TO: ALL HOLDERS OF AUTOTHROTTLE GEARBOX ASSEMBLY COMPONENT MAINTENANCE MANUAL 22-32-31

REVISION NO. 11 DATED JUL 01/05

HIGHLIGHTS

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

CHAPTER/SECTION AND PAGE NO.	DESCRIPTION OF CHANGE
REPAIR 2-1 601 REPAIR 3-1 601 REPAIR 6-1 601 REPAIR 7-1 601	Added information to REPAIR 2-1, 3-1, 6-1 and 7-1.

BOEING

COMPONENT
MAINTENANCE MANUAL

AUTOTHROTTLE GEARBOX ASSEMBLY

PART NUMBERS 015T1017-3
253T7114-1,-3

COMPONENT MAINTENANCE MANUAL
WITH
ILLUSTRATED PARTS LIST

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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

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TEMPORARY REVISION AND SERVICE BULLETIN RECORD

BOEING SERVICE BULLETIN	BOEING TEMPORARY REVISION	OTHER DIRECTIVE	DATE OF INCORPORATION INTO MANUAL
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COMPONENT
MAINTENANCE MANUAL

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BOEING
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MAINTENANCE MANUAL

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 May 26/82
Assembly May 26/82

AUTOTHROTTLE GEARBOX ASSEMBLY

DESCRIPTION AND OPERATION

1. The autothrottle gearbox assembly consists of an aluminum bronze worm gear, a nitralloy servo worm and shaft contained in an aluminum alloy housing.

2. The gearbox transmits mechanical output from servomotor-generator to the clutch pack assembly in the autothrottle assembly when the autothrottle is engaged.

3. Leading Particulars (Approximate)

   Length -- 5 inches
   Width -- 2 inches
   Height -- 5 inches
   Weight -- 3 pounds
   Reduction Ratio -- 367 to 1

DISASSEMBLY

1. Remove pin (5, IPL Fig. 1) and nut (10) from gear (20).

2. Remove screws (30), washers (35), and placard assembly (22).

3. Remove cover assembly (25) and shim (15).

   NOTE: Do not remove bearing (40) from cover (45) unless necessary for repair or replacement.

4. Remove shim (15), ring (100) and bearing (102) from gear (20). Note thickness of shim (15) to facilitate assembly.

5. Remove gear (20) from housing assembly (75).

6. Remove screws (55), washers (60) and remove end cap (50) and shim (65). Note thickness of shim (65) to facilitate assembly.

7. Remove worm (140) and attached bearings (135) from housing assembly (75). Remove bearings (135) from worm (140).

8. Remove screws (70) and retainer (95) and pull shaft assembly (105) out of housing assembly (75). Remove bearing (130) from shaft assembly (105).

   NOTE: Do not disassemble shaft assembly (105) unless repair or replacement is necessary.

CLEANING

1. Clean all parts except bearings (40, 102, 110, 130, 135, IPL Fig. 1) using standard industry practices and information contained in 20-30-03.

2. Clean teflon sealed bearings (40, 102, 110, 130) and bearings (135) according to manufacturer's instructions.

CHECK

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

2. Magnetic particle check per 20-20-01 -- Nut (10, IPL Fig. 1), shaft (125), worm (140).

3. Penetrant check per 20-20-02 -- Gear (20), cover (45), cap (50), housing (90), retainer (95).

REPAIR - GENERAL

1. Content

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

P/N	NAME	REPAIR
253T7114-2	SHAFT	1-1
253T7115	WORM, SERVO	2-1
253T7116	SHAFT, INPUT	3-1
253T7117	HOUSING	4-1
253T7118	CAP, END	5-1
65-42139	COVER, END	6-1
65-42662	WORM GEAR	7-1
- -	MISC PARTS REFINISH	8-1

2. Standard Practices

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

20-30-02 Stripping of Protective Finishes
20-41-01 Decoding Table for Boeing Finish Codes
20-42-05 Bright Cadmium Plating
20-43-01 Chromic Acid Anodizing

3. Materials

NOTE: Equivalent substitutes may be used.

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

4. Dimensioning Symbols

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

—	STRAIGHTNESS
▱	FLATNESS
⊥	PERPENDICULARITY (OR SQUARENESS)
//	PARALLELISM
○	ROUNDNESS
⌭	CYLINDRICITY
⌒	PROFILE OF A LINE
⌓	PROFILE OF A SURFACE
◎	CONCENTRICITY
⌯	SYMMETRY
∠	ANGULARITY
↗	RUNOUT
⌖	THEORETICAL EXACT POSITION OF A FEATURE (TRUE POSITION)
∅	DIAMETER
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)
Ⓢ	REGARDLESS OF FEATURE SIZE (RFS)
Ⓟ	PROJECTED TOLERANCE ZONE

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 IN RELATION 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 (FULL INDICATOR MOVEMENT)
⌯ 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 IN RELATION 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

True Position Dimensioning Symbols
Figure 601

SHAFT ASSEMBLY - REPAIR 1-1

253T7114-2

1. Bearing Replacement (IPL Fig. 1)

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

   A. Remove ring (115) and bearing (110) from shaft (125).

   B. Install new bearing per 20-50-03.

   C. Install new ring and anvil swage per 20-50-03 using swaging tool ST933-100-625.

SERVO WORM - REPAIR 2-1

253T7115-1

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

1. Servo Worm Repair

A. Procedure (Fig. 601)

(1) Repair the servo worm (140):

(a) Machine the worn or damaged servo worm (140) as necessary to remove defects, cracks and corrosion as shown in SOPM 20-10-02. Do not machine more than the repair limit.

(b) Do a magnetic particle check of the servo worm (140) as shown in SOPM 20-20-01.

(c) Chrome plate the servo worm (140), as shown in SOPM 20-42-03.

(d) Machine grind the servo worm (140), as shown in SOPM 20-10-04, to the design diameter. See Fig. 601.

