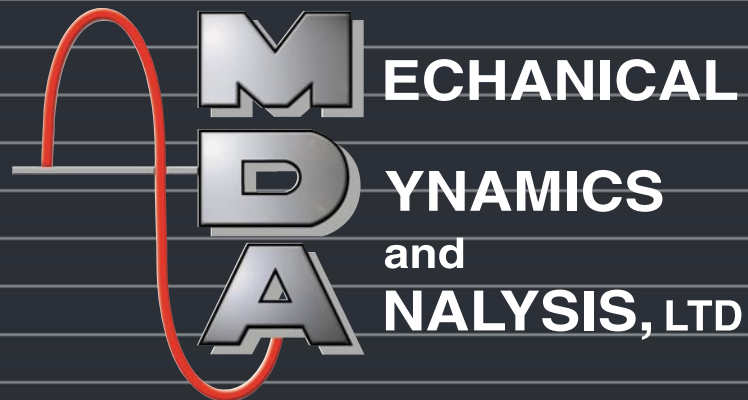


Steampath Services Capabilities



*The Turbine-Generator
Engineering & Outage Services Company*

Mechanical Dynamics & Analysis is one of the world's leading suppliers of steampath engineering services. Our Steampath Engineers provide support for power generators and steam turbine owners worldwide. This group provides experienced, on-site engineering personnel, most of whom are factory-trained and have completed years of field experience prior to joining our team. The Steampath Engineering team is also fully supported by our Outage Services Division, tools and programs that are needed to ensure technical excellence on every project.

An abbreviated list of our steampath engineering services includes:

- Structural steampath analysis of components
- Thermodynamic analysis of steampath components
- Engineered repairs of diaphragms and blade rings
- Engineering & supervision of all bucket and blade installations
- Supervision of dished diaphragm repairs
- Supervision of nozzle block reconstructions
- Owner's representative for turbine repair recommendations
- Failure analysis and second opinions
- Reverse engineering of turbine stationary & rotating components
- Turbine cycle performance testing and trending
- Supervision of complete steampath replacements
- Evaluation of acceptance test data
- Analysis of steampath modifications for increased flow-passing capabilities
- Bowed rotor evaluations & machining
- Heat straightening & machining of rotors
- Recommendations for restoration of efficiency & output losses
- Recommendations for component life extension
- Integration of steampath repairs with alignment recommendations
- Reverse engineering, manufacture & installation of new buckets/blades
- Monitoring & control of component repair schedules
- In-process planning & component repair inspection
- Matching craftsmen to the repair skills required



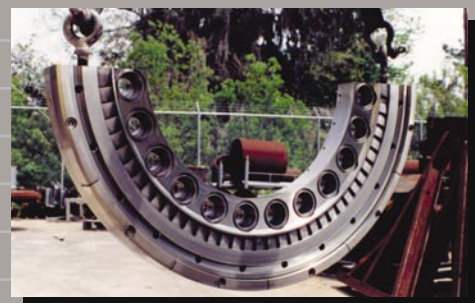
Component repairs are inspected by our on-site staff of full-time, factory trained, engineers to ensure that repairs are completed within tolerances.



Structural and thermodynamic steampath audits are conducted to provide owners with repair recommendations accompanied by associated gains in efficiency.



In-process and final inspections using precision instruments to assure repair quality, unit performance and reliability.



Steampath engineering design knowledge and experience to re-design and manufacture new diaphragms, nozzles, rotating buckets and blades.

Turbine-Generator Repair Facility

MD&A's new state-of-the-art turbine-generator repair facility is centrally located just outside the St. Louis city limits in South St. Louis County, Missouri. Construction of the facility was completed in 2006 and includes a complete array of amenities such as: office space for our administrative and engineering staff members, 80 tons of overhead crane capacity and a direct rail spur for loading and unloading rotors, shells and other large turbine-generator components.

This new 100,000 square foot facility houses both portable and stationary equipment for the machining, repair and overhaul of turbine and generator components. The building was designed to accommodate the rapid growth of our turbine and generator maintenance, repair and overhaul business and has allowed us to consolidate several of our regional shops into one modern, centrally located facility.

