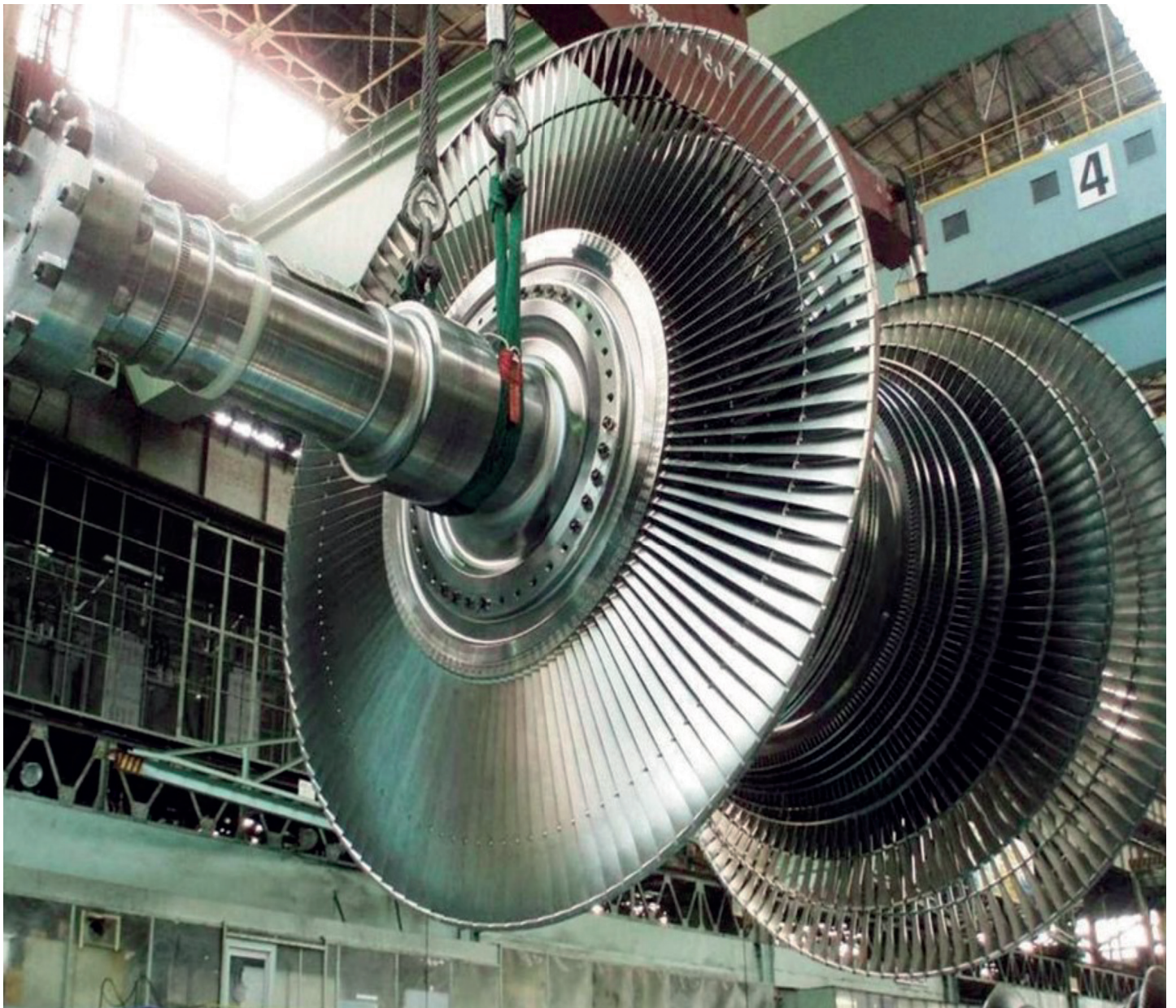


**STEAM TURBINE REPAIR SERVICES**

# **CAPABILITY & EXPERIENCE**



**Mitsubishi Power is a power solutions brand of  
Mitsubishi Heavy Industries.  
Mitsubishi Power Europe, Ltd**

**MOVE THE WORLD FORWARD**  **MITSUBISHI  
HEAVY  
INDUSTRIES  
GROUP**

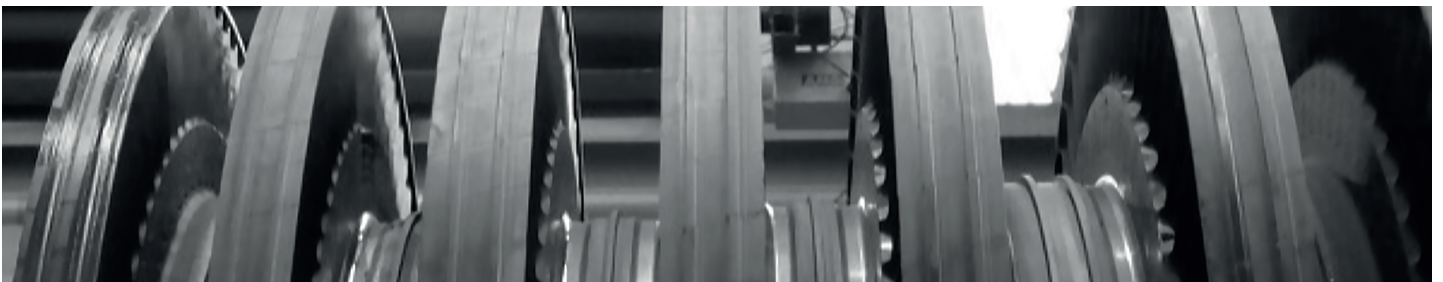
## OUR SERVICES

Mitsubishi Power Europe Middle East and Africa provide a full and comprehensive range of technical services to ensure your Steam Turbines are inspected and maintained to the highest standards.

