TO: ALL HOLDERS OF THRUST REVERSED DIRECTIONAL VALVE ASSEMBLY, 78-33-10

REVISION NO. 7, DATED NOV 1/00

HIGHLIGHTS

DESCRIPTION OF CHANGE	TOPICS AFFECTED												
	D & O	D / Assy	Cleaning	Insp/Chk	Repair	Assy	F/C	Test	T/Shooting	S/Tools	Storage	IPL	L/Overhaul
Updated vendor list												X	
Clarified part to magnetic particle check				X									

THRUST REVERSER DIRECTIONAL VALVE ASSEMBLY

78-33-10

BOEING P/N 65-37831-2, -4, -5, -6

AIRLINE P/N

THE FOLLOWING DIRECTIVES APPLY TO THIS SUBJECT:

BOEING SERVICE BULLETIN	BOEING TEMPORARY REVISION	OTHER DIRECTIVES	DATE DIRECTIVE INCORPORATED INTO TEXT
78-58		PRR 22816-10 PRR 30349-1 PRR 31154	Aug 15/68 Aug 15/68 Aug 15/68

LIST OF EFFECTIVE PAGES

* Indicates pages revised, added or deleted in latest revision

F Indicates foldout pages - print one side only

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	78-33-10					
	T-1	Nov 10/69				
	T-2	BLANK				
*	LEP-1	Nov 1/00				
	LEP-2	BLANK				
	T/C-1	Nov 10/69				
	T/C-2	BLANK				
	1	Sep 1/97				
	2	Sep 1/97				
*	3	Nov 1/00				
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THRUST REVERSER DIRECTIONAL VALVE ASSEMBLY
Boeing Part No. 65-37831-2, -4, -5, -6

1. DESCRIPTION AND OPERATION

A. Description

The thrust reverser directional valve is a two-position pneumatic control operated by an actuation cam on the thrust control shaft. It directs air pressure to the reverse or cruise manifolds. The valve is spring loaded to the cruise position. The inlet port is connected to high pressure bleed air, one outlet port is connected to the reverse manifold and the other to the cruise manifold. An air seal is established by piston rings. A rod end bearing provides a maneuverable link to the actuating mechanism.

B. Operation

The directional valve is actuated by a cam on the thrust control shaft. When reverse or cruise thrust is selected at the control stand a direct cable connection actuates the control shaft cam repositioning the directional valve, and bleed air is routed through the valve to the appropriate manifold.

C. Leading Particulars

Length	-- 7.48 inches
Width	-- 2.40 inches
Height	-- 2.80 inches
Weight	-- 1.67 pounds
Operating medium	-- Manual force opposing a spring force
Leakage test pressure	-- 100 psi
Stroke	-- 0.89 inch
Port size	-- 3/4-16 UNF-3A for 1/2inch OD tube

2. DISASSEMBLY (Fig. 5)

NOTE: Prior to disassembly perform pre-disassembly test described in paragraph 8.C.(1).

A. Remove all lockwire.

B. Remove the following parts:

(1) On 65-37831-2 and -5 valve assemblies, remove rivet (1), rod end bearing (2), nut (3), cap (4) and bushing (5).

(2) On 65-37831-4 and -6 valve assemblies, remove rivet (1), rod end bearing (2), nut (3), spring pins (13) and bushing (5).

C. Remove piston (6) and spring (8).

D. Remove piston rings (7).

E. Remove cap (4) and bushing (9) (65-37831-2 and -5 only). Do not remove bushing (11) from cylinder (12) unless repair or replacement is necessary.

NOTE: Tag or mark rod end and piston to identify for reassembly in matched sets.

3. CLEANING (Fig. 5)

A. General

(1) Wash all metal parts except bearings with dry cleaning solvent, Specification P-D-680, or equivalent.

(2) Use a stiff-bristle brush to remove stubborn accumulations of foreign matter.

(3) Drain and dry thoroughly with a lint-free cloth or with clean, moisture-free air.

(4) For general information refer to "General Cleaning Procedures,"Subject 20-30-03.

B. Bearings

(1) Clean bearing (2) per "Cleaning and Relubricating Antifriction Bearings," Subject 20-30-01.

