TO: ALL HOLDERS OF THRUST REVERSER HYDRAULIC CONTROL VALVE ASSEMBLY OVERHAUL MANUAL, 78-33-11

REVISION NO. 7, DATED NOV 1/99

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
Clarified lever position versus flow test procedure in testing section								X					

THRUST REVERSER HYDRAULIC CONTROL VALVE ASSEMBLY

78-33-11

BOEING P/N 65-44531-3, -4
65-73675-4, -5

AIRLINE P/N

THE FOLLOWING DIRECTIVES APPLY TO THIS SUBJECT:

BOEING SERVICE BULLETIN	BOEING TEMPORARY REVISION	OTHER DIRECTIVES	DATE DIRECTIVE INCORPORATED INTO TEXT
78-1015		PRR 31030-13 PRR 31915	Aug 15/69 Sep 10/70

LIST OF EFFECTIVE PAGES

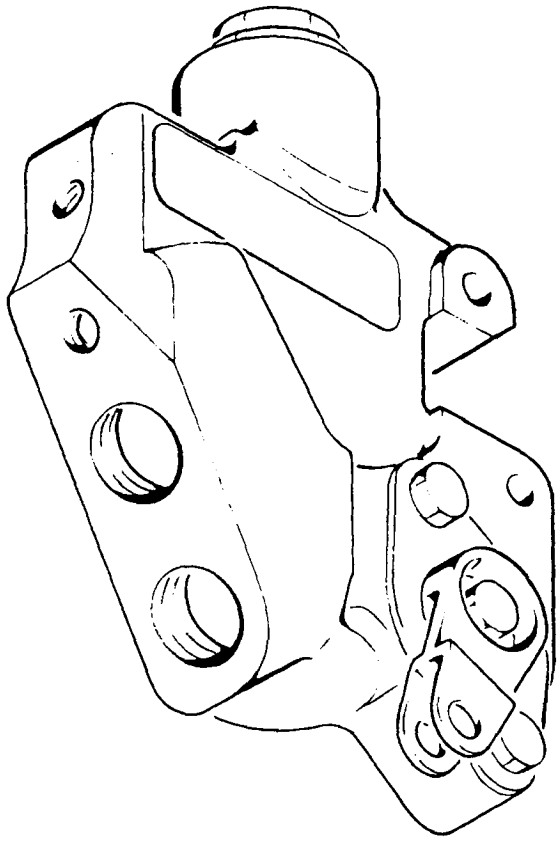
* Indicates pages revised, added or deleted in latest revision
F Indicates foldout pages - print one side only

	PAGE	DATE	PAGE	DATE	PAGE	DATE
	78-33-11					
	T-1	Jul 5/83				
	T-2	BLANK				
*	LEP-1	Nov 1/99				
	LEP-2	BLANK				
	T/C-1	Mar 10/71				
	T/C-2	BLANK				
	1	Mar 10/71				
	2	Aug 15/69				
	3	Aug 15/69				
	4	Mar 10/71				
	5	Dec 25/75				
	6	Mar 10/71				
	7	Dec 5/84				
	8	Mar 10/71				
	9	Mar 10/71				
	10	Jul 5/83				
*	11	Nov 1/99				
	12	Aug 15/69				
*	13	Nov 1/99				
	14	BLANK				
	15	Jul 5/81				
	16	Aug 15/69				
	17	Mar 1/95				
	18	Sep 5/85				
	19	Sep 5/85				
	20	BLANK				

TABLE OF CONTENTS

THRUST REVERSER HYDRAULIC CONTROL VALVE ASSEMBLY

Boeing Part Numbers: 65-44531-3, -4 and 65-73675-4, -5



Thrust Reverser Hydraulic Control Valve Assembly
Figure 1

1. DESCRIPTION AND OPERATION

A. Description

(1) The thrust reverser hydraulic control valve assembly is composed of a housing, containing a matched slide and sleeve type valve, and a lever system, pivoted on ball bearings, to position the slide in the sleeve.

B. Operation

(1) The thrust reverser hydraulic control valve stows or deploys the thrust reverser by porting hydraulic fluid pressure to the thrust reverser actuator. The valve is actuated by linkage from the pilot's reverse thrust lever.

C. Leading Particulars

Height -- 6.3 inches
Length -- 4.1 inches
Width -- 1.9 inches
Weight -- 1.5 pounds
Operating Medium -- fire resistant hydraulic fluid BMS 3-11
Operating Pressure -- 3000 psi
Proof Pressure -- 4500 psi
Port Sizes
Ports D and P -- per MS 33649-6
Ports S and R -- per MS 33649-8

2. DISASSEMBLY (See figure 8.)

A. If necessary remove hydraulic fittings per figure 9.

B. Cut and remove all lockwires.

C. Remove sleeve plug (13), O-ring packing (14) and spring (15).

D. Remove parts (1 through 12) from housing assembly (22).

E. Remove slide assembly (16), cap rings (19) and O-ring packings (20) from housing assembly (22).

NOTE: Slide (17) and sleeve (18) are precision matched parts and must be kept together as serialized. Place in an adequate container when not in work.

