not affect proper synchrophaser operation). Pay particular attention to waveform abnormalities or electromagnetic intergference exceeding +0,5 volts on the input signal baseline. This interference will cause unsatisfactory synchrophaser operation if the control box is triggered more than once in each propeller shaft rotation. This interference is more likely to occur at high RPM so a waveform check at highest RPM is also recommended.

4. Synchrophaser System - Supply Voltage Test

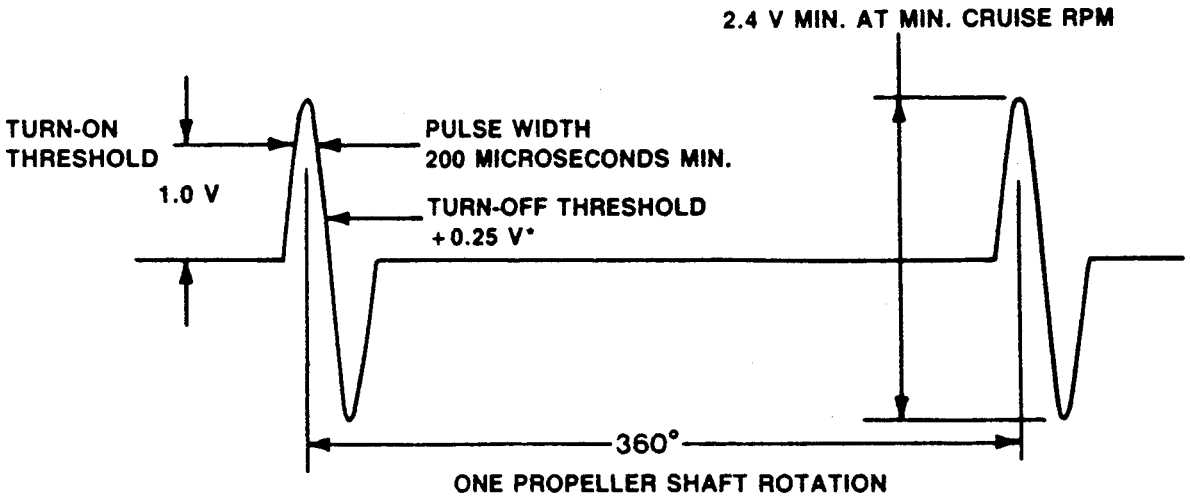
A. Procedure

(1) Upon successful completion of resistance checks, the supply voltage can be checked. With the control box unplugged, close the synchrophaser circuit breaker, turn on the aircraft master switch, and turn on the synchrophaser instrument panel switch. With a DC voltmeter check between pin A (negative) and pin B (positive) of the aircraft wiring connector for proper polarity and bus voltage.

5. Synchrophaser System - Governor Trim Coil Test (Ref. Fig. 503)

A. Procedure

(1) Following a resistance check, it is possible to energize the governor trim coils and test for RPM rise.
Turn off the synchrophaser instrument panel switch, then disconnect the aircraft wiring connector at the control box.



MM_612200-502

Fig. 502 - Synchrophaser System - Phase Signal Waveform

A jumper between receptacles J, K and B can be rigged as shown in Figure 503. Another jumper will be used alternately between L and A and between R and A. Ground run engines at normal cruise RPM with propellers under governor control. With the jumper between A and L the left propeller RPM should increase by the trim range or about one percent of propeller RPM when the instrument panel synchrophaser switch is turned on.

To check the right trim coil, turn the synchrophaser instrument switch OFF and move the jumper so it is between A and R. Turn the synchrophaser switch ON and note the rise in RPM on the right propeller. If neither side increases make sure that enough power is being generated to bring propellers off of their low pitch stops.

Both sides should operate equally. If rise in RPM is abrupt on one side and is sluggish on the other, suspect that the propeller has too much friction.

Hunting and poor phase holding during synchrophaser operation will be the result of too much friction or hysteresis. If manual speed settings wander more than ten RPM in quiet air without the synchrophaser operating, either the governors or the propellers could be the cause of poor synchrophaser operation.

