

RUDDER CONTROL RATIO CHANGER LOAD LIMITER ASSEMBLY

PART NUMBER 251T3624-6

COMPONENT MAINTENANCE MANUAL WITH ILLUSTRATED PARTS LIST

27-21-20

4114



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	вү	REVISION NUMBER	REVISION DATE	DATE FILED	вү

27-21-20 REVISION RECORD



TEMPORARY REVISION AND SERVICE BULLETIN RECORD

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



INTRODUCTION

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

This manual is divided into separate sections:

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

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

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

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

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

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

Verification:

Testing/TS JUN 1/82 Disassembly JUN 1/82 Assembly JUN 1/82



RUDDER CONTROL RATIO CHANGER LOAD LIMITER ASSEMBLY

DESCRIPTION AND OPERATION

- 1. The rudder control ratio changer load limiter assembly consists of a housing assembly, piston assembly, crush core, and two slides. This assembly is the main connecting rod assembly between the ratio changer and the yaw damper summing lever assembly. The crush core prevents the transfer of excessive loads to other units by collapsing its honeycomb cell structure. The assembly sustains loads below 166 lbs and the crush core collapses for loads greater than 166 lbs.
- 2. <u>Leading Particulars</u> (Approximate)

Diameter -- 2 inches Length -- 34 inches Weight -- 3 pounds



TESTING AND TROUBLE SHOOTING

1. Predisassembly Test

CAUTION: THE INDIVIDUAL PARTS USED TO MAKE THE LOAD LIMITER COMPRISE A MATCHED SET. IF ANY PARTS EXCEPT THE CRUSH CORE OR THE RIVETS ARE DAMAGED, THE LOAD LIMITER MUST BE REPLACED AS AN ASSEMBLY.

A. Apply reversing axial loads of approximately 10-20 lbs between housing assy (25A) and piston assy (90A). No free play shall be detectable. If free play is noted, disassemble and replace crush core (80, IPL Fig. 1).

DISASSEMBLY

1. Parts Replacement

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

- A. Rivets (7, 15, 40, 97, 105)
- B. Lockwire

2. <u>Disassembly</u> (IPL Fig. 1)

NOTE: If only a new crush core (80C) is being replaced, refer to steps 2.A. thru 2.E. only.

- A. Remove lockwire from cap (20).
- B. Remove cap (20) and extension stop (55) from housing assembly (25A).

<u>NOTE</u>: If only a new crush core (80C) is being replaced, cap (20) and extension stop (55) will not be removed from piston assembly (90A).

- C. Remove piston assembly (90) and attached parts from housing assembly (25A).
- D. Remove washer (65), nut (60) and extension impeller (70) from piston assembly (90A).
- E. Remove extension slide (75) and crush core (80C) from piston assembly (90A).
- F. Remove retraction slide (85) from piston assembly (90A).
- G. Remove rivets (15), rod end (10), cap (20) and extension stop from piston (110).
- H. Remove rivets (97, 105), retract impeller (95) and plug (100A) from piston assembly (90A).



I. Remove rivets (7, 32, 40), clevis (5), sleeve (30) and retraction stop (35) from casing (45).

<u>NOTE</u>: Do not remove aluminum marker (50) unless necessary for repair or replacement.

Do not remove epoxy resin filler from piston (110) or clevis (5) unless necessary for repair or replacement.

DISASSEMBLY



CHECK

- 1. Check all parts for obvious defects in accordance with standard industry practices.
- 2. Magnetic particle check per 20-20-01 -- Plug (100A, IPL Fig. 1).
- 3. Penetrant check per 20-20-02 -- Clevis (5), cap (20), sleeve (30), stop (35, 55), casing (45), impeller (70, 95), slide (75, 85), piston (110).



