BOEING

COMPONENT
MAINTENANCE MANUAL

CONTROL STAND AUTOTHROTTLE SERVO ASSEMBLY

PART NUMBERS 254T4100-1,-2

COMPONENT MAINTENANCE MANUAL
WITH
ILLUSTRATED PARTS LIST

K86632

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.

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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.

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:

CONTROL STAND AUTOTHROTTLE SERVO ASSEMBLY

DESCRIPTION AND OPERATION

1. Description

   A. The control stand autothrottle servo assemblies are made of a brake assembly and a resolver assembly installed on a shaft. There is a left side assembly and a right side assembly. On the right side assembly, there is also a gearbox and servomotor.

   B. When the autothrottle servo assemblies are installed in the airplane, they are connected by mating splines in their shafts.

   C. Refer to 22-32-33 for details of the gearbox assembly. Refer to the vendor's CMM for details of the resolver assembly and the servomotor.

2. Operation

   A. The autothrottle system gives full range fly-by-wire thrust control during takeoff, climb, cruise, approach, and landing. Thrust control is by manual input from the thrust levers or by autothrottle input from the thrust management system.

   B. When the thrust levers are moved manually, the resolver assemblies send electrical signals to the electronic engine controls to change the thrust. The brake assemblies give feel friction for the thrust levers and let the crew override the thrust management system.

   C. When the autothrottle is engaged, the thrust management computer compares the set speed to the actual airplane speed. The computer then commands the autothrottle servomotor to turn, if necessary. The servomotor drives the resolver assemblies through the gearbox assembly to change the thrust. The brake assemblies also turn to move the thrust levers to their new position.

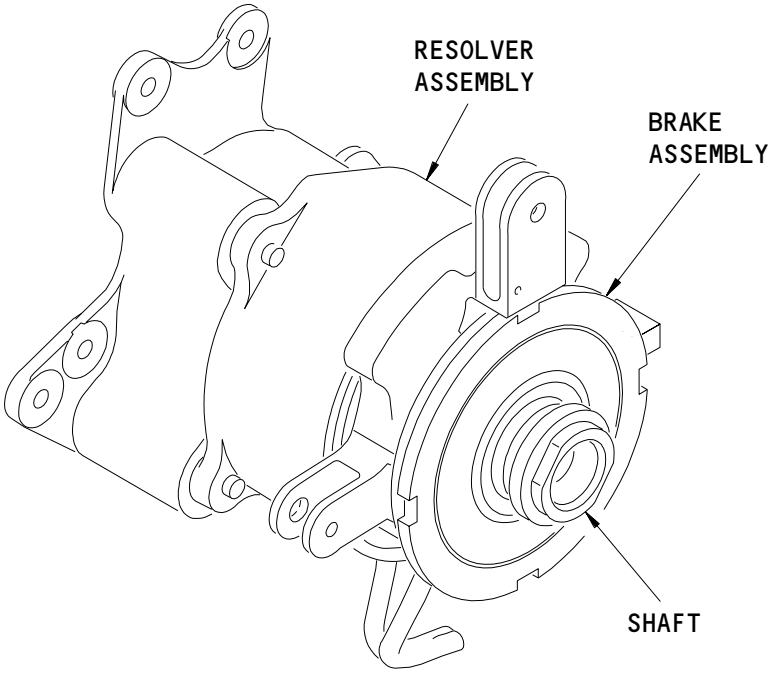
3. Leading Particulars -- Left side assembly (right side assembly) (Approximate)

   A. Length -- 6 (13) inches

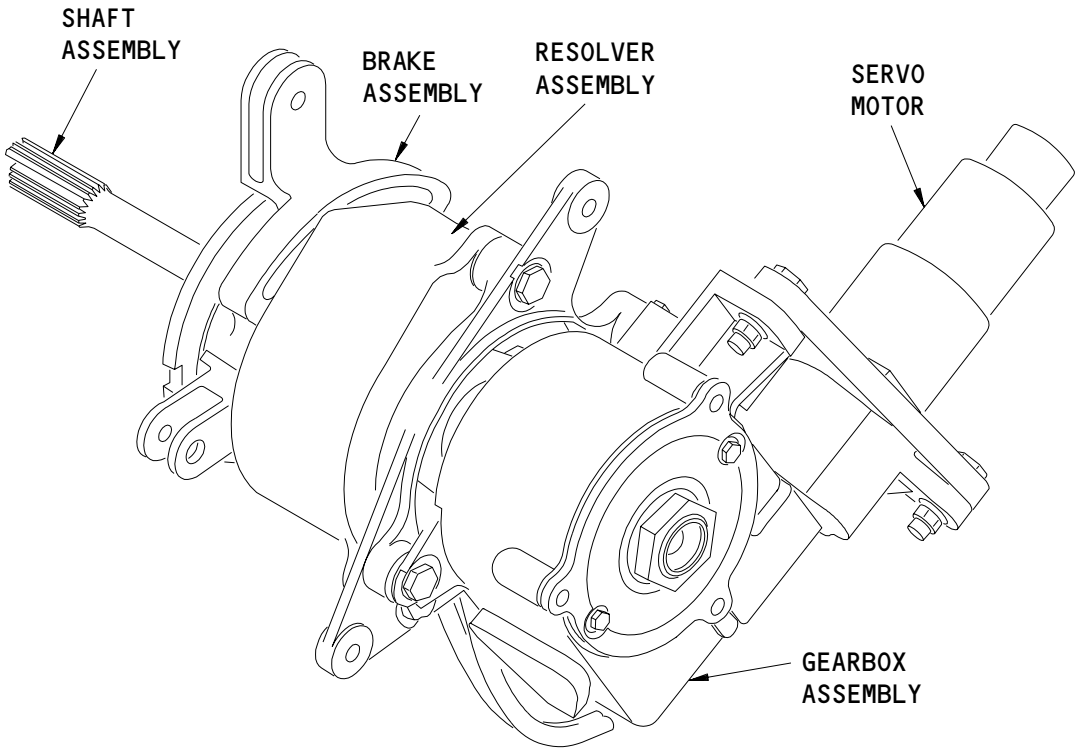
   B. Width -- 7 (11) inches

   C. Height -- 6 (7) inches

   D. Weight -- 10 (15) pounds



LEFT SIDE ASSEMBLY



RIGHT SIDE ASSEMBLY

Autothrottle Servo Assembly
Figure 1

K97396

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 Practices Manual (SOPM) for details of the SOPM chapters identified in this procedure.

2. Testing and Fault Isolation

   A. Special Tools and Equipment

      NOTE: Equivalent tools/equipment can be used.

      (1) B76002-7 - Socket, brake assembly

      (2) B76002-8 - Wrench, seal nut

      (3) B76002-12 - Wrench assembly, shaft nut

      (4) TBD - Fixture, brake assembly holding

      (5) TBD - Fixture, brake assembly test

   B. References

      (1) 22-32-28/301, Disassembly

      (2) 22-32-28/701, Assembly

   C. Procedure

      (1) Prepare for the tests.

         CAUTION: THE BRAKE ASSEMBLY IS OF INSTRUMENT QUALITY. USE CARE WHEN YOU TOUCH OR MOVE THE ASSEMBLY TO PREVENT DAMAGE OR INCORRECT OPERATION.

         (a) Install the brake assembly (IPL Fig. 1; 80), (IPL Fig. 2; 135) in the test fixture. Make sure that the assembly is held tightly.

(b) If the brake assembly was disassembled, do the run-in procedure.and adjust the torque necessary to turn the rotor (IPL Fig. 1; 145), (IPL Fig. 2; 200). Refer to ASSEMBLY, 22-32-28/701.

(2) Do the acceptance test.

(a) Install the brake assembly in the test fixture. Make sure that the assembly is held tightly.

(b) Make sure that the rotor turns smoothly and continuously.

(c) Turn the rotor at 2-3 rpm in one direction until the torque value is stable, but not for more than 5 minutes.

(d) Read the torque value for 30 seconds. Make sure that the torque is 20-24 pound-inches.

(e) If the torque is not in the correct range, adjust the shim thickness as necessary.

(f) Do steps (c) thru (e) again, but turn the rotor in the opposite direction.

(3) Complete the assembly of the brake assembly. Refer to ASSEMBLY, 22-32-28/701.

DISASSEMBLY

1. General

   A. This procedure has the data necessary to disassemble the autothrottle servo 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 details of the SOPM chapters identified in this procedure.

   D. Refer to IPL Fig. 1 for the item numbers.

2. Disassembly

   A. Special Tools

      NOTE: Equivalent tools can be used.

      (1) B76002-7 - Socket, brake assembly

      (2) B76002-8 - Wrench, seal nut

      (3) B76002-12 - Wrench assembly, shaft nut

      (4) TBD - Fixture, brake assembly holding

   B. References

      (1) SOPM 20-50-03, Bearing and Bushing Replacement

      (2) SOPM 20-50-06, Installation of O-Rings and Teflon Seals

   C. Part Replacement

      NOTE: The parts which follow are recommended for replacement. Unless a procedure tells you to replace a part, replacement is optional.

      (1) Cotter pin (IPL Fig. 1; 55), (IPL Fig. 2; 110)

      (2) Scraper (IPL Fig. 1; 70), (IPL Fig. 2; 125)

CAUTION: THE RESOLVER ASSEMBLY AND THE BRAKE ASSEMBLY IN THIS UNIT ARE OF INSTRUMENT QUALITY. BE VERY CAREFUL WHEN YOU TOUCH OR MOVE THE ASSEMBLY OR THESE PARTS TO PREVENT DAMAGE OR INCORRECT OPERATION.

D. Disassembly of the Left Side Autothrottle Servo Assembly (IPL Fig. 1)

(1) Remove the bolt (10) and washer (15), then remove the bracket (20) from the resolver assembly (60).

(2) Use the B76002-12 wrench assembly to remove the nut (25) from the shaft (175).

(3) Remove the spacer (30) from the shaft.

(4) Remove the resolver assembly (60) from the brake assembly (80).

(5) Remove the screws (35), washers (40), plate (45), and bearing (50) from the resolver assembly.

(6) Remove the cotter pin (55) from the resolver assembly.

(7) Use the B76002-8 wrench to remove the seal nut (75) from the resolver assembly.

(8) Remove the scraper (70) from the resolver assembly. Put a cover over the resolver assembly to protect it from contamination.

NOTE: Refer to the supplier's CMM for the disassembly, repair, and assembly procedures for the resolver assembly (60).

(9) Remove the spacer (65) from the shaft, then remove the shaft from the brake assembly.

(10) Remove the spacer (165) and the bearing (170) from the shaft (175).

(11) Disassemble the brake assembly (80).

(a) Remove the lockwire between the nut (85) and the crank arm on the housing assembly (150).

(b) Install the brake assembly in the holding fixture.

(c) Apply a clamp to hold the cap assembly (90) tightly on the housing assembly (150).

(d) Use the B76002-7 socket to remove the nut (85) from the brake assembly.

(e) Slowly release the load on the cap assembly, and remove the brake assembly from the holding fixture.

(f) Remove the cap assembly from the housing assembly.

NOTE: Do not remove the bearing (95) from the cap (100) unless it is necessary for repair or replacement.

(g) Remove the parts (105 thru 145) from the housing assembly. Make a record of the sequence and position of the parts, and the total thickness of the shims (105 thru 120), to help during assembly.

NOTE: Do not remove the bearing (155) from the housing (160) unless it is necessary for repair or replacement.

CAUTION: THE RESOLVER ASSEMBLY AND THE BRAKE ASSEMBLY IN THIS UNIT ARE OF INSTRUMENT QUALITY. BE VERY CAREFUL WHEN YOU TOUCH OR MOVE THE ASSEMBLY OR THESE PARTS TO PREVENT DAMAGE OR INCORRECT OPERATION.

E. Disassembly of the Right Side Autothrottle Servo Assembly (IPL Fig. 2)

(1) Remove the bolts (5), washers (10), and nuts (15), and remove the servomotor (20) from the gearbox assembly (50).

NOTE: Refer to the supplier's CMM for the disassembly, repair, and assembly procedures for the servomotor.

(2) Remove the screw (25) and washer (30) from the ramp plug (35).

(3) Remove the ramp plug from the shaft assembly (230).

(4) Remove the bolts (40) and washers (45), then remove the gearbox assembly (50) from the bracket assembly (65).

NOTE: Refer to CMM 22-32-33 for the disassembly procedures for the gearbox assembly.

(5) Remove the bolts (55) and washers (60), then remove the bracket assembly from the resolver assembly (115).

NOTE: Do not remove the inserts (70) from the bracket (75) unless it is necessary for repair or replacement.

(6) Use the B76002-12 wrench assembly to remove the nut (80) from the shaft assembly (230).

(7) Remove the spacer (85) from the shaft assembly.

(8) Remove the resolver assembly (115) from the brake assembly (135).

(9) Remove the screws (90), washers (95), plate (100), and bearing (105) from the resolver assembly.

(10) Remove the cotter pin (110) from the resolver assembly.

(11) Use the B76002-8 wrench to remove the seal nut (130) from the resolver assembly.

(12) Remove the scraper (125) from the resolver assembly. Put a cover over the resolver assembly to protect it from contamination.

NOTE: Refer to the supplier's CMM for the disassembly, repair, and assembly procedures for the resolver assembly (115).

(13) Remove the spacer (120) from the shaft assembly (230), then remove the shaft assembly from the brake assembly (135).

(14) Remove the spacer (220) and the bearing (230) from the shaft assembly.

NOTE: Do not remove the inserts (235) from the shaft (240) unless it is necessary for repair or replacement.

(15) Disassemble the brake assembly (135).

(a) Remove the lockwire between the nut (140) and the crank arm on the housing assembly (205).

(b) Install the brake assembly in the holding fixture.

(c) Apply a clamp to hold the cap assembly (145) tightly on the housing assembly (205).

(d) Use the B76002-7 socket to remove the nut (140) from the brake assembly.

(e) Slowly release the load on the cap assembly, and remove the brake assembly from the holding fixture.

(f) Remove the cap assembly from the housing assembly.

NOTE: Do not remove the bearing (150) from the cap (155) unless it is necessary for repair or replacement.

(g) Remove the parts (160 thru 200) from the housing assembly. Make a record of the sequence and position of the parts, and the total thickness of the shims (160 thru 175) to help during assembly.

NOTE: Do not remove the bearing (210) from the housing (215) unless it is necessary for repair or replacement.

CLEANING

1. General

   A. This procedure has the data necessary to clean the autothrottle servo assembly.

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

2. Cleaning

   A. References

      (1) SOPM 20-30-03, General Cleaning Procedures

   B. Procedure

      (1) Refer to the manufacturer's instructions to clean the bearings (IPL Fig. 1; 50, 95, 155, 170), (IPL Fig. 2; 105, 150, 210, 225).

      (2) Use standard industry procedures and refer to SOPM 20-30-03 to clean the other 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 details of the SOPM chapters identified in this procedure.

2. Check

   A. References

      (1) SOPM 20-20-01, Magnetic Particle Inspection

      (2) 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 (SOPM 20-20-01) of these parts:

         (a) Plate (IPL Fig. 1; 45), (IPL Fig. 2; 100)

         (b) Spacer (IPL Fig. 1; 65), (IPL Fig. 2; 120)

         (c) Seal nut (IPL Fig. 1; 75), (IPL Fig. 2; 130)

         (d) Nut (IPL Fig. 1; 85), (IPL Fig. 2; 140)

         (e) Stator (IPL Fig. 1; 130), (IPL Fig. 2; 185)

         (f) Disc (IPL Fig. 1; 140), (IPL Fig. 2; 195)

         (g) Rotor (IPL Fig. 1; 145), (IPL Fig. 2; 200)

         (h) Shaft (IPL Fig. 1; 175), (IPL Fig. 2; 240)

(3) Do a penetrant check (SOPM 20-20-02) of these parts:

(a) Ramp plug (IPL Fig. 2; 35)

(b) Bracket (IPL Fig. 1; 20), (IPL Fig. 2; 75)

(c) Spacer (IPL Fig. 1; 30), (IPL Fig. 2; 85)

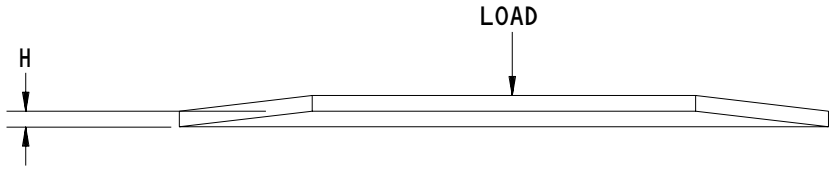
(d) Cap (IPL Fig. 1; 100), (IPL Fig. 2; 155)

(4) Do a check of the bearings (IPL Fig. 1; 50, 95, 155, 170), (IPL Fig. 2; 105, 150, 210, 225).

