COMPONENT MAINTENANCE MANUAL WITH ILLUSTRATED PARTS LIST

THRUST REVERSER NON-LOCKING ACTUATOR ASSEMBLY

PART NUMBER 315A2800–1, –2

PUBLISHED BY BOEING COMMERCIAL AIRPLANES GROUP, SEATTLE, WASHINGTON, USA
A DIVISION OF THE BOEING COMPANY
PAGE DATE: Jul 01/2009

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COMPONENT MAINTENANCE MANUAL

Revision No. 14
Jul 01/2009

To: All holders of THRUST REVERSER NON-LOCKING ACTUATOR ASSEMBLY 78-31-18.

Attached is the current revision to this COMPONENT MAINTENANCE MANUAL

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TEMPORARY REVISION AND SERVICE BULLETIN RECORD

BOEING SERVICE BULLETIN	BOEING TEMPORARY REVISION	OTHER DIRECTIVE	DATE OF INCORPORATION INTO MANUAL
		PRR 38022	SEP 01/96
		PRR 35385-17	MAR 01/97

All revisions to this manual will be accompanied by transmittal sheet bearing the revision number. Enter the revision number in numerical order, together with the revision date, the date filed and the initials of the person filing.

Revision		Filed	
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INTRODUCTION

1. General

A. The instructions in this manual supply the data necessary to do the maintenance functions together with the test, fault isolation, repair, and replacement of the defective parts.

B. This manual is divided into different parts:

(1) Title Page

(2) Transmittal Letter

(3) Highlights

(4) List of Effective Pages

(5) Table of Contents

(6) Temporary Revision & Service Bulletin Record

(7) Record of Revisions

(8) Record of Temporary Revisions

(9) Introduction

(10) Procedures & IPL Sections

C. Components that can be repaired have a different repair number for each specified repair. To find the repair number location of a component, look in the Repair-General procedure at the beginning of the REPAIR section. The Repair-General procedure also has an explanation of the True Position Dimension symbols used.

D. All dimensions, measures, quantities and weights included are in English units. When metric equivalents are given they will be in the parentheses that follow the English units.

E. The introduction to the Illustrated Parts List (IPL) shows how the IPL data is used.

F. Design changes, optional parts, configuration differences and Service Bulletin modifications may cause different part numbers. These part numbers are identified in the IPL with an alphabetical letter which is added to the end of the basic item number. This new item number is referred to as an alpha-variant. Throughout the manual, IPL basic item number references also apply to alpha-variants unless shown differently.

G. The tool reference numbers found in the individual procedures and in the Special Tools, Fixtures, and Equipment section are used to identify if a tool is a standard tool (STD-XXXX), a commercial tool (COM-XXXX), or a Special Tool (SPL-XXXX). This reference number is also used to distinguish between tools with similar names in the same procedure. These reference numbers are for use in the documentation only. They are not to be used for ordering tools.

NON-LOCKING ACTUATOR ASSEMBLY - DESCRIPTION AND OPERATION

1. Description

A. The non-locking actuator assembly is a single-ended linear hydraulic actuator. The actuator is mounted by a spherical ball at the rod end and a gimball ring assembly at the housing end. The primary components of the actuator assembly are a cylinder, housing, lead screw and piston assembly. The actuator assembly has two ports for retract pressure and two ports for extend pressure and connections for the flexible shafts.

B. In the system, the actuators are synchronized with a separate flexible shaft assembly contained in the extend tubes between the actuators.

2. Operation

A. Hydraulic pressure applied to the EXTEND port is directed to both the piston head and the rod-end. The piston extends because of the pressure on the different surface areas.

B. The movement of the piston causes the lead screw to turn by the forces thru the lead screw nut. This rotates the worm wheel and turns the mounting worm gear shaft. In system operation, the worm gear shaft is attached to other actuators by flex shafts for synchronized operation. The flexshafts are closed in rigid hydraulic supply tubes, which transmit hydraulic pressure. The actuator is held in the locked position by the locking actuator and flex shafts.

C. An internal hydraulic snubber restricts fluid flow out of the rod end and stops piston movement within the last 1.5 inches. Snubbing is not required for retraction since the actuator is not subjected to external loads and the retract velocity is lower.

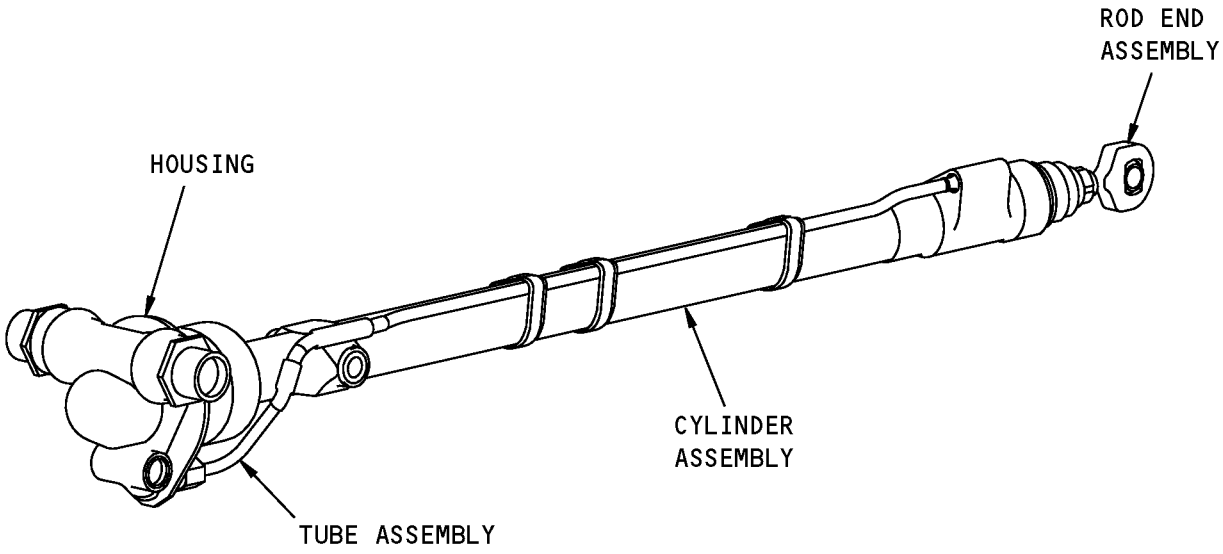
3. Leading Particulars (Approximate)

A. Length – 32 inches

B. Width – 6 inches

C. Height – 4 inches

D. Weight – 44.08 pounds



Non-locking Actuator Assembly
Figure 1

TESTING AND FAULT ISOLATION

1. General

A. This procedure has the data necessary to do a test of the mechanism after an overhaul or for fault isolation.

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to IPL Figure 1 for item numbers.

2. Testing and Fault Isolation

A. Tools/Equipment

NOTE: Equivalent substitutes may be used.

Reference	Description
SPL-5359	Test Fixture - Rod End and Stroke Stop, Locking and Non-Locking Thrust Reverser Actuator (Part #: B78014-37, Supplier: 81205) (Opt Part #: B78014-29, Supplier: 81205)
SPL-6280	Test Equipment - Velocity/Position Transducer (Part #: B20005-82, Supplier: 81205) (Opt Part #: B20005-75, Supplier: 81205)
SPL-6281	Stand - Test, Functional (Part #: B78010-28, Supplier: 81205)
SPL-6323	Pin - Crank (B78014-7 Assembly Included in Test Fixture B78014-29 and B78014-37) (Part #: B78014-37, Supplier: 81205) (Opt Part #: B78014-29, Supplier: 81205)
SPL-6373	Transducer Assembly - Velocity/Position (Part #: B20005-41, Supplier: 81205)

B. Consumable Materials

NOTE: Equivalent substitutes may be used.

Reference	Description	Specification
D00153	Fluid - Hydraulic, Erosion Arresting, Fire Resistant	BMS3-11 Type IV (interchange˜able & intermixable with Type V)

C. References

Reference	Title
SOPM 20-50-01	BOLT AND NUT INSTALLATION
SOPM 20-60-03	LUBRICANTS

D. Special Tools and Equipment

NOTE: Equivalent tool/equipment can be used.

(1) X-Y Plotter or Oscilloscope

(2) Hydraulic Test Stand, 0-4500 psi (variable) 60-140°F

(3) 315A2800, Non-Locking Actuator

(4) 315A2801, Locking Actuator

E. Procedure

NOTE: For disassembly, refer to DISASSEMBLY. For assembly, refer to ASSEMBLY.

NOTE: For bolt and nut installation, refer to SOPM 20-50-01. For lubricants, refer to SOPM 20-60-03.

(1) Length Check

NOTE: This check is not required if the extended and retracted lengths have been adjusted and verified during assembly before testing.

(a) Mount the actuator in rod end and stroke stop test fixture, SPL-5359. Pull out on the rod end to fully extend piston against internal stop. Secure rod end in fixture clevis with fixture pin.

(b) Do a check as shown in the ASSEMBLY and verify that extended length is 44.1650-44.2650 inches and retracted length is 23.6600-23.6700 inches.

CAUTION: DO NOT ROTATE PISTON AT ANY TIME. ROTATION FROM ORIGINAL SETTING WILL CHANGE CRITICAL LINEAR ADJUSTMENTS.

(2) Preparation for Test

(a) Install the actuator in test fixture, SPL-6281. Connect the hydraulic lines per TESTING AND FAULT ISOLATION, Figure 101.

WARNING: DO NOT APPLY AIR PRESSURE TO ANY PORTS, OR DAMAGE TO THE ACTUATOR AND INJURY TO PERSONNEL CAN OCCUR.

CAUTION: DO NOT ROTATE PISTON AT ANY TIME. MAKE SURE THE ACTUATOR PISTON IS FULLY RETRACTED OR EXTENDED IN THE PROPER DIRECTION BEFORE HIGH PRESSURE FLUID IS APPLIED, OR DAMAGE TO ACTUATOR MAY OCCUR.

(b) Fill the actuator with fluid, D00153. Apply 1500 psi pressure to RET and EXT ports and cycle the actuator slowly until the air is removed.

CAUTION: DO NOT EXTEND OR RETRACT THE PISTON AT PROOF PRESSURE, OR DAMAGE TO THE ACTUATOR CAN OCCUR.

(3) Proof Pressure Test

(a) Using crank pin (B78014-7 assembly), SPL-6323, rotate the worm shaft gear (55) and manually retract the piston. Close the ports not used.

(b) Gradually apply a 4500 psi pressure to the RET port and hold the pressure for 2 minutes. There must be no external leakage, permanent deformation, or loosening of parts.

(c) Decrease the pressure to 5 psi and hold the pressure for 2 minutes. There shall be no external leakage.

(d) Decrease the pressure to zero. Manually extend the piston.

(e) Apply a 4500 psi pressure to the RET and EXT ports and hold for 2 minutes. There must be no external leakage, permanent deformation or loosening of parts.

(f) Decrease the pressure to 5 psi and hold the pressure for 2 minutes. There must be no external leakage.

(4) Operation and External Leakage Test

(a) Close any ports that are not used. Retract and extend actuator for 50 full stroke cycles with pressure increasing to 3000 psi at fully retracted and fully extended positions.

(b) Apply a 3000 psi pressure to the RET port.

(c) Apply a 3000 psi pressure to the EXT port and fully extend the actuator. Decrease the pressure at the EXT port to 0 psi to fully retract the actuator.

(d) Repeat the TESTING AND FAULT ISOLATION, Paragraph 2.E.(4)(c) twenty five cycles.

(e) Make sure the actuator moves freely.

(f) The external leakage must not be more than 1 drop for 25 cycles at each seal (180).

(5) Internal Leakage Test

(a) Close any ports that are not used, except leave one EXT port open.

(b) Apply a 3000 psi pressure to the RET port and hold the pressure for 5 minutes.

(c) The internal leakage must not be more than 5 cc/min during the last minute.

(d) No external leakage is permitted.

(6) Friction Test

(a) Apply and maintain a 3000 psi pressure at the RET port for the steps that follow. Extend and retract actuator piston by increasing and decreasing the pressure at the EXT port.

(b) Apply a sufficient pressure to extend the piston approximately two inches. Decrease the pressure to stop the movement, then slowly increase the pressure again to extend the piston another two inches.

(c) Do TESTING AND FAULT ISOLATION, Paragraph 2.E.(6)(b) five times for full travel of the piston (approximately 20 inches). The pressure at the EXT port needed to extend the piston at any two-inch increment shall not exceed 1800 psi.

(d) Apply a 3000 psi pressure to the EXT and RET ports. Decrease the pressure to the EXT port until the piston retracts approximately two inches. Increase the pressure to stop the movement of the piston.

(e) Do TESTING AND FAULT ISOLATION, Paragraph 2.E.(6)(d) five times for the full travel of the piston. The pressure at the EXT port needed to retract the piston must not be less than 1500 psi.

(7) Snubbing Test

(a) Install the transducer assembly, SPL-6373, on the test fixture, SPL-6281. Connect the position and velocity transducer, DV301-60A-50G or DV301-0060-211-1110 to the piston rod end. Connect the assembly transducer, DV301-60A-50G or DV301-0060-211-1110 to the transducer, SPL-6280. Connect the transducer, SPL-6280 to an X-Y plotter or an oscilloscope to record the piston velocity and position.

(b) With the piston fully retracted, apply a 3000 psi pressure to the EXT and RET ports to extend piston at a rate of 11-12 inches/second. Check the velocity versus the position during the last 1.8 inches of travel. The velocity versus the stroke shall be within the performance envelope as shown in TESTING AND FAULT ISOLATION, Figure 102.

(8) Synchronous Drive Backlash Test

NOTE: There is no pressure on the actuator for the synchronous drive backlash test.

(a) Put the actuator piston approximately at mid-stroke. Install the crank pin (B78014-7 assembly), SPL-6323 in the worm shaft gear (55).

(b) Put a dial indicator on the test fixture to measure the movement of the piston.

(c) Turn the worm shaft gear (55) in both directions to extend and retract the piston. Check that the rotation angle of the worm shaft gear is not more than 35 degrees for piston movement of ±0.001 inch.

(9) Synchronous Drive Operational Test

NOTE: There is no pressure on the actuator for the Synchronous Drive Operational Test.

(a) Open the EXT and RET ports to the air.

(b) Turn the worm shaft gear (55) with the crank pin (B78014-7 assembly), SPL-6323.

(c) The maximum force necessary to fully stroke the piston must be less than 2 lb-in.

(10) Static Friction Test

(a) With the RET and EXT ports open to the air, no pressure applied, and the piston fully retracted, apply a 35 lb. maximum tension force to the rod end.

(b) The rod end (115B) and the piston (360) must extend a minimum of 0.75 inch.

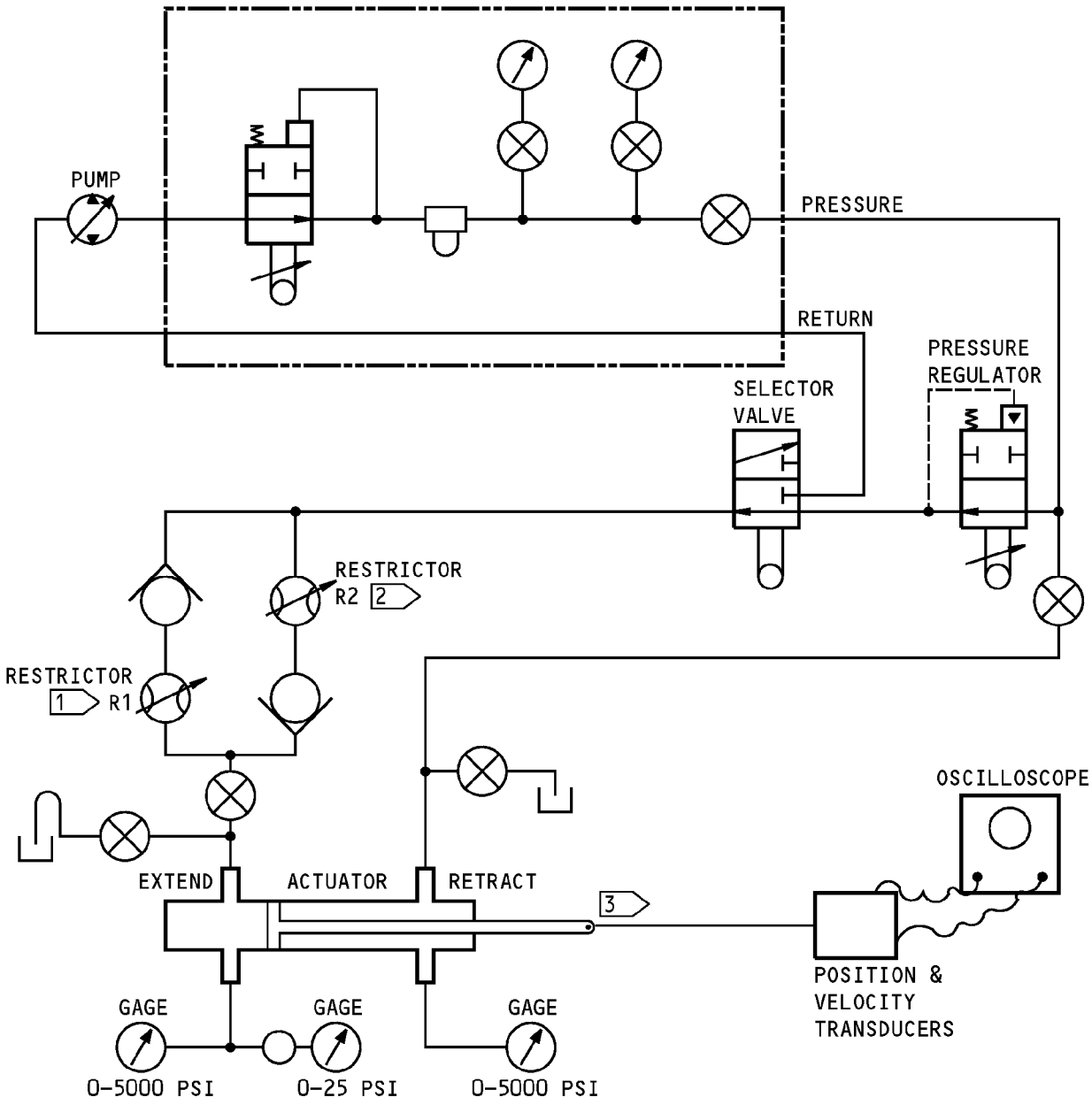
(11) 1800 lb Test

NOTE: An additional locking and non-locking actuator is required to perform this test.

(a) Apply a 3000 psi pressure to the EXT and RET ports. At the same time, apply a tension force of 1800 lb for one extend cycle as shown in TESTING AND FAULT ISOLATION, Figure 103. The actuator must move freely.

F. Disconnect from test

(1) Disconnect the hydraulic lines and remove the actuator from the test fixture. Partially drain the fluid, D00153 from the actuator. Seal the open ports.



1 RESTRICTOR R1 LIMITS EXTEND VELOCITY TO 11-12 IN/SEC WITH BYPASS VALVE OPEN.

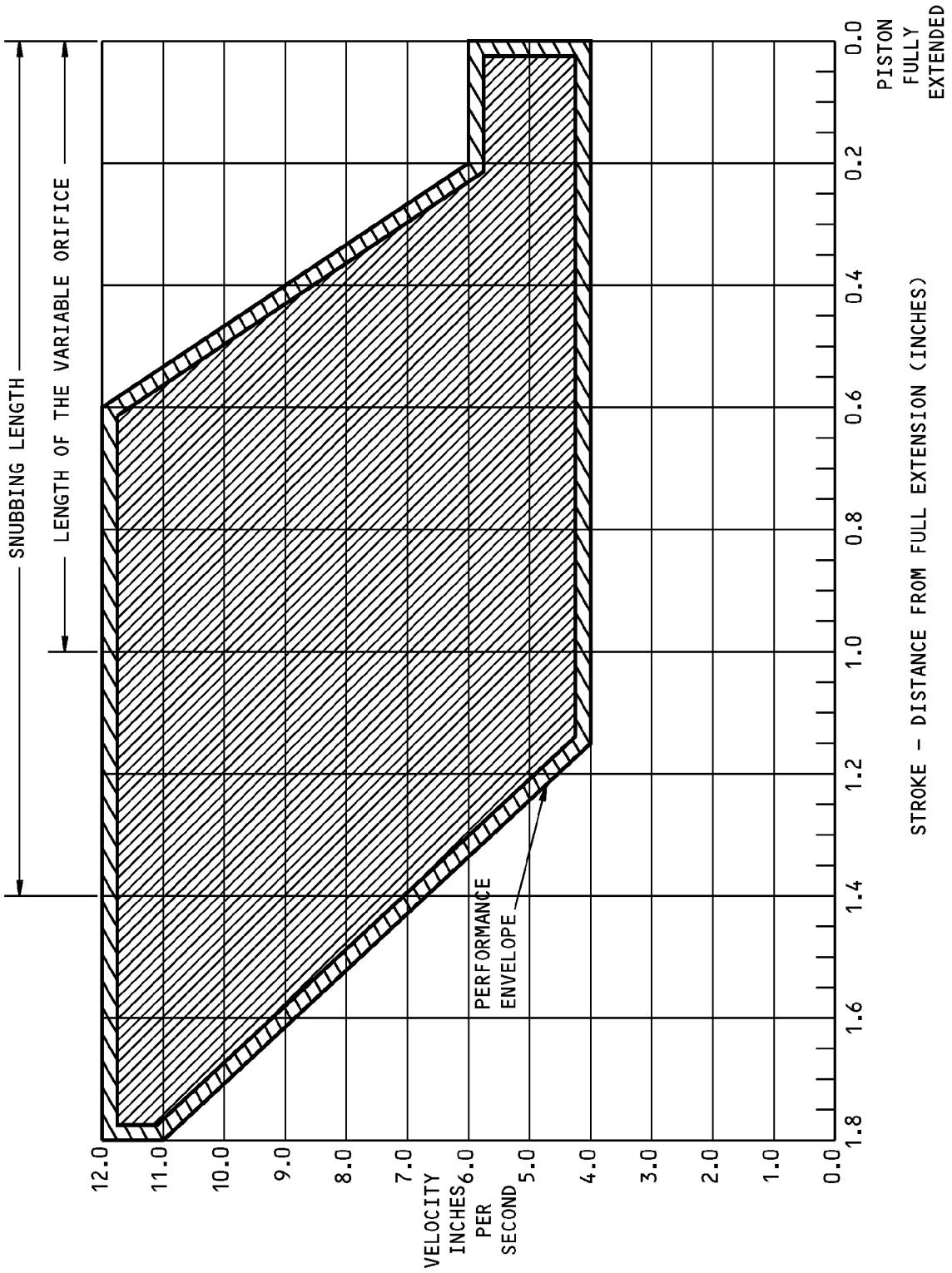
2 RESTRICTOR R2 LIMITS EXTEND VELOCITY TO 3-6 IN/SEC WITH BYPASS VALVE CLOSED.

