

## T-048 Repair Limits

### Rework of EXTEX 4<sup>TH</sup> Stage Turbine Nozzle Blade Tip Paths (BTP)

**Engine Application(s):** Rolls-Royce (Allison) 250-Series II Engines.

**Subject:** Rework of E6851531, E23061922, and 23055939TA blade tip paths.

**Compliance:** As required

<b>Revisions:</b>	N/C	Dated: 6/08/99	Original issue.
	A	Dated: 2/18/03	ECO#1209: Added E23061922.
	B	Dated: 6/26/03	Added PAR 7, PAR 8, PAR 9 for repair of lugs, flange faces, and vanes.
	C	Dated: 5/07/08	Added PAR10 for EFA Measurement
	D	Dated: 9/03/09	Updated EXTEX to TIMKEN.
	E	Dated: 2/04/16	Updated Timken to EXTEX Engineered Products.
	F	Dated: 9/26/19	Added part number 23055939TA
	G	Dated: 9/24/20	Added 4 <sup>th</sup> Stage Blade Tip Path machining limits chart (Section 5)
	H	Dated: 3/24/21	Added "CAUTION" block (Page 1) and inserted "Note" at start of Section 5.

*Note: The EXTEX Engineered Products, Inc. (EXTEX) article configuration is highly similar to the equivalent Type Certificate Holder (e.g. OEM) part in material, dimensions, and processing. As part of the FAA approval process, EXTEX demonstrated that the Type Certificate Holder Instructions for Continued Airworthiness (ICA) is applicable to these replacement articles. Therefore, you may use either these instructions or the Type Certificate Holder instructions for the rework.*

#### CAUTION:

Some new EXTEX nozzles have undersized BTPs and require machining prior to installation.  
Contact your EXTEX Customer Service Representative for additional information.

#### REASON:

To define procedures for restoration of blade path diameters for EXTEX 4<sup>TH</sup> Stage Turbine Nozzles.

Note: Section 5 defines the machining limits for reworking undersized blade tip paths (BTP) in new or overhauled nozzles.

#### DESCRIPTION:

This rework procedure defines the following:

1. Pre-machine limits.
2. FPI requirements.
3. Surface preparation.
4. Metallize plasma spray.
5. Machining limits for finished part.
6. Lug Repair
7. Lug Flange
8. Vane and Band Braze Repair
9. EFA Measurement.

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P/N(s): E6851531, E23061922,  
23055939TA

Revision: H

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### ACCOMPLISHMENT INSTRUCTIONS:

- Machine blade path as necessary to maintain .002" - .007" plasma spray thickness after machining. Maximum pre-machine limits:

- 1.1 3<sup>rd</sup> Stage Blade Path:

Part Number	Maximum Pre-Machine Limits (inch)
E6851531	7.548 diameter
E23061922	7.548 diameter
23055939TA	7.598 diameter

- 1.2 4th Stage Blade Path: 8.400" diameter.
- 1.3 Localized wall thickness .035" minimum. Localized is defined as less than 60° (16%) in total circumference and no greater than 30° (8%) of the blade path circumference in any one area.
2. Fluorescent Penetrant Inspect per ASTM E 1417 (supersedes MIL-STD-6866). No linear indications are allowed. Note that indications less than .015" are considered uninterpretable and can be ignored. Rounded indications (i.e. porosity) up to .030" Dia. are acceptable. Multiple round indications must be separated by at least twice the diameter of the larger indication.
3. Prepare surface for metallize per recommendations of metal spray vendor. Should include as a minimum:
  - 3.1 Degrease
  - 3.2 Grit Blast
  - 3.3 Mask
  - 3.4 Clean surface to be sprayed
4. Plasma Spray surface to be restored with METCO 443, 444, or 450NS.
  - 4.1 Spray parameters to be established using manufacturer's recommendations
  - 4.2 Remove Masking
5. Machine to finished blade path diameters:

*Note: The following blade tip path (BTP) diameters are consistent with the overhauled/new part limits defined in the Rolls-Royce ICA for the corresponding part. Per section 5.4, the BTP diameter necessary to obtain a desired tip clearance for a specific turbine wheel installation may be different.*

- 5.1 3rd Stage Blade Tip Path:

Part Number	Finished Blade Path Diameter Stage 3 (inch)
E6851531	7.533 ±.001
E23061922	7.533 ±.001
23055939TA	7.583 ±.001

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4<sup>th</sup> Stage Blade Tip Path:

