Aerolineas Argentinas

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4	DEC 01/04	06

CHAPTER 76 – ENGINE CONTROLS

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ENGINE CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The engine control system for each engine is divided into three subsystems: the forward thrust control system, the reverse thrust control system, and the start control system (Fig. 1).
   B. The forward thrust control system consists of a thrust lever assembly for each engine, connected to each engine fuel control unit by control cables, a push-pull cable, and a rod linkage. The forward thrust control system regulates the engine fuel flow, and hence forward thrust.
   C. The reverse thrust control system consists of a reverse thrust lever for each engine connected to each engine fuel control by the same control cables, push-pull cable, and rod linkage used to control forward thrust. However, the reverse thrust control system causes cable travel in the opposite direction and actuates the thrust reverser. The system regulates fuel flow to the engine, and hence reverse thrust. A lockout mechanism prevents simultaneous motion of the forward and reverse thrust levers.
   D. The start control system consists of a start lever assembly for each engine, connected to each engine fuel control unit by control cables, a push-pull cable, and a rod linkage. The start control system controls energizing the ignition system and initiating fuel flow to the engine.
   E. On NZ ALL EXCEPT ZK-NAM, ZK-NAP and on; WE ALL EXCEPT N4905W and on; TZ ALL EXCEPT C-FTAQ and on; AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, auto throttle clutches are installed in the throttle control cable runs. The clutches are located between floor beams at the aft end of the electronic equipment compartment. When the auto throttle system is installed and engaged, the clutches are driven by an electrically operated servomotor and the throttle levers on the control stand follow the movement of the clutches (Ref Chapter 22, Auto Flight).
   F. On NZ ZK-NAM, ZK-NAP and on; WE N4905W and on; TZ C-FTAQ and on; AR LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, drum and friction brake assemblies are installed in the throttle control cable runs. The assemblies are located between floor beams at the aft end of the electronic equipment compartment.
   G. A drum-and-shaft assembly for each engine is mounted on the forward face of the front wing spar. It extends through the horizontal firewall into the engine nacelle strut and transmits engine control cable travel to the push-pull cable assemblies. A stop pin in the drum-and-shaft assembly stops start drum travel when the start lever on the control stand is in the CUTOFF position.
   H. Each engine start lever is connected by cables to the drum-and-shaft assembly. A push-pull cable assembly connects a crank on the start shaft to a crank on the engine cross-shaft. A linkage rod connects a crank on the right end of the cross-shaft to a lever on the fuel control unit.

I. On AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on; EF B2601, B2603 and B2607; TS N73711 thru N73713, N73715 and N73717, the thrust lever assembly, autothrottle clutch system, and drum-and-shaft assembly are cable connected. On AR LV-LEB, LV-JTD, LV-LIU and on; EF ALL EXCEPT B2601, B2603 and B2607 ; TS ALL EXCEPT N73711 thru N73713, N73715 and N73717, the thrust lever assembly, drum and friction brake assembly, and drum- and -shaft assembly are cable connected. A push-pull cable assembly connects a crank on the drum-and-shaft assembly to a crank on the engine cross-shaft. A linkage rod connects a crank on the right end of the cross-shaft to the power control shaft crank on the fuel control unit.

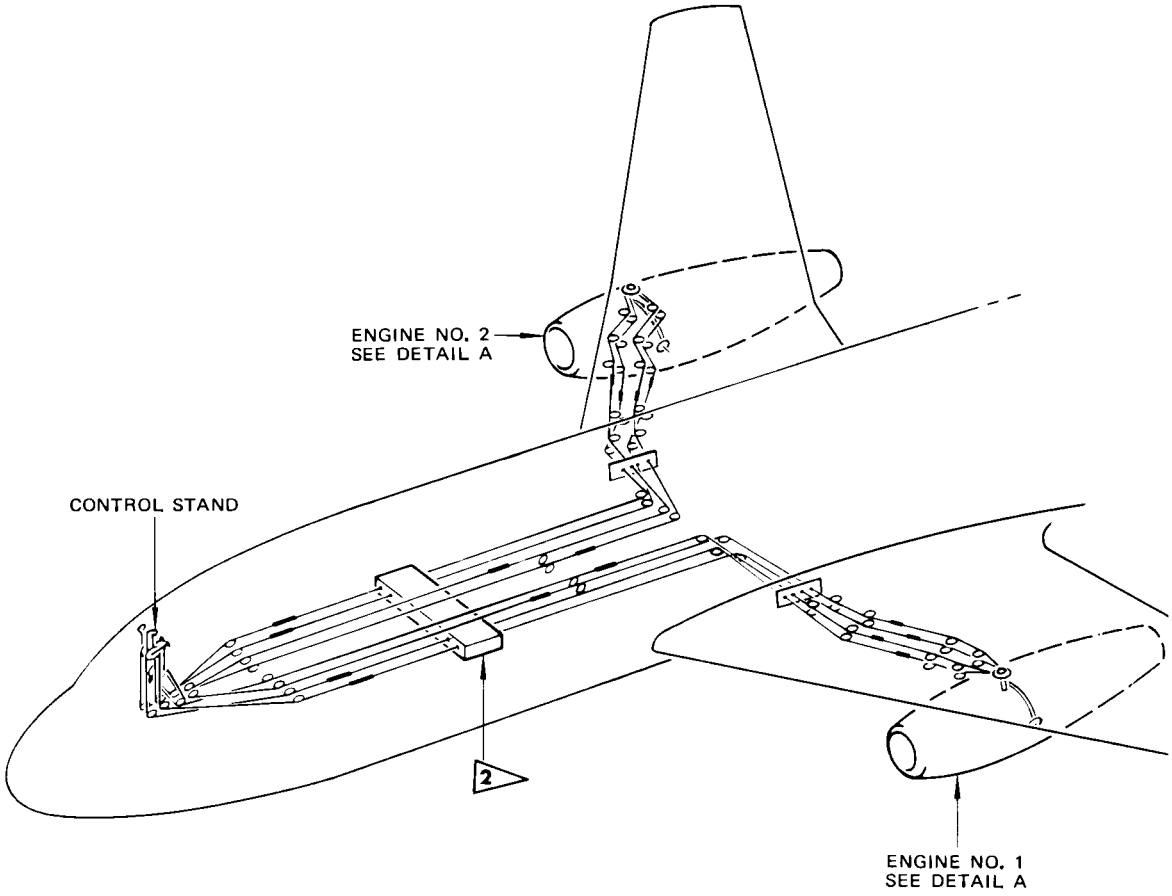
J. Actuation of the thrust lever assembly regulates fuel flow in the fuel control unit. On AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on; EF B2607; TS N73711 thru N73713, when forward thrust is decreased, a flight idle detent is encountered prior to reaching the idle stop. The flight idle detent serves to locate the thrust lever in the flight idle position, resulting in a higher idle speed (rpm) than that obtained at the idle stop. The flight idle position enables faster acceleration of the engine in flight.

K. For reverse thrust, the lever assembly movement actuates the thrust reverser before increasing fuel flow. It should be noted that the direction of travel of the thrust control cables and drums is the same for decreasing forward thrust as it is for increasing reverse thrust. When reverse thrust is increased, a temperature indicating detent is encountered. The detent serves as a caution to the captain and first officer that it is possible to exceed allowable engine temperature limits if the reverse thrust lever is held in a position beyond the detent.

2. Thrust Lever Assembly

A. Two thrust lever assemblies on the control stand control the forward thrust and reverse thrust of the engines. Each thrust lever assembly consists of a forward thrust lever, a reverse thrust lever, a thrust control link, a pawl and a thrust control drum (Fig. 2). The forward thrust lever, with the reverse thrust lever attached to it, is concentrically mounted with the thrust control drum. One end of the control link is riveted to the reverse thrust lever and the opposite end is attached to the thrust control drum. A go-around switch is incorporated in the thrust lever assembly (Ref Chapter 22, Auto Flight).

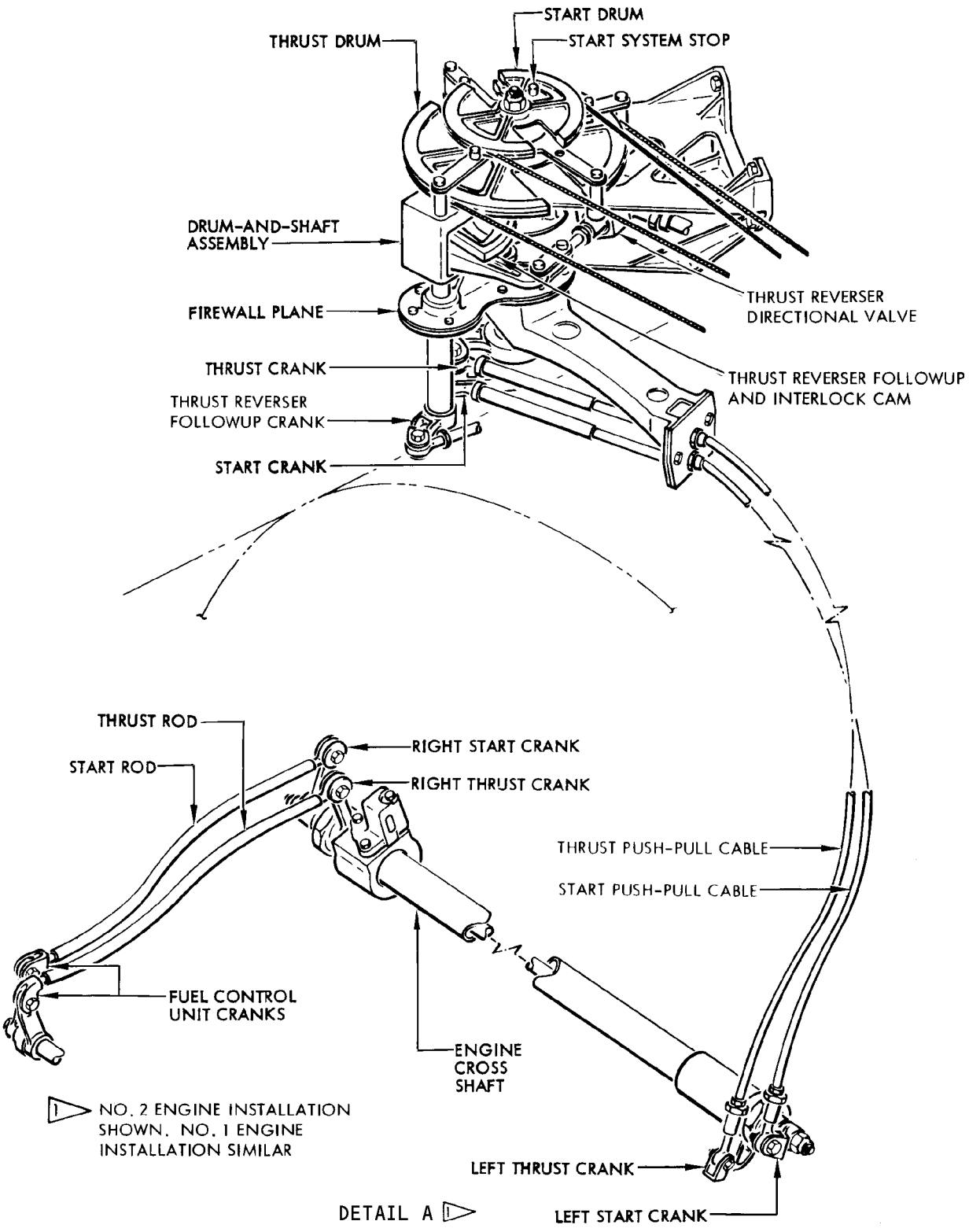
B. As the thrust lever is advanced from the idle position, the control link rotates the thrust control drum to actuate the fuel control unit to increase thrust. The forward thrust idle position is against an idle stop on the control stand cover and full forward thrust is obtained before the lever is all the way forward. The reverse thrust lever, when in the OFF position, is against an idle stop on the forward thrust lever.



2 AUTO THROTTLE CLUTCH ASSEMBLY ON
AR ALL EXCEPT LV–LEB, LV–JTD, LV–JTO, LV–LIU AND ON
AQ ALL EXCEPT N24SW AND ON

DRUM AND FRICTION BRAKE ASSEMBLY ON
AR LV–LEB, LV–JTD, LV–JTO, LV–LIU AND ON
AQ N24SW AND ON

Engine Control System Component Location
Figure 1 (Sheet 1)



Engine Control System Component Location
Figure 1 (Sheet 2)

C. A lockout mechanism prevents simultaneous actuation of the forward and reverse thrust levers to assure positive forward or reverse thrust control. The ability of each lever to move depends on the position of the other lever. If the forward thrust lever is more than slightly forward of the idle position, the reverse thrust lever cannot be moved more than a small travel aft from OFF. However, if the reverse thrust lever is moved more than a small travel from OFF, the forward thrust lever cannot be moved. The lockout between the levers is a pawl, riveted to the forward thrust lever (Fig. 2). The pawl is between the thrust lever and the control link. When the forward thrust lever is in the idle position, the pawl is aligned with a lockout hole in the web of the control stand thrust lever cover. As the reverse thrust lever is moved from the OFF position, the control link forces the pawl into the hole to lock the forward thrust lever in the idle position. As the reverse thrust lever is returned to the OFF position the control link pushes the pawl from the hole to unlock the forward thrust lever. When the forward thrust lever is more than slightly forward of the idle position, the pawl is not aligned with the lockout hole. The web then opposes the force of the control link on the pawl so the reverse thrust lever cannot be moved more than slightly aft of OFF.

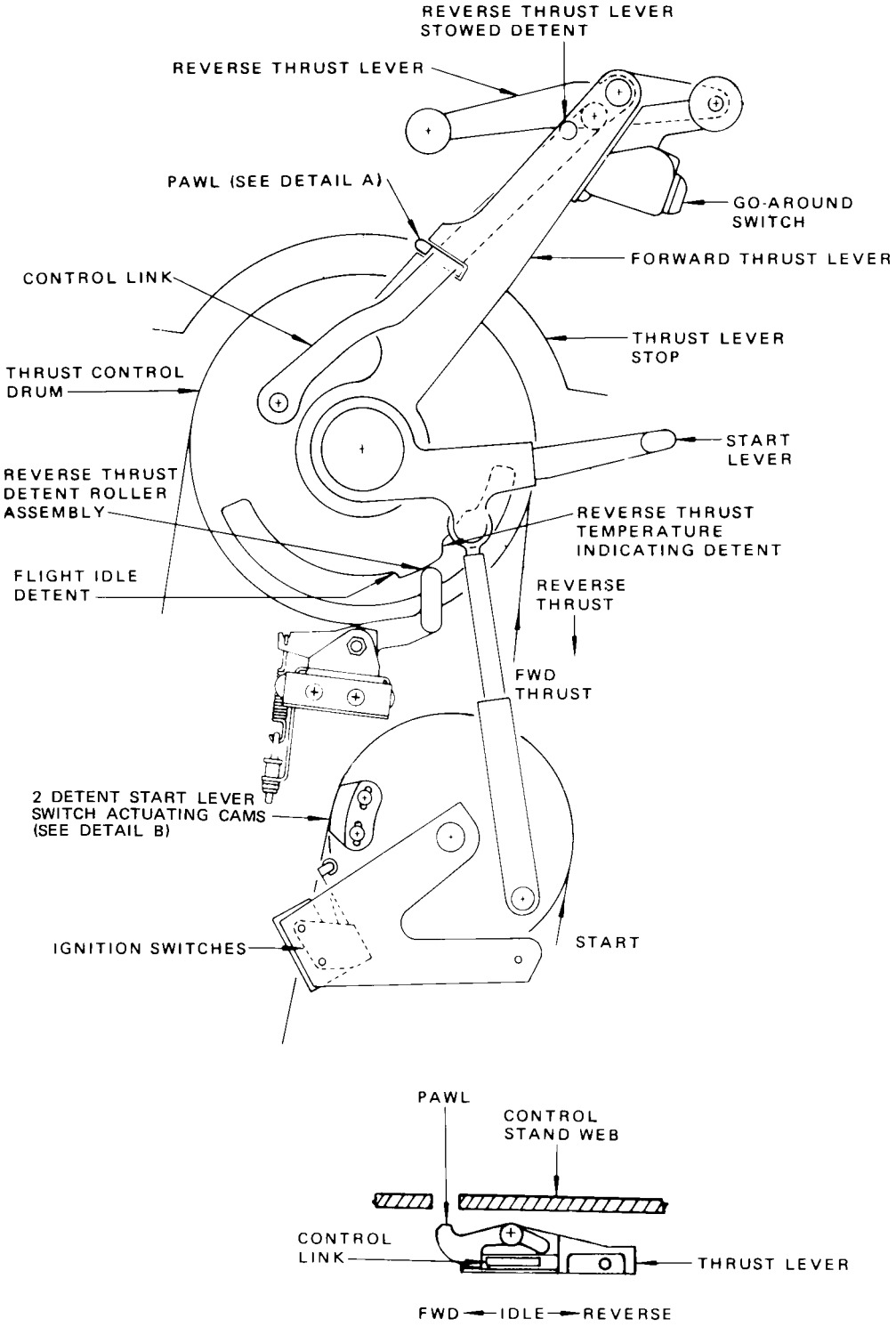
D. On AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, the thrust control drum incorporates a detent cam with separate detents for flight idle and reverse thrust temperature indication. A spring-loaded roller is engaged with the detent cam. The roller and cam provide the flight idle and reverse thrust temperature indicating detents.

E. On AR LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, the thrust control drum incorporates a detent cam in which a spring- loaded roller is engaged. This roller and cam provide the reverse thrust temperature indicating detent.

3. Engine Start Lever

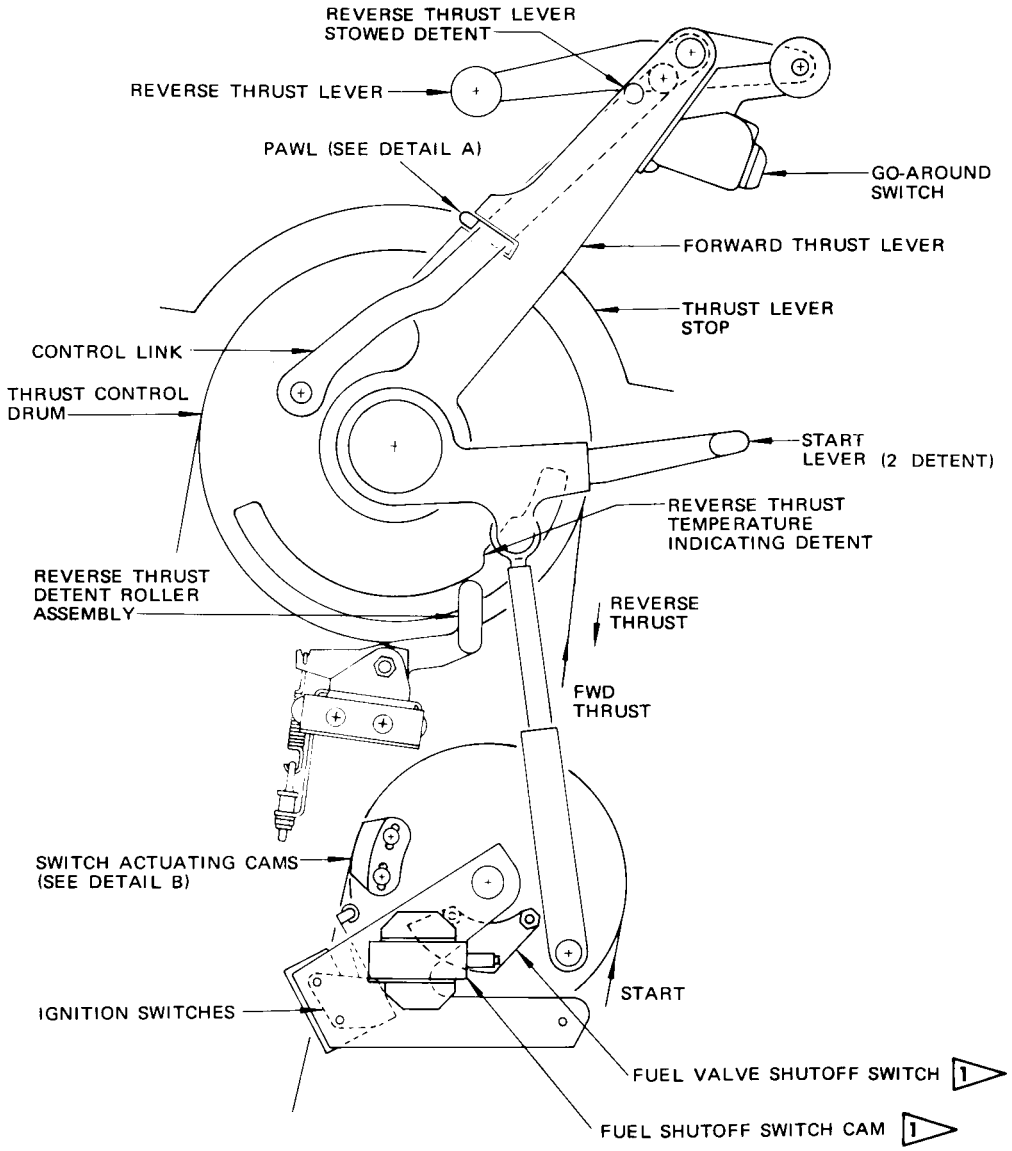
A. Two engine start levers on the control stand are used to start the engines. On AR ALL EXCEPT LV-LEB, LV-JTO, LV-LIU and on, each lever controls energizing the ignition system and initiating fuel flow to the respective engine. On AR LV-LEB, LV-JTO, LV-LIU and on, each lever controls energizing the ignition system and initiating or shutting off fuel flow to the respective engine by switch actuating cams on the start control drum. The start lever is provided with a spring-loaded detent catch which may be released by lifting the knob. A detent secures the lever in the CUTOFF and IDLE positions.

4. Engine Control Cables
   A. Engine control cables consist of engine start and thrust cables which connect the drum-and-shaft assemblies at each engine to the respective engine start lever and thrust lever. The cables are routed from the control stand under the floor, thru the body shell and out the forward face of the wing front spar to the engine control drum-and-shaft assemblies. The thrust control cables also pass through the auto throttle clutch system on AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, or the drum and friction brake assembly on AR LV-LEB, LV-JTD, LV-JTO, LV-LIU and on.
5. Auto Throttle Clutch Assembly
   A. On AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, the autothrottle clutch assembly unlock mechanism consists of three spring-loaded balls, two unlock plates, a ball carrier and an outer ball race. The unlock plates are attached directly to the input quadrant and the ball carrier is attached directly to the output quadrant.
6. Engine Control Drum-and-Shaft Assembly
   A. An engine control drum-and-shaft assembly provides a mechanical link between the thrust and start control cables and the push-pull cable assemblies. The assemblies are located on the forward face of the wing front spar and extend through the nacelle strut firewall. The assembly consists of concentric thrust and start control drums and shafts, and a start and thrust crank. Cable travel is transferred by the drums and shafts to the cranks on the end of the shafts.
7. Engine Control Push-Pull Cables
   A. A pair of push-pull cables transfer thrust and start control travel from the thrust and start cranks on the control drum-and-shaft assembly to the cranks on the left side of the engine cross-shaft. The cross-shaft transfers crank travel to the right side of the engine.
8. Cross-Shaft to Fuel Control Linkage
   A. The cross-shaft to fuel control linkage consists of a start rod and a thrust rod. These rods make the final engine control motion transfer, from the right side of the engine cross-shaft to the fuel control unit.
9. Operation
   A. On AR ALL EXCEPT LV-LEB, LV-JTO, LV-LIU and on, advancing the start lever to the IDLE position causes a start control cam on the control stand start drum to actuate a switch which energizes the intermittent duty starting ignition system (when the overhead start switch is in the ground start position). On AR LV-LEB, LV-JTO, LV-LIU and on, advancing the start lever to IDLE from CUTOFF position causes a start control cam s on the control stand start drum to actuate a switch which energizes the intermittent duty starting ignition system (when the overhead start switch is in the ground start position) and to actuate a fuel shutoff switch which opens the engine fuel shutoff valve (when the emergency fire shutdown switch is in the IN or normal position). The lever motion is also transmitted through the drum-and-shaft assembly and control linkage to the start lever on the fuel control unit. Rotation of the start shaft opens a pilot valve in the fuel control unit to initiate fuel flow.

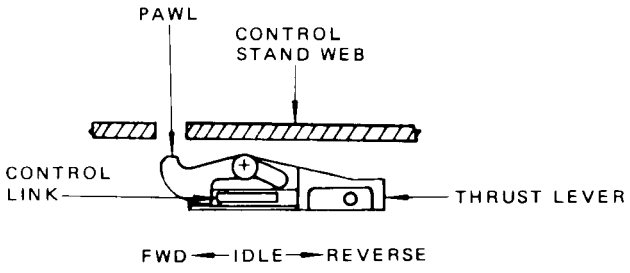


DETAIL A

Thrust and Start Levers
Figure 2 (Sheet 1)

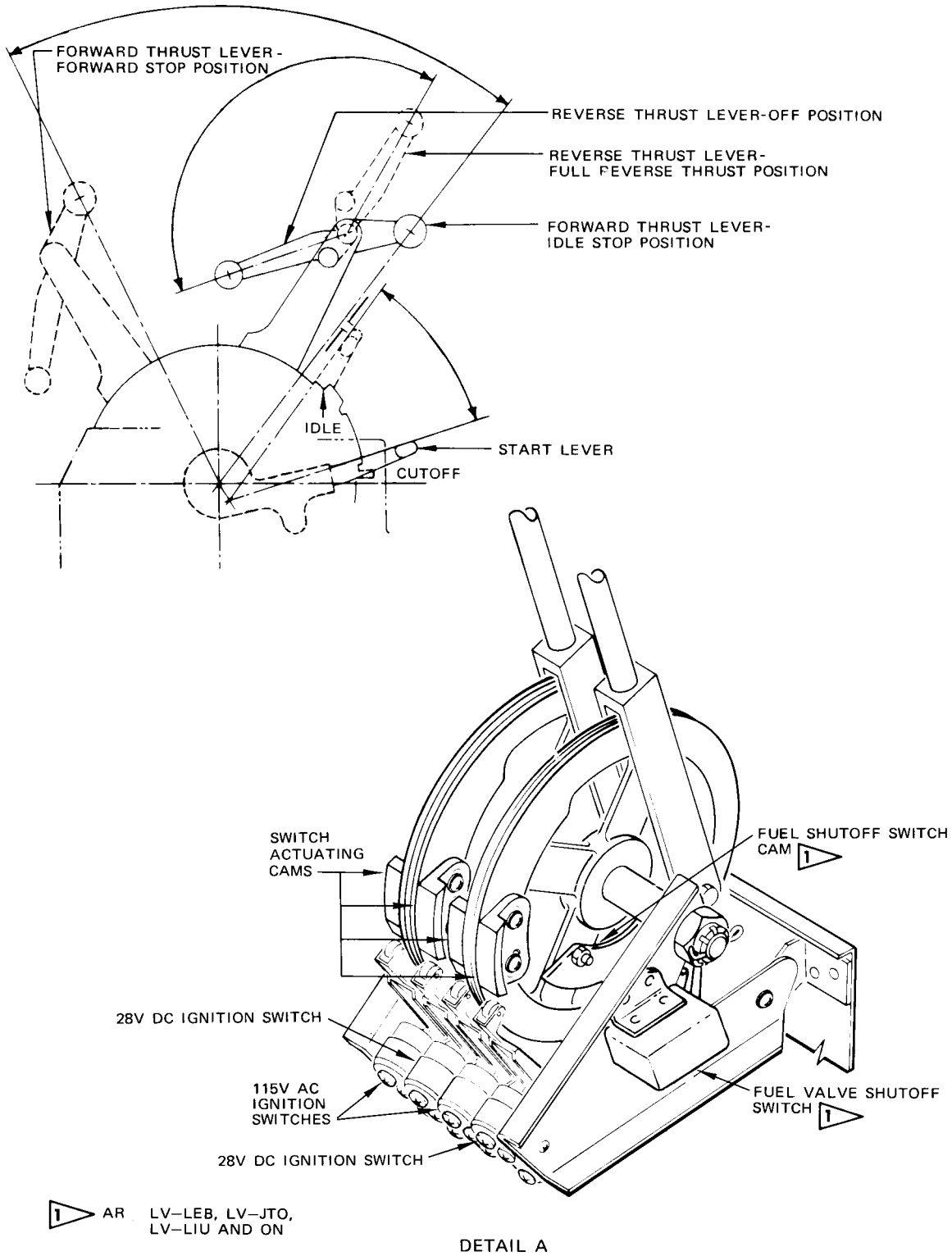


1 AR LV-LEB AND LV-JTO



DETAIL A

Thrust and Start levers
Figure 2 (Sheet 2)



Thrust and Start Levers
Figure 2 (Sheet 3)

B. On AR ALL EXCEPT LV-LEB, LV-JTO, LV-LIU and on, placing the start lever in the CUTOFF position de-energizes the ignition system. On AR LV-LEB, LV-JTO, LV-LIU and on, placing the start lever in the CUTOFF position de-energizes the ignition system and closes the engine fuel shutoff valve in the wing. When the lever is returned toward the CUTOFF position, a stop pin in the drum-and-shaft assembly contacts the end of a slot in the start drum and stops system motion at the strut. Approximately 1-1/2 degrees of additional start lever travel is required to enter the CUTOFF detent. This stretches the control cable and provides sufficient load in the cable system to maintain the start lever in the CUTOFF detent, ensuring positive cutoff.

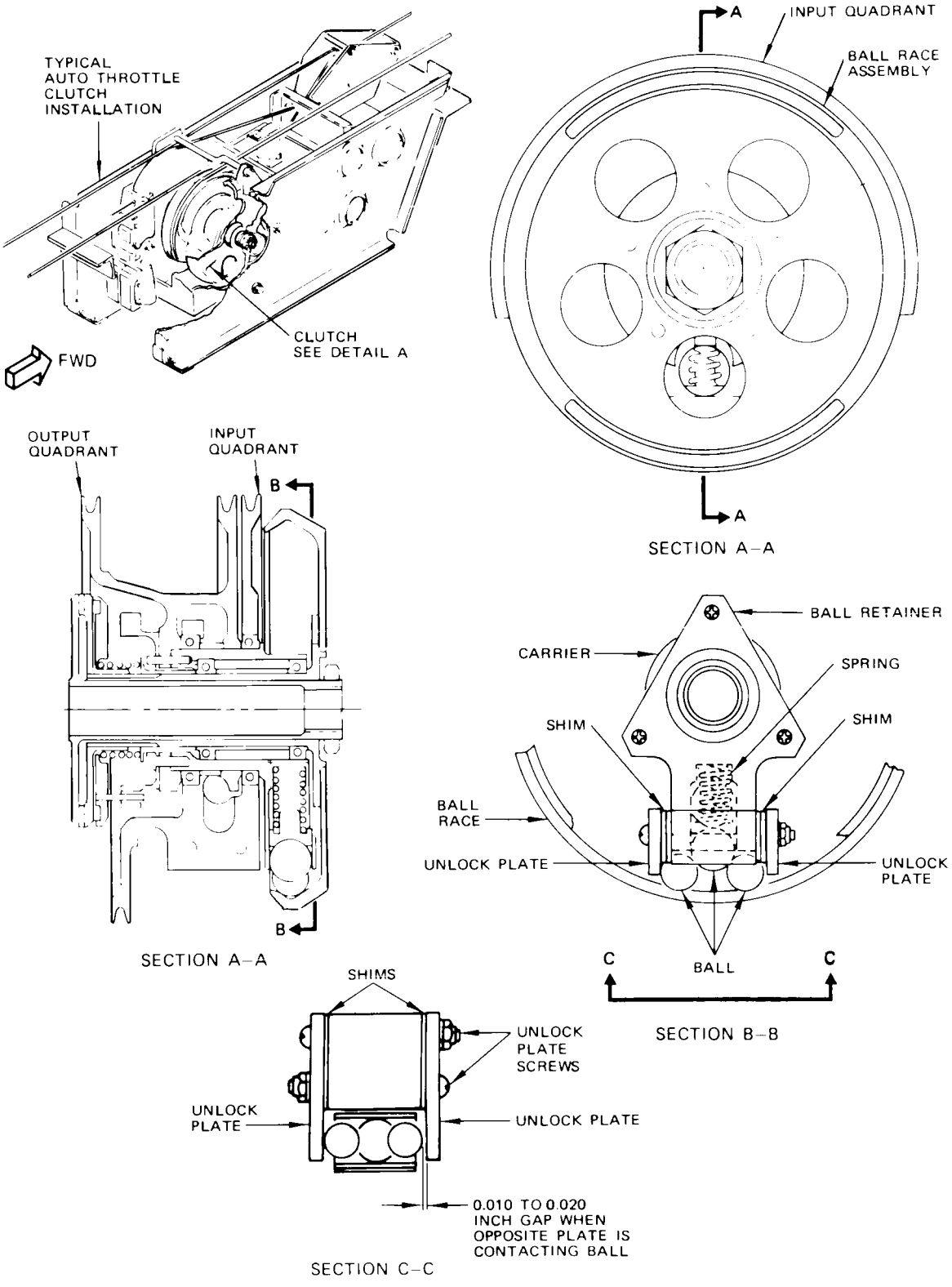
C. Advancing the forward thrust lever from the idle position, locks the reverse thrust lever in idle and rotates the thrust control shaft. As the shaft rotates, motion is transmitted to a lever on the fuel control unit which increases fuel flow to the engine. Forward motion of the forward thrust lever is terminated by a stop on the fuel control unit. Forward motion of the forward thrust levers causes cams in the auto throttle clutch system on AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, or the drum-and-brake assembly on AR LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, to actuate switches which provide takeoff warning and other functions.

D. On AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, forward motion of the forward thrust lever actuates the auto throttle clutch assembly unlock mechanism by exerting a load on the input quadrant which moves the unlock plate through the primary backlash until it contacts the outer ball. The outer ball contacts the center ball causing it to retract and allow the outer ball to unlock the clutch. Two loads are imposed on the center ball; (1) load imposed by the spring and (2) load in the output cable being caused by system friction and operating loads. As the input load to the unlock plate increases the load into the center ball equalizes at which time the clutch will rotate. As the load on the center ball increases the spring deflects allowing the center ball and the outer ball to retract and the unlock plate to move. The amount of movement between the input quadrant (unlock plate) and the output quadrant (ball carrier) is a function of the primary backlash, spring rate, and output cable load (Fig. 3).

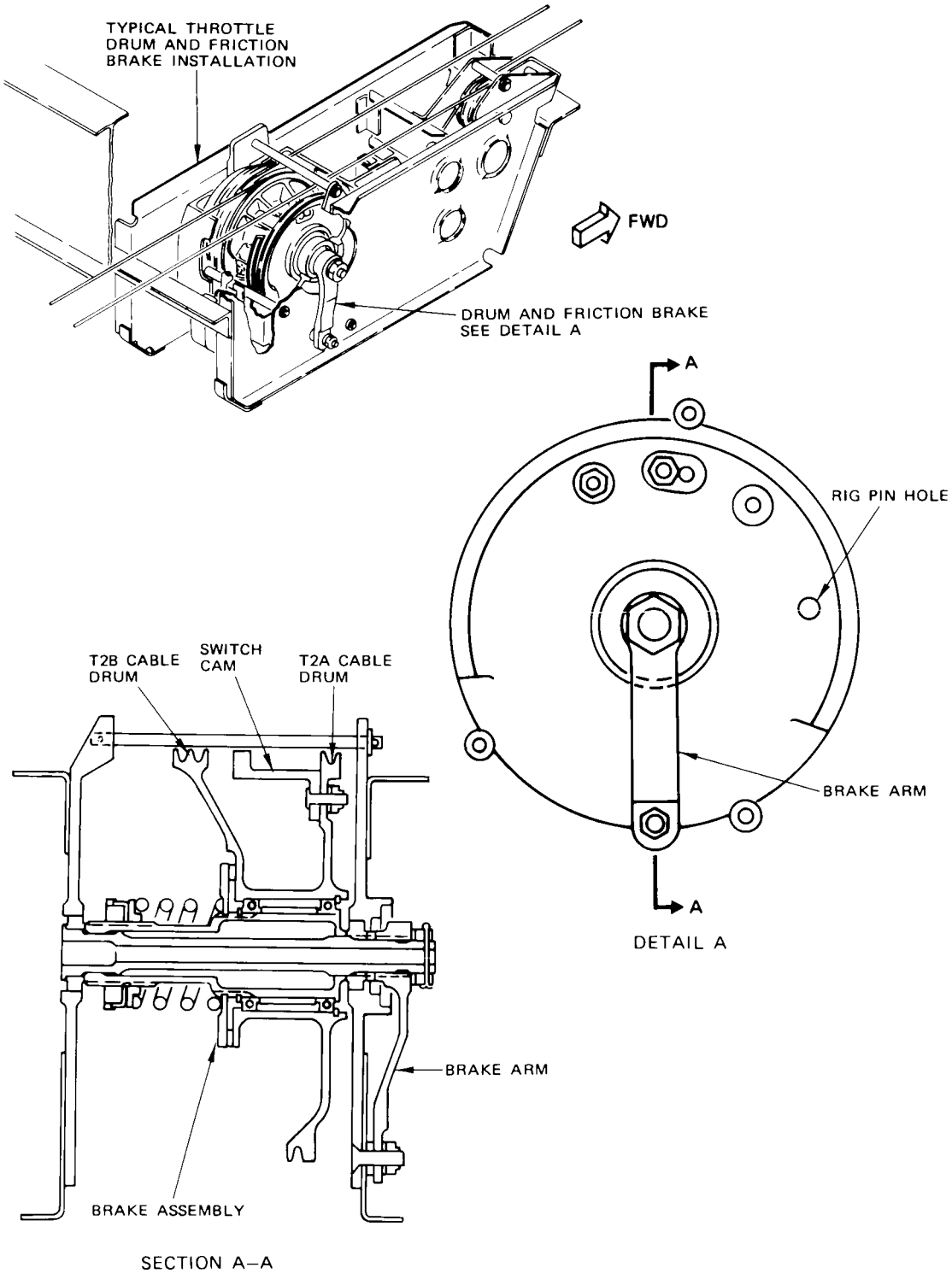
E. On AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, as the forward thrust levers are returned to the flight idle position, fuel flow is reduced and cams in the auto throttle clutch system actuate switches which provide landing gear warning under suitable circumstances. The levers may be moved through the flight idle detents to the idle stops.

F. On AR LV-LEB, LV-JTD, LV-JTO, LV-LIU and on, as the forward thrust levers are returned to the idle position, fuel flow is reduced and cams in the friction brake assembly actuate switches which provide landing gear warning under suitable circumstances.

G. Advancing the reverse thrust lever from the OFF position locks the forward thrust lever in the idle position. The thrust control drum and thrust control shaft rotate moving a cam which activates the thrust reverser control valve. A follow-up cam stop limits further advance of the reverse thrust lever until the thrust reverser deflector doors are in the reverse thrust position. Rotation of the doors aft removes the cam and allows lever motion to continue toward the temperature indicating detent. The lever may be moved through the temperature indicating detent to full reverse thrust. As the reverse thrust lever is returned toward the OFF position a cam actuates the thrust reverser directional valve to cause the doors to return to the forward thrust position. When the doors are stowed the follow-up cam moves to a position which will allow forward thrust. When the reverse thrust lever is in the OFF position the forward thrust lever is unlocked.



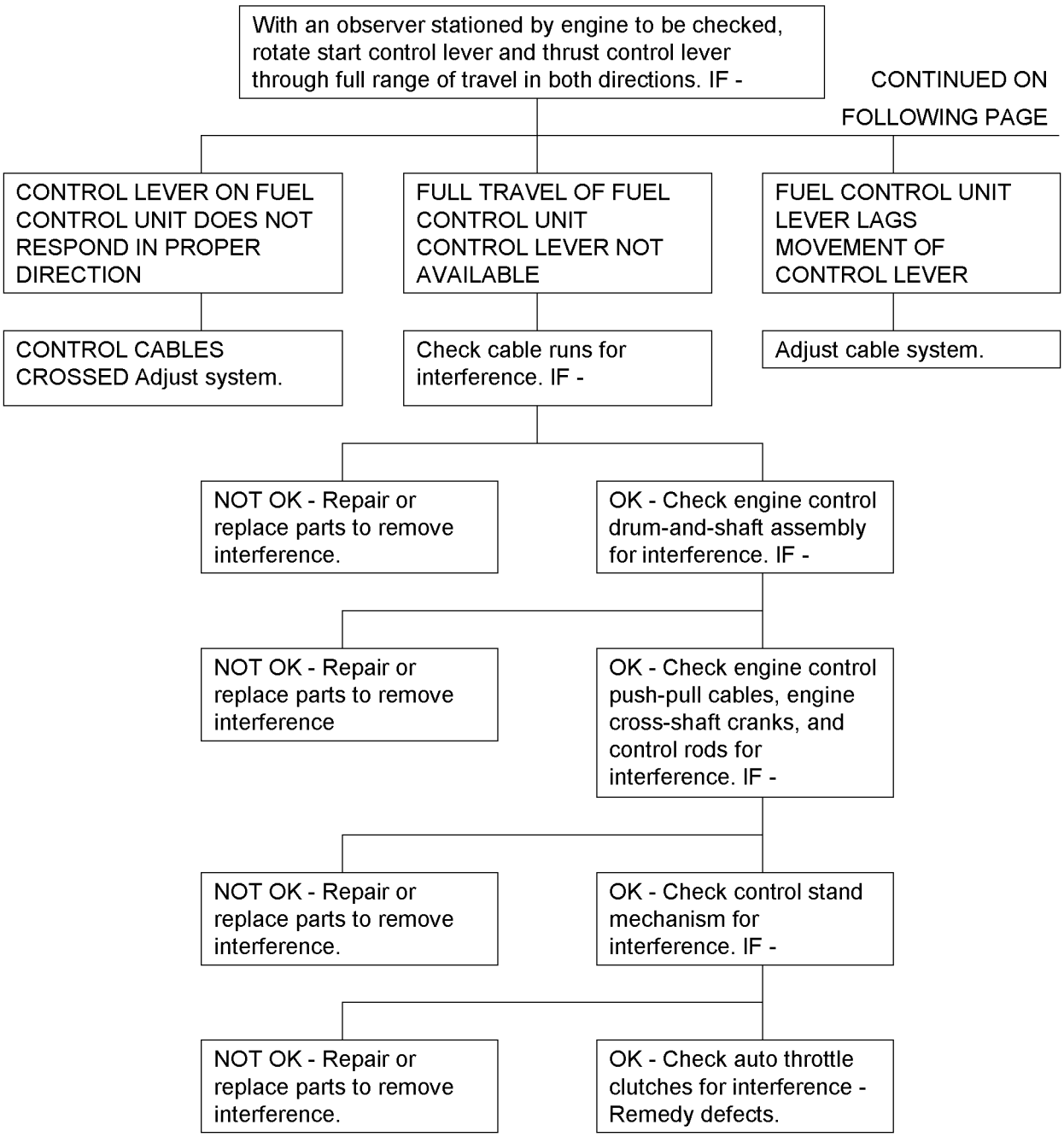
Auto Throttle Clutch Assembly Unlock Mechanism
Figure 3



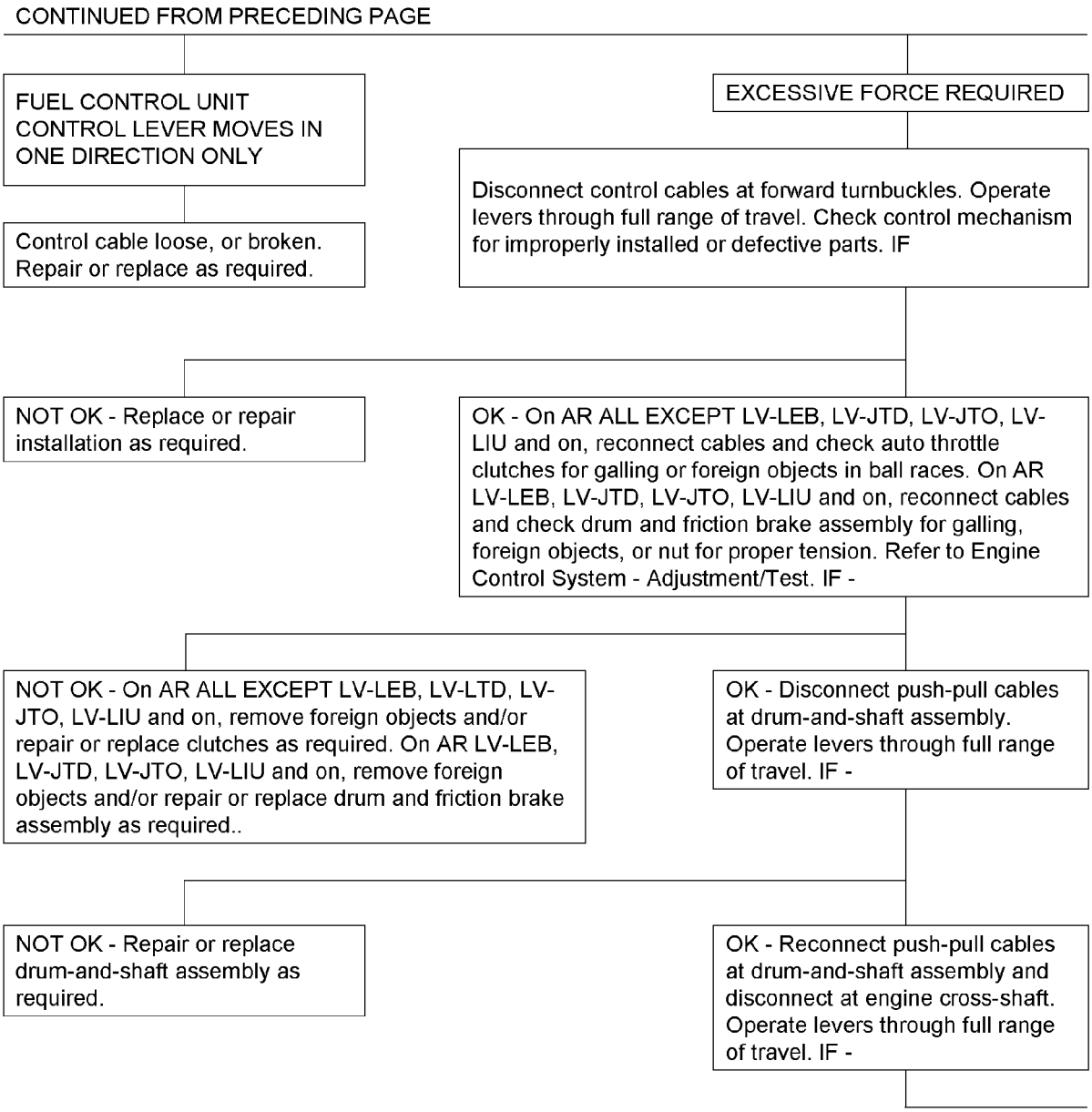
Drum and Friction Brake Assembly
Figure 4

ENGINE CONTROL SYSTEM – TROUBLESHOOTING

1. Engine Control System Troubleshooting Chart



Engine Control System Troubleshooting
Figure 101 (Sheet 1)



Engine Control System Troubleshooting
Figure 101 (Sheet 2)

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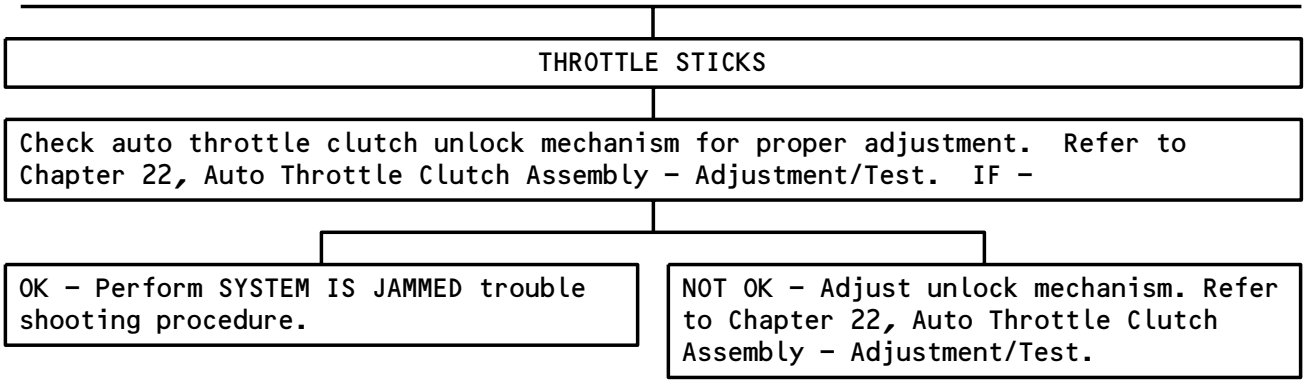

Engine Control System - Troubleshooting
Figure 101 (Sheet 3)

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REVERSE THRUST LEVER LOOSE AND/OR MISALIGNED (AIRPLANES WITH REVERSE THRUST DETENT IN THRUST HANDLE)
Check reverse thrust lever detent mechanism bolt. Replace bolt if sheared or damaged.