CAUTION: DO NOT EXCEED 6 IN/SEC RETRACT VELOCITY UNDER ANY CONDITION.

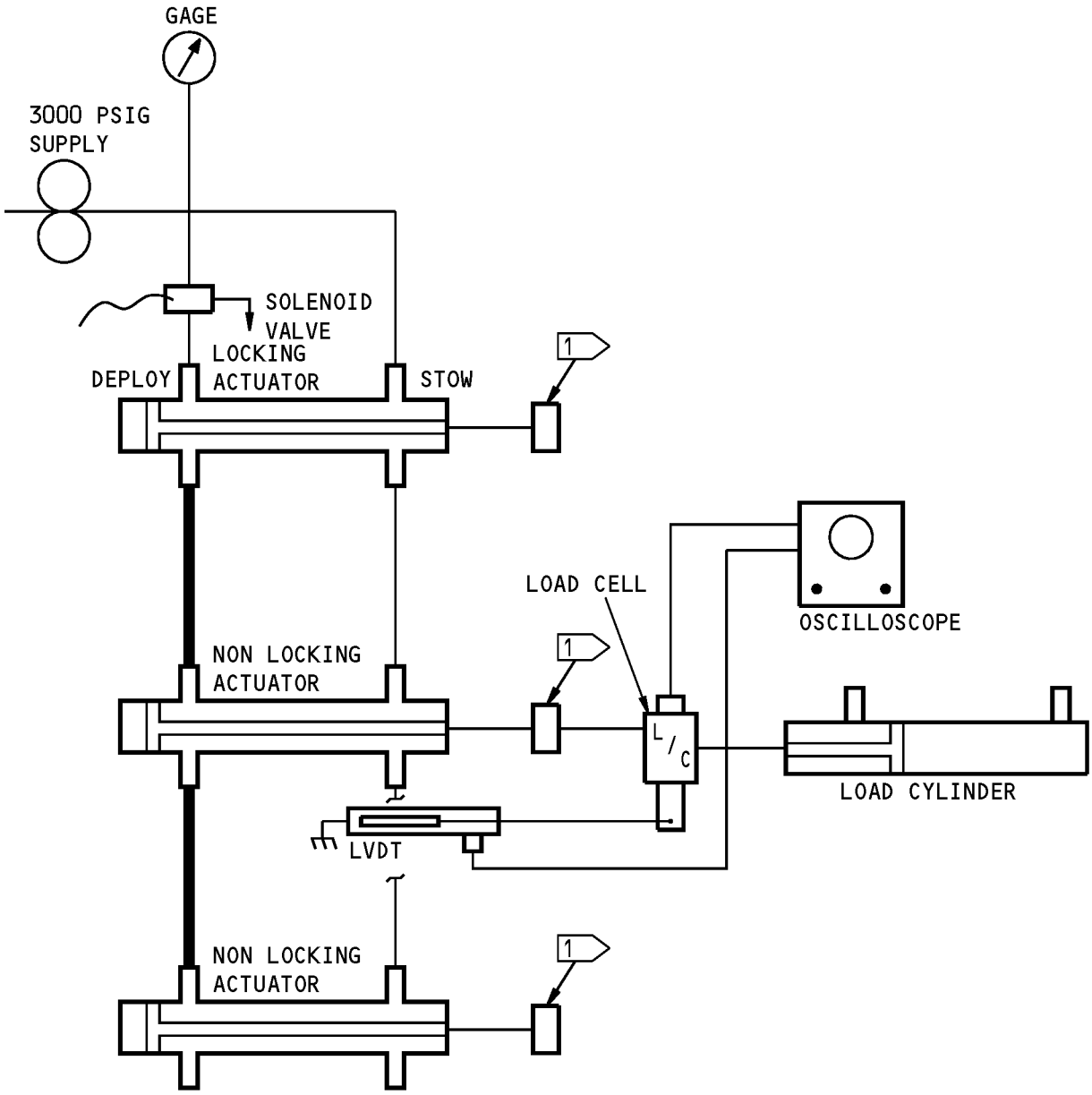
3 DURING ALL TESTS THE FIXTURE SHALL PREVENT PISTON ROD ROTATION.

CAUTION: DO NOT USE AIR PRESSURE IN ANY PORTS.

Test Setup
Figure 101



Snubbing Test
Figure 102



NOTE: TEST ACTUATORS AND MASS RUN ON GUIDE RAILS.

LOADING SYSTEM HYDRAULICS NOT SHOWN.

1 = 1/3 MASS OF 737-700 COWL (WEIGHT). THE MASS OF THE COWL IS 249-255 LBS FOR THE INERTIA FORCE.

1800 Pounds Test Setup
Figure 103

DISASSEMBLY

1. General

A. This procedure has the data necessary to disassemble the non-locking actuator assembly.

B. Disassemble this component sufficiently to isolate the defects, do the necessary repairs, and put the component back to a serviceable condition.

C. Refer to the Standard Overhaul Practices Manual (SOPM) for the SOPM subjects identified in this procedure.

D. Refer to IPL Figure 1 for item numbers.

2. Disassembly

A. Tools/Equipment

NOTE: Equivalent substitutes may be used.

Reference	Description
SPL-6255	Wrench (B78008-7 is included in B78008-19) (Part #: B78008-7, Supplier: 81205)
SPL-6256	Wrench (B78008-6 included in Kit B78008-19) (Part #: B78008-6, Supplier: 81205)
SPL-6257	Wrench (B78008-5 is included in B78008-19) (Part #: B78008-5, Supplier: 81205)
SPL-6260	Wrench (B78008-12 included in B78008-19) (Part #: B78008-12, Supplier: 81205)
SPL-6283	Equipment - Bearing Installation, Lead Screw (Part #: B78017-1, Supplier: 81205)
SPL-6284	Fixture - Torque, Locking and Non-Locking Thrust Reverser Acutator Assembly (Part #: B78011-25, Supplier: 81205)

B. References

Reference	Title
SOPM 20-50-03	BEARING AND BUSHING REPLACEMENT

C. Parts Replacement

NOTE: The following parts are recommended for replacement. Actual replacement may be based on in-service experience.

(1) O-rings (15, 65, 110, 170, 185, 200, 210, 295, 315), backup rings (105, 165, 195, 205, 290, 310), scraper (160), footseal (180).

(2) Cup lockwasher (135), lock ring (305), retaining ring (330), retaining pin (335).

(3) Lead screw guide (340)

(4) Snubber rings (215, 220)

D. Procedure

(1) Use standard industry procedures and the steps shown below to disassemble this component.

NOTE: Many parts of the actuator are selected and adjusted to get specified requirements of dimension and function. If the actuator is not fully disassembled to replace some parts, the parts which are not replaced are to be noted to decrease the number of procedures necessary for reassembly.

(2) Remove the indents in the flange of the cup lockwasher (135). Hold the flats of the stop (140) with a wrench, loosen the nut (130) using wrench, SPL-6255, and unscrew the nut (130) to the rod end. Move the stop back and remove the key (145). Unscrew the rod (115B) from the piston assembly (350) and remove the stop (140), the lockwasher (135) and the nut (130). Remove the O-ring (170) and backup rings (165).

(3) Remove the ties (70) from around the spacers (365). Loosen the nut (85) at the tube coupling. Remove the tube assembly (75) from the cylinder assembly (370).

(4) Remove the union (60) and the O-ring (15) from the housing (230).

(5) Remove the fitting (5A) and the adapter screw (10A) from the housing (230). Remove the worm shaft gear (55) (to the adapter screw end) and remove the sleeve (45), shims (20 thru 40), and the worm shaft gear (55) with the bearing (50) (SOPM 20-50-03). Remove the bearing (50) from the worm shaft gear (55) and the other bearing (50) from the housing (SOPM 20-50-03). Remove the O-rings (15) from the fitting (5A) and the adapter screw (10A).

NOTE: If the parts removed in DISASSEMBLY, Paragraph 2.D.(5) are not replaced, identify the parts to permit easier assembly.

(6) Remove the spacer (150) from the gland nut (155) (the spacer is bonded inside the gland nut). Install the actuator in the torque fixture, SPL-6284. Remove the gland nut (155) using wrench, SPL-6257. Remove the scraper (160). Using wrench, SPL-6260, loosen the cylinder nut (320). Remove the actuator from fixture.

(7) Remove the cylinder nut (320). Slide the cylinder (380) out from the housing (230) and disengage the lead screw (345) and the piston (350). Remove the cylinder nut rings (325).

(8) Remove the gland (190) and remove the O-rings (185, 200, 210), and the backup rings (195, 205). Remove the foot seal (180), the piston bearing (175), and the snubber rings (215, 220) from the gland (190). Remove the piston stop (225) from the cylinder (380).

(9) Remove the assembled lead screw/piston from the housing (230).

NOTE: If the lead screw parts are not replaced, identify the parts to permit easier assembly.

(a) Remove the lockring (305) and remove the locking pin (300). Hold the piston assembly (350) and unscrew the lead screw nut (355) from the piston (360) using wrench (B78008-6), SPL-6256. Remove the piston from the lead screw (345) and remove the O-ring (315) and the backup rings (310).

(b) Remove the retaining ring (330), the retaining pin (335) and the lead screw guide (340) from the end of the lead screw (345). Unscrew the nut (355) from the lead screw (345) and remove the lockring (305).

NOTE: The lead screw nut (355) is part of the piston assembly (350).

(10) Bend back the deformed edges of the cup lockwasher (240) at the end of the lead screw (345). Hold the lead screw (345) with a wrench across the flats of the shoulder and remove the special bolt (235). Remove the cup lockwasher (240) from the lead screw (345).

(11) Using bearing tool, SPL-6283, remove the bearing (245) from the lead screw (345).

(12) Remove the worm wheel (255), the shims (260 thru 280) and the key (250) from the lead screw (345).

(13) Remove the bearing (285) from the lead screw (345) using bearing tool, SPL-6283(SOPM 20-50-03).

NOTE: Bearing (285) is a matched set.

NOTE: If the parts removed in DISASSEMBLY, Paragraph 2.D.(11), DISASSEMBLY, Paragraph 2.D.(12) and DISASSEMBLY, Paragraph 2.D.(13)) are not replaced, identify the parts to permit easier assembly.

CLEANING

1. General

A. This procedure has the data necessary to clean the non-locking actuator assembly.

B. Refer to the Standard Overhaul Practices Manual (SOPM) for the SOPM subjects in this procedure.

C. Refer to IPL Figure 1 for item numbers.

2. Cleaning

A. References

Reference	Title
SOPM 20-30-01	CLEANING AND RELUBRICATING BEARINGS
SOPM 20-30-03	GENERAL CLEANING PROCEDURES

B. Procedure

(1) Clean the bearings (50, 245) as specified in SOPM 20-30-01.

(2) Use standard industry procedures and refer to SOPM 20-30-03 to clean all parts.

CHECK

1. **General**
   A. This procedure has the data necessary to find defects in the material of the specified parts.
   B. Refer to FITS AND CLEARANCES for the design dimension and wear limits.
   C. Refer to the Standard Overhaul Practices Manual (SOPM) for the SOPM subjects identified in this procedure.
   D. Refer to IPL Figure 1 for item numbers.
2. **Check**
   A. References

Reference	Title
SOPM 20-20-01	MAGNETIC PARTICLE INSPECTION
SOPM 20-20-02	PENETRANT METHODS OF INSPECTION

   B. Procedure
      (1) Use standard industry procedures to do a visual check of all the parts for defects. Do the penetrant or magnetic particle check if the visual check shows possible damage or if you suspect possible damage on the parts listed below:
      (2) Do a magnetic particle check, Class A, (SOPM 20-20-01) of these parts:
         (a) lead screw nut (355)
      (3) Do a magnetic particle check, Class B, (SOPM 20-20-01) of these parts:
         (a) Fitting (5A)
         (b) Adapter screw (10A)
         (c) Worm shaft gear (55)
         (d) Housing (230)
         (e) Cylinder nut ring (325)
         (f) Lead screw (345)
         (g) Piston (360)
         (h) Cylinder (380)
      (4) Do a magnetic particle check, Class C, (SOPM 20-20-01) of these parts:
         (a) Rod end body (125A)
         (b) Nut (130)
         (c) Cup Lockwasher (135)
         (d) Stop (140)
         (e) Piston Stop (225)
         (f) Gland (190)
         (g) Cylinder Nut (320)
         (h) Retaining ring (330)
      (5) Do a penetrant check (SOPM 20-20-02) of these parts:

(a) Sleeve (45)

(b) Tube (100)

(c) Rod end ball (120A)

(d) Key (145)

(e) Piston bearing (175)

(f) Snubber ring (215, 220)

(g) Cup lockwasher (240)

(h) Worm wheel (255)

(i) Locking pin (300)

(j) Retaining pin (335)

(k) Lead screw guide (340)

REPAIR

1. General

A. Instructions for repair, refinish, and replacement of the specified subassembly parts are included in each REPAIR when applicable:

Table 601:

PART NUMBER	NAME	REPAIR
—	REFINISH OF OTHER PARTS	1-1
315A1812	GLAND	2-1
315A1816	PISTON	3-1
315A1817	WORM SHAFT GEAR	4-1
315A2808	CYLINDER ASSY	5-1, 5-2
315A2831	ROD END ASSY	6-1, 6-2
—	EXTERNAL PARTS REPLACEMENT	7-1

2. Dimensioning Symbols

A. Standard True Position Dimensioning Symbols used in the applicable repair procedures are shown in REPAIR-GENERAL, Figure 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)
Ø	DIAMETER
S Ø	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 THIS FEATURE 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
⊥ 0.002 B	PERPENDICULAR TO DATUM B WITHIN 0.002
// 0.002 A	PARALLEL TO DATUM 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
⌒ 0.006 A	EACH LINE ELEMENT OF THE SURFACE AT ANY CROSS SECTION MUST LIE BETWEEN TWO PROFILE BOUNDARIES 0.006 INCH APART RELATIVE TO DATUM A
⌓ 0.020 A	SURFACES MUST LIE WITHIN PARALLEL BOUNDARIES 0.020 INCH APART AND EQUALLY DISPOSED ABOUT TRUE PROFILE
◎ Ø 0.0005 C	CONCENTRIC TO DATUM C WITHIN 0.0005 DIAMETER
⌯ 0.010 A	SYMMETRICAL WITH DATUM A WITHIN 0.010
∠ 0.005 A	ANGULAR TOLERANCE 0.005 WITH DATUM A
⌖ Ø 0.002 Ⓢ B	LOCATED AT TRUE POSITION WITHIN 0.002 DIA RELATIVE TO DATUM B, REGARDLESS OF FEATURE SIZE
⊥ Ø 0.010 Ⓜ A 0.510 Ⓟ	AXIS IS TOTALLY WITHIN A CYLINDER OF 0.010 INCH DIAMETER, PERPENDICULAR TO DATUM A, AND EXTENDING 0.510 INCH ABOVE DATUM A, MAXIMUM MATERIAL CONDITION
[2.000] OR 2.000 BSC	THEORETICALLY EXACT DIMENSION IS 2.000

True Position Dimensioning Symbols
Figure 601

REFINISH OF OTHER PARTS - REPAIR 1-1

1. General

A. This procedure has the data necessary to refinish the parts which are not given in the specified repairs.

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to IPL Figure 1 for item numbers.

2. Refinish of other parts

A. References

Reference	Title
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-42-06	SILVER PLATING
SOPM 20-60-02	FINISHING MATERIALS

B. General

(1) Instructions for the repair of the parts listed in REPAIR 1-1, Table 601 is for repair of the initial finish.

C. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

(1) Refer to REPAIR 1-1, Table 601 for refinish details.

Table 601: Refinish details

IPL FIG. & ITEM	MATERIAL	FINISH
IPL Fig. 1		
Shims (20, 25, 30, 35, 40, 260, 265, 270, 275, 280)	301 CRES	Passivate (F-17.09)
Nut (130), Stop (225)	15-5 PH CRES 150-170 Ksi	Passivate (F-17.09)
Sleeve (45) Key (145), Lockwasher (240) Pin (300)	304 CRES	Passivate (F-17.09)
Nut (320)	15-PH CRES 150-170 Ksi	Passivate (F-17.09). Apply silverplate, 0.00015-0.00020 inch thick to the threads as shown in SOPM 20-42-06.
Lockwasher (135) Ring (325, 330)	17-7PH CRES	Passivate (F-17.09)

GLAND REPAIR 2-1

315A1812–1

1. General

A. This repair gives the data that is necessary to repair the gland (190).

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to the REPAIR-GENERAL, Figure 601 for the Standard True Position Dimensioning Symbols shown in the repair.

D. Refer to IPL Figure 1 for item numbers.

E. General repair details:

(1) Material: 15-5PH CRES, AMS 5659 150-170 Ksi

2. Gland Repair

A. References

Reference	Title
SOPM 20-10-04	GRINDING OF CHROME PLATED PARTS
SOPM 20-20-01	MAGNETIC PARTICLE INSPECTION
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-60-02	FINISHING MATERIALS

B. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

(1) Machine or grind the gland (190) to remove defects to the repair dimension shown in REPAIR 2-1, Figure 601.

(2) Break all sharp edges

(3) Do a magnetic particle check as shown in SOPM 20-20-01.

(4) Apply chrome plate to the area shown in REPAIR 2-1, Figure 601 (F-15.03)

(5) Grind the gland to the design dimension shown in REPAIR 2-1, Figure 601 as shown in SOPM 20-10-04. Make sure you maintain a surface finish of 32 microinches Ra.

3. Gland Refinish

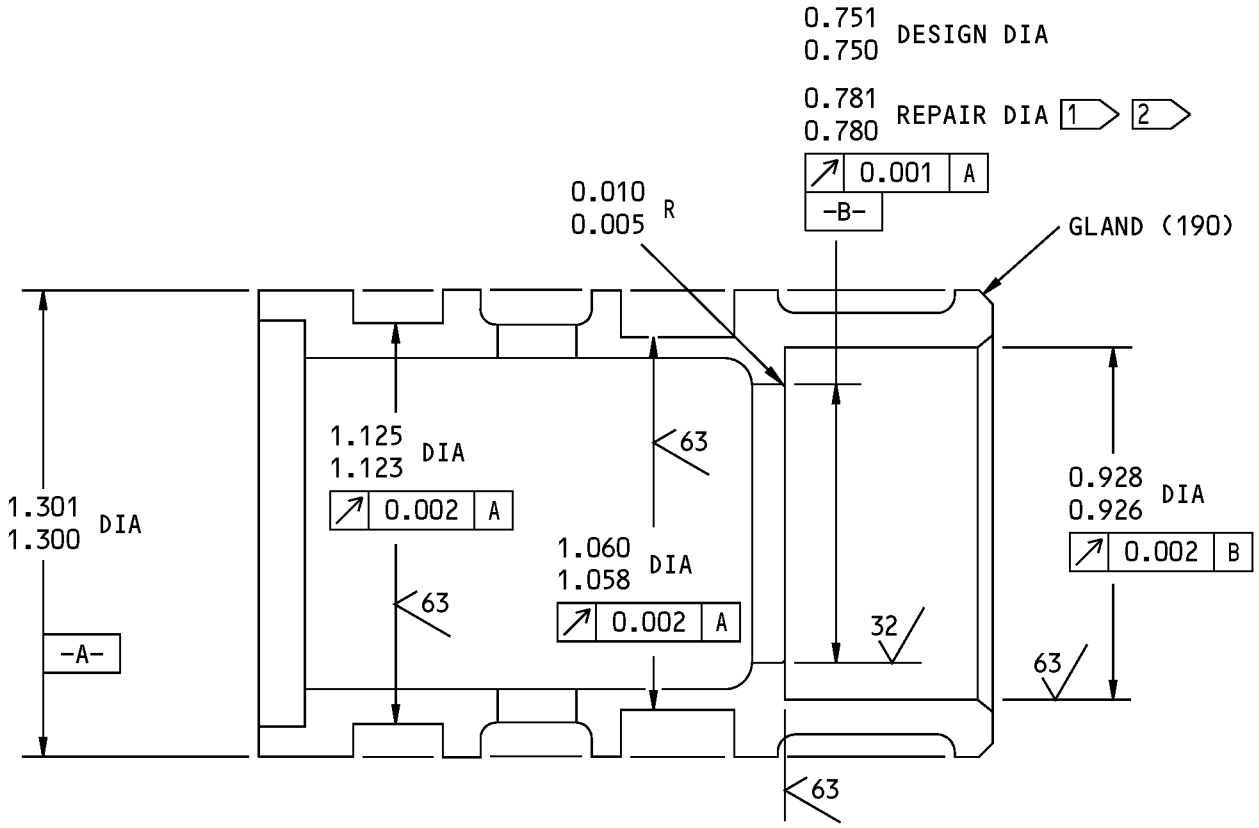
A. References

Reference	Title
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-60-02	FINISHING MATERIALS

B. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

(1) Prepare the surface and passivate (F-17.09).



