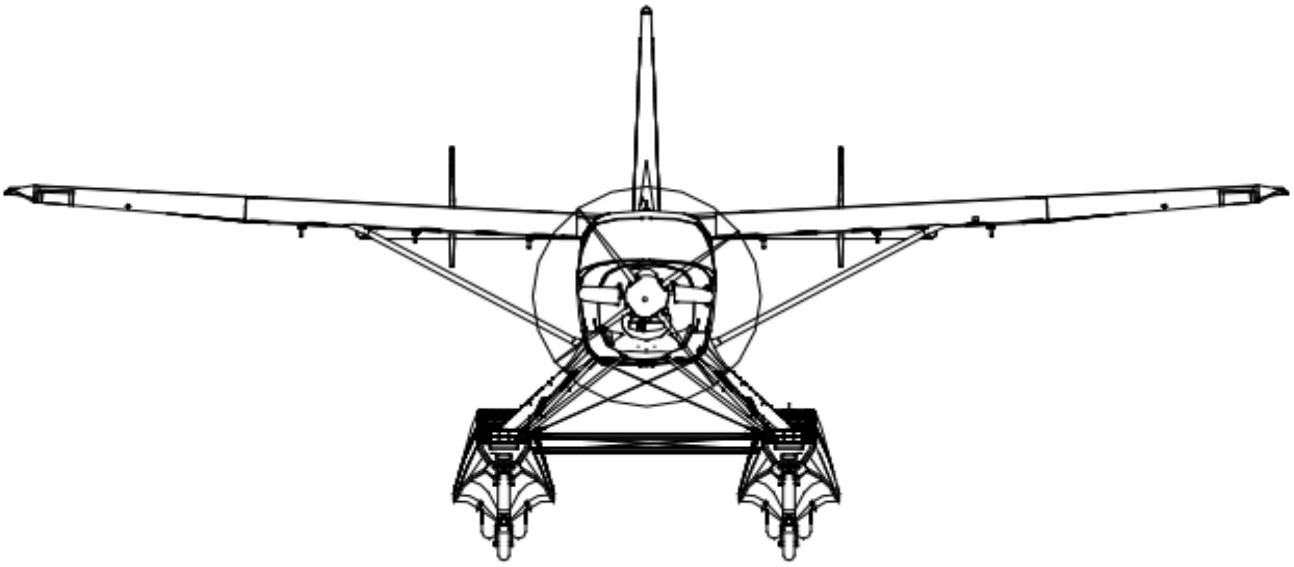
UNITED STATES
DEPARTMENT OF THE INTERIOR



KODIAK 100 SERIES

Complete Engine Rigging and Runs

4 Bladed Propeller

NOTE: THE INSTRUCTION WORK SHEETS / PACKAGES IN THIS DOCUMENT ARE FOR THE 'UNITED STATES DEPARTMENT OF THE INTERIOR' AIRCRAFT ONLY. **DOES NOT SUPERCEED THE MANUFACTURES MAINTENANCE MANUAL.**

DOI - KODIAK 100 SERIES
RECORD OF REVISIONS

MFG REV NO	DESCRIPTION	ISSUE DATE	ATP REV DATE	INSERTED BY

DOI - KODIAK 100 SERIES
RECORD OF TEMPORARY REVISIONS

REVISION No.	PAGE NUMBER	ISSUE DATE	INSERTION DATE	INSERTED BY	REMOVAL DATE	REMOVED BY
DOI-KODIAK-ENGINE-CONRTOL-RIGGING-TR01	1-19	9/26/2018				
DOI-KODIAK-ENGINE-RIGGING-RUNS	1-11	9/26/2018				

INSTRUCTIONS

DOI – KODIAK 100 SERIES – 4 Bladed Propeller ENGINE RIGGING AND RUNS

THE INSTRUCTION WORK SHEETS / PACKAGES IN THIS DOCUMENT ARE FOR THE 'UNITED STATES DEPARTMENT OF THE INTERIOR' AIRCRAFT ONLY.

THESE INSTRUCTIONS ARE COMPOSSED OF 3 DIFFERENT SECTIONS

Section 1: Run Checklist

This section of the Instruction worksheet should be completed by the technician to collect run data to evaluate if the engine is operating within limits. If Engine is not operating within limits, use Section 2, Engine Rigging/Runs, for minor rigging changed and adjustments.

Run Checklist Example

Check Being Performed

CHECK

Value that is to be achieved → Ng 70% +2/-2%

	POWER LEVER-	IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	CONDITION LEVER-	HIGH IDLE
	CHECK Np INDICATION	

Checklist of procedure

Np INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

Value after each check is completed and adjusted

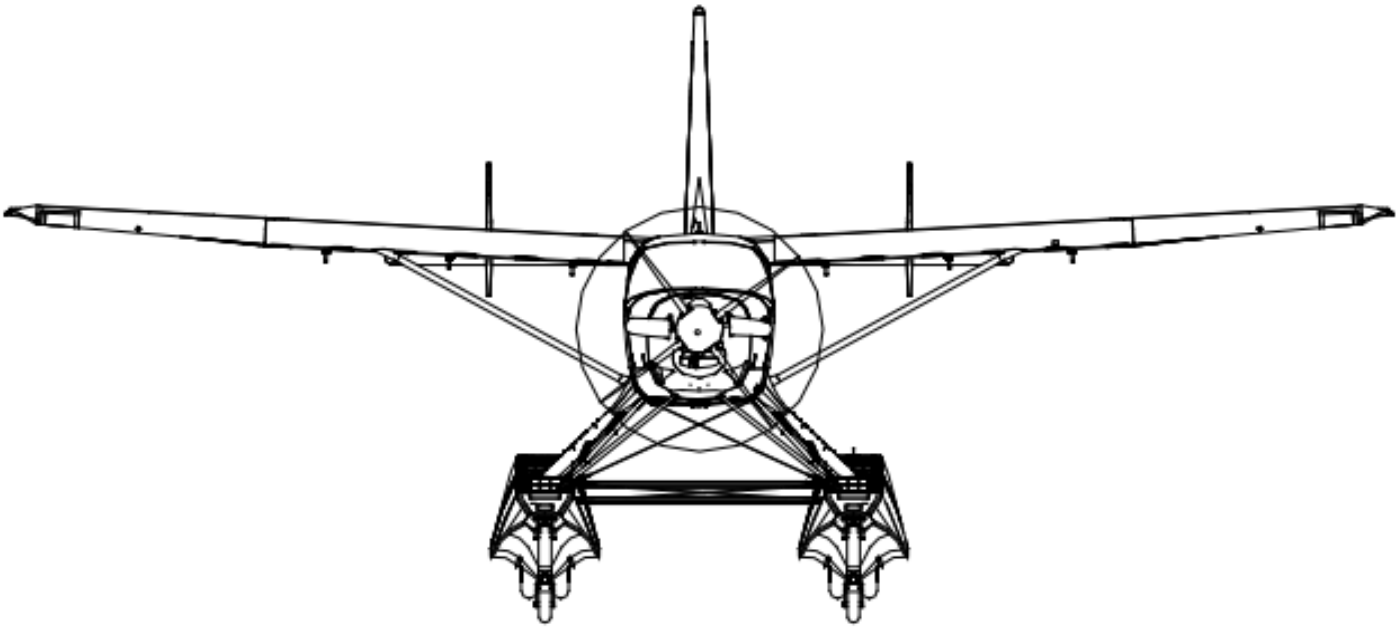
Section 2: Engine Rigging / Runs

This section is used by the technician to make simple rigging adjustments to engine parameters. Contains instructions on how to make changes to engine parameters and included the run checklist in for each operational check

Section 3: Engine Control Rigging

This section contains detailed engine control rigging. To be referenced for Engine removal, control cable change, component change, or engine complete re-rigging of all engine controls.

UNITED STATES
DEPARTMENT OF THE INTERIOR



KODIAK 100 SERIES

4 Bladed Propeller

RUN CHECKS

NOTE: THE INSTRUCTION WORK SHEETS / PACKAGES IN THIS DOCUMENT ARE FOR THE 'UNITED STATES DEPARTMENT OF THE INTERIOR' AIRCRAFT ONLY. **DOES NOT SUPERCEED THE MANUFACTURES MAINTENANCE MANUAL.**

DOI - KODIAK 100 SERIES - RIGGING CHECKLIST

RUN CHECKLIST - 4 Bladed Propeller

1 CAM BOX INPUT LEVER CHECK

	POWER LEVER- IDLE
	CHECK CAM BOX INPUT LEVER ARM INSTALLATION. MUST BE INSTALLED ONE SERRATION DOWN FROM HORIZONTAL POSITION. (REF FIGURE 1)

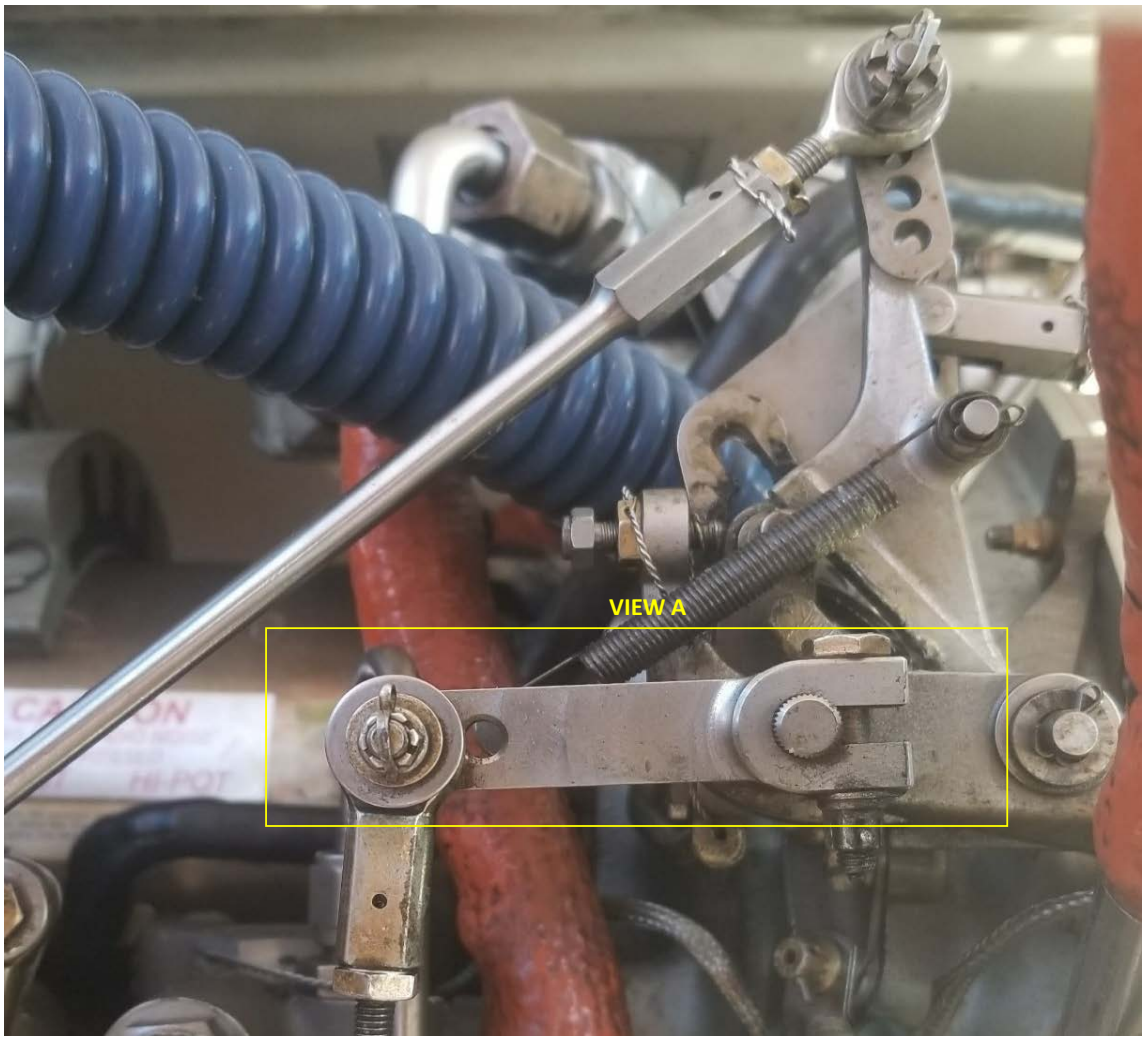


FIGURE 1

DOI - KODIAK 100 SERIES - RIGGING CHECKLIST

RUN CHECKLIST - 4 Bladed Propeller

2 FLIGHT IDLE TORQUE CHECK (SEE FIGURE 51)

Chart target torque (pressure altitude vs. outside air temperature OAT)

Taxi aircraft to suitable run-up area and point aircraft into the wind.

	PROP RPM -	Max RPM
	CONDITION LEVER-	LOW IDLE
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	POWER LEVER -	ADVANCE TO 1800 RPM
	CHECK INDICATED TORQUE vs. CHARTED TARGET TORQUE.	
	CHARTED TARGET TORQUE	

TORQUE INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

3 HIGH IDLE RPM CHECK

Ng 70% +2/-2%

	POWER LEVER-	IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	CONDITION LEVER-	HIGH IDLE
	CHECK Np INDICATION	

Np INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

4 LOW IDLE RPM CHECK

Ng 52.5% - 55.5% (Np 1060 RPM min)

Np 1060 RPM min (4-bladed propeller)

	POWER LEVER-	LOW IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	ELECTRICAL LOAD	30-50 AMPS
	CONDITION LEVER-	LOW IDLE
	CHECK Np and Ng INDICATION	

Ng INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

Np INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

5 MAX NP

FOUR BLADE PROPELLER 2200 +0/-20RPM

	CONDITION LEVER-	LOW IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	POWER LEVER	ADVANCE TO 2200 RPM
	POWER LEVER	ADVANCE ADDITIONAL 10%
	CHECK Np RPM HAS STAYED AT 2200 RPM +0 / -20 RPM.	

Np INICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

6 REVERSE Ng PICK-UP CHECK

	CONDITION LEVER-	LOW IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	BYPASS
	POWER LEVER	MOVE SLOWLY INTO BETA RANGE AND MONITOR Np. RPM MUST PEAK, THEN DROP 0-

Np INICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

7 REVERSE MAX POWER CHECK

(600 FT-LBS MIN / Np DOES NOT EXCEED 2100 RPM)

	CONDITION LEVER-	LOW IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	BYPASS
	ELECTRICAL LOAD	30-50 AMPS
	POWER LEVER	SLOWLY MOVE TO MAX REVERSE.
	CHECK TORQUE AND Np SPEED.	

