



# B and E Rotor Life Management

As a safety-critical gas turbine component, the rotor requires periodic inspection and maintenance to help ensure effective power plant operation. Plant operators with B- and E-class gas turbines that are nearing 20 to 25 years of operation face an important decision about how to best increase rotor life. The periodic inspection and maintenance practices outlined here will help ensure continued safe power plant operation.

## A comprehensive inspection and maintenance plan

GE's 3-pronged maintenance and inspection plan helps keep your rotor operating safely by:

1. Adhering to the maintenance practices detailed in GE's Heavy Duty Gas Turbine Operating and Maintenance Considerations document (GER-3620)
2. Completing periodic inspection as covered in our Technical Information Letters (TILs)
3. Undertaking a timely rotor overhaul according to the rotor life management plan defined in TIL-1576 and GER-3620

Safe operation starts with GER-3620, which provides a general overview of the best operating and maintenance practices for GE's heavy duty gas turbines. It describes how factors such as time, cycle, and temperature impact the life of the rotor and other gas turbine components. The guidance also explains how to document and track rotor life consumption based on listed maintenance factors and the unit's fired hours and starts.

Next, inspections must be employed at normal outage intervals as outlined in GE's Technical Information Letters (TILs) which have been released over the past years. TIL-1049 describes inspections of the turbine wheel dovetail for material loss while TILs 1805/2056 covers inspection of the 9B/9E compressor stub shafts. To help maintain safe rotor operation until the next inspection interval, the TILs associated with each specific unit should be reviewed and all outlined inspections should be performed during normal outages such as a hot gas path or major inspection outage. Each of these inspections are done during normal outages like a hot gas path or major inspection and will help to ensure that the rotor can operate safely to the next inspection interval.

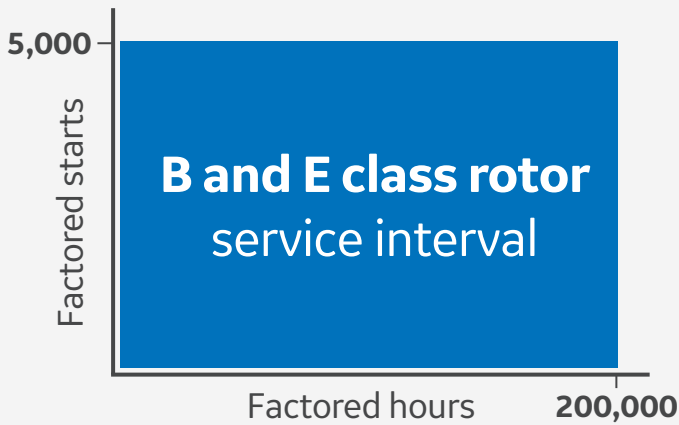
## Rotor inspection recommendations

TIL	Subject	Inspection type	Interval
1049	B/E Turbine Wheel Dovetail Inspections for Material Loss	Visual (with thickness gauge)	After shutdown, hot gas path and major inspections
1805/2056	9B/9E Compressor Aft Stub Shaft Impeller Inspection	Vibration monitoring with component modification or replacement as necessary	At first opportunity

The last step of a robust maintenance and inspection plan involves performing a rotor overhaul to help ensure continued safe turbine operation, when the time is right. Appropriate timing for a required rotor overhaul must be based on operating history and maintenance factors as outlined in TIL-1576 and GER-3620. All B and E rotors require in-shop maintenance and inspection around 200,000 factored fired hours (FFH) and 5,000 factored fired starts (FFS), as defined in GER-3620.

Depending on the specific goals for your plant, several factors must be considered to determine the best approach for completing the rotor overhaul.

Figure 1: Rotor service intervals



## Planning ahead

Planning for rotor life management begins with the following key questions:

4. What are the future operational expectations for the plant?
5. Should rotor life management encompass one or multiple units?
6. What outage constraints, scope, or timing window should be considered?

Based on your plant's long-term strategy and decision-making processes, planning should begin as early as three or more years in advance—when the rotor has approximately 150,000 FFH or 3,500 FFS. Early planning gives you the time and flexibility to examine available solutions and find a good match for your plant's long-term vision. After the plan is set, GE works with you to build the right solution.

## Building the best-fit solution

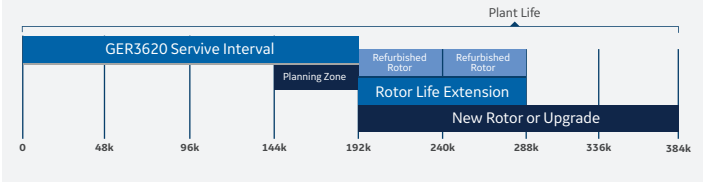
Selecting the rotor life plan that best meets your specific needs requires examining two different options:

- **New Rotor** – If your plant needs to run over a 20-to-25 year time horizon, you can choose a new rotor with 200,000 FFH and 5,000 FFS. What's more, you can select additional gas turbine upgrade solutions to deliver increased output and efficiency.
- **Refurbished Rotor or Rotor Life Extension** – If the long-term plan for your plant is uncertain, you may choose to install a fully inspected refurbished rotor that has been updated with the latest technical improvements. The remaining life of the refurbished rotor can vary. If your outage window is flexible, you can send your rotor to our certified service shop for tear down and repair that can extend rotor life up to 300,000 FFH/7,400 FFS, depending on how much life the rotor had already consumed.

## Delivering overhaul excellence

Based on extensive fleet insights and decades of engineering experience, GE's safety-critical overhaul procedures for used B- or E-class rotors must be completed in a certified shop to help ensure

Figure 2: Options to extend rotor life



personnel safety and avoid equipment damage. Since 1975, GE has performed more than 40 turbine rotor, 15 compressor rotor, and 125 blade configuration modifications based on fleet learnings and engineering analytics. Our deep understanding of each specific gas turbine asset's configuration and design means we can apply the precise repairs needed to help achieve the highest overall rotor reliability from either a rotor life extension or a rotor exchange.

Over the years we have significantly improved our rotor overhaul turn-around times. With proper planning to ensure that all needed inspection equipment and parts are available at our certified service shop, a full B- or E-class rotor life extension can typically be completed about 12 weeks of time after the rotor arrives at the shop.

To help ensure ongoing safe turbine operation, the highly trained and skilled personnel at our certified service shop perform a complete rotor tear-down, including cleaning and inspection of all safety-critical areas of the rotor wheels and shafts. Our advanced inspection technologies include eddy current testing, ultra-sonic testing and magnetic particle/fluorescent penetrant inspection.

Skilled repairs are performed with care while components that cannot be reused, such as some turbine wheel and bolting components, are replaced with new parts.

Rotors that have undergone GE's rotor life extension process, incorporate components with the latest available technology improvements and are certified for continued safe operation.

## Vast experience, broad expertise

More than 160 gas turbine rotors have been replaced with new, refurbished or life life-extended units in GE's B- and E-class fleet. As these rotors come through our service shops, we perform root-cause investigations, observe key findings, and incorporate lessons learned to continuously improve our rotor repair processes and procedures.

Like other key power plant components, the rotor requires maintenance, inspection and a full overhaul to help ensure continued gas turbine operation beyond the expected capabilities of the rotor hardware.

The following table summarizes the choices other plant operators have made—ranging from new or refurbished rotor exchanges to rotor life extensions. In each case, GE's experience and expertise helped tailor a best-fit solution to meet specific plant goals.

Solution	Number of Rotors
New or refurbished rotor exchanges	70
Rotor life extensions	90