1 CHROME PLATE (F-15.03) ON THIS SURFACE

2 GRIND TO DESIGN DIMENSION AND FINISH

125 ALL MACHINED SURFACES UNLESS SHOWN DIFFERENTLY

BREAK ALL SHARP EDGES

ITEM NUMBERS REFER TO IPL FIG. 1

ALL DIMENSIONS ARE IN INCHES

315A1812-1 Gland Repair
Figure 601

PISTON REPAIR 3-1

315A1816–3

1. General

A. This repair gives the data that is necessary to repair and refinish the piston (360).

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to the REPAIR-GENERAL, Figure 601 for the Standard True Position Dimensioning Symbols shown in the repair.

D. Refer to IPL Figure 1 for item numbers.

E. General repair details:

(1) Material: 15-5PH CRES, AMS 5659 150-170 Ksi

(2) Shot peen: Surfaces as shown in REPAIR 3-1, Figure 601.

(a) Shot Size = 0.017 - 0.046

(b) Intensity = 0.008A

(c) Intensity = 0.008A

(d) Coverage = 1.0

2. Piston Repair

A. References

Reference	Title
SOPM 20-10-03	SHOT PEENING
SOPM 20-10-04	GRINDING OF CHROME PLATED PARTS
SOPM 20-20-01	MAGNETIC PARTICLE INSPECTION
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-42-03	HARD CHROME PLATING
SOPM 20-60-02	FINISHING MATERIALS

B. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

(1) Machine or grind the piston (360) to remove defects to the repair dimension as shown in REPAIR 3-1, Figure 601.

(2) Break all sharp edges.

(3) Do a magnetic particle check as shown in SOPM 20-20-01.

(4) Shot peen as shown in REPAIR 3-1, Paragraph 1.E.(2) and REPAIR 3-1, Figure 601 per SOPM 20-10-03.

(5) Apply chrome plate (F-15.03) (SOPM 20-42-03) to the surface shown in REPAIR 3-1, Figure 601.

(6) Grind the piston (360) to the design dimension shown in REPAIR 3-1, Figure 601 as shown in SOPM 20-10-04. Make sure you maintain a surface finish of 16 microinches Ra.

3. Piston Refinish

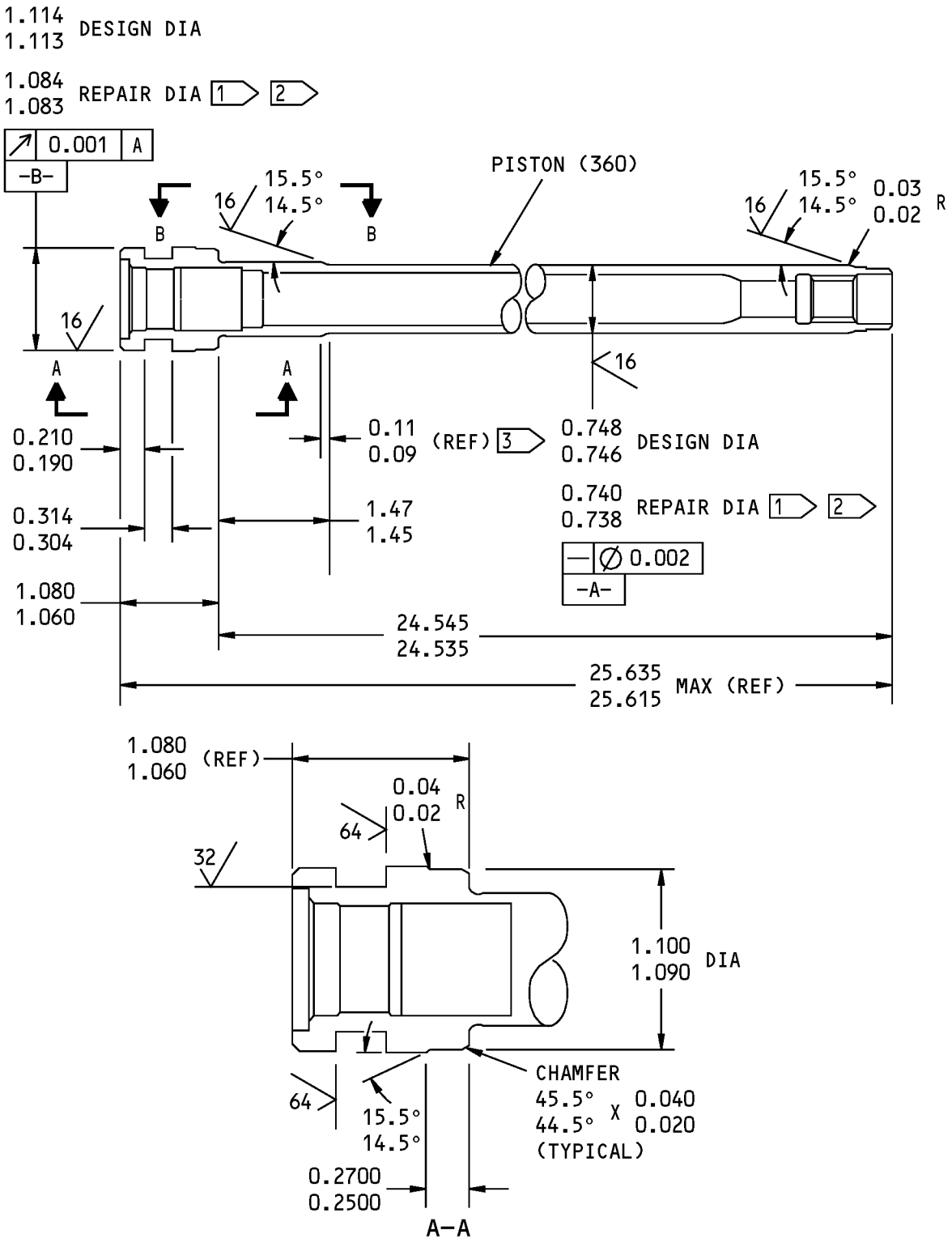
A. References

Reference	Title
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-30-03	GENERAL CLEANING PROCEDURES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-60-02	FINISHING MATERIALS

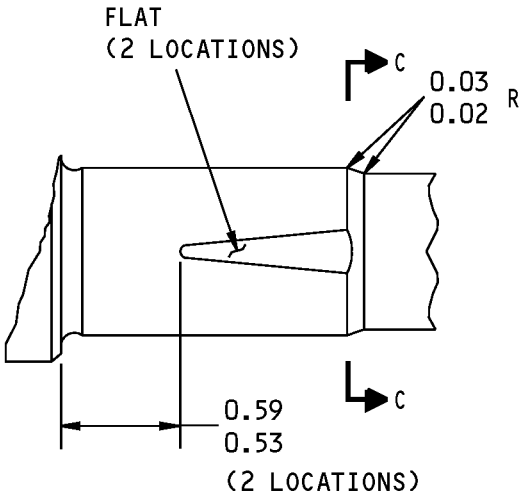
B. References

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

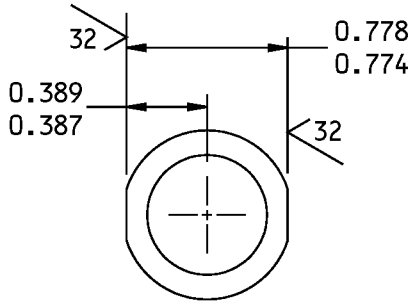
(1) Passivate as shown in SOPM 20-30-03 (F-17.25).



315A1816-3 Piston Repair
Figure 601 (Sheet 1 of 2)



B–B



C–C

1 APPLY CHROME PLATE (F-15.03) TO THIS SURFACE

2 SHOT PEEN THIS SURFACE

3 CHROME PLATING RUNOUT AREA FINISH GRIND 15 DEGREES AFTER CHROME PLATING

125 ALL MACHINED SURFACES UNLESS SHOWN DIFFERENTLY

BREAK ALL SHARP EDGES

ITEM NUMBERS REFER TO IPL FIG. 1

ALL DIMENSIONS ARE IN INCHES

315A1816-3 Piston Repair
Figure 601 (Sheet 2 of 2)

WORM SHAFT GEAR - REPAIR 4-1

315A1817–3

1. General

A. This repair gives the data that is necessary to repair the worm shaft gear (55).

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects in this procedure.

C. Refer to the REPAIR-GENERAL, Figure 601 for the Standard True Position Dimensioning Symbols shown in the repair.

D. Refer to IPL Figure 1 for item numbers.

E. General Repair details:

(1) Material: 9310 Steel, AMS 6265

2. Worm Shaft Gear Repair

A. References

Reference	Title
SOPM 20-10-04	GRINDING OF CHROME PLATED PARTS
SOPM 20-20-01	MAGNETIC PARTICLE INSPECTION
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-42-03	HARD CHROME PLATING
SOPM 20-60-02	FINISHING MATERIALS

B. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

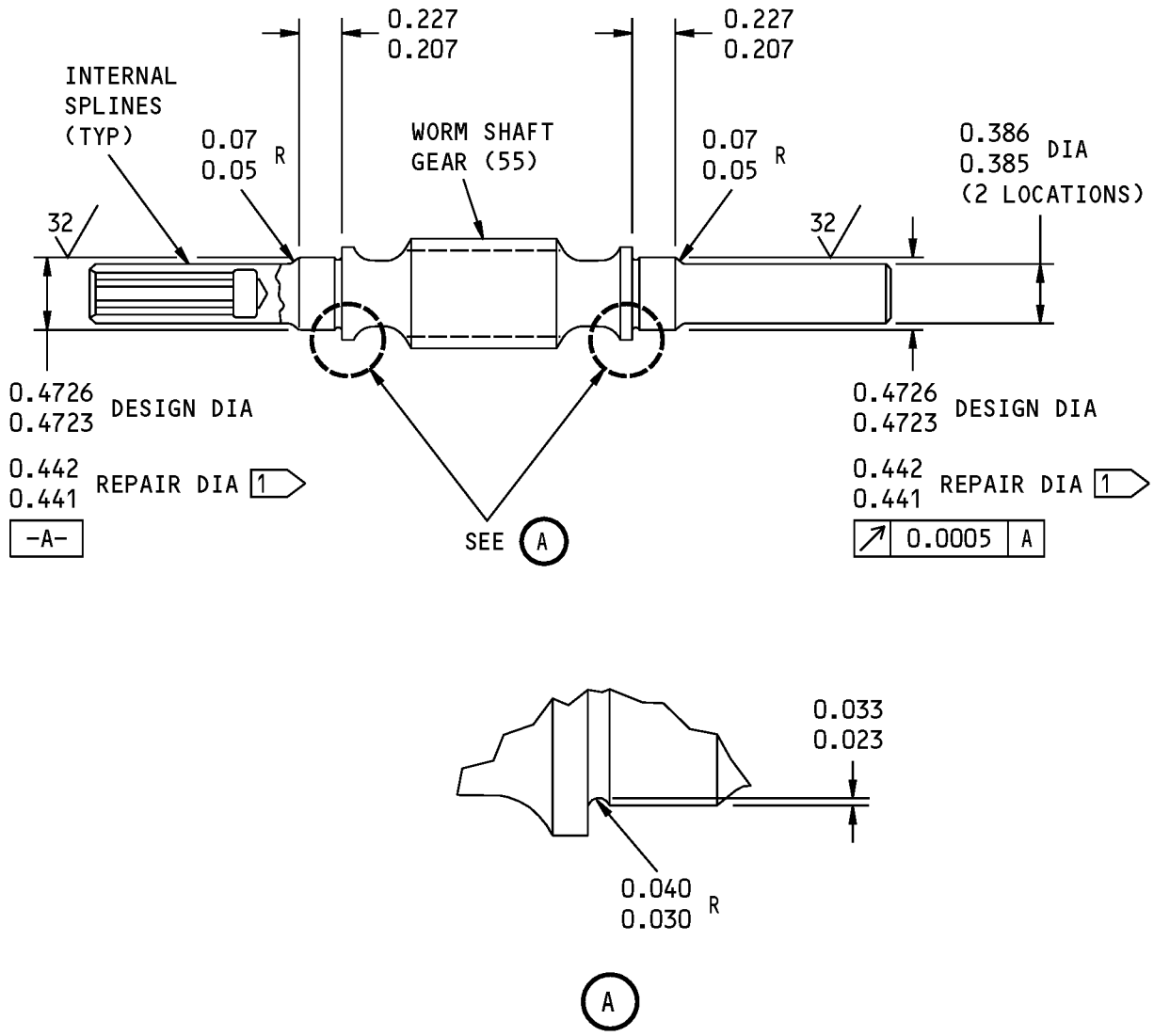
(1) Machine or grind the worm shaft gear (55) to remove defects to the repair dimension shown in REPAIR 4-1, Figure 601.

(2) Break all sharp edges.

(3) Do a magnetic particle check as shown in SOPM 20-20-01.

(4) Apply chrome plate (SOPM 20-42-03) to the area shown in REPAIR 4-1, Figure 601 (F-15.03).

(5) Grind the worm shaft gear (55) to the design dimension shown in REPAIR 4-1, Figure 601 as shown in SOPM 20-10-04. Make sure you maintain a surface finish of 32 microinches Ra.



1 APPLY CHROME PLATE ON THIS SURFACE

125 ALL MACHINED SURFACES UNLESS SHOWN DIFFERENTLY

BREAK ALL SHARP EDGES

ITEM NUMBERS REFER TO IPL FIG. 1

ALL DIMENSIONS ARE IN INCHES

315A1817-3 Worm Shaft Gear Repair
Figure 601

CYLINDER ASSEMBLY - REPAIR 5-1

315A2808–1

1. General

A. This repair gives the data necessary to replace the bushings (375) on the cylinder assembly (370).

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to IPL Figure 1 for item numbers.

2. Bushing Replacement

A. Consumable Materials

NOTE: Equivalent substitutes may be used.

Reference	Description	Specification
D00015	Grease - Aircraft Bearing (Use BMS 3-24 until existing stocks are depleted, BMS 3-33 supersedes BMS 3-24)	BMS3-24 (Superseded by BMS 3-33)

B. References

Reference	Title
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-50-03	BEARING AND BUSHING REPLACEMENT
SOPM 20-60-03	LUBRICANTS
SOPM 20-60-04	MISCELLANEOUS MATERIALS

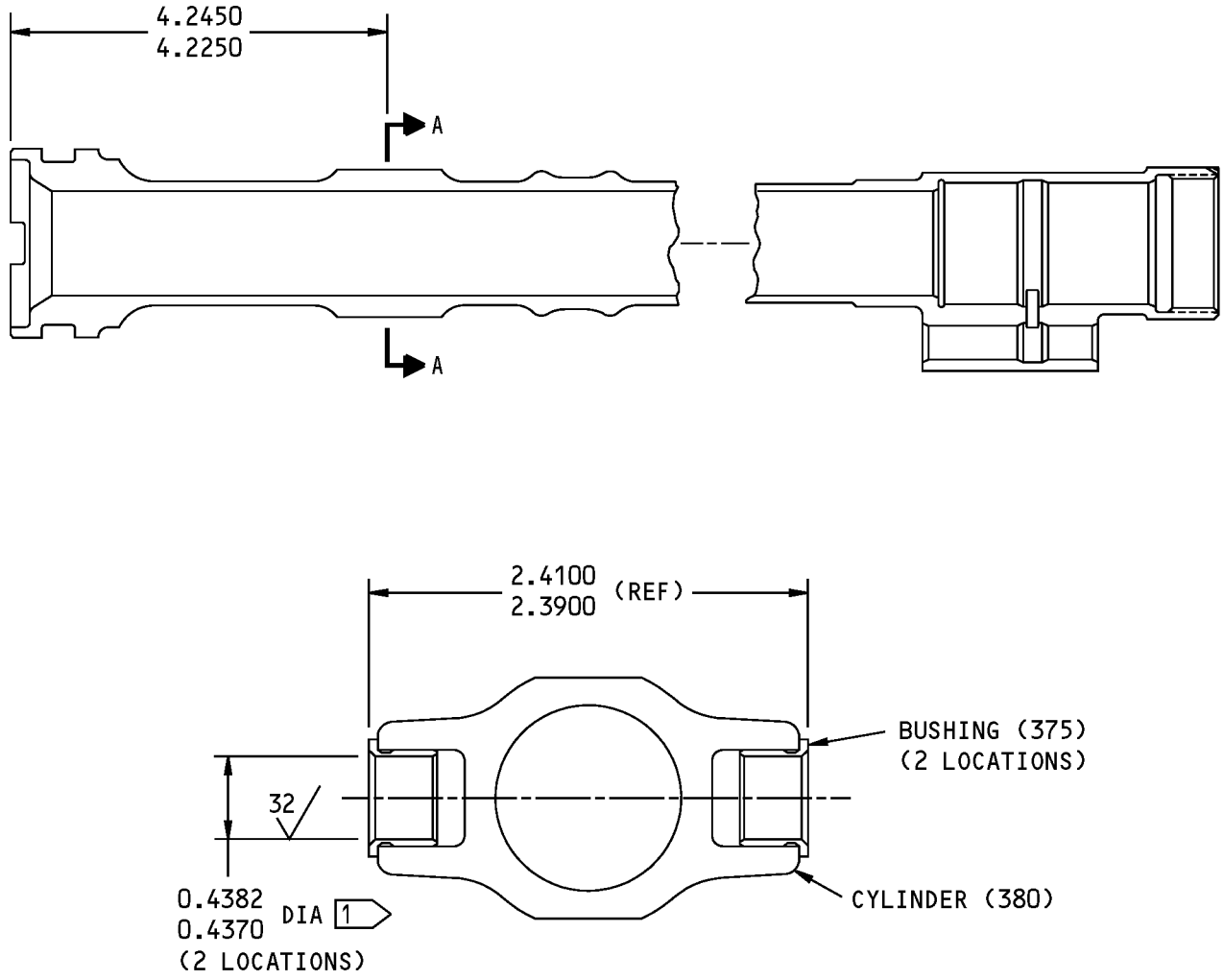
C. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For miscellaneous materials, refer to SOPM 20-60-04.

(1) Remove the bushing (375) from the cylinder (380).

(2) Install the bushing (375) with grease, D00015 (SOPM 20-60-03) as shown in SOPM 20-50-03.

(3) Machine the inside diameters of the bushings to the dimension and surface finish as shown in REPAIR 5-1, Figure 601.



A–A

1 DIMENSION AFTER BUSHING INSTALLATION

125 ALL MACHINED SURFACES UNLESS SHOWN DIFFERENTLY

BREAK ALL SHARP EDGES

ITEM NUMBERS REFER TO IPL FIG. 1

ALL DIMENSIONS ARE IN INCHES

315A2808-1 Cylinder Assembly Repair
Figure 601

CYLINDER - REPAIR 5-2

315A2808–2

1. General

A. This repair gives the data necessary to refinish the cylinder (380).

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to IPL Figure 1 for item numbers.

