AUTOTHROTTLE GEARBOX ASSEMBLY

22-35-01

BOEING P/N 65-42163

CUSTOMER P/N

THIS SUBJECT APPLIES TO THE FOLLOWING BOEING AIRPLANE MODELS:

707 STRATOLINER	707 INTERCONTINENTAL	720	727	737
NONE	LIMITED	NONE	LIMITED	LIMITED

THE FOLLOWING DIRECTIVES APPLY TO THIS SUBJECT:

BOEING SERVICE BULLETIN	BOEING TEMPORARY REVISION	OTHER DIRECTIVES	DATE DIRECTIVE INCORPORATED INTO TEXT

(CONTINUED)

BOEING SERVICE BULLETIN	BOEING TEMPORY BULLETIN	OTHER DIRECTIVES	DATE DIRECTIVE INCORPORATED INTO TEXT

CHECK LIST

* Indicates pages revised, added or deleted in latest revision
F Indicates foldout pages - print one side only

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Boeing Part Number 65-42163-1

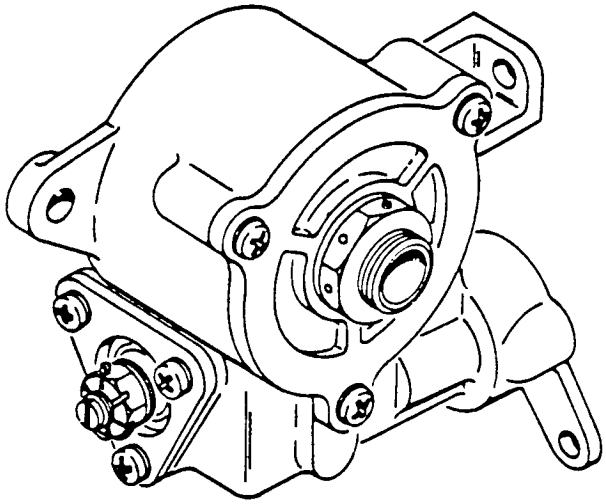


Figure 1. Autothrottle Gearbox Assembly

1. DESCRIPTION AND OPERATION

A. Description

(1) The autothrottle gearbox assembly consists of a set of spur gears and a worm and gear mounted in a housing. The input shaft is splined to mate with a servomotor and the output shaft is splined to mate with the autothrottle clutch assembly.

B. Operation

(1) The autothrottle servomotor drives the gearbox input shaft which is also the smaller of the two spur gears, the larger gear is part of the worm shaft which therefore rotates at a lower speed than the input shaft. The worm shaft drives the gearbox output shaft at a further reduction in speed and changes the direction of the drive 90°.

C. Leading Particulars

Length -- 6.50 inches
Width -- 5.25 inches
Height -- 3.65 inches
Weight -- 4.2 pounds

2. DISASSEMBLY (See figure 3.)

A. Remove pin (1), nut (2) and shim (3).

B. Remove screws (4), washers (5), cover assembly (6) and shim (9).

C. Remove retaining ring (11). Using drift through holes in worm gear (10), drive bearing (12) off worm gear and out of housing assembly (29). Lift worm gear (10) from housing.

D. Remove cotter pin (13), nut (14) and washers (15).

E. Remove screws (16), washers (17) and end cap (18).

F. Remove bearing (19), worm and spur gear (20) and bearing (21).

G. Remove screws (22) and cover (23).

H. Withdraw shaft assembly (24) from housing assembly (29).

NOTE: Do not remove ring (26) and bearing (27) from shaft (25) or sleeves (30 and 31) from housing (32) unless repair or replacement makes it necessary.

3. CLEANING (See figure 3.)

A. General

(1) Wash all parts, except bearings (7, 12, 19, 27, and 29), with cleaning solvent, Specification P-D-680.

(2) Use a stiff bristle brush to remove dirt and grease and to clean all bores, passages, chambers and drain holes.

(3) Drain and dry all parts with clean, lint-free cloth or moisture-free compressed air.

(4) For further information, refer to "General Cleaning Procedures," Subject 20-30-03.

B. Bearings

(1) Wipe bearings (7, 12, 19, 21, 27, and 29) with a clean cloth moistened with cleaning solvent, Specification P-D-680. Dry with a clean, lint-free cloth.

(2) For further information, refer to "Cleaning and Relubricating Antifriction Bearings," Subject 20-30-01.

4. INSPECTION/CHECK (See figure 3.)

A. Check all parts for cracks, burrs, and corrosion, using a strong light and 10-power magnification.

B. Check all threads for cross threading, stripping, and excessive wear.

C. Visually check plated and painted surfaces for flaking or blisters.

D. Check bearings (7, 12, 19, 21, 27, and 29) for roughness, binding and excessive radial or axial play. Pass bearings through a demagnetizer and clean in accordance with paragraph 3.B.