REPAIR - GENERAL

1. Content

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

<u>P/N</u>	<u>NAME</u>	REPAIR
251T3637	PISTON	1–1
251T3639	STOP, EXTENSION	2–1
251T3641	SLIDE, RETRACTION	3–1
251T3646	CLEVIS	4–1
BAC27TCT0006	MARKER	5–1
	MISC PARTS REFINISH	6-1

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
20-30-03	General Cleaning Procedures
20-41-01	Decoding Table for Boeing Finish Codes
20-42-01	Low Hydrogen Embrittlement Cadmium Plating
20-43-01	Chromic Acid Anodizing
20-50-02	Application of Dry Lubricant

3. Materials

NOTE: Equivalent substitutes may be used.

- A. Enamel -- BMS 10-11, Type 2, Color White Gloss (702) (Ref 20-60-02)
- B. Epoxy Resin Filler -- BMS 5-28, Type 6 (Ref 20-60-04)
- C. Lubricant -- MIL-L-8937 Solid Film Lubricant (Ref 20-60-03)
- D. Primer -- BMS 10-11, Type 1 (Ref 20-60-02)
- E. Corrosion Inhibiting Compound -- BMS 3-23, Type II (Ref 20-60-04)



4. <u>Dimensioning Symbols</u>

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

_	STRAIGHTNESS	\oplus	THEORETICAL EXACT POSITION OF A FEATURE (TRUE POSITION)
	FLATNESS	Ø	DIAMETER
\perp	PERPENDICULARITY (OR SQUARENESS)		
//	PARALLELISM	s Ø	SPHERICAL DIAMETER
\circ	ROUNDNESS	R	RADIUS
\mathcal{O}	CYLINDRICITY	SR	SPHERICAL RADIUS
\cap	PROFILE OF A LINE	()	REFERENCE
	PROFILE OF A SURFACE	BASIC	A THEORETICALLY EXACT DIMENSION USED
<u> </u>	CONCENTRICITY	(BSC) OR	TO DESCRIBE SIZE, SHAPE OR LOCATION OF A FEATURE FROM WHICH PERMISSIBLE
=	SYMMETRY	DIM	VARIATIONS ARE ESTABLISHED BY TOLERANCES ON OTHER DIMENSIONS OR NOTES.
_	ANGULARITY	-A-	DATUM
7	RUNOUT	M	MAXIMUM MATERIAL CONDITION (MMC)
21	TOTAL RUNOUT	L	LEAST MATERIAL CONDITION (LMC)
\Box	COUNTERBORE OR SPOTFACE	(\$)	REGARDLESS OF FEATURE SIZE (RFS)
\vee	COUNTERSINK	P	PROJECTED TOLERANCE ZONE
		FIM	FULL INDICATOR MOVEMENT

EXAMPLES

- 0.002	STRAIGHT WITHIN 0.002	⊚ c Ø 0.0005	CONCENTRIC TO C WITHIN 0.0005 DIAMETER
⊥ B 0.002	PERPENDICULAR TO B WITHIN 0.002	≡ A 0.010	SYMMETRICAL WITH A WITHIN 0.010
// A 0.002	PARALLEL TO A WITHIN 0.002	∠ A 0.005	ANGULAR TOLERANCE 0.005 WITH A
0.002	ROUND WITHIN 0.002	⊕ B Ø 0.002 S	LOCATED AT TRUE POSITION WITHIN 0.002 DIA RELATIVE
0.010	CYLINDRICAL SURFACE MUST LIE BETWEEN TWO CONCENTRIC CYLIN-		TO DATUM B, REGARDLESS OF FEATURE SIZE
	DERS, ONE OF WHICH HAS A RADIUS 0.010 INCH GREATER THAN THE OTHER	☐ A Ø 0.010 M 0.510 P	AXIS IS TOTALLY WITHIN A CYLINDER OF 0.010-INCH
∩ A 0.006	EACH LINE ELEMENT OF THE SURFACE AT ANY CROSS SECTION MUST LIE BETWEEN TWO PROFILE BOUNDARIES 0.006 INCH APART		DIAMETER, PERPENDICULAR TO, AND EXTENDING 0.510-INCH ABOVE, DATUM A, MAXIMUM MATERIAL CONDITION
	RELATIVE TO DATUM PLANE A	2.000	EXACT DIMENSION IS 2.000
△ A 0.020	SURFACES MUST LIE WITHIN PARALLEL BOUNDARIES 0.02 INCH APART AND EQUALLY DISPOSED ABOUT TRUE PROFILE	OR 2.000 BSC	
(NOTE THAT	0.020 MAY ALSO APPEAR AS	0.020 A)	