4. INSPECTION/CHECK

A. Visual Check

(1) Visually examine all metal parts for cracks, burrs and corrosion using strong light and minimum of 10-power magnification.

(2) Visually examine all threads for cross threading or stripping.

(3) Check all plated surfaces for blistering or flaking.

B. Special Check (Fig. 5)

(1) Check rod end bearing for roughness, binding and excessive radial or axial play. Allowable play must not exceed 0.005-inch radial and 0.010-inch axial.

(2) Check spring (8) per Fig. 1.

Index No. Figure 5	Max Compressed Ht Without Permanent Set (inches)	Test Length (inches)	Test Load Limit (pounds)
8 P/N 66-17800-1	0.57	1.60 0.71	1.23 to 1.43 1.48 to 1.88
8 P/N 69-53708-1	0.62	1.60 0.71	1.10 to 1.30 2.00 to 2.40

Spring Check Data
Figure 1

(3) Check parts listed in Fig. 3 for wear in excess of specified permissible limits.

(4) If visual examination reveals possible damage:

(a) Perform penetrant examination on cap (4), piston (6), spring (8, P/N 69-53708-1), bushing (9) and cylinder (10, P/N 65-37809-4).

(b) Perform magnetic particle examination on cylinder (10, P/N 65-37913-4).

(5) Check piston rings for wear.

(a) Ring width 0.04 inch minimum

(b) Step tang width 0.02 inch minimum

(c) Installed gap 0.035 inch maximum

(d) Ring must have adequate sealing characteristics as evidenced by at least 80% of the circumference blocking light transmittal when mounted in a 1.00-inch diameter gage.

5. REPAIR (Fig. 5)

A. Repair

NOTE: Cylinders (10, 12) and piston (6) are made of 17-4PH CRES, 180-200 ksi.

(1) Remove minor scratches, nicks and corrosion by polishing with abrasive cloth, 200 grit or finer.

(2) Repair minor thread damage with a thread chaser or small triangular file.

(3) Repair worn or damaged piston ring grooves.

(a) Machine piston ring grooves to 16-microinch finish per 20-10-02 as required to remove damage but do not exceed maximum width of 0.111 inch. Piston rings are available in 0.005-inch width increments from 0.047 (std) to 0.107 inch. A total side clearance of 0.003 to 0.004 inch must be maintained.

(b) Passivate machined surface.

(c) Obtain oversize piston rings per the following list from the Dover Corp., Cook Airtomic Div., P.O. Box 1038, Louisville, Kentucky.

Piston Ring No.	Width	Backup Ring No.
ABA-8405-O	0.052 inch	ABA-6774
ABA-8405-P	0.057	ABA-6774
ABA-8405-Q	0.062	ABA-6774
ABA-8405-R	0.067	ABA-6774
ABA-8405-S	0.072	ABA-6774
ABA-8405-T	0.077	ABA-6774
ABA-8405-U	0.082	ABA-6774

Piston Ring No.	Width	Backup Ring No.
ABA-8405-V	0.087	ABA-6774
ABA-8405-W	0.090	ABA-5740
ABA-8405-X	0.097	ABA-5740
ABA-8405-Y	0.102	ABA-5740
ABA-8405-Z	0.107	ABA-5740

(4) Repair worn or scored inside diameter of cylinder (10).

(a) Machine inside diameter per 20-10-04 as required to eliminate damage, but do not exceed 1.020 inches. Finish of 16 microinches is required.

(b) Build up with hard chrome plate per 20-42-03.

(c) Grind to design diameter (Fig. 3) and 16-microinch finish per 20-10-04.

(5) Repair worn or scored piston (6) (Fig. 2).

(a) Machine piston rod to 16-microinch finish per 20-10-04 as required to remove damage, but do not exceed minimum allowable diameter before plating.

1) For dimension A: 0.606 inch

2) For dimension B: 0.371 inch

(b) Machine piston head to 16-microinch finish per 20-10-02 as required to remove damage, but do not exceed 0.990-inch minimum allowable diameter before plating.

(6) Repair damaged mounting lugs on cylinder (10).

NOTE: This repair will also aid in avoidance of cylinder distortion during installation of the thrust reverser directional valve assembly.

(a) Line drill holes in mounting lugs to 0.359 inch inside diameter.

(b) Line ream holes to 0.3750-0.3756 inside diameter.