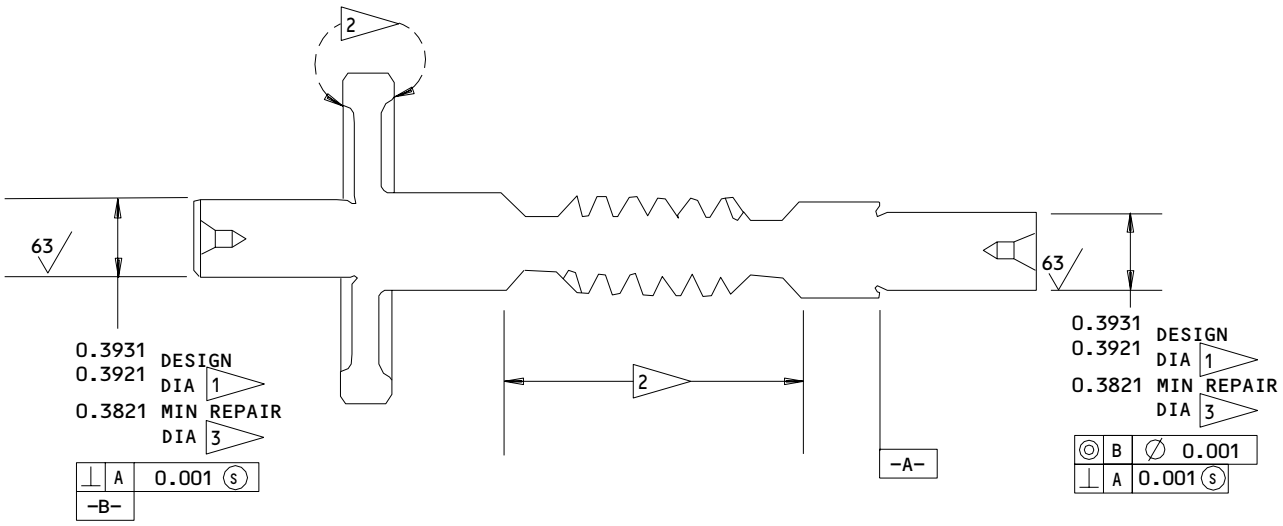
(e) Put a finish on the servo worm (140) as shown below.

2. Servo Worm Refinish

A. Procedure (Fig. 601)

(1) Refinish the servo worm (140).

(a) Cadmium plate (F-15.02), 0.0002-0.003 inch thick, as shown in Fig. 601.



REFINISH

CADMIUM PLATE (F-15.02) 0.0002-0.0003 THICK, ALL OVER EXCEPT AS NOTED

1 DIMENSIONS AFTER PLATING

2 NITRIDE THIS SURFACE ONLY. DO NOT PLATE

3 BUILD UP WITH CHROME PLATE AND GRIND TO DIMENSION AND FINISH SHOWN. CHROME PLATE RUNOUT 0.00-0.08. STOP CHROME PLATE 0.00-0.02 FROM FILLET RADIUS OR EDGE

REPAIR

REF 3

MATERIAL: NITRALLOY 135 MOD PER MIL-S-6709, NITRIDE 0.002-0.004 CASE DEPTH CORE STRENGTH 150-200 KSI

ALL DIMENSIONS ARE IN INCHES

253T7115-1
Servo Worm Refinish
Figure 601

2273

SHAFT, INPUT - REPAIR 3-1

253T7116-1

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

1. Input Shaft Repair

A. Procedure (Fig. 601)

(1) Repair the input shaft (125):

(a) Machine the worn or damaged input shaft (125) as necessary to remove defects, cracks and corrosion as shown in SOPM 20-10-02. Do not machine more than the repair limit.

(b) Do a magnetic particle check of the input shaft (125), as shown in SOPM 20-20-01.

(c) Chrome plate the input shaft (125), as shown in SOPM 20-42-03.

(d) Machine grind the input shaft (125), as shown in SOPM 20-10-04, to the design diameter. See Fig. 601.

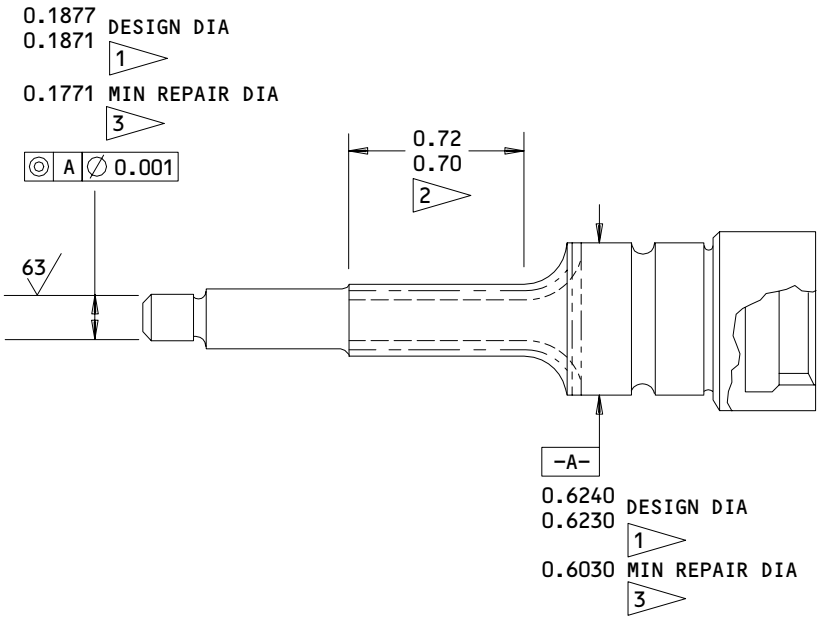
(e) Put a finish on the input shaft (125), as shown below.

2. Input Shaft Refinish

A. Procedure (Fig. 601)

(1) Refinish the input shaft (125):

(a) Cadmium plate (F-15.02), 0.0002-0.0004 inch thick, as shown in Fig. 601.



REFINISH

CADMIUM PLATE (F-15.02) 0.0002-0.0003 THICK EXCEPT AS NOTED

1 DIMENSIONS APPLY AFTER PLATING

2 NITRIDE ONLY. NO PLATING THIS SURFACE

3 BUILD UP WITH CHROME PLATE AND GRIND TO DIMENSION AND FINISH SHOWN. CHROME PLATE RUN OUT 0.00-0.08. STOP CHROME PLATE 0.00-0.02 FROM FILLET RADIUS OR EDGE