Our experienced engineers are available around the clock to provide technical support for your power plant to ensure any issues are resolved efficiently.

Our remote monitoring centres (RMC) provide real time data feedback and performance checking to help you maximise your power plant availability.

Mitsubishi Power is committed to investments in new technology by propelling forward innovative solutions that increase performance and reliability whilst reducing the costs of ownership.

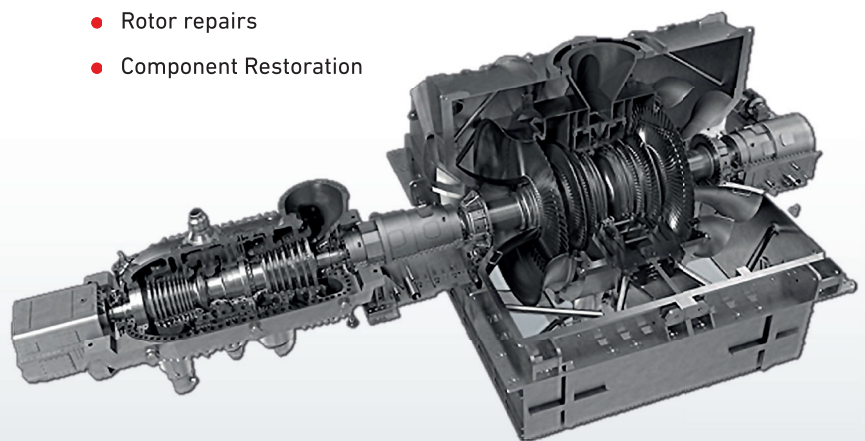


### SERVICE SOLUTIONS

- Minor & Major Overhaul
- Diagnostic Services
- Integrity Inspection
- Component Upgrades
- Reverse Engineering
- Remote based
- Inspection

