

Elliott Rotor Weld Restoration Program

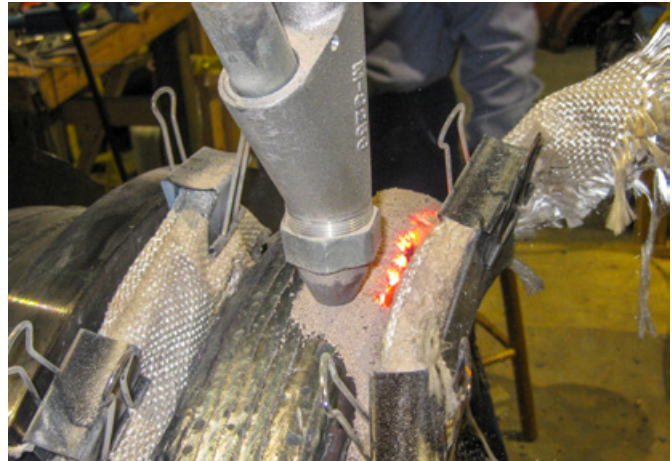
■ ROTOR WELD RESTORATION PROGRAM

When a steam turbine or centrifugal compressor rotor is damaged or inoperable, the associated downtime results in increased costs and lost revenue. Although a rotor replacement is a possible solution, this can be quite costly, and lead time can be over a year.

Elliott Group offers rotor weld restoration as a compelling and cost-effective alternative. With more than three decades of rotor restoration experience and expertise, we use advanced welding techniques and procedures to re-establish rotor integrity, minimize downtime, and provide significant cost savings.

At Elliott, we are at the forefront of rotor repair and restoration for all types of rotating machinery and industrial equipment, regardless of the manufacturer.

We can restore a rotor in a fraction of the time and a fraction of the cost of a new rotor, while maintaining mechanical integrity. Our weld restoration program combines the skills of our dedicated engineers, welders, and machinists; the results of comprehensive testing and analysis; and the reliability of our proven rotor restoration procedures to ensure the highest quality repair.



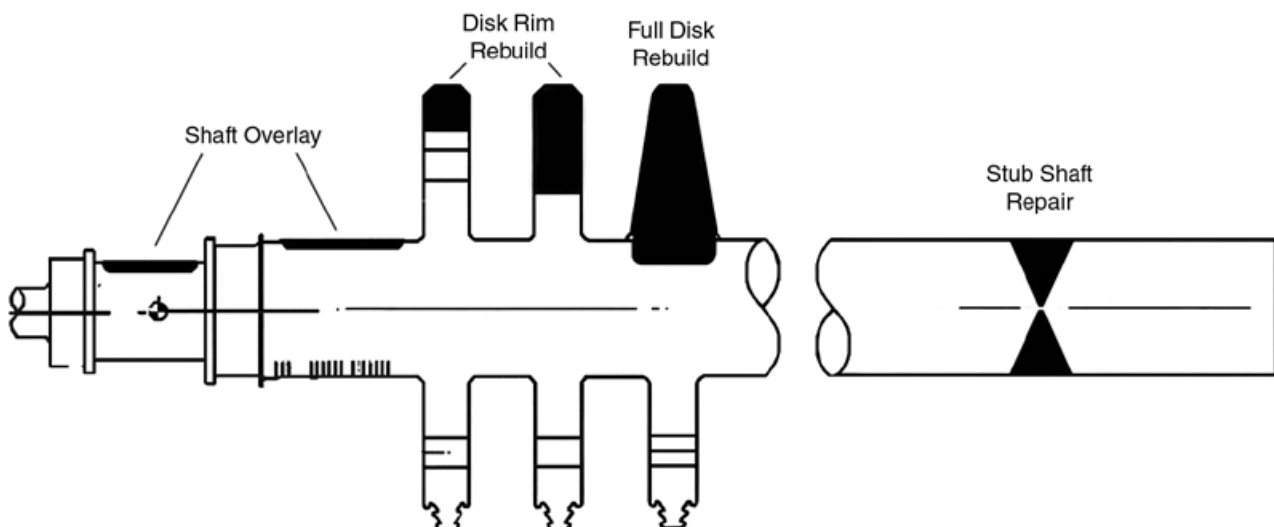
■ PROVEN REPAIR PROCESS

Our specialized testing and repair processes allow us to determine the root cause of the problem, assess the extent of the damage, and formulate a restoration plan that is tailored to meet your unique requirements. We use specially designed repair procedures that include submerged arc and gas tungsten arc welding to ensure each rotor is successfully restored to its original specifications.