REPAIR

REF 3

MATERIAL: NITRALLOY 135 MOD
PER MIL-S-6709, NITRIDE
0.002-0.004 CASE DEPTH
CORE STRENGTH 150-200 KSI

ALL DIMENSIONS ARE IN INCHES

Input Shaft Repair
Figure 601

2274

HOUSING - REPAIR 4-1

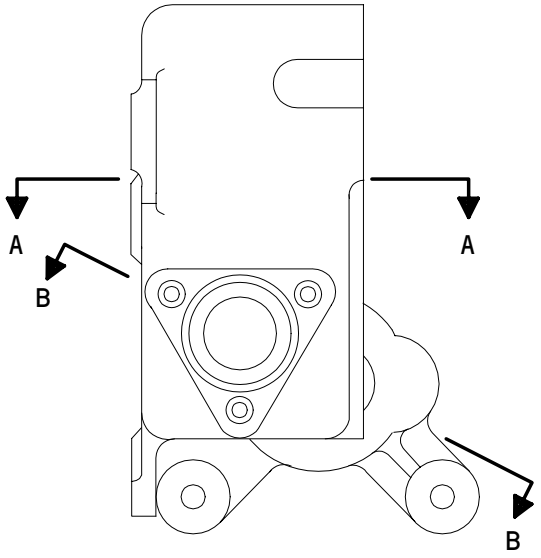
253T7117-1

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

A. Repair (Fig. 601)

B. Machine bearing bores as required, within repair limit shown to remove defects.

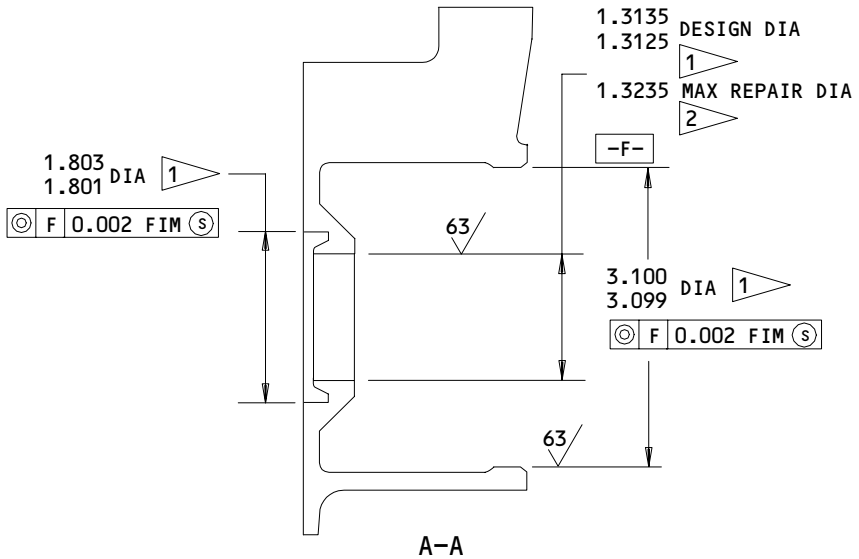
C. Chrome plate buildup repaired surface and grind to dimension and finish shown.



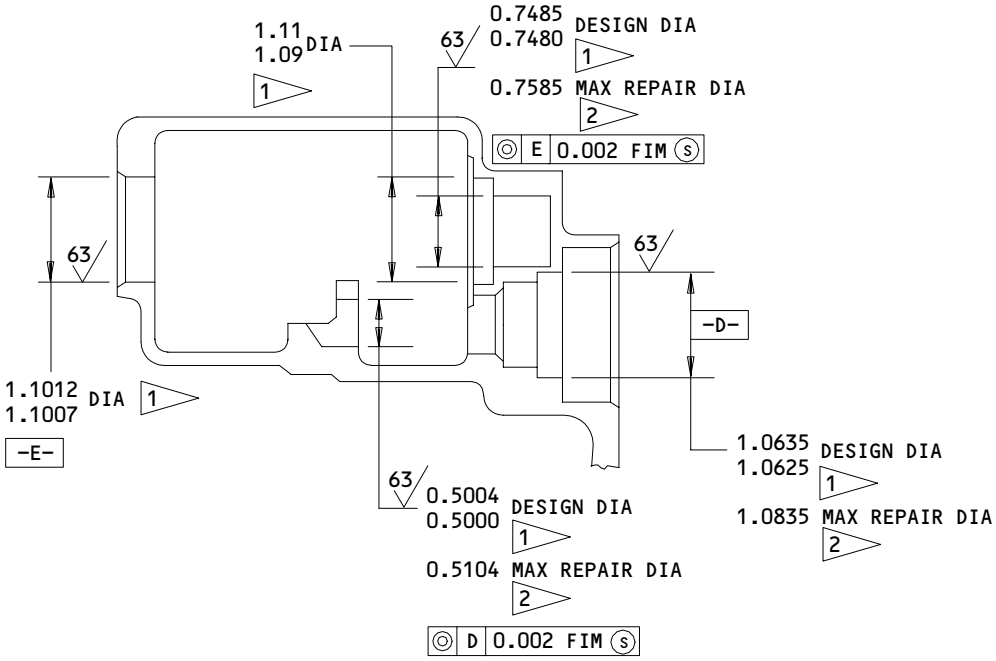
253T7117-1

Housing Repair
Figure 601 (Sheet 1)

2277



A-A



B-B
(ROTATED 60° CLOCKWISE)

REFINISH

ANODIZE (F-17.05) AND APPLY ONE COAT OF BMS 10-11, TYPE 1 PRIMER (F-20.02) EXCEPT AS NOTED

1 NO PRIMER THIS SURFACE

2 BUILD UP WITH CHROME PLATE AND GRIND TO DIMENSION AND FINISH SHOWN. CHROME PLATE RUNOUT 0.00-0.08. STOP CHROME PLATE 0.00-0.02 FROM FILLET RADIUS OR EDGE

REPAIR

REF 2

MATERIAL: AL ALLOY

ALL DIMENSIONS ARE IN INCHES

253T7117-1

Housing Repair
Figure 601 (Sheet 2)

2279

CAP, END - REPAIR 5-1

253T7118-1

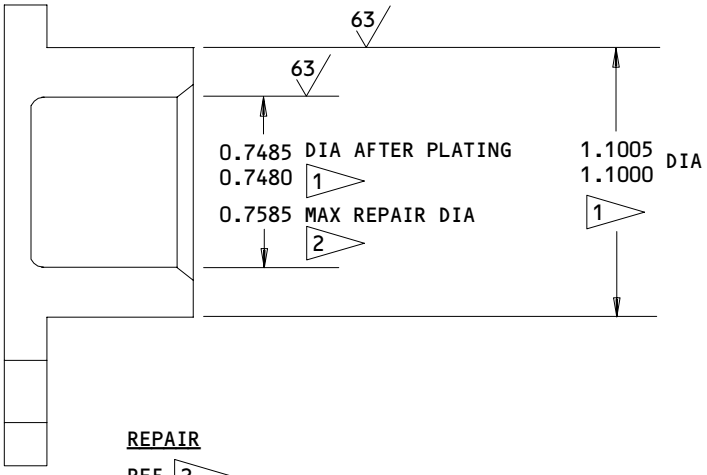
1. Repair (Fig. 601)