Torque:			
RUN 1	RUN 2	RUN 3	RUN 4

Np Speed:			
RUN 1	RUN 2	RUN 3	RUN 4

DO NOT EXCEED 790 ITT TEMP

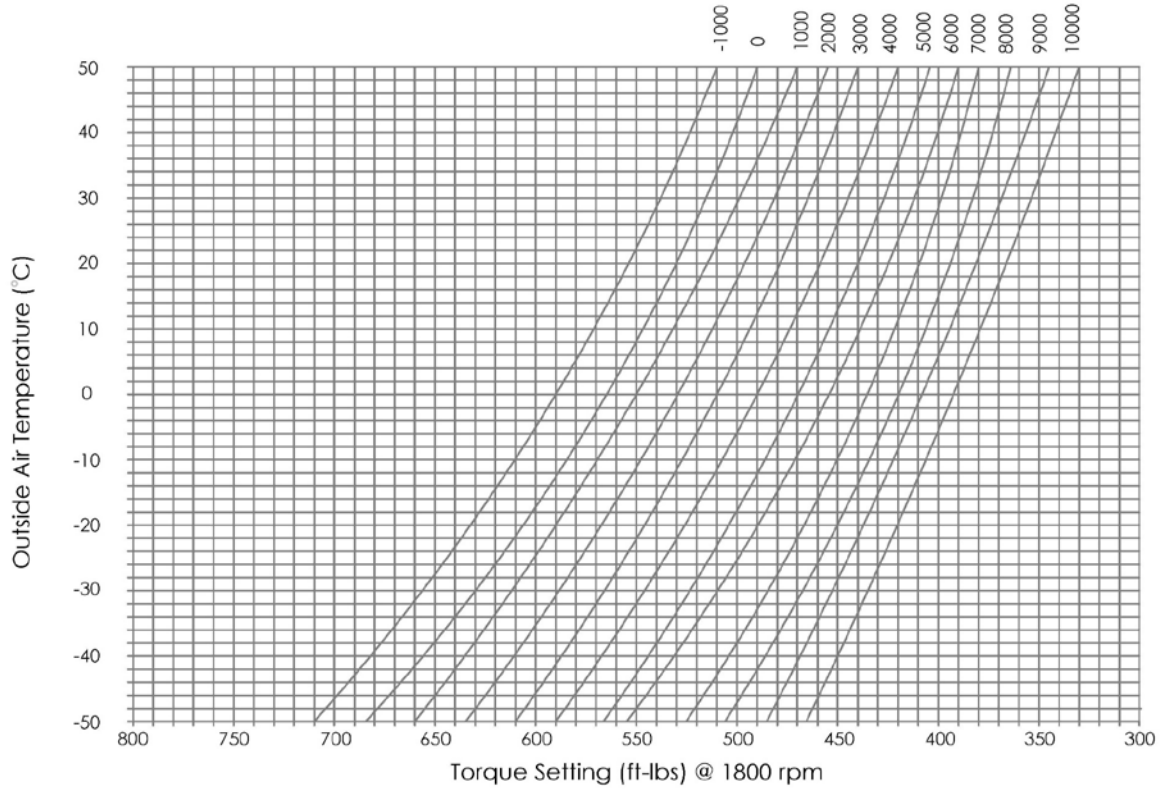


Figure 51 - Low Pitch Torque Chart

Note:
PT6-34 engines
Hartzell 4 Blade Propeller - HC-E4N-3PY / D9511FSB

Post - Inspection runs using this chart will help determine what torque setting should be used at 1800 RPM, at Pressure Altitude and Temperature. The Torque value will correlate to the low pitch blade angle of 17.5 degrees set by the propeller shop.

Engine Runs should be completed facing INTO WIND

Pressure Altitude: _____

OAT °C: _____

Torque: _____

Turbo Air Inc.
Repair Station FZRA132E

Evaluator

DATE	DRAWN BY	APPROVED BY	REV
12/6/2017	BM	RS	IR

Turbo Air, Inc.
4000 S. Orchard Street, Boise, ID 83705
208-343-3300

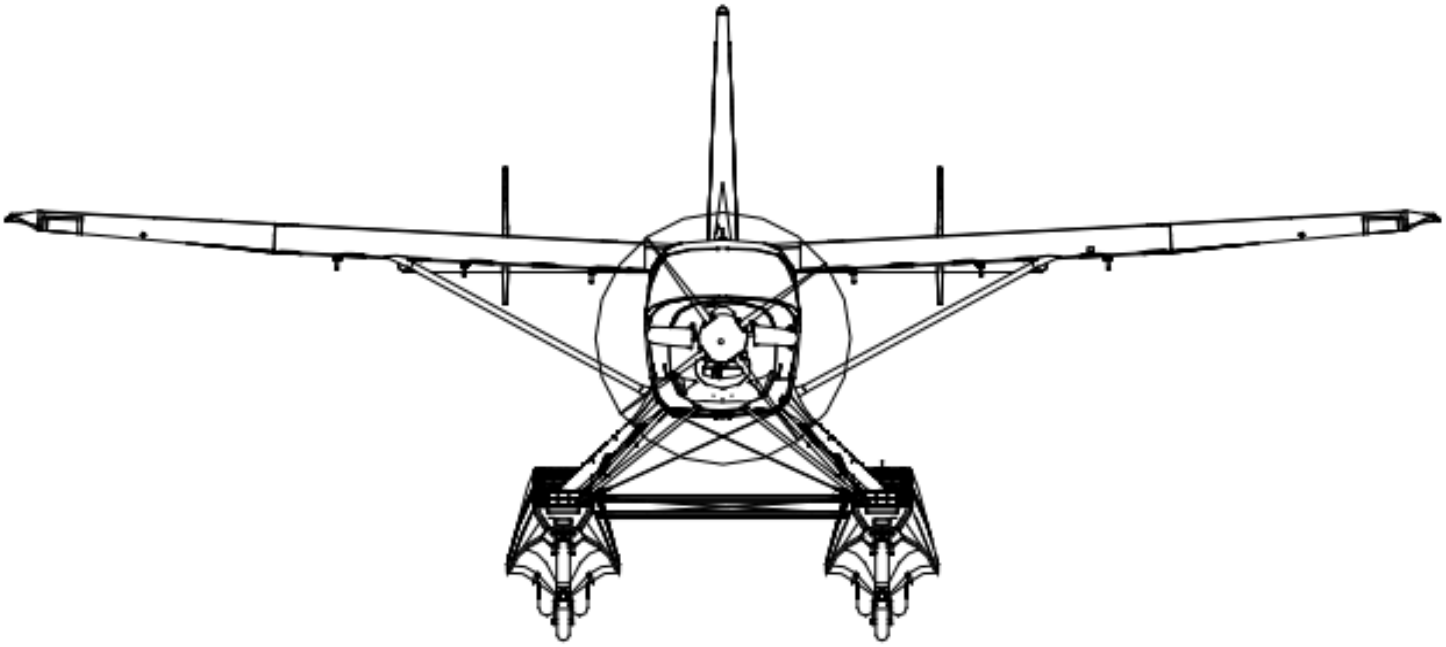
TITLE: DOI Kodiak Low Pitch Torque Chart

DWG. NO. DOIKODIAK-34_FourBlade-001 REV. IR

File No.

SHEET 1 OF 1

UNITED STATES
DEPARTMENT OF THE INTERIOR



KODIAK 100 SERIES

4 Bladed Propeller

ENGINE RIGGING/RUNS

NOTE: THE INSTRUCTION WORK SHEETS / PACKAGES IN THIS DOCUMENT ARE FOR THE 'UNITED STATES DEPARTMENT OF THE INTERIOR' AIRCRAFT ONLY. **DOES NOT SUPERCEED THE MANUFACTURES MAINTENANCE MANUAL.**

DOI - KODIAK 100 SERIES - Engine Run Checks

Cambox Input Lever Rigging Check - 4 Bladed Propeller

1 Move cockpit engine power lever to the idle position. Open Co-pilot side engine cowl door. Inspect the Cambox Input Lever installation. With the Engine Power Lever in the idle position, the Cambox Input Lever must be installed pointing aft towards the firewall and one serration down from the horizontal position. (REF FIGURE 1)

2 If requirements are not met from previous step, rig Cambox Input Arm. In the cockpit, move the Power Control Lever to the idle position. Disconnect the Power Lever Control cable rod end from the Cambox Input Lever. Remove safety and remove Cambox Input Lever clamp bolt. Remove Cambox Input Lever and reposition lever on serrated cambox shaft, pointing aft towards firewall and one serration down from the horizontal position. (Ref fig 1). Install Input Lever clamp bolt and tighten. Lengthen or Shorten the Power Lever Control Cable using the bulkhead jam nuts and/or Control Cable rod end as required to obtain a slip fit for the attach bolt between control cable rod end and Cambox Input Lever. Check to see that the threads are visible through the witness hole in the control cable rod end. After adjustment, Attach the Power Control Cable rod end and Cambox Input Lever together with attachment bolt using the outermost hole of the Cambox Input Lever.

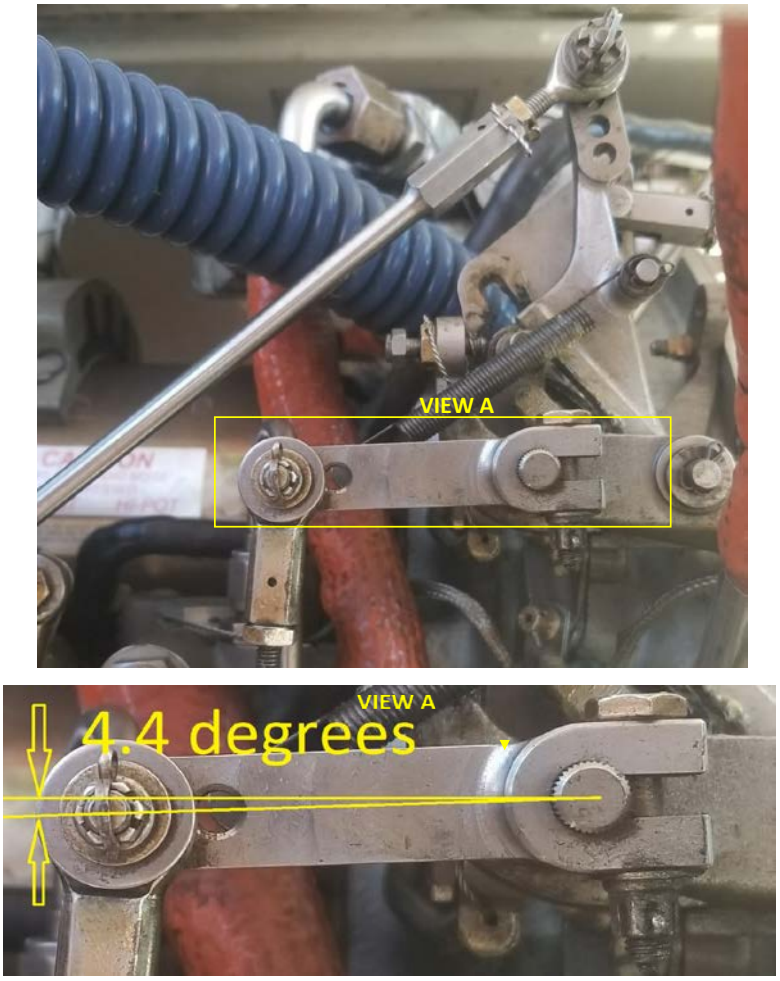


FIGURE 1

3 Check that the Power Control Lever in the cockpit moves through the full range of forward travel without binding. (DO NOT PULL LEVER INTO BETA/REVERSE.) When the power is set to MAX, check the FCU arm max Ng screw contacts the Max Ng stop firmly when the cockpit control has at least 1/8" gap (cushion) from the edge of the quadrant cover slot (REF FIGURE 76-8). When the power is set to MAX, check the Cam Follower Pin does not contact the bottom of the FCU Actuating Lever slot (REF FIGURE 76-7). After Adjustments and operational checks of cockpit Power Control Lever are satisfactory. Check tightness of hardware and install safety's that were removed to make adjustments.

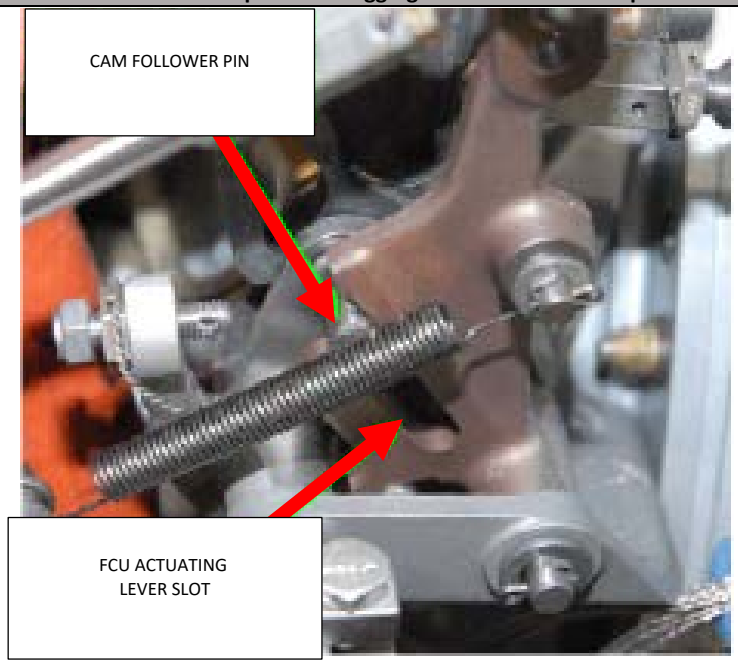


Figure 76-7 - Cam Follower Pin (Shown at Idle)

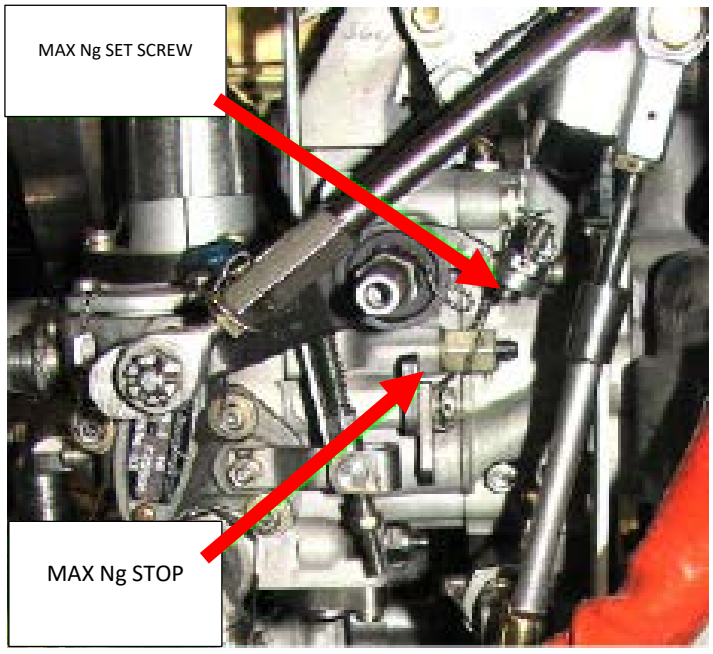


Figure 76-8 - Max Ng Stop and Set Screw (Shown at Idle)

DOI - KODIAK 100 SERIES - Engine Run Checks

Engine Low Idle Rigging Check - 4 Bladed Propeller

1 Start and operate engine in accordance with Kodiak Pilot Operating Handbook. Run the engine for at least 10 minutes to allow engine temperature, operating pressures, and electrical loads to stabilize.