Engine Control System - Troubleshooting
Figure 101 (Sheet 4)

CONTINUED FROM PRECEDING PAGE

RESTRICTED OR NO THRUST LEVER OR REVERSE THRUST LEVER MOVEMENT WHEN ATTEMPTING TO ADVANCE LEVERS.

CHECK THRUST REVERSER PUSH-PULL CABLE - Replace cable if broken or damaged (Ref 78-34-32, R/I).

Engine Control System - Troubleshooting
Figure 101 (Sheet 5)

ENGINE CONTROL SYSTEM – MAINTENANCE PRACTICES

1. General
   A. This section provides a method of converting thrust lever angle in degrees to an equivalent arc length at the control stand cover top (Fig. 201). The linear dimensions can then be used to position thrust levers when this is required for adjustment/test.
   B. To make the linear measurement, a flexible scale is required that will conform to the contour of the seal retainer along the top of the control stand, adjacent to the thrust levers. Thrust lever angle is measured from the lever contact surface on the idle stop to the aft surface of the thrust lever with the scale conforming to the contour of the seal retainer.

THRUST LEVER ANGLE (DEGREES)	EQUIVALENT ARC LENGTH (INCHES)	THRUST LEVER ANGLE (DEGREES)	EQUIVALENT ARC LENGTH (INCHES)	THRUST LEVER ANGLE (DEGREES)	EQUIVALENT ARC LENGTH (INCHES)
0.5	0.05	17.5	1.64	34.5	3.23
1.0	0.09	18.0	1.69	35.0	3.28
1.5	0.14	18.5	1.73	35.5	3.33
2.0	0.19	19.0	1.78	36.0	3.38
2.5	0.23	19.5	1.83	36.5	3.42
3.0	0.28	20.0	1.88	37.0	3.47
3.5	0.33	20.5	1.92	37.5	3.52
4.0	0.38	21.0	1.97	38.0	3.56
4.5	0.42	21.5	2.02	38.5	3.61
5.0	0.47	22.0	2.06	39.0	3.66
5.5	0.52	22.5	2.11	39.5	3.70
6.0	0.56	23.0	2.16	40.0	3.75
6.5	0.61	23.5	2.20	40.5	3.80
7.0	0.66	24.0	2.25	41.0	3.84
7.5	0.70	24.5	2.30	41.5	3.89
8.0	0.75	25.0	2.34	42.0	3.94
8.5	0.80	25.5	2.39	42.5	3.98
9.0	0.84	26.0	2.44	43.0	4.03
9.5	0.89	26.5	2.48	43.5	4.08
10.0	0.94	27.0	2.53	44.0	4.13
10.5	0.98	27.5	2.58	44.5	4.17
11.0	1.03	28.0	2.63	45.0	4.22
11.5	1.08	28.5	2.67	45.5	4.27
12.0	1.13	29.0	2.72	46.0	4.31
12.5	1.17	29.5	2.77	46.5	4.36
13.0	1.22	30.0	2.81	47.0	4.41
13.5	1.27	30.5	2.86	47.5	4.45
14.0	1.31	31.0	2.91	48.0	4.50
14.5	1.36	31.5	2.95	48.5	4.55
15.0	1.41	32.0	3.00	49.0	4.59
15.5	1.45	32.5	3.05	49.5	4.64
16.0	1.50	33.0	3.09	50.0	4.69
16.5	1.55	33.5	3.14		
17.0	1.59	34.0	3.19		

FOR MEASUREMENTS OVER 50°, ADD THE EQUIVALENT ARC LENGTH FOR 50° TO THE EQUIVALENT ARC LENGTH OF THE ADDITIONAL ANGULAR MEASUREMENT REQUIRED.

EXAMPLE: FIND ARC LENGTH EQUIVALENT OF 75° (50° + 25°)

FROM FIGURE 201: FOR 50° ARC LENGTH EQUIVALENT IS 4.69 INCHES
FOR 25° ARC LENGTH EQUIVALENT IS 2.34 INCHES

ADDING: 4.69 + 2.34 = 7.03 INCHES

THEREFORE AN ARC LENGTH OF 7.03 INCHES IS THE EQUIVALENT OF 75°

Thrust Lever Angle (Degrees) to Arc Length (Inches) Conversion Table
Figure 201

ENGINE CONTROL SYSTEM - ADJUSTMENT/TEST

1. General
   A. For the purpose of adjustment/test, the engine control system is divided into three parts: the forward thrust control system, the reverse thrust control system, and the start control system.
   B. The adjustment procedure will describe adjustment of each part of the complete system. The sequence of adjustments for each system will proceed from the control stand to the fuel control. The control cables are adjusted first, followed by the thrust and start push-pull cables, and then the cross-shaft to fuel control linkage. Rig Pins are inserted at fixed points in the systems to isolate various sections for adjustment (Fig. 501).

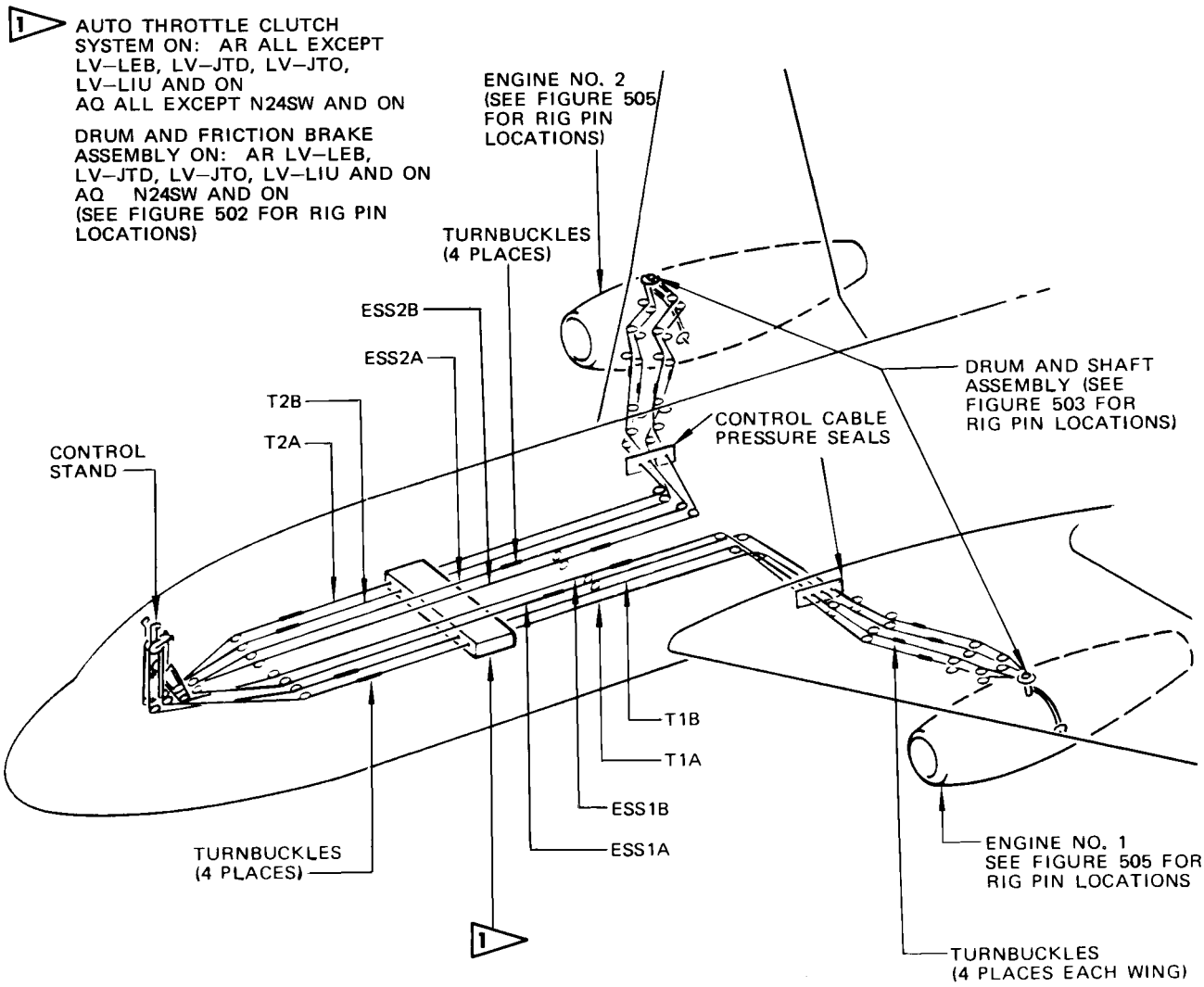
      NOTE: The thrust rod and start rod require adjustment only when the fuel control unit is replaced.

   C. Procedures are given for testing the operation of each part of the complete system. These tests will verify that operation of the system is within prescribed limits. Rig pins are used in the test procedures to verify the correct positioning of controls.
   D. The reverse thrust detent roller assembly is adjusted to engine EPR with the engines running. Refer to AMM 78-32-01/501, Thrust Reverser System. Adjustment of the landing gear warning horn switches and the takeoff warning horn switches is dependent upon the procedure used to rig the engine control system. Refer to AMM 31-26-0, Thrust Lever Actuated Aural Warning and Call Devices, Takeoff Warning System and Landing Gear Warning System Adjustment.
   E. In each area, adjustment/test of the complete system is provided. Should adjustment/test of only a portion of a system be desired, the reader should proceed to the appropriate subdivision of the full system involved.
   F. When new control cables are installed, the initial yield must be compensated for before the control cables are rigged to the normal operating tension. In addition, the control cables must be well seated in the pulleys. This is accomplished by rigging to a high tension and cycling the system prior to adjusting to normal operating tension.
   G. When tensioning control cables, careful attention should be paid to following the values given for various temperatures. Care should be used to obtain an accurate airframe temperature and make sure that the temperature has stabilized. Failure to take these precautions could lead to serious stretching or slackening of the control cables due to the different thermal expansion rates of the aluminum airframe and the steel control cables.

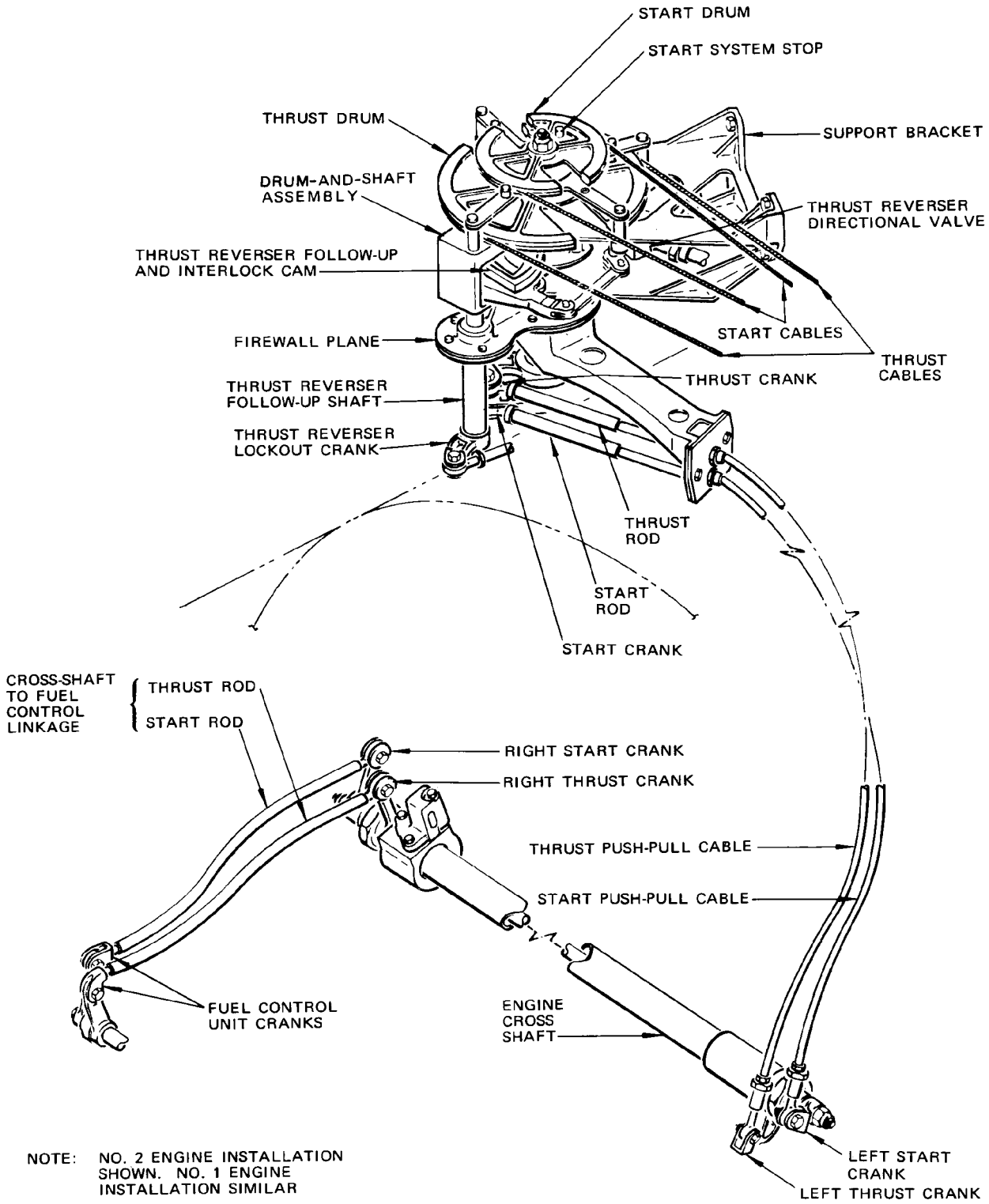
H. Following engine control cable maintenance, observe these requirements:
(1) Control cables should not be deflected by fairleads, rubstrips, or grommets from the rigged or normal operation position.
(2) All pulleys should rotate freely with no interference with cable guards.
(3) Control cables should not contact pulley or drum flanges for entire travel of cable.
(4) Control cables should lie within 2 degrees of the plane of their pulleys.

2. Engine Control System Adjustment
A. Forward Thrust Control System Adjustment
(1) Equipment and Materials
(a) Tensiometer - 0- to 125-pound capacity
(b) Rig Pin Kit - F70207-3, -52 or -61
1) Type 1 - F70207-8 (2 required), 0.311 +0.000/-0.002-inch diameter rod
2) Type 2 - Fuel Control Unit Idle Rig Pin - F70207-50, 0.0940 +0.0000/-0.0005-inch thick x 0.20-inch wide x 2.0-inch long flat rig pin made from hardened steel
3) Type 3 - F70207-23, 0.248 +0.000/-0.002-inch diameter rod
(c) Airplane Control Surfaces Protractor - 4MIT65B80307-1 or F52485-500
(d) Protractor Adapter, Cross-Shaft - 2MIT65-45109-22
(e) Protractor Adapter, Thrust Lever - F72952-15 (Preferred), F72952-2 (Optional)
(f) Spring scale - 0- to 30-pound capacity
(2) Prepare engine forward thrust control system for adjustment/test.
(a) Remove engine side removable cowl panels (AMM Chapter 71, Removable Cowl Panels).
(b) Remove access door No. 6301 (left wing) or No. 6401 (right wing) from wing leading edge above wing-to-engine fairing (AMM Chapter 12, Access Doors and Panels).
(c) Open electronic equipment access door No. 1201. Remove forward cargo ceiling panels as required for turnbuckle access.
(d) Extend forward airstairs (AMM Chapter 52, Forward Airstairs and Door).
(e) When adjusting control cables, leading edge flaps must be extended to provide access to control cable turnbuckles in wing leading edge. Extend flaps and install leading edge flap locks (AMM 27-81-0/201).

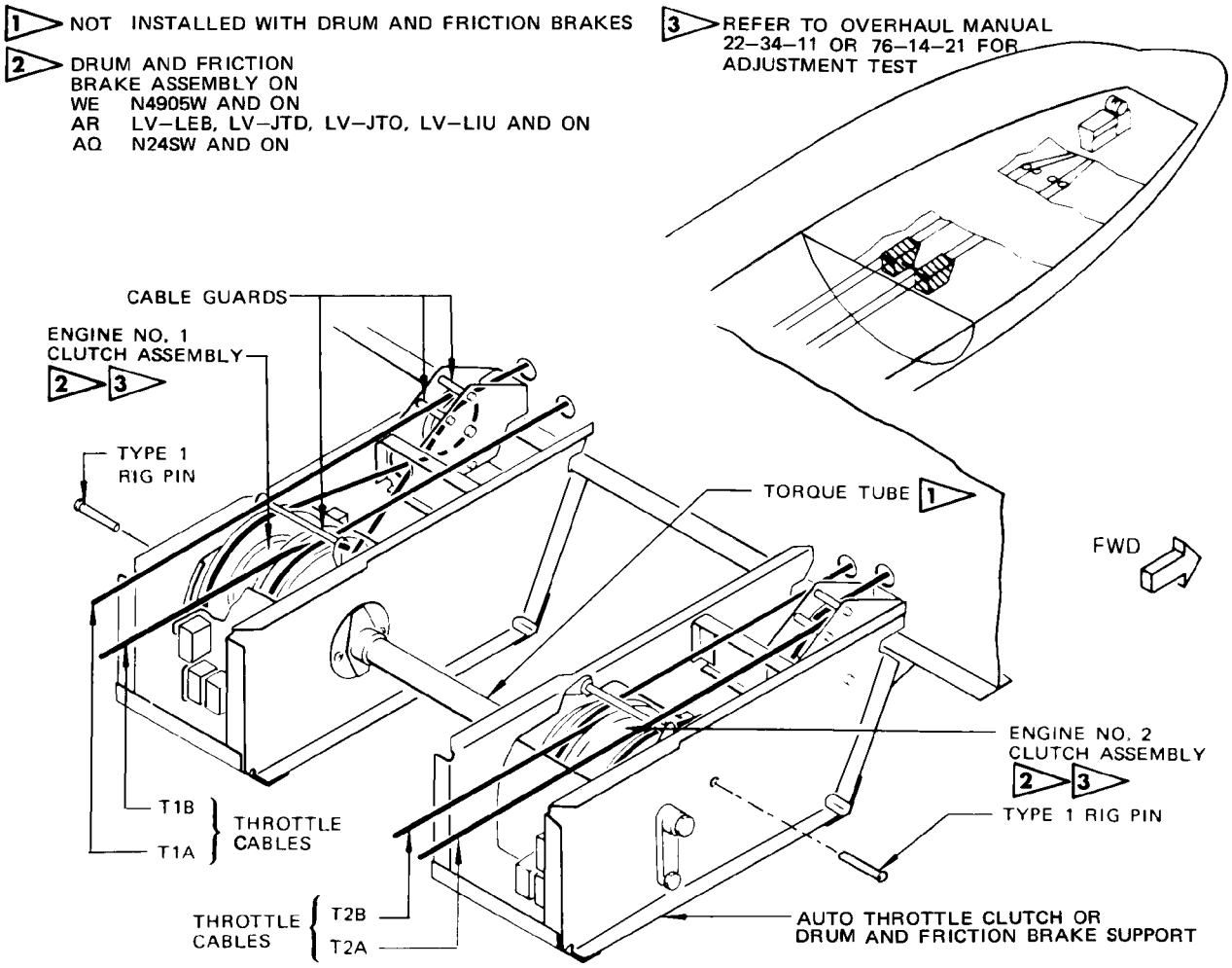
WARNING: REFER TO AMM 27-81-0/201 FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.



Engine Control System Adjustment Locations
Figure 501 (Sheet 1)



Engine Control System Adjustment Locations
Figure 501 (Sheet 2)



Auto Throttle Clutch or Drum and
Figure 502

(3) Adjust thrust control cables.
  (a) Disconnect engine thrust push-pull cable from thrust crank on left side of engine cross-shaft.
  (b) Install Type 1 rig pin through engine thrust drum and its support bracket located above engine at wing front spar (Fig. 503).
  (c) AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on;
  Install Type 1 rig pin through autothrottle support and clutch and cam assembly at top rear of electronic equipment compartment (Fig. 502).
  (d) AR LV-LEB, LV-JTD , LV-JTO, LV-LIU and on;
  Install Type 1 rig pin through autothrottle support and drum and friction brake at top rear of electronic equipment compartment.
  (e) Perform steps (3)(e) and on for new cable installation and steps (3)(f) and on for rerigged cables. Clamp thrust lever against control stand idle stop.
  (f) New cable installation:
    1) Using tensiometer to measure load, adjust cable tension to 125 pounds of tension.
    2) Remove rig pins from engine thrust quadrant and the drum and brake mechanism or the autothrottle clutch mechanism.
    3) Unclamp thrust lever.
    4) Operate the thrust lever through 25 cycles.
    5) Install Type 1 rig pin through Support Installation and the drum and brake mechanism or the autothrottle clutch and cam assembly located between the floor beams in the electronic equipment compartment (Fig. 502).
    6) Install Type 1 rig pin through Support Installation and the drum and brake mechanism or the autothrottle clutch and cam assembly located between the floor beams in the electronic equipment compartment (Fig. 503).
    7) Clamp thrust lever against control stand idle stop.
  (g) New or rerigged control cables:
    1) Use the tensiometer to measure load, adjust control cable tension (Fig. 501 for turnbuckle locations). Adjust the load for the appropriate temperature (Fig. 503).
      a) Adjust forward thrust control cables so that rig pin can be freely inserted through the drum and friction brake mechanism or the autothrottle clutch mechanism.
      b) Make sure the Type 1 rig pin is installed in the drum and brake mechanism or the autothrottle clutch mechanism. Adjust the aft throttle cables using turnbuckles in the wing so that rig pin can be freely inserted through the engine thrust quadrant and its support bracket (Fig. 503). Cables must still have rig load specified on Fig. 502A.
    2) Unclamp thrust lever and remove rig pins.
    3) Cycle system three times.

CABLE	TYPE	ENGINE	FROM	TO	FUNCTION
T1A	THRUST	NO. 1	CONTROL STAND	DRUM AND SHAFT ASSY	INCREASE FORWARD THRUST
T1B	THRUST	NO. 1	DRUM AND SHAFT ASSY	CONTROL STAND	DECREASE FORWARD THRUST
T2A	THRUST	NO. 2	CONTROL STAND	DRUM AND SHAFT ASSY	INCREASE FORWARD THRUST
T2B	THRUST	NO. 2	DRUM AND SHAFT ASSY	CONTROL STAND	DECREASE FORWARD THRUST
ESS 1A	START	NO. 1	CONTROL STAND	DRUM AND SHAFT ASSY	START ENGINE
ESS 1B	START	NO. 1	DRUM AND SHAFT ASSY	CONTROL STAND	ACTUATE FUEL SHUTOFF
ESS 2A	START	NO. 2	CONTROL STAND	DRUM AND SHAFT ASSY	START ENGINE
ESS 2B	START	NO. 2	DRUM AND SHAFT ASSY	CONTROL STAND	ACTUATE FUEL SHUTOFF

CABLE FUNCTION
TABLE I

TEMP °F	CABLE RIGGING LOAD IN POUNDS (±5 POUNDS)		
	THRUST CABLE – FWD OF STATION 372.75	THRUST CABLE – AFT OF STATION 372.75	START CABLE
110	66	86	71
90	61	81	66
70	55	75	60
50	49	69	54
30	44	64	49
10	38	58	43
–10	33	53	38
–30	27	47	32
–40	25	45	30

CABLE LOADING
TABLE II

NOTE: TEMPERATURE OF AIRPLANE SHOULD BE WITHIN ±5° OF TABLE VALUE. TO ENSURE THAT PROPER CABLE RIGGING LOAD IS OBTAINED, TEMPERATURE SHOULD BE STABLE FOR 1 HOUR PRIOR TO RIGGING.

Cable Function and Loading
Figure 503

4) With thrust lever against idle stop, verify that the rig pin in autothrottle clutch or drum and friction brake can be installed without any visible movement in clutch or brake cable drum and rig pin in engine thrust drum can be installed freely.
5) Install Type 1 rig pin through the engine thrust quadrant and its support bracket (Fig. 503).
6) With fuel control unit thrust crank in idle position, install type 2 flat rig pin (Fig. 505).
7) Install the rod end of engine thrust push-pull cable to the left thrust crank of the engine cross-shaft, the bolt must fit freely (Fig. 505).

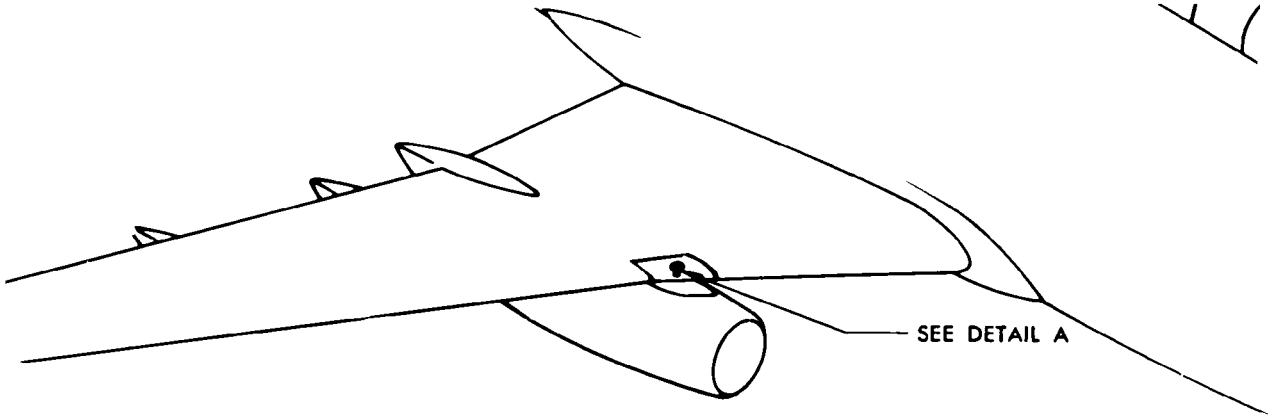
NOTE: If the bolt cannot fit freely through the rod end of the engine thrust push-pull cable, adjustment of the engine thrust push-pull cable is necessary.

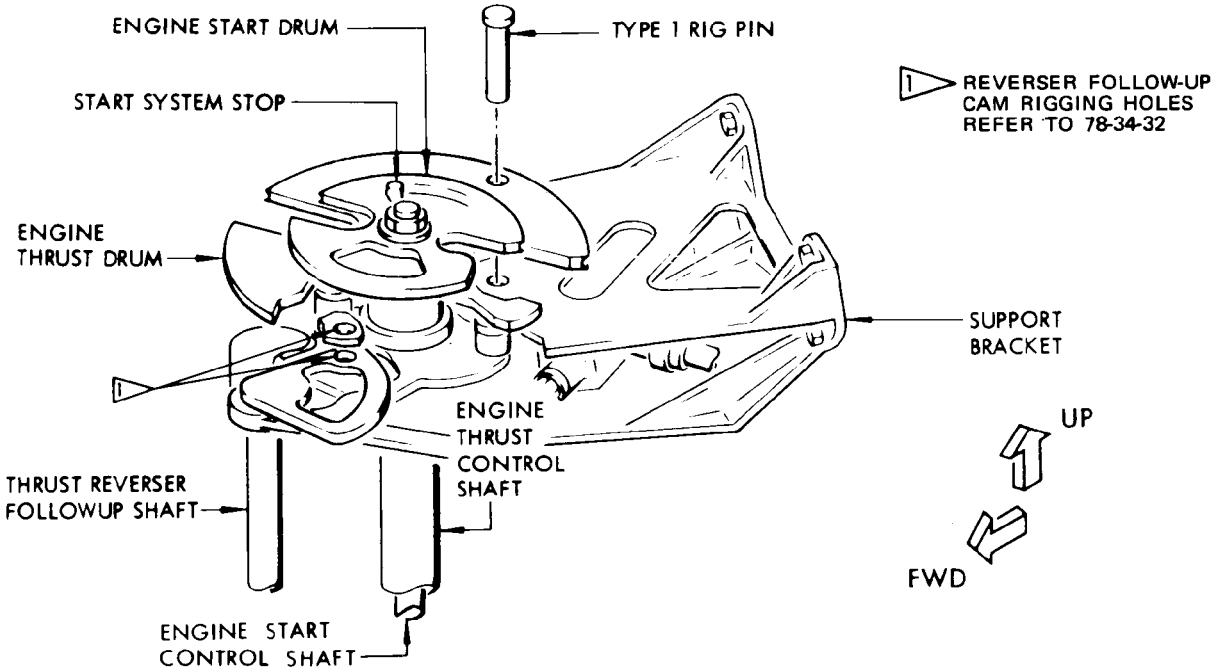
8) For push-pull cable installations using locknut, install washer and locknut and torque nut 50 to 70 pound-inches (Fig. 505). For push-pull cable installations using castellated nut, install washer and castellated nut, and torque castellated nut 30 to 40 pound-inches and install cotter pin (Fig. 505). For push-pull cable installations with bolt retainer, install washer and locknut. Torque nut 50 to 70 pound-inches and bend retainer tab over bolthead (Fig. 505).
9) Reinstall all thrust cable turnbuckle locking clips.
10) Remove rig pins.

(h) If no further adjustments to the engine thrust control system are to be performed:
1) Perform Engine Thrust Control System Test Procedure

NOTE: If the engine control system is disturbed for any reason, both forward and reverse thrust system tests should be performed.

(4) Adjust engine thrust push-pull cable.
(a) If not installed, insert Type 1 rig pin through engine thrust drum and its support bracket (Fig. 503).





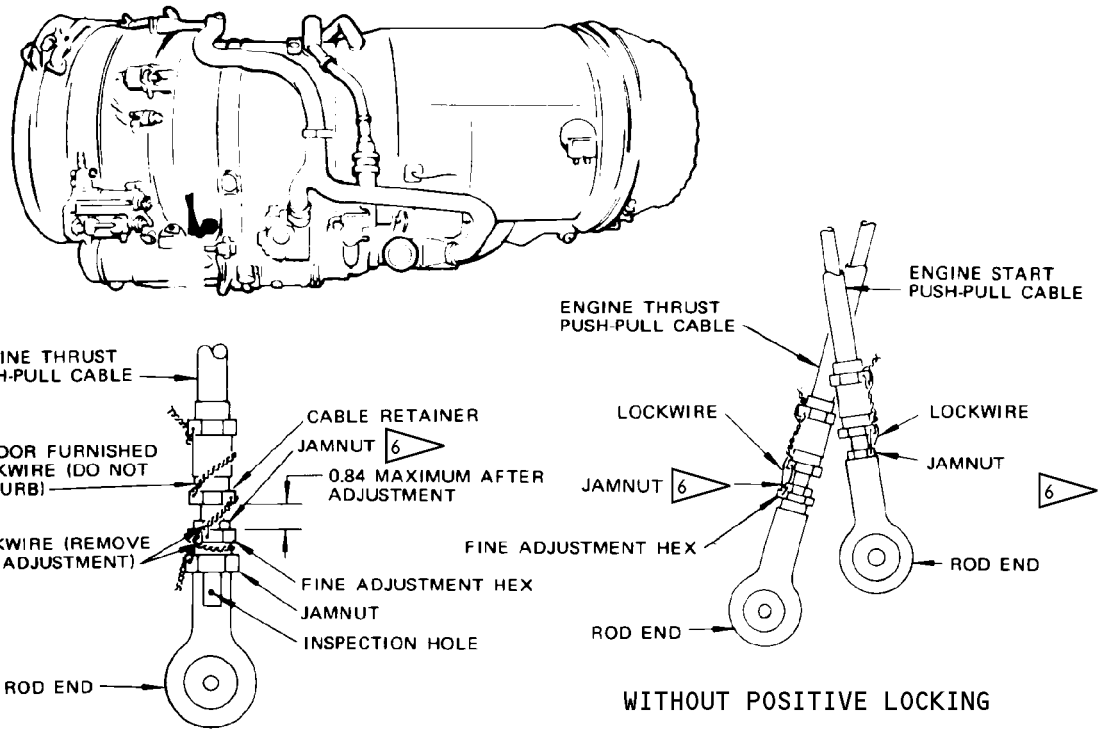
DETAIL A

Drum and Shaft Assembly
Figure 504

(b) If not installed, insert Type 1 rig pin through engine thrust drum and its support bracket (Fig. 505).
(c) Disconnect the thrust push-pull cable from the thrust crank on the engine cross-shaft (Fig. 505).
(d) With the thrust crank for the fuel control unit in the idle position, install the Type 2 flat rig pin (Fig. 506).
(e) Make sure the Type 3 rig pin can be freely installed through the right thrust crank and the thrust control rig pin bracket (Fig. 506).
    1) If the Type 3 rig pin cannot be freely installed, adjust the thrust rod.
(f) Remove the rig pin from the fuel control unit.
(g) With the Type 3 rig pin installed, adjust the length of the thrust push-pull cable at the lower end (Fig. 505):
    1) Remove lockwire and loosen rod end jamnut. Adjust rod end to obtain best adjustment within 1/2 turn of rod end.

        CAUTION: DO NOT DISTURB VENDOR INSTALLED LOCKWIRE.

    2) Loosen fine adjustment jamnut and adjust (rotate) fine adjustment hex until holes in rod end and thrust crank are aligned to allow free insertion of bolt. Do not exceed 0.84 inch maximum between cable retainer and fine adjustment hex after adjustment.
    3) Use lockwire to check that inspection hole in rod end is completely covered. Insert bolt through aligned holes in rod end and thrust crank. Bolt shall fit freely prior to attaching nut.
    4) Secure thrust push-pull cable:
        a) For push-pull cable installation without bolt retainer and using locknut, install washer and locknut on rod end connecting bolt. Bolt shall fit freely prior to attaching nut. Tighten self-locking nut 50 to 70 pound-inches.
        b) For push-pull cable installation without bolt retainer and using castellated nut, install washer and castellated nut on rod end connecting bolt. Tighten castellated nut 30 to 40 pound-inches and install cotter pin.
        c) For push-pull cable installation with bolt retainer, install bolt retainer around crank fork and under bolthead. Install locknut on rod end connecting bolt with washer. Tighten nut 50 to 70 pound-inches and bend retainer tab over bolthead (Fig. 505).
    5) Tighten jamnut against fine adjustment hex (Fig. 505).
    6) Tighten jamnut against lower rod end on airplanes affected by 3) above.
    7) Secure fine adjustment hex and jamnut(s) by installing lockwire as shown.
(h) Remove rig pin from engine thrust drum.
(i) Remove rig pin from the right start crank extension.



1. FOR THRUST CABLE USING LOCKNUTS, WITH OR WITHOUT BOLT RETAINER - TIGHTEN NUTS 50 TO 70 POUND-INCHES
2. FOR START CABLE USING LOCKNUTS, WITH OR WITHOUT BOLT RETAINER - TIGHTEN NUTS 100 TO 140 POUND-INCHES
3. FOR THRUST CABLE USING CASTELLATED NUTS, AND WITHOUT BOLT RETAINER - TIGHTEN NUTS 30 TO 40 POUND-INCHES
4. FOR START CABLE USING CASTELLATED NUTS, AND WITHOUT BOLT RETAINER - TIGHTEN NUTS 60 TO 85 POUND-INCHES
5. BEND RETAINER TAB OVER BOLT HEAD AFTER TIGHTENING NUT.
6. TIGHTEN JAMNUT 24 TO 30 POUND-INCHES

Start and Thrust Push-Pull Cable Disconnects
Figure 505

(j) Perform engine thrust control system test procedure.

(5) Adjust the engine thrust rod.

(a) Install a Type 1 rig pin through the engine thrust quadrant (Fig. 503).

(b) Disconnect the thrust push-pull cable at the left thrust crank (Fig. 505).

(c) Put the thrust crank for the fuel control unit in the idle position, install the Type 2 rig pin (Fig. 506).

(d) Remove the nut, washer and bolt securing the thrust rod to the right thrust crank (Fig. 506).

(e) Install the thrust control rig pin bracket (Fig. 506).

(f) Install a Type 3 rig pin through the right thrust crank, thrust rod and the thrust control rig pin bracket, adjust the thrust rod (Fig. 506).

(g) If the Type 3 rig pin cannot be freely installed through the right thrust crank, thrust rod and the thrust control rig pin bracket, adjust the thrust rod (Fig. 506).

1) Loosen the thrust rod jamnut.

2) Adjust the rod end until the rig pin is freely installed into the control rig pin bracket.

3) Tighten the jamnut.

(h) Secure the thrust rod to the right thrust crank using bolt, washer and nut. Torque nut 30 to 40 pound-inches and install cotter pin.

(i) Install the thrust push-pull cable at the left thrust crank with bolt: For push-pull cable installations using locknut, install washer and locknut and torque nut 50 to 70 pound-inches (Fig. 505). For push-pull cable installations using castellated nut, install washer and castellated nut, torque castellated nut 30 to 40 pound-inches and install cotter pin (Fig. 505). For push-pull cable installations with bolt retainer, insert bolt retainer around crank for and under bolthead, install washer and locknut. Torque nut 50 to 70 pound-inches and bend retainer tab over bolthead (Fig. 505).

(j) Remove the rig pins.

(k) Remove the thrust control rig pin bracket.

B. Reverse Thrust Detent Roller Adjustment

NOTE: The following procedures are only required if thrust lever or detent roller assemblies are replaced or procedures are used to check for system malfunction.

(1) Prepare reverse thrust control system for detent roller adjustment.

(a) Gain access to control stand interior as follows (Fig. 507):

1) Remove tie rod nut from tie rod on left side on control stand and remove left stabilizer trim control wheel.

2) Remove screws and left side, upper and lower doors from control stand.

(b) Override the thrust reverse follow-up system:

1) Disconnect reverse thrust follow-up push-pull cable from crank arm at thrust reverse (Fig. 507).
2) Rotate engine control drum and shaft assembly thrust reverser interlock cam in the direction which allows movement of reverse thrust lever by pulling push-pull cable until end of normal travel.
3) Open reverse thrust isolation valve circuit breakers C276 and C277.
4) Install reverse thrust isolation valve ground lock assembly F80109-3.

NOTE: The following procedure makes initial detent setting. Refer to AMM 78-32-01/501 for final detent setting with engine operating.

