CHAPTER

76

ENGINE CONTROLS

CHAPTER 76 - ENGINE CONTROLS
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SPECIAL NOTE

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

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

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

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

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ENGINE CONTROLS - DESCRIPTION AND OPERATION

1. General

This chapter gives description, operation and maintenance practice information for the controls which:

- regulate the power setting of the engines
- regulate the setting of the speed control spring, Beta valve and feathering dump valve of the propeller governor
- regulate the position of the fuel control lever on the fuel control unit (FCU)
- stop the flow of fuel to the engine during normal and emergency procedures.

Additionally, because the two cam switches S94 and S95 are built into the control box assembly and are operated by the POWER LEVERS, the maintenance practices for these two switches are given in this chapter.

The chapter is divided into two main sections, as follows:

76-20-00	Power Control (this section includes propeller and fuel condition control)
76-20-00	Emergency Shutdown (this section consists of a self-explanatory token page).

The Maintenance Practices for the cam switches S94 and S95 are given in their own sub-section 76-11-00.

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POWER CONTROL - DESCRIPTION AND OPERATION

1. General (Ref. Figs. 1 and 2)

   A. The P-180 Avanti is equipped with conventional push-pull manual controls comprising (for each of the two power plants) an engine power output control lever and a combined propeller control and fuel condition lever.
   The manually-operated lever for engine power control is called the POWER LEVER, and the manually-operated lever for propeller control and fuel condition is called the CONDITION LEVER; these levers are mounted together in a control box assembly located on the control pedestal in the flight compartment.

      NOTE: Throughout the text of this chapter, capital letters are used for writing the titles of the manually-operated levers on the control pedestal. This is to avoid any confusion with the other levers (in the control systems) which have the word "power" or "condition" in their titles.

   B. The control box assembly (sometimes called the control lever quadrant or the throttle quadrant) provides the means of mounting the two POWER LEVERS and the two CONDITION LEVERS together on a single pivot shaft; the levers are arranged so that the POWER LEVERS are on the left side and the CONDITION LEVERS on the right.
   The levers project from a slotted plate which is marked to show lever position; this plate is also used for mounting the FLAP position selector switch. Approximately two-thirds of each lever extends upward from the pivot shaft; the tops of the levers incorporate hand grips (knobs) - the POWER LEVER knobs are cylindrical and the CONDITION LEVER knobs are shaped so that, by feel alone, the pilot can differentiate between the POWER and CONDITION LEVERS.
   The LH POWER LEVER knob incorporates a GO AROUND switch and the RH POWER LEVER knob incorporates a GEAR WARNING MUTE switch.
   To make sure that the pilot can operate the GO AROUND switch regardless of the position of the CONDITION LEVERS, the POWER LEVERS are approximately 1.5 inches (35 mm) longer than the CONDITION LEVERS. The control box assembly incorporates two cam switch assemblies (S94 and S95) which are operated by the POWER LEVERS. A lever-linkage, connected to the RH POWER LEVER at a point mid-way between the pivot shaft and the lower end of the lever, operates cam switch S94; similarly, the LH POWER LEVER operates S95. The cam switches are connected to the POWER LEVERS to "tie-in" the lever position (power setting) to the following systems:

      – pressurization (refer to 21-30-00)
      – aural warning (refer to 32-60-00)
      – autofeather (refer to 61-21-00).

   C. The amount of manual force required to move the levers is adjustable by means of a friction control knob located on the left side of the control box assembly. Turning the knob adjusts the pressure on the friction pads installed on the pivot shaft between the levers.

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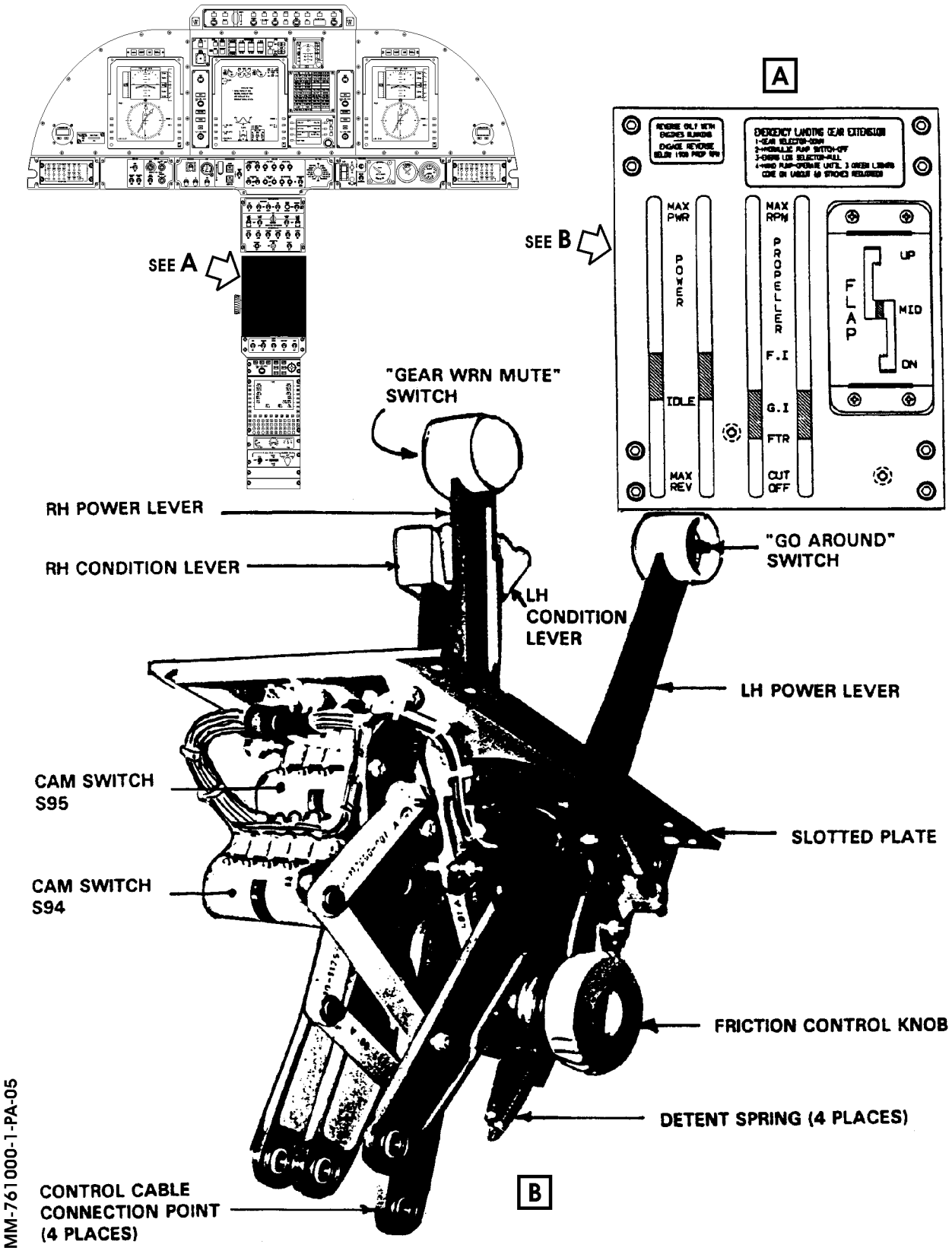

Fig. 1 - Control Box Assembly

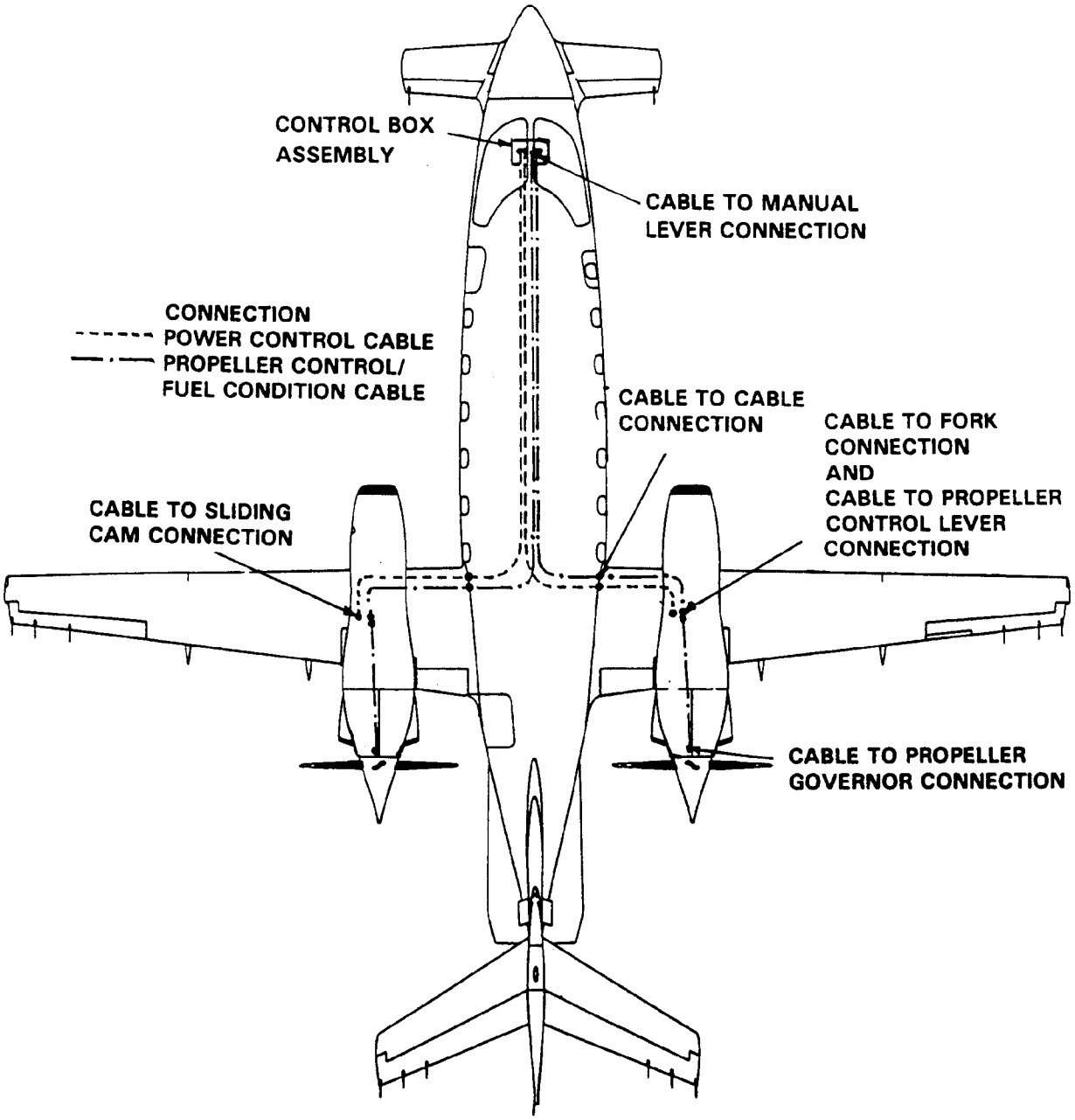

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Fig. 2 - Control Cable Routing and Connection Locations - Schematic

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D. The control cables are attached to the lower ends of the POWER and CONDITION levers and are routed below the passenger compartment floor to the rear bulkhead then out through the fuselage into the wing and up into the nacelle. For ease of maintenance, the cable from each lever to its respective attachment on the engine is in two pieces, with the connection at the wing/fuselage joint.

2. Engine Power Control (Ref. Figs. 3 thru 5)

A. The engine power manual control is called the POWER LEVER and it provides the means of selecting engine power output in the range from IDLE to MAX PWR ("take off"). The POWER LEVER is also used to select propeller reverse pitch position; inadvertent selection of REVERSE pitch is prevented by a gate-type detent, at the lever IDLE position, so that the POWER LEVER must be lifted (against spring force) before it can be moved rearward from IDLE into the reverse (REV) range.

B. The reason for utilizing the POWER LEVER (and not the CONDITION LEVER) for selection of propeller REVERSE is to make sure that engine power output and propeller reverse pitch are matched for maximum efficiency; in this way, selection of an increase in REVERSE pitch also causes an increase in engine power output to maintain propeller speed.

C. Control inputs from the POWER LEVER are transmitted, via a cable and a control extension assembly, to a fuel-control input lever mounted on a cambox assembly located on the engine accessory gearbox.
The fuel-control input lever transmits all POWER LEVER inputs to the control arm of the fuel control unit (FCU) via an interconnection rod; additionally, in the IDLE to MAX REV range the input lever transmits POWER LEVER inputs to the propeller reversing system.

D. The control extension assembly is a unique feature of the P-180 Avanti. The FCU of PT6 engines is designed to produce a certain rate of power response to power control lever movement - the rate of response is lowest in the lower range of power control lever movement and increases as the lever is moved forward from the idle position towards maximum (takeoff) power. This FCU rate of response is suitable for most PT6 engine installations, but for the P.180 Avanti, there is a requirement to have a higher rate of response in the lower range of power lever movement and a decrease in the rate of response in the range from IDLE to MAX PWR - this is to give the pilot a better sense of power response to POWER LEVER movement in the IDLE to MAX PWR range and is achieved by the control extension assembly.

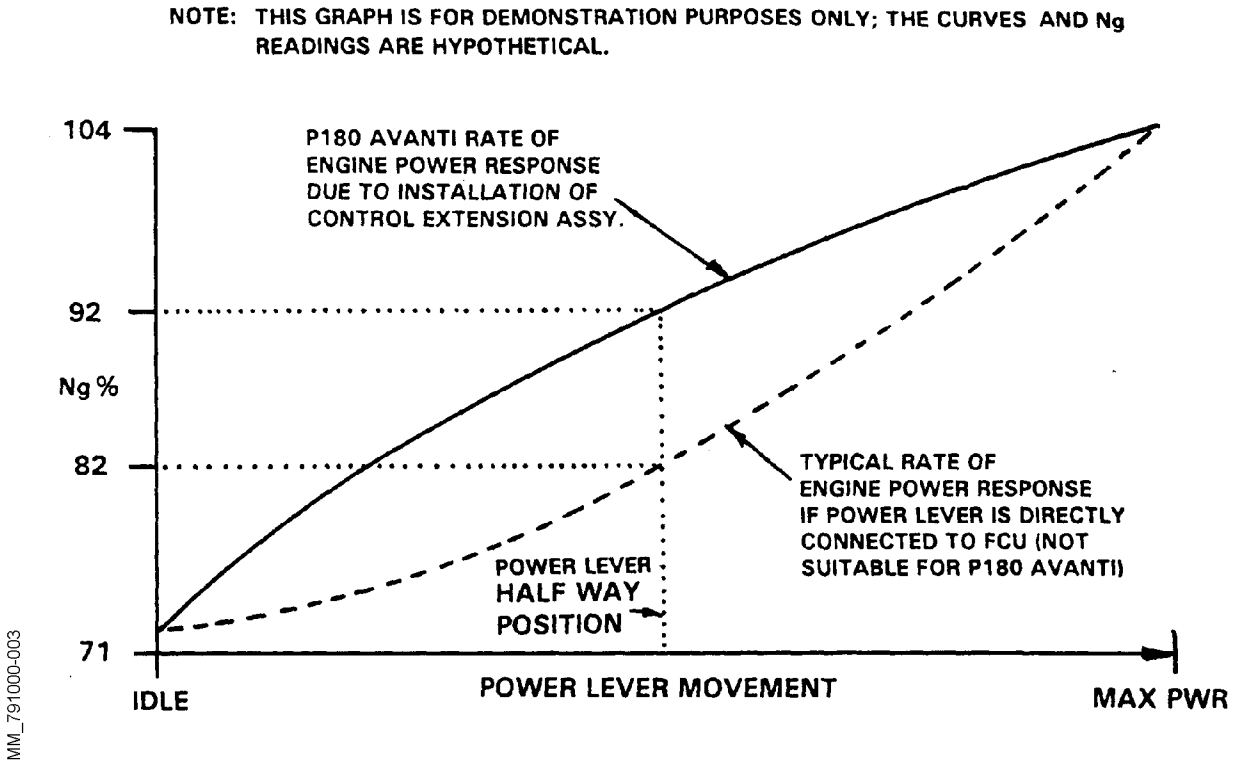

Fig. 3 - Simplified Graph of Engine Power Response

E. The control extension assembly comprises a camslide and support, a sliding cam and an extension lever. The cam, which is connected to the power control cable, moves (in a straight line) on the slide and support in direct proportion to the input from the POWER LEVER. The extension lever, which is bolted to the fuel-control input lever, has a roller at its upper end which rides in the slot of the cam.
The shape of the cam slot is such that there is a high gain section at its upper end, and a low gain section at its lower end. The high gain section is for the IDLE to MAX PWR range, and is shaped so that the speed of angular travel of the FCU control arm starts at a high rate and decreases as the POWER LEVER is moved from IDLE towards MAX PWR. The low gain section is for the IDLE to MAX REV range and is shaped to maintain the ratio between POWER LEVER movement and FCU control arm movement.

F. The fuel-control input lever is pivot-mounted on a bracket/rigging plate which is bolted to the engine accessory gearbox flange. At its lower end, the input lever is bolted to the lower end of the extension lever; the upper end of the input lever is connected to the FCU control arm by a control rod. The input lever incorporates a roller, located between the pivot point and the upper end, which rides in the slot of the propeller control (reversing) cam; the slot has a circumferential section and a radial section so that:

– when the POWER LEVER is in the range between IDLE and MAX PWR, the roller is in the circumferential section of the slot and input lever movement is transmitted to the FCU control arm only, causing no movement of the propeller control cam

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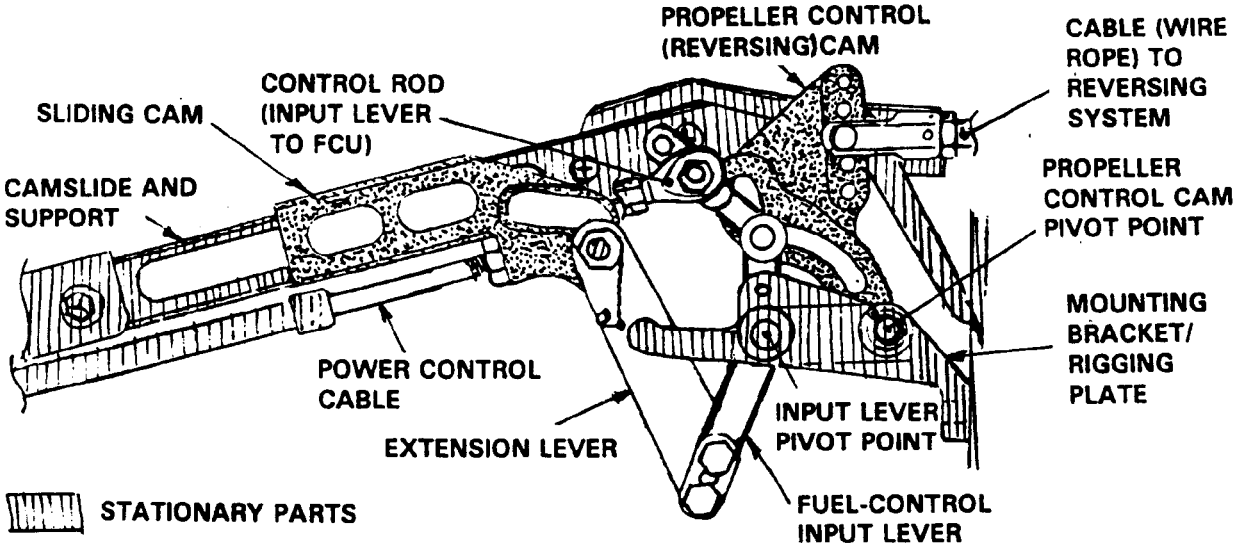

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Fig. 4 - Detail of Control Extension and Cambox Assemblies

– when the POWER LEVER is in the range between IDLE and MAX REV, the roller is in the radial section of the slot and input lever (roller) movement is transmitted to the propeller control cam which transmits the movement to the Beta valve of the propeller governor through a cable (wire rope), rod and lever system. Movement of the input lever is transmitted at the same time to the FCU control arm so that engine power output is matched to the propeller reverse pitch setting.

G. Refer to 73-00-00 of the engine maintenance manual for more details of the engine fuel control system, and to 76-10-00 for more details of the propeller reversing system.

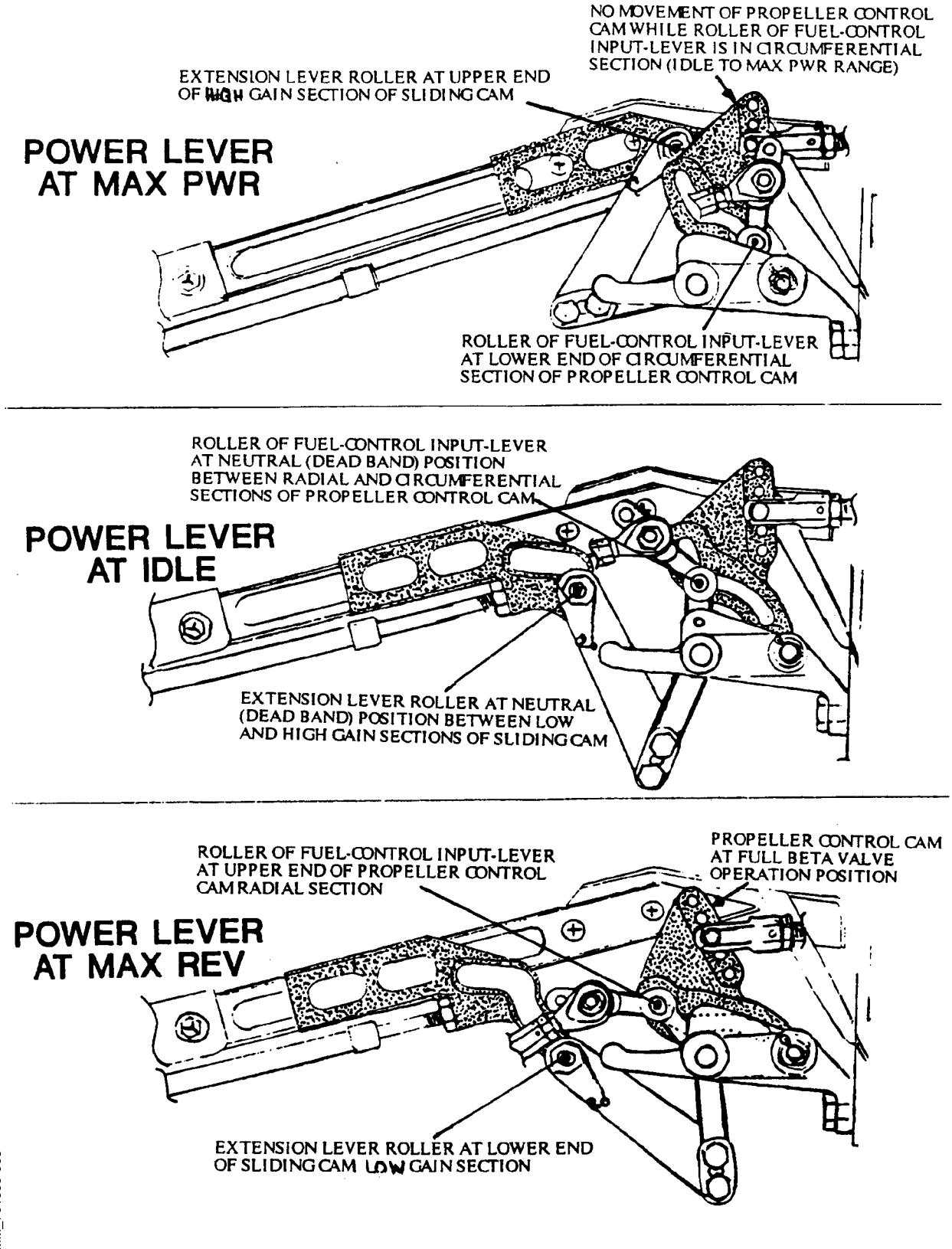

Fig. 5 - Control Extension and Input Lever Operation

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3. Propeller Governor/Fuel Condition Control (Ref. Figs. 6 and 7)

A. The manual lever for control of the propeller governor and fuel condition settings is called the CONDITION LEVER. The CONDITION LEVER provides a means of selecting:

– the cut-off, ground idle and flight idle positions of the fuel condition lever on the FCU
– the feather, ground fine pitch, flight fine pitch and (the range up to) maximum rpm positions of the speed control lever on the propeller governor.

B. In the range between the flight idle and maximum rpm positions, movement of the CONDITION LEVER affects only the speed control lever of the propeller governor; from cut-off to flight idle, CONDITION LEVER movement affects both the speed control lever and the fuel control lever. This single/dual control arrangement is achieved by an inter-acting lever and cam mechanism which is pivot-mounted on a bracket secured to the engine accessory gearbox.

C. The main parts of the cam and lever mechanism are an input lever and a cam lever. The input lever is surmounted by a fork to which the control cable (from the CONDITION LEVER) is attached; the distance between the cable attachment hole of the fork and the input lever is adjustable to allow for minor rigging adjustments. The input lever is directly connected to the speed control lever of the propeller governor by a control cable. The input lever has a cam near its upper end, and a roller at its lower end.

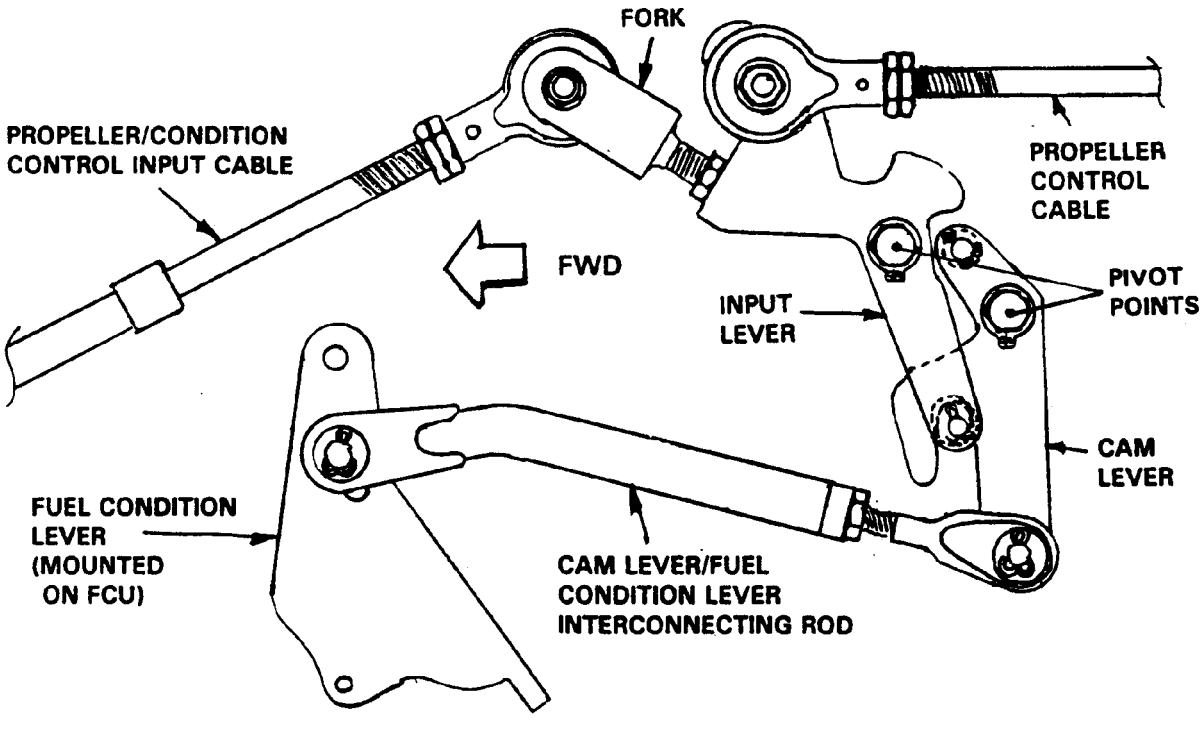

Fig. 6 - Detail of Propeller/Fuel Condition Control Mechanism

The cam lever is directly connected at its lower end to the fuel condition lever on the FCU by a control rod. The cam lever has a roller at its top end and a cam slot located between its pivot point and lower end. In the CONDITION LEVER movement range between CUT-OFF and F.I., the roller of the input lever acts in the cam lever slot to transmit input lever movement to the cam lever and, through the interconnecting rod, to the fuel condition lever.
The cam of the input lever acts on the roller of the cam lever to hold the fuel condition lever at the flight idle position when the CONDITION LEVER is anywhere in the range from F.I. to MAX RPM. The slot of the cam lever is open at its lower end to allow the roller of the input lever to move out of the slot and impart no movement to the cam lever when the CONDITION LEVER is in the F.I. to MAX RPM range.

D. The slotted plate of the control box assembly is marked at five nominated positions as follows:

CUT OFF	–	the fuel control lever on the FCU is positioned to stop all fuel flow from the FCU to the engine fuel gallery
	–	the speed control lever on the propeller governor is positioned to push the plunger of the feathering valve fully in
FTR	–	the fuel control lever is positioned to an initial (incomplete) open setting
	–	the speed control lever is positioned to push the plunger of the feathering valve fully in
G.I.	–	the fuel control lever is positioned to provide for a fuel flow which will give an engine IDLE speed of approx. 54% Ng
	–	the speed control lever is positioned to provide "ground fine" propeller pitch; this gives the propeller a minimum speed setting
F.I.	–	the fuel control lever is positioned to provide for a fuel flow which will give an engine IDLE speed of approx. 71% Ng
	–	the speed control lever is positioned to provide "flight fine" propeller pitch, which gives a higher propeller speed setting than the G.I. position
MAX RPM	–	the fuel control lever remains at the position which provides for an engine IDLE speed of approx. 71% Ng
	–	the speed control lever is positioned to provide "maximum fine" propeller pitch which gives a (maximum) propeller speed of 2000 rpm.

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E. Soft detents (roller in part-cylindrical cut-out) are incorporated at the FTR, G.I., and F.I. positions, to give positive feel of the exact location of these positions. Inadvertent selection of CUT-OFF is prevented by a gate-type detent at the FTR position so that the CONDITION LEVER must be lifted (against spring force) before it can be moved rearward from FTR into the CUT-OFF position.

F. Refer to 73-06-30 of the engine maintenance manual for more details of the fuel condition lever, and to 61-26-31 for more details of the propeller governor. Chapter 61 of this manual also gives more details of the propeller governor.