E. Examine splines of worm gear (10) and input shaft (25) for nicks, chips, or wear.

F. Examine teeth of worm gear (10), worm and spur gear (20), and shaft (25) for nicks, chips, or abnormal wear pattern. Wear pattern must be smooth and centered on teeth.

G. Perform a fluorescent penetrant check, per Subject 20-20-02, on worm gear (10).

H. Perform a magnetic particle examination, per Subject 20-20-01, on worm and spur gear (20) and input shaft (25).

5. REPAIR AND REPLACEMENT (See figure 3.)

A. Repair

(1) Remove minor scratches, nicks or corrosion by polishing with abrasive cloth, No. 220 grit or finer. Refinish as required for corrosion protection.

(2) Repair minor defects on worm and gear teeth by light filing or using an abrasive.

(3) Chase or file minor thread damage.

B. Refinish

(1) If plated or painted surfaces are worn or chipped, refinish parts listed below as indicated.

NOTE: Refer to Subject 20-41-01 for decoding of F and SRF finish symbols and their BAC equivalents and to Subject 20-30-02 for stripping of protective finishes.

(a) Nut (2) -- Apply F1.1913 all over.

(b) Cap (18) -- Apply SRF-2.30 all over.

(c) Retainer (23) -- Apply SRF-2.20 all over.

(d) Gear (20) and shaft (25) -- Apply F1.1927 all over except teeth; plating to be 0.0002 to 0.0003 inch thick. Omit post plating treatment for shaft (25).

(e) Cover (8) -- Apply F2.20 all over, followed by SRF-12.205 all over, except in bore, outer machined diameter, and annular surface between bore and outer machined diameter.

(f) Housing (32) -- Apply F2.20 all over, followed by SRF-12.205 on exterior surfaces only. No primer on 1.801 inch machined diameter.

C. Replacement

(1) Replace all parts found unserviceable or damaged beyond minor repair.

(2) Replace cotter pin (13) at each overhaul.

(3) Replace retaining ring (11) at each overhaul.

(4) If bearing (27) or shaft (25) require replacing, press bearing on shaft and install ring (26) using Swaging Tool ST933-100. Refer to "Bearing Installation and Retention," Subject 20-50-03.

6. ASSEMBLY (See figure 3.)

A. Press bearing (28) on shaft assembly (24). Butter lubricate gear teeth on shaft with grease, Specification MIL-G-23827.

B. Insert shaft assembly (24) in housing assembly (29) and install bearing retainer (23) with screws (22).

C. Press bearing (21) on gear (20). Butter lubricate worm and gear teeth with grease, Specification MIL-G-23827. Insert gear in housing and install bearing (19), end cap (18), washers (17), and screws (16).

D. Install washers (15), nut (14), and cotter pin (13).

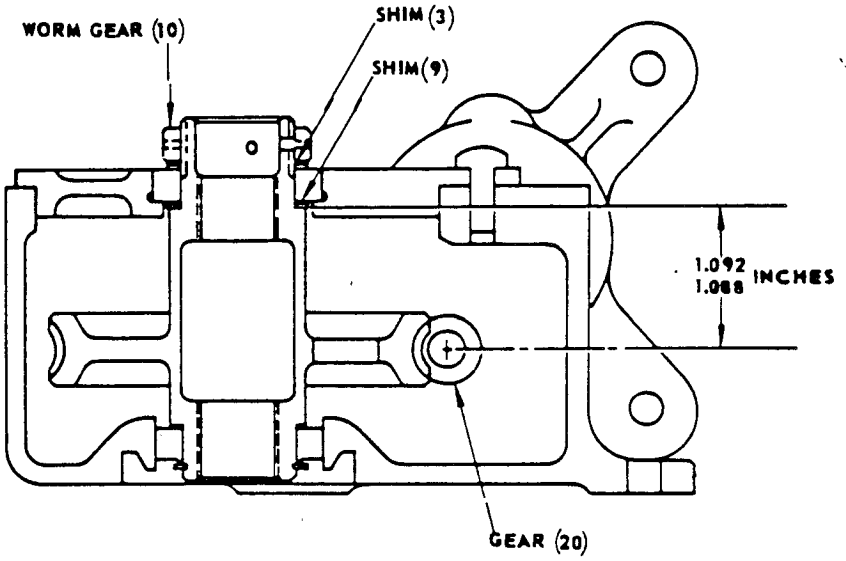
E. Butter lubricate teeth of worm gear (10) with grease, Specification MIL-G-23827. Insert gear into housing and mesh with worm threads on gear (20).