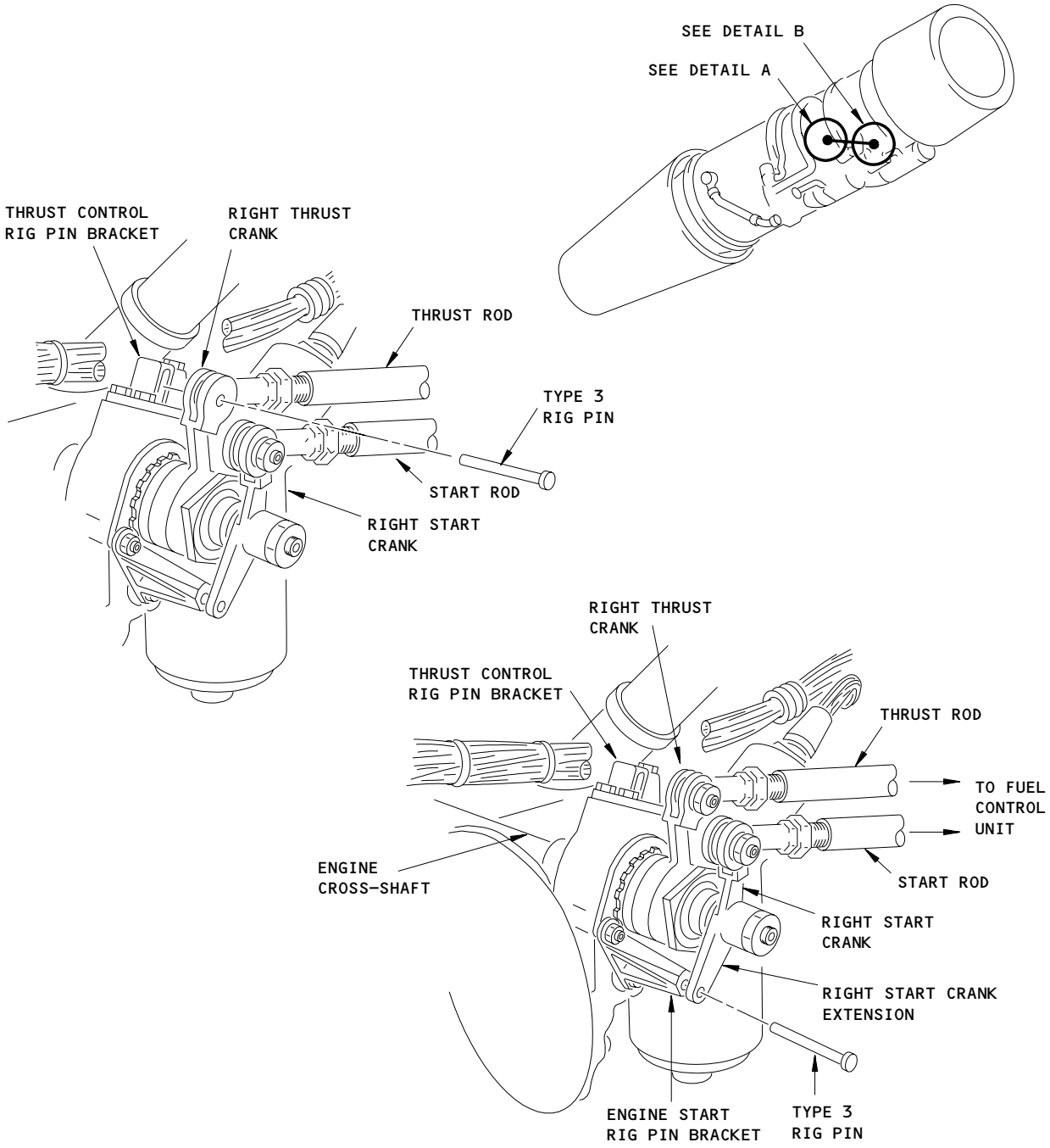
(2) Check reverse thrust detent roller assembly position in control stand thrust drum as follows (Fig. 508):

(a) Measure distance between inner face surfaces of roller detent slot in thrust drum and detent roller.
(b) Add 0.125 inch to dimension obtained and adjust inboard edge of rollers on roller assembly with washers to the total width dimension ± 0.010 inch.

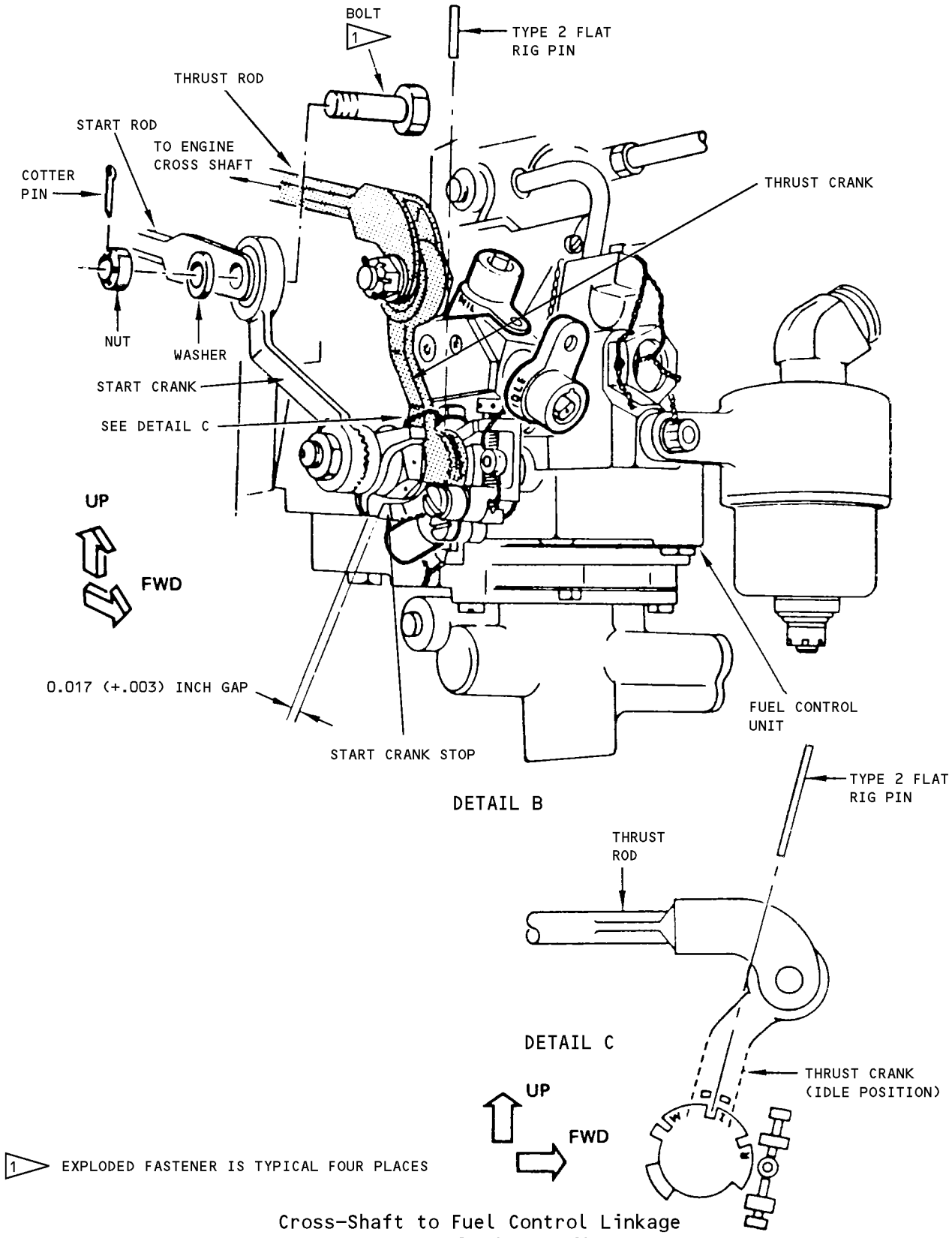
NOTE: Adjust detent assembly forward or aft from control stand left side after loosening left adjustment screws through access holes in left upper and lower doorframe or right screws through access holes in lower portion of control stand right upper side door (Fig. 508).

(3) TZ ALL EXCEPT C-FTAQ and on;
WE ALL EXCEPT N4905W and on;
AR ALL EXCEPT LV-LEB, LVJTD, LV-JTO, LV-LTU and on;
Adjust detent roller assembly (Fig. 508):

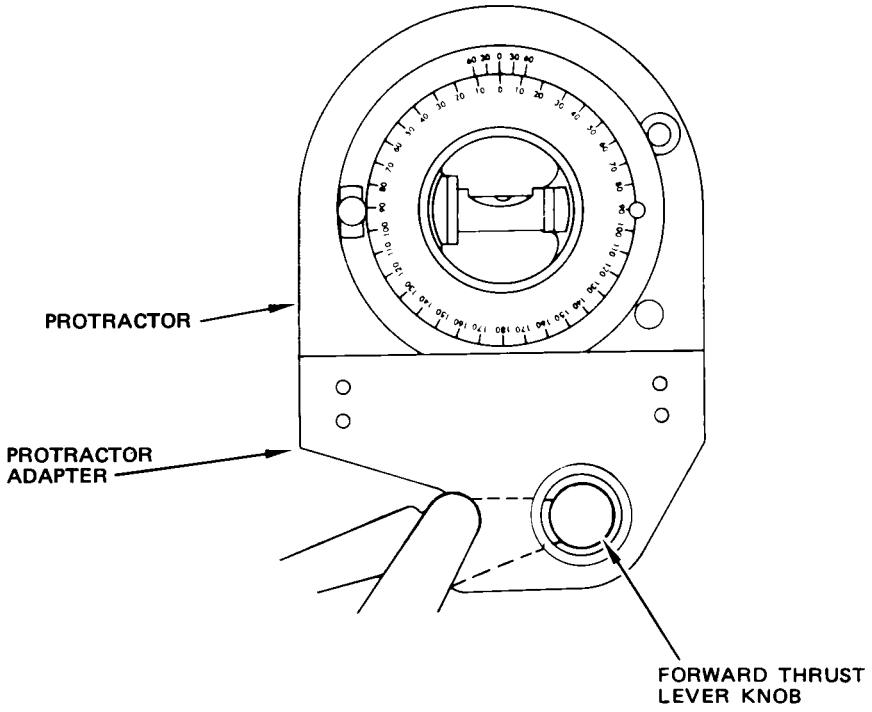
(a) Adjust spring tension to provide a load of 9.0 ±1.0 pounds to move the forward thrust lever aft through the flight idle detent.
(b) Adjust the spring tension to provide a maximum load of 15 to 30 pounds at the reverse thrust lever knob to pass through the reverse thrust No. 2 detent. For loads above 30 pounds, reduce the flight idle detent load to its minimum. For loads less than 15 pounds, increase the flight idle load to its maximum.



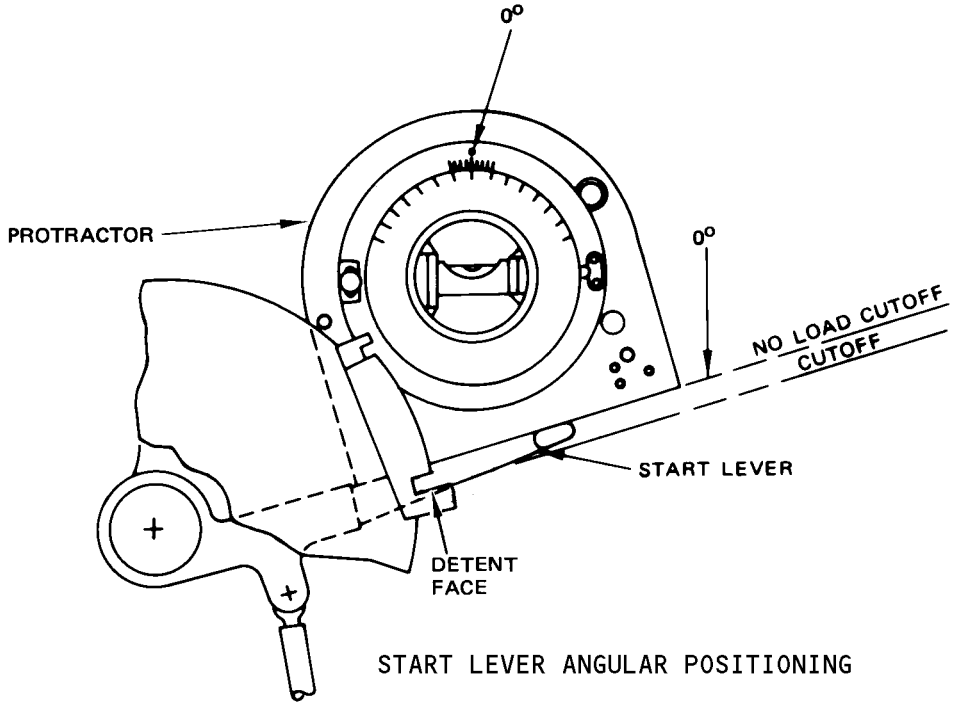
Cross-Shaft to Fuel Control Linkage
Figure 506 (Sheet 1)



Cross-Shaft to Fuel Control Linkage
Figure 506 (Sheet 2)

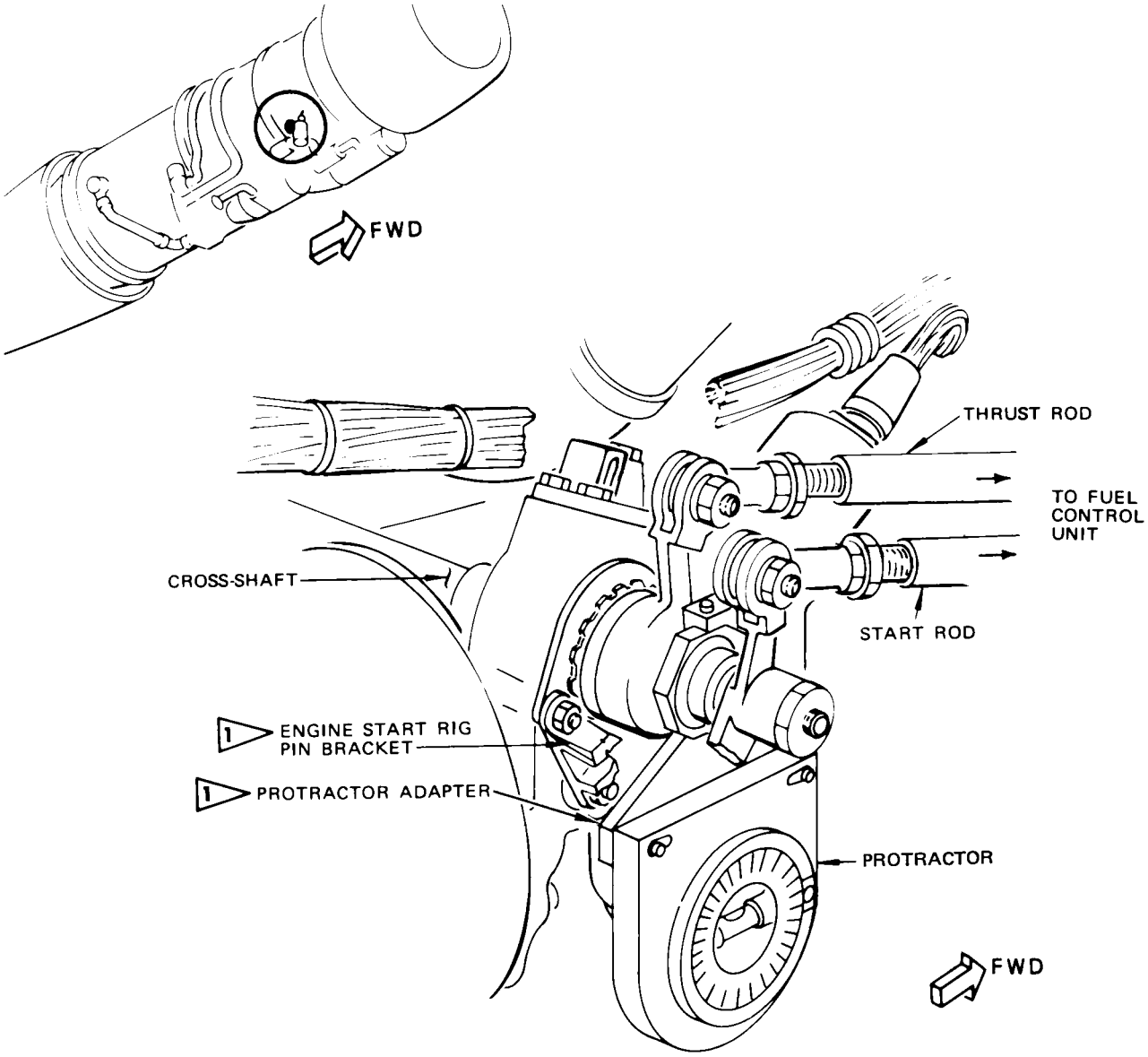


THRUST LEVER ANGULAR POSITIONING



START LEVER ANGULAR POSITIONING

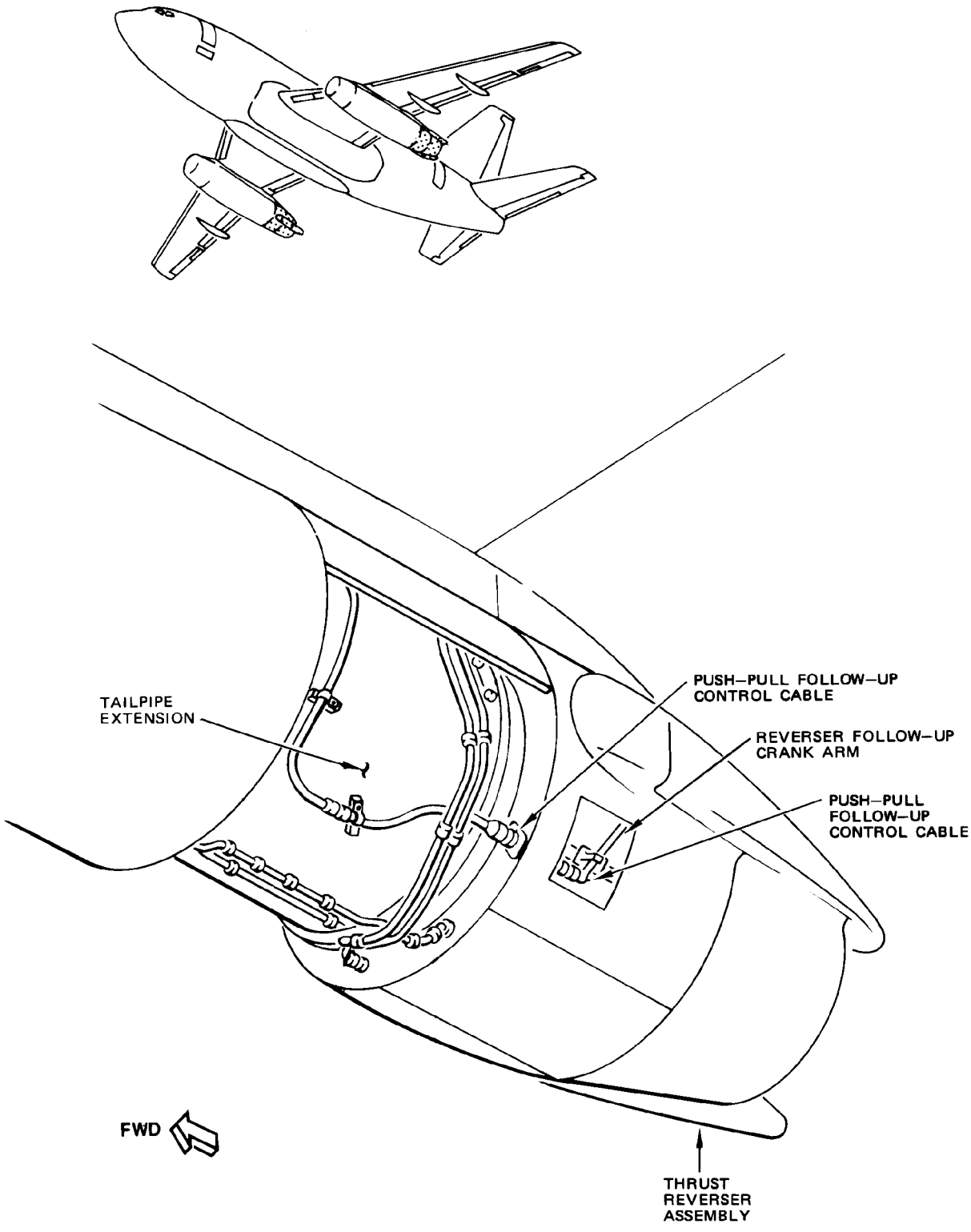
Control System Rigging
Figure 507 (Sheet 1)



CROSS-SHAFT ANGULAR POSITIONING

1 REMOVE RIGGING PIN BRACKET WHEN USING PROTRACTOR ADAPTER

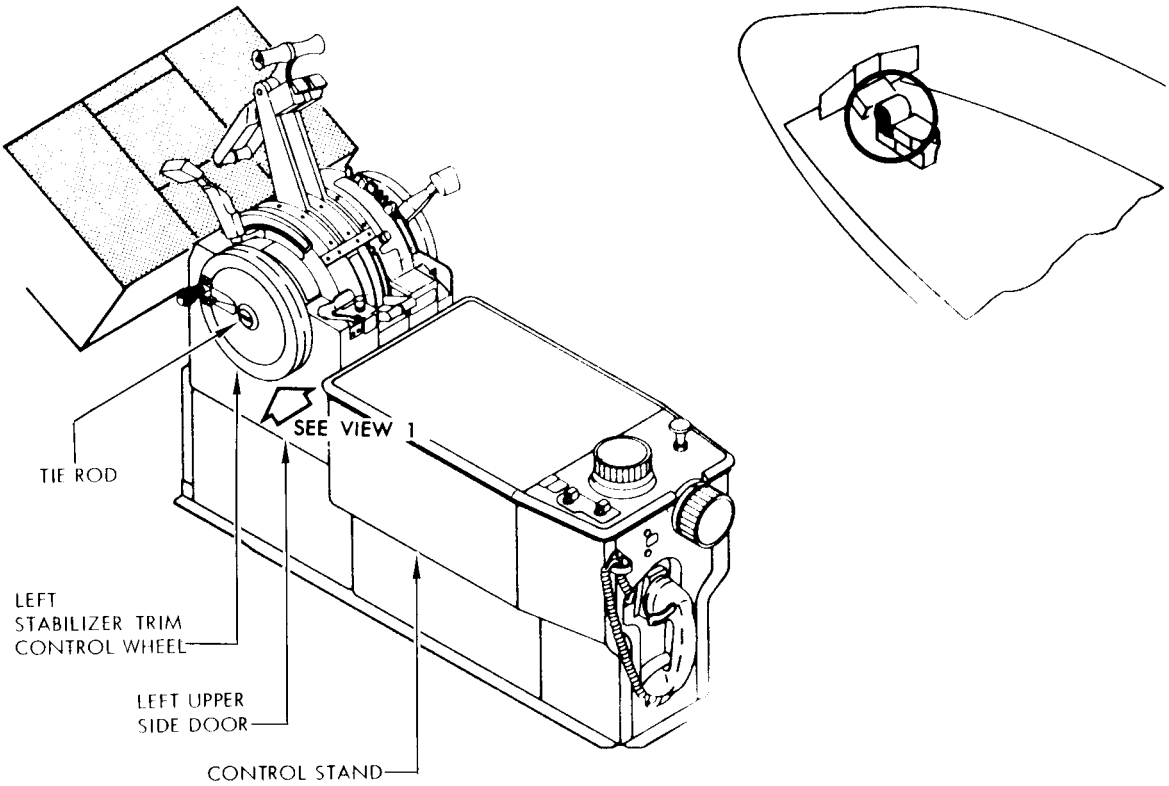
Control System Rigging
Figure 507 (Sheet 2)

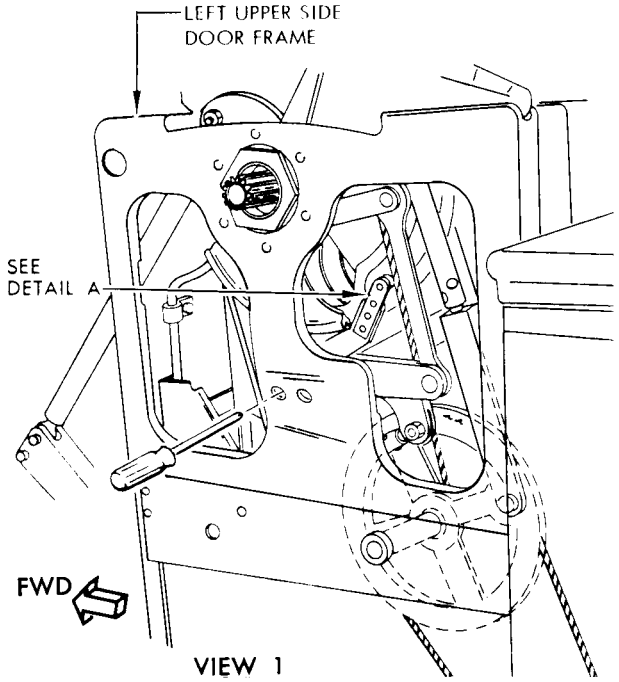


Control System Rigging
Figure 507 (Sheet 3)

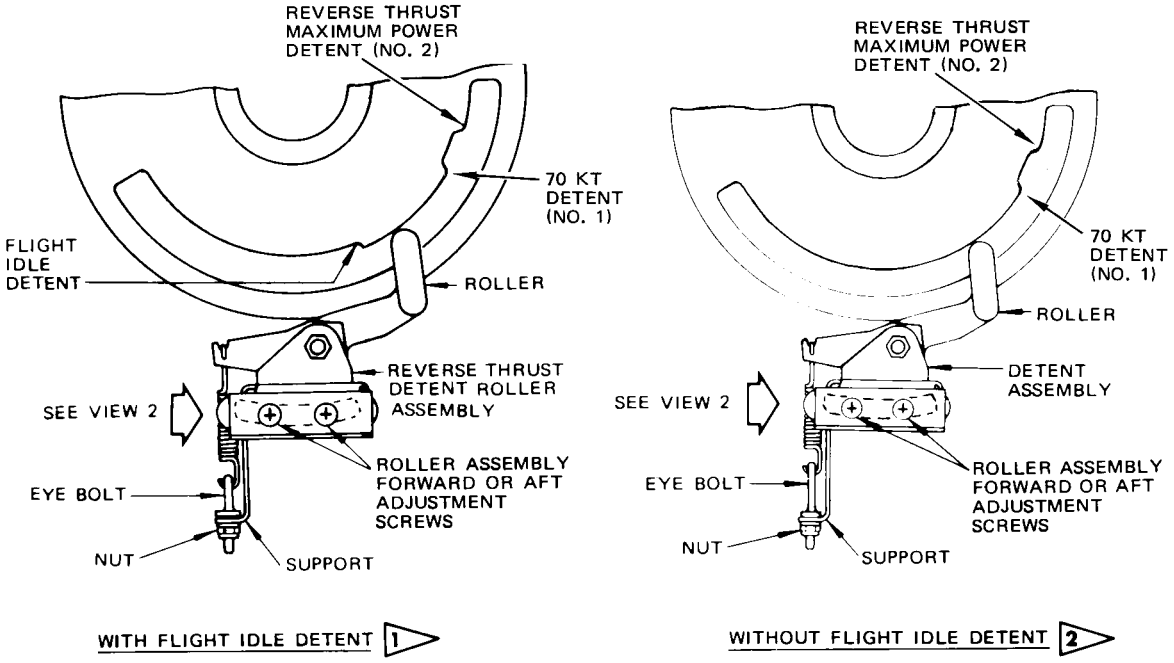
(4) WE N49O5W and on;
TZ C-FTAQ and on;
AR LV-LEB, LV-JTD, LV-JTO, LV-LIU and on;
Adjust detent roller assembly (Fig. 508) spring tension to provide a load of 18 to 25 pounds at the reverse thrust lever knob to pass through No. 2 detent.
(5) Check for rolling contact between roller assembly and thrust drum slot for remaining slot travel.
(6) Secure detent spring eyebolts by tightening nuts on bottom of eyebolts against supports.
(7) Install reverse thrust follow-up push-pull cable on thrust reverser crank arm (AMM 78-34-32/401, Thrust Reverser Push-Pull Cable).
(8) Close reverse thrust isolation valve circuit breakers C276 and C277.
(9) Remove reverse thrust isolation valve ground lock assembly.
(10) Perform reverse thrust control system test procedure.

C. Start Control System Adjustment
(1) Equipment and Materials
(a) Tensiometer - O- to 125-pound capacity
(b) Rig Pin Kit - F70207-3, -52 or -61
1) Type 3 - F70207-23, 0.248 +0.000/-0.002-inch diameter rod
(2) Prepare engine start control system for adjustment/test.
(a) Remove side removable cowl panels (AMM Chapter 71, Removable Cowl Panels).
(b) Remove following access door in wing leading edge above wing-to-engine fairing (AMM Chapter 12, Access Doors and Panels):
1) No. 6301 in left wing.
2) No. 6401 in right wing.
(c) Gain access to control cable turnbuckles in wing leading edge by extending leading edge flaps as described in par. 2.A.(2)(e).
(3) Adjust start control cables.
(a) Disconnect engine start push-pull cable at left start crank on engine cross-shaft (Fig. 505).
(b) Check that start lever is in the cutoff detent.
(c) Perform steps (3)(d) and on for new cables and steps (3)(e) and on for rerigged cables.
(d) New cables installed:
1) Rig cables to 100 pounds tension.
2) Cycle system 25 times.
3) Return start lever to cutoff detent.
(e) New cables or rerigged cables:
1) Using tensiometer to measure load, adjust tension in ESS( )A and ESS( )B cables to rigging load for appropriate temperature as given in Table II, Fig. 503. See Fig. 501 for turnbuckle locations.

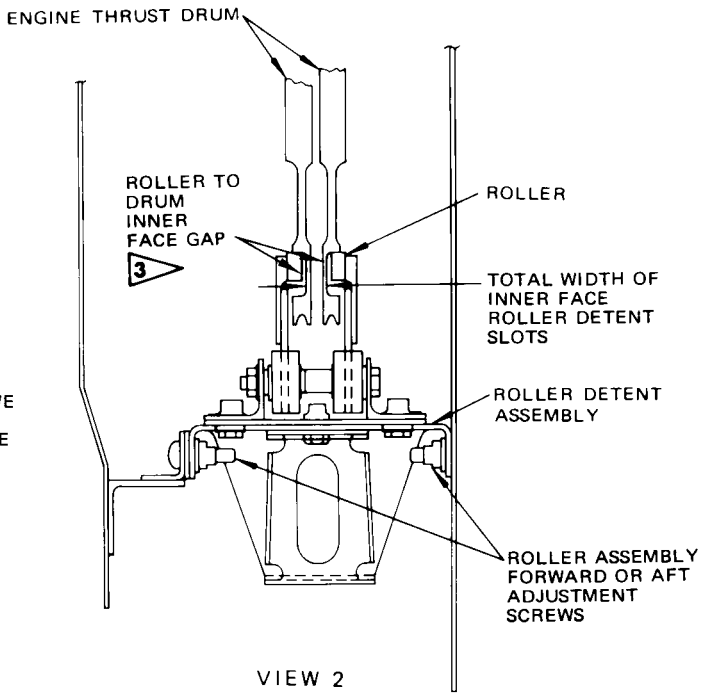




Flight Idle and Reverse Thrust Detent Roller Alignment
Figure 508 (Sheet 1)



DETAIL A



1 PW CF–PWC THRU CF–PWE
IN EI–ASA AND EI–ASB
VP PP–SMA THRU PP–SME
TZ ALL EXCEPT C–FTAQ
AQ N25SW
AR ALL EXCEPT LV–LEB, LV–JTD, LV–JTO, LV–LIU AND ON

2 PW ALL EXCEPT CF–PWC THRU CF–PWE
IN ALL EXCEPT EI–ASA AND EI–ASB
VP ALL EXCEPT PP–SMA THRU PP–SME
TZ C–FTAQ
AQ ALL EXCEPT N25SW
AR LV–LEB, LV–JTD, LV–JTO, LV–LIU AND ON

3 USE WASHERS AS REQUIRED TO OBTAIN EQUAL ROLLER TO INNER FACE GAP

Flight Idle and Reverse Thrust Detent Roller Alignment
Figure 508 (Sheet 2)

2) Check that engine start drum, located above engine at wing front spar, is against start system stop (Fig. 503).
3) Increase tension in ESS( )B cable until a 6.0 ±2.0-pound force is required at start lever knob to unseat the start lever from the detent face.
4) Install all turnbuckle locking clips.

(f) If no further adjustments to the engine start control system are to be performed:
1) Remove lockwire, loosen jamnut, and adjust length of start push-pull cable at lower rod end.
a) For push-pull cable installation without bolt retainer and using locknut, install washer, locknut and rod end at left start crank on engine cross-shaft with connecting bolt and tighten locknut 100 to 140 pound-inches.
b) For push-pull cable installation without bolt retainer and using castellated nut and cotter pin, install washer, castellated nut and rod end at left start crank on engine cross-shaft with connecting bolt, tighten castellated nut 60 to 85 pound-inches and install cotter pin.
c) For push-pull cable installation with bolt retainer, install bolt retainer around cross-shaft left start crank fork and under bolthead. Insert bolt through aligned holes in start push-pull cable rod end and start crank. Bolt shall fit freely prior to attaching nut. Install locknut on connecting bolt with washer. Tighten nut 100 to 140 pound-inches and bend retainer tab over bolthead (Fig. 505).
2) Perform Engine Start Control System Test procedure.

(4) Adjust engine start push-pull cable.
(a) With forward thrust lever in the idle position on control stand, place start lever in cutoff detent.
(b) Disconnect the engine start push-pull cable at the left start crank on the engine cross-shaft (Fig. 505).

(c) Install type 3 rig pin through right start crank extension and rig pin bracket (Fig. 506).
(d) Do a check of the gap between the start crank and its stop on the fuel control unit (Fig. 506).
1) If the gap is not 0.017 ±0.003 inch, adjust the start rod.
(e) Remove lockwire, loosen jamnut, and adjust length of start push-pull cable at lower rod end. Install rod end at left start crank on engine cross-shaft.

NOTE: You must be able to freely install the bolt before you install the nut.

1) For push-pull cable installation without bolt retainer and using locknut, secure with bolt, washer, and locknut. Tighten self-locking nut 100 to 140 pound-inches.
2) For push-pull cable installation without bolt retainer and using castellated nut and cotter pin, secure with bolt, washer, castellated nut and cotter pin. Tighten castellated nut 60 to 85 pound-inches and install cotter pin. Tighten jamnut and lockwire as shown on Fig. 505.
3) For push-pull cable installation with bolt retainer, remove lockwire, loosen jamnut, and adjust length of start push-pull cable at lower rod end. Install bolt retainer around crank fork and under bolthead. Insert bolt through aligned holes in rod end and start crank. Install locknut on rod end connecting bolt with washer. Tighten nut 100 to 140 pound-inches and bend retainer tab over bolthead. Tighten rod end jamnut and lockwire as shown on Fig. 505.
(f) Remove rig pin from right start crank.
(g) Perform Engine Start Control System Test procedure.

3. Engine Control System Test
A. Forward Thrust Control System Test
(1) Equipment and Materials
(a) Spring scale - 0- to 25-pound capacity
(b) Type 1 Rig Pin - F70207-8 (1 required), 0.311 +0.000/-0.002-inch diameter.
(2) Test engine forward thrust control system.
(a) Remove engine side removable cowl panels (AMM Chapter 71, Removable Cowl Panels).
(b) Test engine forward thrust control system friction.
1) Using spring scale, advance forward thrust lever from aft stop to forward stop.
a) AR ALL EXCEPT LV-JMX, LV-JMY, LV-JMZ;
TZ ALL EXCEPT CF-TAN, CF-TAU;
WE ALL EXCEPT N2711R, N4902W, N4906, N4907;
PW ALL EXCEPT 731 and 733;
Check that force required at 70°F or above does not exceed 5.5 pounds through entire forward thrust travel. For thrust lever force at temperatures below 70°F (Fig. 509).

b) AR LV-JMW, LV-JMX, LV-JMY, LV-JMZ;
TZ CF-TAN, CF-TAO;
WE N2711R, N4902W, N4906, N4907;
PW 731 and 733;
Check that force required at 70°F or above does not exceed 5.5 pounds through forward thrust travel ahead of flight idle detent. For thrust lever force at temperatures below 70°F (Fig. 509). Check that force required to move the thrust lever through flight idle detent toward idle stop is 9.0 ±1.0 pounds.

NOTE: All control lever loads are to be measured at knob centerline and perpendicular to the lever.

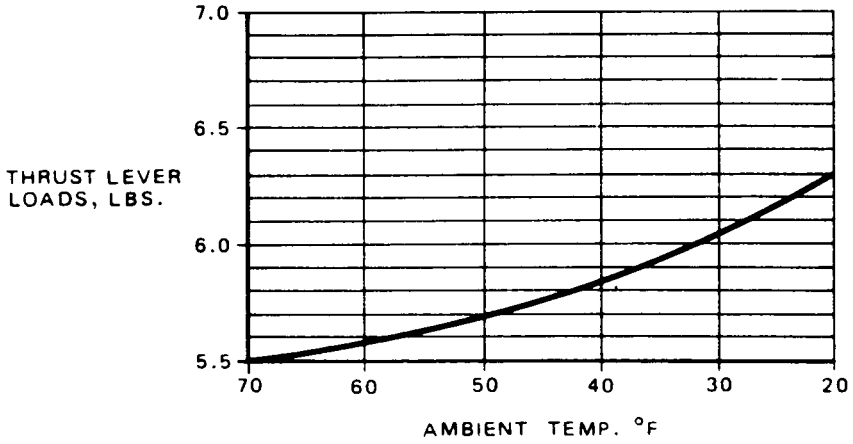
(c) Test engine forward thrust control system travel.
1) Move thrust lever to idle stop on control stand.
2) Move forward thrust lever to maximum forward thrust position; then retard lever toward idle stop position. On airplanes with throttle quadrant flight idle detent, AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU, and on; WE ALL EXCEPT N4905W and on; PW 731, 732, 762, and 772, check for sudden increase in load (flight idle detent) at approx 10 degrees forward of idle stop.
3) Advance forward thrust lever until fuel control unit forward stop is contacted. At this position, the forward edge of the thrust control lever shall be 0.10-inch minimum from the control stand forward stop.

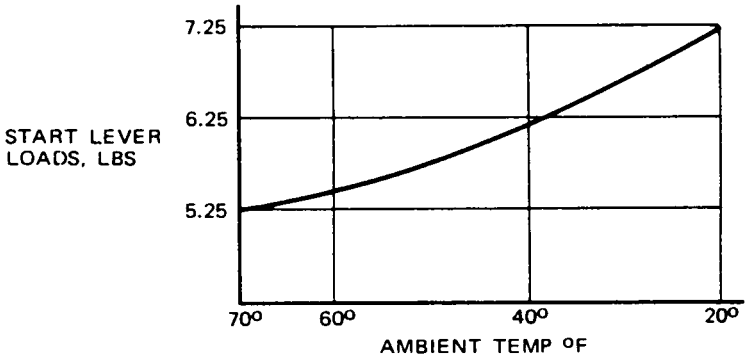
(d) Test engine thrust push-pull cable.
1) Install Type 1 rig pin through engine thrust drum and its support bracket located above engine at wing front spar (Fig. 504).

NOTE: With the rig pin installed, care must be taken not to exceed the cable test loads specified below.

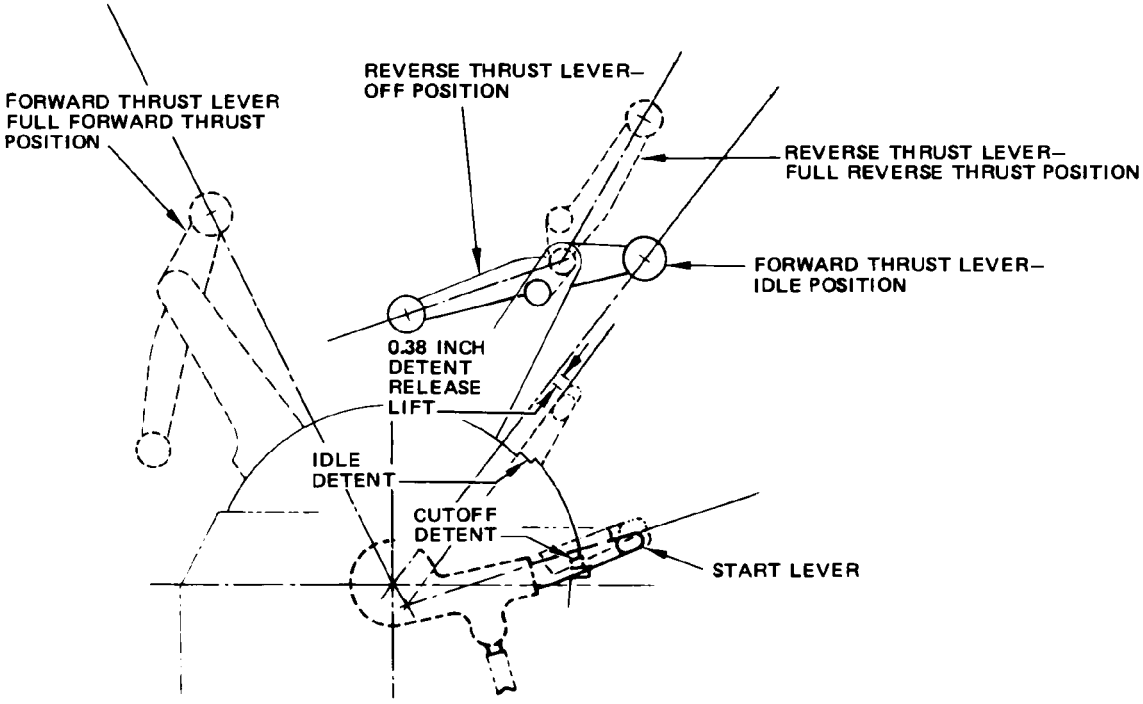
2) Apply 10 lbs push load to cross-shaft end of the cable (Fig. 510).
3) Apply 10 lbs pull load to the cable and check the thrust crank travel. A travel of more than 0.14 inch indicates excessive backlash of push-pull cable assembly which should be replaced.

B. Reverse Thrust Control System Test
(1) Equipment and Materials
(a) Spring Scale - 0- to 30-pound capacity
(b) Airplane Control Surfaces Protractor - 4MIT65B80307-1 or F52485-500
(c) Protractor Adapter, Thrust Lever - F72952-15 (Preferred), F72952-2 (Optional)

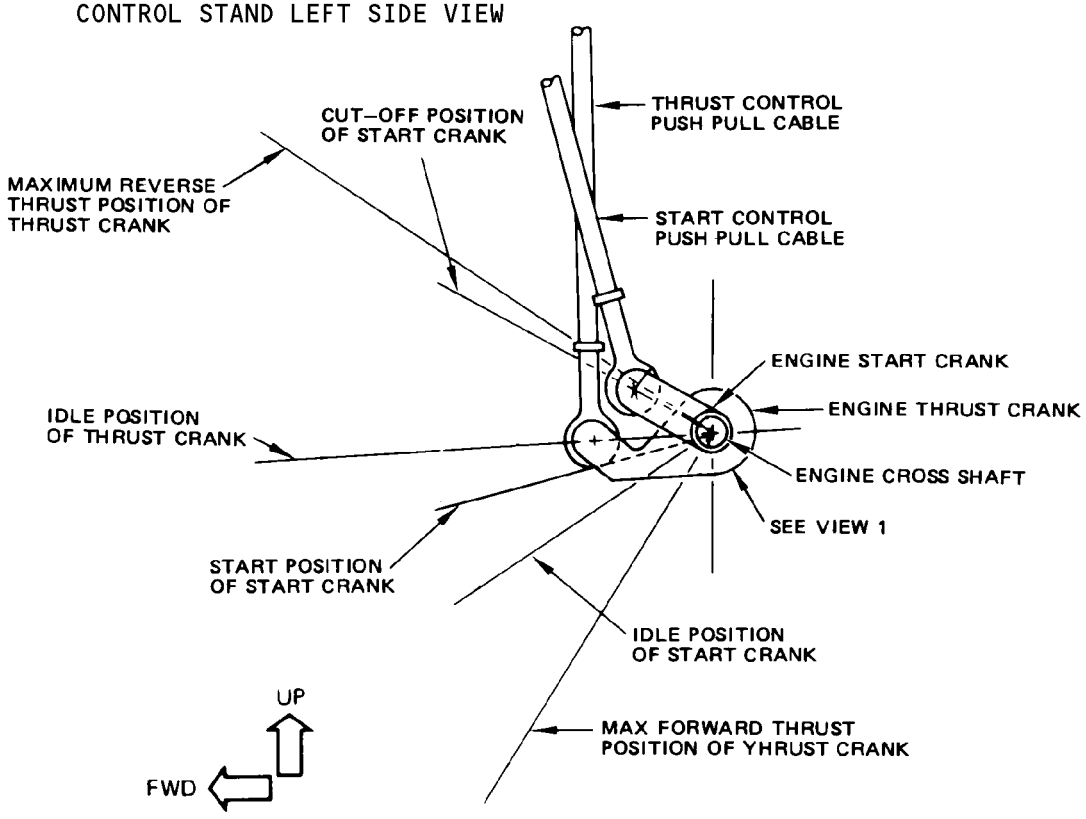




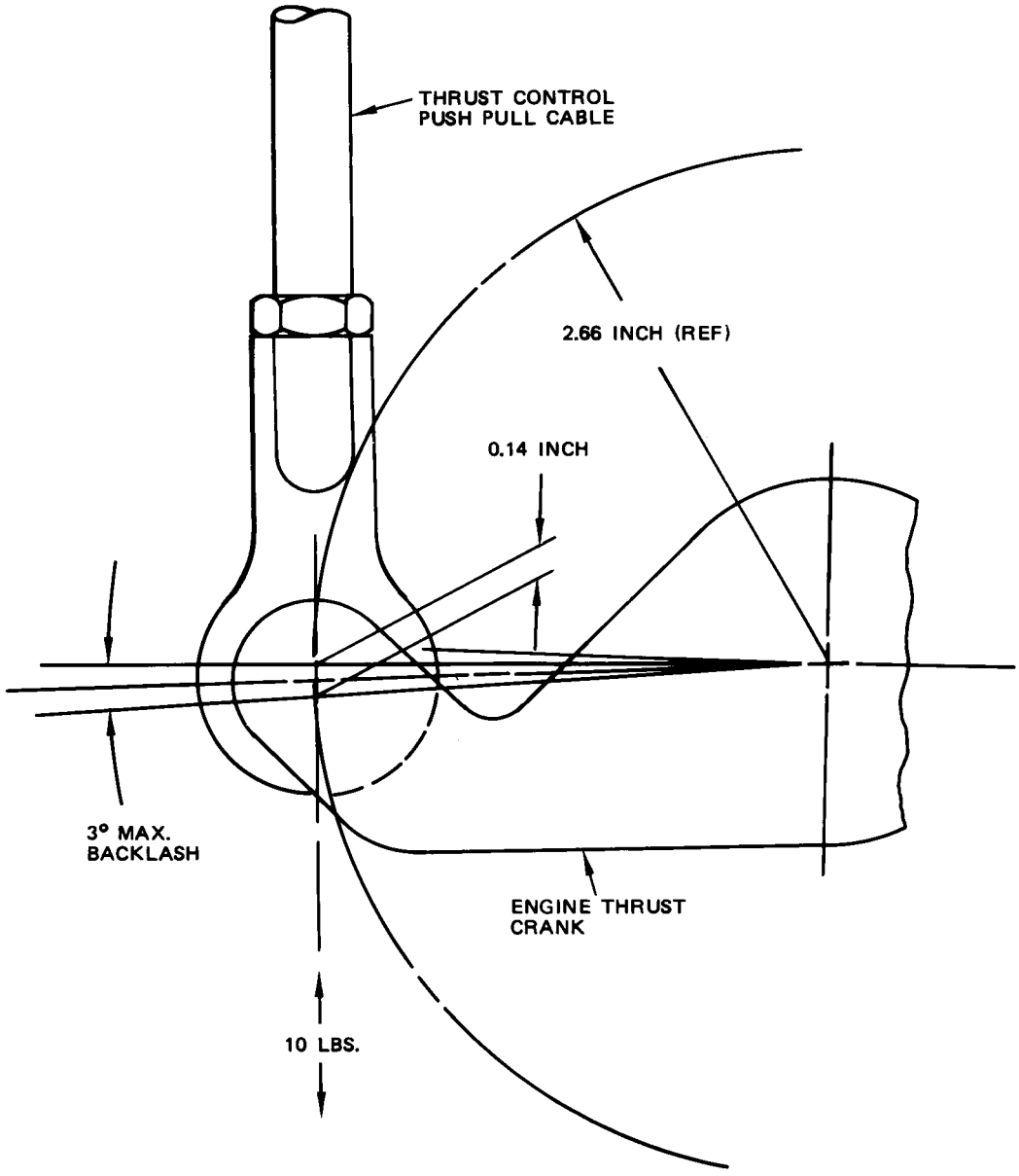
Temperature Chart
Figure 509



CONTROL STAND LEFT SIDE VIEW



Thrust and Start Lever and Crank Travel
Figure 510 (Sheet 1)



VIEW 1

Thrust and Start Lever and Crank Travel
Figure 510 (Sheet 2)

(d) Protractor Assembly, Reverse Thrust Lever - F70044-500 (preferred) or F70044

(e) A BMS 3-11 hydraulic test bench capable of delivering 20 gpm at 3000 psi with pressure adjustment from 0 to 3000 psi and filters capable of filtering to 5 microns absolute. Airplane B hydraulic system can be pressurized in lieu of hydraulic test bench (AMM 29-11-0, Hydraulic System A).

