TO: ALL HOLDERS OF FEEL ACTUATOR CYLINDER ASSEMBLY COMPONENT MAINTENANCE MANUAL 27-31-15

REVISION NO. 19 DATED NOV 01/00

HIGHLIGHTS

Pages which have been added or revised are outlined below together with the highlights of the revision. Remove and insert the affected pages as listed and enter Revision No. and date on the Record of Revision Sheet.

CHAPTER/SECTION AND PAGE NO.	DESCRIPTION OF CHANGE
801	Revised indicating arrow for reference letter B in Fig. 801, Sheet 1.

FEEL ACTUATOR CYLINDER ASSEMBLY

PART NUMBER 65-44503-7,-8,-10

COMPONENT MAINTENANCE MANUAL
WITH
ILLUSTRATED PARTS LIST

BOEING

COMPONENT
MAINTENANCE MANUAL

REVISION RECORD

- Retain this record in front of manual. On receipt of revision, insert revised pages in the manual, and enter revision number, date inserted and initial.

REVISION NUMBER	REVISION DATE	DATE FILED	BY	REVISION NUMBER	REVISION DATE	DATE FILED	BY

TEMPORARY REVISION AND SERVICE BULLETIN RECORD

BOEING SERVICE BULLETIN	BOEING TEMPORARY REVISION	OTHER DIRECTIVE	DATE OF INCORPORATION INTO MANUAL
		PRR 33467 PRR 53671-1	JUL 10/84 JUL 10/87

PAGE	DATE	CODE
27-31-15		
TITLE PAGE		
1	JUL 10/87	01.1
2	BLANK	
REVISION RECORD		
1	JUL 10/83	01.1
2	BLANK	
TR & SB RECORD		
1	JUL 10/87	01.1
2	BLANK	
LIST OF EFFECTIVE PAGES		
*1	NOV 01/00	01
THRU LAST PAGE		
CONTENTS		
1	JUL 10/83	01.1
2	BLANK	
INTRODUCTION		
1	OCT 10/86	01.101
2	BLANK	
DESCRIPTION & OPERATION		
1	JUL 10/83	01.1
2	BLANK	
TESTING & TROUBLE SHOOTING		
101	JAN 01/93	01.1
102	OCT 01/90	01.1
103	OCT 01/90	01.1
104	JUL 01/98	01.1
105	JUN 01/96	01.1
106	JUN 01/96	01.1
DISASSEMBLY		
301	JUL 10/83	01.1
302	JUL 10/83	01.1
CHECK		
501	JUL 10/83	01.1
502	BLANK	
REPAIR-GENERAL		
601	OCT 10/86	01.1
602	OCT 01/87	01.1
REPAIR 1-1		
601	JUL 01/90	01.1
602	JUL 01/90	01.1
REPAIR 2-1		
601	OCT 10/86	01.1
602	BLANK	
REPAIR 3-1		
601	OCT 10/86	01.1
602	BLANK	
REPAIR 4-1		
601	OCT 10/86	01.1
602	BLANK	
REPAIR 5-1		
601	JUL 01/99	01.1
602	BLANK	
REPAIR 6-1		
601	JUL 10/83	01.1
602	BLANK	
ASSEMBLY		
701	OCT 01/88	01.1
702	JUN 01/96	01.1
703	MAR 01/95	01.1
704	BLANK	
FITS AND CLEARANCES		
*801	NOV 01/00	01.1
802	OCT 10/86	01.1

* = REVISED, ADDED OR DELETED

PAGE	DATE	CODE
SPECIAL TOOLS		
901	OCT 01/90	01.1
902	BLANK	
ILLUSTRATED PARTS LIST		
1001	JUL 10/83	01.1
1002	JUL 10/83	01.1
1003	JUL 10/83	01.1
1004	JUN 01/96	01.1
1005	JUN 01/96	01.101
1006	DEC 01/96	01.1
1007	DEC 01/96	01.1
1008	JUN 01/96	01.1

PAGE	DATE	CODE

* = REVISED, ADDED OR DELETED

TABLE OF CONTENTS

*[1] Special instructions not required. Use standard industry practices and information contained in 20-30-03.

INTRODUCTION

The instructions in this manual provide the information necessary to perform maintenance functions ranging from simple checks and replacement to complete shop-type repair.

This manual is divided into separate sections:

1. Title Page
2. Record of Revisions
3. Temporary Revision & Service Bulletin Record
4. List of Effective Pages
5. Table of Contents
6. Introduction
7. Procedures & IPL Sections

Refer to the Table of Contents for the page location of applicable sections. An asterisked flagnote *[ ] in place of the page number indicates that no special instructions are provided since the function can be performed using standard industry practices.

The beginning of the REPAIR section includes a list of the separate repairs, a list of applicable standard Boeing practices, and an explanation of the True Position Dimensioning symbols used.

An explanation of the use of the Illustrated Parts List is provided in the Introduction to that section.

All weights and measurements used in the manual are in English units, unless otherwise stated. When metric equivalents are given they will be in parentheses following the English units.

Design changes, optional parts, configuration differences and Service Bulletin modifications create alternate part numbers. These are identified in the Illustrated Parts List (IPL) by adding an alphabetical character to the basic item number. The resulting item number is called an alpha-variant. Throughout the manual, IPL basic item number references also apply to alpha-variants unless otherwise indicated.

Verification:

Testing/TS	Jul 6/81
Disassembly	Jul 6/81
Assembly	Jul 6/81

FEEL ACTUATOR CYLINDER ASSEMBLY

DESCRIPTION AND OPERATION

1. The feel actuator cylinder assembly consists of two cylinder and piston units held together with tie bolts, and mounting bolts through the center flange faces. The cylinder bores are separated by two dams, and each cylinder encloses a movable piston. A clevis attaches to the protruding end of each piston. Hydraulic pressure and return ports are provided at the top of each cylinder and piston unit for connection to the feel computer.

2. The cylinder is part of the aircraft elevator feel and centering mechanism. The elevator feel computer directs varying hydraulic fluid pressure to the cylinders providing artificial feel for the pilot and centering elevator.

3. Leading Particulars (Approximate)

   Length -- 14 inches
   Height -- 3.5 inches
   Width -- 3.25 inches
   Weight -- 6 lbs.
   Operating Medium -- BMS 3-11 Hydraulic Fluid
   Operating Pressure -- 50-2150 psi (variable input)
   Proof Pressure -- 4600 psi
   Stroke (installed) -- 1.67-1.73 inches

TESTING/TROUBLE SHOOTING

1. Test Equipment and Materials

NOTE: Equivalent substitutes may be used.

A. Assembly test fixture F80085-1 plus test fixture adapter assembly F80085-12, or equivalent test fixture which will rigidly hold unit at fixed center distance of 12.685-12.715 inches, between clevis (65) centerline. Body of unit must be free to move horizontally over full stroke distance in both directions (Fig. 102).

B. Hydraulic test stand capable of supplying hydraulic pressure from two separate sources controllable from 0 to 4600 psi.