CAUTION: TO PREVENT DAMAGE TO SHARP EDGES, DO NOT BUFF SLIDE (17) OR SLEEVE (18) AT ANY TIME.

F. Do not remove nameplate (21), pins (24), plugs (23) or inserts (25) from housing (26) unless repair or replacement makes it necessary.

3. CLEANING (See figure 8.)

A. Wash and rinse all parts except bearings (6 and 11) in solvent, Specification P-D-680. Ensure that all passages are thoroughly cleaned.

B. Dry parts with clean, lint-free cloth or clean, dry, compressed air.

C. For further information refer to Subject 20-30-03.

D. Clean bearings (6 and 11) per Subject 20-30-01.

4. INSPECTION/CHECK

A. Visual Checks

(1) Examine metal parts for damage such as pits, scratches, cracks and corrosion. Use strong light and 10-power magnification.

(2) Check sealing surfaces for distortion and defects which will cause leakage after assembly.

(3) Examine plated surfaces for chipping, flaking and improper adhesion.

(4) Check nameplate for legibility and security of attachment.

B. Special Checks (See figure 8.)

(1) If visual examination discloses evidence of defects in any of listed parts, perform the following checks:

(a) Fluorescent dye penetrant check -- bushing (7), sleeve plug (13) and housing (26).

(b) Magnetic particle check -- lever (3), retainer (5), crank (8), slide (17) and sleeve (18).

(2) Slide assembly (16)

(a) Lubricate slide (17) and sleeve (18) with hydraulic fluid BMS 3-11. Position slide in sleeve. Turn on end. Check that slide moves by its own weight at each of three angular positions approximately 120° apart with respect to sleeve.

(3) Check bearings for roughness, and excessive radial and axial play.

(4) Spring Checks

(a) Check spring (15) by rolling it on a flat surface. There must be no wobble.

(b) Check that free length of spring (15) is approximately 1.68 inches. At a length of 1.26 inches, test load is 3.35-4.35 pounds; and at a length of 0.67 inch, test load is 8.3-10.3 pounds.

(5) Check parts for wear in accordance with limits and requirements specified in figure 4.

5. REPAIR

A. Repair (See figure 8.)

(1) Remove minor defects and corrosion from metal parts by polishing with aluminum oxide abrasive cloth 200 grit or finer. Refinish as necessary for protection against corrosion.

(2) Remove minor defects from threads with a small triangular file or a thread chaser.

(3) Rework slide (17).

NOTE: Material is Nitralloy rod heat-treated to 150-200 ksi or 52100 steel, heat-treated to 300 ksi.

(a) Machine actuating slot to clean up per Subject 20-10-01. Maximum allowable width of slot is 0.3170 inch.

(b) Build up with hard chrome plate per Subject 20-42-03. Grind per Subject 20-10-04 to original design dimension per figure 4. Surface finish is 8 microinches.

(4) Rework crank (8).

NOTE: Material is 17-4 ph steel, heat-treated to 180-200 ksi.

(a) Machine actuating spherical surface of crank to clean up per Subject 20-10-01. Minimum allowable spherical diameter is 0.3115 inch.

(b) Build up with hard chrome plate per Subject 20-42-03. Grind per Subject 20-10-04 to original design spherical diameter per figure 4. Surface finish is 8 microinches.

B. Refinish (Fig. 8)

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 or anodized surfaces are worn or chipped, refinish the following parts as indicated.