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

   B. Chrome plate buildup repaired surface and grind to dimension and finish shown.

2. Refinish (Fig. 601)

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



REFINISH

CHROMIC ACID ANODIZE AND APPLY ONE COAT OF BMS 10-11, TYPE 1 PRIMER (F-18.13) EXCEPT OMIT PRIMER ON AREAS NOTED BY 1

1 NO PRIMER THIS SURFACE

2 BUILD UP WITH CHROME PLATE AND GRIND TO DIMENSION AND FINISH SHOWN. CHROME PLATE RUNOUT 0.00-0.08. STOP CHROME PLATE 0.00-0.02 FROM FILLET RADIUS OR EDGE

REPAIR

REF 2

MATERIAL: AL ALLOY

ALL DIMENSIONS ARE IN INCHES

253T7118-1
End Cap Repair
Figure 601

2281

COVER ASSEMBLY, END - REPAIR 6-1

65-42139-1

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

1. End Cover Repair

A. Procedure (Fig. 601)

(1) Repair the end cover (45):

(a) Machine the worn or damaged bearing hole as necessary to remove defects, cracks and corrosion. Do not machine more than the repair limit.

(b) Do a penetrant check of the end cover (45) as shown in SOPM 20-20-02.

(c) Chrome plate the bearing hole.

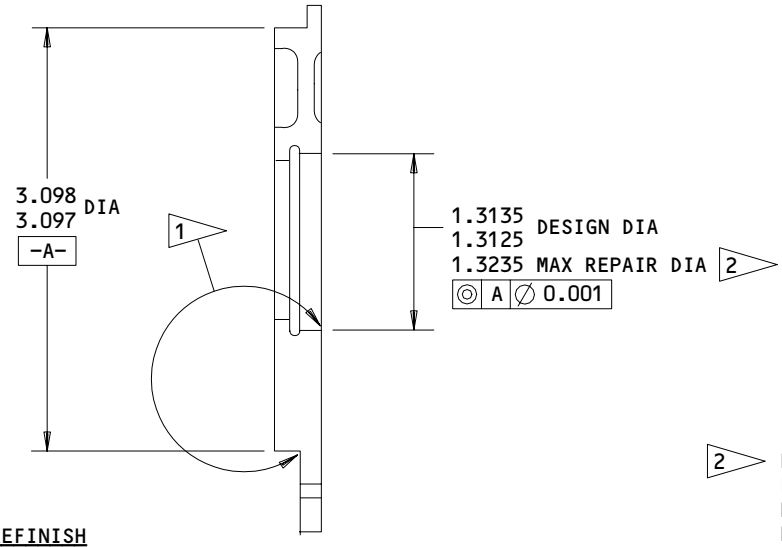
(d) Machine grind the bearing hole to the design dimensions and finish, as shown in Fig. 601.

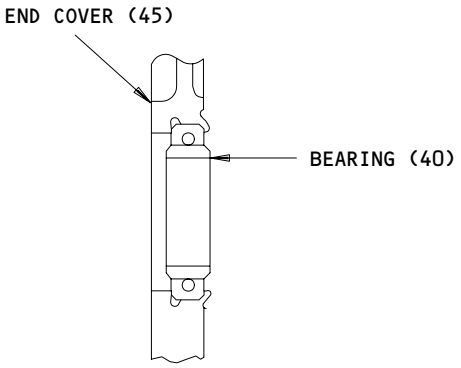
2. End Cover Refinish

A. Procedure (Fig. 601)

(1) Chromic acid anodize or sulfuric acid anodize (F-2.20) all over.

(2) Apply one layer of BMS 10-11, Type 1 primer (SRF-12.205), as shown in Fig. 601.





REFINISH

ANODIZE (F-2.20) AND APPLY ONE COAT OF BMS 10-11, TYPE 1 PRIMER (SRF-12.205) EXCEPT AS NOTED

1 NO PRIMER THESE SURFACES

2 BUILD UP WITH CHROME PLATE AND GRIND TO DIMENSION AND FINISH SHOWN. CHROME PLATE RUNOUT 0.00-0.08. STOP CHROME PLATE 0.00-0.02 FROM FILLET RADIUS OR EDGE

REPAIR

REF 2

MATERIAL: AL ALLOY

ALL DIMENSIONS ARE IN INCHES

End Cover Repair
Figure 601

2283

WORM GEAR - REPAIR - 7-1

65-42662-1

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

1. Servo Worm Repair

A. Procedure (Fig. 601)

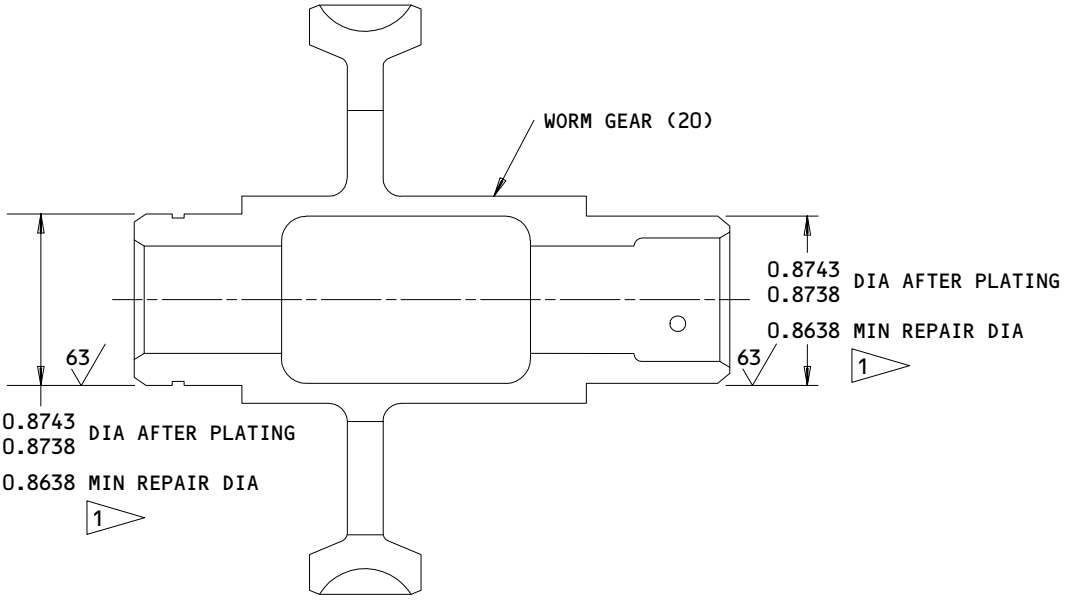
(1) Repair the worm gear (20):

(a) Machine the worn or damaged worm gear (20) as necessary to remove defects, cracks and corrosion as shown in SOPM 20-10-02. Do not machine more than the repair limit.