RPM rise time is normally between one half of a second and one and one half seconds. If input signals are satisfactory and trim coil action is correct, the control box should be checked.

If resistance and continuity checks are correct, a new control box can be substituted.

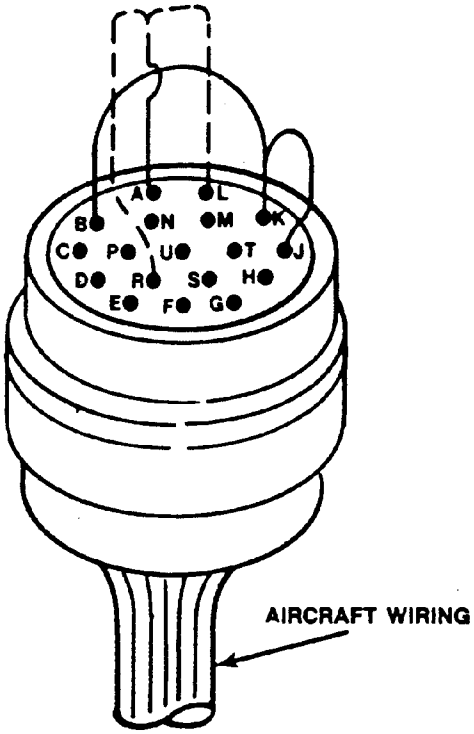
6. Synchrophaser System - Troubleshooting (Ref. Fig. 504)

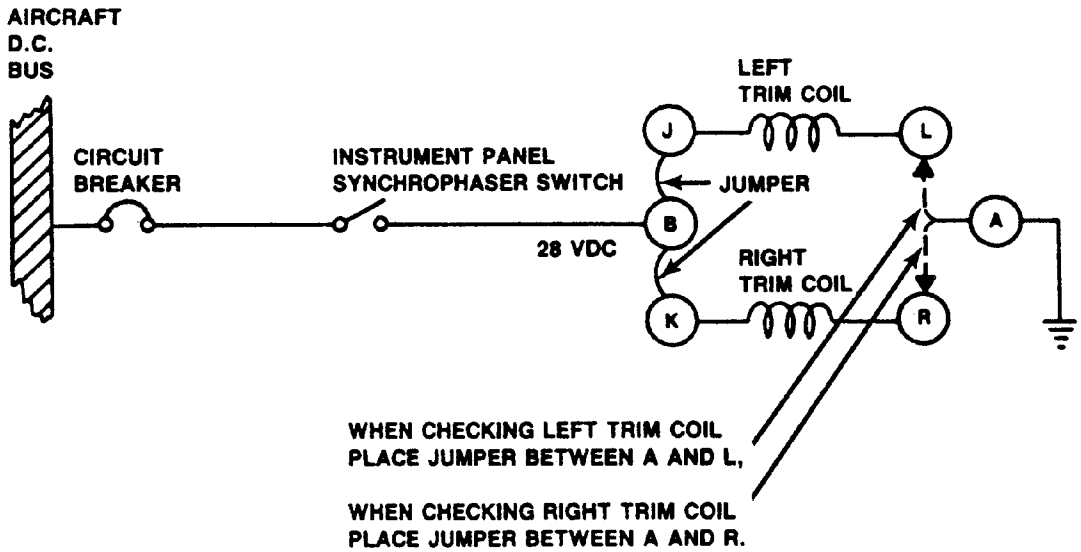
A. Procedure

(1) Figure 504 illustrates problems most likely to occur along with probable cause, troubleshooting method and corrective action.