2 LOW IDLE RPM CHECK

Ng 52.5% - 55.5% (Np 1060 RPM min)

Np 1060 RPM min (4-bladed propeller)

	POWER LEVER-	LOW IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	ELECTRICAL LOAD	30-50 AMPS
	CONDITION LEVER-	LOW IDLE
	CHECK Np and Ng INDICATION	

Np INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

Np INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

3 Observe engine idle Ng speed. If Ng speed is between 52.5% -55.5%, and Np is above 1060 RPM minimum for 4 blade propeller, no further action is necessary.

4 If the Ng speed is more than 55.5%, check FCU Lever Arm rigging. While engine is running, move engine Power Lever forward slowly. As the power lever is advanced, observe engine speed pick-up. There should be a 'dead band' before the engine Ng speed starts to increase. If there is no 'dead band', return the Power Lever back to idle. Lift the Power Lever up and slowly move into reverse so that the lever is on the BETA range gate. While moving Power Lever aft over the gate, observe Ng speed. If there is a slight drop in Ng speed before propeller goes into BETA and no 'dead band' while advancing Power Lever, this would indicate that the FCU Lever arm has been improperly rigged above the Ng pick-up point. Rig FCU Lever arm in accordance with FCU Lever arm rigging instructions and check Low idle speed.

5 If Ng is not within Low Idle Limits, adjust the low idle speed adjustment screw (REF FIGURE 2). Remove safety wire from adjustment screw and jam nut. Loosen nut and rotate adjustment screw counterclockwise (CCW) to reduce idle speed, and clockwise (CW) to increase idle speed. Due to the sensitivity of the adjustment screw, you must turn the adjustment in very small amounts and hold the adjustment screw with an allen wrench while tightening the jam nut to prevent further rotation of adjustment screw. Adjust idle speed screw as required. 52.5% -55.5% Ng and Np above 1060 RPM minimum for Four Bladed Propeller installations.

6 After adjustments and operational runs are complete, check tightness of hardware and restore safeties removed for adjustments.

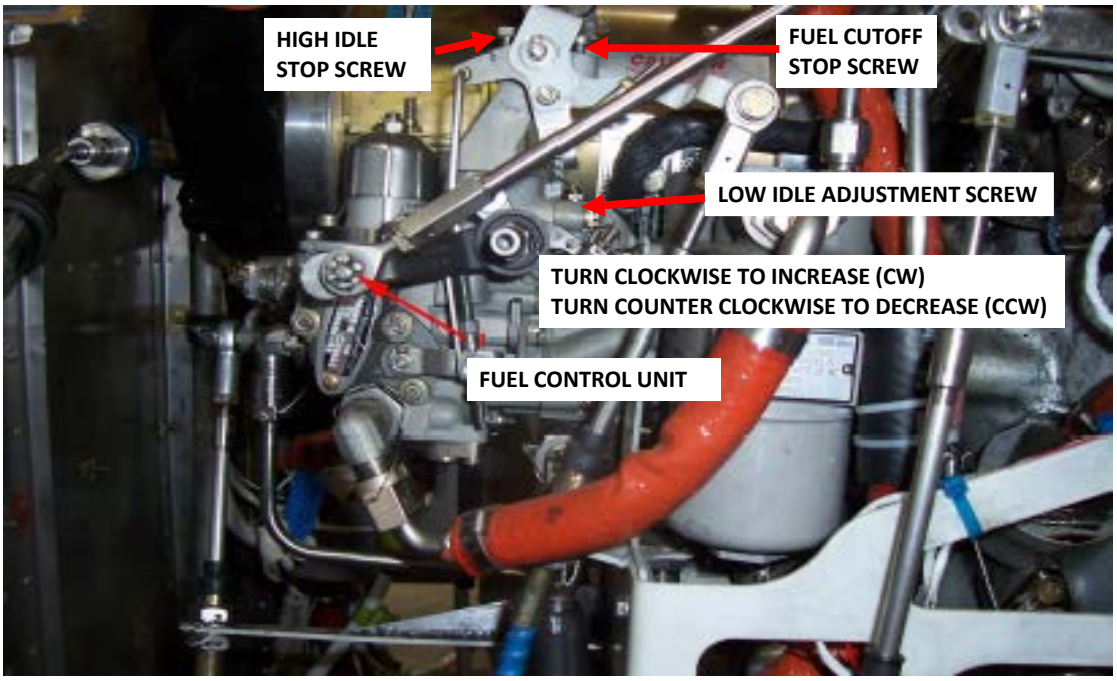


Figure 2

DOI - KODIAK 100 SERIES - Engine Run Checks

Low Pitch Torque Check - 4 Bladed Propeller

1 Start and operate engine in accordance with Kodiak Pilot Operating Handbook. Run the engine for at least 10 minutes to allow engine temperature, operating pressures, and electrical loads to stabilize.

2 FLIGHT IDLE TORQUE CHECK (SEE FIGURE 51)

Chart target torque (pressure altitude vs. outside air temperature OAT)

Taxi aircraft to suitable run-up area and point aircraft into the wind.

	PROP RPM -	Max RPM
	CONDITION LEVER-	LOW IDLE
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	POWER LEVER -	ADVANCE TO 1800 RPM
	CHECK INDICATED TORQUE vs. CHARTED TARGET TORQUE.	
	CHARTED TARGET TORQUE	

TORQUE INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

NOTE: MAKE CERTAIN THAT THE TEMPERATURE READING HAS STABILIZED ON AIRPLANES RECENTLY REMOVED FROM HANGAR

3 REFER to FIGURE 51 - LOW PITCH TORQUE CHART. Locate the pressure altitude curve corresponding to the reading taken in the preceding step. Trace this curve down to the point where it intersects the OAT reading indicated on the left hand side of the chart. A line dropped perpendicular from this point to the bottom of the graph will indicate the torque value in FT-LBS at which the engine should operate under the existing conditions.

4 With the propeller lever fully forward (MAX RPM), advance the Power Lever to obtain 1800 RPM. The torque readings should be within 10 ft-lbs of the value obtained in step 2.

5 If the readings taken fail to fall within the prescribed range, disconnect the Reset Arm Interconnect Rod at the governor reset Lever end (aft end). Disconnect Reversing Cable aft clevis at the Reverse Cam (cam box) REF FIGURE 76-35. Mark Low Pitch stop adjuster with a reference line. Adjust low pitch stop adjuster by removing safety wire from adjuster lock-nut and loosen lock nut. Pull forward on forward end of reversing cable to remove backlash in Reversing Cable. Rotate the aft end of the adjuster while holding the threads steady (REF FIGURE 76-31) until engine torque is within prescribed limits. One full turn IN of the low pitch stop adjuster will reduce the torque by 120 ft-lbs approximately and one full turn OUT will increase torque by the same amount. Tighten the Low Pitch Stop Adjuster jam nut to 150-200 in-lbs. Remove the safety wire on the governor reset arm interconnect rod and loosen the rod end jam nuts. Adjust the length of the interconnect rod as required so that there is a slip fit of the bolt between rod end and lower hole of the governor reset arm. When adjusting the length of the rod, ensure that there is approximately the same length of threads showing on both rod ends. Once the slip fit of the attachment bolt has been achieved, shorten the rod another 1/2 turn to assure that the interconnect rod is in tension. It is imperative that the reset arm is firmly against its forward stop. Reconnect governor rest arm and interconnect rod. Returning to the Cambox, remove the safety wire and loosen the jam nut on the rear clevis of the reversing cable. While maintaining forward pressure on the reversing cam, position the rear clevis over the second hole from the top on the reversing cam. Adjust the rear clevis length as required so the clevis pin slides smoothly through the hole. Once the pin slides freely through the hole, lengthen the clevis another 1/2 turn to prevent system backlash, and reinsert the clevis pin. In contrast with the forward end of the reversing cable, it is important to rig the rear end of the reversing cable so it is slightly in compression. The rear clevis should slightly be in compression, but not to the point where the cam follower pin rides hard against the forward face of the reverse cam slot. Therefore, after extending the clevis as previously described, move the Cambox Input Lever through its forward range of motion. If the friction feels very noticeable, shorten the clevis 1/2 turn as required. If the friction is acceptable, tighten the jam nut on the rear clevis of the reversing cable, and insert a stainless cotter pin to retain the clevis pin.

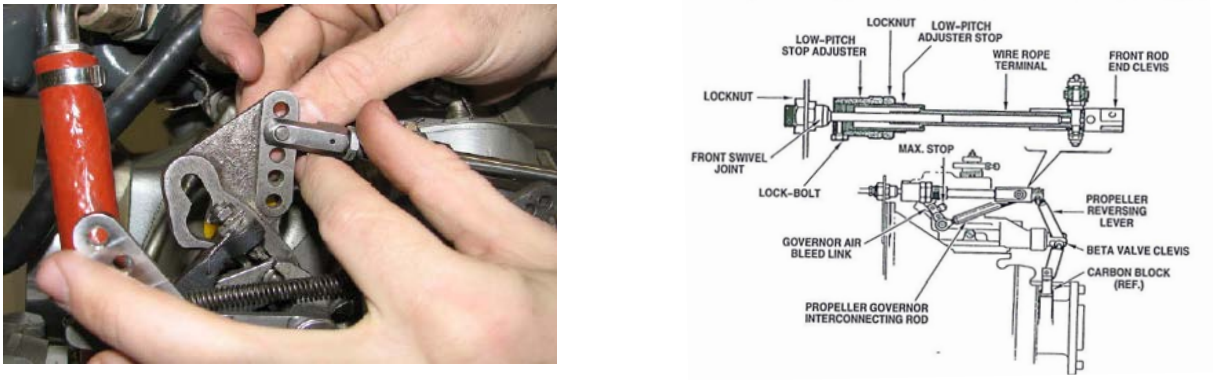
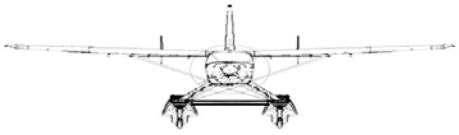


Figure 76-35 - Reinsert the Clevis Pin After Extending the Clevis 1/2 to 1 Turn



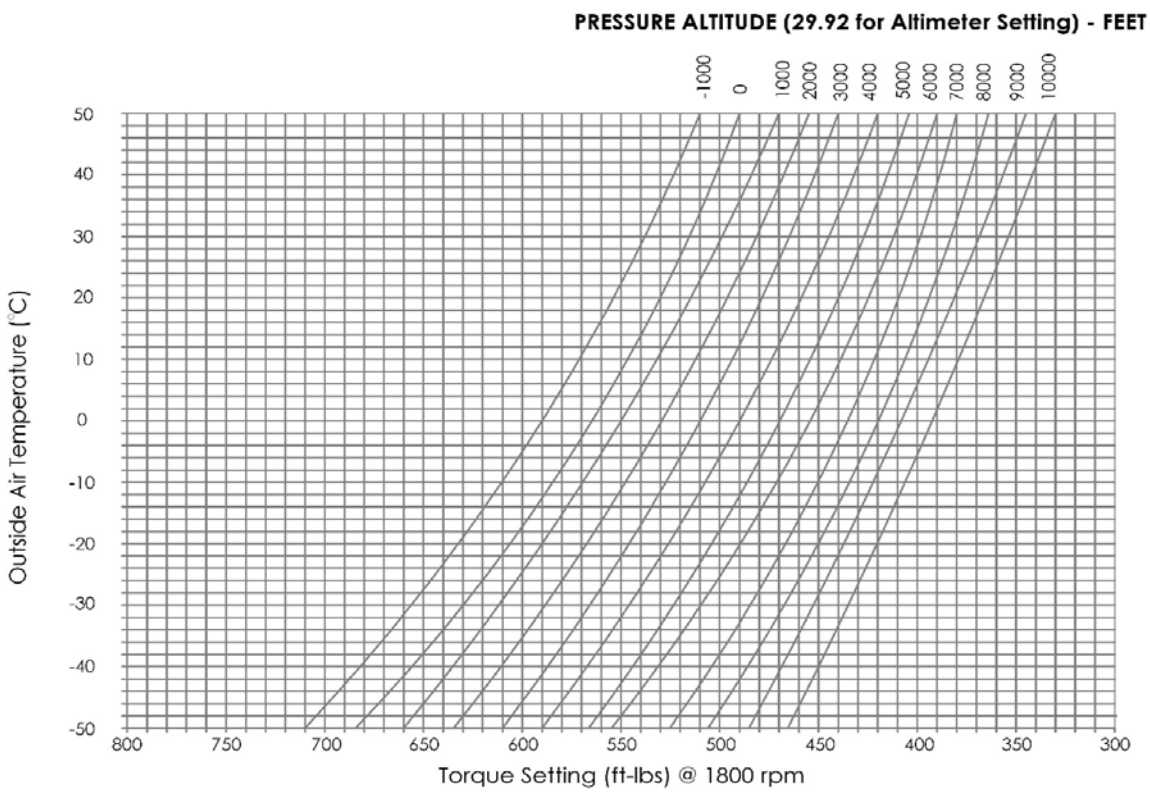


Figure 51 - Low Pitch Torque Chart

Note:
PT6-34 engines
Hartzell 4 Blade Propeller - HC-E4N-3PY / D9511FSB

Post - Inspection runs using this chart will help determine what torque setting should be used at 1800 RPM, at Pressure Altitude and Temperature. The Torque value will correlate to the low pitch blade angle of 17.5 degrees set by the propeller shop.

Engine Runs should be completed facing INTO WIND

Pressure Altitude: _____

OAT °C: _____

Torque: _____

Turbo Air Inc.
Repair Station FZRA132E

Evaluator

DATE	DRAWN BY	APPROVED BY	REV
12/6/2017	BM	RS	IR

Turbo Air, Inc.
4000 S. Orchard Street, Boise, ID 83705
208-343-3300

TITLE: DOI Kodiak Low Pitch Torque Chart
DWG. NO. DOIKODIAK-34_FourBlade-001 REV. IR
THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROPRIETARY AND MUST NOT BE USED WITHOUT WRITTEN CONSENT OF TURBO AIR, INC., BOISE
File No.
SHEET 1 OF 1

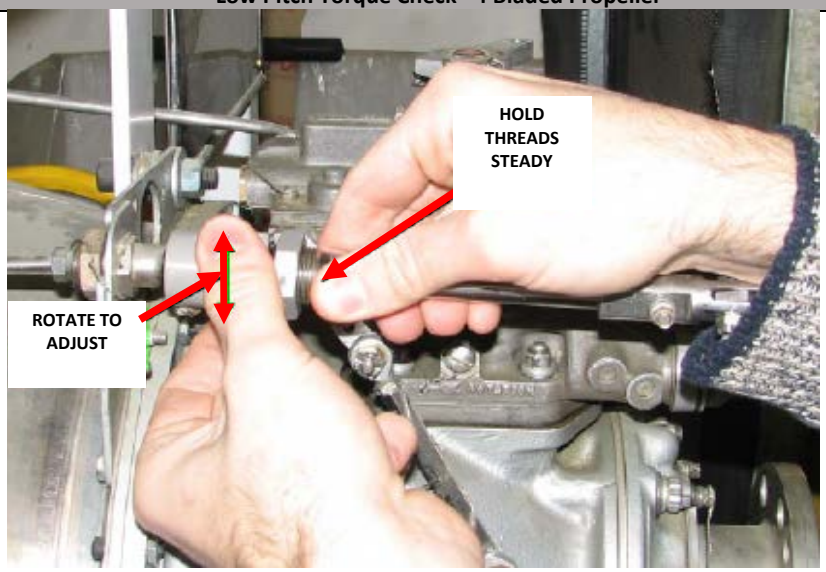


FIGURE 76-31 - Adjusting the Low Pitch Stop Adjuster to Rig the Beta Valve Flush

6 After adjustment, run engine per step 2. Check engine torque reading against FIGURE 51 - LOW PITCH TORQUE CHART. If torque reading falls within prescribed values, check tightness of hardware and restore safeties removed for adjustment.