(c) Make two bushings from 321 or 347 CRES bar stock to the following dimensions:

1) Outside diameter 0.3760 to 0.3764 inch

2) Inside diameter 0.257 inch (F drill)

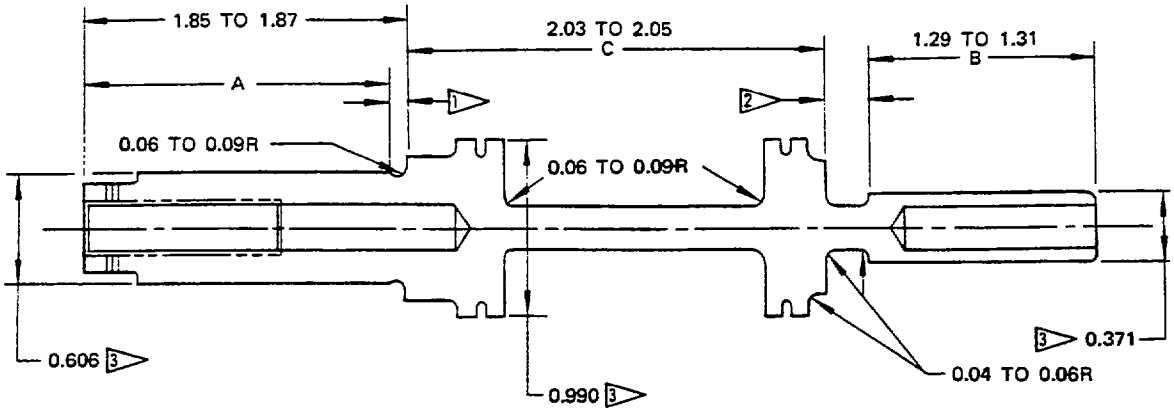
3) Length 1.200 to 1.210 inch

(d) Press bushings into mounting lugs.

(e) If required, machine ends of bushings off flush with lug side face.

(f) Build up piston rod (dimensions A and B) with hard chrome plate per 20-42-03. Grind to design dimensions (Fig. 3) and 16-microinch finish per 20-10-04.

(g) Build up piston head (dimension C) except grooves, with silver plate per 20-42-06. Control plating process to obtain design dimensions (Fig. 3).



1 TRANSITION OF A AND C ALLOWED IN THIS AREA

2 TRANSITION OF B AND C ALLOWED IN THIS AREA

3 MINIMUM ALLOWABLE REWORK DIAMETER BEFORE PLATING

REPAIR OF PISTON

B. Refinish

NOTE: Refer to 20-30-02 for stripping of protective finishes and to 20-41-01 for explanation of F and SRF finish codes.

(1) If plated surfaces are marred or chipped, but damage does not extend into base metal, refinish as follows:

(a) Cap (4) -- Silver plate (F-1.901) on threaded areas, 0.0002 to 0.0003 inch thick. Finish is optional on other surfaces. Material: 316 CRES, annealed.

(b) Cylinder (10) -- Cadmium plate (F-1.1913) on mounting lugs. This finish is optional on all other external surfaces except threaded areas. Thin, dense chrome plate inside diameter, 0.0002 to 0.0003 inch thick, per BMS 10-70. Material: 17-4PH CRES, 180-200 ksi.

(c) Piston (6) -- Thin, dense chrome plate (F-14.89) piston rod (dimensions A and B), 0.0002 to 0.0003 inch thick. Silver plate (F-1.901) on piston head (dimension C) except piston ring grooves, 0.0002 to 0.0003 inch thick. Passivate other surfaces per F-8.07 (Fig. 2). Material: 17-4PH CRES, 180-200 ksi.

C. Replacement

(1) Replace rivet (1) at each overhaul.

(2) Replace any parts damaged beyond simple repair.

(3) Replace damaged bushing (11) as follows:

(a) Press bushing out of cylinder (10).

(b) Coat new bushing with BMS 11-10, type 1, primer and press into cylinder.

(c) Ream new bushing to 0.3775-0.3787 inch inside diameter. Bore of bushing after reaming shall be concentric with bore of cylinder (10) with 0.0005-inch total indicator reading.

(4) Replace parts worn beyond wear limits stated in Fig. 3 and in INSPECTION/CHECK.

