TO: ALL HOLDERS OF TRAILING EDGE FLAP DRIVE POWER DRIVE UNIT GEARBOX ASSEMBLY
COMPONENT MAINTENANCE MANUAL 27-51-50

REVISION NO. 5 DATED NOV 01/99

HIGHLIGHTS

Pages which have been added or revised are outlined below together with the highlights of the revision.

CHAPTER/SECTION AND PAGE NO.	DESCRIPTION OF CHANGE
101	Revised testing to indicate both hydraulic and electrical input tests have to be passed for the unit to return to service.

TRAILING EDGE FLAP DRIVE
POWER DRIVE UNIT GEARBOX ASSEMBLY

PART NUMBER 256T3130-4,-5

COMPONENT MAINTENANCE MANUAL
WITH
ILLUSTRATED PARTS LIST

12844

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 B10264	APR 10/82
27-0069			APR 10/87
		PRR B11618	OCT 01/87
27-0120			APR 01/93

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TABLE OF CONTENTS

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:

Disassembly	Feb 09/82
Assembly	Feb 09/82

TRAILING EDGE FLAP DRIVE POWER DRIVE UNIT GEARBOX ASSY

DESCRIPTION AND OPERATION

1. Description

   A. The trailing edge flap drive power drive unit (PDU) gearbox assembly consists of power input gears, intermediate reduction gears, and an output shaft all mounted in a covered aluminum alloy housing. Through a worm and gear arrangement, output is also rotated 90° and transmitted to a follow-up gear mounted in the same housing.

2. Operation

   A. The single PDU gearbox assembly provides the power to activate all trailing edge flaps. Power is supplied to the gearbox assembly by hydraulic motor or backup electric motor. The output shaft is connected at each end to the flap torque tube drive shafts via internally-splined coupling sleeves. Rotation of the follow-up gear provides a flap position signal for feedback control of the hydraulic motor.

3. Leading Particulars (approximate)

   Length -- 14 inches (36 centimeters)
   Width -- 17 inches (43 centimeters)
   Height -- 18 inches (46 centimeters)
   Weight -- 14 pounds (6 kilograms)
   Overall Gear Ratio -- 5.4737 (Hydraulic motor to output)
   -- 2.9714 (Electric motor to output)
   -- 435.5556 (Followup gear train)

TESTING AND TROUBLE SHOOTING

1. Test Equipment

NOTE: Equivalent substitutes may be used.

A. Backlash Check Fixture -- A27048-4

B. Input Crank Assembly -- A27051-8

C. Clamp Assembly -- A27051-7

D. Lock Assembly -- A27051-12

E. Dial Indicator

2. Check Backlash

A. Install gearbox assembly on check fixture A27048-4. Install lock assembly A27051-12 on nut (20) and clamp in place. Adjust head screw on lock assembly to prevent output shaft from moving.

B. Install input crank assembly A27051-8 and clamp assembly A27051-7 on hydraulic motor input and electric motor input in turn. With output shaft locked, apply a torque of 5-10 pound-inches (6-12 kg-cm) in each direction, to each input shaft in turn. Check the backlash per par. C and D.

C. On new or overhauled units, check that the backlash measured at the scribe line on clamp assembly is within the allowable design range 0.096-0.288 inch (2.438-7.315 mm) FIM (Full Indicator Movement) at the hydraulic motor input and 0.048-0.168 inch (1.219-4.267 mm) FIM at the electric motor input.

NOTE: These measurements correspond to a backlash of 0.012-0.036 inch (0.305-0.914 mm) at the pitch line of the hydraulic motor input spline (160) and 0.006-0.020 inch (0.152-0.508 mm) at the pitch line of the electric motor input spline (175).

D. The maximum in-service wear limits for the backlash measured at the scribe line on clamp assembly shall be 0.384 inch (9.754 mm) FIM (Full Indicator Movement) at the hydraulic motor input and 0.216 inch (5.486 mm) FIM at the electric motor input.

NOTE: These measurements correspond to a maximum in-service backlash of 0.048 inch (1.219 mm) at the pitch line of the hydraulic motor input spline (160) and 0.027 inch (0.686 mm) at the pitch line of the electric motor input spline (175).

3. Check for Binding or Roughness and No-Load Torque

A. Remove lock assembly and clamp assembly from unit. With no load on the output shaft, rotate individually, by hand, each power unit input shaft (150, 165). Check that gear train operates smoothly, with no significant binding or roughness, through at least two complete revolutions of each input shaft in each direction.

B. Check that no-load torque at either input shaft does not exceed 5.0 pound-inches when shaft is rotated through at least two complete revolutions in each direction.

4. Corrective Procedures

A. If backlash exceeds limit, completely disassemble gearbox assembly and visually check gears for obvious signs of wear. Check that gear bearing pattern is centered in area of pitch diameter. If gears appear satisfactory, replace bearings. Reassemble unit and retest per Par. 2. If backlash is still out of range, disassemble unit and replace all gears.

B. If no-load torque exceeds limit, or if significant binding or roughness is experienced, disassemble gearbox and visually check gears for pitting or other obvious defects. Replace gears as required. Replace all bearings. Reassemble unit and retest per Par. 3.

DISASSEMBLY

NOTE: See Testing and Trouble Shooting to establish the condition of the component or most probable cause of its malfunction. This is to determine the extent of disassembly required without completely tearing down and rebuilding the component.

1. Equipment

NOTE: Equivalent substitutes may be used.

A. Input Crank Assembly -- A27051-11

B. Spanner Adapter -- A27051-5

C. Spanner Adapter -- A27051-4

2. Parts Replacement (Ref IPL Fig. 1)

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

A. Molded sleeve (40), lockwire.

3. Disassembly

A. Remove nuts (20) and washers (25), then slide parts (30 thru 40, 60) off of each end of output shaft (280).

NOTE: Use input crank assembly A27051-11 to hold coupling sleeve (30) while loosening remaining nut after one nut has been removed.

B. Remove lockwire from bolt (73), then remove bolts (65, 70A, 72, 73), washers (75) and nuts (80). Remove cover assembly (100) and follow-up cover (115) from housing assembly (120A). Remove lockwire from bolts (85), then remove parts (85 thru 97) from cover.

NOTE: Do not remove inserts (105) or nameplate (285A) from cover assembly unless repair or replacement is necessary.

C. Remove gear (200) and attached parts from housing assembly. Use spanner adapter A27051-5 to remove nut (180) and separate parts (185 thru 205).

D. Remove gear assemblies (150, 165) with bearings (195) from housing assembly. Remove bearings from gear assemblies.

NOTE: Do not remove plugs (155, 170) from gear assemblies unless repair or replacement is necessary.

E. Remove lockwire from bolts (212) then remove parts (210 thru 220). Remove bearings (215) from gear (220).

F. Rotate output shaft (280) while pulling from outboard side (Ref IPL Fig. 1) until worm disengages from gear (260). Remove shaft from housing assembly and remove bearing (215) and gear (275) from shaft.

G. Remove lockwire from bolts (45A). Remove parts (45A thru 55) from housing assembly then remove bearing (225).

H. Remove follow-up gear (270) from housing assembly and remove bearings (230, 235).

I. Remove parts (240 thru 265) from housing assembly. Remove shims (240) from each end of follow-up gear shaft (265) and measure and record shim thickness S1, S2 (Ref Fig. 701). Use spanner adapter A27051-4 to remove nut (250) and washer (255) and separate gear (260) and shaft (265).

J. Remove lockwire from bolts (5, 85), then remove parts (5 thru 15) and parts (85 thru 95) from housing assembly.

NOTE: Do not remove inserts (125, 130, 135) or bushings (140, 145) from housing assembly unless repair or replacement is necessary. Do not remove nameplate (285B) from cover unless replacement is necessary.

CLEANING

1. Clean all parts using standard industry practices and information contained in 20-30-03, except as noted in Par. 2.

2. Clean sealed bearings (190, 195, 215, 225, 230, 235, 245, IPL Fig. 1) per manufacturer's instructions.

CHECK

1. Check all parts for obvious defects in accordance with standard industry practices.

2. Refer to FITS AND CLEARANCES for design dimensions and wear limits.

3. Magnetic particle check the following parts (Ref IPL Fig. 1) per 20-20-01.

   A. Coupling sleeve (30) and coupling half (35)

   B. Retainer (60)

   C. Gear (200) and gear shaft (205)

   D. Gear (220)

   E. Follow-up gear shaft (265)

   F. Gear (275) and output shaft (280)

4. Penetrant check the following parts (Ref IPL Fig. 1) per 20-20-02.

   A. Retainer (55)

   B. Drain cover (95, 97)

   C. Cover (110), follow-up cover (115), and housing (147A)

   D. Bearing housing (210)

   E. Follow-up worm gear (260) and follow-up gear (270)

REPAIR - GENERAL

1. Contents

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

P/N	NAME	REPAIR
256T2633	DRAIN COVER	1-1
256T3111	HOUSING	2-1
256T3113	COVER	3-1
256T3115	FOLLOW-UP COVER	4-1
256T3117	GEAR	5-1
256T3119	GEAR	6-1
256T3121	GEAR SHAFT	7-1
256T3122	GEAR	8-1
256T3124	GEAR	9-1
256T3125	OUTPUT SHAFT	10-1
256T3126	FOLLOW-UP WORM GEAR	11-1
256T3127	FOLLOW-UP GEAR SHAFT	12-1
256T3128	FOLLOW-UP GEAR	13-1
256T3749	COUPLING HALF	14-1
256T2635	NAMEPLATE	15-1
- - - -	MISC PARTS REFINISH	16-1

2. Standard Practices

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

20-10-03	Shot Peening
20-10-04	Gringing of Chrome Plated Parts
20-30-02	Stripping of Protective Finishes
20-30-03	General Cleaning Procedures
20-41-01	Decoding Table for Boeing Finish Codes
20-41-02	Application of Chemical and Solvent Resistant Finishes
20-42-03	Hard Chrome Plating
20-42-05	Bright Cadmium Plating
20-43-01	Chromic Acid Anodizing
20-50-03	Bearing Installation and Retention
20-50-10	Application of Stencils, Insignia, Silk Screen, Part Numbering and Identification Markings
20-50-12	Application of Adhesives

3. Materials

NOTE: Equivalent substitutes may be used.

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

B. Corrosion preventive compound -- MIL-C-11796, class 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)

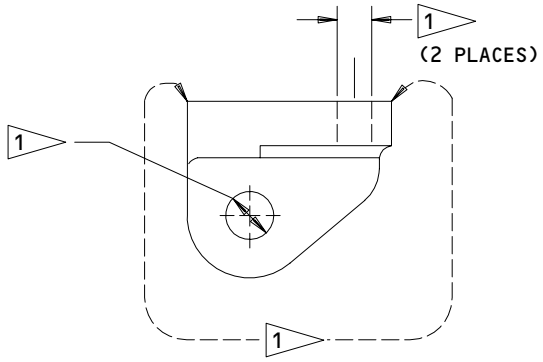
True Position Dimensioning Symbols
Figure 601

DRAIN COVER - REPAIR 1-1

256T2633-1, -3

1. Plating Repair

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



256T2633-1

REFINISH

MATERIAL: AL ALLOY

256T2633-1:
CHROMIC ACID OR SULFURIC ACID ANODIZE (F-17.05) ALL OVER AND APPLY 1 COAT OF PRIMER BMS 10-11, TYPE 1 (F-20.02) TO SURFACES INDICATED BY 1

256T2633-3:
CHROMIC ACID OR SULFURIC ACID ANODIZE (F-17.05) AND APPLY 1 COAT OF PRIMER BMS 10-11, TYPE 1 (F-20.02) ALL OVER

256T2633-1,-3

Drain Cover Refinish
Figure 601

12848

HOUSING ASSEMBLY - REPAIR 2-1

256T3111-3

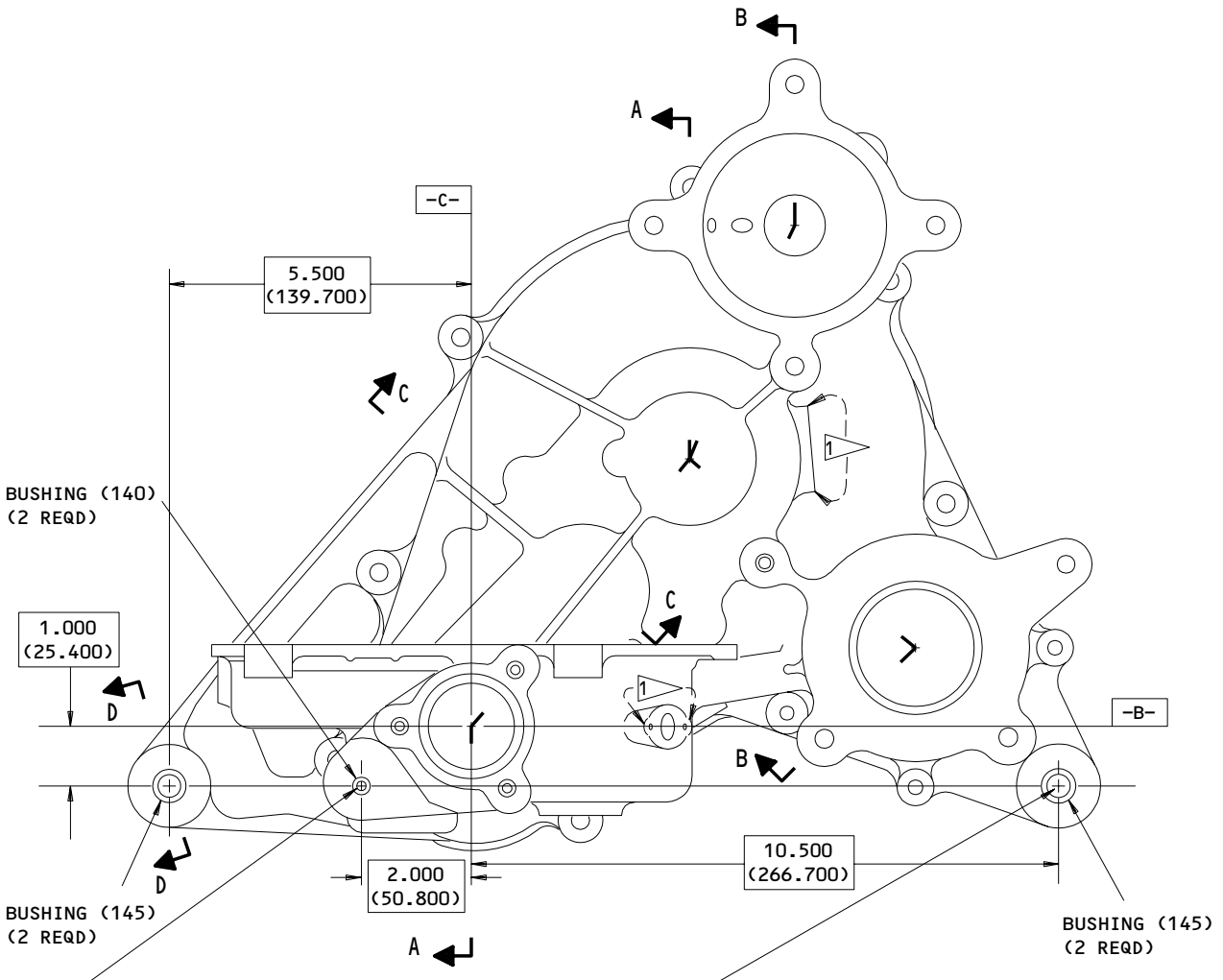
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require stripping and restoration of original finish, refer to REFINISH instruction, Fig. 601.

1. Bushing Replacement (Ref IPL Fig. 1)

   A. Remove bushings (140, 145).

   B. Install replacement bushings with primer BMS 10-11, type 1, either wet or dry.

   C. Machine ID to dimensions shown in Fig. 601.



63 (1.6µm)

BEFORE BUSHING INSTALLATION
0.4380 (11.125)
0.4375 (11.113) DIA THRU

AFTER BUSHING INSTALLATION
0.319 (8.103)
0.315 (8.001) DIA THRU 1

⊕	E	∅ 0.002 (0.051)
⊥	A	0.001 (0.025)

(1 PLACE)

63 (1.6µm)

BEFORE BUSHING INSTALLATION
0.5633 (14.308)
0.5628 (14.295) DIA THRU

AFTER BUSHING INSTALLATION
0.442 (11.227)
0.438 (11.125) DIA THRU 1

⊕	E	∅ 0.002 (0.051)
⊥	A	0.001 (0.025)

(2 PLACES)

REFINISH

HOUSING (127A):
CHROMIC ACID OR SULFURIC ACID ANODIZE (F-17.05) PLUS ONE COAT PRIMER, BMS 10-11, TYPE 1 (F-20.02) ON EXTERNAL SURFACE AND BOLT HOLES, EXCEPT AS NOTED.