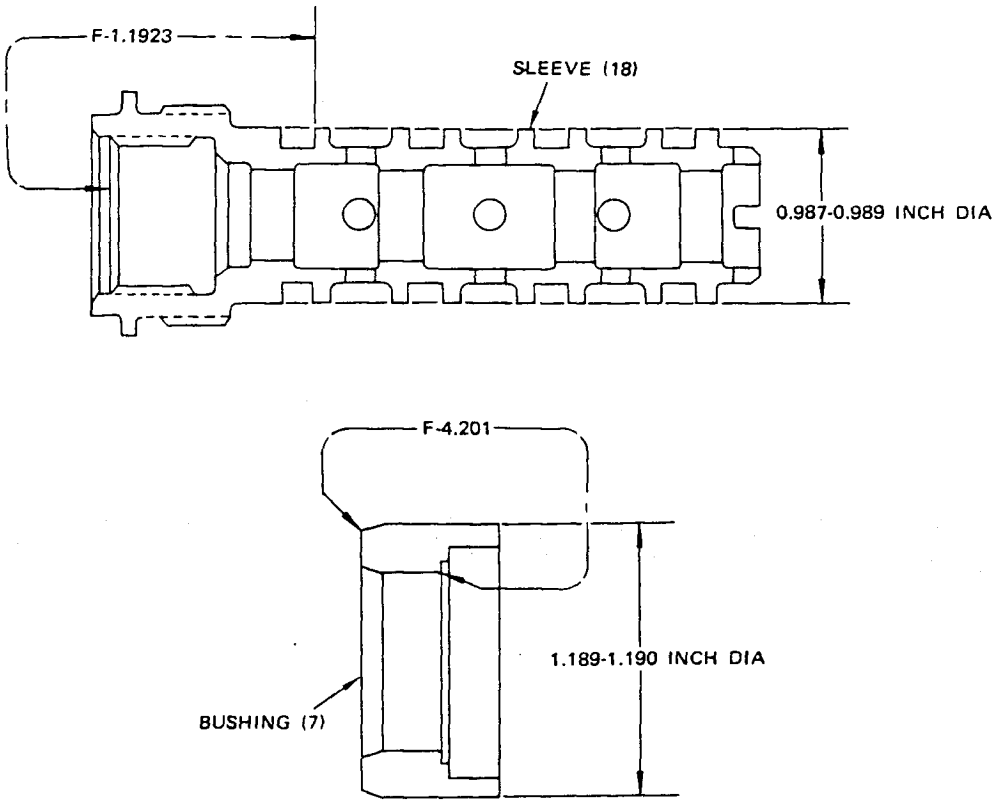
(a) Lever (3), crank (8) -- Passivate (F-8.07).

(b) Retainer (5) -- Cadmium plate (F-1.1923). Material: 4340 steel, 180-200 ksi.

(c) Bushing (7) -- Cadmium plate (F-4.201), single plating thickness 0.0003 to 0.0005 inch, to areas indicated in Fig. 2. Material: Al-Ni-Bronze per AMS 4640.

(d) Sleeve plug (13) and housing (26) -- Chromic acid anodize (F-2.26).

(e) Sleeve (18) -- Cadmium plate (F-1.1923), single plating thickness 0.0003 to 0.0005 inch, to areas indicated in Fig. 2. Material: Nitralloy per MIL-S-6709, case hardened Rockwell 15N 93.5 minimum. Core 150-200 ksi.



Refinish Diagrams
Figure 2

C. Replacement (See figure 8.)

(1) Replace parts damaged beyond simple repair or worn beyond allowable limits listed in figure 4.

(2) Replace packing cap rings (9 and 19) and O-ring packings (10, 12, 14 and 20) at each overhaul per Subject 20-50-06.

NOTE: Slide assembly (16) is a matched set and must be replaced as a unit if slide (17) or sleeve (18) requires replacing.

(3) If nameplate (21) requires replacement, use a sharp knife or equivalent to remove nameplate (21). Methyl ethyl ketone, Specification TTM-261, may be brushed on the parting line to facilitate removal. Bond new nameplate (21) to housing (26) per Subject 20-50-12, type 38.

(4) If plugs (23) and pins (24) require replacing, remove and replace per Subject 20-50-04.

(5) If inserts (25) require replacement, remove damaged insert. Clean bore and apply primer, BMS 10-11, type 1, to faying surfaces of new insert and bore. While primer is still wet, install insert with top coil 3/4 to 1-1/2 turns below top surface of bore. Remove tang.

6. ASSEMBLY

A. General

(1) Lightly lubricate packings with fire resistant hydraulic fluid BMS 3-11 or assembly lube MCS 352 prior to installation and install per Subject 20-50-06.

B. Assembly (See figure 8.)

(1) Place O-ring packings (20) and packing cap rings (19) on sleeve (17). Lubricate slide (17) and the ID of sleeve (18) with BMS 3-11 and carefully install slide (17) in sleeve (18).

CAUTION: SLIDE (17) AND SLEEVE (18) MAKE UP A PRECISION MATCHED SET AND MUST BE MATED AS SERIALIZED TO OBTAIN PROPER FIT.

(2) Install slide assembly (16) and preassembled parts in housing assembly (22). Tighten within a torque range of 50 to 75 pound-inches.

(3) Install O-ring packing (12) and bearing (11) in housing assembly (22).

(4) Place O-ring packing (10) and cap ring (9) on crank (8). Install crank (8).

NOTE: Ensure that crank (8) is seated in bearing (11) and the crank ball engages the slot of slide (17).

(5) Install parts (7 through 1).

(6) Install spring (15).

(7) Place O-ring packing (14) on sleeve plug (13). Install sleeve plug (13) and tighten within a torque range of 20 to 25 pound-inches.