Part Number	Finished Blade Path Diameter Stage 4 (inch)
E6851531	8.355 ± .001
E23061922	8.383 ± .001
23055939TA	8.385 ± .001

5.2 Finished blade path diameters must runout within .002" to inside seal diameter and to tang pattern.

5.3 Blade path diameters may be machined undersize to allow for optimum fit with turbine wheel.

6. Lug Repair: Just prior to welding, all surfaces to be welded should be cleaned with a carbide burr. Weld build-up as necessary via Gas Tungsten Arc (GTA) welding, also known as Tungsten Inert Gas (TIG) welding. It is recommended to use .030" to .045" diameter weld filler. Weld filler may be AMS 5789 or AMS 5801, Minimize heat input to avoid cracking.
7. Lug Flange (Both Sides): Degrease the part. Mask the part to prevent overspray of adjacent surfaces. Brush surface to be metallized with lacquer thinner or methyl ethyl ketone. Metallize per Plasma Spray Coating Nickel-Aluminum Composite (METCO 443, 444 or AMDRY 960) or Nickel Plate per MIL-C-26074. Remove masking carefully and clean off overspray. Remachine to Figure 1 and 2, inspect.
8. Vane and Band Braze Repair: Furnace brazing AMS 2675 is an excellent method to repair cracks or to fill shallow voids on the vane ring features such as airfoils and inner/outer bands. Furnace brazing can fill cracks up to .020" wide and creates less distortion than welding. A high temperature braze must be used to repair the vane ring in order to ensure that the braze alloy does not remelt when rejoining the vane ring to the diaphragm assembly.

Surfaces to be braze repaired must be cleaned. Cracks cannot be cleaned via abrasive media or carbide burrs because the crack would be opened beyond the bridging capability of the braze alloy. Instead, cracks should be cleaned in a reducing atmosphere. Examples of reducing atmospheres include heating the vane ring in hydrogen atmosphere up to 2100°F in some kind of furnace or retort. An alternate and better method, known as Fluoride Ion Cleaning (FIC), places the part to be brazed in an atmosphere of hydrogen fluoride at very high temperature (i.e. 2050°F - 2150°F).

All brazing must be performed in a reliable vacuum furnace, which is capable of controlling temperature to within ±10°F. This measure of control is necessary to insure melting of the braze alloy while avoiding melting of the base metal

Braze filler can be applied via a simple syringe or can consist of precut preforms. Extex recommends that an appropriate "stop off" be used to contain braze to those areas being repaired. Following brazing, hand finishing should be employed to restore part to its original dimensions and features.

9. EFA Measurement: The nozzle must be airflow tested after a Vane and Band Braze repair. The acceptable EFA range for the Fourth Stage Turbine Nozzle is:

Part Number	EFA Range
E6851531	14.00 – 14.60 square inches
E23061922	14.00 – 14.60 square inches
23055939TA	14.56 – 14.77 square inches

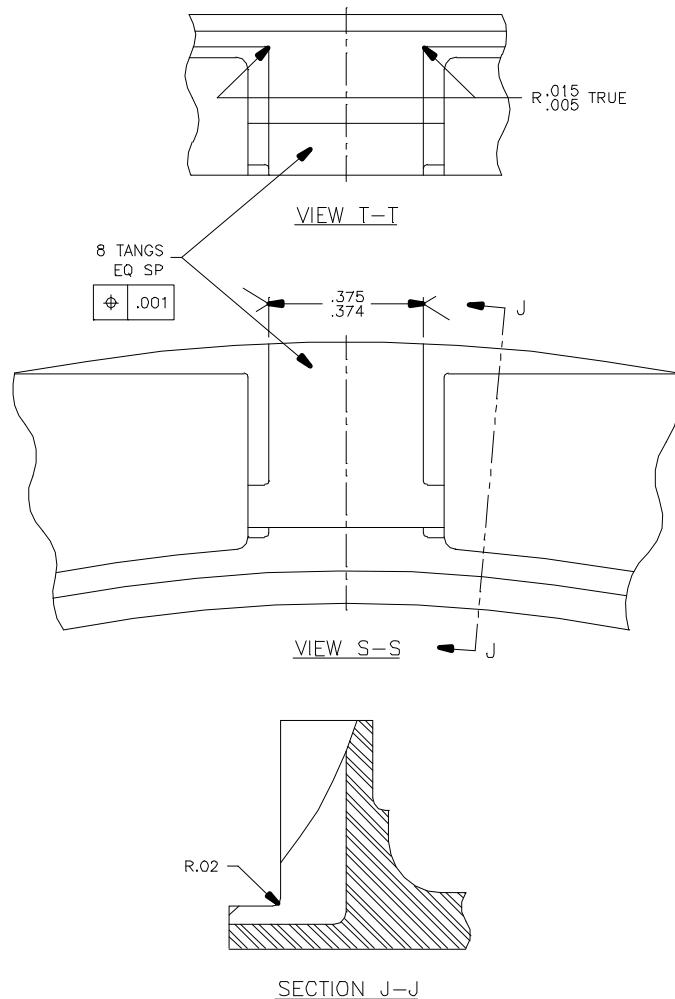
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**Figure 1**

