



DRESSER-RAND

Bringing energy and the environment into harmony.*

TURBINE TECHNOLOGY SERVICES

Complete services for heavy industrial gas turbines and large steam turbines.

F-Class

& Industrial Gas Turbine Repair

D-R TTS provides complete refurbishment of mature and F-Class frame components using the latest repair technology and upgrades.

We've provided high-quality repairs on mature and F-Class frame industrial gas turbines for more than 200 clients worldwide. Our goal is to provide on-time, high-quality repair and technical services, no matter how big or small the challenge.

Combustion Repair

Dresser-Rand provides comprehensive repairs on mature and F-Class frame combustion components. Our maintenance and repair capabilities for these critical components are enhanced by our ability to provide flow testing for F-Class fuel nozzles and combustion liners. We offer the following combustion repairs:

- IGT casing simulation fixture checks
- GE DLN 1.0 – 2.6
- Manufacturing capabilities for most Westinghouse and GE frames
- Liquid and natural gas fuel flow testing capabilities

Hot Gas Path Component Repair

Our industry-leading capabilities for stationary IGT component repairs are complemented by D-R TTS's full-service facility, which is equipped to handle all aspects of your repairs in-house, including material testing, heat treat rejuvenation and coatings. Not only are all repaired components final-fixture checked to ensure correct dimensional restoration, but we also provide innovative couponing and nozzle flow testing of critical air-cooled airfoils and vane segments. We have the following repair capabilities:

- Traditional downstream deflection correction and CorrectPath™
- Rail replacement (improves the material and mechanical properties of the diaphragm aft rail by replacing the section with a patented 400-series stainless steel)
- Full heat-treat capabilities
- Slide-through fixtures simulate shroud blocks for inspection of sidewall-to-sidewall alignment and casing fit-up

In-process fixture check on a set of Frame 7FA transition pieces.

