

STEAM TURBINE UPGRADES, REVAMPS AND REPAIRS



DRESSER-RAND®

Listening. Innovating. Delivering.

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The legacies of more than a dozen companies
create today's Dresser-Rand—a world leader
in energy conversion solutions.



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ustomized solutions for getting the most out of your steam turbine investment

No one can match our experience, expertise, and resources.

Whatever your needs, you'll find Dresser-Rand can provide innovative, reliable, customized solutions that will renew your steam turbines and deliver the highest levels of performance, while minimizing costly downtime.

For example, our digital electronic governor conversion kits put digital control at your fingertips, replacing mechanical or hydraulic governors with precise electronics. The result is improved overall turbine control, increased precision, and simplified maintenance and operation that reduces costs. Another upgrade, our mechanical overspeed trip kit, provides maximum reliability in full compliance with the latest API 611 requirements.

D-R is a manufacturer of world-class equipment, leading the industry with superior engineering and advanced technology.

Every upgrade, rerate or overhaul project begins with a comprehensive needs analysis based on your turbine's configuration, operating conditions, and output requirements.

Along with on-site inspections and consultations with your plant's staff, our engineers have access to the original design specifications, equipment drawings, service records, and other engineering data for Dresser-Rand, Turbodyne, Terry, Moore, Worthington, McGraw-Edison, Coppus, Murray, Nadrowski, and Ingersoll-Rand steam turbines. Together, these resources enable us to develop a complete picture of both your current operating needs and your future requirements.

Dresser-Rand engineers thoroughly review the needs analysis, concentrating on areas such as blade stress, shaft end capability,

rotor dynamics, thermodynamics, and blade dynamics. Where required, we perform a complete steam-path analysis based on the extensive engineering data available to us. We apply the same rigorous standards we use to manufacture new equipment, so you can be assured any rebuilt unit will reflect the latest design, engineering, and safety considerations.

The result of this comprehensive analysis is a customized proposal for services tailored to your current operating needs, your budget, and your schedule.



UNRIVALED EXPERIENCE MATCHED WITH RESPONSIVE SERVICE

Drawing on a century of experience and thousands of steam turbine installations in more than 140 countries, Dresser-Rand delivers unparalleled reliability. With our constantly evolving approach to turbine design, meticulous attention to detail, and world-class manufacturing, our steam turbines are exceptionally reliable, even under the most demanding conditions.

D-R is available anytime, anywhere to upgrade your steam turbine and get it back on-line quickly, efficiently, and safely. Regardless of your needs—blading, rotors, casings, bearings, auxiliary lubrication, monitoring systems, or beneficial new enhancements you might not even be aware of—D-R offers an unmatched combination of expertise, technology, production capability, and commitment to quality.

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Your assurance of quality parts.

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Raise the bar on efficiency

Dresser-Rand is always working to improve the overall efficiency of our steam turbines. We can put this same leading-edge technology to work in your equipment, lowering your operating costs for years to come.



BLADE DESIGN

Advances in steam-flow-path aerodynamics and thermodynamics, combined with improved materials and manufacturing processes, have made it possible to improve steam turbine performance with simple component upgrades—even if the units are operating at or close to their original specifications. For example, the performance of nozzles and buckets (stationary and rotating blades) has improved significantly.



DIAPHRAGM & NOZZLE CONSTRUCTION

New nozzle ring and diaphragm construction techniques yield significant improvements compared to previous methods. Our design combines the performance benefits of sophisticated endwall profiling with the cost-effectiveness of a ring-and-vane flow-path configuration. For every application, we develop unique flow-path endwall profiles to maximize stage-to-stage energy recovery and minimize losses at the nozzle/bucket interface.

*Evaluation of equipment is needed to determine actual efficiency improvements.

RETRACTABLE LABYRINTH SEALS

Dresser-Rand's patented, retractable seals reduce seal and shaft wear and help prevent steam loss between stages. The spring-loaded seals allow for shaft upsets (bowing) during start-ups, critical speeds, and other normal operating conditions.