MATERIAL: AL ALLOY

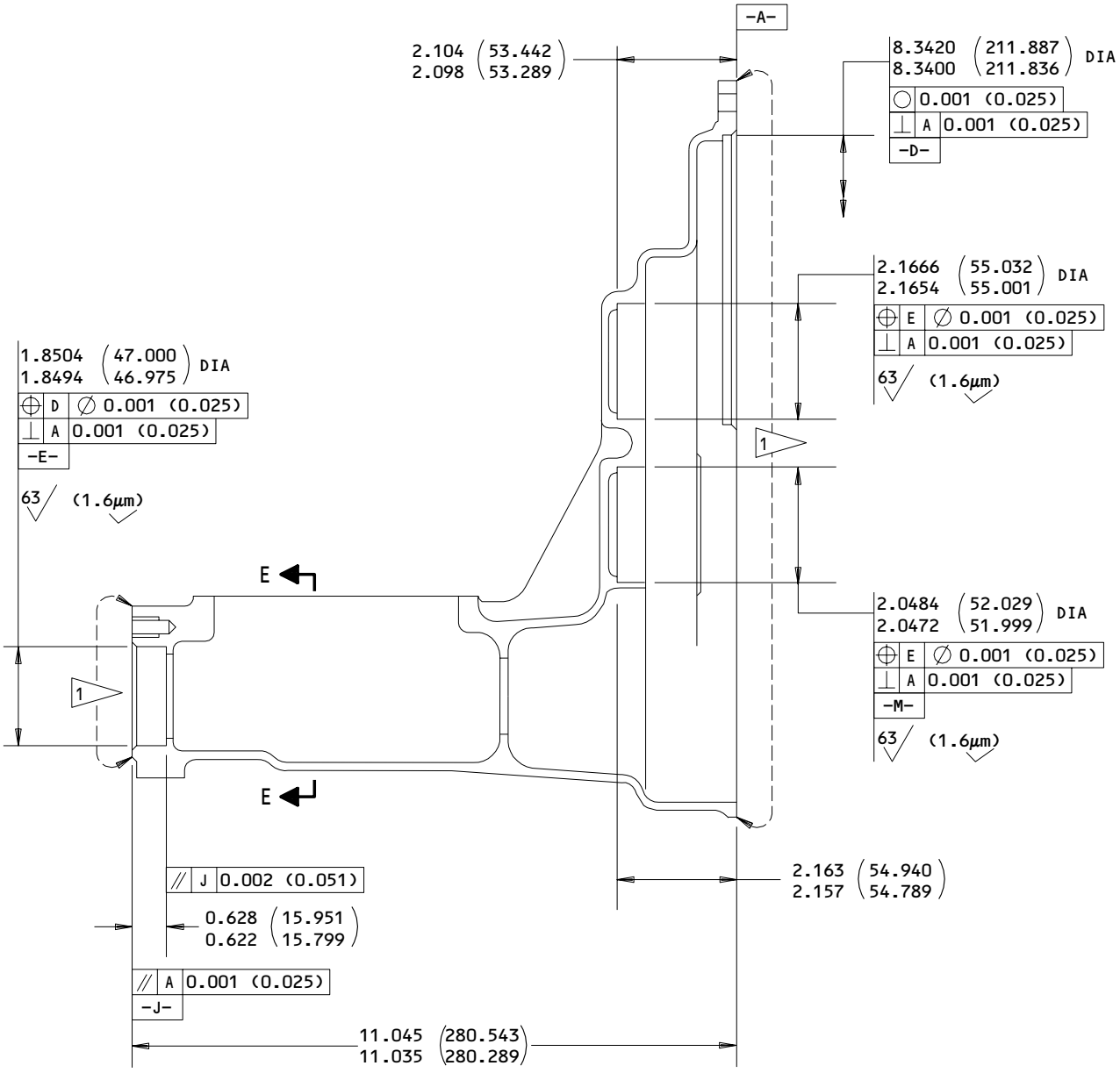
DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

1 NO PRIMER THIS SURFACE

256T3111-3

Housing Assembly Repair
Figure 601 (Sheet 1)

12849

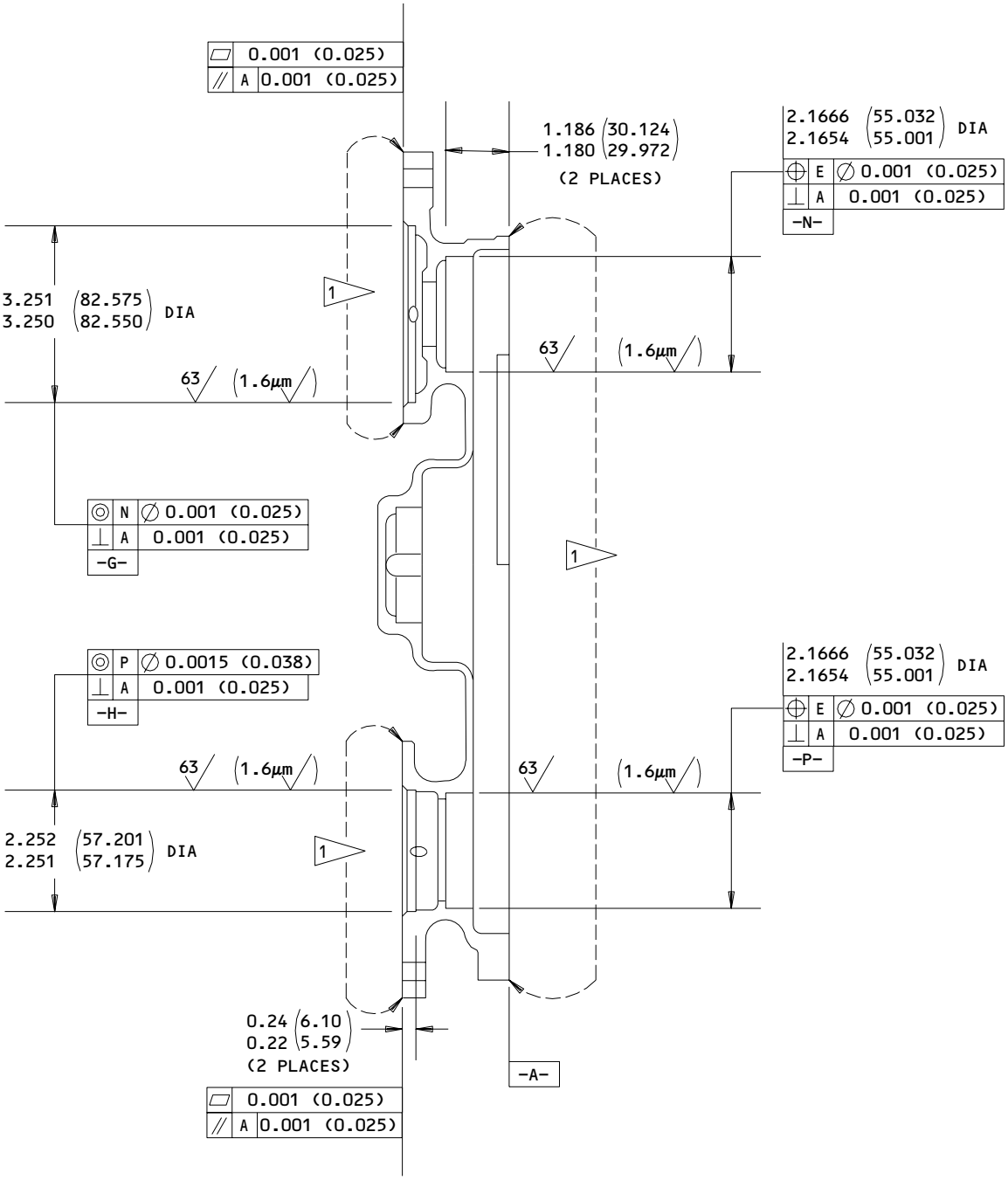


A-A

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3111-3

Housing Assembly Repair
Figure 601 (Sheet 2)



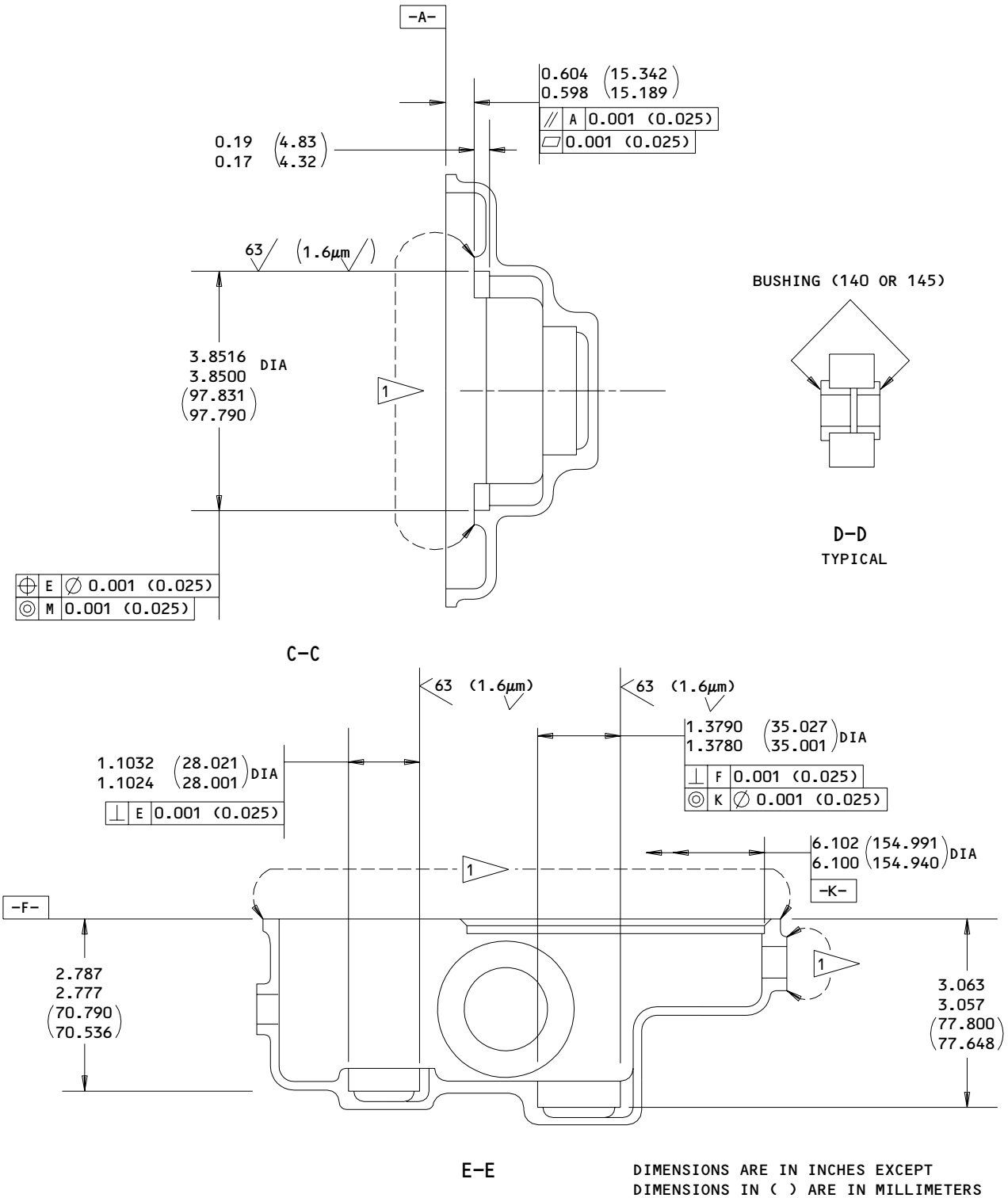
B-B

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3111-3

Housing Assembly Repair
Figure 601 (Sheet 3)

12850



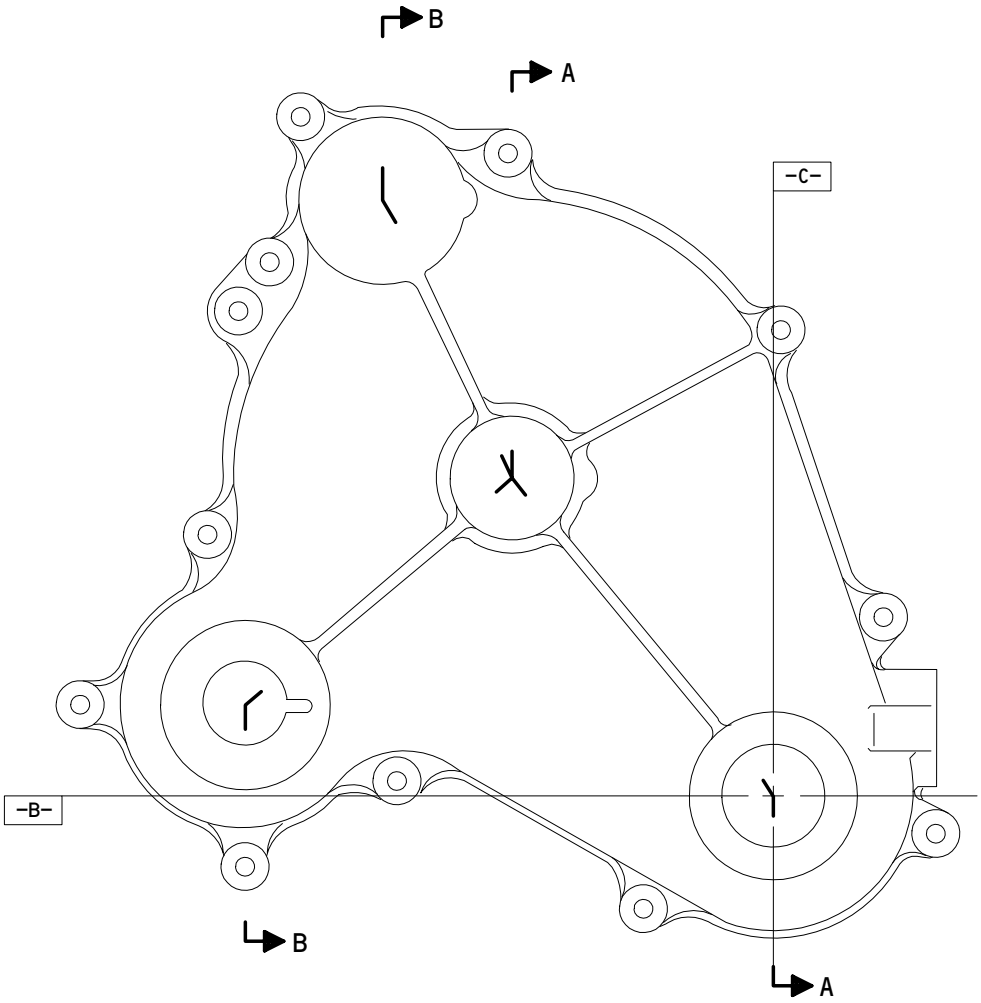
Housing Assembly Repair
Figure 601 (Sheet 4)

COVER ASSEMBLY - REPAIR 3-1

256T3113-1

1. Plating Repair

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



REFINISH

COVER (110):

CHROMIC ACID OR SULFURIC ACID ANODIZE (F-17.05) ALL OVER AND APPLY ONE COAT PRIMER, BMS 10-11, TYPE 1 (F-20.02) ON EXTERNAL SURFACE AND BOLT HOLES, EXCEPT AS NOTED.

1 NO PRIMER THIS SURFACE

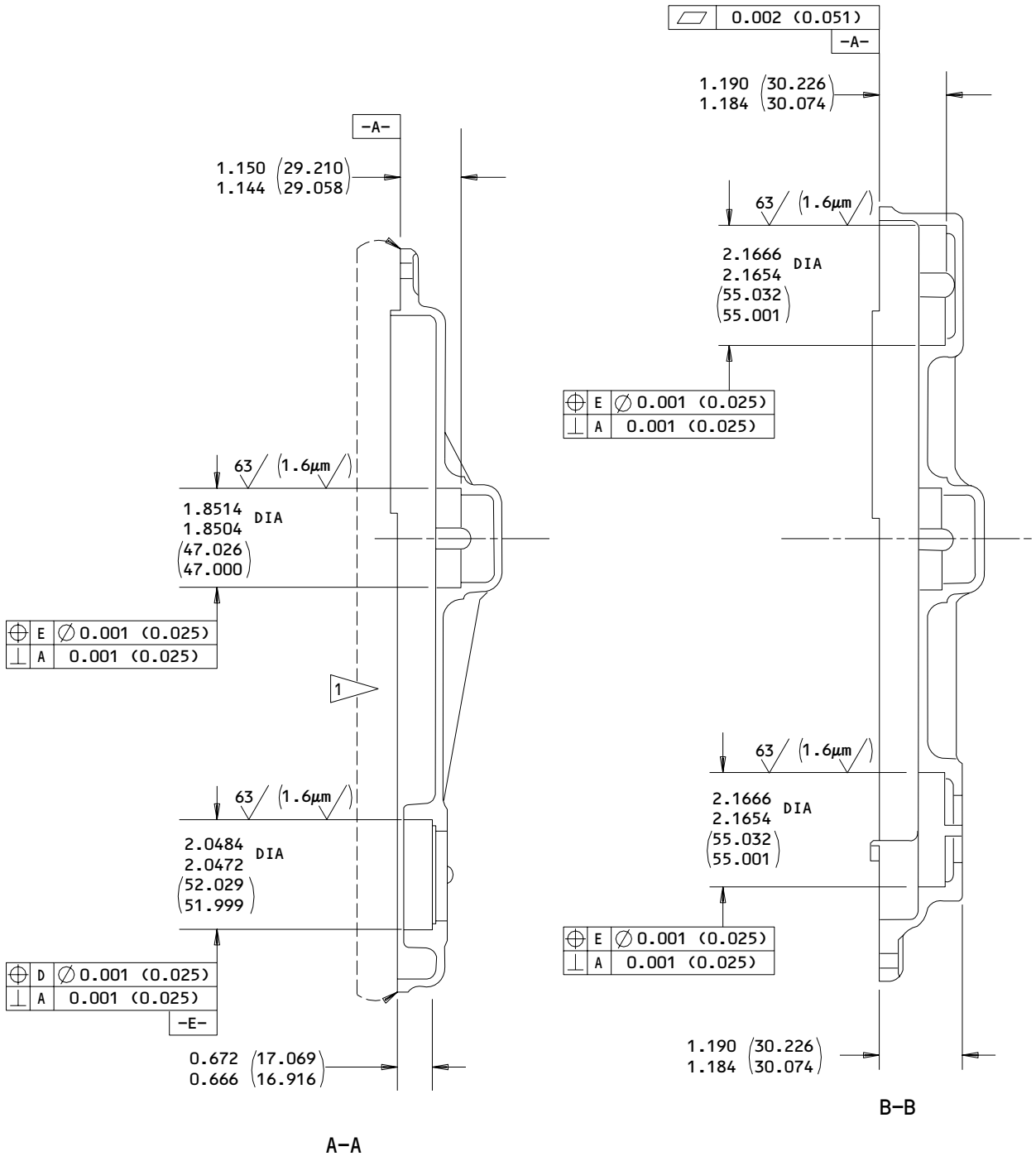
MATERIAL: AL ALLOY

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3113-3

Cover Assembly Refinish
Figure 601 (Sheet 1)

12927



DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3113-1

Cover Assembly Refinish
Figure 601 (Sheet 2)