D. General repair details:

(1) Materials: 15-5PH CRES, AMS 5659 150-170 Ksi

2. Cylinder Refinish

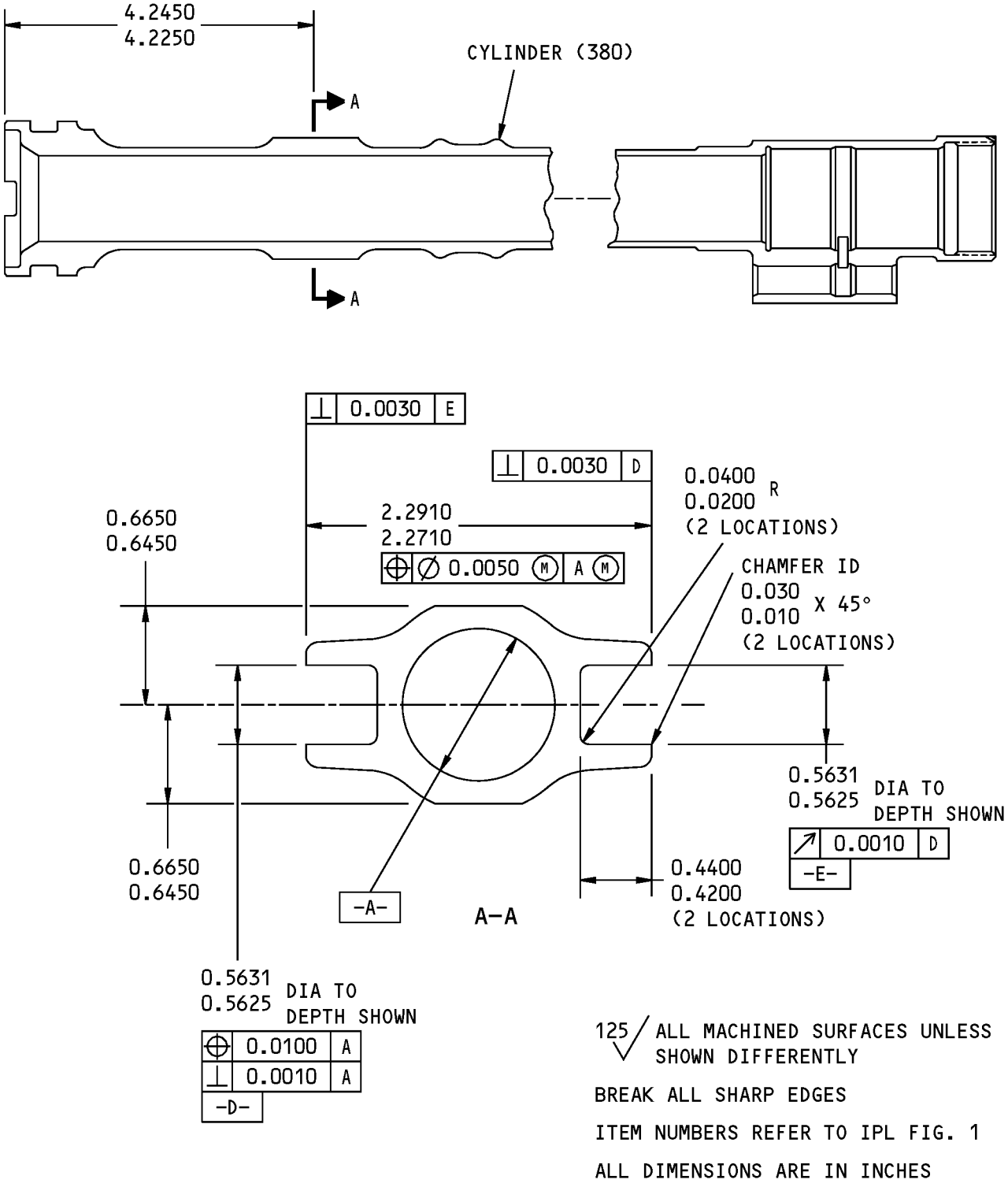
A. References

Reference	Title
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-30-03	GENERAL CLEANING PROCEDURES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-60-02	FINISHING MATERIALS

B. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

(1) Passivate as shown in SOPM 20-30-03 (F-17.25).



315A2808-2 Cylinder Repair
Figure 601

BOEING®

COMPONENT MAINTENANCE MANUAL

ROD END ASSEMBLY - REPAIR 6-1

315A2831–1

1. General

A. This repair gives the data that is necessary to replace the ball (120A) in the rod end assembly (115B).

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to the REPAIR-GENERAL, Figure 601 for the Standard True Position Dimensioning Symbols shown in the repair.

D. Refer to IPL Figure 1 for item numbers.

2. Ball Replacement

A. Consumable Materials

NOTE: Equivalent substitutes may be used.

Reference	Description	Specification
D00543	Lubricant - Dry Film - Everlube 967	
G50227	Tie - Plastic, Adjustable, Self-clinching, Tiedown Strap	AS33671

B. References

Reference	Title
SOPM 20-60-03	LUBRICANTS
SOPM 20-60-04	MISCELLANEOUS MATERIALS

C. Procedure

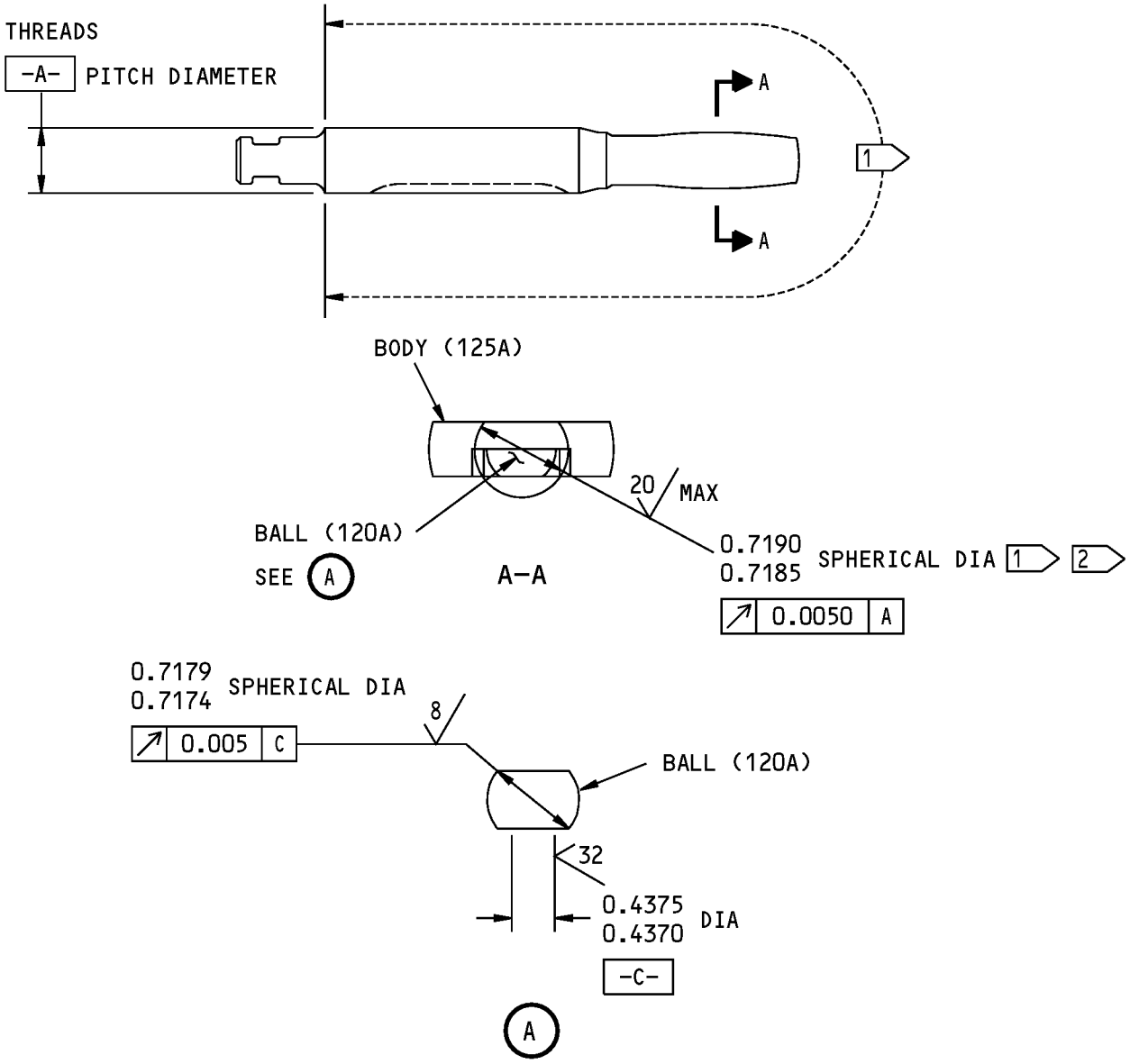
NOTE: For miscellaneous materials, refer to SOPM 20-60-04.

(1) Remove the ball (120A) from the body (125A).

(2) Apply Everlube 967 lubricant, D00543, 0.0003-0.0005 inch thick as shown in REPAIR 6-1, Figure 601 and SOPM 20-60-03. The body (125A) must accept 0.7180 inch diameter ball (120A) after Everlube 967 lubricant, D00543. Make sure the surface finish of the spherical inner diameter of the body (125A) is 20 microinches Ra maximum.

(3) Install the ball (120A) in the body (125A).

(4) Install a tie wrap, G50227 to keep the ball (120A) in place until the installation of the non-locking actuator.



1 APPLY DRI-FILM LUBE, EVERLUBE 967, 0.0003-0.0005 INCH THICK

2 AFTER DRI-FILM LUBE, BODY (125A) MUST ACCEPT 0.7180 INCH DIAMETER BALL

125 ALL MACHINED SURFACES UNLESS SHOWN DIFFERENTLY

ITEM NUMBERS REFER TO IPL FIG. 1

ALL DIMENSIONS ARE IN INCHES

315A2831-1 Rod End Assembly Repair
Figure 601

ROD END BODY - REPAIR 6-2

315A2831–2

1. General

A. This repair gives the data necessary to refinish the body (125A).

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to IPL Figure 1 for items numbers.

D. General repair details:

(1) Materials: PH13-8MO CRES 175-200 KSI

2. Rod End Body Refinish

A. References

Reference	Title
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-30-03	GENERAL CLEANING PROCEDURES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-60-02	FINISHING MATERIALS

B. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

(1) Prepare the surface and passivate as shown in SOPM 20-30-03 (F-17.09).

BOEING®

COMPONENT MAINTENANCE MANUAL

EXTERNAL PARTS REPLACEMENT - REPAIR 7-1

BAC27DTR0032, 315A1836–1

1. General

A. This repair gives the data that is necessary to replace the marker (390) and the nameplate strap (385) on the cylinder assembly (370).

B. Refer to the Standard Overhaul Practice Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to IPL Figure 1 for item numbers.

2. Marker Replacement

A. Consumable Materials

NOTE: Equivalent substitutes may be used.

Reference	Description	Specification
A00435	Adhesive - Epoxy Polyamide, 2 Part, Thickened	BMS5-126, Type III
A50092	Adhesive - Epibond 1534 A/B, Type 2, Class 1, Grade B	BMS 5-126, Type 2, Class 1

B. References

Reference	Title
SOPM 20-30-02	STRIPPING OF PROTECTIVE FINISHES
SOPM 20-41-01	DECODING TABLE FOR BOEING FINISH CODES
SOPM 20-50-12	APPLICATION OF ADHESIVES
SOPM 20-60-02	FINISHING MATERIALS

C. Consumable Materials

NOTE: Equivalent material can be used.

(1) C00179 Coating – 683-3-2

D. Procedure

NOTE: For stripping of protective finishes, refer to SOPM 20-30-02. For the decoding table for Boeing finish codes, refer to SOPM 20-41-01. For finishing materials, refer to SOPM 20-60-02.

(1) Remove the nameplate strap (385) and the marker (390) from the cylinder assembly (370).

(2) Shape the marker (390) to a radius smaller than the radius of the cylinder (380).

(3) Apply adhesive, A00435 to the marker (390) as shown in SOPM 20-50-12.

(4) Bend the corners of the marker (390) to the mounting surface.

(5) Install the marker (390) and the nameplate strap (385) on the cylinder at the location shown in REPAIR 7-1, Figure 601.

NOTE: Nameplate strap may be used only one time.

(6) Make a bend on end 1 of the strap (385) as shown in REPAIR 7-1, Figure 601.

(7) Insert the strap (385) thru the hole in the marker (390) and shape the end of the strap as shown in REPAIR 7-1, Figure 601.

(8) Insert end 2 of the strap (385) thru the other hole in the marker (390) while holding the marker on the cylinder assembly (370).

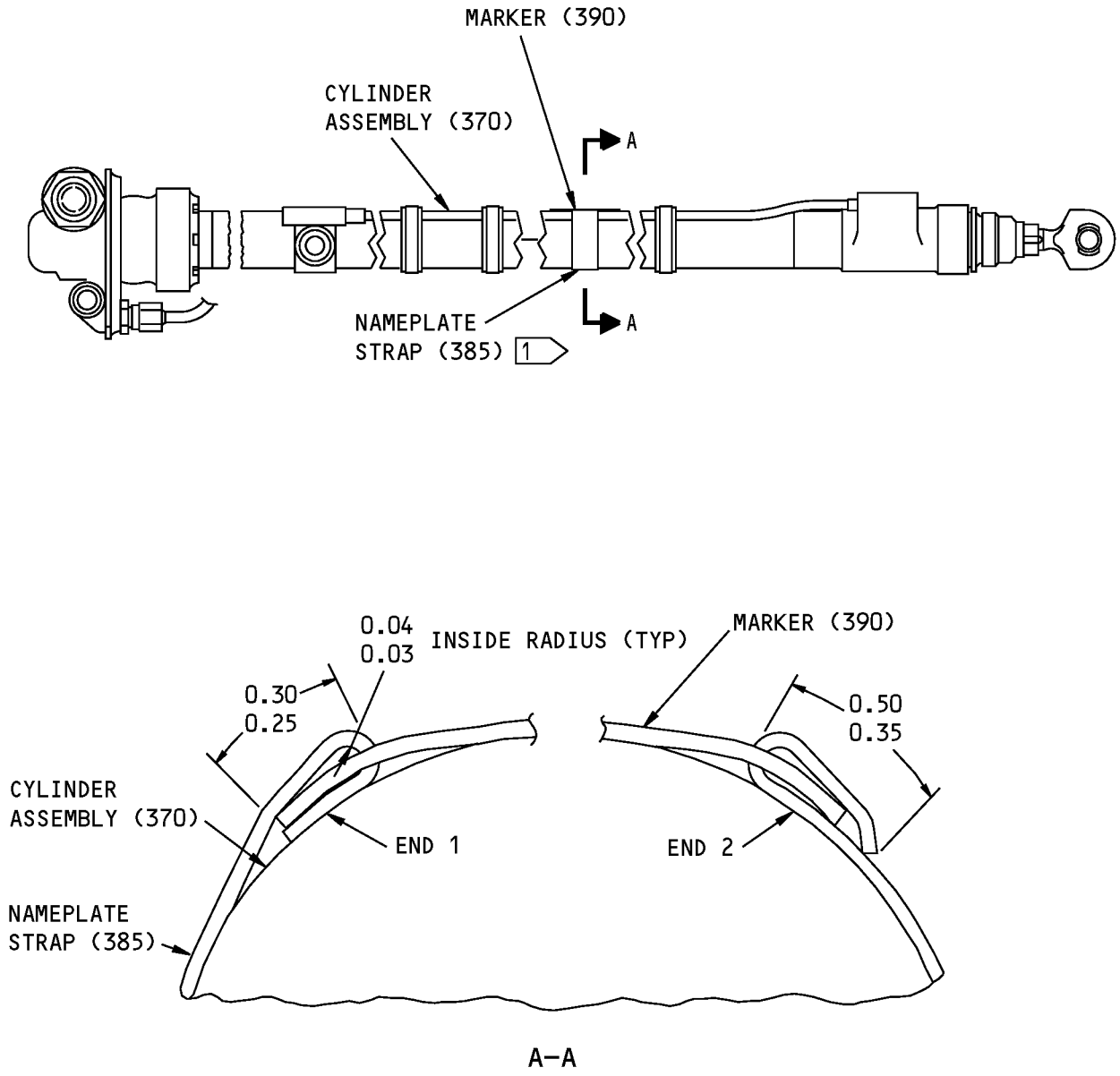
(9) Bend end 2 of the strap (385) while applying a pull force to get pretension of the marker (390) and the strap (385).

(10) Cut the end 2 of the strap (385) to the dimension shown in REPAIR 7-1, Figure 601.

(11) Keep the pretension and use an applicable tool to make the final bend of end 2 of the strap (385) to get more tension.

(12) Bend the strap (385) over the edge of the marker (390) and hit lightly with an applicable soft-nosed hammer.

(13) Make a fillet around the edge of the marker (390) and the nameplate strap (385) with adhesive, A50092. Make sure the adhesive, A50092 fills the holes in the marker (390).



1 NAMEPLATE STRAP (385) MAY BE USED ONLY ONE TIME

ITEM NUMBERS REFER TO IPL FIG. 1

ALL DIMENSIONS ARE IN INCHES

BAC27DTR0032 315A1836-1 External Parts Replacement
Figure 601

ASSEMBLY

1. General

A. This procedure has the data necessary to assemble the non-locking actuator assembly.

B. Refer to the Standard Overhaul Practices Manual (SOPM) for the SOPM subjects identified in this procedure.

C. Refer to IPL Figure 1 for item numbers.

2. Assembly

A. Tools/Equipment

NOTE: Equivalent substitutes may be used.

Reference	Description
COM-4950	Installation Tool - Cable Tie, (Part #: GS4MT, Supplier: 06383) (Part #: PPTMT, Supplier: 06383) (Part #: ST2MT, Supplier: 06383)
SPL-5359	Test Fixture - Rod End and Stroke Stop, Locking and Non-Locking Thrust Reverser Actuator (Part #: B78014-37, Supplier: 81205) (Opt Part #: B78014-29, Supplier: 81205)
SPL-6255	Wrench (B78008-7 is included in B78008-19) (Part #: B78008-7, Supplier: 81205)
SPL-6256	Wrench (B78008-6 included in Kit B78008-19) (Part #: B78008-6, Supplier: 81205)
SPL-6257	Wrench (B78008-5 is included in B78008-19) (Part #: B78008-5, Supplier: 81205)
SPL-6259	Wrench (B78008-10 included in B78008-19) (Part #: B78008-10, Supplier: 81205)
SPL-6260	Wrench (B78008-12 included in B78008-19) (Part #: B78008-12, Supplier: 81205)
SPL-6272	Plug (B78016-6 is included in B78016-1) (Part #: B78016-6, Supplier: 81205)
SPL-6273	Sleeve (B78016-5 inlcuded in Overhaul Set B78016-1) (Part #: B78016-5, Supplier: 81205)
SPL-6274	Cap (B78016-3 is included in B78016-1) (Part #: B78016-3, Supplier: 81205)
SPL-6283	Equipment - Bearing Installation, Lead Screw (Part #: B78017-1, Supplier: 81205)
SPL-6284	Fixture - Torque, Locking and Non-Locking Thrust Reverser Acutator Assembly (Part #: B78011-25, Supplier: 81205)

Reference	Description
SPL-6323	Pin - Crank (B78014-7 Assembly Included in Test Fixture B78014-29 and B78014-37) (Part #: B78014-37, Supplier: 81205) (Opt Part #: B78014-29, Supplier: 81205)

B. Consumable Materials

NOTE: Equivalent substitutes may be used.

Reference	Description	Specification
A00435	Adhesive - Epoxy Polyamide, 2 Part, Thickened	BMS5-126, Type III
D00015	Grease - Aircraft Bearing (Use BMS 3-24 until existing stocks are depleted, BMS 3-33 supersedes BMS 3-24)	BMS3-24 (Superseded by BMS 3-33)
D00153	Fluid - Hydraulic, Erosion Arresting, Fire Resistant	BMS3-11 Type IV (interchange˜able & intermixable with Type V)
G50347	Lockwire - Nickel-copper, 0.032 inch diameter	NASM20995N˜C32

C. References

Reference	Title
SOPM 20-50-01	BOLT AND NUT INSTALLATION
SOPM 20-50-02	INSTALLATION OF SAFETYING DEVICES
SOPM 20-50-03	BEARING AND BUSHING REPLACEMENT
SOPM 20-50-06	INSTALLATION OF O-RINGS AND TEFLON SEALS
SOPM 20-50-07	LUBRICATION
SOPM 20-50-12	APPLICATION OF ADHESIVES
SOPM 20-60-02	FINISHING MATERIALS
SOPM 20-60-03	LUBRICANTS
SOPM 20-60-04	MISCELLANEOUS MATERIALS

D. Procedure

NOTE: For bolt and nut installation, refer to SOPM 20-50-01. For finishing materials, refer to SOPM 20-60-02. For lubricants, refer to SOPM 20-60-03. For miscellaneous materials, refer to SOPM 20-60-04.

(1) Use standard industry procedures and the steps shown below to assemble this component.

(2) Using bearing tool, SPL-6283, install the bearing (285) as shown in SOPM 20-50-03 using system fluid on the lead screw (345). Make sure the unstamped faces of the outer races are together. Make sure the bearings (285) are seated firmly.

(3) Using plug, SPL-6272 installed in the housing (230), measure the distance from the shoulder of the lead screw bearing diameter to the centerline of the worm gear bearing diameters to the nearest 0.001 inch. This is dimension A (dimension A will be between 0.515 and 0.545 inch) (ASSEMBLY, Figure 701, ASSEMBLY, Figure 702).

(4) Measure the distance on the worm wheel (255) from the end of the part to the centerline of the worm shaft gear (55) to the nearest 0.001 inch. This is dimension B (dimension B will be between 0.415 and 0.425 inch) (ASSEMBLY, Figure 701, ASSEMBLY, Figure 702).

(5) Subtract dimension B obtained in ASSEMBLY, Paragraph 2.D.(4) from dimension A obtained in ASSEMBLY, Paragraph 2.D.(3). The result is dimension S1 (ASSEMBLY, Figure 701, ASSEMBLY, Figure 702). S1 is the required shim thickness. Select the minimum combination of shims (260 thru 280) to achieve dimension S1 to the nearest 0.001 inch.

(6) Install the shims (260 thru 280) on the lead screw (345). Install the key (250) in the slot on the lead screw (345). Install the worm wheel (255) on the lead screw (345). Make sure the shims firmly seat on the bearing (285) and the worm wheel (255) firmly seats on the shims.

(7) Using bearing tool, SPL-6283, install the bearing (245) on the lead screw (345) and seat the inner race firmly against the worm wheel (255).

(8) Apply an ink index-mark on the flange of the cup lockwasher (240) opposite the tang. Install the lockwasher (240) with the tang in the keyway of the lead screw. Install the bolt (235) in the lead screw (345). Restrain the lead screw (345) with a wrench across the flats of the shoulder and tighten the bolt (235) to 275-325 pound-inches.