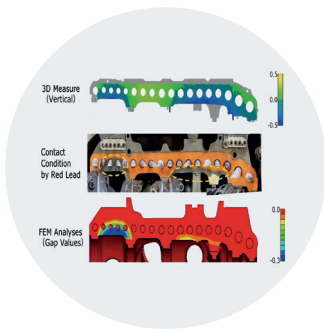
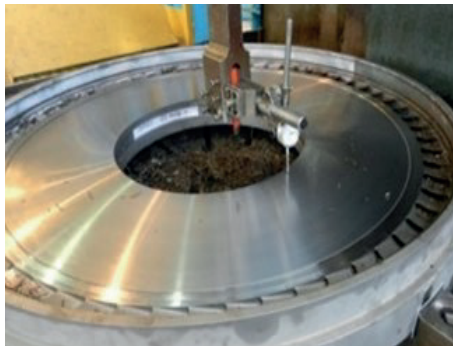
### REPAIR SERVICES

- Blade Rings / Diaphragms
- Casing Repair
- Control Valves
- Welding Repair
- Rotor repairs
- Component Restoration



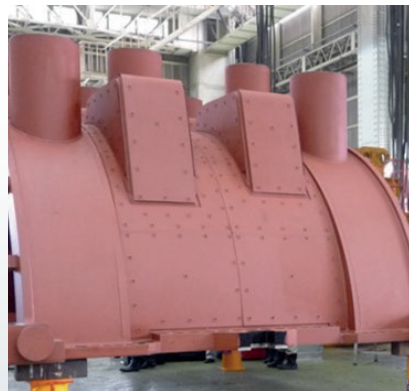
# BLADE RING AND DIAPHRAGM REPAIR

- Blade Ring component repair / parts replacement OEM
- Distortion Correction / Partition Repair
- Diaphragm welding repair, vanes/seals replacement
- NDT inspection (PT, FPT, MPI, UT, Radiography)



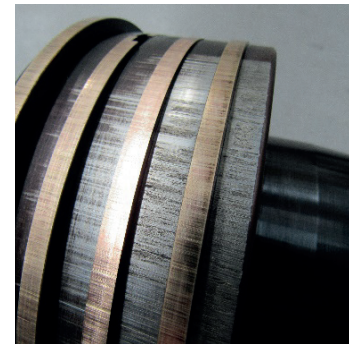
# CASINGS REFURBISHMENT

- Geometry Analysis / Casing Modification
- Comprehensive inspection and 3D Laser Alignment scanning
- Clearance / Rubbing Correction capabilities
- Metallurgical analysis
- New casing manufacture



## CONTROL & STOP VALVES

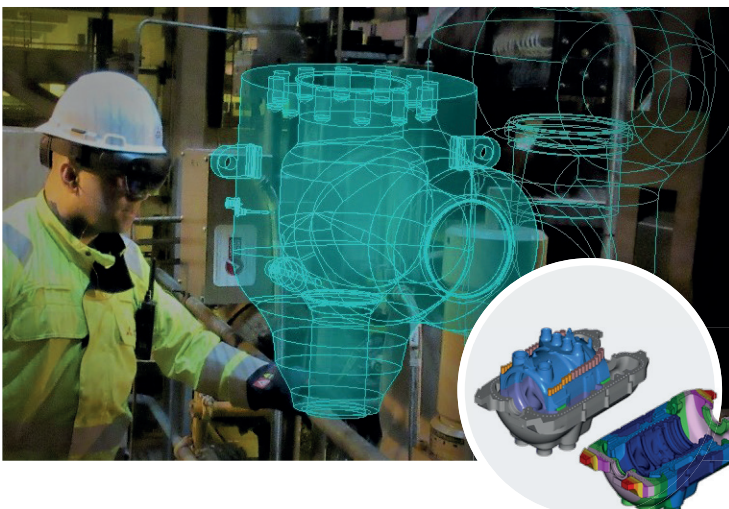
- Valve Refurbishment and Enhancement
- Actuator services (TOMONI Integration)
- Bushing material upgrades (Stellite)
- CNC machining and weld build up repair
- Valve seat replacement



## MODELLING AND COMPUTER AIDED MAINTENANCE

- Computer Aided Design (CAD)
- Finite Element Analysis (FEA) / Computer Aided Design (CAD)
- Computational Fluid Dynamics (CFD)
- Reverse Engineering
- Predictive Data Analysis for Rotor Life Management
- Augmented Reality assisted Remote inspections

### SHORTENING OF OUTAGE DURATIONS FROM APPLICATIONS OF 3D METROLOGY TECHNOLOGY



We strive to shorten the outage duration for all overhaul projects in order to reduce outage costs and to improve the availability rate of our customer's plant.