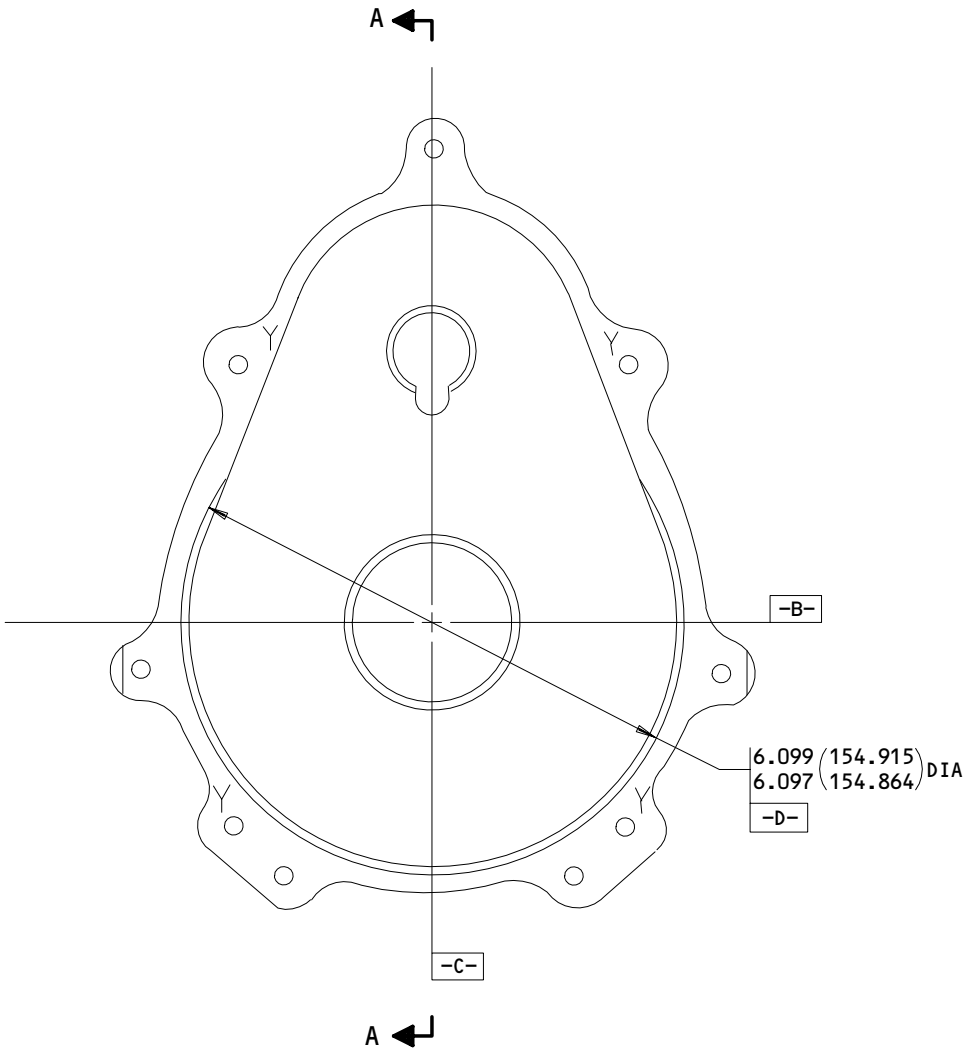
12934

FOLLOW-UP COVER - REPAIR 4-1

256T3115-1

1. Plating Repair

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



REFINISH

CHROMIC ACID OR SULFURIC ACID ANODIZE (F-17.05) ALL OVER. APPLY ONE COAT PRIMER, BMS 10-11, TYPE 1 (F-20.02) ON EXTERNAL SURFACES AND BOLT HOLES EXCEPT AS NOTED

1 NO PRIMER THIS SURFACE

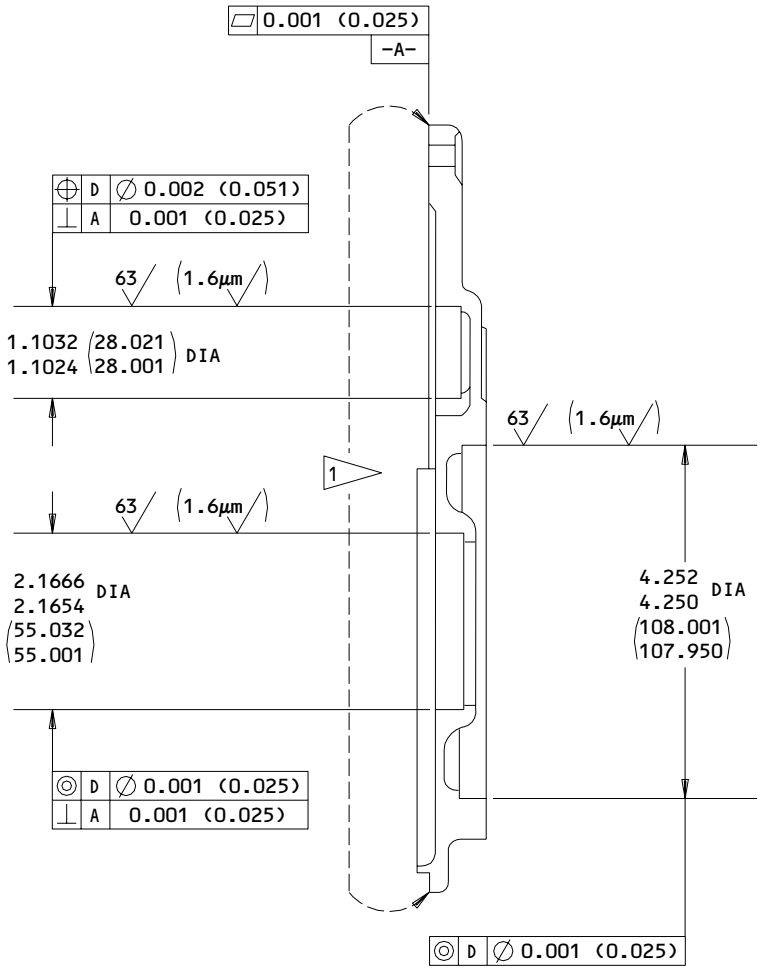
MATERIAL: AL ALLOY

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3115-1

Followup Cover Refinish
Figure 601 (Sheet 1)

12935



A-A

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3115-1

Followup Cover Refinish
Figure 601 (Sheet 2)

GEAR ASSEMBLY - REPAIR 5-1

256T3117-1, -3

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

1. Plug Replacement (IPL Fig. 1)

   A. Remove plug (155).

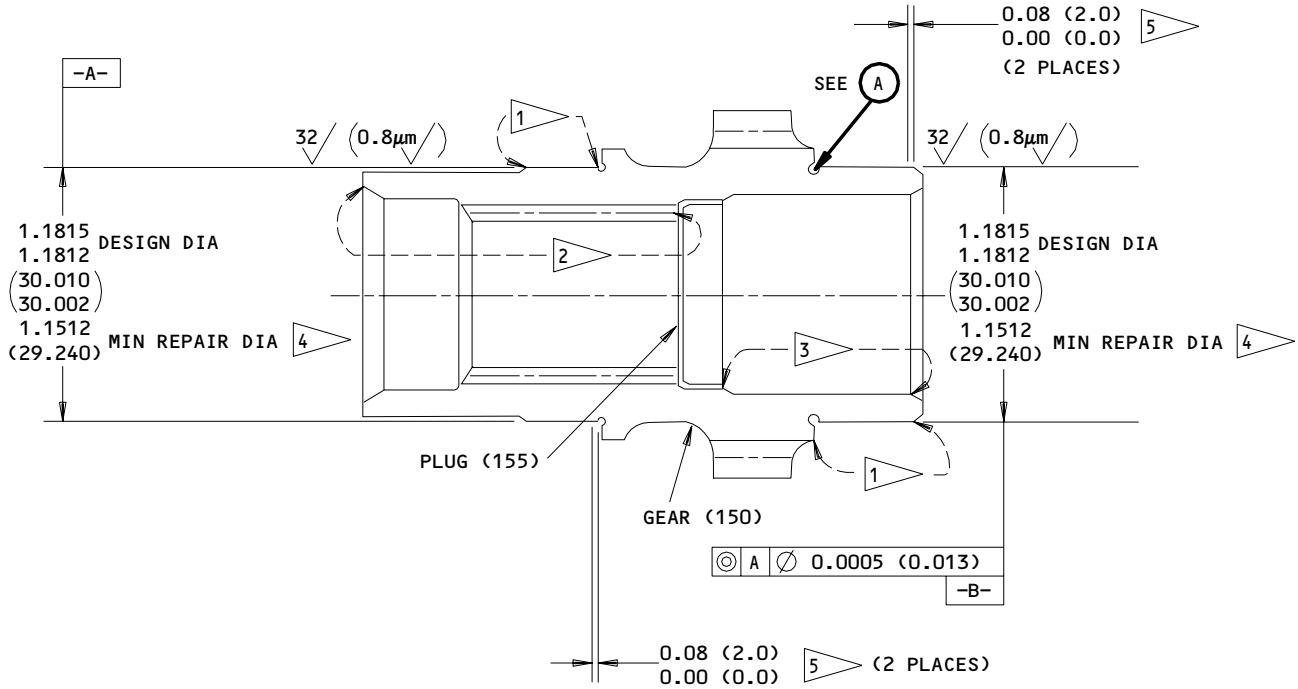
   B. Install replacement plug with wet primer.

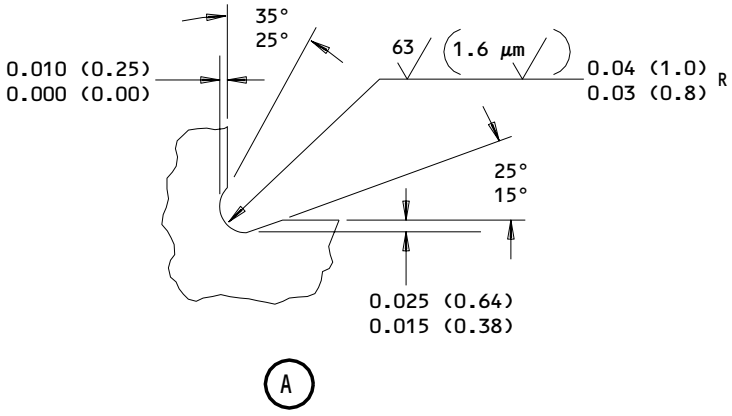
2. Shaft Repair (Fig. 601)

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

   B. Shot peen as indicated.

   C. Build up repaired area with chrome plate and grind to design dimensions and finish shown. Chrome plate must not exceed 0.015 inch (0.381 mm) after grinding.





256T3117-1,-3

Gear Assembly Repair
Figure 601 (Sheet 1)

12940

REFINISH

CADMIUM PLATE (F-15.23) GEAR
ALL OVER EXCEPT AS NOTED BY 1
PLATING THICKNESS 0.00015-0.0004
(0.004-0.010) ALLOWABLE ON GEAR TEETH

FOR PLUG REFINISH REFER TO REPAIR 16-1

1 NO CADMIUM PLATING THESE SURFACES

2 UNCONTROLLED CADMIUM PLATING THICKNESS PERMITTED THIS AREA

3 AFTER PLUG INSTALLATION, PHOSPHATE COAT (F-18.02) EXCEPT OMIT FOLLOW-UP OIL TREATMENT. APPLY TWO COATS PRIMER, BMS 10-11, TYPE 1 (F-20.03) AND CORROSION PREVENTIVE COMPOUND, MIL-C-11796, CLASS 1 (F-19.03)

4 BUILD UP WITH CHROME PLATE (F-15.03) AND GRIND TO DESIGN DIMENSIONS AND FINISH SHOWN. MINIMUM PLATING THICKNESS 0.005 (0.127) AFTER GRINDING. OBSERVE PLATING RUNOUT 0.00-0.02 (0.0-0.5) FROM INTERFACE EDGE AND FILLET RADII

5 PLATING RUNOUT

REPAIR

REF 4 5

125 / (3.2 µm /) ALL MACHINED SURFACES EXCEPT AS NOTED

BREAK SHARP EDGES 0.008 (0.2)R

SHOT PEEN: 170-460 SHOT SIZE
0.006 A INTENSITY
2.0 COVERAGE

MATERIAL: 9310 STEEL, CARBURIZED
(150-190 KSI CORE STRENGTH)

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3117-1,-3

Gear Assembly Repair
Figure 601 (Sheet 2)

190444

GEAR ASSEMBLY - REPAIR 6-1

256T3119-1, -3

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

1. Plug Replacement (IPL Fig. 1)

   A. Remove plug (170).

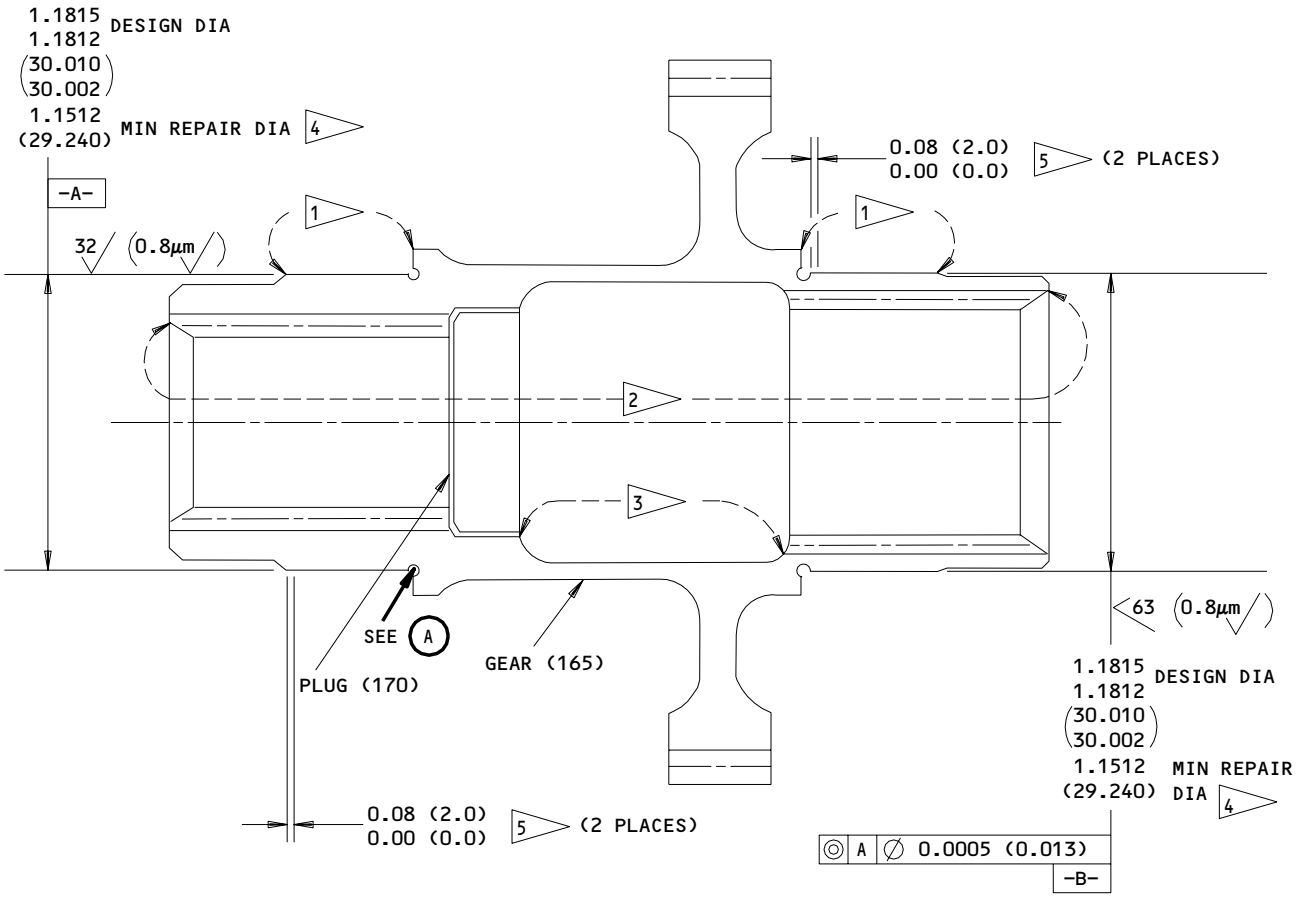
   B. Install replacement plug with wet primer.

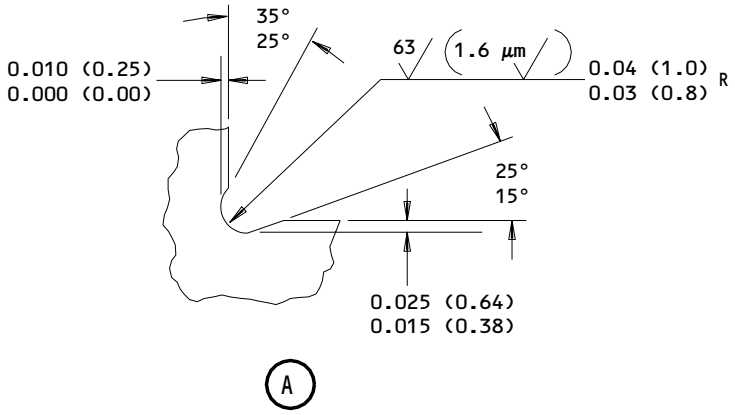
2. Shaft Repair (Fig. 601)

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

   B. Shot peen as indicated.

   C. Build up repaired area with chrome plate and grind to design dimensions and finish shown. Chrome plate must not exceed 0.015 inch (0.381 mm) after grinding.





256T3119-1,-3
Gear Assembly Repair
Figure 601 (Sheet 1)

REFINISH

CADMIUM PLATE (F-15.23) GEAR ALL OVER EXCEPT AS NOTED BY 1
PLATING THICKNESS 0.00015-0.0004 (0.004-0.010) ALLOWABLE ON GEAR TEETH

FOR PLUG REFINISH REFER TO REPAIR 16-1

REPAIR

PREF 4 5

125 / (3.2 µm /) ALL MACHINED SURFACES EXCEPT AS NOTED

MATERIAL: 9310 STEEL, CARBURIZED (150-190 KSI CORE STRENGTH)

BREAK SHARP EDGES 0.008 (0.2)R

SHOT PEEN: 170-460 SHOT SIZE
0.006 A INTENSITY
2.0 COVERAGE

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

1 NO CADMIUM PLATING THESE SURFACES

2 UNCONTROLLED CADMIUM PLATING THICKNESS PERMITTED THIS AREA

3 AFTER PLUG INSTALLATION, PHOSPHATE COAT (F-18.02) EXCEPT OMIT FOLLOW-UP OIL TREATMENT. APPLY TWO COATS PRIMER, BMS 10-11, TYPE 1 (F-20.03) AND CORROSION PREVENTIVE COMPOUND, MIL-C-11796, CLASS 1 (F-19.03)

4 BUILD UP WITH CHROME PLATE (F-15.03) AND GRIND TO DESIGN DIMENSIONS AND FINISH SHOWN. MINIMUM PLATING THICKNESS 0.005 (0.127) AFTER GRINDING. OBSERVE PLATING RUNOUT 0.00-0.02 (0.0-0.5) FROM INTERFACE EDGE AND FILLET RADII

5 PLATING RUNOUT

256T3119-1,-3
Gear Assembly Repair
Figure 601 (Sheet 2)

GEAR SHAFT - REPAIR 7-1

256T3121-1, -2

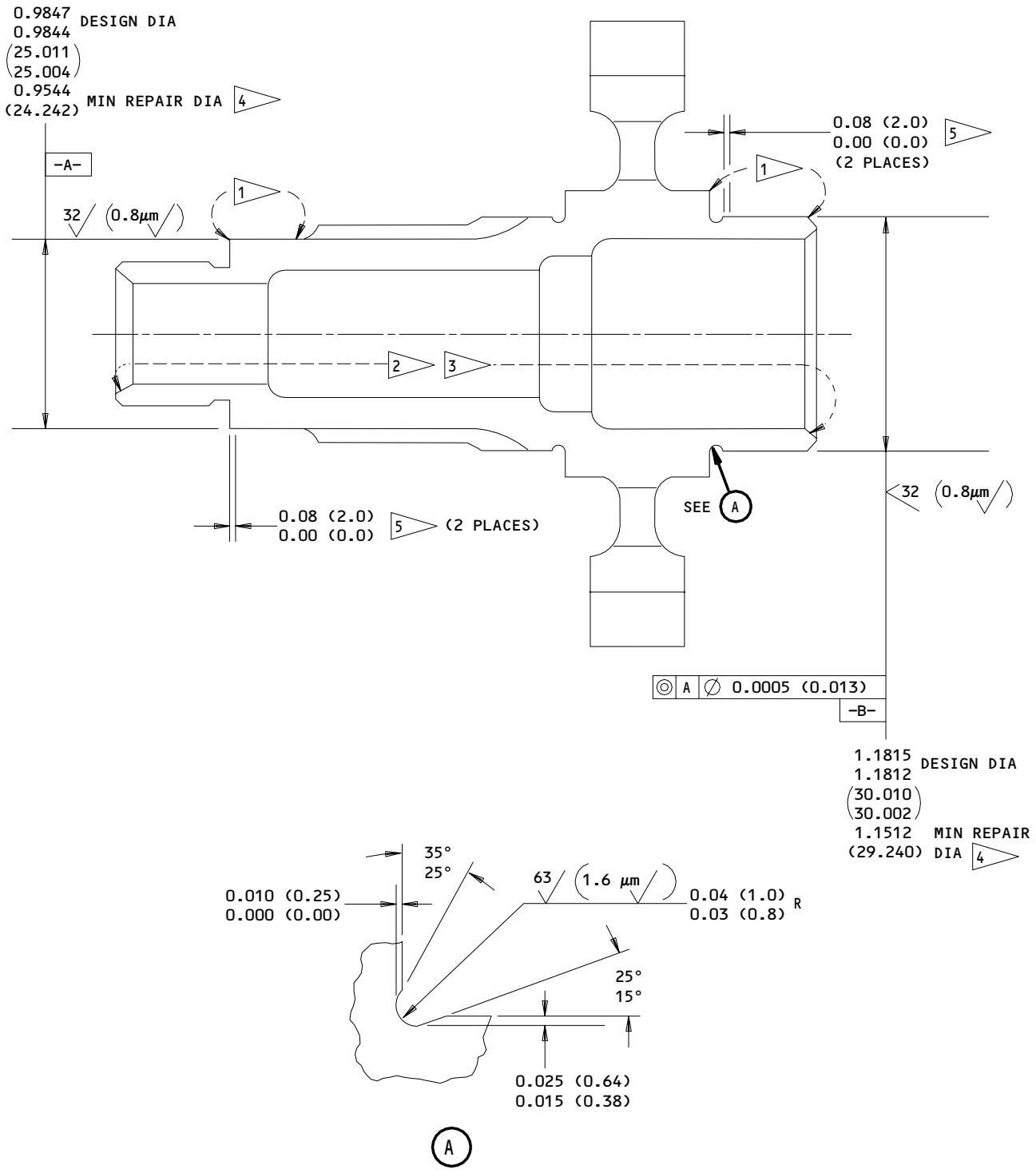
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require stripping and restoration of original finish, refer to Refinish instruction, Fig. 601.