True Position Dimensioning Symbols Figure 601

27-21-20

01



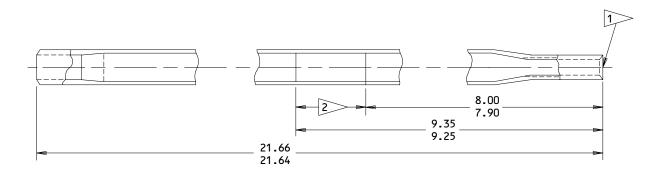
PISTON - REPAIR 1-1

251T3637-1

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

1. Epoxy Filler Replacement (Fig. 601)

- Punch out damaged filler and clean piston interior with dry compressed air.
- Touch up bare surfaces with primer. Cast epoxy resin filler, BMS 5-28, Type 6, approximately as shown.
- C. After filler has cured, drill two 0.128-0.135 inch diameter holes through filler using existing holes in piston as a guide.



REFINISH

CHEMICAL TREAT INTERIOR AND EXTERIOR SURFACES AND APPLY ONE COAT OF PRIMER, BMS 10-11, TYPE 1 (F-18.07) EXCEPT AS NOTED. THEN APPLY, BMS 3-23, TYPE 2 CORROSION INHIBITING COMPOUND (F-19.26) ON INTERIOR ONLY.

MATERIAL: AL ALLOY

ALL DIMENSIONS ARE IN INCHES

OMIT PRIMER ON THREADS AND COUNTERSUNK AREAS.

2>

MINIMUM EPOXY CASTING AREA AFTER APPLICATION OF PRIMER.

> Piston - Filler Replacement and Refinish Figure 601

> > 27-21-20

REPAIR 1-1 Page 601

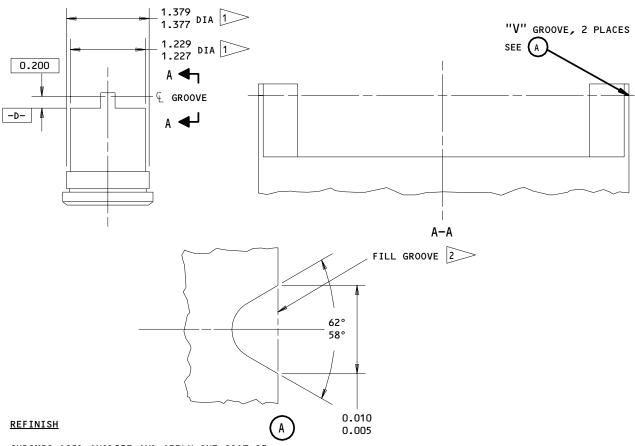


EXTENSION STOP - REPAIR 2-1

251T3639-1

1. Plating Repair (Fig. 601)

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



CHROMIC ACID ANODIZE AND APPLY ONE COAT OF PRIMER, BMS 10-11, TYPE 1 (F-18.13) EXCEPT AS NOTED.

MATERIAL: AL ALLOY

ALL DIMENSIONS ARE IN INCHES

1 OMIT PRIMER

FILL GROOVE BY APPLYING ONE COAT OF BMS 10-11, TYPE 2 ENAMEL, BOEING COLOR 702, WHITE GLOSS (F-21.03)

Extension Stop - Plating Repair Figure 601

27-21-20

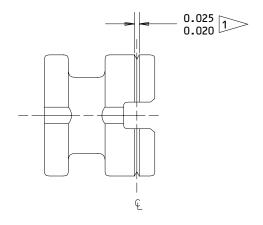


RETRACTION SLIDE - REPAIR 3-1

251T3641-1

1. Plating Repair (Fig. 601)

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



REFINISH

CHROMIC ACID ANODIZE (F-17.04). APPLY SOLID FILM LUBRICANT, MIL-L-8937 EXCEPT AS NOTED.