C. Device capable of measuring stroke in 0.001 inch increments.

D. Spring scale, 25 pound capacity.

E. Pressure gages, 0 to 5000 psi.

F. Hydraulic fluid -- BMS 3-11 (Skydrol 7000 optional)

G. Fittings - To fit MS33649-04 and MS33649-06 ports

2. Preparation for Test

A. Filter test fluid to level shown in Fig. 101.

B. Install fittings and hydraulic lines to ports of cylinder, refer to Fig. 102 for location of test ports.

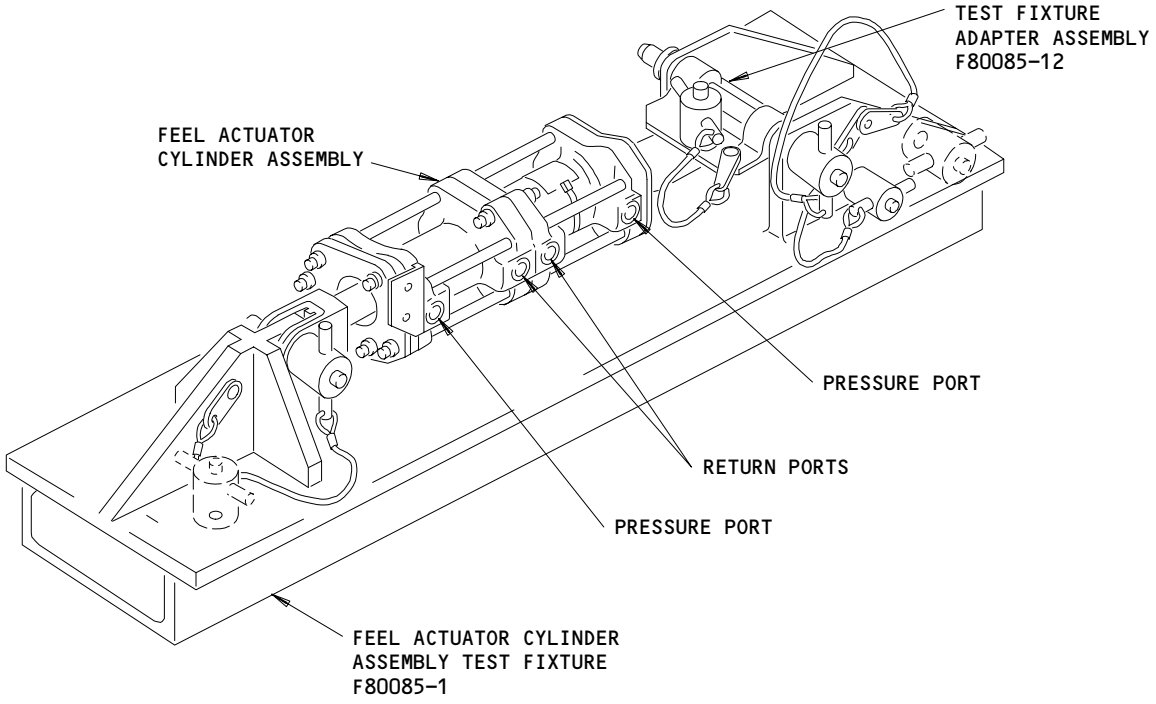
C. Cycle both pistons until all air is removed from unit.

D. Conduct all tests at room temperature.

Particle Size (microns)	Max. Quantity per 100 ml
10 - 25	6,000
26 - 50	1,400
51 - 100	400
101 - 150	20
Over 150	0

Hydraulic Fluid Filtering Limits
Figure 101

E. Conduct the following tests in the order listed.



Functional Test Setup
Figure 102

1874

3. Test

WARNING: DO NOT APPLY COMPRESSED AIR TO PORTS AT ANY TIME.

A. External Leakage Test

(1) Apply 2100 psi hydraulic pressure to both pressure (outer) ports for one minute.

(2) Reduce pressure from one source to 1500 psi while maintaining 2100 psi on other. When body has fully stroked, reverse 1500 and 2100 psi pressures. Continue to alternate pressures for 25 complete cycles.

(3) Leakage at either piston rod seal shall not exceed one drop in 25 complete cycles of operation.

B. Seal Friction Tests (Unit Pressurized)

(1) Apply equal or nearly equal pressures of 900 psi to both pressure ports with body in approximately center position. Adjust pressure to obtain hydraulic balance so that cylinder body remains stationary.

(2) Slowly reduce pressure on one port until body starts to move. At this point record pressure gage reading on reduced pressure side.

(3) Slowly increase pressure on same port until body starts to move in opposite direction. Record pressure gage reading. Total change in recorded pressure shall not exceed 125 psi for 65-44503-7 assembly or 112 psi for 65-44503-8, -10 assemblies.

(4) Repeat at 200 psi equal pressure. Total change in recorded pressure shall not exceed 57 psi for 65-44503-7 assembly or 51 psi for 65-44503-8, -10 assemblies.

C. Proof Pressure Test

WARNING: DO NOT CYCLE UNIT AT PROOF PRESSURE.

(1) Apply 50 psi pressure to one pressure port with all other ports open to atmosphere. When body has fully stroked, increase pressure to 4500-4600 psi proof pressure at a rate of 25,000 psi per minute maximum. Maintain pressure for two minutes.

(2) Lower pressure to 3-7 psi and hold for two minutes. There shall be no external leakage, failure or permanent set.

(3) Repeat steps (1) and (2) using other pressure port.

(4) Apply 50 psi to one return (inner) port with all other ports open to atmosphere. When body has fully stroked, plug pressure port and increase pressure to 2950-3050 return proof pressure at a maximum rate of 25,000 psi per minute. Maintain pressure for 2 minutes.

(5) Lower pressure to 3-7 psi and hold for two minutes. There shall be no external leakage, failure or permanent set.

(6) Repeat steps (4) and (5) using other return port.

D. Internal Leakage Test

(1) Apply 50 psi pressure to one pressure port with all other ports open to atmosphere. When body has reached fully retracted position, increase pressure to 2100 to 2150 psi and maintain for five minutes. Total leakage from return port of pressurized barrel shall not exceed 10 cc per minute.

(2) Repeat step (1) using 200 psi pressure. Leakage shall not exceed 20 cc per minute.

(3) Repeat steps (1) and (2) using other pressure port.

E. Stroke Tests

(1) Unit installed in test fixture.

(a) Apply 50 psi to one pressure port with both return ports open to atmosphere, until body has fully stroked.

(b) Position device on body for measuring stroke with an accuracy of ± 0.001 inch.

(c) Pressurize other pressure port with 100 psi. Record stroke required to bottom body at other end. Check that stroke is 1.67-1.73 inches.

(2) Unit free.

(a) Remove unit from test fixture.

(b) Apply 50 psi to both return (inner) ports until both pistons are fully extended.

(c) Apply 100 psi to one pressure port while maintaining 50 psi pressure on both return ports.

(d) Measure total stroke of piston. Stroke shall be 0.03 to 0.12 inch more than recorded stroke in step E.(1)(c).

(e) Repeat steps (b), (c) and (d) using other pressure port.

(f) Remove hydraulic pressure and manually stroke pistons. There shall be no evidence of sticking or binding.

TROUBLE	PROBABLE CAUSE	CORRECTION
Leakage at piston rod	Faulty or defective channel seal (115, IPL Fig.1) or packing (120)	Disassemble per Disassembly and replace part per Assembly
Leakage at bearing (125) (125)	Faulty or defective packing (105)	Disassemble per Disassembly and replace part per Assembly
Leakage between piston rod and clevis assy	Faulty or defective packing (40,41)	Disassemble per Disassembly and replace part per Assembly
Leakage between barrels (185)	Faulty or defective packing (150)	Disassemble per Disassembly and replace part per Assembly
Leakage beyond allowable limit on ports	Faulty or defective seals (80)	Disassemble per Disassembly and replace part per Assembly

Trouble Shooting Chart
Figure 103

4. Corrective Procedures

A. Drain hydraulic fluid from unit and remove fittings before disassembly.

B. Channel seal (115) or packing (120) replacement.

(1) Disassemble parts per par. 2.A. thru 2.E. of DISASSEMBLY.

(2) Check channel seal (115) or packing (120) and replace if defective.

(3) Assemble parts per par. 3.C. thru 3.I. of ASSEMBLY and retest for leakage.

C. Packing (105) replacement.

(1) Disassemble parts per par. 2.A. thru 2.E. of DISASSEMBLY.

(2) Check packing (105) and replace if defective.

(3) Assemble parts per par. 3.C. thru 3.I. of ASSEMBLY and retest for leakage.

D. Packing (40) replacement.

(1) Disassemble parts per par. 2.A. thru 2.C. of DISASSEMBLY.

(2) Check packing (40, 41) and replace if defective.

(3) Assemble parts per par. 2.G. thru 2.I. of ASSEMBLY and retest for leakage.