CAUTION

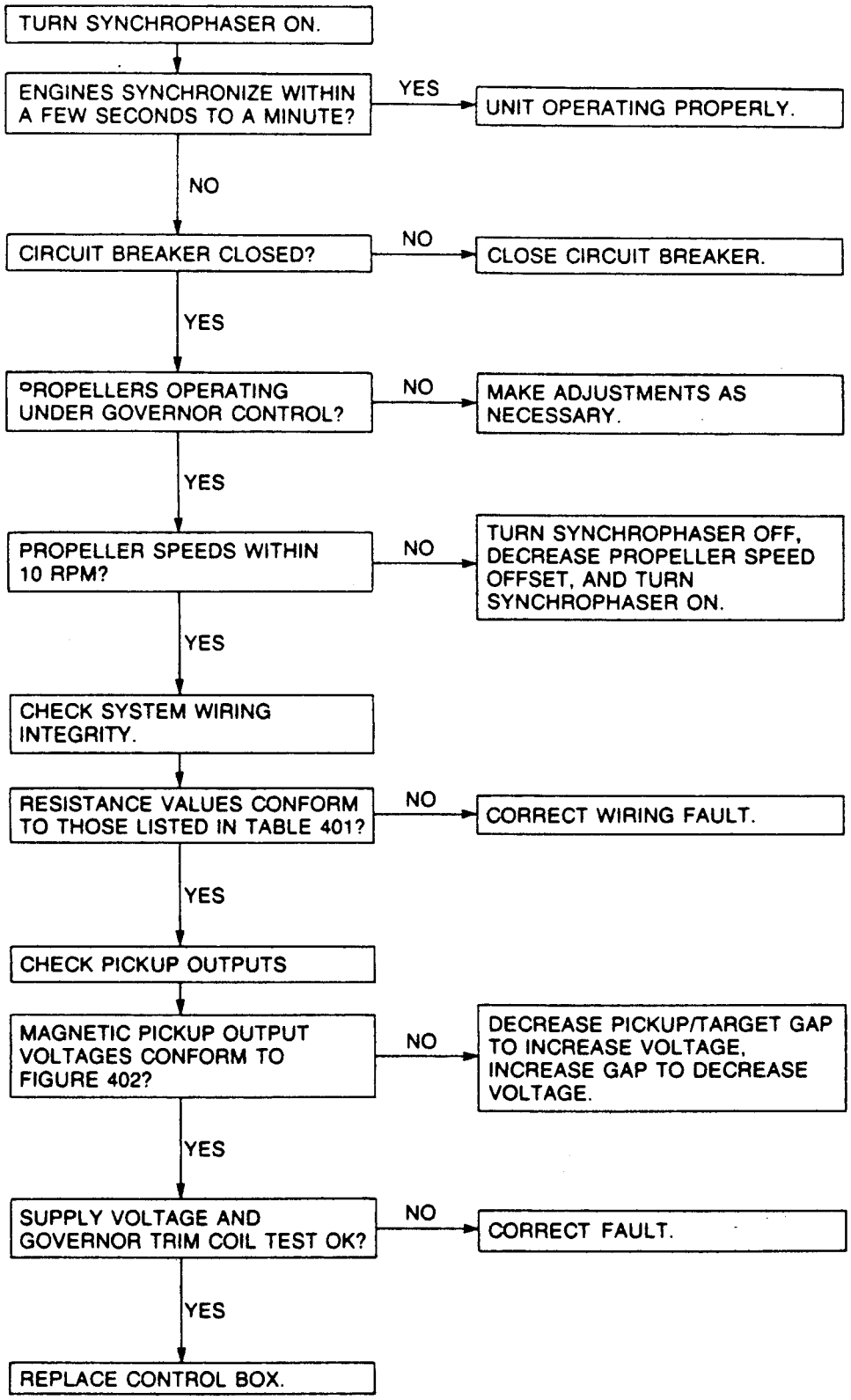
DO NOT INSERT A JUMPER LARGER THAN 0.040 INCH DIAMETER INTO CONNECTOR SOCKETS OR CONNECTORS WILL BE DAMAGED.





MM_612200-503

Fig. 503 - Synchrophaser System - Governor Trim Coil Test Schematic



MM_612200-504

Fig. 504 - Synchrophaser System - Troubleshooting

INDICATING - DESCRIPTION AND OPERATION

1. General

Indication of the propeller system consists of a propeller rotational speed (Np) indication system, a low pitch annunciator system, and an autofeather annunciation system.
This section gives description, operation and maintenance practice details for the Np indication system, and description and operation of the low pitch annunciator system. The autofeather annunciation system is dealt with in 61-21-00, and the maintenance practices for the low pitch annunciation system is included in 76-10-00 (Engine Rigging Procedures).