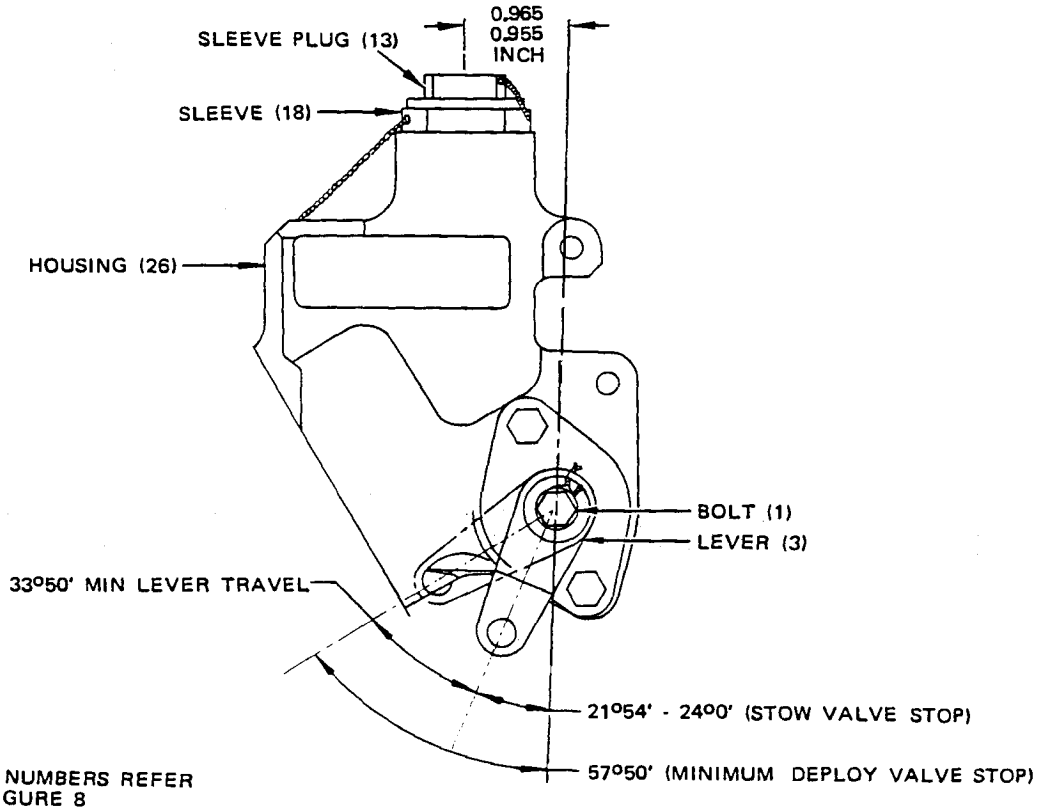
(8) Ensure that lever movement conforms to indicated angles per figure 3.

(9) After completion of testing per paragraph 8, lockwire per Subject 20-50-02; bolt (1) to lever (3), sleeve plug (13) to sleeve (18) and sleeve (18) to housing (26) as shown in figure 3.

C. Materials

(1) BMS 3-11 fire-resistant hydraulic fluid -- source optional

(2) MCS 352 Skydrol Assembly Lube -- Monsanto Co. Inc., 800 North Lindbergh Blvd., St. Louis Missouri 63166

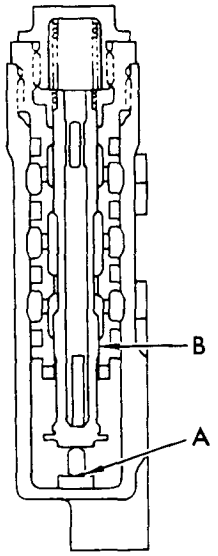


Assembly Details
Figure 3

7. FITS AND CLEARANCES

A. The fits and clearances table lists design dimensions and service wear limits for close tolerance parts of the assembly that are subject to wear or corrosion. Unless otherwise specified, parts should be returned to the design dimensions whenever rework is accomplished.

B. Clearances are given to aid assembly of the components. The values given in the Maximum Allowable Clearance column are the maximum permitted to ensure proper functioning of the unit. If assembled parts fail to meet this requirement, 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 the design clearances be used as the guiding assembly criteria when newly reworked parts are assembled.



Ref Letter Fig. 4	Mating Item No. Fig. 8	Design Dimensions				Service Wear Limits		
		Dimensions (inches)		Assembly Clearance (inch)		Dimension Limits (inches)		Maximum Allowable Clearance (inch)
		Min	Max	Min	Max	Min	Max	
*[3] A	ID 17	0.3155	0.3165	0.0025	0.0045	0.3115	0.3170	0.0055
	OD 8	0.3120	0.3130					
B	ID 18			*[1]	*[1]			*[2]
	OD 17							

*[1] Lap fit in accordance with functional test requirements.

*[2] Maximum allowable internal leakage shall be 22.5 cc per minute when performing test per paragraph 8.D.

*[3] Width of slot.