7 After final torque adjustment has been made. Start and run engine in accordance with Kodiak Pilot's Operating Handbook. Check engine Low Idle and adjust as required in accordance with Engine Low Idle check / rig instructions.

DOI - KODIAK 100 SERIES - Engine Run Checks

Engine High Idle Check - 4 Bladed Propeller

1 Start and operate engine in accordance with Kodiak Pilot Operating Handbook. Run the engine for at least 10 minutes to allow engine temperature, operating pressures, and electrical loads to stabilize.

2 HIGH IDLE RPM CHECK

Ng 70% +2/-2%

	POWER LEVER-	IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	CONDITION LEVER-	HIGH IDLE
	CHECK Np INDICATION	

Np INDICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

3 Slowly advance Fuel Condition Lever to HIGH IDLE. Monitor ITT temp while advancing the condition lever. DO NOT EXCEED engine operating temperature REDLINE (790°C). With condition lever at HIGH IDLE stop, observe engine high idle Ng speed. If Ng speed is between 68% to 72%, no further action is necessary.

4 If the Ng speed is more than 72% turn the high idle adjusting nut Counter Clockwise (CCW) to decrease Ng speed to within limits. One turn of nut is approximately 1% of Ng speed (REF FIGURE 3).

5 If the Ng speed is less than 68%, turn the high idle adjusting nut Clockwise (CW) to increase Ng speed to within limits. One turn of nut is approximately 1% of Ng speed (REF FIGURE 3).

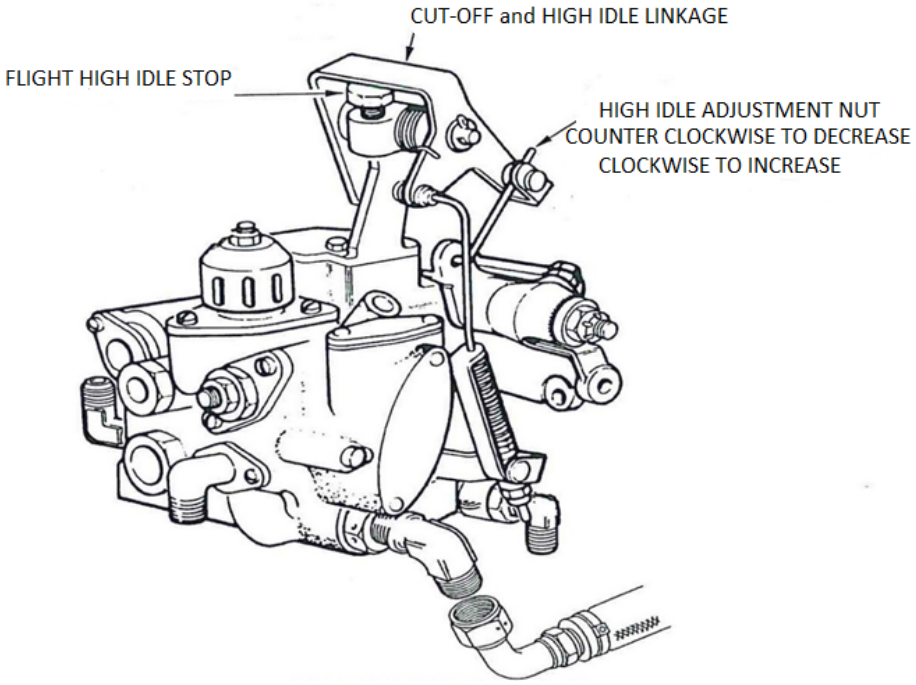


Figure 3 - FUEL CONTROL UNIT ADJUSTMENT

DOI - KODIAK 100 SERIES - Engine Run Checks

Propeller Governor Checks - 4 Bladed Propeller

1 Start and operate engine in accordance with Kodiak Pilot Operating Handbook. Run the engine for at least 10 minutes to allow engine temperature, operating pressures, and electrical loads to stabilize.

2 MAX NP

FOUR BLADE PROPELLER 2200 +0/-20RPM

	CONDITION LEVER-	LOW IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	NORMAL
	POWER LEVER	ADVANCE TO 2200 RPM
	POWER LEVER	ADVANCE ADDITIONAL 10%
	CHECK Np RPM HAS STAYED AT 2200 RPM +0 / -20 RPM.	

Np INICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

3 Slowly advance Engine Power Lever until Np stabilizes at 2200 RPM +0/-20 RPM (4-Bladed Propeller). Monitor ITT temp while advancing Power Lever. DO NOT EXCEED engine operating temperature redline 790° C. Advance Power Lever another 10% Ng, Np must remain at 2200 RPM +0/-20 RPM. If Np falls in between 2180-2200 RPM, no further action is necessary.

4 If MAX Np speed fails to fall within limits, cut and remove safety wire from MAX Np stop screw and loosen jam nut. Turn stop screw Clockwise (CW) to decrease MAX Np or Counter Clockwise (CCW) to increase MAX Np RPM as required to achieve 2200 +0/-20 RPM. Tighten jam nut as required (REF FIGURE 76-6).

5 After adjustment of MAX Np stop screw, operate propeller control cable. Make sure the control touches the MAX RPM stop before the control lever touches the end of the slot in the pedestal. If required, rig the propeller control cable by adjusting the length of the cable at the cable bulkhead and/or control cable rod end. Adjust cable as required to obtain a slip fit of the attach bolts between the control cable rod end and the propeller speed control lever. After the slip fit is found, lengthen control rod end 1/2 turn. Check to see that threads are visible through the witness hole in the control cable rod end after adjustment. Attach propeller control cable and propeller speed control lever.

6 Check that the Propeller Control Cable moves through the full range of travel without binding. Move the Propeller Control Lever aft to the feather position. Check that the Propeller Speed Control Lever firmly contacts the Feather stop screw when the cockpit control has at least and 1/8'' gap (cushion) from the edge of the quadrant cover slot (REF FIGURE 76-5). Move the Propeller Control Lever forward to the MAX RPM position. Check that the Propeller Speed Control Lever firmly contacts the MAX Np stop screw when the cockpit control is set the MAX RPM position with at least a 1/8" gap (cushion) from the edge of the quadrant cover slot (REF FIGURE 76-6). After adjustments and operational checks of the cockpit Propeller Control Lever are satisfactory, check tightness of hardware and install safeties that were removed to make adjustments.

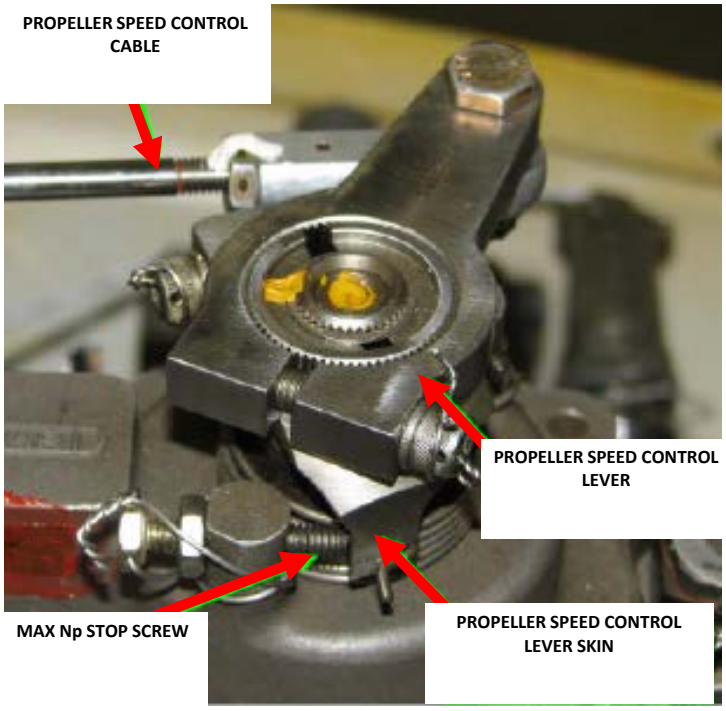


Figure 76-18 - Propeller Speed Control Lever

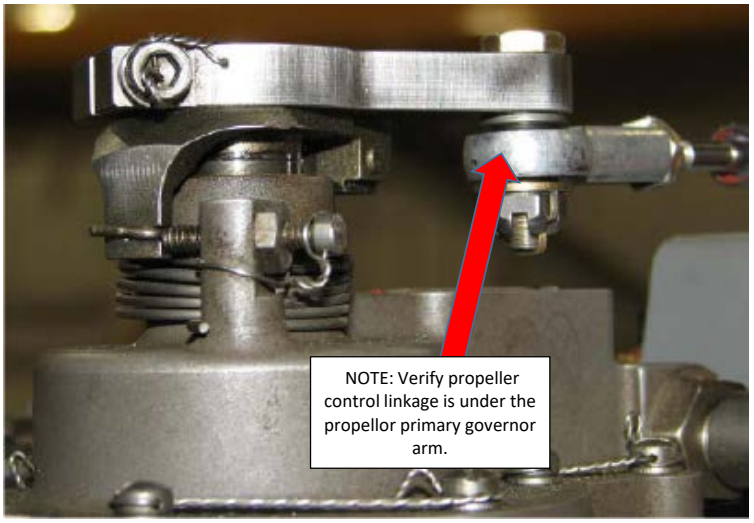


Figure 76-19 - Propeller Speed Control Lever on the Feather Stop Screw

DOI - KODIAK 100 SERIES - Engine Run Checks

Power Lever Reverse - 4 Bladed Propeller

1 Start and operate engine in accordance with Kodiak Pilot Operating Handbook. Run the engine for at least 10 minutes to allow engine temperature, operating pressures, and electrical loads to stabilize.

2 REVERSE Ng PICK-UP CHECK

	CONDITION LEVER-	LOW IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	BYPASS
	POWER LEVER	MOVE SLOWLY INTO BETA RANGE AND MONITOR Np. RPM

Np INICATION:			
RUN 1	RUN 2	RUN 3	RUN 4

3 Slowly move Power Lever into Beta range. While moving Power Lever observe Np speed. Propeller RPM must peak, then drop 0-100 RPM before Ng speed begins to increase.

4 Continue to slowly move Power Lever into Max Reverse. Observe Torque, Np Speed, and ITT indications. Torque must exceed 600 FT/LBS minimum of torque. Np speed must NOT exceed 2100 RPM. DO NOT EXCEED engine operating temperature redline (790^{o}C). If torque indication indicated above 600 FT-LBS minimum and propeller speed doesn't exceed 2100 RPM, no further action is necessary.

7 REVERSE MAX POWER CHECK

(600 FT-LBS MIN / Np DOES NOT EXCEED 2100 RPM)

	CONDITION LEVER-	LOW IDLE
	PROP RPM -	MAX RPM
	A/C -	OFF
	BLEED AIR -	OFF
	ENGINE INLET BYPASS-	BYPASS
	ELECTRICAL LOAD	30-50 AMPS
	POWER LEVER	SLOWLY MOVE TO MAX REVERSE.
	CHECK TORQUE AND Np SPEED.	

Torque:			
RUN 1	RUN 2	RUN 3	RUN 4

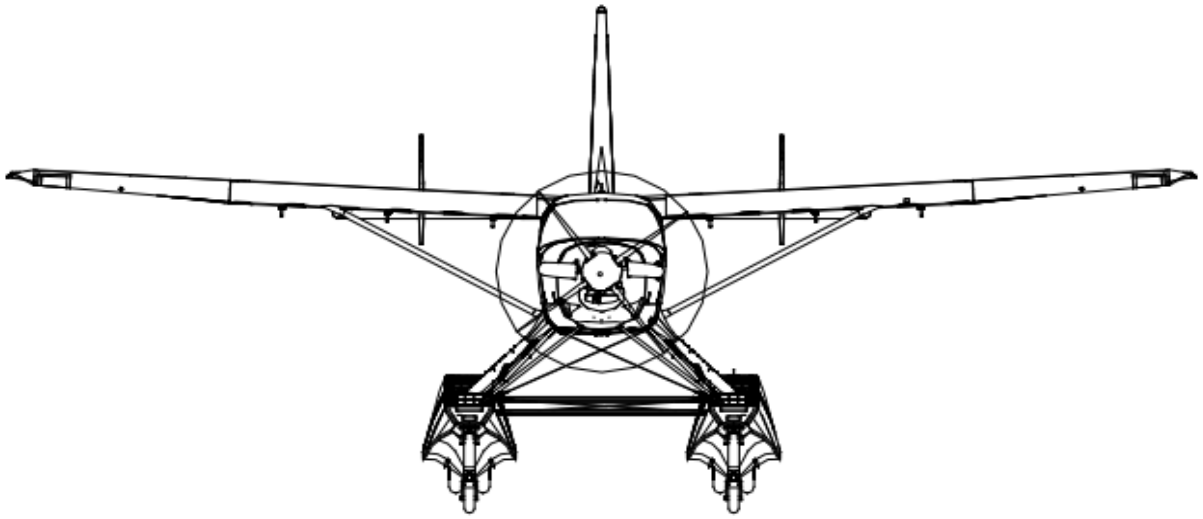
Np Speed:			
RUN 1	RUN 2	RUN 3	RUN 4

DO NOT EXCEED 790 ITT TEMP

5 If any parameters fall outside of limits, check engine control rigging in accordance with Engine Control Rigging Procedure.

UNITED STATES

DEPARTMENT OF THE INTERIOR



KODIAK 100 SERIES

4 Bladed Propeller

ENGINE CONTROL RIGGING

NOTE: THE INSTRUCTION WORK SHEETS / PACKAGES IN THIS DOCUMENT ARE FOR THE
'UNITED STATES DEPARTMENT OF THE INTERIOR' AIRCRAFT ONLY. **DOES NOT SUPERCEED THE MANUFACTURES MAINTENANCE MANUAL.**

1 Rig the engine controls as follows:

A. Position each of the control cable bulkhead fittings as shown in Figure 76-10, and loosely screw the jam nuts up to the tab or bracket that secures the cable. Do not tighten them at this time.