E. Packing (150) replacement.

(1) Completely disassemble parts per DISASSEMBLY.

(2) Check packing (150) and replace if defective.

(3) Reassemble per ASSEMBLY and retest for leakage.

F. Seal (80) replacement.

(1) Disassemble parts per par. 2.A., 2.B. of DISASSEMBLY.

(2) Check seal (80) and replace if defective.

(3) Reassemble per par. 4.H. and 4.I. of ASSEMBLY and retest for leakage.

DISASSEMBLY

NOTE: Refer to TESTING/TROUBLE SHOOTING to establish condition or probable cause of any malfunction and to determine extent of disassembly and repair.

1. Equipment

   NOTE: Equivalent substitutes may be used.

   A. Adapter -- A27035-1

2. Parts Replacement

   NOTE: The following parts are recommended for replacement. Unless otherwise specified, actual replacement of parts may be based on in-service experience.

   A. Lockwire, lockwashers, packings and backup rings.

3. Disassembly (IPL Fig. 1)

   A. Disassemble parts (5 thru 25).

   B. Pull out pistons (85) together with bearings (125) and attached parts from barrels (185).

   C. Remove lockwire and remove spring pins (30). Unscrew redundant rods (55) and disassemble parts (35 thru 50).

   D. Bend back tabs of lockwashers (60). Remove clevis assemblies (65) using adapter A27035-1. Remove lockwashers (60), retainer (90), retainer guide (95), scrapers (100) and bearings (125).

   E. Remove seals (80) from pistons (85), and parts (105 thru 120) from bearings (125).

   CAUTION: BARRELS (185) COMPRISE A MATCHED SET AND MUST BE KEPT TOGETHER TO ENSURE PROPER OPERATION AFTER ASSEMBLY.

   F. Disassemble parts (130 thru 145) to separate barrels.

   G. Push out dams (155) and remove packings (150).

H. Remove strap (160) and nameplate (165).

NOTE: Do not remove dowel pins (175) or inserts (180) from barrel (185) unless necessary for repair or replacement.

CHECK

1. Check all parts for obvious defects in accordance with standard industry practices. Refer to FITS AND CLEARANCES for design dimensions and wear limits.

2. Penetrant check per 20-20-02 -- Bearings (125), Dams (155), Barrels (185).

3. Magnetic particle check per 20-20-01 -- Piston (85).

REPAIR - GENERAL

1. Content

A. Repair, refinish and replacement procedures are included in separate repair sections as follows:

P/N	NAME	REPAIR
69-35676	PISTON	1-1
69-35679	RETAINER	2-1
66-22815	CLEVIS ASSY	3-1
69-35673	BEARING	4-1
65-44559	BARREL	5-1
- -	MISC PARTS REFINISH	6-1

2. Standard Practices

A. Refer to the following standard practices as applicable, for details of procedure in individual repairs.

20-10-01 Repair and Refinish of High Strength Steel Parts
20-10-03 Shot Peening
20-10-04 Grinding of Chrome Plated Parts
20-10-05 Application and Finishing of Plasma Flame Sprayed Coatings
20-30-02 Stripping of Protective Finishes
20-30-03 General Cleaning Procedures
20-41-01 Decoding Table for Boeing Finish Codes
20-42-03 Hard Chrome Plating
20-43-01 Chromic Acid Anodizing

3. Material

NOTE: Equivalent substitutes may be used.

A. Primer -- BMS 10-11, Type 1 (Ref 20-60-02)

4. Dimensioning Symbols

A. Standard True Position Dimensioning Symbols used in applicable repair procedures are shown in Fig. 601.

—	STRAIGHTNESS
▱	FLATNESS
⊥	PERPENDICULARITY (OR SQUARENESS)
//	PARALLELISM
○	ROUNDNESS
⌭	CYLINDRICITY
⌒	PROFILE OF A LINE
⌓	PROFILE OF A SURFACE
◎	CONCENTRICITY
⌯	SYMMETRY
∠	ANGULARITY
↗	RUNOUT
⌰	TOTAL RUNOUT
⌴	COUNTERBORE OR SPOTFACE
⌵	COUNTERSINK
⌖	THEORETICAL EXACT POSITION OF A FEATURE (TRUE POSITION)
∅	DIAMETER
S ∅	SPHERICAL DIAMETER
R	RADIUS
SR	SPHERICAL RADIUS
()	REFERENCE
BASIC (BSC) OR [DIM]	A THEORETICALLY EXACT DIMENSION USED TO DESCRIBE SIZE, SHAPE OR LOCATION OF A FEATURE FROM WHICH PERMISSIBLE VARIATIONS ARE ESTABLISHED BY TOLERANCES ON OTHER DIMENSIONS OR NOTES.
[-A-]	DATUM
Ⓜ	MAXIMUM MATERIAL CONDITION (MMC)
Ⓛ	LEAST MATERIAL CONDITION (LMC)
Ⓢ	REGARDLESS OF FEATURE SIZE (RFS)
Ⓟ	PROJECTED TOLERANCE ZONE
FIM	FULL INDICATOR MOVEMENT

EXAMPLES

— 0.002	STRAIGHT WITHIN 0.002
⊥ B 0.002	PERPENDICULAR TO B WITHIN 0.002
// A 0.002	PARALLEL TO A WITHIN 0.002
○ 0.002	ROUND WITHIN 0.002
⌭ 0.010	CYLINDRICAL SURFACE MUST LIE BETWEEN TWO CONCENTRIC CYLINDERS, ONE OF WHICH HAS A RADIUS 0.010 INCH GREATER THAN THE OTHER
⌒ A 0.006	EACH LINE ELEMENT OF THE SURFACE AT ANY CROSS SECTION MUST LIE BETWEEN TWO PROFILE BOUNDARIES 0.006 INCH APART RELATIVE TO DATUM PLANE A
⌓ A 0.020	SURFACES MUST LIE WITHIN PARALLEL BOUNDARIES 0.02 INCH APART AND EQUALLY DISPOSED ABOUT TRUE PROFILE
◎ C ∅ 0.0005	CONCENTRIC TO C WITHIN 0.0005 DIAMETER
⌯ A 0.010	SYMMETRICAL WITH A WITHIN 0.010
∠ A 0.005	ANGULAR TOLERANCE 0.005 WITH A
⌖ B ∅ 0.002 Ⓢ	LOCATED AT TRUE POSITION WITHIN 0.002 DIA RELATIVE TO DATUM B, REGARDLESS OF FEATURE SIZE
⊥ A ∅ 0.010 Ⓜ 0.510 Ⓟ	AXIS IS TOTALLY WITHIN A CYLINDER OF 0.010-INCH DIAMETER, PERPENDICULAR TO, AND EXTENDING 0.510-INCH ABOVE, DATUM A, MAXIMUM MATERIAL CONDITION
2.000 OR 2.000 BSC	EXACT DIMENSION IS 2.000

(NOTE THAT ⌓ A 0.020 MAY ALSO APPEAR AS ⌓ 0.020 A)