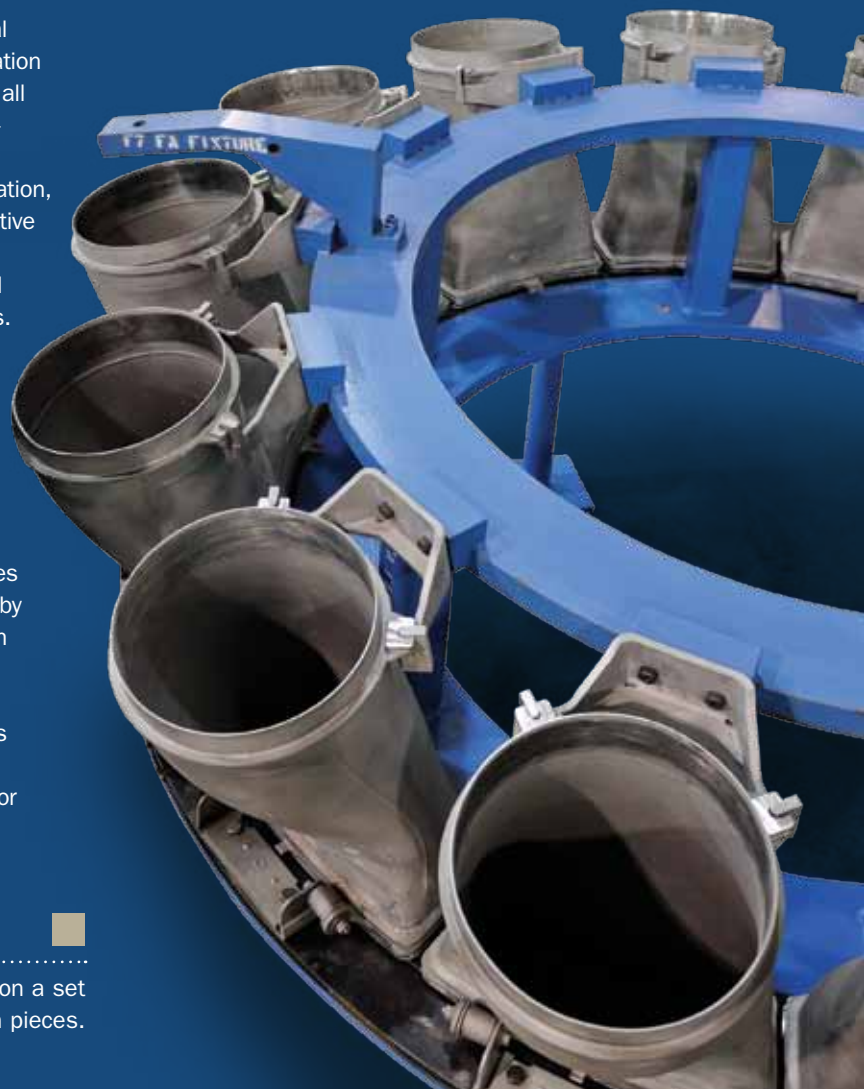


- CNC machining technology
- Complete airfoil coupon manufacturing and replacement
- Engineered braze repair including pre-sintered preforms (PSPs, slurry and dry-powder applications)
- Tip build-ups
- Angel wing restoration
- Moment weights
- Shroud mods to 7EA and 7FA
- Full ultrasound and eddy current nondestructive testing (NDT) including Level III
- Coatings include APS, HVOF and dense vertically segmented TBC (DVS-TBC)

Blade and Bucket Repair Services

D-R TTS has a work area dedicated specifically for rotating blade and bucket repairs. Our in-house heat treating, material testing and coating services provide you with a convenient, one-stop source for servicing these critical parts. Our capabilities include the following:

- Stellite inlay
- Life assessment analysis
- Rotor disc fixture checks
- Z-notch repairs
- 5-axis fully automated laser system
- Automated shot peening
- Elevated temperature welding
- Bucket dovetail restoration



E ngineered Repair Solutions



STEAM TURBINE REPAIR

Dresser-Rand provides complete repairs for all makes and models of steam turbines from 10 MW to 1000 MW. Our in-house solutions for steam turbines include the following:

- Diaphragm repair, sidewall, hook fit restoration, and computer area analysis
- Blade ring restoration (for casings and blades)
- Nozzle plate and nozzle box restoration
- Complete repair of high-pressure inner shells and cylinders
- Repair or manufacture of oil deflectors, shaft or diaphragm packing, spill strips, and hydrogen seals
- Complete rotor refurbishment (including reblading and shaft welding)
- Valve repair

HIGH BAY ROTOR FACILITY

We provide services on all brands of industrial gas and steam turbine rotors, including blade replacement, unstacking and restacking, balancing, and NDT. D-R TTS in-house capabilities include:

- Vertical balancing system for wheels and discs 5000 lbs. (2268 kg) and 9000 lbs. (4082 kg)
- Four horizontal balance systems with capacity up to 175,000 lbs. (79,378 kg)
- Engine lathe capacity up to 120 in. (305 cm) and a swing of 384 in. between centers
- 80 tons of overhead crane capacity and hook height of 50 ft.
- 60 x 20 x 20 ft. (18.2 x 6.1 x 6.1 m) blast cleaning facility in full environmental compliance
- Rotor stacking pits/platform capable of handling large gas turbine rotors
- Rotor welding
- Rotor life assessment program
- Rotor storage



IN-HOUSE CAPABILITIES

Our repair solutions are supported by machining, ultrasonic cleaning capabilities, vacuum heat treatment capabilities, braze repair, sonic nozzle and high-volume flow testing, and HVOF and air plasma coatings. Dresser-Rand also offers metallurgical evaluation, failure analysis material engineering, ASNT Level III certified inspection, factory-trained and -certified tool calibration, and more than 35 combined years of coating development experience. These in-house services reduce repair cycle times and ensure quality control.

Metallurgical Laboratory

The D-R TTS metallurgical lab provides quality services including:

- Hardness testing and material/chemical analysis
- Microphotography examination and evaluation
- Life assessment services/stress rupture testing
- Coating evaluation
- Precision blade/bucket moment weighing and sequencing
- Optical microscopy
- In-house calibration and repair services of precision measuring tools, furnaces and machines

Heat Treat Capabilities

Dresser-Rand offers complete vacuum heat treat capacity to meet clients' needs. The state-of-the-art Ipsen TurboTreater vacuum furnace has hydrogen cleaning, thermal cycling for high-temperature wide-gap brazing operations, material rejuvenation, alloy heat tinting, and quenching capabilities. It reaches temperatures of 2400°F (1315.6°C) in the horizontal work zone.