(2) Prepare reverse thrust control system for test.

(a) Pressurize thrust reverser hydraulic system as follows:

1) Provide electrical power.
2) Check that ground lock assemblies F80109-3 are removed from both thrust reverser isolation valves.
3) Place landing gear selector lever in DN position.
4) Place both forward thrust levers in IDLE position.
5) Place both reverse thrust levers in OFF position.

WARNING: ASSURE THAT REVERSE THRUST LEVER IS IN OFF POSITION AND HYDRAULIC SYSTEM IS NOT PRESSURIZED TO PREVENT PERSONNEL INJURY FROM REVERSER DEFLECTOR DOOR OPERATION.

6) Check that engine fire switches are closed.
7) Place engine thrust reverser override switch to NORMAL.
8) Pressurize hydraulic systems A and B using the B system electric motor-driven pumps or by connecting ground hydraulic test bench to ground service connection forward of right wheel well. Increase pressure to 3000 psi (AMM 29-11-0, Hydraulic System A).
9) Close ENG 1 THRUST REVERSER and ENG 2 THRUST REVERSER circuit breakers on P6 panel.
10) Close MASTER CAUTION circuit breakers, DIM & TEST circuit breakers, and nine INDICATOR circuit breakers on P6 panel.
11) Place engine No. 1 and 2 thrust reverser override switches on P5 panel to OVERRIDE position.

WARNING: PERSONNEL SHALL STAND CLEAR OF THRUST REVERSERS. SERIOUS INJURIES COULD RESULT FROM BEING CAUGHT BY ROTATING DEFLECTOR DOORS. REVERSE THRUST LEVERS SHALL NOT BE OPERATED WHILE PERSONNEL ARE WORKING ON THRUST REVERSERS AND OVERRIDE SWITCHES ARE IN OVERRIDE POSITION.

(3) Test reverse thrust control system.

(a) Test engine reverse thrust control system friction.

1) With forward thrust lever against idle stop and utilizing spring scale, check that load required to pull reverse thrust lever out of OFF (fully down) detent is 1.5 +3.0/-0.0 pounds measured at knob centerline.

WARNING: THRUST REVERSER WILL ACTUATE WHEN REVERSE THRUST LEVER IS MOVED OUT OF OFF POSITION. PERSONNEL SHOULD STAND CLEAR OF THRUST REVERSERS DURING TEST OF REVERSE THRUST CONTROL SYSTEM.

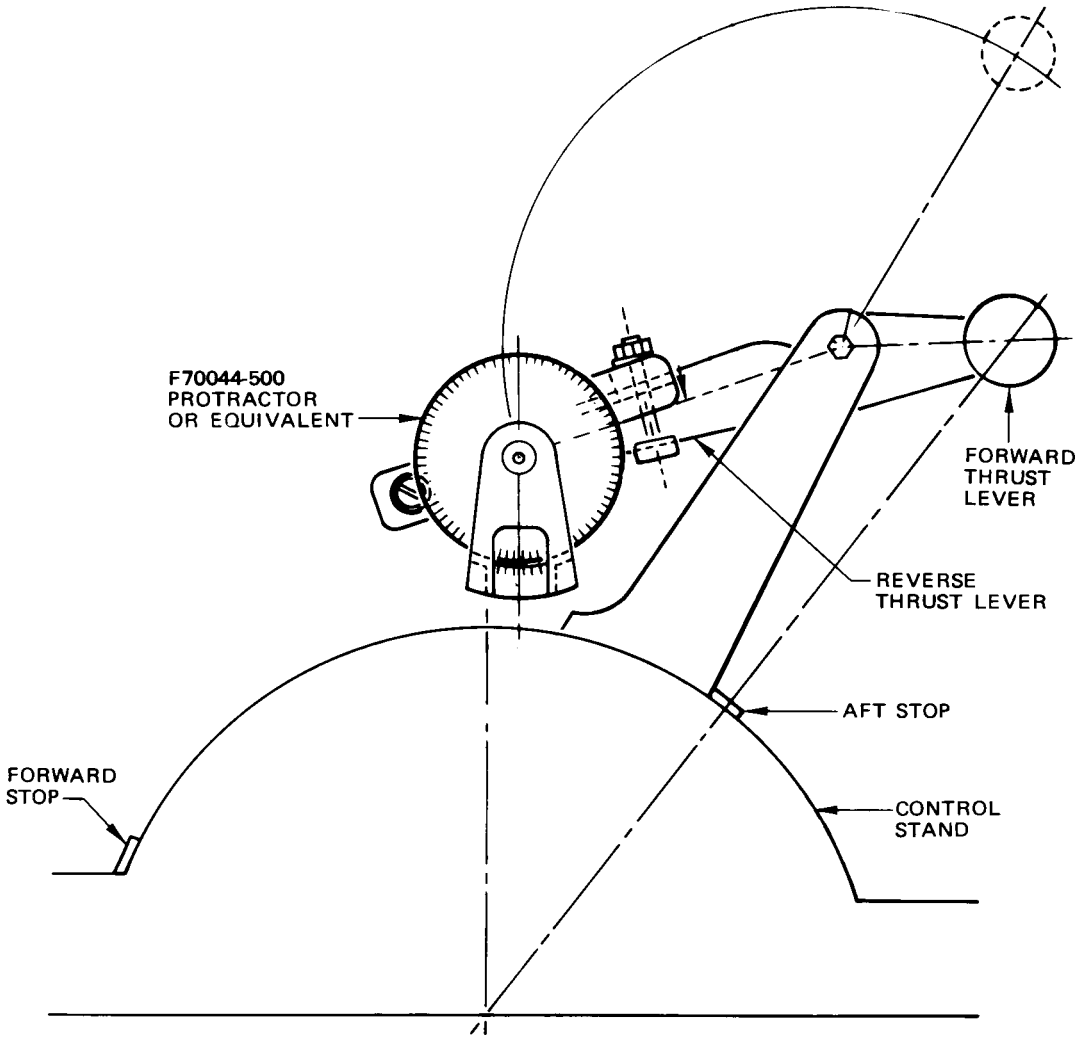
2) ALL EXCEPT ZD G-AVRN, G-AVRO, G-AWSY, G-AXNC;
PW CF-PWP, CF-PWW;
MD 5R-MFB and PV CF-EPP;
WE ALL EXCEPT N495W and on;
AR ALL EXCEPT LV-LEB, LV-JTD, LV-JTO, LV-LIU and on;
TZ ALL EXCEPT C-FTAQ and on;
Pull reverse thrust lever back from OFF position to full reverse and check for freedom of travel and for 30-pound maximum lever load required to move lever through No. 2 reverse thrust detent at approximately 100 degrees from OFF (Fig. 508 and 510).

3) ZD G-AVRN, G-AVRO, G-AWSY, G-AXNC;
PW CF-PWP, CF-PWW;
MD 5R-MFBL;
PV CF-EPP;
WE N495W and on;
AR LV-LEB, LV-JTD, LV-JTO, LV-LIU and on;
TZ C-FTAQ and on;
Pull reverse thrust lever back from OFF position to full reverse and check for freedom of travel and for 25-pound maximum lever load required to move lever through No. 2 reverse thrust detent at approximately 100 degrees from OFF (Fig. 508 and 510).

4) Advance reverse thrust lever from full reverse to the OFF position. Check that a lever load greater than 9-1/2 pounds is required to move reverse thrust lever through No. 1 reverse thrust detent at approximately 95 degrees from OFF position (Fig. 507 and 509).

(b) Test thrust lever lockout.

1) With reverse thrust lever not less than 20 degrees from OFF position, apply 20-pound load in forward direction to forward thrust lever when it is against idle stop. Check that lockout resists this load.



Reverser Thrust Lever Positioning
Figure 511

2) With reverse thrust lever in OFF position, advance forward thrust lever 5 ±2 degrees forward of idle stop position. Apply a 10-pound load to reverse thrust lever knob in aft direction. Check that lockout prevents reverse thrust lever from moving more than 20 degrees aft. Use protractor to measure thrust lever travel (Fig. 506). Use protractor assembly to measure reverse thrust lever travel (Fig. 510).

(c) Test engine reverse thrust control system travel.

1) With forward thrust lever against idle stop, bring reverse thrust lever back toward No. 2 reverse thrust detent (Fig. 507 and 509). Check that a sudden increase in load is felt at No. 2 detent.

NOTE: Refer to AMM 78-30-01/501 for final detent setting with engine operating.

2) Continue aft travel of reverse thrust lever until fuel control unit reverse thrust stop is contacted. The fuel control unit reverse thrust stop shall be contacted prior to contacting the reverse thrust lever stop.

3) Return reverse thrust lever to OFF position.

C. Engine Start Control System Test

(1) Equipment and Materials

(a) Spring Scale - 0- to 25-pound capacity

(b) Airplane Control Surfaces Protractor - 4MIT65B80307-1 or F52485-500

(2) Test engine start control system.

(a) Remove left removable cowl panel (AMM Chapter 71, Removable Cowl Panels).

(b) Test engine start control system friction.

1) Using spring scale, move start lever in either direction between detents. Force required at 70°F or above should not exceed 5.25 pounds as measured at knob centerline. For start lever force at temperatures below 70°F (Fig. 509). The force required to unseat the start lever from the detent face shall be 4 to 8 pounds after moving into the CUTOFF detent. The lever shall return to the detent face when released.

(c) Test engine start control system travel.

1) Check that start lever is in the CUTOFF detent.

2) Hold protractor on left start crank on engine cross-shaft (Fig. 510), center protractor bubble and record degrees shown.

NOTE: Protractor should be placed in same position on start crank after start lever advancement, as it was in step 2). Difference between step 2) and 3) determine degrees of travel.

3) Advance start lever to IDLE detent. Place protractor on start crank, center bubble and record degrees shown. Left start crank shall have traveled a minimum of 55 degrees (Fig. 507).
4) Return start lever to CUTOFF.

4. Return Airplane to Normal Configuration
A. Install left upper side door on control stand using 10 attachment screws (Fig. 507).
B. Install left stabilizer trim control wheel. Secure with tie rod nut.

NOTE: Handles on stabilizer trim control wheels should be 90 ±15 degrees apart when installed on control stand.

C. Restore all circuit breakers to pre-test position.
D. If desired, install ground lock assemblies F80109-3 in isolation valves.
E. Deleted.
F. If removed, install side removable cowl panels (AMM Chapter 71, Removable Cowl Panels).
G. If removed, install access doors No. 6301 and 6401 in wing leading edges above each wing-to-engine fairing (AMM Chapter 12, Access Doors and Panels).
H. Retract forward airstairs (AMM Chapter 52, Forward Airstairs and Door).
I. Close electronic equipment access door No. 1201, and install nose gear wheel well right and left aft panels as necessary.
J. Remove leading edge flap locks (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

K. If no longer required, remove electrical and hydraulic power.
L. Engine Start Control System Test
(1) Equipment and Materials
(a) Spring scale - 0- to 25-pound capacity
(b) Airplane Control Surfaces Protractor - 4MIT65B80307-1 or F52485-500
(2) Test engine start control system.
(a) Remove left removable cowl panel (AMM Chapter 71, Removable Cowl Panels).
(b) Test engine start control system friction.
1) Using spring scale, move start lever in either direction between detents. Force required at 70°F or above should not exceed 5.25 pounds as measured at knob centerline. For start lever force at temperatures below 70°F (Fig. 509). The force required to unseat the start lever from the detent face shall be 4 to 8 pounds after moving into the CUTOFF detent. The lever shall return to the detent face when released.
(c) Test engine start control system travel.
1) Check that start lever is in the CUTOFF detent.

2) Hold protractor on left start crank on engine cross-shaft (Fig. 510), center protractor bubble and record degrees shown.

NOTE: Protractor should be placed in same position on start crank after start lever advancement, as it was in step 2). Difference between step 2) and 3) determine degrees of travel.

3) Advance start lever to IDLE detent. Place protractor on start crank, center bubble and record degrees shown. Left start crank shall have traveled a minimum of 55 degrees (Fig. 507).

4) Return start lever to CUTOFF.

5. Return Airplane to Normal Configuration

A. Install left upper side door on control stand using 10 attachment screws (Fig. 507).

B. Install left stabilizer trim control wheel. Secure with tie rod nut.

NOTE: Handles on stabilizer trim control wheels should be 90 ±15 degrees apart when installed on control stand.

THRUST LEVERS - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Tensiometer - 0- to 125-pound capacity.
   B. Rig Pin Kit - F70207-3, -52 or -61.
      (1) SB-1 - F70207-11, 0.311 + 0.000/-0.002-inch diameter rod
   C. C-Clamps - as required.
   D. Dowel Set - Thrust Lever, Control Stand - F80195-1 or Dowel, Thrust Lever Control Stand - SE76-1004 (2 required).
2. Prepare for Thrust Levers Removal
   A. Depressurize hydraulic systems A and B.
      (1) Provide electrical power.
      (2) On forward overhead panel, position switches as follows:
         (a) Hydraulic system A ENG 1 and ENG 2 pump switches to OFF.
         (b) Hydraulic system B ELEC 1 and ELEC 2 pump switches to OFF.
      (3) Open circuit breakers as follows:
         (a) Pump B on P6-11 panel.
         (b) Pump B on P6-12 panel.
         (c) Hydraulic pump depressurize valve on P6 panel.
      (4) On forward overhead panel, position GRD INTERCONNECT switch to OPEN.
      (5) If no longer required, remove electrical power from airplane.
   B. Place thrust levers in IDLE and start levers in CUTOFF and clamp cables.
   C. Open lower nose compartment access door.
   D. Relieve tension on flap control cables WFA and WFB by loosening turnbuckles in lower nose compartment (Fig. 406).
   E. Install speed brake system rigging pin SB-1 through forward speed brake control drum into structure (Fig. 408).
   F. Relieve tension on stabilizer trim chain assembly by adjusting forward and aft support links to raise forward mechanism in lower nose compartment (Fig. 405).
   G. Open electronics equipment access door 1201.
   H. Relieve tension on thrust control cables T1A, T1B, T2A, and T2B. Use turnbuckles located in electronics equipment compartment (Fig. 407). Disconnect and tag cables for thrust lever being removed.
3. Remove Thrust Levers
   A. Remove left and right stabilizer trim control wheel tie rod nut (1, Fig. 404).
   B. Pull stabilizer trim control wheel tie rod (8) from stabilizer trim control wheel shaft.
   C. Remove right stabilizer trim control wheel (7) from stabilizer trim control wheel shaft (2).
   D. Remove both left and right upper side door (6).
   E. Remove lower right access panel (10).
   F. Disconnect stabilizer trim cutout switches (9).
   G. Cut lockwire and remove right control shaft nut (5).
   H. Remove forward electronic units (16) from aft electronic panel.

I. Remove start lever detents (10, Fig. 402) for No. 1 and No. 2 engine start levers.
J. Remove forward and aft cover tie straps (4 and 2).
K. Remove forward and aft cover angles (6 and 8).
L. Remove horn cutout switch (17, Fig. 404).
M. Remove stabilizer trim warning light cover (15).
N. Lift cover assemblies (5, Fig. 402) from control stand.
O. Remove right control stand frame (4, Fig. 404).
P. Remove key (3) from slot in right control shaft (12).
Q. Replace right control shaft nut (5) on right control shaft (12) to allow removal of spacer, stabilizer trim indicator, spacer and flap handle as a unit.
R. Detach stabilizer trim indicator link (13) from stabilizer trim indicator by removing bolt (14).
S. Remove right control shaft (12) with nut, spacer, trim indicator, spacer, and flap handle as a unit.
T. Rotate left stabilizer trim wheel until connector link (11) in stabilizer trim chain is accessible for removal.
U. Detach connector link and remove chain from sprocket. Secure chain in bottom of control stand.
V. Remove left stabilizer trim control wheel (1, Fig. 402) from stabilizer trim control wheel shaft (7).
W. Remove stabilizer trim control wheel shaft (7) and sprocket from right side of control stand.
X. Tag and disconnect thrust lever wire bundle terminals, and remove wire clamp (Fig. 403).
Y. Cut lockwire and remove left control shaft nut (3, Fig. 402) from left control shaft.
Z. Using dowel, (5, Fig. 401) push left control shaft clear of control stand. Use care to prevent loss of key (9, Fig. 402).

CAUTION: KEY (9, FIG. 402) WILL BE FREE FROM LEFT CONTROL SHAFT AND LEFT FRAME WHEN LEFT CONTROL SHAFT IS DRIVEN FROM CONTROL STAND.

AA. Rotate thrust lever assembly until cam roller and detent assembly is opposite opening in cam (7, Fig. 401) on applicable thrust lever.
AB. Pull cam roller out of cam to release thrust lever assembly from detent assembly.
AC. Pull dowel to left until thrust lever assembly can be lifted from control stand. Use additional dowel from right side of control stand to hold right start lever and thrust lever not being removed.

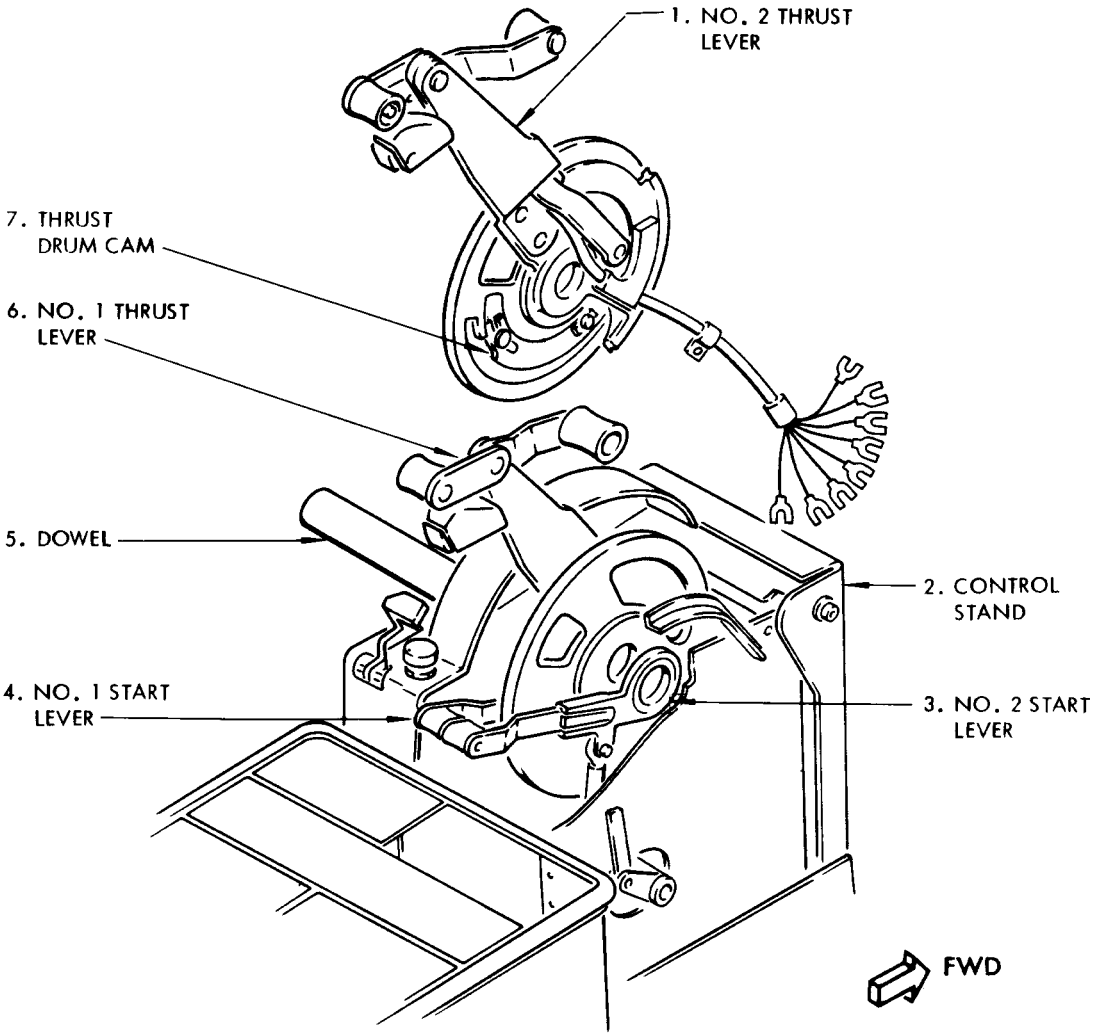
NOTE: Tag position of spacers removed. Position and thickness of spacers may vary in different control stands.

4. Install Thrust Levers
   A. Position applicable thrust lever (1 and 6, Fig. 401) in control stand with cable on drum.
      (1) Levers are positioned from right to left as follows: large spacer, No. 2 start lever, No. 2 thrust lever, No. 1 thrust lever, No. 1 start lever, speed brake crank with spacer on each side if required, and stabilizer trim indicator with spacer.
      (2) Secure cable to drum, seat ball in relieved area and lockwire.
      (3) Insert detent assembly cam rollers in cams on thrust drums.
      (4) Position spacers as they were removed. Ensure spacers are in thrust lever assemblies.
      (5) Advance left control shaft from right to left as levers and spacers are positioned.
   B. Complete installation of left control shaft.
      (1) Push left control shaft against dowel (5).
      (2) Force dowel to left until clear of control stand by pushing with left control shaft.

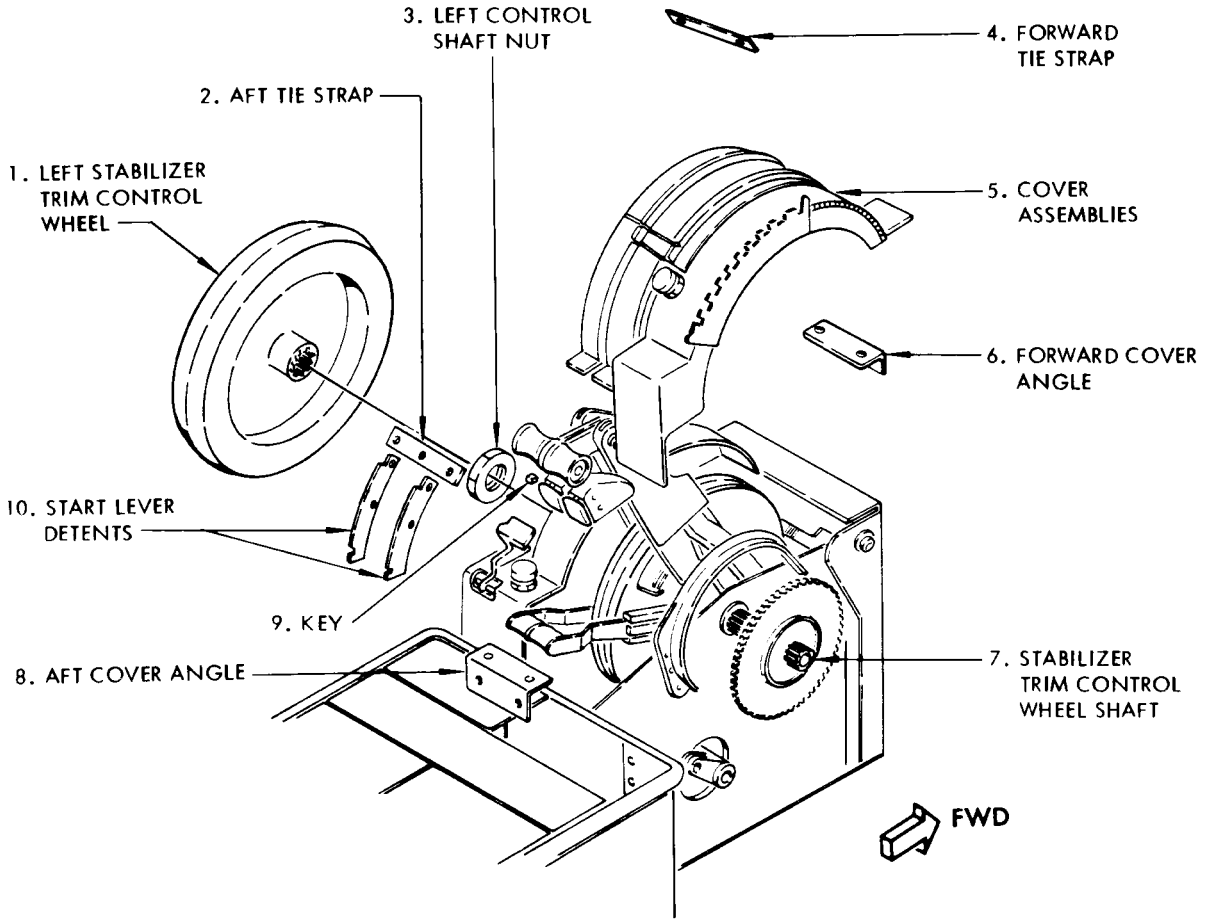
          CAUTION: EXCEPT CARE TO PREVENT SPACERS FROM FALLING WHEN DOWEL IS FORCED FROM CONTROL STAND.

      (3) Left control shaft shall extend 0.25 (+0.06/-0.07) inch through left control stand frame.
   C. Insert key (9, Fig. 402) in left control shaft and left control stand frame and install left control shaft nut (3). Tighten nut to 200 to 300 pound-inches. Lockwire nut to frame.
   D. Complete installation of thrust lever assemblies.
      (1) Position wire bundle on outboard side of thrust lever control cable.
      (2) Connect thrust lever wire bundle terminals at terminal strip (Fig 403).
          CAUTION: CLAMP WIRE WITH SUFFICIENT SLACK TO PERMIT FULL TRAVEL OF THRUST LEVERS. ENSURE THAT THERE IS NO INTERFERENCE BETWEEN WIRE BUNDLE AND CONTROL CABLES.

      (3) Check that detent assembly (figure 403) is properly adjusted. Refer to 76-11-0, Engine Control System - Adjustment/Test.
   E. Install stabilizer trim control wheel shaft (7, figure 402) and sprocket in left control shaft. Install with long spacer and bearing at left end.
   F. Place stabilizer trim chain on sprocket and install connector link (11, figure 404).
   G. Install left stabilizer trim control wheel (l, figure 402) on stabilizer trim control wheel shaft (7).



Thrust Lever Installation
Figure 401



Control Stand Center Components Installation
Figure 402

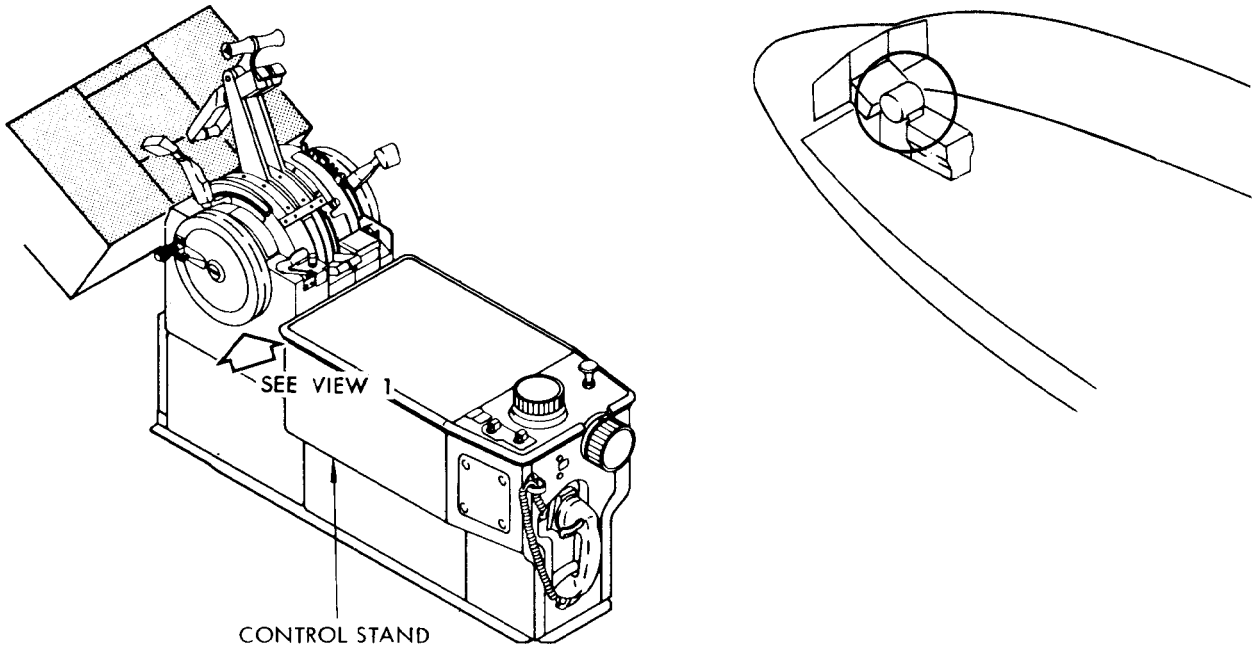
H. Install right control shaft (12, figure 404) with levers on stabilizer trim control wheel shaft (2).
   (1) Assemble right control shaft with the cranks arranged from left to right: flap handle, spacer, stabilizer trim indicator, spacer, and nut.
   (2) Ensure spacers are installed between bearings on flap handle.
   (3) Place assembly on stabilizer trim control wheel shaft (2) ensuring two bearings and spacer are properly seated and that the flap switch lever enters the cam on the flap drum.
I. Connect stabilizer trim indicator link (13) to stabilizer trim indicator by installing bolt (14).
J. Remove right control shaft nut (5) from right control shaft (12).
K. Attach right control stand frame (4) to control stand.
L. Connect stabilizer trim cutout switches (9).
M. Install key (3) in right control shaft and right control stand frame.
N. Install right control shaft nut (5) and tighten to 200-300 pound-inches. Lockwire nut to frame.
O. Install cover assemblies (5, Fig 402) on control stand.
P. Install stabilizer trim warning light cover (15, figure 404) on cover assemblies (5, figure 402).
Q. Install horn cutout switch (17, figure 404).
R. Install forward and aft cover angles (6 and 8, figure 402) on control stand and install forward and aft cover tie straps (4 and 2).
S. Install start lever detents (10) for number 1 and 2 engines.
T. Replace forward electronic units (16, figure 404) in aft electronics control panel.
U. Install both left and right upper side door (6).
V. Install right stabilizer trim control wheel (7) on stabilizer trim control wheel shaft (2).

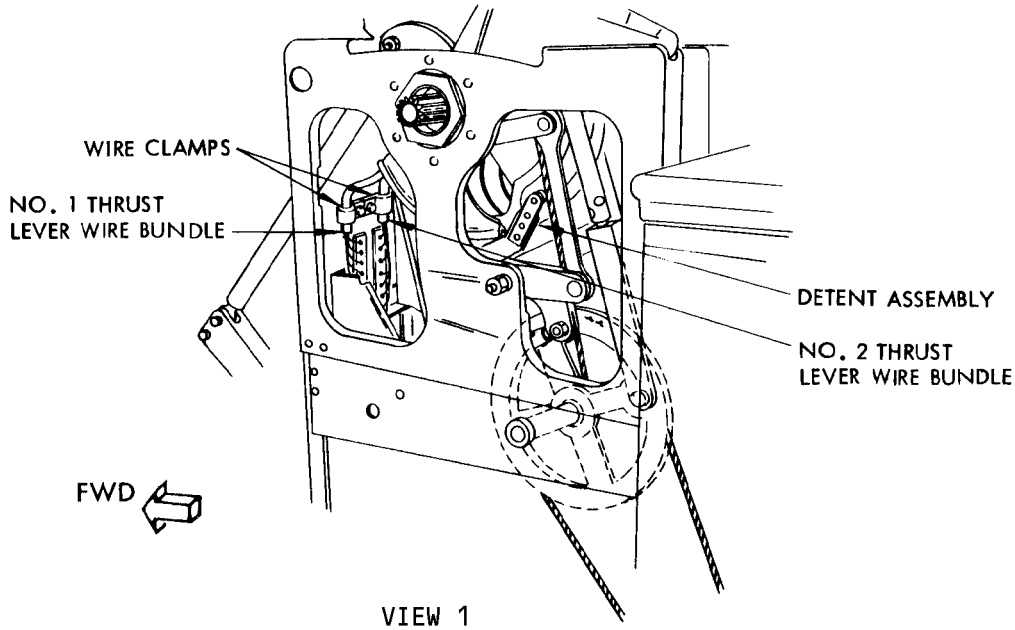
NOTE: Handles on stabilizer trim control wheels should be 90°(±15°) apart when installed on control stand.

W. Install stabilizer trim control wheel tie rod (8) and secure with tie rod nut (1) at each end. Tighten nuts to 60-70 inch-pounds.

NOTE: It is recommended that you discard the old tie rod nuts and replace with new tie rod nuts.

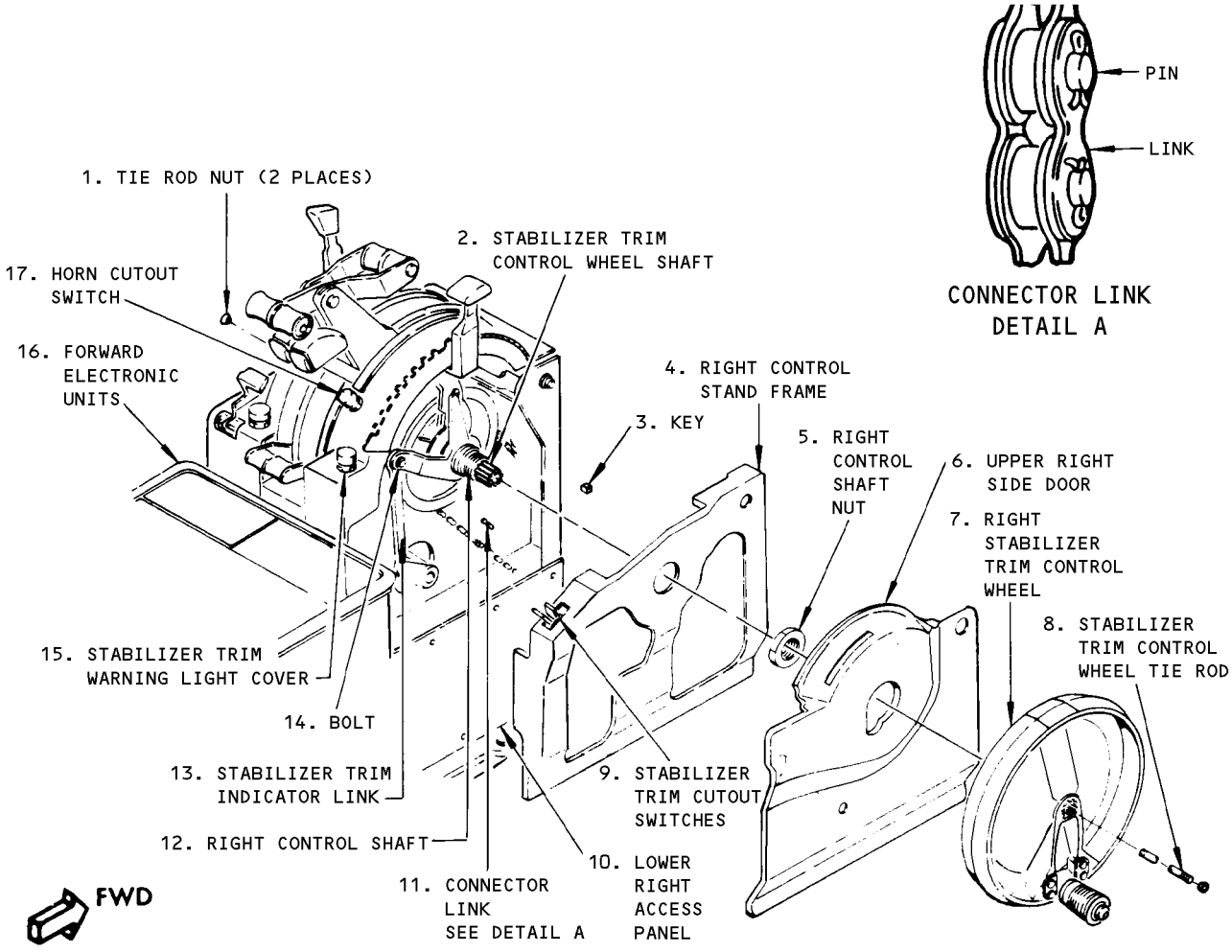
NOTE: Make sure at least two threads on the tie rod show after you tighten the tie rod nut.





VIEW 1

Thrust Lever Wire Bundle Installation
Figure 403



Control Stand Accesses Installation
Figure 404

X. In lower nose compartment, tighten stabilizer trim chain by adjusting support links to lower forward mechanism (Fig. 405). Adjust chain so that after application of a 20-pound force to remove slack, reduction to a 5-pound force will deflect chain 0.25 ±0.07 inch at a point 4.5 ±1.0 inches above the forward tangent of the forward mechanism sprocket. Ensure dimension A of forward and aft support links match within ±0.06 inch. Check that stabilizer trim control wheels rotate freely.

Y. Check that stabilizer trim indicator position agrees with position of stabilizer. If out of adjustment, refer to Chapter 27, Horizontal Stabilizer Trim Control System - Adjustment/Test.

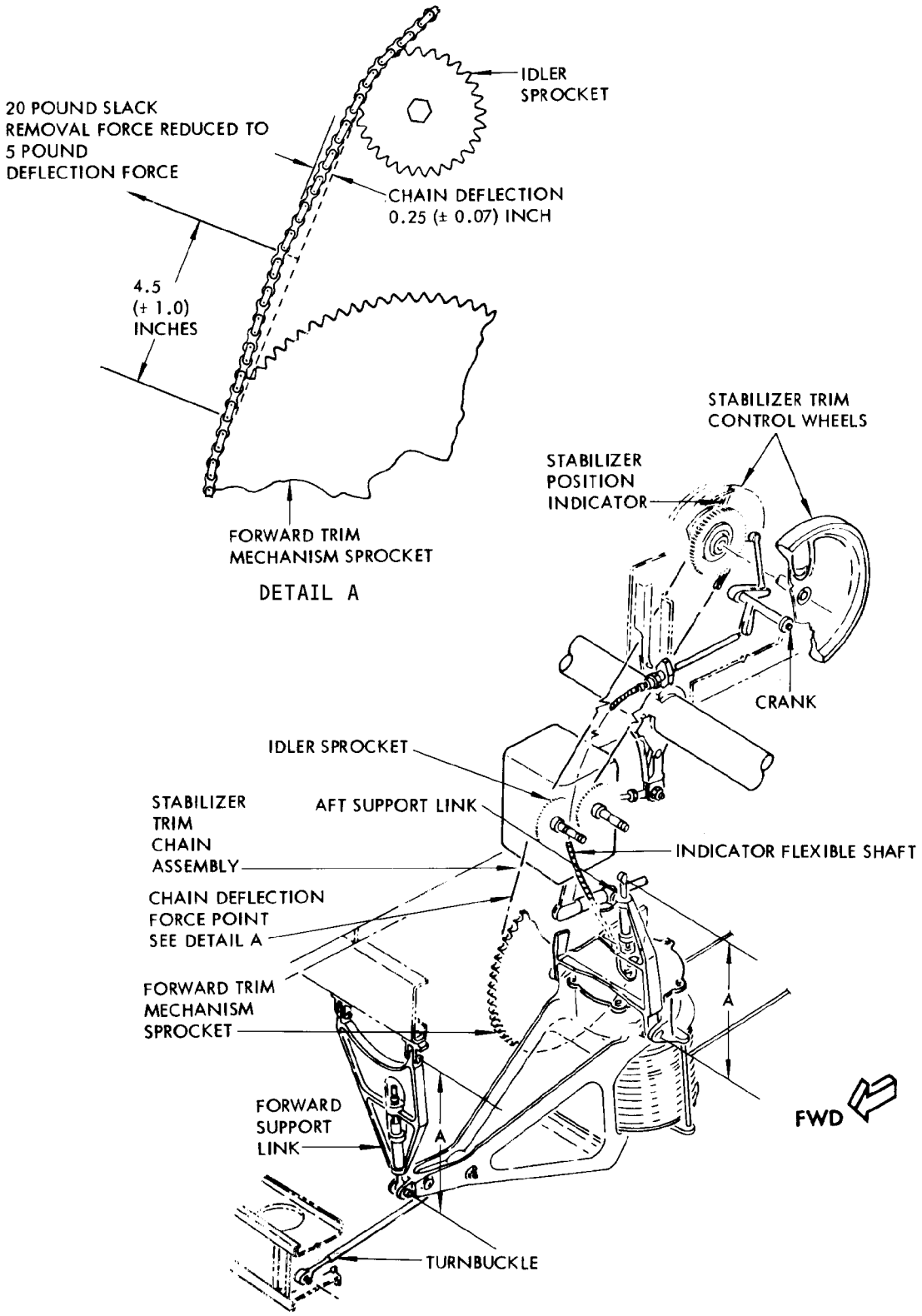
Z. Adjust flap control cables WFA and WFB.
   (1) Lift flap control lever and clamp so that lever latch is disengaged from detent plate (Fig. 406).
   (2) In lower nose compartment, adjust turnbuckles to tighten flap control cables WFA and WFB to load specified for ambient temperature.
   (3) Position flap control lever all the way forward and then release lever.
   (4) Check that lever springs back to rigging position.
   (5) Install turnbuckle-locking clips.
   (6) Remove clamp from flap control lever.
   (7) Check that flap lever moves smoothly without binding through full range of travel.
   (8) Position flap control lever in FLAP UP detent.