True Position Dimensioning Symbols
Figure 601

PISTON - REPAIR 1-1

69-35676-2, -3

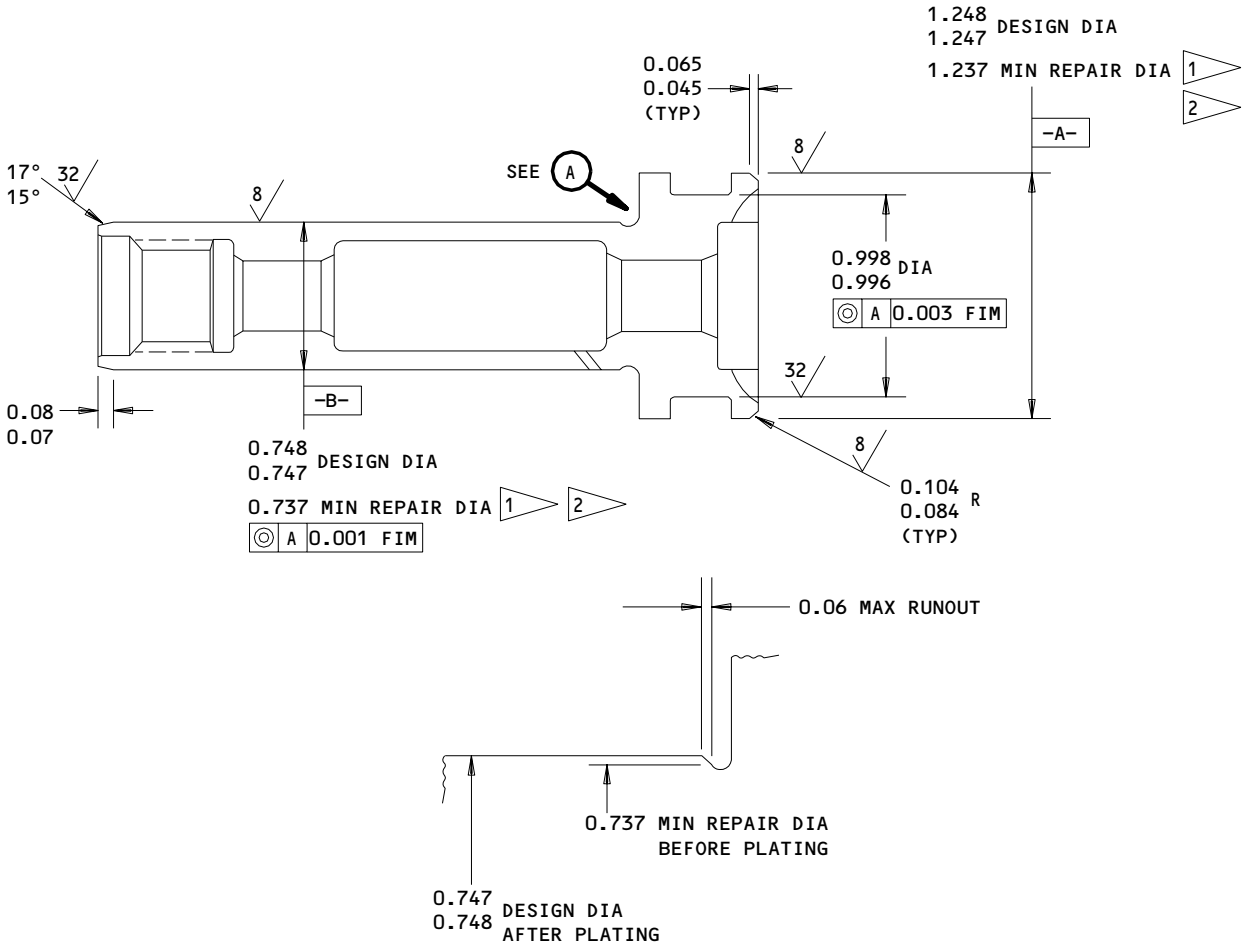
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require restoration of original finish, refer to Refinish Instructions, Fig. 601.

1. OD Repair (Fig. 601)

   A. Machine diameters A and B as required to remove corrosion and defects. Maintain limits and dimensions shown.

   B. Shot-peen as indicated.

   C. Build up repaired surfaces with stainless steel plasma flame spray (opt: chrome plate). Machine to design dimensions and finishes shown.



PLATING RUNOUT DETAIL

A

REFINISH

PASSIVATE (F-8.07) ALL OVER

1 BUILD UP WITH STAINLESS STEEL PLASMA FLAME SPRAY (REF 20-10-05) BMS 10-67, TYPE 8 AND MACHINE TO FINISH AND DIMENSIONS SHOWN.

2 OPTIONAL: BUILD UP WITH CHROME PLATE (REF 20-42-03) AND GRIND TO FINISH AND DIMENSIONS SHOWN. OBSERVE 0.06 PLATING RUNOUT AT SURFACE EDGES.

REPAIR

REF 1 2

125 ALL MACHINED SURFACES EXCEPT AS NOTED

BREAK ALL SHARP EDGES 0.010-0.015 R

SHOT-PEEN: (REF 20-10-03)

160-330 SHOT SIZE
0.009-0.015 A2 INTENSITY
2.0 COVERAGE

MATERIAL: 17-4PH CRES (180-200 KSI)

ALL DIMENSIONS ARE IN INCHES

69-35676-2 SHOWN
69-35676-3 SIMILAR
Piston Repair
Figure 601

1877

RETAINER, GUIDE - REPAIR 2-1

69-35679-1

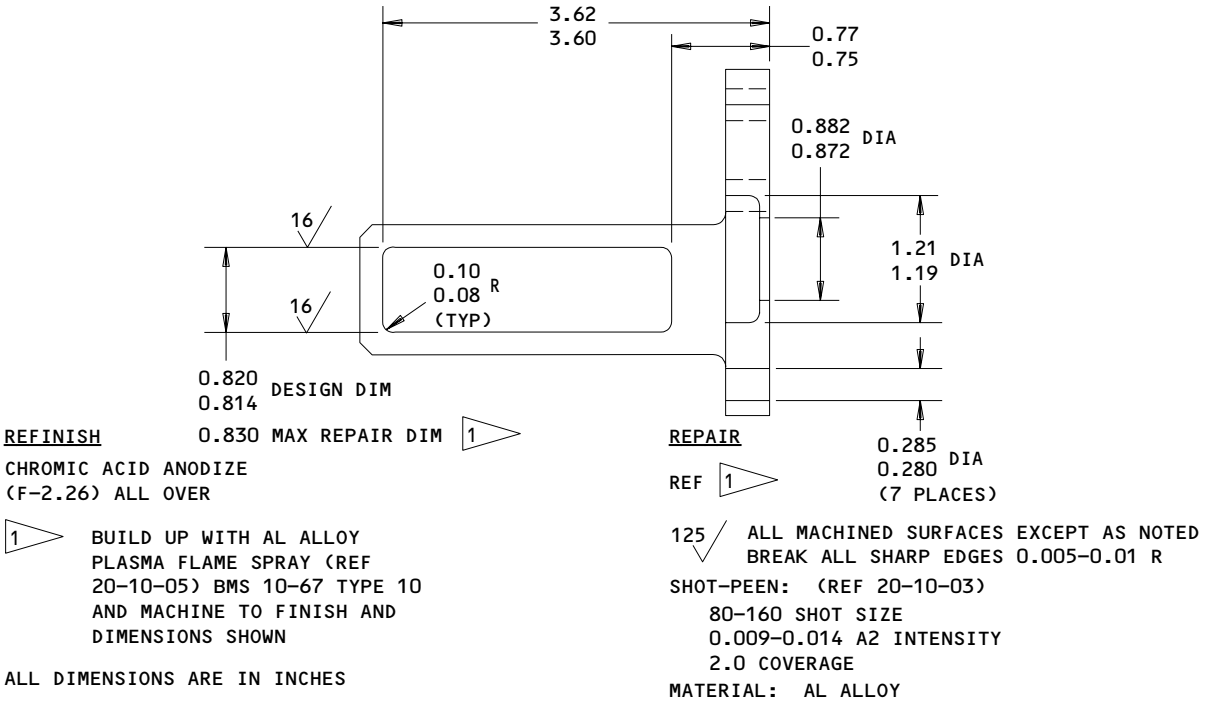
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of parts which only consists of stripping and restoration of original finish, refer to Refinish instructions, Fig. 601.