8. TESTING (Fig. 5, 6)

A. Test Equipment

(1) Hydraulic test stand providing hydraulic fluid flow of 8.5 gpm at room temperature and capable of controlled pressure from zero to 4500 psi

(2) Calibrated pressure gages 0- to 200-psi and 0 - to 5000-psi range

(3) Test Fluid: Fire-resistant hydraulic fluid BMS 3-11

(4) Deleted.

B. Preparation for Test

(1) Apply hydraulic fluid BMS 3-11 or Skydrol Assembly Lube MCS 352 to O-ring packings (2) and the threads of unions (1) and install per Fig. 8.

(2) Secure control valve in standard bench support fixture.

(3) Fill unit with test fluid, and bleed off all air.

WARNING: DO NOT APPLY COMPRESSED AIR TO PORTS AT ANY TIME. SEVERE FRAGMENTATION MAY RESULT.

C. Input Lever Travel Test

(1) With slide fully extended against stop, input lever position shall be 21°54'-24°0' as shown in Fig. 3.

(2) Rotate lever to depress slide to stop position.

(3) Lever travel shall be 33°50' minimum.

D. Proof Pressure Test

CAUTION: DO NOT CYCLE UNIT AT PROOF PRESSURE. DAMAGE TO MECHANISM MIGHT RESULT.

(1) Close ports D and S, open port R. Move lever to bottom slide in extended position. Apply 4500-psi hydraulic pressure to port P. Hold for 2 minutes. Check that there is no external leakage or permanent set.

(2) Move lever to fully depress slide. Apply 4500-psi hydraulic pressure to port P. Hold for 2 minutes. Check that there is no external leakage or permanent set.

(3) With lever set in any position, close ports D, S, P. Apply 900 psi hydraulic pressure to port R. Hold for 2 minutes. Check that there is no external leakage or permanent set.

(4) Repeat step (3) using 2 psi hydraulic pressure. Check that there is no external leakage.

E. Internal Leakage Test

(1) Move lever to place slide in extended position. Close port S and open ports R, D. Apply 3000 psi hydraulic pressure to port P. Check that leakage from ports R and D does not exceed 15 cc per minute from each port.

(2) Close port D and open ports R, S. Move lever to 45°-47° position. Apply 3000 psi hydraulic pressure to port P. Check that leakage from ports R and S does not exceed 15 cc per minute from each port.

F. Pressure Drop Test

(1) Place lever at a position of 43° 45'-46°. Establish a flow of 5 gpm from port P to port D. Check that pressure drop from port P to port D does not exceed 150 psi.

(2) Establish a flow of 8.5 gpm from port S to port R. Check that pressure drop from port S to port R does not exceed 150 psi.

G. Slide Return Spring Test

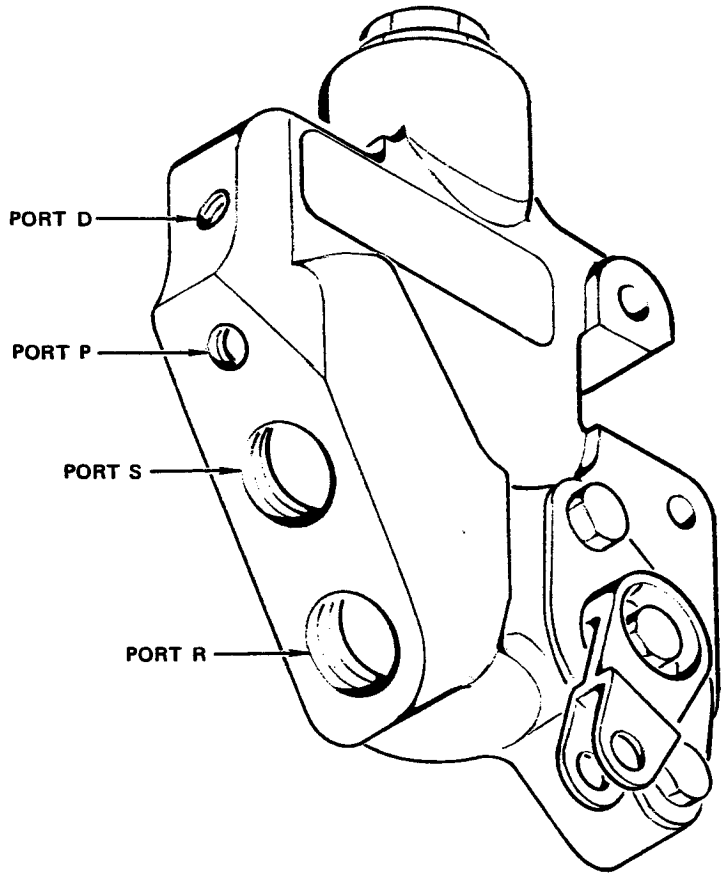
(1) Close ports S and D, open port R, and apply 3000 psi hydraulic pressure to port P. Move lever to slide depressed position. Check that slide returns to extended position without any force being applied to lever.