Flow Test Capabilities

Critical industrial gas turbine components require flow tuning to ensure precise, consistent and equal air and fuel flow distribution throughout the components. We use a state-of-the-art sonic flow-testing bench to balance components, eliminating variations in temperatures and pressures. Our sonic flow testing allows the necessary tuning precision required for DLN and LEC fuel nozzles, combustion liners, as well as F-class nozzle/vane segments, buckets, and blades required to meet optimal operating conditions.



Coatings

We offer advanced HVOF, dual-wire arc, air plasma coatings, class C-TBC and DVS-TBC. Our coatings are robotically applied to ensure superior quality and consistent performance.

Coating equipment and capabilities include:

- MCrAlY, TBC, chrome carbide, aluminide, DVS, and cold-end compressor coatings
- Twin arc wire spray coating
- Automated shot peening
- Rotor disc dovetail restoration

Engineering Expertise

Our engineered repair solutions are possible because of our industry-leading engineer-to-craft personnel ratio of 1:8. Our engineering team provides repair solutions and efficient process applications, ensuring state-of-the-art repairs and on-time deliveries.

MECHANICAL DRIVE STEAM TURBINE AND COMPRESSOR OVERHAULS

Dresser-Rand provides total repair services for turbomachinery products. Depending on your needs, Dresser-Rand can service your high-speed critical rotating equipment for both the power generation and oil and gas energy sectors. Our

skilled craftsmen and service representatives support your repair requirements either at our facility or in the field using the following repair services:

- Steam turbine overhaul, on-site inspection and component parts replacement
- Mechanical overhaul of gear boxes, fans and pumps
- Repair and overhaul on all critical rotating equipment including centrifugal, axial and screw compressors
- Complete unit turnkey overhaul

CONTROL SYSTEMS

For more than 50 years, Dresser-Rand Control Systems has been designing and manufacturing reliable, state-of-the-art control systems for gas and steam turbines; expander-driven compressors and generators; motor-driven compressors; reciprocating compressors; and plant, station, supervisory control and data acquisition (SCADA), and process applications. Project engineers work closely with clients to design control systems that meet demanding

operational requirements. All phases of design, manufacturing, installation, training, and documentation are coordinated to ensure the effective performance and reliability of these modern control systems. Dresser-Rand Control Systems also provides upgrades and complete replacements of existing control systems.

PARTS SERVICES

We have been supplying parts since 2001 including replacement sets, individual component replacements and complete units. We have a worldwide network of OEM parts providers and manufacturers that maintain an extensive inventory for all types of industrial gas turbines. In addition:

- Running hours and historical service life references are available upon request
- Non-OEM suppliers provide equivalent parts that are interchangeable with OEM parts

- We offer immediate delivery (subject to availability)
- All parts come with a Dresser-Rand warranty

FIELD SERVICE

Our worldwide field service organization and network of service centers allow Dresser-Rand to provide the right bundled service solutions for your outage, including the following:

- Training
- Technical services
- Field crews
- Borescope services by trained technicians

In-process vacuum anneal heat treat on Frame 7FA 2nd stage buckets.



Turbine Technology Services

With more than 100 years of combined experience repairing steam and gas turbines around the world, we are ready to meet client needs.

D-R TTS provides complete refurbishment for most frame components using the latest repair technology and available upgrades.

When Dresser-Rand acquired Leading Edge Turbine Technologies in 2010 it strengthened its service solutions and capabilities for industrial gas turbines and the power generation market and expanded its service center network. By combining Dresser-Rand field services capabilities with the engineered repair solutions offered by Leading Edge, Dresser-Rand Turbine Technology Services (D-R TTS) can now provide complete bundled services for all of your steam and industrial gas turbine needs.

The D-R TTS facility in Houston, TX, specializes in the service and repair of

heavy industrial gas and steam turbines.

We provide aftermarket solutions for combustion, hot gas path, stationary and rotating components for most major gas turbine models and frame sizes. This facility has complete welding, coating, heat treating, metallurgical, balancing, machining, and engineering capabilities to service all brands of industrial gas and steam turbines. Our 127,600-square-foot (11,854-square-meter) facility offers clients comprehensive, unique and personalized service that is also cost effective.



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For more information on **Dresser-Rand Turbine Technology Services**, contact the following locations:

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