(a) Make sure that the bearing turns freely and smoothly. If there is too much noise or the cleaned bearing is too loose, replace the bearing.

(b) Do a check of the surfaces of the inner and outer races. If you see wear or pits, cracks, corrosion, or other damage, replace the bearing.

(5) Do a load check of the Belleville springs (IPL Fig. 1; 125), (IPL Fig. 2; 180) as shown in Fig. 501.



ITEM NO.	H (INCH)	LOAD (POUNDS)
IPL FIG. 1; 125 IPL FIG. 2; 180	0.040	85-128
	0.030	153-229

Spring Check
Figure 501

K96809

REPAIR - GENERAL

1. General

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

PART NUMBER	NAME	REPAIR
---	REFINISH OF OTHER PARTS	1-1
253T7535	ROTOR	2-1
253T7539	CAP	3-1
254W4102	HOUSING	4-1
254W4120	SHAFT	5-1

2. Dimensioning Symbols

A. Standard True Position Dimensioning Symbols used in the 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 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
[◎ | ∅ 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
[⌖ | ∅ 0.002 Ⓢ | B]	LOCATED AT TRUE POSITION WITHIN 0.002 DIA RELATIVE TO DATUM B, REGARDLESS OF FEATURE SIZE
[⊥ | ∅ 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

K86635

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 Practices Manual (SOPM) for details of the SOPM chapters identified in this procedure.

2. Refinish of Other Parts

   A. General

      (1) Instructions for the repair of the parts listed in Table 601 are for repair of the initial finish.

   B. Consumable Materials

      NOTE: Equivalent material can be used.

      (1) C00259 Primer -- BMS 10-11, Type 1 (Ref 20-60-02)

   C. References

      (1) SOPM 20-30-02, Stripping of Protective Finishes

      (2) SOPM 20-30-03, General Cleaning Procedures

      (3) SOPM 20-41-01, Decoding Table for Boeing Finish Codes

      (4) SOPM 20-41-02, Application of Chemical and Solvent Resistant Finishes

      (5) SOPM 20-42-05, Bright Cadmium Plating

      (6) SOPM 20-43-01, Chromic Acid Anodizing

      (7) SOPM 20-60-02, Finishing Materials

   D. Procedure

IPL FIG. & ITEM	MATERIAL	FINISH
IPL Fig. 1		
Bracket (20), spacer (30)	Aluminum alloy	Anodize (F-17.05) and apply BMS 10-11, type 1 primer (F-20.02) all over.
Plate (45), seal nut (75), nut (85)	15-5PH CRES, 180-200 ksi	Cadmium plate (F-15.06).
Spacer (65,165)	15-5PH CRES, 180-200 ksi	Passivate (F-17.25).
Shim (105,110,115, 120)	17-7PH CRES, 180-200 ksi	Passivate (F-17.25).
Spring (125)	AISI 301 or 302 CRES, full hard, or 17-7PH CRES, TH1050 condition	Passivate (F-17.25).
IPL Fig. 2		
Bracket (75)	Aluminum alloy	Anodize (F-17.05) all over. Apply BMS 10-11, type 1 primer (F-20.02), but not on the three threaded holes.
Spacer (80)	Aluminum alloy	Anodize (F-17.05) and apply BMS 10-11, type 1 primer (F-20.02) all over.
Plate (100), seal nut (130), nut (140)	15-5PH CRES, 180-200 ksi	Cadmium plate (F-15.06).
Spacer (120,220)	15-5PH CRES, 180-200 ksi	Passivate (F-17.25).
Shim (160,165,170, 175)	17-7PH CRES, 180-200 ksi	Passivate (F-17.25).
Spring (180)	AISI 301 or 302 CRES, full hard, or 17-7PH CRES, TH1050 condition	Passivate (F-17.25).

Refinish Details
Table 601

ROTOR - REPAIR 2-1

253T7535-2

1. General

A. This procedure has the data necessary to refinish the rotor (IPL Fig. 1; 145), (IPL Fig. 2; 200).

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

C. Refer to the REPAIR - GENERAL (22-32-28/601, REPAIR - GENERAL) for the Standard True Position Dimensioning Symbols shown in the repair.

D. General repair details:

(1) Material: 5160H or A304 steel

2. Rotor Refinish

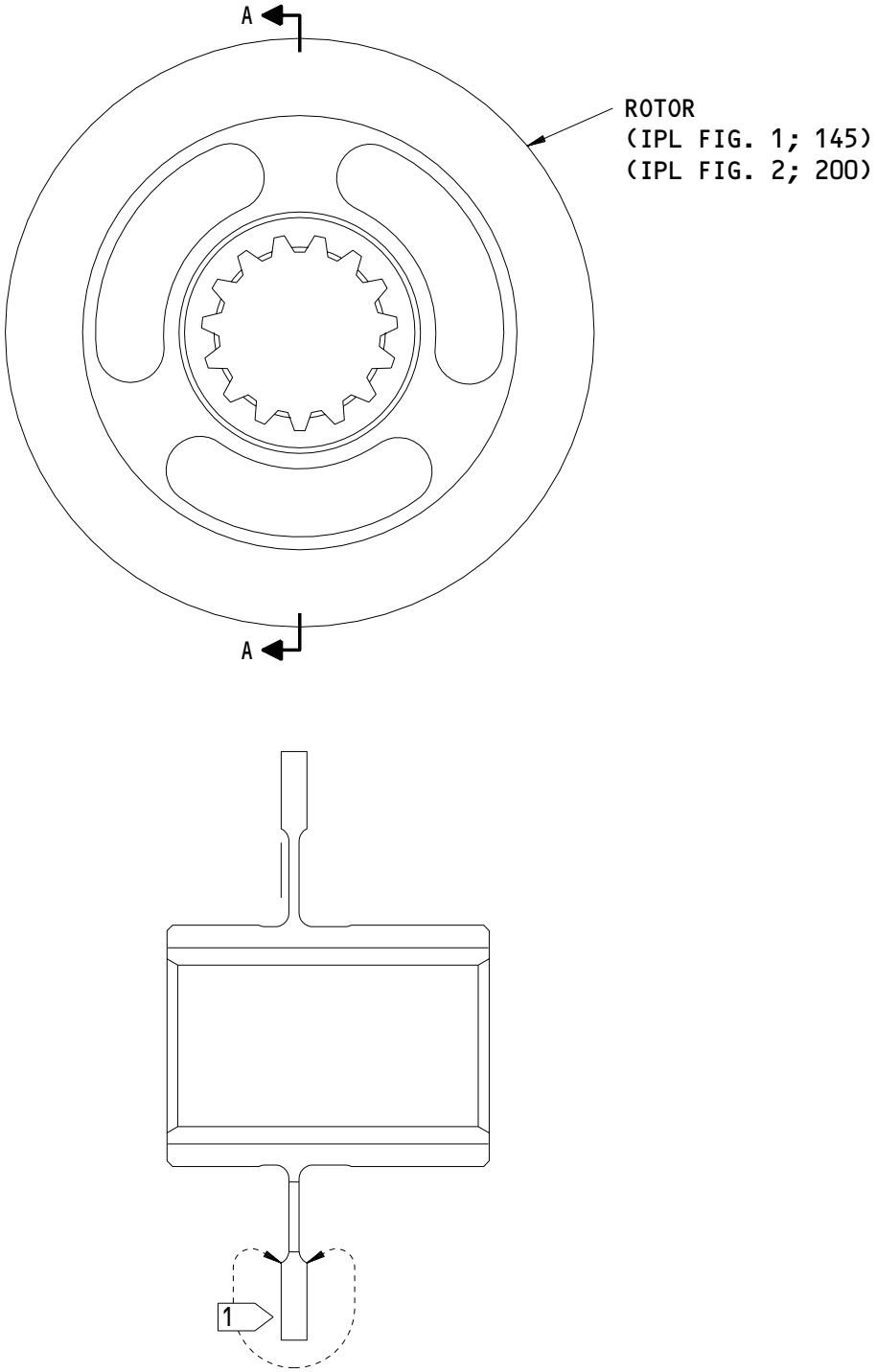
A. References

(1) SOPM 20-41-01, Decoding Table For Boeing Finish Codes

(2) SOPM 20-42-05, Bright Cadmium Plating

B. Procedure (Fig. 601)

(1) Cadmium plate (F-15.06), but bake at 250-300 deg F after you plate. Do not plate the outer section of the rotor, as shown in Fig. 601.



A–A

1 NO PLATING IN THIS AREA

253T7535-2
Rotor Refinish
Figure 601

CAP ASSEMBLY - REPAIR 3-1

253T7539-3

1. General

A. This procedure has the data necessary to repair and refinish the cap assembly (IPL Fig. 1; 90), (IPL Fig. 2; 145).

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

C. Refer to the REPAIR - GENERAL (22-32-28/601, REPAIR - GENERAL) for the Standard True Position Dimensioning Symbols shown in the repair.

D. General repair details:

(1) Material -- Cap (IPL Fig. 1; 100), (IPL Fig. 2; 155):

Aluminum alloy

2. Bearing Replacement

A. Consumable Materials

NOTE: Equivalent material can be used.

(1) AOO257 Sealant -- BMS 5-95 (SOPM 20-60-04)

(2) COO259 Primer - BMS 10-11, Type 1 (SOPM 20-60-02)

B. References

(1) SOPM 20-41-02, Application of Chemical and Solvent Resistant Finishes

(2) SOPM 20-50-03, Bearing and Bushing Replacement

(3) SOPM 20-60-02, Finishing Materials

(4) SOPM 20-60-04, Miscellaneous Materials

C. Procedure

(1) Remove the bearing (IPL Fig. 1; 95), (IPL Fig. 2; 150) from the cap assembly (IPL Fig. 1; 90), (IPL Fig. 2; 145).

(2) Install the new bearing in the cap (IPL Fig. 1; 100), (IPL Fig. 2; 155) with sealant. You can use wet primer as an alternative to the sealant. Refer to SOPM 20-50-03.

3. Cap Refinish

A. Consumable Materials

NOTE: Equivalent materials can be used.

(1) C00259 Primer -- BMS 10-11, Type 1 (SOPM 20-60-02)

B. References

(1) SOPM 20-30-02, Stripping of Protective Finishes

(2) SOPM 20-41-01, Decoding Table For Boeing Finish Codes

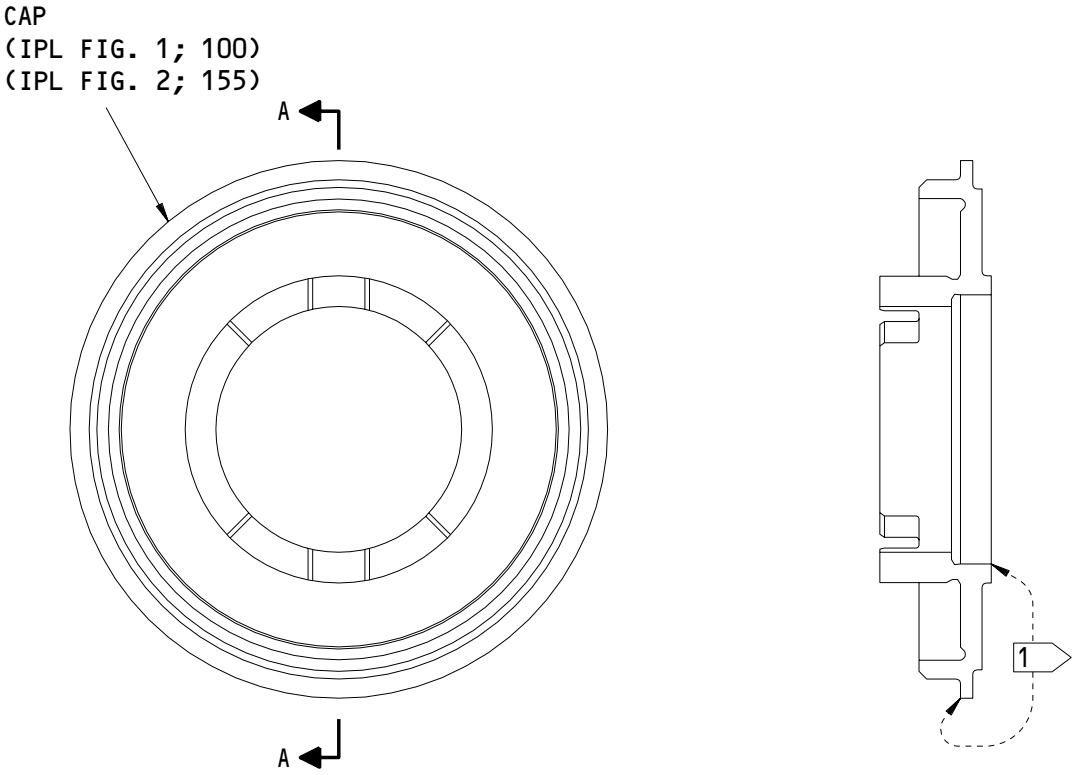
(3) SOPM 20-41-02, Application of Chemical and Solvent Resistant Finishes

(4) SOPM 20-43-01, Chromic Acid Anodizing

(5) SOPM 20-60-02, Finishing Materials

C. Procedure (Fig. 601)

(1) Chromic acid anodize all over, and apply BMS 10-11, type 1 primer only to the area shown in Fig. 601 (F-18.13).



1 APPLY BMS 10-11 PRIMER TO THIS AREA ONLY

253T7539-3
Cap Refinish
Figure 601

K96826

HOUSING ASSEMBLY - REPAIR 4-1

254W4102-1, -2

1. General

   A. This procedure has the data necessary to repair and refinish the housing assembly (IPL Fig. 1; 150), (IPL Fig. 2; 205).

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

   C. Refer to the REPAIR - GENERAL (22-32-28/601, REPAIR - GENERAL) for the Standard True Position Dimensioning Symbols shown in the repair.

   D. General repair details:

      (1) Material -- Housing (IPL Fig. 1; 160), (IPL Fig. 2; 215):

      Aluminum alloy

2. Bearing Replacement

   A. Consumable Materials

      NOTE: Equivalent materials can be used.

      (1) A00247 Sealant -- BMS 5-95 (SOPM 20-60-04)

      (2) D00013 Grease - MIL-G-23827 (SOPM 20-60-03)

      (3) D00633 Grease - BMS 3-33 (SOPM 20-60-03)

   B. References

      (1) SOPM 20-50-03, Bearing and Bushing Replacement

      (2) SOPM 20-60-03, Lubricants

   C. Procedure

      (1) Remove the bearing (IPL Fig. 1; 155), (IPL Fig. 2; 210) from the housing assembly (IPL Fig. 1; 150), (IPL Fig. 2; 205).

      (2) Install the new bearing in the housing (IPL Fig. 1; 160), (IPL Fig. 2; 215) with sealant. Refer to SOPM 20-50-03.

(3) Roller swage the housing over the bearing with BMS 3-33 or BMS 3-24 grease. Refer to SOPM 20-50-03.

3. Housing Refinish

A. Consumable Materials

NOTE: Equivalent materials can be used.