1. Shaft Repair (Fig. 601)

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

   B. Shot peen as indicated.

   C. Build up repaired area with chrome plate and grind to design dimensions and finish shown. Chrome plate must not exceed 0.015 inch (0.381 mm) after grinding.



256T3121-1,-2

Gear Shaft Refinish
Figure 601 (Sheet 1)

REFINISH

CADMIUM PLATE (F-15.23) ALL OVER EXCEPT AS NOTED BY 1. PLATING THICKNESS 0.00015-0.0004 (0.004-0.010) ALLOWABLE ON GEAR TEETH

1. NO CADMIUM PLATING THESE SURFACES
2. UNCONTROLLED CADMIUM PLATING THICKNESS PERMITTED THIS AREA
3. PHOSPHATE COAT (F-18.02) EXCEPT OMIT FOLLOW-UP OIL TREATMENT. APPLY TWO COATS PRIMER, BMS 10-11, TYPE 1 (F-20.03) AND CORROSION PREVENTIVE COMPOUND MIL-C-11796, CLASS 1 (F-19.03)
4. BUILD UP WITH CHROME PLATE (F-15.03) AND GRIND TO DESIGN DIMENSIONS AND FINISH SHOWN. MINIMUM PLATING THICKNESS 0.005 (0.127) AFTER GRINDING. OBSERVE PLATING RUNOUT 0.00-0.02 (0.0-0.5) FROM INTERFACE EDGE, FILLET RADII, AND SPLINE EDGE
5. PLATING RUNOUT

REPAIR

REF 4 5

125 (3.2 µm) ALL MACHINED SURFACES EXCEPT AS NOTED

BREAK SHARP EDGES 0.008 (0.2)R

SHOT PEEN: 170-460 SHOT SIZE
0.006 A INTENSITY
2.0 COVERAGE

MATERIAL: 9310 STEEL, CARBURIZED
(150-190 KSI CORE STRENGTH)

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3121-1,-2
Gear Shaft Refinish
Figure 601 (Sheet 2)

190540

GEAR - REPAIR 8-1

256T3122-1, -2

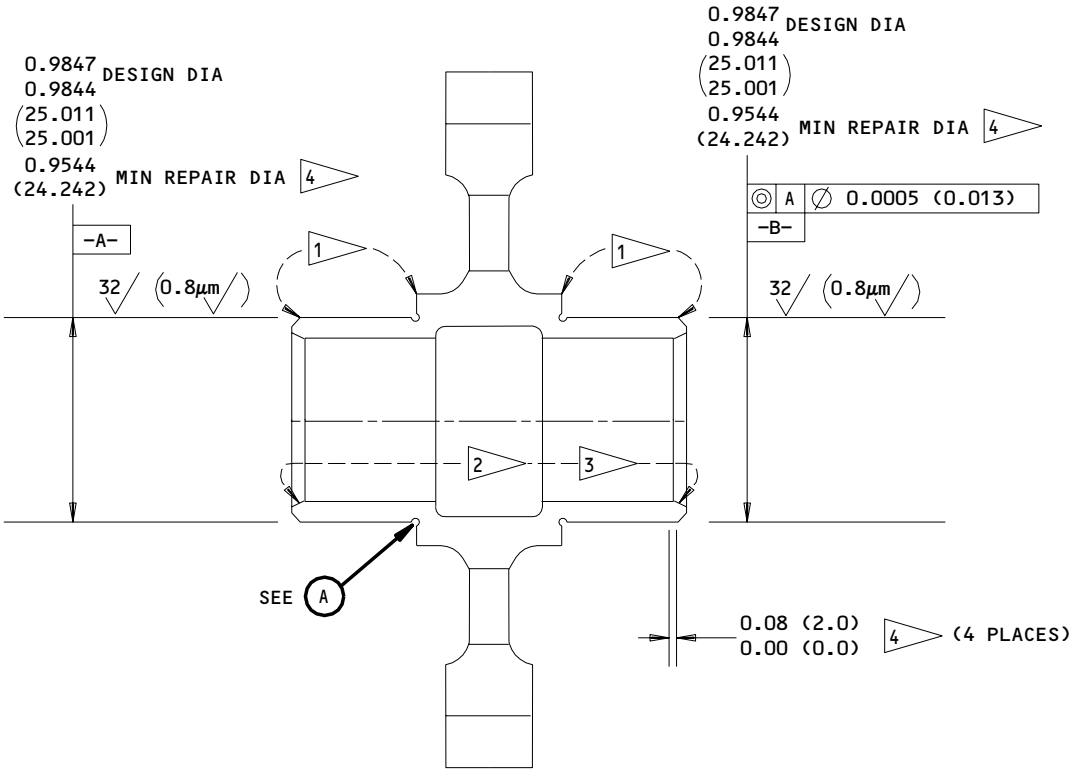
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require stripping and restoration of original finish, refer to Refinish instruction, Fig. 601.

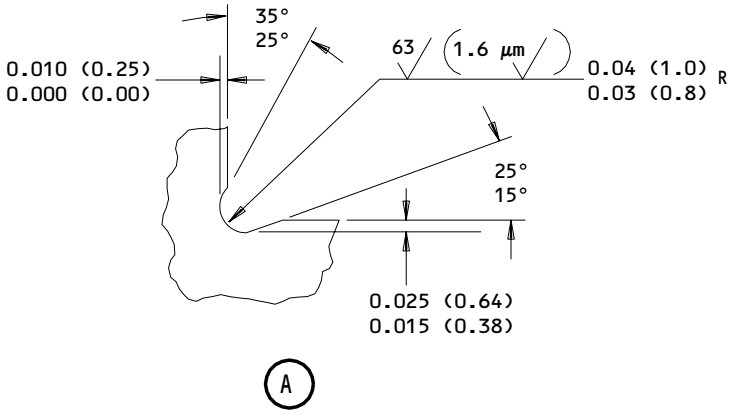
1. Shaft Repair (Fig. 601)

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

   B. Shot peen as indicated.

   C. Build up repaired area with chrome plate and grind to design dimensions and finish shown. Chrome plate must not exceed 0.015 inch (0.381 mm) after grinding.





256T3122-1,-2

Gear Refinish
Figure 601 (Sheet 1)

12944

REFINISH

CADMIUM PLATE (F-15.23) ALL OVER EXCEPT AS NOTED BY 1. PLATING THICKNESS 0.00015-0.0004 (0.004-0.010) ALLOWABLE ON GEAR TEETH

1. NO CADMIUM PLATING THESE SURFACES
2. UNCONTROLLED CADMIUM PLATING THICKNESS PERMITTED THIS AREA
3. PHOSPHATE COAT (F-18.02) EXCEPT OMIT FOLLOW-UP OIL TREATMENT. APPLY TWO COATS PRIMER, BMS 10-11, TYPE 1 (F-20.03) AND CORROSION PREVENTIVE COMPOUND MIL-C-11796, CLASS 1 (F-19.03)
4. BUILD UP WITH CHROME PLATE (F-15.03) AND GRIND TO DESIGN DIMENSIONS AND FINISH SHOWN. MINIMUM PLATING THICKNESS 0.005 (0.127) AFTER GRINDING. OBSERVE PLATING RUNOUT 0.00-0.02 (0.0-0.5) FROM INTERFACE EDGE AND FILLET RADII
5. PLATING RUNOUT

REPAIR

REF 4 5

125 / (3.2 µm /) ALL MACHINED SURFACES EXCEPT AS NOTED

BREAK SHARP EDGES 0.008 (0.2)R

SHOT PEEN: 170-460 SHOT SIZE
0.006 A INTENSITY
2.0 COVERAGE

MATERIAL: 9310 STEEL, CARBURIZED
(150-190 KSI CORE STRENGTH)

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3122-1,-2

Gear Refinish
Figure 601 (Sheet 2)

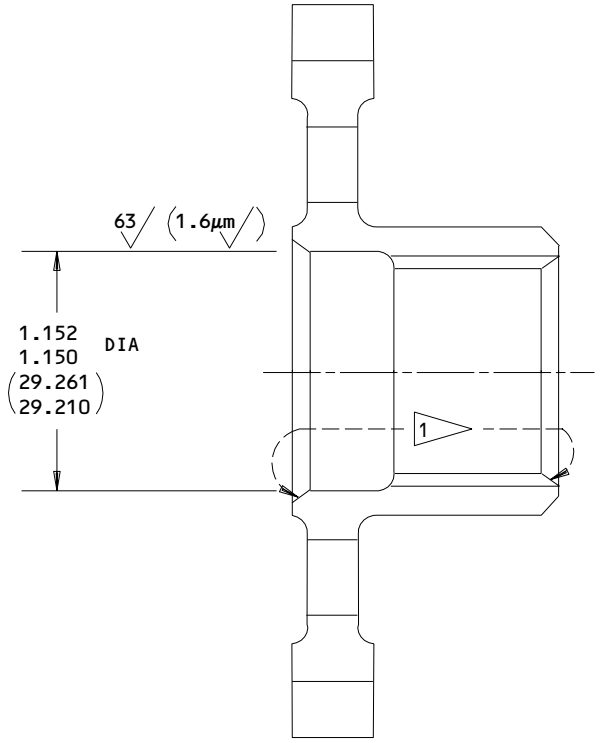
190542

GEAR - REPAIR 9-1

256T3124-1, -2

1. Plating Repair

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



REFINISH

CADMIUM PLATE (F-15.23) ALL OVER.
PLATING THICKNESS 0.00015-0.0004
(0.0038-0.0102) ON GEAR TEETH

MATERIAL: 9310 STEEL, CARBURIZED
(150-190 KSI CORE STRENGTH)

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

1 UNCONTROLLED PLATING THICKNESS PERMITTED THIS AREA

256T3124-1,-2

Gear Refinish
Figure 601

12945

OUTPUT SHAFT - REPAIR 10-1

256T3125-1

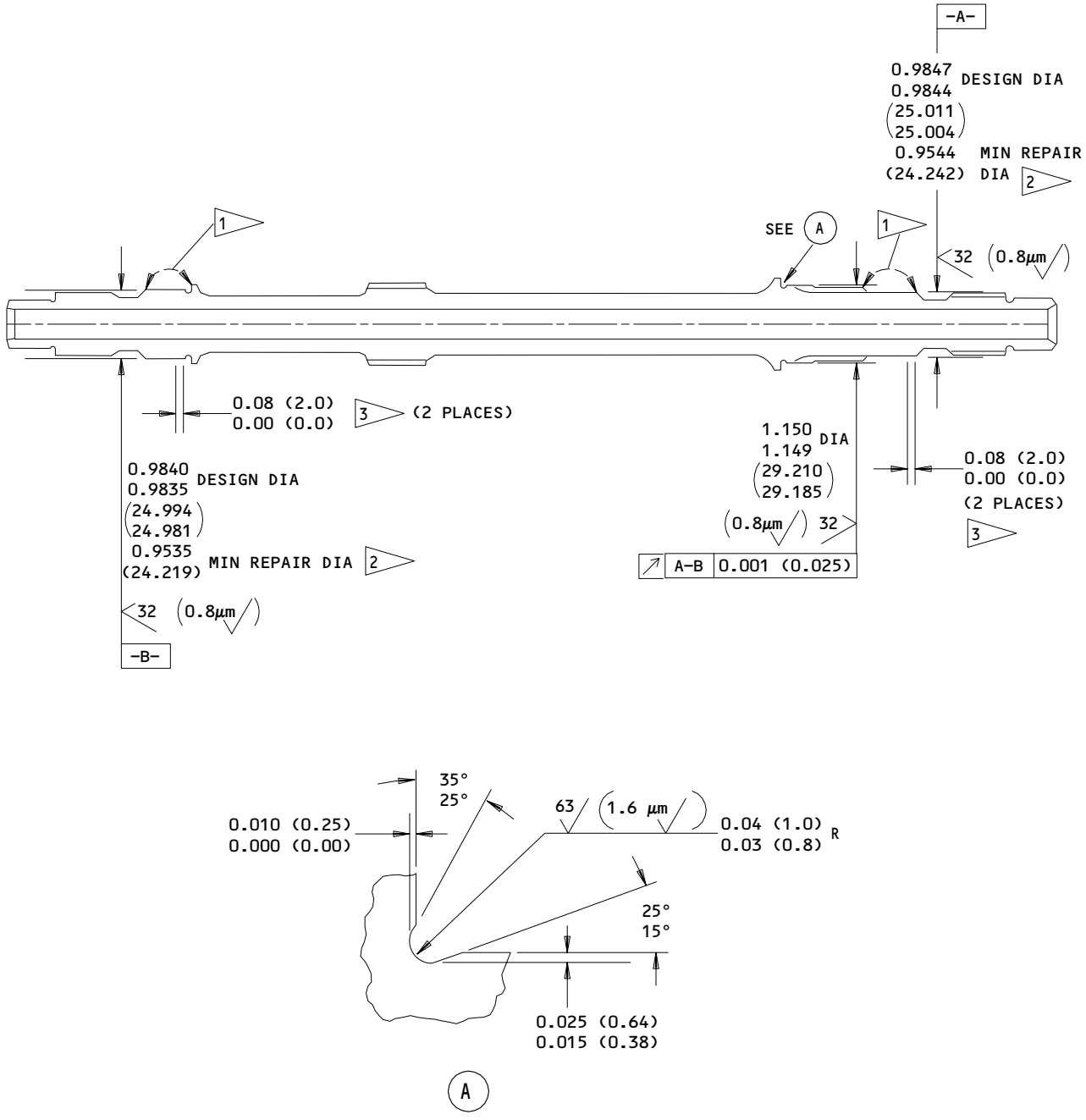
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require stripping and restoration of original finish, refer to Refinish instruction, Fig. 601.

1. Shaft Repair (Fig. 601)

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

   B. Shot peen as indicated.

   C. Build up repaired area with chrome plate and grind to design dimensions and finish shown. Chrome plate must not exceed 0.015 inch (0.381 mm) after grinding.