(9) Install the assembled parts in the housing (230) and retain with cap, SPL-6274 used with the rings (325) and the cylinder nut (320) with grease, D00015 per (SOPM 20-50-07). Tighten the cylinder nut (320) to 2900-3100 pound-inches with wrench, SPL-6260.

(10) Using wrench, SPL-6259, make sure the force necessary to turn the lead screw (345) is not more than 2.5 pound-inches. If the force is acceptable, go on to ASSEMBLY, Paragraph 2.D.(10). If the force is more than 2.5 pound-inches, do the following:

  (a) Remove the parts from the housing and replace the bearings (285).

  (b) Install the parts per ASSEMBLY, Paragraph 2.D.(2) thru ASSEMBLY, Paragraph 2.D.(9) again and check the force again.

(11) Remove the lead screw (345) from the housing (230). Deform the flange of the lockwasher (240) against two opposite bolt flats that are not next to the ink index-mark.

(12) Remove the lead screw nut (355) from the piston assembly (350). Install the new lockring (305) on the lead screw nut (355). Install the lead screw nut (355) on the lead screw (345) to the approximate center of the threaded length.

(13) Install the guide (340), retaining pin (335) and the retaining ring (330) on the end of the lead screw (345).

(14) Move the piston (360) over the lead screw (345). Using wrench (B78008-6), SPL-6256, turn the lead screw nut (355) into the piston (360) until the two halves of the holes for the locking pin (300) align. (ASSEMBLY, Figure 703).

(15) Align the half-circular groove on the ring (305) with the half-circular groove on the lead screw nut (355).

(16) Insert the locking pin (300) into the hole and lightly tap it until it bottoms. Make sure the retaining ring (305) engages the shoulder of the locking pin (300). Turn the ring (305) until its radius passes the locking pin (300). Deform the lock ring (305) into the slot in the lead screw nut (355) as shown in ring as shown in ASSEMBLY, Figure 703.

(17) Install the O-ring (315) and the two back-up rings (310) in the groove on the piston (360) (SOPM 20-50-06).

(18) Using sleeve, SPL-6273, install one bearing (50) as shown in SOPM 20-50-03 using system fluid, D00153 against the shoulder of the worm shaft gear (55).

(19) Install the worm shaft gear (55) in the housing (230) from the left side. Seat the bearing (50) against the shoulder in the housing (230) as shown in ASSEMBLY, Figure 704.

(20) Install the O-ring (15) (SOPM 20-50-06) on the undercut of the adapter screw (10A). Install the adapter screw (10A) in the housing (230). Tighten the adapter screw (10A) to 1140-1200 lb-in.

(21) Install the other bearing (50) as shown in SOPM 20-50-03 using system fluid, D00153 on the worm shaft gear (55) and into the housing (230) with sleeve, SPL-6273.

(22) Put the actuator so that the worm shaft gear (55) is vertical and the adapter screw (10A) is at the bottom. From the top, press down on the worm shaft gear (55) to make sure the outer race of the bottom bearing is seated against the adapter screw (10A). Make sure the inner race of the upper bearing is seated against the shoulder of the worm shaft gear (55).

(23) Using a depth micrometer, measure the distance from the outer face of the housing (230) to the outer race of the bearing. Measure at two locations, 180 degrees apart, and divide the sum by two (2). This is dimension C (dimension C will be between 0.783 and 0.833 inch) (ASSEMBLY, Figure 701, ASSEMBLY, Figure 704).

(24) Install the sleeve (45) in the bore of the fitting (5A) (in the end with the shortest thread). Using a depth micrometer, measure the distance from the face of the sleeve (45) to the bottom face of the fitting flange. Measure at two locations, 180 degrees apart, and divide the sum by two (2). This is dimension D (dimension D will be between 0.740 and 0.760 inch) (ASSEMBLY, Figure 701, ASSEMBLY, Figure 704).

(25) Subtract dimension C obtained in ASSEMBLY, Paragraph 2.D.(23) from dimension D obtained in ASSEMBLY, Paragraph 2.D.(24). The result is dimension S2 (ASSEMBLY, Figure 701, ASSEMBLY, Figure 704). S2 is the required shim thickness. Select the minimum combination of shims (20 thru 40) to achieve the value, S2, to the nearest 0.001 inch.

(26) Remove the sleeve (45) from the fitting (5A). Install the O-ring (15) (SOPM 20-50-06) on the end of the fitting with the shortest thread. Install the shims (20 thru 40) selected in ASSEMBLY, Paragraph 2.D.(25) on the sleeve (45) and install the sleeve in the fitting. Install the assembled parts in the housing (230). Tighten the fitting (5A) to 1140-1200 pound-inches.

(27) Check that the worm shaft gear (55) turns freely. Check that the axial movement (end play) is not more than 0.003 inch.

(a) If the shaft does not turn freely, decrease the total shim thickness in 0.001 inch increments until the shaft turns freely.

(b) If the axial movement is more than 0.003 inch, replace the bearings (50) and do the assembly and check procedures again.

(28) Disassemble all of the parts from the housing (230), take note of the attitude of the bearings (50). Parts will be identically installed at a later time.

(29) Install the lead screw/piston assembly in the housing (230). Make sure the outer race of the bearing (285) seats tightly against the shoulder in the housing (230).

(30) Apply a layer of fluid, D00153 to the inside diameter of the cylinder assembly (370). Put the cylinder nut (320) on the outside diameter of the cylinder. Install the O-ring (295) (SOPM 20-50-06) and the back-up rings (290) in the groove on the cylinder (380). Slide the cylinder assembly (370) over the piston assembly but do not engage the cylinder (380) with the housing (230).

(31) Apply grease, D00015 to the cylinder nut rings (325) and the threads of the cylinder nut (320) per SOPM 20-50-07. Install the cylinder nut rings (325) in the cylinder nut (320). Install the cylinder nut (320) in the housing (230), finger tight.

(32) Install the piston stop (225) in the cylinder (380) (ASSEMBLY, Figure 705).

(33) Install the O-ring (210) and the back-up rings (205) and the O-ring (200) and the backup rings (195) in the grooves in the gland (190) (SOPM 20-50-06).

(34) Install the footseal (180) and the O-ring (185) and the bearing (175) in the gland (190) (SOPM 20-50-06).

(35) Apply grease (SOPM 20-50-07) to the snubber rings (215, 220) and install the snubber rings (215, 220) in the gland (190). Make sure they are located as shown in ASSEMBLY, Figure 705. Slide the gland (190) over the piston against the stop (225).

(36) Apply grease, D00015 to the threads of the gland nut (155) per SOPM 20-50-07. Install the scraper (160) in the end of the gland nut (155).

(37) Move the gland nut (155) over the piston (360), and install it into the cylinder (380), finger tight.

(38) Put the actuator in torque fixture, SPL-6284. Use adapter wrench, SPL-6257 and tighten the gland nut (155) to 800-1000 pound-inches.

(39) Tighten the cylinder nut (320) to 2900-3100 pound-inches with wrench, SPL-6260. Remove the actuator from the torque fixture, SPL-6284.

(40) Install the worm gear parts (5 thru 55) determined in the previous steps.

NOTE: The worm shaft gear (55) is to be rotated to engage the worm worm wheel (255).

(41) Install the O-ring (65) (SOPM 20-50-06) on the union (60). Install the union (60) in the housing (230) and tighten to 133-147 pound-inches.

(42) Install the O-rings (110) and the backup rings (105) (SOPM 20-50-06) in the end of the tube assembly (75). Install the tube assembly (75) in the actuator. Tighten the coupling nut (85) of the tube assembly (75) to 133-147 lb-in.

(43) Install the nut (130) on the rod end assembly (115B) until it reaches the end of the thread, near the bearing. Slide the cup lockwasher (135) over the rod end assembly (115B). Make sure the tang is pointed away from the bearing. Slide the stop (140) over the rod end assembly (115B). Make sure the chamfered edge is closest to the bearing.

(44) Install the O-ring (170) and the backup rings (165) (SOPM 20-50-06) in the grooves on the rod end assembly (115B). Make sure the spiral direction of the backup rings (165) will prevent separation of the rings during installation.

(45) Pull on the rod end assembly (115B) to put the piston (360) in the fully extended position. The piston (360) will be against the internal stop (225). Put the actuator in the assembly rod end and stroke stop test fixture, SPL-5359. Make sure the minimum clearance between the tube assembly (75) and any part of the cylinder (380) is 0.02 inch.

(46) Turning the piston (360) by hand and the worm shaft gear (55) using crank pin (B78014-7 assembly), SPL-6323, visually align the slots in the end of the piston in a horizontal position. Make sure the piston is against the piston stop (225) in the full extended position.

(47) Turn the rod end assembly (115B) into the piston (360) until the hole in the bearing aligns with the hole in the clevis of the assembly rod end and stroke stop test fixture, SPL-5359 and the key slot in the rod end body (125A) aligns with either slot in the end of the piston (360).

NOTE: If the piston (360) is turned slightly to adjust the rod end to the clevis of the assembly test stand, turn the worm shaft gear (55) accordingly to maintain the piston (360) against the piston stop (225).

(48) Install the fixture pin through the fixture clevis and the rod end bearing (120A). Install the key (145) in the slots in the piston (360) and the rod end (115B). Make sure the key (145) seats firmly against the bottom of the slots.

(49) Move the stop (140) over the key (145) and seat the inner shoulder tightly against the end of the piston (360). Locate the tang of the lockwasher (135) in the slot in the stop (140). Hold the stop (140) with a wrench and tighten the nut (130) to 600-800 pound-inches using wrench, SPL-6255. Do not break the flange of the lockwasher (135).

(50) Put a dial indicator on the rod end and stroke stop test fixture, SPL-5359 to measure the axial movement of the piston (360) in from the fully extended position. Turn the worm shaft gear (55) using crank pin (B78014-7 assembly), SPL-6323 and retract the piston (360) until movement is stopped by contact of the fixture pin with the fixture clevis. Record the distance moved and add this value to 44.210 inches (ASSEMBLY, Figure 701). This sum is the fully extended dimension of the actuator. Remove the dial indicator.

(51) Remove the fixture pin from the rod end (115B). Push the piston (360) in until the stop (140) contacts the gland nut (155). Make sure the rod end does not turn related to the actuator body.

(52) Slide the fixture clevis along its mounting block until the holes in the clevis align with the hole in the rod end assembly (115B). Install the fixture pin thru the clevis and the rod end assembly (115B) . Push lightly on the clevis to make sure the stop (140) is in contact with the gland nut (155). Tighten the clamp of the fixture clevis.

(53) Using a micrometer, measure the dimension across the fixture gage block and the fixture pin to the nearest 0.001 inch. This is dimension E1. Subtract 1.665 inches from the value and note this dimension. This is dimension F (dimension F will be between 0.023 and 0.115 inch) (ASSEMBLY, Figure 701, ASSEMBLY, Figure 706).

(54) Hold the stop (140) with a wrench and loosen the nut (130) using wrench, SPL-6255. Remove the fixture pin, and turn the actuator to remove the rod end from the fixture clevis. Remove the nut (130), move the lockwasher (135) and the stop (140) and remove the key (145). Unscrew the rod end from the piston, then remove the stop. Screw the rod end back into the piston to prevent separation.

(55) Machine surface -B surface of the stop (140) to remove the amount of material equal to dimension F, obtained in ASSEMBLY, Paragraph 2.D.(53), to within 0.0005 inch (ASSEMBLY, Figure 706). Break all sharp edges.

(56) Remove the rod end assembly (115B) from the piston (360) and reinstall the stop (140). Make sure the chamfered edge is nearest to the bearing. Repeat ASSEMBLY, Paragraph 2.D.(44) thru ASSEMBLY, Paragraph 2.D.(48), ASSEMBLY, Paragraph 2.D.(50) and ASSEMBLY, Paragraph 2.D.(51).

(57) Using a micrometer, measure the dimension across the fixture gage block and the pin of the fixture. Verify the dimension is between 1.661 and 1.669 inches. Add this dimension to 22.000 inches. This sum is the fully retracted dimension of the actuator and should be noted for functional test data (ASSEMBLY, Figure 701). Remove the actuator from the rod end and stroke stop test fixture, SPL-5359.

(58) Do the functional test as shown in TESTING AND FAULT ISOLATION.

(59) Do the following:

(a) Lockwire the nut (155) to the cylinder (370) using lockwire, G50347 per SOPM 20-50-02.

(b) Lockwire the cylinder nut (320) to the housing (230) using lockwire, G50347 per SOPM 20-50-02.

(c) Lockwire the fitting (5A) and the adapter screw (10A) to the housing (230) using lockwire, G50347 per SOPM 20-50-02.

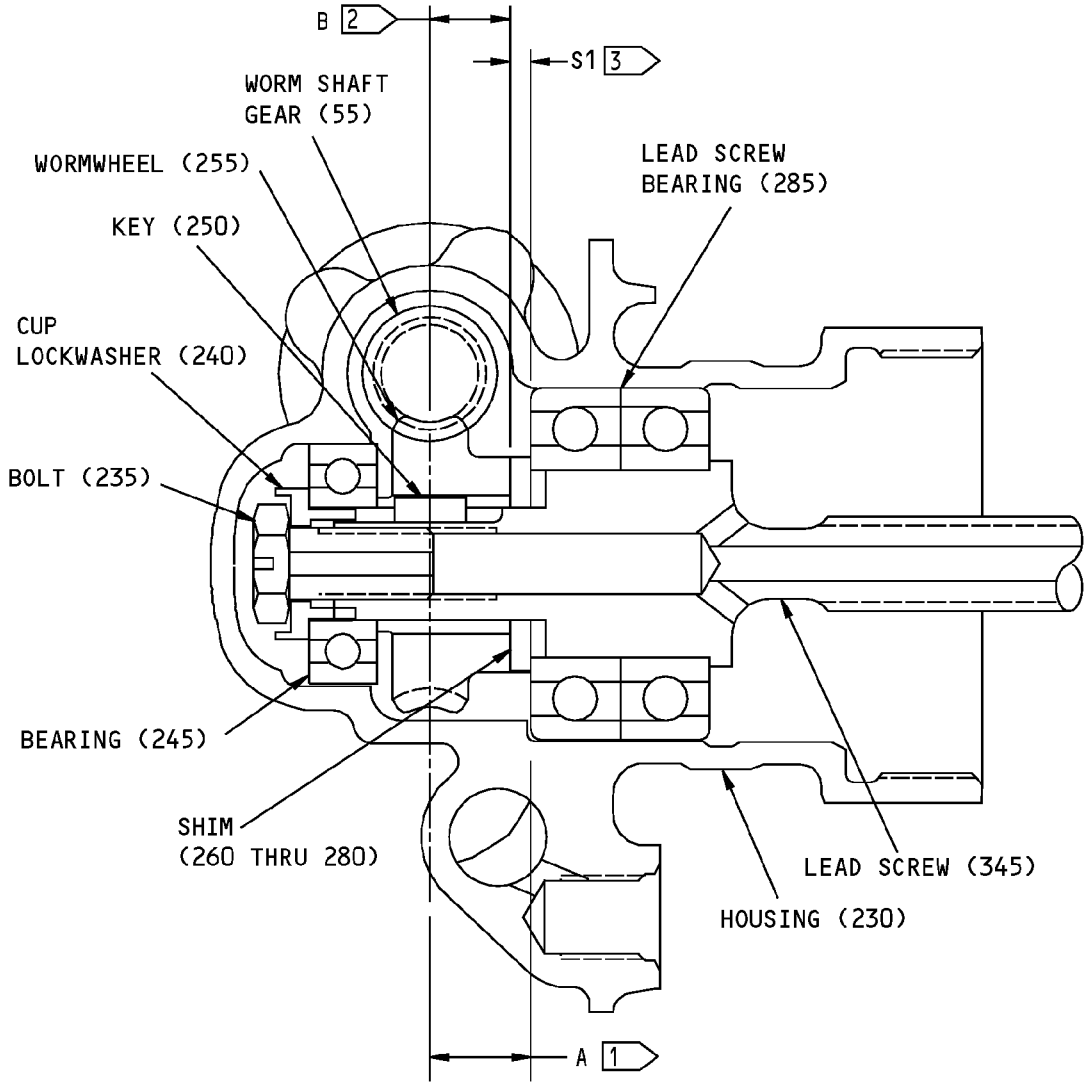
(60) Using a 0.12 inch square punch, break the flange of the cup lockwasher (135) at the piston rod end (115B) into each of the four slots in the nut (130). Make sure the break is complete.

(61) Install the spacers (365) around the cylinder (380) and the tube assembly (75) . Bond the spacers (365) to the cylinder with adhesive, A00435 per SOPM 20-50-12. Install the ties (70) around the spacers using cable tie installation tool, COM-4950. Set the tool to 165 pounds maximum, locating the joints of the ties approximately as shown in ASSEMBLY, Figure 707. If necessary, retighten the coupling nut (85) to 133-147 pound-inches.

(62) Install the spacer (150) in the groove on the gland nut (155) with adhesive, A00435 per SOPM 20-50-12.

DIMENSION A (FIG. 702)	1. ENTER HOUSING (230) DIMENSION	1	
DIMENSION B (FIG. 702)	2. ENTER CENTERLINE-TO-FACE DIMENSION AS MARKED ON WORM WHEEL (255)	2	
SHIM THICKNESS, S1 (FIG. 702)	3. SUBTRACT LINE 2 FROM LINE 1, THIS IS THE REQUIRED SHIM (260 THRU 280) THICKNESS TO WITHIN 0.001 INCH .	3	
CALCULATION OF C (FIG. 704)	4. A. ENTER FIRST READING OF DISTANCE FROM HOUSING FACE TO BEARING OUTER RACE	4A	
	B. ENTER SECOND READING OF DISTANCE FROM HOUSING FACE TO BEARING OUTER RACE	4B	
	C. ADD LINES 4A AND 4B.	4C	
	D. DIVIDE LINE 10C BY TWO (2), THIS IS DIMENSION C.	4D	
CALCULATION OF D (FIG. 704)	5. A. ENTER FIRST READING OF DISTANCE FROM SLEEVE FACE TO BOTTOM FACE OF FITTING FLANGE	5A	
	B. ENTER SECOND READING OF DISTANCE FROM SLEEVE FACE TO BOTTOM FACE OF FITTING FLANGE.	5B	
	C. ADD LINES 5A AND 5B.	5C	
	D. DIVIDE LINE 5C BY TWO (2), THIS IS DIMENSION D.	5D	
CALCULATION OF S2 SHIM THICKNESS (FIG. 704)	6. ENTER LINE 4D AMOUNT	6	(-)
	7. SUBTRACT LINE 6 FROM LINE 5D, THIS IS THE REQUIRED THICKNESS OF SHIMS (20 THRU 40) TO WITHIN 0.001 INCH.	7	
EXTENDED ACTUATOR LENGTH	8. ENTER DIAL INDICATOR READING OF PISTON AXIAL MOVEMENT INWARD FROM FULLY EXTENDED POSITION.	8	
	9. ADD 44.210 TO LINE 8, THIS IS THE FULLY EXTENDED DIMENSION OF THE ACTUATOR	9	44.210
MACHINING OF STOP (FIG. 706)	10. WITH STOP IN CONTACT WITH GLAND NUT, MEASURE AND ENTER DISTANCE ACROSS GAGE BLOCK AND PIN OF FIXTURE, THIS IS DIMENSION E1.	10	
	11. SUBTRACT 1.665 FROM LINE 10, THIS IS DIMENSION F.	11	(-)1.665
RETRACTED ACTUATOR LENGTH	12. WITH MACHINED STOP IN CONTACT WITH GLAND NUT, MEASURE AND ENTER DISTANCE ACROSS GAGE BLOCK AND PIN OF FIXTURE.	12	
	13. ADD 22.000 TO LINE 12, THIS IS THE FULLY RETRACTED DIMENSION OF THE ACTUATOR	13	22.000

Non-locking Actuator Assembly Worksheet
Figure 701



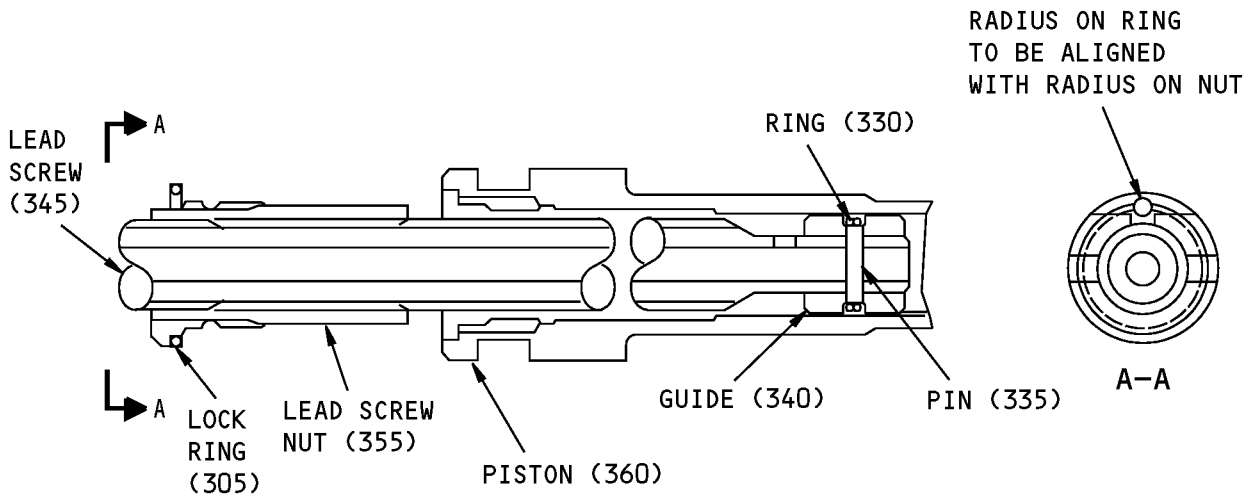
1 A = THE DISTANCE FROM THE SHOULDER OF THE LEAD SCREW BEARING DIAMETER TO THE CENTERLINE OF THE WORM GEAR BEARING DIAMETER TO THE NEAREST 0.001 INCH. (A WILL BE BETWEEN 0.515 AND 0.545 INCH)