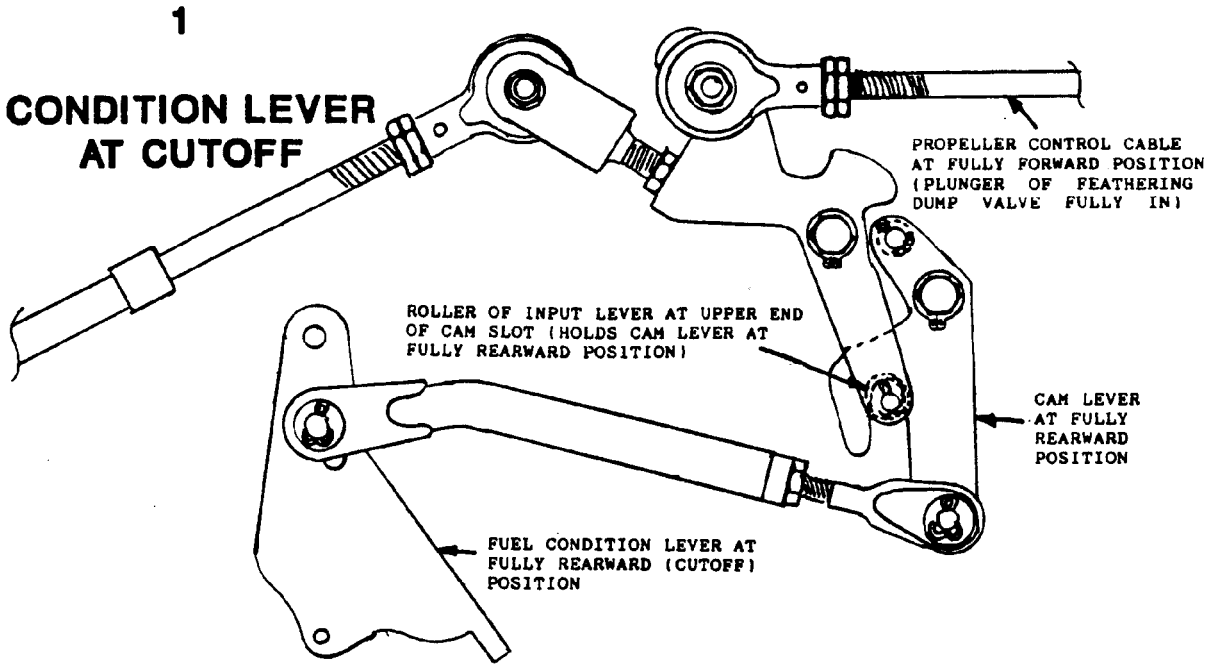

Fig. 7 - Propeller/Fuel Condition Control - Operation (Sheet 1 of 3)

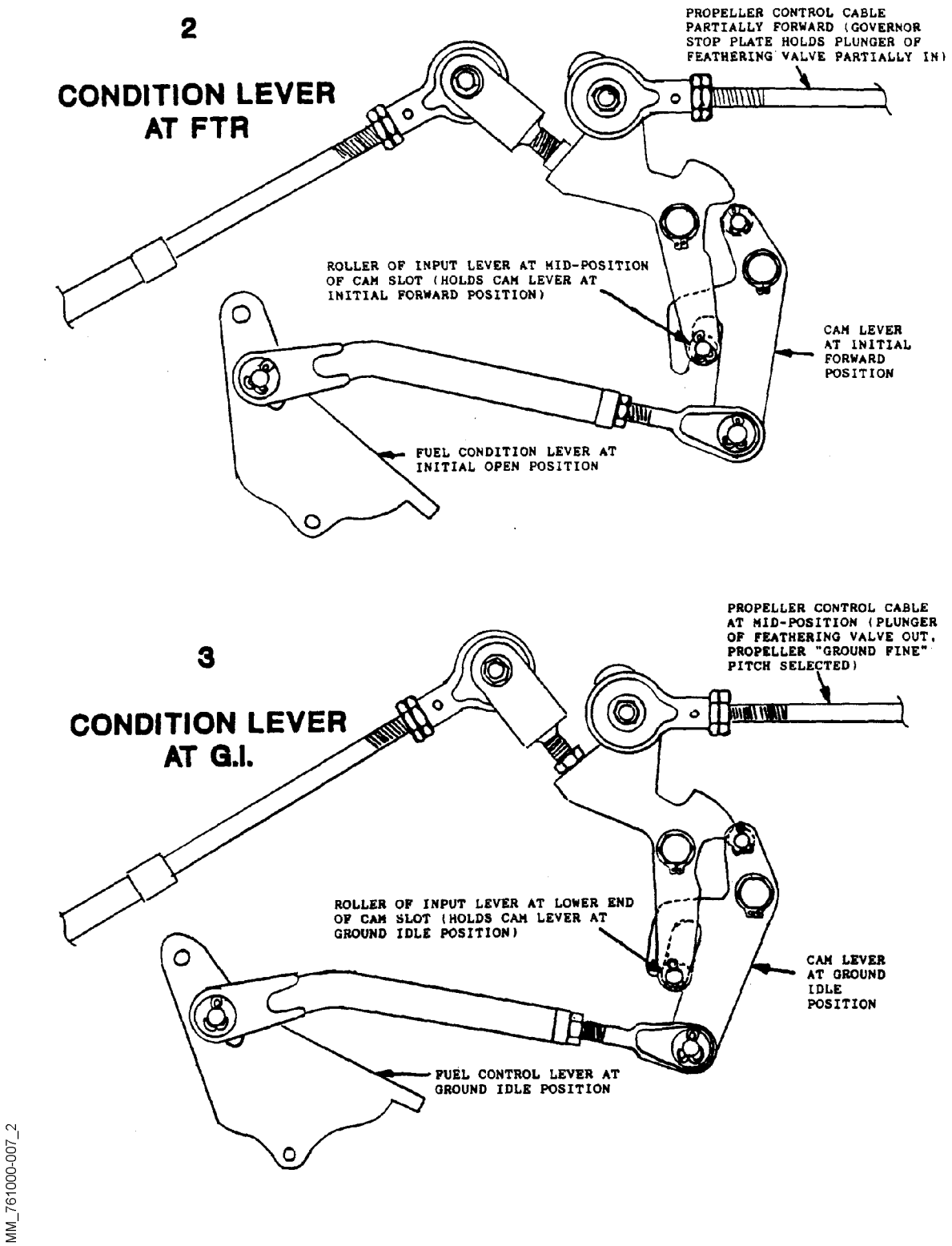

Fig. 7 - Propeller/Fuel Condition Control - Operation (Sheet 2 of 3)

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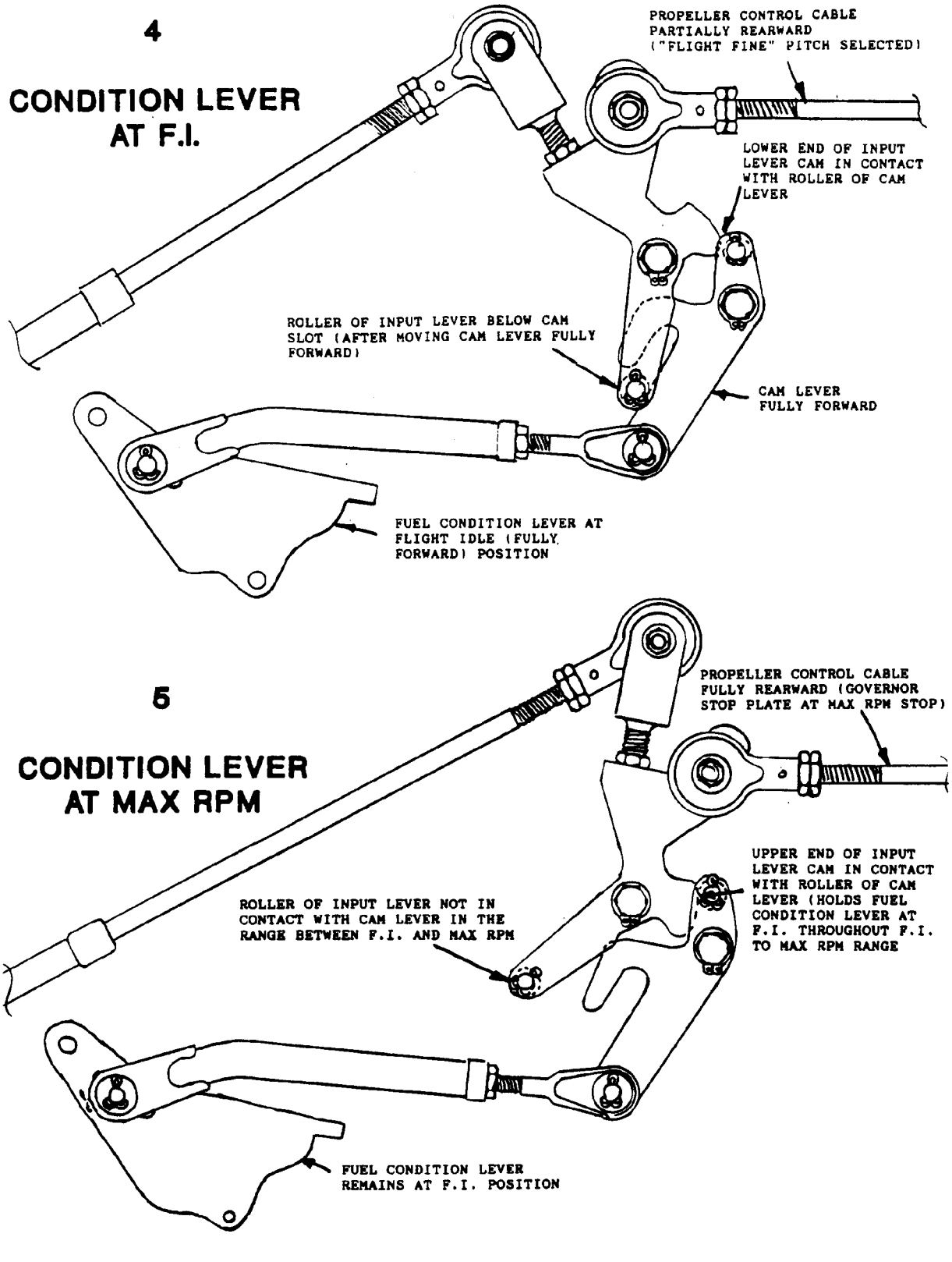

Fig. 7 - Propeller/Fuel Condition Control - Operation (Sheet 3 of 3)

POWER CONTROL - MAINTENACE PRACTICES

1. General

A. This topic gives the rigging procedures for the engine and the propeller control systems. The procedures are given in the form of a list of checks and adjustments which verify the integrity of the individual systems and their correlation with each other.
Part or all of the procedures will be required after replacement of an engine, fuel control unit (FCU) and/or propeller governor and after replacement/disturbance of a control system component. If there is any doubt about which parts of the procedure apply after work has been done on the system, do a complete check of the system.

B. The forward ends of the control cables and the lower ends of the manual levers are accessible through the access panels in the sides of the control pedestal in the flight compartment. The rear ends of the cables and their connecting parts on the engine are accessible by removal of the upper and rear nacelle panels of the applicable engine.

C. Detailed replacement procedures for individual components of the control systems are not given; such work is to be done using standard engineering practices.

2. Standard Rigging Precautions

A. Before disconnecting controls, make a note of the exact position, size and number of attaching parts and make sure that all parts are installed, as noted, when connecting controls. If there is any doubt about the correct arrangement of a connection and the particulars are not illustrated in this section, refer to the engine or airplane Illustrated Parts Catalog (IPC), as applicable, for the correct installation details.

B. Make sure that bolts are installed in the direction illustrated; a bolt installed incorrectly could result in loss of design clearance and cause fouling.

C. Make sure that there is sufficient thread engagement at the ends of clevises, rods and forks by checking that it is not possible to pass a length of small-gage wire through the safety hole.

D. Before you safety items, make sure that controls and levers move freely and smoothly through their full range of travel.

E. To avoid foreign object damage (FOD), remove any loose articles from your clothing before working on the controls.

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3. Control Systems Rigging - Before Engine Run

A. Fixtures, Test and Support Equipment

Access platform (approx. 3 ft/1 m)	Not Specified
Warning Notice	Not Specified
Strip of mm Graph Paper (approx. 6 x 0.6 inch/150 x 15 mm)	Not Specified

B. Tools

Engine Rigging Tool	80-909189-401
Rigging Pin 3/32 inch (2.4 mm) dia.	Not Specified
Rigging Pin 3/16 inch (4.8 mm) dia.	Not Specified
Protractor	Not Specified

C. Materials

Lockwire	04-008

D. Expendable Parts

Cotter Pin (Qty 3 per engine)	MS9245-23
Cotter Pin (Qty 1 per engine)	MS24665-151
Cotter Pin (Qty 2 per engine)	MS24665-88

E. Referenced Information

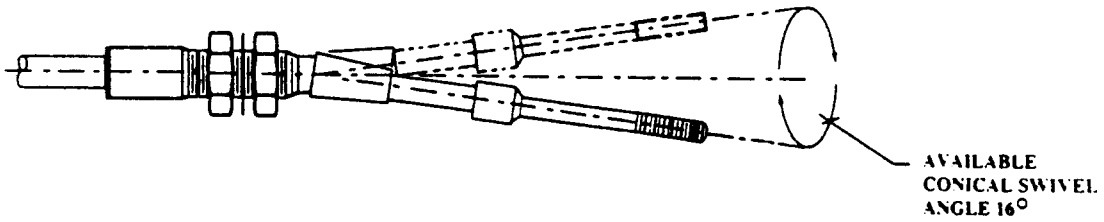
Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 71-00-00
Engine Maintenance Manual 76-10-00

F. Procedure - Control Cables and Manual Levers Installation Checks (Ref. Fig. 201 and 202)

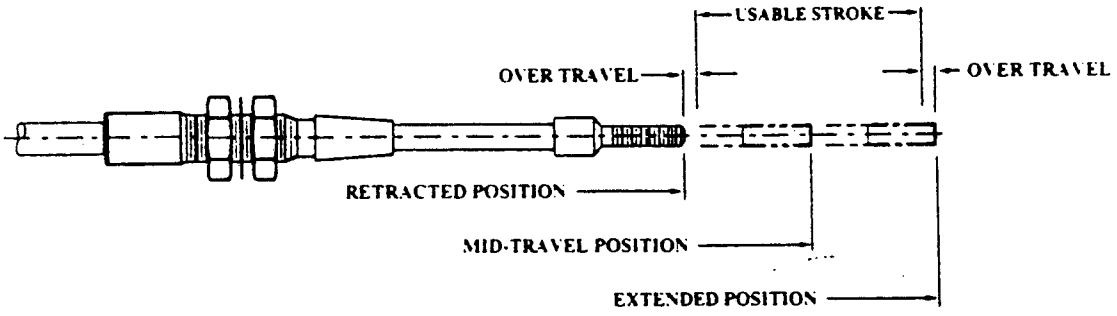
WARNING:
- CABLECRAFT CONTROL CABLES ARE DESIGNED TO BE NON-REPAIRABLE. DO NOT PERFORM ANY REPAIRS TO THESE CONTROL CABLES.
- CABLECRAFT CONTROL CABLES ARE LUBRICATED FOR THE LIFE OF THE CONTROL CABLE. DO NOT REMOVE THE SEALS OR LUBRICATE THE CONTROL CABLE.
- A GRADUAL OR SUDDEN INCREASE IN THE NO-LOAD (CABLE FREE AND UNATTACHED) FRICTION OF A CONTROL CABLE IS A GOOD INDICATION OF PENDING PERFORMANCE PROBLEMS AND/OR CONTROL CABLE FAILURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.
- A GRADUAL OR SUDDEN DECREASE IN THE STROKE (TRAVEL) LENGTH OF THE CONTROL CABLE IS A GOOD INDICATION OF PENDING PERFORMANCE PROBLEMS AND/OR CONTROL CABLE FAILURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.

– CONTROL CABLES WHICH HAVE MOISTURE INSIDE OF THEM OR HAVE FROZEN, MUST BE REPLACED. DO NOT APPLY HEAT TO ATTEMPT TO REMOVE THE MOISTURE. APPLYING HEAT WILL NOT REMOVE THE MOISTURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.
– DO NOT INSTALL THE CONTROL CABLE WITH THE POWER ON OR THE ENGINE RUNNING. SERIOUS INJURY OR DEATH MAY RESULT.

CAUTION:
– CABLECRAFT CABLES ARE DESIGNED TO BE CONTAMINANT RESISTANT; NOT CONTAMINANT PROOF. PROTECT THE CABLE FROM CONTAMINANTS SUCH AS FUEL, OIL, WATER, DIRT AND CHEMICALS WHICH MAY DAMAGE THE CONTROL CABLE.
– PROTECT THE CONTROL CABLE FROM PHYSICAL DAMAGE BY PAINT, KINKING, VIBRATION, ETC., WHICH MAY DAMAGE THE CONTROL CABLE.
– THE SWIVEL ANGLE MUST BE CENTERED WITHIN THE AVAILABLE SWIVEL ANGLE AS SHOWN BELOW:



– THE USABLE STROKE MUST BE CENTERED WITHIN THE AVAILABLE TRAVEL AS SHOWN BELOW:



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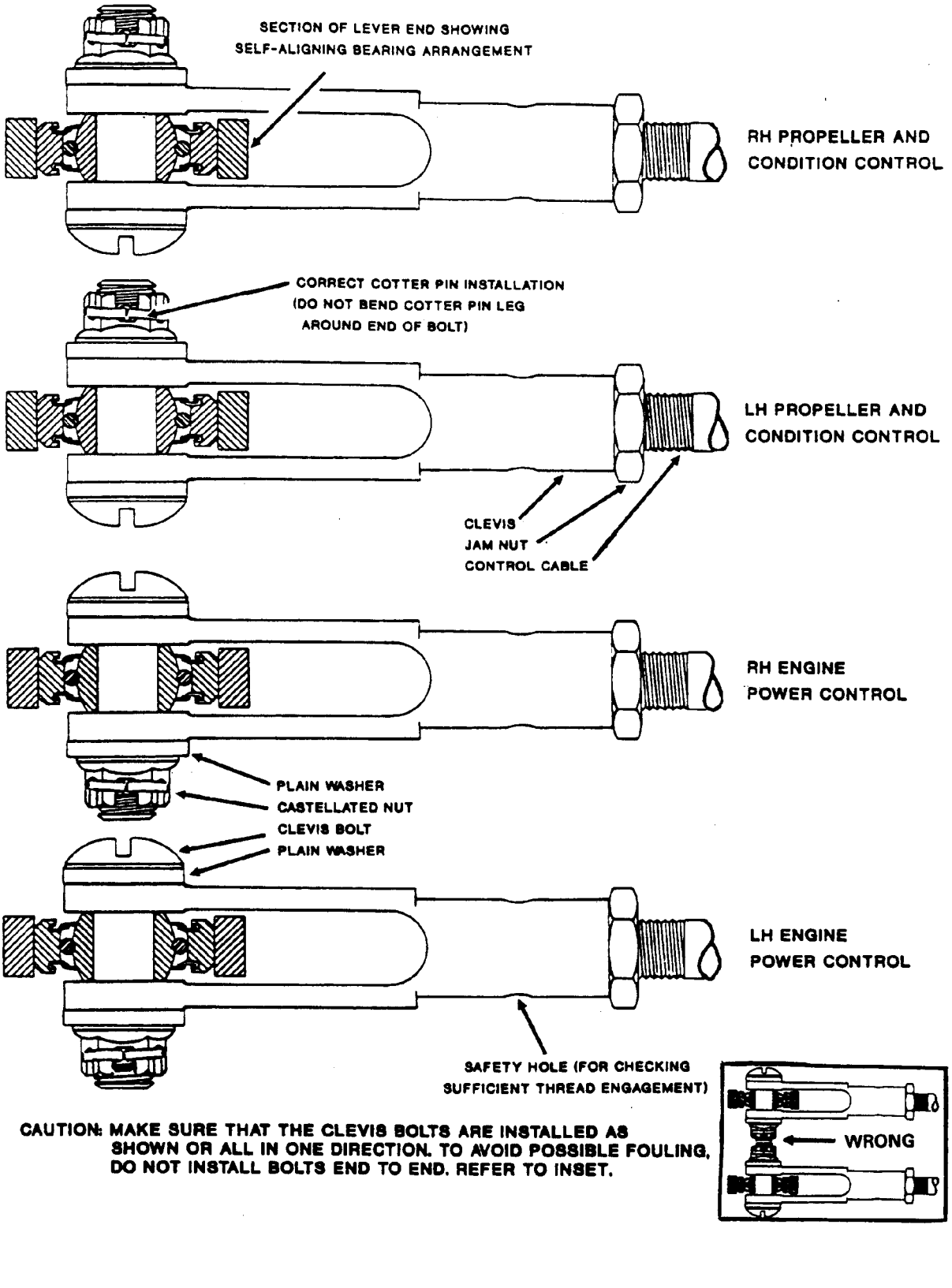

Fig. 201 - Manual Lever/Control Cable Attachment

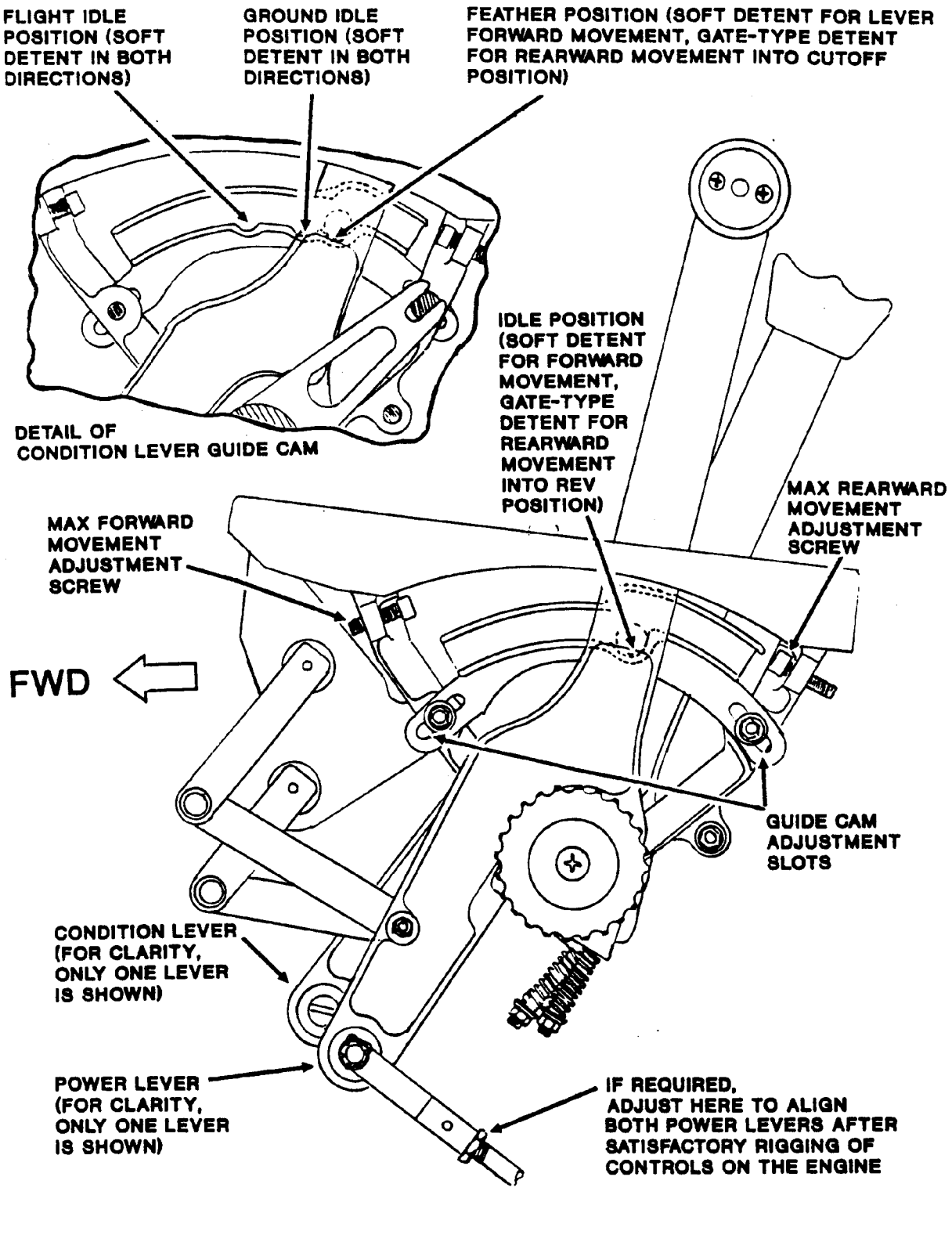

Fig. 202 - Manual Lever Guide Cam and Alignment Details

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

Pilot CB panel:
L ENG START
R ENG START

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

(3) At the accessory gearbox of both engines:
  (a) Disconnect the power control cable at the sliding cam by removing the jam nut nearest the end of the cable. Move the cable end out of the sliding cam lug and temporarily install the jam nut on the end of the cable (to prevent a loose article hazard).
  (b) Disconnect the propeller/condition control input cable at the fork of the control mechanism mounted on the accessory gearbox.
  (c) Position the ends of the cable conduits so that the cable ends will not contact any other item when the cables are moved through their full range of travel. Move the conduits the minimum amount necessary to make sure that the cables will not make contact, then use temporary ties to hold the cables in position.

(4) At the control pedestal in the flight compartment:
  (a) Remove the access panel from each side of the pedestal.
  (b) Examine the four manual lever/control cable connections for proper installation of attaching parts; make sure that the clevis bolts are intalled so that there is no possibility of fouling (refer to the CAUTION in Fig. 201).
  (c) Make sure that there is sufficient engagement of the control cable threaded ends in their respective clevises; check that a piece of small-gage wire will not pass through the safety hole provided in the clevis.
  (d) Turn the friction control knob fully out to minimize manual lever friction.
  (e) Move each of the four manual levers (one at a time) slowly through its full range of travel in both directions. Make sure that (except at the detents) there is no resistance to movement and that movement is constantly smooth for the full range of travel.
  (f) Check that the two POWER LEVERS are in line when both are at the MAX PWR, IDLE and MAX REV positions.
  (g) Check that the two CONDITION LEVERS are in line when both are at the MAX RPM, FTR and CUT-OFF positions.
  (h) If the conditions of the previous two steps are not met, refer to Fig. 202 for adjustment details. It will be necessary to remove the control box assembly to do any adjustments; make sure that the control box assembly is installed and correctly connected to the control cables after adjustment.
  (i) On satisfactory completion of the check for freedom of travel and alignment, set the POWER LEVERS to the IDLE position and the CONDITION LEVERS to FTR.
  (j) Put a warning notice at the manual levers to tell other persons not to move the controls.

G. Procedure - Sliding Cam and FCU Mechanisms Installation Check (Ref. Fig. 203 thru 205)

(1) At the accessory gearbox of both engines:

(a) Disconnect the reversing cable (wire rope) clevis from the propeller control cam and position the cable conduit so that the cable end will not make contact with the propeller cam when the cam moves rearward.

(b) By hand, move the sliding cam slowly through its full range of travel in both directions; make sure that the control extension system, the propeller control cam, and the control arm of the FCU move freely through the full range of travel without excessive backlash.

(c) Do step (b) again three more times, each time increasing the speed of movement to simulate more rapid movement of the POWER LEVER.

(d) If there is any resistance to free travel, especially when the roller of the extension lever is in the high gain (upper) section of the sliding cam, adjust the height of the cam slide and support at its rear end to get free travel of the cam.

NOTE: Adjustment is limited to the small amount of movement possible as a result of manufacturing tolerances of bolt holes, etc. Adjustment is done by loosening the nuts and bolts which secure the rear support bracket to the engine, holding the bracket up or down as required, and tightening the nuts and bolts.
A small amount of adjustment is also available by loosening the two nuts and bolts which secure the slide to the rear support bracket, holding the slide up or down as required, and tightening the nuts and bolts.

(e) Install the rigging tool in the upper section of the sliding cam as shown in Fig. 203.

(f) Move the control input lever clockwise so that the roller of the extension lever makes contact with the rigging tool; at this IDLE position of the control extension assembly make sure that the control input lever is also at IDLE by installing a 3/32 inch (2.4 mm) rigging pin through the rigging plate and into the input lever.

(g) Remove the rigging pin, move the control input lever counterclockwise and remove the rigging tool.

(h) In preparation for alignment of the power control cable and the sliding cam, position the sliding cam at the top of the slide.

(2) At the control pedestal in the flight compartment:

(a) Move the two POWER LEVERS, first to MAX REV, then to MAX PWR and finally back to IDLE.

(b) Make sure that the warning notice which tells other people not to move the controls is placed at the levers.

(3) At the accessory gearbox of both engines:

(a) Remove the temporary tie from the power control cable and remove the jam nut nearest the end of the cable.

(b) Screw the other jam nut fully onto the cable.

(c) Hold the power control cable in position so that the cable end is in line with the hole in the attachment lug of the sliding cam.

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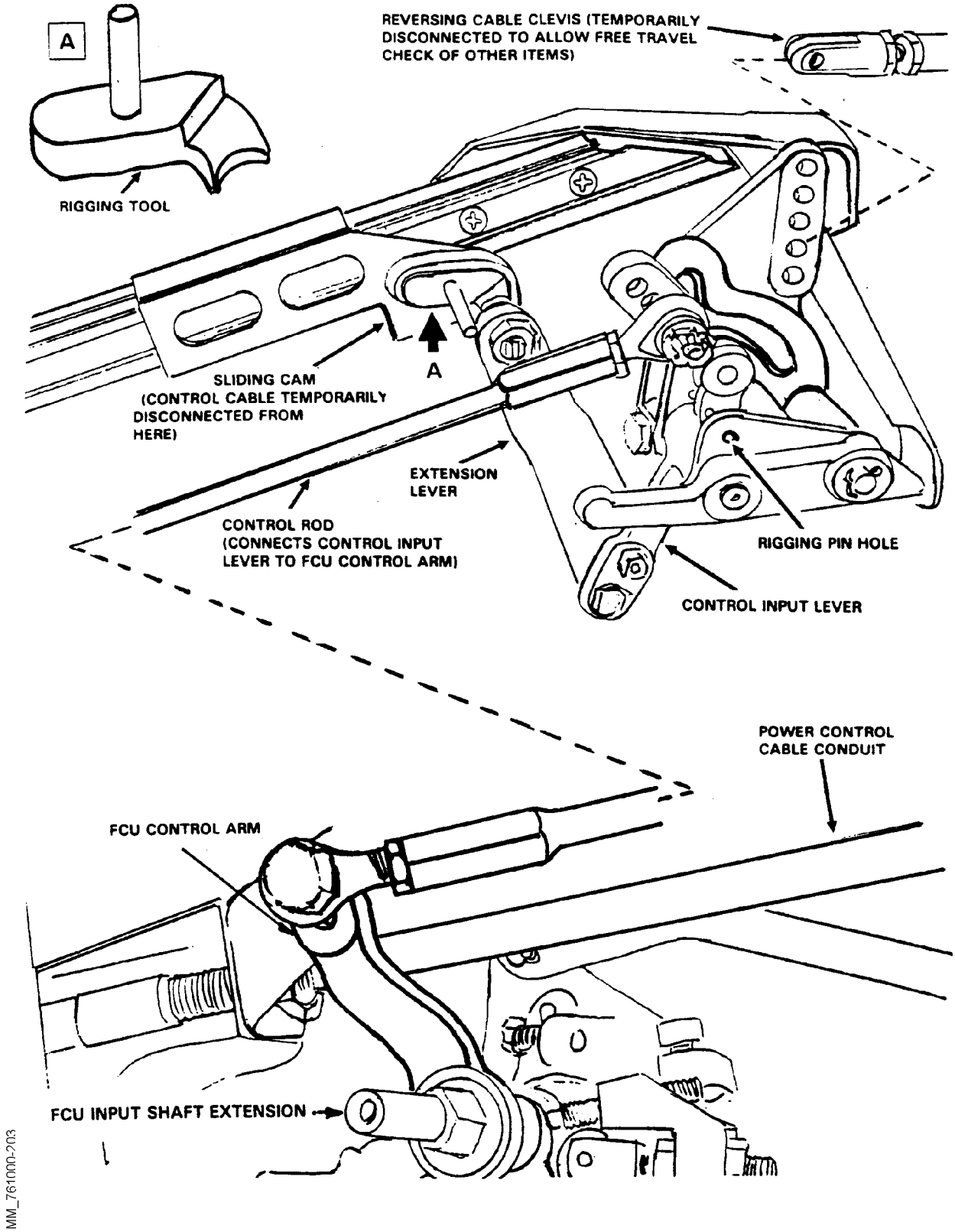

Fig. 203 - Control Extension Free Travel and Idle Position Checks

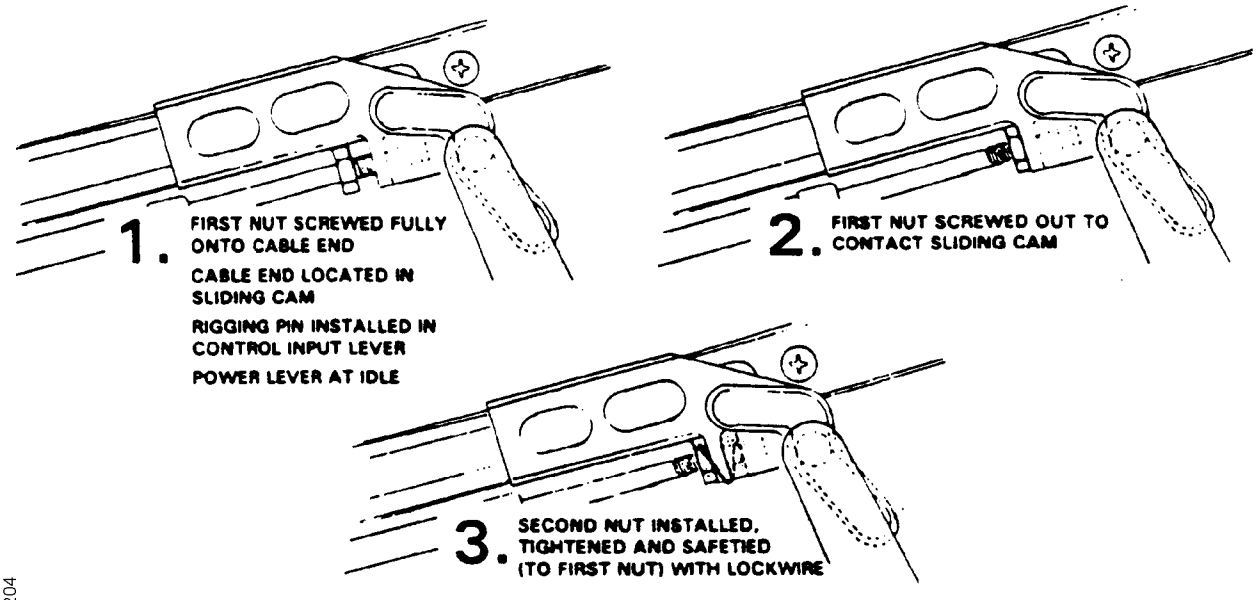

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Fig. 204 - Power Control Cable to Sliding Cam - Attachment Details

(d) Move the sliding cam to the idle position and install the rigging pin through the rigging plate and into the control input lever; at the same time guide the end of the control cable into the attachment lug of the sliding cam.