256T3125-1

Output Shaft Refinish
Figure 601 (Sheet 1)

REFINISH

CADMIUM PLATE (F-15.06) ALL OVER EXCEPT AS NOTED BY 1. PLATING THICKNESS 0.00015-0.0004 (0.004-0.010) ALLOWABLE ON WORM THREAD

PHOSPHATE COAT (F-18.02) BORE EXCEPT OMIT FOLLOW-UP OIL TREATMENT. APPLY TWO COATS PRIMER, BMS 10-11, TYPE 1 (F-20.03) AND CORROSION PREVENTIVE COMPOUND MIL-C-11796, CLASS 1 (F-19.03)

1 NO CADMIUM PLATING THESE SURFACES

2 BUILD UP WITH CHROME PLATE (F-15.03) AND GRIND TO DESIGN DIMENSIONS AND FINISH SHOWN. MINIMUM PLATING THICKNESS 0.005 (0.127) AFTER GRINDING. OBSERVE PLATING RUNOUT 0.00-0.02 (0.0-0.5) FROM INTERFACE EDGE, FILLET RADII, AND SPLINE EDGE

3 PLATING RUNOUT

REPAIR

REF 2 3

125 (3.2 µm) ALL MACHINED SURFACES EXCEPT AS NOTED

BREAK SHARP EDGES 0.008 (0.2)R

SHOT PEEN: 170-460 SHOT SIZE
0.006A INTENSITY
2.0 COVERAGE

MATERIAL: 4340 STEEL
(180-200 KSI)

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3125-1
Output Shaft Refinish
Figure 601 (Sheet 2)

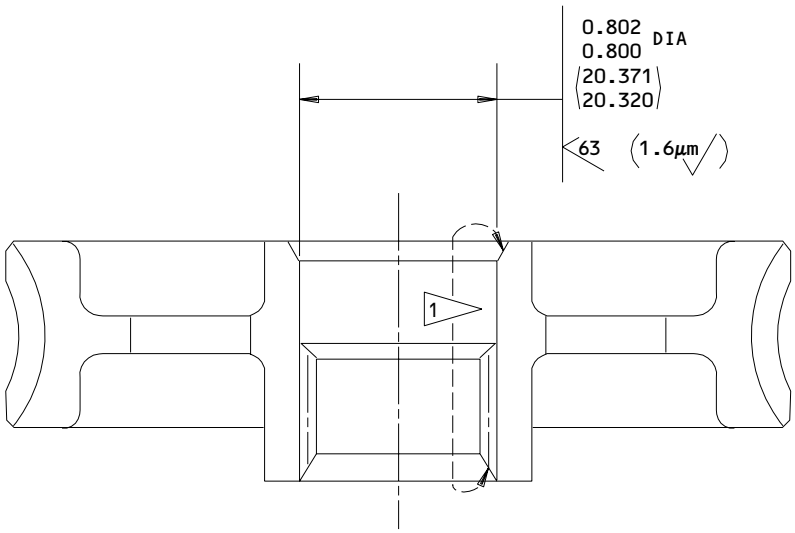
190543

FOLLOW-UP WORM GEAR - REPAIR 11-1

256T3126-1

1. Plating Repair

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



REFINISH

CADMIUM PLATE (F-15.06) ALL OVER.
PLATING THICKNESS 0.00015-0.0004
(0.0038-0.0102) ALLOWABLE ON WORM
GEAR TEETH

1 UNCONTROLLED PLATING THICKNESS
PERMITTED THIS AREA

MATERIAL: AL-NI-BRONZE
(110 KSI MIN)

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3126-1

Follow-up Worm Gear Refinish
Figure 601

FOLLOW-UP GEAR SHAFT - REPAIR 12-1

256T3127-1

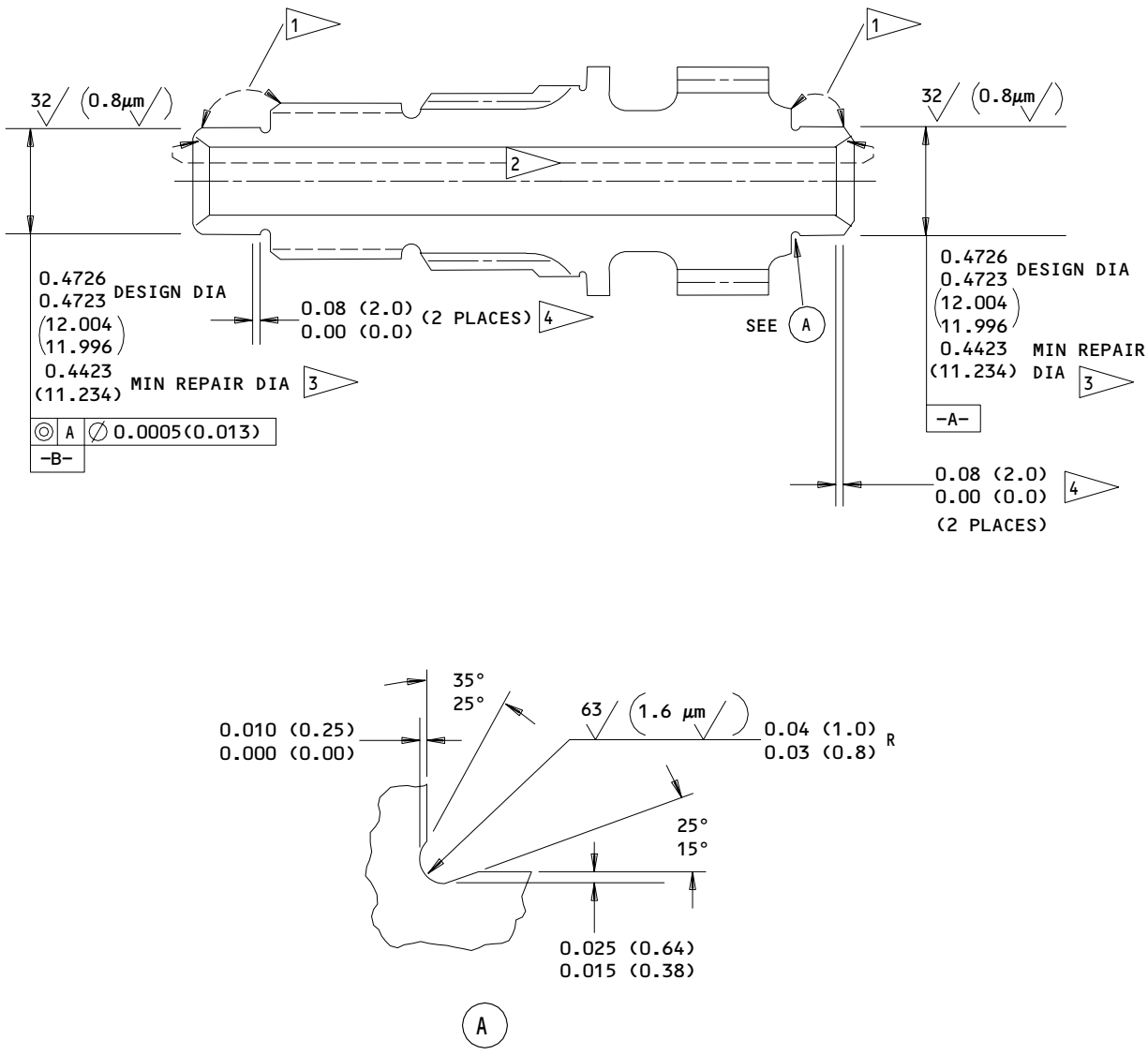
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require stripping and restoration of original finish, refer to Refinish instruction, Fig. 601.

1. Shaft Repair (Fig. 601)

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

   B. Shot peen as indicated.

   C. Build up repaired area with chrome plate and grind to design dimensions and finish shown. Chrome plate must not exceed 0.015 inch (0.381 mm) after grinding.



256T3127-1

Follow-up Gear Shaft Refinish
Figure 601 (Sheet 1)

REFINISH

CADMIUM PLATE (F-15.06) ALL OVER EXCEPT AS NOTED BY 1. PLATING THICKNESS 0.00015-0.0004 (0.004-0.010) ALLOWABLE ON GEAR TEETH.

PHOSPHATE COAT (F-18.02) BORE EXCEPT OMIT FOLLOW-UP OIL TREATMENT. APPLY TWO COATS PRIMER, BMS 10-11, TYPE 1 (F-20.03) AND CORROSION PREVENTIVE COMPOUND, MIL-C-11796 CLASS 1 (F-19.03).

1 NO CADMIUM PLATING THESE SURFACES

2 UNCONTROLLED CADMIUM PLATING THICKNESS PERMITTED THIS AREA

3 BUILD UP WITH CHROME PLATE (F-15.03) AND GRIND TO DESIGN DIMENSIONS AND FINISH SHOWN. MINIMUM PLATING THICKNESS 0.005 (0.127) AFTER GRINDING. OBSERVE PLATING RUNOUT 0.00-0.02 (0.0-0.5) FROM INTERFACE EDGE AND FILLET RADII

4 PLATING RUNOUT

REPAIR

REF 3 4

125 / (3.2 µm /) ALL MACHINED SURFACES EXCEPT AS NOTED

BREAK SHARP EDGES 0.008 (0.2)R

SHOT PEEN: 170-460 SHOT SIZE
0.006A INTENSITY
2.0 COVERAGE

MATERIAL: 4340 STEEL
(150-170 KSI)

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3127-1

Follow-up Gear Shaft Refinish
Figure 601 (Sheet 2)

190544

FOLLOW-UP GEAR - REPAIR 13-1

256T3128-1

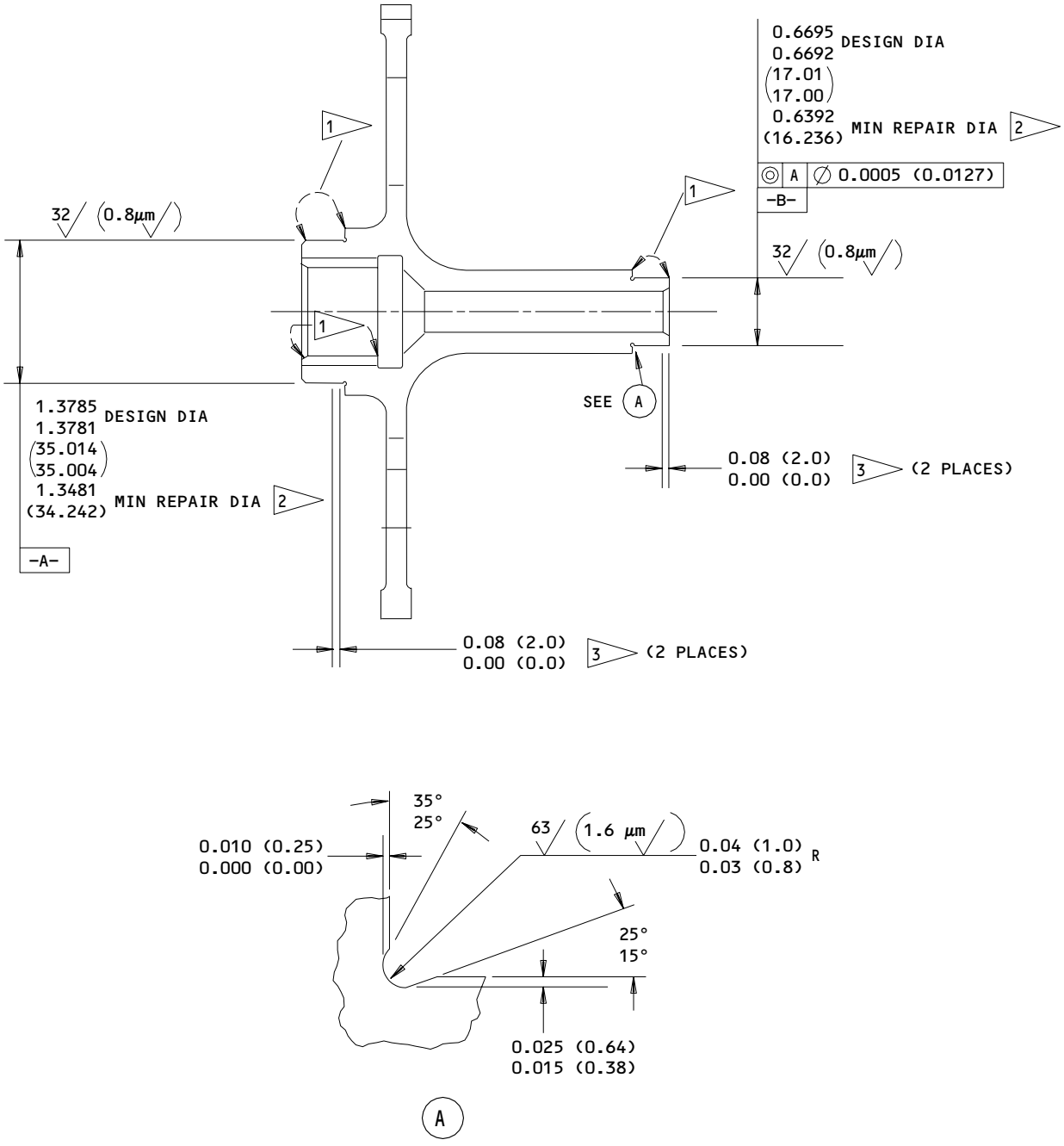
NOTE: Refer to REPAIR-GEN for list of applicable standard practices. For repair of surfaces which may only require stripping and restoration of original finish, refer to Refinish instruction, Fig. 601.

1. Shaft Repair (Fig. 601)

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

   B. Shot peen as indicated.

   C. Build up repaired area with chrome plate and grind to design dimensions and finish shown. Chrome plate must not exceed 0.015 inch (0.381 mm) after grinding.



256T3128-1

Follow-up Gear Refinish
Figure 601 (Sheet 1)

13031

REFINISH

CHROMIC ACID ANODIZE (F-17.04) ALL OVER
APPLY ONE COAT PRIMER, BMS 10-11, TYPE 1
(F-20.02) EXCEPT AS NOTED BY 1

1 NO PRIMER THESE SURFACES

2 BUILD UP WITH CHROME PLATE (F-15.03) AND GRIND TO DESIGN DIMENSIONS AND FINISH SHOWN. MINIMUM PLATING THICKNESS 0.005 (0.127) AFTER GRINDING. OBSERVE PLATING RUNOUT 0.00-0.02 (0.0-0.5) FROM INTERFACE EDGE AND FILLET RADII

3 PLATING RUNOUT

REPAIR

REF 2 3

125 (3.2 µm) ALL MACHINED SURFACES EXCEPT AS NOTED

BREAK SHARP EDGES 0.008 (0.2)R

SHOT PEEN: 170-460 SHOT SIZE
0.006A INTENSITY
2.0 COVERAGE

MATERIAL: AL ALLOY

DIMENSIONS ARE IN INCHES EXCEPT
DIMENSIONS IN ( ) ARE IN MILLIMETERS

256T3128-1

Follow-up Gear Refinish
Figure 601 (Sheet 2)

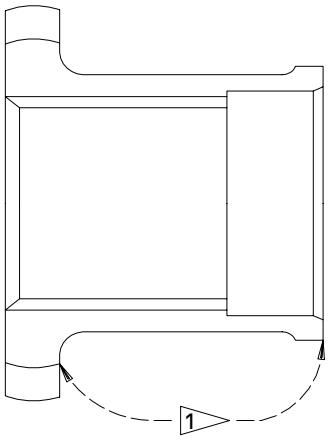
190545

COUPLING HALF - REPAIR 14-1

256T3749-1

1. Plating Repair

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



REFINISH

CADMIUM PLATE (F-15.02)
ALL OVER AND APPLY ONE COAT
PRIMER, BMS 10-11, TYPE 1
(F-20.02) AS INDICATED BY 1

MATERIAL: 4340 STEEL, 150-170 KSI

Coupling Half Refinish
Figure 601

NAMEPLATE - REPAIR 15-1

256T2635-6, -7

NOTE: Refer to REPAIR-GEN for list of applicable standard practices.

1. Nameplate Replacement

   A. Steel stamp assembly part number and serial number on nameplate.

   B. Bond nameplate to cover assembly (100, IPL Fig. 1) per 20-50-12, type 70. Install in location shown in IPL Fig. 1.

MISCELLANEOUS PARTS REFINISH - REPAIR 16-1

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

IPL FIG. & ITEM	MATERIAL	FINISH
Fig. 1		
Cover (15)	Al alloy	Chromic acid anodize (F-17.04) and apply one coat primer, BMS 10-11, type 1 (F-20.02). Primer optional in holes.
Coupling sleeve (30)	4140 steel (150-170 ksi)	Cadmium plate (F-15.02).
Retainer (55)	Al alloy	Chromic acid or sulfuric acid anodize (F-17.05) all over. Apply one coat primer, BMS 10-11, type 1 (F-20.02) on external surface and bolt holes. No primer on faying surfaces or center bore.
Retainer (60)	4340 Steel (150-170 ksi)	Cadmium plate (F-15.06)
Plug (155,170)	4130 steel (125-145 ksi)	Cadmium plate (F-15.06).
Gear (200)	9310 steel (150-190 ksi)	Cadmium plate (F-15.23) all over. Plating thickness 0.00015-0.0004 (0.0038-0.0102) on gear teeth.*[1] Uncontrolled plating thickness permitted on internal surfaces.
Bearing housing (210)	Al alloy	Chromic acid anodize (F-17.04).

*[1] Dimensions are in inches except dimensions in ( ) are in millimeters.

Refinish Details
Figure 601

ASSEMBLY

1. Materials

NOTE: Equivalent substitutes may be used.

A. Grease -- MIL-G-23827A (Ref 20-60-03)

B. Grease -- MIL-G-21164 (Aeroshell 17 preferred) (Ref 20-60-03)

C. Lockwire -- MS20995C32

D. Primer -- BMS 10-11, type 1 (Ref 20-60-02)

E. Sealant -- BMS 5-26 (Ref 20-60-04)

2. Equipment

NOTE: Equivalent substitutes may be used.

A. Spanner Adapter -- A27051-4

B. Spanner Adapter -- A27051-5

3. Lubrication

A. Install bolts and screws with wet primer.

B. Coat surfaces and splines of following parts with grease, MIL-G-23827A:

(1) Coupling sleeve (30), coupling half (35)

(2) Gear assemblies (150, 165)

(3) Gear (200), gear shaft (205), bearing housing (210)

(4) Follow-up worm gear (260), follow-up gear shaft (265), follow-up gear (270), gear (275), output shaft (280).

C. Fill gear tooth spaces on following parts with grease, MIL-G-21164:

(1) Gear assemblies (150, 165)

(2) Gear (200, 220), gear shaft (205)

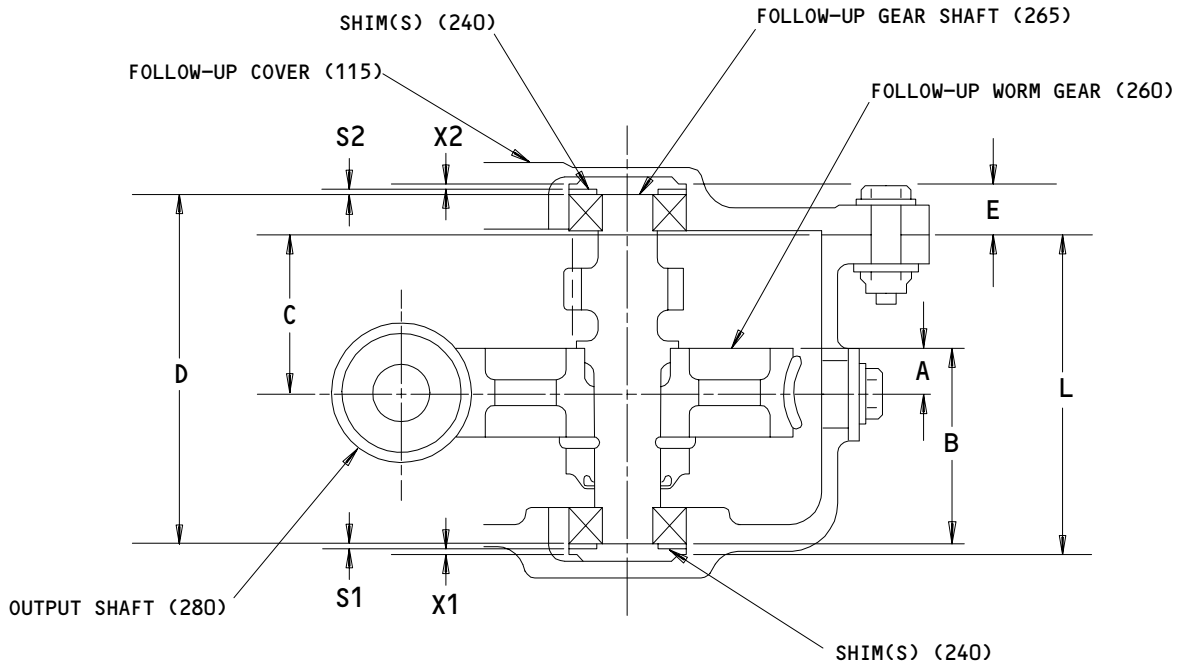
(3) Follow-up worm gear (260), follow-up gear shaft (265), follow-up gear (270), gear (275), output shaft (280)

D. Fill pocket areas with grease, MIL-G-21164, per Fig. 702.

4. Assembly (Ref IPL Fig. 1)

A. Install bearing (225) in housing assembly (120) and attach retainer (55) with bolts (45A) and washers (50). Tighten bolts to 50-80 lb-in. (58-92 kg-cm).