An abbreviated list of the steampath related capabilities and equipment located in this facility includes:

- Machining to support upgrades and uprates
- Shell nozzle fit modifications
- State of the art inspection services
- Valve seat refinishing
- Installation of erosion shields
- Throttle, governor, main stop & control valve refurbishment
- Stud removal and re-threading of bolt holes
- Coupling and thrust collar machining
- Boring of blade carriers
- Restoration of blades and buckets
- Machining of inner cylinder nozzle chambers
- Line boring of coupling bolt holes on-site
- Overhaul of blade rings and diaphragms
- Correction of distortion and out-of-roundness
- Machining of steam inlet pipe bell seal retaining nut areas
- Milling of turbine casing fit areas
- Non-destructive evaluation of components
- GTAW, FCAW and SMAW welding



Time saving portable machine shops containing a lathe, milling machine, drill press, surface grinder and many expendable tools are available for rent.



Fully CNC capable milling machines are contained in portable shipping containers for immediate transport and on-site fabrication of components such as blade shrouds and bucket covers.



MD&A's newly constructed turbine-generator repair facility includes state of the art machining, equipment, and tooling needed for the reverse engineering of components.



Specialized portable field machining is stored at the St. Louis facility where it can be quickly and easily deployed via our rail spur to anywhere in the country.

**For more information on MD&A's products and services please call (518) 399-3616.
Visit us on-line at www.MDAturbin.com**

MD&A provides comprehensive repairs of stationary steampath components. Our steampath engineers specialize in the engineered repair of diaphragms and blade rings. We are the only service provider to offer full-time, on-site supervision of your steampath repairs by factory-trained steampath engineers. Our facilities, located in St. Louis, contain state-of-the-art welding and field machining equipment such as portable lathes and VTLs, as well as a full-time staff of welders and machinists who specialize in steampath repair.

An abbreviated list of our stationary steampath component services includes:

- Complete steampath upgrades, replacement and installation
- Nozzle box reconstruction, repair and replacement
- Nozzle plate rebuilds in accordance with GE TIL 1088
- Blast cleaning of all components
- Non-destructive testing
- Horizontal joint repair and machining
- Manufacture of new inner shells
- Area checks and harmonic analysis of diaphragms
- Replacement and machining of caulked-in seals
- Dished diaphragm restoration
- Profile modifications to reduce solid particle erosion
- Diaphragm and blade ring modification for life extension
- Failure analysis and second opinions on repair recommendations
- Distortion analysis with integrated, customized seal replacement
- Sidewall restoration
- End / dummy / gland packing overhauls, upgrades, replacement and installation
- Major and minor weld repairs of blade rings and diaphragms
- Grinding and polishing of airfoils
- Steam valve inspections and overhauls



Repair recommendations that meet or exceed OEM requirements are made following detailed, itemized inspections of all components.



Partition & blade profiles are restored to OEM specifications and then polished to meet or exceed the original OEM specifications for surface roughness.



Caulked-in steam seals are replaced and out-of-roundness checked on all diaphragms and blade rings prior to final quality control checks and shipping.



On-site and in-place orbital TIG welding of worn and cracked Governor valve seats are repaired using custom-designed equipment and remote control operation.

Rotating Component Repairs

MD&A has provided engineering and repair services for owners of heavy rotating equipment for more than two decades. Our offerings include a complete array of rotor repair services, backed by the experience of factory-trained engineers. Most repairs on rotors up to 100 tons can be performed on-site or in MD&A's turbine-generator repair facility located just outside of St. Louis, Missouri. MD&A maintains a vast inventory of portable lathes and other field machining equipment dedicated to the repair of turbine components anywhere in the world.