2. Np Indication - Description(Ref. Fig. 1)

A. The Np indication system for each propeller consists of a tachometer generator, an gauge displayed on the MFD (Multi Function Display) System Page and associated electrical circuitry.

B. The tachometer generator, located on the left side of the engine reduction gearbox, consists of a permanent magnet rotor (which rotates inside a three-phase stator) and a transducer (which converts the speed of the rotor into a corresponding electrical signal) housed in a common casing. The casing has a flange at one end for mounting the tachometer generator on the engine, and an electrical connector at the other end for connection to the airplane circuitry.

The propeller RPM displays consists of an analog and digital display for each engine. Prop RPM is a measure of the rotation speed of the propeller.

Prop RPM shall be controlled by the respective engine's propeller lever.

Annunciations:

- Prop RPM is displayed on a semi-circle shaped analog scale.
- The Scale Range and Scale Factor for the Prop Rpm is listed in Limits.
  - Prop RPM scaling is piece-wise linear as listed in Limits.
  - There is a Prop RPM Redline icon with its leading edge at 2000 RPM, the beginning of the Prop RPM Over Limit Scale, with pointer range to 2200 RPM for engine Prop RPM exceedance.
  - The Prop RPM Over Limit Scale, which extends to 190 degrees and ends in a grey terminator, is added to the normal scale whenever Prop RPM is greater than the Prop RPM Transient Limit.
- The Prop RPM Ponter is positioned at the Prop RPM digital value and is the same color as the Prop RPM digital display.
- The Prop RPM ponter flash when the digital readout flashes.
- The pointer is displayed when Prop RPM=>0.
- The Prop RPM Pointer is removed if the Prop RPM digital readout is dashed.
  - Automatic source selection between data sources is provided.
  - L DCU is the priority source for the left engine.
  - R DCU is the priority source for the right engine.
  - Cross-side DCU is the secondary source.

- Onside EDC is the third priority source.

NOTE: Inputs from the cross-side DCU are not independently calculated. These inputs represent the onside DCU's Prop RPM calculation via a different path to the MFD.

- Prop RPM Digital Readout
  - The Prop RPM digital display readout is right justified and allow up to 4 digits and has leading zeros suppressed.
  - The Prop RPM Digital Readout has the same source of data as the Prop RPM analog pointer.
  - Four yellow dashes are displayed if all sources of Prop RPM are Fail, missing or NCD.
  - The grey PROP Legend is displayed between the left and right digital readouts.
  - The Digital Readout flash for 5 seconds when it first turns yellow, it stops flashing if it turns green in less than 5 second time period.
  - The Digital Readout flash for 5 seconds when it first turns red, it continues to flash if it turns yellow within the 5 second time period, but stops flashing if it turns green in that 5 second time period.
- ADF Analog Prop RPM Scale
  - Range is 0 to 2000 RPM for normal scale and is linear.
  - Scale factor fron 0 to <= 2000 is 11.11 RPM for 1 degree of movement.
  - Range and scale is extend to 2200 RPM for over Limit Scale.
  - Scale factor for Over Limit is 20.0 RPM for 1 degree of movement.
  - Analog Pointer Range is the same as the Prop RPM Scale Range
- ADF digital display Range is 0 to 2300 RPM
  - Resolution is 1 RPM
  - Hysteresis is 0.7 x 1 RPM
  - The Prop RPM display use a 0.25 seconds low pass fiter.
  - All ADF Prop RPM Limit values, Redlines, and associated timers, shall be with respect to Prop RPM as Displayed to the Pilot. All Prop RPM Limit is listed in Table 1.
  - Prop RPM is green or white when within the Normal Limit region as indicated in Table 1.
  - Prop RPM is yellow within the Transient Limit region.
  - If Prop RPM exceed the Transient Limit time or if Prop RPM goes into the Redline Limit region, it turn red.
  - If Prop RPM > 2200 it is red and flash continuously.
  - If Prop RPM > 2000 at ADF power up, it is displayed as a red limit.
  - If valid input < 0 RPM, it is processed as Failed.
  - If valid input 2300 RPM, it is processed as 2300 RPM.
  - Prop RPM Normal Limit, Transient Limit, Redline Limit, and timer durations is stored in the ADF. See Table 1 for values.