(b) Do a magnetic particle check of the worm gear (20), as shown in SOPM 20-20-01.

(c) Chrome plate the worm gear (20), as shown in SOPM 20-42-03.

(d) Machine grind the worm gear (20), as shown in SOPM 20-10-04, to the design diameter. See Fig. 601.



REPAIR

REF 1

MATERIAL: AL BRONZE

ALL DIMENSIONS ARE IN INCHES

1 BUILD UP WITH CHROME PLATE AND GRIND TO DIMENSION AND FINISH SHOWN.

65-42662-1
Worm Gear Repair
Figure 601

130937

MISC PARTS REFINISH - REPAIR 8-1

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

IPL FIG. & ITEM	MATERIAL	FINISH
Fig. 1		
Nut (10)	4130 Steel, 125-145 ksi	Cadmium plate (F-1.1913).
Plate (23)	Al alloy	Chromic acid anodize and apply 1 coat of BMS 10-11, type 1 primer (F-18.13).
Retainer (95)	Al alloy	Chromic acid anodize and apply 1 coat of BMS 10-11, type 1 primer (F-18.13).

Refinish Details
Figure 601

ASSEMBLY

1. Material and Equipment

NOTE: Equivalent substitutes may be used.

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

B. Mounting dimension checking tool -- Part number A22004-1

2. Assembly (IPL Fig. 1, Fig. 701)

A. Apply liberal amount of grease to all gear teeth and threads of worm.

B. Determine shim (15) thickness using mounting dimension checking tool part number A22004-1.

C. Install bearing (130) on shaft assembly (105) and install shaft assembly in housing assembly (75). Install bearing retainer (95) on housing assembly (75) and secure with screws (70).

D. Install worm (140) as follows:

(1) Install bearing (135) in housing assembly (75).

(2) Install worm (140) in shaft race of previously installed bearing (135) in housing assembly (75).

NOTE: It may be necessary to separate bearing (135) to three pieces (a shaft race, balls with retainer, and thrust race) in order to install worm (140) in housing assembly (75). If bearing (135) cannot be separated, do not use this type of bearing. Some bearings with same part number cannot be separated. Install shaft race of bearing (135) in housing assembly (75). Install race and balls of bearing (135) on worm (140).

(3) Mate spur gear teeth of worm (140) and shaft assembly (105).

(4) Install the other bearing (135) on worm (140).

(5) Position end cap (50) on bearing (135) and check gap between end cap (50) and housing assembly (75) with a feeler gage.

(6) Adjust shim (65) to the measured gap or less by peeling.

(7) Install shim (65) and end cap (50) on housing assembly (75) and secure with screws (55), washers (60). Maximum axial movement of worm (140) must be less than 0.0033 inch.

NOTE: Use of the same shim thickness as noted during disassembly may eliminate the need for further adjustment.

E. Install gear (20) in housing assembly (75) while meshing gear teeth with threads on worm (140), then seat bearing (102) on gear (20) and in housing assembly (75). Install ring (100) on gear (20).

F. Peel off laminations of shim (15) to achieve correct shim thickness, as determined in par. 2.B, required to locate gear (20) at mounting dimension shown in Fig. 701. Install shim (15), cover assembly (25), and placard assembly (22) on housing assembly with screws (30) and washers (35).

NOTE: Use same shim thickness as noted during disassembly. Shim thickness may be correct and eliminate need for further adjustment.

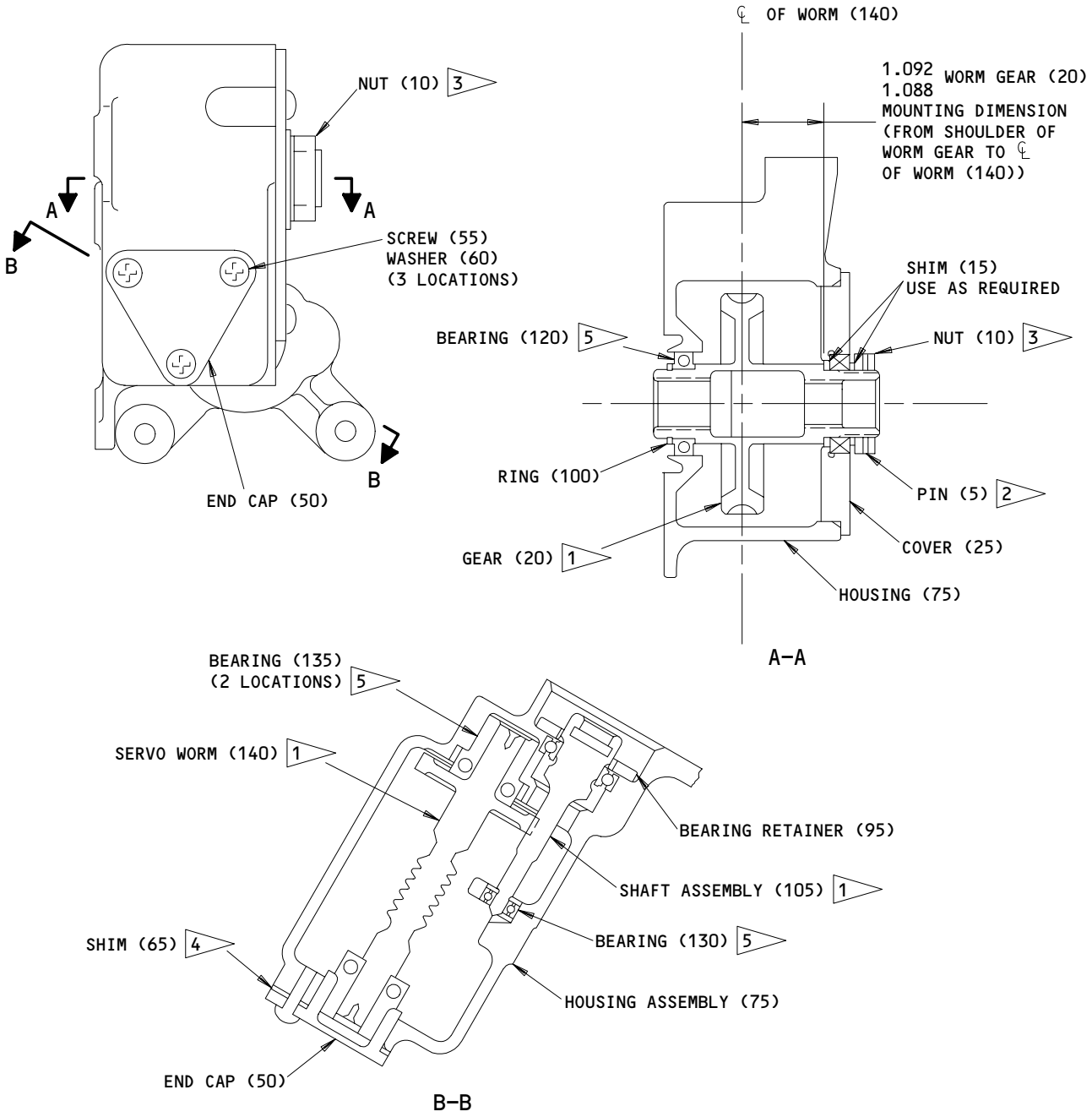
G. Install nut (10) and tighten to 100-200 lb-in. Align holes in nut with holes in gear (20) using shim (15) and install pin (5). Point stake pin flush to 0.03 inch below nut with a single point stake on the edge of hole.