An abbreviated list of MD&A's rotating component services includes:

- Rotor surface cleaning
- Visual inspections by factory-trained steampath engineers or specialists
- NDE of rotor peripherals and bores using magnetic particle, liquid penetrant, ultrasonic, eddy current and boresonic inspections
- Sonic testing of finger bucket dovetail pins and wheel dovetails
- Wheelsonic testing of shrunk-on/integral turbine wheels
- Removal and replacement of bore plugs
- Complete dimensional inspections, including run out checks on couplings and journals
- Structural and efficiency steampath audits
- Reverse engineering of rotors for uprate/upgrade projects
- Dovetail machining/enhanced geometry
- Journal and coupling face machining to remove out-of-roundness and scoring
- Thrust runner face refinishing to remove run out
- Restoration of rabbet fits
- Analyze and re-machining of bowed rotors
- Installation of Hitachi CCB long buckets
- Line boring of coupling bolt holes
- Reverse engineering, supply and installation of pine-tree, finger, tangential and axial entry blades and buckets
- Erosion shield replacement
- Bucket and blade cover replacement
- Low speed balancing / high speed balance upon request



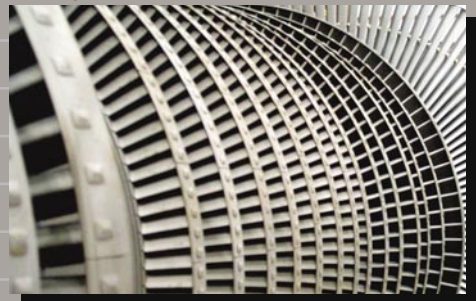
Multiple turbine rotors can be removed and machined while coupled, reducing outage time and improving the consistency of machined surfaces.



Erosion shield installations and replacements on LP rotors can be conducted on-site or in one of MD&A's repair facilities.



Journal and coupling face machining is conducted using portable lathes with up to 100 tons capacity to remove out-of-roundness and scoring.



Complete steampath replacement including L-0 blades is supervised by factory trained engineers who remain on-site during all repairs.

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MD&A Steampath Engineers specialize in providing condition assessments of steampath stationary and rotating components through the performance of structural and/or efficiency audits. A structural audit performed by a highly qualified and experienced MD&A Steampath Engineer will provide the owner with the most cost effective method of determining the structural integrity and operating reliability of the unit. By applying their historical knowledge and experience, MD&A Steampath Engineers make component repair/replacement recommendations which are based upon the conditions observed and the owner's intended operation plans for the unit.

Coupled with an MD&A efficiency audit, the structural audit provides the most comprehensive evaluation of turbine steampath conditions available. The efficiency or performance audit measures losses throughout the turbine by using measured data that enables the Steampath Engineer to calculate output losses and their effect on heat rate. As a result, the MD&A Steampath Engineer will provide repair recommendations accompanied by clearly identifiable economic paybacks.

Data taken during a steampath audit can also help to:

- Measure deposits & determine their impact on efficiency
- Assess recoverable seal & packing leakage losses
- Determine losses due to surface roughness changes
- Evaluate the effects of solid particle erosion
- Calculate losses associated with foreign object damage
- Provide quantifiable data for the review of repair recommendations
- Integrate decisions with alignment recommendations
- Provide historical records for future outages

Photographic Records & Quantifying Parts

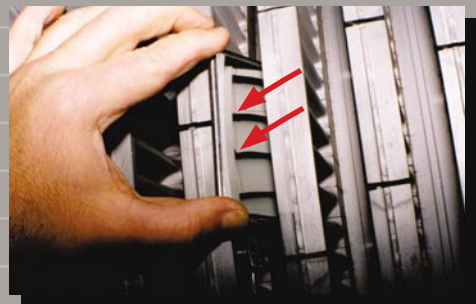
During an audit, photographs are taken of damage and are included in each unit's audit report. Photographs provide a convenient method for recording and confirming the history of repairs and the extent of damage. Steampath audits are also a useful method to quantify and isolate the performance of new parts. For example, suppliers often guarantee that certain steampath upgrades will contribute a specific percentage to improve turbine performance. A steampath audit is an accepted and repeatable method for quantifying the contribution of these parts, while also determining the performance gained as a result of other maintenance that was performed during the outage.



Foreign objects that can impede steam flow are identified and their impact on efficiency quantified during steampath inspections.



Structural audits identify erosion under bucket covers and shroud bands that can affect the structural integrity of a stage.



During steampath audits trailing edge thickness is measured and the performance effects quantified to assist owners in making repair decisions.