1. Slot Repair (Fig. 601)

   A. Machine as required, within repair limit shown to remove defects.

   B. Shot-peen as indicated.

   C. Build up repaired surfaces with aluminum alloy plasma flame spray and machine to dimension and finish shown.



69-35679-1
Retainer Repair
Figure 601

1888

CLEVIS ASSEMBLY - REPAIR 3-1

66-22815-1

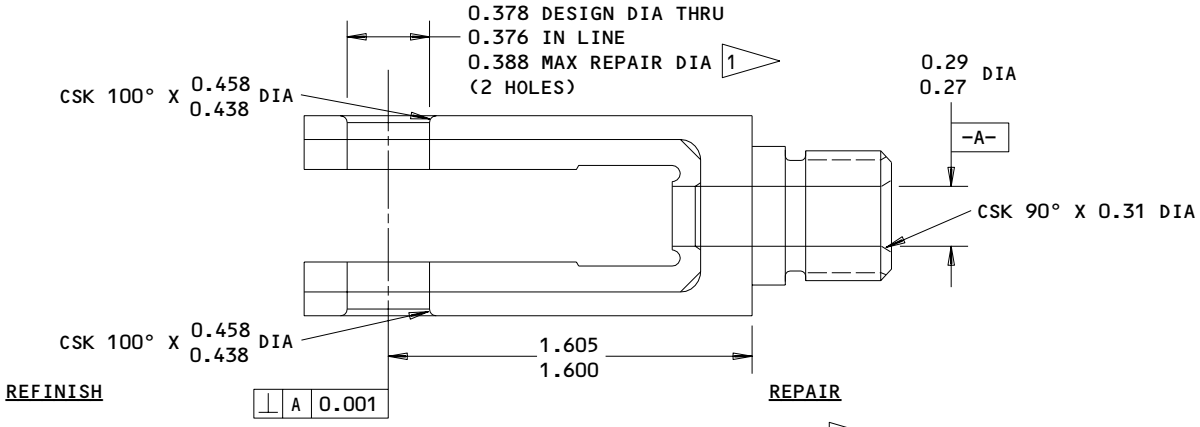
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require restoration of original finish, refer to Refinish Instructions, Fig. 601.

1. ID Repair (Fig. 601)

   A. Machine diameter A, as required, to remove corrosion or defects. Maintain limits and dimensions shown.

   B. Shot-peen as indicated.

   C. Chrome plate buildup repaired surfaces and grind to design dimension and finish shown.



REFINISH

PASSIVATE (F-8.07) ALL OVER

1 BUILD UP WITH CHROME PLATE (REF 20-42-03) AND GRIND TO FINISH AND DIMENSION SHOWN. OBSERVE 0.06 PLATING RUNOUT AT EDGES.

REPAIR

REF 1

125 ALL MACHINED SURFACES

SHOT-PEEN (REF 20-10-03)

330-460 SHOT SIZE
0.009-0.014 A2 INTENSITY
2.0 COVERAGE

MATERIAL; 17-4PH CRES STEEL (180-200 KSI)

ALL DIMENSIONS ARE IN INCHES

66-22815-1
Clevis Repair
Figure 601

2055

BEARING - REPAIR 4-1

69-35673-2

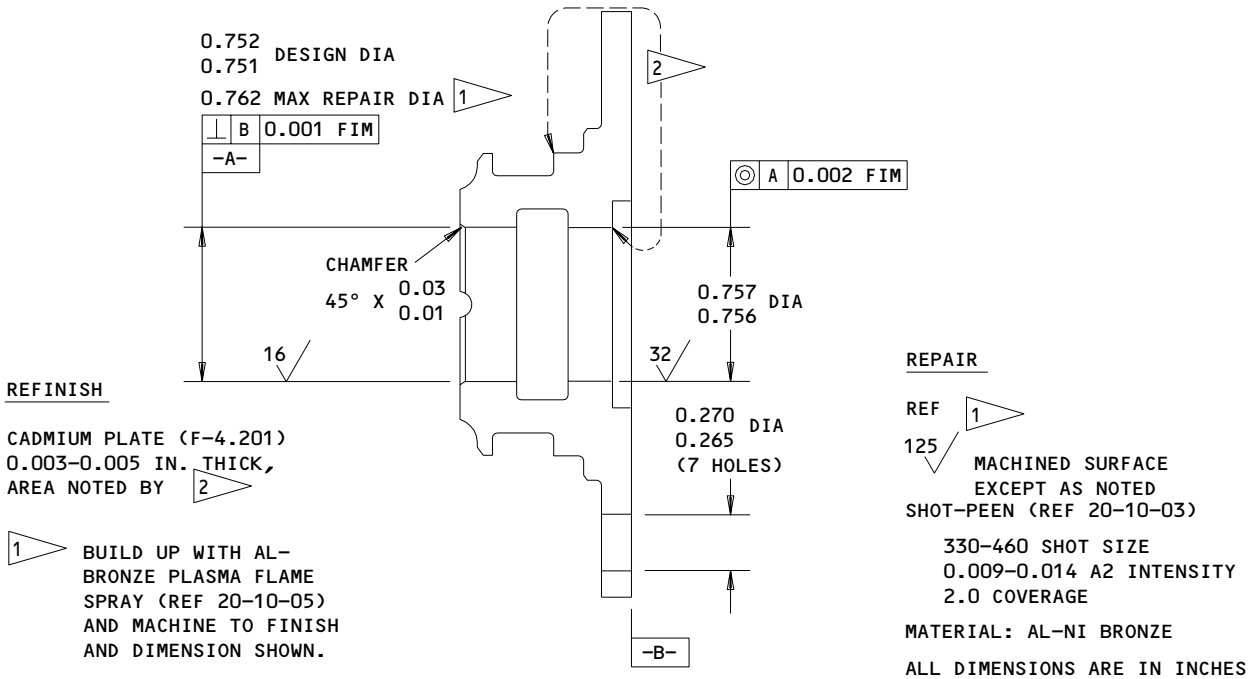
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require restoration of original finish refer to Refinish Instructions, Fig. 601.

