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## **6889700HT Power Train Drive Helical Gear**

*For Warranty Policy & Model Eligibility, Please visit us at [www.hyetechllc.com](http://www.hyetechllc.com)*

**Subject:** Removal, cleaning, inspection, rework, repair, and installation procedures for 6889700HT- Power Train Drive Helical Gear

**Compliance:** Anytime the Power Train Drive Helical Gear is removed.

**Notes:** Refer to OEM's published engine operation data.

Technical aspects are FAA approved

Standard shop practices may be substituted for materials and procedures referenced herein provided they have been demonstrated as effective and safe for use with these parts or their OEM and other FAA approved equivalents.

### 1.0 REMOVAL

Remove gearbox and disassemble to remove the bearings from the helical power takeoff gear shaft in accordance with the manufacturer's instructions.

Remove Power Train Drive Helical Gear from the gearbox cover. Remove the bearings from the gear using 6872746 puller with 6796948 drift.

Remove internal retaining ring and #2½ roller bearing from inside the helical drive gear.

### 2.0 CLEANING

2.1 Cleaning Precautions. Observe the following precautions when cleaning.

2.1.1 Exercise extreme caution in cleaning parts. Parts with fine finished surfaces, bearings, shafts, or parts with closely machined tolerances must be cleaned with care to avoid damage.

2.1.2 Vapor degrease.



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3.1 INSPECTION

3.2 Inspect and repair or replace the Gear in accordance with the following tables.

*NOTE: Anytime the gearbox is opened, review the engine & gearbox records to determine the number of operating hours that have elapsed since the 6889700HT P.T. Helical Drive Gear Shaft was new or was last magnafluxed (at overhaul or repair). Gear must not exceed more than 3500 operating hours between magnetic partial inspections. MPI Gear if unable to determine time since last inspection. Record compliance with this inspection in the appropriate section of the engine log book (gearbox section) stating the date & engine/gearbox total operating hours.*

**Table 1: Gears**

Condition/Inspection	Service Limit	Repair Limit	Corrective Action
<b>Wear on gear teeth (Visual)</b>	Slight normal wear with all mating parts in good condition.	Wear pattern which is more than a matte (dull) surface condition.	Remove sharp edges by stoning. Replace if evidence exists of healed prior scuffing.
<b>Measurement over pins.</b> Measure gear teeth over 0.1440 pins.	Min. measurement: 2.0770 inches.	Min. measurement: 2.0770 inches.	Measure the distance over pins for the gear. Hone or grind <sup>1</sup> to remove irregular tooth wear. The allowable reduction of the distance over pins after honing shall not exceed 0.002 inch. Replace gears which have less than the over pins dimension listed.
<b>Spalling: Check using 20X magnification lens.</b>	Spalling as evidenced by a matte (dull) worn area not exceeding 35% of the tooth width (contact area).  An interrupted area of 1/32 inch max. height across the gear tooth width.  PD limits as given for gear wear.	Any amount of spalling can be repaired.	Hone or grind <sup>1</sup> gears to remove spalling
<b>Scuffing. (Visual)</b>	Scuffing when accompanied by wear off metal pickup. If gear assembly is still matched with respective mating gears.  PD limits as given for gear wear.	Scuffing evidenced by pickup.	Remove scuffing by stoning, honing or grinding.



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**Table 1: Gears**

Condition/Inspection	Service Limit	Repair Limit	Corrective Action
<b>Tooth damage which involves metal displacement to a degree when sub-surface damage is detected by magnetic inspection. (Visual and MPI<sup>2</sup>)</b>	No sub-surface damage acceptable.	No repair.	Replace gear assembly.

**NOTES:**

1. Inspect for grinding burns per paragraph 4.0 Grinding Burn Inspection.
2. Magnetic Inspection Requirements are as follows.  
 Circular Magnetizing: 1200-1500 amps.  
 Longitudinal Magnetizing: 1500-1800 amps.  
 Magnetize part three times with a current pulse of 600 amperes. Rotate part 120° around its center after the first and second current pulse.  
 Inspect all surfaces. Mark cracks with an approved colored pencil.

**Table 2: Splines**

Condition	Service Limit	Repair Limit	Corrective Action
<b>Wear. (Visual)</b>	0.001 in. max. wear allowed. 1.1153 in. max. dia. Allowed when measured between two 0.054 in. dia. Pins, two places.	No Repair.	Install new or serviceable Gear.
Cracks. Radii root corners of spline teeth (or)  <b>In line or parallel in close proximity on the involute of a gear tooth side (Visual and MPI<sup>2</sup>)</b>	No cracks.	No repair.	Install new or serviceable Gear.



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**Table 2: Splines**

Condition	Service Limit	Repair Limit	Corrective Action
Tooth damage which involves metal displacement to a degree where subsurface damage is detected by magnetic inspection (Visual and MPI <sup>2</sup> )	No sub-surface damage acceptable.	No repair.	Install new or serviceable Gear.