Table 1:

Parameter	Condition	Normal Limit	Transient Limit Cautionary (Yellow	Redline Limit (Red)
Prop RPM	All	0<= Prop RPM <=600 or 900< Prop RPM <=1300 or 1600< Prop RPM <=1800 (White) 1800< Prop RPM <=2000 (Green)	600< PROP RPM <=900 or 1300< PROP RPM <=1600 or 2000< PROP RPM <=2020 for 15 seconds or less	2000< PROP RPM <=2020 for more than 15 seconds or PROP RPM > 2020 PROP RPM > 2200 is continuous red flashing.

3. Np Indication - Operation

A. The rotor of the tachometer generator is driven by a bevel gearshaft which itself is driven by a bevel gear on the propeller shaft inside the reduction gearbox of the engine. When the rotor is turning, a three-phase signal is induced in the stator and this signal is transmitted to the signal conditioner.

B. The signal conditioner circuitry converts the input signal to the output signals required for the moving coil galvanometer and the analog-to-digital converter. The galvanometer influences a magnetic coupling to transmit a torque, proportional to Np, to the indicating gear mechanism which drives the pointer to indicate Np. The analog-to-digital converter transmits the applicable signal to the display driver for the same indication of Np in digital form.

4. Propeller Low Pitch Annunciation - Description

A. The propeller low pitch annunciation system consists of a plunger-type switch and an amber annunciator captioned L PROP PITCH for the left propeller and R PROP PITCH for the right propeller.

B. The switch is mounted on the engine reduction gearbox so that the plunger is in contact with the propeller reversing lever. The annunciators are located on the annunciator panel on the instrument panel.

5. Propeller Low Pitch Annunciation - Operation

A. During normal (forward thrust) operation of the propellers, the reversing levers are stationary and the low pitch switches are set so that the annunciators remain off.

B. When the reverse mode of operation is selected, the propeller blades move through the fully fine pitch position into the Beta range toward reverse pitch. This blade movement causes the Beta ring on the propeller to move rearward and, because the reversing lever is connected to the Beta ring, the reversing lever also moves rearward. Rearward movement of the reversing lever operates the switch to cause the applicable annunciator to come on and remain on until propeller pitch returns to the fully fine (forward pitch) position when reverse pitch is de-selected.

C. The low pitch switches are set so that the annunciators are on when the propeller pitch is anywhere in the Beta and reverse ranges, and are off when pitch is anywhere between full fine and feather.