B. Attach the appropriate rod ends to the control cables without attaching the rod ends to the levers on the engine or in the cockpit control pedestal.

C. Starting at the cockpit control quadrant, move both the cable and the lever arm through its full range of travel, using a small scale to measure the amount of over-travel of the push-pull cable relative to the lever arm. Adjust the position of the cable bulkhead fitting so that half of the over-travel is on each side of the lever arm, (or 1/8" minimum over-travel on each end if the over-travel cannot be matched on both ends).

D. Retighten the jam nuts (finger-tight only). Once each cable bulkhead fitting has been adjusted in the cockpit, repeat the process at the output end of the cable at the engine.

NOTE: DO NOT move the cambox input lever aft of the idle position when the engine is off until the rear clevis of the reversing cable has been disconnected from the propeller reversing cam.

E. When the bulkhead fittings have been positioned both at the input and output ends of each control cable, return to the pedestal in the cockpit and tighten the bulkhead fitting jam nuts. Connect the clevis rod ends to the control quadrant lever arms as shown in the installation drawing. Ideally none of the bulkhead fittings should have to be adjusted during subsequent rigging steps. However , at times the adjustment of the rod end terminals may run out of control cable threads and it may be necessary to further adjust the bulkhead fittings. But always try to meet the rigging requirements with adjustments only to the rod end, and adjust the bulkhead fittings only if necessary .

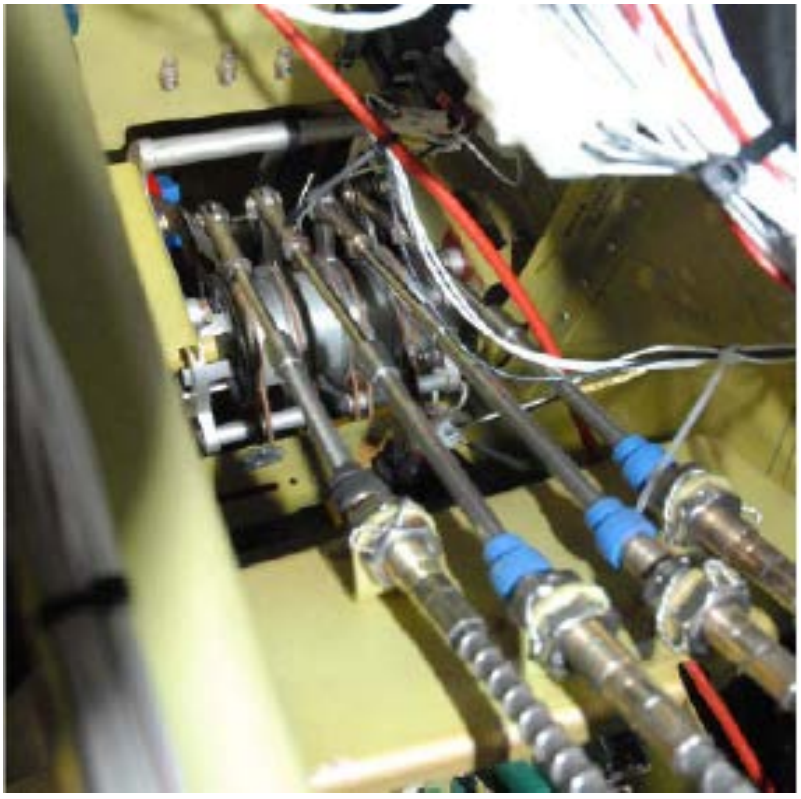


FIGURE 76-10 - Control Quadrant Lever Identification

2 Connect the Fuel Condition Lever and the Emergency Power Lever As Follows:

A. Once the position of the bulkhead fittings has been optimized as just described, rigging the fuel condition lever and the emergency power lever is very simple. The most important objective for each is to ensure that when the pilot selects the fuel cut-off position in the cockpit that the levers on the engine are in fact in solid contact with the fuel cutoff stops.

B. Beginning in the cockpit, move both the fuel condition lever and the emergency power lever through their full ranges of motion. Ensure there is no binding and that both the levers move freely through their full range of motion. During this check ensure that the friction control knob on the side of the quadrant is not overly tight.

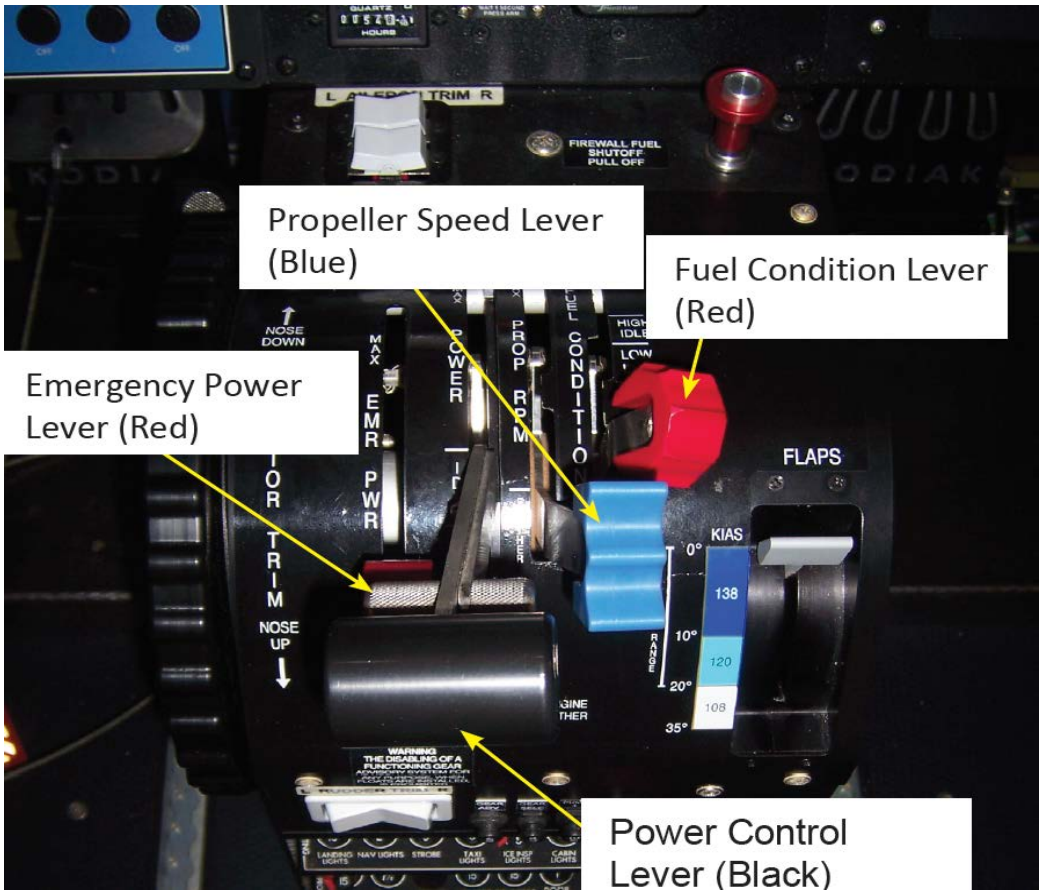


FIGURE 76-11 - Control Quadrant Lever Identification

C. Set both quadrant control levers to the fuel cut-off position, and set the friction control knob on the co-pilot side of the pedestal a moderately-high friction setting.

D. At the fuel condition lever on the engine rotate the lever until it is hard against the fuel cut-off stop. **Figure 76-12** shows the cut-off stop and the high idle stop pictorially, and **Figure 76-13** shows the same features on the actual engine installation (in the fuel cut-off position).

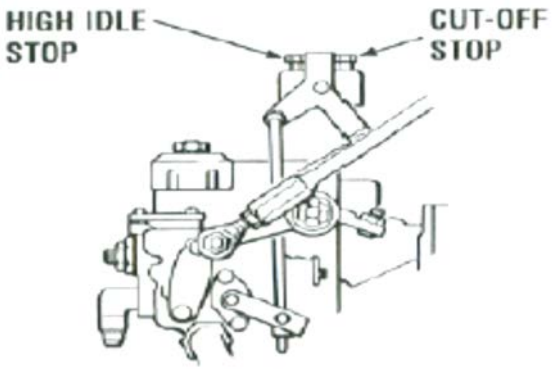


FIGURE 76-12 - Fuel Condition Lever in Cut-Off Position

E. With the lever held hard against the cut-off stop, adjust the rod end length to allow the bolt to slide smoothly through both the hole in the bracket and the rod end bearing. Then remove the bolt again and shorten the rod end another½ turn to ensure a firm seat against the cut-off stop. The engine fuel condition lever arm should actually contact the cut-off stop when the cockpit control is about 1/8" from reaching the fuel cut-off detent in the quadrant cover.

F. Install the nut finger tight.

G. Before beginning the rigging of the emergency power lever, study the pictures shown in **Figure 76-14**. Be extra careful in rigging the emergency power lever. The design team has worked to make it awkward to rig the emergency power lever arm in the wrong direction (i.e. fully open when the cockpit lever is in the cut-off position), but it is not impossible to do so.

WARNING: Catastrophic engine damage can result in mere seconds if this lever is improperly installed.

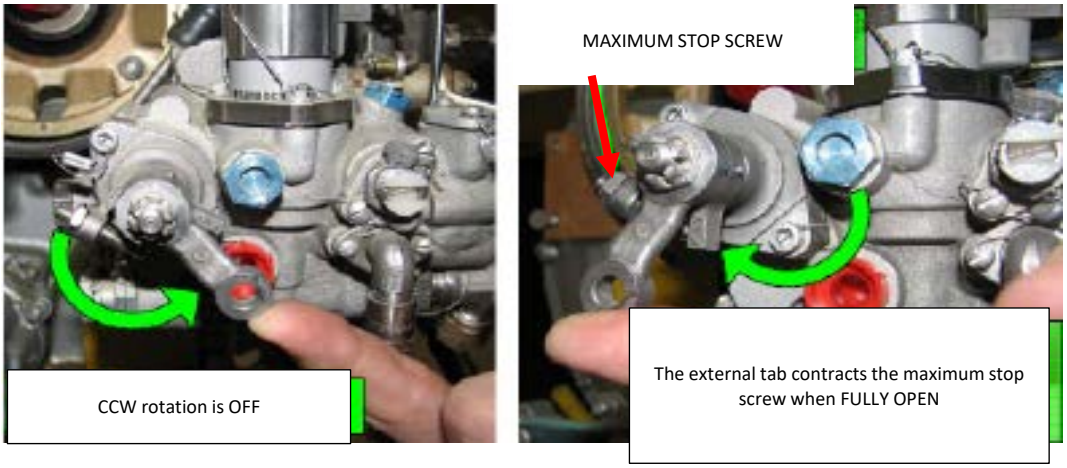


FIGURE 76-14 - Emergency Power Lever Rigging

H. When viewed from the rear (looking forward) the emergency power lever arm should always move through the 6 o'clock position in its arc of travel (it rotates approximately 112°). Viewed in this way, the emergency power lever arm is in the cut-off position when it is rotated counterclockwise until it contacts the internal stop. Clockwise rotation opens an internal valve in the FCU, overriding any input in the power control lever. At the fully open position the external tab that is part of the lever arm will contact the external maximum stop screw. Never adjust the lever arm position so the arc of travel is above the pivot point. Note that there is an external stop for the fully open position, but there is no external stop for the cut-off position. This is one way of double-checking that the rigging is done properly.

I. With the cockpit emergency power lever control still in the fuel cut-off position, rotate the emergency lever arm counterclockwise until it contacts the internal stop.

J. While holding the lever arm against its cut-off stop adjust the rod end length to allow the bolt to slide smoothly through the lever arm and the rod end bearing (do not forget to install the bushing in the lever arm bolt hole first).

K. Remove the bolt again, and shorten the rod end another 1-1½ turn to ensure that it is firmly seated against the cutoff stop, then re-insert the bolt and oversize washer, and screw the castle nut until it is lightly seated against the oversize washer. The engine emergency lever arm should actually contact the cut-off stop when the cockpit control is about 1/8" away from being completely in the fuel cut-off detent in the quadrant cover.

L. Have an assistant loosen the friction control knob on the side of the pedestal, and slowly move the emergency power lever to the maximum fuel flow position. Check for binding in the cable or rod ends. Watch the movement of the emergency lever arm as it moves through the arc of travel. Ensure that the lever arm reaches the maximum stop screw with a minimum of 1/16" clearance between the oversize washer and the starter generator.

M. If the lever arm does not reach the maximum stop, use a permanent marker to make a mark across the serrations between the adjustable lever arm and the base (with the rotating tab). Loosen the lever arm retaining nut, and rotate the lever arm the required number of serrations until the rotating tab can firmly touch the maximum fuel stop, while maintaining the required 1/16" minimum clearance from the starter generator.

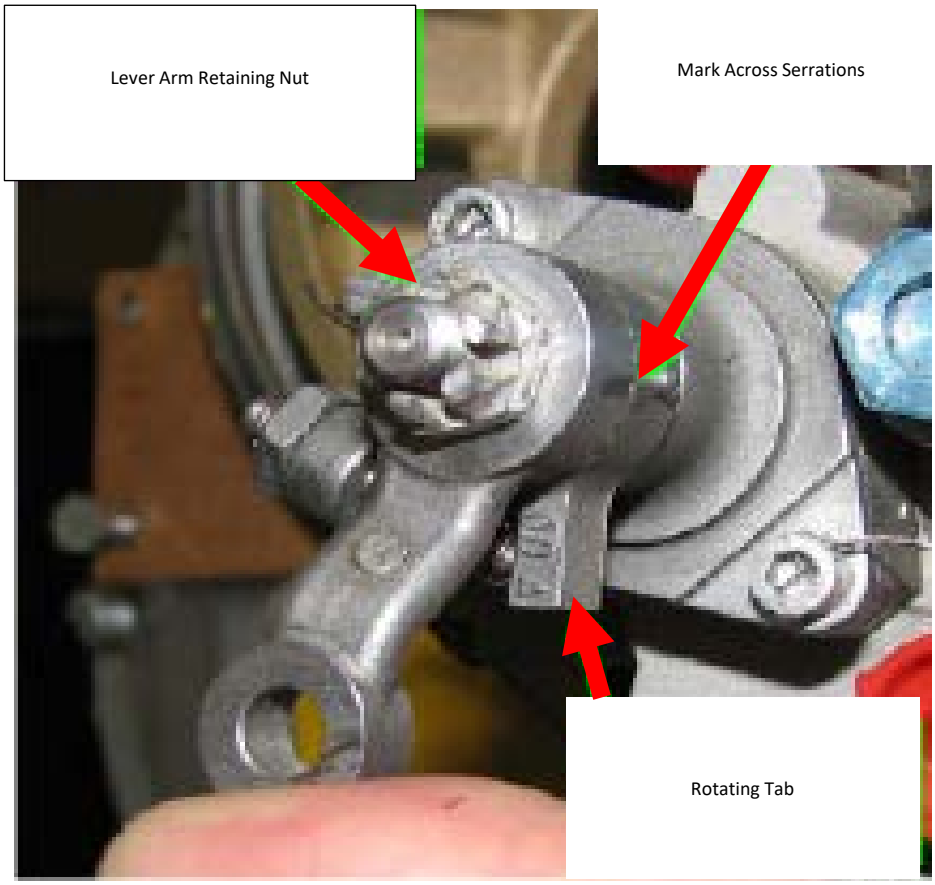


FIGURE 76-15 - EMERGENCY POWER LEVER RIGGING

N. Have the assistant in the cockpit move the emergency power lever through its full range of motion again, and ensure that the arm now firmly reaches both the maximum stop and fuel cut-off stop, with greater emphasis placed on ensuring a firm fuel cut-off when the pilot has selected the cut-off position. Adjust the rod end length to the extent possible, and if further refinement is needed readjust the bulkhead fittings as necessary.

