

## TECHNICAL MANUAL

### OVERHAUL INSTRUCTIONS NOSE LANDING GEAR DOOR 90 DEGREE GEARBOX ASSEMBLY

#### PART NUMBER

177370

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177370-2

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## INTRODUCTION

### 1. PURPOSE OF MANUAL.

This Technical Manual contains instructions for the overhaul of the Nose Landing Gear Door 90 Degree Gearbox Assembly, part No. 177370, hereinafter referred to as the gearbox. This gearbox is manufactured by Curtiss Wright Flight Systems, Inc., Fairfield, NJ, 07006.

### 2. SCOPE OF MANUAL.

Chapter 1, Chapter 2, and Chapter 3 of this manual contain overhaul and test instruction for Nose Landing Gear Door 90 Degree Gearbox assembly, part No. 177370. Overhaul and test instructions for additional models will be provided in Chapter 4 by the use of Difference Data Sheets. The additional models included in Chapter 4 will be listed in Chapter 4.

### 3. LIST OF RELATED PUBLICATIONS.

The following list identifies technical manuals related to this manual.

#### List of Related Publications

<u>Publication Number</u>	<u>Publication Title</u>
T.O. 0-1-44B-5	Maintenance Instructions, Anti-Friction Bearings

### 4. LIST OF SYMBOLS AND ABBREVIATIONS.

The following symbols and abbreviations are used in this manual.

°	degree
—	minus
+	plus
Fig	Figure
in.	inch
lb.	pound
MSDS	Material Safety Data Sheet
No.	Number
psi	pounds per square inch
T.O.	Technical Order



## SAFETY SUMMARY

### 1. GENERAL SAFETY INSTRUCTIONS.

This safety summary includes general safety precautions and instructions that must be understood and applied during operation and maintenance to ensure personnel safety and protection of equipment. Prior to performing any task, the WARNINGS, CAUTIONs and NOTEs included in that task shall be reviewed and understood.

### 2. WARNINGS, CAUTIONS, AND NOTES.

WARNINGS and CAUTIONs are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements which are considered essential to protection of personnel (WARNING) or equipment (CAUTION). WARNINGS and CAUTIONs immediately precede the step or procedure to which they apply. WARNINGS and CAUTIONs consist of four parts: heading (WARNING, CAUTION or Icon [see HAZARDOUS MATERIALS WARNINGS]), a statement of the hazard, minimum precautions, and possible result if disregarded. NOTEs are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements which are not essential to protection of personnel or equipment. NOTEs may precede or follow the step or procedure, depending upon the information to be highlighted. The headings used and their definitions are as follows.

#### **WARNING**

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc, which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

#### **CAUTION**

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc, which if not strictly observed, could result in damage to, or destruction of equipment or loss of mission effectiveness.

#### **NOTE**

Highlights an essential operating or maintenance procedure, condition, or statement.





## CHAPTER 1

### GENERAL INFORMATION

#### 1.1 GENERAL.

##### NOTE

Many repair parts for equipment covered in this publication are provided in the form of kits. See applicable Illustrated Parts Breakdown for details. Activities shall replace all parts (regardless of condition) which are removed in the process of disassembly with all like parts furnished in the kit. Therefore, instructions for cleaning, inspecting, and reworking used parts have been omitted. If any parts in the kit must be cleaned, inspected or tested prior to installation, instructions for performing these requirements are included in the manual. An installed part which is not defective need not be removed solely for the purpose of replacement by a corresponding kitted part. Residue from kit and removed parts in this category shall be administratively condemned.

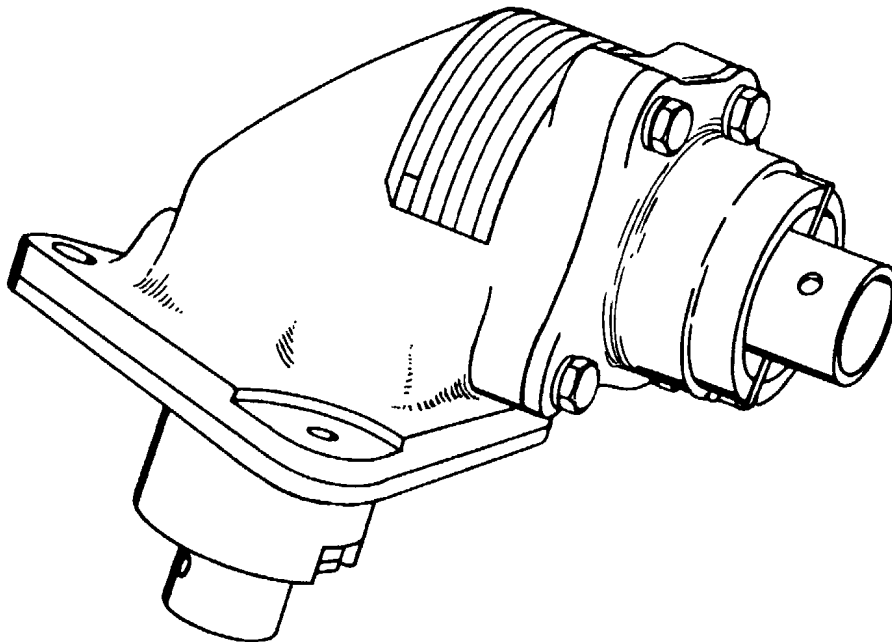
The gearbox shown in Figure 1-1 is a part of the aircraft nose landing gear door actuation system. The gearbox provides a 90 degree change in direction of the torque necessary to operate the nose landing gear doors.

#### 1.2 LEADING PARTICULARS.

The leading particulars for the gearbox are given in Table 1-1.

**Table 1-1. Leading Particulars**

Angle Between Input and Output Shafts	90 degrees
Height	7 inches
Width	5 inches
Length	6.250 inches
Weight	3.4'71 lbs (avg)
Gear ratio	1:1



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**Figure 1-1. Nose Landing Gear Door 90 Degree Gearbox Assembly**



## CHAPTER 2

### OVERHAUL INSTRUCTIONS

#### 2.1 SPECIAL TOOLS.

The special tools required to overhaul the gearbox are listed in Table 2-1.