APPLY ONE COAT OF BMS 10-11, TYPE 1
PRIMER (F-20.02) AND ONE COAT OF
BMS 10-11, TYPE 2 ENAMEL, COLOR
WHITE (F-21.03) TO FILL GROOVE

MATERIAL: AL ALLOY

ALL DIMENSIONS ARE IN INCHES

Retraction Slide, Plating Repair Figure 601

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REPAIR 3-1
Page 601

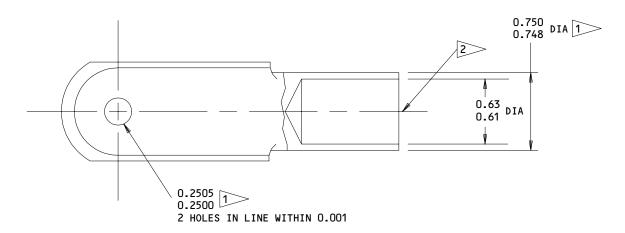


CLEVIS - REPAIR 4-1

251T3646-1

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

- 1. Epoxy Filler Replacement (Fig. 601)
 - A. Drill out damaged filler and clean cavity with dry compressed air.
 - Touch up bare surfaces with primer. Cast epoxy resin filler, BMS 5-28, Type 6.
 - C. After filler has cured, drill two 0.128-0.135 inch diameter holes through filler using existing holes in clevis (5) as a guide.



REFINISH

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

MATERIAL: AL ALLOY

ALL DIMENSIONS ARE IN INCHES

1 >> OMIT PRIMER

2 AFTER APPLICATION OF FINISH, FILL CAVITY WITH EPOXY FILLER

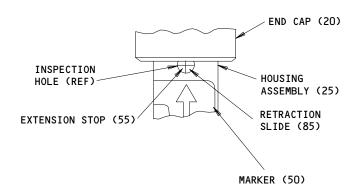
> Clevis - Filler Replacement and Refinish Figure 601

MARKER - REPAIR 5-1

BAC27TCT0006

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

- 1. Marker Replacement (IPL Fig. 1, Fig. 601)
 - A. Remove marker (50) and clean surfaces.
 - B. Position new marker with arrow pointing at inspection hole of housing assembly (25A).
- C. Install marker (50) per 20-50-05.



Marker Replacement Figure 601



MISC PARTS REFINISH - REPAIR 6-1

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

IPL FIG. & ITEM	MATERIAL	FINISH
Fig. 1		
Cap, end (20) Sleeve (30)	Al alloy	Chromic acid anodize and apply one coat of primer, BMS 10-11, type 1 (F-18.13) except omit primer on threaded surface.
Stop (35) Plug (100A)	Al alloy 4130 Steel, 125-145 ksi	Cadmium plate and apply one coat of primer, BMS 10-11, type 1 (F-16.01).
Casing (45)	Al alloy	Chemical treat interior and exterior and apply one coat of primer, BMS 10-11, type 1 (F-18.07).
Impeller (70,95)	Al alloy	Chromic acid anodize and apply one coat of primer, BMS 10-11, type 1 (F-18.13)
Slide (75)	Al alloy	Apply solid film lubricant, MIL-L-8937 (Ref 20-50-08).

Refinish Details Figure 601

ASSEMBLY

1. Material

- A. Lockwire -- MS20995NC32
- 2. Assembly (IPL Fig. 1, Fig. 701)

CAUTION: INDIVIDUAL PARTS USED TO MAKE LOAD LIMITER ASSEMBLY COMPRISE A MATCHED SET. IF ANY PARTS EXCEPT THE CRUSH CORE OR THE RIVETS ARE UNUSABLE, LOAD LIMITER MUST BE REPLACED AS AN ASSEMBLY.