H. Check that the assembly operates smoothly without chatter when operating in either direction.

I. Turn input shaft (105) manually at least 367 revolutions in both directions (clockwise and counterclockwise) in order to obtain at least one full revolution of the worm gear (20). Check that there is no binding or rough operation.

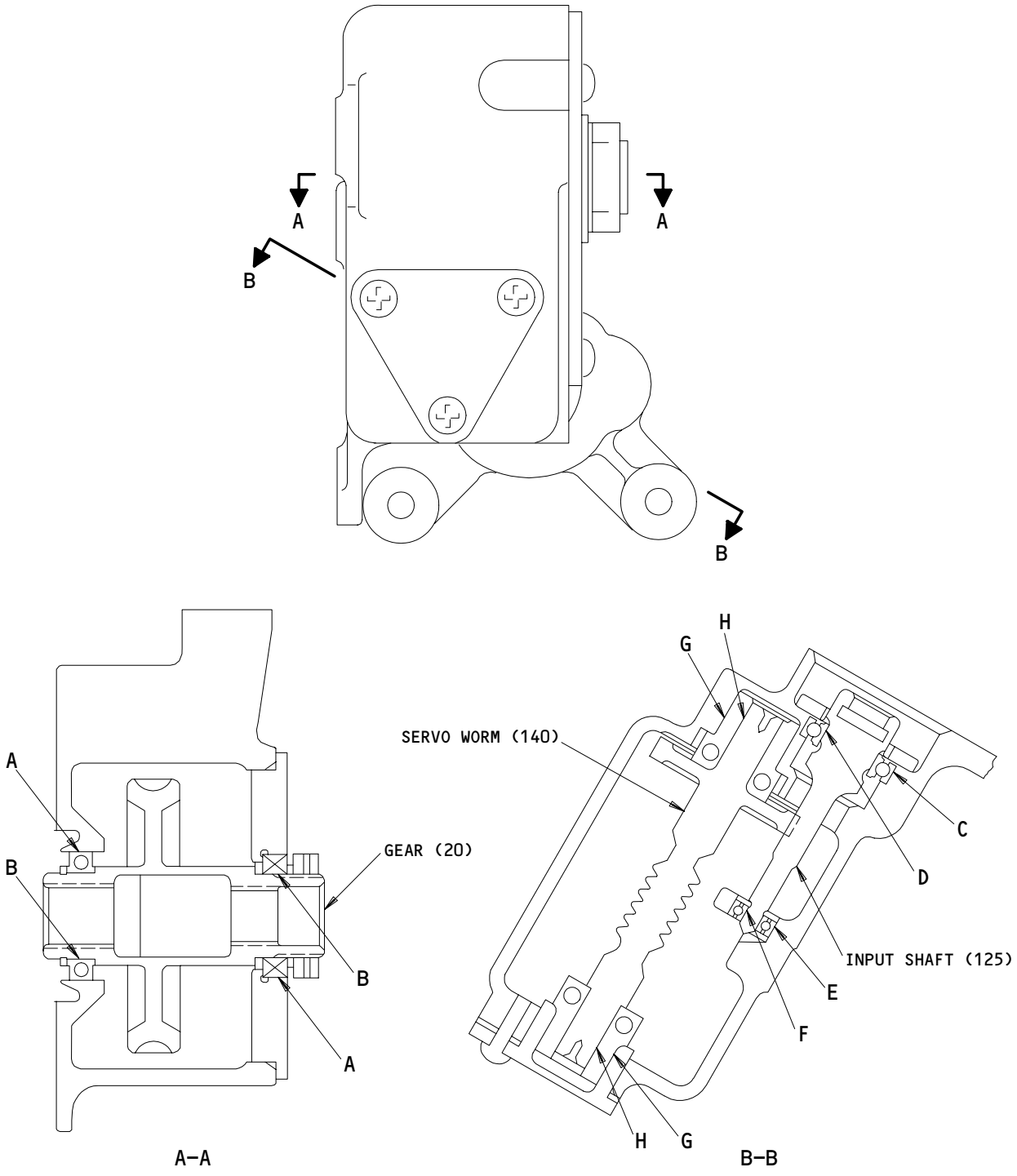
J. With worm gear (20) held, backlash measured at input shaft (125) must not exceed 95°.

3. Prepare and store component in accordance with standard industry practices.



1. LUBRICATE LIBERALLY WITH MIL-G-23827 GREASE PER 20-50-07.
2. POINT STAKE FLUSH TO 0.03 IN. BELOW NUT (10) WITH A SINGLE POINT STAKE ON THE EDGE OF THE HOLE.
3. TIGHTEN NUT (10) TO 100-200 LB-IN.
4. SHIM END CAP (50) USING SHIM (65) AS REQUIRED TO LIMIT MOVEMENT TO 0.0033 IN. MAXIMUM.
5. INSTALL PER 20-50-03.