6. ASSEMBLY (See figure 5.)

A. On valve assemblies 65-37831-2 and -5 only, install bushing (9) and cap (4) on cylinder (10). Tighten cap 300 to 350 pound-inches.

B. Install piston rings (7) on piston (6).

NOTE: Ring expander of piston ring (7) shall have a free open assembled gap of 0.12 to 0.22 inch.

C. Assemble the following parts:

(1) On 65-37831-2 and -5 valve assemblies, install spring (8), piston (6), bushing (5) and cap (4). Tighten cap 300 to 350 pound-inches.

(2) On 65-37831-4 and -6 valve assemblies, install spring (8), piston (6), bushing (5) and spring pins (13).

D. Assemble checknut (3) and rod end bearing (2) and install in piston (6).

E. Secure rod end to piston.

(1) With piston (6) seated against bushing (5), adjust rod end to 5.44 inch dimension shown in figure 3. Align rivet holes in rod end and piston. Tighten checknut (3) and install rivet (1).

NOTE: If replacement rod end is being installed, use existing hole in piston (6) as a guide for drilling rivet hole (0.093 to 0.103 inch) in rod end (2).

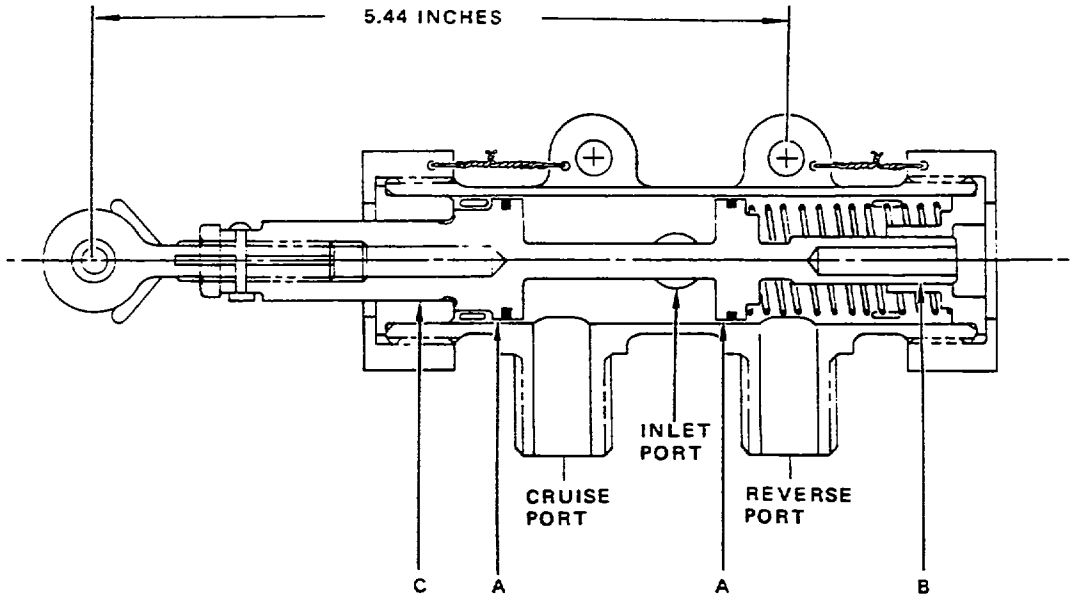
F. Lockwire caps (4) to cylinder ear lugs as shown in figure 3 per Subject 20-50-02.