(e) Check that the end of the cable is located in the attachment lug of the sliding cam so that the threaded part is approximately central in the lug (approx. the same number of threads each side of the lug); if it is, proceed to step (g).

(f) If the cable end is positioned in the lug so that there is not sufficient thread on either side of the lug to allow for proper installation of the two jam nuts plus at least three full threads (for adjustment purposes), adjust as required at one or more of the following places:

- the power cable conduit end at its connection to the support assembly
- the power cable end in the clevis at its connection to the lower end of the POWER LEVER
- the power lever guide cam in the control box assembly.

On satisfactory completion of any adjustments, check again for full and free movement and make sure that there is sufficient thread engagement in clevises, etc.

(g) Screw out the first jam nut until it makes contact with the sliding cam, then install the second jam nut.

(h) Tighten the two jam nuts and safety them, to each other, with lockwire (Ref. Fig. 204).

(i) Remove the rigging pin.

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(4) At the control pedestal, move the POWER LEVERS to the MAX PWR position and back to the IDLE position; at the same time check that the top hole of the propeller control cam moves forward approximately 0.040 inch (1 mm) when the POWER LEVER reaches the IDLE detent.

(5) If necessary, adjust the position of the two jam nuts at the end of the cable until the requirements of step (4) are met.

(6) Set the CONDITION LEVERS of both engines to the CUT-OFF position.

(7) At the FCU control arm, disconnect the control rod that connects the control input lever to the control arm.

(8) Make sure that the rear end of the control rod is connected to the control input lever at the second hole from the bottom.

(9) Measure the control rod length from center to center of the eye ends and adjust as necessary to a length of 8.25 inches (210 mm).

(10) Use a protractor to check that the FCU control arm angular movements are within the following limits (Ref. Fig. 205):

- Ng pickup to MAX PWR . . . . . between 50 and 52 degrees
- Ng dead band. . . . . between 22 and 24 degrees
- Ng pickup to MAX REV . . . . . between 14 and 16 degrees

Refer to the Engine M.M. if control arm motion is outside these limits.

(11) Install the rigging pin through the rigging plate and into the control input lever.

(12) Loosen (by a few threads only) the extension of the FCU input shaft.

(13) Connect the control rod to the FCU control arm (at its outer hole) as shown in Fig. 203.

(14) Apply light pressure on the control rod (in the direction of flight) and position the control arm on the input shaft so that the idle select cam is in contact with the dead band adjustment screw (Ref. Fig. 205). If may be necessary to turn the serrated washer to allow the lever to engage with the shaft at this lever position.

(15) Temporarily tighten, by hand, the extension of the FCU input shaft.

(16) Remove the rigging pin from the input lever/rigging plate.

(17) Set the FCU control arm 6 degrees counterclockwise (into the Ng dead band range) as follows:

(a) Mark the position of the serrated washer in relation to the shaft.

(b) Loosen the extension of the input shaft just enough so that the serrated washer can be moved (turned) without moving any other item.

(c) Move the serrated washer 10 serrations clockwise in relation to the shaft, hold the washer against the shaft (serrations engaged) then move the control arm 6 degrees counterclockwise and engage the serrations of the arm and the washer.

(18) Tighten the extension of the FCU input shaft. Safety the extension to the control arm with lockwire.

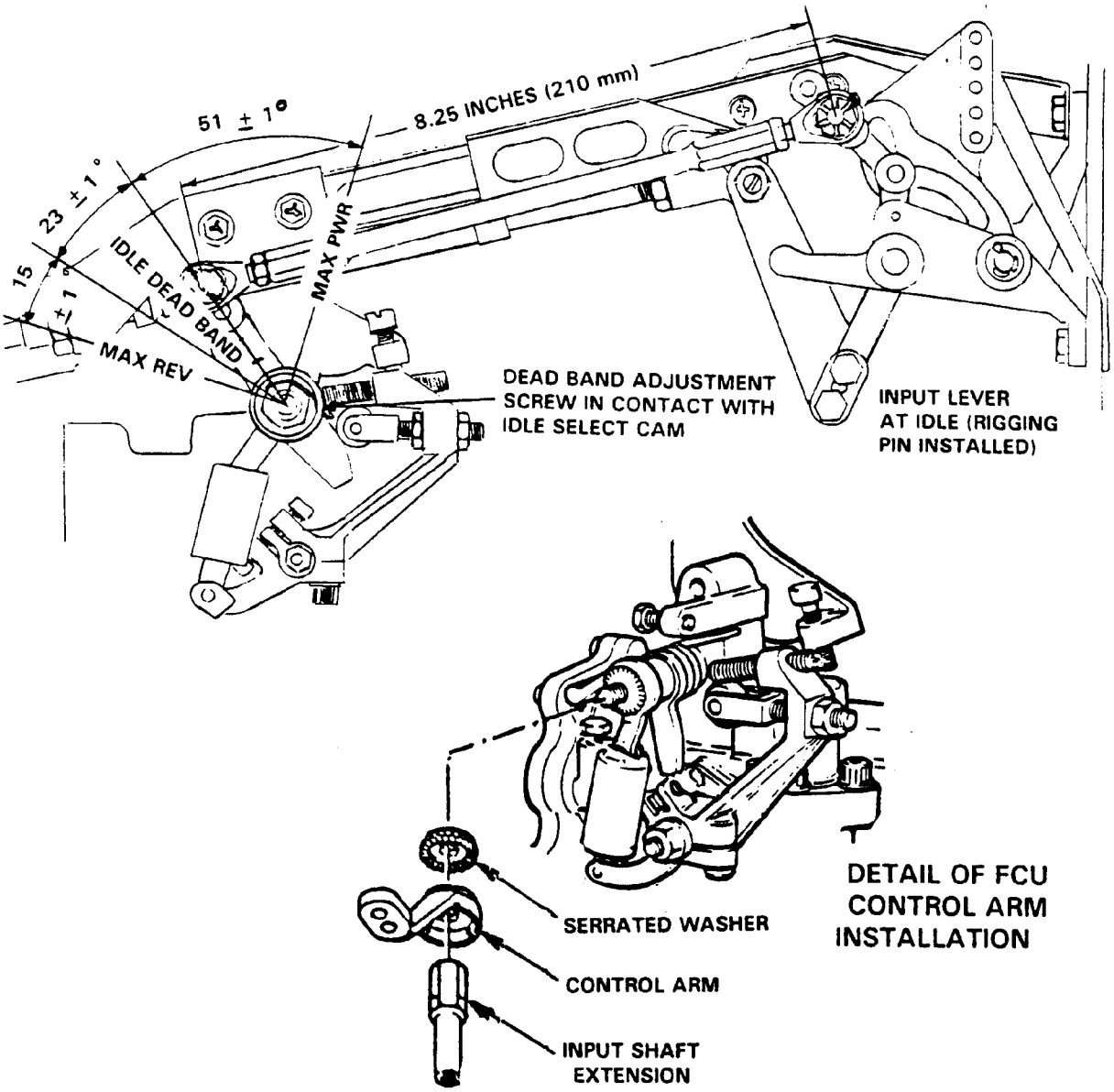

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Fig. 205 - FCU Control Rod and Arm Installation and Motion Details

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H. Procedure - Propeller/Fuel Condition Control Mechanism Installation

(1) Check the engine-mounted mechanism for full and free travel, as follows:

(a) Disconnect the propeller control cable from the input lever of the mechanism. Move the cable end away from the input lever so that when the lever moves through its full range of travel, the cable will not contact the lever; use a temporary tie to hold the cable away from the lever.

NOTE: The check for full and free travel of the propeller/condition control input cables and the CONDITION LEVERS is given in Para. F. The check procedure includes an instruction for the disconnection of the control input cable from the fork, so the input cable will be found disconnected and temporarily tied away from the fork.

(b) Disconnect the interconnecting rod from the fuel condition lever.

(c) Hold the fork with one hand and support the interconnecting rod with the other hand, then move the mechanism through its full range of travel. Make sure that:

– there is no resistance to movement and that movement is constantly smooth for the full range of travel

– the cam lever does not move when the input lever is in the range from FLIGHT IDLE to MAX RPM (this is when the input lever roller is out of the cam lever slot)

– the cam lever clears the fuel pump by at least 0.060 inch (1.5 mm).

(2) Check that the center of the hole in the fork is between 1.319 and 1.358 inches (33.5 and 34.5 mm) from the surface into which it is installed (Ref. Fig. 206). Adjust as required to get the necessary measurement.

(3) Check that the interconnecting rod measures between 5.472 and 5.669 inches (139 and 141 mm) from hole center to hole center (Ref. Fig. 206). Adjust as required to get the necessary measurement.

(4) Connect the interconnecting rod to the fuel condition lever at the second hole from the top; safety the pin with a new cotter pin (Ref. Fig. 206).

(5) Install the 3/16 inch (4.8 mm) rigging pin through the FCU lug and into the elongated rigging hole in the fuel condition lever (Refer to Fig. 206).

(6) Make sure that the two CONDITION LEVERS on the control pedestal in the flight compartment are at the feather (FTR) position.

(7) Connect the propeller/condition control input cable to the fork. Adjust the position of the cable eye-end as required to align the holes of the eye-end and the fork.

(8) Remove the rigging pin.

(9) Set the two CONDITION LEVERS on the control pedestal to the CUT OFF and check at the FCU of each engine that the fuel condition lever is firmly in contact with the cut-off stop. If necessary, adjust the length of the interconnecting rod to get contact.

(10) When the CONDITION LEVERS are at the CUT OFF position and the fuel condition lever is in contact with the cut-off stop on the FCU, check that there is a small gap (minimum 0.08 inch/2 mm) between the manual lever and the rear end of its slot. This makes sure of the required lever "bounce".

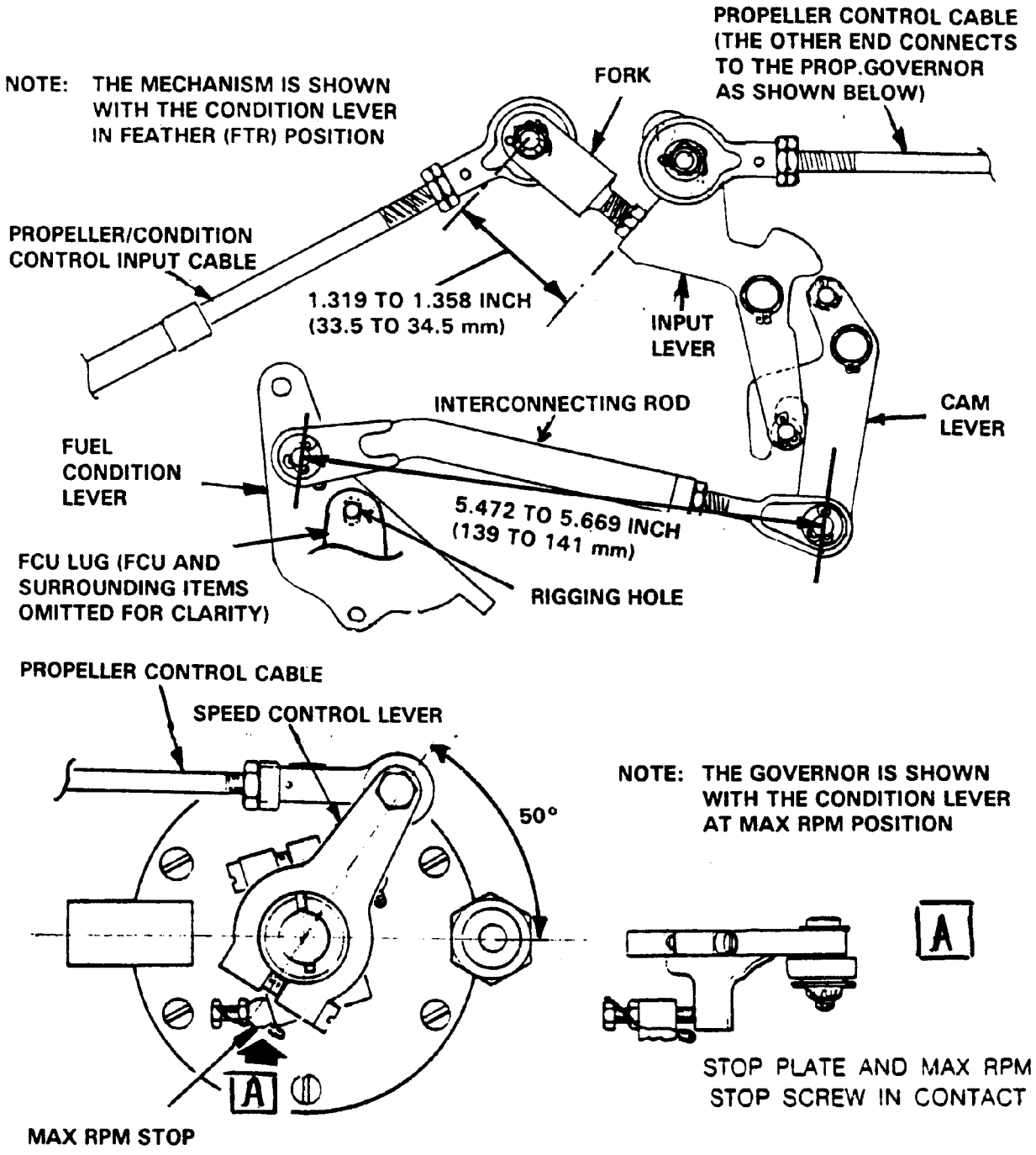

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Fig. 206 - Propeller/Fuel Condition Control Mechanism Installation Details

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NOTE: Lever "bounce" (or "spring-back") is the cushion effect, felt by hand, when the lever is moved slightly past the point at which it causes contact at the applicable stop on the FCU or the propeller governor.

(11) Move the two CONDITION LEVERS on the control pedestal to the MAX RPM position.

(12) Check on the FCU of each engine that there is a gap of 0.275 inch (7 mm) between the dead band adjustment screw and the idle select cam. Adjust the position of the flight idle roller (cam follower) as required to get the correct gap.

(13) Move the two CONDITION LEVERS to the G.I. position and check that the flight idle roller is not in contact with the idle select cam.

(14) Connect the propeller control cable to the input lever at the middle attachment hole as shown in Fig. 206.

(15) Move the two CONDITION LEVERS to the MAX RPM position and check that, on each engine:

- the speed control lever of the propeller governor is 50› from the engine axis
- the stop plate is firmly in contact with the max rpm stop screw.

Adjust the position of the speed control lever as necessary to get the conditions required.

(16) Move the two CONDITION LEVERS back to the CUT OFF position and forward to the MAX RPM position three times and check, when the stop plate contacts the max rpm stop screw, that:

- the support bracket of the propeller/condition input cable (which is bolted to the No. 4 pad of the accessory gearbox) deflects approx. 0.040 inch (1 mm) at its top end
- there is a small gap (minimum 0.080 inch (2 mm) between the manual lever and the forward end of its slot. This makes sure of the required lever "bounce".

(17) Move the two CONDITION LEVERS to the CUT OFF position and check that the cut-off stop on the FCU is contacted by the fuel condition lever without interference from the feather stop on the propeller governor.

NOTE: The feather stop on the propeller governor operates the plunger of the feathering valve. The plunger is fully in when the CONDITION LEVER is at the CUT-OFF position and at the FTR position.

I. Procedure - Power Control System Installation Checks (Ref. Fig. 207)

CAUTION: THIS PROCEDURE INCLUDES AN INSTRUCTION FOR SELECTION OF POWER IN THE PROPELLER REVERSE RANGE. MAKE SURE THAT THE REVERSING CABLE IS DISCONNECTED FROM THE PROPELLER REVERSING CAM AT THE ACCESSORY GEARBOX (REFER TO PARA G. PRECEDING). SELECTION OF REVERSE POWER WHEN THE REVERSING CABLE IS CONNECTED (AND THE ENGINE IS NOT RUNNING) CAN DAMAGE THE LINKAGE OF THE PROPELLER REVERSING MECHANISM.

(1) Install a position scale on the control pedestal between the two POWER LEVERS as shown in Fig. 207. Use adhesive tape to hold the scale in place.

NOTE: For convenience, because of the limited space between the POWER LEVERS, the measurements of POWER LEVER position is done in millimeters only. It is suggested that a strip of mm graph paper or similar, marked at 5 mm intervals, is used as a position scale. The position scale shown on Fig. 207 is printed full size and may be copied and used in place of the suggested strip of mm graph paper on condition that the copy is checked for dimensional accuracy.

(2) Set the two CONDITION LEVERS to the G.I. position.

NOTE: For the following steps it will be necessary to have one person located at the engine in voice contact with the person operating the POWER LEVERS.
If a control arm angle protractor (such as the one made by the Kell-Strom Tool Co., 214 Church Street, Wethersfield, CT 06109, USA) is available, it is recommended that the angular movements of the FCU control arm are measured during this procedure.

(3) Slowly move the left POWER LEVER forward and be ready to stop movement when the forward Ng pickup is reached. This is indicated at the FCU when the dead band screw lifts off the idle cam; when this occurs, the person at the engine should inform the POWER LEVER operator immediately so that POWER LEVER movement is stopped and the LEVER position can be noted and recorded.

NOTE: Fig. 207 includes a suggested format for recording the POWER LEVER position measurements. Do not write on the illustration or mark it in any way. As required, remove the illustration from the binder, copy it and return it to its proper place in the binder.

(4) Stop the movement of the POWER LEVER immediately the forward Ng pickup is reached. Make a note of the POWER LEVER position as indicated on the position scale.

(5) Continue to slowly move the left POWER LEVER forward and be ready to stop the movement when the stop tab of the FCU control arm contacts the max. forward stop.

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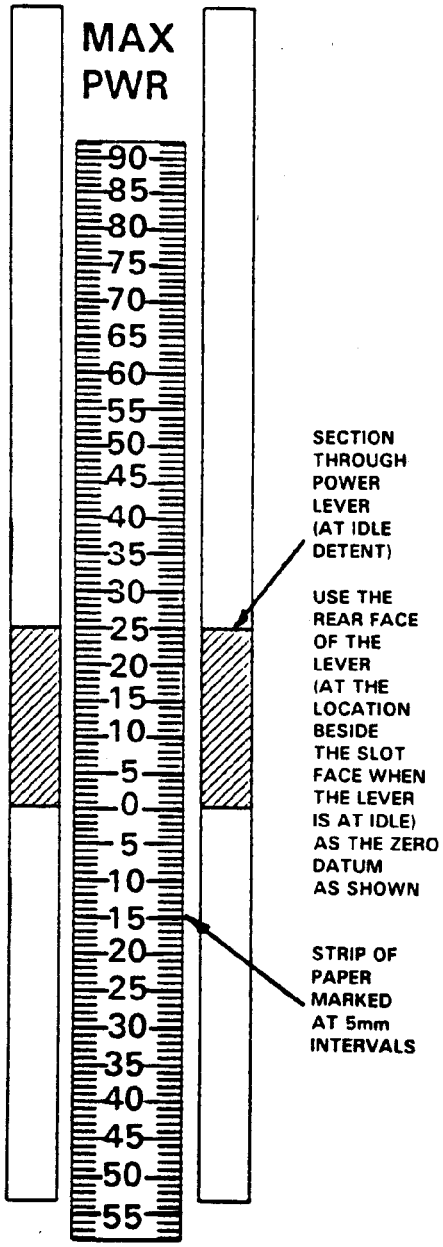

POWER LEVER POSITION MEASUREMENTS				
POWER LEVER POSITION (SEE CODE BELOW)	CONDITION LEVER AT G.I.		CONDITION LEVER AT F.I.	
	LEFT ENGINE	RIGHT ENGINE	LEFT ENGINE	RIGHT ENGINE
A	1 mm	25 mm	9 mm	17 mm
B	2 mm	26 mm	10 mm	18 mm
C	3 mm	27 mm	11 mm	19 mm
D	4 mm	28 mm	12 mm	20 mm
E	5 mm	29 mm	13 mm	21 mm
F	6 mm	30 mm	14 mm	22 mm
G	7 mm	31 mm	15 mm	23 mm
H	8 mm	32 mm	16 mm	24 mm

A = Forward Ng Pickup (deadband screw lifts off idle cam)
B = Max.Ng (FCU control arm stop tab contacts max.forward stop)
C = Start of idle deadband with POWER LEVER moving rearward (engine power stops decreasing before IDLE detent is reached)
D = POWER LEVER position at IDLE detent after moving rearward
E = Reverse Ng Pickup (engine power starts to increase after POWER LEVER has moved rearward through idle deadband)
F = Max.Reverse Ng (FCU stop tab contacts max.reverse stop)
G = Start of idle deadband with POWER LEVER moving forward (engine power stops decreasing before idle detent is reached)
H = POWER LEVER position at IDLE detent after moving forward

NOTE: The boxed numbers show the sequence in which measurements are recorded in accordance with the procedure given.

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Fig. 207 - POWER LEVER Position Scale and Measurements Details

(6) Stop the movement of the POWER LEVER immediately the max. forward stop is reached. Make a note of the POWER LEVER position as indicated on the position scale.

(7) Slowly move the left POWER LEVER rearwards and be ready to stop the movement when the start of the idle deadband is reached.

(8) Stop the movement of the POWER LEVER immediately the start of the idle deadband is reached. Make a note of the POWER LEVER position.

(9) Continue to slowly move the left POWER LEVER rearward until the IDLE detent is reached. Make a note of the POWER LEVER position.

(10) Slowly move the left POWER LEVER up (to release the detent) and rearwards and be ready to stop the movement when the reverse Ng pickup is reached.

(11) Stop the movement of the POWER LEVER immediately the reverse Ng pickup is reached. Make a note of the POWER LEVER position.

(12) Continue to slowly move the left POWER LEVER rearwards and be ready to stop the movement when the stop tab of the FCU control arm contacts the max. reverse stop.

(13) Stop the movement of the POWER LEVER immediately the max. reverse stop is reached. Make a note of the POWER LEVER position.

(14) Slowly move the left POWER LEVER forward and be ready to stop the movement when the start of the idle deadband is reached.

(15) Stop the movement of the POWER LEVER immediately the start of the idle deadband is reached. Make a note of the POWER LEVER position.

(16) Continue to slowly move the left POWER LEVER forward until the IDLE detent is reached. Make a note of the POWER LEVER position.

(17) Set the two CONDITION LEVERS to the F.I. position and do steps (3) thru (16) again, once with the left POWER LEVER followed by the right POWER LEVER.

(18) Set the two CONDITION LEVERS to the G.I. position and do steps (3) thru (16) again with the right POWER LEVER.

(19) On satisfactory completion of the POWER LEVER position measurements on both engines at G.I. and F.I., examine the results and check:

- that there is at least 1.5 mm deadband forward of the IDLE position when the POWER LEVER is moved rearward from forward settings (measurement C on Fig. 207).
  If measurement C is less than 1.5 mm, do steps (6) thru (18) of Para. G. again
- symmetry of deadband starting positions, Ng pickups in forward and reverse, and max Ng stops
- that FCU control arm angular movements (if measured) correspond to the angles measured in step (10) of Para. G.

NOTE: It is not necessary to correct any asymmetry at this time unless substantial differences are noted; asymmetry will be corrected as required after engine runs. Do not remove the position scale at this time, the same scale can be used during the engine runs after rigging.

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J. Procedure - Beta Control Mechanism Installation Check (Ref. Fig. 208)

(1) On both engines:

(a) Disconnect the rear clevis of the reversing push-pull cable (wire rope) from the propeller reversing lever; make sure that the sleeve spacer (bushing) in the lever does not drop out. Use a temporary tie to secure the spacer in the lever end.

(b) By hand, move the cable its full range of travel in both directions and check that full travel is at least 1 inch (25.4 mm).

(c) Connect the front clevis of the reversing cable to the propeller control at the second hole from the bottom. Safety the pin and washer with a new cotter pin.

(2) At the control pedestal, set the two POWER LEVERS at a position approximately half-way between IDLE and MAX PWR (mid-forward position).

(3) On both engines:

(a) Check that, when the rear clevis of the reversing cable is connected to the reversing lever, the slot face of the beta valve clevis and the rear face of the beta valve cap-nut are in line (flush). Refer to Fig. 208.

(b) If necessary, adjust at the reversing cable rear clevis to achieve the requirements of step (a) preceding. After any adjustment, make sure that there is a sufficient amount of the threaded cable end in the clevis by checking through the safety hole provided; if there is not, adjust as required at the front clevis until satisfactory. Safety the connection with a new cotter pin.

(c) Make sure that the interconnect rod of the air bleed reset lever and the push-pull control is correctly installed as shown in Fig. 208.

(d) Measure the gap between the inner and outer parts of the interconnect rod. The gap must be 0.7 mm (0.028 inch); adjust the length of the rod as necessary to achieve the correct gap.

(4) At the control pedestal, move the two POWER LEVERS back to the IDLE detent.

(5) Check at the beta valve on the propeller governor that the clevis slot face is approx. 0.020 inch (0.5 mm) below the rear face of the cap

NOTE: The clevis of the beta valve moves approx. 0.020 inch (0.5 mm) into the valve as a result of the small amount of forward movement of the propeller control cam when the POWER LEVER reaches the IDLE position. This part of the rigging was established in Para. G., step (4).