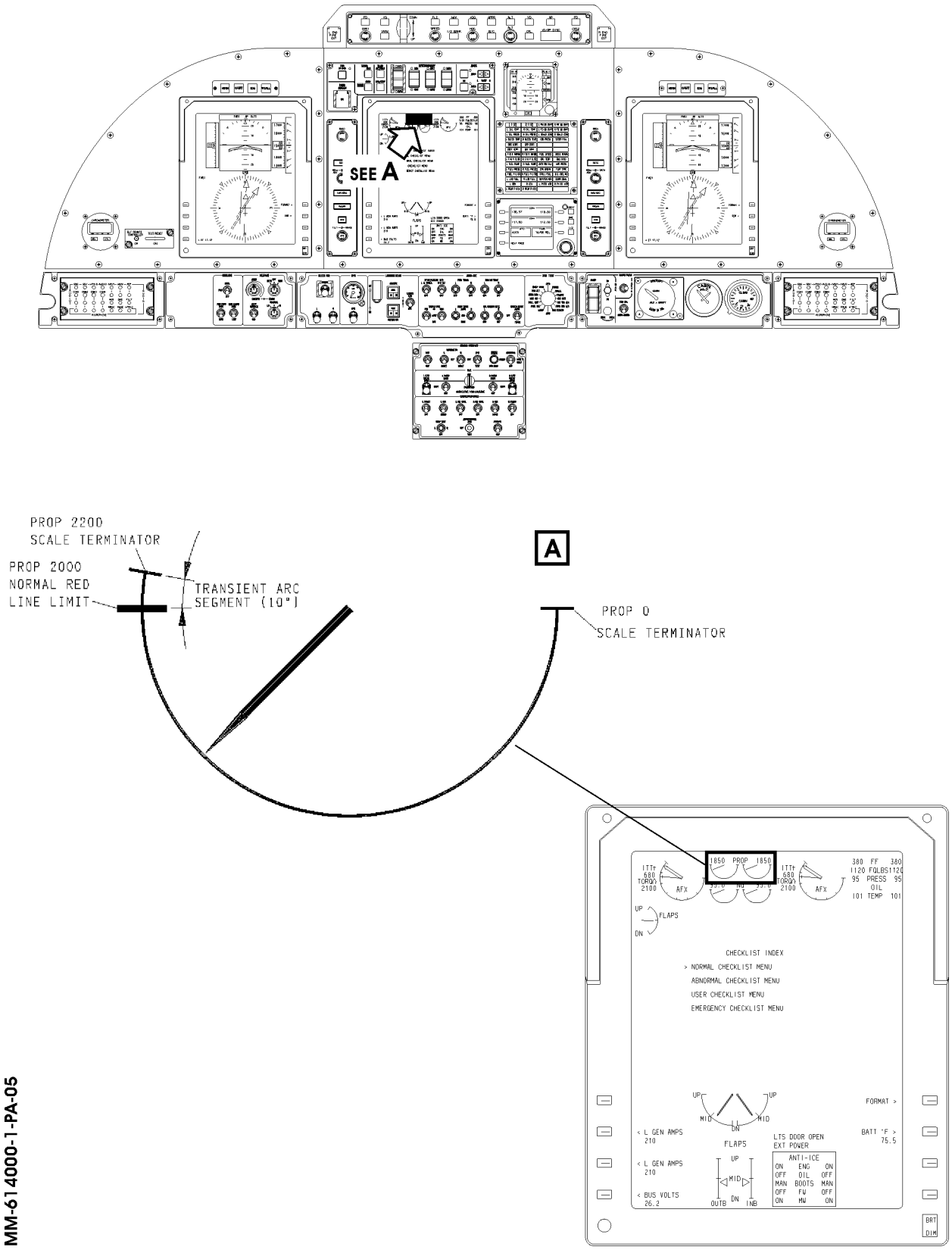


Fig. 1 - RPM Indicating

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INDICATING - MAINTENANCE PRACTICES

1. General

This topic covers the removal and installation of the propeller tachometer generator. Removal and installation of the propeller speed indicator is dealt with in Chapter 77-10-00.

2. Tachometer Generator - Removal (Ref. Fig. 201)

A. Fixtures, Test and Support Equipment

Cover, engine pad	P&WC PK255
Access Platform	3 ft.(1 m)

B. Referenced Information

Maintenance Manual Chapter 54-00-00

C. 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.

(1) Open, tag and safety this circuit breaker:

Pilot CB Panel
L ENG START
(R ENG START)

(2) Remove nacelle panels 430AL and 430AR (440AL and 440AR) (Refer to 54-00-00).
(3) Remove the lockwire and disconnect the electrical connector from the tachometer generator.
(4) Remove the four nuts and washers securing the tachometer generator to its mounting pad.
(5) Remove the tachometer generator from the engine taking care to avoid damaging the drive shaft splines.
(6) Remove and discard the gasket.
(7) Install a cover on the mounting pad.