#### 2.2 DISASSEMBLY.

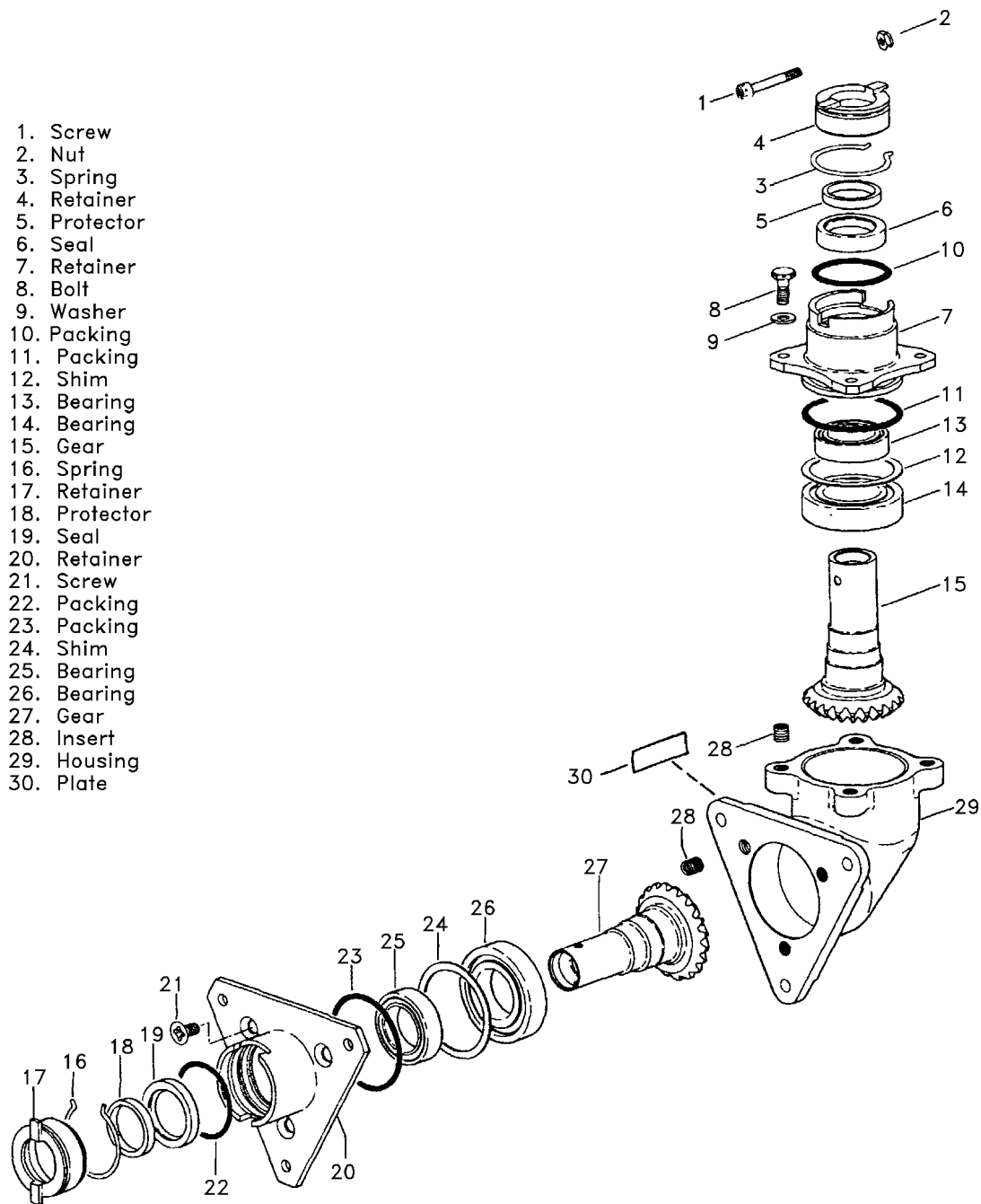
- a. The gearbox being repaired shall be surface cleaned and tested in accordance with Chapter 3 prior to disassembly.
- b. The discrepancy should be located to the subassembly and the extent of repair determined.
- c. Disassemble only to the extent necessary to replace or repair by parts replacement those subassemblies found defective.
- d. The gearbox should again be tested to assure serviceability.
- e. Disassemble the gearbox in the order of ascending callout number of Figure 2-1. Measure, record, and identify the thickness of all shims as disassembled. If the same parts are used together in reassembly, the shim size shall remain the same.
- f. During disassembly, discard seals, seal protectors, packings and seal assemblies.
- g. Mount the gearbox in a padded vise.
- h. Remove bolts (8), washers (9), screws (21), and retainers (7, 20). Remove screw (1) and nut (2) from bevel gear (15).
- i. Compress the ends of seal retaining spring (3) and remove seal assembly (4, 5, and 6) with Removal Tool, part No. ST5999.
- j. Compress the ends of seal retaining spring (16) and remove seal assembly (17, 18, and 19) with Removal Tool, part No. ST5999.
- k. Remove bearings (13) and (14) from gear (15), using Plate, part No. ST5806, and an arbor press.

**CAUTION**

During the pressing operation, protect gears with soft stock such as aluminum.

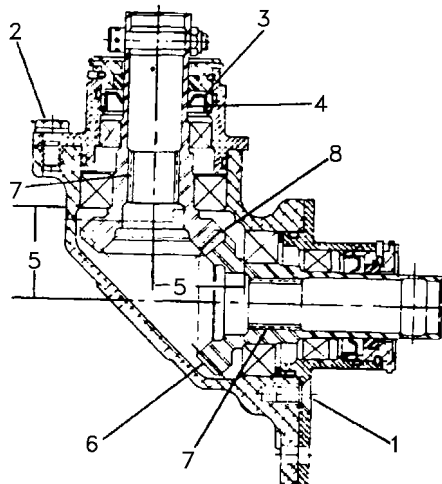
**Table 2-1. Special Tools**

Part No.	Nomenclature	Procuring Service Stock No.
ST5806	Plate, Support (Part of Kit ST792)	
ST5808	Adapter, Torque Wrench	FSN 5120-121-3684LH
ST5902	Fixture, Gearbox	
ST5903	Adapter, Gearbox	FSN 4920-132-1596LH
ST5999	Removal Tool, Seal	FSN 5120-520-3905LH
ST6278	Gage, Internal Spline (Part of Kit ST799)	
ST6366-2	Setmaster, Internal (Part of Kit ST799)	
ST792	Tool Kit, Installing and Removal, Bearing and Sea	FSN 5180-117-6045LH
ST798	Fixture, Gearbox bevel gear shimming	FSN 4920-132-3787LH
ST799	Gage Kit, Actuator drive components	FSN 5280-420-7093LH
125105	Inspection Unit, Fluorescent Penetrant	FSN 6635-334-7419
LFM1A	Lamp Magnifier	FSN 6650-967-8316
OP2-85	Degreaser	
RCQ-1086	Inspection Unit, Magnetic	FSN 6635-575-4642



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Figure 2-1. Exploded View of Nose Landing Gear Door 90 Degree Angle Gearbox Assembly



<u>Ref. No.</u>	<u>Description</u>	<u>Min.</u>	<u>Max.</u>
1	Tightening torque (in./lb.)	50	70
2	Tightening torque (in./lb.)	50	70
3	Fit of seal in retainer	Press Fit	
4	Fit of seal on gear	Interference Fit	
5	Bevel gear mounting distace (ref) 2 places (in.)	1.370	1.373
6	Backlash at pitch diameter (in.)	0.006	0.016
7	Spline Wear—internal. Measure using ST6278 Gage, ST6266-2 Setmaster. Set indicator at zero (in.)		+0.0016
8	Bevel gear teeth wear should not be more than 0.002 inches.		