H. Lever Position vs Flow Test

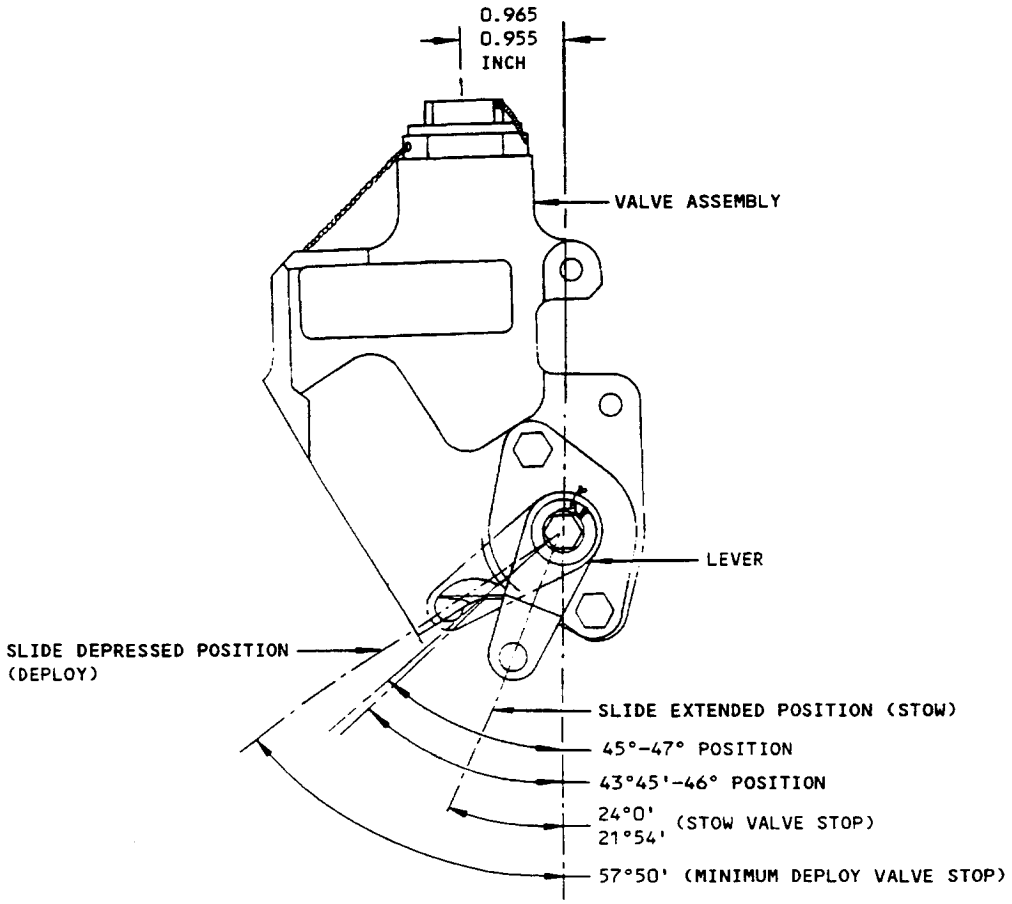
(1) Open ports R, S, D, place lever at stow stop position, and apply pressure to port P to obtain flow of approximately 0.5 gpm at port S.

(2) Move lever in deploy direction past position at which flow from port S stops. Allow lever to slowly return in the stow direction and note the lever position where flow starts from port "S". The lever position where flow starts from port "S" shall not be less than 34 degrees.

I. After testing, install lockwire per Assembly instructions.



Port Locations
Figure 5



Testing Details
Figure 6

(Figure 7 Deleted)

9. TROUBLE SHOOTING

Trouble	Possible Cause	Correction
A. External leak	Defective O-ring packings (10, 12, 20, 14) or rings (9, 19)	Check and replace packings or rings
B. Excessive internal leakage	Improper matching of slide (17) and sleeve (18)	Check serial numbers on slide (17) and sleeve (18) and correct as necessary
	Excessive clearance between slide (17) and sleeve (18)	Replace worn slide (16)
C. Excessive pressure drop	Foreign material in internal passage	Check and clean
D. Excessive spring force	Defective spring (15)	Replace spring
	Foreign material between sliding surfaces of slide assy (16)	Clean slide (17) and sleeve (18)