AA. Connect and tighten all thrust control cables by adjusting turnbuckles (Fig. 407). Remove clamps (AMM 76-11-0 A/T).

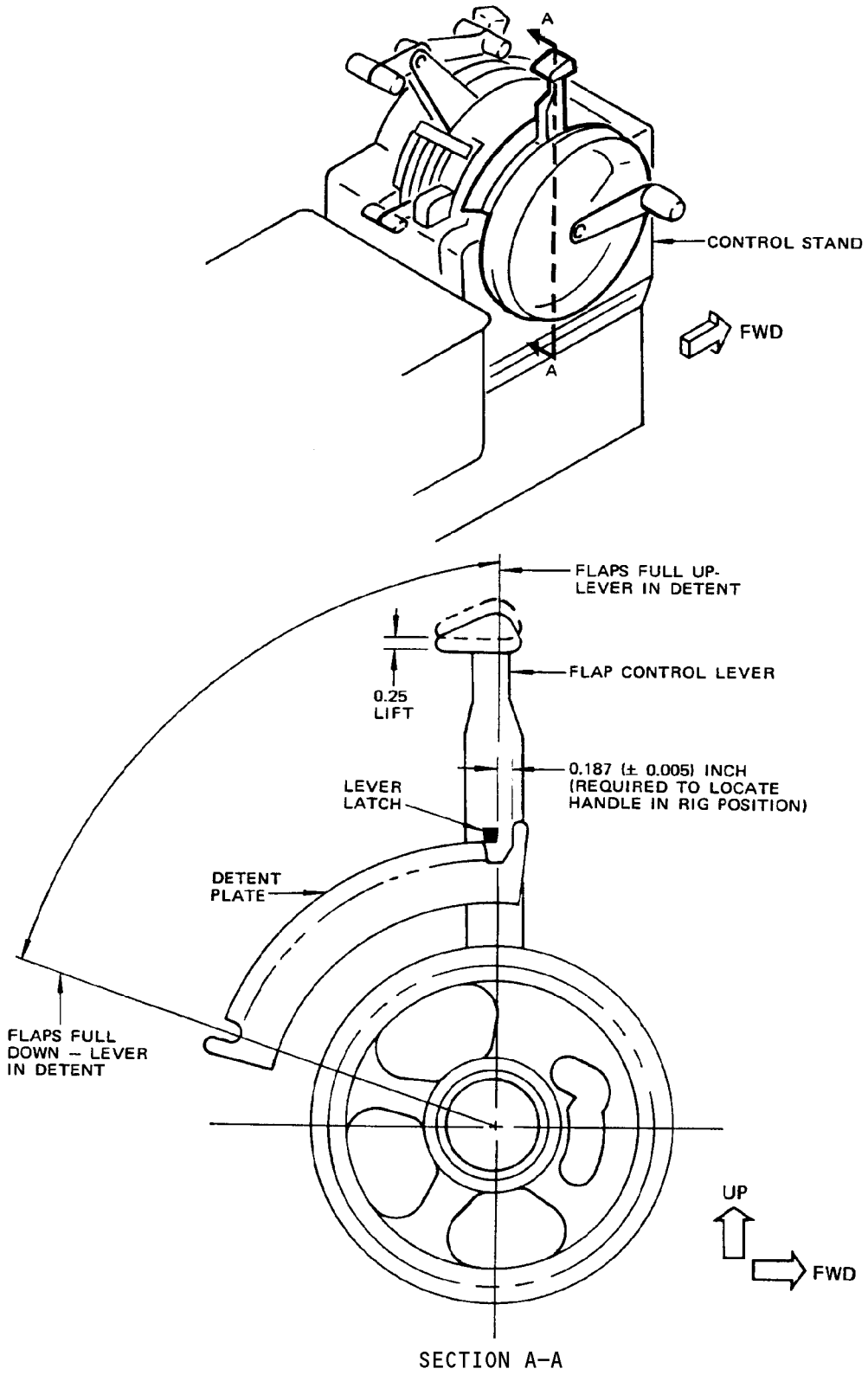
AB. Tighten all engine start control cables (Fig. 407). Remove clamps (AMM 76-11-0 A/T).

AC. Adjust speed brake control lever.
   (1) Place speed brake control lever in DOWN detent. Ensure that lever latch is in detent on control stand (Fig. 408).
   (2) In lower nose compartment, check that rigging pin SB-1 can be freely installed through speed brake forward drum into structure. If pin cannot be installed freely, accomplish following:
      (a) Disconnect upper end of lower control rod from idler link.
      (b) Loosen checknut and adjust rod end until rod end bolt fits freely with rigging pin SB-1 installed.
      (c) Install rod end bolt with washer under bolt head. Secure bolt with washer and locknut.
      (d) Tighten checknut on rod end.
      (e) Ensure that rod end is visible in inspection hole in control rod.
      (f) Remove rigging pin SB-1.

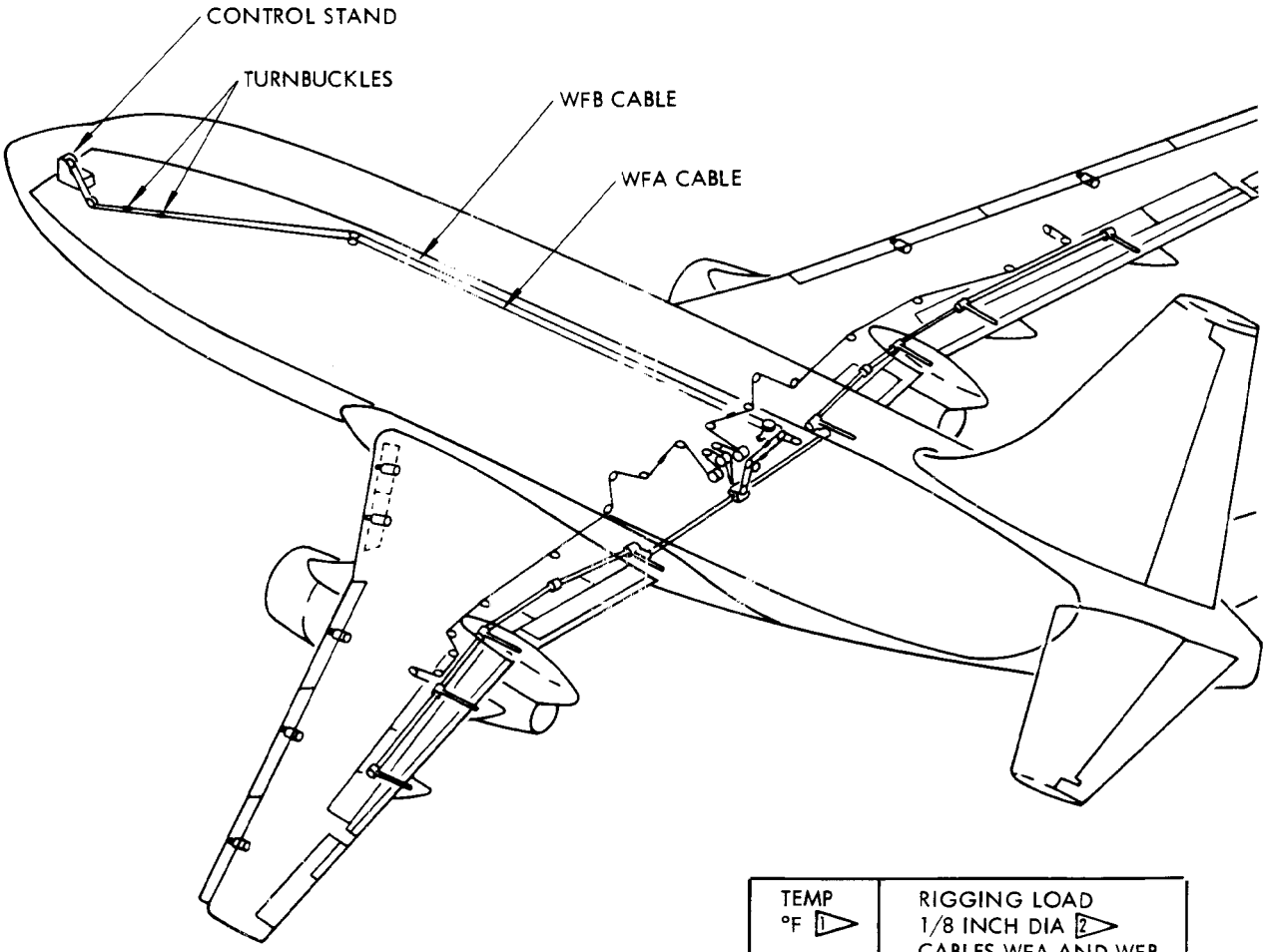
AD. Close forward nose compartment and electronics equipment access door 1201.



Stabilizer Trim Chain Assembly Adjustment
Figure 405



Flap Control Lever Rigging
Figure 406 (Sheet 1)



CABLE CODE	FUNCTION
WFA	WING FLAPS UP
WFB	WING FLAPS DOWN

TEMP °F [1]	RIGGING LOAD 1/8 INCH DIA [2] CABLES WFA AND WFB
110	117
90	108
70	100
50	91
30	83
+10	74
-10	65
-30	57
-40	52

[1] TO INSURE THAT PROPER CABLE TENSION IS OBTAINED, ALLOW A MINIMUM OF ONE HOUR AT CONSTANT AMBIENT TEMPERATURE (+5°F) FOR AIRFRAME TEMPERATURE TO STABILIZE.

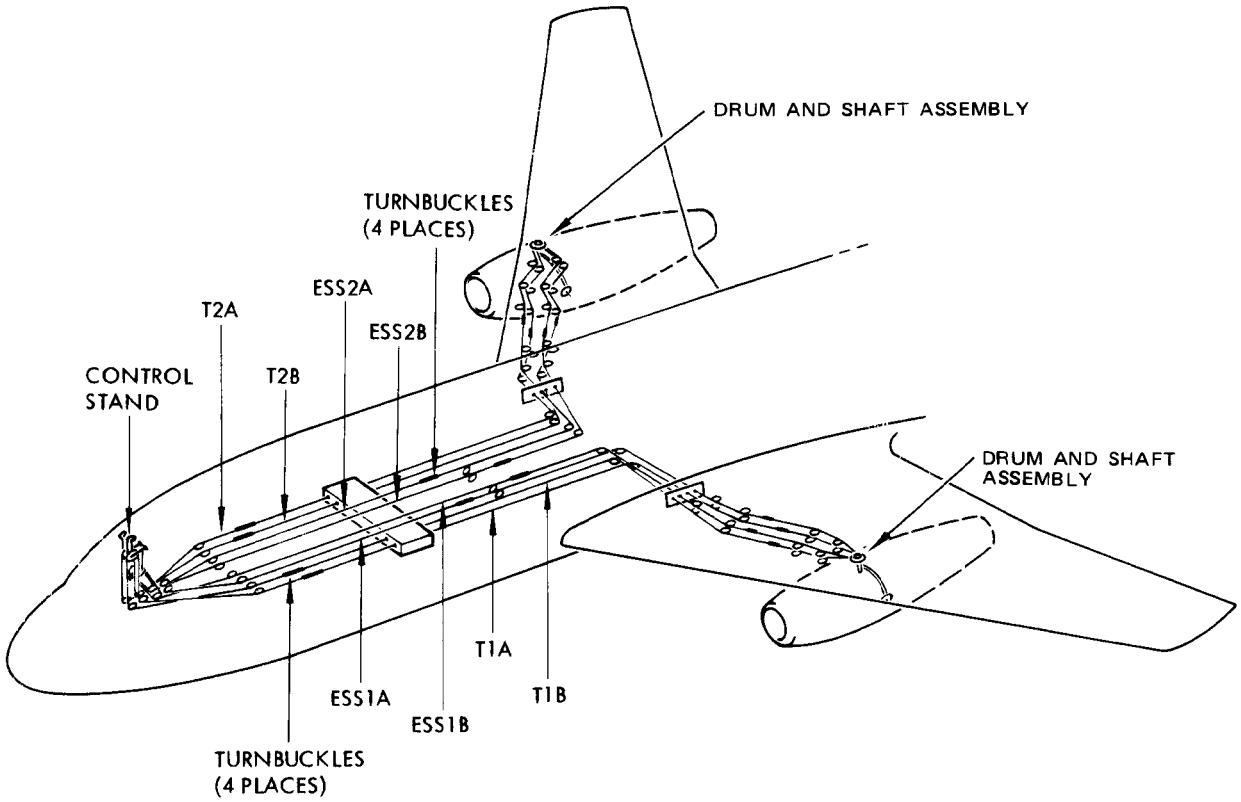
[2] CABLES MUST BE ADJUSTED WITHIN +10/-0 POUNDS OF THAT SPECIFIED. RE-RIG SYSTEM WHEN CABLE LOADS DEVIATE FROM SPECIFIED VALUE MORE THAN 15 POUNDS.

Flap Control Lever Rigging
Figure 406 (Sheet 2)

AE. Connect external electrical power to airplane and perform following:
    (1) On forward overhead panel, position GRD INTERCONNECT switch to CLOSE.
    (2) Close circuit breakers as follows:
        (a) Hydraulic pump depressurize valve on P6-2 panel.
        (b) Pump B on P6-12 panel.
        (c) Pump B on P6-11 panel.
    (3) On forward overhead panel, position switches as follows:
        (a) Hydraulic system B ELEC 1 and ELEC 2 pump switches to ON.
        (b) Hydraulic system A ENG 1 and ENG 2 pump switches to ON.

AF. If no further requirement exists for external electrical power, disconnect from airplane.

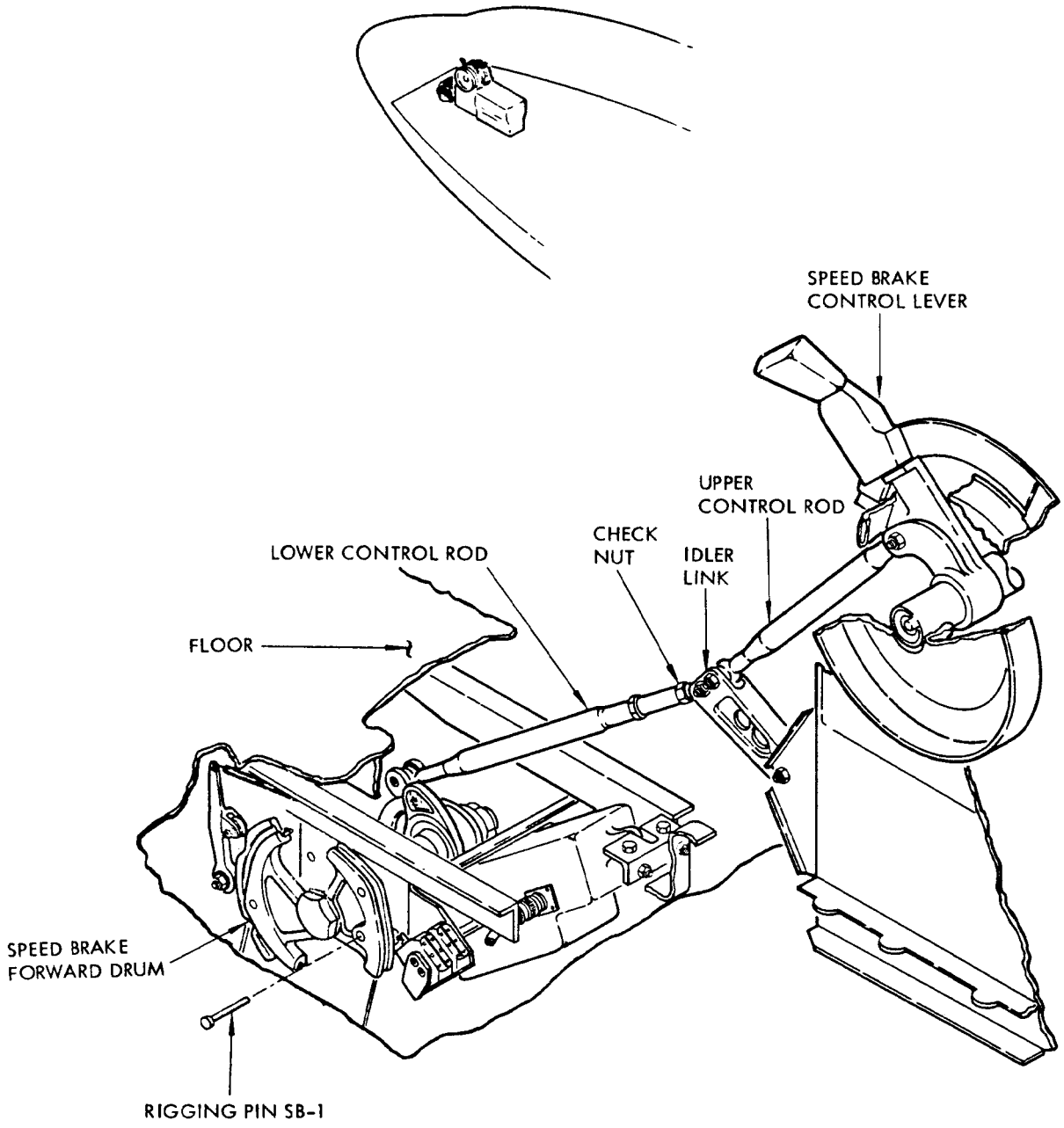
AG. Test engine start and thrust control systems. Refer to 76-11-0, Engine Control System - Adjustment/Test.



CABLE	TYPE	ENGINE	FROM	TO	FUNCTION
T1A	THRUST	NO. 1	CONTROL STAND	DRUM AND SHAFT ASSY	INCREASE FORWARD THRUST
T1B	THRUST	NO. 1	DRUM AND SHAFT ASSY	CONTROL STAND	DECREASE FORWARD THRUST
T2A	THRUST	NO. 2	CONTROL STAND	DRUM AND SHAFT ASSY	INCREASE FORWARD THRUST
T2B	THRUST	NO. 2	DRUM AND SHAFT ASSY	CONTROL STAND	DECREASE FORWARD THRUST
ESS 1A	START	NO. 1	CONTROL STAND	DRUM AND SHAFT ASSY	START ENGINE
ESS 1B	START	NO. 1	DRUM AND SHAFT ASSY	CONTROL STAND	ACTUATE FUEL SHUTOFF
ESS 2A	START	NO. 2	CONTROL STAND	DRUM AND SHAFT ASSY	START ENGINE
ESS 2B	START	NO. 2	DRUM AND SHAFT ASSY	CONTROL STAND	ACTUATE FUEL SHUTOFF

CABLE DEFINITIONS

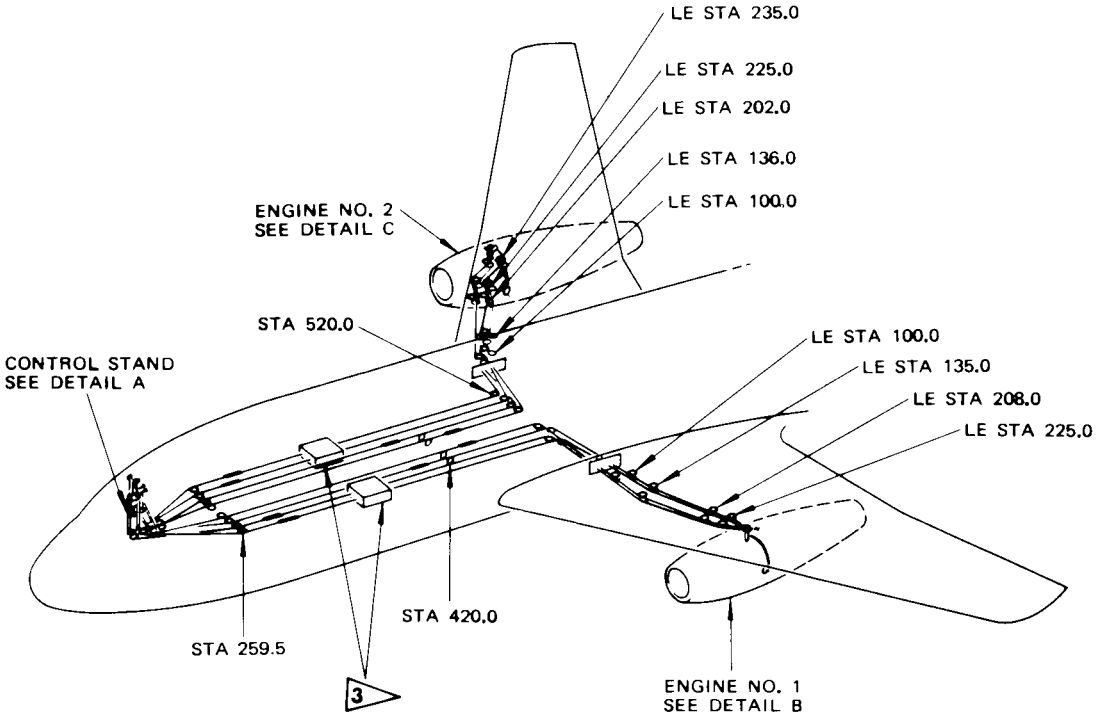
Engine Control System Cable Locations and Definitions
Figure 407



Speed Brake Control Lever Adjustment
Figure 408

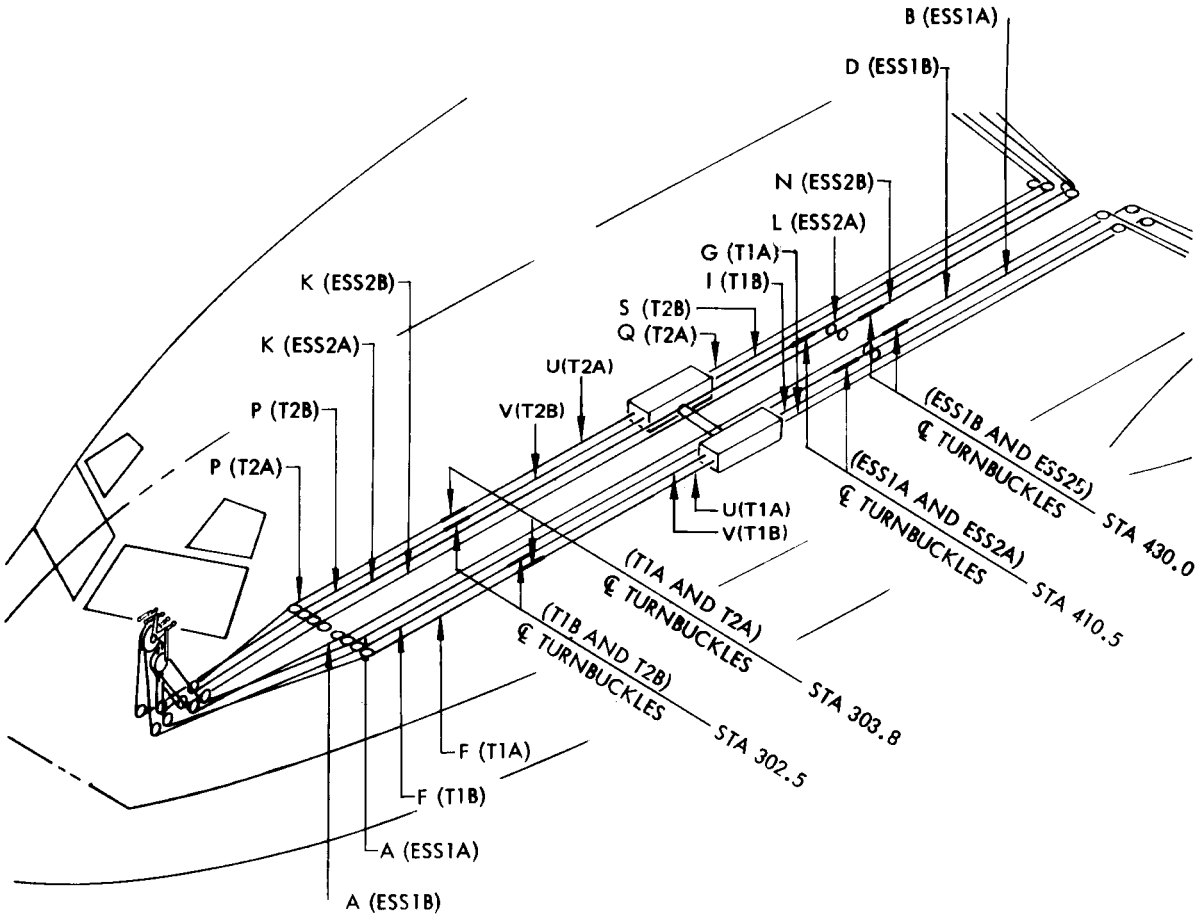
ENGINE CONTROL CABLES - MAINTENANCE PRACTICES

1. General
   A. No engine control cable maintenance practices are provided in this section. Instead, illustrations and tables are used to show cable lengths and terminal fittings, and pulley and turnbuckle locations.
   B. Control cable maintenance practices which apply to engine control cables are covered in the airframe standard practices chapter. For maintenance practices on control cables (including cable wear limits), air pressure seal, grommet, and turnbuckle locking clips, refer to Chapter 20, Standard Practices - Airframe.



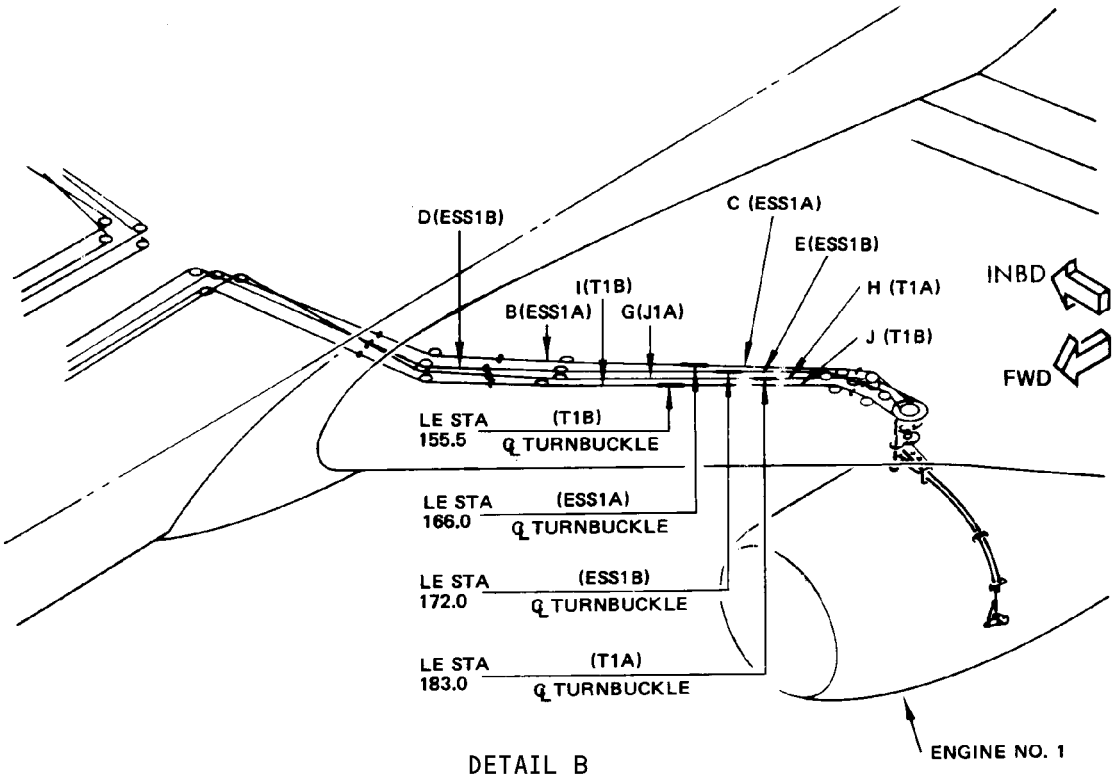
3 AUTO THROTTLE CLUTCH ASSEMBLY ON
WE ALL EXCEPT N4905W AND ON
NZ ALL EXCPPT ZK–NAM, ZK–NAP AND ON
SD ST–AIB AND ON
AR ALL EXCEPT LV–LEB, LV–JTD, LV–JTO, LV–LIU AND ON
ND CF–NAB THRU CF–NAQ
DRUM AND FRICTION BRAKE ASSEMBLY ON
WE N4905W AND ON
NZ ZK–NAM, ZK–NAP AND ON
SD ALL EXCEPT ST–AIB AND ON
AR LV–LEB, LV–JTD, LV–JTO, LV–LIU AND ON
ND ALL EXCEPT CF–NAB THRU CF–NAQ

Engine Control Cables
Figure 201 (Sheet 1)

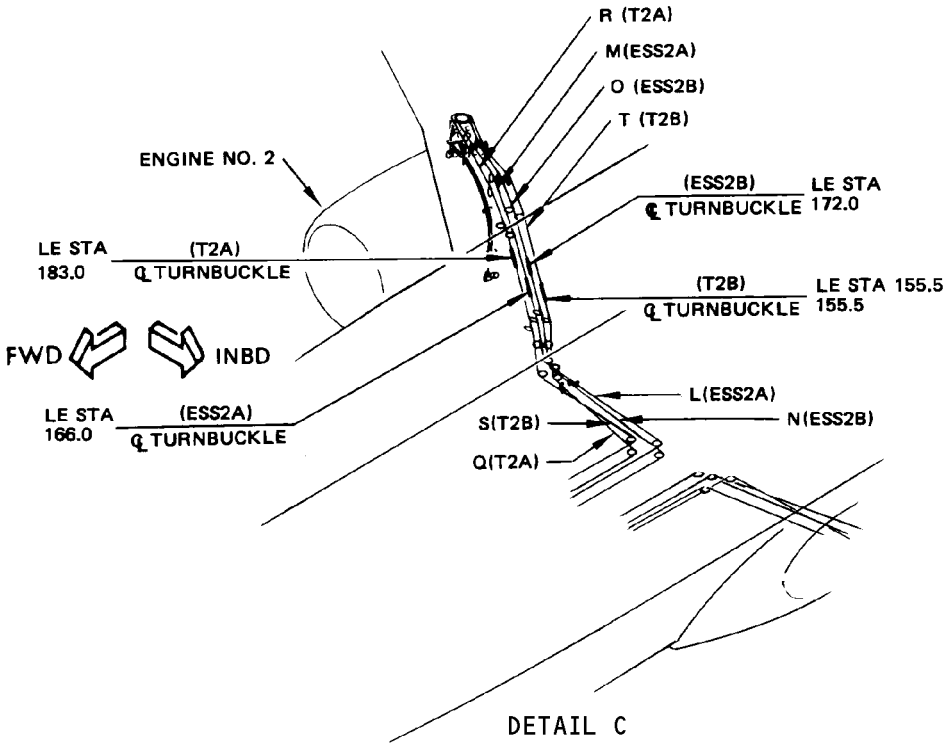


DETAIL A

Engine Control Cables
Figure 201 (Sheet 2)



DETAIL B



DETAIL C

Engine Control Cables
Figure 201 (Sheet 3)

CABLE REF.	FUNC-TION	NO. REQ	CABLE SIZE AND MATL	LENGTH (INCHES) 5		FITTINGS 2		
				A	B	1	2	3
A	ESS1A, ESS1B	2	1	420.3	220.8	MS21260L3LH	MS21260L3RH	BACT14B3
B	ESS1A	1	3	282.3/246.2 7	——	MS21260L3LH	MS21260L3LH	——
C	ESS1A	1		79.3	——	MS21260L3RH	BACT14A3 6	——
D	ESS1B	1		270.3/234.3 7	——	MS21260L3RH	MS21260L3RH	——
E	ESS1B	1		72.3	——	MS21260L3LH	BACT14A3 6	——
F	T1A,T1B	2	1	224.6	113.0	MS21260S3LH	MS21260S3RH	BACT14B3
G	T1A	1	3	361.8/340.7/325.8 7	——	MS21260L3LH	BACT14A3 6	——
H	T1A	1		64.3	——	MS21260L3RH	BACT14A3 6	——
I	T1B	1		312.2/315.1/276.2 7	——	MS21260L3LH	BACT14A3 6	——
J	T1B	1		91.1	——	MS21260L3RH	BACT14A3 6	——
K	ESS2A, ESS2B	2	1	420.3	220.8	MS21260L3LH	MS21260L3RH	BACT14B3
L	ESS2A	1	3	282.3/246.2 7	——	MS21260L3LH	MS21260L3LH	——
M	ESS2A	1		86.5	——	MS21260L3RH	BACT14A3 6	——
N	ESS2B	1		269.2/233.2 7	——	MS21260L3RH	MS21260L3RH	——
O	ESS2B	1		81.5	——	MS21260L3LH	BACT14A3 6	——
P	T2A,T2B	2	1	224.6	113.0	MS21260S3LH	MS21260S3RH	BACT14B3
Q	T2A	1	3	361.0/339.9/325.0 7	——	MS21260L3LH	BACT14A3 6	——
R	T2A	1		71.0	——	MS21260L3RH	BACT14A3 6	——
S	T2B	1		311.0/313.9/275.0 7	——	MS21260L3LH	BACT14A3 6	——
T	T2B	1		100.5	——	MS21260L3RH	BACT14A3 6	——
U	T1A,T2A	2	4 1	76.4/77.4/70.7 7	——	MS21260S3LH	BACT14A3 6	——
V	T1B,T2B	2		73.5/74.0/71.3 7	——	MS21260S3RH	BACT14A3 6	——

1 3/32 7X7 CABLE, CARBON STEEL, TIN COATED PER MIL-W-1511

2 TERMINALS ARE CORROSION RESISTANT STEEL PER MIL-T-781

3 3/32 7X7 CABLE, CORROSION RESISTANT STEEL PER MIL-W-83420, TYPE I, COMP B

4 3/32 7X7 CABLE, CARBON STEEL PER MIL-W-83420, TYPE I, COMP A (PREFERRED)

5 "A" REFERS TO TOTAL CABLE LENGTH. "B" REFERS TO FUNCTION B CABLE RUN LENGTH

6 DIES FOR THE NEXT LARGER SIZE AN STANDARD TERMINALS ARE REQUIRED FOR SWAGING ALL BACT14A TERMINALS

7 THIS CABLE WILL BE ONE OF THE LENGTHS SHOWN. THESE CABLE LENGTHS ARE SHOWN FOR REFERENCE ONLY. THE CORRECT CABLE LENGTH IS IN THE AIRCRAFT ILLUSTRATED PARTS CATALOG (AIPC). TO DETERMINE THE CABLE LENGTH FOR A PARTICULAR AIRPLANE, REFER TO AIPC 76-10-00-01.

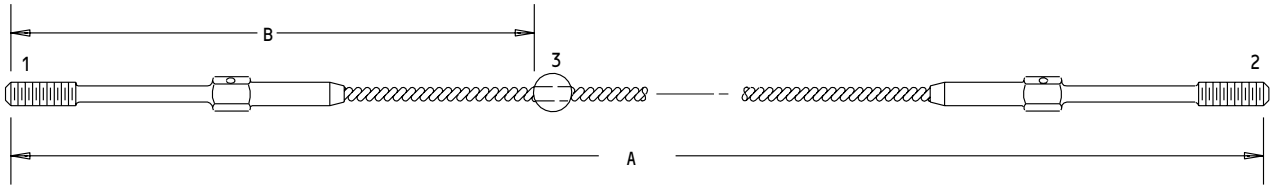
IN THE AIPC, GO TO THE LIST OF AIRPLANES IN THE "FRONT MATTER - AIRPLANE EFFECTIVITY CROSS REFERENCE" AND DETERMINE THE "CUST EFFECT CODE" FOR THE AIRPLANE IN WORK. NEXT GO TO AIPC 76-10-00-01, AND FIND THE CORRECT CABLE IN THE "NOMENCLATURE" COLUMN. MAKE SURE THE CABLE IS EFFECTIVE FOR THE AIRPLANE IN WORK. DO THIS BY FINDING THE AIRPLANE FROM THE "CUST EFFECT CODE" IN THE "EFFECT FROM TO" COLUMN. NEXT DETERMINE THE LENGTH OF THE CABLE USING THE INFORMATION BELOW.

DETERMINE THE CABLE LENGTH BY LOOKING AT THE PART NUMBER WHICH WILL BE SIMILAR TO BACCxx...xxNNNNxx. IN THIS EXAMPLE, x REPRESENTS PART NUMBER COMPONENTS WHICH ARE NOT RELEVANT TO THE CABLE LENGTH. THE CABLE LENGTH IS DESIGNATED BY THE NNNN. THIS IS THE LAST 4 NUMERIC CHARACTERS OF THE PART NUMBER. THE CABLE LENGTH IS IN INCHES AND TENTHS OF AN INCH. ANY ALPHA CHARACTERS AT THE END OF THE PART NUMBER DO NOT DEFINE CABLE LENGTH.

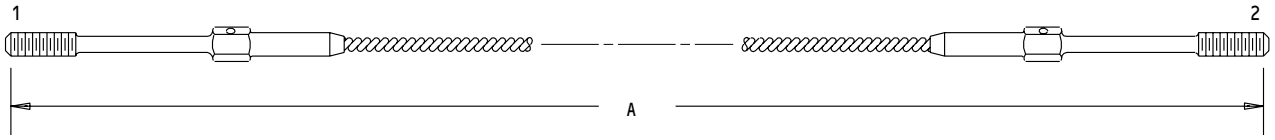
EXAMPLES: BACC13AP3D3122 IS A CABLE 312.2 INCHES LONG.
BACC13AP3D3610 IS A CABLE 361.0 INCHES LONG
BACC2A3C03610EG IS A CABLE 361.0 INCHES LONG

USE THE CABLE LENGTH YOU FIND IN THE AIPC.

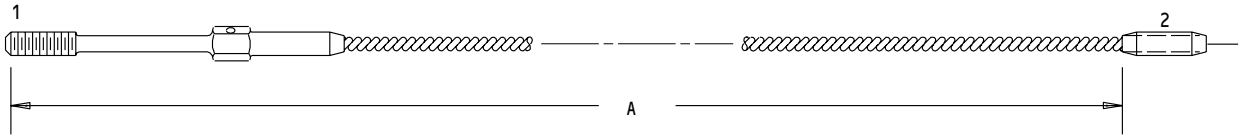
Engine Control Cables
Figure 201 (Sheet 4)



FOR CABLE REF. A, F, K AND P



FOR CABLE REF. B, D, L AND N



FOR CABLE REF. C, E, G THRU J, M, Q THRU V

CABLE	TYPE	ENGINE	FROM	TO	FUNCTION
T1A	THRUST	NO. 1	CONTROL STAND	DRUM AND SHAFT ASSY	INCREASE FORWARD THRUST
T1B	THRUST	NO. 1	DRUM AND SHAFT ASSY	CONTROL STAND	DECREASE FORWARD THRUST
T2A	THRUST	NO. 2	CONTROL STAND	DRUM AND SHAFT ASSY	INCREASE FORWARD THRUST
T2B	THRUST	NO. 2	DRUM AND SHAFT ASSY	CONTROL STAND	DECREASE FORWARD THRUST
ESS 1A	START	NO. 1	CONTROL STAND	DRUM AND SHAFT ASSY	START ENGINE
ESS 1B	START	NO. 1	DRUM AND SHAFT ASSY	CONTROL STAND	ACTUATE FUEL SHUTOFF
ESS 2A	START	NO. 2	CONTROL STAND	DRUM AND SHAFT ASSY	START ENGINE
ESS 2B	START	NO. 2	DRUM AND SHAFT ASSY	CONTROL STAND	ACTUATE FUEL SHUTOFF

CABLE DEFINITIONS

Engine Control Cables
Figure 201 (Sheet 5)

ENGINE CONTROL CABLES - INSPECTION/CHECK

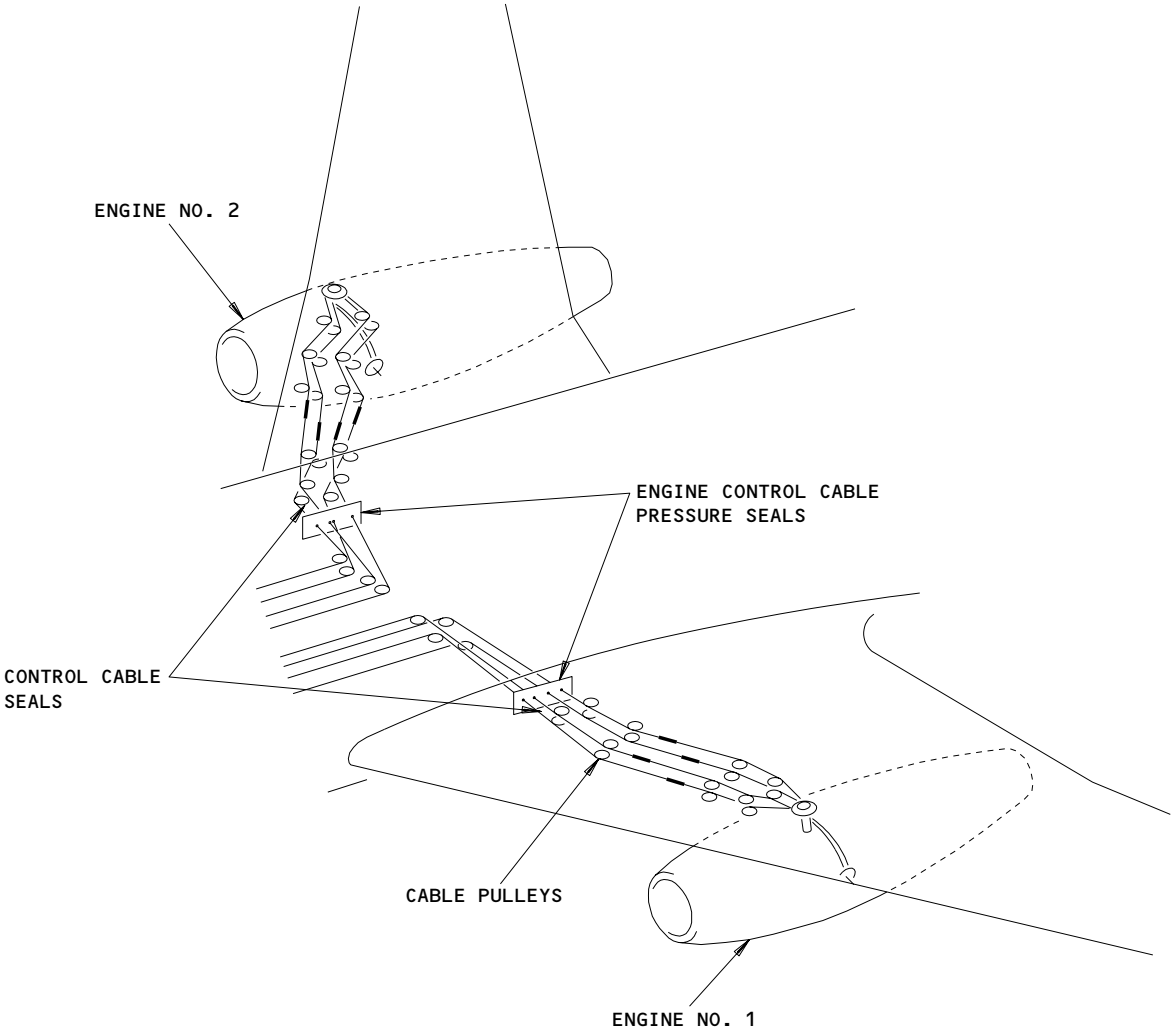
1. General
   A. This section provides the steps necessary for the inspection/check of the engine control cables from the wing/body pressure seals to the engine strut.
2. Engine Control Cables Inspection/Check (Fig. 601)
   A. Remove access door 6302 (left wing) or 6402 (right wing) on the top of the wing (Ref 12-31-71 MP).
   B. Extend the leading edge flaps and install the locks for the leading edge flaps (Ref 27-81-0 MP).

      WARNING: THE LEADING EDGE FLAPS CAN MOVE QUICKLY IF YOU DO NOT INSTALL THE SAFETY LOCKS CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

   C. Examine the cables for wear, corrosion, fraying, and broken wires (Ref 20-20-31 I/C).
   D. Replace unserviceable cables (Ref 20-10-91 R/I).
   E. Examine the wing/body pressure seals and related parts for wear, corrosion, collected unwanted material, and damaged parts or parts not there.
   F. Replace unserviceable pressure seals (Ref 20-10-101 R/I).
   G. Examine the control cable seals and related parts for wear, corrosion, collected unwanted material, and damaged parts or parts not there.
   H. Examine the cable pulleys and the pulley brackets (Ref 20-20-31 I/C).
   I. Replace unserviceable cable pulleys.
   J. Replace unserviceable cable pulley brackets.
   K. Examine the cable guides and fairleads for wear, damage, aligns correctly and attached correctly (Ref 20-20-31 I/C).
   L. Examine the cable routing and the fairlead deflection angles (Ref 20-20-31 (I/C).
   M. Make sure the cable tension is correct and adjust the tension if it is necessary (Ref 76-11-0 A/T).
   N. Make sure that the cable moves freely when the forward and reverse thrust levers are moved full forward and full aft.
   O. Remove the locks for the leading edge flaps and retract the leading edge flaps (Ref 27-81-0 MP).