2 B = THE DISTANCE FROM THE FACE OF THE WORMWHEEL (255) TO THE CENTERLINE OF THE WORM SHAFT GEAR (55) TO THE NEAREST 0.0001 INCH. THE DIMENSION IS MARKED IN THE FACE. (B WILL BE BETWEEN 0.415 AND 0.425 INCH)

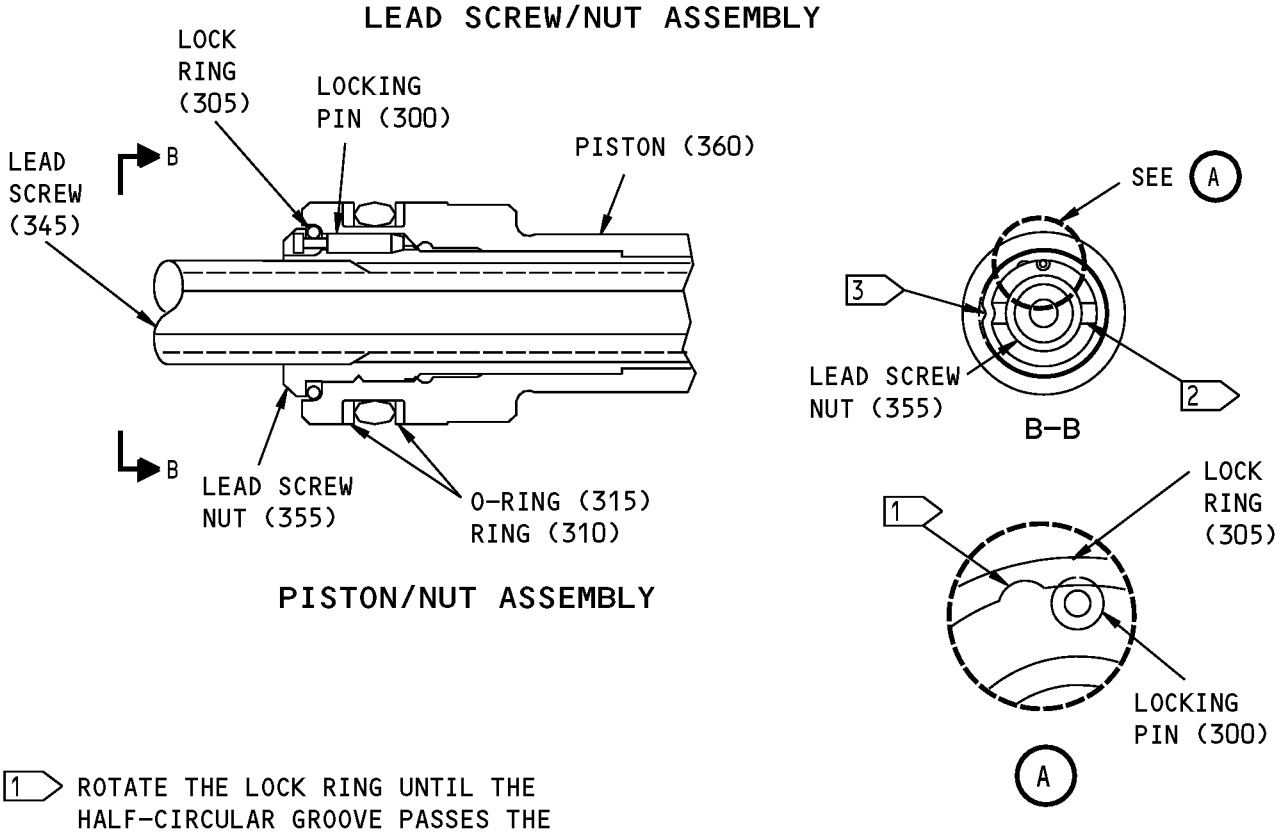
3 S1 = A-B: THE REQUIRED SHIM (260 THRU 280) THICKNESS. (S1 WILL BE BETWEEN 0.090 AND 0.130 INCH)

ITEM NUMBERS REFER TO IPL FIG. 1

Housing/Wormwheel Assembly Shim Requirement
Figure 702



LEAD SCREW/NUT ASSEMBLY



PISTON/NUT ASSEMBLY

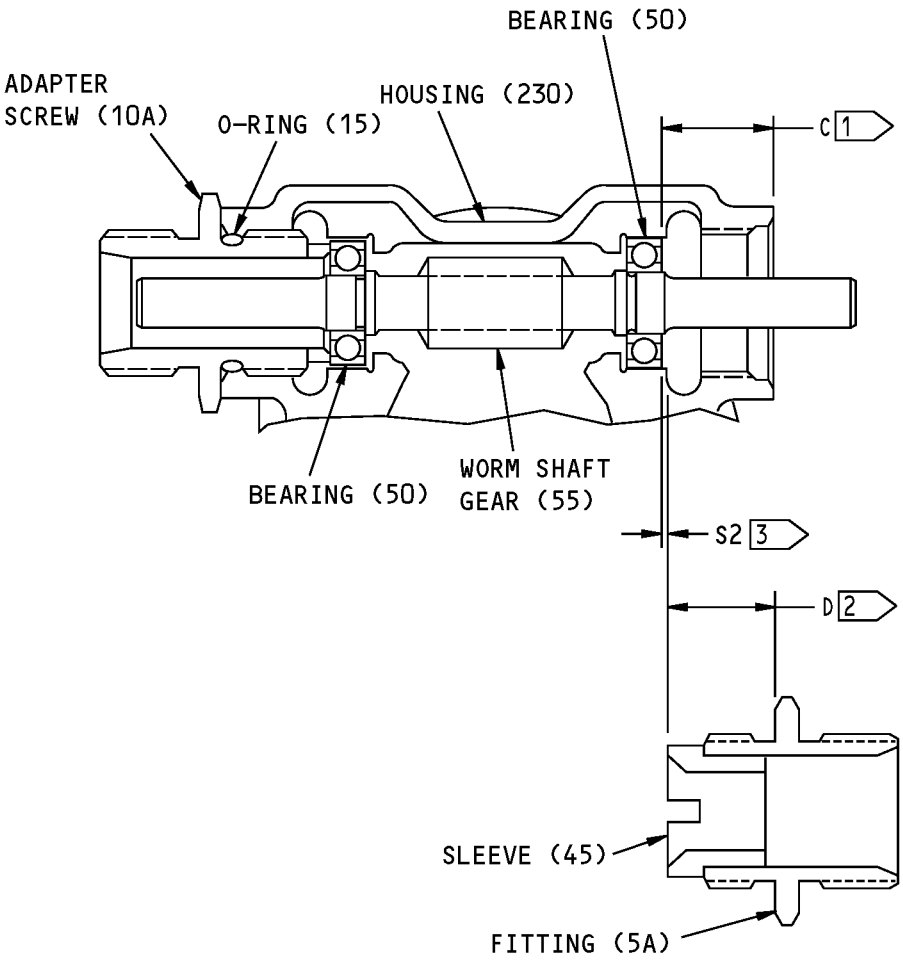
1 ROTATE THE LOCK RING UNTIL THE HALF–CIRCULAR GROOVE PASSES THE LOCKING PIN

2 USE THE SLOT OF THE LEAD SCREW NUT TO ROTATE THE RING

3 DEFORM LOCK RING

ITEM NUMBERS REFER TO IPL FIG. 1

Non-locking Actuator Assembly
Figure 703



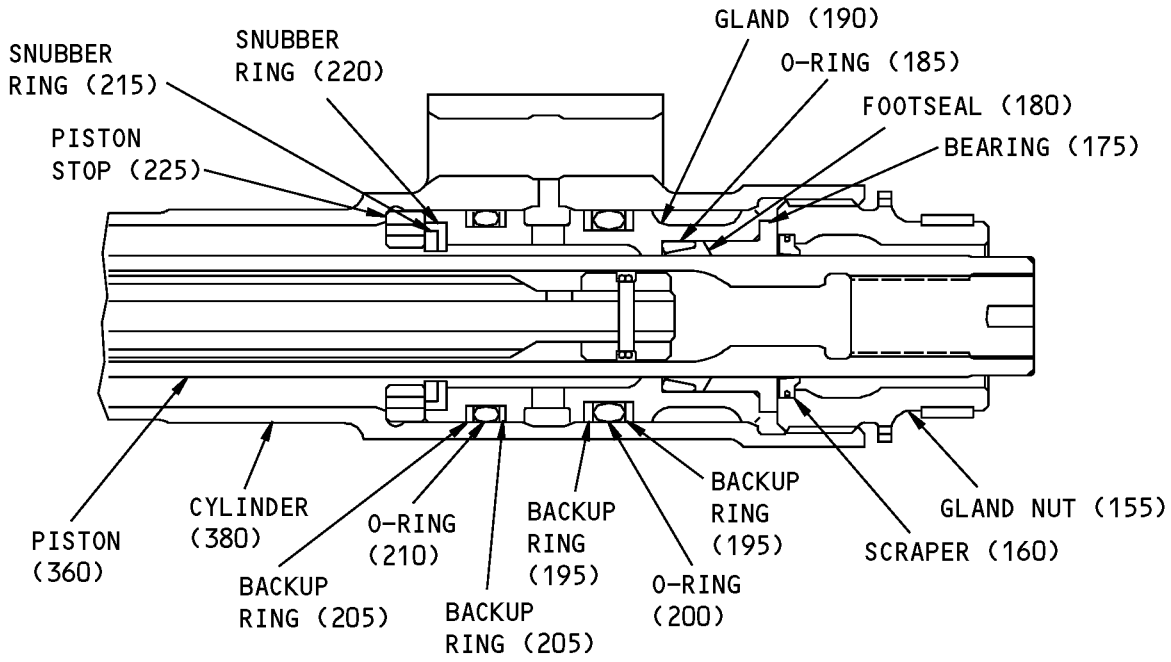
ITEM NUMBERS REFER TO IPL FIG. 1

1 C = THE DISTANCE FROM THE OUTER FACE OF THE HOUSING TO THE OUTER FACE OF THE BEARING. (C WILL BE BETWEEN 0.783 AND 0.833 INCH)

2 D = THE DISTANCE FROM THE FACE OF THE SLEEVE TO THE BOTTOM FACE OF THE FLANGE OF THE FITTING. (D WILL BE BETWEEN 0.740 AND 0.760 INCH)

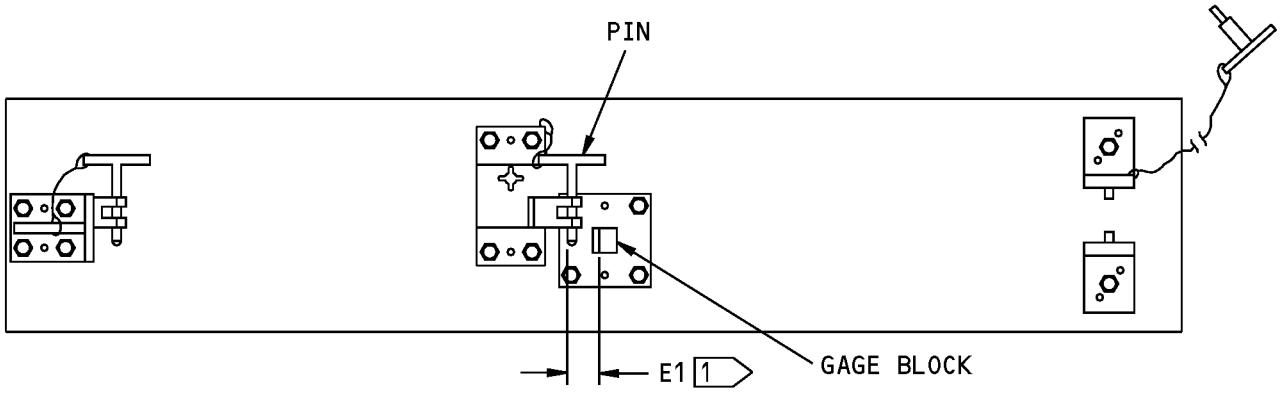
3 S2 = C-D: THE REQUIRED SHIM (20 THRU 40) THICKNESS. (S2 WILL BE BETWEEN 0.023 AND 0.093 INCH)

Worm Shaft Assembly/Shim Requirement
Figure 704

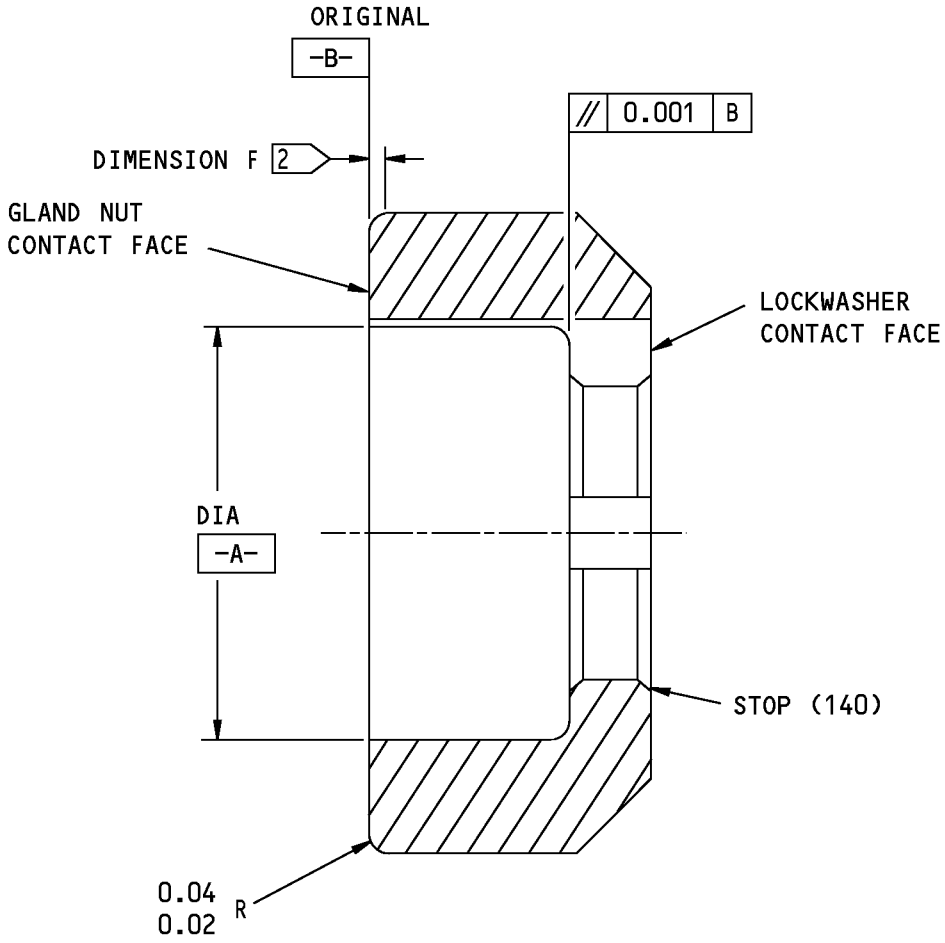


ITEM NUMBERS REFER TO IPL FIG. 1

Non-locking Actuator Assembly
Figure 705



Machining of Stop
Figure 706 (Sheet 1 of 2)



1 E1 = THE DISTANCE ACROSS THE GAGE BLOCK AND THE FIXTURE PIN

2 F = E1 - 1.665: THE AMOUNT OF MATERIAL TO REMOVE FROM SURFACE -B- (F WILL BE BETWEEN 0.023 AND 0.115 INCH)

E1 = THE DISTANCE ACROSS THE GAGE BLOCK AND THE FIXTURE PIN

CAUTION: STOP (140) REMOVED FROM SERVICE WILL HAVE SURFACE -B- AND DEPTH DIMENSION DIFFERENT FROM ORIGINAL DESIGN CONFIGURATION. DUE TO ABOVE MACHINING HAVING BEEN ALREADY PERFORMED DURING PREVIOUS ASSEMBLY OF PARTS.

125 ALL MACHINED SURFACES UNLESS SHOWN DIFFERENTLY

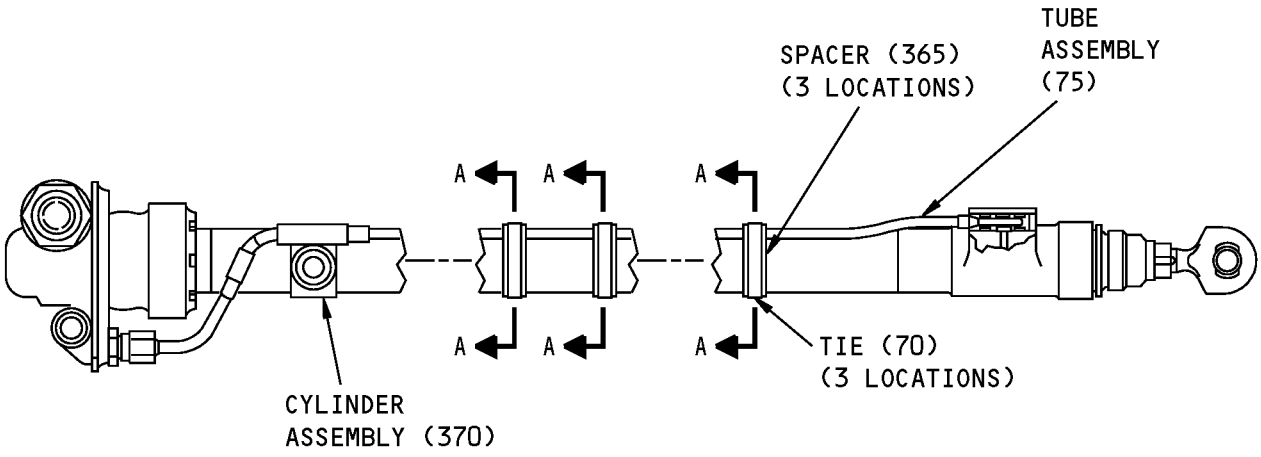
BREAK ALL SHARP EDGES

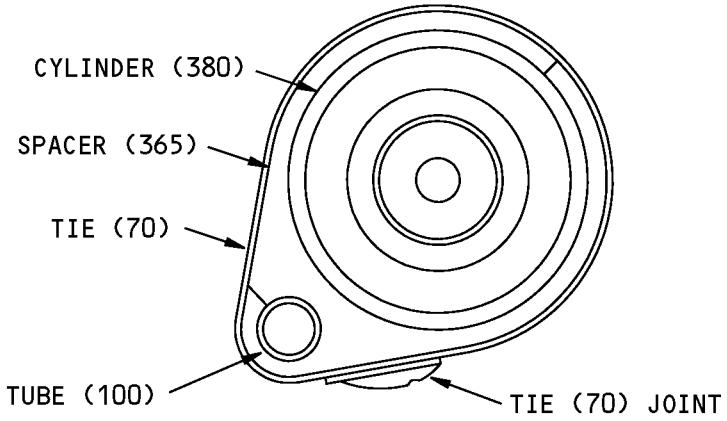
ITEM NUMBERS REFER TO IPL FIG. 1

ALL DIMENSIONS ARE IN INCHES

F68504 S00041009189_V2

Machining of Stop
Figure 706 (Sheet 2 of 2)