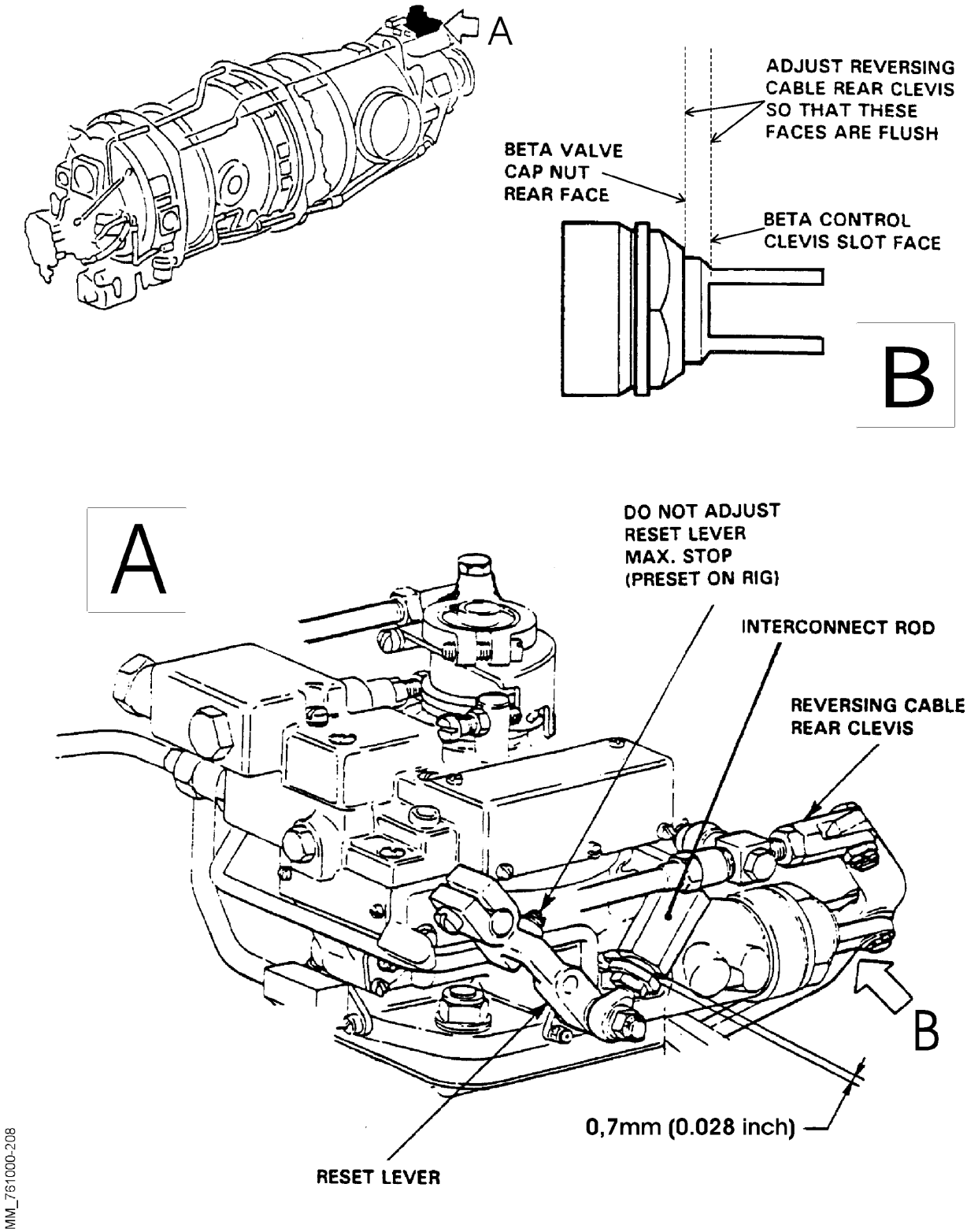

Fig. 208 - Beta Control Mechanism Installation Details

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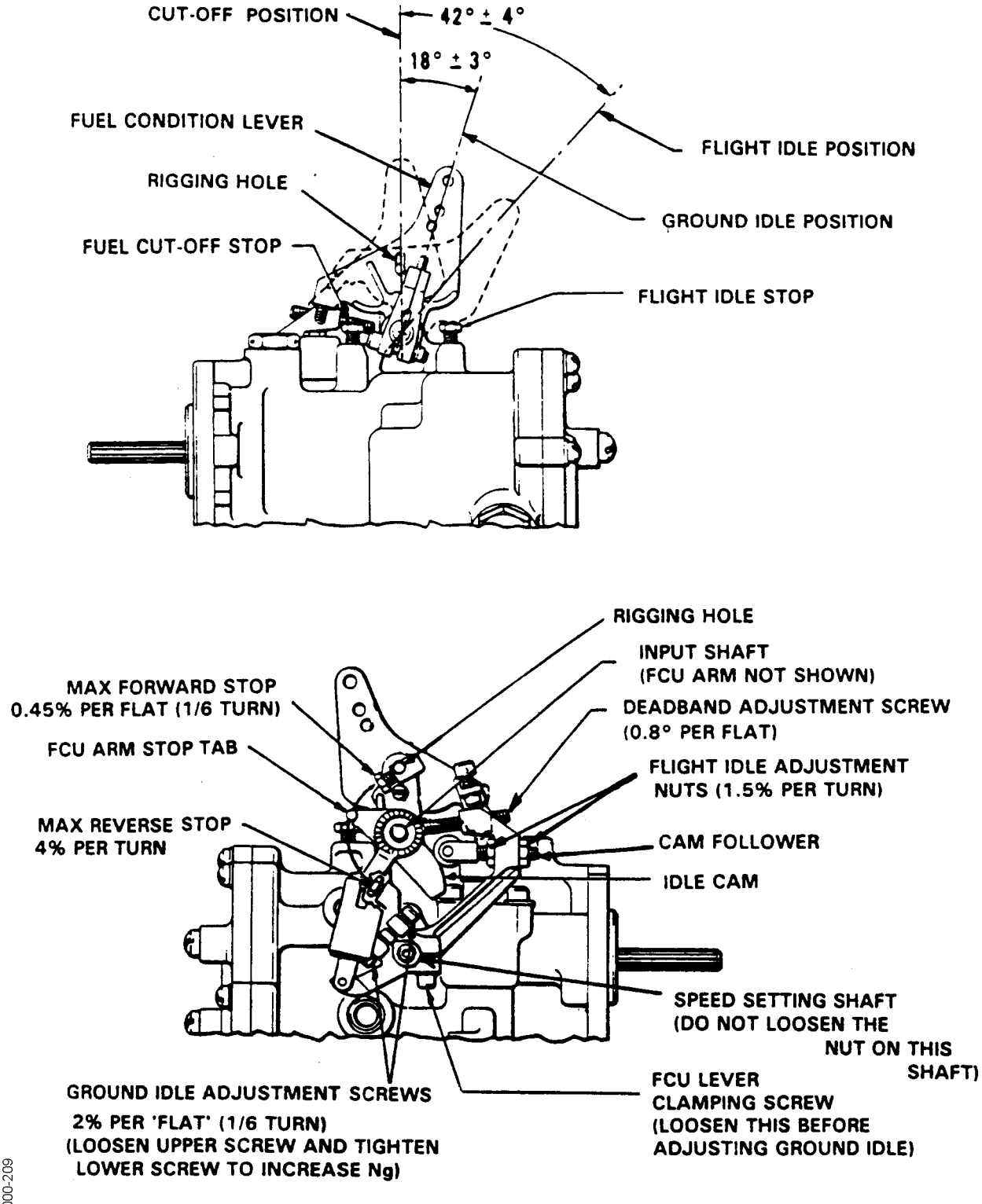

Fig. 209 - Fuel Control Unit Adjustment Locations

4. Control Systems Rigging - Engine Running Procedures

A. Referenced Information

Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 71-10-00
Engine Maintenance Manual Chapter 73-16-33

B. Preparation for Engine Running

(1) Check that all required rigging before engine run has been done (Ref. Para. 3).
(2) Check that all parts of the engine controls are secure and safetied with cotter pins or lockwire as applicable.
(3) Refer to 71-00-00, Page Block 501, for the safety precautions, limitations, emergency procedures, starting faults and preparation for ground running.

NOTE: The preparation for ground running detailed in 71-00-00 includes an instruction for checking the security of the nacelle panels but, for the following motoring and idle run procedures, nacelle panels 410AT, 430AL, 430AR, 420AT, 440AL and 440AR may remain off.

C. Procedure - Engine Motoring Run

NOTE: This procedure is applicable to both engines. Do the motoring run first on one engine (left or right) then the other.
The purpose of the engine motoring run is to check for correct operation of the fuel cut-off valve in the FCU. On a new engine the motoring run also serves to:
- depreserve the engine fuel system
- check the starter for correct operation
- check for correct indication of gas generator speed (Ng), fuel flow (Wf) and oil pressure.

(1) Disconnect the fuel inlet line at the flow divider and purge valve (Refer to 73-16-33 of the engine M.M. for details).
(2) Attach a suitable hose to the fuel inlet line and place the free end of the hose in a container, ready to collect the fuel drained during this procedure (approx. 0.5 liter per test cycle).
(3) Do a wet motoring run as detailed in 71-00-00, Page Block 501, Para. 9. During this procedure:
- set the CONDITION LEVER to GI for 20 seconds instead of the 10 seconds specified
- check that the fuel drained toward the end of the cycle is free of air and preservative oil
- check that fuel stops flowing when the CONDITION LEVER is moved to the CUT OFF position
- check that indications of Ng, Wf and oil pressure are normal.

(4) On satisfactory completion of the wet motoring runs, remove the hose and container from the vicinity of the airplane.
(5) Connect the fuel inlet line to the flow divider and purge valve (Refer to 73-16-33 of the engine M.M.).

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D. Procedure - Engine Idle Run

NOTE: The purpose of the engine idle run is:

- to check for correct operation of the condition control system and make any necessary final adjustments
- to set the correct idle speeds in accordance with the ambient atmospheric conditions
- to verify the idle deadband location according to POWER LEVER position
- to verify correct operation of the propeller low pitch switch.

(1) Start both engines as detailed in 71-00-00, Page Block 501, Para. 12, CHECK 1.

(2) Do an engine idle speed check on both engines as detailed in 71-00-00, Page Block 501, Para. 12, CHECK 2.

(3) Starting at the IDLE position, move the POWER LEVER of the LH engine slowly forward and be ready to stop the movement at the moment when Ng starts to rise above the stabilized idle Ng.

(4) Stop the forward movement of the POWER LEVER immediately the Ng starts to rise and make a note of the POWER LEVER position according to the position scale.

(5) Move the POWER LEVER back to the IDLE position and check that Ng returns to the same stabilized reading as before.

(6) Move the POWER LEVER up (to clear the IDLE detent), then slowly move it rearward and be ready to:

- check that the applicable PROP PITCH annunciator comes on and remains on when the POWER LEVER is in the reverse range
- stop the movement at the moment when Ng starts to rise above the stabilized idle Ng.

(7) Stop the rearward movement of the POWER LEVER immediately the Ng starts to rise and make a note of the POWER LEVER position according to the position scale.

(8) Move the POWER LEVER back to the IDLE detent position and check that:

- Ng returns to the same stabilized reading as before
- the applicable PROP PITCH annunciator goes off and remains off when the lever is at the IDLE position.

(9) Check the feathering and unfeathering positions of the CONDITION LEVERS as follows:

(a) Slowly move the CONDITION LEVER of the LH engine rearward to the FTR position and check that the propeller starts to feather just before the FTR detent is reached.

(b) Slowly move the CONDITION LEVER forward to the GI position and check that propeller unfeathering is complete before the GI detent is reached.

(10) Do steps (3) thru (9) for the POWER and CONDITION LEVERS of the RH engine.

(11) Shut down both engines (Refer to 71-00-00, Page Block 501, Para. 12, CHECK 12); during the shutdown procedure check that the engine starts to shut down just before the CONDITION LEVER reaches the end of its rearward travel.

(12) Adjust idle speed as necessary (Refer to 71-00-00, Page Block 501, Para. 12, CHECK 2).

(13) Adjust condition/propeller controls as necessary to correct any feathering/ unfeathering or cut-off position differences.

NOTE: There is no need to make any adjustments to the power control mechanism at this time.

(14) Compare the idle deadband position measurements noted in steps (4) and (7) with the measurements noted in steps (4) and (11) of Para. I of this topic. The two POWER LEVER forward measurements (forward Ng pickup positions) must be within 1 mm of each other, and the two POWER LEVER rearward measurements (reverse Ng pickup positions) must be within 1 mm of each other.

(15) Adjust the plunger of the propeller low pitch switch as necessary to comply with the requirements given in Fig. 211.

(16) After adjustment, do the idle run again until results are satisfactory.

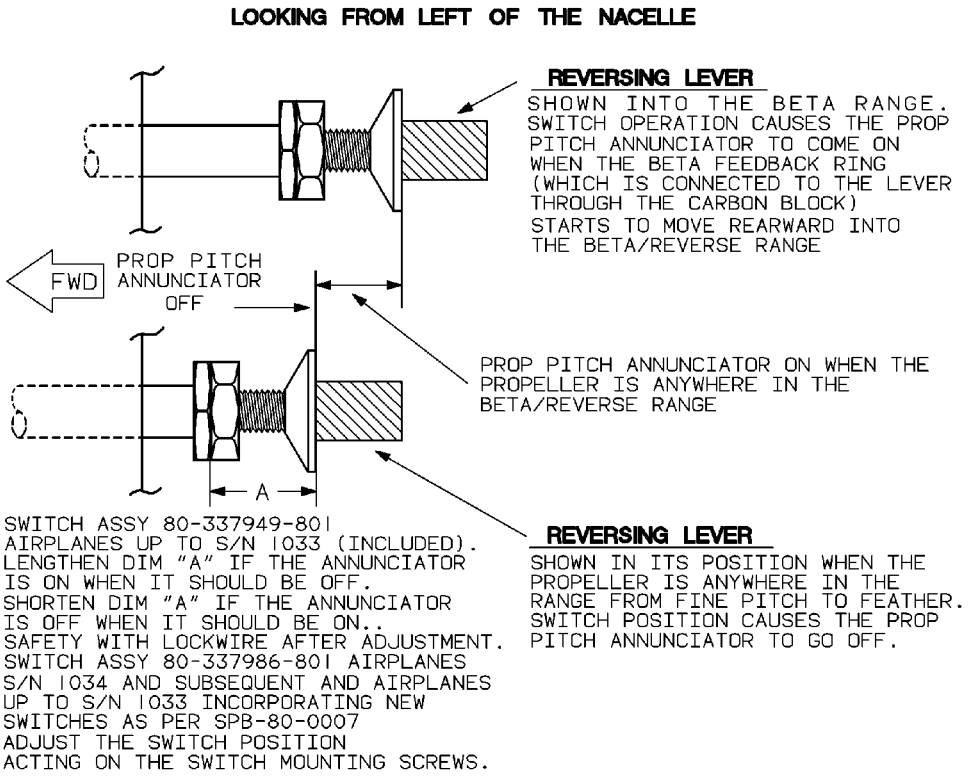

Fig. 210 - Propeller Low Pitch Switch - Operation and Adjustment Details

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E. Procedure - Engine Power Run

NOTE: The purpose of the engine power run is:
- to confirm that the engine meets its performance specification
- to confirm that operating parameters remain within limits at all power settings
- to establish if any final rigging or adjustment is required
- to verify that the autofeather switches operate at the correct POWER LEVER position
- to check that engine-related systems function satisfactorily.

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

NOTE: After each engine power run it may be necessary to adjust items on the engine. To minimize the work involved with removing and installing the nacelle panels, the panels may be secured in place using a limited number of screws (approx. six per panel, evenly spaced and at corner locations) at this time.

(2) Check that the motoring and idle run procedures (Para. C and D preceding) have been satisfactorily completed.

NOTE: For the operator's convenience this procedure includes a suggested format for two Supplementary Ground Run Check Sheets for use (in addition to the Standard Ground Run Check Sheet given in 71-00-00) during the engine power run after controls rigging.
In the absence of any other supplementary check sheets which the operator may have produced, remove the two given in this procedure, obtain copies as required, and return the original two to their proper place in the manual.

(3) Start both engines as detailed in 71-00-00, Page Block 501, Para. 12, CHECK 1.

(4) Set both CONDITION LEVERS to MAX RPM.

NOTE: It is important that POWER LEVER movements are done slowly, in the direction specified, until the desired setting is reached. If you go past a specified setting, it is necessary to move the POWER LEVER(S) in the opposite direction (at least 0.5 inch/13 mm past setting) and approach the setting again in the correct direction.

(5) Slowly move both POWER LEVERS forward and make a note of the POWER LEVERS position when:
- the forward Ng pickup is reached
- propeller rpm stops increasing (max. Np)

Record these as Parameters A and B on the Supplementary Ground Run Check Sheet 1.

(6) Continue to slowly move the POWER LEVERS forward and make a note of the torque indication and the POWER LEVER position when MAX PWR is reached (Parameter C).

(7) With the POWER LEVERS at MAX PWR make a note of the following:
- ITT (Parameter D)
- Np (Parameter E)
- Ng (Parameter F)
- Wf (Parameter G)
- Oil Pressure (Parameter H)
- Oil Temperature (Parameter I)

(8) Slowly move the POWER LEVERS back toward IDLE and make a note of the torque indication when Np reaches 1900 rpm (Parameter J).

(9) Continue to slowly move the POWER LEVERS back to the IDLE position and make a note of the increase in Np just before the IDLE detent is reached (Parameter K).

(10) Lift both POWER LEVERS (to clear the IDLE detent), slowly move them back into the reverse range and make a note of the POWER LEVER position when:
- Np stops increasing (Parameter L)
- the reverse Ng pickup is reached (Parameter M).

(11) Move the POWER LEVERS to the IDLE position.

(12) Set both CONDITION LEVERS to the FI detent position.

(13) Move the POWER LEVERS forward and make a note of the POWER LEVER position when Np stops increasing (Parameter N).

(14) Move the POWER LEVERS back to the IDLE position.

(15) Set the CONDITION LEVERS to the GI detent position.

(16) Slowly move the POWER LEVERS forward and make a note of the POWER LEVER position when the forward Ng pickup is reached (Parameter O).

(17) Move the POWER LEVERS back to the IDLE position.

(18) Shut down both engines (Refer to 71-00-00, Page Block 501, Para. 12, CHECK 12.

(19) Examine the results of the engine power run after control rigging, as noted on the Supplementary Ground Run Check Sheet 1, and make any necessary adjustments (Refer to Para. 5).

(20) After adjustment to satisfy the requirements detailed in Para. 5, do the engine power run again until results are satisfactory.

F. Procedure - Engine Check Run

NOTE: This ground run is to check that the rigging before engine runs, and any adjustments done after examining the results of the power runs, sets the controls so that the engines run at all operating parameters within the tolerances given for performance and alignment of POWER LEVERS.

(1) Get a copy of Supplementary Ground Run Check Sheet 2.

(2) Start both engines as detailed in 71-00-00, Page Block 501, Para. 12, CHECK 1.

(3) Operate the engines at the POWER LEVER settings specified on the Supplementary Ground Run Check Sheet 2 and record the results in the spaces provided on the sheet.

(4) Shut down both engines (Refer to 71-00-00, Page Block 501, Para. 12, CHECK 12).

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P180 ENGINE POWER RUN AFTER CONTROLS RIGGING SUPPLEMENTARY GROUND RUN CHECK SHEET 1

	PARAMETER TO BE RECORDED	CONDITION LEVER AT MAX RPM	
		LH ENGINE	RH ENGINE
A	POWER LEVER position at Forward Ng Pickup	MM	MM
B	POWER LEVER position when Maximum Np is reached with Power Lever Moving forward	MM	MM
C	Torque reading and POWER LEVER at MAX PWR position	FT LBS MM	FT LBS MM
D	ITT at MAX PWR	°C	°C
E	Propeller Speed (Np) at MAX PWR	RPM	RPM
F	Gas Generator Speed (Ng) at MAX PWR	%	%
G	Fuel Flow (Wf) at MAX PWR	PPH	PPH
H	Oil Pressure at MAX PWR	PSI	PSI
I	Oil Temperature at MAX PWR	°C	°C
J	Torque Indication when 1900 Np is reached with POWER LEVER moving rearward	FT LBS	FT LBS
K	Np increase just before the IDLE detent with POWER LEVER moving rearward	RPM	RPM
L	POWER LEVER position when Np stops increasing with POWER LEVER moving rearward in reverse	MM	MM
M	POWER LEVER position at Reverse Ng pickup	MM	MM
		CONDITION LEVER AT FI DETENT	
N	POWER LEVER position when MAX Np (min. governing) is reached with POWER LEVER moving forward	MM	MM
		CONDITION LEVER AT GI DETENT	
O	POWER LEVER position at Forward Ng Pickup	MM	MM

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P180 ENGINE POWER RUN AFTER CONTROLS RIGGING
SUPPLEMENTARY GROUND RUN CHECK SHEET

2

POWER LEVER (PL) SETTINGS	BLEED AIR OFF				BLEED AIR ON			
	PL Position		Ng %		PL Position		Ng %	
	LH Eng.	RH Eng.	LH Eng.	RH Eng.	LH Eng.	RH Eng.	LH Eng.	RH Eng.
Ng Pickup - GI	MM	MM			MM	MM		
Ng Pickup - FI	MM	MM			MM	MM		
Np 2000 rpm	MM	MM			MM	MM		
Tq 500 FT LBS	MM	MM			MM	MM		
Tq 1000 FT LBS	MM	MM			MM	MM		
Tq 1500 FT LBS	MM	MM			MM	MM		
Tq 2000 FT LBS	MM	MM			MM	MM		
Tq 2230 FT LBS (if available, or max. torque)	MM	MM			MM	MM		

OPERATING PARAMETERS WITH POWER LEVER AT MAX PWR SETTING	BLEED AIR OFF		BLEED AIR ON	
	LH ENG.	RH ENG.	LH ENG.	RH ENG.
Tq indication in FT LBS				
ITT Indication in °C				
Np Indication in RPM				
Ng Indication in %				
Wf Indication in PPH				
Oil Pressure Indication in PSI				
Oil Temp Indication in °C				

OPERATING PARAMETERS WITH POWER LEVER AT MAX REV SETTING	BLEED AIR OFF	
	LH ENG.	RH ENG.
Tq Indication in FT LBS		
ITT Indication in °C		
Np Indication in RPM		
Ng Indication in %		

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(5) Examine the results of the engine check run as noted on the Supplementary Ground Run Check Sheet 2 and make any necessary adjustments (Refer to Para. 5).

(6) After adjustment to satisfy the requirements of Para. 5, do the check run again until results are satisfactory.

(7) On satisfactory completion of all ground runs, install all fasteners in the nacelle panels and install the access panel each side of the control pedestal.

5. Control Systems Rigging - After Engine Runs

A. Referenced Information

Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 71-00-00

B. Procedure - General

CAUTION: DO THE ADJUSTMENTS, AS REQUIRED, IN THE SEQUENCE GIVEN.

NOTE: If adjustment is required, remove nacelle panels as necessary to get access, and install the panels after adjustment (Refer to 54-10-00).

(1) Refer to Supplementary Ground Run Check Sheet 1 on which the engine run data is recorded, and determine the need for adjustment. The following steps give the necessary details of the parameters required and the adjustments necessary to correct any misalignment/incorrect positioning of the POWER LEVERS and/or any excessive differences between the operating parameters of the two engines at the same POWER LEVER setting.

(2) A small adjustment of the power control cable position in the lug of the sliding cam is required if:

- the Np increase just before the IDLE detent (Parameter K) is not between 30 and 50 rpm and/or is not equal for both engines
- there is misalignment of the POWER LEVERS when the speed of both propellers stops increasing (this occurs at the propeller flat pitch position) in the beta/reverse range (Parameter L). Both of the above items must be mismatched in a consistant manner to justify adjustment of the cable in the lug. A large Np change at the IDLE detent, together with a more forward position of the POWER LEVER at max Np in reverse, requires that the cable be moved forward in the lug (away from the propeller). Normally, no more than one half turn of the nuts will be required. Refer to Para. C for actual adjustment details.

(3) Check that propeller speed at MAX PWR (Parameter E) is between 1990 and 2010 rpm. If necessary, adjust the propeller max. rpm as detailed in 71-00-00, Page Block 501, Para. 12.D. (CHECK 4). On the next ground run, check that the adjustment of the max. rpm setting has not affected the cut-off function of the CONDITION LEVER.

NOTE: If it is difficult to get positive contact of the max. rpm stop do a check of the cables and linkage for interference or binding, and rectify as necessary.

(4) Adjustment of the FCU control arm (to change the idle deadband position) is required if there is more than 1 mm (0.40 inch) of asymmetry (non-alignment) of the POWER LEVERS at:

- Ng pickup positions when the CONDITION LEVERS are at GI and/or FI (refer to Supplementary Ground Run Check Sheet 2)
- MAX PWR position (Parameter C)
- Reverse Ng pickup position (Parameter M).

With the CONDITION LEVERS at FI, the forward Ng pickup position of the POWER LEVERS must be between 14 and 16 mm forward of the IDLE detent. If necessary, adjust the position of the FCU control arm as detailed in Para. D.

NOTE: The Ng pickups may also be repositioned by changing the length of the control rod which connects the control input lever (at the cambox assembly) to the control arm of the FCU. This method should only be used if the required adjustment is small and the same for both enngines.
Para. F gives the procedure for changing the length of the control rod.

(5) Adjustment of the max. reverse stop on the FCU is required if the torque indication at the MAX REV setting (Refer to Supplementary Ground Run Check Sheet 2) is not between 650 and 700 FT LBS.
The stop should be set to limit Ng in reverse to a nominal 86% which gives the required 650 to 700 FT LBS of torque at the MAX REV setting.
If required, adjust the max. reverse stop as detailed in Para. E.

(6) Any adjustments done as a result of the requirements of the previous steps (2) thru (5), in the sequence given, will normally result in correct engine operation with a minimum amount of POWER LEVER misalignment throughout the full lever range.
The following steps will not normally be required but may be used in specific circumstances to correct a particular operating problem.

(7) To correct for unequal POWER LEVER travel from forward Ng pickup to MAX PWR (when the CONDITION LEVER is anywhere between FI and MAX RPM) a small adjustment of the FCU/cambox linkage may be necessary. If required, do the adjustment as detailed in Para. F.

(8) To correct for unequal torque at 1900 rpm Np (Parameter J) and unequal Np when the POWER LEVER is at IDLE and throughout POWER LEVER movement in the reverse range up to Ng pickup, a small adjustment of the beta valve setting may be necessary. If required, do the adjustment as detailed in Para. G.

CAUTION: BEFORE DOING THE ADJUSTMENT, VERIFY THAT WEATHER CONDITIONS DURING THE GROUND RUN WERE NOT THE CAUSE OF UNEQUAL TORQUE/NP. STRONG CROSS-WINDS MAY BE THE CAUSE OF TORQUE/NP DIFFERENCES.

C. Procedure - Adjustment of Power Control Cable in Sliding Cam Lug

(1) If this adjustment is required (Ref. Para. B, Step (2)), remove the lockwire from the two nuts and loosen the second nut (Ref. Fig. 204).

(2) If a lengthening of the cable is required, turn the first nut (no more than one half turn) toward the cable end; if the cable needs to be shortened turn the first nut (no more than one half turn) away from the cable end.

(3) Hold the first nut in its new position and tighten the second nut. Safety the two nuts, to each other, with lockwire.

D. Procedure - Adjustment of Idle Deadband Position

(1) If this adjustment is required (Ref. Para. B, step (4)), remove the lockwire from the extension of the FCU input shaft (Ref. Fig. 205).

(2) Mark the position of the serrated washer in relation to the shaft.

(3) Loosen the extension of the input shaft just enough so that the serrated washer can be moved (turned) without moving any other item.

(4) Move the serrated washer, clockwise (to move the Ng pickup forward) or counterclockwise as required; a movement of two serrations will move the pickup by approximately 1 mm.

(5) Move the control arm the minimum amount necessary to engage the serrations and tighten the extension of the input shaft. Safety the extension to the control arm with lockwire.

E. Procedure - Adjustment of Max. Reverse Power

(1) If this adjustments is required (Ref. Para. B, Step 5), remove the lockwire from the max. reverse stop (Refer to Fig. 210).

(2) Turn the stop, in to increase Ng% at the MAX REV setting or out to decrease Ng% as required; one full turn of the stop will change Ng by approximately 4%.

(3) Safety the stop with lockwire.

F. Procedure - Adjustment of FCU Linkage Differential

CAUTION: BEFORE DOING THIS ADJUSTMENT, MAKE SURE THAT THE ROLLER OF THE EXTENSION LEVER IS CORRECTLY POSITIONED IN THE SLIDING CAM (REFER TO PARA. G OF THE RIGGING PROCEDURE BEFORE ENGINE RUN), AND THAT FLIGHT IDLE NG SPEEDS ARE THE SAME (REFER TO THE GROUND RUN CHECK SHEET).

(1) Examine the ground run data and determine if the POWER LEVER travel needs to be lengthened or shortened. To shorten the POWER LEVER travel, the control rod between the control input lever (at the cambox assembly) and the FCU control arm must be shortened.

(2) Adjust the length of the control rod as required. Three turns of the control rod end will change POWER LEVER travel by approximately 1 mm.

(3) On completion of adjustment tighten the attachment nut and safety it with a new cotter pin.

(4) When the control rod end is changed, the Ng pickup position changes also. Unless the rod length is changed for the purpose of repositioning the Ng pickup (Refer to the NOTE following step (4) of Para. B) it will be necessary to restore the Ng pickup, to its original setting, by means of the serrated washer at the FCU control arm. When the rod is shortened, the washer must be turned clockwise 5 serrations for every 3 turns of the control rod end. Refer to Para. D for the method of moving the serrated washer.

G. Procedure - Adjustment of the Beta Valve Setting

(1) This adjustment is required if:

– the ground run data shows unequal torque at 1900 rpm Np, unequal Np at IDLE and unequal Np in the reverse range up to Ng pickup

– the pilot reports that, at low airspeed and low power, the airplane has a tendancy to yaw towards the faster turning propeller.

(2) To increase propeller rpm at IDLE, decrease torque at 1900 rpm increase in-flight idling propeller drag, set the beta valve slightly outside its flush rigging position as follows:

(a) Disconnect the rear clevis of the reversing cable from the reversing lever (Ref. Fig. 208); make sure that the sleeve spacer (bushing) in the lever does not drop out. Use a temporary tie to secure the spacer in the lever end.

(b) Adjust the rear clevis (out) as required to move the beta control clevis slot face away from the rear face of the beta valve cap nut no more than 1 mm.

CAUTION: DO NOT EXCEED THE 1 mm LIMIT GIVEN ABOVE. IF NECESSARY, SET THE BETA CONTROL CLEVIS OF THE OPPOSITE ENGINE IN BY NO MORE THAN 1 mm TO GET THE REQUIRED SYMMETRY.

(c) Tighten the clevis attachment nut and safety the connection with a new cotter pin.

(d) Make sure that there is a sufficient amount of threaded cable end in the clevis by checking through the safety hole provided; if there is not, adjust at the front clevis until satisfactory.

6. Engine Control Cables - Inspection (Ref. Fig. 211)

A. Referenced Information

Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 06-00-00
Maintenance Manual Chapter 57-00-00

B. Procedure

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

Pilot CB panel:
L ENG START
R ENG START.

(2) Remove the nacelle panels (Refer to 54-00-00).

(3) Remove the floor panels 211DLF, 211GLF, 231ALF, 231FLF, 231MLF, 231QLF, 231RLF (Refer to 06-00-00).

(4) Remove the access panel from each side of the control pedestal.

(5) Remove the inboard leading edges (Refer to 57-00-00).

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(6) Remove the lavatory compartment:
- Vanity closet
- Toilet
- Vanity console.

(7) Remove completely the insulation panels at the 6000 bulkhead.

(8) At the control pedestal in the flight compartment:
(a) Examine the four manual lever/control cable connections for proper installation of attaching parts; make sure that the clevis bolts are installed so that there is no possibility of fouling.
(b) Make sure that there is sufficient engagement of the control cable threaded ends in their respective clevises; check that a piece of small-gage wire will not pass through the safety hole provided in the clevis.

(9) Along the fuselage (between the control pedestal and the wing):
(a) Check that the clamps that secure the power and the propeller control cables to the structure are tightened firmly. Clamps are for support only and overtightening could result in binding.
(b) Check that the propeller and power control cables unions located between the fuselage and the wing are firmly secured to the fuselage.

(10) Along the inboard leading edge:
(a) Check that the clamps that secure the power and the propeller control cables to the structure are firmly tightened. Clamps are for support only and overtightening could result in binding.
(b) Check that the drain holes located at the engine/propeller control cables sheaths ends (fuselage side), are directed downwards.

(11) At the engine:
(a) Examine the power and propeller control cable connections for proper installation of attaching parts.

(12) Install the nacelle panels (Refer to 54-10-00).

(13) Install the inboard leading edges (Refer to 57-00-00).

(14) Install the floor panels.

(15) Install the insulation panels at the 6000 bulkhead.

(16) Install the lavatory compartment.

(17) Install the access panels to the control pedestal.

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

Pilot CB panel:

L ENG START

R ENG START.