Autothrottle Gearbox Assembly
Figure 701



Fits and Clearances
Figure 801 (Sheet 1)

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 45,75 OD 40,102	1.3125 1.3120	1.3135 1.3125	0.0000	0.0015	1.3110	1.3145	0.0035
B	ID 40,102 OD 20	0.8745 0.8738	0.8750 0.8743	0.0002	0.0012	0.8728	0.8760	0.0032
C	ID 75 OD 110	1.0625 1.0615	1.0635 1.0625	0.0000	0.0020	1.0605	1.0645	0.0040
D	ID 110 OD 125	0.6243 0.6230	0.6257 0.6240	0.0003	0.0027	0.6220	0.6267	0.0047
E	ID 75 OD 130	0.5000 0.4996	0.5004 0.5000	0.0000	0.0008	0.4986	0.5014	0.0028
F	ID 130 OD 125	0.1872 0.1871	0.1875 0.1877	−0.0005 [1]	0.0004	0.1861	0.1885	0.0024
G	ID 50,75 OD 135	0.7480 0.7476	0.7485 0.7480	0.0000	0.0009	0.7466	0.7495	0.0029
H	ID 135 OD 140	0.3933 0.3921	0.3937 0.3931	0.0002	0.0016	0.3911	0.3947	0.0036

[1] NEGATIVE VALUES DENOTE INTERFERENCE FIT

ALL DIMENSIONS ARE IN INCHES

Fits and Clearances
Figure 801 (Sheet 2)

59435

FOR TORQUE VALUES OF STANDARD FASTENERS, REFER TO 20-50-01			
ITEM NO. IPL FIG. 1	NAME	TORQUE	
		POUND-INCHES	POUND-FEET
10	NUT	100 - 200	

Torque Table
Figure 802

59436

SPECIAL TOOLS, FIXTURE, AND EQUIPMENT

NOTE: Equivalent substitutes may be used.

