

T-015 Inspection Limits and Repair

Revision: F Issued: 2/02/16

P.T. Outer Shaft

Engine Application(s):	Allison 250-B17, B17B, B17C, B17D, B17E, B17F, B17F/1, B17F/2; 250-C20, C20B, C20F, C20J, C20R, C20R/1, C20R/2, C20R/4, C20S, C20W; 250-C22B.																					
Compliance:	Any time the PT Outer Shaft is removed for engine overhaul, it should be inspected to Extex criteria. The inspection will determine if the component is serviceable in its current condition, if the component is repairable per this instruction or if the component should be replaced.																					
Notes:	Replaces Service Letter T95-002 issued by Superior Turbine on April 1, 1995. Refer to Type Certificate Holder's published data for installation, engine operation, and disassembly. EH23037413 added 9/8/98. The "H" denotes High Strength Tool Steel. Otherwise, it is identical to E23037413.																					
Revisions:	<table border="0"> <tr> <td>N/C</td> <td>Dated: 01/30/97</td> <td>Original Revision.</td> </tr> <tr> <td>A</td> <td>Dated: 12/02/97</td> <td>Updated format.</td> </tr> <tr> <td>B</td> <td>Dated: 06/11/98</td> <td>Added repair data and updated format.</td> </tr> <tr> <td>C</td> <td>Dated: 09/08/98</td> <td>Added EH23037413 applicability (equivalent part mad from high strength steel).</td> </tr> <tr> <td>D</td> <td>Dated: 09/09/09</td> <td>Updated EXTEX to TIMKEN.</td> </tr> <tr> <td>E</td> <td>Dated: 04/23/12</td> <td>Added equivalent TAATI part number 23037413AL.</td> </tr> <tr> <td>F</td> <td>Dated: 2/02/16</td> <td>Updated Timken to EXTEX Engineered Products.</td> </tr> </table>	N/C	Dated: 01/30/97	Original Revision.	A	Dated: 12/02/97	Updated format.	B	Dated: 06/11/98	Added repair data and updated format.	C	Dated: 09/08/98	Added EH23037413 applicability (equivalent part mad from high strength steel).	D	Dated: 09/09/09	Updated EXTEX to TIMKEN.	E	Dated: 04/23/12	Added equivalent TAATI part number 23037413AL.	F	Dated: 2/02/16	Updated Timken to EXTEX Engineered Products.
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Inspection Procedures

- 1.0 Clean part in an alkaline bath per standard practices using AMS 1536, AMS 1537, or equivalent.
- 2.0 Perform Non-Destructive Testing (NDT) via Magnetic Particle Inspection (MPI) per AMS 2640 or equivalent.
- 3.0 Inspect part using the following criteria.

Condition	Service Limit	Repair Limit	Corrective Action
Cracks, visual and MPI*	Cracks are not acceptable.	No Repair.	Replace.
Imperfections in the Curvic Coupling	See Figure 1.	No Repair.	Replace.
Bearing Journal Wear	See Figure 2.	1.573 Dia.	Grind journal diameter to prepare surface. Build up diameter with Nickel Plate per MIL-C-26074 or AMS 2404 or Chrome Plate per AMS 2406. Grind per Figure 2.
Wear on 1.0410 I.D.	See Figure 2.	1.0415 Dia.	Grind diameter to prepare surface. Build up diameter with Nickel Plate per MIL-C-26074 or AMS 2404 or Chrome Plate per AMS 2406. Grind per Figure 2.
Loss of Plating	Loss of plating coverage is not acceptable.	Any amount of plating coverage loss.	Re-plate per Figure 2 OR Replace.

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Internal Spline Wear	Max 0.001 inch Max over pin diameter (measured in two places): 1.1153 inch between 0.054 inch pins. ** See Note Below	No Repair.	Replace.
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Condition	Service Limit	Repair Limit	Corrective Action
Spline Tooth Damage: grooves, gouges, spalled areas, etc.	No damage allowed.	No Repair.	Replace.
Spline Tooth Damage: chips, nicks	Up to 2 chips, not greater than .06" each, are acceptable on end of spline teeth provided spline working faces are not affected.	No Repair.	Replace.
Scuffing Wear on the Outside Diameters	See Figure 2. Scuffing wear is not acceptable.	Min. wall thickness: 0.042 inch.	Blend worn area removing minimum material OR Replace Shaft.
Corrosion Pitting on 1.670/1.645 inch O.D. and on corresponding I.D.*** (Ref Figure 2)	Corrosion pitting is not acceptable.	Max. metal removal 0.010 inch deep. Min. wall thickness: 0.042 inch, except 0.030 inch minimum at spherical dimples.	Blend pitted area removing minimum material OR Replace Shaft.
Corrosion Pitting in the 0.620 inch area next to Curvic Coupling*** (Ref Figure 2)	Max pit depth in spherical dimples: 0.005 inch. Max pit depth elsewhere: 0.010 inch.	No repair limit	Blend pitted area removing minimum material OR Replace Shaft.
Burrs or wear on rotating mating ring seal shoulder	Shoulder FIR to A-A Axis within 0.0002 inch.	No Repair.	Replace.