We perform rotor repairs on all types of turbomachinery including steam turbines, compressors, and gas turbines. We also weld repair rotors for other industrial equipment including pumps, gears, mixers, blowers, motors, and rolls.

Elliott offers four types of repairs for integrally forged shafts, including:

- Shaft overlay for rotors that have damage to seal areas, journals, and couplings.
- Full disk stage rebuild for rotor disks that have cracks or rub damage. Full disk repair can also be used to retrofit different blade styles or eliminate severe corrosion or high temperature damage.
- Disk rim rebuild for rotors that have damage to the disk rim or disk root where blades are attached.
- Stub shaft repair for rotors that have been bent, cracked, or have severe damage at the ends.



■ POST-WELD HEAT TREATMENT

Elliott performs post-weld heat treatment (PWHT) for rotor repairs in-house. We use precise temperatures and proper procedures to prevent degradation to the surrounding base material and damage to adjacent surfaces.

■ IN-HOUSE MACHINING

Elliott has in-house machining capabilities for all sizes of shafts and rotors. Highly skilled machinists work to close tolerances and can restore the welded surfaces back to their original dimensions.

■ COMPREHENSIVE TESTING AND ANALYSIS OF BASE METAL AND WELD MATERIAL

Regardless of the type of rotor repair that is needed, we complete extensive testing on the mechanical properties of the base metal to determine its suitability for repair. The type of turbomachinery – steam turbine, compressor, or gas turbine – and the complexity and criticality of the repair dictate the tests that are required. Tests may include:

- ◆ Non-destructive testing
- ◆ Ultrasonic and magnetic particle inspection of the entire rotor
- ◆ Chemical analysis
- ◆ Hardness testing
- ◆ Impact and fracture appearance transition temperature (FATT) testing
- ◆ Tensile testing
- ◆ Metallographic analysis
- ◆ Analytical evaluation to determine operating stresses and critical component characteristics

Elliott engineers also extensively test the selected weld material to ensure it will meet the rotor operating requirements, and in some cases, improve the properties of the original base metal. The type of turbomachinery dictates the testing performed and may include:

- ◆ Tensile testing
- ◆ Fatigue – complete stress reversal
- ◆ FATT evaluation
- ◆ Rupture (continuing long-term tests)
- ◆ Microhardness transverse
- ◆ Stress corrosion crack propagation

Contact Elliott today to learn how our rotor weld restoration program can provide you with a practical and cost-effective alternative to purchasing a new rotor for your turbomachinery as well as other rotating and industrial equipment.





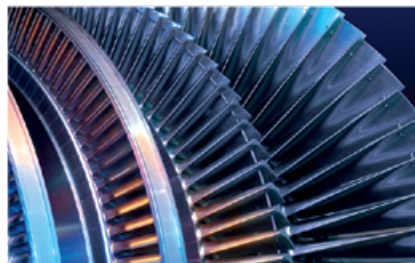
Elliott Group is a global leader in the design, manufacture, and service of technically advanced centrifugal and axial compressors, steam turbines, and power recovery expanders used in the oil & gas, petrochemical, refining, and process industries, as well as in power applications. Elliott Group is a wholly owned subsidiary of Ebara Corporation, a major industrial conglomerate headquartered in Tokyo, Japan.



901 North Fourth Street
Jeannette, PA 15644-1473
Telephone: 724-527-2811
Fax: 724-600-8442
Email: info@elliott-turbo.com

www.elliott-turbo.com

T H E W O R L D T U R N S T O E L L I O T T



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