NOTE: Gear (20) has slot in end of shaft for turning the gear to facilitate meshing the teeth.

F. Install bearing (12) and retaining ring (11).

G. Place shim (9) on gear (10) and install cover assembly (6) with washers (5) and screws (4). Install shim (3) and nut (2), tighten nut to a torque range of 100 to 200 pound-inches. Shims (3) and (9) must be adjusted to locate worm gear (10) in relation to gear (20) as shown in figure 2.

H. Install pin (1) and point stake, flush to 0.03 inch below surface of nut, with a single point stake on edge of hole.



Gearbox Assembly Details
Figure 2

7. FITS AND CLEARANCES

A. The "Fits and Clearances" table lists original design dimensions and service wear limits for certain close tolerance parts of the assembly. The original design dimensions are to be used as a guide for rework of parts which fail to meet the wear tolerance requirements. Unless otherwise specified in the rework procedure, a part should be returned to the design dimensions whenever rework is accomplished.

B. Clearances are given to aid assembly of the component. The value given in the "Maximum Allowable Clearance" column is the maximum permitted to ensure proper functioning until the next overhaul cycle of the component. If assembled parts fail to meet these requirements, one or more of the parts must be rejected. Parts that are rejected should be reworked if within the rework limits given in the repair procedure; if not within rework limits, the parts should be scrapped. It is recommended that whenever newly reworked parts are assembled, the design clearances should be used as the guiding assembly criteria.

FITS AND CLEARANCES

		Assembly Fits and Clearances				Permissible Wear Limits		
Ref. Letter Fig( )	Mating Index No. Fig(3)	Dimension (inches) Min.	Dimension (inches) Max.	Assembly Clearance (inches) Min.	Assembly Clearance (inches) Max.	Dimension Limits (inches) Min.	Dimension Limits (inches) Max.	Replace When Clearance Exceeds
	20 25			0.002 ▷1	0.004 ▷1			0.012 ▷1
	20 10			0.003 ▷2	0.006 ▷2 0.010			0.018 ▷2 0.030 ▷3

▷1 SPUR GEAR BACKLASH
▷2 WORM GEAR BACKLASH
▷3 TOTAL GEARBOX BACKLASH

Table I

8. TESTING (See figure 3.)

A. Check gearbox for smooth operation by rotating input shaft (25) manually for at least 254 revolutions in each direction, to obtain at least one complete revolution of worm gear (10). There shall be no binding or rough operation.

9. TROUBLE SHOOTING (See figure 3.)

	Trouble	Possible Cause	Correction
A.	Backlash excessive between input shaft (25) and output shaft	Gears (10, 20 or 25) worn to excess	Disassemble, check, replace as necessary and reassemble
B.	Binding or rough operation	Improperly installed parts. Bearings or gears binding or seizing. Incorrect shim (3 or 9) thickness	Dissassemble, examine correct condition and reassemble