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**Figure 2-2. Service Tolerances****NOTE**

Presence of a new part in the applicable kit eliminates the necessity of cleaning, inspecting, or reworking the equivalent used part removed from the assembly being repaired. Residue from kits and removed parts in this category shall be administratively condemned. The instructions which follow cover removed parts not supplied in kits and kitted parts (if any) which require cleaning, inspection, or testing prior to installation.

1. Remove bearings (25 and 26) from gear (27), using plate, part No. ST5806, and an arbor press.

**2.3 CLEANING.****WARNING**

Use of cleaning agents must be accomplished with necessary precaution to avoid skin irritations or injury to eyes.

Clean all metal parts using cleaning solvent, Federal Specification MIL-PRF-680A. Blow dry with clean air. Use Degreaser, part No. OP2-85 to perform cleaning operation.

**2.4 INSPECTION.**

Perform the following inspections of paragraph 2.4 thru paragraph 2.6. The tolerances listed in Figure 2-2 are to be used for establishing the serviceability of parts when wear or improper fit is evident.

**NOTE**

Magnetic particle inspection or fluorescent penetrant inspection must be used for parts suspected of being defective due to abuse or overload. After magnetic particle inspection, all parts must be demagnetized and the magnetic substance shall be completely removed.

- a. Examine parts for condition, specifically those associated with malfunction. Perform a magnetic particle inspection or a fluorescent penetrant inspection in accordance with (ASTM E 1417) and (ASTM E 1444), respectively, for all parts listed in Table 2-2. Use part No. RCQ-1086, FSN 6635-575-4642, and part No. 125105, FSN 6635-334-7419 respectively.

Table 2-2. Non-Destructive Inspection

Part No.	Name	Type of Inspection	Procedure	Acceptable Indications
177278	Gear	*	CB1500A	#
177534	Bolt	*	CB500A	#
177353	Housing	**		
117358	Retainer	**		
117359	Retainer	**		
A - Amperage preceded by the current value in amperes CH - Circular Head CB - Circular Bar LC - Longitudinal Coil LH - Longitudinal Head X - Between Heads				
* Magnetic Particle Method # All indications except cracks caused by fatigue or over stressing ** Fluorescent Penetrant Method				

- b. Inspect ball bearings in accordance with T.O. 0-1-44B-5, "Maintenance Instructions, Anti-Friction Bearings."

Reposition gage by moving gage dial in or out of holder. Tighten set screw.

- (2) Tighten all threaded parts by hand except the Allen screw.

## 2.5 SPLINE INSPECTION.

### NOTE

When measuring spline wear, special dial indicator gages and ball anvil sets are required. The available gages are designed for specific internal and external spline inspection application and are parts of Kit, part No. ST799.

- Prior to use of gage, set it to measure the proper spline diameter, which is accomplished with the appropriate setmaster, specified in Figure 2-2.
- Gage part No. ST6278 is used to measure internal spline wear on pitch diameters from 0.600-1.125 inch. Two ball sizes 0.07217 and 0.05774 inch are utilized with this gage. Applicable Setmasters, part No. ST6366 are available through the required range of pitch diameters. (Refer to Figure 2-2, item 7 for specific tool sizes). Assemble the gages in the following manner:
  - When measuring the part No. 177278 gear pitch diameter of 0.6875 inch, use gage head with ball size of 0.05774 inch. Assemble short extension of gage ball with head, tighten small lock ring securely. If gage dial deflection adjustment is required, loosen set screw with Allen wrench.

- With the internal gage positioned on the proper setmaster set the dial indicator of the gage to read zero.
- Determine spline wear over entire length of splines. Refer to Figure 2-2 for wear tolerances. The dial indicator reading is the actual wear on the splines. Replace part if worn beyond tolerances.

## 2.6 GEAR INSPECTION.

- Inspect all gears using an illuminated magnifier (part No. LFM1A).

### NOTE

- Wear may be visually detected on some gears by a wear step or a visible change in tooth profile. Visual comparison can be readily made between the loaded and unloaded sides of teeth, or between teeth of a used gear and a new gear. Normal tooth polishing, indicated by a shiny pattern, should not be considered as wear.
- If a bevel gear is replaced for apparent wear, the mating gear must also be replaced.

- b. Replace gears exhibiting any of the following conditions:

- (1) Any displaced metal, horizontal and vertical indentions, or pitting in the face or flank area. See wear pattern A in Figure 2-3.
- (2) Wear which tends to round the top edge of a tooth decreasing the top land thickness and the face area. See wear pattern B in Figure 2-3.
- (3) Any tooth edge breakage or chipping.

## 2.7 REPAIR OR REPLACEMENT.

**2.7.1 Repair.** Replace all parts that do not meet inspection requirements or that cannot be repaired by these instructions.

- a. Remove minor scratches, burrs, and corrosion from steel parts by polishing lightly with crocus cloth, Federal Specification ANSI B74.18. After repair, clean all parts thoroughly.

### CAUTION

Do not use crocus cloth on aluminum parts. Its abrasive is a ferric oxide which causes aluminum to corrode rapidly.

- b. Remove minor defects from aluminum parts by polishing lightly with No. 400 or No. 320 aluminum oxide or silicon carbide abrasive cloth, Federal Specification ANSI B74.18. After repair, clean parts thoroughly.

**2.7.2 Heli-Coil Insert Replacement.** See Figure 2-1, 28.

- a. Remove the defective insert with Extracting Tool No. 1227-6, or equivalent.
- b. Clean and dry the female thread from which the defective insert was removed.
- c. Apply primer (Federal Specification TT-P-1757B) sparingly to the cleaned female thread.
- d. Before the primer dries, install new insert using installing tool No. 7552-4 (1/4-28 thd) or equivalent. Top end of insert shall be 3/4 to 1-1/2 threads below the surface.
- e. Remove the insert driving tang with Tang Breakoff Tool No. 1196-4 (1/4-28 thd) or equivalent.

- f. Inspect the insert to ensure that the tang broke off clean and the insert ends are firmly seated.

## 2.7.3 Repair of Painted Surfaces.

### WARNING

Conduct all preparation and painting operations as directed throughout this chapter in a well-ventilated area or in an approved spray booth equipped with adequate ventilation and exhaust.

Painting procedures cover repair of painted surfaces as outlined in paragraph 2.7.8 and paragraph 2.7.9.