G. Relubricate bearing in rod end (2) with lubricating grease, Shell Oil Company, part number ETR, Type H or equivalent.

7. FITS AND CLEARANCES

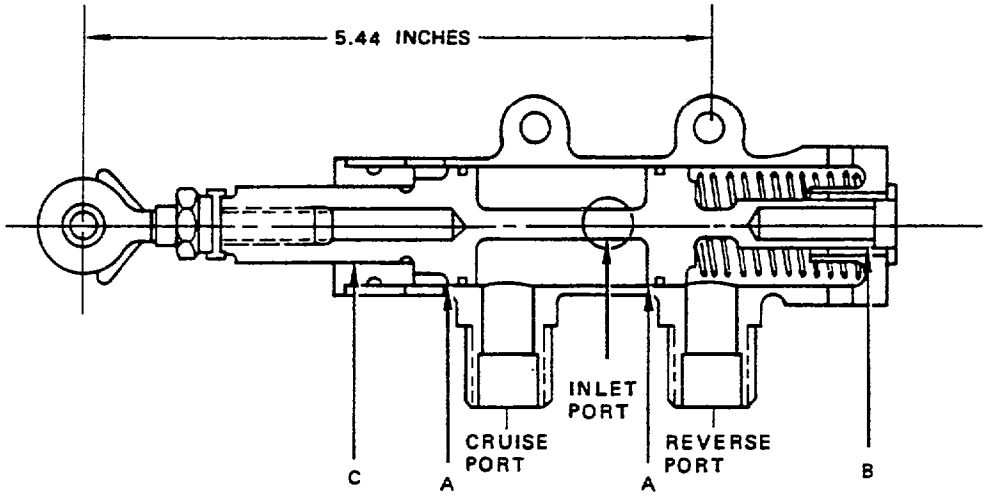
A. The "Fits and Clearances," figure 3, lists original design dimensions and service wear limits for certain close tolerance parts of the assembly. The original design dimensions are to be used as a guide for rework of parts which fail to meet the wear tolerance requirements. Unless otherwise specified in the rework procedure, a part should be returned to the design dimensions whenever rework is accomplished.

B. Clearances are given to aid assembly of the component. The value given in the "Maximum Allowable Clearance" column is the maximum permitted to ensure proper functioning until the next overhaul cycle of the component. If assembled parts fail to meet these requirements, one or more of the parts must be rejected. Parts that are rejected should be reworked if within the rework limits given in the repair procedure; if not within rework limits, the parts should be scrapped. It is recommended that whenever newly reworked parts are assembled, the design clearances should be used as the guiding assembly criteria.



65-37831-2 AND -5

Fits and Clearances
Figure 3 (Sheet 1)



65-37831-4 and -6

Ref. Letter Fig.3	Mating Index No. Fig.5	Original Design Limits				Service Wear Limits		
		Dimension (inches)		Assembly Clearance (inch)		Dimension Limits (inches)		Maximum Allowable Clearance (inch)
		Min.	Max.	Min.	Max.	Min.	Max.	
A	ID 10	1.0000	1.0007	0.0060	0.0080	0.9907	1.0027	0.0120
	OD 6	0.9927	0.9940					
B	ID 9	0.3775	0.3787	0.0025	0.0047	0.3725	0.3817	0.0092
	OD 6	0.3740	0.3750					
C	ID 5	0.6265	0.6275	0.0025	0.0047	0.6213	0.6305	0.0092
	OD 6	0.6228	0.6240					

8. TESTING (See figures 3 and 5.)

A. Test Equipment

(1) Pneumatic test stand capable of supplying 200 psi air pressure and measuring up to 5 standard cubic feet per minute leakage.

(2) One-half inch OD tubes, fittings (threads 3/4-16 UNF-3A) and gaskets for attaching pneumatic test stand to ports in cylinder (10). Scale capable of measuring up to 5-pound force to move piston.

B. Preparation for Test

(1) After completion of steps 8.D.(1), connect pneumatic test stand pressure source to inlet port of unit (indicated in figure 3).

C. Predisassembly Test

NOTE: If unit meets requirements of this test, it may be continued in service without overhaul.

(1) Operation

(a) Perform "Post Overhaul Operation" test 8.D.(1). Unit must meet requirements of these tests.

(2) Leakage

(a) Perform "Post Overhaul Leakage" test 8.D.(2), except leakage at 200 psi shall not exceed 5 standard cubic feet of air per minute.

D. Post Overhaul Test

(1) Operation

(a) With all ports vented, place valve in vertical position with rod end down. Cycle piston over its full length of travel at least six times. There shall be no evidence of seizing or binding.

(b) With valve positioned vertically (step 8.D.(1)(a)) and piston in full down position, upward force on piston required to overcome initial breakaway friction shall not exceed 4 pounds.

NOTE: For valve assemblies 65-37831-5 and 65-37831-6 only, a force of 4.60 pounds shall raise the piston at least 0.90 inch.