**Table 3: Bearing Journals and Bores**

Condition	Service Limit	Repair Limit	Corrective Action
Shaft O.D. (Dia. <b>E</b> & <b>F</b> )	1.5760/1.5763 inch	1.5760/1.5763 inch	Copper plate dia. <b>E</b> & <b>F</b> per AMS-2418. Plating thickness to be 0.0001-0.0004 (See Figure 1).
Housing I.D. (Dia. <b>J</b> )	1.2604/1.2609 inch	1.2604/1.2609 inch	Copper plate per AMS-2418. Dia. <b>J</b> to show complete coverage to 0.0004 max. plating thickness on designated areas. Optional to plate radii & shoulders adjacent to dia. <b>E</b> , <b>F</b> , & <b>J</b> to 0.0004 max. plating thickness (See Figure 2).

**Table 4: Bearing Thrust Shoulders**

Condition	Service Limit	Repair Limit	Corrective Action
Grinding checks on bearing shaft thrust shoulders. (Visual and MPI <sup>2</sup> )	Checks not breaking an edge or extending into a radius.	No repair permitted.	Replace part exceeding serviceable limits.



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**Table 4: Bearing Thrust Shoulders**

Condition	Service Limit	Repair Limit	Corrective Action
<b>Roughened surface on thrust face. (Visual)</b>	No roughened surface.	Max of 20% of the area is affected and condition well dispersed.	Remove by light stoning and polishing. If this does not remove roughness, it is permissible to grind the mounting face to remove damage if no more than 0.005 inch stock is removed. Chrome plate surface per paragraph 5.0 Journal Repair.

**NOTES:** See Table 1 for notes.

**Table 5: All Areas**

Condition	Service Limit	Repair Limit	Corrective Action
<b>Nonmetallic inclusion on small gears and gearshafts. (MPI<sup>2</sup>)</b>	Light scattered non-metallic indications parallel to the material flow lines.	No repair permitted.	Install new or serviceable Gear
<b>Nicks and dents in gear teeth. (Visual)</b>	Nicks and dents, without sharp corners, not readily detected using a 0.030 inch radius scribe.	Nicks and dents with sharp corners stoned off which are detected using a 0.030 inch radius scribe but which do not exceed 0.060 inch in length, width or diameter.	Remove repairable nicks and dents by stoning, honing or grinding.

**NOTES:** See Table 1 for notes.

**Table 6: End Face Contact Area**

Condition	Service Limit	Repair Limit	Corrective Action
<b>Contact wear with P.T. Outer Shaft</b>	0.521 – 0.519 in. dimension from shoulder	Below 0.517 in. min.	Grind to 0.517 in. & hard chrome plate per AMS-2406 to 0.521 – 0.519 in.



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#### 4.1 GRINDING BURN INSPECTION

4.2 After a gear has been reground to remove surface defects, the ground surface must be inspected as follows to determine if grind burns are present

4.3 CAUTION: Contamination (fingerprints, oil, etc.) will give a false indication; therefore, use care in handling the gear to prevent such contamination.

4.4 The surface shall be thoroughly cleaned by vapor degreasing, or other suitable means, to remove grease and assure uniform etching.

4.5 Nital etch the parts as follows:

- 4.5.1 Cool the gear to room temperature. The gear may be submerged in a tank of cold water to facilitate cooling.
- 4.5.2 Submerge the gear in a tank of 3 to 5% (by volume) of nitric acid (O-N-350) and water until defective areas are delineated-not to exceed 60 seconds. Remove the part as soon as discoloration is noted.
- 4.5.3 Rinse the part in cold water.
- 4.5.4 Thoroughly rinse the part in hot water and blow dry with an air blast.
- 4.5.5 Submerge the gear in a tank containing a solution of 10% (by weight) of tri-sodium phosphate in de-ionized water or suitable alkaline neutralizers.
- 4.5.6 Rinse Gear in cold water.
- 4.5.7 Thoroughly rinse Gear in hot water and blow dry with an air blast.
- 4.5.8 Examine the part immediately under a diffused light. Apply petroleum solvent to make the tempered areas more pronounced and aid in the inspection.
- 4.5.9 After nital etch, a gear is acceptable if the surface discoloration is uniform and dull grey to light brown in color.



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- 4.5.10 Grinding burns appear as dark grey to black colored streaks or areas. The darker the color, the greater the burning. Burning causes abnormal tempering and is cause for repair. Gears containing such indications may be reground and re-etched to determine if all indications have been removed.
- 4.5.11 A gear having white and grey spots surrounded by large dark grey and black areas is not acceptable and shall be replaced. These areas are indicative of extreme overheating resulting in residual stresses and complete local re-hardening.

***WARNING: Flight safety parts that have journal repairs have these critical characteristics.***

- 2) Dimension requirements
- 3) Crack limits.