**2.7.4 Painting Procedures.** Prepare surfaces of various materials as follows:

### WARNING

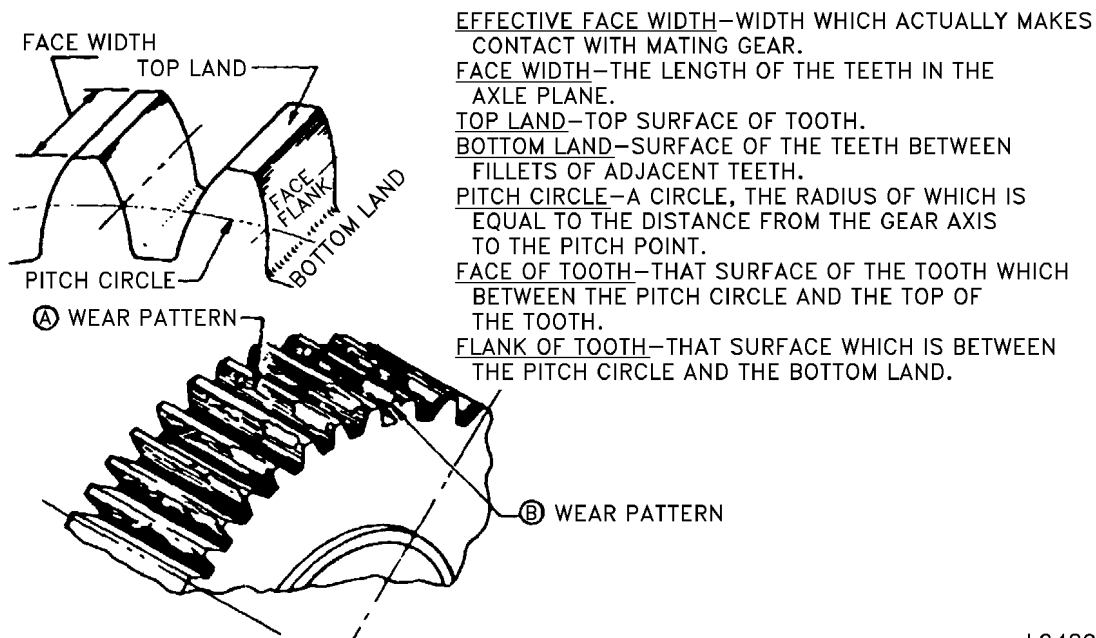
Acetone and methyl-ethyl-ketone are extremely flammable (flash points of 0 °F and 16 °F); methyl-propyl-ketone is highly flammable (flash point 45 °F). All three solvents are toxic. Use in a well-ventilated area. Keep away from open flame and other ignition sources. Avoid breathing vapors and spray mist. Avoid eye and skin contact. Safety glasses and protective gloves are required. Wash hands after use. Remove contaminated clothing and launder before use. Refer to MSDS for additional information.

### NOTE

- Repair refers to a condition in which the base metal is exposed through the paint.
- Lower vapor pressure solvents may require increased drying times.

a. Aluminum Alloys.

- (1) Feather-edge the film adjacent to the damaged area using No. 400 or No. 320 silicon carbide abrasive cloth (Federal Specification ANSI B74.18). Wipe surface clean with a cloth wetted with methyl-ethyl-ketone (Federal Specification ASTM D740) or a 50/50 blend of methyl-ethyl-ketone (ASTM D740) and acetone (ASTM D329) or methyl-propyl-ketone (MPK) (BAC 5750) and wipe dry.



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**Figure 2-3. Typical Gear Nomenclature and Wear Pattern**

- (2) Apply Iridite No. 14-2 solution (MIL-C-5541E), four ounces of Iridite per gallon of water at room temperature with a brush or swab to the exposed area. A contact time of 15 to 30 seconds will usually produce a golden yellow color. Rinse thoroughly with water and dry.
- b. Cadmium-Titanium Plated Steel or Cadmium Plated Steel.
  - (1) Feather-edge the film adjacent to the damaged area using No. 400 or No. 320 silicon carbide abrasive cloth (Federal Specification ANSI B74.18).
  - (2) Wipe clean with a cloth wetted with methyl-ethyl-ketone (Federal Specification ASTM D740) and wipe dry.
  - (3) With a brush or swab, clean the affected area with an approved alkaline cleaner until it is completely wetted and shows no water breaks. Rinse thoroughly.
  - (4) Prepare a solution of one ounce of Iridite 8P, manufactured by Allied Research Products, Inc., 4004 E. Monument Street, Baltimore, MD, 21205 (or equivalent), 0.406 fluid ounces (12 milliliters) of concentrated nitric acid (Federal Specification A-A-59105B), and sufficient water to make one gallon of solution. Apply the solution to the affected area. When Iridite 8P is used as specified the requirements of AMS-QQ-P-416A, Type II, Class 2 are met. If an equivalent is selected, consideration must be given to assure that it also meets the requirements of AMS-QQ-P-416A, Type II, Class 2.
  - (5) Keep the surface wet with the mixed solution until the desired color is obtained. Rinse thoroughly with water and dry.

**2.7.5 Touch-Up Painting Procedures.** Prepare surfaces for minor repair as follows:

**WARNING**

Acetone and methyl-ethyl-ketone are extremely flammable (flash points of 0 °F and 16 °F); methyl-propyl-ketone is highly flammable (flash point 45 °F). All three solvents are toxic. Use in a well-ventilated area. Keep away from open flame and other ignition sources. Avoid breathing vapors and spray mist. Avoid eye and skin contact. Safety glasses and protective gloves are required. Wash hands after use. Remove contaminated clothing and launder before use. Refer to MSDS for additional information.



**NOTE**

- Lower vapor pressure solvents may require increased drying times.
  - Repair refers to a condition in which one or more of the paint films has been damaged without exposing the base metal.
- a. Feather-edge the film adjacent to the damaged area using No. 400 or No. 320 silicon carbide abrasive cloth, Federal Specification ANSI B74.18, being careful not to expose the base metal.
  - b. Wipe area with methyl-ethyl-ketone (ASTM D740) or a 50/50 blend of methyl-ethyl-ketone (ASTM D740) and acetone, (ASTM D329) or methyl-propyl-ketone (MPK) (BAC 5750) and dry.
  - c. Apply one coat of epoxy primer (MIL-PRF-23377H) per paragraph 2.7.8 and two coats of polyurethane enamel per paragraph 2.7.9.

**2.7.6 Repainting.** The affected area shall be repainted with the following: one coat of epoxy primer (MIL-PRF-2337H) and two coats of polyurethane enamel manufactured by De Soto Chemical Coatings, Inc., Garland, TX, (manufacturer's designation 82 1-010/910-177, Gloss White), or U.S. Paint, Lacquer, and Chemical Co., St. Louis, MO, (manufacturer's designation 91-W-1, Gloss white), or Andrew Brown Co., Irving, TX, (manufacturer's designation A-1250-66/7-1070-66, Gloss White).

**2.7.7 Application of Epoxy Primer.** Prior to applying epoxy primer, mix and thin the primer as follows:

**WARNING**

- Primer-Epoxy Polyamide MIL-PRF-23377H is highly toxic to skin, eyes, and respiratory tract. Skin, eye, and respiratory protection is required.
- Methyl-Isobutyl-Ketone, Methyl-Ethyl-Ketone and toluene are flammable and highly toxic. Use only in a well-ventilated area. Avoid prolonged breathing of vapors. Avoid eye and skin contact. Use personal protective equipment, goggles/face shield and gloves when handling. Keep away from open flames or other sources of ignition. When not in use, close containers securely.