NOTES:

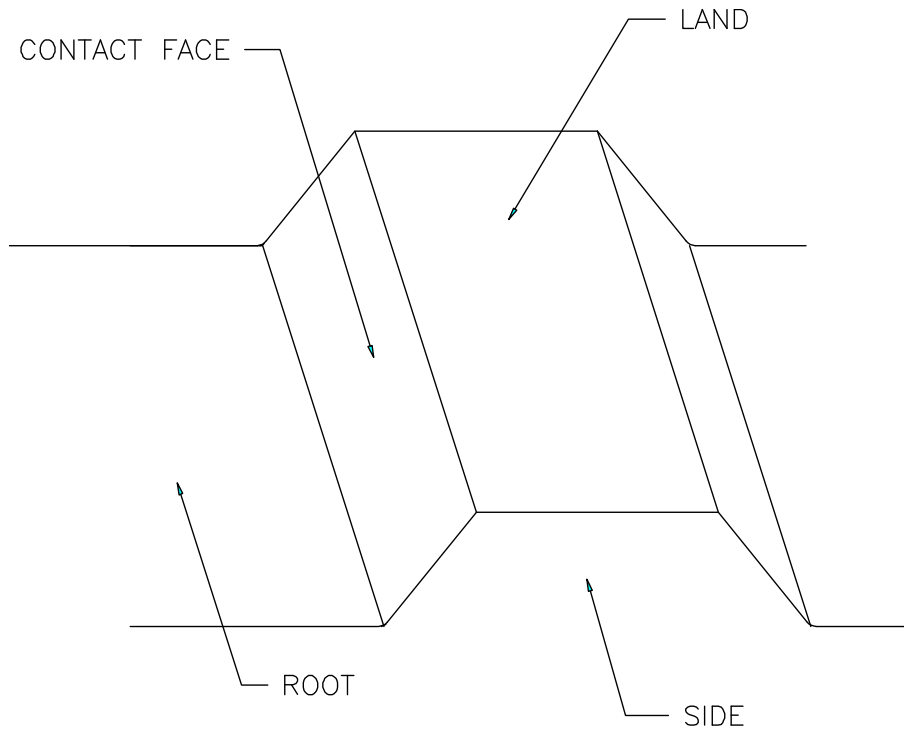
* MPI technique as follows: A) Circular between heads
AND
B) Longitudinal in a coil.

** Check spline wear using both scribe method and over pin method. Use a sharp pointed scribe, 0.020 inch radius, to detect a wear step. If it can be felt with the scribe, it is larger than 0.001 inch, which is over the service limit.

*** Use a sharp scribe (0.003 inch radius), to detect corrosion pit 0.006 inch or larger.

TABLE 1

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FPI	MAX SIZE	MIN SEPARATION	LIMITATIONS
INDIVIDUAL INDICATIONS	0.020 INCH	2X	NOT OVER EDGE
CLUSTER INDICATIONS	NONE PERMITTED		

VISUAL (INSPECT WITH 10x MAGNIFICATION OR GREATER.)

POSITIVE IMPERFECTION:

NONE ALLOWED ON CONTACT FACE, ROOT, LAND (SEE ILLUSTRATION).
FOLLOW REWORK PROCEDURES FOR HIGH METAL REMOVAL. 0.010 IN.
IS ALLOWED ON SIDES IF IMPERFECTION IS SMOOTH AND ADHERENT.

NEGATIVE IMPERFECTION:

CONTACT FACE, SIDES AND LANDS - 0.030 IN. DEEP OR LESS ON NO
MORE THAN 25% OF THE SURFACE AREA ON NO MORE THAN FOUR
TEETH. DAMAGED AND REWORKED TEETH MUST BE SEPARATED BY AT
LEAST ONE UNDAMAGED TOOTH.