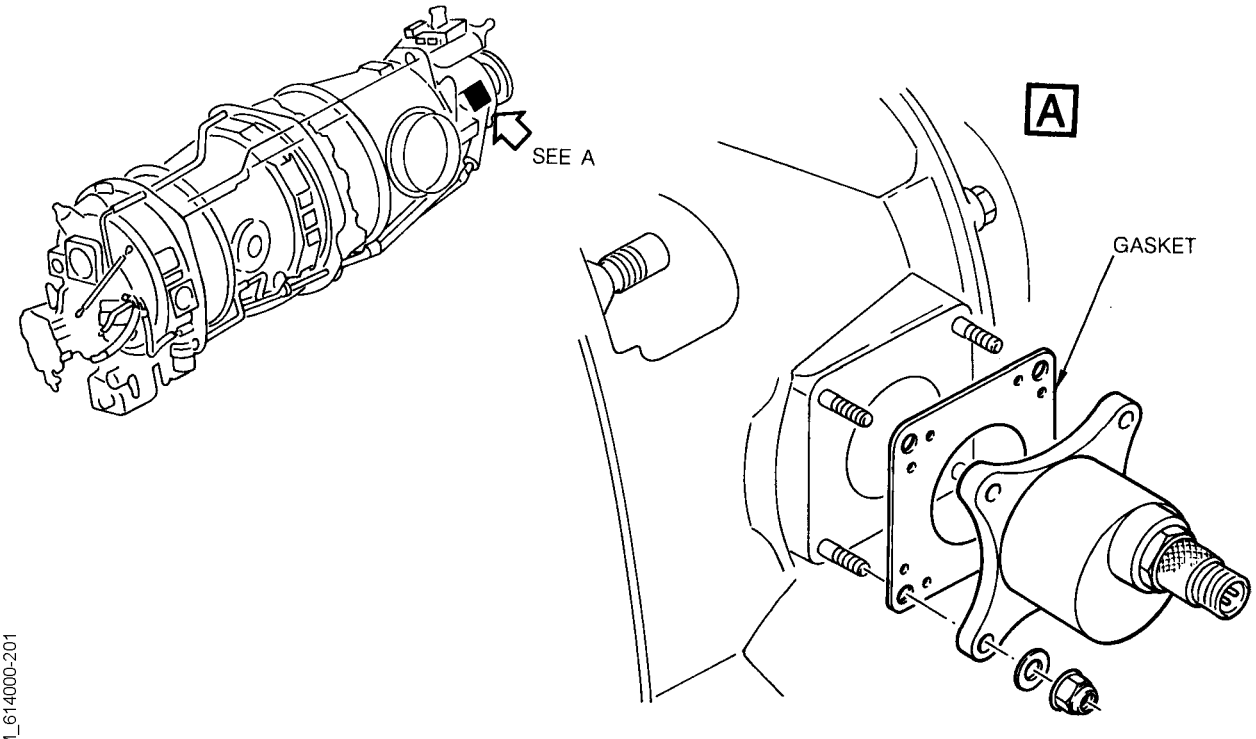

Fig. 201 - Propeller Tachometer Generator - Removal and Installation

3. Tachometer Generator - Installation (Ref. Fig. 201)

A. Tools

Torque Wrench 75-85 lb.in. (8.5-9.6 Nm)	Not specified

B. Expendable Parts

Gasket	MS9134-01

C. Materials

Lockwire	04-008

D. Referenced Information

Maintenance Manual Chapter 54-00-00
Maintenance Manual Chapter 71-00-00

E. Procedure

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) Make sure that:
- the L ENG START (R ENG START) circuit breaker is open, tagged and safetied
- access is available.

(2) Make sure that the tachometer generator base, its drive shaft and electrical receptacle are clean and free from damage.

(3) Remove the cover from the mounting pad and make sure that the pad and its internal drive are clean and free from damage.

(4) Install a new gasket on the pad.

(5) Install the tachometer generator on the pad taking care to avoid damaging the splines of the drive shaft.

(6) Secure the tachometer generator to the pad with the four nuts and washers. Torque tighten the nuts, progressively and diametrically, to between 75 and 85 lb.in. (8.5 and 9.6 Nm) plus the run-down torque applicable to each nut.

(7) Connect the electrical connector to the receptacle and safety the connector with lockwire.

(8) Remove the safety tags and close this circuit breaker:

Pilot CB Panel

L ENG START
(R ENG START)

(9) Ground run the engine (Refer to 71-00-00) and check the operation of the propeller speed indication system.

(10) After the ground run inspect the tachometer generator installation for oil leaks and rectify as necessary.

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

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