10. STORAGE INSTRUCTIONS

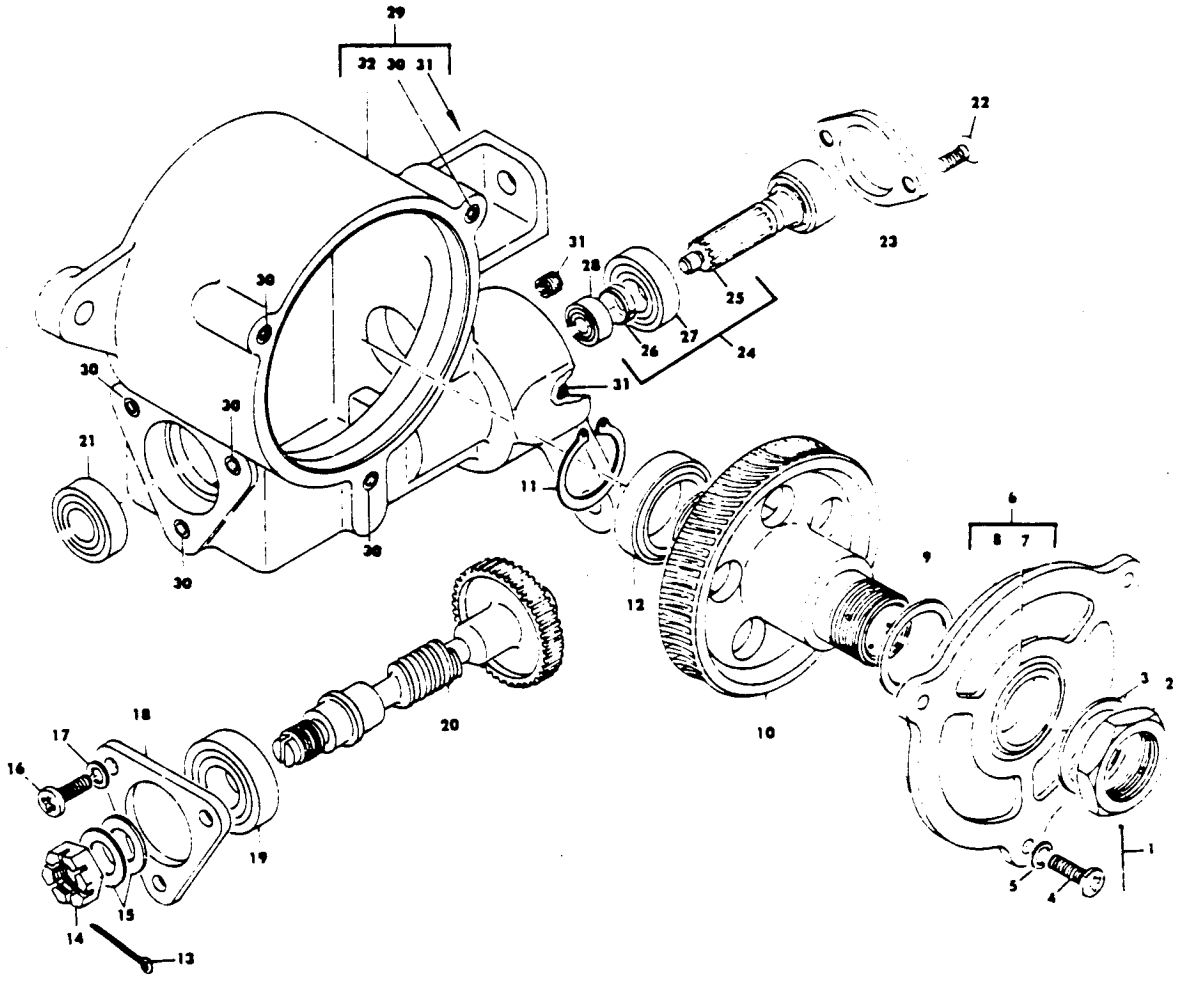
A. Wrap gearbox assembly in vapor barrier paper and tape securely. Tag or mark with test date and store.

B. Refer to "Temporary Protective Coatings," Subject 20-44-02, for further information.

11. SPECIAL TOOLS

A. ST933-100 -- Bearing Ring Shaft Type Swaging Tool

NOTE: Listed items are recommended. Equivalent substitutes may be used.



Autothrottle Gearbox Assembly
Figure 3

12. GROUP ASSEMBLY PARTS LIST (See figure 3.)

FIG. ITEM NO.	PART NO.	AIRLINE PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	USE CODE	QTY PER ASSY
3-	65-42163-1		GEARBOX ASSEMBLY.		1
1	MS16562-1		. PIN		1
2	66-22132-1		. NUT		1
3	66-21146-1		. SHIM.		1
4	NAS603-8		. SCREW		3
5	AN960PD10L		. WASHER.		3
6	65-42139-1		. COVER ASSEMBLY.		1
7	MB540ZZ		. . BEARING, V38443		1
8	65-42139-2		. . COVER		1
9	66-21146-1		. SHIM.		1
10	65-42662-1		. GEAR, Worm.		1
11	MS16624-1087		. RING, Retaining		1
12	MB540ZZ		. BEARING, V38443		1
13	MS24665-283		. PIN, Cotter		1
14	MS17826-6		. NUT		1
15	AN960-616		. WASHER.		2
16	NAS603-8		. SCREW		3
17	AN960PD10L		. WASHER.		3
18	66-21140-1		. CAP, End.		1
19	R8ZZ		. BEARING, V38443		1
20	65-40518-1		. GEAR, Worm and Spur		1
21	BACB10A516		. BEARING		1
22	NAS517-2-0		. SCREW		2
23	66-21233-1		. RETAINER, Bearing		1
24	65-42163-2		. SHAFT ASSEMBLY.		1
25	69-31995-1		. . SHAFT, Input.		1
26	BACR12Y69		. . RING, Staking		1
27	BACB10A516		. . BEARING		1
28	R3ZZ		. BEARING, Ball V38443.		1
29	65-40519-1		. HOUSING ASSEMBLY, Gear.		1
30	BACS13W3CN4		. . SLEEVE.		6
31	BACS13W2CN3		. . SLEEVE.		2
32	65-40519-2		. . HOUSING, Gear		1

VENDOR CODE

Code	Name and Address
V38443	Marlin-Rockwell Corporation Jamestown, New York