(1) C00259 Primer -- BMS 10-11, Type 1 (SOPM 20-60-02)

B. References

(1) SOPM 20-30-02, Stripping of Protective Finishes

(2) SOPM 20-41-01, Decoding Table For Boeing Finish Codes

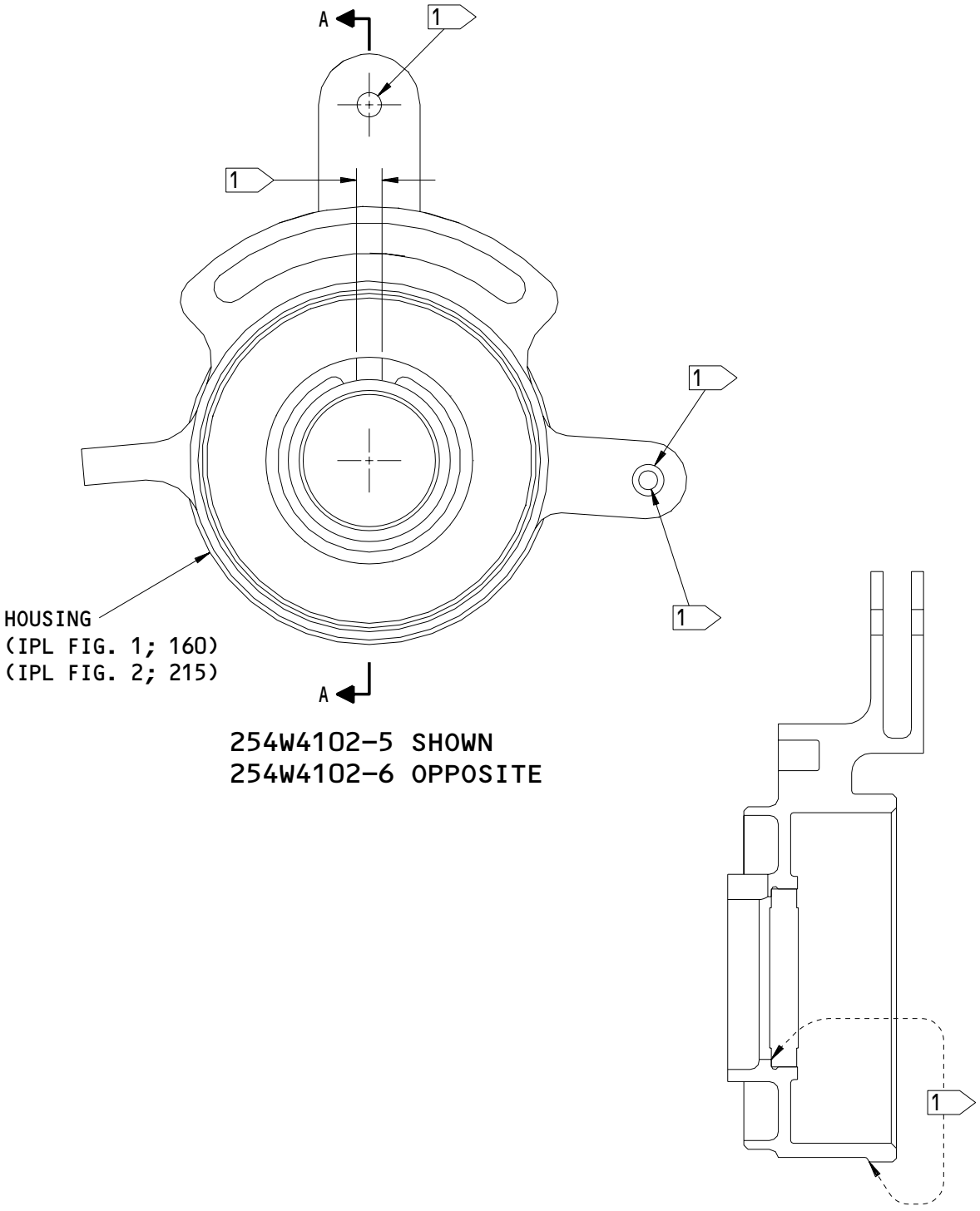
(3) SOPM 20-41-02, Application of Chemical and Solvent Resistant Finishes

(4) SOPM 20-43-01, Chromic Acid Anodizing

(5) SOPM 20-60-02, Finishing Materials

C. Procedure (Fig. 601)

(1) Anodize (F-17.05) all over, and apply BMS 10-11, type 1 primer (F-20.02). Do not apply the primer to the surfaces shown in Fig. 601.



254W4102–5 SHOWN
254W4102–6 OPPOSITE

1 NO PRIMER ON THESE SURFACES

254W4102-5,-6
Housing Refinish
Figure 601

K96792

SHAFT ASSEMBLY - REPAIR 5-1

254W4120-13, -14

1. General

A. This procedure has the data necessary to repair and refinish the shaft (IPL Fig. 1; 175) and the shaft assembly (IPL Fig. 2; 230).

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

C. Refer to the REPAIR - GENERAL (22-32-28/601, REPAIR - GENERAL) for the Standard True Position Dimensioning Symbols shown in the repair.

D. General repair details:

(1) Material -- Shaft (IPL Fig. 1; 175), (IPL Fig. 2; 240):

15-5PH CRES, 180-200 ksi

(2) Shot peen: All repaired surfaces (Refer to SOPM 20-10-03)

2. Shaft Repair

A. References

(1) SOPM 20-10-01, Repair and Refinish of High Strength Steel Parts

(2) SOPM 20-10-02, Machining of Alloy Steel

(3) SOPM 20-10-03, Shot Peening

(4) SOPM 20-10-04, Grinding of Chrome Plated Parts

(5) SOPM 20-20-01, Magnetic Particle Inspection

(6) SOPM 20-41-01, Decoding Table for Boeing Finish Codes

(7) SOPM 20-42-03, Hard Chrome Plating

B. Procedures (Fig. 601)

(1) Machine the shaft (IPL Fig. 1; 175), (IPL Fig. 2; 240) as necessary to remove damage or defects. Do not machine more than the limit shown.

(2) Break all sharp edges.

(3) Do a magnetic particle check of the machined area. Refer to SOPM 20-20-01.

(4) Shot peen the machined area. Refer to SOPM 20-10-03.

(5) Build up the machined surface with chrome plate (F-15.03). Chrome plate is not permitted in the fillet radii or on the edges of the part.

(6) Grind the chrome plate to the design dimensions and finish shown. Refer to SOPM 20-10-04. Make sure that the chrome plate is 0.003-0.015 inch thick after you grind the surface.

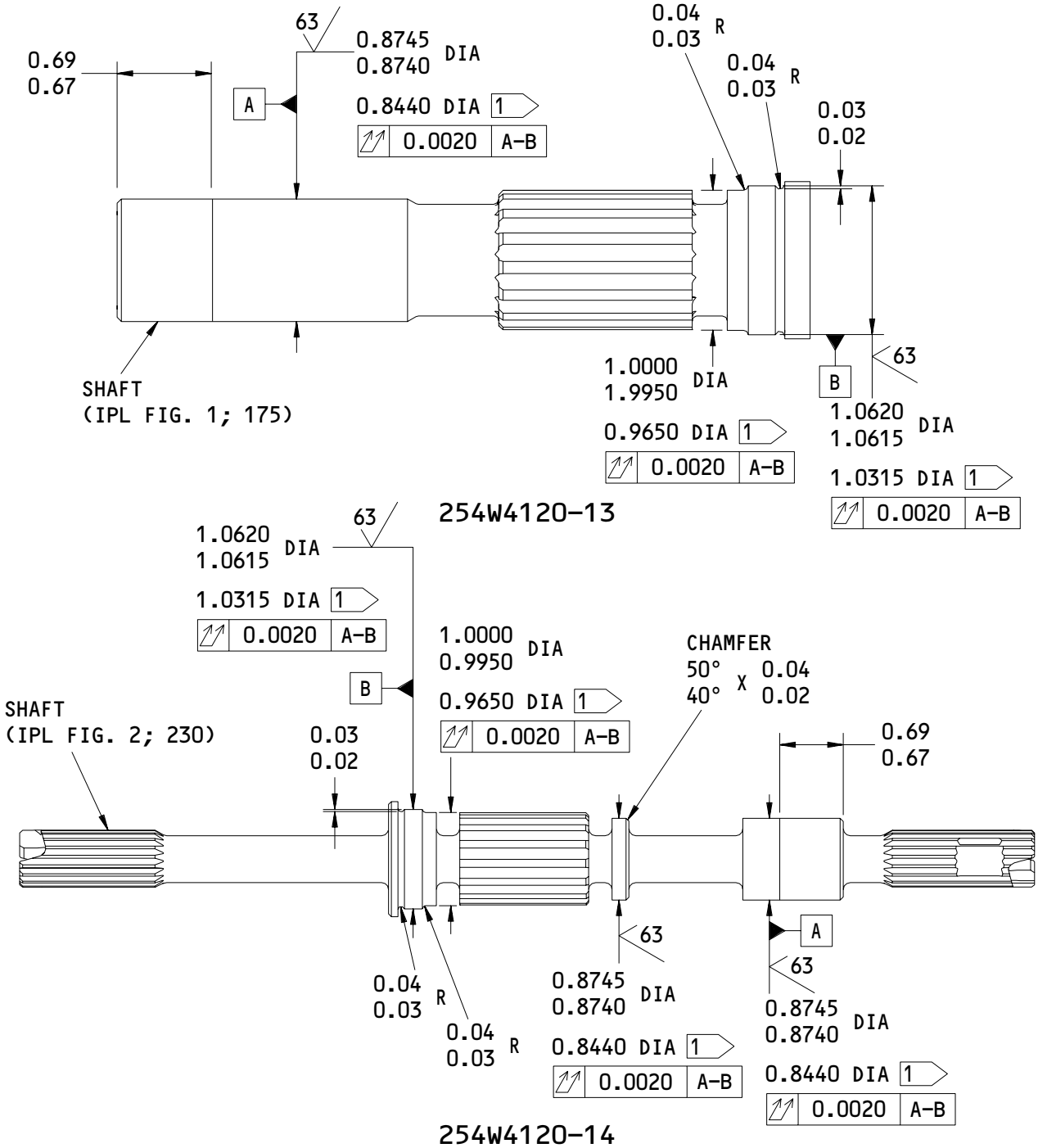
3. Shaft Refinish

A. References

(1) SOPM 20-30-03, General Cleaning Procedures

B. Procedure (Fig. 601)

(1) Passivate (F-17.25).



1 REPAIR LIMIT

125 ALL MACHINED SURFACES UNLESS SHOWN DIFFERENTLY

ALL DIMENSIONS ARE IN INCHES

254W4120-13,-14
Shaft Repair
Figure 601

K96972

ASSEMBLY

1. General

   A. This procedure has the data necessary to assemble the auto throttle servo assembly.

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

   C. Refer to IPL Fig. 1 for item numbers.

2. Assembly

   A. Special Tools

      NOTE: Equivalent tool can be used.

      (1) B76002-7 - Socket, brake assembly

      (2) B76002-8 - Wrench, seal nut

      (3) B76002-12 - Wrench assembly, shaft nut

      (4) TBD - Fixture, brake assembly holding

      (5) TBD - Fixture, brake assembly test

   B. Consumable Materials

      NOTE: Equivalent material can be used.

      (1) D00013 Grease - MIL-G-23827 (SOPM 20-60-03)

      (2) D00015 Grease - BMS 3-24 (SOPM 20-60-03)

      (3) G00376 Lockwire - MS20995C32

   C. References

      (1) SOPM 20-50-02, Installation of Safetying Devices

      (2) SOPM 20-50-03, Bearing and Bushing Replacement

      (3) SOPM 20-50-06, Installation of O-Rings and Teflon Seals

(4) SOPM 20-50-07, Lubrication

(5) SOPM 20-60-03, Lubricants

CAUTION: THE RESOLVER ASSEMBLY AND THE BRAKE ASSEMBLY IN THIS UNIT ARE OF INSTRUMENT QUALITY. BE VERY CAREFUL WHEN YOU TOUCH OR MOVE THE AUTOTHROTTLE SERVO ASSEMBLY OR THESE PARTS TO PREVENT DAMAGE OR INCORRECT OPERATION.

D. Assemble the Left Side Assembly (IPL Fig. 1).

(1) Assemble the brake assembly (80). Refer to Fig. 702.

NOTE: If the run-in procedure is completed, assemble parts so they are in the same order and position as before disassembly.

(a) Apply a large quantity of grease on both sides of the two skewed roller assemblies (135). Refer to SOPM 20-50-07.

(b) Apply a large quantity of grease on the sides of the stator (130), disc (140), and rotor (145) that touch the skewed roller assemblies.

(c) Install the disc, one skewed roller assembly, and the rotor in the housing assembly.

(d) Install the other skewed roller assembly and the stator on the rotor. Make sure that the rollers in the skewed roller assemblies spiral in opposite directions.

(e) Install the shims (105 thru 120) in the cap assembly (90), then install the cap assembly on the housing assembly (150).

NOTE: For the initial shim thickness, use the dimension that was recorded during disassembly.

(f) Install the brake assembly (80) in the test fixture.

(g) Use the fixture to to compress the springs (125), and hold the cap assembly (90) tightly against the housing assembly (150).

(h) Install the nut (85) to hold the cap assembly on the housing assembly. Use the nut spanner wrench to tighten the nut to 100-200 pound-inches.

(i) Do a torque check of the rotor (145) in the brake assembly.

1) Make sure that the torque necessary to turn the rotor is 17-37 pound-inches in each direction.

2) If the torque is not 17-37 pound-inches, adjust the shim thickness to get the correc0 value. Refer to Fig. 701.

(j) Do the run-in procedure.

1) Install the brake assembly in the test fixture. Make sure that the housing is held tightly by the fixture.

2) Turn the rotor (145) at 50-100 rpm for 15 minutes in one direction. Monitor the assembly continuously for chatter. If there is chatter, change the RPM as necessary to stop the chatter. Do not let the temperature increase to more than 200 deg F.

NOTE: You can use a fan to keep the temperature to less than 200 deg F.

3) Turn the rotor in the opposite direction at 50-100 rpm for 15 minutes. Continue to monitor for chatter, and adjust the speed as necessary. This completes one run-in cycle.

4) Do 2 more run-in cycles, for a total of 90 minutes of operation.

(k) Disassemble the brake assembly. Refer to DISASSEMBLY, 22-32-28/301.

(l) Clean and remove the grease from all parts of the brake assembly. Refer to S0PM 20-30-03.

(m) Lubricate the parts of the brake assembly. Refer to steps D.1.(a) and (b).

(n) Assemble the brake assembly. Refer to steps D.1.(c) thru (i), but adjust the shim thickness to get 20-24 pound-inches of torque. Refer to Fig./701.

NOTE: It is not necessary to do the run-in procedure again.

(o) Do the acceptance test. Refer to TESTING AND FAULT ISOLATION, 22-32-28/101.

(p) After the acceptance test is completed satisfactorily, make sure that the nut (85) is tightened to 100-200 pound-inches.

(q) Install lockwire between the nut and the crank arm on the housing assembly (150). Refer to SOPM 20-50-02.

(2) Install the parts on the resolver assembly (60).

(a) Install the scraper (70) in the resolver assembly (60). Refer to SOPM 20-50-06.

(b) Install the seal nut (75) in the resolver assembly. Use the seal nut spanner wrench to turn the seal nut. Monitor the run-on torque. After the seal nut touches the scraper, continue to tighten the nut until a slot in the seal nut aligns with the hole in the resolver housing. Do not tighten the seal nut to more than 40 pound-inches more than the run-on torque.

(c) Install the cotter pin (55) through the slot in the seal nut and the hole in the resolver housing, as shown in Fig. 703. Refer to SOPM 20-50-02.

(d) Install the bearing (50) in the resolver assembly (60) with grease. Refer to SOPM 20-50-03.

(e) Install the plate (45) on the resolver assembly with the screws (35) and washers (40).

(3) Assemble the resolver assembly and the brake assembly.

(a) Install the bearing (170) on the shaft (175) with grease. Refer to SOPM 20-50-03.

(b) Install the spacer (165) on the shaft with grease. Refer to SOPM 20-50-07.

(c) Apply grease to the external splines of the shaft, then install the shaft in the brake assembly.

(d) Apply grease to the remaining external surfaces of the shank of the shaft, but not on the threads . Install the spacer (65) on the shaft.

(e) Apply grease to the outer diameter of the spacer (65), then install the resolver assembly on the shaft and the brake assembly.