ROOT:

NONE ALLOWED.

FIGURE 1

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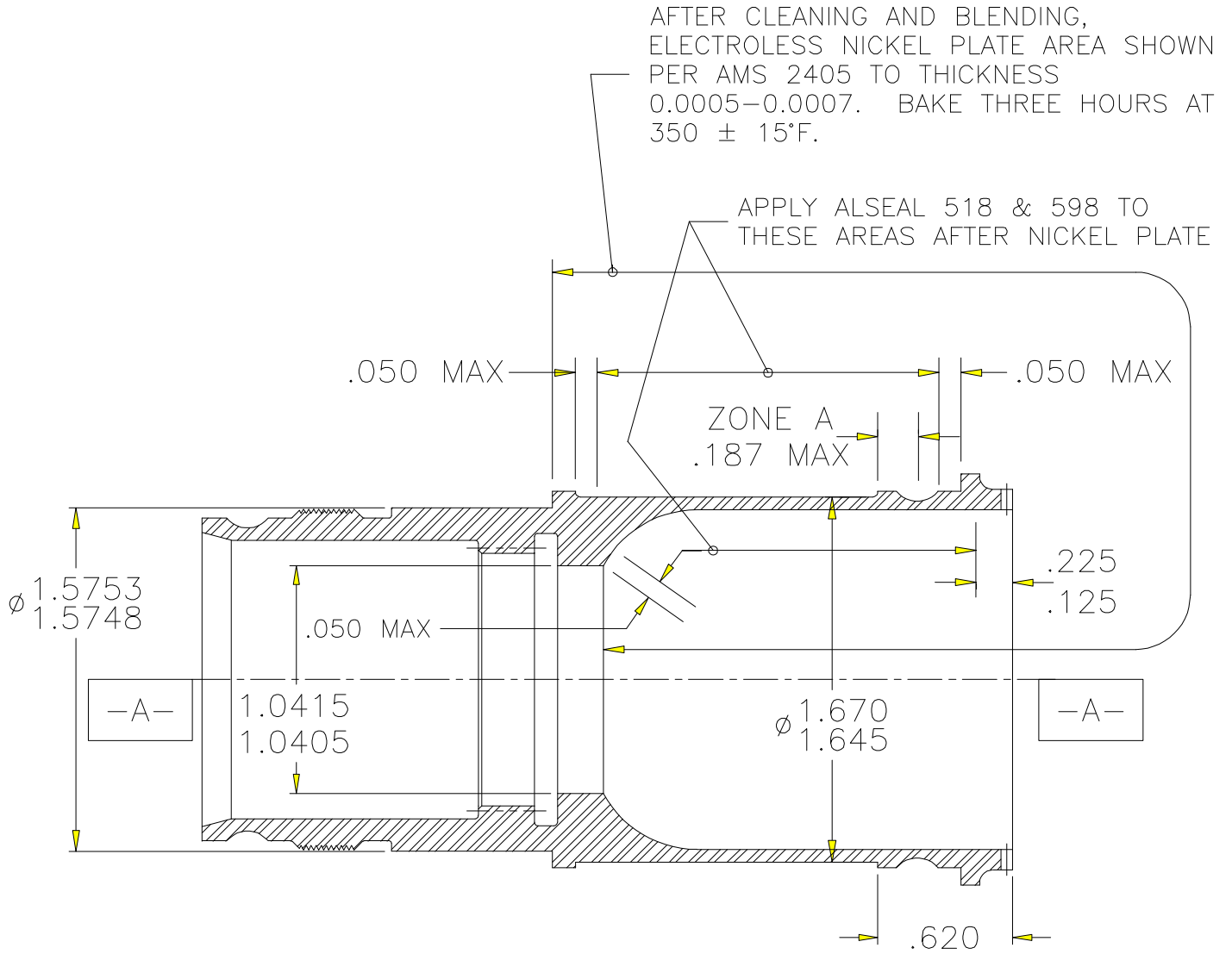


FIGURE 2

T-015 Inspection Limits and Repair

Repair Procedures

1.0 The following procedure is to be used at time of overhaul to inspect the power turbine shaft for re-hardening and/or tempering.

a. Surface Preparation

- (1) Remove Alseal coating by soaking the part in a caustic solution of potash.

WARNING

When mixing the caustic solution, wear protective gloves, apron and safety glasses. Add the caustic potash to the water. Never add water to the caustic pot ash or solution. To do so could result in the caustic pot ash or solution boiling over violently.