10. STORAGE INSTRUCTIONS

A. Partially fill unit with hydraulic fluid BMS 3-11.

B. Cap or plug ports with BMS 3-11 resistant caps or plugs.

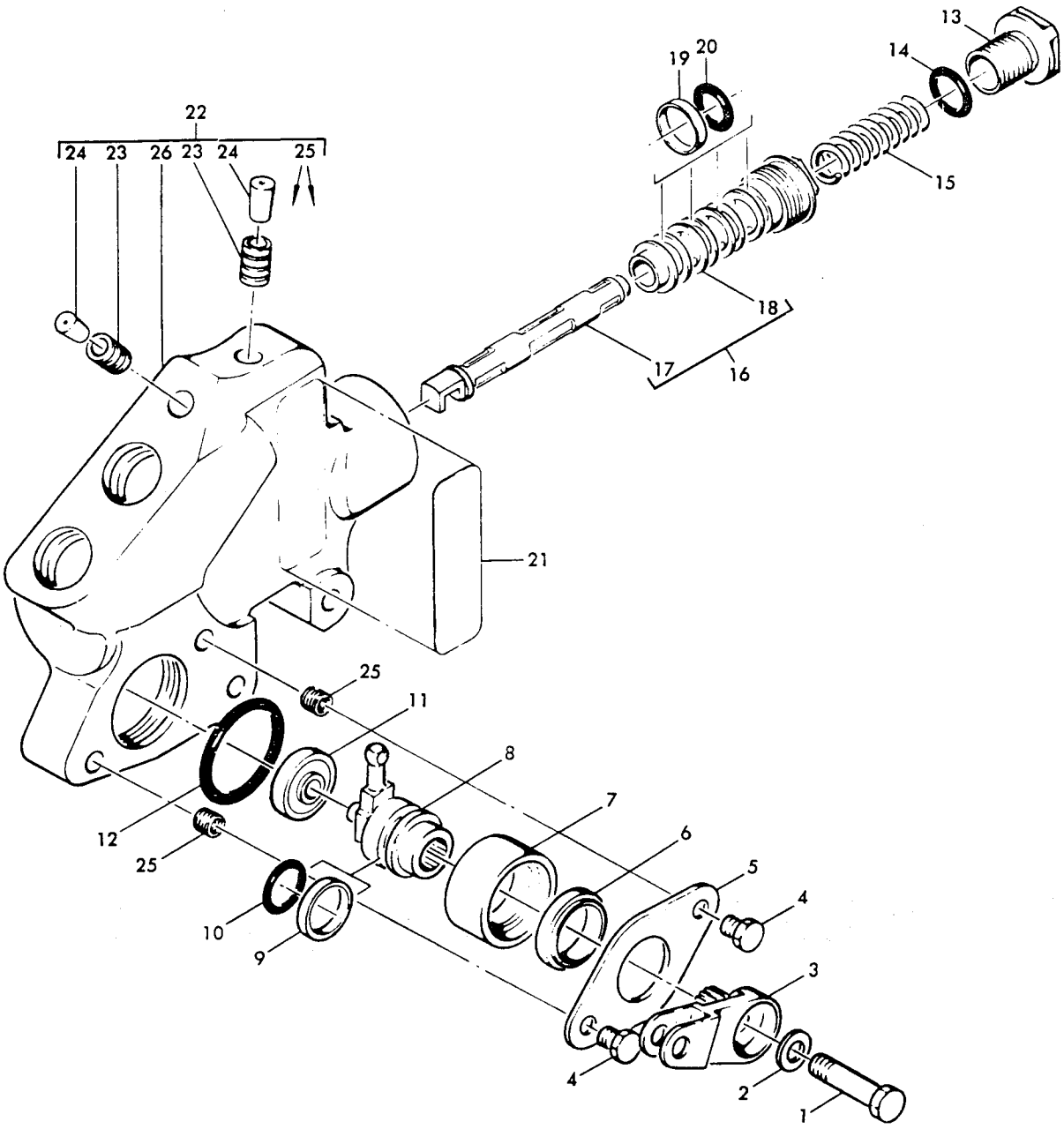
C. Wrap unit in vapor barrier paper. Tag or mark with test data. For further information refer to 20-44-02.