(f) Install the spacer (30) on the shaft, then install the nut (25). Use the nut spanner wrench to tighten the nut. Monitor the run-on torque. Tighten the nut to 200-220 pound-inches more than the run-on torque. Refer to SOPM 20-50-01.

(4) Attach the bracket (20) to the resolver assembly with the bolts (10) and washers (15).

CAUTION: THE RESOLVER ASSEMBLY AND THE BRAKE ASSEMBLY IN THIS UNIT ARE OF INSTRUMENT QUALITY. BE VERY CAREFUL WHEN YOU TOUCH OR MOVE THE AUTOTHROTTLE SERVO ASSEMBLY, OR THESE PARTS, TO PREVENT DAMAGE OR INCORRECT OPERATION.

E. Assemble the Right Side Assembly (IPL Fig. 2)

(1) Assemble the brake assembly (135). Refer to Fig. 702.

NOTE: If the run-in procedure is completed, assemble parts so they are in the same order and position as before disassembly.

(a) Apply a large quantity of grease on both sides of the two skewed roller assemblies (190). Refer to SOPM 20-50-07.

(b) Apply a large quantity of grease on the sides of the stator (185), disc (195), and rotor (200) that touch the skewed roller assemblies.

(c) Install the disc, one skewed roller assembly, and the rotor in the housing assembly (205).

(d) Install the other skewed roller assembly and the stator on the rotor. Make sure that the rollers in the skewed roller assemblies spiral in opposite directions.

(e) Install the shims (160 thru 175) in the cap assembly (145), then install the cap assembly on the housing assembly (205).

NOTE: For the initial shim thickness, use the dimension that was recorded during disassembly.

(f) Install the brake assembly (135) in the test fixture.

(g) Use the fixture to to compress the springs (180), and hold the cap assembly (145) tightly against the housing assembly (205).

(h) Install the nut (140) to hold the cap assembly on the housing assembly. Use the nut spanner wrench to tighten the nut to 100-200 pound-inches.

(i) Do a torque check of the rotor (200) in the brake assembly.

1) Make sure that the torque necessary to turn the rotor is 17-37 pound-inches in each direction.

2) If the torque is not 17-37 pound-inches, adjust the shim thickness to get the correct value. Refer to Fig. 701.

(j) Do the run-in procedure.

1) Install the brake assembly in the test fixture. Make sure that the housing is held tightly by the fixture.

2) Turn the rotor (200) at 50-100 rpm for 15 minutes in one direction. Monitor the assembly continuously for chatter. If there is chatter, change the RPM as necessary to stop the chatter. Do not let the temperature increase to more than 200 deg F.

NOTE: You can use a fan to keep the temperature to less than 200 deg F.

3) Turn the rotor in the opposite direction at 50-100 rpm for 15 minutes. Continue to monitor for chatter, and adjust the speed as necessary. This completes one run-in cycle.

4) Do 2 more run-in cycles, for a total of 90 minutes of operation.

(k) Disassemble the brake assembly. Refer to DISASSEMBLY, 22-32-28/301.

(l) Clean and remove the grease from all parts of the brake assembly. Refer to SOPM 20-30-03.

(m) Lubricate the parts of the brake assembly. Refer to steps E.1.(a) and (b).

(n) Assemble the brake assembly. Refer to Steps E.1.(c) thru (i), but adjust the shim thickness to get 20-24 pound-inches of torque. Refer to Fig./701.

NOTE: It is not necessary to do the run-in procedure again.

(o) Do the acceptance test. Refer to TESTING AND FAULT ISOLATION, 22-32-28/101.

(p) After the acceptance test is completed satisfactorily, make sure that the nut (140) is tightened to 100-200 pound-inches.

(q) Install lockwire between the nut and the crank arm on the housing assembly (205). Refer to SOPM 20-50-02.

(2) Install the parts on the resolver assembly (115).

(a) Install the scraper (125) in the resolver assembly (115). Refer to SOPM 20-50-06.

(b) Install the seal nut (130) in the resolver assembly. Use the seal nut spanner wrench to turn the seal nut. Monitor the run-on torque. After the seal nut touches the scraper, continue to tighten the nut until a slot in the seal nut aligns with the hole in the resolver housing. Do not tighten the seal nut to more than 40 pound-inches more than the run-on torque.

(c) Install the cotter pin (110) through the slot in the seal nut and the hole in the resolver housing, as shown in Fig. 704. Refer to SOPM 20-50-02.

(d) Install the bearing (105) in the resolver assembly (115) with grease. Refer to SOPM 20-50-03.

(e) Install the plate (100) on the resolver assembly with the screws (90) and washers (95).

(3) Assemble the resolver assembly and the brake assembly.

(a) Install the bearing (225) on the shaft assembly (230) with grease. Refer to SOPM 20-50-03.

(b) Install the spacer (220) on the shaft with grease. Refer to SOPM 20-50-07.

(c) Apply grease to the splines of the shaft which mate with the rotor (200), then install the shaft in the brake assembly.

(d) Apply grease to the external surfaces of the shaft between the splines. Install the spacer (120) on the shaft.

(e) Apply grease to the outer diameter of the spacer (120), then install the resolver assembly on the shaft and the brake assembly.

(f) Install the spacer (85) on the shaft, then install the nut (80). Use the nut spanner wrench to tighten the nut. Monitor the run-on torque. Tighten the nut to 200-220 pound-inches more than the run-on torque. Refer to SOPM 20-50-01.

(4) Attach the bracket assembly (65) to the resolver assembly with the bolts (55) and washers (60).

(5) Install the gearbox assembly (50) on the bracket assembly with the bolts (40) and washers (45).

(6) Install the ramp plug (35) in the gearbox assembly. Make sure that the spline teeth of the ramp plug align with the spline teeth of the shaft. Refer to Fig. 704.

NOTE: The adjacent ramp faces of the ramp plug and the shaft touch each other when the parts are aligned correctly. The end of the ramp plug is approximately aligned with the end of the internal spline on the worm gear of the gearbox assembly (50).

(7) Do a check of the ramp plug alignment.

(a) Put a 3-inch long, 0.06-inch diameter pin through the notch at the missing spline tooth of the ramp plug.

(b) Make sure that the pin continues into the notch of the missing spline tooth of the shaft, to a total depth of 1.7 inches, measured from the end of the ramp plug.

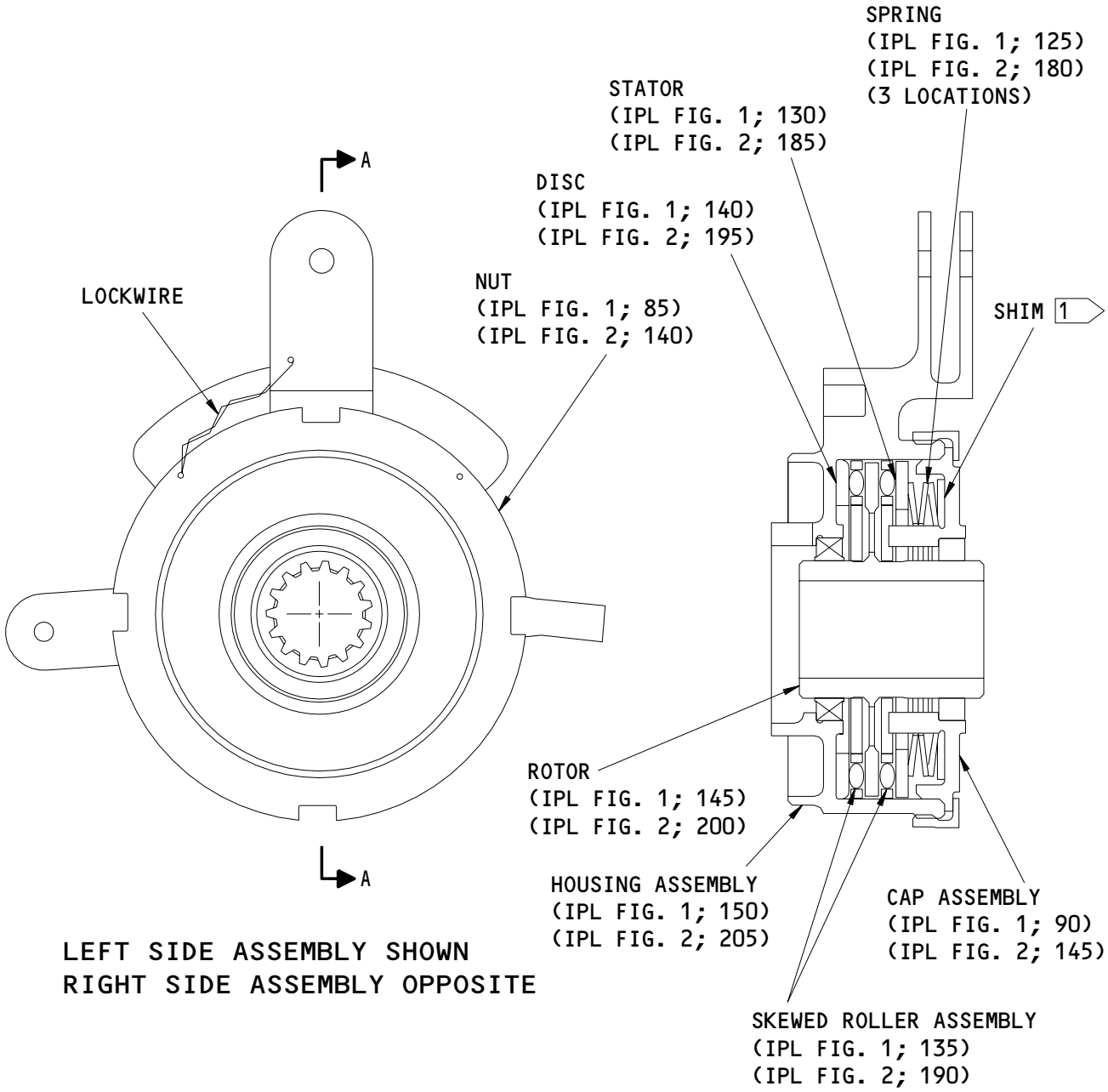
(8) Attach the ramp plug to the shaft with the screw (25) and washer (30). Tighten the screw to 25-35 pound-inches more than the run-on torque. Refer to SOPM 20-50-01.

(9) Install the servomotor (20) on the gearbox assembly (50) with the bolts (5), washers (10), and nuts (15).

ITEM NUMBER IPL FIG.1	ITEM NUMBER IPL FIG.2	SHIM P/N	THICKNESS (INCH)
105	160	253T7530-1	0.013-0.017
110	165	253T7530-2	0.017-0.023
115	170	253T7530-3	0.022-0.028
120	175	253T7530-4	0.044-0.054

NOTE: An increase of 0.005 inch in shim thickness gives an increase of approximately 3 pound-inches in torque.