O. Next have the assistant in the cockpit move the fuel condition control through its full range of motion. Ensure that there is no binding.

P. Next check that the condition lever reaches the Hi-Idle stop, and that it is approximately vertical in the low idle position, as shown in **Figure 76-16** and **Figure 76-17**.

FIGURE 76-16 - Fuel Condition Lever at High Idle

Q. Adjust the rod end length and the bulkhead fitting as required to ensure it reaches the high Idle stop, and also contacts the fuel cut-off stop firmly when the pilot selects the cut-off position . The fuel condition lever arm should actually contact the cut-off stop when the lever in the cockpit is about 1/8" shy of completely reaching the cut-off detent in the quadrant cover.

3 Set the Propeller Speed Control Linkage Rigging as Follows:

A. Place the cockpit propeller speed control lever about 1/8" short of the maximum forward position, and tighten the friction knob on the side of the pedestal.

B. Move the propeller speed control lever to its maximum forward position, so the propeller speed control lever skirt is firmly against the max Np stop screw. See **Figure 76-18**.

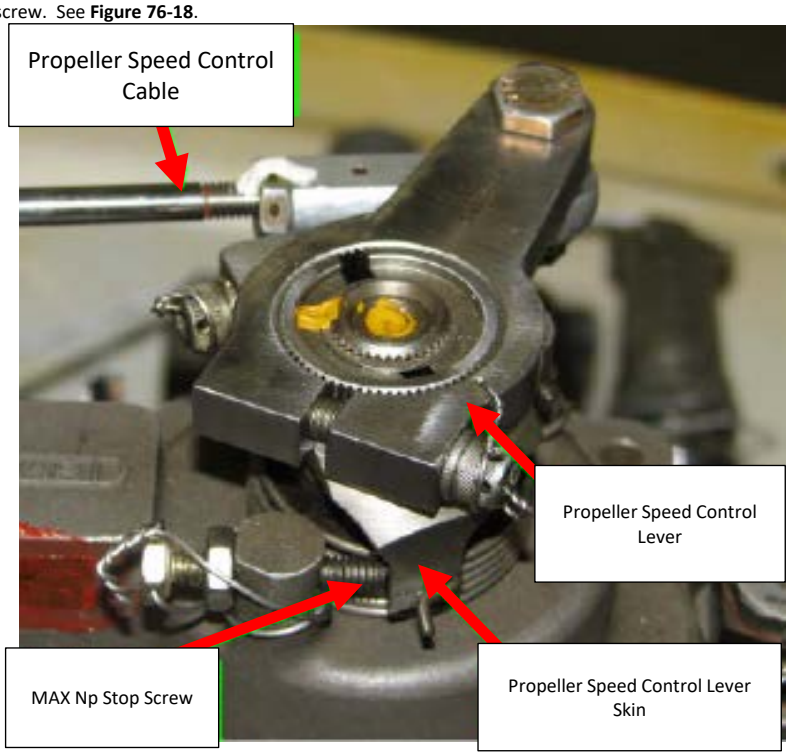


Figure 76-18 - Propeller Speed Control Lever

C. With the propeller speed control lever firmly against the stop, adjust the rod end so that the bolt slides smoothly through the hole and the bearing. Then lengthen the rod end another 1 - 2 turns and reinstall the bolt and associated hardware.

D. Loosen the friction knob in the cockpit, and pull the propeller control slowly back to the feather position. Ensure there is no binding in the linkages.

E. With the cockpit control set to feather ensure that the propeller speed control lever on the engine is hard against the feather stop screw.

F. If the rigging can not be set so both stops are contacted, then the effective stroke of the lever must be shortened . This can be

1. Move the propeller control in the cockpit to feather. Then, as shown in **Figure 76-19** clip the safety wire and remove the lever retaining screw.
2. Using a permanent marker, draw a line across the serrated shaft and onto the speed control lever, to serve as an indexing reference.
3. Remove the lever and keep the lower lever (the portion with the skirt) in hard contact with the feather stop.
4. Rotate the lever 2-3 serrations (or as required) counter-clockwise (when viewed from above). Referring again to Figure 76-20, the lever may be adjusted counterclockwise until the indicated face of the lever arm is parallel to the indicated face of the boss on the governor. Further rotation is prohibited, as it may cause the linkage to go over center.

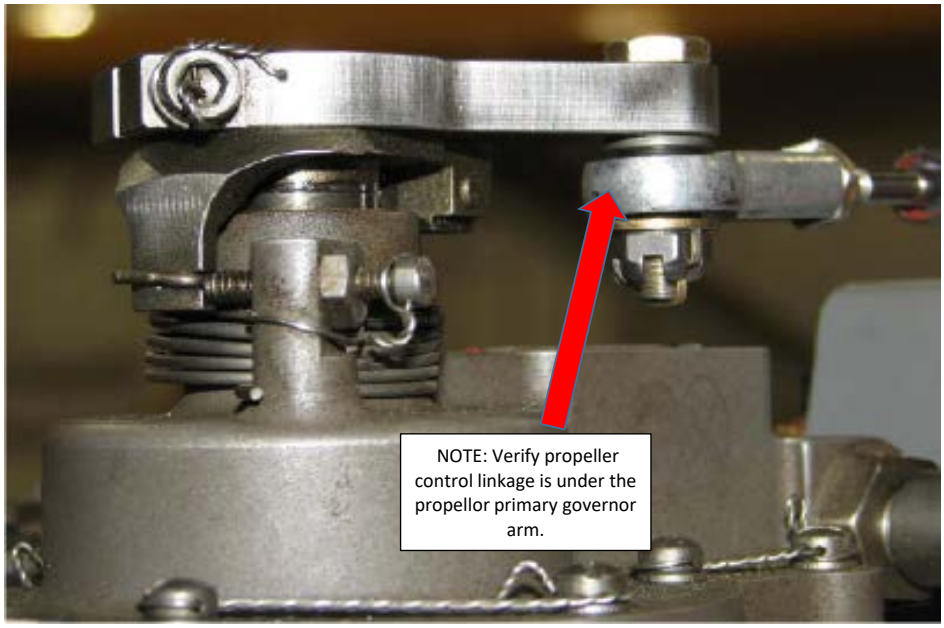


Figure 76-19 - Shortening the Effective Lever Arm Stroke (If Required)

5. Reinstall the speed control lever, and repeat Steps 1 - 5 to ensure that both the max Np Stop and the feather stop are firmly contacted when actuated from the cockpit. **NOTE: Verify propeller control linkage is under the propeller primary governor arm as shown in FIGURE 76-19.**
6. Once satisfactory, reinstall the lever retaining screw and safety-wire.

4 Establish the Cambox Idle - Cockpit Idle Set-Point:

A. One of the most important steps in the rigging process is to establish the proper relationship between the idle position of the power lever in the cockpit, and the idle position of the cambox. If this step is carefully set from the beginning, the amount of time spent "tweaking" the rigging after the first engine run can be significantly reduced. In the following steps refer to **Figure 76-21** and **Figure 76-22**.

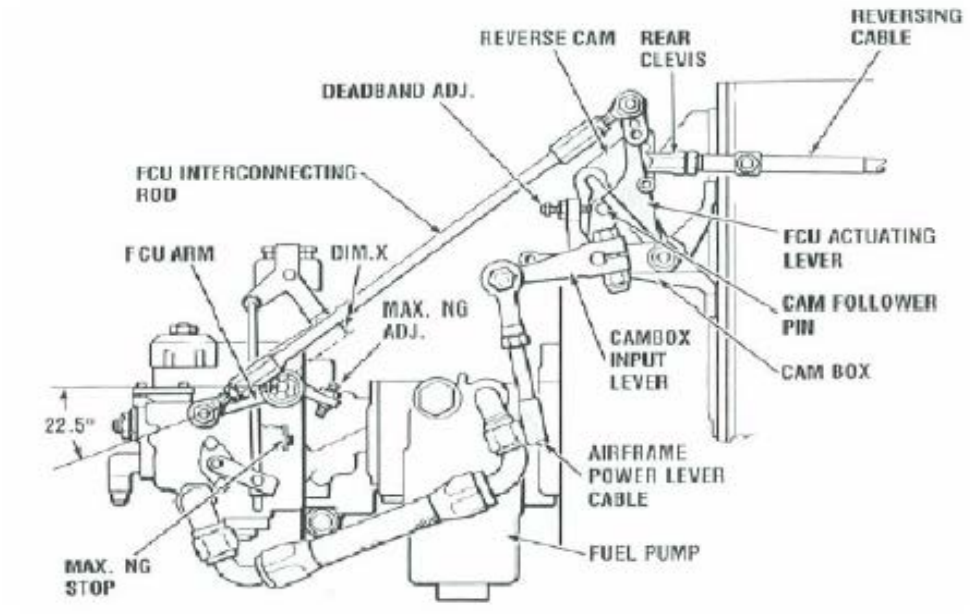


Figure 76-21 - Rear Linkage Overview

Figure 76-22 - Rear Linkage Overview with Actual Brackets

B. Begin by disconnecting the forward end of the FCU Interconnecting Rod from the FCU Actuating Lever.

C. Using your hand, move the cambox input lever into the forward range of travel (i.e. medium-high power). Note that the reverse cam should not move as the cam follower pin slides along in the radial slot.

D. Using your other hand to apply slight forward pressure on the reverse cam, slowly move the cambox input lever back towards idle. As the cam follower pin nears the trailing edge of the radial portion of the slot in the reverse cam, you should notice a slight aft movement in the reverse cam. The point where this reverse cam movement begins to occur is called the "Track Point." Cycle the input lever several times to identify where the track point is.

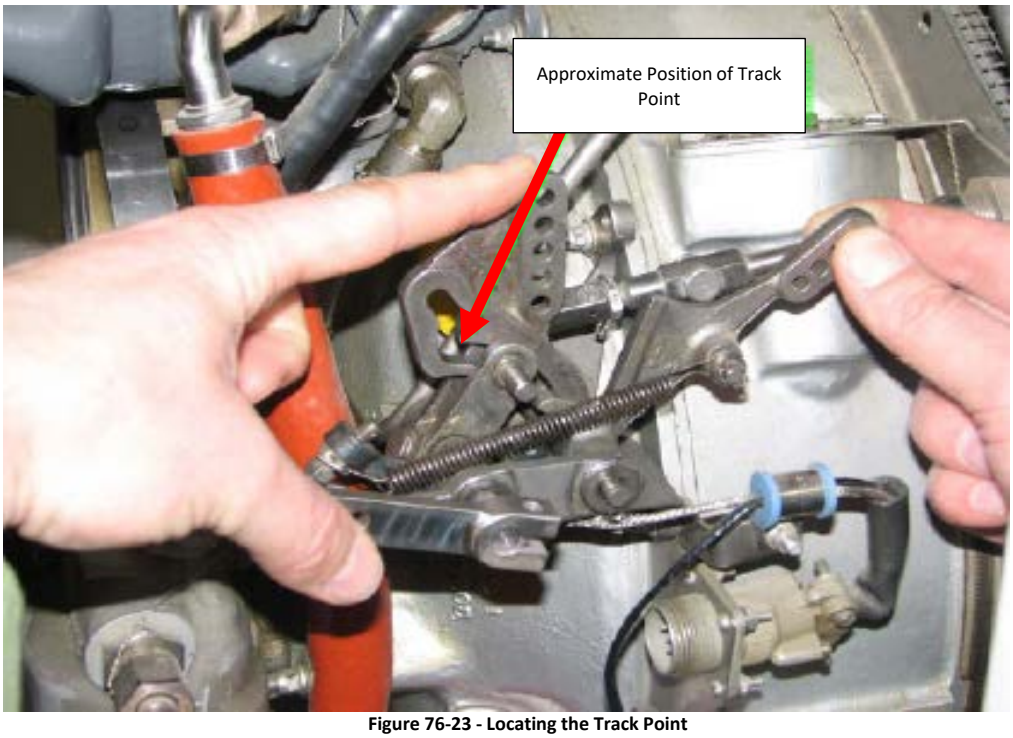


Figure 76-23 - Locating the Track Point

E. With the cockpit power lever in the idle position and the cam follower pin at the track point, check the cambox input lever installation.

Figure 76-24 - Connect the Rod to the Outermost hole on the Cambox Lever

F. Once again, move the cambox input lever into the forward range of travel, but this time do so using the cockpit power lever.
G. Obtain a scale with 1/32" or finer increments , and have an assistant move the power lever in the cockpit slowly back to the idle position.

H. While maintaining forward pressure on the reverse cam, use the scale to measure the amount of aft movement of the reverse cam as the pilot reaches the idle position.
I. Use the aft face of the rear fire seal (or other suitable reference) as a datum (see Figure 76-25).
J. Fine-tune the rod end length to produce 1/32" of reverse cam movement at the cockpit idle position. This is the idle position (track point) of the cambox.
K. Tighten the rod end jam nut, and the castle nut that secures the rod end to the cambox input lever.

Figure 76-25 - Measuring Reverse Cam Movement to Pin-Point the Track Location

5 Set the Beta Valve Position and Remove Reversing Cable Backlash:

A. Once the cambox idle relationship between the cockpit and the cambox has been established, the connection between the cambox and the beta valve, and the connect ion between the cambox and the FCU can both be set. For purposes of consistency beta valve rigging will be accomplished before moving to the FCU rigging. In the steps that follow, refer to **Figure 76-26** and **Figure 76-27** for feature terminology.
B. With the propeller installed and feathered, ensure that the carbon block is properly seated in the beta feedback ring.
C. Disconnect the Aft end of the reset arm interconnect rod, as well as the beta lever connection to the reversing cable front clevis.
D. Once the reversing cable is disconnected from the beta lever, at the aft end of the reversing cable (by the cambox) pull the reversing cable as far aft as it will go.