11. SPECIAL TOOLS, FIXTURES, AND EQUIPMENT

A. No special tools required for disassembly and assembly. For tools required in test procedures refer to TESTING.

12. ILLUSTRATED PARTS LIST

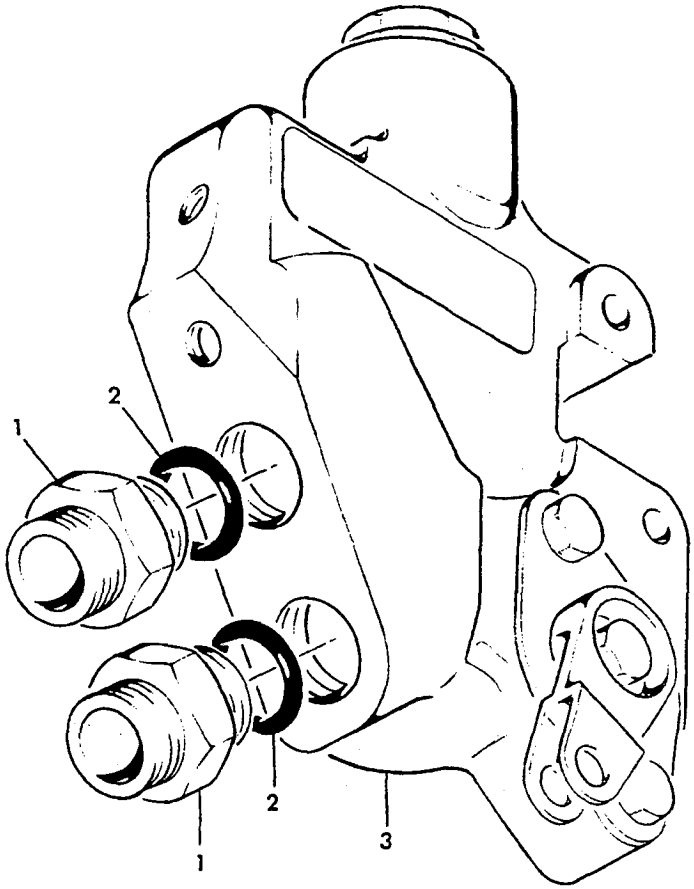
A. Exploded View



Thrust Reverser Hydraulic Control Valve Assembly
Figure 8

FIG. & ITEM NO.	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USE CODE	QTY PER ASSY
8-					
	65-44531-3		THRUST REVERSER HYDRAULIC CONTROL VALVE ASSY	A	
	65-44531-4		THRUST REVERSER HYDRAULIC CONTROL VALVE ASSY	B	
1	BACB30NE3H9		. BOLT		1
2	AN960C10L		. WASHER		1
3	69-35764-1		. LEVER		1
4	BACB30NE3-1		. BOLT	A	2
4	BACB30MT4T3		. BOLT (SB 78-1015)	B	2
4	BACB30NE4-3		. BOLT (OPTIONAL ON 65-44531-4)(SB 78-1015)		2
5	69-35816-1		. RETAINER	A	1
5	69-54713-1		. RETAINER (SB 78-1015)	B	1
6	BACB10A27DDH		. BEARING		1
6	BACB10CF10PP		. BEARING (OPT)		1
7	69-35838-2		. BUSHING		1
8	69-35761-1		. CRANK		1
9	BACR12BE114A		. RING, PACKING CAP (USED WITH ITEMS 10, 10A)		1
9A	S30640-114		. RING, PACKING CAP (USED WITH ITEM 10)		1
10	NAS1611-114		. PACKING, O-RING (USED WITH ITEM 9)		1
10A	NAS1611-113		. PACKING, O-RING (USED WITH ITEM 9)		1
11	65-44531-2		. BEARING		1
12	NAS1611-123		. PACKING, O-RING		1
13	69-35718-1		. PLUG, SLEEVE		1
14	NAS1612-10		. PACKING, O-RING		1
15	69-35720-1		. SPRING		1
16	69-54597-1		. SLIDE ASSY		1
17	69-54598-1		. . SLIDE		1
18	65-44587-1		. . SLEEVE		1
19	BACR12BE210A		. RING, PACKING CAP		4
20	NAS1611-210		. PACKING, O-RING		4
21	BAC27DHY128		. NAMEPLATE		1
22	65-44532-4		. HOUSING ASSY	A	1
22	65-44532-9		. HOUSING ASSY (SB 78-1015)	B	1
22	65-44533-3		. HOUSING ASSY (OPT)	A	1
22	65-44533-6		. HOUSING ASSY (SB 78-1015)	B	1
23	BACP20AX25D		. . PLUG		2
24	BACP20AX25DP		. . PIN		2

FIG. & ITEM NO.	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USE CODE	QTY PER ASSY
8-					
25	MS21209F1-15		. . INSERT		2
25	MS21209F4-15		. . INSERT (used on 65-44532-9 and 65-44533-6)(SB 78-1015)		2
26	65-44532-5		. . HOUSING (used on 65-44532-4)		1
26	65-44532-10		. . HOUSING (used on 65-44532-9)		1
26	65-44533-4		. . HOUSING (used on 65-44533-3)		1
26	65-44533-7		. . HOUSING (used on 65-44533-6)		1



Thrust Reverser Hydraulic Control Valve Assembly
Figure 9

FIG. & ITEM NO.	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USE CODE	QTY PER ASSY
9-					
	65-73675-4		THRUST REVERSER HYDRAULIC CONTROL VALVE ASSY		
	65-73675-5		THRUST REVERSER HYDRAULIC CONTROL VALVE ASSY (SB 78-1015)		
1	MS21902-8		. UNION		2
2	NAS1612-8		. PACKING, O-ring		2
3	65-44531-3		. VALVE ASSY, Thrust reverser hydraulic control (used on 65-73675-4)		1
3	65-44531-4		. VALVE ASSY, Thrust reverser hydraulic control (used on 65-73675-5)(SB 78-1015)		1