B. Install gear (275) and bearing (215) on output shaft (280).



NOTE: ITEM NUMBERS REFER TO IPL FIG. 1

Shim Adjustment
Figure 701

13035

CAUTION: SUPPORT OUTPUT SHAFT IN HOUSING ASSEMBLY UNTIL COVER ASSEMBLY (100) IS INSTALLED.

C. Install shaft in housing assembly, then install cover assembly (100). Secure cover with bolts (65, 70A, 72, 73), washers (75), and nuts (80), tightened sufficiently to ensure that bearings (215, 225) are fully seated.

NOTE: Shaft and cover are being installed temporarily to permit following measurement.

CAUTION: SUPPORT OUTPUT SHAFT IN HOUSING ASSEMBLY WHEN COVER ASSEMBLY IS REMOVED.

D. Measure dimension "C" (Ref Fig. 701) from shaft centerline to housing faying surface, then remove cover and shaft from housing.

E. Assemble follow-up worm gear (260) and follow-up gear shaft (265) with nut (250) and washer (255). Use spanner adapter A27051-4 to tighten nut to 300-350 lb-in. (346-404 kg-cm).

F. Install bearings (245) on ends of shaft.

G. Install follow-up gear shaft, adjusting endplay with shims (240) using following procedure (Ref Fig. 701).

(1) Measure dimension "D" between outer faces of bearings (245) with axial load of approximately 5 lbs (2.3 kg) applied between bearings.

(2) Measure dimension "B" from outer face of lower bearing to top face of gear (260). Measure dimension "A" from top face of gear to mid-plane of gear.

(3) On housing assembly, measure dimension "L" from bottom of bearing bore to cover mating surface.

(4) On follow-up cover (115), measure dimension "E" from bottom of bearing bore to housing mating surface.

(5) Using shim thicknesses S1, S2 obtained during disassembly as starting points, determine endplay dimensions X1, X2 as follows:

$$X1 = L - C - B + A - S1$$

$$X2 = L + E - D - S1 - S2 - X1$$

Adjust S1, S2 as required to obtain endplay dimensions.

X1, X2 = 0.002-0.006 in. (0.051-0.152 mm)

CAUTION: SUPPORT OUTPUT SHAFT IN HOUSING ASSEMBLY UNTIL COVER ASSEMBLY (100) IS INSTALLED.

H. Install output shaft in housing assembly. Rotate shaft as worm engages gear.

I. Install bearings (230, 235) on follow-up gear (270). Install in housing, making sure follow-up gear meshes with follow-up gear shaft.

J. Install follow-up cover (115) with bolts (65), washers (75), and nuts (80). Tighten nuts to 50-80 lb-in/ (23-35 kg-cm).

K. Install inspection hole covers (15) and drain cover (95) with bolts (5, 85) and washers (10, 90). Tighten bolts to 20-30 lb-in. (23-35 kg-cm).

L. Install bearings (215) on gear (220) and install in housing assembly. Coat bearing housing (210) with grease and install with bolts (212) and washers (213). Tighten bolts to 50-80 lb-in. (58-92 kg-cm).

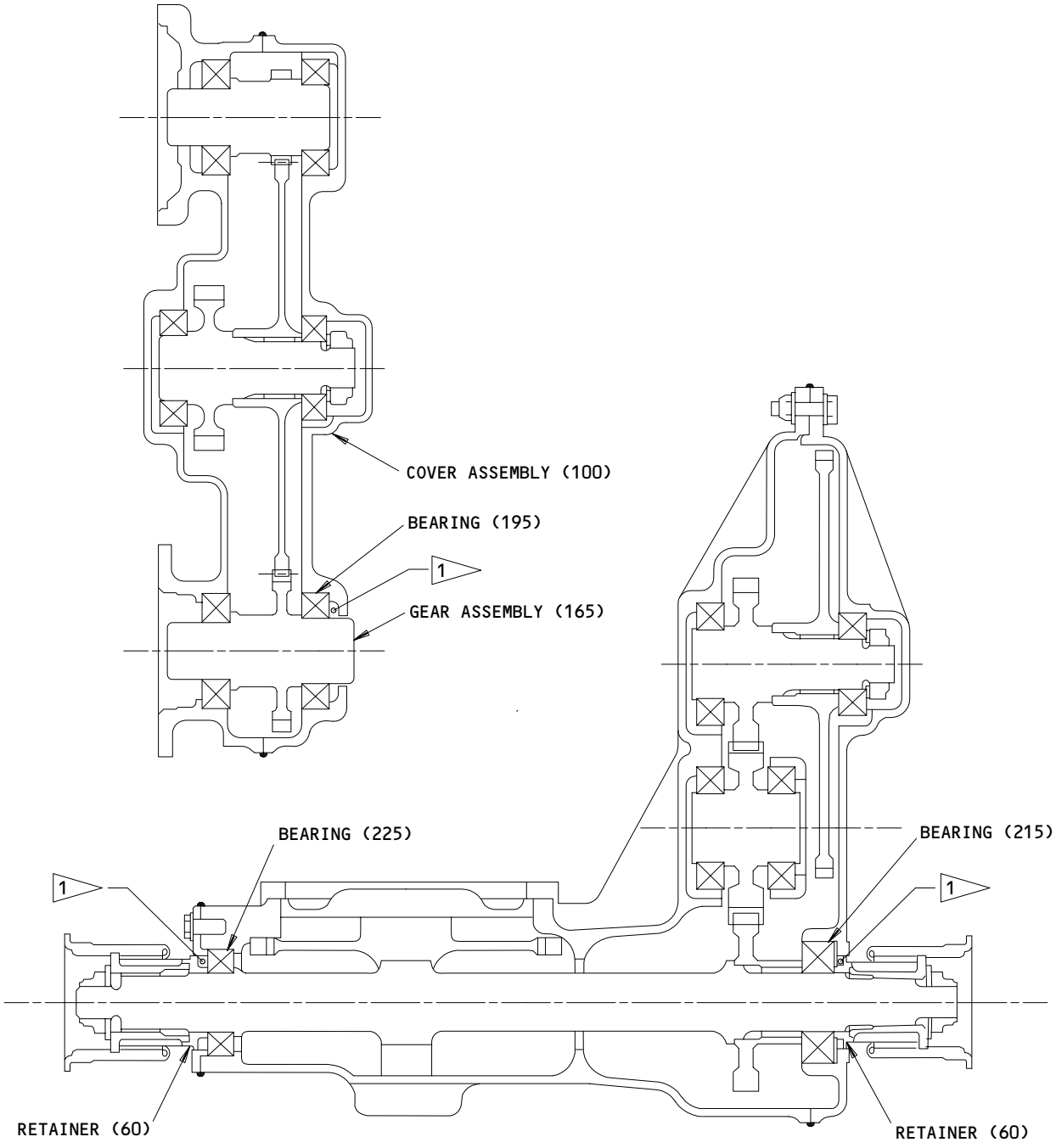
M. Install bearings (195) on both ends of gear assembies (150, 165) and install in housing.

N. Assemble gear (200) and gear shaft (205). Install bearing (190) and secure with nut (180) and washer (185) using spanner adapter A27051-5. Tighten nut to 1200-1300 lb-in. (1385-1500 kg-cm). Install bearing (195) on shaft then install entire assembly in housing, making sure all gear teeth mesh smoothly.

O. Fill pocket between bearing (195) on gear assembly (165) and cover assembly (100) with grease as shown in Fig. 702. Install cover assembly and secure with bolts (65, 70A, 72), washers (75), and nuts (80). Tighten nuts to 50-80 lb-in. (58-92 kg-cm).

P. Check drain cover (97) and plug with BMS 5-26 sealant, if open. Attach drain cover to cover assembly with bolts (85) and washers (90). Tighten bolts to 20-30 lb-in. (23-35 kg-cm).

NOTE: Only drain cover (97) is to be plugged.



1 FILL POCKET AREAS WITH GREASE, MIL-G-21164

NOTE: ITEM NUMBERS REFER TO IPL FIG. 1

Assembly Lubrication Details
Figure 702

Q. Temporarily install retainer (60), coupling half (35), washer (25), and nut (20) on followup end of output shaft (280). Tighten nut (20) to 250-300 lb-in. (300-340 kg-cm).

R. Test unit per TESTING AND TROUBLE SHOOTING.

S. Remove parts (20, 25, 35, 60) temporarily installed in step Q. Slide retainers (60) loosely onto ends of output shaft. Fill gaps between retainers and bearings (215, 225) with grease per Fig. 702 then press retainers against bearing faces. Coat surfaces and splines of coupling sleeves (30) and coupling halves (35) with grease. Install new molded sleeves (40) on coupling halves, then install parts (20 thru 40) on ends of output shaft. Tighten nuts (20) to 400-450 pound-inches (461-518 kg-cm).

T. Remove inspection hole cover (15) located between hydraulic motor and electric motor inputs. Pump in 2.0-2.5 pounds grease, MIL-G-21164, to fill housing approximately 80 percent full. Reinstall cover. Tighten bolts (5) to 20-30 pound-inches (23-35 kg-cm).

U. Modify nameplate (285B), as required, to indicate use of molybdenum disulfide grease.

(1) Add letter "A" to assembly serial number.

(2) Change "MIL-G-23827A" to read "MIL-G-21164".

V. Apply a bead of BMS 5-26 sealant to seal seams between housing assembly (120A) and the following parts.

(1) Inspection hole cover (15)

(2) Retainer (55)

(3) Drain cover (95)

(4) Cover assembly (100)

(5) Follow-up cover (115)

W. Fillet seal heads of bolts (5, 45A, 65, 70A, 72, 73, 85, 212). Fillet seal nuts (80) and exposed end of bolt (72). Use BMS 5-26 sealant.

X. Fillet seal seam between drain cover (97) and cover assembly (100). Use BMS 5-26 sealant.

Y. Lockwire the following parts per 20-50-02 using double-twist method.

(1) Bolt (5) to bolt (5) (2 places)

(2) Bolt (45A) to retainer (55) (3 places)

(3) Bolt (73) to web of cover (100)

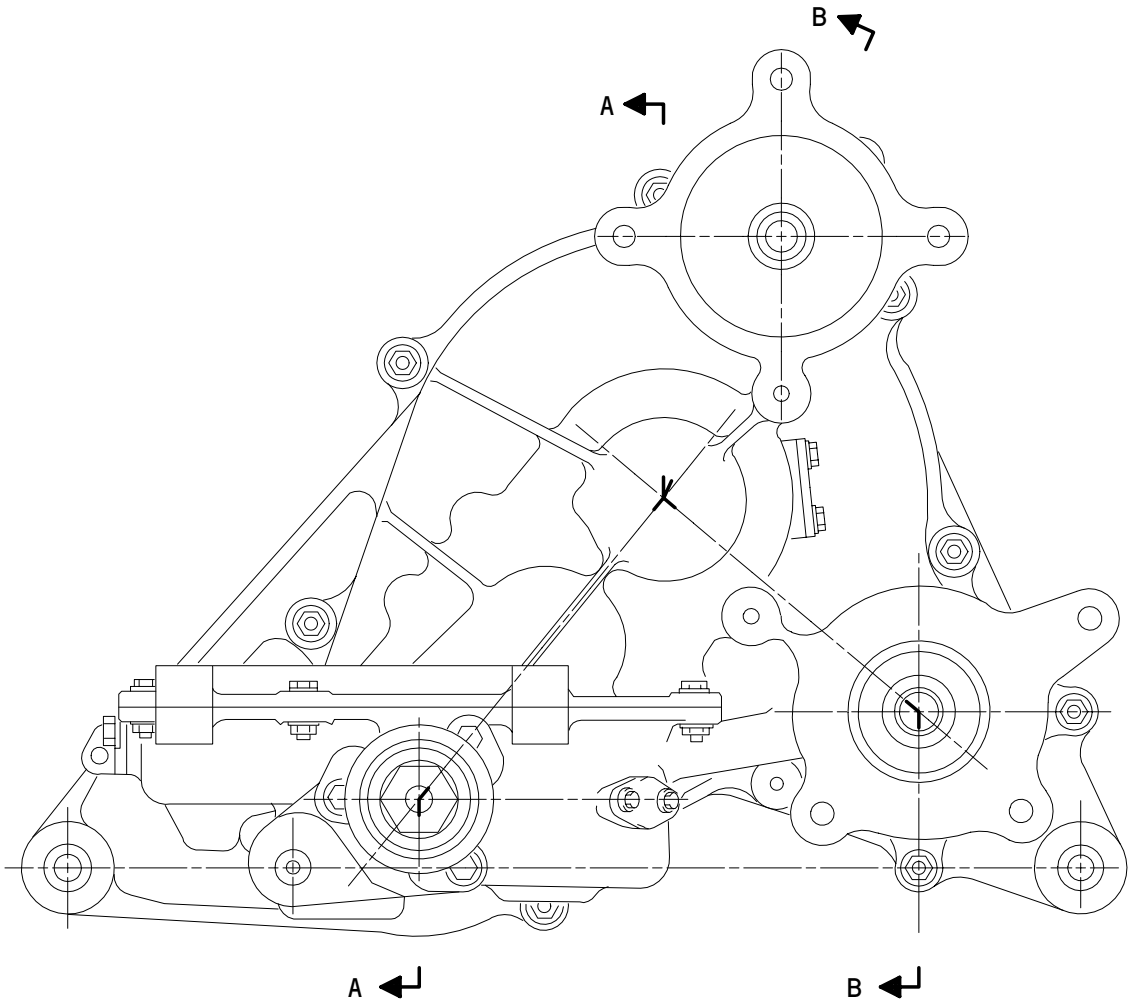
(4) Bolt (85) to bolt (85) (2 places)

(5) Bolt (212) to bolt (212) (2 places)

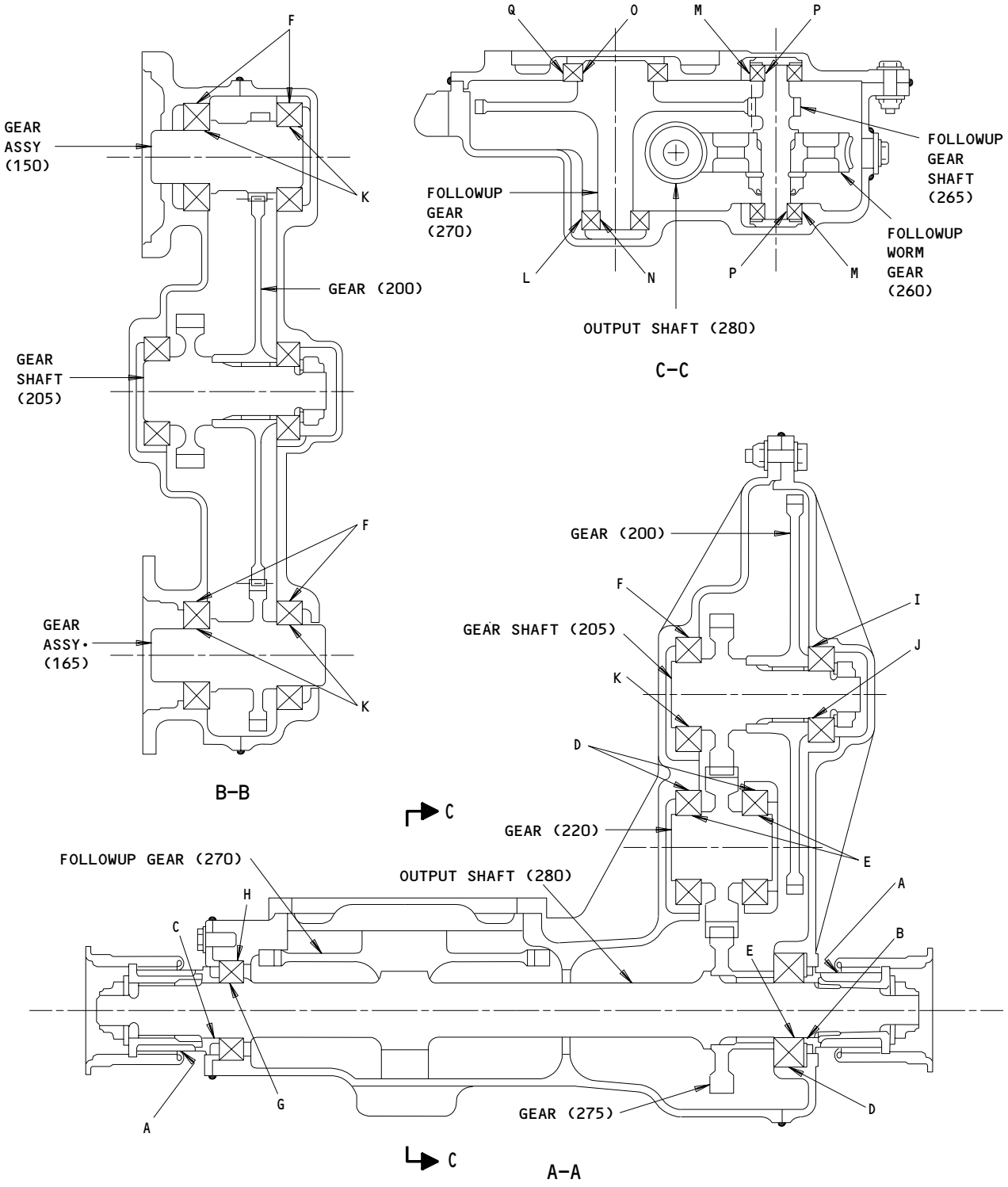
5. Storage

A. Use standard industry practices and information contained in 20-44-02 for storage of this component.

FITS AND CLEARANCES



Fits and Clearances
Figure 801 (Sheet 1)



Fits and Clearances
Figure 801 (Sheet 2)