1. ID Repair (Fig. 601)

   A. Machine diameter A, as required, to remove corrosion or defects. Maintain limits and dimensions shown.

   B. Shot-peen as indicated.

   C. Build up repaired surface with aluminum bronze flame spray and machine to design dimension and finish.



69-35673-2
Bearing Repair
Figure 601

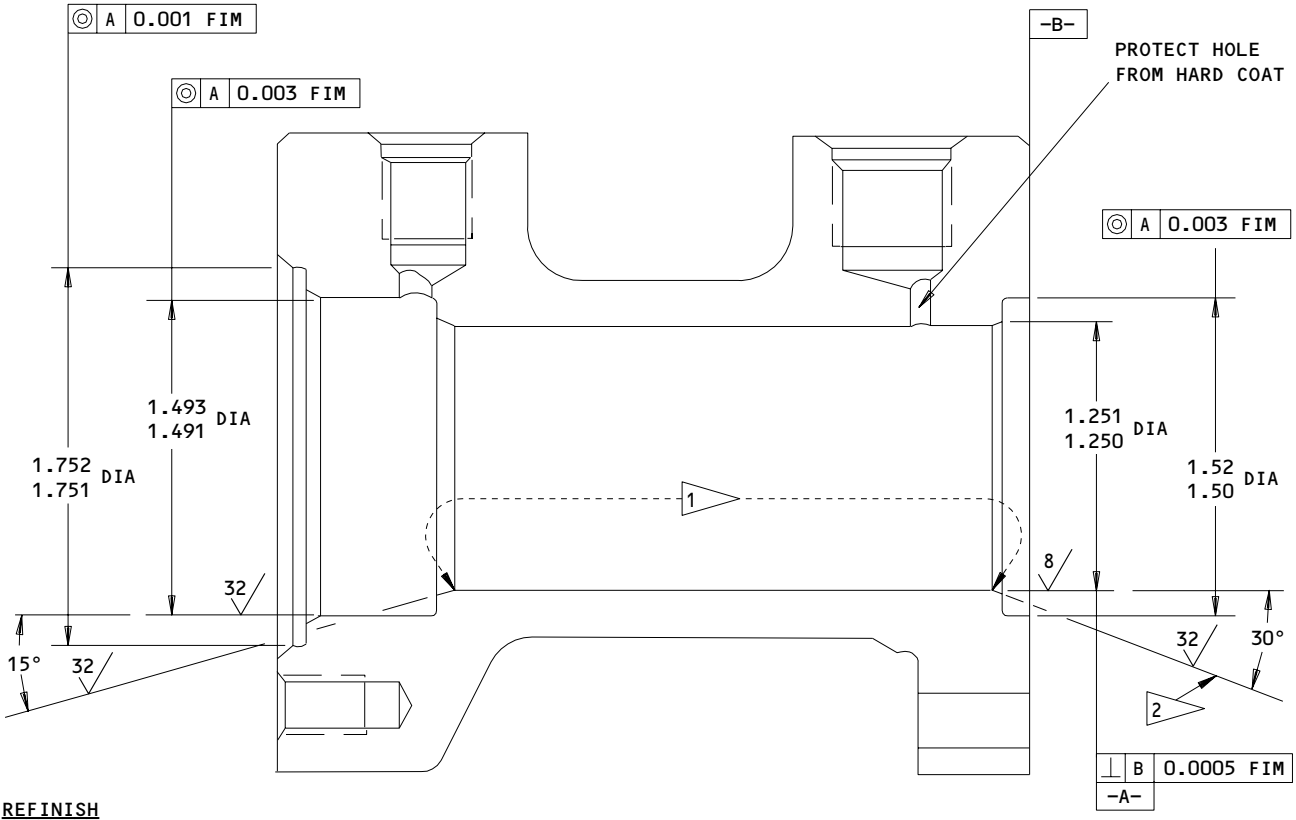
2058

BARREL - REPAIR 5-1

65-44559-2

1. Plating Repair

NOTE: Repair consists of restoration of original finish. Refer to Refinish Instructions, Fig. 601 and to REPAIR-GEN for list of applicable standard practices.



REFINISH

HONE BARREL I.D. TO 1.251-1.252 INCHES DIAMETER. SURFACE FINISH SHOULD BE 25 MICROINCHES. ANODIZE (F-2.204) THE INDICATED AREA OF THE PISTON BORE, 0.0020-0.0025 INCH THICK. HONE BARREL I.D. TO FINAL DIAMETER OF 1.250-1.251 INCHES AND SURFACE FINISH OF 8 MICROINCHES. FOR ALL OTHER SURFACES EXCEPT HOLES WITH THREADED INSERTS, FLASH HARD ANODIZE 0.0002-0.0003 INCH THICK AND SODIUM DICHROMATE SEAL. (OPTIONAL: CHROME ACID ANODIZE (F-17.04) AND SEAL IN 5 PERCENT, PLUS OR MINUS 1 PERCENT, NICKEL OR COBALT ACETATE SOLUTION)

1 ANODIZE (F-2.204) ENCLOSED AREA ONLY

2 ANODIZE (F-2.204) RUNOUT OPTIONAL THIS SURFACE

MATERIAL: AL ALLOY

ALL DIMENSIONS ARE IN INCHES

65-44559-2
Barrel Repair
Figure 601

1879

MISCELLANEOUS PARTS - REPAIR 6-1

1. Repair of parts listed in Fig. 601 consists of restoration of the original finish.

IPL FIG. & ITEM	MATERIAL	FINISH
Fig. 1		
Tie bolts (15)	17-4PH CRES, 180-200 ksi	Passivate (F-8.07).
Retainer (45)	Al alloy	Chromic acid anodize (F-2.26).

Refinish Details
Figure 601

ASSEMBLY

1. Materials and Equipment

   NOTE: Equivalent substitutes may be used.

   A. Hydraulic Fluid -- BMS 3-11 (Ref 20-60-03)

   B. Lubricant -- Skydrol Assembly Lube MCS352 (Ref 20-60-03)

   C. Adapter -- A27035-1

2. Lubrication

   A. Lubricate all threads before assembly with lubricant.

   B. Lightly lubricate all packings and channel seals at assembly with hydraulic fluid or lubricant.

3. Assembly (IPL Fig. 1)

   A. Install packings (150) on dam (155). Push dam into inner end of barrel (185) bore. Assemble barrels with bolts (145), washers (135, 140) and nuts (130). Tighten nuts (130) to 80-100 pound-inches.

   B. Install nameplate (165) on one barrel and secure with strap (160).

   C. Install packings (120), channel seals (115), backup rings (110) and packings (105) on bearings (125).

   D. Slide bearings (125), scrapers (100), guide retainer (95) and retainer (90) on rod of piston (85) using feel actuator piston alignment pin, B27070-1.

   E. Slide lockwashers (60) on clevises (65). Thread clevises (65) onto pistons (85), checking that preformed tabs on lockwashers (60) seat into piston rod slots. Tighten clevises to 260-280 pound-inches using adapter A27035-1. Bend over a minimum of two tabs of lockwashers protruding beyond surface of clevis assembly.

F. Install washers (50), backup rings (45, 46) and packings (40, 41) on redundant rods (55). Carefully slide redundant rods into bore of pistons (85) and install nuts (35). Tighten nuts (35) to 63-77 pound-inches. Secure with spring pins (30). Lockwire nuts (35) by threading wire through pin and around nut face. If holes for spring pin (30) do not align, drill new 0.062-0.065 inch hole on opposite side of nut (35) (Fig. 701).

G. Assemble seal assemblies (80) in piston groove. Carefully slide pistons (85) and attached parts into barrel bores. Secure with washers (25) and bolts (20).

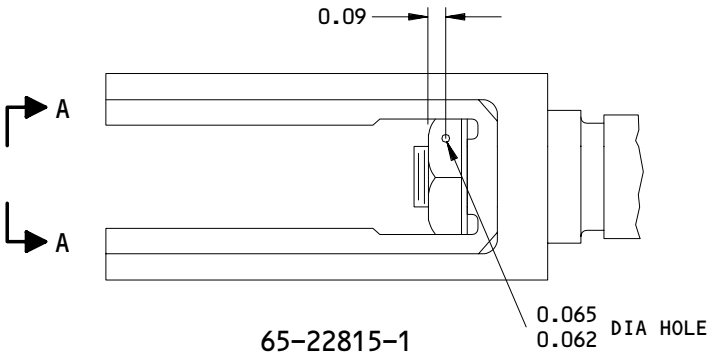
H. Install tie bolts (15) on barrel (170) with washers (10) and nuts (5). Tighten nuts (5) to 63-77 pound-inches. Tighten bolts (20) to 80-100 pound-inches.

4. Storage Instructions

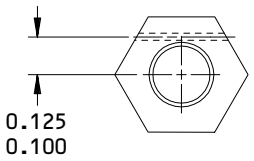
A. Partially fill unit with hydraulic fluid. If Skydrol 7000 has been used for testing, drain unit thoroughly before partially filling with hydraulic fluid.