NOTE: If only a new crush core (80C) is being installed, refer to steps 2.D. thru 2.G., 2.I. and 2.J.

- A. Install sleeve (30) on casing (45) with rivets (32) so that sleeve (30) chamfer is oriented as shown.
- B. Install retraction stop (35) in casing (45) with rivets (40) inserted through access holes of casing (45) so that rivet head is located inside casing (45).

<u>CAUTION</u>: BOTH MANUFACTURED AND DRIVEN HEADS OF RIVETS (105) MUST BE FLUSH TO 0.02 INCH BELOW SURFACE.

- C. Install retract impeller (95) and plug (100A) on piston (110) with rivets (97, 105) and ensure rivet heads are below surface.
- D. Install retraction slide (85), crush core (80C), extension slide (75), extension impeller (70), washer (65) and nut (60) on piston (110). Ensure that tangs on retract impeller (95) engage slots in retraction slide (85). Tighten nut (60) to 120-160 lb-in. Verify that impeller (70) is in contact with end face of plug (100) by looking through inspection hole in impeller (70).
- E. Slide extension stop (55) over retract impeller (95). Ensure that tangs of stop (55) enter slots in retraction slide (85).
- F. Carefully slide parts assembled in par. 2.E. into housing assembly (25A), ensuring that tangs of sleeve (30) enter slots in extension stop (55).
- G. Screw in end cap (20) over sleeve (30). Verify through inspection hole of cap (20) that extension stop (55) is in contact with end face of casing (45). Verify through inspection hole of casing (45) that narrow index mark on extension stop (55) is within wide index mark on retraction slide (85) per caution marker (50).

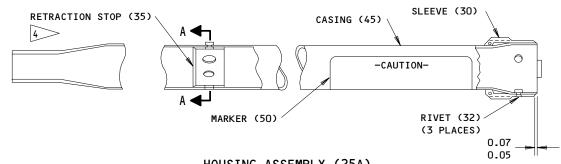


H. Install clevis (5) on casing (45), and rod end (10) on piston (110), with rivets (7, 15), per dimensions and orientation shown.

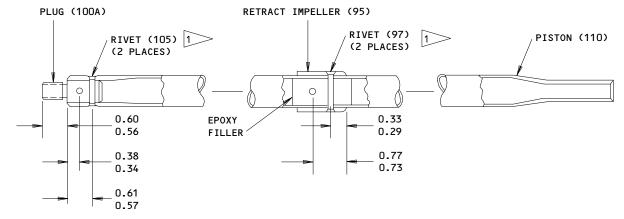
CAUTION: TIGHTEN END CAP (20) TO SPECIFIED TORQUE BY USING FLATS OF CLEVIS (5) IN AREA WHERE CLEVIS IS SOLID, IMMEDIATELY ADJACENT TO NECK OF CASING (45).

- I. Tighten end cap (20) to 50-100 lb-in. reaction torque.
- J. Lockwire end cap (20) to housing assembly (25) as shown, using double twist method per 20-50-02.
- 3. Prepare and store component in accordance with standard industry practices.

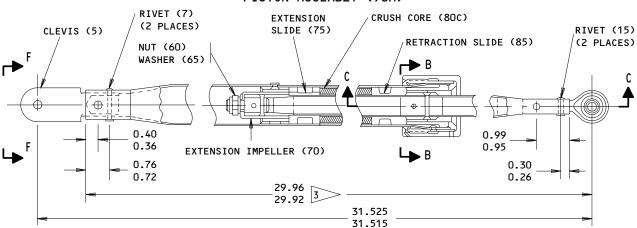




HOUSING ASSEMBLY (25A)



PISTON ASSEMBLY (90A)