**NOTE**

The surfaces to be painted shall be clean, dry and free from dust, dirt, oil, or other foreign matter. The epoxy primer (MIL-PRF-23377H)

shall be applied to the prepared surface within eight hours from the time of initial mixing. Primer not used within this period shall be discarded.

- a. Prepare the epoxy primer (MIL-PRF-23377H) in accordance with the manufacturer's recommendations under clean conditions and with clean equipment.
- b. Mix the components at room temperature. Remove skins if present.
- c. Thin the mixed primer to a viscosity of 17 to 19 seconds in a No. 2 Zahn cup by the addition of approximately three volumes of thinner to four volumes of the mixed primer. The thinner shall be a 1:1 mixture by volume of methyl-isobutyl-ketone, Federal Specification ASTM D1153 and toluene, Federal Specification A-A-59107.
- d. Thoroughly stir the mixed primer while thinning. Strain the primer after thinning and allow to stand in a closed container for one hour prior to use.
- e. The primer is to be applied in a single wet pass by spraying; when necessary, the fill-and-drain method may be used for inaccessible surfaces. This method consists of wetting the inaccessible surfaces by pour-filling with primer and then draining the primer. A prime coating is thus left on the surfaces.
- f. The average dry film thickness of each coat of epoxy primer shall be 0.0004 to 0.0007 inch.
- g. A minimum air drying time of one hour and a maximum of eight hours shall elapse before applying the polyurethane enamel. When these maximum time limits have been exceeded, the epoxy primed surface shall be scuff-sanded using No. 400 or No. 320 silicon carbide abrasive cloth, Federal Specification ANSI B74.18, and reactivate with methyl-ethyl-ketone Federal Specification ASTM D740 and then cleaned and dried prior to applying enamel. No oven drying processes shall be used.
- h. Full closed containers of both components have a storage life of one year from date of manufacture when stored at temperature of 70° to 90 °F.

**2.7.8 Preparation Of Enamel.** Prior to applying enamel, prepare the enamel as follows:

**NOTE**

The mixing of paints supplied by different manufacturers is prohibited, to avoid any possibility of incompatibility.

- a. The components to be mixed shall be at room temperature (70 °F minimum) and the mixing shall be done with clean equipment.
- b. The polyurethane enamel shall be vigorously shaken on a "Red Devil" shaker, or equivalent, before mixing with the isocyanate/thinner (supplied).
- c. The enamel shall be prepared by mixing the two components in a 1:1 volume ratio, stirring thoroughly, straining, and allowed to stand for one hour before use. No thinning is required.

**2.7.9 Application of Enamel.** Apply two coats of polyurethane enamel.

- a. The polyurethane enamel shall be applied either by spray or brush to properly prepared surfaces within eight hours from the time of initial mixing. Enamel not used within this period shall be discarded. After mixing, pot life is eight hours at 70° to 90 °F.
- b. When using the spraying method, a high air atomization pressure (40 to 60 psi) has been found to produce a coating with good leveling properties and without causing "orange peel." Grounding the tables or racks holding the parts has been found advantageous, since it prevents a build-up of a static charge which could attract airborne dust particles.
- c. The epoxy-primed surfaces to be enamelled shall be clean and dry. Any surfaces which require repair shall be prepared in accordance with paragraph 2.7.4 and paragraph 2.7.5 prior to applying enamel. If more than eight hours time has elapsed since the application of the epoxy primer (MIL-PRF-23377H) the primer coat shall be scuff-sanded and solvent activated with methyl-ethyl-ketone Federal Specification ASTM D740 or both, then cleaned and dried just prior to applying enamel.
- d. Drying time to be one hour before handling and dry hard is not more than eight hours. Full cure will be achieved in seven days. Oven dry process is to bake dry for 15 to 20 minutes in an oven at 200 °F.
- e. All marking applied over the polyurethane enamel shall be made with a gloss black polyurethane stencil enamel.
- f. Removal of polyurethane enamel, when necessary, can be made using stripper part No. T-5003, a

product of Turco Products, Inc., Wilmington, CA, or equivalent.

**2.8 LUBRICATION.**

During reassembly, pack bearings and lubricate all working surfaces and seals with a mixture of five parts (Specification MIL-PRF-23827A) grease blended with one part (Specification MIL-PRF-7808L) oil.

**2.9 REASSEMBLY.**

**NOTE**

Just prior to installing, coat OD of all hearings and seals with primer (Federal Specification TT-P-1757B).

To ensure proper tooth bearing and backlash, the bevel gears must locate in the housing at the design mounting distances (MD). See Figure 2-4 and Figure 2-5. Shims (12) and (24), Figure 2-1 of the proper thickness, which must be calculated, are used to locate the gears.

**2.9.1 Shim Calculations.**

**NOTE**

Shimming shall be done to properly locate the bevel gears only. It shall not be done to obtain correct backlash. If parts originally removed are reassembled together, the shim sizes recorded at disassembly should provide required dimensions and calculation procedure may be omitted.

Make all measurements to the nearest 0.0005 inch. Compare dimensions with stacked gage blocks, or equivalent. After calculating, keep affected parts mated. All assembly requirements to be accomplished per detailed instructions of paragraph 2.10.

- a. Calculate shim thickness to be used in retainer (Figure 2-1, 7). Refer to Figure 2-4 for use of Fixture, part No. ST798.
- (1) Install bearing (Figure 2-1, 14) in retainer (7) and place in Fixture, part No. ST798; load the bearing, by tightening the Thumbscrew, part No. ST5902-8, until the screw clicks. This provides a 10-pound load. While in the loaded condition, measure dimension A1.

- (2) Calculate the shim thickness, T1, using the following formula:

$$T_1 = B_1 - C_1$$

Where:

B1 = 2.3XX (Use actual dimension marked on housing parting surface).

C1 = A1 + MD + 0.004 inch

- b. Peel shims to the calculated thickness within the limits of +0.000 to -0.002 inch. Smooth all burrs. See Figure 2-4.
- c. Calculate shim thickness to be used in retainer (20). See Figure 2-5 for use of Fixture, part No. ST798.
- (1) Install bearing (Figure 2-1, 26) in retainer (20) and place in Fixture, part No. ST798; load the bearing, by tightening the Thumbscrew, part No. ST5902-8, until the screw clicks. This provides a 10-pound load. While on the loaded condition, measure dimension A2.
- (2) Calculate the shim thickness, T2, using the following formula:

$$T_2 = B_2 - C_2$$

Where:

B2 = 2.3XX (Use actual dimension marked on housing parting surface).

C2 = A2 + MD + 0.004 inch

#### NOTE

Use the same MD for calculating T2 as was used for calculating T1.

- d. Peel shims to the calculated thicknesses within the limits of +0.000 to -0.002 inch. Smooth all burrs.