(c) Manually move piston to full up or compressed spring position, then release. Piston shall freely return to full down position as shown in figure 3, without any external force applied.

(d) Repeat steps (b) and (c) with piston rotated 90 degrees each time.

(2) Leakage

(a) With piston in fully extended position in cylinder as shown in figure 3, with cruise port capped and with reverse port vented, apply 200 psi air to inlet port. Total leakage shall not exceed 3 standard cubic feet of air per minute.

Test Phase	Limit
Predisassembly - 200 psi at inlet port, cruise port capped	5 standard cubic feet of air maximum leakage in extended position
Predisassembly - no pressure applied to unit	4 pound maximum force to move piston from extended to retracted position
Post Overhaul - 200 psi at inlet port, cruise port capped	3 standard cubic feet of air maximum leakage in extended position
Post Overhaul - no pressure applied to unit, rod end down	4 pound maximum force to move piston from extended to retracted position NOTE: For valve assemblies 65-37831-5 and -6 only, a force of 4.60 pounds shall raise piston a minimum of 0.90 inch

Test Limits
Figure 4

9. TROUBLE SHOOTING (See figure 5.)

Trouble	Possible Cause	Correction
A. Excessive leakage	Piston (6) or cylinder (10) has excessive wear	Repair as stated in paragraph 5.A.(4) or 5.A.(5)
	Defective piston rings (7)	Replace defective parts per paragraph 5.C.(1)
B. Piston (6) movement is restricted	Foreign matter accumulations	Disassemble and clean in accordance with paragraph 3
	Defective piston rings (7)	Replace defective parts per paragraph 5.C.(1)

10. STORAGE INSTRUCTIONS

A. Provide closures for storage, per Specification MIL-C-5501C or equivalent.

B. Wrap entire unit in vapor barrier paper. Mark or tag with test date and store.

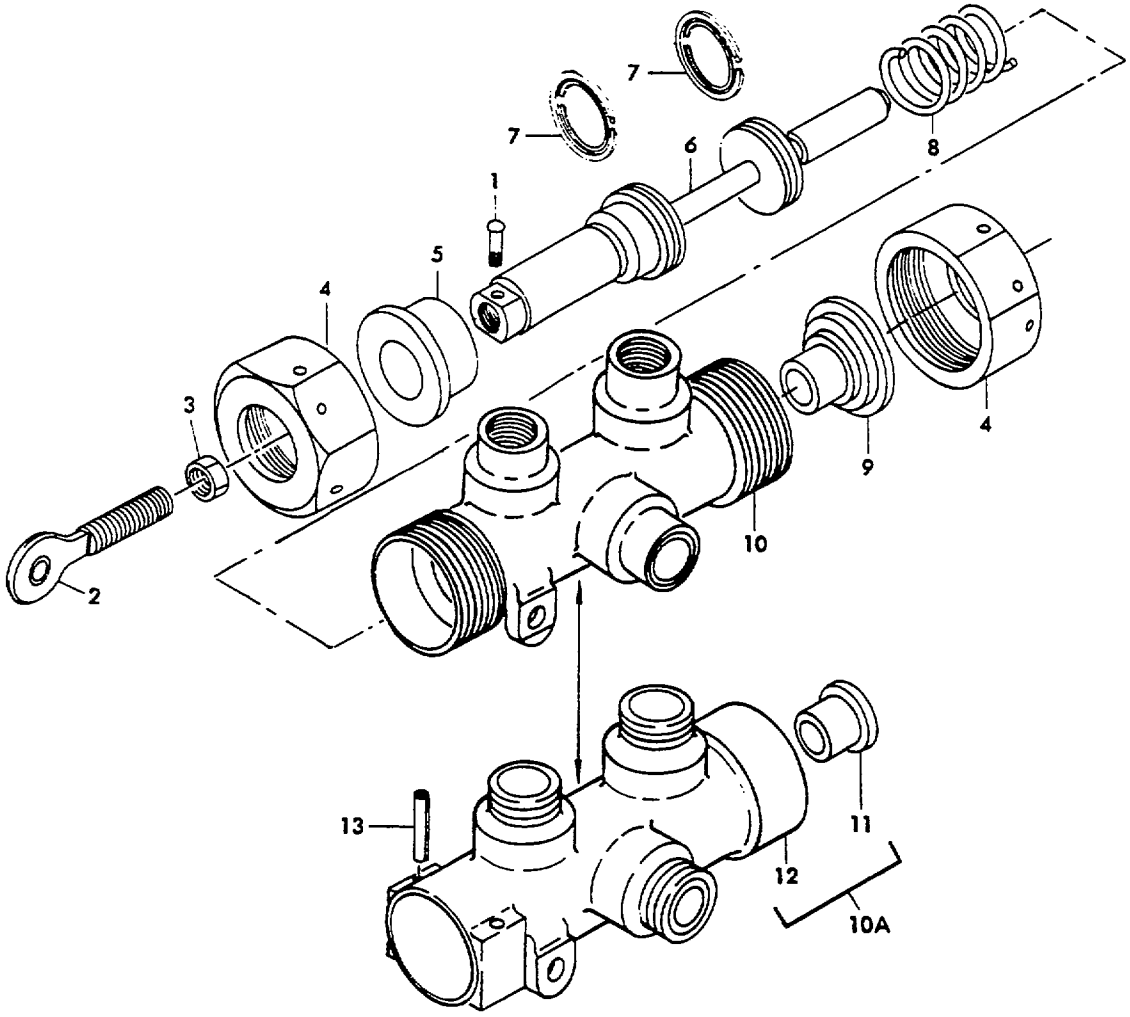
C. For general information, refer to "Temporary Protective Coatings," Subject 20-44-02.