      WARNING: THE LEADING EDGE FLAPS CAN MOVE QUICKLY IF YOU DO NOT REMOVE THE SAFETY LOCKS CORRECTLY. THIS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

   P. Install access door 6302 (left wing) or 6402 (right wing) on the top of the wing (Ref 12-31-71 MP).



Engine Control Cable Inspection
Figure 601

ENGINE CONTROL DRUM AND SHAFT ASSEMBLY - REMOVAL/INSTALLATION

1. General
   A. The control drum and shaft assembly transmits engine control cable motion thru the strut firewall to the push-pull cable assemblies. This is done using a series of drums, shafts, and cranks assembled together in the control drum and shaft assembly.
   B. The procedure provided in this section allows for the removal of the major portion of the drum and shaft assembly as a unit, including the drums, shafts, and support bracket. Removal of this entire unit is necessary if replacement of the lower thrust shaft bearing support bracket or access to the wing front spar is required. The entire unit may also be removed if replacement of shaft bearings is to be performed away from the airplane.
   C. It is anticipated that replacement of shaft bearings will be the primary maintenance required on the drum and shaft assembly. The assembly is designed to permit shaft-bearing replacement on the airplane. Should only bearing replacement be desired, refer to 76-11-41 for the start shaft, 76-11-51 for the thrust shaft, and 76-11-61 for the thrust reverser follow-up shaft. These sections provide removal/installation procedures for the respective shafts, during which bearing replacement may be performed.
   D. Removal of the drum and shaft assembly is accomplished by removing some of the cranks and hardware beneath the firewall, unbolting the support bracket from the wing front spar, and lifting the major portion of the assembly out thru the access opening in the wing leading edge.
   E. The illustrations accompanying this procedure show the No. 1 engine drum and shaft assembly. The No. 2 engine drum and shaft assembly is similar and the procedure is valid for both installations.
2. Prepare to Remove Engine Control Drum and Shaft Assembly
   A. Remove the following access door in wing leading edge above wing-to-engine fairing (Ref Chapter 12, Access Doors and Panels).
      (1) No. 6301 in left wing
      (2) No. 6401 in right wing
   B. Extend flaps and install leading edge flap locks (Ref 27-81-0 MP).

      WARNING: REFER TO 27-81-0 MP FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

   C. Clamp appropriate thrust lever against aft stop on control stand.
   D. Clamp appropriate start lever in CUTOFF position.
   E. Gaining access thru extended leading edge flaps, remove turnbuckle-locking clips of two thrust cables and two start cables of applicable engine in wing leading edge. Loosen the four engine control cables using the turnbuckles.

3. Remove Engine Control Drum and Shaft Assembly
   A. Remove four cable end fitting cotter pins (35) from engine start and thrust drums (Fig. 401). Remove and tag cables to identify function and location. Remove cable guards (11) as required to free cables.
   B. Deleted.
   C. Depressurize thrust reverser hydraulic system. Disconnect hydraulic lines (7) connecting to thrust reverser directional valve.
   D. Remove locknut (24) and washer (25) retaining follow-up crank (26).
   E. Push follow-up crank (26) down off splined portion of thrust reverser follow-up shaft (32) and swing crank out of way.

      NOTE: Spacer (27) will fall free when follow-up crank (26) is removed from follow-up shaft (32).

   F. Remove three screws, washers, and locknuts (28, 29) securing cover plate(30) to firewall and remove cover plate and spacer (30A).
   G. Remove washers and locknuts securing push-pull cable brackets to support bracket studs (13). Rotate engine thrust crank (17) and start crank (23)to disengage push-pull cables from support bracket studs.

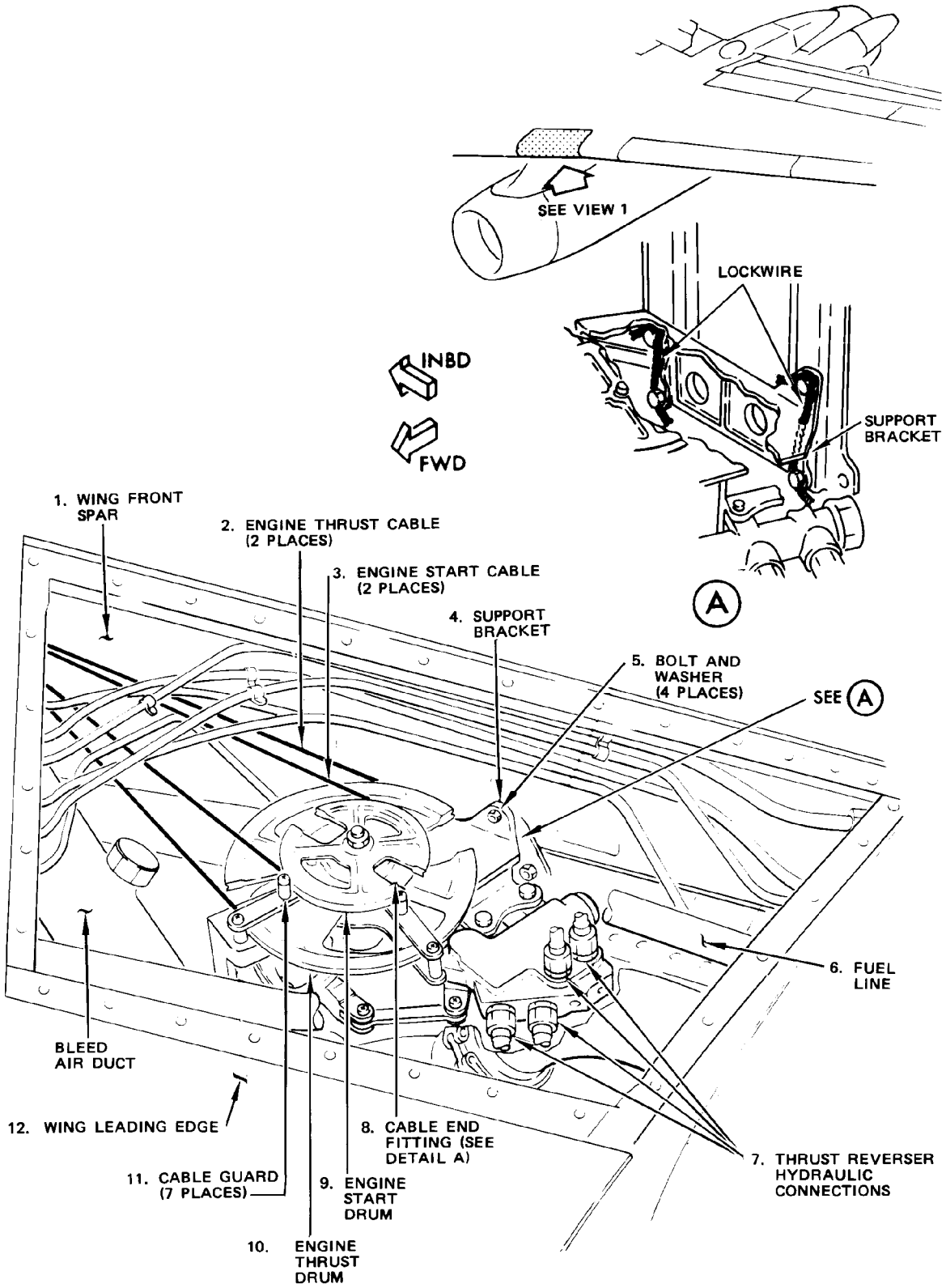
      NOTE: Thrust reverser follow-up shaft lower bearing (31) may fall free when coverplate (30) and spacer (30A) are removed. If bearing is loose on shaft, remove to prevent falling out during removal of drum and shaft assembly.

   H. Remove locknut (23) and washer (22) retaining engine start crank (21) and remove start crank from engine start shaft (33). Spacer (20) above start crank will fall free when start crank is removed.
   I. Cut lockwire and remove nut (19) and washer (18) from engine thrust shaft (34). Remove engine thrust crank (17) from thrust shaft.
   J. Remove five screws , washers, and locknuts (15, 16) securing lower support bracket (14) to firewall and remove bracket.
   K. Remove lockwire, four bolts and washers (5) attaching support bracket (4) to wing front spar.
   L. Grasp drum and shaft assembly by the support bracket and carefully lift assembly out of airplane.
4. Install Engine Control Drum and Shaft Assembly
   A. This installation procedure assumes the drum and shaft assembly was removed using the preceding removal procedure. Thus the assembly will consist of the engine thrust and start shafts and the thrust reverser follow-up shaft installed in the support bracket less only the components installed beneath the strut firewall. The thrust reverser directional valve should be installed.
   B. Position drum-and-shaft assembly over strut firewall at wing front spar. Thrust reverser follow-up shaft should be forward.

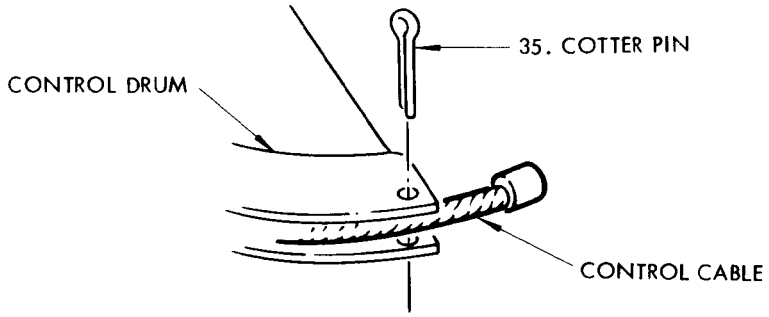
C. Carefully lower drum and shaft assembly through two holes in strut firewall.
D. Secure support bracket (4) to wing front spar using four attaching bolts and washers (5). Install lockwire on bolts through support bracket lockwire holes.
E. Position spacer (30A) and coverplate (30) on reverser follow-up shaft (32) with coverplate against strut lower firewall surface. Insert three screws through support bracket, strut firewall, and coverplate and secure with washers and locknuts (28, 29).

NOTE: The thrust reverser follow-up shaft lower bearing (31), if removed during drum and shaft assembly removal, must be installed on thrust reverser follow-up shaft prior to installation of spacer and coverplate.

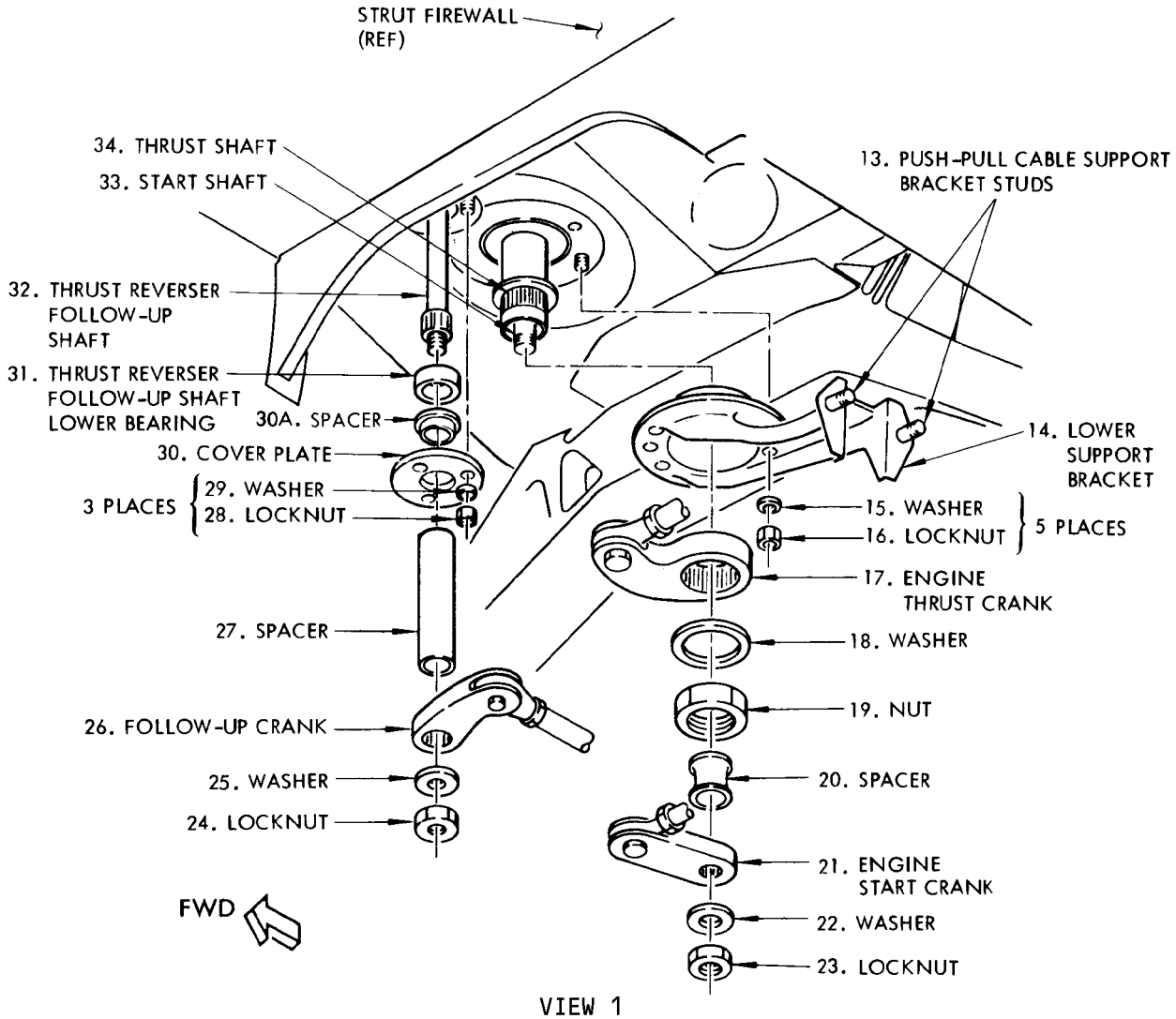
F. Position lower support bracket (14) on strut lower firewall around engine start and thrust shafts. Insert five screws through support bracket, strut firewall, and low support bracket and secure with washers and locknuts (15, 16).
G. Position engine thrust push-pull cable bracket over push-pull cable support bracket studs (13).
H. Position engine thrust crank (17) on splined portion of engine thrust shaft (34) with indexing (wide) tooth and valley mated.
I. Retain thrust crank using washer (18) and nut (19). Tighten nut to 200 to 500 pound-inches and lockwire to thrust crank (17).
J. Position engine start push-pull cable bracket over push-pull cable support bracket studs (13).
K. Place spacer (20) on lower end of engine start shaft (33).
L. Position engine start crank (21) on splined portion of start shaft (33) with indexing (wide) tooth and valley mated.
M. Retain spacer (20) and start crank (21) on start shaft using washer (22) and locknut (23). Tighten locknut to 100 to 140 pound-inches.
N. Position spacer (27) on lower end of thrust reverser follow-up shaft (32).
O. Position follow-up crank (26) on splined portion of follow-up shaft (32) with indexing (wide) tooth and valley mated.
P. Retain spacer (27) and follow-up crank (26) on follow-up shaft using washer (25) and lock- nut (24). Tighten locknut to 100 to 140 pound-inches.
Q. Secure engine push-pull cable brackets to push-pull cable support bracket studs (13) using two washers and locknuts.
R. Connect hydraulic lines (7) to thrust reverser directional valve.
S. Install four engine control cables on their respective drums using new cotter pins (35) to retain cables (detail A). Remove identification tags from cables and install removed cable guards (11).



Control Drum and Shaft Assembly Installation
Figure 401 (Sheet 1)



DETAIL A



VIEW 1

Control Drum and Shaft Assembly Installation
Figure 401 (Sheet 2)

T. Adjust and test engine control system for applicable engine (Ref 76-11-0, Adjustment/Test).

5. Restore Airplane to Normal Configuration
   A. Install access door No. 6301 or 6401 in wing leading edge above wing-to-engine fairing (Ref Chapter 12, Access Doors and Panels).
   B. Unclamp start and thrust levers on control stand.
   C. Ensure that turnbuckle locking clips are installed in four control cable turnbuckles located in wing leading edge.
   D. Remove leading edge flap locks (Ref 27-81-0 MP).

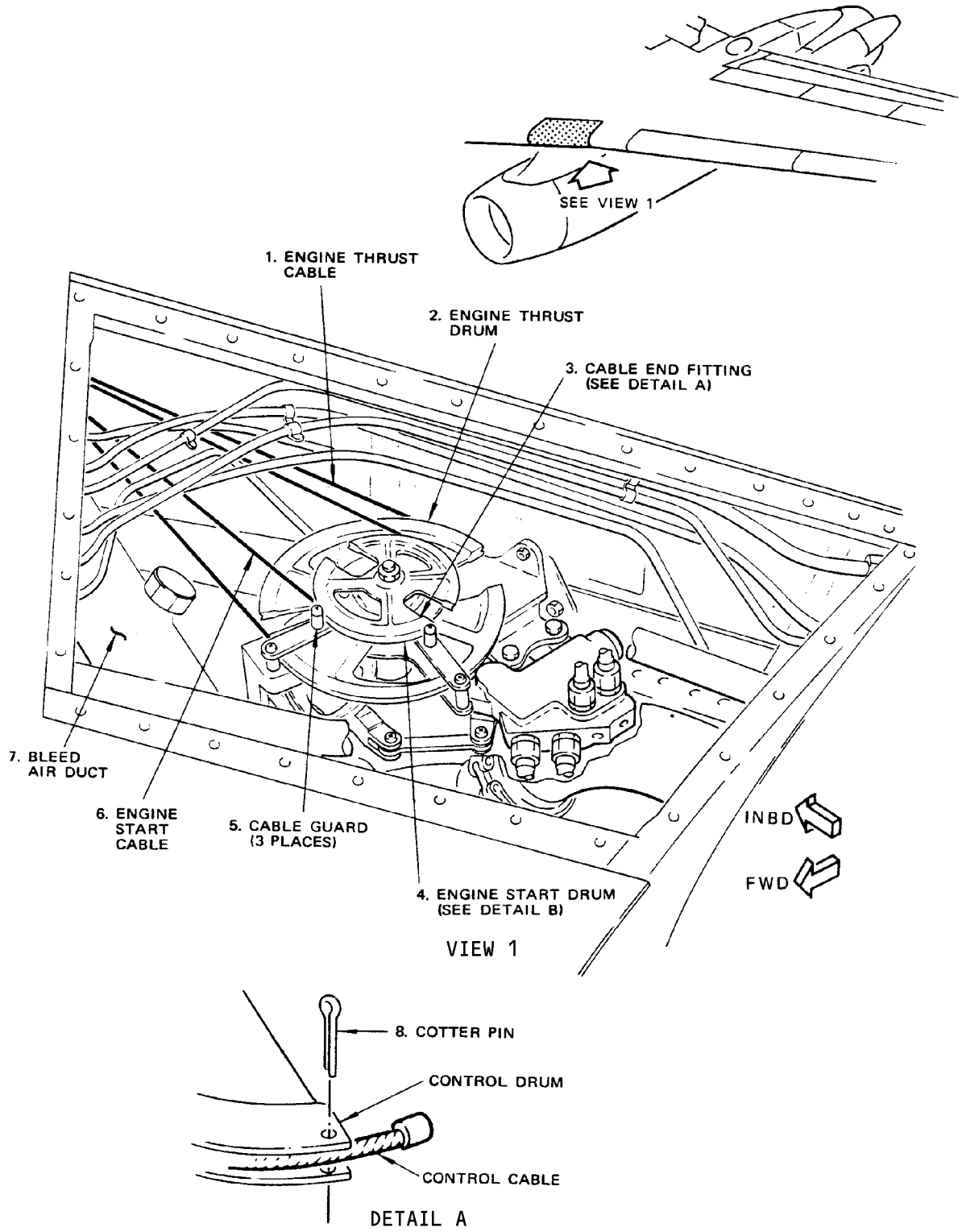
      WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

ENGINE START SHAFT - REMOVAL/INSTALLATION

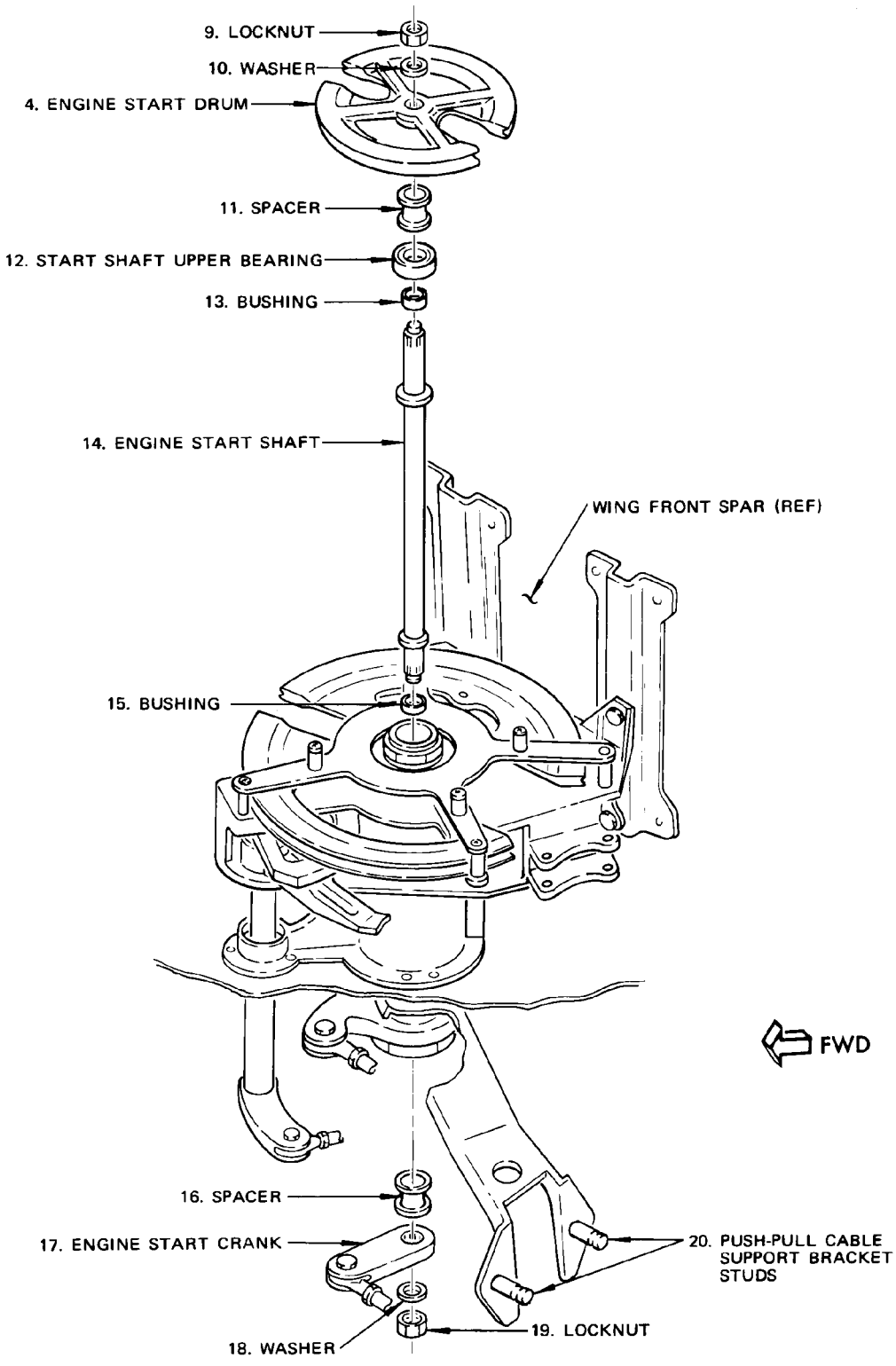
1. General
   A. The engine start shaft may be removed from the control drum and shaft assembly by removing the engine start crank from the start shaft below the strut firewall, and then lifting the start shaft out thru the top of the drum and shaft assembly. The engine need not be removed for this procedure.
   B. Replacement of shaft bearings is anticipated to be the primary maintenance required on this component. Following start shaft removal, the bearings may be examined for condition, and if necessary, replaced prior to shaft reinstallation.
2. Prepare to Remove Engine Start Shaft
   A. Remove following access door in wing leading edge above wing-to-engine fairing (Ref Chapter 12, Access Doors and Panels).
      (1) No. 6301 in left wing
      (2) No. 6401 in right wing
   B. Remove side cowl panels.
   C. Remove fixed fairing (AMM 71-11-21/401).
   D. Extend flaps and install leading edge flap locks (Ref 27-81-0 MP).

      WARNING: REFER TO 27-81-0 MP FOR LOCK INSTALLATION PROCEDURE. FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

   E. Clamp appropriate start lever in CUTOFF position.
   F. Gaining access thru extended leading edge flaps, remove turnbuckle-locking clips of two start cables of applicable engine in wing leading edge. Loosen two start control cables using the turnbuckles.
3. Remove Engine Start Shaft
   A. Remove two start cable end fitting cotter pins (8, figure 401) from engine start drum (4). Remove and tag cables to identify function and location. Remove cable guards (5) as required to free cables.
   B. Remove washers and locknuts securing push-pull cable brackets to support bracket studs (20).
   C. Remove locknut (19) and washer (18) retaining engine start crank (17) and remove start crank from engine start shaft (14). Spacer (16) above start crank will fall free when start crank is removed.
   D. Remove locknut (9) and washer (10) securing engine start drum (4) to engine start shaft (14) and remove drum.
   E. Remove spacer (11) from engine start shaft (14).
   F. Push up on engine start shaft (14) from below until start shaft upper bearing (12) clears engine thrust shaft and remove engine start shaft. Remove upper bearing (12).
   G. If desired, start shaft bushings (13,15) may be removed or replaced while the start shaft is removed.



Engine Start Shaft Installation
Figure 401 (Sheet 1)



DETAIL B

Engine Start Shaft Installation
Figure 401 (Sheet 2)

H. To remove start shaft lower bearing, the following procedure may be used, (optional).
   (1) Remove start shaft lower bearing retaining nut from position inside lower end of thrust shaft using a spanner wrench.
   (2) Insert start shaft down thru thrust shaft and push start shaft lower bearing out bottom of thrust shaft.

4. Install Engine Start Shaft
   A. If start shaft lower bearing is not installed in lower end of engine thrust shaft, install it as follows:
      (1) Push start shaft lower bearing up into lower portion of engine thrust shaft.
      (2) Retain start shaft lower bearing by installing start shaft lower bearing retaining nut. Tighten nut with spanner wrench.
   B. Check that start shaft bushings (13, 15) are installed on engine start shaft (14) before installing start shaft.
   C. Insert engine start shaft (14) down thru open upper end of engine thrust shaft.
   D. Install start shaft upper bearing (12) and spacer (11) on upper end of start shaft (14). Use spacer to push bearing (12) down over bushing (13).
   E. Install engine start drum (4) on splined upper portion of engine start shaft (14) with indexing (wide) tooth and valley mated.
   F. Secure start drum using washer (10) and locknut (9). Tighten locknut to torque of 100 to 140 pound-inches.
   G. Position engine start push-pull cable bracket over push-pull cable support bracket studs (20).
   H. Place spacer (16) on lower end of engine start shaft (14).
   I. Position engine start crank (17) on splined lower portion of start shaft (14) with indexing (wide) tooth and valley mated.
   J. Retain spacer (16) and start crank (17) on start shaft (14) using washer (18) and locknut (19). Tighten locknut to torque of 100 to 140 pound-inches.
   K. Secure engine push-pull cable brackets to push-pull cable support bracket studs (20) using two washers and locknuts.
   L. Install two engine start control cables on engine start drum using new cotter pins (8) to retain cables. Remove identification tags and install removed cable guards (5).
   M. Adjust and test engine start control system for applicable engine (Ref 76-11-0, Adjustment/Test).

5. Restore Airplane to Normal Configuration
   A. Install access door No. 6301 or 6401 in wing leading edge above wing-to-engine fairing (Ref Chapter 12, Access Doors and Panels).

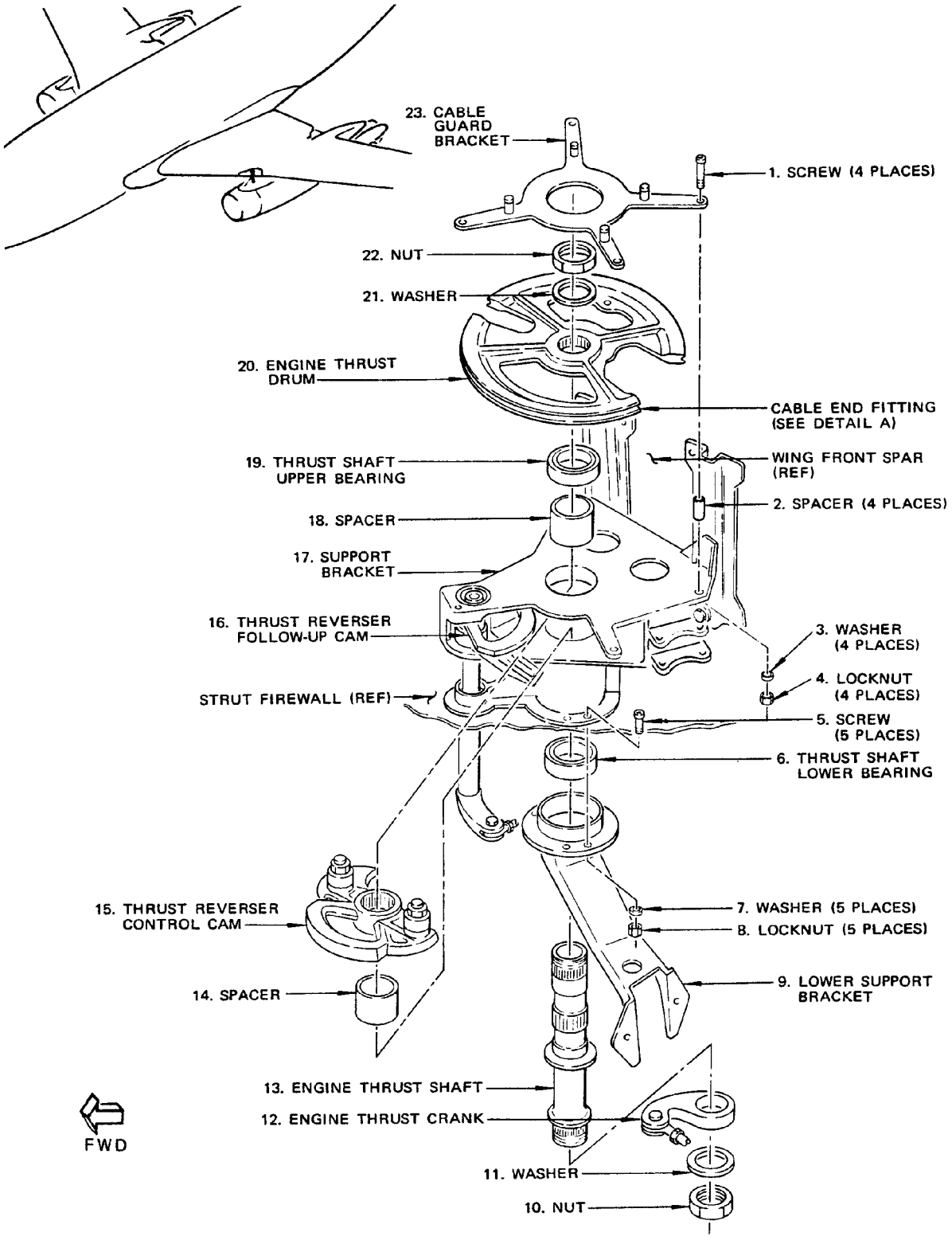
B. Remove leading edge flap locks and retract flaps (AMM 27-81-0/201).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

C. Install fixed fairing (Chapter 71, Fixed Fairings).
D. Install side cowl panels.

ENGINE THRUST SHAFT - REMOVAL/INSTALLATION

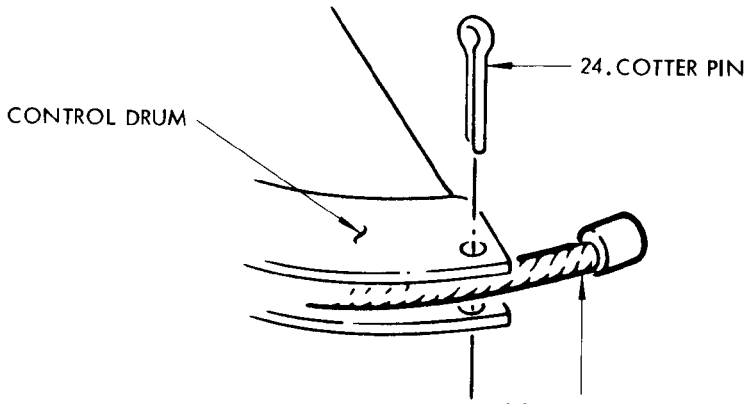
1. General
   A. The engine thrust shaft transmits engine control cable motion thru the strut firewall to the engine thrust push-pull cable. Prior to the removal of the engine thrust shaft, the engine start shaft must be removed. This procedure is given in 76-11-41, Removal/Installation. Following removal of the engine start shaft, the cable guard assembly and engine thrust drum are removed from the upper part of the control drum and shaft assembly. The thrust shaft is then worked down thru the drum and shaft assembly. This procedure may require prior removal of the power plant to assist thrust shaft removal.
   B. Replacement of shaft bearings is anticipated to be the primary maintenance required on the engine thrust shaft. Following thrust shaft removal, the bearings may be examined for condition, and if necessary, replaced prior to shaft reinstallation.
2. Prepare to Remove Engine Thrust Shaft
   A. Remove engine start shaft (Ref 76-11-41, Removal/Installation).
   B. Clamp appropriate thrust lever against aft stop on control stand.
   C. Remove power plant, if required to assist thrust shaft removal (Ref Chapter 71, Power Plant).
   D. Gaining access thru extended leading edge flaps, remove turnbuckle locking clips of two thrust cables of applicable engine in wing leading edge. Loosen two thrust control cables using the turnbuckles.
3. Remove Engine Thrust Shaft
   A. Remove four screws (1), spacers (2), washers (3) and locknuts (4) securing cable guard bracket (23) to support bracket (17) (Fig. 401).
   B. Remove two thrust cable end fitting cotter pins (24) from engine thrust drum (20). Remove and tag cables to identify function and location.
   C. Cut lockwire and remove nut (10) and washer (11) from lower end of engine thrust shaft (13). Remove engine thrust crank (12) from thrust shaft.
   D. Cut lockwire and remove nut (22) and washer (21) from upper end of engine thrust shaft (13). Remove engine thrust drum (20) from thrust shaft.
   E. Remove thrust shaft upper bearing (19) and spacer (18).
   F. Remove five screws (5), washers (7), and locknuts (8) securing lower support bracket (9) to firewall and remove bracket.
   G. Carefully pull engine thrust shaft (13) down thru support bracket (17). As shaft moves down thru support bracket, remove thrust reverser control cam (15) as it is pushed off the shaft upper end.
   H. Push down on spacer (14) and remove spacer (14) and thrust shaft lower bearing (6).
4. Install Engine Thrust Shaft
   A. Install thrust shaft lower bearing (6) down on thrust shaft (13) shoulder. Install spacer (14) on thrust shaft (13) above bearing (6).



Engine Thrust Shaft Installation
Figure 401 (Sheet 1)

B. Position thrust reverser control cam (15) over shaft opening on lower portion of support bracket (17). Control cam (15) should be below thrust reverser follow-up crank (16).
C. Slowly insert thrust shaft (13) up thru support bracket (17) and thrust reverser control cam (15) with indexing (wide) tooth and valley mated.
D. Push thrust shaft up until lower bearing seats against flange in support bracket.
E. Install spacer (18) and thrust shaft upper bearing (19) on thrust shaft (13) above thrust reverser control cam (15).
F. Install engine thrust drum (20) on engine thrust shaft (13) with indexing (wide) tooth and valley mated.
G. Secure thrust drum using washer (21) and nut (22). Tighten nut to torque of 200 to 500 pound-inches and lockwire to thrust drum (20).
H. Position lower support bracket (9) on strut lower firewall over engine thrust shaft. Insert five screws (5) thru support bracket, strut firewall, and lower support bracket and secure with washers (7) and locknuts (8).
I. Position engine thrust push-pull cable bracket over push-pull cable support bracket studs.
J. Position engine thrust crank (12) on splined lower portion of engine thrust shaft (13) with indexing (wide) tooth and valley mated.
K. Retain thrust crank (12) using washer (1) and nut (10). Tighten nut to torque of 200 to 500 pound-inches.
L. Check endplay of thrust shaft; maximum allowable endplay is 0.061 inch.
M. Lockwire nut (10) to thrust crank (12).
N. Install two engine thrust control cables on engine thrust drum using new cotter pins (24) to retain cables. Remove identification tags.
O. Install cable guard bracket (23) using four screws (1), spacers (2), washers (3), and locknuts (4).
P. Install engine start shaft (Ref 76-11-41, Removal/Installation).
Q. Install power plant, if removed (Ref Chapter 71, Power Plant).
R. Adjust and test engine thrust control system for applicable engine (Ref 76-11-0 A/T).

5. Restore Airplane to Normal Configuration
A. Install access door No. 6301 or 6401 in wing leading edge above wing-to-engine fairing (Ref Chapter 12, Access Doors and Panels).
B. Install fixed fairing (Chapter 71, Fixed Fairings).
C. Install side cowl panels.



DETAIL A

Engine Thrust Shaft Installation
Figure 401 (Sheet 2)

THRUST REVERSER FOLLOW-UP SHAFT - REMOVAL/INSTALLATION

1. Prepare to Remove Thrust Reverser Follow-up Shaft
   A. Remove the following access door in wing leading edge above wing -to-engine fairing (Ref Chapter 12, Access Doors and Panels).
      (1) No. 6301 in left wing
      (2) No. 6401 in right wing
   B. Extend flaps and install leading edge flap locks (Ref 27-81-0 MP).

      WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

   C. Clamp appropriate thrust lever against aft stop on control stand.
   D. Clamp appropriate start lever in CUTOFF position.
   E. Gaining access thru extended leading edge flaps, remove turnbuckle-locking clips of two thrust cables and two start cables of applicable engine in wing leading edge. Loosen the four engine control cables using turnbuckles.
2. Remove Thrust Reverser Follow-up Shaft
   A. Remove four cable end fitting cotter pins (13) from engine start and thrust drums (Fig. 401). Remove and tag cables to identify function and location. Remove cable guards (8) as required to free cables.
   B. Deleted.
   C. Remove locknut (14) and washer (15) retaining engine start drum (6) on engine start shaft and remove start drum.
   D. Remove cable guard bracket (9) by removing cable guard screws (16), spacers (17), washers (18) and locknuts (19).
   E. Cut lockwire, and remove nut (46) and washer (45) retaining engine thrust drum (7) on engine thrust shaft and remove thrust drum.
   F. Cut lockwire and remove follow-up shaft upper bearing retaining nut (44) using a spanner wrench.
   G. Remove locknut (31) and washer (30) retaining follow-up crank (29).
   H. Push follow-up crank (29) down off splined portion of thrust reverser follow-up shaft (32) and swing crank out of way.
   I. Remove locknut (43) and washer (42) on top of follow-up shaft (32).
   J. Remove screw (21), spacer (22), and locknut (23) securing directional valve rocker arm (34) to thrust reverser directional valve (20).
   K. Push follow-up shaft up dislodging follow-up shaft upper bearing (41) from seat in support bracket (10). Remove bearing.
   L. Remove three screws (38), washers (26), and locknuts (27) securing cover plate (25) to firewall.

M. Carefully pull down on follow-up shaft (32). As shaft is cleared, remove spacer (40), thrust reverser follow-up cam (39), spacer (37), and directional valve rocker arm (34) with spacer (35), upper bearing (36) and lower bearing (33). If necessary, partially remove support bracket (10) to facilitate part removal procedures. Do not disconnect hydraulic fittings on the hydraulic directional valve (20).

N. Lift shaft (32) out from above holding spacers (24A) and (28) and cover plate (25) to prevent parts from falling when cleared by shaft.

O. Remove follow-up shaft lower bearing (24) from shaft (32).

3. Install Thrust Reverser Follow-up Shaft

A. Position spacer (24A), coverplate (25) and spacer (28).

B. Install thrust reverser follow-up shaft lower bearing (24) on lower end of follow-up shaft (32). Seat bearing against flange on follow-up shaft.

C. Lower follow-up shaft (32) down through spacer (24A), cover plate (25) and spacer (28).

D. Install thrust reverser follow-up shaft upper bearing (41) in support bracket (10) and seat against flange.

E. Install follow-up shaft upper bearing retainer nut (44) in support bracket (10) with a spanner wrench. Tighten nut to torque of 200 to 500 pound-inches and lockwire to hole in support bracket.

F. Raise thrust reverser follow-up shaft (32) into bottom of support bracket (10). Carefully place following components on follow-up shaft as it is inserted between middle and upper parts of support bracket. Follow order given.

(1) Directional valve rocker arm lower bearing (33)
(2) Directional valve rocker arm (34)
(3) Spacer (35)
(4) Directional valve rocker arm upper bearing (36)
(5) Spacer (37)
(6) Thrust reverser follow-up cam (39)
(7) Spacer (40)

G. Install support bracket (10) if partially removed in step 2.M. Install lockwire on airplanes with bolts and support bracket drilled for lockwire.

H. Carefully raise follow-up shaft until its top is just inserted into thrust reverser follow-up shaft upper bearing (41).

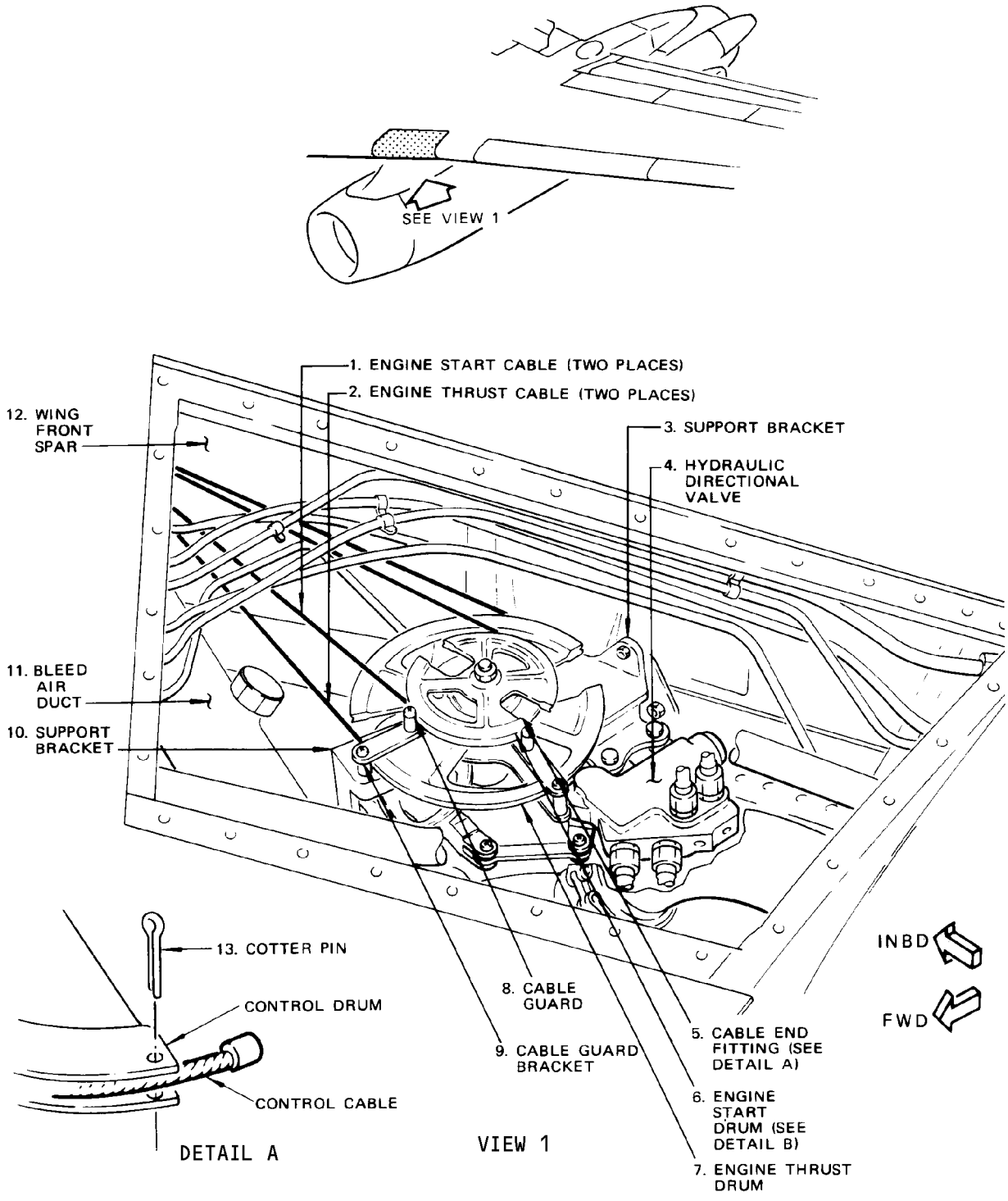
I. Push directional valve rocker arm lower bearing (33) down on follow-up shaft until it is seated against shaft flange then push directional valve rocker arm (34) down until seated on lower bearing (33).