### 2.10 ASSEMBLE GEARBOX.

#### CAUTION

Avoid undue pressure or shock loads on ends of shafts when gears and bearings are installed

as this may result in jammed bevel gears. This is apparent if a noticeable stiffness is present when shafts are manually rotated. Since only seal friction normally is present, free gearboxes rotate fairly easily. If jamming occurs, either rotate shafts until free, or hold box shaft and, using a plastic mallet only, tap housing at various locations until gears are free.

Reassemble the gearbox in the reverse order of disassembly, except as noted as follows:

#### NOTE

Lubricate all moving parts and pack bearings with grease. (Refer to paragraph 2.8).

- a. Install bearings (25, 26) on bevel gear (27) using Plate, part No. ST5806, and an arbor press.
- b. Coat OD of bearings with primer (Federal Specification TT-P-1757B) and insert bevel gear (27) into housing (29) and install shim (24). Refer to Figure 2-5 for correct thickness of shim.
- c. Place packings (22, 23) onto retainer (20), install retainer (20) using screw (21) and secure to the housing (29). Torque per reference 1, Figure 2-2.
- d. Install seal assembly (17, 18, 19) and spring (16) using Removal Tool, part No. ST5999.
- e. Install bearings (13, 14) on bevel gear (15) using Plate, part No. ST5806, and an arbor press.
- f. Coat OD of bearings with primer (Federal Specification TT-P-1757B) and insert bevel gear (15) into housing (29) and install shim (12). Refer to Figure 2-4 for correct thickness of shim.
- g. Place packings (10, 11) onto retainer (7), install retainer (7) using bolt (8) and washer (9) and secure to housing (29). Torque per reference 2, Figure 2-2.
- h. Install seal assembly (4, 5, 6) and spring (3) using Removal Tool, part No. ST5999.
- i. Install screw (1) and nut (2) into bevel gear (15), after completion of Chapter 3 tests.