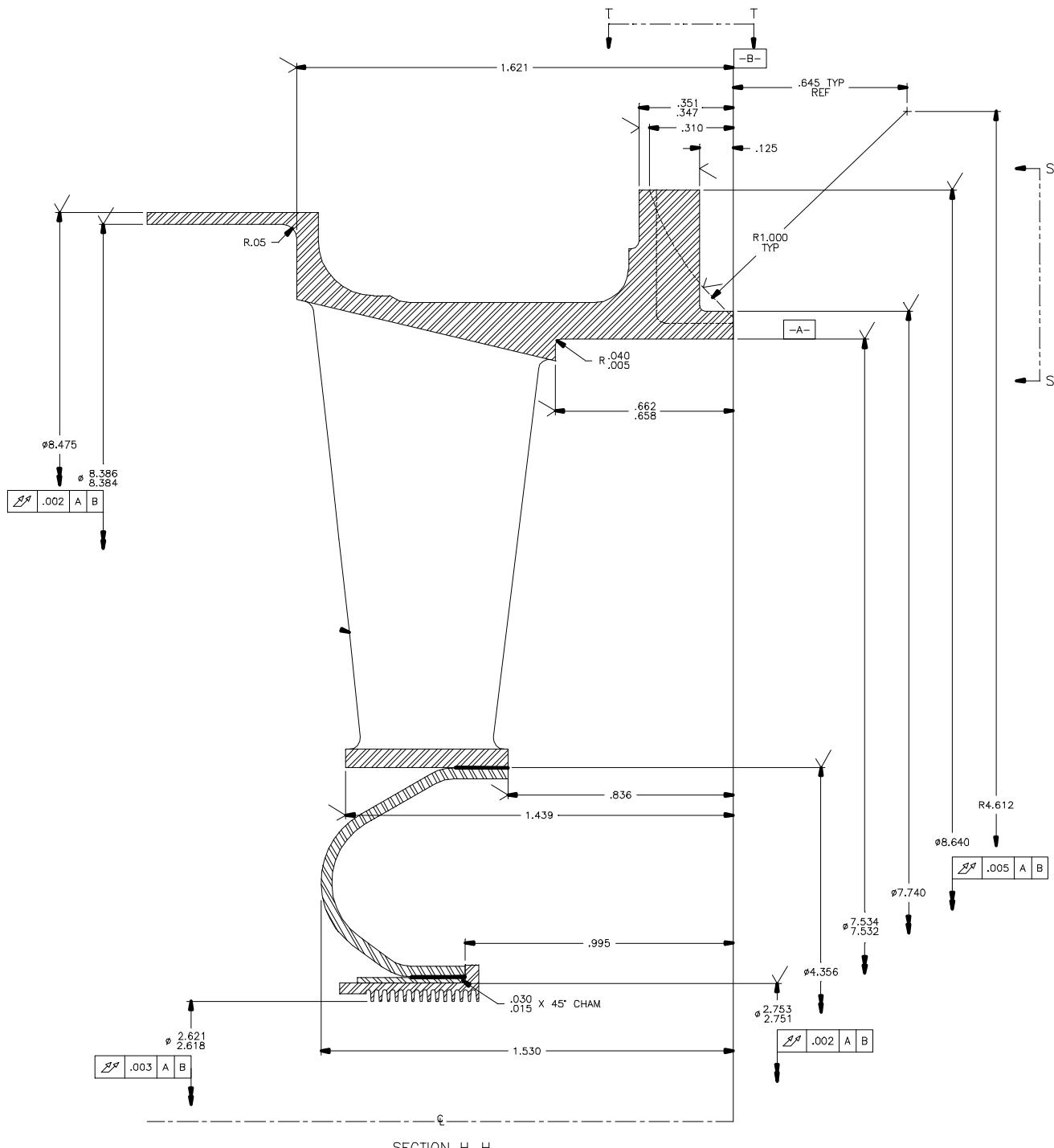
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**Figure 2**