B. Cap or plug ports with hydraulic fluid resistant packing and plugs or caps.

C. Store and protect unit in accordance with standard industry practices and the information contained in 20-44-02.



65-22815-1
CLEVIS ASSEMBLY



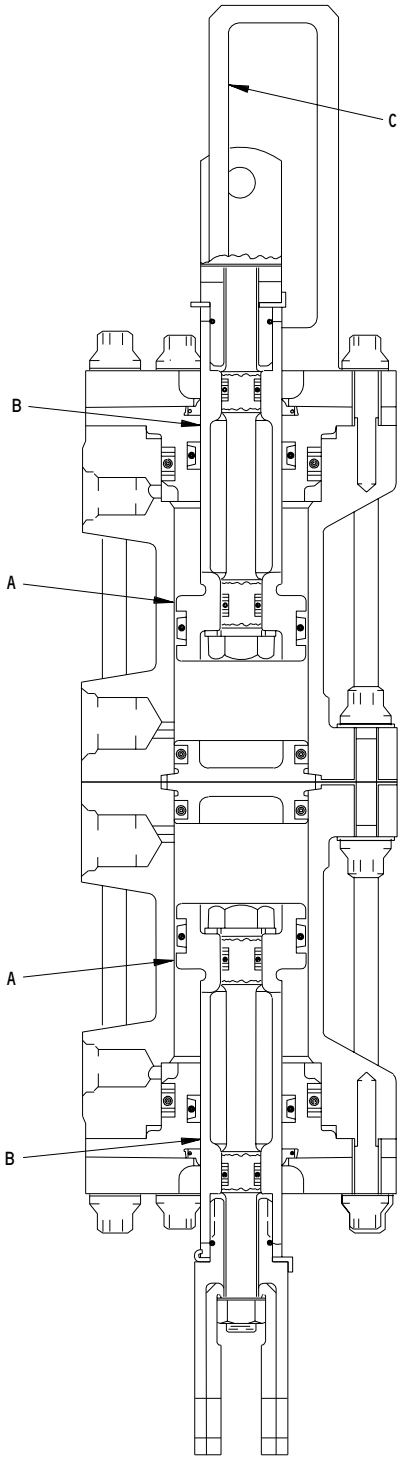
AN315C4R
NUT

A-A

Spring Pin Hole Location
Figure 701

E72961

FITS AND CLEARANCES



Fits and Clearances
Figure 801 (Sheet 1)

		Design Dimensions				Service Wear Limits		
Ref. Letter Fig. 801	Mating Item No. IPL Fig. 1	Dimensions		Assembly Clearance		Dimension Limits		Maximum Clearance
		Min	Max	Min	Max	Min	Max	
A	ID 185	1.250	1.251	0.002	0.004		1.256	0.008
	OD 85	1.247	1.248			1.242		
B	ID 125	0.756	0.757	0.008	0.010		0.758	0.010
	OD 85	0.747	0.748			0.746		
C	*[1] 95	0.814	0.820	0.006	0.020		0.848	0.040
	*[2] *[3]	0.800	0.808			0.774		

*[1] WIDTH OF SLOT
*[2] WIDTH OF SLIDE BLOCK
*[3] INSTALLATION PART 65-38904-2
ALL DIMENSIONS ARE IN INCHES

Fits and Clearances
Figure 801 (Sheet 2)

FOR TORQUE VALUES OF STANDARD FASTENERS, REFER TO 20-50-01			
IPL FIG. 1 ITEM NO.	NAME	TORQUE	
		POUND-INCHES	POUND-FEET
5	Nut	63-77	
20	Bolt	80-100	
35	Nut	63-77	
65	Clevis	260-280	
130	Nut	80-100	

Torque Table
Figure 802

SPECIAL TOOLS, FIXTURES, AND EQUIPMENT

NOTE: Equivalent substitutes may be used.

1. Test Fixture -- F80085-1

2. Adapter -- A27035-1.

3. Feel Actuator Piston Alignment Pin -- B27070-1

4. Test Fixture Adapter Assembly -- F80085-12

ILLUSTRATED PARTS LIST

1. This section lists and illustrates replaceable or repairable component parts. The Illustrated Parts Catalog contains a complete explanation of the Boeing part numbering system.

2. Indentures show parts relationships as follows:

    Assembly
      Detail Parts for Assembly
      Subassembly
      Attaching Parts for Subassembly
        Detail Parts for Subassembly

    Detail Installation Parts (Included only if installation parts may be returned to shop as part of assembly)

3. One use code letter (A, B, C, etc.) is assigned in the EFF CODE column for each variation of top assembly. All listed parts are used on all top assemblies except when limitations are shown by use code letter opposite individual part entries.

4. Letter suffixes (alpha-variants) are added to item numbers for optional parts, Service Bulletin modification parts, configuration differences (except left- and right-hand parts), product improvement parts, and parts added between two sequential item numbers. The alpha-variant is not shown on illustrations when appearance and location of all variants of the part is the same.

5. Service Bulletin modifications are shown by the notations PRE SB XXXX and POST SB XXXX.

    A. When a new top assembly part number is assigned by Service Bulletin, the notations appear at the top assembly level only. The configuration differences at detail part level are then shown by use code letter.

    B. When the top assembly part number is not changed by the Service Bulletin, the notations appear at the detail part level.

6. Parts Interchangeability

Optional (OPT)	The parts are optional to and interchangeable with other parts having the same item number.
Supersedes, Superseded By (SUPSDS, SUPSD BY)	The part supersedes and is not interchangeable with the original part.
Replaces, Replaced By (REPLS, REPLD BY)	The part replaces and is interchangeable with, or is an alternate to, the original part.