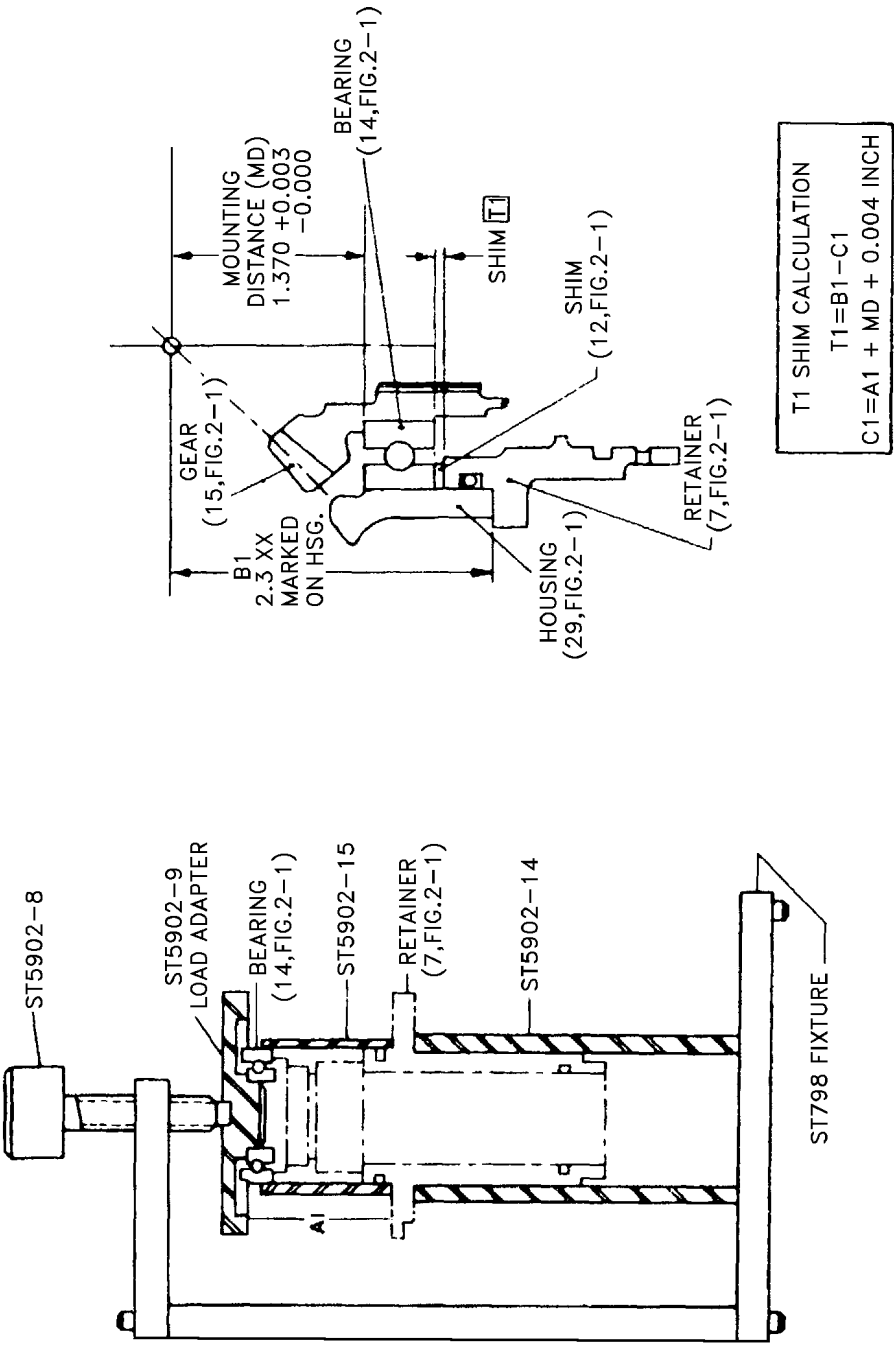


Figure 2-4. Shim Determination T1

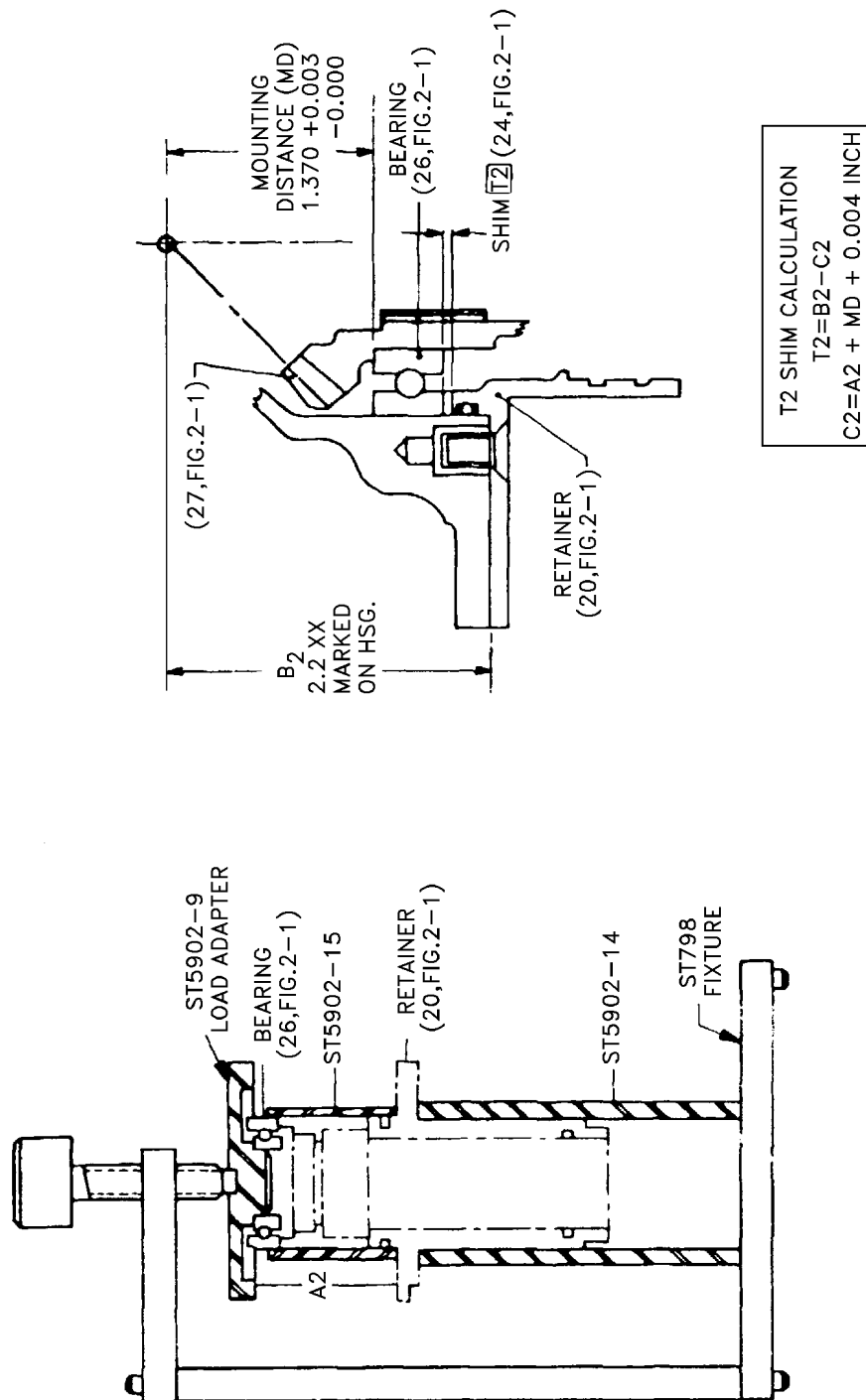
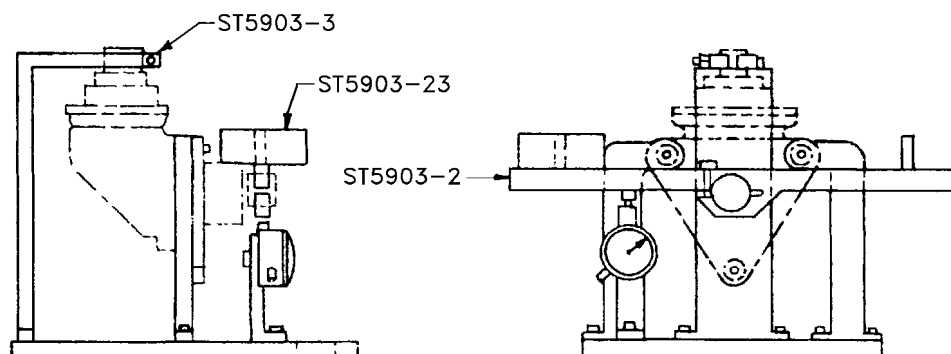


Figure 2-5. Shim Determination T2



## CHAPTER 3

### TEST PROCEDURE



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**Figure 3-1. Checking Backlash**

#### 3.1 BACKLASH TEST.

Test the assembled gearbox for backlash. Conduct tests at room temperature. First, shock or load the gears in the direction which increases the gear mounting distance to seat the bearings and flatten the shims.

- a. Install the assembled gearbox on Adapter, part No. ST5903. Refer to Figure 3-1.
- b. Lock the output shaft with the ST5903-3 support clamp. Attach the adapter weight arm in a horizontal position to the input shaft using the supplied hardware.
- c. Place the ST5903-23 weight over the locating pin on the end of the weight arm opposite the dial indicator.
- d. Zero the indicator.
- e. Move the weight to the indicator end of the weight arm, placing it over the locating pin.

#### NOTE

If backlash is not acceptable, the shim measuring procedures must be repeated for accuracy

and the shims checked for correct thickness. If procedures and shims are correct, equal thickness of shims must be added to both gears to obtain an acceptable backlash. Do not add shims to one gear only.

- f. Read indicator. The backlash is acceptable if indicator reads between 0.017 and 0.046 inch. If less than 0.017 or more than 0.046 inch, disassemble and recheck all of the shimming measurements to determine the cause of the error.

#### 3.2 FRICTION TORQUE TEST.

Test the assembled gearbox for friction torque. Conduct test at room temperature.

- a. With both gears free, rotate one gear five turns clockwise and five turns counterclockwise using Adapter, part No. ST5808, and a 0 to 25 inch-pound torque wrench.
- b. The force required to turn the gears shall not exceed 0.10 inch-pounds torque at any location.
- c. Install screw (1) and nut (2) into bevel gear (15).





## CHAPTER 4

### DIFFERENCE DATA SHEETS

#### 4.1 INTRODUCTION.

Overhaul and test procedures for the models included in this chapter are the same as the procedures for Gearbox Assembly Part Number 177370, except for the specific differences noted by the applicable Difference Data Sheets. Chapter 1 thru Chapter 3 contain complete overhaul and test information for the 177370 Gearbox Assembly.

#### 4.2 INDEX TO PART NUMBERS.

The following index lists applicable part numbers and corresponding page numbers of respective difference data sheets.

<b>Part No.</b>	<b>Nomenclature</b>	<b>Page</b>
177370-1	Nose Landing Gear Door 90 Degree Gearbox Assembly	4-3
177370-2	Nose Landing Gear Door 90 Degree Gearbox Assembly	4-5



## DIFFERENCE DATA SHEET

## NOSE LANDING GEAR DOOR 90 DEGREE GEARBOX ASSEMBLY

PART NO. 177370-1

THE INSTRUCTIONS CONTAINED IN THE PRECEDING CHAPTERS OF THIS TECHNICAL MANUAL ARE APPLICABLE TO THIS MODEL EXCEPT FOR THE DIFFERENCES CITED IN THIS DIFFERENCE DATA SHEET.

1. CHARACTERISTIC DIFFERENCES.

Nose Landing Gear Door 90 Degree Gearbox Assembly, Part Number 177370-1 is physically and functionally identical to Gearbox Part Number 177370, except that configuration of seal assemblies (Figure 2-1, 4, 5, 6) and (Figure 2-1, 17, 18, 19) are different by containing seal (Figure 4-1, 1), Part Number 178746-1 in place of seal Part Number 177298 and seal (Figure 4-1, 2), Part Number 178747-1 in place of protector, Part Number 177286.