BOTH MANUFACTURED AND DRIVEN HEADS MUST BE FLUSH TO 0.02 BELOW SURFACE

LOCKWIRE WITH MS20995NC32, USING DOUBLE TWIST METHOD

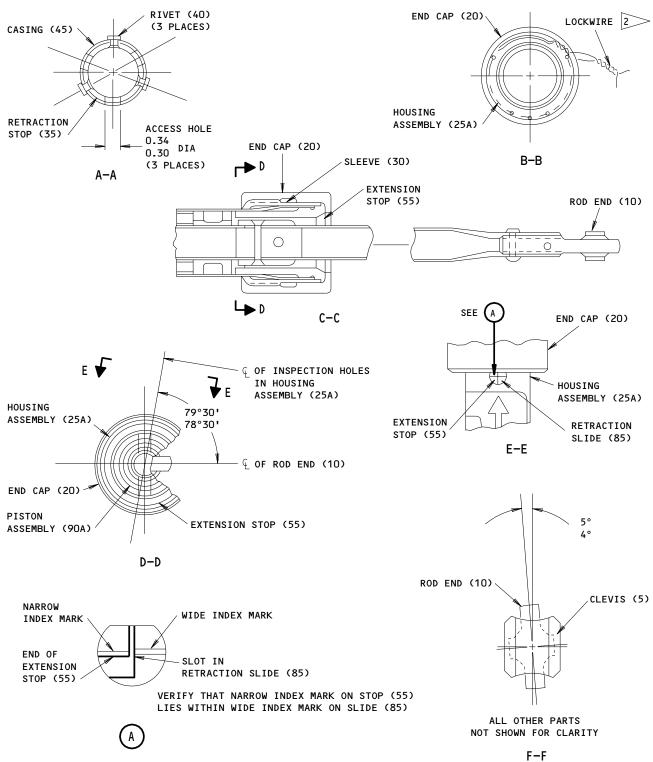
THIS DIMENSION TO BE ATTAINED CONCURRENTLY WITH 79° ANGLE (REFER TO SECTION D-D)

INSTALL WITH CHAMFER THIS SIDE

Load Limiter Assembly Figure 701 (Sheet 1)

> 27-21-20 **ASSEMBLY**





Load Limiter Assembly Figure 701 (Sheet 2)

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01

ASSEMBLY Page 704 Oct 01/87



FITS AND CLEARANCES

FOR TORQUE VALUES OF STANDARD FASTENERS, REFER TO 20-50-01			
ITEM NO.		TORG	AUE
IPL FIG. 1	NAME	POUND-INCHES	POUND-FEET
60	Nut	120–160	
20	End Cap	50-100	

Torque Table Figure 801

Oct 01/87



ILLUSTRATED PARTS LIST

- 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 The parts are optional to and interchangeable (OPT) with other parts having the same item number.

Supersedes, Superseded By The part supersedes and is not interchangeable (SUPSDS, SUPSD BY) with the original part.

Replaces, Replaced By

The part replaces and is interchangeable with, (REPLS, REPLD BY)

or is an alternate to, the original part.