Shim Thickness
Figure 701

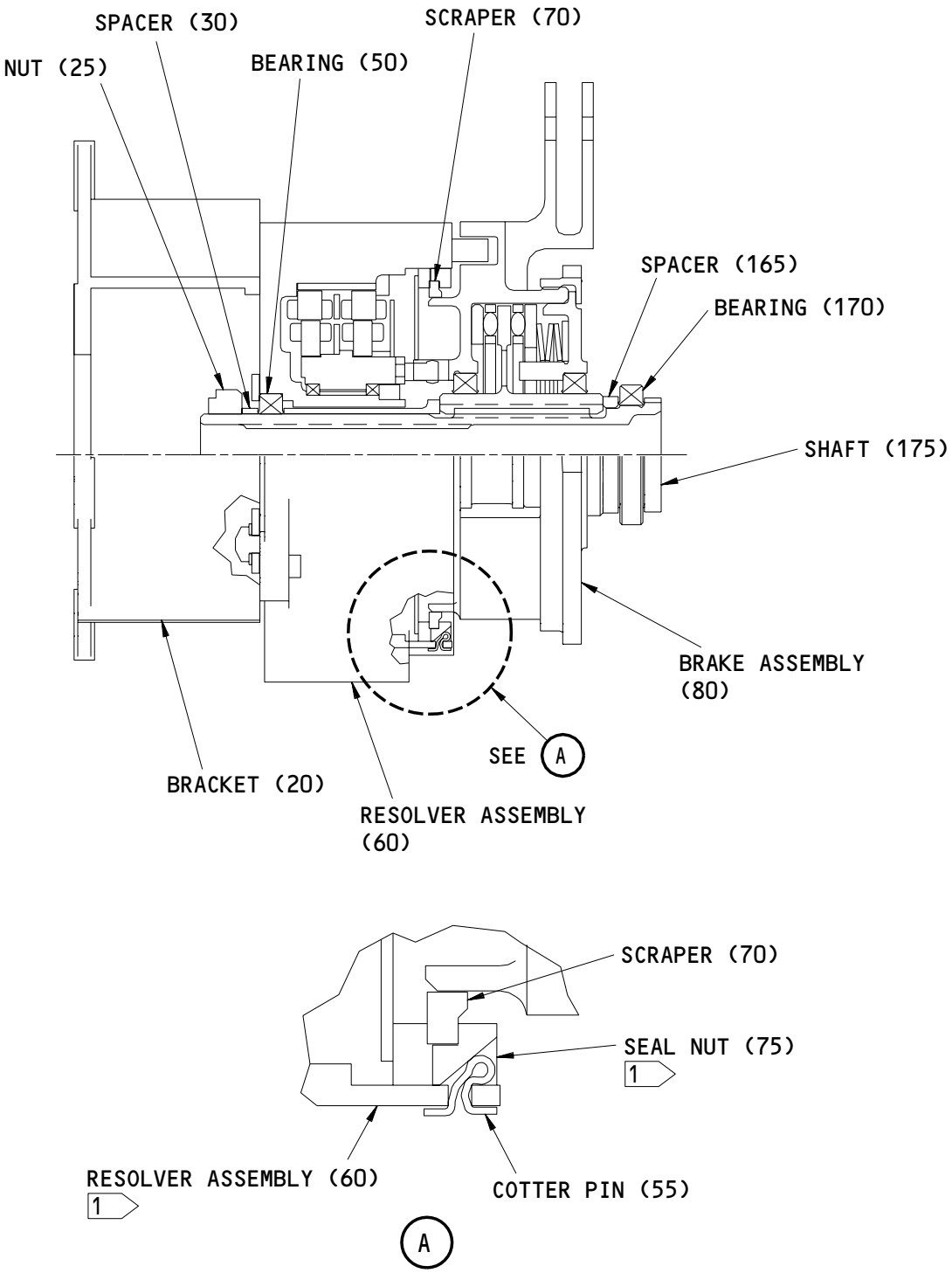


LEFT SIDE ASSEMBLY SHOWN
RIGHT SIDE ASSEMBLY OPPOSITE

1 INSTALL SHIMS (IPL FIG. 1; 105, 110,115,120), (IPL FIG 2; 160,165, 170,175) TO GET THE NECESSARY TORQUE

Brake Assembly Details
Figure 702

L03565

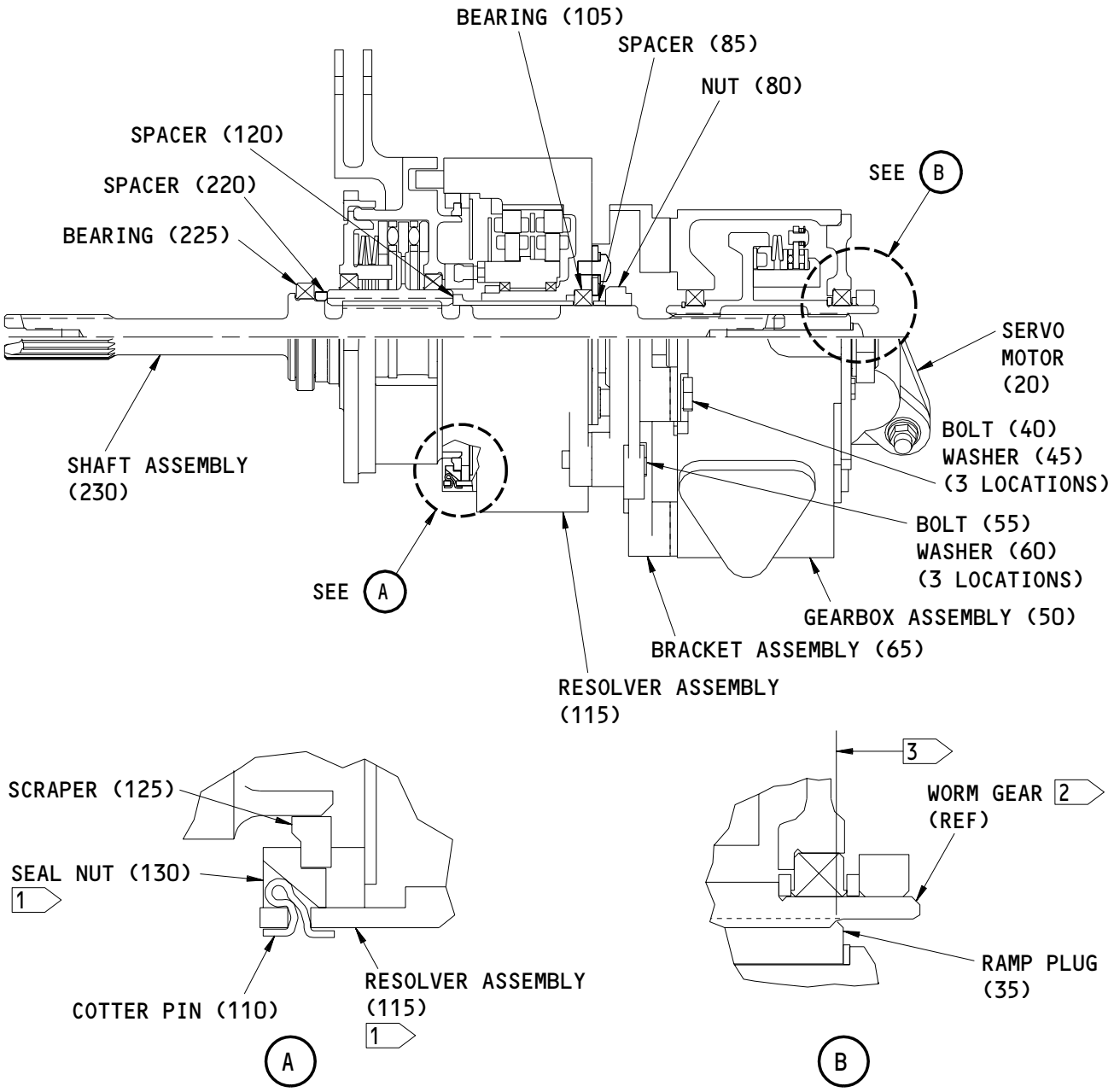


1 ALIGN SLOT IN SEAL NUT WITH HOLE IN RESOLVER HOUSING

ITEM NUMBERS REFER TO IPL FIG. 1

Left Side Assembly Details
Figure 703

L03583



1 ALIGN SLOT IN SEAL NUT WITH HOLE IN RESOLVER HOUSING

2 PART OF GEARBOX ASSEMBLY (50)

3 END OF RAMP PLUG IS ALIGNED WITH END OF WORM GEAR SPLINE WHEN CORRECTLY INSTALLED

ITEM NUMBERS REFER TO IPL FIG. 2

Right Side Assembly Details
Figure 704

L03629

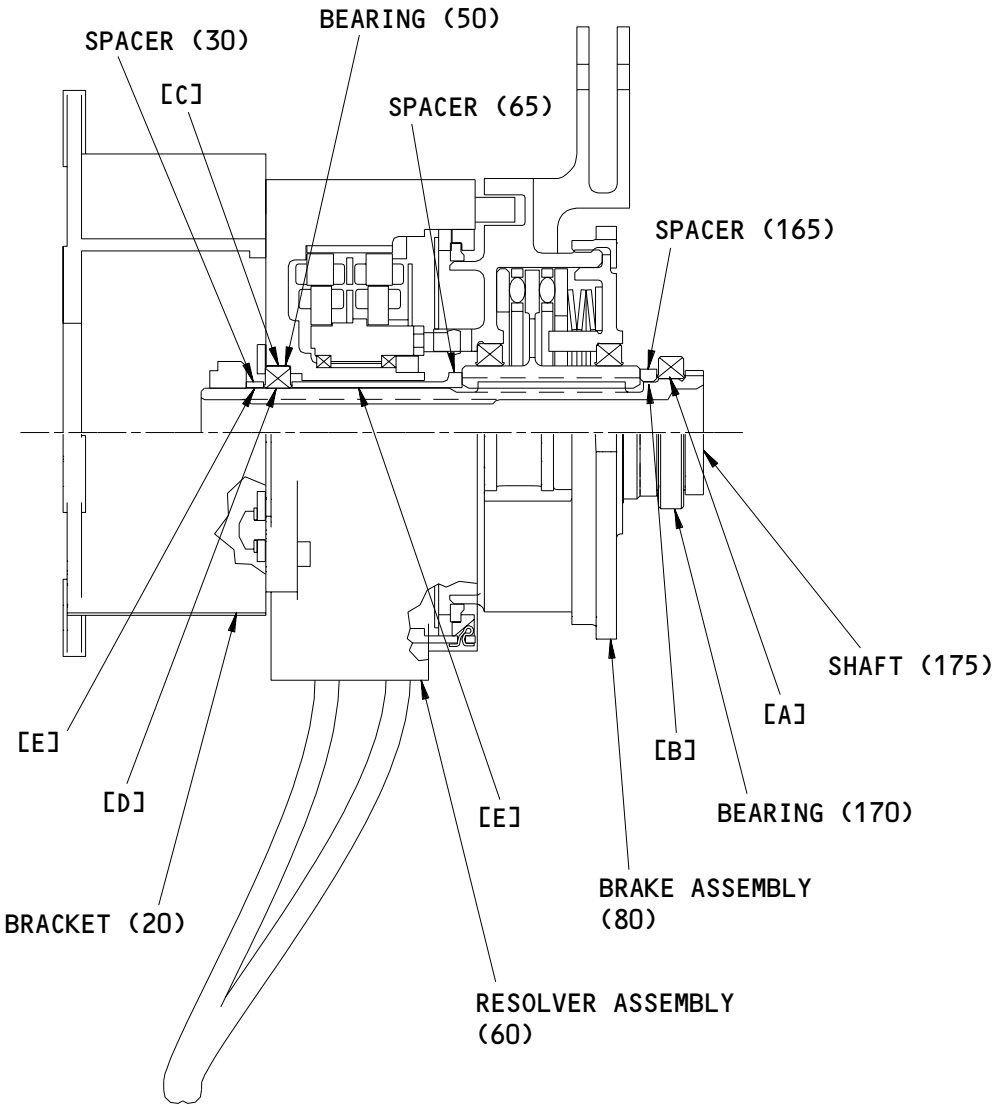
3. Storage

A. Reference

(1) SOPM 20-44-02, Temporary Protective Coatings

B. Procedure

(1) Use standard industry procedures and the information in SOPM 20-44-02 to store this component.



LEFT SIDE AUTOTHROTTLE SERVO ASSEMBLY

ITEM NUMBERS REFER TO IPL FIG. 1

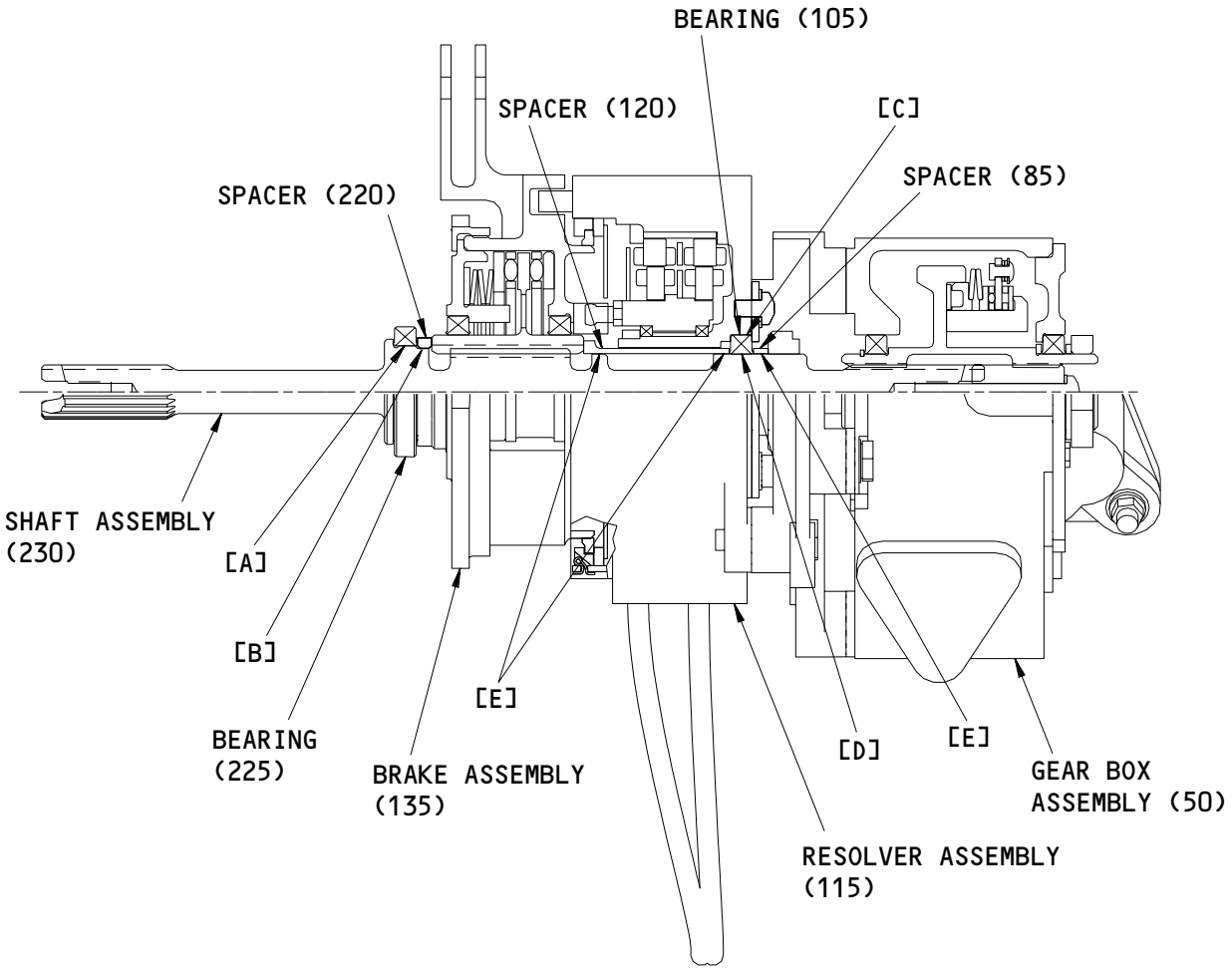
Fits and Clearances
Figure 801 (Sheet 1)

K94185

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 170	1.0620	1.0625	0.0000	0.0010		1.0635	0.0040
	OD 175	1.0615	1.0620			1.0595		
[B]	ID 165	1.0050	1.0100	0.0050	0.0150		1.0200	0.0350
	OD 175	0.9950	1.0000			0.9850		
[C]	ID 60	1.3125	1.3130	0.0000	0.0010		1.3150	0.0040
	OD 50	1.3120	1.3125			1.3110		
[D]	ID 50	0.8745	0.8750	0.0000	0.0010		0.8760	0.0040
	OD 175	0.8740	0.8745			0.8720		
[E]	ID 30,65	0.8800	0.8900	0.0055	0.0160		0.9000	0.0280
	OD 175	0.8740	0.8745			0.8720		

* ALL DIMENSIONS ARE IN INCHES

Fits and Clearances
Figure 801 (Sheet 2)



RIGHT SIDE AUTOTHROTTLE SERVO ASSEMBLY

ITEM NUMBERS REFER TO IPL FIG. 2

Fits and Clearances
Figure 802 (Sheet 1)

REF LETTER	REF IPL FIG. 2, MATING ITEM NO.	DESIGN DIMENSION*				SERVICE WEAR LIMIT*		
		DIMENSION		ASSEMBLY CLEARANCE		DIMENSION		MAXIMUM CLEARANCE
		MIN	MAX	MIN	MAX	MIN	MAX	
[A]	ID 225	1.0620	1.0625	0.0000	0.0010		1.0635	0.0040
	OD 230	1.0615	1.0620			1.0595		
[B]	ID 220	1.0050	1.0100	0.0050	0.0150		1.0200	0.0350
	OD 230	0.9950	1.0000			0.9850		
[C]	ID 115	1.3125	1.3130	0.0000	0.0010		1.3150	0.0040
	OD 105	1.3120	1.3125			1.3110		
[D]	ID 105	0.8745	0.8750	0.0000	0.0010		0.8760	0.0040
	OD 230	0.8740	0.8745			0.8720		
[E]	ID 85,120	0.8800	0.8900	0.0055	0.0160		0.9000	0.0280
	OD 230	0.8740	0.8745			0.8720		

* ALL DIMENSIONS ARE IN INCHES

Fits and Clearances
Figure 802 (Sheet 2)

K94460

REF IPL		NAME	TORQUE*	
FIG. NO.	ITEM NO.		POUND-INCHES	POUND-FEET
1	25	Nut	200-220 1	
1	75	Seal Nut	0-40 1	
1	85	Nut	100-200	
2	35	Screw	25-35 1	
2	80	Nut	200-220 1	
2	130	Seal Nut	0-40 1	
2	140	Nut	100-200	

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

1 MORE THAN THE RUN-ON TORQUE

Torque Table
Figure 803

K94471

SPECIAL TOOLS AND EQUIPMENT

NOTE: Equivalent tools and equipment can be used.