VENDORS

02107 SPARTA MANUFACTURING COMPANY
PO BOX 449 5200 NORTH WOOSTER ROAD
DOVER, OHIO 44622

02886 DODGE-WASMUND MFG CO INC
9603 BEVERLY ROAD
PICO RIVERA, CALIFORNIA 90660

07128 TETRAFLUOR INC
2051 EAST MAPLE AVENUE
EL SEGUNDO, CALIFORNIA 90245

08524 DEUTSCH FASTENER CORPORATION
PO BOX 92925 7001 WEST IMPERIAL HIGHWAY
LOS ANGELES, CALIFORNIA 90045

11815 TOWNSEND DIV OF TEXTRON INC CHERRY FASTENER UNIT
BOX 2157 1224 EAST WARNER AVENUE
SANTA ANA, CALIFORNIA 92707

15653 KAYNAR MFG COMPANY INC KAYLOCK DIV
PO BOX 3001 800 SOUTH STATE COLLEGE BLVD
FULLERTON, CALIFORNIA 92634

26303 OHIO AIRCRAFT SUPPLIES INC
717 HINDRY AVENUE
INGLEWOOD, CALIFORNIA 90301

26879 CORONADO PLASTICS INCORPORATED
11069 PENROSE AVENUE
SUN VALLEY, CALIFORNIA 91352

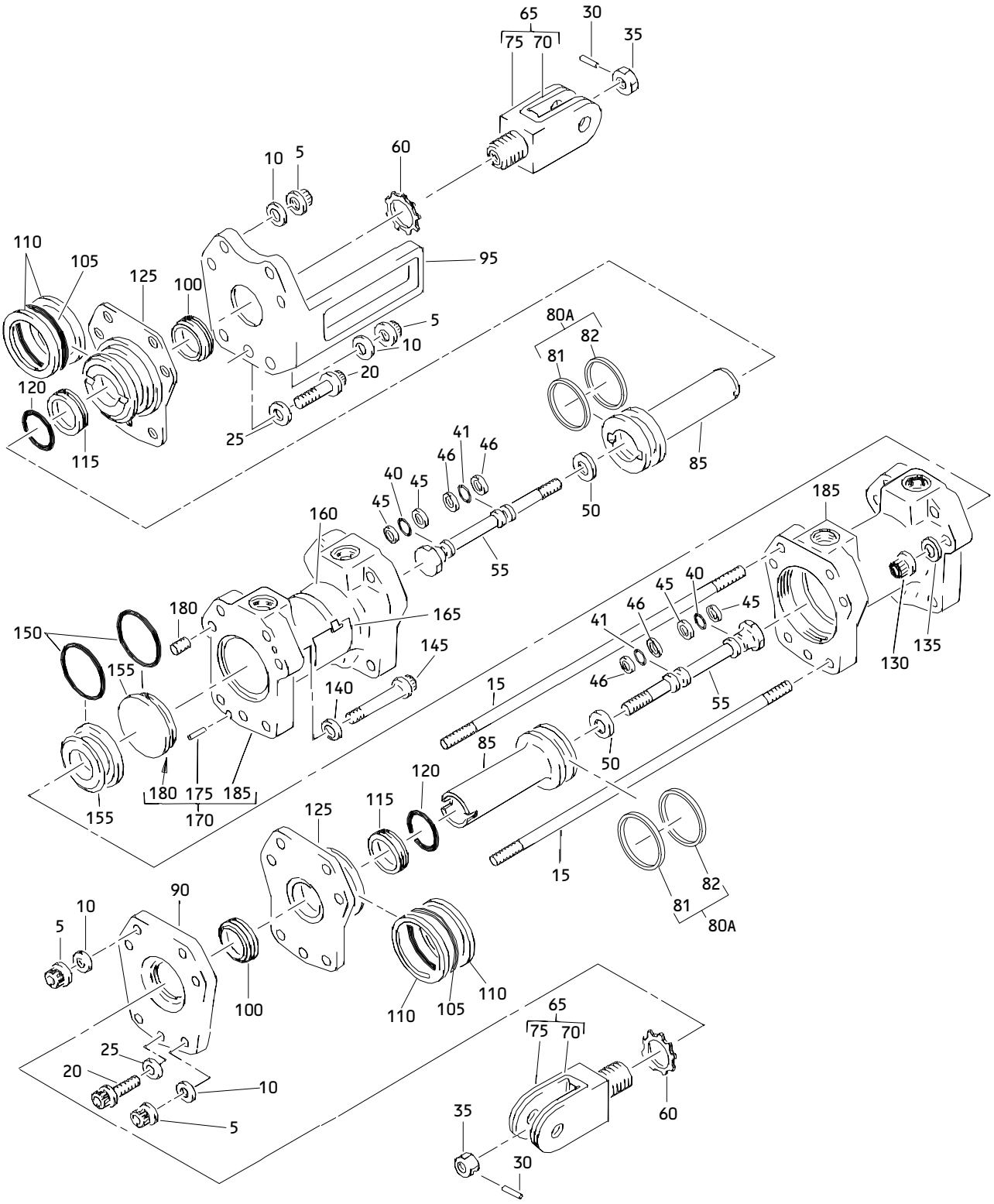
56878 SPS TECHNOLOGIES INC
HIGHLAND AVENUE
JENKINTOWN, PENNSYLVANIA 19046

72962 ESNA DIV OF AMERACE CORP
2330 VAUXHALL ROAD
UNION, NEW JERSEY 07083

94878 RAYBESTOS-MANHATTAN INC PACIFIC COAST DIV
1400 E. ORANGETHROPE
FULLERTON, CALIFORNIA 92631

VENDORS

97820 SHAMBAN W S AND CO
711 MITCHELL ROAD
NEWBURY PARK, CALIFORNIA 91320



Feel Actuator Cylinder Assembly
Figure 1

T15946

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
-1	65-44503-7		CYLINDER ASSY-FEEL ACTUATOR	A	RF
-1A	65-44503-8		CYLINDER ASSY-FEEL ACTUATOR	B	RF
-1B	65-44503-10		CYLINDER ASSY-FEEL ACTUATOR	C	RF
5	BACN10CT4		.NUT-		8
			(REPLD BY ITEM 5A)		
-5A	BMNN10HR4		.NUT-		8
			(V08524)		
			(SPEC BACN10HR4)		
			(OPT H96-4		
			(V15653))		
			(OPT RMLH22-4		
			(V72962))		
			(OPT SL7058S428		
			(V11815))		
			(OPT 67832-428		
			(V56878))		
			(REPLS ITEM 5)		
10	AN960PD416L		.WASHER		8
15	66-22816-1		.BOLT-TIE		4
20	BACB30MT4-6		.BOLT	AB	6
			(OPT ITEM 20A)		
-20A	BACB30CW4-6		.BOLT	AB	6
			(OPT EWB22-4-6		
			(V56878))		
			(OPT ITEM 20)		
-20B	BACB30US4K6		.BOLT	C	6
25	BACW10AKC4		.WASHER-		6
			(REPLD BY ITEM 25A)		
-25A	BACW10BN4C		.WASHER-		6
			(REPLS ITEM 25)		
30	MS16562-191		.PIN-SPG		2

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
35	AN315C4R		.NUT		2
40	NAS1611-010		.PACKING		2
41	NAS1611-010		.PACKING (USED WITH ITEM 85A)		2
45	MS28782-5		.RING-BACKUP	AB	4
45A	MS28782-5		.RING-BACKUP (OPT ITEM 45B)	C	4
45B	BACR12BM010		.RING-BACKUP (OPT ITEM 45A)	C	4
46	MS28782-5		.RING-BACKUP (USED WITH ITEM 85A)	AB	4
46A	MS28782-5		.RING-BACKUP (USED WITH ITEM 85A) (OPT ITEM 46B)	C	4
46B	BACR12BM010		.RING-BACKUP (USED WITH ITEM 85A) (OPT ITEM 46A)	C	4
50	AN960C616L		.WASHER		2
55	69-35675-1		.ROD-REDUNDANT		2
60	69-35729-2		.WASHER-LOCK (OPT ITEM 60A)		2
-60A	69-35969-1		.WASHER-LOCK (OPT ITEM 60)		2
65	66-22815-1		.CLEVIS ASSY		2
70	66-22814-1		..CLEVIS-INNER		1
75	69-35671-1		..CLEVIS-OUTER		1
-80	65-44583-1		.SEAL ASSY (OPT ITEM 80B)	A	2
80A	S33709-214H20		.SEAL ASSY (V97820)	BC	2
80B	S33709-214H20		.SEAL ASSY (V97820) (OPT ITEM 80)	A	2

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
81	S33709-214-20		..RING-SEAL (V97820) (USED ON ITEM 80A,80B)		1
82	S33709-214H		..RING-PLUS (V97820) (USED ON ITEM 80A,80B)		1
85	69-35676-3		.PISTON (OPT ITEM 85A)		2
-85A	69-35676-2		.PISTON (OPT ITEM 85)		2
90	66-22785-1		.RETAINER		1
95	69-35679-1		.RETAINER-GUIDE		1
100	BACS34A5A		.SCRAPER (OPT ITEM 100A)		2
-100A	BACS34A5		.SCRAPER (OPT ITEM 100)		2
105	NAS1611-218		.PACKING		2
110	MS28782-23		.RING-BACKUP		4
115	CS1250-116-1		.SEAL-CHANNEL (V02107) (SPEC BACR12BJ116A) (OPT C2121011-116B (V26879)) (OPT DW96901116A (V02886)) (OPT S30010-116-1 (V97820)) (OPT TF451-116A (V07128)) (OPT 11298-116 (V94878)) (OPT 2097-116A (V26303)) (OPT ITEM 115A) (USED WITH ITEM 120)	ABC	2

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
-115A	S34572-116H99N		.SEAL ASSY (V97820) (PREF) (OPT ITEM 115)	A-C	2
120	NAS1611-116		.PACKING (USED WITH ITEM 115)	A-C	2
125	69-35673-2		.BEARING		2
130	BACN10CT4		.NUT (REPLD BY ITEM 130A)		3
-130A	BMNN10HR4		.NUT (V08524) (SPEC BACN10HR4) (SEE ITEM 5A FOR OPTIONAL PARTS) (REPLS ITEM 130)		3
135	AN960PD416L		.WASHER	AB	3
-135A	AN960PD416		.WASHER	C	3
140	BACW10AKC4		.WASHER (OPT ITEM 140A)		3
-140A	BACW10BN4C		.WASHER (OPT ITEM 140)		3
145	BACB30MT4-16		.BOLT (OPT ITEM 145A)	AB	3
-145A	BACB30CW4-16		.BOLT (OPT EWB22-4-16 (V56878)) (OPT ITEM 145)	AB	3
-145B	BACB30US4K16		.BOLT	C	3
150	NAS1611-214		.PACKING		2
155	69-35674-1		.DAM		2
160	69-35587-1		.STRAP		1
165	BACN12A3MB		.NAMEPLATE (OPT ITEM 165A)		1
-165A	BAC27NCT0289		.NAMEPLATE (OPT ITEM 165)		1
170	65-44559-1		.BARREL ASSY (MATCHED SET)		1
175	NAS607-2-4P		..PIN-DOWEL		2
180	MS21209F4-15		..INSERT		6
185	65-44559-2		..BARREL		2