One example is the shortening of the re-assembly period of casings rebuild by using 3D measurement technology.

3D models are created from laser scanning.

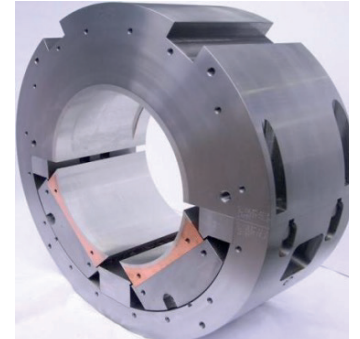
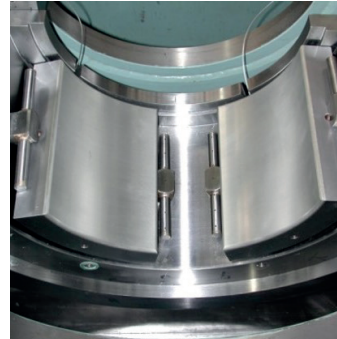
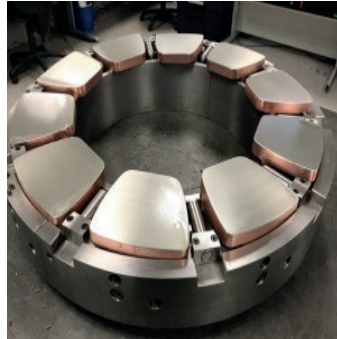
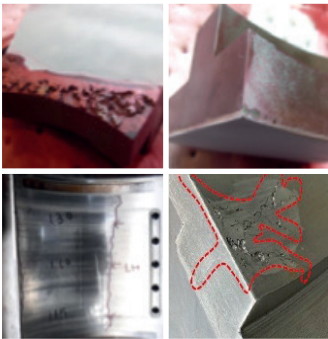
The results of which allow casings to be refurbished and readied for assembly.

Possible interference and pinch points of can be detected from the models and quick countermeasures are applied in advance.

Augmented reality accesses live engineering support from our Global centres to provide 24/7 remote real time assistance.

## BEARINGS SERVICE AND MANUFACTURING

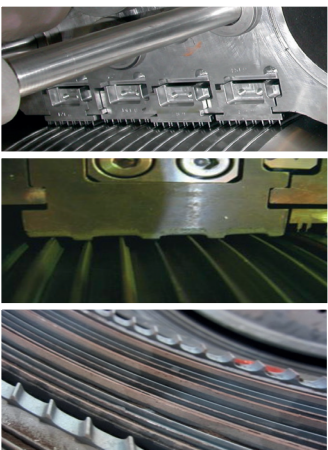
- Journal and Thrust Bearing Refurbishment Services
- Alternative Thrust material options using Resin applications
- Reverse Engineering and Manufacture
- Enhanced lubrication applications
- Enhancement of stiffening structures to improve damping



## SHAFT SEALING SYSTEMS

- Active Clearance Control
- Abradable Sealing Systems
- Leaf seal technology application
- Dedicated parts manufacturing
- Retrofit on site during outages

### NEW DESIGN SEALING SYSTEMS ACTIVE CLEARANCE CONTROL ACC



Mitsubishi Power Europe offers Active Clearance Control for shaft sealing systems to increase the sealing performance and improve efficiency of the unit. These modifications are simple and quick to apply to the unit and will reduce maintenance costs.

Our state-of-the-art Abradable Sealing Systems can be combined with Active Clearance control systems reduce the adverse effects of friction heat deformation.