1. B76002-7 - Socket, brake assembly
2. B76002-8 - Wrench, seal nut
3. B76002-12 - Wrench assembly, shaft nut
4. TBD - Fixture, brake assembly holding
5. TBD - Fixture, brake assembly test

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

K8455 RHP BEARINGS PLC RHP AEROSPACE
OLDENDS LANE
STONEHOUSE GL10 3RM UK

02886 DODGE-WASMUND MFG CO INC
9607 BEVERLY ROAD
PICO RIVERA, CALIFORNIA 90660-2136

05088 KEARFOTT GUIDANCE AND NAVIGATION CORP
ROUTE 70
BLACK MOUNTAIN, NORTH CAROLINA 28711

06144 INDUSTRIAL TECTONICS BEARING CORP
18301 SOUTH SANTA FE AVENUE
RANCO DOMINQUEZ, CALIFORNIA 90221

07128 TETRAFLUOR INC
2051 EAST MAPLE AVENUE
EL SEGUNDO, CALIFORNIA 90245-5009

09257 BUSAK AND SHAMBAN INC SEALS DIV
2531 BREMER DR PO BOX 176
FORT WAYNE, INDIANA 46801

15653 KAYNAR TECHNOLOGY KAYNAR DIV
800 SOUTH STATE COLLEGE BLVD PO BOX 3001
FULLERTON, CALIFORNIA 92634-3001

19710 MPC PRODUCTS CORP
7426 NORTH LINDER AVENUE
SKOKIE, ILLINOIS 60077-3219

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

26303 GREENE TWEED IND INC ADVANTEC DIV
7101 PATTERSON DRIVE PO BOX 5037
GARDEN GROVE, CALIFORNIA 92645-5037

26879 CORONADO MFG INC
11069 PENROSE AVENUE
SUN VALLEY, CALIFORNIA 90352-2722

VENDORS

38443 MRC BEARINGS
402 CHANDLER STREET
JAMESTOWN, NEW YORK 14701-3802

40920 MPB MINIATURE PRECISION BEARING DIV
PRECISION PARK PO BOX 547
KEENE, NEW HAMPSHIRE 03431

43991 FAG BEARING INCORPORATED
118 HAMILTON AVENUE
STAMFORD, CONNECTICUT 06904

51761 ASTRO INSTRUMENT CORP
450 GOLDSBY BLVD
DEERFIELD, FLORIDA 33442-3019

62554 SIMMONDS MECAERO FASTENERS INC
1734 SEQUOIA AVENUE
ORANGE, CALIFORNIA 92668

82402 GEAR SYSTEMS
6125 SILVER CREEK DR PO BOX 680910
PARK CITY, UTAH 84068-0910

83086 NEW HAMPSHIRE BALL BEARINGS, INCORPORATED
ROUTE 202
PETERBOROUGH, NEW HAMPSHIRE 03458

94878 RAYBESTOS-MANHATTAN INC PACIFIC COAST DIV
FULLERTON, CALIFORNIA 92631
BUSINESS DISCONTINUED

97393 SHUR-LOK CORPORATION
2541 WHITE ROAD PO BOX 19584
IRVINE, CALIFORNIA 92713

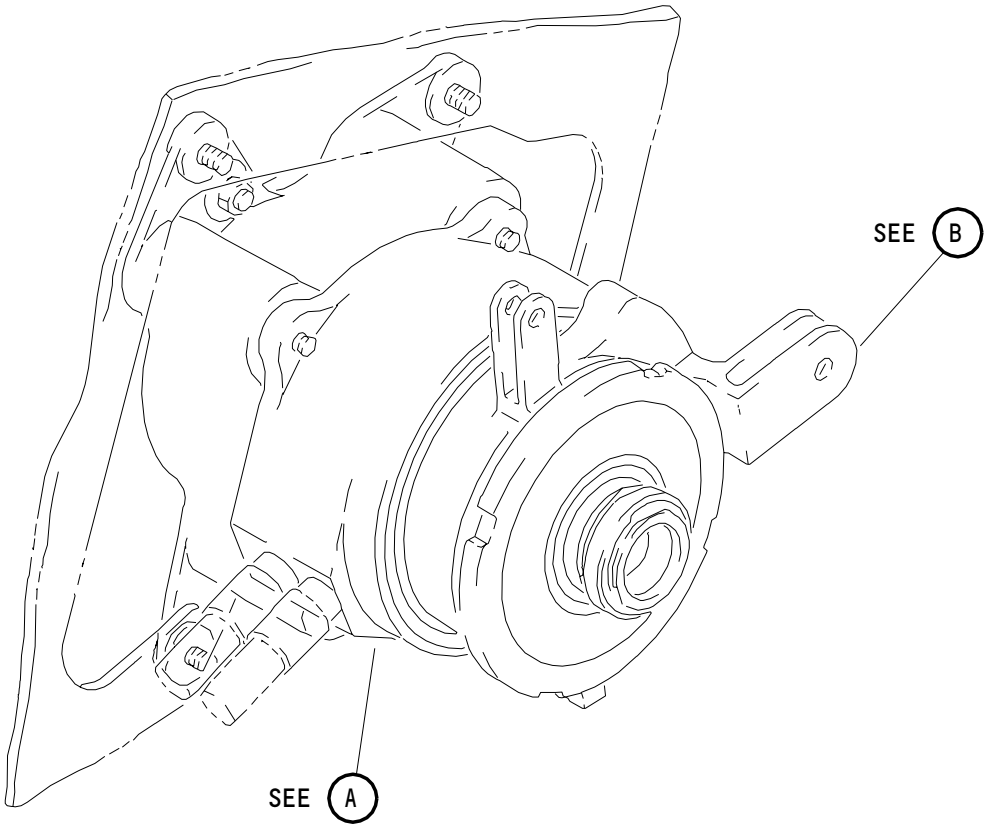
PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
AC2A		2	20	1
BACB10AS14		1	50	1
		2	105	1
BACB10AS17		1	170	1
		2	225	1
BACB10AS21		1	95	1
		1	155	1
		2	150	1
		2	210	1
BACN10YR4CD		2	15	3
BACS34A32		1	70	1
		2	125	1
CU09644003		1	60	1
		2	115	1
CWR76-32A		1	70	1
		2	125	1
DW96801-32		1	70	1
		2	125	1
H52732-4CD		2	15	3
LLMB540		1	50	1
		2	105	1
LLMB541		1	170	1
		2	225	1
LLMB542		1	95	1
		1	155	1
		2	150	1
		2	210	1
MB540-2TS		1	50	1
		2	105	1
MB540DD		1	50	1
		2	105	1
MB540DDFS428		1	50	1
		2	105	1
MB540DDG20		1	50	1
		2	105	1
MB540DDLY196		1	50	1
		2	105	1
MB540DDSD610		1	50	1
		2	105	1

PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
MB540TT		1	50	1
		2	105	1
MB541-2TS		1	170	1
		2	225	1
MB541DD		1	170	1
		2	225	1
MB541DDFS428		1	170	1
		2	225	1
MB541DDG20		1	170	1
		2	225	1
MB541DDLY196		1	170	1
		2	225	1
MB541DDSD610		1	170	1
		2	225	1
MB541TT		1	170	1
		2	225	1
MB542-2TS		1	95	1
		1	155	1
		2	150	1
		2	210	1
MB542DD		1	95	1
		1	155	1
		2	150	1
		2	210	1
MB542DDFS428		1	95	1
		1	155	1
		2	150	1
		2	210	1
MB542DDG20		1	95	1
		1	155	1
		2	150	1
		2	210	1
MB542DDLY196		1	95	1
		1	155	1
		2	150	1
		2	210	1

PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
MB542DDSD610		1	95	1
		1	155	1
		2	150	1
		2	210	1
MB542TT		1	95	1
		1	155	1
		2	150	1
		2	210	1
MS21209F1-25		2	235	2
MS21209F4-15P		2	70	3
MS24665-71		1	55	1
		2	110	1
MT340E		1	50	1
		2	105	1
MT341E		1	170	1
MT341E		2	225	1
MT342E		1	95	1
		1	155	1
		2	150	1
		2	210	1
NAS1149D0332J		1	40	3
		2	30	1
		2	95	3
NAS1149D0416J		1	15	3
		2	10	3
		2	45	3
		2	60	3
NAS603-28P		2	25	1
NAS603-5P		1	35	3
		2	90	3
NAS6604-10		2	5	3
		2	55	3
NAS6604-3		1	10	3
		2	40	3
PLH54CD		2	15	3
P76200		2	20A	1
RMS34A32		1	70	1
		2	125	1

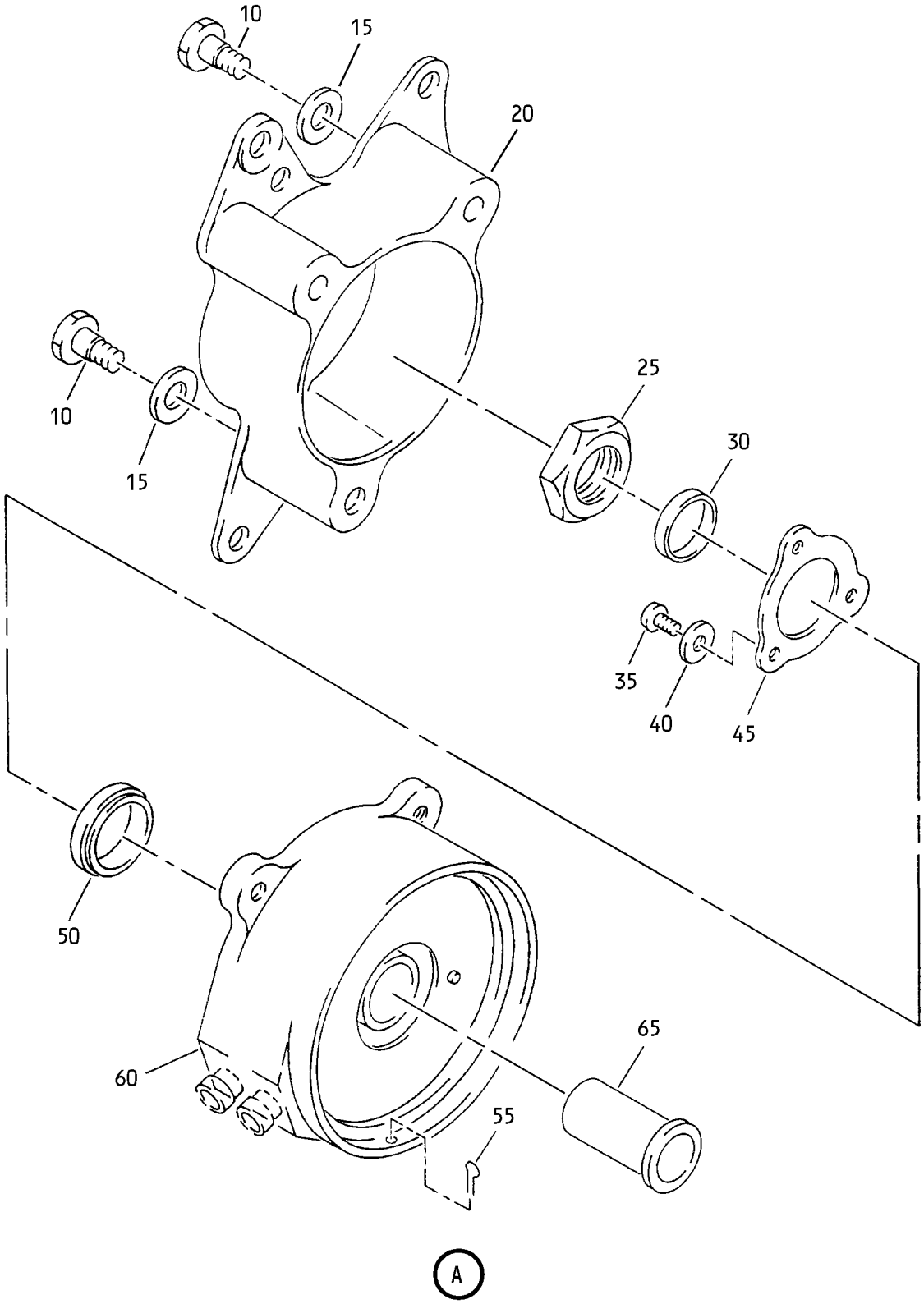
PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
SL7165C14C		1	25	1
		2	80	1
S1106532		1	70	1
		2	125	1
S253T409-1		2	20	1
S254N101-4		1	60	1
		2	115	1
S3038832-1		1	70	1
		2	125	1
S3038832-5		1	70	1
		2	125	1
TF005-32		1	70	1
		2	125	1
2140-32		1	70	1
		2	125	1
253T7530-1		1	105	1
		2	160	1
253T7530-2		1	110	1
		2	165	1
253T7530-3		1	115	1
		2	170	1
253T7530-4		1	120	1
		2	175	1
253T7535-2		1	145	1
		2	200	1
253T7536-3		1	130	1
		2	185	1
253T7539-3		1	90	1
		2	145	1
253T7539-4		1	100	1
		2	155	1
254N1154-2		1	45	1
		2	100	1
254N1155-1		1	75	1
		2	130	1
254N1161-1		1	125	3
		2	180	3
254N1166-2		1	140	1
		2	195	1
254N1169-2		1	30	1
		2	85	1

PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
254N1183-1		1	85	1
		2	140	1
254T4100-1		1	1A	RF
254T4100-2		1	5	RF
		2	1A	RF
254W4101-7		1	80	1
254W4101-8		2	135	1
254W4102-5		1	150	1
254W4102-6		2	205	1
254W4102-7		1	160	1
254W4102-8		2	215	1
254W4103-2		1	20	1
254W4104-1		2	65A	1
254W4104-2		2	75A	1
254W4104-3		2	65	1
254W4104-4		2	75	1
254W4105-1		1	65	1
		2	120	1
254W4106-1		1	165	1
		2	220	1
254W4120-13		1	175	1
254W4120-14		2	230	1
254W4120-15		2	240	1
254W4130-2		2	35	1
254W4140-1		2	50A	1
254W4140-3		2	50	1
90650		1	135	2
		2	190	2



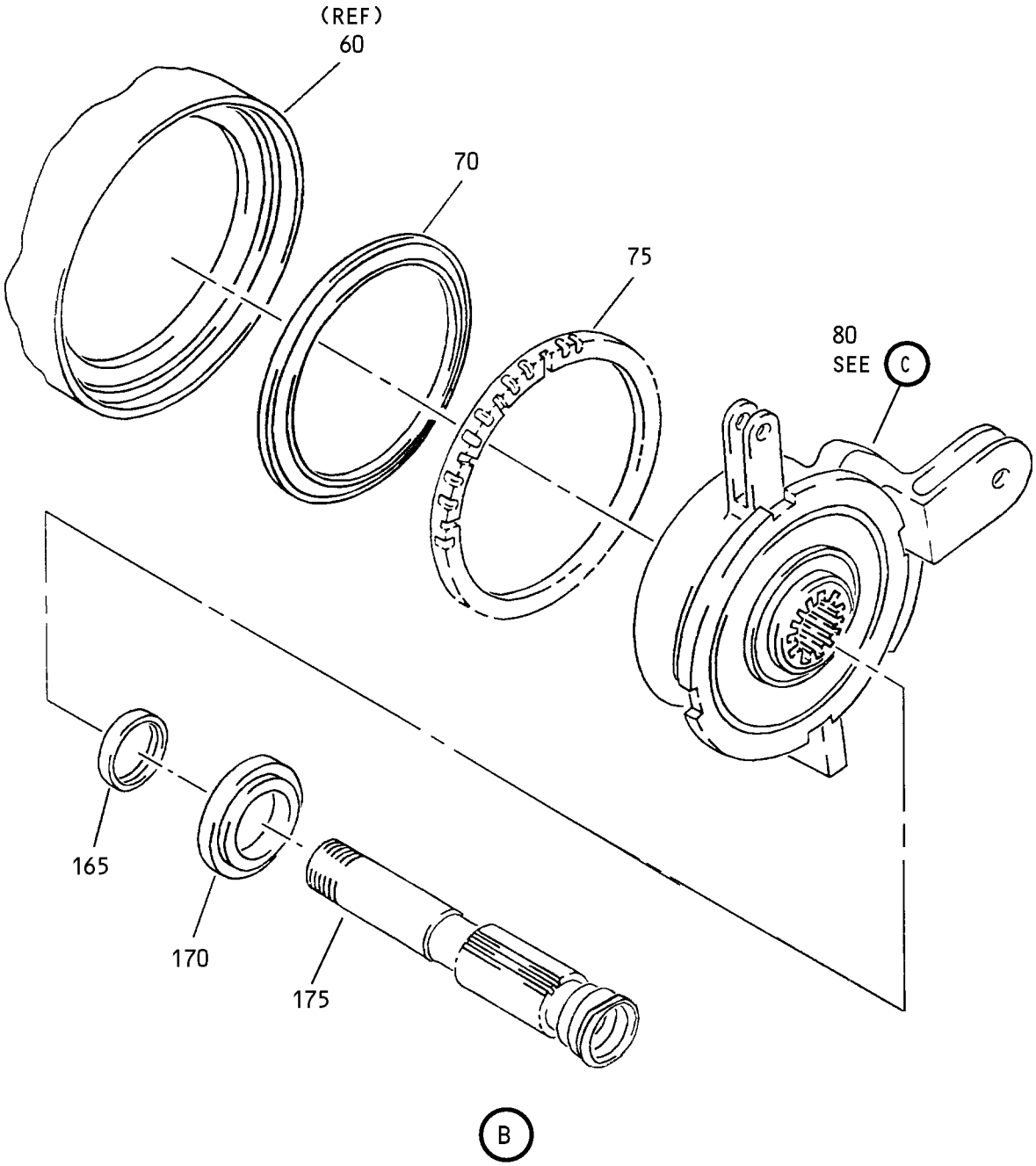
Control Stand Left Side Autothrottle Servo Assembly
Figure 1 (Sheet 1)