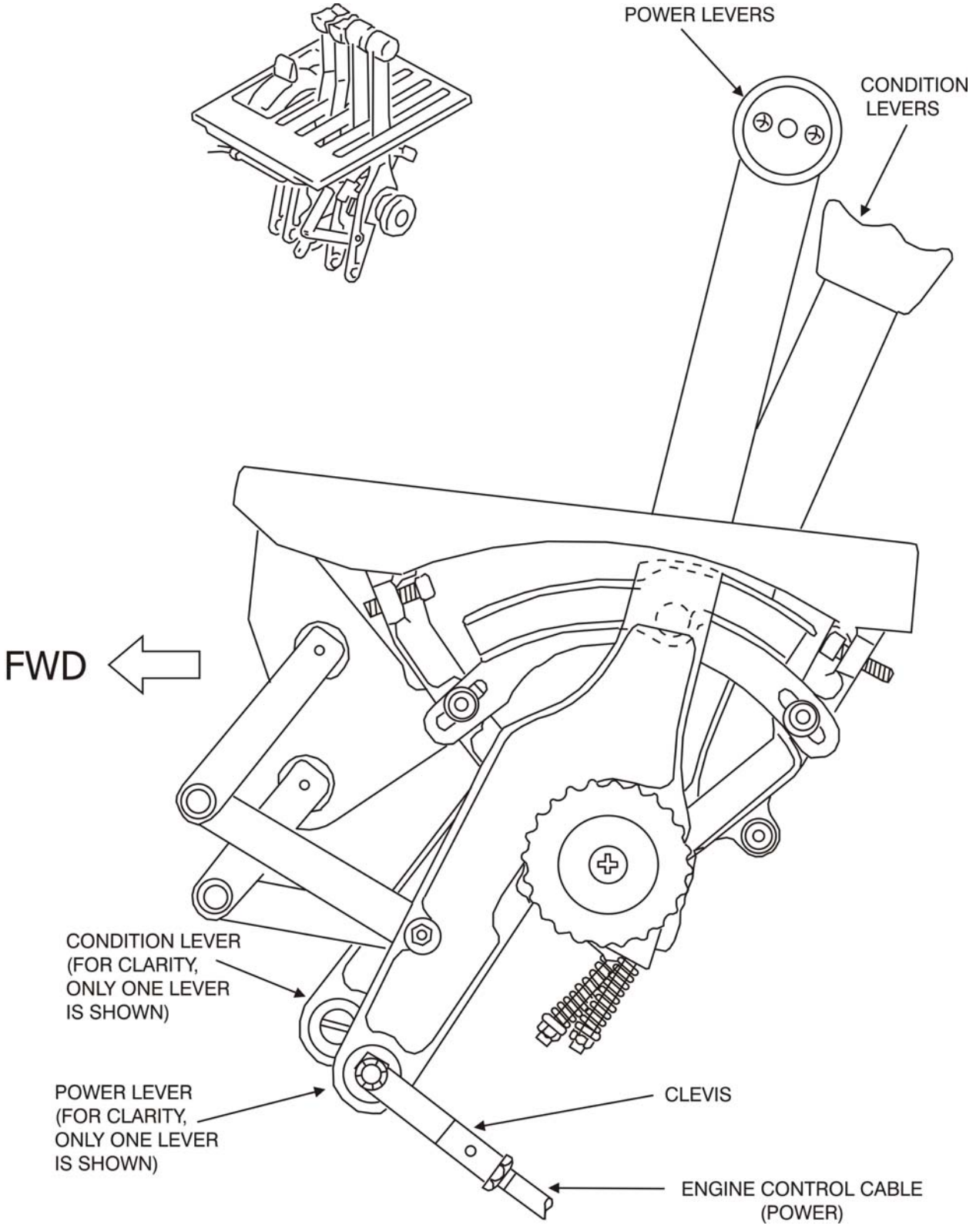

Fig. 211 - Engine Control Cables - Inspection (Sheet 1 of 5)

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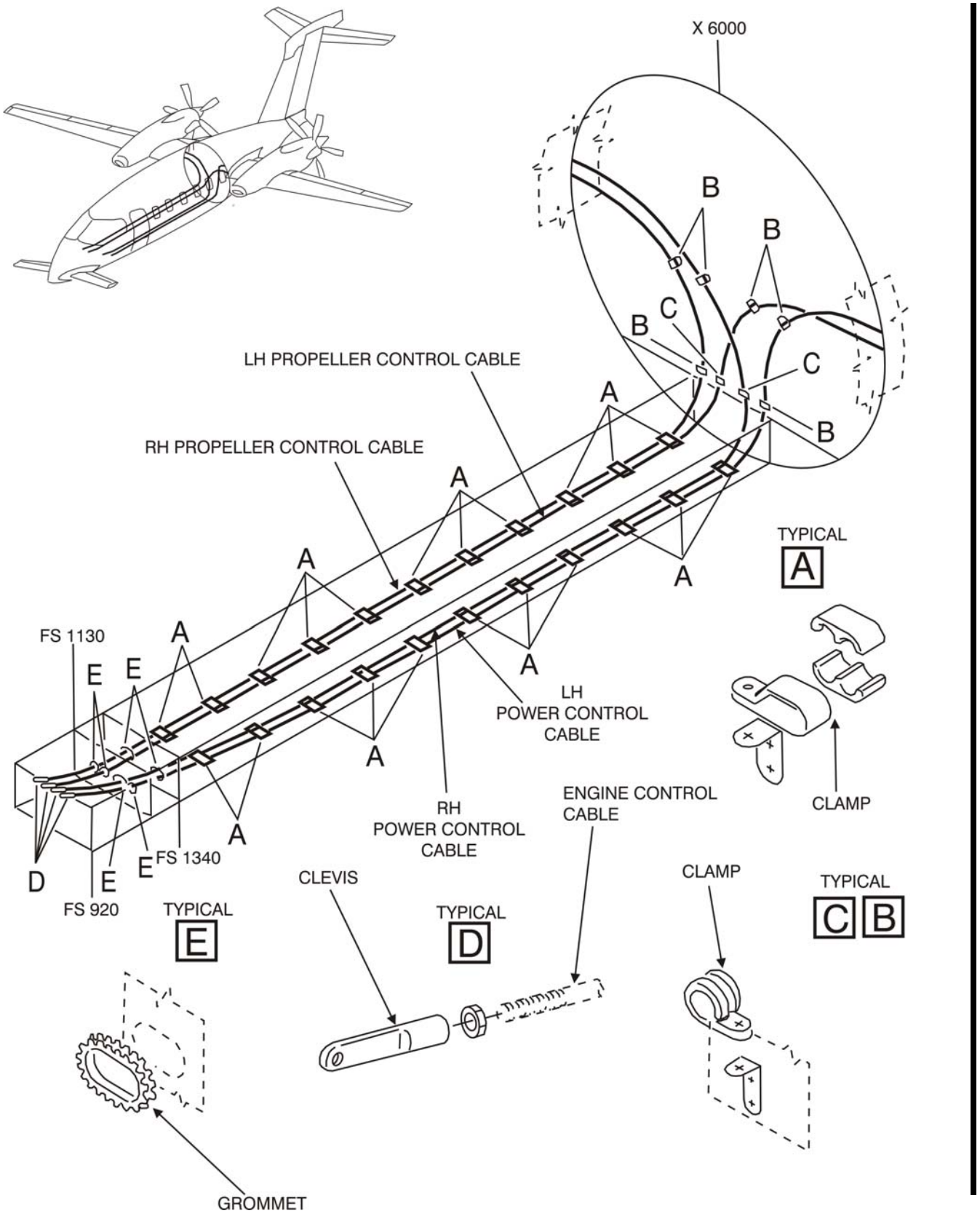

Fig. 211 - Engine Control Cables - Inspection (Sheet 2 of 5)

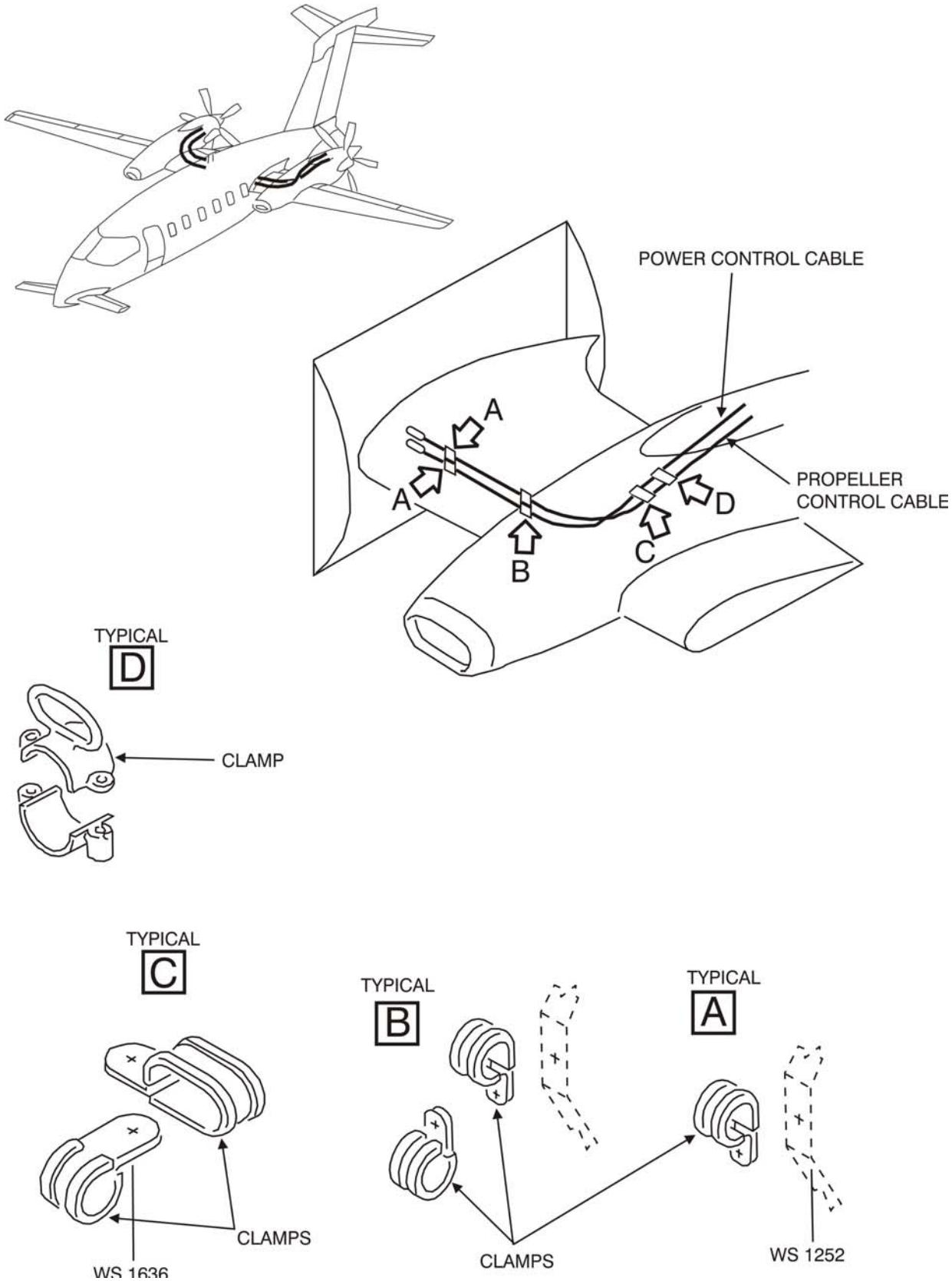

Fig. 211 - Engine Control Cables - Inspection (Sheet 3 of 5)

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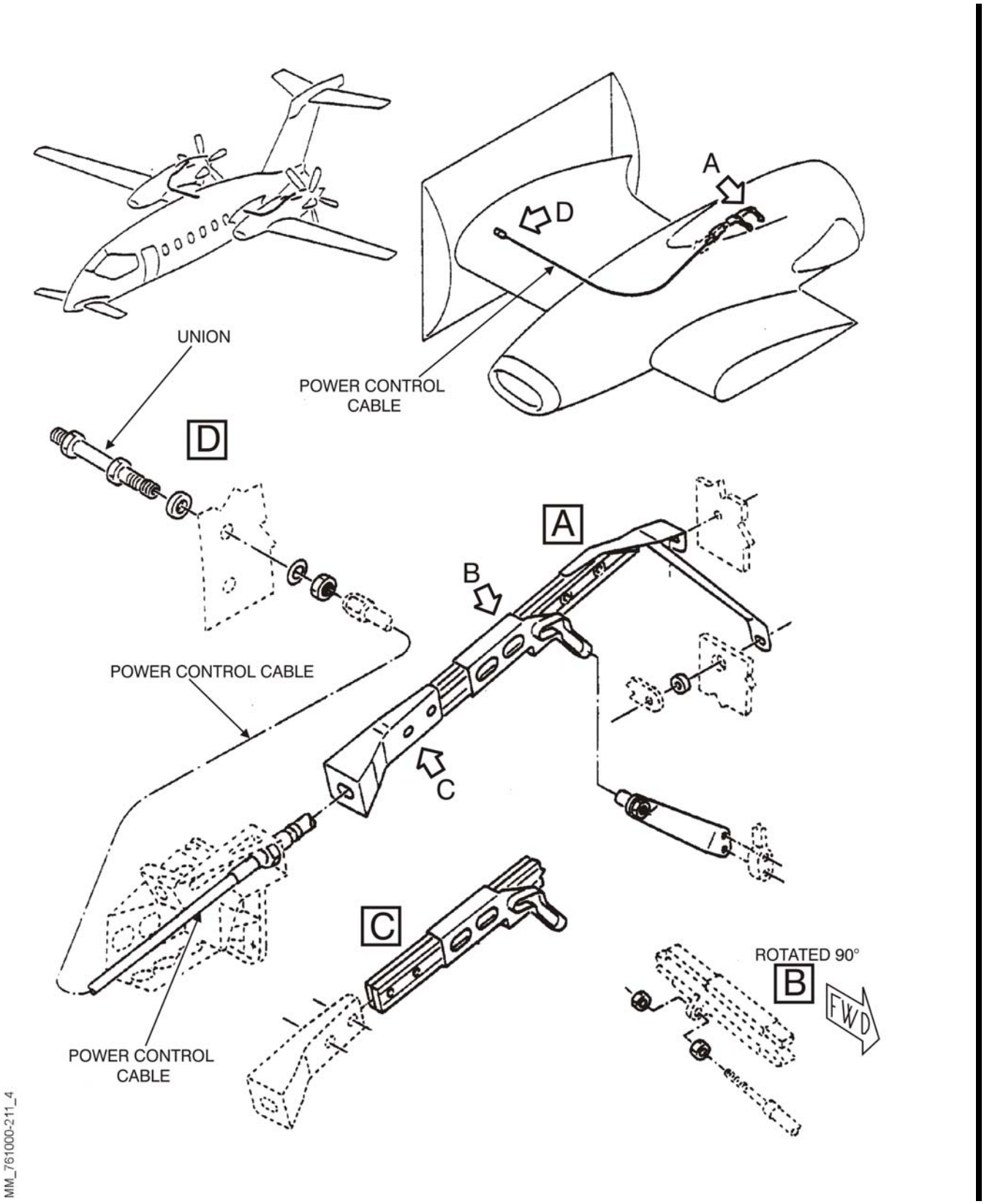

Fig. 211 - Engine Control Cables - Inspection (Sheet 4 of 5)

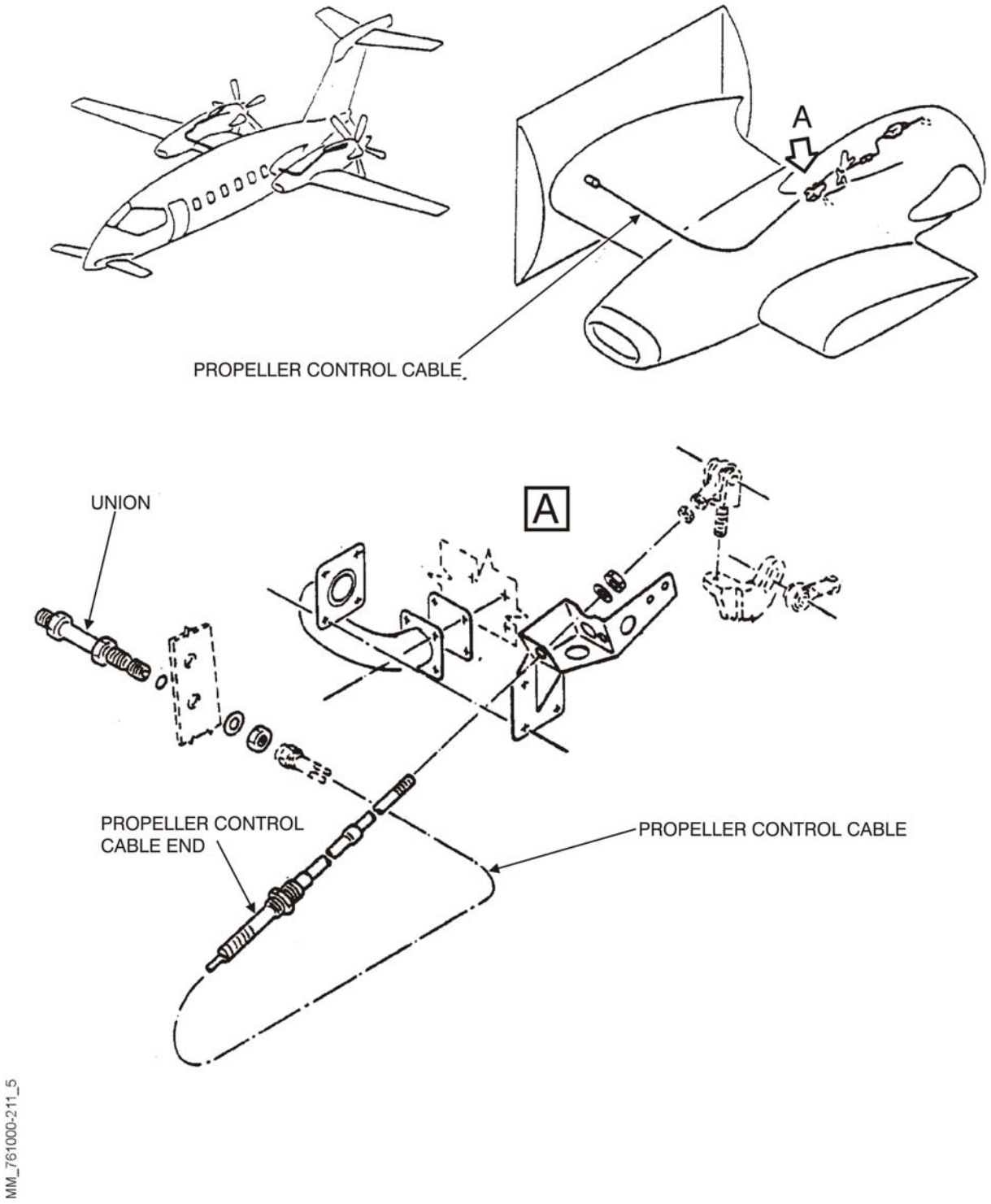

Fig. 211 - Engine Control Cables - Inspection (Sheet 5 of 5)

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7. Engine and Propeller Control Cables (Fuselage-Engine) - Removal (Ref. Fig. 211)

A. Fixtures, Test and Support Equipment

Access Platform (approx. 3 ft/1 m)
Warning Notice

B. Referenced Information

Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 57-40-00

C. Procedure

NOTE: Procedures for the LH removal are described, the RH removal is identical.

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

Pilot CB panel:
L ENG START
R ENG START.

(2) Remove nacelle panels 410AT, 430AL, 430AR, 420AT, 440AL and 440AR (Refer to 54-10-00).
(3) Remove the main wing leading edge between fuselage and engine (refer to Chapter 57-40-00).
(4) Remove the access panels from each side of the center pedestal.
(5) If the engine control cable can be removed do as follows:
  (a) Disconnect at the center pedestal the fork end (24) of the power control cable (26) from the power control lever (33) by removing plain washers (29, 30), castellated nut (28) and clevis bolt (31).
  (b) Disconnect, on the engine, the power control cable from the sliding cam (16) by removing the nuts (17).
  (c) Disconnect the end fitting (18) from the union (19) (toward the wing) so that the power control cable casing (20) is clear.
  (d) Remove the clamps (10) that secure the power control cable casing (20) to the support (11).
  (e) Remove the nuts (21) and washers (22) that secure the power control cable casing (20) to the support (23) on the engine.
  (f) Pull the engine control cable slowly from the wing until the cables connection (15) is out of the union (19).
  (g) Disconnect the power control cables.
  (h) Remove the power control cable with casing (fuselage-engine).
(6) If the propeller control cable can be removed do as follows:
  (a) Disconnect at the center pedestal the fork end (25) of the propeller control cable (27) from the propeller control lever (32) by removing plain washers (29, 30), castellated nut (28) and clevis bolt (31).
  (b) Disconnect, on the engine, the propeller control cable eye end (5) from the fork (6) by removing cotter pin (1), nut (3), washer (4) and bolt (2).

(c) Disconnect the end fitting (7) from the union (9) (toward the wing) so that the propeller control cable casing (8) is clear.
(d) Remove the clamps (10) that secure the propeller control cable casing (8) to the supports (11).
(e) Remove the nuts (13) and washers (12) that secure the propeller control cable casing (8) to the support (14) on the engine.
(f) Pull the propeller control cable slowly from the wing until the cable connection (15) is out of the union (9).
(g) Disconnect the propeller control cable.
(h) Remove the propeller control cable with casing (fuselage-engine).

8. Engine and Propeller Control Cable (Fuselage-Engine) - Installation (Ref. Fig. 211)

A. Fixtures, Test and Support Equipment

Access platform (approx. 3 ft/1 m)	Not Specified
Warning Notice	Not Specified
Strip of mm Graph Paper (approx. 6 x 0.6 inch/150 x 15 mm)	Not Specified

B. Tools

Engine Rigging Tool	80-909189-401
Rigging Pin 3/32 inch (2.4 mm) dia.	Not Specified
Rigging Pin 3/16 inch (4.8 mm) dia.	Not Specified
Protractor	Not Specified

C. Materials

Lockwire	04-008

D. Expendable Parts

Cotter Pin (Qty 3 per engine)	MS9245-23
Cotter Pin (Qty 1 per engine)	MS24665-151
Cotter Pin (Qty 2 per engine)	MS24665-88

E. Referenced Information

Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 71-00-00
Engine Maintenance Manual

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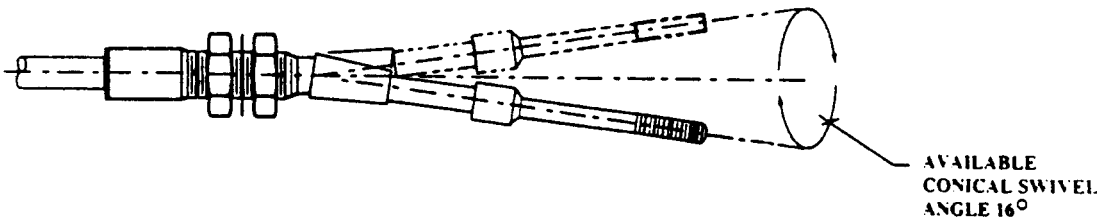
F. Procedure

WARNING:

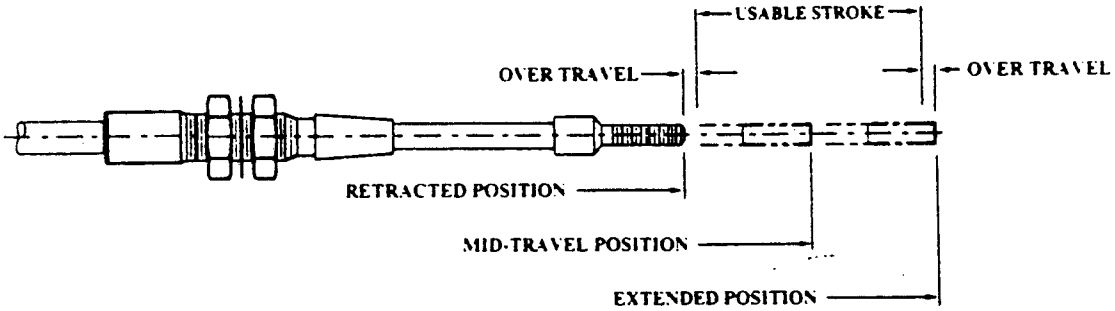
- CABLECRAFT CONTROL CABLES ARE DESIGNED TO BE NON-REPAIRABLE. DO NOT PERFORM ANY REPAIRS TO THIS CONTROL CABLE.
- CABLECRAFT CONTROL CABLES ARE LUBRICATED FOR THE LIFE OF THE CONTROL CABLE. DO NOT REMOVE THE SEALS OR LUBRICATE THE CONTROL CABLE.
- A GRADUAL OR SUDDEN INCREASE IN THE NO-LOAD (CABLE FREE AND UNATTACHED) FRICTION OF A CONTROL CABLE IS A GOOD INDICATION OF PENDING PERFORMANCE PROBLEMS AND/OR CONTROL CABLE FAILURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.
- A GRADUAL OR SUDDEN DECREASE IN THE STROKE (TRAVEL) LENGTH OF THE CONTROL CABLE IS A GODD INDICATION OF PENDING PERFORMANCE PROBLEMS AND/OR CONTROL CABLE FAILURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.
- CONTROL CABLES WHICH HAVE MOISTURE INSIDE OF THEM OR HAVE FROZEN, MUST BE REPLACED. DO NOT APPLY HEAT TO ATTEMPT TO REMOVE THE MOISTURE. APPLYING HEAT WILL NOT REMOVE THE MOISTURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.
- DO NOT INSTALL THE CONTROL CABLE WITH THE POWER ON OR THE ENGINE RUNNING. SERIOUS INJURY OR DEATH MAY RESULT.

CAUTION:

- CABLECRAFT CABLES ARE DESIGNED TO BE CONTAMINANT RESISTANT; NOT CONTAMINANT PROOF. PROTECT THE CABLE FROM CONTAMINANTS SUCH AS FUEL, OIL, WATER, DIRT AND CHEMICALS WHICH MAY DAMAGE THE CONTROL CABLE.
- PROTECT THE CONTROL CABLE FROM PHYSICAL DAMAGE BY PAINT, KINKING, VIBRATION, ETC., WHICH MAY DAMAGE THE CONTROL CABLE.
- THE SWIVEL ANGLE MUST BE CENTERED WITHIN THE AVAILABLE SWIVEL ANGLE AS SHOWN BELOW:



– THE USABLE STROKE MUST BE CENTERED WITHIN THE AVAILABLE TRAVEL AS SHOWN BELOW:



NOTE: Procedures for LH installation are described, the RH installation is identical.

CAUTION: THE DRAIN HOLES LOCATED AT THE ENGINE/PROPELLER CONTROL CABLES SHEATHS ENDS (FUSELAGE SIDE), MUST BE DIRECTED DOWNWARDS IN ORDER TO ALLOW THE PROPER DRAINAGE OF HUMIDITY DROPLETS.

(1) Make sure as necessary that:
- The applicable circuit breakers are open, tagged and safetied
- The system is safe
- Access is available (Refer to the Removal Procedure).

(2) If the power control cable can be installed do as follows:
(a) Place the power control cable casing (20) in position on the wing leading edge.
(b) Connect the power control cable (fuselage-engine) near the union (19) with the power control cable (wing-control lever) and push the cables connection (15) into the union (19).
(c) Secure the power control cable casing (along the wing and the engine) to the supports with clamps (10). Do not tighten the clamps (10), so that the casing (20) can keep its position and an adjustment is possible.
(d) Connect the power control cable casing end fitting (18) to the union (19) (toward the wing).
(e) Connect, on the engine, the power control cable (34) to the sliding cam (16) with nuts (17).
(f) Connect, on the engine, the power control cable casing to the support (23) with nuts (21) and washers (22).
(g) Tighten the clamps, along the wing leading edge and engine, that secure the power control cable casing (20).
(h) Connect at the center pedestal the power control cable fork end (24) to the power control lever (33) with clevis bolt (31), castellated nut (28) and plain washers (29, 30).

(3) If the propeller control cable can be installed do as follows:

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(a) Place the propeller control cable casing (8) in position to the wing leading edge.

(b) Connect the propeller control cable (fuselage-engine) near the union (9) with the propeller control cable (wing-control lever) and push the cable connection (15) into the union (9).

(c) Place the propeller control cable casing along the wing and the engine to the supports (11) with the clamps (10). Do not tighten the clamps (10), so that the casing (8) can keep its position and an adjustment is possible.

(d) Connect the propeller control cable casing end fitting (7) to the union (9) (toward the wing).

(e) Connect, on the engine, the propeller control cable eye end (5) to the fork (6) with bolt (2), washer (4), nut (3) and cotter pin (1).

(f) Secure the propeller control cable casing (8) to the supports (11) and tighten the clamps (10).

(g) Connect at the center pedestal the propeller control cable fork end (25) to the propeller control lever with clevis bolt (31), castellated nut (28) and plain washers (29, 30).

(4) Do a system rigging as described in this chapter.

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

Pilot CB panel:

L ENG START

R ENG START.

(6) Install the main wing leading edge between fuselage and engine (Refer to Chapter 57-00-00).

(7) Install the access panel from each side of the pedestal.

(8) Install nacelle panels 410AT, 430AL, 430AR, 420AT, 440AL and 440AR (Refer to 54-40-00).