J. Push spacer (35) and directional valve rocker arm upper bearing (36) down follow-up shaft (32) and seat firmly within rocker arm (34).

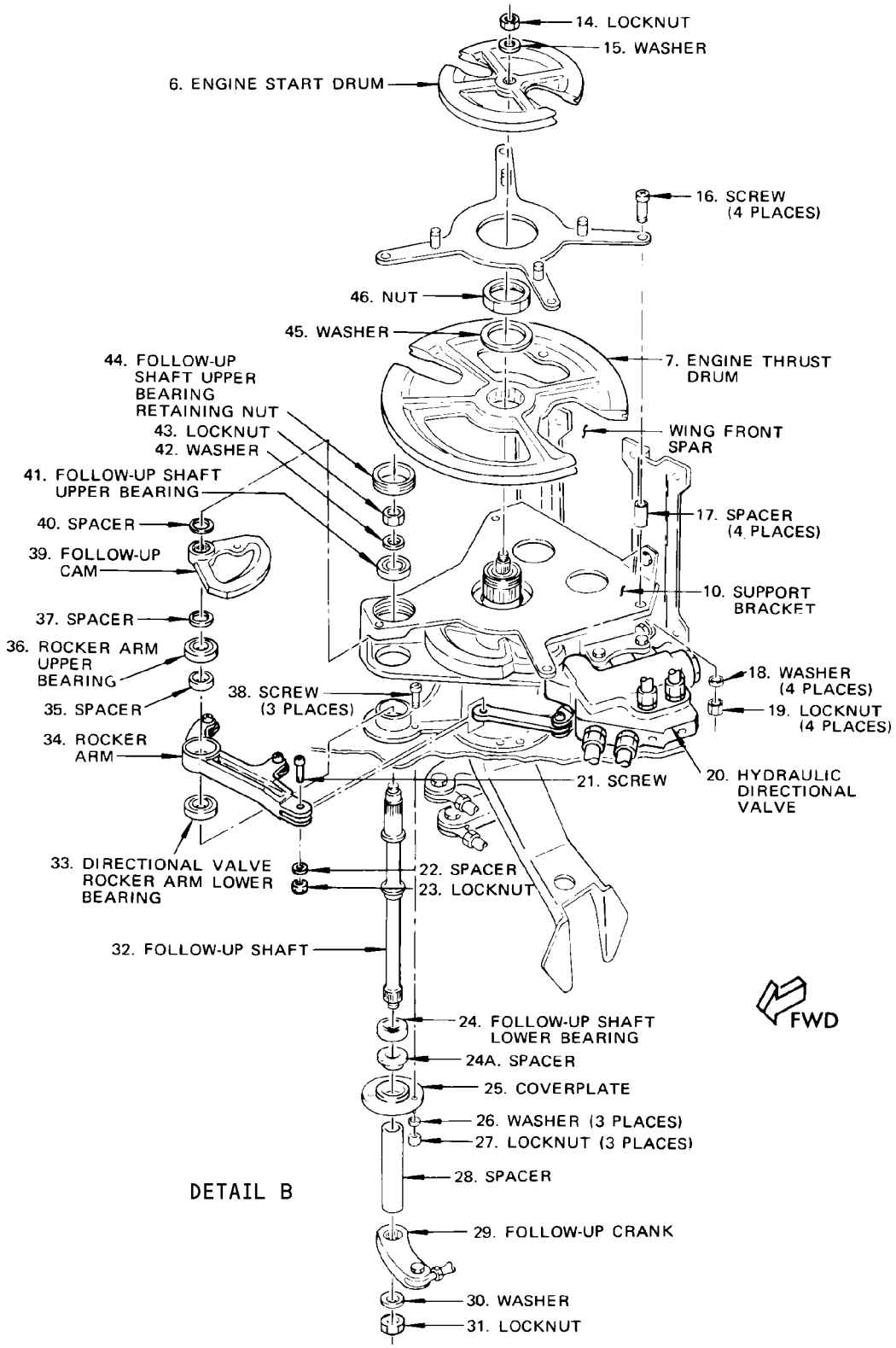
K. Push spacer (37) down and seat against directional valve rocker arm upper bearing (36).

L. Seat thrust reverser follow-up cam (39) against spacer (37) with indexing (wide) tooth and valley mated.

M. Seat spacer (40) against thrust reverser follow-up cam (39).



Thrust Reverser Follow-Up Shaft Installation
Figure 401 (Sheet 1)



Thrust Reverser Follow-Up Shaft Installation
Figure 401 (Sheet 2)

N. Push follow-up shaft upward until spacer (40) seats against follow-up shaft upper bearing (41). Retain follow-up shaft by installing washer (42) and locknut (43). Tighten locknut to torque of 100 to 140 pound-inches.
O. Position spacer (24A) and cover plate (25) on reverser follow-up shaft (32) with cover plate against strut lower firewall surface. Insert three screws (38) through support bracket, strut firewall, and cover plate and secure with washers (26) and locknuts (27).
P. Position follow-up crank (29) on splined portion of follow-up shaft (32) with indexing (wide) tooth and valley mated.
Q. Secure spacer (28) and follow-up crank (29) on follow-up shaft using washer (30) and locknut (31). Tighten locknut to 100 to 140 pound-inches.
R. Secure directional valve rocker arm (34) to thrust reverser directional valve (20) using screw (21), spacer(s) (22), and locknut (23). Tighten locknut to torque of 40 to 50 pound-inches.
S. Install engine thrust drum (7) on engine thrust shaft with indexing (wide) tooth and valley mated.
T. Secure engine thrust drum (7) to thrust shaft using washer (45) and nut (46). Tighten nut to torque of 200 to 500 pound-inches and lockwire to thrust drum (7).
U. Install engine control cables (2) on engine thrust drum (7) using new cotter pins (13) to retain cables. Remove identification tags from cables.
V. Install cable guard bracket (9) using four screws (16), spacers (17), washers (18) and locknuts (19). Check that all three start drum cable guards are installed before installing bracket.
W. Install two engine start control cables on engine start drum (6) using new cotter pins (13) to retain cables. Align start drum (6) with start shaft splining prior to installing cables. Remove identification tags from cables.
X. Install engine start drum (6) with start cables installed on engine start shaft with indexing (wide) tooth and valley mated.
Y. Secure engine start drum (6) using washer (15) and locknut (14). Tighten locknut to torque of 100 to 140 pound-inches.
Z. Adjust and test engine control system for applicable engine (Ref 76-11-0, Adjustment/Test).

4. Restore Airplane to Normal Configuration
A. Install access door No. 6301 or 6401 in wing leading edge above wing-to-engine fairing (Ref Chapter 12, Access Doors and Panels).
B. Remove leading edge flap locks (Ref 27-81-0 MP).

WARNING: LEADING EDGE FLAPS ARE FAST ACTING AND CAN CAUSE SERIOUS INJURY TO PERSONNEL.

START LEVERS - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Tensiometer - 0- to 125-pound capacity
   B. Rig Pin Kit - F70207-3, -52 or -61
      (1) SB-1 - F70207-11, 0.311 + .000/-0.002-inch diameter rod
   C. C-Clamps - as required
   D. Dowel Set - Thrust Lever, Control Stand - F80195-1 or Dowel, Thrust Lever Control Stand - SE76-1004 (2 required)
2. Prepare for Start Levers Removal
   A. Depressurize hydraulic systems A and B.
      (1) Provide electrical power.
      (2) On forward overhead panel, position switches as follows:
         (a) Hydraulic system A ENG 1 and ENG 2 pump switches to OFF.
         (b) Hydraulic system B ELEC 1 and ELEC 2 pump switches to OFF.
      (3) Open circuit breakers as follows:
         (a) Pump B on P6-11 panel
         (b) Pump B on P6-12 panel
         (c) Hydraulic pump depressurize valve on P6 panel
      (4) On forward overhead panel, position GRD INTERCONNECT switch to OPEN.
      (5) If no longer required, remove electrical power from airplane.
   B. Place thrust levers in IDLE and start levers in CUTOFF and clamp cables.
   C. Open lower nose compartment access door.
   D. Relieve tension on flap control cables WFA and WFB by loosening turnbuckles in lower nose compartment (Fig. 406).
   E. Install speed brake system rigging pin SB-1 through forward speed brake control drum into structure (Fig. 408).
   F. Relieve tension on stabilizer trim chain assembly by adjusting forward and aft support links to raise forward mechanism in lower nose compartment (Fig. 405).
   G. Open electronics equipment access door 1201.
   H. Relieve tension on thrust control cables T1A, T1B, T2A, and T2B. Use turnbuckles located in electronics equipment compartment (Fig. 407).
   I. Relieve tension on all engine start control cables. Disconnect and tag cables for start drums as applicable for start levers being removed.
3. Remove Start Levers
   A. Remove left stabilizer trim control wheel tie rod nut (1, Fig. 404).
   B. Pull stabilizer trim control wheel tie rod (8) from stabilizer trim control wheel shaft.
   C. Remove right stabilizer trim control wheel (7) from stabilizer trim control wheel shaft (2).
   D. Remove both left and right upper side door (6).
   E. Remove lower right access panel (10).
   F. Disconnect stabilizer trim cutout switches (9).
   G. Cut lockwire and remove right control shaft nut (5).
   H. Remove forward electronic units (16) from aft electronic panel.

I. Remove start lever detents (10, Fig. 403) for No. 1 and 2 engine start levers.
J. Remove forward and aft cover tie straps (4 and 2).
K. Remove forward and aft cover angles (6 and 8).
L. Remove horn cutout switch (17, Fig. 404).
M. Remove stabilizer trim warning light cover (15).
N. Lift cover assemblies (5, Fig. 403) from control stand.
O. Remove right control stand frame (4, Fig. 404).
P. Remove key (3) from slot in right control shaft (12).
Q. Replace right control shaft nut (5) on right control shaft (12) to allow removal of spacer, stabilizer trim indicator, spacer and flap handle as a unit.
R. Detach stabilizer trim indicator link (13) from stabilizer trim indicator by removing bolt (14).
S. Remove right control shaft (12) with nut, spacer, trim indicator, spacer, and flap handle as a unit.
T. Rotate left stabilizer trim wheel until connector link (11) in stabilizer trim chain is accessible for removal.
U. Detach connector link and remove chain from sprocket. Secure chain in bottom of control stand.
V. Remove left stabilizer trim control wheel (1, Fig. 403) from stabilizer trim control wheel shaft (7).
W. Remove stabilizer trim control wheel shaft (7) and sprocket from right side of control stand.
X. Cut lockwire and remove left control shaft nut (3) from left control shaft.
Y. Remove left lower access panel.
Z. Remove cotter pin and nut at right end of start drum shaft and remove start drum shaft (4, Fig. 402).

NOTE: Tag positions of spacers as they are removed. All start drums will have to be removed from shaft to facilitate removal of start control rods.

AA. Disconnect start control rod (1) from start drum (3) by removing bolt.
AB. Remove two cotter pins (2) securing cable to drum and remove start drum from control stand.
AC. Using dowel (6, Fig. 401), push left control shaft clear of control stand. Use care to prevent loss of key (9, Fig. 403).

CAUTION: KEY (9, FIG. 403) WILL BE FREE FROM LEFT CONTROL SHAFT AND LEFT FRAME WHEN LEFT CONTROL SHAFT IS DRIVEN FROM CONTROL STAND.

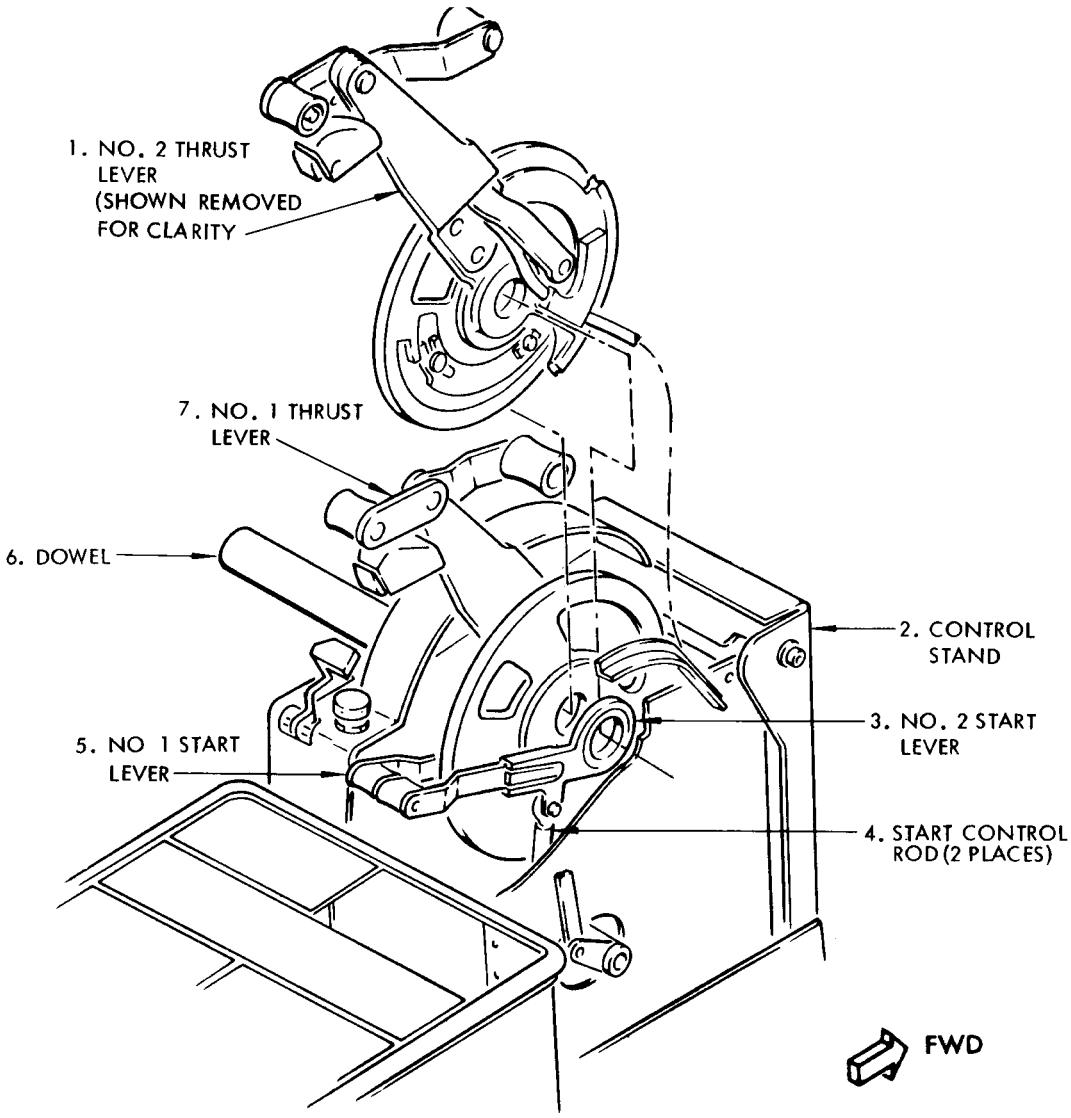
AD. Pull dowel to left until start lever assembly can be lifted from control stand. Use additional dowel from right side of control stand to hold thrust levers and right start lever if left start lever is being removed.

NOTE: Tag position of spacers removed. Position and thickness of spacers may vary in different control stands.

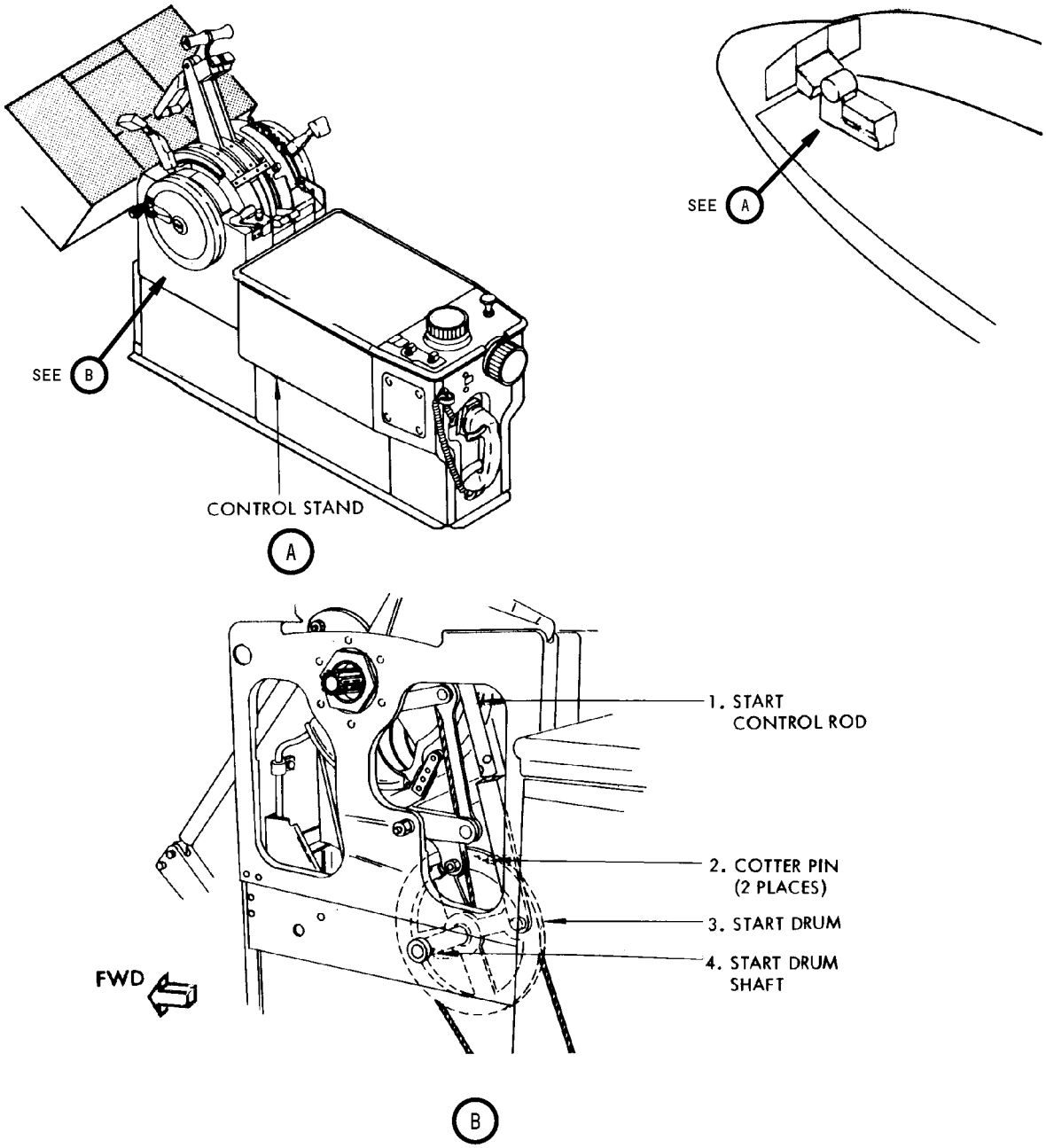
4. Install Start Levers
   A. Install Start Lever and Drum Assembly
      (1) Install start levers and start control rod (3,4, and 5, Fig. 401). Levers are positioned from right to left as follows: large spacer, No. 2 start lever, No. 2 thrust lever, No. 1 thrust lever, No. 1 start lever, speed brake crank with spacer on each side if required, and stabilizer trim indicator with spacer. Each thrust lever also has a spacer. Advance left control shaft from right to left as levers and spacers are positioned.
      (2) Place cable on start drum (3, Fig. 402) and secure at ball with two cotter pins (2).
      (3) Connect start control rod (1) to start drum (3) with thick washer between rod clevis and drum on left side. Secure with washers, nut, and cotter pin.
      (4) Install start drum shaft (4) with spacers and start drums. Secure with nut and cotter pin.
      (5) Install left lower access panel.
   B. Complete installation of left control shaft.
      (1) Push left control shaft against dowel (6, Fig. 401).
      (2) Force dowel to left until clear of control stand by pushing with left control shaft.

      CAUTION: EXERCISE CARE TO PREVENT SPACERS FROM FALLING WHEN DOWEL IS FORCED FROM CONTROL STAND.

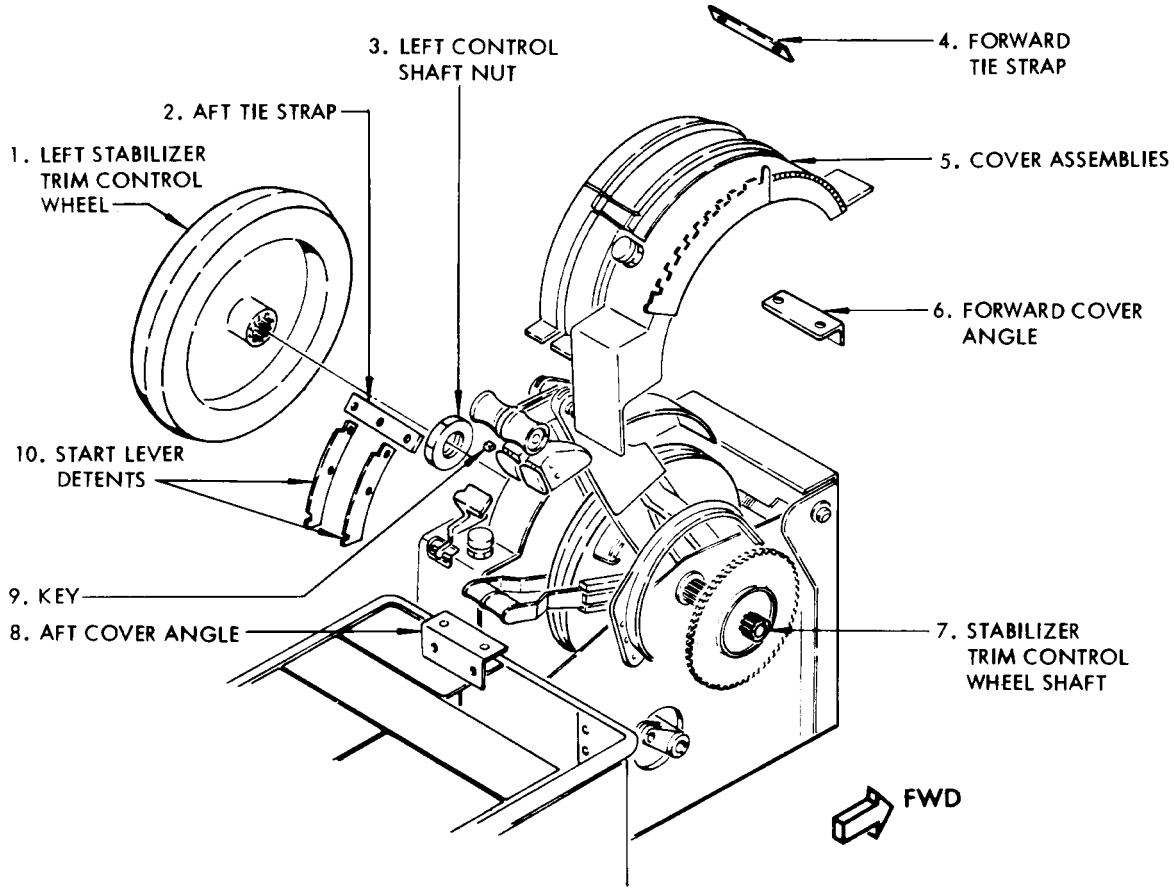
      (3) Left control shaft shall extend 0.25 +0.06/-0.07 inch through left control stand frame.
   C. Insert key (9, Fig 403) in left control shaft and left control stand frame and install left control shaft nut (3). Tighten nut to 200 to 300 pound-inches. Lockwire nut to frame.
   D. Install stabilizer trim control wheel shaft (7, Fig 403) and sprocket in left control shaft. Install with long spacer and bearing at left end.
   E. Place stabilizer trim chain on sprocket and install connector link (11, Fig. 404).
   F. Install left stabilizer trim control wheel (1, Fig. 403) on stabilizer trim control wheel shaft (7).



Start Lever Installation
Figure 401



Control Stand Start Drums Installation
Figure 402

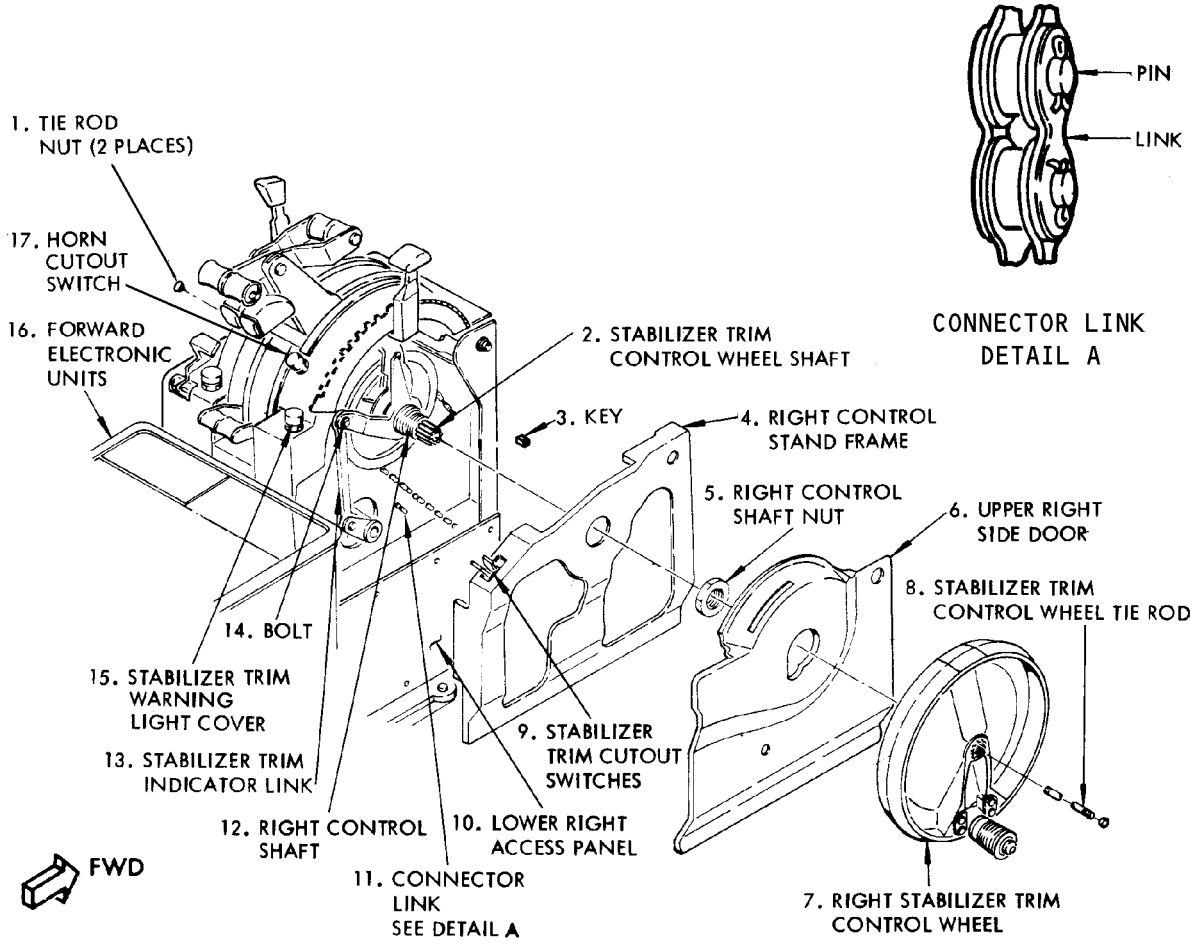


Control Stand Center Components Installation
Figure 403

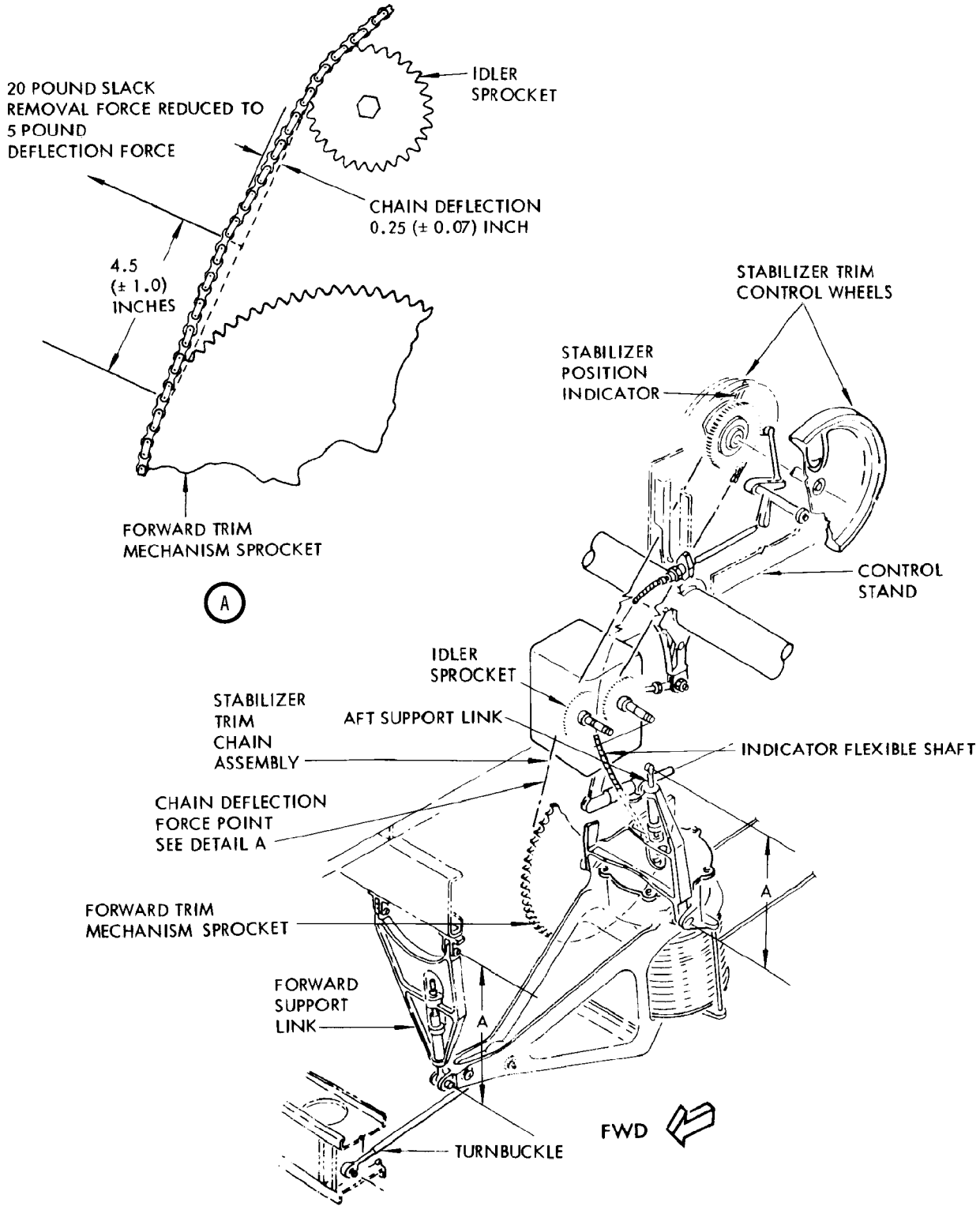
G. Install right control shaft (12, Fig. 404) with levers on stabilizer trim control wheel shaft (2).
   (1) Assemble right control shaft with the cranks arranged from left to right: flap handle, spacer, stabilizer trim indicator, spacer and nut.
   (2) Make sure that spacers are installed between bearings on flap handle.
   (3) Place assembly on stabilizer trim control wheel shaft (2) ensuring two bearings and spacer are properly seated and that the flap switch lever enters the cam on the flap drum.
H. Connect stabilizer trim indicator link (13) to stabilizer trim indicator by installing bolt (14).
I. Remove right control shaft nut (5) from right control shaft (12).
J. Attach right control stand frame (4) to control stand.
K. Connect stabilizer trim cutout switches (9).
L. Install key (3) in right control shaft and right control stand frame.
M. Install right control shaft nut (5) and tighten to 200-300 pound-inches. Lockwire nut to frame.
N. Install cover assemblies (5, Fig. 403) on control stand.
O. Install stabilizer trim warning light cover (15, Fig. 404) on cover assemblies (5, Fig. 403).
P. Install horn cutout switch (17, Fig. 404).
Q. Install forward and aft cover angles (6 and 8, Fig. 403) on control stand and install forward and aft cover tie straps (4 and 2).
R. Install start lever detents (10) for number 1 and 2 engines.
S. Replace forward electronic units (16, Fig. 404) in aft electronics control panel.
T. Install both left and right upper side door (6).
U. Install right stabilizer trim control wheel (7) on stabilizer trim control wheel shaft (2).

NOTE: Handles on stabilizer trim control wheels should be 90 ±15 degrees apart when installed on control stand.

V. Install stabilizer trim control wheel tie rod (8) and secure with tie rod nut (1) at each end.
W. In lower nose compartment, tighten stabilizer trim chain by adjusting support links to lower forward mechanism (Fig. 405). Adjust chain so that after application of a 20-pound force to remove slack, reduction to a 5-pound force will deflect chain 0.25 ±0.07 inch at a point 4.5 ±1.0 inches above the forward tangent of the forward mechanism sprocket. Ensure dimension A of forward and aft support links match within ± 0.06 inch. Make sure that stabilizer trim control wheels rotate freely.
X. Check that stabilizer trim indicator position agrees with position of stabilizer. If out of adjustment, refer to AMM Chapter 27, Horizontal Stabilizer Trim Control System - Adjustment/Test.



Control Stand Accesses Installation
Figure 404



Stabilizer Trim Chain Assembly Adjustment
Figure 405

Y. Adjust flap control cables WFA and WFB.
   (1) Lift flap control lever and clamp so that lever latch is disengaged from detent plate (Fig. 406).
   (2) In lower nose compartment, adjust turnbuckles to tighten flap control cables WFA and WFB to load specified for ambient temperature.
   (3) Install turnbuckle-locking clips.
   (4) Position flap control lever all the way forward and then release lever.
   (5) Make sure that lever springs back to rigging position.
   (6) Remove clamp from flap control lever.
   (7) Make sure that flap lever moves smoothly without binding through full range of travel.
   (8) Position flap control lever in FLAP UP detent.

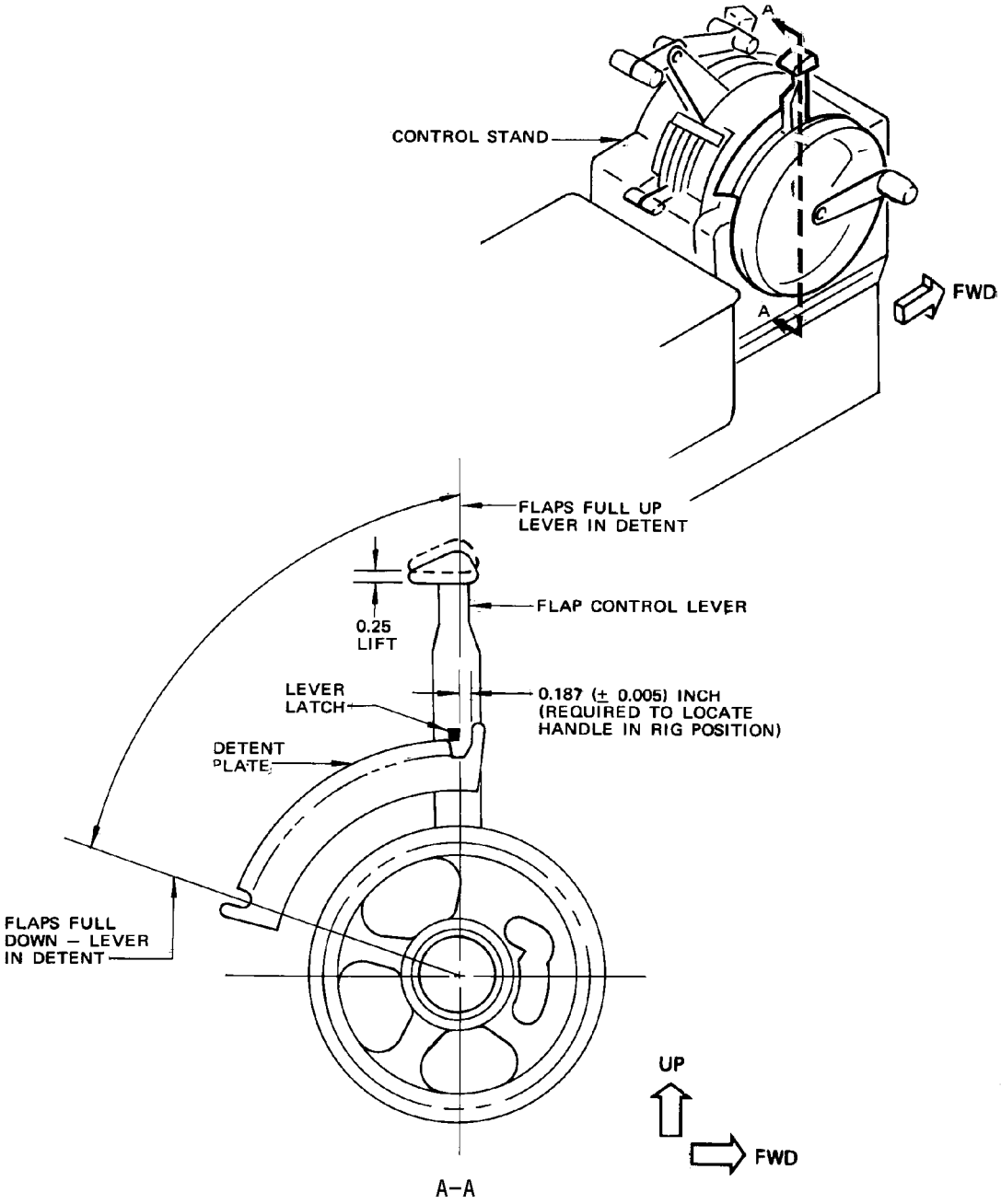
Z. Tighten all thrust control cables by adjusting turnbuckles (Fig. 407). Remove clamps (AMM 76-11-0/501, Engine Control System).

AA. Connect and tighten all engine start control cables (Fig. 407). Remove clamps (AMM 76-11-0/501, Engine Control System).

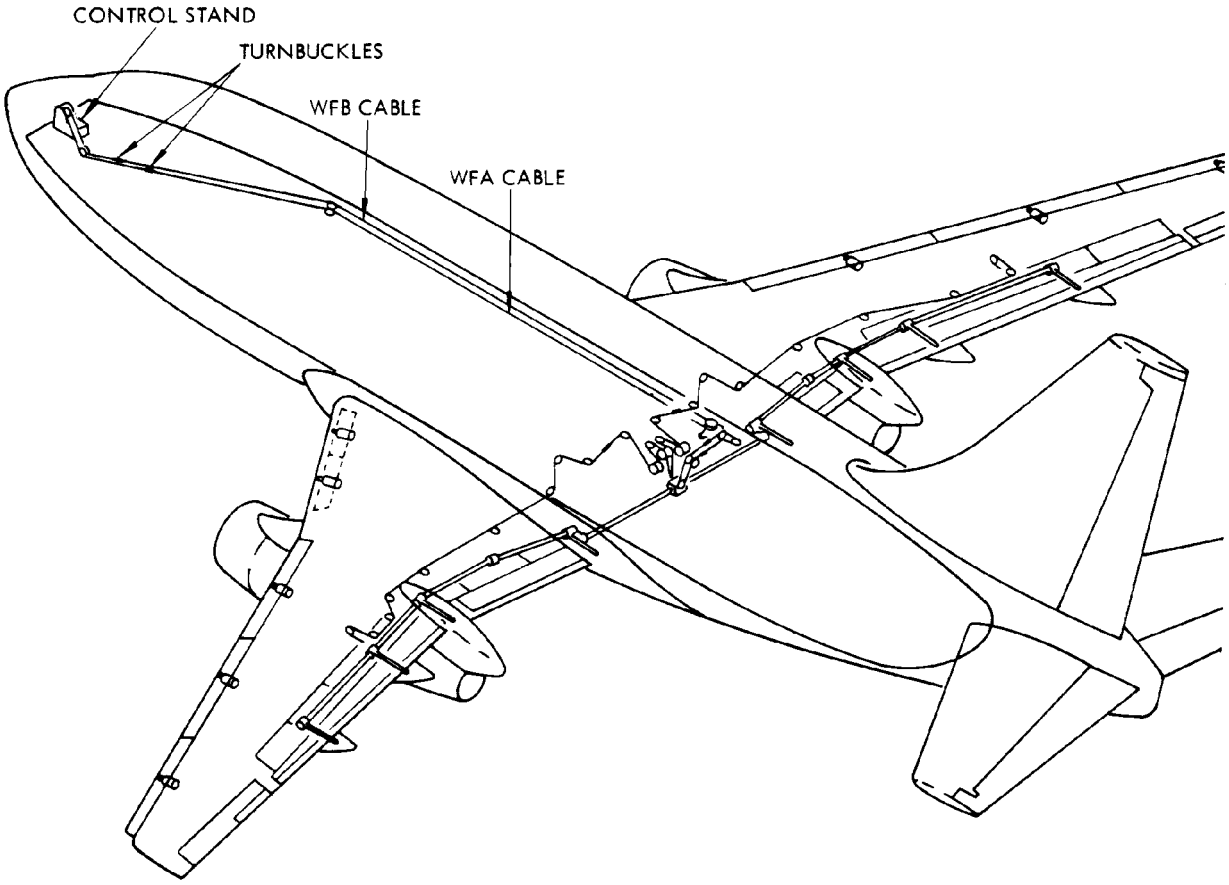
AB. Adjust speed brake control lever.
   (1) Place speed brake control lever in DOWN detent. Make sure that lever latch is in detent on control stand (Fig. 408).
   (2) In lower nose compartment, check that rigging pin SB-1 can be freely installed through speed brake forward drum into structure. If pin cannot be installed freely, accomplish following:
      (a) Disconnect upper end of lower control rod from idler link.
      (b) Loosen checknut and adjust rod end until rod end bolt fits freely with rigging pin SB-1 installed.
      (c) Install rod end bolt with washer under bolthead. Secure bolt with washer and locknut.
      (d) Tighten checknut on rod end.
      (e) Ensure that rod end is visible in inspection hole in control rod.
      (f) Remove rigging pin SB-1.

AC. Close forward nose compartment and electronics equipment access door 1201.

AD. Provide electrical power and perform following:
   (1) On forward overhead panel, position GRD INTERCONNECT switch to CLOSE.
   (2) Close circuit breakers as follows:
      (a) Hydraulic pump depressurize valve on P6 panel.
      (b) Pump B on P6-12 panel.
      (c) Pump B on P6-11 panel.
   (3) On forward overhead panel, position switches as follows:
      (a) Hydraulic system B ELEC 1 and ELEC 2 pump switches to ON.
      (b) Hydraulic system A ENG 1 and ENG 2 pump switches to ON.