RETRACTABLE LABYRINTH BRUSH SEALS

In addition to this, Dresser-Rand offers a brush seal upgrade as a retrofit for standard labyrinth seals and as an option for retractable labyrinth seals. Brush seals offer some additional protection against excessive wear and steam loss and can improve efficiencies by up to approximately .05 percent.*



CARBON RING SEAL

Dresser-Rand's improved carbon ring seal reduces leakage by approximately 50 percent and doubles the replacement interval. The redesigned ring geometry incorporates a reformulated carbon material and utilizes successful experiences with the U.S. Navy and the nuclear market.

Dresser-Rand has available one-to-one replacements for 11 common carbon ring seals covering single-stage and multistage applications from 2.38" (60.33 mm) to 7.25" (184.15 mm). The replacement seal, as well as required spring, stop and spacer, can be ordered as a complete assembly. The package allows the new seal to fit within the existing seal cavity with no field rework required.

Improve operating convenience and performance

Our state-of-the-art components and services can keep things running smoothly.



OEM parts and repairs ensure maximum performance and reliability throughout the life cycle of your steam turbine.

TRIP VALVES/TRIP AND THROTTLE VALVES

The operational reliability of shutdown components is of critical importance to ensure personnel, plant, and equipment safety. Dresser-Rand can provide “drop-in”



trip valve upgrades. We also manufacture a full range of both mechanical, latch-type, and oil-operated trip and throttle valves. Both types can be fitted with an “Exerciser” feature (per API 612 requirements) to enable operators to carry out in-service/on-line testing of the trip valves without shutting down the steam turbine. These valves can be implemented either as direct replacements of mechanical/hydraulic trip systems, or in conjunction with overall trip system upgrades such as “two-out-of-three voting” electronic overspeed trip systems.

WHEEL-WELD REPAIR

We have the expertise and offer extensive weld repair capability for rotors. Turbine rotors, machined from solid forgings, require long lead time and are expensive to replace when they are damaged. Emphasis is being placed on operating and maintaining existing assets in the absence of significant new plant construction in the utility and energy industries. This has promoted the increased use and acceptance of turbine wheel-weld repairing. Successfully completed repairs throughout the world have revealed that weld repair is a viable alternative to replacement.



IMPROVEMENTS IN BEARINGS

D-R has made extensive enhancements in its bearing design and materials. The new tilting-pad bearings feature directed lubrication instead of the oil-flooded technique previously used. With this improved lubrication, the new D-R bearings require less oil flow, to reduce losses and decrease the operating-pad temperature. This results in longer life, potentially higher power output, process improvements, enhanced safety, and increased availability and reliability. Recommended for all turbines, these tilting-pad bearings have been installed in both new units and as aftermarket upgrades. They can generally be used as drop-in replacements and require no additional installation time.



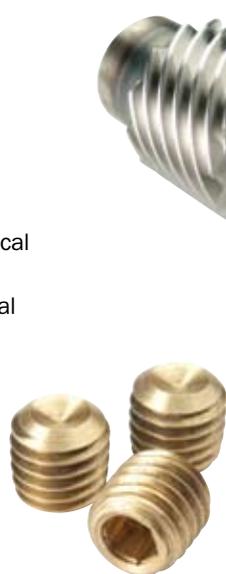
PTFE SHAFT SEALS

We recommend replacing existing bearing labyrinth seals with a more efficient oil-sealing system with a PTFE (polytetrafluoroethylene) carbon ring. These seals’ thermal coefficient is twice that of steel. They prevent oil leakage from the bearing housing and can be installed with no casing modifications.



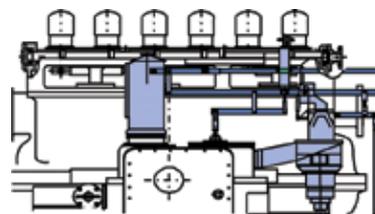
MECHANICAL FACE SEAL

D-R has developed a reliable mechanical face seal and installation design for steam turbine applications. Mechanical face seals can reduce leakage by as much as 90 percent, compared to traditional carbon-ring or labyrinth end-gland-sealing systems.