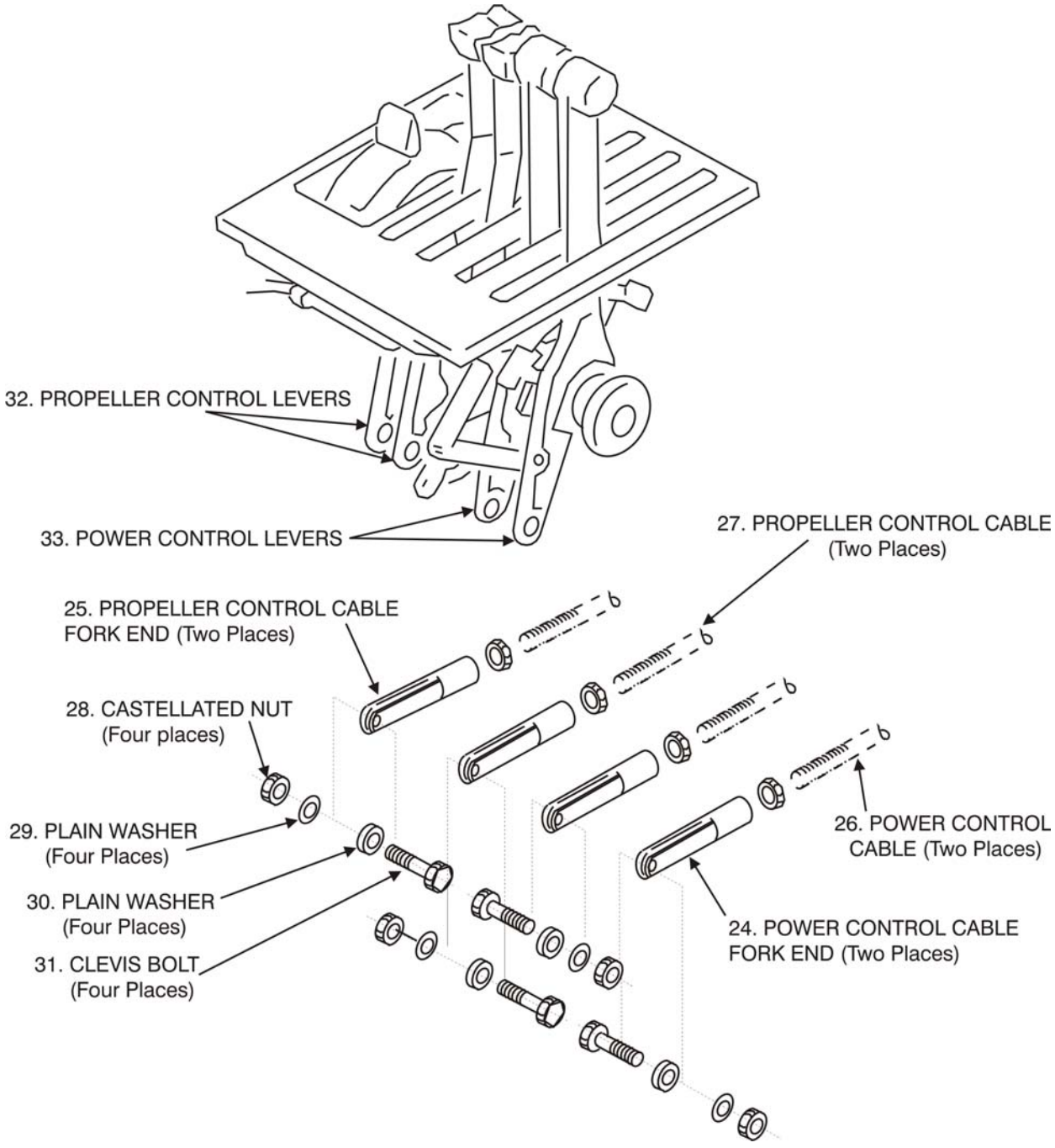

Fig. 212 - Power/Propeller Control Cables (Fuselage-Engine) - Removal/Installation (Sheet 1 of 4)

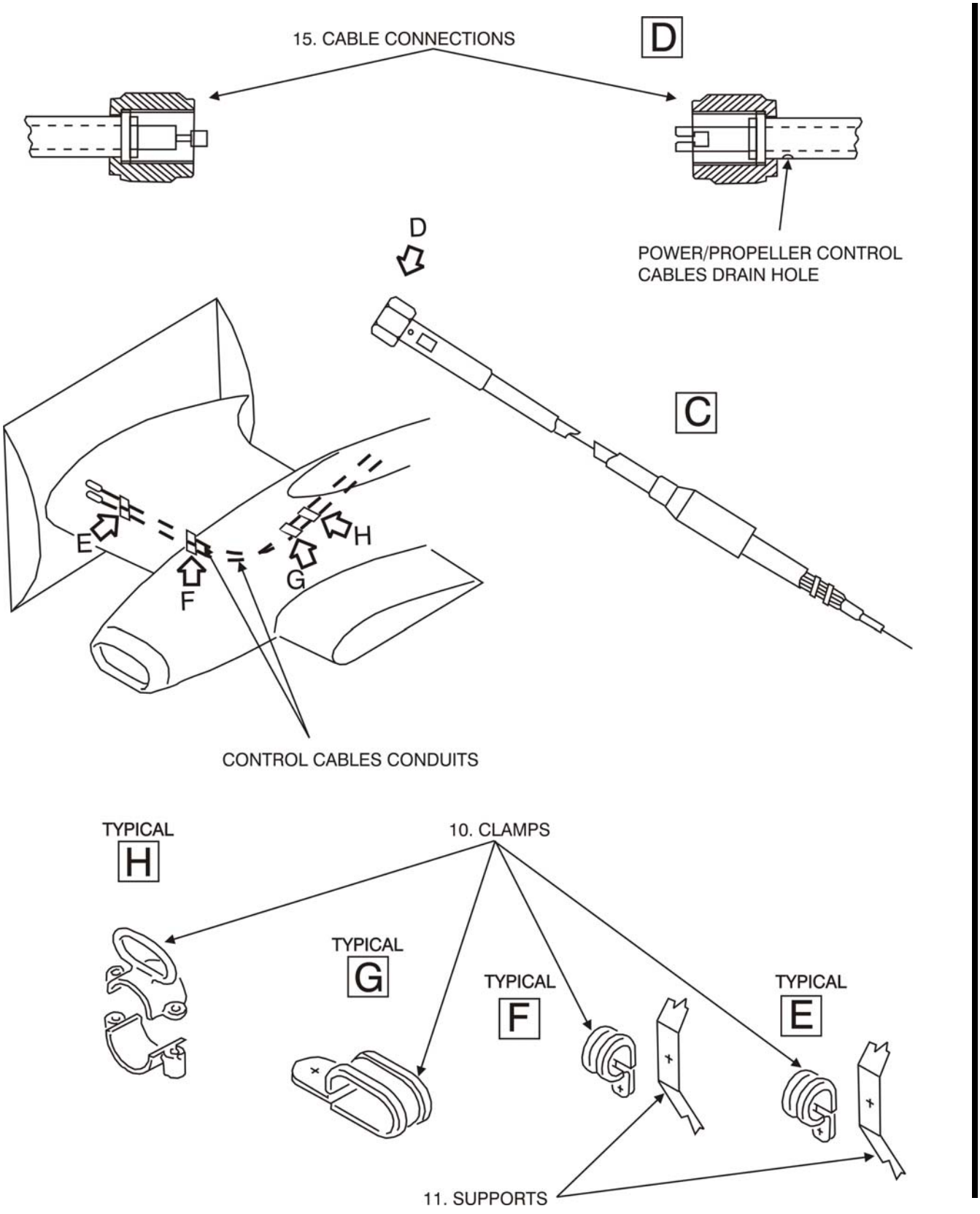

Fig. 212 - Power/Propeller Control Cables (Fuselage-Engine) - Removal/Installation (Sheet 2 of 4)

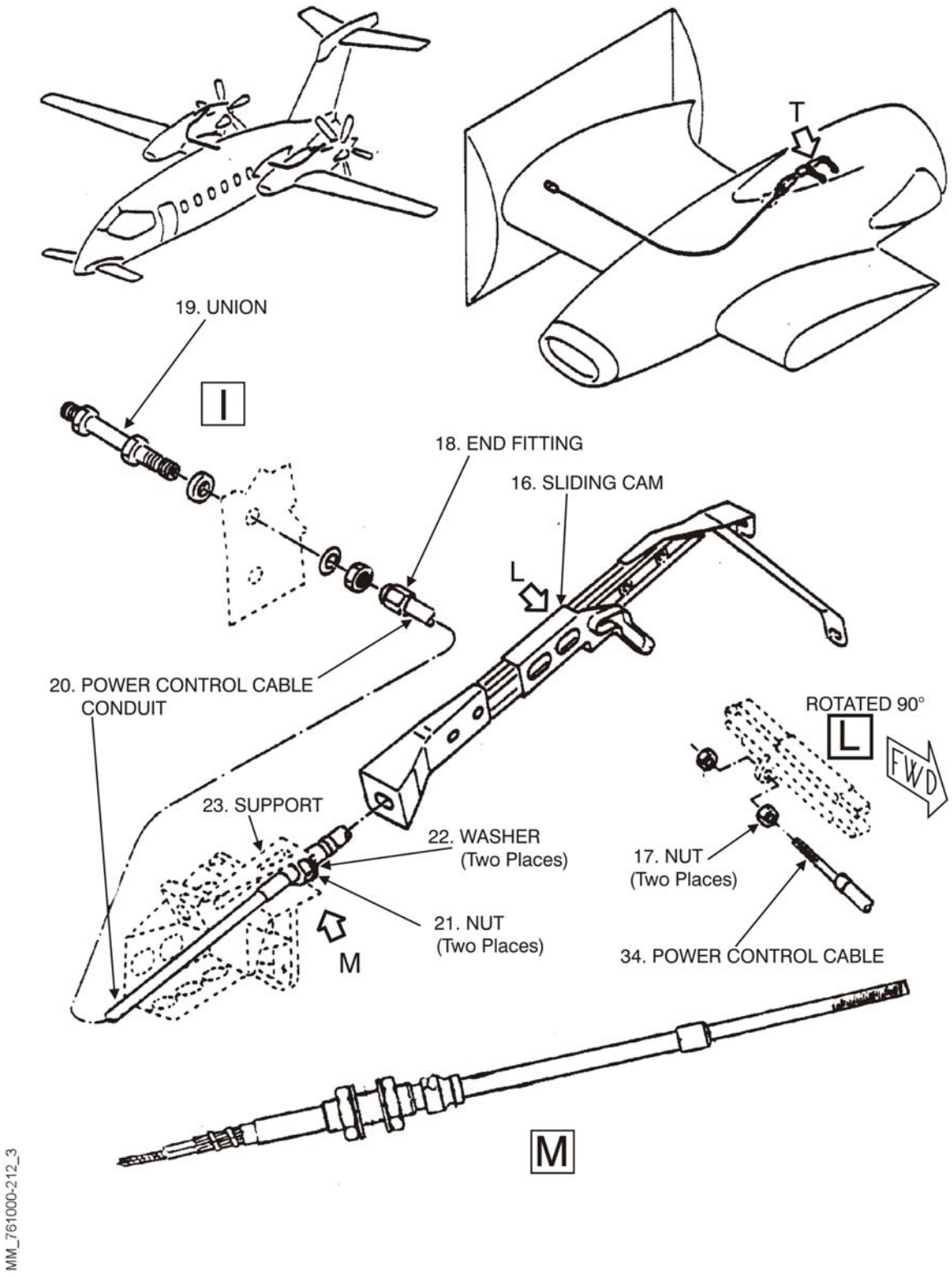

Fig. 212 - Power/Propeller Control Cables (Fuselage-Engine) - Removal/Installation (Sheet 3 of 4)

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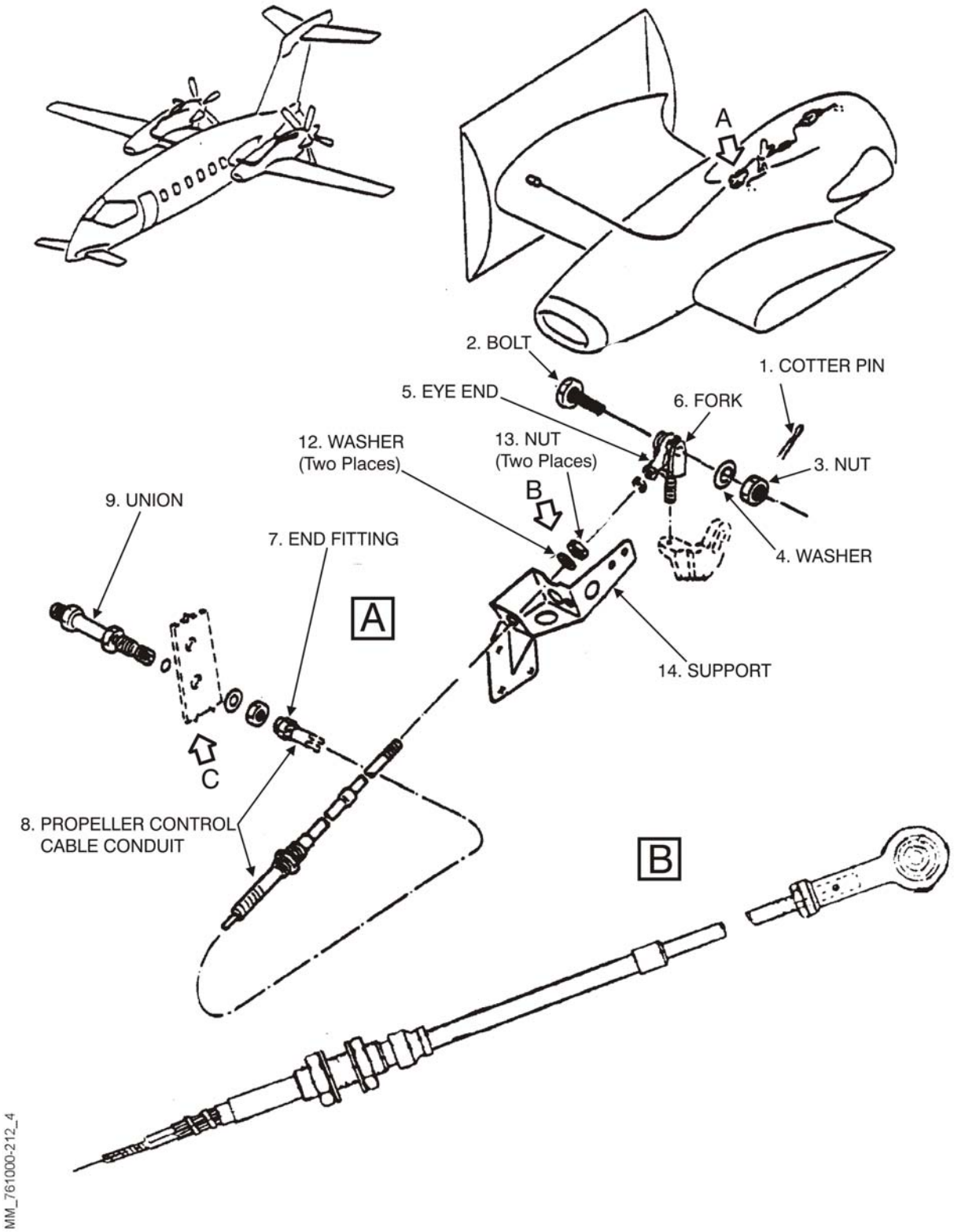

Fig. 212 - Power/Propeller Control Cables (Fuselage-Engine) - Removal/Installation (Sheet 4 of 4)

9. Engine and Propeller Control Cable (Control Lever-Wing) - Removal (Ref. Fig. 213)

A. Fixtures, Test and Support Equipment

Access Platform (approx. 3 ft/1 m)

Warning Notice

B. Referenced Information

Maintenance Manual Chapter 06-00-00
Maintenance Manual Chapter 25-40-00
Maintenance Manual Chapter 57-00-00

C. Procedure

NOTE: Procedures for the LH removal are described, the RH removal is identical.

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

Pilot CB panel:
L ENG START
R ENG START.

(2) Remove the panels 211DLF, 211GLF, 231ALF, 231FLF, 231MLF, 231QLF and 231RLF (Refer to Chapter 06-00-00).
(3) Remove the access panels from each side of the center pedestal and the nacelle panels 410AT, 430AL, 430AR, 420AT, 440AL and 440AR (Refer to 54-40-00).
(4) Remove all furnishing located in the lavatory compartment.
(5) Remove the insulation blanket.
(6) Remove the main wing leading edge (Refer to Chapter 57-00-00).
(7) If the engine control cable can be removed do as follows:
  (a) Disconnect at the center pedestal the fork end (24) of the engine control cable (26) from the power control lever (33) by removing plain washers (29, 30), castellated nut (28) and clevis bolt (31) (Ref. Fig. 211).
  (b) Disconnect, on the engine, the power control cable from the sliding cam (16) by removing the nuts (17) (Ref. Fig. 211).
  (c) Disconnect the end fitting (18) from the union (19) (toward the fuselage) so that the power control cable casing (20) is clear (Ref. Fig. 211).
  (d) Remove the clamps (1) that secure the power control cable casing (2) to the supports (6) located along the fuselage and at the 6000 bulkhead.
  (e) Remove the nuts (4) that secure the power control cable casing to the swivel (5) in the control pedestal.
  (f) Pull the engine control cable slowly from the fuselage until the cable connection (15) is out of the union (19) (Ref. Fig. 211).
  (g) Disconnect the engine control cables.
  (h) Remove the power control cable with casing (control lever-wing).
(8) If the propeller control lever can be removed do as follows:
  (a) Disconnect at the center pedestal the fork end (25) of the propeller control cable (27) from the propeller control lever (32) by removing plain washers (29, 30), castellated nut (28) and clevis bolt (31) (Ref. Fig. 211).

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(b) Disconnect on the engine the propeller control cable eye end (5) from the fork (6) by removing cotter pin (1), nut (3), washer (4) and bolt (2) (Ref. Fig. 211).
(c) Disconnect the end fitting (7) from the union (9) (toward the fuselage) so that the propeller control cable casing (8) is clear (Ref. Fig. 211).
(d) Remove the clamps (1) that secure the propeller control cable casing (3) to the supports (6) located along the fuselage and at the 6000 bulkhead.
(e) Remove the nuts (4) that secure the propeller control cable casing to the swivel (5) in the control pedestal.
(f) Pull the propeller control cable slowly from the fuselage until the cable connection (15) is out of the union (9) (Ref. Fig. 211).
(g) Disconnect the propeller control cable.
(h) Remove the propeller control cable with casing (control lever-wing).

10. Engine and Propeller Control Cable (Control Lever-Wing) - Installation (Ref. Fig. 213)

A. Fixtures, Test and Support Equipment

Access platform (approx. 3 ft/1 m)	Not Specified
Warning Notice	Not Specified
Strip of mm Graph Paper (approx. 6 x 0.6 inch/150 x 15 mm)	Not Specified

B. Tools

Engine Rigging Tool	80-909189-401
Rigging Pin 3/32 inch (2.4 mm) dia.	Not Specified
Rigging Pin 3/16 inch (4.8 mm) dia.	Not Specified
Protractor	Not Specified

C. Materials

Lockwire	04-008

D. Expendable Parts

Cotter Pin (Qty 3 per engine)	MS9245-23
Cotter Pin (Qty 1 per engine)	MS24665-151
Cotter Pin (Qty 2 per engine)	MS24665-88

E. Referenced Information

Maintenance Manual Chapter 54-10-00
Maintenance Manual Chapter 71-00-00
Engine Maintenance Manual

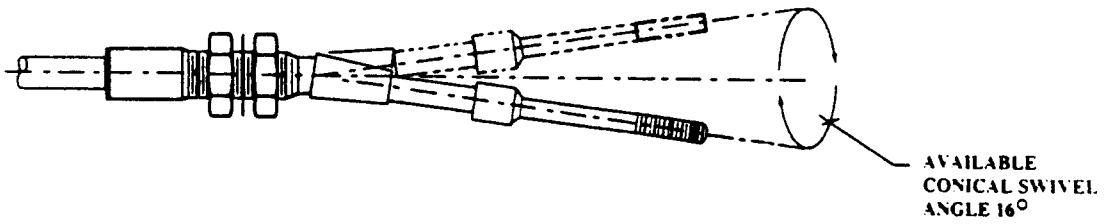
F. Procedure

WARNING:

- CABLECRAFT CONTROL CABLES ARE DESIGNED TO BE NON-REPAIRABLE. DO NOT PERFORM ANY REPAIRS TO THIS CONTROL CABLE.
- CABLECRAFT CONTROL CABLES ARE LUBRICATED FOR THE LIFE OF THE CONTROL CABLE. DO NOT REMOVE THE SEALS OR LUBRICATE THE CONTROL CABLE.
- A GRADUAL OR SUDDEN INCREASE IN THE NO-LOAD (CABLE FREE AND UNATTACHED) FRICTION OF A CONTROL CABLE IS A GOOD INDICATION OF PENDING PERFORMANCE PROBLEMS AND/OR CONTROL CABLE FAILURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.
- A GRADUAL OR SUDDEN DECREASE IN THE STROKE (TRAVEL) LENGTH OF THE CONTROL CABLE IS A GODD INDICATION OF PENDING PERFORMANCE PROBLEMS AND/OR CONTROL CABLE FAILURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.
- CONTROL CABLES WHICH HAVE MOISTURE INSIDE OF THEM OR HAVE FROZEN, MUST BE REPLACED. DO NOT APPLY HEAT TO ATTEMPT TO REMOVE THE MOISTURE. APPLYING HEAT WILL NOT REMOVE THE MOISTURE. SERIOUS INJURY OR DEATH MAY RESULT. REPLACEMENT IS REQUIRED.
- DO NOT INSTALL THE CONTROL CABLE WITH THE POWER ON OR THE ENGINE RUNNING. SERIOUS INJURY OR DEATH MAY RESULT.

CAUTION:

- CABLECRAFT CABLES ARE DESIGNED TO BE CONTAMINANT RESISTANT; NOT CONTAMINANT PROOF. PROTECT THE CABLE FROM CONTAMINANTS SUCH AS FUEL, OIL, WATER, DIRT AND CHEMICALS WHICH MAY DAMAGE THE CONTROL CABLE.
- PROTECT THE CONTROL CABLE FROM PHYSICAL DAMAGE BY PAINT, KINKING, VIBRATION, ETC., WHICH MAY DAMAGE THE CONTROL CABLE.
- THE SWIVEL ANGLE MUST BE CENTERED WITHIN THE AVAILABLE SWIVEL ANGLE AS SHOWN BELOW:



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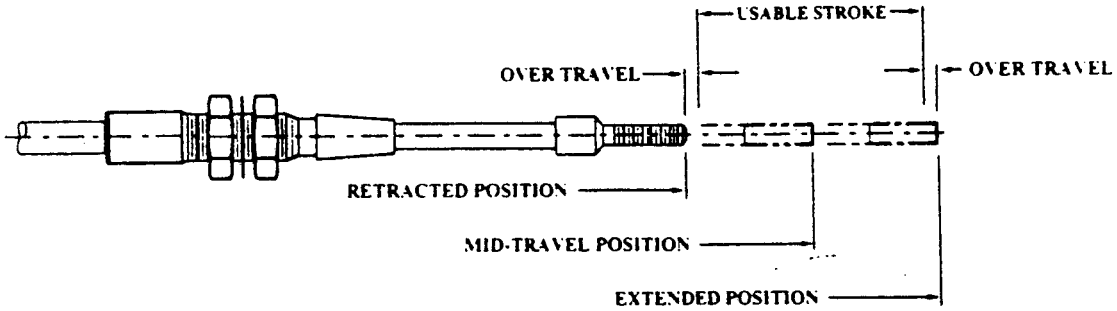
– THE USABLE STROKE MUST BE CENTERED WITHIN THE AVAILABLE TRAVEL AS SHOWN BELOW:



NOTE: Procedures for LH installation are described, the RH installation is identical.

(1) Make sure as necessary that:
- The applicable circuit breakers are open, tagged and safetied
- The system is safe
- Access is available (Refer to the Removal Procedure).

(2) If the power control cable can be installed do as follows:
(a) Place the power control cable casing (2) in position along the fuselage and at the 6000 pressure bulkhead.
(b) Connect the power control cable (fuselage-engine) near the union (19) with the engine control cable (wing-control lever) and push the cables connection (15) into the union (19) (Ref. Fig. 211).
(c) Secure the power control cable casing (along the fuselage and at the 6000 pressure bulkhead) to the supports with clamps (1). Do not tighten the clamps (1) so that the casing (2) can keep the position and an adjustment is possible.
(d) Connect the power control cable casing end fitting (18) to the union (19) (toward the fuselage) (Ref. Fig. 211).
(e) Connect on the engine the power control cable (34) to the sliding cam (16) with nuts (21) and washers (22).
(f) Tighten the clamps along the fuselage and at the 6000 bulkhead.
(g) Connect at the control pedestal the engine control cable fork end (24) to the power control lever (33) with bolt (31), castellated nut (28) and plain washers (29, 30) (Ref. Fig. 211).

(3) If the propeller control cable can be installed do as follows:
(a) Place the propeller control cable casing (3) in position along the fuselage and at the 6000 bulkhead.
(b) Connect the propeller control cable (fuselage-engine) near the union (9) with the propeller control cable (wing-control lever) and push the cable connection (15) into the union (9) (Ref. Fig. 211).

(c) Secure the propeller control cable casing along the fuselage and at the 6000 bulkhead to the supports (6) with the clamps (1). Do not tighten the clamps (1), so that the casing (3) can keep the position and an adjustment is possible.

(d) Connect the propeller control cable casing end fitting (7) to the union (9) (toward the fuselage).

(e) Connect on the engine the propeller control cable eye end (5) to fork (6) with bolt (2), washer (4), nut (3) and cotter pin (1) (Ref. Fig. 211).

(f) Tighten the clamps (1) along the fuselage and at the 6000 bulkhead that secure the propeller control cable casing.

(g) Connect at the center pedestal the propeller control cable fork end (25) to the propeller control lever with clevis bolt (31), castellated nut (28) and plain washers (29, 30) (Ref. Fig. 211).

(4) Do a system rigging as described in this chapter.

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

Pilot CB Panel:

L ENG START

R ENG START.

(6) Remove the panels 211DLF, 211GLF, 231ALF, 231FLF, 231MLF, 231QLF and 231RLF (Refer to Chapter 06-00-00).

(7) Remove the access panels from each side of the center pedestal and the nacelle panels 410AT, 430AL, 430AR, 420AT, 440AL and 440AR (Refer to 54-40-00).

(8) Remove all furnishing located in the lavatory compartment.

(9) Remove the insulation blanket.

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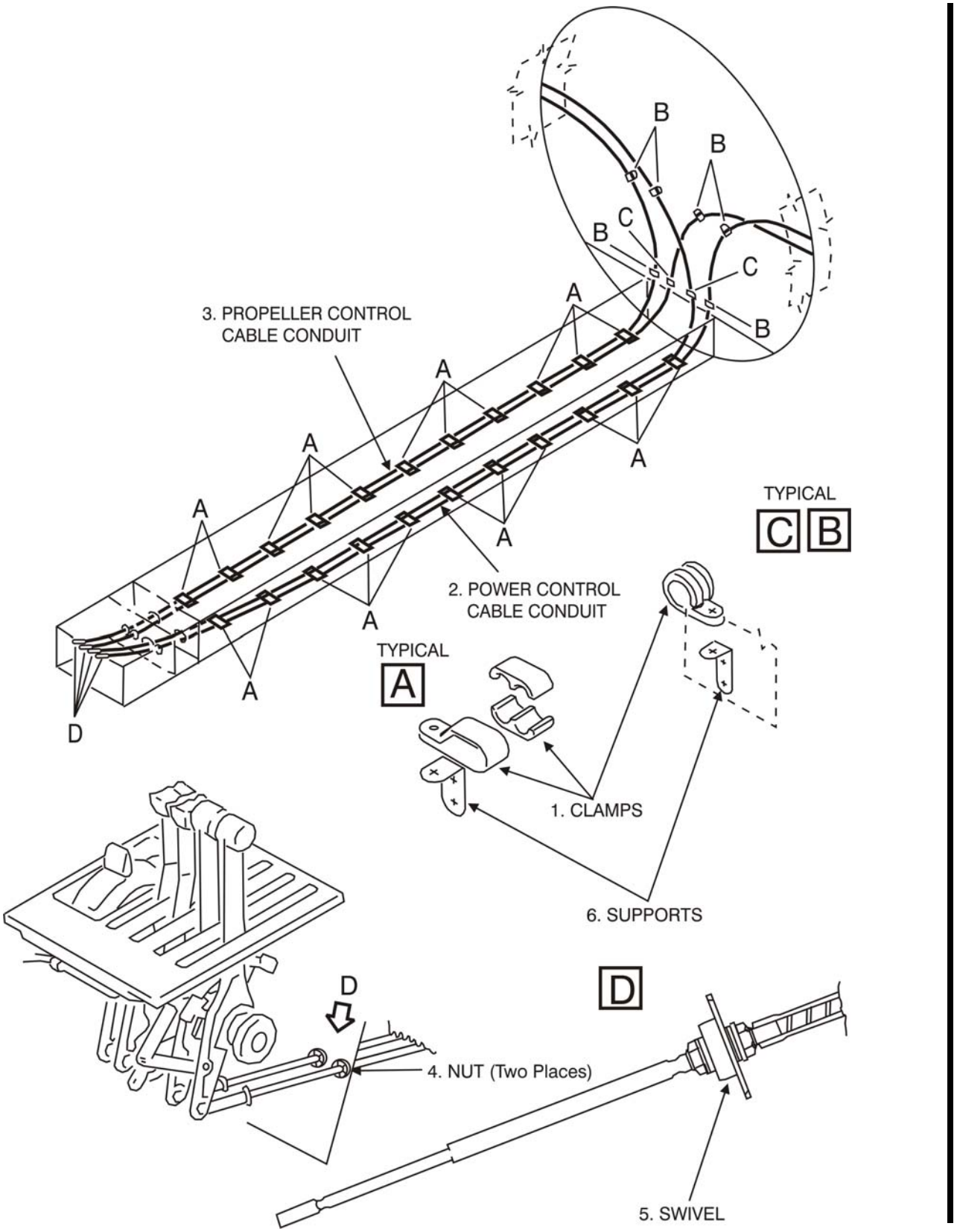

Fig. 213 - Power/Propeller Control Cables (Control Lever-Wing) - Removal/Installation

11. Fuel Control Unit (FCU) - Dead Band Adjustment (Ref. Fig.214)

A. Fixtures, Test and Support Equipment

Access platform (approx. 3 ft/1 m)	Not Specified
Warning Notice	Not Specified
Millimeter Rule (30 mm approx.)	Not Specified

B. Tools

Rigging Pin (2,5 mm)	Not Specified

C. Procedure

NOTE: Procedures for the LH removal are described, the RH removal is identical.

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

Pilot CB panel:
L ENG START
R ENG START.

(2) Check the length of the Control Rod (1) between l'FCU (2) and the Cam Box (3) is 210 mm; adjust if necessary. The measure must be taken between the link hole axis with the FCU Control Arm and the one with the Cam Box (Ref. to Fig.205).
Let the Control Rod (1) disconnected from the FCU.

(3) Insert the Rigging Pin (4) in the zero setting hole of the Cam Box.