- (a) Add two pounds of potash to one gallon of water. (0.907 kg potash to 3.8 liters of water.)
 (b) Stir material well until all is mixed.
 (c) Soak the part in the solution for one hour at 125°F (79°C). Rinse with clear water.
 (d) After rinsing, remove the residue by glass bead peening at 20 psi (138 kPa).

- (2) Remove the nickel coating by immersing the clean dry shaft into concentrated nitric acid. Rinse thoroughly in clear running water for 30 to 60 seconds. Immerse in clean hot water, 160°F (71°C) minimum, for at least 10 seconds, then dry.

b. Etch the Power Turbine Shaft as follows:

Step	Process	Solution	Time	Temp.	Remarks
1	Nitric acid etch	Nitric acid 3-5% (by volume) in alcohol or Nitric acid 3-5% (by volume) in water.	3 min. max.	Ambient	Agitate parts when immersed. Exact time may vary to produce desired black oxide film.
2	Rinse	Circulating water	Rinse only	40°-80°F (4°-26.6°C)	To remove acid, total immersion is required.
3	Hydrochloric acid drip	Hydrochloric acid 4%-6% (by volume in alcohol or water)	30-60 seconds	Ambient	Agitate parts when immersed to remove black oxide film and provide uniform brownish-gray surface.
4	Rinse	Running water	Rinse only	60°-80°F (4°-26.6°C)	Agitate parts when immersed.
5	Neutralize	Any alkali solution, pH of 10 minimum	15 seconds minimum	60°-180°F (15.5°-82.2°C)	Agitate parts when immersed.
6	Rinse	Circulating Water	Rinse only	40°-80°F (4.4°-26.6°C)	To remove caustic.
7	Rinse	Alcohol	Rinse only	Ambient	To remove water.
8	Oil	Rust preventative oil	Dip only	Ambient	To prevent corrosion and aid to color contrast of burns.
9	Inspect and Evaluate				Inspect and evaluate per appropriate criteria within 15 minutes.

TABLE 2

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c. Interpretation of Results

- (1) Parts showing no evidence of tempering/re-hardening will be straw to gray color and are acceptable.
- (2) Tempered areas will acquire a dark coloration and are acceptable.
- (3) If overheating has been extreme, a light colored area surrounded by a dark area will appear. These parts shall either be rejected or tempered and returned to service.

NOTE: The etch inspection cannot be used to inspect shafts that have been tempered because the grain structure of the re-hardened zone will still be evident.

Repair Procedures

2.0 The following procedure is to be used to temper any shaft that has been rejected because localized circumferential rub has caused re-hardening.

- a. The tempering cycle should be $1050^{\circ} \pm 25^{\circ}\text{F}$ ($566^{\circ} \pm 14^{\circ}\text{C}$) for two hours in an inert atmosphere with a dewpoint of -60°F (-51°C) or below. Cool at a rate equivalent to air cooling. Parts must be properly supported to prevent distortion and permit uniform heating.
- b. After each tempering, etch T symbol on the area with the part number and serial number.
- c. Tempering will be allowed 3 times on any shaft.

3.0 Apply electroless nickel plating, as shown in Figure 2, to the shafts that have passed the inspection criteria and are considered serviceable.

4.0 Apply Alseal 518 & 598 coating over the electroless nickel plating in areas shown in Figure 2 except for:

- a. Base coat (518) shall be 0.002-0.004 inch thick (two layers 0.001-0.002 in).
- b. Prior to application of top coat (598), burnish base coat using 00 grade steel wool or lightly aluminum oxide grit blast until a reading of 0.25-3.0 ohms is obtained when the probes of an ohmmeter are lightly held 1.00 in apart.
- c. No requirements are established for coating thickness for deep recesses in which controlled coating thickness cannot be obtained under normal application techniques.

NOTE: Scratches on the outer shaft that occur during disassembly and assembly are acceptable if:

- (1) Scratched area is less than 5% of the coated area.
- (2) Maximum scratch is 0.040 X 0.750 inch.
- (3) Nickel plating is not damaged under the scratch. The Alseal coating is sacrificial so any uncoated area of a limited size will be protected by the coating on adjacent surfaces.

Scratches on the coated safety flange are acceptable if:

- (1) Scratches are in zone A (See Figure 2).
- (2) Nickel plating under the scratch is not damaged.