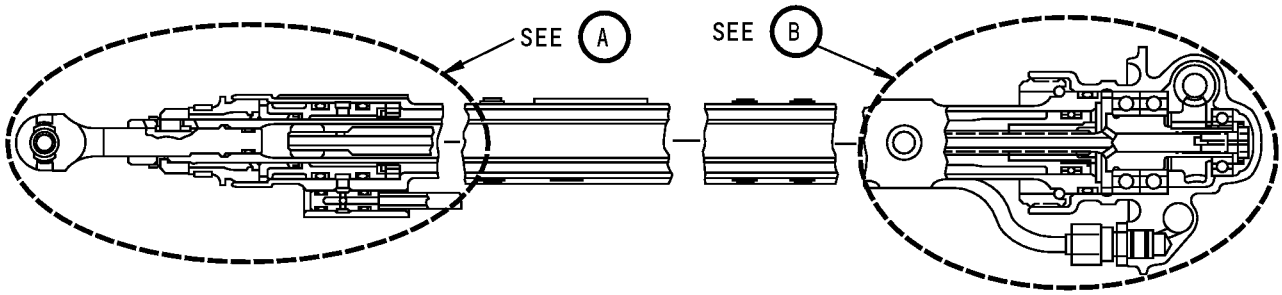


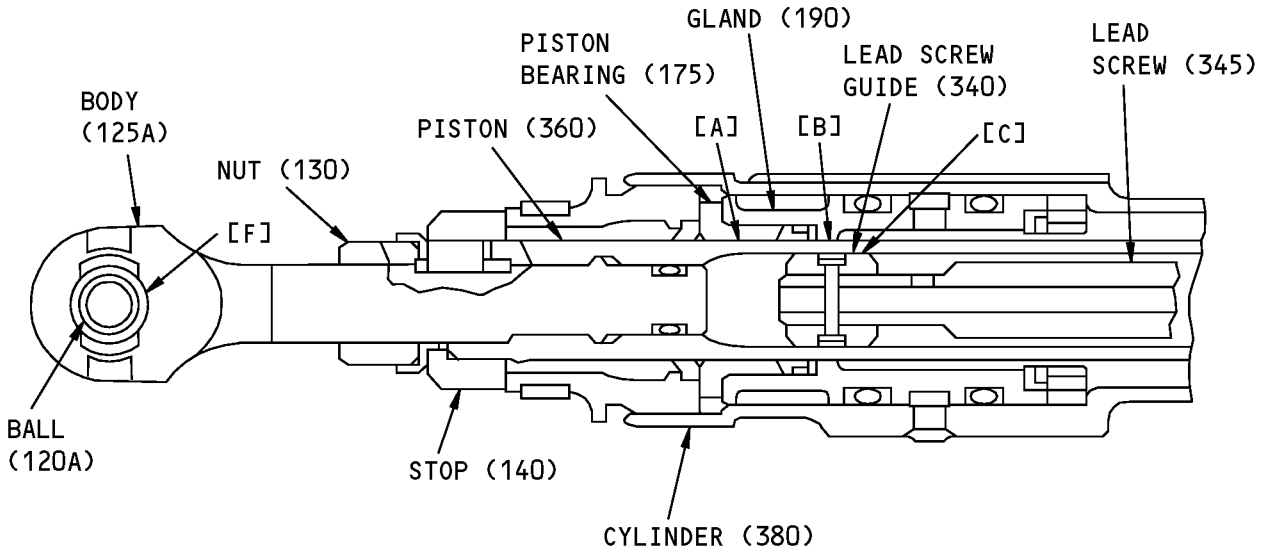


A–A

ITEM NUMBERS REFER TO IPL FIG. 1

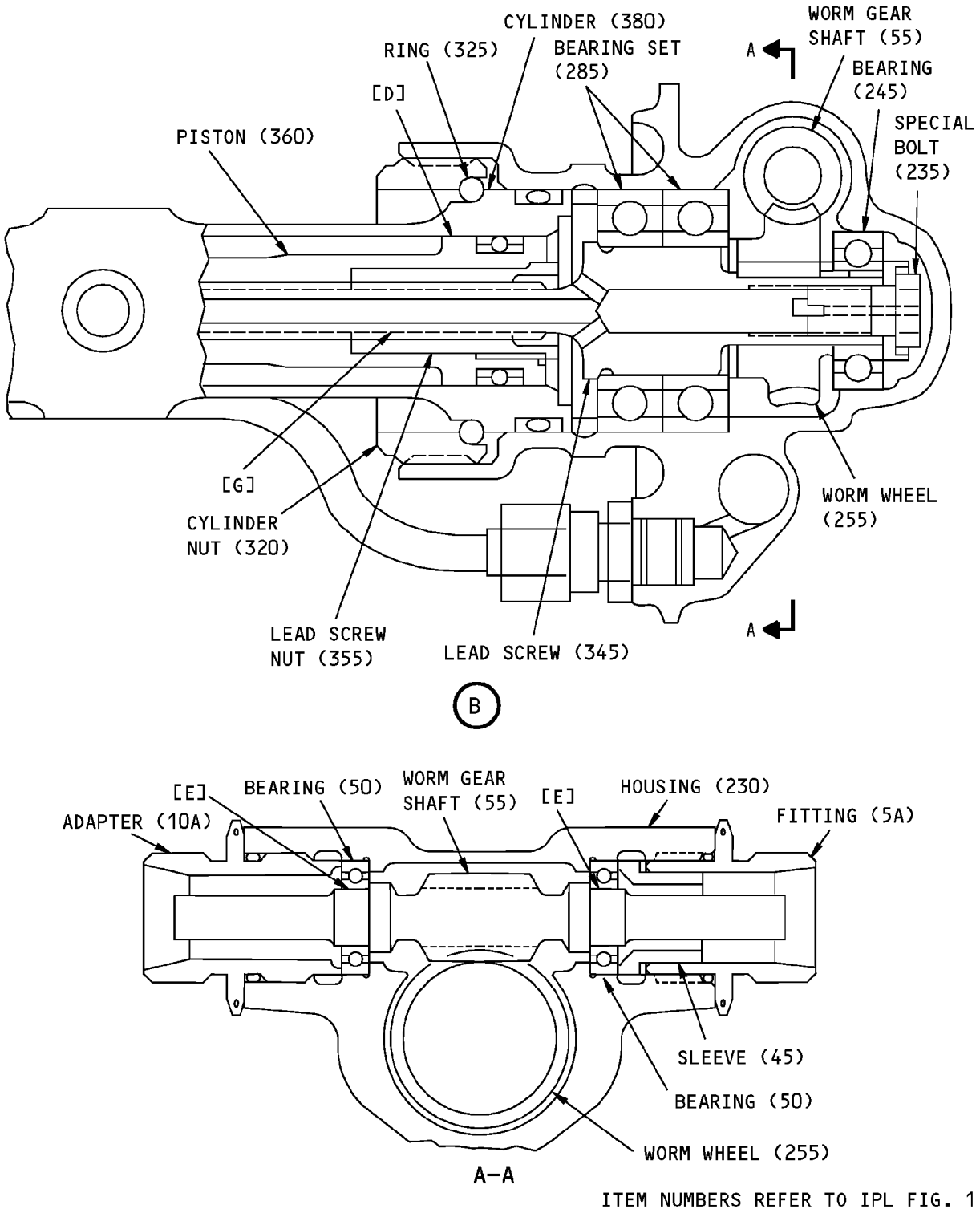
Non-locking Actuator Assembly
Figure 707





A

Fits and Clearances
Figure 801 (Sheet 1 of 3)



Fits and Clearances
Figure 801 (Sheet 2 of 3)

REF LETTER	REF IPL FIG. 1, MATING ITEM NO.	DESIGN DIMENSION*				SERVICE WEAR LIMIT*		
		DIMENSION		ASSEMBLY CLEARANCE		DIMENSION		MAXIMUM CLEARANCE
		MIN	MAX	MIN	MAX	MIN	MAX	
[A]	ID 175 OD 360	0.750 0.746	0.751 0.748	0.002	0.005	0.745	0.755	0.010
[B]	ID 190 OD 360	0.750 0.746	0.751 0.748	0.002	0.005	0.745	0.755	0.010
[C]	ID 360 OD 340	0.557 0.548	0.560 0.552	0.005	0.012	0.525	0.570	0.045
[D]	ID 380 OD 360	0.116 1.113	1.118 1.114	0.002	0.005	1.110	1.121	0.011
[E]	ID 50 OD 55	0.4721 0.4723	0.4724 0.4726	-0.0005 (1)	0.0001	0.470	0.473	0.003
[F]	ID 125A OD 120A	0.7185 0.7174	0.7190 0.7179	0.0006	0.0016			
[G]	ID 355 OD 345	0.448 (2) 0.440 (2)	0.452 (2) 0.444 (2)	0.0011 (3)	0.0033 (3)	(4)	(5)	0.020 (3)

* ALL DIMENSIONS ARE IN INCHES

(1) DENOTES INTERFERENCE FIT

(2) PITCH DIAMETER

(3) AXIAL BACKLASH

(4) MINUS 10% FLANKWEAR

(5) PLUS 10% FLANKWEAR

Fits and Clearances
Figure 801 (Sheet 3 of 3)

REF IPL		NAME	TORQUE*	
FIG. NO.	ITEM NO.		POUND-INCHES	POUND-FEET
1	5A	Fitting	1140-1200	
1	10A	Adapter Screw	1140-1200	
1	60	Union	125-155	
1	130	Nut	600-800	
1	155	Gland Nut	800-1000	
1	235	Special Bolt	275-325	
1	320	Cylinder Nut	2900-3100	

* REFER TO SOPM 20-50-01 FOR TORQUE VALUES OF STANDARD FASTENERS.

Torque Table
Figure 802

SPECIAL TOOLS, FIXTURES, AND EQUIPMENT

1. General

A. This section lists the special tools, fixtures, and equipment necessary for maintenance.

NOTE: Equivalent substitutes may be used.

Special Tools

Reference	Description	Part Number	Supplier
SPL-5359	Test Fixture - Rod End and Stroke Stop, Locking and Non-Locking Thrust Reverser Actuator	B78014-37 Opt: B78014-29	81205 81205
SPL-6255	Wrench (B78008-7 is included in B78008-19)	B78008-7	81205
SPL-6256	Wrench (B78008-6 included in Kit B78008-19)	B78008-6	81205
SPL-6257	Wrench (B78008-5 is included in B78008-19)	B78008-5	81205
SPL-6259	Wrench (B78008-10 included in B78008-19)	B78008-10	81205
SPL-6260	Wrench (B78008-12 included in B78008-19)	B78008-12	81205
SPL-6272	Plug (B78016-6 is included in B78016-1)	B78016-6	81205
SPL-6273	Sleeve (B78016-5 inlcuded in Overhaul Set B78016-1)	B78016-5	81205
SPL-6274	Cap (B78016-3 is included in B78016-1)	B78016-3	81205
SPL-6280	Test Equipment - Velocity/Position Transducer	B20005-82 Opt: B20005-75	81205 81205
SPL-6281	Stand - Test, Functional	B78010-28	81205
SPL-6283	Equipment - Bearing Installation, Lead Screw	B78017-1	81205
SPL-6284	Fixture - Torque, Locking and Non-Locking Thrust Reverser Acutator Assembly	B78011-25	81205
SPL-6323	Pin - Crank (B78014-7 Assembly Included in Test Fixture B78014-29 and B78014-37)	B78014-37 Opt: B78014-29	81205 81205
SPL-6373	Transducer Assembly - Velocity/Position	B20005-41	81205

Commercial Tools

Reference	Description	Part Number	Supplier
COM-4950	Installation Tool - Cable Tie,	GS4MT PPTMT	06383 06383

Commercial Tools (Continued)

Reference	Description	Part Number	Supplier
		ST2MT	06383

Tool Supplier Information

CAGE Code	Supplier Name	Supplier Address
06383	PANDUIT CORP.	17301 S. RIDGELAND AVE. TINLEY PARK, IL 60477-3048 Telephone: 800-777-3300 Facsimile: 708-532-1811 www.panduit.com
81205	THE BOEING COMPANY	17930 INTERNATIONAL BLVD. SOUTH SEATAC, WA 98188-4321 Telephone: 206-662-6650 Facsimile: 206-662-7145

ILLUSTRATED PARTS LIST

1. Introduction

A. The Illustrated Parts List (IPL) contains an illustration and a list of component parts you can repair or replace. The Illustrated Parts Catalog (IPC) shows how to use the Boeing part number system.

B. This shows how parts are related: The relation of each item to its next higher assembly (NHA) is shown in the NOMENCLATURE column. Use the indenture system that follows:

1 2 3 4 5 6 7

. Assembly

. Attaching parts for assembly

. . Detail parts for assembly

. . Subassembly

. . Attaching parts for subassembly

. . . Detail parts for subassembly

. . . Sub-subassembly

. . . Attaching parts for subassembly

. . . . . Details parts for sub-subassembly

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

C. Each top assembly is given one use code letter (A, B, C, etc.) in the USAGE CODE column. All subsequent component parts in the list can have one or more of the use code letters to show effectivity to top assemblies. A component part without a use code applies to all top assemblies.

D. An alphabetical letter is added after the item number for optional parts, parts changed by a Service Bulletin, configuration differences (except left-handed and right-handed parts), last engineering releases, and parts added between item numbers in a sequence. The alphabetical letter will not be shown on the illustration for equivalent parts of the same part number.

E. Color-coded parts are identified with a single digit alpha following the dash number or with ''SP'' suffix. If the ''SP'' suffix is used, it represents consolidation of all color codes applicable for a given usage which are not separately listed. Orders for color-coded parts should include the registry number of the airplane for which the parts are ordered.

F. If a part number is 15 characters long but will not fit in the part number column, the part number will be displayed with a ''~'' at the end of the line and will be continued on the next line. The ''~'' denotes that the part number continues on the next line.

G. Parts changed by a Service Bulletin are shown by PRE SB XXXX and POST SB XXXX added to the NOMENCLATURE column.

(1) When a new top assembly is added by a Service Bulletin, PRE SB XXXX and POST SB XXXX will be added at the top assembly level only. The configuration differences at the detail part level are shown by use code letters.

(2) When the top assembly part number is not changed by the Service Bulletin, PRE SB XXXX and POST SB XXXX will be added at the detail level.

H. Interchangeable Parts

Optional (OPT)	The part is optional to and interchangeable with other parts that have the same item number.
Replaces, Replaced by and not interchangeable with (REPLACES, REPLACED BY AND NOT INTCHG/W)	The part replaces and is not interchangeable with the initial part.
Replaces, Replaced by (REPLACES, REPLACED BY)	The part replaces and is interchangeable with, or is an alternative to, the initial part.

VENDOR CODES

Code	Name
01673	AIRDROME PRECISION COMPONENTS 3251 E AIRPORT WAY LONG BEACH, CALIFORNIA 90806-2407 FORMERLY AIRDROME PARTS CO
02107	FLOUROCARBON CO OHIO DIV DOVER, OHIO 44622 CANCELLED NO REPLACEMENT FORMERLY SPARTA MANUFACTURING CO
02886	DODGE-WASMUND MFG CO INC 9607 BEVERLY ROAD PICO RIVERA, CALIFORNIA 90660-2136
06383	PANDUIT CORPORATION 17301 RIDGELAND AVENUE TINLEY PARK, ILLINOIS 60477-3048
07128	TETRAFLUOR INC 2051 EAST MAPLE AVENUE EL SEGUNDO, CALIFORNIA 90245-5009 FORMERLY ROYAL IND TETRAFLUOR DIV V0667B ENGLEWOOD CALIF
08199	SIERRACIN CORPORATION DBA HARRISON 3020 EMPIRE AVENUE BURBANK, CALIFORNIA 91504-3109 FORMERLY TECHNICAL IND INC OR HARRISON MFG CO DIV AXIAL CORP

Code	Name
09257	BUSAK AND SHAMBAN INC SEALS DIV 2531 BREMER DR PO BOX 176 FORT WAYNE, INDIANA 46801 FORMERLY SHAMBAN, W S AND CO
11328	Replaced: [V11328] AEROQUIP SEE EATON AEROQUIP V00624 LINAIR ENG A TELEDYNE CO SEE TELEDYNE LINAIR ENGINEERING TELEDYNE INC SEE LINAIR ENGINEERING TELEDYNE LINAIR ENG SEE AEROQUIP CORP LINAIR DIV by Code: Name and Address below 00624: EATON AEROQUIP INC ENGINEERED SYSTEMS DIV 300 S EAST AVE JACKSON, MICHIGAN 49203-1972 FORMERLY AEROQUIP ELBEE PLANT V99879 OR WESTERN PLANT V70128; FORMERLY AEROQUIP AEROSP DIV JACKSON PLANT; FORMERLY V11328 AEROQUIP LINAIR DIV
14798	DEUTSCH CO METAL COMPONENTS DIV 14800 SOUTH FIGUEROA STREET GARDEN, CALIFORNIA 90248-1795 FORMERLY WEATHERHEAD V79470 FOR AEROSPACE PROD V 61498 DEUSCH CO THE DEUTSCH AEROSPACE FITTINGS CO DIV
21335	TIMKEN US CORPORATION DIV FAFNIR 336 MECHANIC STREET LEBANON, NH 03766-0267 FORMERLY FAFNIR BRG AND TEXTRON INC FAFNIR DIV IN NEW BRITAIN, CONNECTICUT ; FORMERLY TORRINGTON CO THE SPECIAL PRODUCTS DIV SUB OF THE INGERSOLL-RAND CO V8D210 FORMERLY TORRINGTON CO FAFNIR BEARING DIV IN TORRINGTON, CT
21760	SCHATZ BEARING CORP 10 FAIRVIEW AVENUE PO BOX 1191 POUGHKEEPSIE, NEW YORK 12601-1312 FORMERLY FEDERAL BRG CO AND SCHATZ MFG CO V53268 FORMERLY SCHATZ MFG CO
26303	GREENE TWEED IND INC ADVANTEC DIV 7101 PATTERSON DRIVE PO BOX 5037 GARDEN GROVE, CALIFORNIA 92645-5037 FORMERLY OHIO AIRCRAFT SUPPLIES INC IN INGLEWOOD, CALIFORNIA FORMERLY ADVANTEC DIV OF IFP INC, LOS ANGELES, CA V5P801

Code	Name
26879	CORONADO MFG INC 11069 PENROSE AVENUE SUN VALLEY, CALIFORNIA 90352-2722 FORMERLY CORONADO PLASTICS INC IN BURBANK, CALIFORNIA
29337	HOOVER GROUP INC BALL AND ROLLER DIV 2220 PENDLEY ROAD PO BOX 899 CUMMING, GEORGIA 30130-8671 FORMERLY IN ERWIN, INDIANA, HOOVER UNIVERSAL CO
30974	AEROFIT PRODUCTS INC 6460 DALE STREET BUENA PARK, CALIFORNIA 90621-3115
38443	MRC BEARINGS 402 CHANDLER STREET JAMESTOWN, NEW YORK 14701-3802 FORMERLY MARLIN-ROCKWELL CORP DIV TRW AND TRW INC
40920	MPB MINIATURE PRECISION BEARING DIV PRECISION PARK PO BOX 547 KEENE, NEW HAMPSHIRE 03431 FORMERLY MPB CORP AND MINIATURE BRG DIV MPB CORP
43334	GENERAL MOTORS CORP DELCO MORAINE DIV 2509 HAYES AVENUE SANDUSKY, OHIO 44870-5359 FORMERLY IN BRISTOL, CONNECTICUT FORMERLY NEW DEPARTURE-HYATT BRG DIV GEN MOTORS CORP
43991	FAG BEARING INCORPORATED 118 HAMILTON AVENUE STAMFORD, CONNECTICUT 06904 FORMERLY NORMA-HOFFMAN BEARING CORPORATION FORMERLY NORMA FAG BEARINGS CORPORATION
52676	SKF INDUSTRIES INC 1100 FIRST AVENUE KING OF PRUSSIA, PENNSYLVANIA 19406-1312 FORMERLY SKF INDUSTRIES INC FRANDFORD PLANT FORMERLY ATLAS BALL DIV OF SKF IND V70648 AND VB0017 FORMERLY IN PHILADELPHIA, PENNSYLVANIA

Code	Name
78118	SPLIT BALL BEARING DIV OF MPB CORP HIGHWAY 4 LEBANON, NEW HAMPSHIRE 03766-7301
94878	RAYBESTOS-MANHATTAN INC PACIFIC COAST DIV FULLERTON, CALIFORNIA 92631 BUSINESS DISCONTINUED
97820	BUSAK AND SHAMBAN INC BEARING DIV 711 MITCHELL ROAD PO BOX 665 NEWBURY PARK, CALIFORNIA 91320-2214 FORMERLY IN CULVER CITY, CALIF; FORMERLY SHAMBAN W S & CO
9V013	TEXTRON INC FAFNIR BEARING DIV US RT 41 S CALHOUN, GEORGIA 30701-9145