K86702



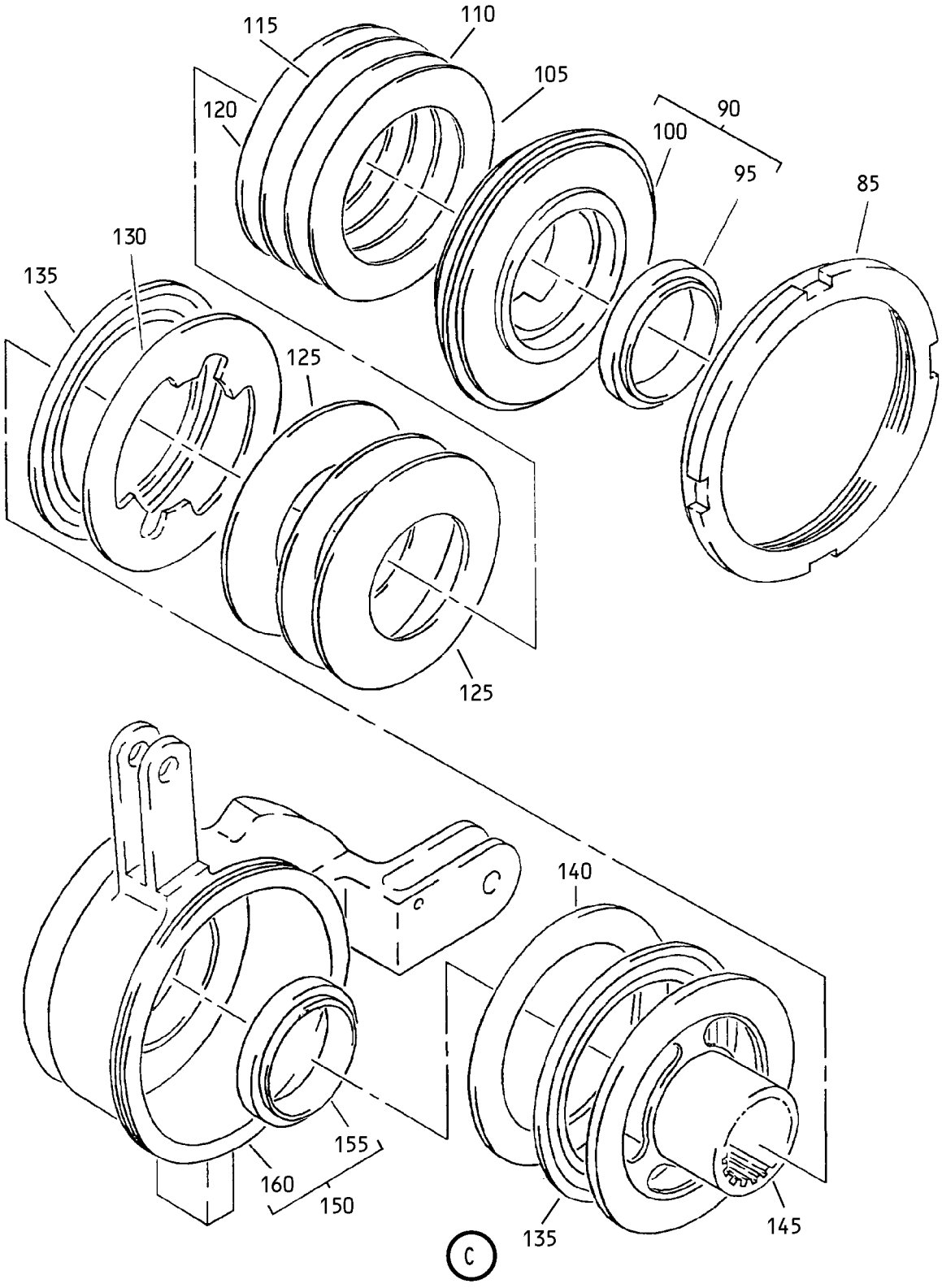
Control Stand Left Side Autothrottle Servo Assembly
Figure 1 (Sheet 2)

K86714



Control Stand Left Side Autothrottle Servo Assembly
Figure 1 (Sheet 3)

K86777



Control Stand Left Side Autothrottle Servo Assembly
Figure 1 (Sheet 4)

K86823

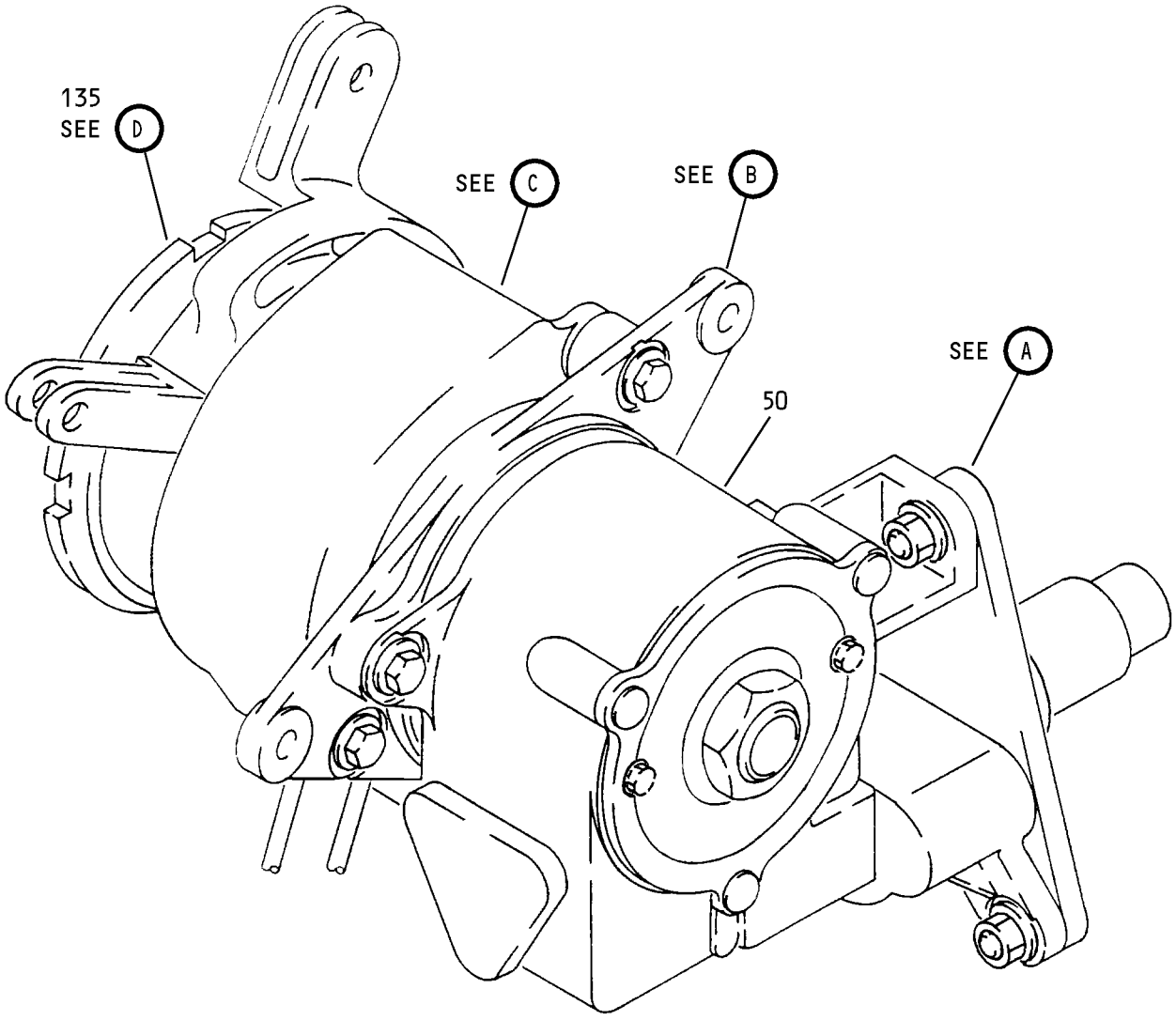
FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
-1A	254T4100-1		SERVO ASSY-L	A	RF
-5	254T4100-2		SERVO ASSY-R	B	RF
			(FOR DETAILS SEE FIG. 2)		
10	NAS6604-3		.BOLT	A	3
15	NAS1149D0416J		.WASHER	A	3
20	254W4103-2		.BRACKET	A	1
25	SL7165C14C		.NUT-	A	1
			(V97393)		
30	254N1169-2		.SPACER	A	1
35	NAS603-5P		.SCREW	A	3
40	NAS1149D0332J		.WASHER	A	3
45	254N1154-2		.PLATE	A	1
50	MB540DDSD610		.BEARING-	A	1
			(V83086)		
			(SPEC BACB10AS14)		
			(OPT LLMB540		
			(V38443))		
			(OPT MB540-2TS		
			(V43991))		
			(OPT MB540DDFS428		
			(V21335))		
			(OPT MB540TT		
			(V43991))		
			(OPT MB540DDG20		
			(V38443))		
			(OPT MT340E		
			(VK8455))		
			(OPT MB540DDLY196		
			(V40920))		
			(OPT MB540DD		
			(V06144))		
55	MS24665-71		.PIN-COTTER	A	1
60	CU09644003		.RESOLVER ASSY-	A	1
			(V05088)		
			(SPEC S254N101-4)		
65	254W4105-1		.SPACER	A	1

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
70	CWR76-32A		.SCRAPER- (V26879) (SPEC BACS34A32) (OPT DW96801-32 (V02886)) (OPT RMS34A32 (V94878)) (OPT S1106532 (V09257)) (OPT S3038832-1 (V09257)) (OPT S3038832-5 (V09257)) (OPT TF005-32 (V07128)) (OPT 2140-32 (V26303))	A	1
75	254N1155-1		.NUT-SEAL	A	1
80	254W4101-7		.BRAKE ASSY	A	1
85	254N1183-1		..NUT	A	1
90	253T7539-3		..CAP ASSY	A	1
95	MB542DDSD610		...BEARING- (V83086) (SPEC BACB10AS21) (OPT LLMB542 (V38443)) (OPT MB542-2TS (V43991)) (OPT MB542DDFS428 (V21335)) (OPT MB542TT (V43991)) (OPT MB542DDG20 (V38443)) (OPT MT342E (VK8455)) (OPT MB542DDLY196 (V40920)) (OPT MB542DD (V06144))	A	1

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
100	253T7539-4		...CAP	A	1
105	253T7530-1		..SHIM	A	AR
110	253T7530-2		..SHIM	A	AR
115	253T7530-3		..SHIM	A	AR
120	253T7530-4		..SHIM	A	AR
125	254N1161-1		..SPRING	A	3
130	253T7536-3		..STATOR	A	1
135	90650		..ROLLER ASSY-SKEWED (V82402)	A	2
140	254N1166-2		..DISC	A	1
145	253T7535-2		..ROTOR	A	1
150	254W4102-5		..HOUSING ASSY	A	1
155	MB542DDSD610		...BEARING- (V83086) (SPEC BACB10AS21) (OPT LLMB542 (V38443)) (OPT MB542-2TS (V43991)) (OPT MB542DDFS428 (V21335)) (OPT MB542TT (V43991)) (OPT MB542DDG20 (V38443)) (OPT MT342E (VK8455)) (OPT MB542DDLY196 (V40920)) (OPT MB542DD (V06144))	A	1
160	254W4102-7		...HOUSING	A	1
165	254W4106-1		.SPACER	A	1

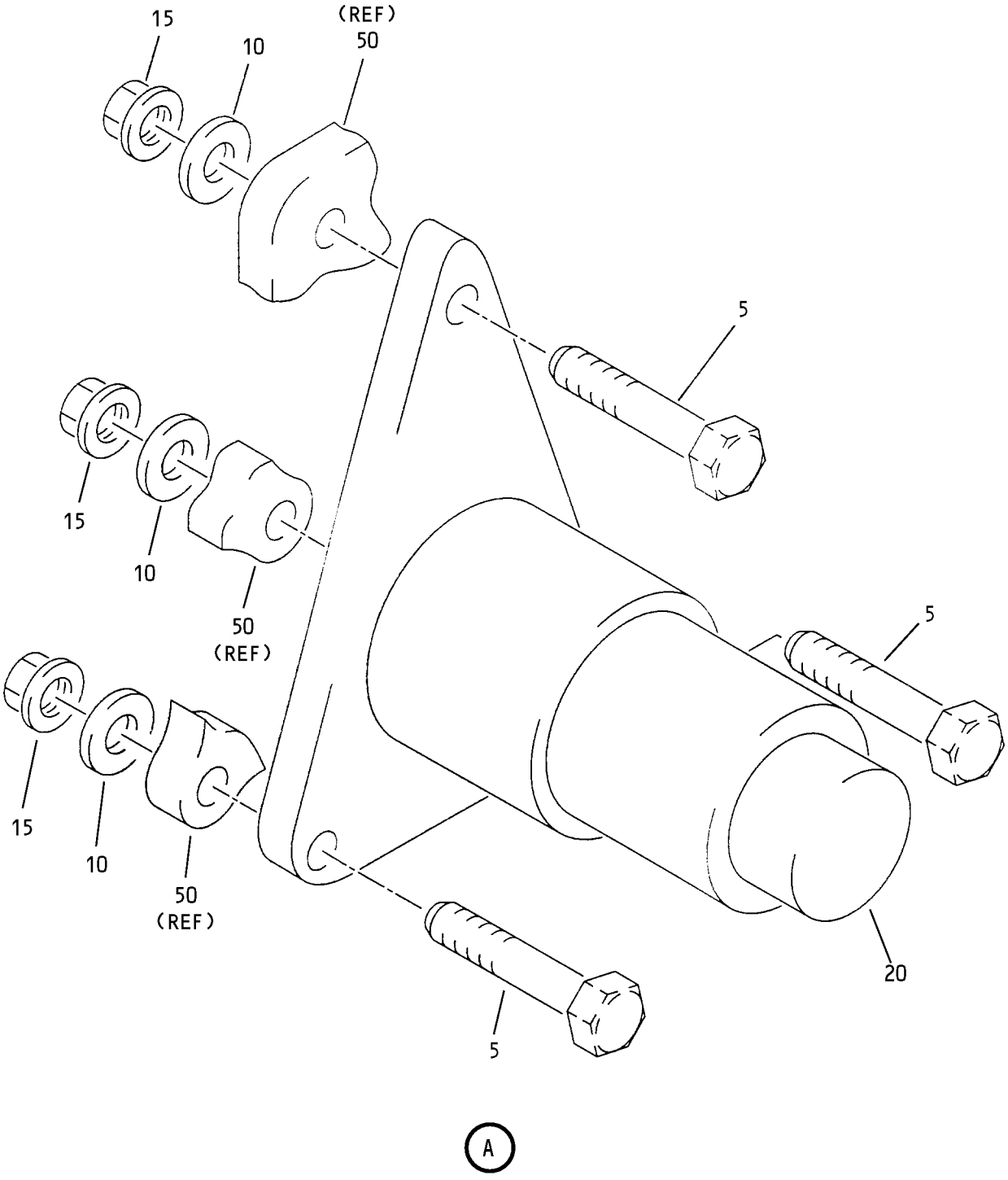
FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-170	MB541DDSD610		.BEARING- (V83086) (SPEC BACB10AS17) (OPT LLMB541 (V38443)) (OPT MB541-2TS (V43991)) (OPT MB541DDFS428 (V21335)) (OPT MB541TT (V43991)) (OPT MB541DDG20 (V38443)) (OPT MT341E (VK8455)) (OPT MB541DDLY196 (V40920)) (OPT MB541DD (V06144))	A	1
175	254W4120-13		.SHAFT	A	1