11. SPECIAL TOOLS, FIXTURES AND EQUIPMENT

A. A pneumatic test stand capable of supplying 200 psi air pressure and measuring 5 standard cubic feet per minute air flow.

12. ILLUSTRATED PARTS LIST

A. Exploded View



Thrust Reverser Direction Valve Assembly
Figure 5

FIG. & ITEM NO.	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USE CODE	QTY PER ASSY
5					
	65-37831-2		THRUST REVERSER DIRECTIONAL VALVE ASSY		
	65-37831-4		THRUST REVERSER DIRECTIONAL VALVE ASSY		
	65-37831-5		THRUST REVERSER DIRECTIONAL VALVE ASSY		
	65-37831-6		THRUST REVERSER DIRECTIONAL VALVE ASSY		
1	MS20613-3C10		. RIVET (RPLCS AN435F3)		1
1	AN435F3		. RIVET (REPLD BY MS20613-3C10)		1
2	R53		. BEARING, ROD END, V77896		1
2	DREM-3-070		. BEARING, ROD END, V81376 (OPT)		1
2	BACB10C660		. BEARING, ROD END (OPT)		1
3	AN316C5R		. NUT		1
4	69-17865-1		. CAP	AC	2
5	69-17854-1		. BUSHING	AC	1
5	69-17854-2		. BUSHING (OPT)	AC	1
5	69-17854-2		. BUSHING	BD	1
6	65-37808-1		. PISTON		1
7	ABA4699		. RING, PISTON, V71687		2
8	66-17800-1		. SPRING	AB	1
8	69-53708-1		. SPRING	CD	1
9	69-17866-1		. BUSHING	AC	1
10	65-37809-4		. CYLINDER	AC	1
10A	65-37913-3		. CYLINDER ASSY	BD	1
11	BACB28W6B60		. . BUSHING		1
12	65-37913-4		. . CYLINDER		1
13	MS51923-291		. SPRING PIN	BD	2

A USED ON 65-37831-2
B USED ON 65-37831-4
C USED ON 65-37831-5
D USED ON 65-37831-6

VENDORS

V5G098 SIERRA PACIFIC SUPPLY CO., 1801 W. EL SEGUNDO AVE., P.O. BOX 4848, COMPTON, CALIFORNIA 90222-1026, PHONE: (310) 638-9318

V71687 COOK AIRTOMIC, A DOVER RESOURCES CO., 916 S. 8th ST., P.O. BOX 1038, LOUISVILLE, KENTUCKY 40203-3304

V77896 REXNOR INC., 2400 CURTIS ST., DOWNERS GROVE, ILLINOIS 60515-4307

V81376 SMITH ACQUISITION CO., DBA SOUTHWEST PRODUCTS CO., 2240 BUENA VISTA ST., BALDWIN PARK, CALIFORNIA 91706