#### 4.0 JOURNAL REPAIR

- 5.1 Repair the copper plated or electroless nickel and copper plated journal as follows:

- 5.1.1 Strip off in accordance with 5.1.1.1

- 5.1.1.1 Electroless nickel and/or copper plating may be stripped from bearing journals and bores as follows:

Strip off plating in accordance with the following applicable stripping method:

If copper plating only is to be stripped off, use method A. If both copper and electroless nickel are to be stripped off, use method B. Stripping of electroless is not required if damage can be removed by stripping copper plating only.

**Method A:** Immerse in the following stripping solution until all copper plating is removed. Chromic acid (16oz. per gal), Sulfuric acid (1fl oz per gal), and Water (Remainder) at a temperature of 160°F to 170°F. Rinse in still water. Blow dry with clean compressed air.

**Method B:** Immerse in the following stripping solution until all copper and electroless nickel plating is removed. Metex strip acid (6 to 10 oz per gal), Sodium cyanide (10 to 14 oz per gal), and water (Remainder) at a temperature of 100°F to 130°F. Rinse





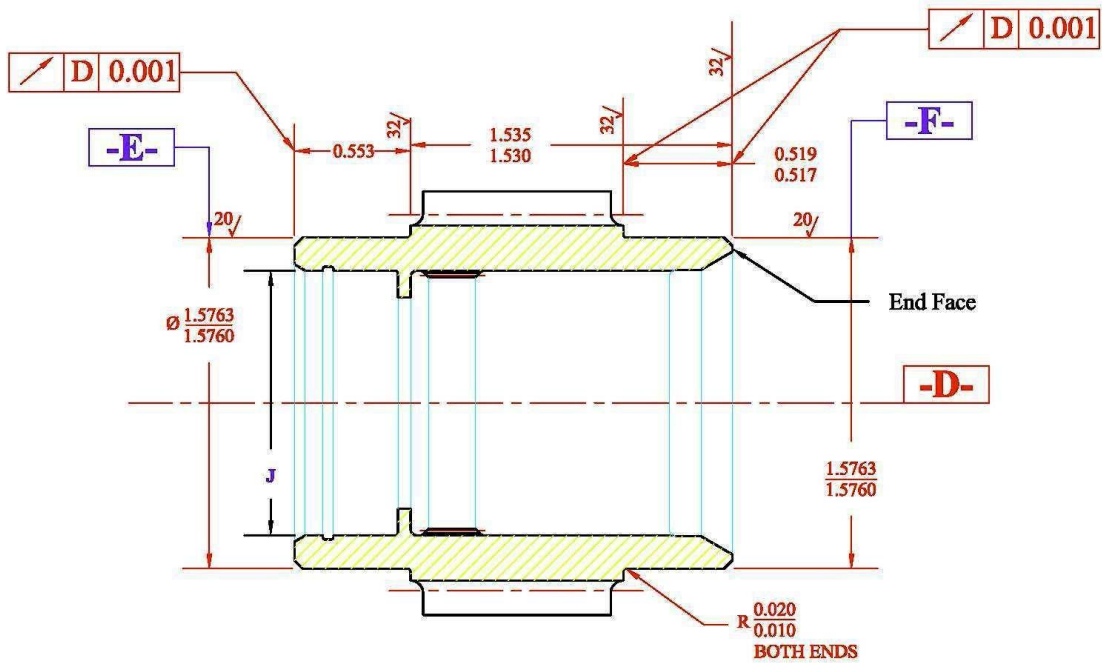
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thoroughly in clean running water for 30 to 60 seconds. Immerse in clean hot water (160°F min.) for at least 10 seconds. Blow dry with clean compressed air.

- 5.1.2 Grind the journal as necessary to remove damage. Grinding is not necessary if journal damage is removed by the stripping operation, provided surface finish and concentricity limits are maintained. If grinding is not required, proceed to 5.1.5.
- 5.1.3 MPI the ground journal.
- 5.1.4 Heat treat at  $275 \pm 10^{\circ}\text{F}$  for five hours.
- 5.1.5 Mask areas not to be plated with suitable mechanical masking.
- 5.1.6 Electroless nickel plate the journal per AMS 2405 to a thickness sufficient to permit copper plating 0.0001 to 0.0004 in. thick to the finish dimension. It may be necessary to grind the electroless nickel plating to maintain surface finish and concentricity limits if more than 0.002 in thickness is applied.
- 5.1.7 Copper plate the journal per AMS 2418 to the finish dimension. The copper plating must be 0.0001 to 0.0004 in. thick and within 0.060 in. of the adjacent shoulder.
- 5.1.8 Check concentricity and finish to ensure that they are within limits in Figure 1.
- 5.1.9 Bake at  $275^{\circ}\text{F}$  for five hours. The bake cycle is required on journals which are both electroless nickel and copper plated and on journals which are copper plated only.
- 5.1.10 Identify gears which are copper plated only by vibro-peening a P near the part serial number. Identify gears which are both electroless nickel plated and copper plated by vibro-peening a PI near the serial number. Vibro-peen per AS478-2D1.





Features shall be concentric & square within the TIR specified by **D**

**Figure 1**