- Item Not Illustrated



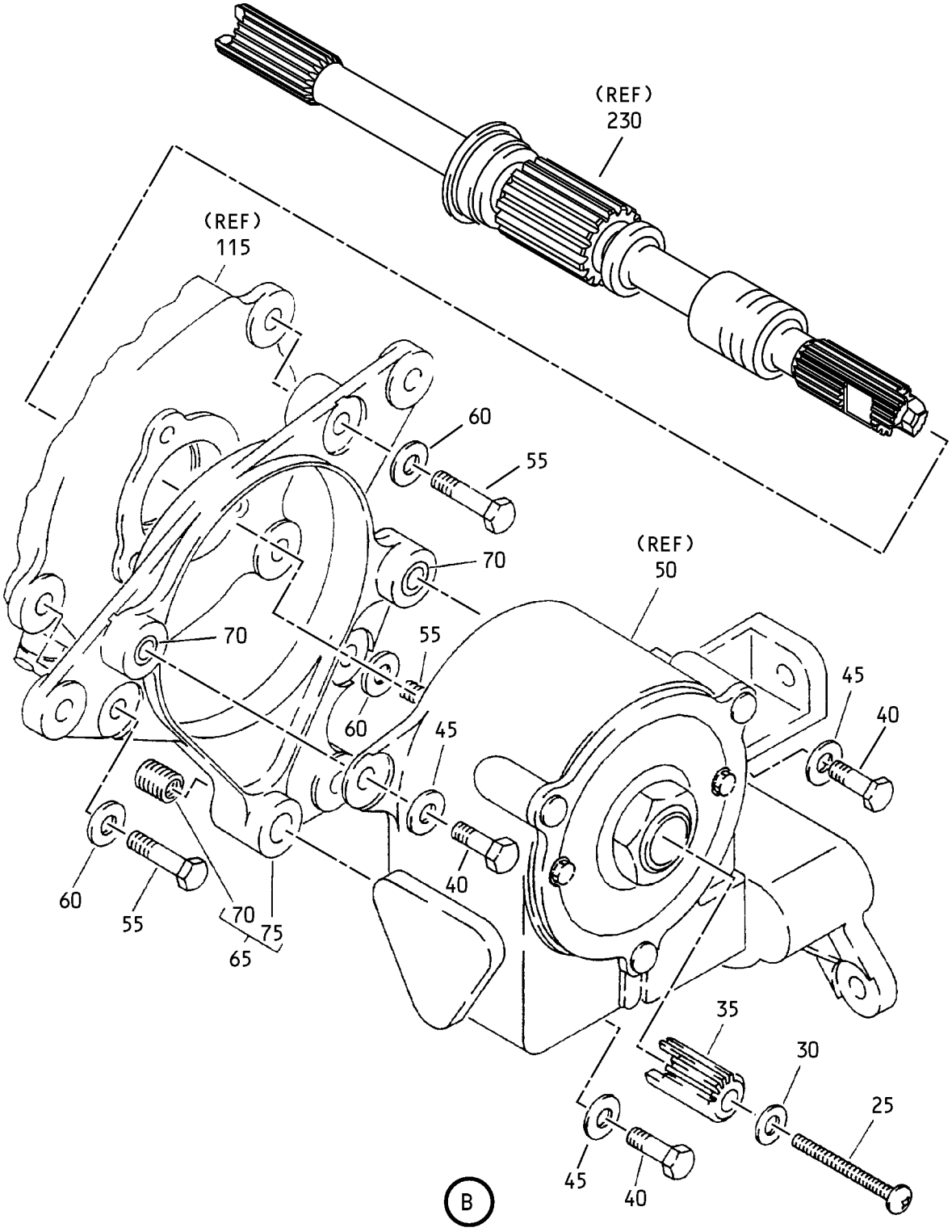
Control Stand Right Side Autothrottle Servo Assembly
Figure 2 (Sheet 1)

K86955



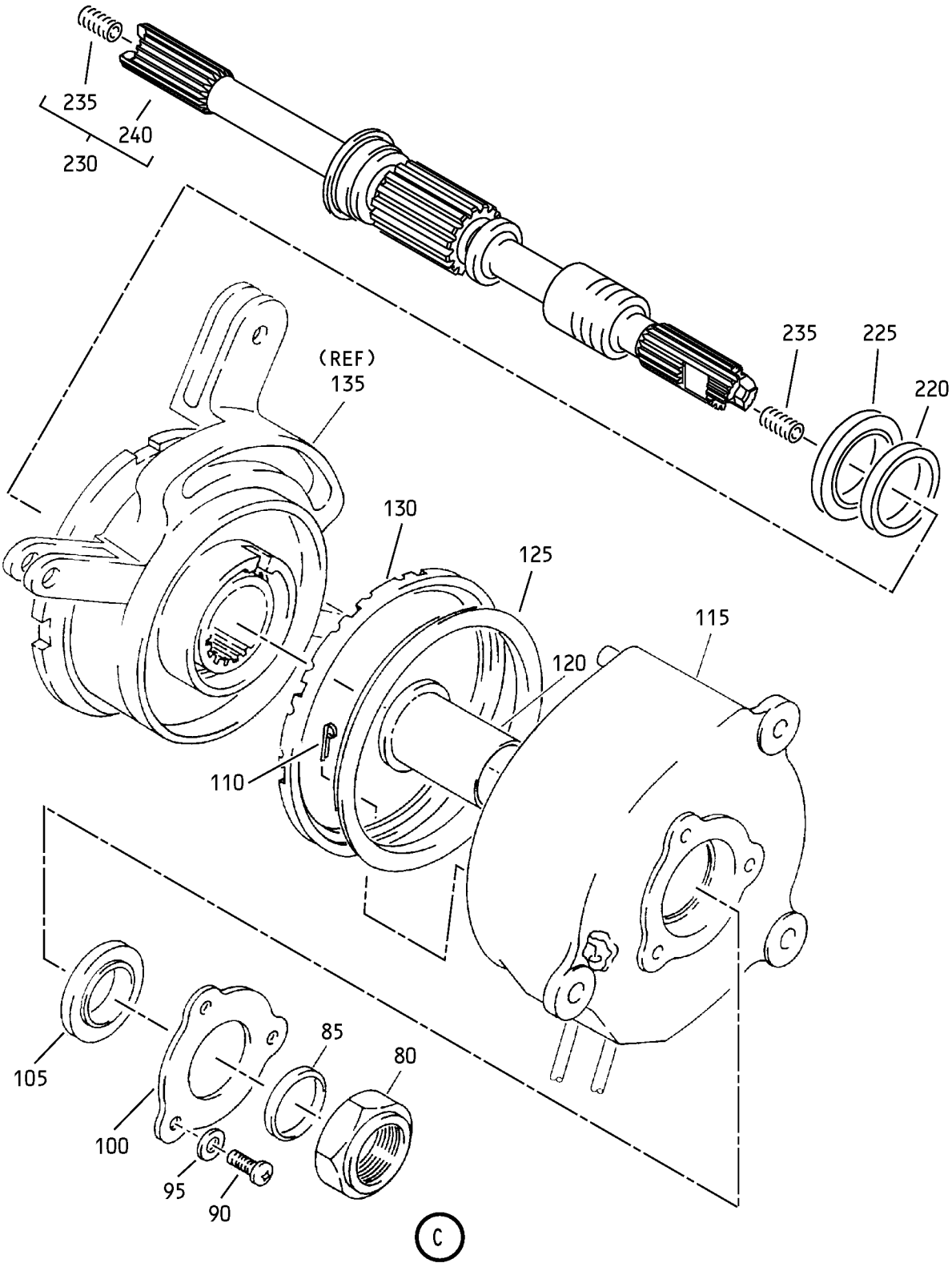
Control Stand Right Side Autothrottle Servo Assembly
Figure 2 (Sheet 2)

K87077



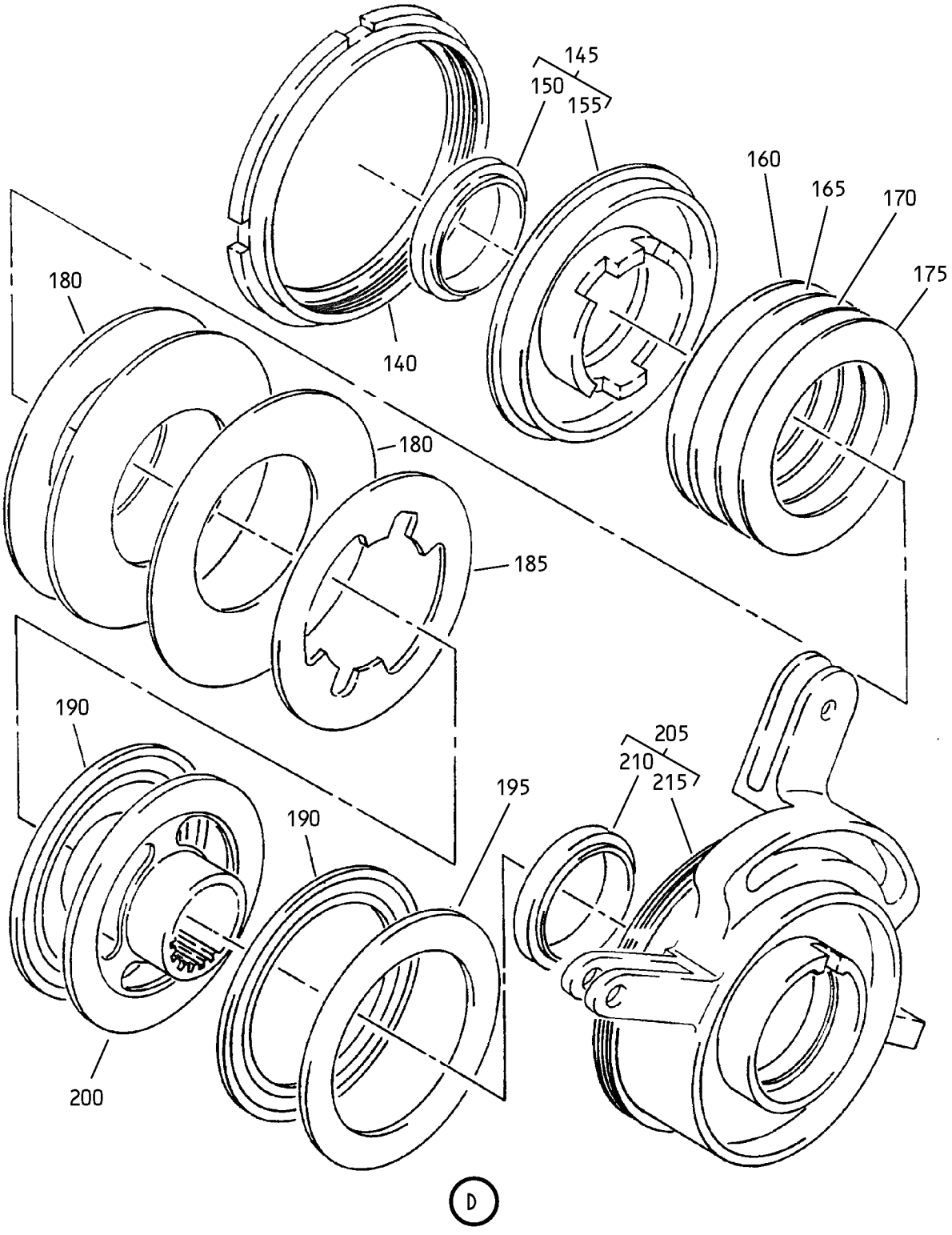
Control Stand Right Side Autothrottle Servo Assembly
Figure 2 (Sheet 3)

K87172



Control Stand Right Side Autothrottle Servo Assembly
Figure 2 (Sheet 4)

K88624



Control Stand Right Side Autothrottle Servo Assembly
Figure 2 (Sheet 5)

K87521

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
02-					
-1A	254T4100-2		SERVO ASSY-R	B	RF
5	NAS6604-10		.BOLT	B	3
10	NAS1149D0416J		.WASHER	B	3
15	H52732-4CD		.NUT- (V15653) (SPEC BACN10YR4CD) (OPT PLH54CD (V62554))	B	3
20	AC2A		.MOTOR-SERVO (V51761) (SPEC S253T409-1) (OPT ITEM 20A)	B	1
-20A	P76200		.MOTOR-SERVO (V19710) (SPEC S253T409-4) (OPT ITEM 20)	B	1
25	NAS603-28P		.SCREW	B	1
30	NAS1149D0332J		.WASHER	B	1
35	254W4130-2		.PLUG-RAMP	B	1
40	NAS6604-3		.BOLT	B	3
45	NAS1149D0416J		.WASHER	B	3
50	254W4140-3		.GEAR BOX ASSY- (OPT ITEM 50A) (REF CMM 22-32-33)	B	1
-50A	254W4140-1		.GEAR BOX ASSY- (OPT ITEM 50) (REF CMM 22-32-33)	B	1
55	NAS6604-10		.BOLT	B	3
60	NAS1149D0416J		.WASHER	B	3
65	254W4104-3		.BRACKET ASSY- (OPT ITEM 65A)	B	1
-65A	254W4104-1		.BRACKET ASSY- (OPT ITEM 65)	B	1
70	MS21209F4-15P		..INSERT	B	3
75	254W4104-4		..BRACKET- (USED ON ITEM 65)	B	1
-75A	254W4104-2		..BRACKET- (USED ON ITEM 65A)	B	1

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
02-					
80	SL7165C14C		.NUT- (V97393)	B	1
85	254N1169-2		.SPACER	B	1
90	NAS603-5P		.SCREW	B	3
95	NAS1149D0332J		.WASHER	B	3
100	254N1154-2		.PLATE	B	1
105	MB540DDSD610		.BEARING- (V83086) (SPEC BACB10AS14) (OPT LLMB540 (V38443)) (OPT MB540-2TS (V43991)) (OPT MB540DDFS428 (V21335)) (OPT MB540TT (V43991)) (OPT MB540DDG20 (V38443)) (OPT MT340E (VK8455)) (OPT MB540DDLY196 (V40920)) (OPT MB540DD (V06144))	B	1
110	MS24665-71		.PIN-COTTER	B	1
115	CU09644003		.RESOLVER ASSY- (V05088) (SPEC S254N101-4)	B	1
120	254W4105-1		.SPACER	B	1

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
02-					
125	CWR76-32A		.SCRAPER- (V26879) (SPEC BACS34A32) (OPT DW96801-32 (V02886)) (OPT RMS34A32 (V94878)) (OPT S1106532 (V09257)) (OPT S3038832-1 (V09257)) (OPT S3038832-5 (V09257)) (OPT TF005-32 (V07128)) (OPT 2140-32 (V26303))	B	1
130	254N1155-1		.NUT-SEAL	B	1
135	254W4101-8		.BRAKE ASSY	B	1
140	254N1183-1		..NUT	B	1
145	253T7539-3		..CAP ASSY	B	1
150	MB542DDSD610		...BEARING- (V83086) (SPEC BACB10AS21) (OPT LLMB542 (V38443)) (OPT MB542-2TS (V43991)) (OPT MB542DDFS428 (V21335)) (OPT MB542TT (V43991)) (OPT MB542DDG20 (V38443)) (OPT MT342E (VK8455)) (OPT MB542DDLY196 (V40920)) (OPT MB542DD (V06144))	B	1

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
02-					
155	253T7539-4		...CAP	B	1
160	253T7530-1		..SHIM	B	AR
165	253T7530-2		..SHIM	B	AR
170	253T7530-3		..SHIM	B	AR
175	253T7530-4		..SHIM	B	AR
180	254N1161-1		..SPRING	B	3
185	253T7536-3		..STATOR	B	1
190	90650		..ROLLER ASSY-SKEWED (V82402)	B	2
195	254N1166-2		..DISC	B	1
200	253T7535-2		..ROTOR	B	1
205	254W4102-6		..HOUSING ASSY	B	1
210	MB542DDSD610		...BEARING- (V83086) (SPEC BACB10AS21) (OPT LLMB542 (V38443)) (OPT MB542-2TS (V43991)) (OPT MB542DDFS428 (V21335)) (OPT MB542TT (V43991)) (OPT MB542DDG20 (V38443)) (OPT MT342E (VK8455)) (OPT MB542DDLY196 (V40920)) (OPT MB542DD (V06144))	B	1

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
02-					
215	254W4102-8		...HOUSING	B	1
220	254W4106-1		.SPACER	B	1
225	MB541DDSD610		.BEARING- (V83086) (SPEC BACB10AS17) (OPT LLMB541 (V38443)) (OPT MB541-2TS (V43991)) (OPT MB541DDFS428 (V21335)) (OPT MB541TT (V43991)) (OPT MB541DDG20 (V38443)) (OPT MT341E (VK8455)) (OPT MB541DDLY196 (V40920)) (OPT MB541DD (V06144))	B	1
230	254W4120-14		.SHAFT ASSY	B	1
235	MS21209F1-25		..INSERT	B	2
240	254W4120-15		..SHAFT	B	1

- Item Not Illustrated