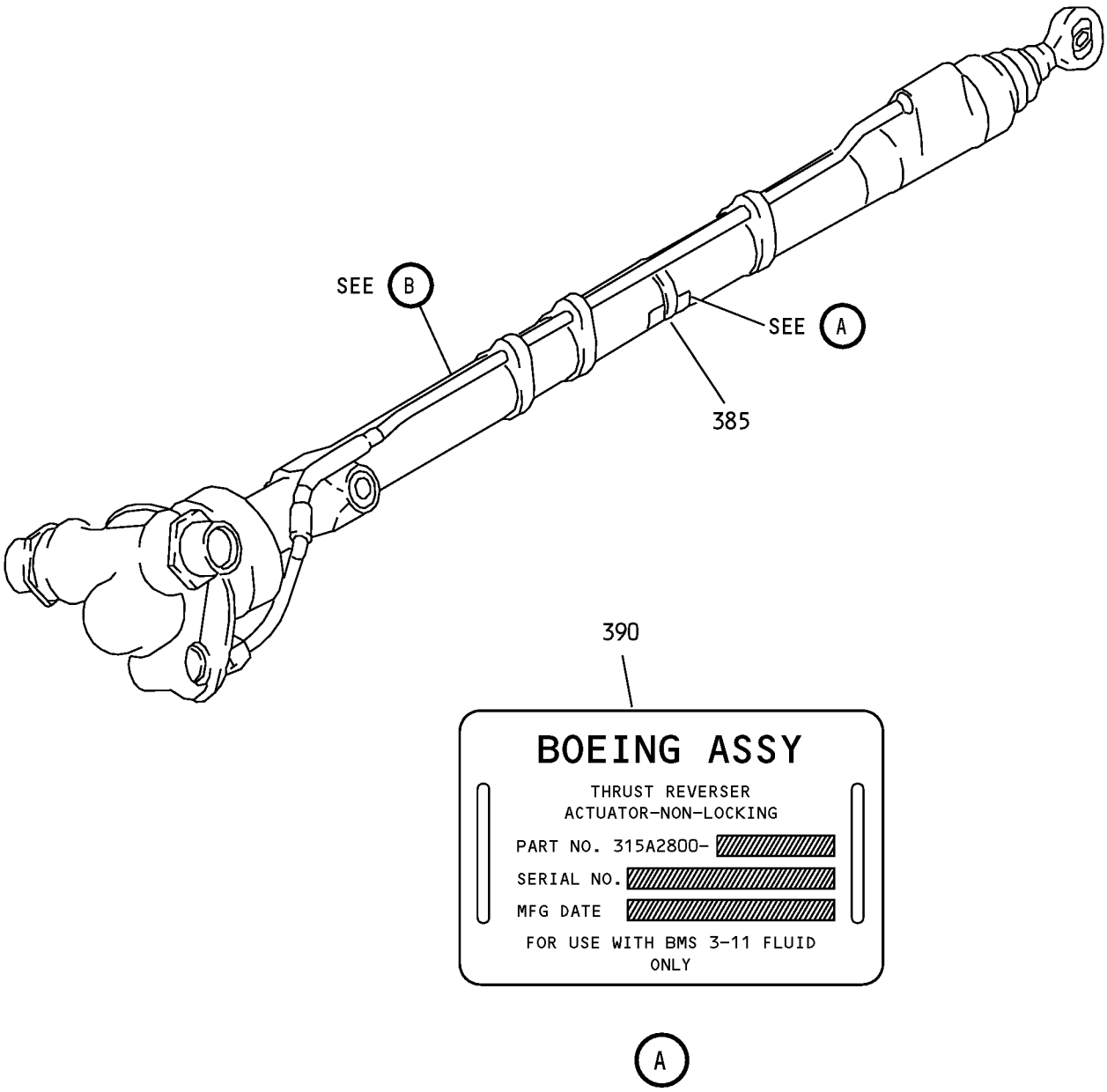
NUMERICAL INDEX

PART NUMBER	AIRLINE PART NUMBER	FIGURE	ITEM	UNITS PER ASSEMBLY
102KS		1	245	1
1452-011		1	305	1
1819-4		1	350A	1
1822-6		1	345A	1
1901-1B1-01		1	50	2
1901S		1	50	2
2-02903-04H		1	80	1
2140-5A		1	160	1
2150-122		1	205	2
315A1810-1		1	230	1
		1	230A	1
315A1810-4		1	230B	1
315A1811-1		1	320	1
315A1812-1		1	190	1
315A1813-4		1	255	1
315A1816-3		1	360	1
315A1817-3		1	55	1
315A1818-3		1	5A	1
315A1819-4		1	350	1
315A1821-2		1	325	2
315A1822-6		1	345	1
315A1824-2		1	215	1
315A1824-3		1	220	1
315A1826-1		1	340	1
315A1827-1		1	330	1
315A1828-2		1	300	1
315A1829-1		1	335	1
315A1832-12		1	95	1
315A1834-1		1	45	1
315A1835-1		1	20	AR
315A1835-12		1	260	AR
315A1835-13		1	265	AR
315A1835-14		1	270	AR
315A1835-15		1	275	AR

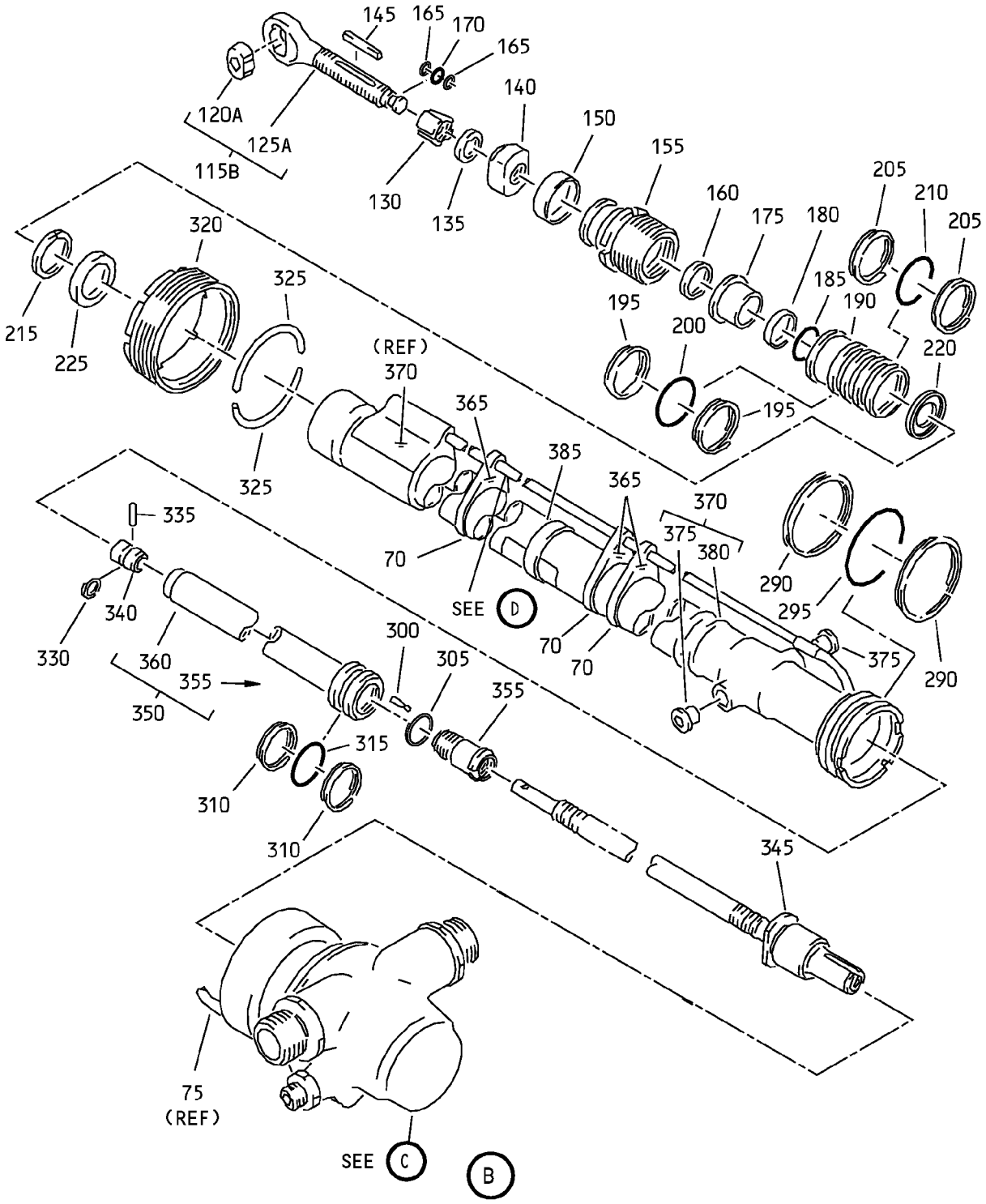
PART NUMBER	AIRLINE PART NUMBER	FIGURE	ITEM	UNITS PER ASSEMBLY
315A1835-16		1	280	AR
315A1835-2		1	25	AR
315A1835-3		1	30	AR
315A1835-4		1	35	AR
315A1835-5		1	40	AR
315A1836-1		1	385	1
315A1837-1		1	285	1
315A1853-1		1	175	1
315A1865-1		1	225	1
315A1866-2		1	155	1
315A1867-1		1	150	1
315A1867-3		1	365	3
315A1870-4		1	355	1
315A1874-1		1	130	1
315A1890-1		1	135	1
315A1891-1		1	140	1
315A1901-1		1	145	1
315A1903-3		1	10A	1
315A1910-1		1	240	1
315A1914-1		1	235	1
315A2800-1		1	1A	RF
315A2800-2		1	1B	RF
315A2808-1		1	370	1
315A2808-2		1	380	1
315A2831-1		1	115B	1
315A2831-2		1	125A	1
315A2831-3		1	120A	1
315A2832-1		1	75	1
315A2832-2		1	90	1
315A2858-1		1	100	1
35235V04		1	80	1
3L02		1	245	1
		1	245	1
6002		1	245	1
6002J		1	245	1

PART NUMBER	AIRLINE PART NUMBER	FIGURE	ITEM	UNITS PER ASSEMBLY
9102-1B1-01		1	245	1
9102K		1	245	1
9301K		1	50	2
AFP175V04		1	80	1
AP2097-04H		1	80	1
BAC27DTR32		1	390	1
BACB10BA15		1	245	1
BACB10BB12		1	50	2
BACB28X7F037		1	375	2
BACN10CS04J		1	85	1
BACR12BP122		1	205	2
BACS13BX04H		1	80	1
BACS34A5A		1	160	1
C001MCP0		1	50	2
C001R1P17LY331		1	50	2
C102RR1P17LY331		1	245	1
C102RRP0		1	245	1
C11237-122		1	205	2
CWR76-5B		1	160	1
DB0S13BX04H		1	80	1
DW96801-5A		1	160	1
DW969516-122		1	205	2
MLT2HLP		1	70	3
MS20068-53		1	250	1
MS21902J4		1	60	1
MS28782-17		1	310	2
MS28782-20		1	195	2
MS28782-5		1	105	4
		1	165	2
MS28783-01		1	290	2
NAS1611-010		1	110	2
		1	170	1
NAS1611-116		1	185	1
NAS1611-122		1	210	1
NAS1611-212		1	315	1

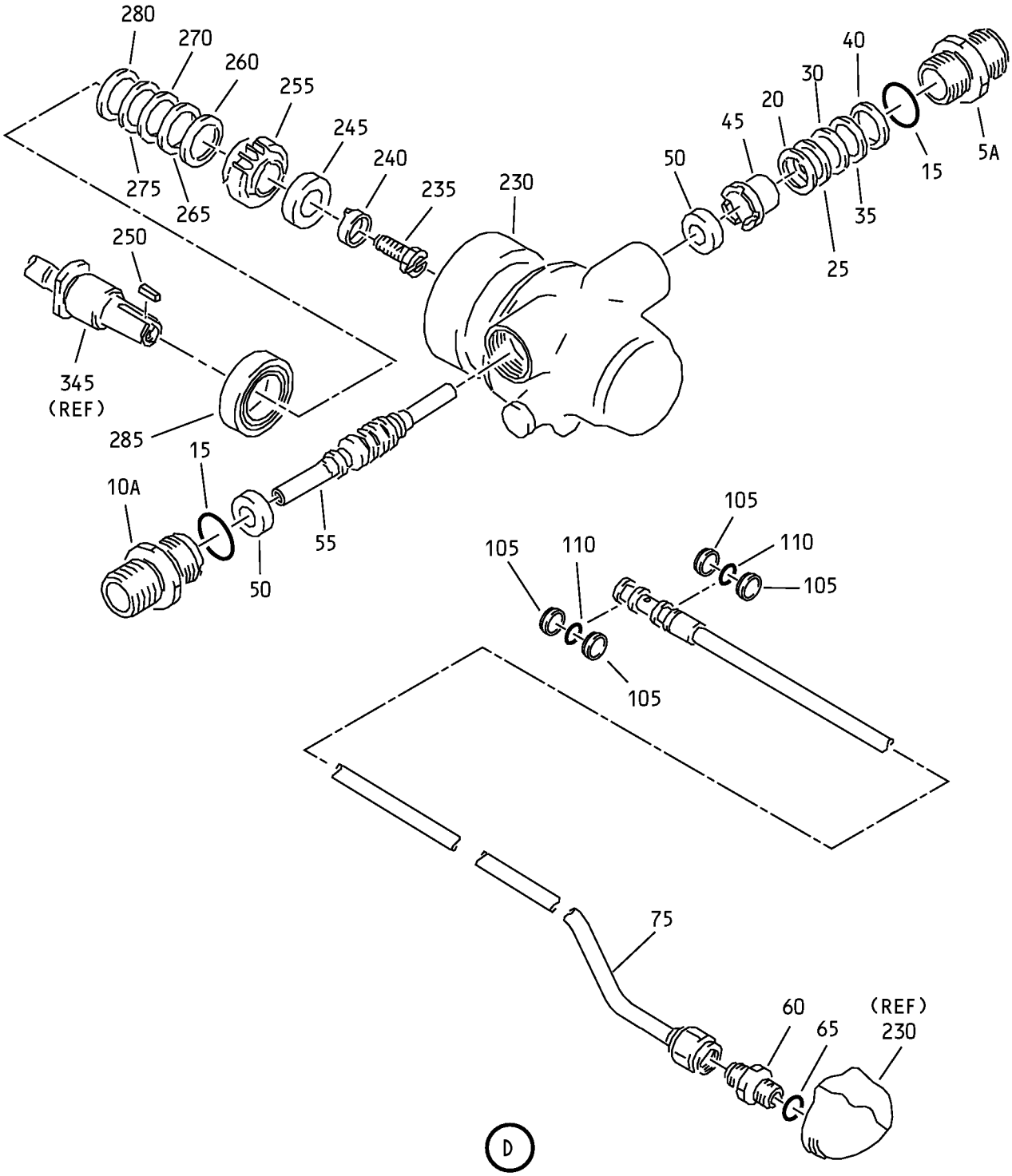
PART NUMBER	AIRLINE PART NUMBER	FIGURE	ITEM	UNITS PER ASSEMBLY
NAS1611-215		1	200	1
NAS1611-223		1	295	1
NAS1612-12		1	15	2
NAS1612-4		1	65	1
PKT001P1		1	50	2
PKT102P1		1	245	1
R9102KA4298		1	245	1
		1	245	1
R9301KA4298		1	50	2
		1	50	2
RM9157BU122		1	205	2
S30310-122		1	205	2
S30388-5-1		1	160	1
S33121-116-99		1	180	1
STS900-122		1	205	2
TF005-5A		1	160	1
TF456-122		1	205	2



Non-locking Actuator Assembly
IPL Figure 1 (Sheet 1 of 3)



Non-locking Actuator Assembly
IPL Figure 1 (Sheet 2 of 3)



Non-locking Actuator Assembly
IPL Figure 1 (Sheet 3 of 3)

FIG/ ITEM	PART NUMBER	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USAGE CODE	UNITS PER ASSY
1–					
–1A	315A2800-1		ACTUATOR ASSY-NON-LOCKING	A	RF
–1B	315A2800-2		ACTUATOR ASSY-NON-LOCKING	B	RF
–5	315A1818-2		DELETED		
5A	315A1818-3		. FITTING		1
–10	315A1903-2		DELETED		
10A	315A1903-3		. SCREW-ADPTR		1
15	NAS1612-12		. PACKING		2
20	315A1835-1		. SHIM (MAKE FROM CRES SHEET AISI 301 1/2 HARD TO HARD MIL-S-5059 FINISH PASSIVE PER BAC 5751 TYPE II 0.040IN 1.0IN 1.0IN)		AR
25	315A1835-2		. SHIM (MAKE FROM CRES SHEET AISI 301 1/2 HARD TO HARD MIL-S-5059 FINISH PASSIVE PER BAC 5751 TYPE II 0.010IN 1.0IN 1.0IN)		AR
30	315A1835-3		. SHIM (MAKE FROM CRES SHEET AISI 301 1/2 HARD TO HARD MIL-S-5059 FINISH PASSIVE PER BAC 5751 TYPE II 0.005IN 1.0IN 1.0IN)		AR
35	315A1835-4		. SHIM (MAKE FROM CRES SHEET AISI 301 1/2 HARD TO HARD MIL-S-5059 FINISH PASSIVE PER BAC 5751 TYPE II 0.003IN 1.0IN 1.0IN)		AR
40	315A1835-5		. SHIM (MAKE FROM CRES SHEET AISI 301 1/2 HARD TO HARD MIL-S-5059 FINISH PASSIVE PER BAC 5751 TYPE II 0.001IN 1.0IN 1.0IN)		AR
45	315A1834-1		. SLEEVE		1

–Item not Illustrated

FIG/ ITEM	PART NUMBER	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USAGE CODE	UNITS PER ASSY
1–					
50	R9301KA4298		. BEARING (V21335) (SPEC BACB10BB12) (OPT 1901S (V38443)) (OPT 9301K (V21335)) (OPT PKT001P1 (V78118)) (OPT C001MCP0 (V40920)) (OPT C001R1P17LY331 (V40920)) (OPT R9301KA4298 (V9V013)) (OPT 1901-1B1-01 (V21760))		2
55	315A1817-3		. SHAFT-WORM GEAR		1
60	MS21902J4		. UNION		1
65	NAS1612-4		. PACKING		1
70	MLT2HLP		. TIE (V06383)		3
75	315A2832-1		. TUBE ASSY		1
–80	DB0S13BX04H		. . SLEEVE (V14798) (SPEC BACS13BX04H) (OPT 2-02903-04H (V11328)) (OPT 35235V04 (V08199)) (OPT AP2097-04H (V01673)) (OPT AFP175V04 (V30974))		1
–85	BACN10CS04J		. . NUT		1
–90	315A2832-2		. . SPACER		1
–95	315A1832-12		. . SPACER		1
–100	315A2858-1		. . TUBE		1
105	MS28782-5		. RING		4
110	NAS1611-010		. PACKING		2
–115	315A1831-4		DELETED		
–115A	1831-4		DELETED		
115B	315A2831-1		. END ASSY-ROD		1
–120	315A1831-3		DELETED		
120A	315A2831-3		. . BALL		1
–125	315A1831-5		DELETED		
125A	315A2831-2		. . BODY		1
130	315A1874-1		. NUT		1

–Item not Illustrated

FIG/ ITEM	PART NUMBER	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USAGE CODE	UNITS PER ASSY
1–					
135	315A1890-1		. WASHER-LOCK		1
140	315A1891-1		. STOP		1
145	315A1901-1		. KEY		1
150	315A1867-1		. SPACER		1
155	315A1866-2		. NUT-GLAND		1
160	CWR76-5B		. SCRAPER (V26879) (SPEC BACS34A5A) (OPT S30388-5-1 (V97820)) (OPT TF005-5A (V07128)) (OPT 2140-5A (V26303)) (OPT DW96801-5A (V02886))		1
165	MS28782-5		. RING		2
170	NAS1611-010		. PACKING		1
175	315A1853-1		. BEARING-PISTON		1
180	S33121-116-99		. SEAL-FOOT (V09257)		1
185	NAS1611-116		. PACKING		1
190	315A1812-1		. GLAND		1
195	MS28782-20		. RING		2
200	NAS1611-215		. PACKING		1
205	C11237-122		. RING (V26879) (SPEC BACR12BP122) (OPT DW969516-122 (V02886)) (OPT RM9157BU122 (V94878)) (OPT STS900-122 (V02107)) (OPT S30310-122 (V97820)) (OPT TF456-122 (V07128)) (OPT 2150-122 (V26303))		2
210	NAS1611-122		. PACKING		1
215	315A1824-2		. RING-SNUBBER		1
220	315A1824-3		. RING-SNUBBER		1
225	315A1865-1		. STOP-PISTON		1
230	315A1810-1		. HOUSING	A	1
–230A	315A1810-1		. HOUSING (OPT ITEM 230B)	B	1

–Item not Illustrated

FIG/ ITEM	PART NUMBER	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USAGE CODE	UNITS PER ASSY
1–					
–230B	315A1810-4		. HOUSING (OPT ITEM 230A)	B	1
235	315A1914-1		. BOLT-SPECIAL		1
240	315A1910-1		. LOCKWASHER-CUP		1
245	R9102KA4298		. BEARING (V21335) (SPEC BACB10BA15) (OPT C102RR1P17LY331 (V40920)) (OPT 102KS (V38443)) (OPT 3L02 (V29337)) (OPT 3L02 (V43334)) (OPT 6002 (V43991)) (OPT 6002J (V52676)) (OPT 9102-1B1-01 (V21760)) (OPT 9102K (V21335)) (OPT PKT102P1 (V78118)) (OPT C102RRP0 (V40920)) (OPT R9102KA4298 (V9V013))		1
250	MS20068-53		. KEY		1
255	315A1813-4		. WHEEL-WORM		1
260	315A1835-12		. SHIM		AR
265	315A1835-13		. SHIM		AR
270	315A1835-14		. SHIM		AR
275	315A1835-15		. SHIM		AR
280	315A1835-16		. SHIM		AR
285	315A1837-1		. BEARING		1
290	MS28783-01		. RETAINER		2
295	NAS1611-223		. PACKING		1
300	315A1828-2		. PIN-LOCKING		1
305	1452-011		. RING-LOCK		1
310	MS28782-17		. RING		2
315	NAS1611-212		. PACKING		1
320	315A1811-1		. NUT-CYL		1
325	315A1821-2		. RING-CYL NUT		2
330	315A1827-1		. RING-RETAINING		1
335	315A1829-1		. PIN-RETAINING		1

–Item not Illustrated

FIG/ ITEM	PART NUMBER	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USAGE CODE	UNITS PER ASSY
1–					
340	315A1826-1		. GUIDE-LEAD SCREW		1
345	315A1822-6		. SCREW-LEAD (OPT ITEM 345A)		1
–345A	1822-6		. SCREW-LEAD (OPT ITEM 345)		1
350	315A1819-4		. PISTON ASSY (OPT ITEM 350A)		1
–350A	1819-4		. PISTON ASSY (OPT ITEM 350)		1
355	315A1870-4		. . NUT-LEAD SCREW (USED ON ITEM 350)		1
360	315A1816-3		. . PISTON (USED ON ITEM 350)		1
365	315A1867-3		. SPACER		3
370	315A2808-1		. CYLINDER ASSY		1
375	BACB28X7F037		. . BUSHING		2
380	315A2808-2		. . CYLINDER		1
385	315A1836-1		. STRAP-NAMEPLATE		1
390	BAC27DTR32		. MARKER-ALUMINUM FOIL		1

–Item not Illustrated