ELECTRONIC CONTROLS

To remain competitive in today’s marketplace, your processes require tight control and a high level of reliability. Our adaptable and flexible electronic control systems can regulate speed with greater responsiveness and accuracy than older controls, while increasing reliability and reducing maintenance costs because there are fewer parts.



In a typical conversion, the shaded parts above are eliminated.



M ore innovative solutions

Much more than an energy-equipment company, Dresser-Rand is actually an energy solutions company, with a wealth of creative ways to meet your energy-conversion requirements and your bottom-line goals. D-R's Solution Development Process is continually seeking process and product developments to improve equipment efficiency, operation, life cycle, and maintainability. Here's a small sample of our comprehensive portfolio of innovative products and services.

AVAILABILITY PLUS™

D-R's *Availability PLUS* program provides competitive technical advisory, maintenance, or operations and maintenance (O&M) services for energy-conversion equipment or facilities, no matter what the nameplate. The program allows equipment owners and users to concentrate on their core businesses, while D-R provides the integrated services necessary to improve the equipment's availability, reliability, and efficiency.

COMPUFLOW

Our CompuFlow performance-measuring system allows you to monitor and track steam consumption, thereby providing early warning of steam-path degradation caused by erosion or contaminant build-up. This early warning system can actually help you detect and prevent potential catastrophic failures.

FIELD SUPPORT SERVICES

Field Support Services (FSS) provides complete field maintenance, installation, and repair of all rotating equipment and control systems. Our integrated teams around the world can help you develop cost-effective, field-proven solutions or repairs, overhauls, upgrades, rerates, and virtually any other challenge involving rotating equipment—24 hours a day, 365 days a year. Our personnel have access to original designs, historical data, and factory engineers that are simply not available to other field service providers, plus all the tooling required to handle the most extensive field overhauls and get the job done with minimal downtime and at minimal cost.

Our dedicated staff is positioned to assist you with responsive, reliable technical support for your steam turbines at our 26 fully equipped service centers located strategically throughout the world.

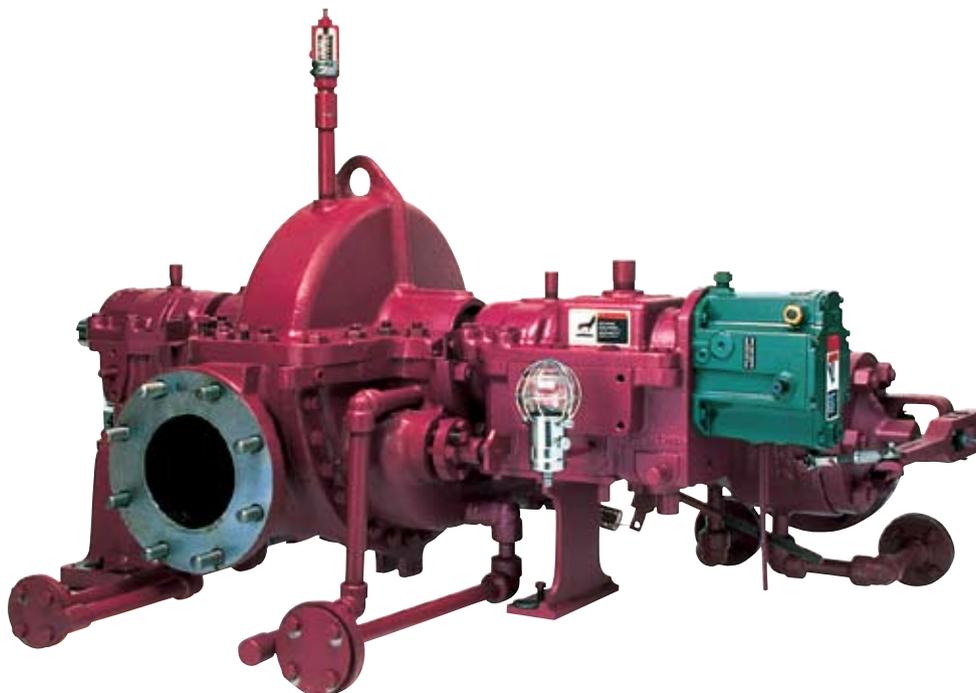


Find thousands of steam turbine parts on-line

Shop on-line for more than 7,000 OEM parts for steam turbines. Get on-line quotations and execute the order with a credit card or purchase order (with preapproved account). Most parts ship within 48 hours. Find details, including how to register at www.dresser-rand.com/estore