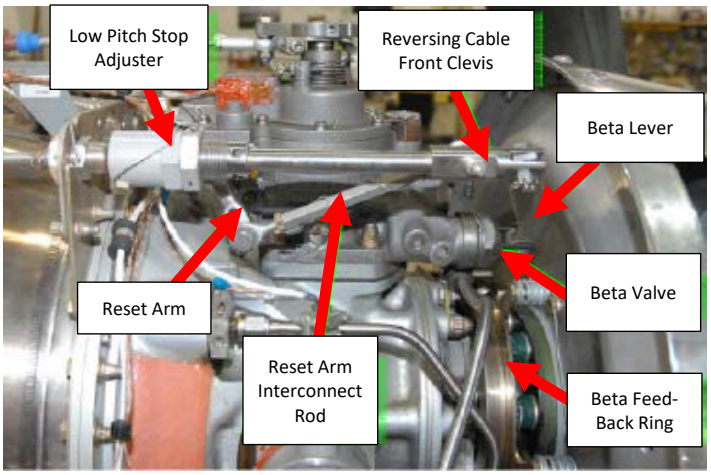


Figure 76-26 - Front Linkage Feature Terminology (Right Side)

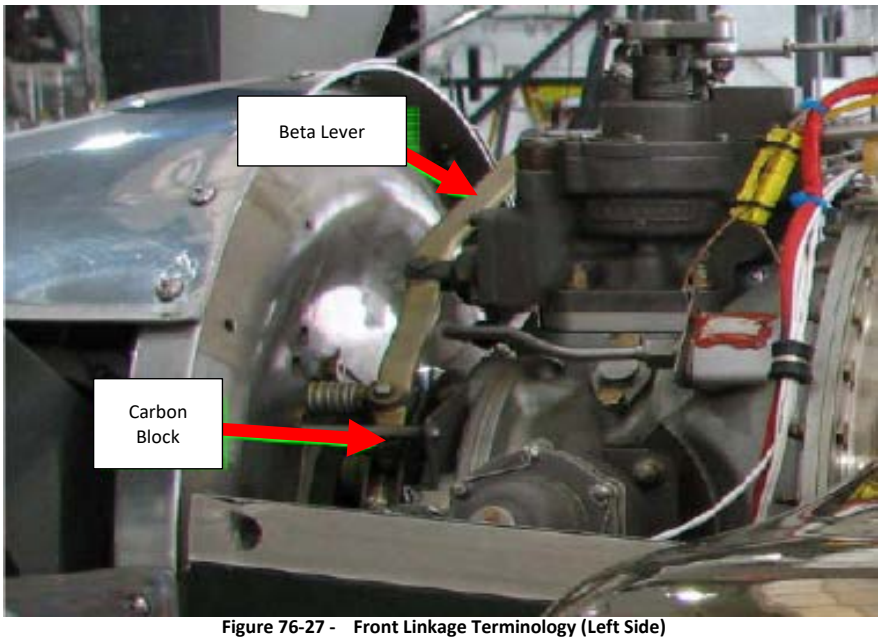


Figure 76-27 - Front Linkage Terminology (Left Side)

E. Returning to the forward end of the reversing cable, measure the distance from the forward edge of the low pitch stop adjuster to the aft edge of the reversing cable front clevis (see **Figure 76-28**).

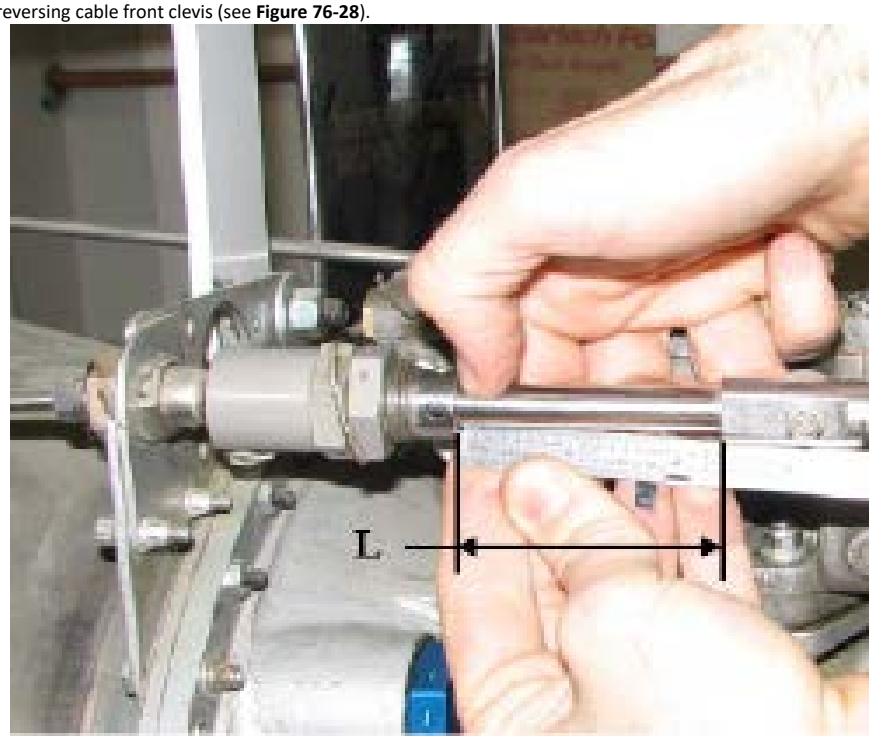


Figure 76-28 - Measure Distance "L" as Shown

F. Next, pull the reversing cable to its full forward position, and re-measure the distance L with the cable fully extended. The difference between the two measurements should be a minimum of one inch. If there is less than 1" of stroke, report the issue to engineering and continue with the remainder of the rigging process.

Figure 76-29 - Recheck Distance "L" with Cable Extended

G. Reconnect the beta lever to the reversing cable front clevis.

H. Pull forward on reversing cable front clevis. With forward tension on the reversing cable to ensure there is no backlash, inspect the beta valve clevis to see if the clevis is flush with the beta valve cap nut.

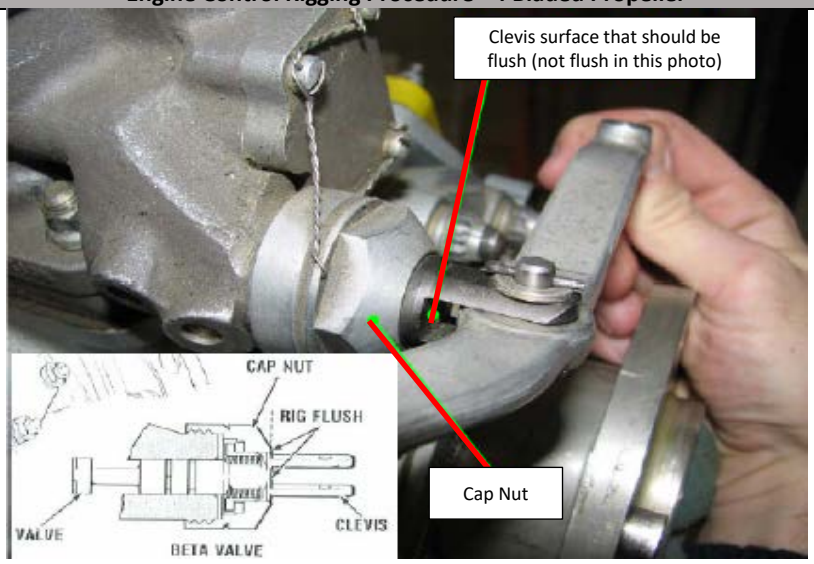


Figure 76-30 - Beta Valve Rigging

I. Adjust the low pitch stop adjuster as necessary to make the clevis surface flush with the beta valve cap nut. To adjust the low pitch stop adjuster, remove any safety wire present, loosen the jam nut, pull forward on the reversing cable front clevis to eliminate cable backlash, and rotate the aft end of the adjuster while holding the threads steady (see Figure 76-31). The low pitch stop adjuster can be adjusted very accurately, so it should not be difficult to rig the clevis flush. For reference, the tolerance on this rigging step should be approximately +.000/-.020, where a positive tolerance would be when the clevis surface protrudes forward of the cap nut. However a dimensional inspection of the beta valve rigging is not necessary since the running engine will indicate whether or not further refinement is necessary. It must be emphasized that this step in the rigging process will be of no value unless the backlash in the cable is eliminated by maintaining forward tension on the reversing cable while checking the adjustment.

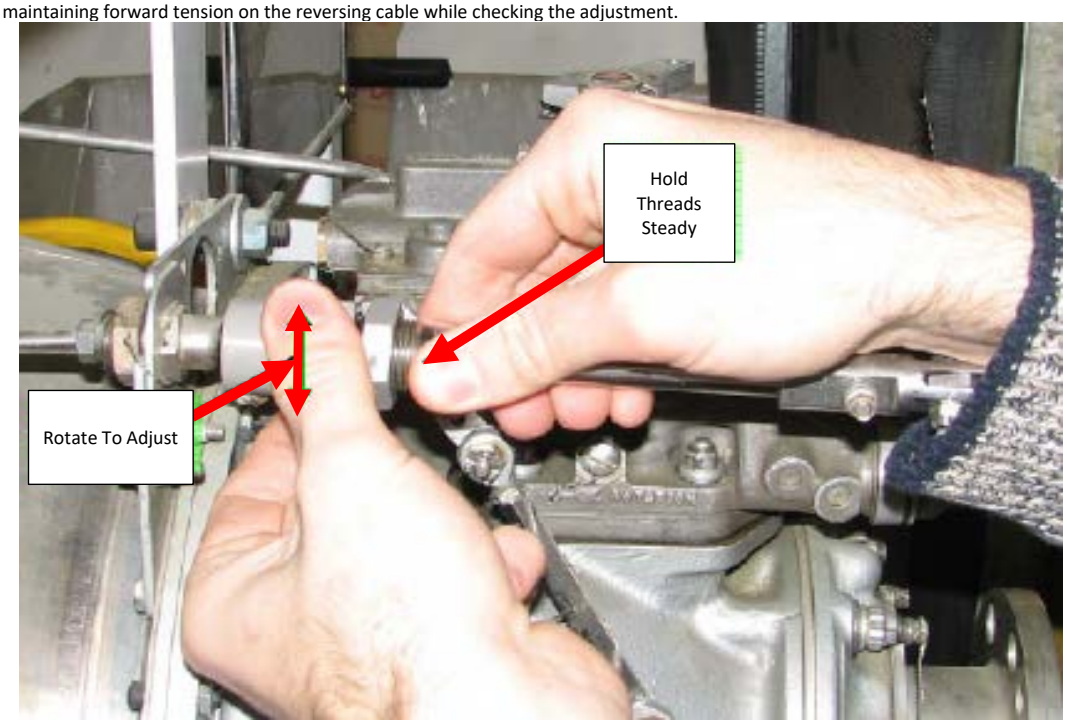


Figure 76-31 - Adjusting the Low Pitch Stop Adjuster to Rig the Beta Valve Flush

J. Retighten the low pitch stop adjuster jam nut to 150 - 200 inch-pounds.

K. Next, remove the safety wire on the reset arm interconnect rod and loosen the rod end jam nuts.

M. Adjust the length of the interconnect rod as required to achieve a slip fit of the attach bolt between the aft end of the interconnect rod and the lower hole of the governor reset arm (REF FRIGURE 76-33).

N. When adjusting the length of the rod, ensure that there is approximately the same length of threads showing on both rod ends. Do not re-install the nut yet.

O. Once the rod length has been adjusted to achieve the slip fit of the attach bolt at the aft end of the interconnect rod, shorten the rod another 1/2 turn to ensure that the interconnect rod is in tension. It is imperative that the reset arm is firmly against its forward stop.

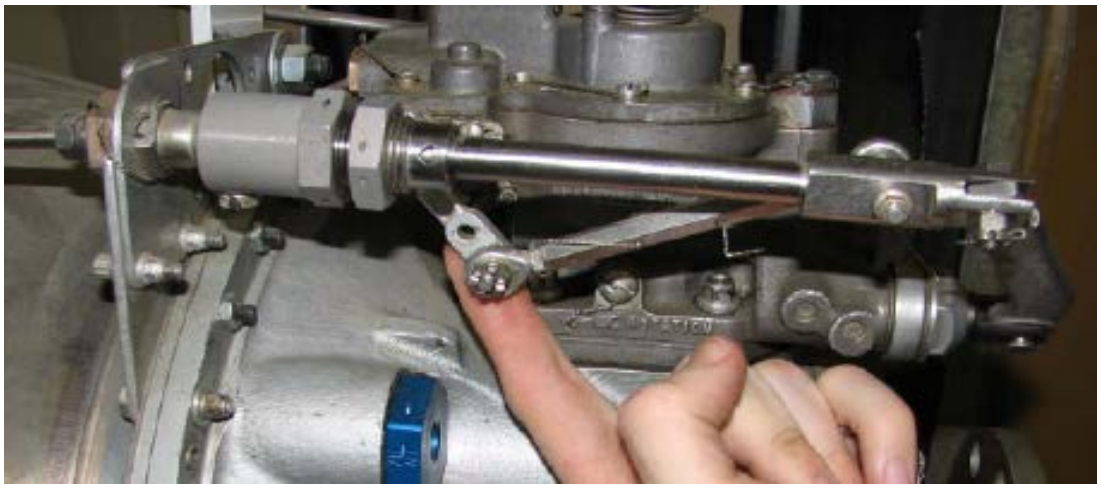


Figure 76-33 - Ensure Reset Arm is Rigged Firmly Against Its Forward Stop

P. Reconnect the reset arm and the interconnect rod, and torque the interconnect rod jam nuts to 32-36 in-lbs.
Q. Returning to the cambox, trim the safety wire and loosen the jam nut on the rear clevis of the reversing cable.
R. Move the power control lever in the cockpit into the forward range of power (medium-high power). While keeping forward pressure on the reversing cam, position the rear clevis over the second hole from the top on the reversing cam.

Figure 76-34 - Position the Rear Clevis Over the Reversing Cam (2nd Hole From Top)

S. Adjust the rear clevis length as required so the clevis pin slides smoothly through the hole.

T. Once the pin slides freely through the hole, lengthen the clevis another 1/2, turn to prevent system backlash, and reinsert the clevis pin. In contrast with the forward end of the reversing cable , it is important to rig the rear end of the reversing cable so it is slightly in compression.

Figure 76-35 - Reinsert the Clevis Pin After Extending the Clevis 1/2 Turn

U. Very Important: It is common in PT6 installations to hear pilots complaining that there is a lot of friction in the power lever in the cockpit. Normally, the reason for this friction is that the compression in the rear end of the reversing cable is excessive.

V. The rear clevis should be slightly in compression, but not to the point where the cam follower pin rides hard against the forward face of the reverse cam slot. Therefore, after extending the clevis as previously described, move the cambox input lever through its forward range of motion. If the friction feels very noticeable, shorten the clevis 1/2 turn as required.

W. If the friction is acceptable tighten the jam nut on the rear clevis of the reversing cable, and insert fresh stainless cotter pin to retain the clevis pin.