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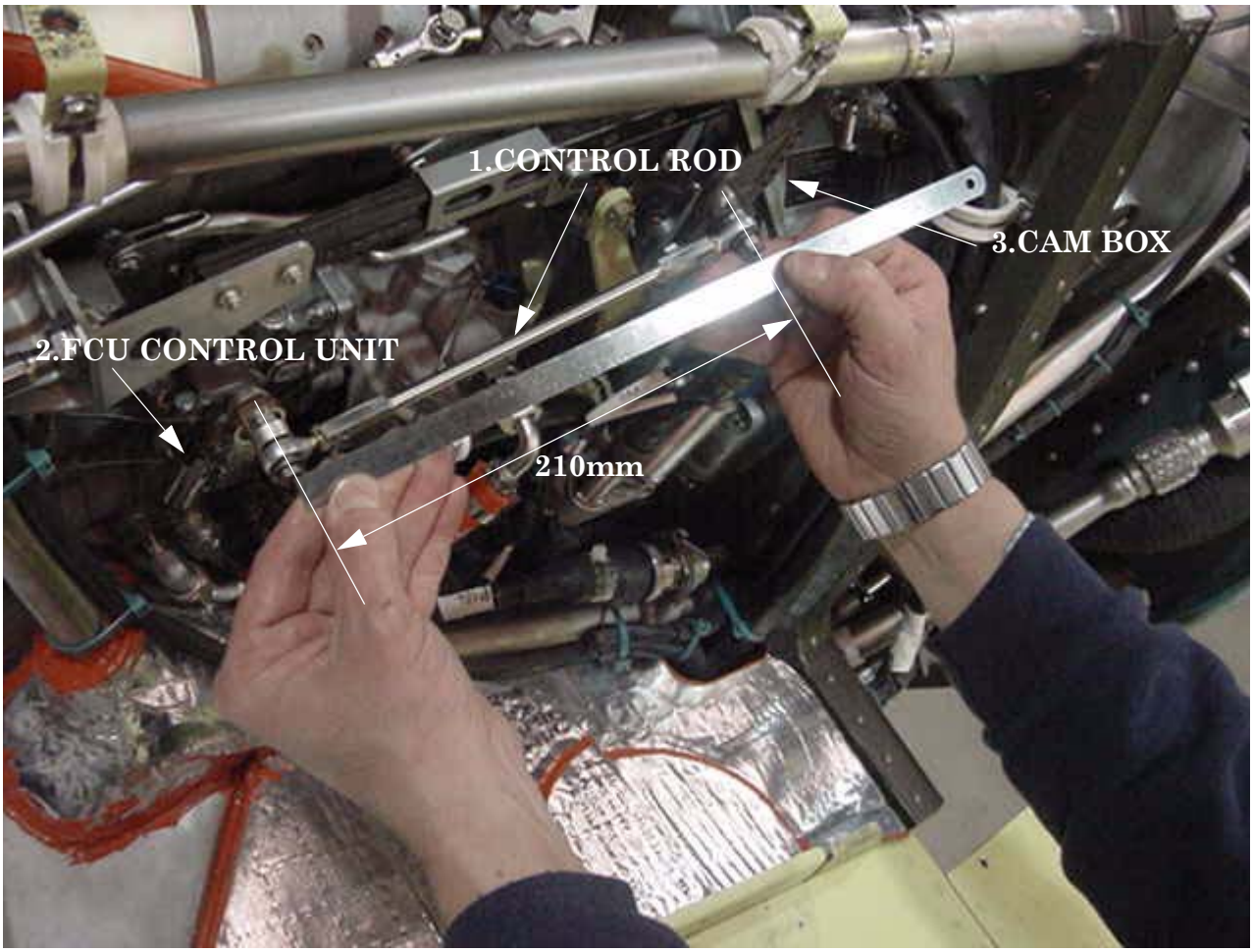

Fig. 214 - Fuel Control Unit (FCU) - Dead Band Adjustment (Sheet 1 of 6)

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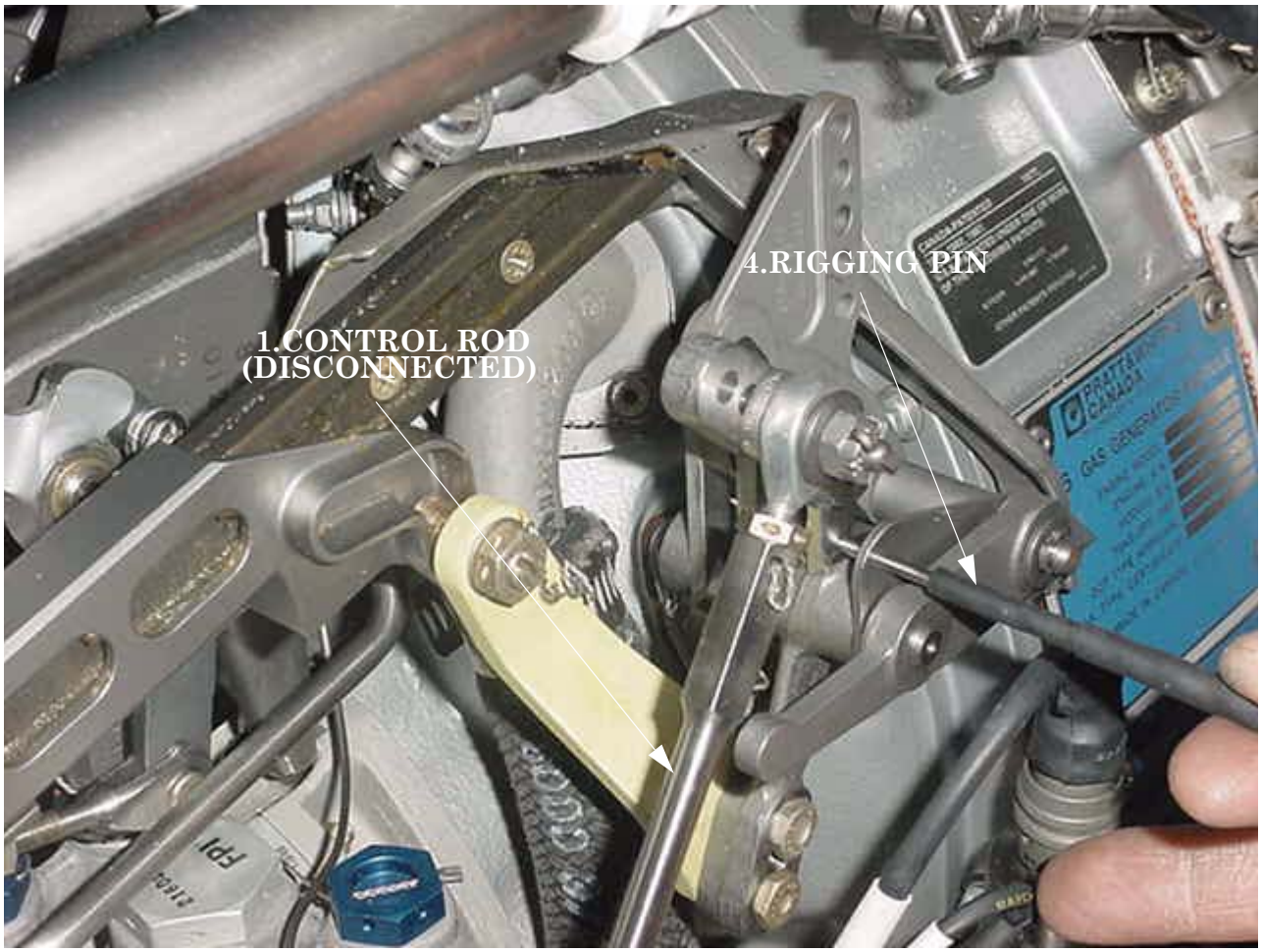

Fig. 214 - Fuel Control Unit (FCU) - Dead Band Adjustment (Sheet 2 of 6)

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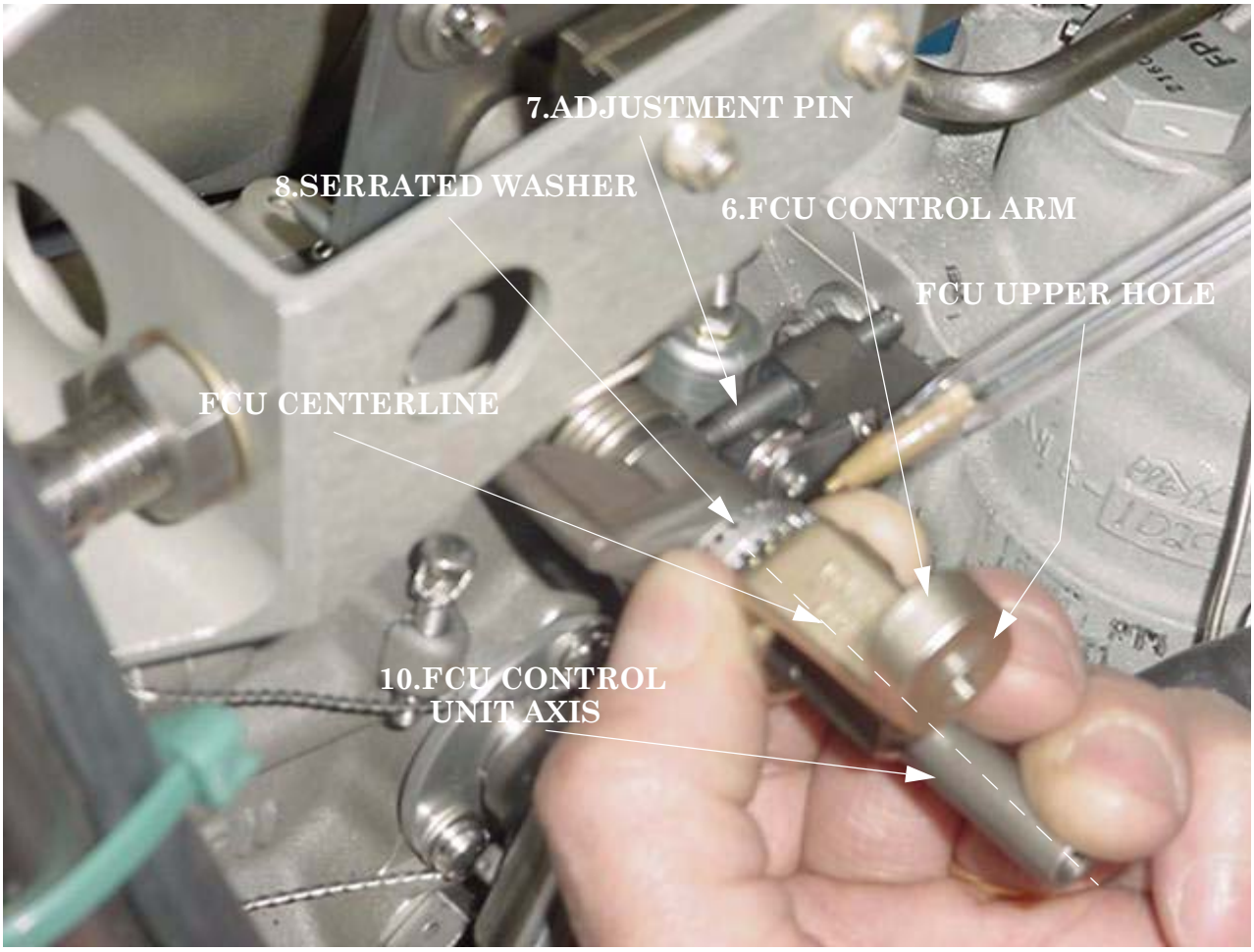

Fig. 214 - Fuel Control Unit (FCU) - Dead Band Adjustment (Sheet 3 of 6)

(4) Bring the FCU Control Arm (6) at the leading end of the Dead Band maintaining the Adjustment Pin (7) in contact with the FCU Control Arm axis (6)

(5) Insert the bolt that connect the Control Rod (1) in the upper hole of the FCU Control Arm (6) and than check that it will enter without interference.

(6) If it does not work, after having loosen the FCU Control Unit axis (10), rotate the Serrated Washer (8) in order to make it work well, holding the adjustment Pin (7) in contact with the FCU Control Arm axis(6)

(7) Let the Control Rod (1) disconnected from the FCU Control Arm (6)

(8) Draw a line with a pen to indicate the FCU, the Serrated Washer and the FCU Control Arm..

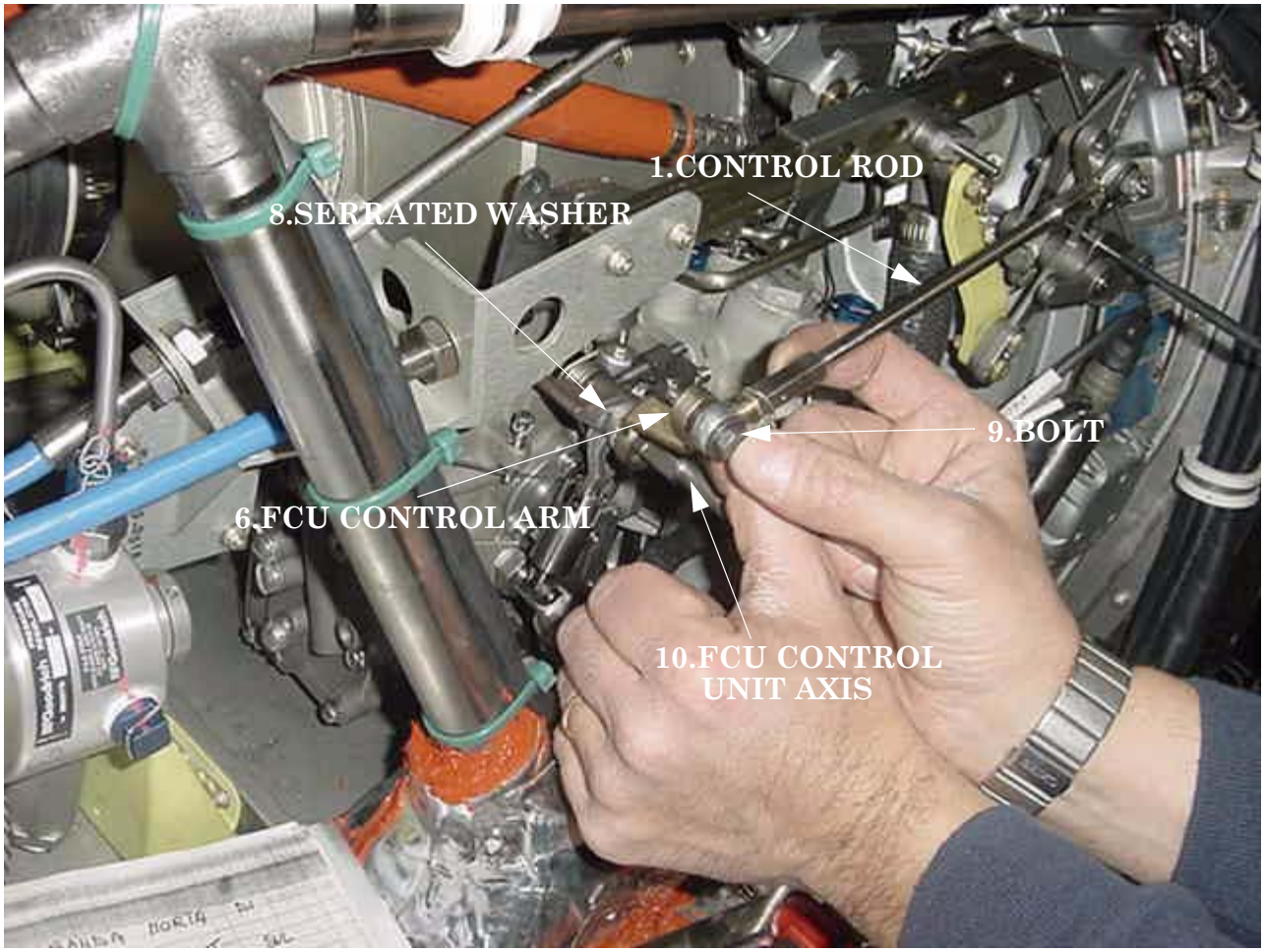

Fig. 214 - Fuel Control Unit (FCU) - Dead Band Adjustment (Sheet 4 of 6)

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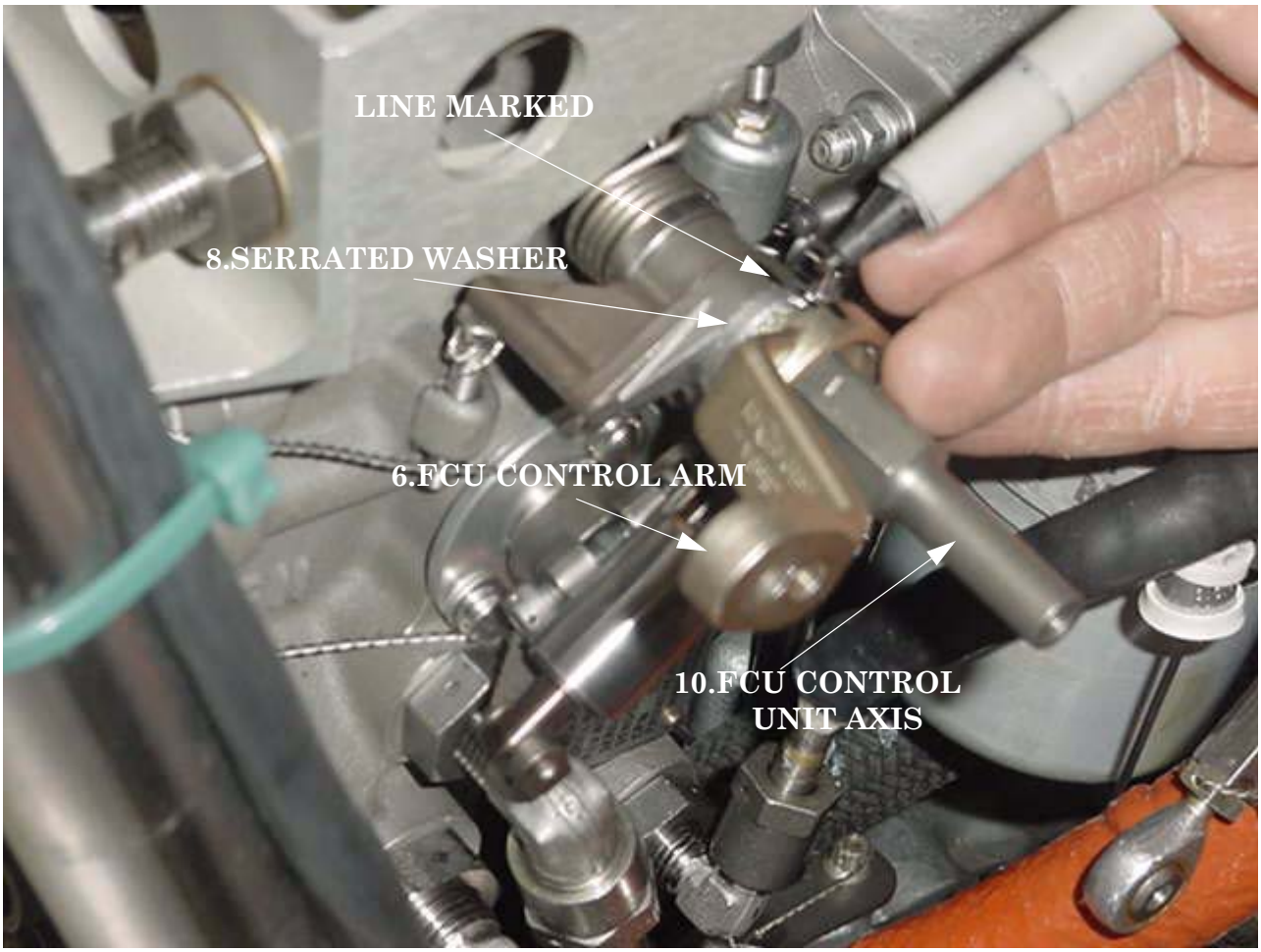

Fig. 214 - Fuel Control Unit (FCU) - Dead Band Adjustment (Sheet 5 of 6)

(9) Loosen the FCU Control Unit axis (10) and rotate, in clockwise direction, ten teeth of the Serrated Washer (6) (take care to keep lined up the marks on the FCU and on the FCU Control Arm (4)).

(10) Tighten the FCU Control Arm (6) and the Serrated Washer (8) to the FCU. While inserting the bolt, check the anticlokwise rotation of the FCU Control Arm (6) is about 1 hole (See Fig 5).

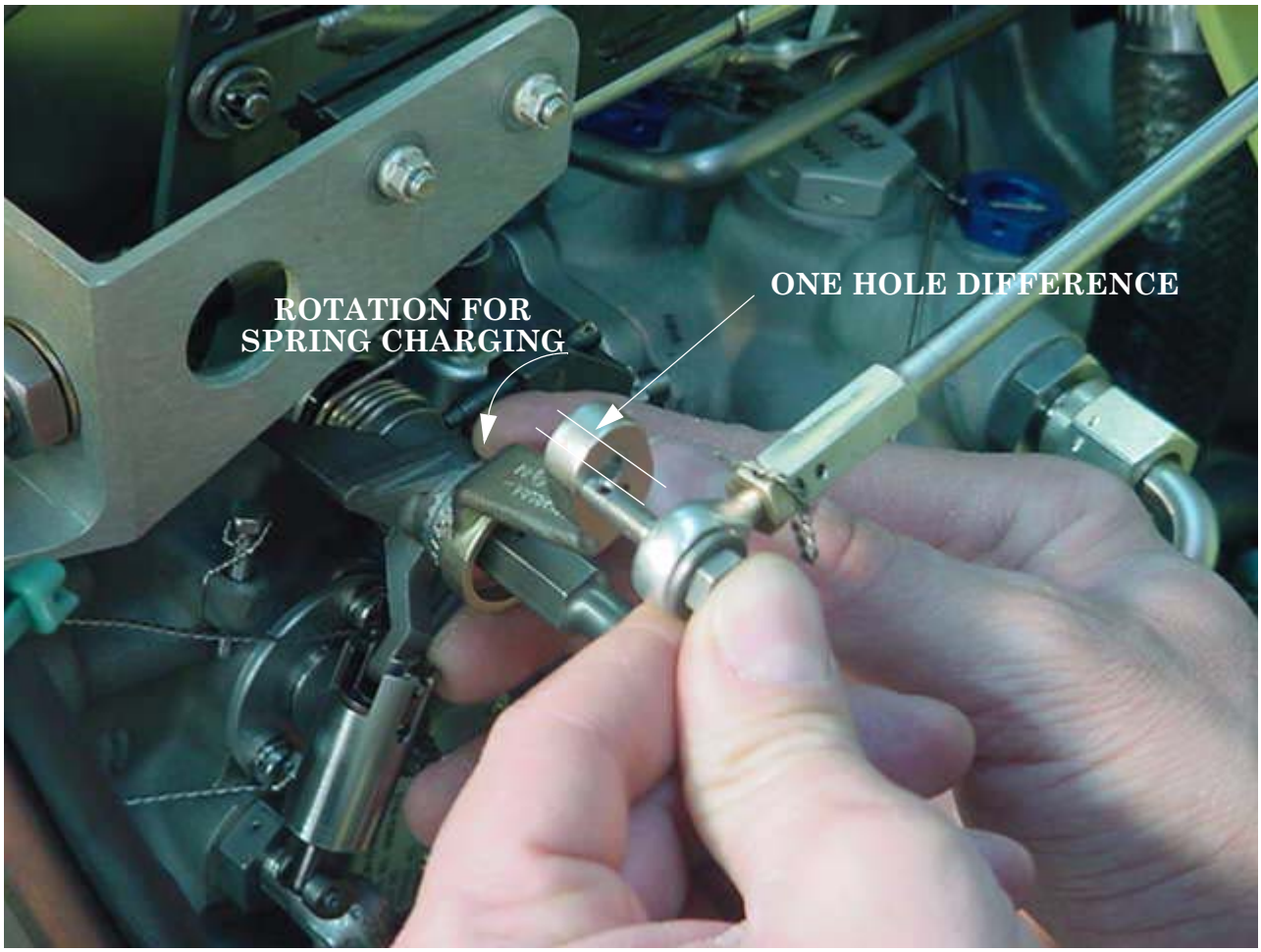

Fig. 214 - Fuel Control Unit (FCU) - Dead Band Adjustment (Sheet 6 of 6)

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CAM SWITCHES - MAINTENANCE PRACTICES

1. General

A. This topic consists of:

- a test to make sure that the cam switches operate at the correct POWER LEVER setting at all ambient temperatures between -30°C and +50°C (-22°F and 122°F).
- an operational test to make sure that the cam switches operate correctly
- an adjustment procedure to set the switches at the correct operating positions
- a Power Control Cam Switch cleaning procedure
- a self test for Cam Switch Test Set TEM-761000-002

B. The illustrations give the necessary details for location and wiring of all the switches. Switch settings are as follows:

SWITCH	**FUNCTION**	**NOMINAL SETTING PWR LEVER** (Ng)	**TOLERANCE** (on power lever position)
S94A S95A	Landing Gear Aural Warning	Ng at upper limit of FCU dead band (i.e. when the fuel flow stops decreasing moving the power lever from MAX POWER to IDLE) (NOTE 1)	+/- 2mm
S94B S94C S95B S95C	Autofeather	Ref to Fig.201 (NOTE 2)	+/- 1mm
S95E	Landing Gear Aural Warning	Left power lever at 40 mm above IDLE (NOTE 1)	+/- 2mm
S94D S94E S95D	Pressurization	85% Ng (NOTE 2)	+/- 2mm

NOTE 1:closes with Ng decreasing
NOTE 2:closes with Ng increasing

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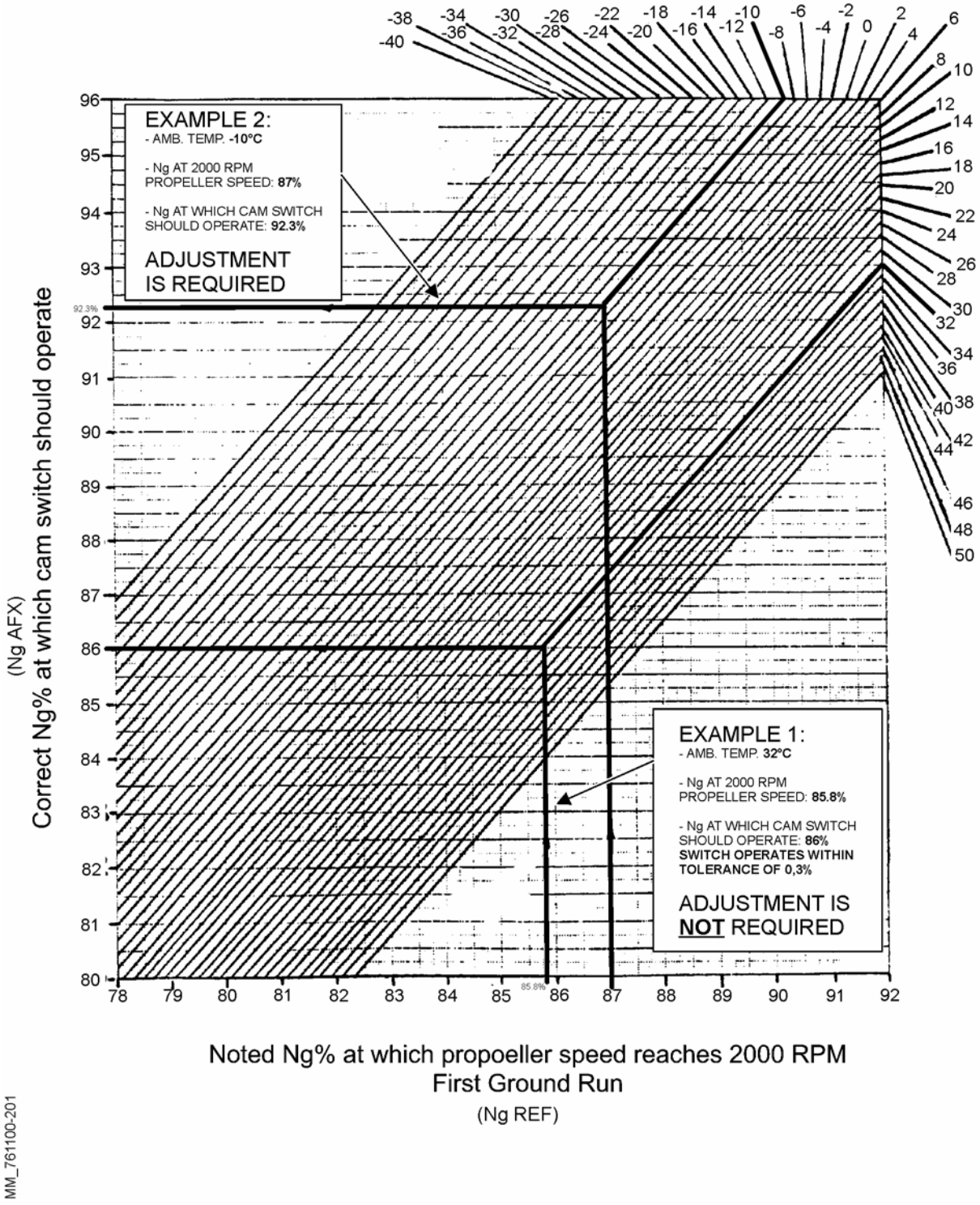

Fig. 201 - Autofeather Cam Switch Operation/Ambient Temperature Correlation Graph

2. Power Control Cam Switches - Test (Ref. Fig. 201 thru 204)

A. Fixtures, Test and Support Equipment

Ohmmeter (or similar)	Not Specified
or	
Cam Switch Test Set	TEM-761000-002

B. Reference Information

Maintenance Manual Chapter 76-11-00
Maintenance Manual Chapter 12-10-00

C. Materials

Masking Tape	Not Specified

D. Procedure

(1) Start both left and right engine (Refer to 76-11-00).
(2) Make sure that all anti-ice switches are on OFF position.

NOTE: Use masking tapes attached on the pedestal, in order to record the relevant positions of the Power Levers (Ref. Fig. 204).

(3) Move the Condition Levers fully forward, keep the Power Levers on IDLE and wait for the oil temperature to be between 60°C and 75°C.
(4) Be prepared to make a note of the Ng reading at the instant when propeller speed reaches Np MAX (Propeller RPM).
(5) Move the Power Levers slowly forward until propellers speed reach Np Max (Propeller RPM) on each side.
(6) Record the Ng value of both RH Engine and LH Engine (Ng REF) and the ambient temperature (°C) at Max Np (Propeller RPM).
(7) Apply the noted Ng (Ng REF) and the ambient temperature (°C) to the graph (Ref. Fig. 201) and find the correct Ng at which the switches should operate (Ng AFX).
(8) Move the Power Levers to IDLE.
(9) Slightly move both Power Levers forward and record the following positions on masking tape:

REFERENCE	**FUNCTION**	**NOMINAL SETTING PWR LEVER** (Ng)
Ng HORN1	Landing Gear Aural Warning	Ng at upper limit of FCU dead band (i.e. when the fuel flow start increasing moving the power lever from IDLE to MAX POWER)
Ng HORN2	Landing Gear Aural Warning	Left power lever at 40 mm above IDLE (only on the LH POWER LEVER)
Ng PRESS	Pressurization	85% Ng
Ng AFX	Autofeather	Ng at which the switch should operate (Ref to Step7)

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(10) Move the Power Levers to IDLE

(11) Shut down the engines in accordance with AMM chapter 71-00-00.

NOTE: Perform next step (12) only if the Power Control Cam Switches Test is performed during the "200 FH Aircraft Light Inspection and Servicing"

(12) Perform the oil level check as per AMM chapter 12-10-08 .

(13) Open the inspection panel 213ARW (located on the right side of the centre pedestal).

(14) Disconnect the electrical connection P4029.

NOTE: Perform the steps from 15 to 29 of this procedure if the test set TEM-761000-002 is available.
If the test set is not available perform the steps from 30 to 50 using an ohmmeter (or similar).

(15) Connect the plug P4029 on the connector J1 of the test set.

NOTE: "START" and "Test OK" buttons are located on the Test Set TEM-761000-002

(16) Perform the Cam Switch Test Set - Self Test as per AMM chapter 76-11-00

(17) Rotate the switch of test set on the position **1** to test the **S95E** cam switch, which is required to close at Ng HORN2.

(a) Move the LH POWER LEVER lightly below the Ng HORN2 reference on masking tape.

(b) Push the "START" button and verify the red light "Test OK" illuminates.

(c) Keep the "START" button pushed and move the LH POWER LEVER forward lightly above the Ng HORN2 position. Verify the red light "Test OK" switches off when the power lever position corresponding to Ng HORN2 ($\pm$ 2mm) is exceeded.

NOTE: if the red light switches off at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(18) Rotate the switch in the position **2** to test the **S95A** cam switch, which is required to close at Ng HORN1.

(a) Position the LH POWER LEVER lightly below the Ng HORN1 position.

(b) Push the "START" button and verify the red light "Test OK" illuminates.

(c) Keep the "START" button pushed and move the LH POWER LEVER forward lightly above the Ng HORN1 position. Verify the red light "Test OK" switches off when the power lever position is between IDLE and Ng HORN1.

NOTE: if the red light switches off at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(19) Rotate the switch in the position **3** to test the **S95B** cam switch, which is required to open at Ng AFX ± 0.3%.

(a) Position theLH POWER LEVER lightly below the Ng AFX position.

(b) Push the "START" button and verify the red light "Test OK" does not illuminate.

(c) Keep the "START" button pushed and move the LH POWER LEVER forward lightly above the Ng AFX position. Verify the red light "Test OK" switches on when the power lever position corresponding to Ng AFX (± 1mm) is exceeded.

NOTE: if the red light switches on at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(20) Rotate the switch in the position **4** to test the **S95C** cam switch, which is required to open at Ng AFX ± 0.3%.

(a) Position the LH POWER LEVER lightly below the Ng AFX position.

(b) Push the "START" button and verify the red light "Test OK" does not illuminate.

(c) Keep the "START" button pushed and move the LH POWER LEVER forward lightly above the Ng AFX position. Verify the red light "Test OK" switches on when the power lever position corresponding to Ng AFX (± 1mm) is exceeded.

NOTE: if the red light switches on at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

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(21) Rotate the switch in the position **5** to test the **S94D** and **S95D** cam switches, which are required to open at 85%.