13670

Ref Letter Fig.801	Mating Item No. IPL Fig.1	Design Dimension				Service Wear Limit		
		Dimension		Assembly Clearance *[1]		Dimension		Maximum Clearance
		Min	Max	Min	Max	Min	Max	
A	ID 30	1.50 (38.10)	1.52 (38.61)	0.00 (0.00)	0.04 (1.02)			
	OD 40	1.48 (37.59)	1.50 (38.10)					
B	ID 60	0.9850 (25.019)	0.9860 (25.044)	0.0003 (0.008)	0.0016 (0.040)		0.9877 (25.088)	
	OD 280	0.9844 (25.004)	0.9847 (25.011)			0.9830 (24.968)		0.0030 (0.076)
C	ID 60	0.9850 (25.019)	0.9860 (25.044)	0.0010 (0.025)	0.0025 (0.063)		0.9870 (25.070)	
	OD 280	0.9835 (24.981)	0.9840 (24.994)			0.9830 (24.968)		0.0030 (0.076)
D	ID 100, 120,210	2.0472 (51.999)	2.0484 (52.029)	0.0000 (0.000)	0.0017 (0.043)		2.0502 (52.075)	
	OD 215	2.0467 (51.986)	2.0472 (51.999)			2.0464 (51.979)		0.0030 (0.076)
E	ID 215	0.9839 (24.991)	0.9843 (25.001)	−0.0008 (−0.020)	−0.0001 (−0.003)		0.9844 (25.004)	
	OD 220,280	0.9844 (25.004)	0.9847 (25.011)			0.9843 (25.001)		0.0000 (0.000)
F	ID 100,120	2.1654 (55.001)	2.1666 (55.032)	0.0000 (0.000)	0.0017 (0.044)		2.1684 (55.077)	
	OD 195	2.1649 (54.988)	2.1654 (55.001)			2.1636 (54.955)		0.0030 (0.076)
G	ID 225	0.9839 (24.991)	0.9843 (25.001)	−0.0001 (−0.003)	0.0008 (0.020)		0.9850 (25.019)	
	OD 280	0.9835 (24.981)	0.9840 (24.994)			0.9833 (24.976)		0.0010 (0.003)
H	ID 120	1.8494 (46.975)	1.8504 (47.000)	−0.0010 (−0.025)	0.0005 (0.013)		1.8514 (47.026)	
	OD 225	1.8499 (46.987)	1.8504 (47.000)			1.8494 (46.975)		0.0010 (0.003)
I	ID 100	1.8504 (47.000)	1.8514 (47.026)	0.0000 (0.000)	0.0015 (0.039)		1.8534 (47.076)	
	OD 190	1.8499 (46.987)	1.8504 (47.000)			1.8484 (46.949)		0.0030 (0.076)

*[1] NEGATIVE VALUES DENOTE INTERFERENCE FIT

DIMENSIONS ARE IN INCHES EXCEPT DIMENSIONS IN ( ) ARE IN MILLIMETERS

Fits and Clearances
Figure 801 (Sheet 3)

Ref Letter Fig.801	Mating Item No. IPL Fig.1	Design Dimension				Service Wear Limit		
		Dimension		Assembly Clearance *[1]		Dimension		Maximum Clearance
		Min	Max	Min	Max	Min	Max	
J	ID 190	0.9839 (24.991)	0.9843 (25.001)	-0.0008 (-0.020)	-0.0001 (-0.003)		0.9844 (25.004)	
	OD 205	0.9844 (25.004)	0.9847 (25.011)			0.9843 (25.001)		0.0000 (0.000)
K	ID 195	1.1807 (29.990)	1.1811 (30.000)	-0.0008 (-0.020)	-0.0001 (-0.002)		1.1812 (30.002)	
	OD 150, 165,205	1.1812 (30.002)	1.1815 (30.010)			1.1811 (30.000)		0.0000 (0.000)
L	ID 120	1.3780 (35.001)	1.3790 (35.027)	0.0000 (0.000)	0.0015 (0.038)		1.3810 (35.077)	
	OD 235	1.3775 (34.989)	1.3780 (35.001)			1.3760 (34.950)		0.0030 (0.076)
M	ID 115,120	1.1024 (28.001)	1.1032 (28.021)	0.0000 (0.000)	0.0012 (0.030)		1.1054 (28.077)	
	OD 245	1.1020 (27.991)	1.1024 (28.001)			1.1002 (27.945)		0.0030 (0.076)
N	ID 235	0.6690 (16.993)	0.6693 (17.000)	-0.0005 (-0.012)	0.0001 (0.003)		0.6696 (17.008)	
	OD 270	0.6692 (16.998)	0.6695 (17.005)			0.6689 (16.990)		0.0001 (0.003)
O	ID 230	1.3775 (34.989)	1.3780 (35.001)	-0.0010 (-0.025)	-0.0001 (-0.003)		1.3781 (35.004)	
	OD 270	1.3781 (35.004)	1.3785 (35.014)			1.3780 (35.001)		0.0000 (0.000)
P	ID 245	0.4721 (11.991)	0.4724 (11.999)	-0.0005 (-0.013)	0.0001 (0.003)		0.4727 (12.007)	
	OD 265	0.4723 (11.996)	0.4726 (12.004)			0.4723 (11.996)		0.0001 (0.003)
Q	ID 115	2.1654 (55.001)	2.1666 (55.032)	0.0000 (0.000)	0.0017 (0.044)		2.1684 (55.077)	
	OD 230	2.1649 (54.988)	2.1654 (55.001)			2.1636 (54.955)		0.0030 (0.076)

*[1] NEGATIVE VALUES DENOTE INTERFERENCE FIT

DIMENSIONS ARE IN INCHES EXCEPT DIMENSIONS IN ( ) ARE IN MILLIMETERS

Fits and Clearances
Figure 801 (Sheet 4)

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FOR TORQUE VALUES OF STANDARD FASTENERS, REFER TO 20-50-01			
ITEM NO. IPL FIG. 1	NAME	TORQUE	
		POUND-INCHES (Kg-Cm)	POUND-FEET (Kg-M)
20	NUT	400-450 (461-518)	
45A,65,70A,72,212	BOLT	50-80 (58-92)	
5,85	BOLT	20-30 (23-35)	
180	NUT	1200-1300 (1385-1500)	
80	NUT	50-80 (58-92)	
250	NUT	300-350 (346-404)	

Torque Table
Figure 802

SPECIAL TOOLS, FIXTURES, AND EQUIPMENT

NOTE: Equivalent substitutes may be used.

1. Backlash Check Fixture -- A27048-4
2. Spanner Adapter -- A27051-4, -5 *[1]
3. Clamp Assembly -- A27051-7 *[1]
4. Input Crank Assembly -- A27051-8 *[1]
5. Lock Assembly -- A27051-12 *[1]
6. Dial Indicator

*[1] These tools are included in Tool Set A27051-31 (repls A27051-1).

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

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

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

21335 TEXTRON INC FAFNIR BEARING DIVISION
37 BOOTH STREET
NEW BRITAIN, CONNECTICUT 06050

21760 SCHATZ FEDERAL BEARINGS CO INC
FAIRVIEW AVENUE
POUGHKEEPSIE, NEW YORK 12602

23294 AVALON MACHINE PRODUCTS INC
15337 ALLEN STREET
PARAMOUNT, CALIFORNIA 90723

29337 HOOVER UNIVERSAL INC BALL AND ROLLER DIV
ERWIN, TENNESSEE 37650

38443 TRW INC BEARING DIV
402 CHANDLER STREET
JAMESTOWN, NEW YORK 14701

43991 FAG BEARING INCORPORATED
HAMILTON AVENUE
STAMFORD, CONNECTICUT 06904

52828 REPUBLIC FASTENER MFG CORP
1300 RANCHO CONEJO BLVD
NEWBURY PARK, CALIFORNIA 91320

56878 SPS TECHNOLOGIES INC
HIGHLAND AVENUE
JENKINTOWN, PENNSYLVANIA 19046

71087 BOOTS ACFT NUT DIV TOWNSEND CO SEE TEXTRON INC CHERRY
FASTENER TOWNSEND DIV V11815

VENDORS

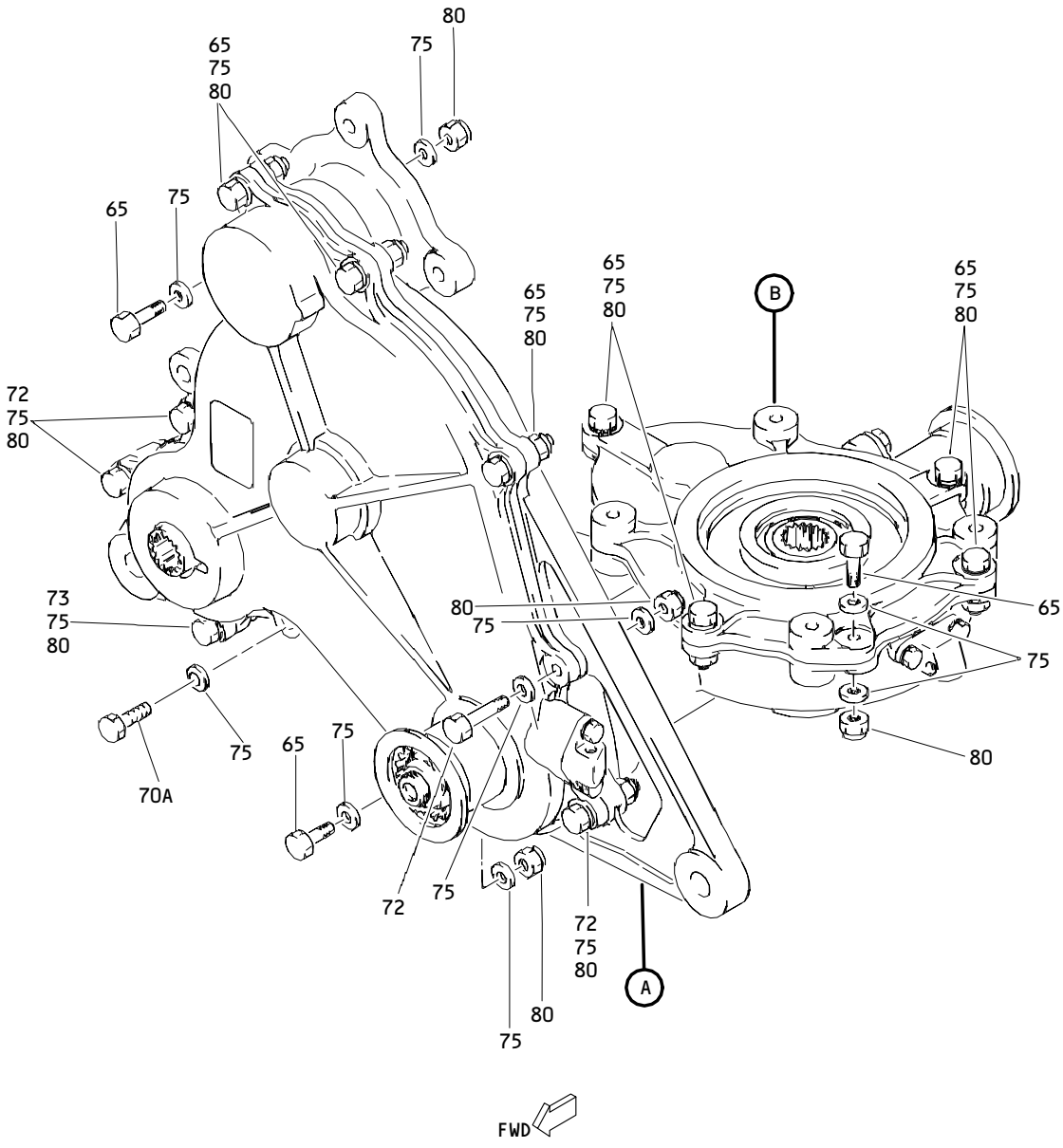
72962 ESNA DIV OF AMERACE CORP
2330 VAUXHALL ROAD
UNION, NEW JERSEY 07083

80539 SPS TECHNOLOGIES INC AEROSPACE PRODUCTS DIV
2701 SOUTH HARBOR BOULEVARD
SANTA ANA, CALIFORNIA 92702

92215 VOI-SHAN DIV OF VSI CORP
8463 HIGUERA STREET
CULVER CITY, CALIFORNIA 90230

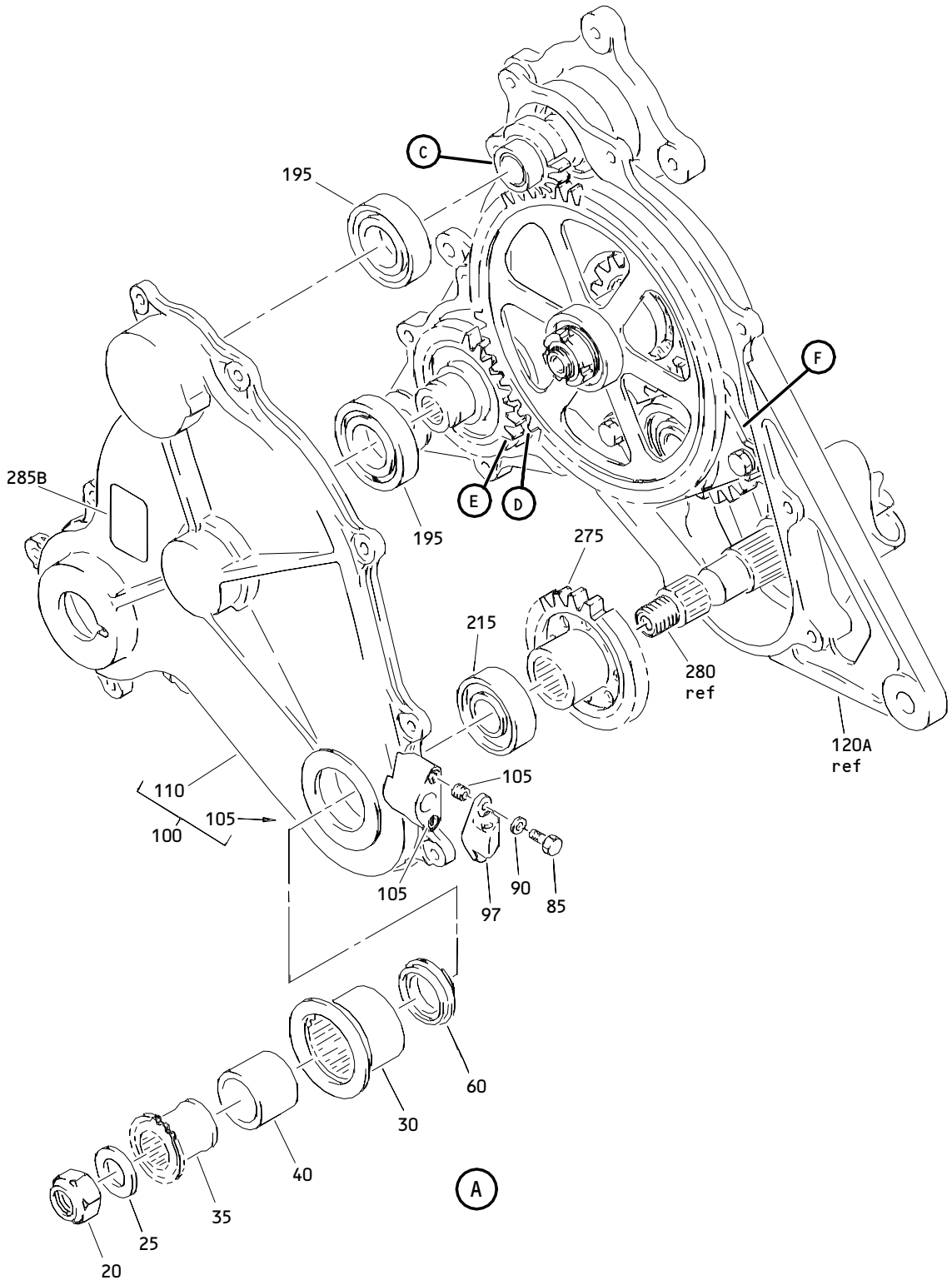
94892 MASTER MACHINE PRODUCTS CORPORATION
2069 RANDOLPH STREET
HUNTINGTON PARK, CALIFORNIA 90255

97393 SHUR-LOK CORPORATION
2541 WHITE ROAD
IRVINE, CALIFORNIA 92713



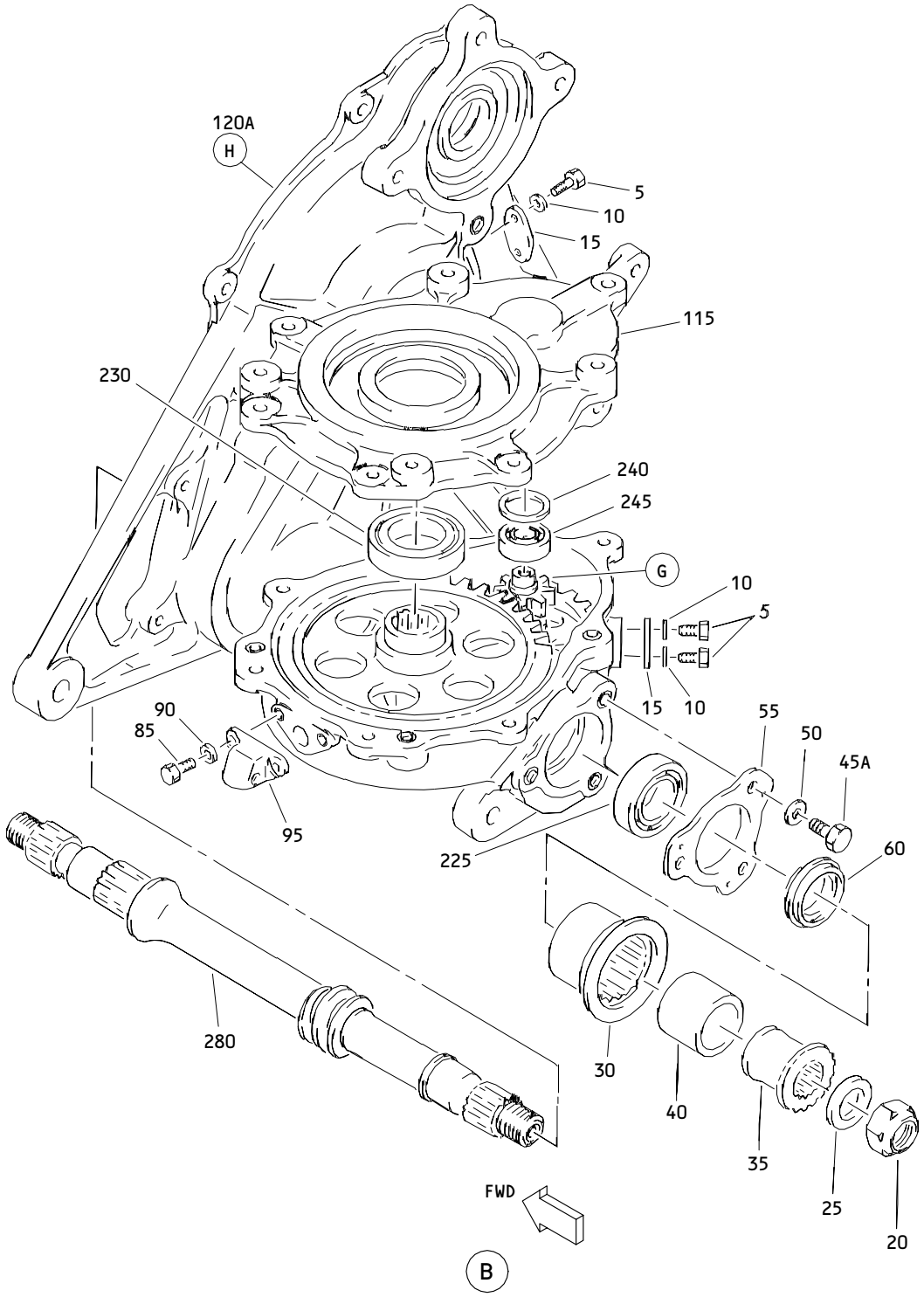
Trailing Edge Flap Drive Power Drive Unit Gearbox Assembly
Figure 1 (Sheet 1)