6 Locate the FCU Arm Idle Position and Adjust the FCU Interconnecting Rod:

A. At this point the idle position has been set in the cockpit, at the cambox, and the reversing cable has been adjusted accordingly. The next stage of the rigging process ties all three elements of the engine power control system together by linking the cambox to the FCU. The primary control for the FCU is the FCU arm. The FCU arm is the principal control for the speed of the gas generator (Ng), and it is actuated via the cambox through the FCU actuating lever and the FCU interconnecting rod.

B. Set the cockpit power control lever back to the idle position.

C. Set the fuel condition lever control to cut-off.

D. Using two fingers to gently grasp the free end of the FCU interconnecting rod, pivot the rod until it is vertically oriented, and directly above the FCU arm. Refer to **Figure 76-36** for a review of the linkage terminology.

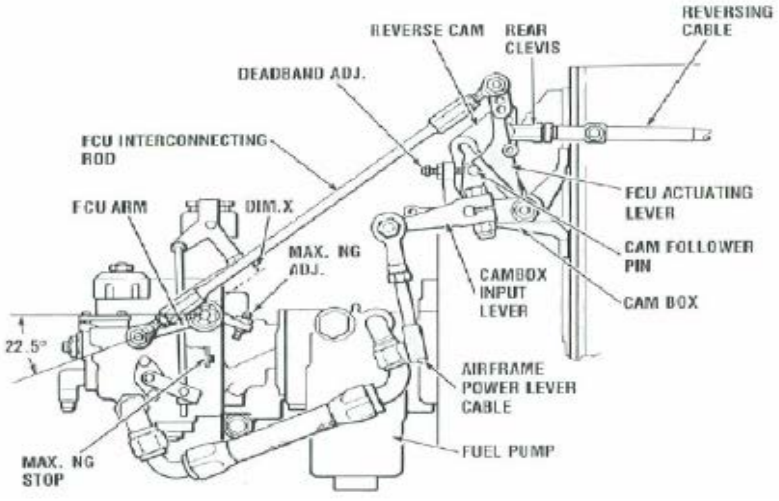


Figure 76-36 - Rear Linkage Feature Terminology

E. Slowly lift the arm off its stop and feel for the so-called "pick-up point," indicated by slight increase in spring tension. The pick-up point is the where the compressor speed (Ng) will begin to rise above idle.

Figure 76-37 - Gently Feel for the FCU Arm Pick-Up Point

F. When the pick-up point is identified, hold the arm steady at that position and pivot the FCU interconnecting rod to the position where the rod (not the holes) is aligned with the topmost hole of the FCU actuating lever.

G. The next objective is to adjust the position of the FCU arm in order to set Gap "Y" in Figure 76-38 to approximately 3/8 to 1/2 inch, when the FCU arm is at the pick-up point. The arm is equipped with serrations to allow an adjustment of the arm position relative to the pick-up point.

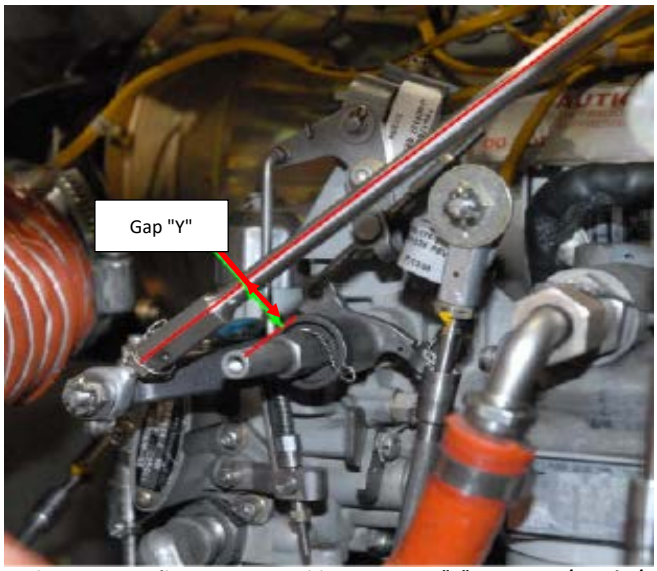


Figure 76-38 -Adjust FCU Arm Position to Set Gap "Y" Between 3/8 and 1/2 Inch

H. To make fine adjustments of the FCU arm position, use the serrated washer as described next:
   1 Remove safety wire and loosen the FCU Arm Retaining Shaft.
   2 Using a permanent marker draw a line across both sides of the serrated washer to mark the starting position (to aid in indexing the lever arm accurately).
   3 Grasp the serrated washer and the FCU Arm as one unit (with their teeth still engaged), and rotate them in the direction that the arm needs to move. Count the number of serrations that the arm is rotated.
   4 Next, hold the washer steady (teeth engaged with the FCU Arm Root) and rotate the FCU Arm back by the same number of serrations as the washer was rotated. When adjusted in this manner, if the washer is adjusted 1 serration, the FCU arm will rotate 0.6°, which corresponds to approximately .02 inches of adjustment to the end of the FCU Arm. Since the FCU Arm has 25 teeth, a one-tooth adjustment to the FCU Arm without moving the serrated washer will cause 15° or .44 inches of adjustment to the end of the arm.

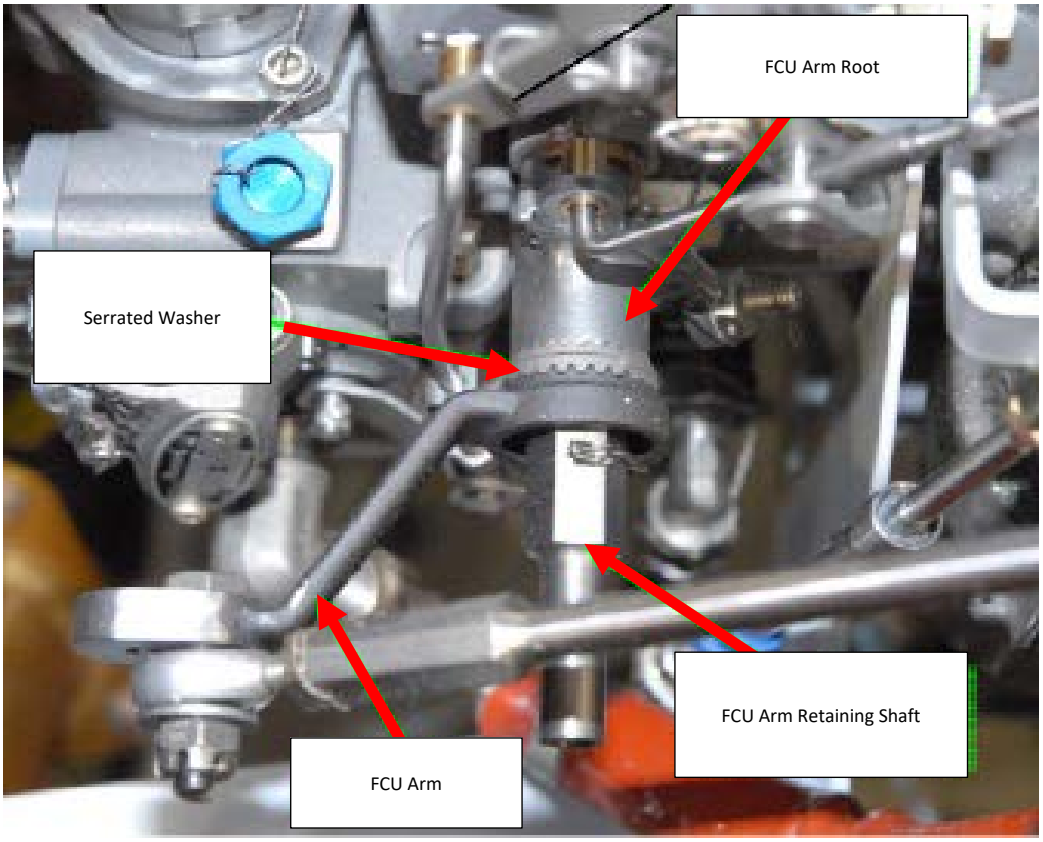


Figure 76-39 - Detail View of the FCU Arm Adjustment Features

   5 Adjust the FCU Arm orientation until the desired 3/8 - 1/2 inch spacing is obtained between the FCU interconnect rod centerline and the FCU arm pivot point. Remember that the spacing should be measured when the rod is aligned with topmost hole of the FCU actuating lever , and the FCU arm is at the pick-up point.
   6 Retighten the FCU Arm Retaining Shaft.

I. Cut the safety wire and loosen the lock nuts on the FCU interconnecting rod.

J. With the FCU Arm held at the pickup point adjust the length of the rod until the upper rod end hole aligns with the topmost hole of the FCU actuating lever, and the bolt can be smoothly inserted.

K. Carefully measure the length of the rod, and then lengthen the rod another 1/8 - 3/16 inch and reconnect.

L. With the FCU arm at the pick-up point, reconnect the upper end of the FCU interconnect rod, and verify that when held at this position, there is approximately an 1/8" gap between the cam follower pin and the FCU actuating lever. There should also be approximately 1/8" between the cam follower pin and the reversing dead-band adjustment screw, as illustrated in Figure 76-40. Make adjustments as necessary.

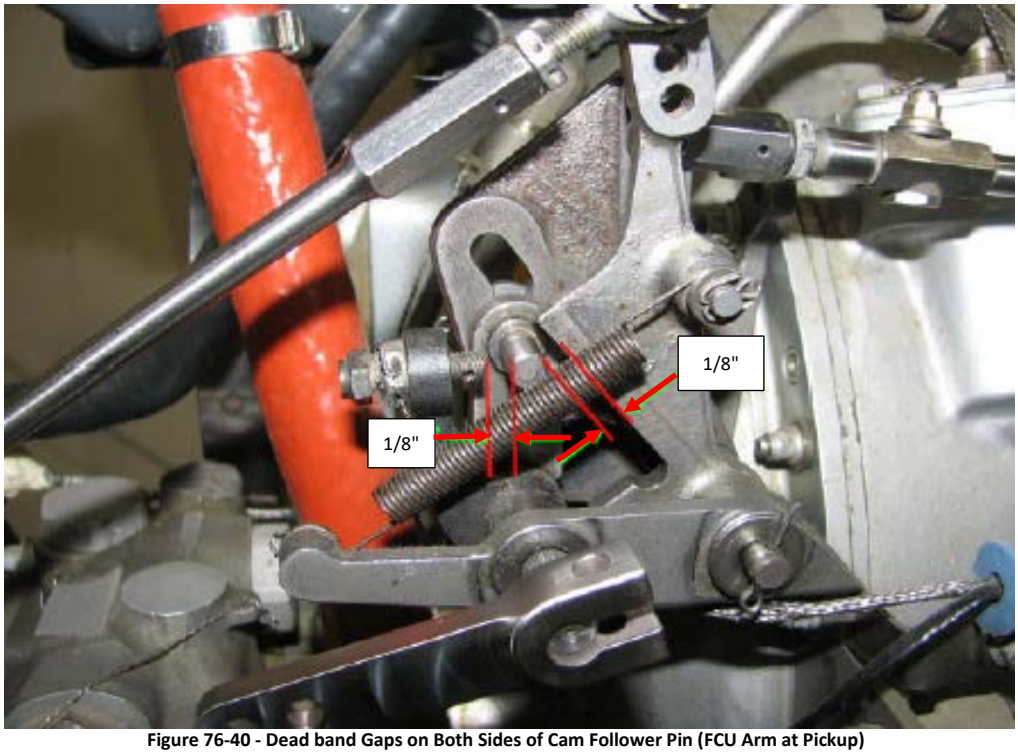


Figure 76-40 - Dead band Gaps on Both Sides of Cam Follower Pin (FCU Arm at Pickup)

M. As a final check of system functionality, push the cockpit power control lever to MAX.

N. While the power is set to MAX, verify that the Maximum Ng Stop Set Screw firmly contacts the Max Ng Stop, as shown in **Figure 76-41**. Also, as shown in **Figure 76-42**, at the cambox verify that the cam follower pin does not reach the bottom of the FCU Actuating Lever slot.

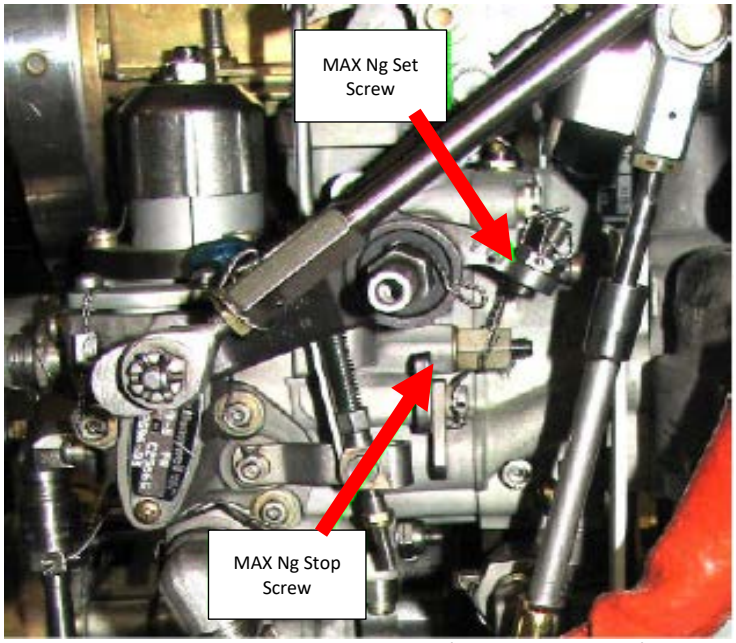


Figure 76-41 - Max Ng Stop and Set Screw (Shown in Idle Position)

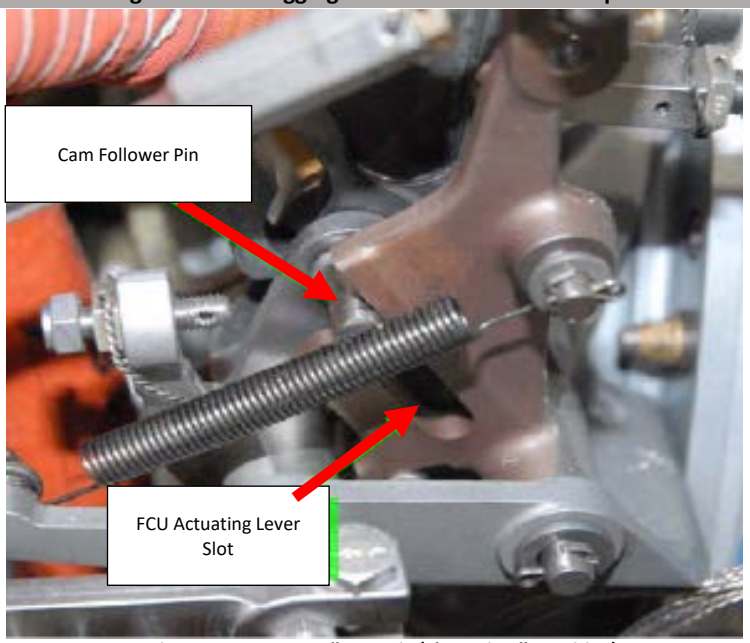


Figure 76-42 - Cam Follower Pin (Shown in Idle Position)