ACC systems reduce rubbing potential and increase efficiency. Mitsubishi Power Europe recommend ACC as an alternative sealing methodology.

Our leaf seal technology utilises hydrodynamic lifting forces to reduce shaft leakages leading to a more efficient and reliable unit.

Our next generation swirl breakers actively reduce the vibrational forces experienced on the rotor reducing efficiency loss, material erosion and serious damage.

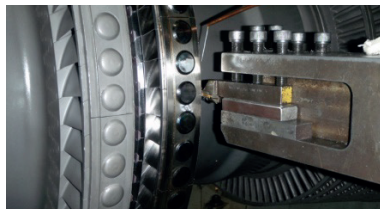
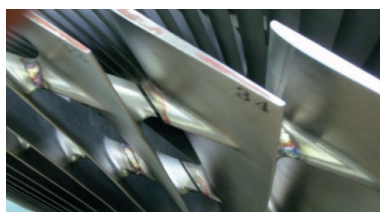
# ROTOR MAINTENANCE

By utilising our vast experience and engineering capabilities, we are able to perform Comprehensive Rotor maintenance services within our network of approved maintenance centres.

From site inspection to in depth structural repairs, we are able to deliver a high quality and efficient service using OEM quality components.



## TOTAL BLADE REPLACEMENT - SERVICES

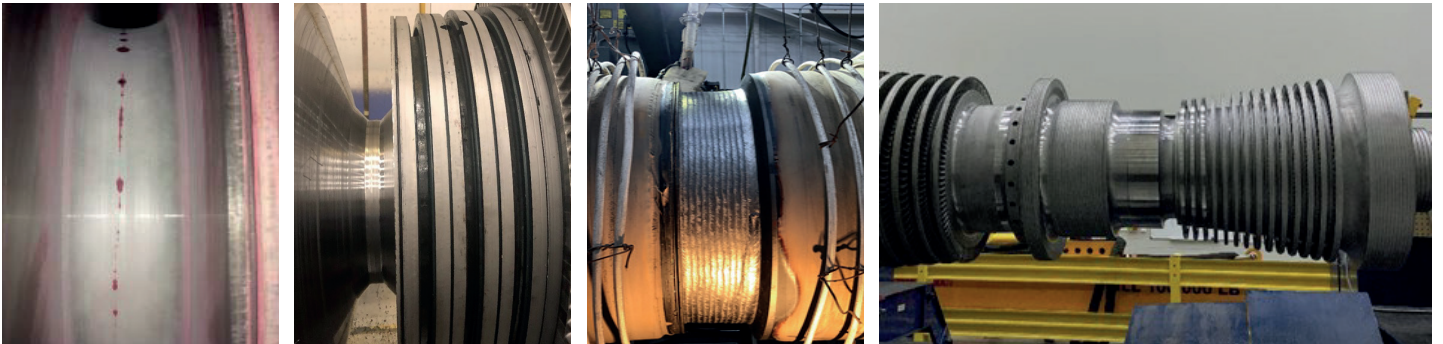


Our extensive supply chain ensures that you will experience minimal lead times and receive a swift response in emergencies. Our expert field service engineers will inspect and carry out damage analysis on the rotor and blades allowing for cost effective repair.

Our workshop team has the full capability "to perform" total blade replacement high speed balancing to ensure that your rotor is "within vibration limits and is" ready to synchronize with the grid

# ROTOR BODY WELD REPAIR

- Rotor Crack Repair
- Tungsten Inert Gas Welding (TIG)
- Submerged Arc Welding (SAW)
- ST Rotors Seal Replacement/Machining



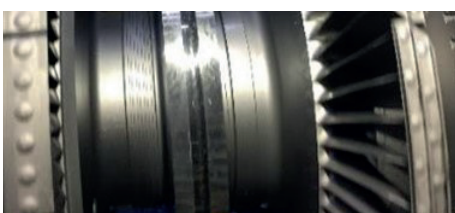
# ROTOR DISC & SHAFT RECOVERY

- Disc Restoration and Deep radial crack recovery
- Blade Mounting Geometry Enhancement
- Straightening via Heat Treatment
- Shaft End and Journal Repair



## ROW 8 DISC RESTORATION WITH UPGRADED MATERIAL

- Rotor Material: Class 4-7 (NiCrMo) Forging
- Filler Material: 12 Cr - Stainless Upgrade
- Weld Process: SAW
- Weld build up: 230 lbs.