(a) Move the LH POWER LEVER lightly below the NgPRESS position and the RH POWER LEVER on IDLE.

(b) Push the "START" button and verify the red light "Test OK" does not illuminate.

(c) Keep the "START" button pushed and move the LH POWER LEVER forward lightly above the NgPRESS position. Verify the red light "Test OK" switches on when the power lever position corresponding to NgPRESS (± 2mm) is exceeded.

(d) Release the "START" button

(e) Position the RH POWER LEVER lightly below the NgPRESS position and the LH POWER LEVER on IDLE.

(f) Push the "START" button and verify the red light "Test OK" does not illuminate.

(g) Keep the "START" button pushed and move the RH POWER LEVER forward lightly above the NgPRESS position. Verify the red light "Test OK" switches on when the power lever position corresponding to NgPRESS (± 2mm) is exceeded.

NOTE: if the red light switches on at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(22) Rotate the switch in the position **6** to test the **S95E** cam switch, which is required to open at Ng HORN2.

(a) Position the LH POWER LEVER lightly below the Ng HORN2 position.

(b) Push the "START" button and verify the red light "Test OK" does not illuminate.

(c) Keep the "START" button pushed and move the LH POWER LEVER forward lightly above the Ng HORN2 position. Verify the red light "Test OK" illuminates when the power lever position corresponding to Ng HORN2 (± 2 mm) is exceeded.

NOTE: if the red light switches on at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(23) Rotate the switch in the position **7** to test the **Aural Warning Mute switch**.

(a) Move both the Power Levers on IDLE.

(b) Push the "START" button and verify the red light "Test OK" does not illuminate.

(c) Keeping pushed the "MUTE" button on the RH POWER LEVER, push the "START" button and verify the red light "Test OK" illuminates.

(24) Rotate the switch in the position **8** to test the **S94A** cam switch, which is required to close at Ng HORN1.

(a) Position the RH POWER LEVER lightly below the Ng HORN1 position.

(b) Push the "START" button and verify the red light "Test OK" illuminates.

(c) Keep the "START" button pushed and move RH POWER LEVER forward lightly above the Ng HORN1 position. Verify the red light "Test OK" switches off when the power lever position is between IDLE and Ng HORN1.

NOTE: if the red light switches off at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(25) Rotate the switch in the position **9** to test the **S94B** cam switch, which is required to open at Ng AFX ± 0.3%.

(a) Position RH POWER LEVER lightly below the Ng AFX position.

(b) Push the "START" button and verify the red light "Test OK" does not illuminate.

(c) Keep the "START" button pushed and move the RH POWER LEVER forward lightly above the Ng AFX position. Verify the red light "Test OK" switches on when the power lever position corresponding to Ng AFX (± 1mm) is exceeded.

NOTE: if the red light switches on at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(26) Rotate the switch in the position **10** to test the **S94C** cam switch, which is required to open at Ng AFX ± 0.3%.

(a) Position the RH POWER LEVER lightly below the Ng AFX position.

(b) Push the "START" button and verify the red light "Test OK" does not illuminate.

(c) Keep the "START" button pushed and move the RH POWER LEVER forward lightly above the Ng AFX position. Verify the red light

(d) "Test OK" switches on when the power lever position corresponding to Ng AFX (± 1mm) is exceeded.

NOTE: if the red light switches on at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

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(27) Rotate the switch in the position **12** to test the **Go Around switch**.

(a) Push the "START" button and verify the red light "Test OK" does not illuminate.

(b) Keeping pushed the "Go Around" button on the LH POWER LEVER, push the "START" button and verify the red light "Test OK" illuminates.

(28) Rotate the switch in the position **13** to test the **S94E** cam switch, which is required to open at 85% Ng.

(a) Position the RH POWER LEVER lightly below the 85% Ng position.

(b) Push the "START" button and verify the red light "Test OK" does not illuminate.

(c) Keep the "START" button pushed and move the RH POWER LEVER forward lightly above the Ng PRESS Ng position. Verify the red light "Test OK" switches on when the power lever position corresponding to Ng PRESS (± 2 mm) is exceeded.

NOTE: if the red light switches on at settings different from required ones, adjust in accordance with AMM 76-11-00.

NOTE: if the red light does not switch on or does not switch off, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(29) Perform steps from 47 to 50.

(30) Connect the ohmmeter (or similar) to pins **Z** and **V** of plug P4029 to test the **S95B** cam switch, which is required to open at Ng AFX ± 0.3%.

(a) Move the LH POWER LEVER lightly below the Ng AFX reference on masking tape.

(b) Move the LH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(c) Verify the switch operates when the power lever position corresponding to Ng AFX (± 1mm) is exceeded.

NOTE: if the switch operates at settings different from required one, adjust in accordance with AMM 76-11-00.

NOTE: if the switch does not operate at all, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(31) Disconnect the ohmmeter from pins Z and V.

(32) Connect the ohmmeter (or similar) to pins **a** and **W** of plug P4029 to test the **S95C** cam switch, which is required to open at Ng AFX ± 0.3%.

(a) Move the LH POWER LEVER lightly below the Ng AFX reference on masking tape.

(b) Move the LH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(c) Verify the switch operates when the power lever position corresponding to ..Ng AFX (± 1mm) is exceeded.

NOTE: if the switch operates at settings different from required one, adjust in accordance with AMM 76-11-00.

NOTE: if the switch does not operate at all, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(33) Disconnect the ohmmeter from pins a and W.

(34) Connect the ohmmeter (or similar) to pins **b** and **X** of plug P4029 to test the **S94B** cam switch, which is required to open at Ng AFX ± 0.3%.

(a) Move the RH POWER LEVER lightly below the Ng AFX reference on masking tape.

(b) Move the RH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(c) Verify the switch operates when the power lever position corresponding to Ng AFX (± 1mm) is exceeded.

NOTE: if the switch operates at settings different from required one, adjust in accordance with AMM 76-11-00.

NOTE: if the switch does not operate at all, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(35) Disconnect the ohmmeter from pins b and X

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(36) Connect the ohmmeter (or similar) to pins **c** and **Y** of plug P4029 to test the **S94C** cam switch, which is required to open at Ng AFX ± 0.3%.

(a) Move the RH POWER LEVER lightly below the Ng AFX reference on masking tape.

(b) Move the RH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(c) Verify the switch operates when the power lever position corresponding to Ng AFX (± 1mm) is exceeded.

NOTE: if the switch operates at settings different from required one, adjust in accordance with AMM 76-11-00.

NOTE: if the switch does not operate at all, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(37) Disconnect the ohmmeter from pins c and Y.

(38) Connect the ohmmeter (or similar) to pins **F** and **E** of plug P4029 to test the **S95E** cam switch, which is required to close at Ng HORN2.

(a) Move the LH POWER LEVER lightly below the Ng HORN2 reference on masking tape.

(b) Move the LH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(c) Verify the switch operates when the power lever position corresponding to Ng HORN2 (± 2mm) is exceeded.

NOTE: if the switch operates at settings different from required one, adjust in accordance with AMM 76-11-00.

NOTE: if the switch does not operate at all, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(39) Disconnect the ohmmeter from pins F and E.

(40) Connect the ohmmeter (or similar) to pins **M** and **J** of plug P4029 to test the **S94D** and **S95D** cam switches, which is required to close at Ng PRESS.

(a) Move the LH POWER LEVER lightly below the Ng PRESS reference on masking tape, and put the RH POWER LEVER on IDLE position.

(b) Move the LH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(c) Verify the switch operates when the power lever position corresponding to Ng PRESS (± 2mm) is exceeded

(d) Move the RH POWER LEVER lightly below the Ng PRESS reference on masking tape, and put the LH POWER LEVER on IDLE position.

(e) Move the RH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(f) Verify the switch operates when the power lever position corresponding to Ng PRESS (± 2mm) is exceeded

NOTE: if the switch operates at settings different from required one, adjust in accordance with AMM 76-11-00.

NOTE: if the switch does not operate at all, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(41) Disconnect the ohmmeter from pins M and J.

(42) Connect the ohmmeter (or similar) to pins **B** and **A** of plug P4029 to test the **S95A** cam switch, which is required to close at Ng HORN1.

(a) Move the LH POWER LEVER lightly below the Ng HORN1 reference on masking tape.

(b) Move the LH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(c) Verify the switch operates when the power lever position is between Ng HORN1 and IDLE.

NOTE: if the switch operates at settings different from required one, adjust in accordance with AMM 76-11-00.

NOTE: if the switch does not operate at all, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

(43) Disconnect the ohmmeter from pins B and A.

(44) Connect the ohmmeter (or similar) to pins **K** and **N** of plug P4029 to test the **S94E** cam switch, which is required to open at Ng PRESS.

(a) Move the RH POWER LEVER lightly below the Ng PRESS reference on masking tape.

(b) Move the LH POWER LEVER slowly forward until the switch operates (as indicated by the ohmmeter)

(c) Verify the switch operates when the power lever position corresponding to Ng PRESS (+ 2mm) is exceeded.

NOTE: if the switch operates at settings different from required one, adjust in accordance with AMM 76-11-00.

NOTE: if the switch does not operate at all, check for proper installation of cam switches.
Cam switch replacement or cleaning may be required.

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(45) Connect the ohmmeter (or similar) to pins **D** and **A** of plug P4029 to test the **Aural Warning Mute switch** (Ref. to Fig. 205)
   (a) Move both the Power Levers on IDLE.
   (b) Keeping pushed the "MUTE" button on the RH POWER LEVER, check that the switch operates (as indicated by the ohmmeter).
   (c) Disconnect the ohmmeter from pins D and A
(46) Connect the ohmmeter (or similar) to pins **R** and **S** of plug P4029 to test the **Go Around switch** (Ref. to Fig. 205)
   (a) Keeping pushed the "GO AROUND" button on the LH POWER LEVER, check that switch operates (as indicated by the ohmmeter).
(47) Disconnect the ohmmeter from pins R and S.
(48) Disconnect the plug P4029 from the ohmmeter.
(49) Close the electrical connection P4029.
(50) Close the inspection panel 213ARW (located on the right side of the centre pedestal).

3. Power Control Cam Switches - Operational Check (Ref. Fig. 205)

A. Fixtures, Test and Support Equipment

Ohmmeter (or similar)	Not Specified
or	
Cam Switch Test Set	TEM-761000-002

B. Materials

N/A

C. Referenced Information

N/A

D. Procedure

(1) Remove the side panels of the control pedestal.
(2) Disconnect the electrical plug (P4029) of the control pedestal wiring harness.
(3) Connect the plug P4029 on the connector J1 of the test set or connect the ohmmeter (or similar) to pins of plug P4029.
(4) Perform the operational test for each cam switch (Ref. to Tables 201 and 202) moving the power levers slowly forward and rear until the relevant switch of cam switch assembly (or button) operates (ref also to Fig. 205).
(5) The Operational Test procedure gives good results if, during the power lever excursion, the cam switches operate correctly (as indicated by the ohmmeter or test set).

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POWER LEVERS POSITION	CAM SWITCH	TEM-761000-002 POSITION SELECTED	P4029 CONNECTOR PINS SELECTED (Ref to Fig. 205)	LH POWER LEVER	RH POWER LEVER
HORN 1	S94A	8	C-A	N/A	_____
	S95A	2	B-A	_____	N/A
HORN 2	S95E	1	U-F	_____	N/A
	S95E	6	E-F	_____	N/A
PRESS	S94D	5	M-L	N/A	_____
	S94E	13	K-N	N/A	_____
	S95D	5	M-L	_____	N/A
AFX	S94B	9	X-b	N/A	_____
	S94C	10	Y-c	N/A	_____
	S95B	3	V-Z	_____	N/A
	S95C	4	W-a	_____	N/A

Table 201 - Operational Test References (Switches)

BUTTON CHECK		TEM-761000-002 POSITION SELECTED	P4029 CONNECTOR PINS SELECTED (Ref to Fig. 205)	LH POWER LEVER	RH POWER LEVER
GEAR MUTE		7	D-A	N/A	N/A
GO AROUND		12	R-S	N/A	N/A

Table 202 - Operational Test References (Buttons)

4. Power Control Cam Switches - Adjustment (Ref. Figs. 202 thru 204)

A. Fixtures, Test and Support Equipment

Ohmmeter (or similar)	Not Specified

B. Materials

Cotter Pin	MS24665-151

C. Referenced Information

Maintenance Manual Chapter	76-11-00
Illustrated Parts Catalog	76-11-00

D. Procedure

(1) Make sure that the inspection panel 213ARW (located on the right side of the centre pedestal) has been removed, if not remove it.
(2) Remove the friction control knob at the left side of the control pedestal.
(3) Attach tags to the power and propeller control cables to identify which cable is connected to which lever.
(4) Disconnect the control cables from the control levers (Refer to 76-11-00).
(5) Remove the eight screws which secure the control box assembly to the pedestal.
(6) Carefully remove the box assembly from its location.

NOTE: This procedure is for any one of the switches. Repeat the procedures as required for the number of switches to be adjusted.

NOTE: The method of adjustment is given on the end cap of the switch assembly, and is shown on Fig. 203 which also gives wiring details of the switches.

(7) Connect the ohmmeter to the applicable pins for the switch being adjusted. Refer to Fig. 203 for pin details.
(8) Loosen the locking screw and turn the adjusting screw as required to achieve switch operation at the correct Ng setting. Refer to Fig. 203 for adjustment details.
(9) Use the marks alongside the POWER LEVER to check that the switch operates at the power lever position which equates to the correct % Ng setting.
(10) When the switch is adjusted as required, tighten the locking screw.
(11) Install the control box assembly in its location on the control pedestal.
(12) Install the eight screws to secure the box assembly to the pedestal.
(13) Connect the control cables to the control levers in accordance with the details on the identity tags (Refer to 76-11-00).
(14) Safety the four nuts with new cotter pins.
(15) Install the friction control knob at the left side of the control pedestal.
(16) Do the test again (Refer to Para. 2); this is to make sure that the switches operate at the correct % Ng setting as determined at the first test.
(17) Do a "Landing Gear Warning Test" as detailed in the chapter 32-60-00 Page Block 501.

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5. Power Control Cam Switches - Cleaning

A. Fixtures, Test and Support Equipment

Cam Switch Test Set	TEM-761000-002

B. Materials

N/A

C. Referenced Information

N/A

D. Procedure

NOTE: "Cam Switch Test Set - Self Test" - has to be performed before start the cleaning procedure.

(1) Open the inspection panel 213ARW located on the right side of the pedestal.
(2) Connect the plug P4029 on the connector J1 of the test set.
(3) Connect electrical power (28Vdc - 1.5A) to the test set and verify the green light "Power ON" illuminates.
(4) Set the rotary switch on position 1.
(5) Push and hold the "START" button.
(6) Perform 4 complete excursions (IDLE ' MAX PWR ' IDLE) of the Power Lever corresponding to the switch to be cleaned.
(7) The cleaning procedure gives good results if, during the power lever excursion, the red light "Test OK" illuminates.
(8) Release the "START" button.
(9) For every channel corresponding to the rotary switch positions from 2 to 13, repeat steps from (5) to (7).
(10) Disconnect the plug P4029 from the connector J1 of the test set.
(11) Disconnect the electrical power (28Vdc) from the test set.

6. Cam Switch Test Set - Self Test

A. Fixtures, Test and Support Equipment

Cam Switch Test Set	TEM-761000-002

B. Materials

N/A

C. Referenced Information

N/A

D. Procedure

(1) Connect electrical power (28Vdc - 1.5A) to the test set and verify the green light "Power ON" illuminates.
(2) Set the rotary switch on position 1.
(3) Push and hold the "TEST ON" button.
(4) Push the "START" button and verify the red light "Test OK" illuminates.
(5) Release the "START" button.
(6) For every channel corresponding to the rotary switch positions from 2 to 13, repeat steps from (3) to (5)
(7) Disconnect electrical power from the test set

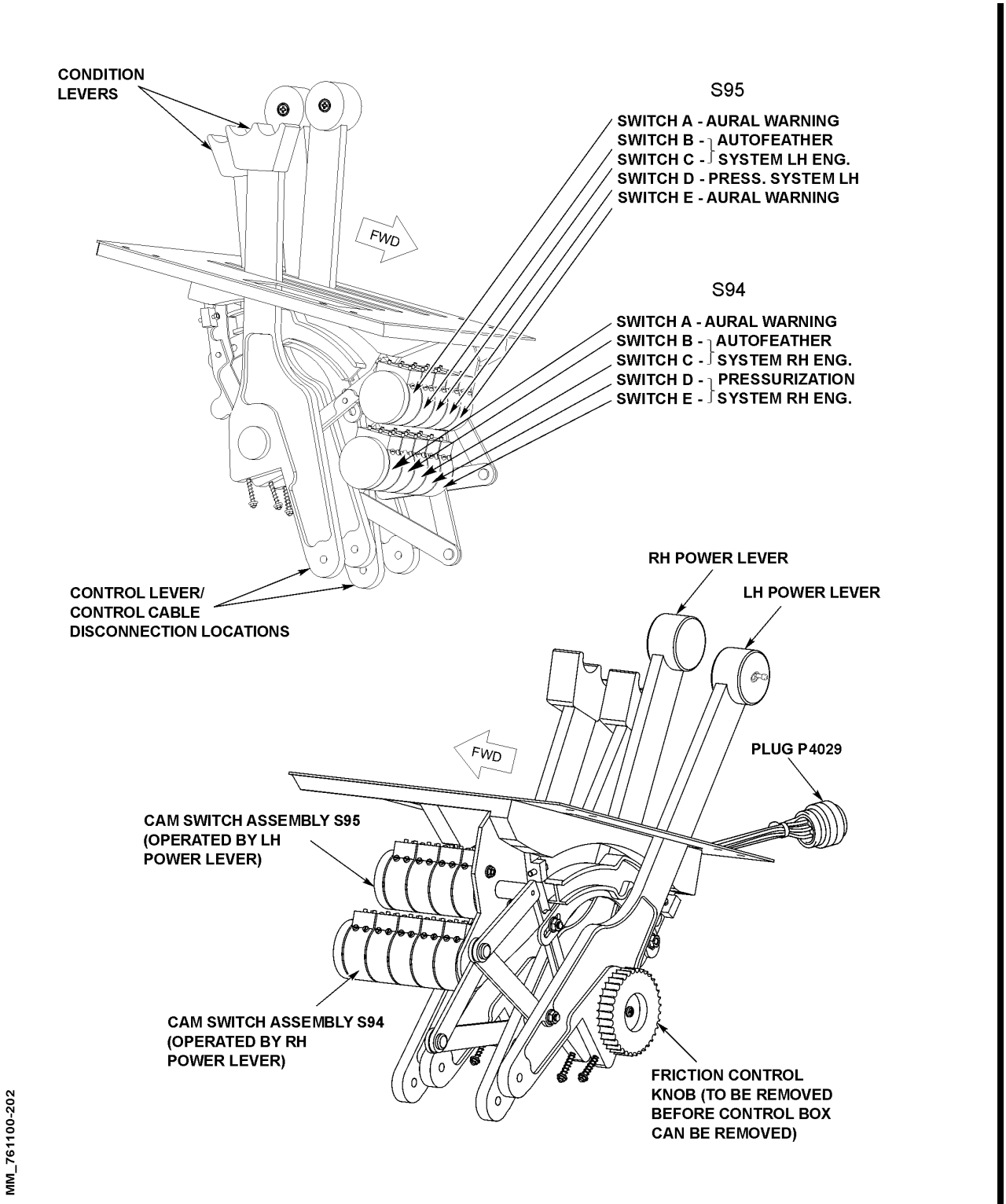

Fig. 202 - Details of Control Box Assembly

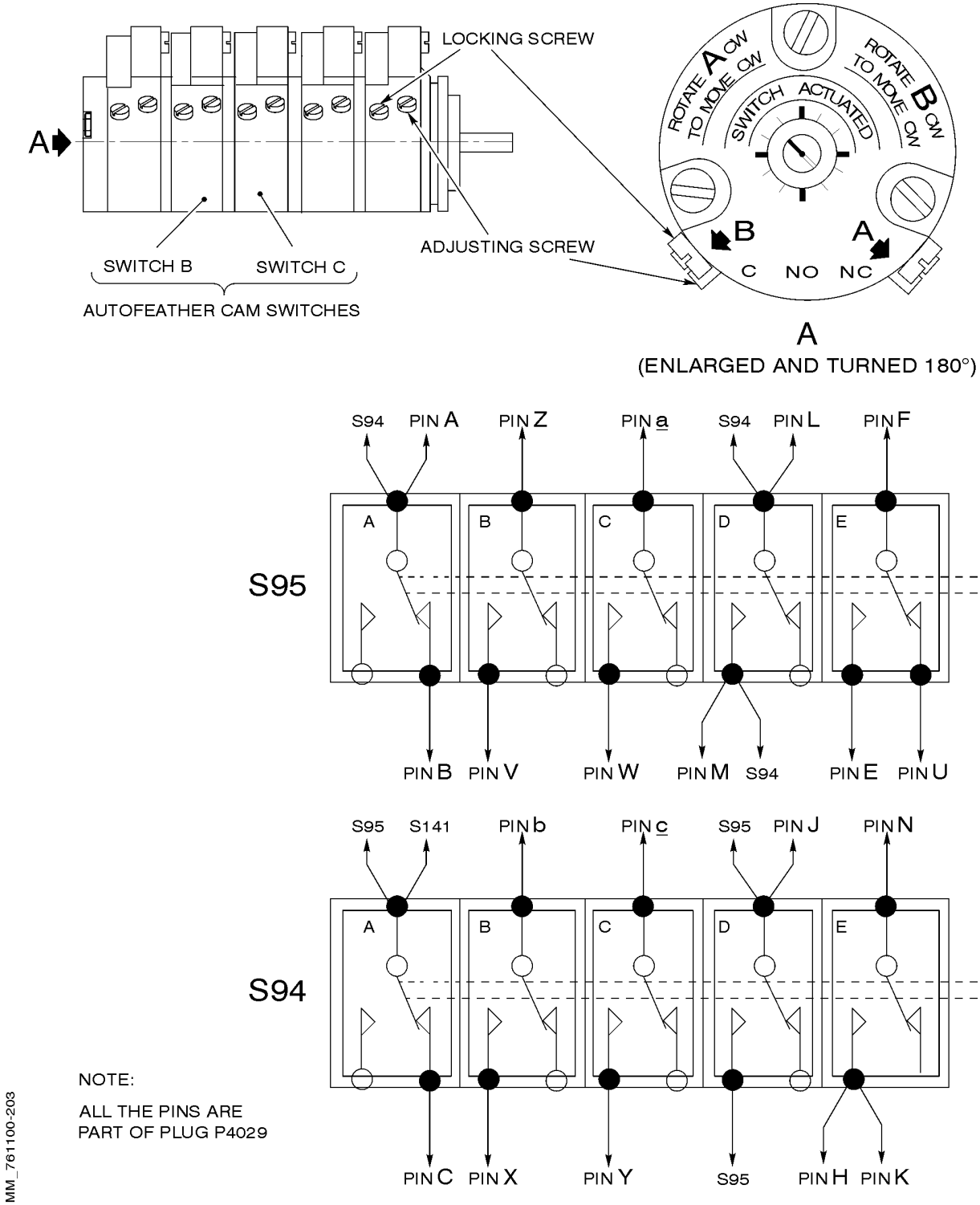

Fig. 203 - Cam Switch Wiring and Adjustment Details

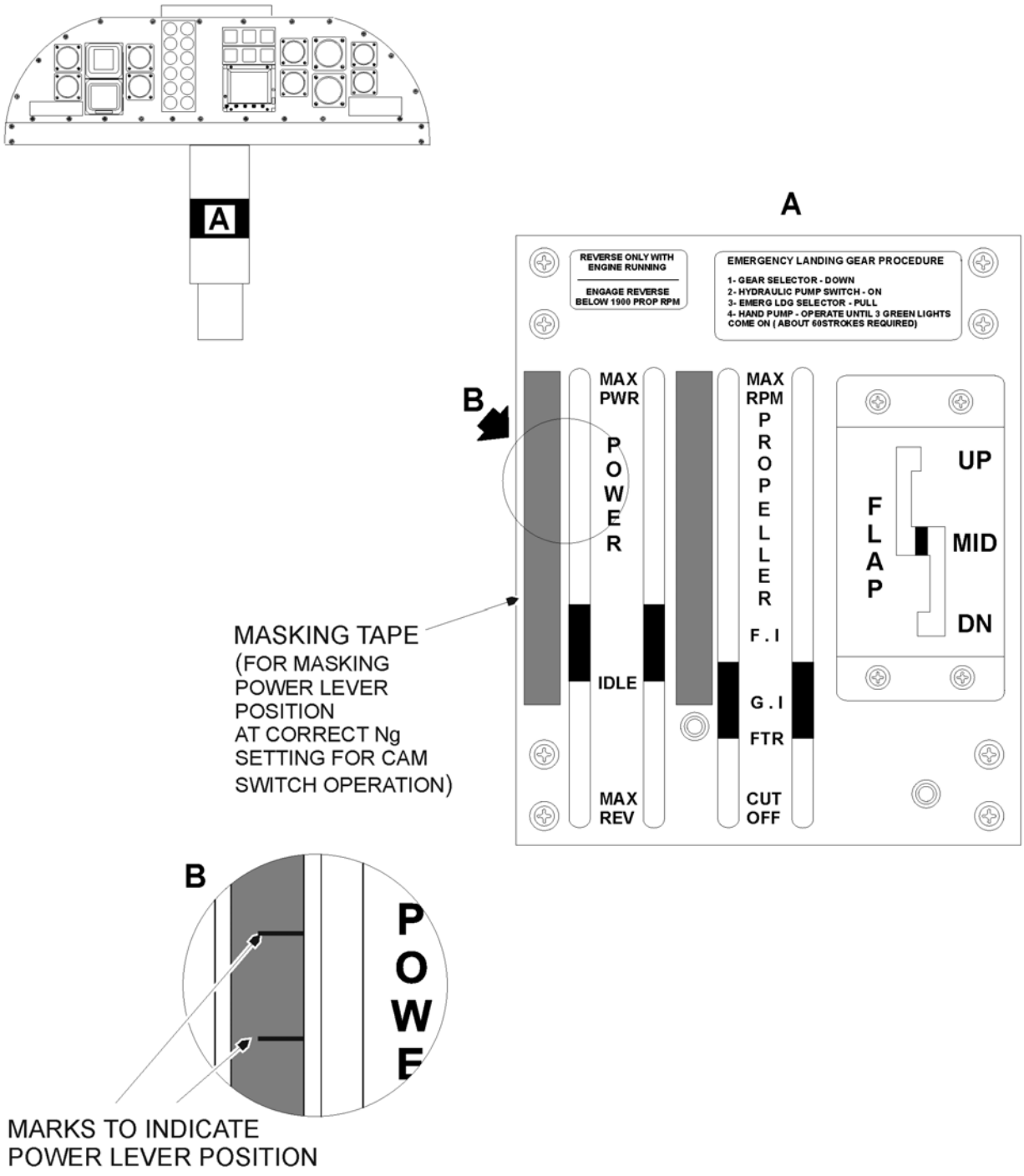

Fig. 204 - Example of Marking POWER LEVER Position

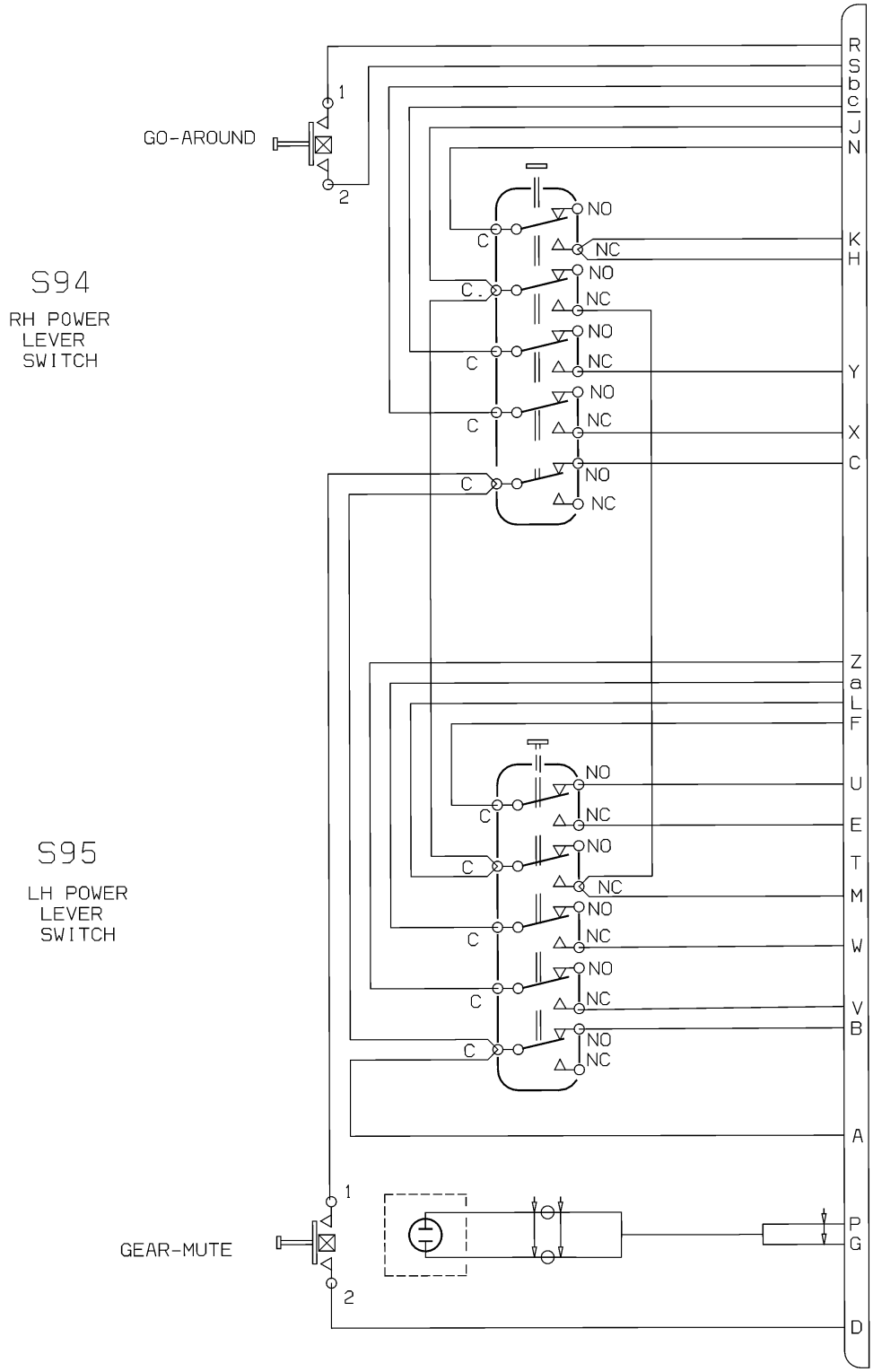

Fig. 205 - Power Control Cam Switches - Electrical Schematic

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EMERGENCY SHUTDOWN - DESCRIPTION AND OPERATION

1. General

There are no specific engine controls for emergency shutdown. Fuel flow from the tanks to the engine is stopped by setting the switch of the firewall fuel-shutoff valve to the CLOSED position.

The shutoff valve is part of the airplane fuel system and is dealt with in Chapter 28-20-00 of this manual.

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