2. SPECIAL TOOLS.

Same as for Part Number 177370 with addition of tools listed in Table 4-1.

3. DISASSEMBLY.

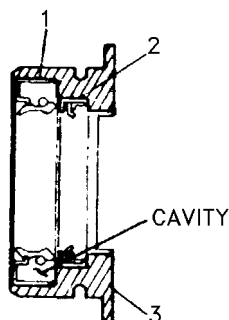
Same as for Part Number 177370 except seal assembly Part Number 177804-1 removed in accordance with paragraph 2.2, step i and paragraph 2.2, step k are disassembled as follows: Remove seals (Figure 4-1, 1, 2) from retainer (Figure 4-1, 3) using Plate, Part Number ST5803, Insert/Remover, Part Number ST5804, and an arbor press.

4. CLEANING.

Same as for Part Number 177370.

5. INSPECTION.

Same as for Part Number 177370.



- 1. SEAL
- 2. SEAL
- 3. RETAINER

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Figure 4-1. Seal Assembly Part Number 177804-1

6. TESTING DURING OVERHAUL.

Same as for Part Number 177370.

7. REPAIR OR REPLACEMENT.

Same as for Part Number 177370.

8. LUBRICATION.

Same as for Part Number 177370.

9. REASSEMBLY.

Same as for Part Number 177370 except paragraph 2.10 step d and step h do not apply. Seal assembly Part Number 177804-1 is assembled and installed to gearbox Part Number 177370-1 as follows:

- a. Pack cavity in seal (Figure 4-1, 1) with grease, (refer to paragraph 2.8) and coat OD of seals (Figure 4-1, 1, 2) with sealing compound (Specification SAE-AMS-8802A) and immediately install seals into retainer (Figure 4-1, 3) with sealing lips facing outer end of retainer. Use Plate, Part Number ST5804 and Insert/Remover, Part Number ST5804 with an arbor press to install seals. Wipe excess sealant from retainer.
- b. Fill cavity between seals (Figure 4-1, 1 and 2) and between lips of seal (Figure 4-1, 1) with grease. (Refer to paragraph 2.8). Install seal assemblies (Figure 4-1) in retainers (Figure 2-1, 7, 20) using packing (Figure 2-1, 10, 22) and springs (Figure 2-1, 3, 16).

10. TEST PROCEDURE.

Same as for Part Number 177370.

## DIFFERENCE DATA SHEET

Table 4-1. Special Tools

Part No.	Nomenclature	Procuring Service Stock No.
ST5803	Plate, Support (Part of Kit ST792)	
ST5804	Insertor/Remover, Seal and Protector (Part of Kit ST792)	

## DIFFERENCE DATA SHEET

## NOSE LANDING GEAR DOOR 90 DEGREE GEARBOX ASSEMBLY

PART NO. 177370-2

THE INSTRUCTIONS CONTAINED IN THE PRECEDING CHAPTERS OF THIS TECHNICAL MANUAL ARE APPLICABLE TO THIS MODEL EXCEPT FOR THE DIFFERENCES CITED IN THIS DIFFERENCE DATA SHEET.

1. CHARACTERISTIC DIFFERENCES.

Nose Landing Gear Door 90 Degree Gearbox Assembly, Part Number 177370-2 is physically and functionally identical to Gearbox Part Number 177370 except that configuration of seal assemblies (Figure 2-1, 4, 5, 6) and (Figure 2-1, 17, 18, 19) are different by containing seal (Figure 4-2, 1), Part Number 178176-1 in place of seal Part Number 177298 and seal (Figure 4-2, 2), Part Number 178747-1 in place of protector, Part Number 177296. Gear/plug assembly Part Number 177278-10 (Figure 2-1, 15, 27) is used in lieu of bevel gear Part Number 177278. Identification plate Part Number 178117-96 (Figure 2-1, 30) is used in lieu of Part Number 178117-31.

2. SPECIAL TOOLS.

Same as for Part Number 177370 with addition of tools listed in Table 4-2.

3. DISASSEMBLY.

Same as for Part Number 177370 except for the following procedures:

- a. Seal assembly Part Number 177804-1 is removed in accordance with paragraph 2.2, step i and paragraph 2.2, step k and is disassembled as follows: Remove seals (Figure 4-2, 1, 2) from retainer (Figure 4-2, 3) using Plate, Part Number ST5803, Inserter/Remover, Part Number ST5804, and an arbor press.

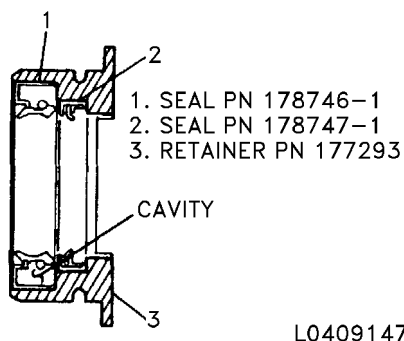


Figure 4-2. Seal Assembly Part Number 177804-1

- b. Gear/plug assembly, Part Number 177278-10 (Figure 2-1, 15, 27) is not disassembled.

4. CLEANING.

Same as for Part Number 177370.

5. INSPECTION.

Same as for Part Number 177370.

6. TESTING DURING OVERHAUL.

Same as for Part Number 177370.

7. REPAIR OR REPLACEMENT.

Same as for Part Number 177370.

8. LUBRICATION.

Same as for Part Number 177370.

9. REASSEMBLY.

Same as for Part Number 177370 except paragraph 2.10 step d and step h do not apply. Seal assembly Part Number 177804-1 is assembled and installed to gearbox Part Number 177370-2 as follows:

- a. Pack cavity in seal (Figure 4-2, 1) with grease (refer to paragraph 2.8) and coat the OD of seals (Figure 4-2, 1, 2) with sealing compound (Specification SAE-AMS-8802A) and immediately install seals into retainer (Figure 4-2, 3) with sealing lips facing outer end of retainer. Use Plate, Part Number ST5803 and Inserter/Remover, Part Number ST5804 with an arbor press to install seals. Wipe excess sealant from retainer.
- b. Fill cavity between seals (Figure 4-2, 1 and 2) and between lips of seal (Figure 4-2, 1) with grease. (Refer to paragraph 2.8) Install seal assemblies (Figure 4-2) in retainers (Figure 2-1, 7, 20) using packings (Figure 2-1, 10, 22) and springs (Figure 2-1, 3, 16).

**DIFFERENCE DATA SHEET**

10. TEST PROCEDURE.

Same as for Part Number 177370.

**Table 4-2. Special Tools**

<b>Part No.</b>	<b>Nomenclature</b>	<b>Procuring Service Stock No.</b>
ST5803	Plate, Support (Part of Kit ST792)	
ST5804	Insertor Remover, Seal and Protector (Part of Kit ST792)	