Damage caused by foreign objects is identified and repairs are recommended that can correct profiles and reduce future performance losses.

Portable Field Machining

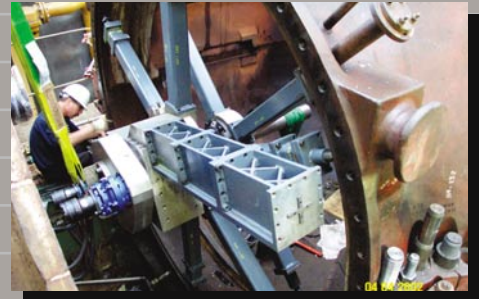
MD&A offers an outstanding array of portable field machining and portable steampath repair equipment. Most equipment can be transported anywhere in the world with just a few days notice. MD&A is a single-source supplier of both repair services and reliable portable field machining solutions. Our services are supported by fully qualified, factory-certified technicians and engineers with a depth of experience in addressing the most unique engineering challenges. We specialize in innovative machining solutions, backed by technical support and a network of field engineering and factory-trained engineers.

An abbreviated list of MD&A's portable field machining capabilities includes:

- Journal machining & grinding
- End / Dummy / Gland packing case overhauls
- Machining and replacement of seals
- Turbine casing stud removal and re-threading
- Milling and grinding of horizontal joint faces
- Machining of base plates
- Machining and replacement of steam seals
- Honing of bores
- Machining and grinding of seats on steam valves
- Cylinder and face grinding
- Inlet sleeve replacement and machining
- Machining of diaphragm fits
- Field certified welders and machinists
- Line boring of coupling bolt holes
- Refacing of flange fits
- Fully equipped portable machine shops
- Complete restoration of throttle and governor valves
- Bell seal repair & restorations
- Collector ring re-surfacing
- Machining of bowed rotors
- Rotor coupling rabbet & face restoration, including generator couplings



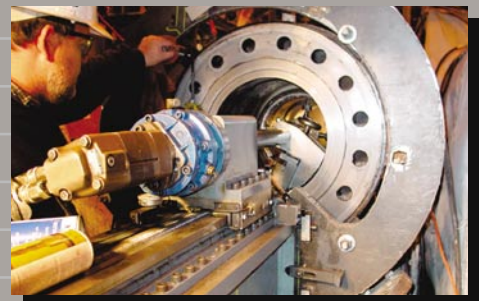
Our unique portable vertical turning lathes enable our technicians to machine blade ring and diaphragm critical fit areas on-site, eliminating shipping and promoting timely turnaround.



Large diameter casings up to 140 inches can be machined inside, outside and axially using an array of boring bars and other portable equipment.



Set up of portable lathes can be completed within a twelve hour shift and require no drilling or anchors that could damage the turbine deck.

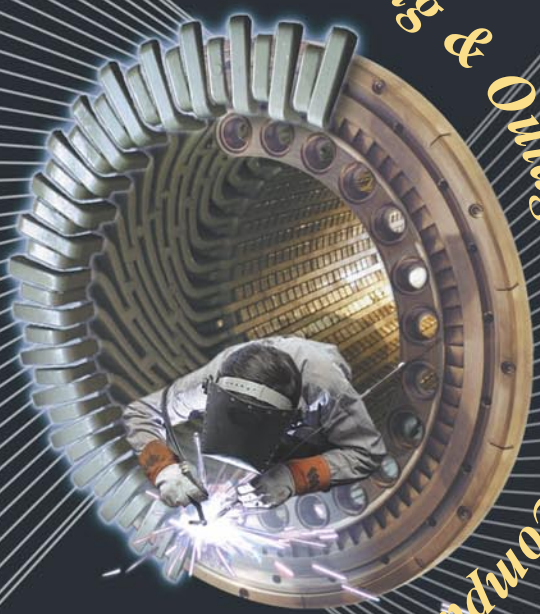


MD&A is equipped to address seat and stud replacements, machining of critical gaskets and seat fit areas including weld restoration of valve seats using our unique orbital TIG welders.

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**One Call
One Source
Powerful Solutions**

The Turbine-Generator Engineering & Outage Services Company



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