A. Part Number ST933-100-625 -- Swaging tool

B. Part Number A22004-1 -- Mounting dimension checking tool

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

S0352 NIPPON MINATURE BRG CO LTD
TOKYO, JAPAN

08073 MAMCO MANUFACTURING CO INC
1411 NORTHWEST 50TH
SEATTLE, WASHINGTON 98107-5123

15805 FLUOROCARBON CO SEATTLE DIV
3711 SO HUDSON STREET PO BOX 18319
SEATTLE, WASHINGTON 98118-1919

21335 TORRINGTON CO FAFNIR BEARING DIV
59 FIELD STREET
TORRINGTON, CONNECTICUT 06790-4942

21760 SCHATZ MANUFACTURING CO
FAIRVIEW AVENUE PO BOX 1191
POUGHKEEPSIE, NEW YORK 12601

27737 INA BEARING COMPANY INC
1 INA DRIVE
CHERAW, SOUTH CAROLINA 29520

29337 HOOVER UNIVERSAL INC BALL AND ROLLER DIV
RT 10 PENDLEY ROAD PO BOX 899
CUMMING, GEORGIA 30130-8671

30163 VALENTEC DAYRON INC
333 MAGUIRE BLVD PO BOX 140394
ORLANDO, FLORIDA 32814-0394

38443 TRW INC BEARING DIV
402 CHANDLER STREET
JAMESTOWN, NEW YORK 14701-3802

43991 FAG BEARING INCORPORATED
118 HAMILTON AVENUE
STAMFORD, CONNECTICUT 06904

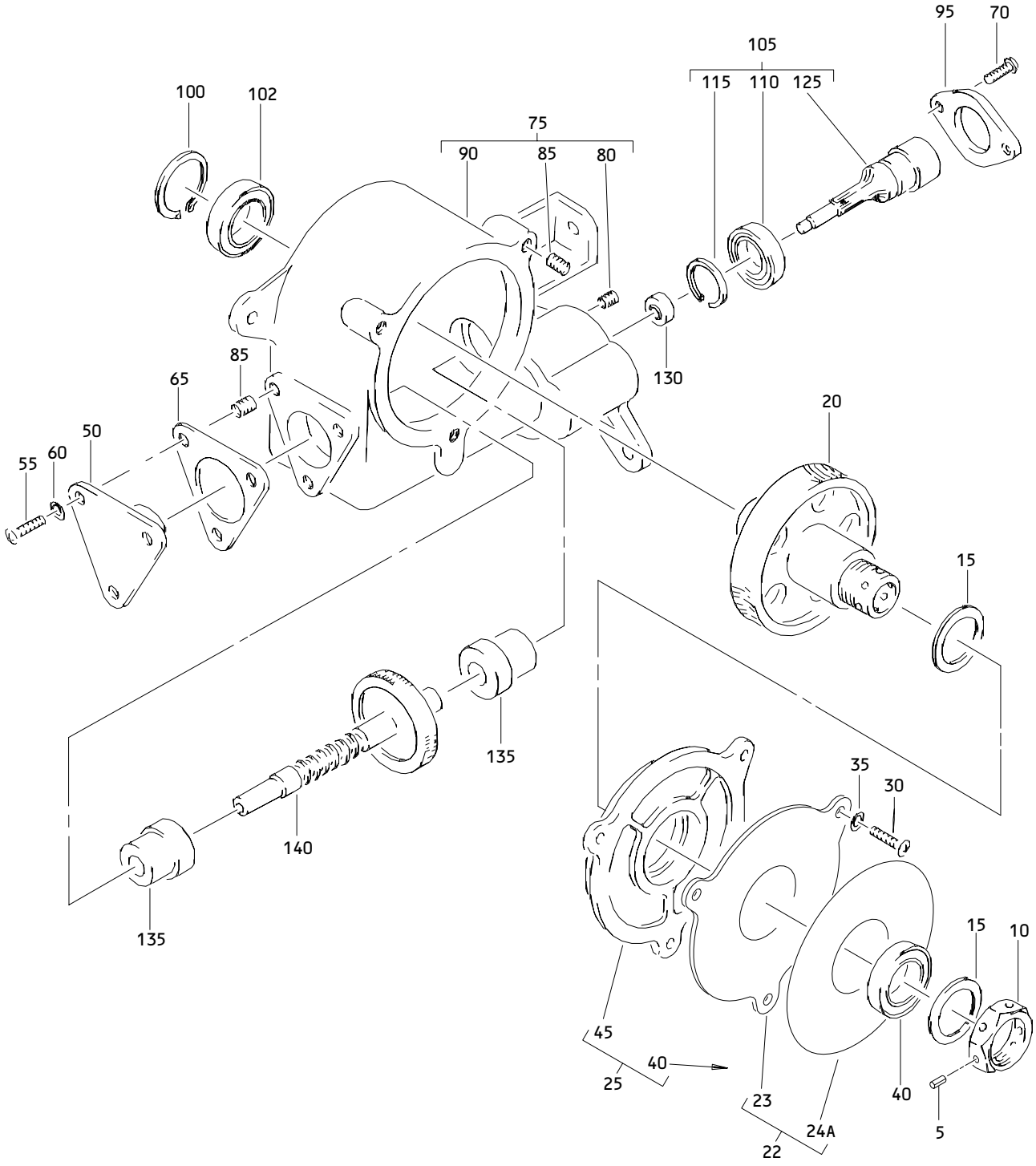
VENDORS

50294 NEW HAMPSHIRE BALL BEARINGS INC
9730 INDEPENDENCE AVENUE PO BOX 2515
CHATSWORTH, CALIFORNIA 91311-4323

53268 SCHATZ MFG CO SEE SCHATZ FEDERAL BRG CO INC V21760

PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
AN960PD10L		1	35	3
		1	60	3
BACB10AS14		1	40	1
		1	102	1
BACB10AT3MM		1	130	1
BACB10CF10PP		1	110	1
BACR12Y75		1	115	1
BACS13W2CN3		1	80	2
BACS13W3CN4		1	85	6
BAC27TCT0442		1	24A	1
B538-2TS		1	110	1
B538DD		1	110	1
B538DDFS428		1	110	1
B538SSG27		1	110	1
LLMB540		1	40	1
		1	102	1
LLR3N		1	130A	1
		1	102	1
MB540DDFS428		1	40	1
		1	102	1
MB540DDG20		1	40	1
		1	102	1
MB540TT		1	40	1
		1	102	1
MB540ZZ		1	40A	1
		1	102A	1
MS16562-1		1	5	1
MS16624-1087		1	100	1
NAS514P832-7P		1	70	2
NAS603-8		1	30	3
		1	55	3
NKX10ZTN		1	135	2
R3FF1L1-01		1	130	1
R3LL		1	130A	1
R3NFFM		1	130	1
R3PP		1	130	1
R3RRT1L1-01		1	130A	1
R3TT		1	130A	1
R3ZZ		1	130	1
015T1017-3		1	1B	RF
253T7114-1		1	1	RF
253T7114-2		1	105	1

PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
253T7114-3		1	1A	RF
253T7115-1		1	140	1
253T7116-1		1	125	1
253T7117-1		1	90	1
253T7117-3		1	75	1
253T7118-1		1	50	1
253T7119-1		1	65	1
253T7120-1		1	95	1
253T7126-1		1	22	1
253T7126-2		1	23	1
33KDD5FS160		1	130	1
33PP5FS428		1	130A	1
65-42139-1		1	25	1
65-42139-2		1	45	1
65-42662-1		1	20	1
66-21146-1		1	15	2
66-22132-1		1	10	1
77R3		1	130	1



Autothrottle Gear Box Assembly
Figure 1

T25167

	FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
	01-					
	-1	253T7114-1		GEAR BO ASSY-AUTOTHROTTLE (PRE SB 767-22-0034) (PRE SB 767-22-0081)	A	RF
R	-1A	253T7114-3		GEAR BO ASSY-AUTOTHROTTLE (POST SB 767-22-0034) (REPLACED BY ITEM 1B FOR SPARES PER SB 767-22-0081)	B	RF
	-1B	015T1017-3		GEAR BO ASSY-AUTOTHROTTLE (POST SB 767-22-0081) (REPLS ITEM 1A FOR SPARES PER SB 767-22-0081)	C	RF
	5	MS16562-1		.PIN		1
	10	66-22132-1		.NUT-CLUTCH ASSY		1
	15	66-21146-1		.SHIM		2
	20	65-42662-1		.GEAR-WORM		1
R	22	253T7126-1		.PLACARD ASSY	B,C	1
R	23	253T7126-2		..PLATE	B,C	1
R	24	BACT27TCT0442		DELETED		
	24A	BAC27TCT0442		..DECAL-VINYL	B,C	1
	25	65-42139-1		.COVER ASSY-END ATTACHING PARTS		1
	30	NAS603-8		.SCREW		3
	35	AN960PD10L		.WASHER -------*-------		3
R	40	MB540DDG20		..BEARING- (V38443) (SPEC BACB10AS14) (OPT LLMB540 (V38443)) (OPT MB540-2TS (V43991)) (OPT MB540DDFS428 (V21335)) (OPT MB540TT (V43991)) (OPT ITEM 40A)		1
R	-40A	MB540ZZ		..BEARING- (V38443) (OPT ITEM 40)		1
	45	65-42139-2		..COVER-END		1
	50	253T7118-1		.CAP-END ATTACHING PARTS		1

	FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
	01-					
	55	NAS603-8		.SCREW		3
	60	AN960PD10L		.WASHER		3
				-------*-------		
	65	253T7119-1		.SHIM		2
	70	NAS514P832-7P		.SCREW		2
	75	253T7117-3		.HOUSING ASSY		1
	80	BACS13W2CN3		..INSERT		2
	85	BACS13W3CN4		..INSERT		6
	90	253T7117-1		..HOUSING		1
	95	253T7120-1		.RETAINER-BRG		1
	100	MS16624-1087		.RING		1
R	102	MB540DDG20		.BEARING- (V38443) (SPEC BACB10AS14) (OPT LLMB540 (V38443)) (OPT MB540-2TS (V43991)) (OPT MB540DDFS428 (V21335)) (OPT MB540TT (V43991)) (OPT ITEM 102A)		1
R	-102A	MB540ZZ		.BEARING- (V38443) (OPT ITEM 102)		1
	105	253T7114-2		.SHAFT ASSY		1
R	110	B538DD		..BEARING- (V38443) (SPEC BACB10CF10PP) (OPT B538-2TS (V43991)) (OPT B538DDFS428 (V21335)) (OPT B538SSG27 (V30163))		1
R	115	BACR12Y75		..RING- (V08073) (SPEC BACR12Y75) (OPT BACR12Y75 (V15805))		1
	120	MB540DD		DELETED		
	-120A	MB540ZZ		DELETED		
	125	253T7116-1		..SHAFT-INPUT		1

	FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
	01-					
R	130	R3FF1L1-01		.BEARING- (V53268) (SPEC BACB10AT3MM) (OPT R3NFFM (V38443)) (OPT R3PP (V43991)) (OPT R3FF1L1-01 (V21760)) (OPT 77R3 (V29337)) (OPT R3ZZ (V50294)) (OPT 33KDD5FS160 (V21335)) (OPT ITEMS 130A, 130B)		1
R	-130A	LLR3N		.BEARING- (V38443) (SPEC BACB10AT3PP) (OPT R3RRT1L1-01 (V21760)) (OPT R3TT (V43991)) (OPT 33PP5FS428 (V21335)) (OPT R3LL (V50294)) (OPT ITEM 130)		1
R	-130B	R3ZZ		.BEARING- (V50352) (OPT ITEM 130)		1
	135	NKX10ZTN		.BEARING- (V27737)		2
	140	253T7115-1		.WORM-SERVO		1