Flap Control Lever Rigging
Figure 406 (Sheet 1)



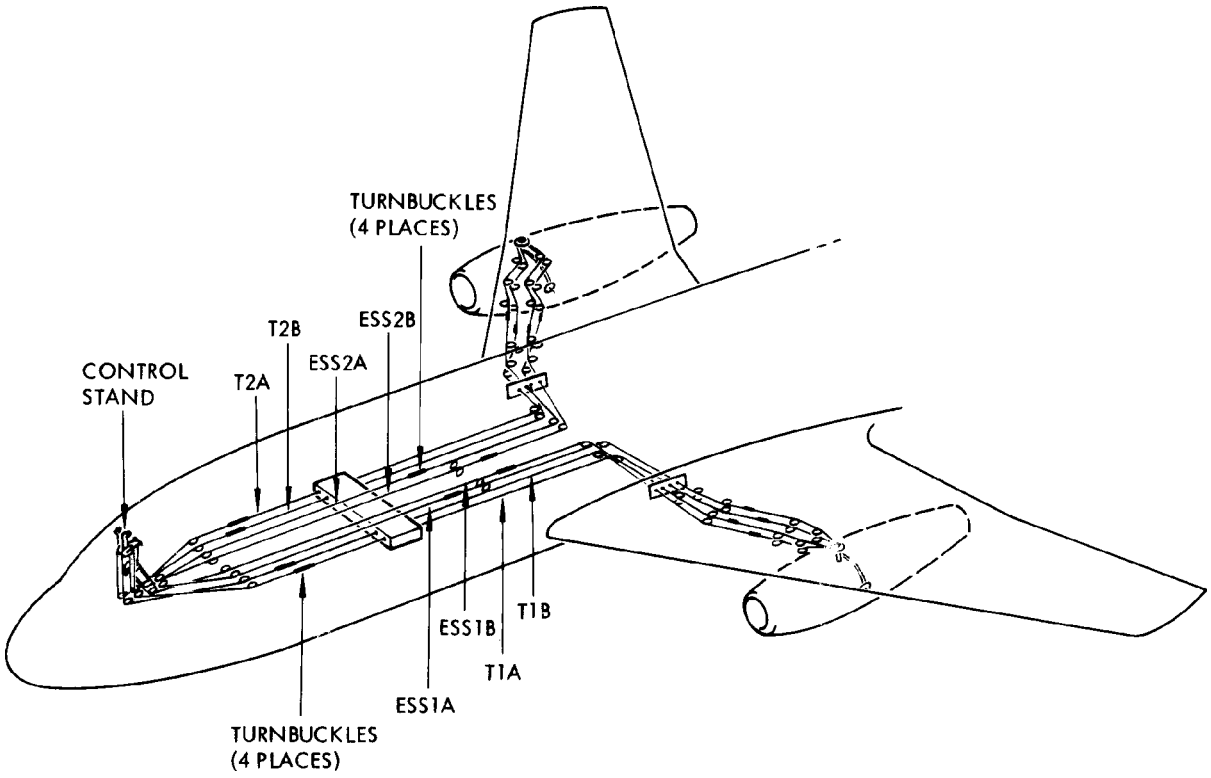
CABLE CODE	FUNCTION
WFA	WING FLAPS UP
WFB	WING FLAPS DOWN

TEMP °F [1]	RIGGING LOAD 1/8 INCH DIA CABLES WFA AND WFB [2]
110	117
90	108
70	100
50	91
30	83
+10	74
-10	65
-30	57
-40	52

[1] TO INSURE THAT PROPER CABLE TENSION IS OBTAINED, ALLOW A MINIMUM OF ONE HOUR AT CONSTANT AMBIENT TEMPERATURE (+5°F) FOR AIRFRAME TEMPERATURE TO STABILIZE.

[2] CABLES MUST BE ADJUSTED WITHIN +10/-0 POUNDS OF THAT SPECIFIED. RE-RIG SYSTEM WHEN CABLE LOADS DEVIATE FROM SPECIFIED VALUE MORE THAN 15 POUNDS.

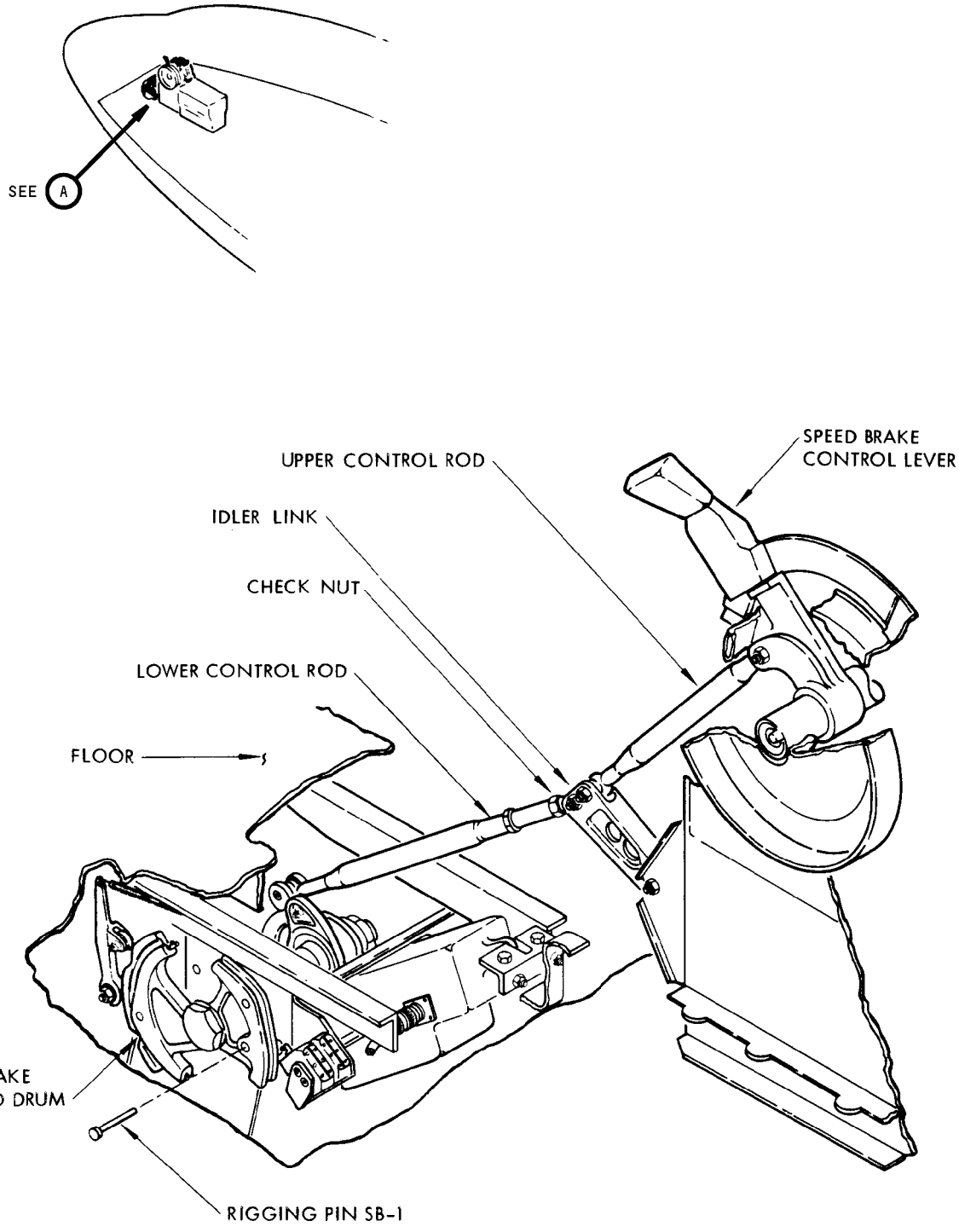
Flap Control Lever Rigging
Figure 406 (Sheet 2)



CABLE	TYPE	ENGINE	FROM	TO	FUNCTION
T1A	THRUST	NO. 1	CONTROL STAND	DRUM AND SHAFT ASSY	INCREASE FORWARD THRUST
T1B	THRUST	NO. 1	DRUM AND SHAFT ASSY	CONTROL STAND	DECREASE FORWARD THRUST
T2A	THRUST	NO. 2	CONTROL STAND	DRUM AND SHAFT ASSY	INCREASE FORWARD THRUST
T2B	THRUST	NO. 2	DRUM AND SHAFT ASSY	CONTROL STAND	DECREASE FORWARD THRUST
ESS 1A	START	NO. 1	CONTROL STAND	DRUM AND SHAFT ASSY	START ENGINE
ESS 1B	START	NO. 1	DRUM AND SHAFT ASSY	CONTROL STAND	ACTUATE FUEL SHUTOFF
ESS 2A	START	NO. 2	CONTROL STAND	DRUM AND SHAFT ASSY	START ENGINE
ESS 2B	START	NO. 2	DRUM AND SHAFT ASSY	CONTROL STAND	ACTUATE FUEL SHUTOFF

CABLE DEFINITIONS

Engine Control System Cable Locations and Definitions
Figure 407



Speed Brake Control Lever Adjustment
Figure 408

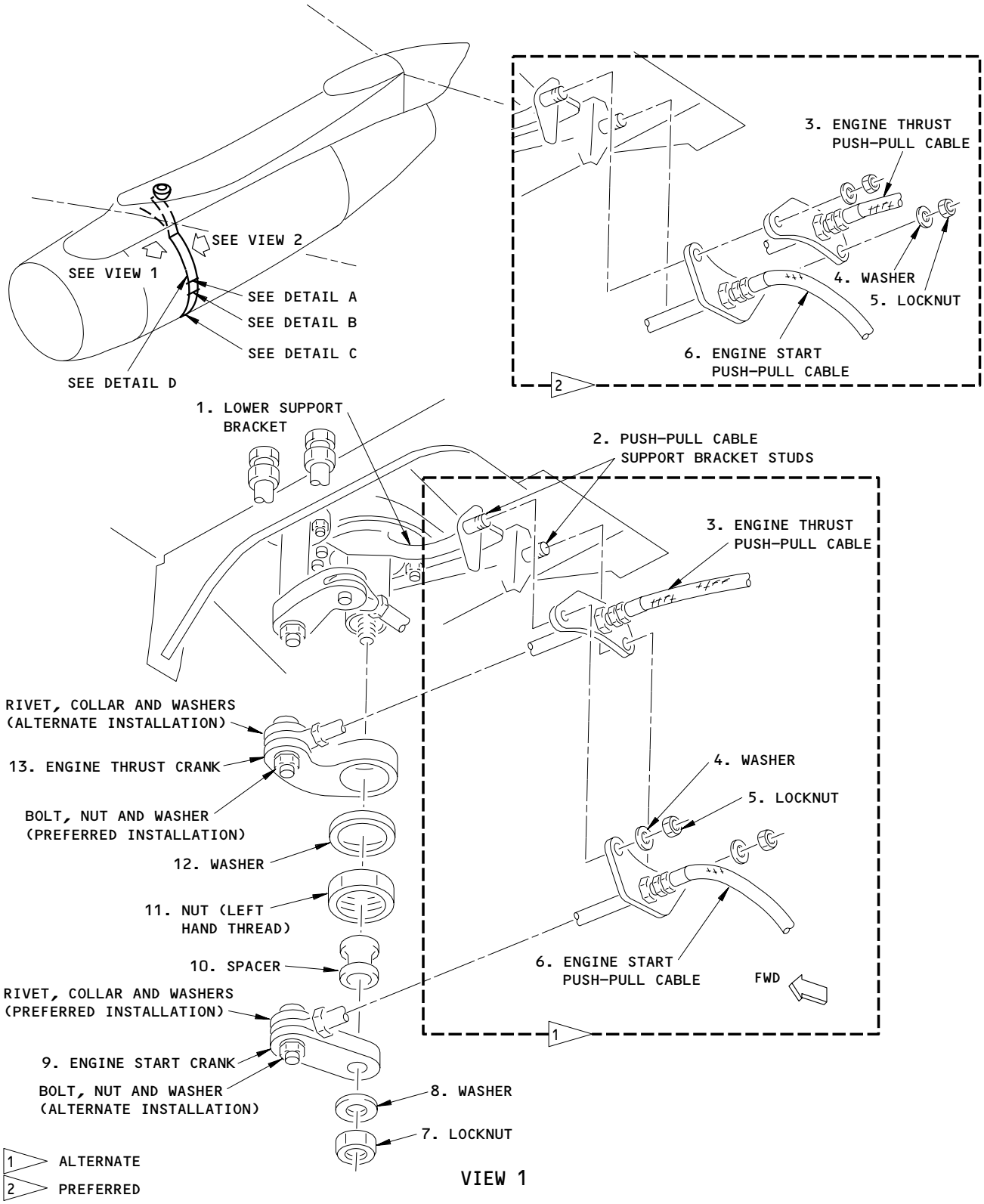
AE. If no longer required, remove electrical power from airplane.
AF. Test engine start and thrust control systems (AMM 76-11-0/501, Engine Control System).

PUSH-PULL CABLES - REMOVAL/INSTALLATION

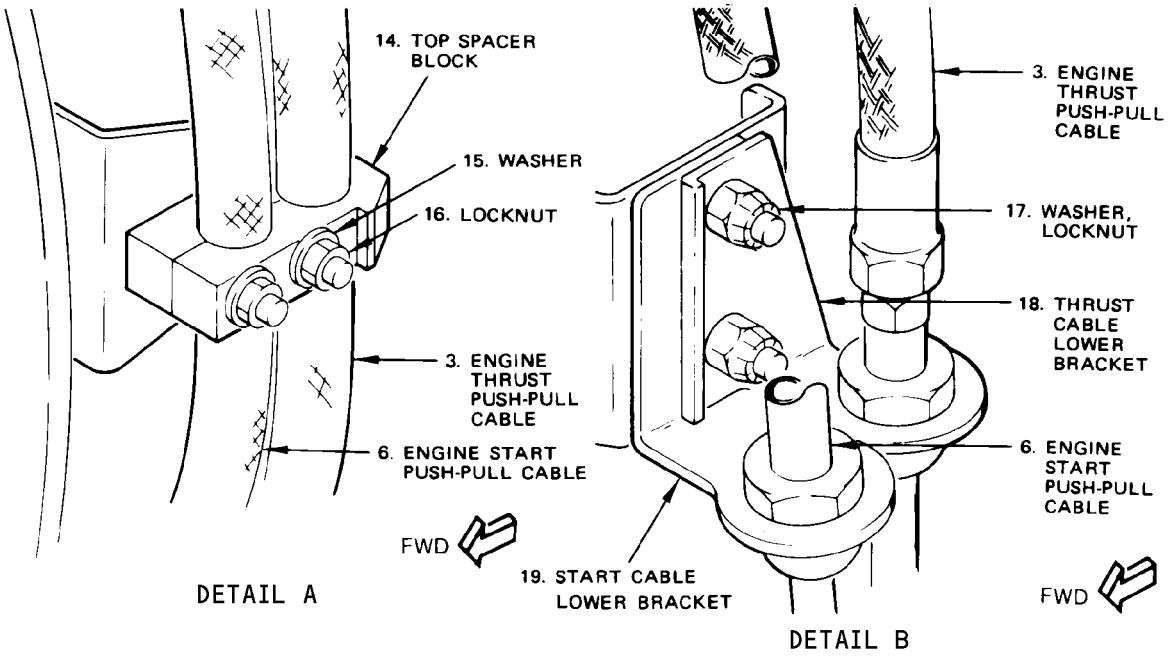
1. General
   A. The push-pull cables transmit the rotary motion of the engine start and thrust shafts at the strut firewall to the left side of the engine cross shaft. Each push-pull cable is an assembly consisting of a push-pull cable in a flexible conduit, a telescopic unit at both the upper and lower ends, and two support brackets.
   B. The upper telescopic units are attached to cranks with rivets or preferred bolts for installation on the engine start and thrust shafts at the strut firewall. The lower telescopic units have end fittings for connection to cranks on the engine cross-shaft. The lower telescopic unit on the engine thrust push-pull cable has a fine adjustment feature, which permits precise adjustment of the cable for length.
   C. The push-pull cables are supported at three common points. Brackets on the push-pull cables attach to the lower support bracket below the firewall and to a bracket at about the 8 o'clock position on the engine. A spacer block at about the 10 o'clock position on the engine spaces and supports the cables. Additionally, the engine start cable is supported by a clamp at the 9 o'clock position on the engine. A common separator block rub strip is installed on the cables about 7-1/2 inches from the attachment brackets at the upper ends.
2. Deleted
3. Prepare to Remove Push-Pull Cables
   A. Remove side removable cowl panels.
   B. Remove fixed fairing (Ref Chapter 71, Fixed Fairing).
4. Remove Push-Pull Cables
   A. Remove washers (4, Fig, 401) and locknuts (5) securing push-pull cable brackets to support bracket studs (2). Rotate engine thrust crank (13) and start crank (9) to disengage push-pull cables from support bracket studs.
   B. On preferred installation, remove nut, washers, bolt and bushing to disconnect thrust push-pull cable (3) from thrust crank (13). If required, remove locknut (7) and washer (8) retaining engine start crank (9) and remove start crank from engine start shaft. Spacer (10) above start crank (9) will fall free when start crank is removed.
   C. On preferred installation, remove nut, washers and bolt to disconnect start push-pull cable (6) from start crank (9). If required, cut lockwire and remove nut (11) and washer (12) from engine thrust shaft. Remove engine thrust crank (13) from thrust shaft.

      NOTE: Thrust crank retaining nut (11) has left-hand thread.

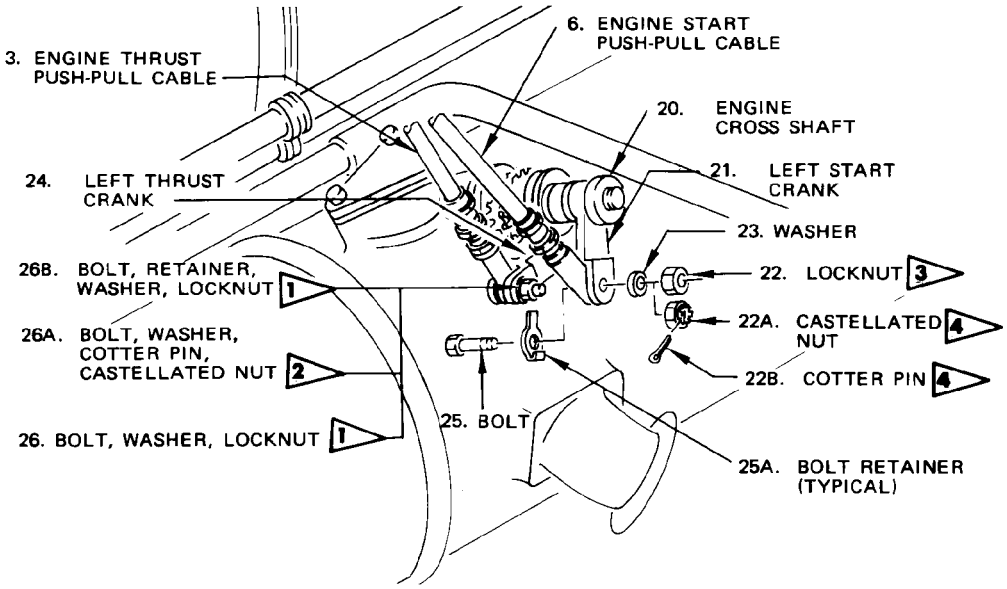
   D. Remove two locknuts (35) and washers (34) from bolts (33) and remove both halves of separator block rub strip (32).



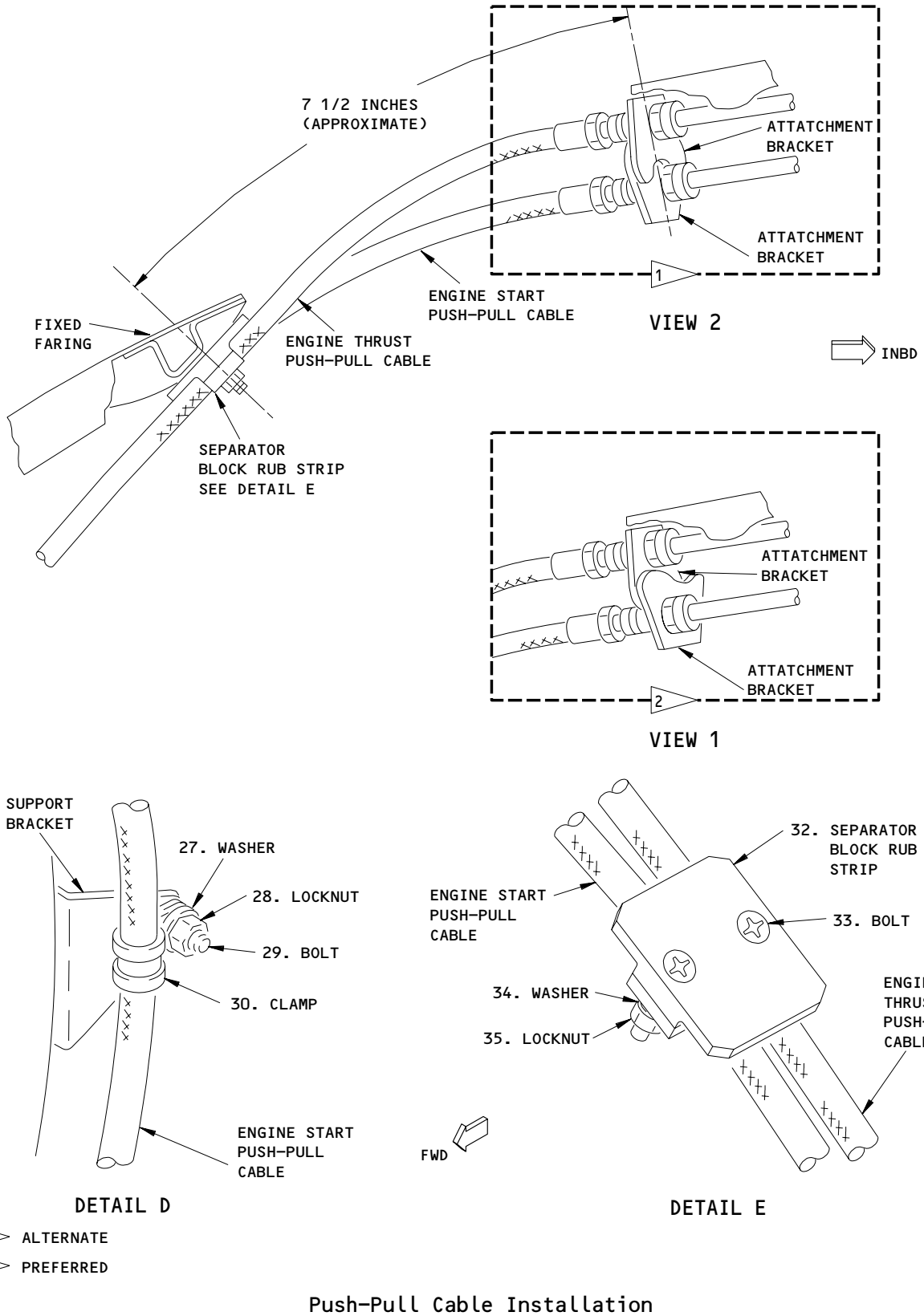
Push-Pull Cable Installation
Figure 401 (Sheet 1)



1. FOR THRUST CABLE USING LOCKNUTS WITH OR WITHOUT BOLT RETAINER – TIGHTEN NUTS 50 TO 70 POUND–INCHES
2. FOR THRUST CABLE USING CASTELLATED NUTS AND WITHOUT BOLT RETAINER – TIGHTEN NUTS 30 TO 40 POUND–INCHES
3. FOR START CABLE USING LOCKNUTS WITH OR WITHOUT BOLT RETAINER – TIGHTEN NUTS 100 TO 140 POUND–INCHES
4. FOR START CABLE USING CASTELLATED NUTS AND WITHOUT BOLT RETAINER – TIGHTEN NUTS 60 TO 85 POUND–INCHES



Push–Pull Cable Installation
Figure 401 (Sheet 2)



Push-Pull Cable Installation
Figure 401 (Sheet 3)

E. Remove locknut (28), washer (27), and bolt (29) attaching clamp (30) to engine start cable support bracket (31) on engine flange. Remove clamp from cable.
F. Remove two washers (15) and locknuts (16) securing push-pull cables to spacer block. Remove top spacer block (14).
G. Remove bolts, bolt retainers, washers, locknuts and/or castellated nuts and cotter pins (22, 22A, 22B, 23, 25A, 25, 26, 26A and/or 26B) which secure thrust and start push-pull cables (3, 6) to the thrust and start cranks (21, 24) on engine cross-shaft (20). Remove cables from cranks.
H. Remove two washers and locknuts (17) securing push-pull cable lower brackets (18,19) to engine. Pull lower brackets away from fixed bracket and remove push-pull cable assemblies.

5. Install Push-Pull Cables
A. Install the engine push-pull cable brackets over the push-pull cable support bracket studs (2, Fig. 401)
(1) On the preferred installation, install the engine start push-pull cable bracket first and then install the engine thrust push-pull cable bracket.
(2) On the alternate installation, install the engine thrust push-pull cable bracket first and then install the engine start push-pull cable bracket.
B. On preferred installation, attach thrust push-pull cable (3) to thrust crank (13) with bushing, bolt, washers and nut. If required, position engine thrust crank (13) on splined portion of engine thrust shaft with indexing (wide) tooth and valley mated.
C. If required, retain thrust crank using washer (12) and nut (11). Tighten nut 200 to 500 pound-inches and lockwire to thrust crank (13).

NOTE: Thrust crank retaining nut (11) has left-hand thread.

D. Deleted
E. On preferred installation, attach start push-pull cable (6) to start crank (9) with bolt, washers and nut. If required, place spacer (10) on lower end of engine start shaft.
F. If required, position engine start crank (9) on splined portion of start shaft with indexing (wide) tooth and valley mated.
G. If required, retain spacer (10) and start crank (9) on start shaft using washer (8) and locknut (7). Tighten locknut 100 to 140 pound-inches.
H. Secure engine push-pull cable brackets to push-pull cable support bracket studs (2) using two washers (4) and locknuts (5).
I. Connect lower rod of engine thrust push-pull cable (3) to left thrust crank (24) using bolt, washer, and self-locking nut (26) castellated nut and cotter pin (26A) or bolt, bolt retainer, washer and self-locking nut (26B). On engines using locknut, tighten self-locking nut 50 to 70 pound-inches. On engines using castellated nut, tighten castellated nut 30 to 40 pound-inches and install cotter pin.

J. Connect lower rod of engine start push-pull cable (6) to left start crank (21) using bolt (25), bolt retainer (25A), washer (23) and self-locking nut (22) or castellated nut (22A) and cotter pin (22B). On engines using locknut, tighten self-locking nut 100 to 140 pound-inches. On engines using castellated nut, tighten castellated nut 60 to 85 pound-inches and install cotter pin.

K. Position start and thrust cable lower brackets (18, 19) on studs of fixed bracket at about 8 o'clock position on engine. The thrust cable lower bracket (18) with the lip should be on top of start cable lower bracket (19). Install washers and locknuts (17).

L. Position push-pull cables in grooves of lower spacer block at about 10 o'clock position on engine. Engine start push-pull cable (6) should be forward of engine thrust push-pull cable (3). Install top spacer block (14) and secure with washers (15) and locknuts (16).

M. Install clamp (30) on engine start push-pull cable and attach to support bracket (31) on engine flange with bolt (29), washer (27), and locknut (28).

N. Install separator block rub strip (32) using two bolts (33), washers (34), and locknuts (35). Install with locknuts inboard and engine start push-pull cable forward. Position approximately 7-1/2 inches from attachment brackets at cable upper ends. Adjust position as required to ensure rub strip prevents direct contact between fixed fairing and push-pull cables.

O. Test engine control system (Ref 76-11-0 A/T).

6. Restore Airplane to Normal Configuration

A. Install fixed fairing (Ref Chapter 71, Fixed Fairing).

B. Install side removable cowl panels.

DRUM AND BRAKE ASSEMBLY - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Grease - BMS 3-33 (Preferred)
   B. Grease - MIL-PRF-23827 (Supercedes MIL-G-23827) (Alternate)
2. Remove Drum and Brake Assembly
   A. Open circuit breakers for throttle actuated takeoff warning and landing gear warning system (Ref 31-26-0).
   B. Clamp control stand thrust levers in IDLE position.
   C. Remove cotter pin, nut, and washer (8) from shaft of drum and brake assembly (Fig. 401).
   D. Remove nut and washers (7) from locking arm (2) and remove locking arm, shim (6) and spacer (1).
   E. Fully extend flaps on leading edge to expose control cable turnbuckles at leading edge stations 183 and 155 (Ref Chapter 27, Leading Edge Flaps and Slats - Maintenance Practices).

      WARNING: ASSURE THAT LEADING EDGE FLAP LOCKS ARE PROPERLY INSTALLED TO PREVENT PERSONNEL INJURY OR AIRPLANE DAMAGE.

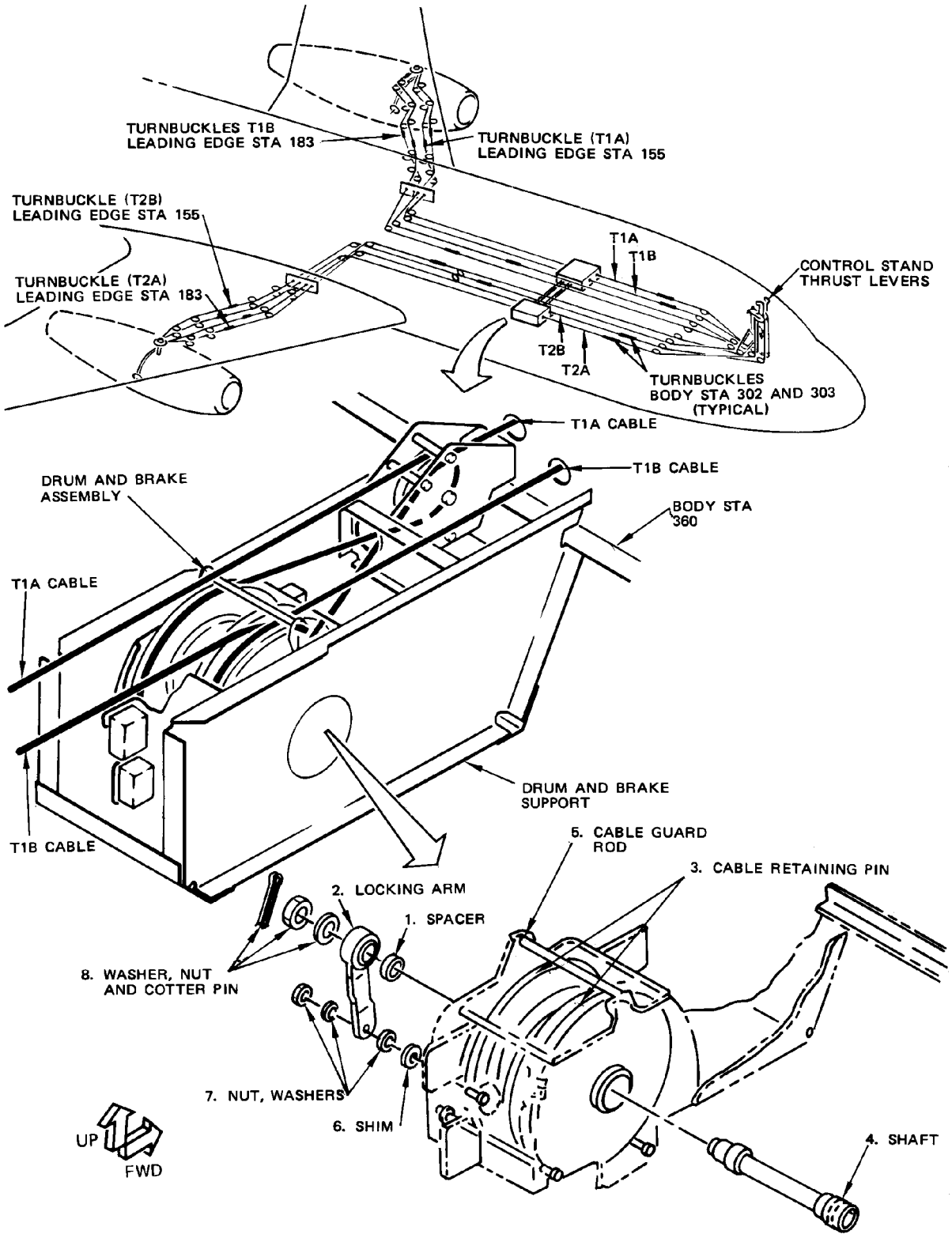
   F. Loosen turnbuckles in wings and at body station 303. Tag applicable TA and TB throttle control cables for each engine.
   G. Remove cotter pins, washers and three cable guard rods (5) from each drum and brake support.
   H. Remove cable retaining pin (3) at end of each cable retainer on drum and brake assembly.
   I. Remove cables from input and output drums of drum and brake assembly and tag cables.
   J. Support clutch assembly; slide clutch shaft (4) inboard until shaft is removed and remove drum and brake assembly.

      CAUTION: SHAFT SUPPORT BEARING MAY SLIDE OUT WITH SHAFT. TAKE CARE THAT BEARING IS NOT DAMAGED.

   K. Tag drum and brake assemblies No. 1 and No. 2 respectively.

      NOTE: Drum and brake assemblies are not interchangeable.

3. Install Drum and Brake Assembly
   A. Clamp control stand thrust lever in IDLE position.
   B. Apply a light film of grease to drum and brake assembly spline and shaft (4) (Fig. 401).
   C. Position drum and brake assembly between assembly supports and instal1 shaft (8) until inboard end of shaft is seated against support bearing.
   D. Position cables on input and output drums of drum and brake assembly and install new cotter pins (3). Remove identification tags from cables.
   E. Install cable guard rods (5) with washers and cotter pins.



Drum and Brake Assembly Installation
Figure 401

F. Install locking arm (2) with washers and nut (7), shim (6) and spacer (1).
G. Remove shim (6) laminations as required to limit the gap between locking arm and shim before clamp-up to 0.020 inch.
H. Install washer, nut and cotter pin (8). Nut shall be tightened only finger-tight.
I. Tighten all thrust control cables by adjusting turnbuckles at leading edge station 183 and 155 and body station 303. Adjust and test control cables (Ref 76-11-00, Adjustment/Test).
J. Install cable turnbuckle clips (Ref 20-10-81, Standard Practices).
K. Remove clamp from control stand thrust lever.
L. Remove leading edge flap locks and close flaps (Ref Chapter 27, Leading Edge Flaps and Slats - Maintenance Practices).

ENGINE FIRE EMERGENCY SHUTDOWN - DESCRIPTION AND OPERATION

1. General

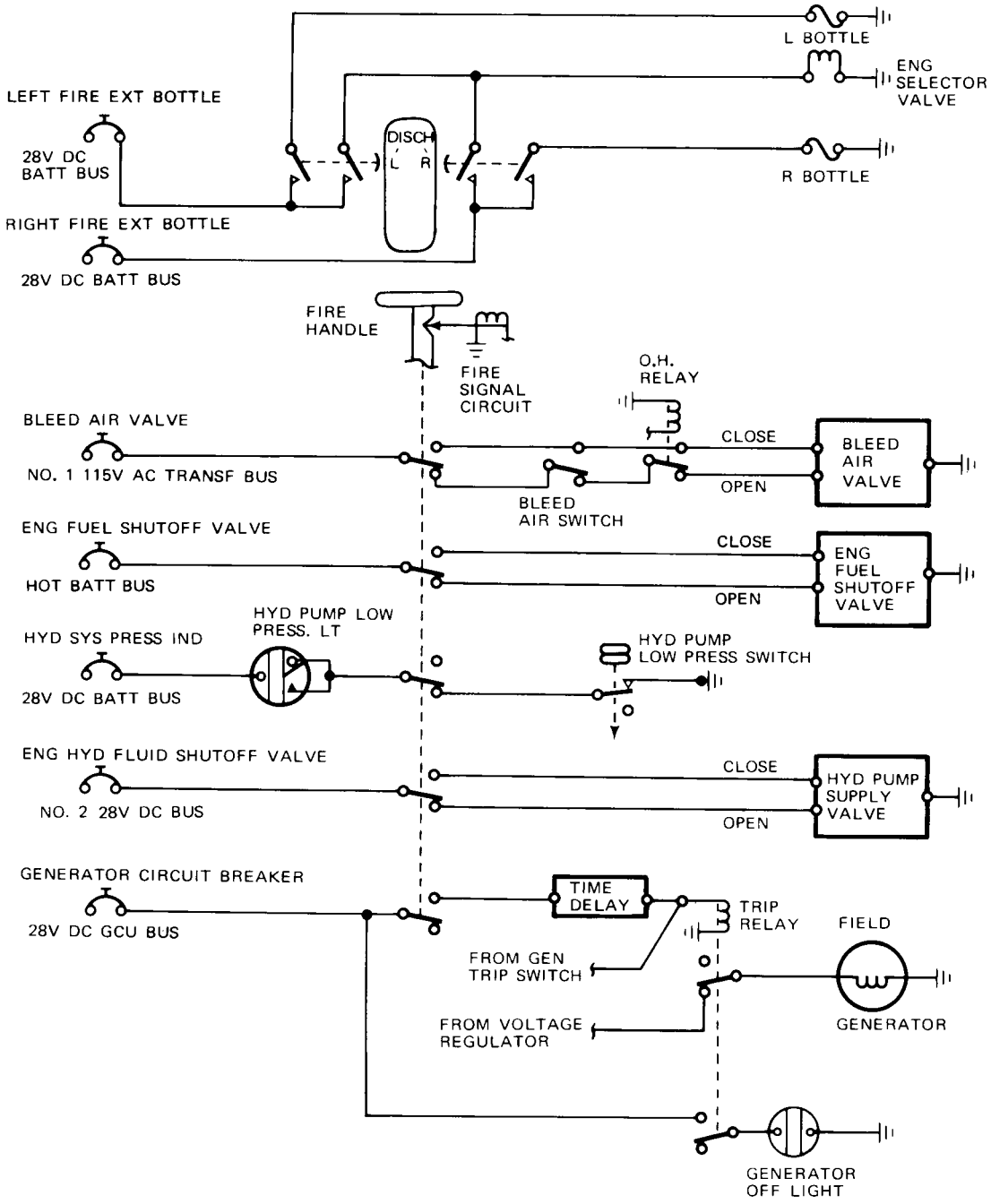
A. Emergency fire shutdown is initiated by receipt of a fire signal in the control cabin. The fire signal consists of a continuously sounding fire alarm bell, the lighting of the master fire warning lights on the captain's and first officer's light shield and the lighting of the applicable fire switch handle in the fire protection system module on the control stand aft electronic control panel. The alarm bell is silenced by depressing either of the master fire warning lights or the bell cutout switch on the control stand aft electronic control panel. A fire signal unlocks the corresponding fire switch handle, leaving it free to be pulled and rotated. Emergency fire shutdown consists of shutting off the engine and isolating it from the other systems.

B. On AR ALL EXCEPT LV-LEB, LV-JTO, LV-LIU and on, emergency shutoff is accomplished by moving the thrust lever to idle and positioning the start lever to cutoff, which closes an outflow valve in the fuel control unit.

C. On AR LV-LEB, LV-JTO, LV-LIU and on, emergency shutoff is accomplished by moving the thrust lever to idle and positioning the start lever to cutoff which closes an outflow valve in the fuel control unit and closes the engine fuel cutoff valve.
On AR ALL EXCEPT LV-LEB, LV-JTO, LV-LIU and on, pulling the fire switch handle will close the applicable engine bleed air, engine fuel and hydraulic shutoff valves and open the generator field circuit.
On AR LV-LEB, LV-JTO, LV-LIU and on, pulling the fire switch handle will close the applicable engine bleed air, hydraulic shutoff valve and open the generator field circuit.
On AR LV-LEB, LV-JTO, LV-LIU and on, closure of the engine fuel valve will also occur by pulling the fire switch if positioning the start lever to cutoff has not been accomplished (Fig. 1).

D. Counterclockwise rotation of the handle will discharge the left fire extinguisher bottle and clockwise rotation will discharge the right fire extinguisher bottle into the selected nacelle (Ref Chapter 26, Engine Fire Extinguishing System).

E. On AR ALL EXCEPT LV-LEB, LV-JTO, LV-LIU and on, engine fuel shutoff valve in the wing will begin closing as soon as the fire switch handle is pulled.
On AR LV-LEB, LV-JTO, LV-LIU and on, engine fuel shutoff valve in the wing will begin closing as soon as the start lever is positioned to cutoff or the fire switch handle is pulled. A blue "valve closed" light on the overhead panel will burn brightly while the engine fuel shutoff valve is in transit and will continue to burn dimly after the valve has reached the closed position.



Engine Fire Switch Circuit
Figure 1 (Sheet 1)

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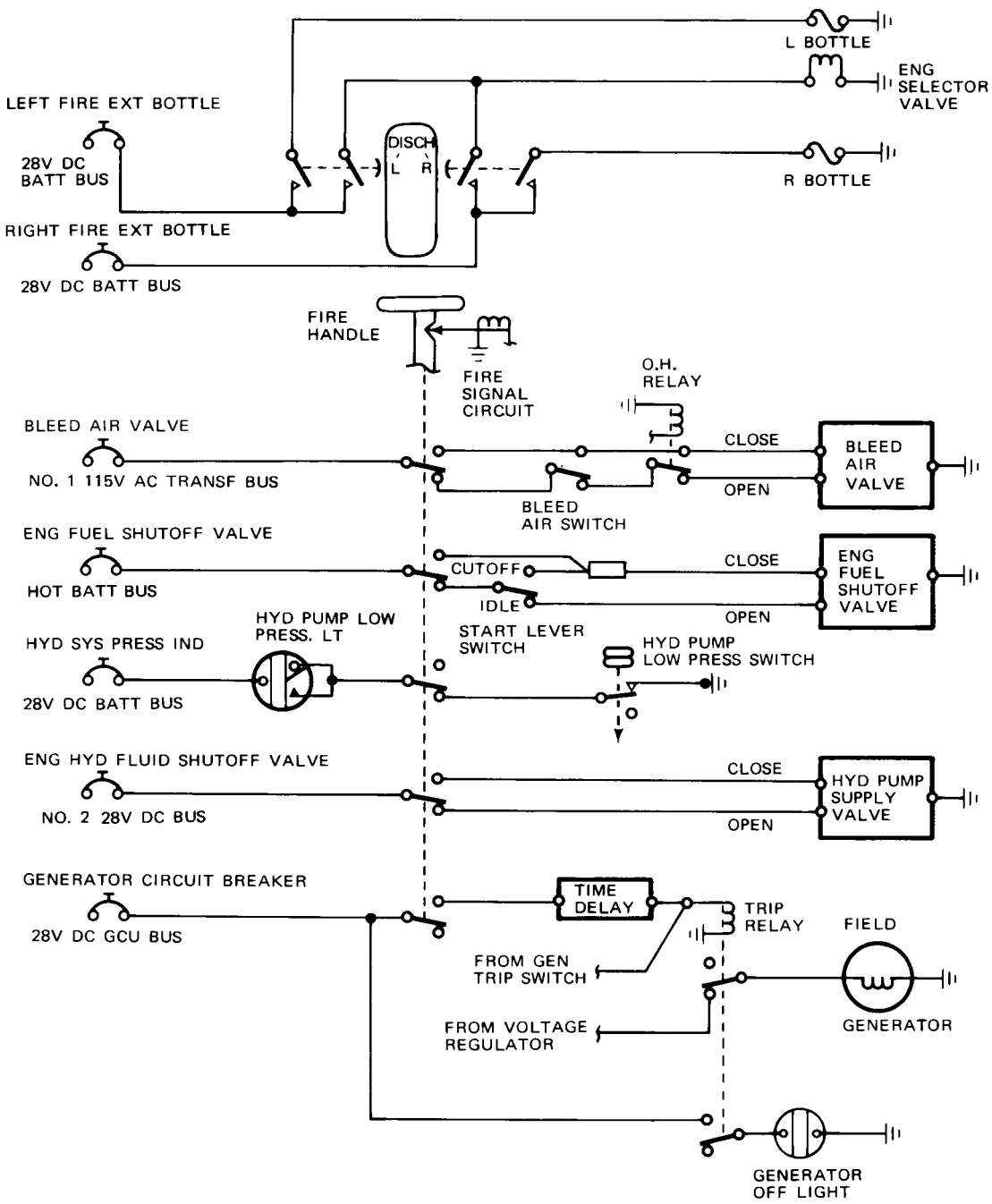

Engine Fire Switch Circuit
Figure 1 (Sheet 2)

449549

F. The engine bleed air valve is closed to prevent smoke from being distributed in the pneumatic system and to cut off flow to the wing thermal anti-ice system. The hydraulic supply valve will be closed and the pump low pressure warning light on the overhead panel will be de-energized. There is a 5- to 10-second delay in generator shutdown so that power will be provided long enough to close the above valves. At the time of generator shutdown, the "generator off" light on the forward overhead panel will come on.