T59085



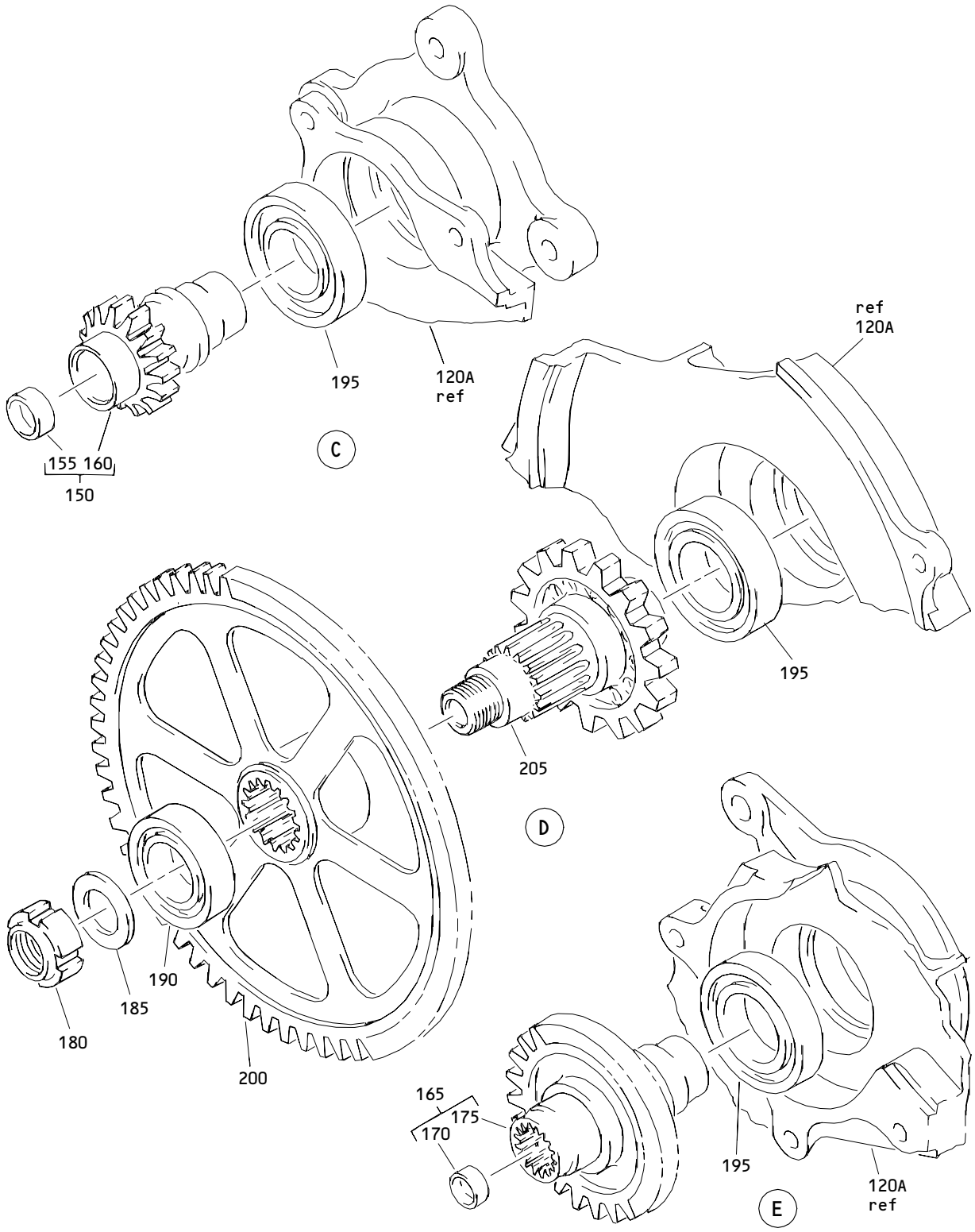
Trailing Edge Flap Drive Power Drive Unit Gearbox Assembly
Figure 1 (Sheet 2)

T55901



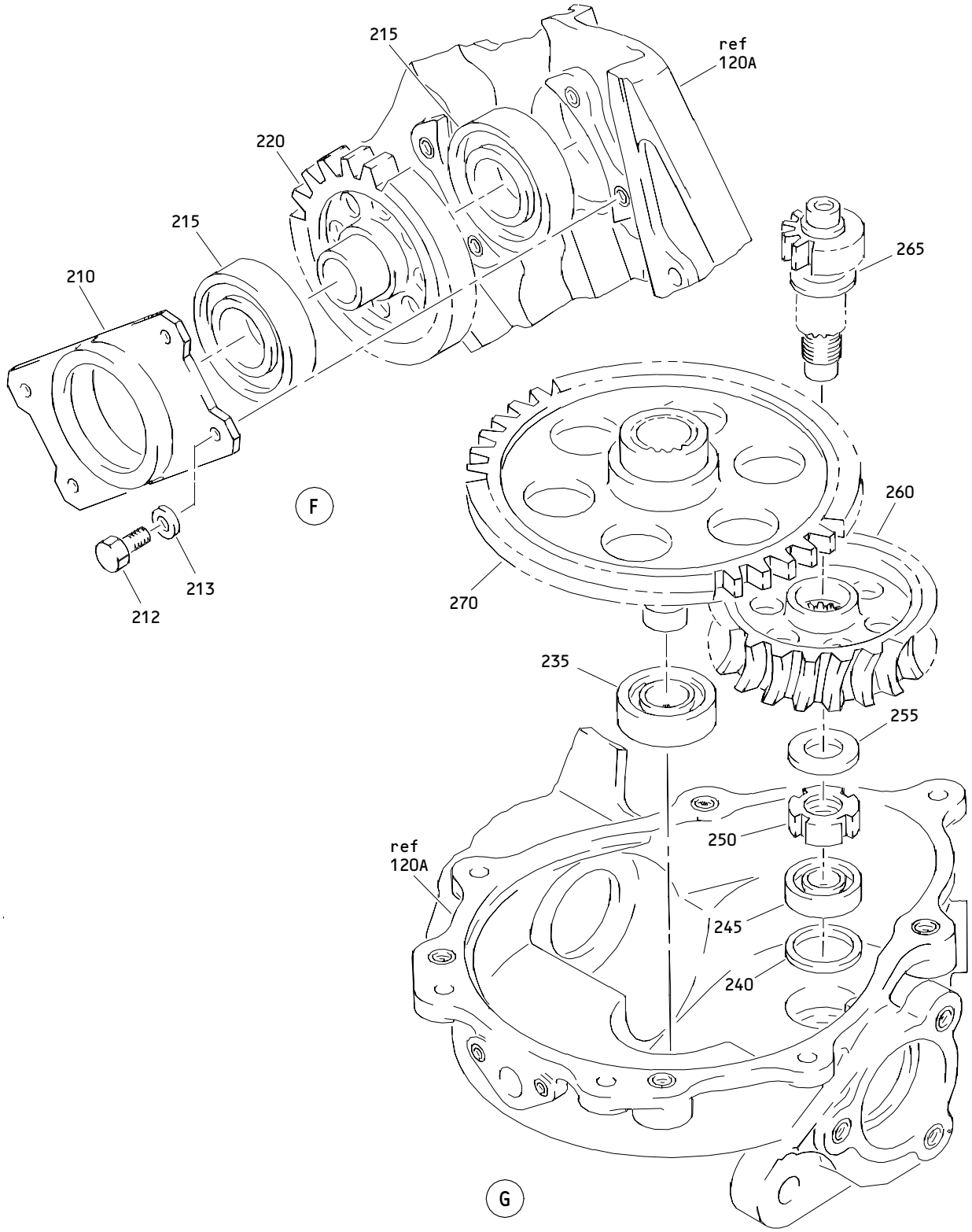
Trailing Edge Flap Drive Power Drive Unit Gearbox Assembly
Figure 1 (Sheet 3)

T55902

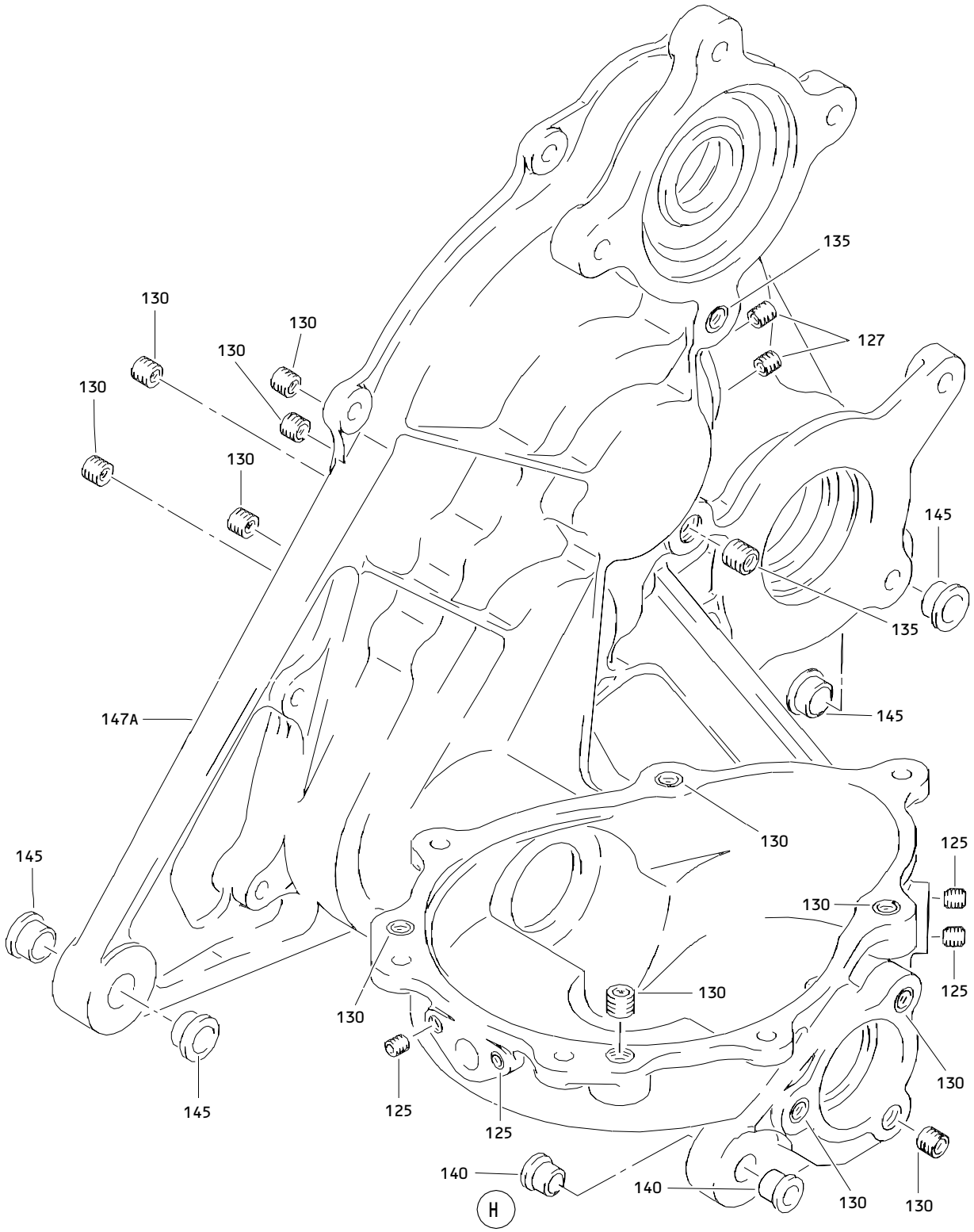


Trailing Edge Flap Drive Power Drive Unit Gearbox Assembly
Figure 1 (Sheet 4)

T55903



Trailing Edge Flap Drive Power Drive Unit Gearbox Assembly
Figure 1 (Sheet 5)



Trailing Edge Flap Drive Power Drive Unit Gearbox Assembly
Figure 1 (Sheet 6)

T59086

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
-1	256T3130-2		DELETED		
-1A	256T3130-4		GEARBOX ASSY-TE FLAP DRIVE PWR DRIVE UNIT (PRE SB 27-0120)	A	RF
-1B	256T3130-5		GEARBOX ASSY-TE FLAP DRIVE PWR DRIVE UNIT (POST SB 27-0120)	B	RF
5	NAS563-15		.BOLT		4
10	AN960PD10		.WASHER		4
15	256T2313-1		.COVER-INSPECTION HOLE		2
20	BRH10-12		.NUT- (V52828) (SPEC BACN10JC12) (OPT BMN4122AD3-12 (V08524)) (OPT BMN4122A12 (V08524)) (OPT H10-12BAC (V15653)) (OPT RMLH9074-12 (V72962)) (OPT 48FT1216 (V56878))		2
25	AN960PD1216		.WASHER		2
30	65B84034-3		.SLEEVE-CPLG		2
35	256T3749-1		.COUPLING HALF		2
40	65B84033-18		.SLEEVE-MOLDED		2
45	NAS564-25		DELETED		3
45A	NAS564-27		.BOLT		3
50	AN960PD416		.WASHER		3
55	256T3131-1		.RETAINER		1
60	256T3132-1		.RETAINER		2
65	NAS6604-9		.BOLT		10
70	NAS6604H11		DELETED		3
70A	NAS564-27		.BOLT		1
72	NAS6604-14		.BOLT		4
73	NAS6604-14		.BOLT		1
75	AN960PD416		.WASHER		31

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
80	BRH10-4		.NUT-		15
			(V52828)		
			(SPEC BACN10JC4)		
			(OPT H10-4BAC		
			(V15653))		
			(OPT NS202101-048		
			(V80539))		
			(OPT RMLH9075-4W		
			(V72962))		
			(OPT T6S428J		
			(V71087))		
			(OPT VN303A048		
			(V92215))		
			(OPT 96-048		
			(V80539))		
85	NAS563-15		.BOLT		4
90	AN960PD10		.WASHER		4
95	256T2633-1		.COVER-DRAIN		1
97	256T2633-1		.COVER-DRAIN	A	1
-97A	256T2633-3		.COVER-DRAIN	B	1
100	256T3113-1		.COVER ASSY		1
105	MS21209F1-15		..INSERT		2
110	256T3113-2		..COVER		1
115	256T3115-1		.COVER-FOLLOWUP		1
120	256T3111-1		DELETED		1
120A	256T3111-3		.HOUSING ASSY		1
125	MS21209F1-15		..INSERT		6
130	MS21209F4-20		..INSERT		12
135	MS21209F5-20		..INSERT		2
140	BACB28AP05P028		..BUSHING-		2
			(V23294)		
			(SPEC BACB28AP05P028)		
			(V70625)		
			(V94892)		
145	BACB28AP07P028		..BUSHING-		4
			(V23294)		
			(SPEC BACB28AP07P028)		
			(V70625)		
			(V94892)		

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
147	256T3111-2		DELETED		1
147A	256T3111-4		..HOUSING		1
150	256T3117-1		.GEAR ASSY	A	1
-150A	256T3117-3		.GEAR ASSY	B	1
155	256T2629-2		..PLUG		1
160	256T3117-2		..GEAR	A	1
-160A	256T3117-4		..GEAR	B	1
165	256T3119-1		.GEAR ASSY	A	1
-165A	256T3119-3		.GEAR ASSY	B	1
170	256T2629-2		..PLUG		1
175	256T3119-2		..GEAR	A	1
-175A	256T3119-4		..GEAR	B	1
180	SL2822-12		.NUT- (V97393) (SPEC BACN10RF12) (OPT BR9080-12 (V72962))		1
185	AN960PD1216		.WASHER		1
190	LL105KS		.BEARING- (V38443) (SPEC BACB10BA25PP) (OPT 6005TT (V43991)) (OPT 9105LLT1C1-01 (V21760)) (OPT 9105NPPFS428 (V21335)) (OPT 993L05 (V29337))		1
195	LL106KS		.BEARING- (V38443) (SPEC BACB10BA30PP) (OPT 6006TT (V43991)) (OPT 9106LLT1C1-01 (V21760)) (OPT 9106NPPFS428 (V21335)) (OPT 993L06 (V29337))		5

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
200	256T3120-1		.GEAR	A	1
-200A	256T3120-2		.GEAR	B	1
205	256T3121-1		.SHAFT-GEAR	A	1
-205A	256T3121-2		.SHAFT-GEAR	B	1
210	256T3129-1		.HOUSING-BRG		1
212	NAS564-29		.BOLT		4
213	AN960PD416		.WASHER		4
215	1205LLT1C1-01		.BEARING- (V21760) (SPEC BACB10AZ25PP) (OPT 205NPPFS428 (V21335)) (OPT 205TT (V43991)) (OPT 99205 (V29337))		3
220	256T3122-1		.GEAR	A	1
-220A	256T3122-2		.GEAR	B	1
225	LL105KS		.BEARING- (V38443) (REFER TO ITEM 190 FOR OPTIONAL PARTS)		1
230	1907RRT1C1-01		.BEARING- (V21760) (SPEC BACB10BB35PP) (OPT 9307PPPRBFS428 (V21335))		1
235	LL103KS		.BEARING- (V38443) (SPEC BACB10BA17PP) (OPT 6003TT (V43991)) (OPT 9103LLT1C1-01 (V21760)) (OPT 9103NPPFS428 (V21335)) (OPT 993L03 (V29337))		1
240	256T2631-1		.SHIM		AR
-240A	256T2631-2		.SHIM		AR

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
-240B	256T2631-3		.SHIM		AR
-240C	256T2631-4		.SHIM		AR
-240D	256T2631-5		.SHIM		AR
-240E	256T2631-6		.SHIM		AR
245	LL101KS		.BEARING- (V38443) (SPEC BACB10BA12PP) (OPT 6001FTT (V43991)) (OPT 9101LLT1C1-01 (V21760)) (OPT 9101NPPFS428 (V21335)) (OPT 993L01 (V29337))		2
250	SL2822-10		.NUT- (V97393) (SPEC BACN10RF10) (OPT BR9080-10 (V72962))		1
255	AN960PD1016		.WASHER		1
260	256T3126-1		.GEAR-FOLLOWUP WORM		1
265	256T3127-1		.SHAFT-FOLLOWUP GEAR		1
270	256T3128-1		.GEAR-FOLLOWUP		1
275	256T3124-1		.GEAR	A	1
-275A	256T3124-2		.GEAR	B	1
280	256T3125-1		.SHAFT-OUTPUT		1
285	256T2635-3		DELETED		1
285A	256T2635-4		DELETED		1
285B	256T2635-6		.NAMEPLATE	A	1
-285C	256T2635-7		.NAMEPLATE	B	1