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estored classic single-stage steam turbines



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An "in-stock" 1000 HP (745 kW) RLHA24 was restored and shipped in less than half the time required for a new turbine, which saved the client thousands of dollars in production costs.

Through our large inventory and network of previously owned single-stage steam turbines, Dresser-Rand offers a worldwide Restored Classic Program. A Restored Classic is a previously owned steam turbine, which D-R upgrades, completely reconditions and re-engineers to meet your needs. Not only are Restored Classics cost-effective and offer faster delivery times, they even come with the same warranties given to new units. In addition, the unit is tested to provide the safe and reliable service you'd expect from an original equipment manufacturer (OEM).

When you choose a Restored Classic single-stage steam turbine from Dresser-Rand, you're getting:

- A completely reconditioned turbine upgraded to D-R's OEM specifications and re-engineered for your application.
- Same as new, full, one-year warranty.
- A turbine with similar (if not identical) "footprint," inlet and exhaust orientations and sizes, and a shaft-end height that operates as a "drop-in" replacement whenever possible (to reduce costs associated with piping and foundation changes).
- A steam turbine that will maintain your valuable investment in replacement parts inventory and operating knowledge.
- The original design specifications, engineering drawings, and service history records.

- A reprint of the original instruction manual revised for your conditions of service, including sectional drawings, a parts list, and the inspection and repair reports; only Dresser-Rand—as the OEM—can supply this valuable, proprietary information to you.
- A detailed engineering evaluation, including a complete review of blading and rotor reliability, turbine efficiency, and mechanical design limitation.

For more information and to check the availability of Dresser-Rand's Restored Classics single-stage steam turbines, contact your local Dresser-Rand representative, call our Technical Center at 508-595-1700 or (toll free in the U.S.) 1-888-268-8726.

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Before and after photo of a Restored Classic completed at Dresser-Rand's Oberhausen, Germany facility.





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For a complete list of D-R's products and services, visit us on the Internet at www.dresser-rand.com or contact:

Dresser-Rand

Corporate Headquarters

1200 West Sam Houston Pkwy. N.
Houston, Texas 77043
Tel: 713-467-2221
Fax: 713-935-3490
email: info@dresser-rand.com

REGIONAL HEADQUARTERS

The Americas

Dresser-Rand
1200 West Sam Houston Pkwy. N.
Houston, Texas 77043
Tel: 713-467-2221
Fax: 713-935-3490

European Served Areas (ESA)

(Europe, Eurasia, Middle East, Africa)
Dresser-Rand S.A.
31 Boulevard Winston Churchill
Cedex 7013
Le Havre 76080 France
Tel: 33-2-35-25-5225
Fax: 33-2-35-25-5366/5367

Asia Pacific

Dresser-Rand Asia Pacific Sdn Bhd
Unit 8-1, 8th Floor
Bangunan Malaysian Re
17 Lorong Dungun
Damansara Heights
50490 Kuala Lumpur, Malaysia
Tel: 603-2093-6633
Fax: 603-2093-2622

STEAM TURBINE MANUFACTURING OPERATIONS

Bielefeld, Germany

Tel: 49-521-1085-0
Fax: 49-521-1085-199

Burlington, Iowa USA

Tel: 1-888-614-9168
Fax: 319-752-1616

Oberhausen, Germany

Tel: 49-208-656020
Fax: 49-208-653900

Wellsville, New York USA

Tel: 585-596-3100
Fax: 585-593-5815

STEAM TURBINE TECHNOLOGY CENTER

Worcester, Massachusetts USA

Tel: 888-268-8726/508-595-1700
Fax: 508-595-1780



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