Mitsubishi Power Europe has the full capability of machining the blade grooves. New root designs can be applied to accept new, original or upgraded design mountings. Utilising our global design and engineering capability to design and develop repair plans using Finite Element Analysis modelling.

With a wealth of hands-on experience, we create fully tailored weld test plans to suit each rotor.

# MATERIALS TESTING & INTEGRITY INSPECTION

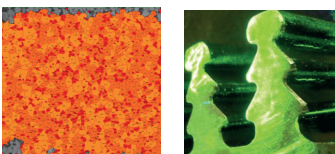
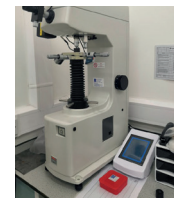
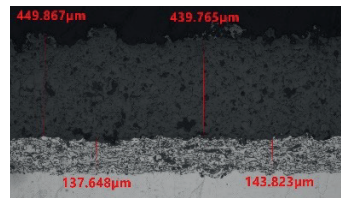
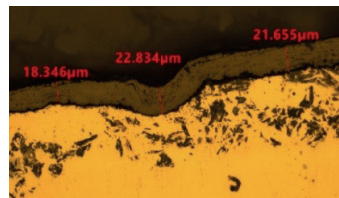
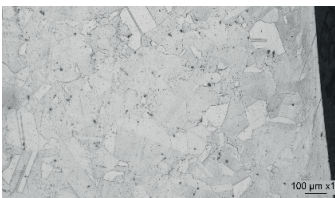
As your components approach their design life an integrity inspection can be performed to assess the actual material condition so that residual life can be assessed accurately.

Non-destructive inspection methods are carried out in-situ to reduce downtime by using various assessment techniques we are able to analyse the samples taken during the onsite inspection and evaluate the potential microstructural decay and creep damage.

Once the damage is assessed we can process the results through our Mitsubishi Life Time Assessment System (MLAS) and provide customers with an accurate snapshot of the health and remaining life of their components, as well as providing recommendations to enable the implementation of proactive damage mitigation strategies.

Mitsubishi Power Europe provides materials testing and analysis through our dedicated materials laboratory network.

Mitsubishi Power Europe also offers investigative failure analysis and destructive testing services for all components.

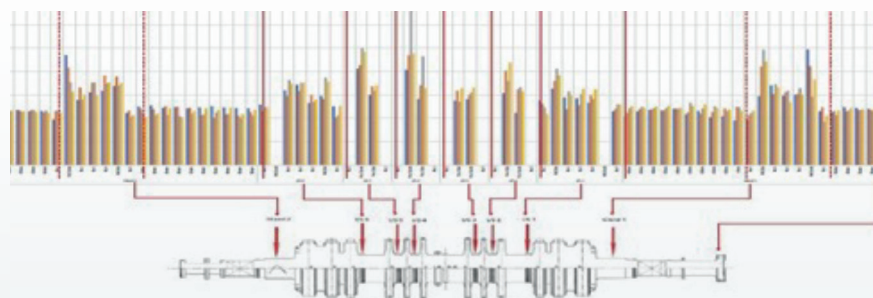


## LABORATORY

- Precision Sample Preparation
- Microscopy
- Mechanical Testing
- Heat Treatment Development
- On-site Inspection
- Chemical Handling
- Quality Assessment

## CAPABILITY

- Integrity Assessment
- On-site Material Assessment
- Failure Investigation
- Metallurgical Assessment
- Chemical Assessment
- Weld & Coating Assessments
- Machining Validation





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