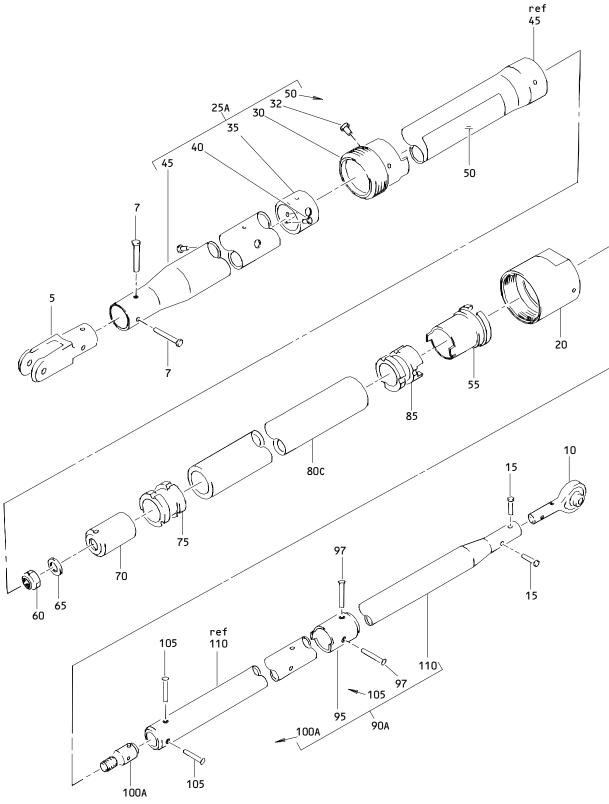
27-21-20 ILLUSTRATED PARTS LIST



<u>VENDORS</u>

15653	KAYNAR MFG COMPANY INC KAYLOCK DIV PO BOX 3001 800 SOUTH STATE COLLEGE BLVD FULLERTON, CALIFORNIA 92634
50294	NMB INC 9730 INDEPENDENCE AVENUE CHATSWORTH, CALIFORNIA 91311
52828	REPUBLIC FASTENER MFG CORP 1300 RANCHO CONEJO BLVD NEWBURY PARK, CALIFORNIA 91320
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
97613	SARGENT INDUSTRIES KAHR BEARING DIVISION 3010 NORTH SAN FERNANDO ROAD BURBANK, CALIFORNIA 91503





Load Limiter Assy - Rudder Control Ratio Changer Figure 1

27-21-20

FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01- -1 -1A	251T3624-1 251T3624-6		DELETED LOAD LIMITER ASSY-RUD		RF
5 7 10	251T3646-1 BACR15BB4AD KBDE4-107		CONT RATIO CHANGER .CLEVIS-(MATCHED PART) .RIVET .ROD END ASSY-(MATCHED		1 2 1
-10A	ARYT4E105		PART) (V97613) (OPT ITEM 10A) .ROD END ASSY-(MATCHED PART) (V50294) (OPT ITEM 10)		1
15	BACR15BB4AD		ATTACHING PARTS -RIVET		2
20	251T3645-1		.CAP-END (MATCHED PART)		1
25	251T3624-3		DELETED		
25A	251T3624-5		.HOUSING ASSY-(MATCHED PART)		1
30	251T3644-1		SLEEVE-THREADED (MATCHED PART)		1
32	BACR15BA4AD		RIVET		3
35	251T3629-1		STOP-RETRACTION (MATCHED PART)		1
40	BACR15BA4AD		RIVET		3
45 50	251T3643-1 BAC27TCT0006		CASING-(MATCHED PART) MARKER-CAUTION ALUMINUM FOIL		1
55	251T3639-1		STOP-EXTENSION (MATCHED PART)		1
60	BRH10-6		.NUT- (V52828) (SPEC BACN10JC6) (OPT H10-6BAC (V15653)) (OPT RMLH9075-6 (V72962)) (OPT 96-064 (V80539))		1



FIG. & ITEM	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFF CODE	QTY PER ASSY
01-					
65	AN960PD616		-WASHER		1
70	251T3638-1		.IMPELLER-EXTENSION (MATCHED PART)		1
75	251T3632-1		.SLIDE-EXTENSION (MATCHED PART)		1
80	S251T364-1		DELETED		
80c	S251T364-2		_CORE-CRUSH		1
85	251T3641-1		.SLIDE-RETRACTION (MATCHED PART)		1
90	251T3624-2		DELETED		
90A	251T3624-7		.PISTON ASSY- (MATCHED PART)		1
95	251T3640-1		IMPELLER-RETRACT (MATCHED PART)		1
97	BACR15BA4AD		RIVET		2
100	251T3642-1		DELETED		
100A	251T3642-2		PLUG-THREADED (MATCHED PART)		1
105	BACR15BA4AD		RIVET		2
110	251T3637-1		PISTON-(MATCHED PART)		1