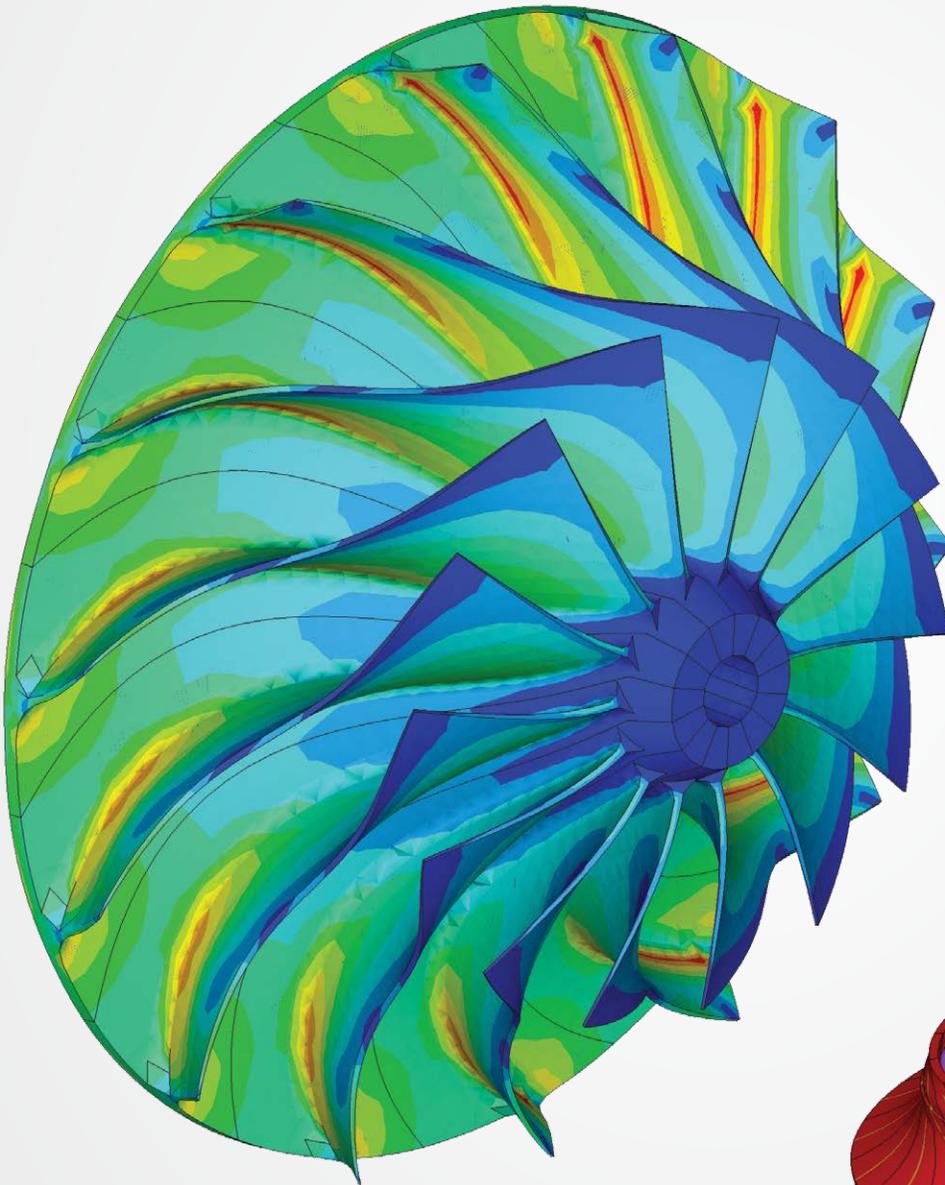


Excellence in Engineering

From air separation, to plant air, to a variety of process gas applications, Ingersoll Rand's engineers have a broad range of experience in designing systems for customers around the world.

Our teams of engineers and technicians are continually adding to our experience base in a wide variety of applications. These professionals face varying challenges in all compression applications and strive to deliver the best solution every time.



Impeller Stress Analysis (left)

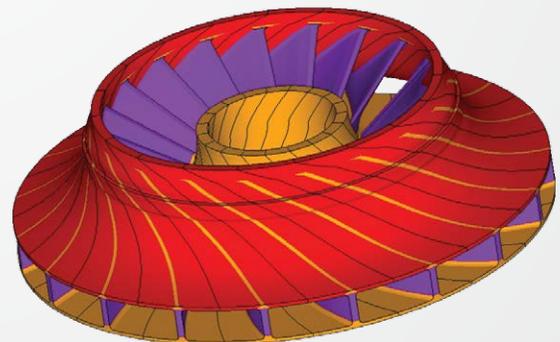
All five-axis impellers are analyzed with FEA to ensure robust designs

Closed Impeller (below)

A finite element model of a shrouded impeller

MSG Cutaway (right)

Unigraphics rendering of a compressor gearbox showing internal bullgear and rotor assemblies



The Latest Technology in Design Engineering

1D, 2D AND 3D CFD SOFTWARE

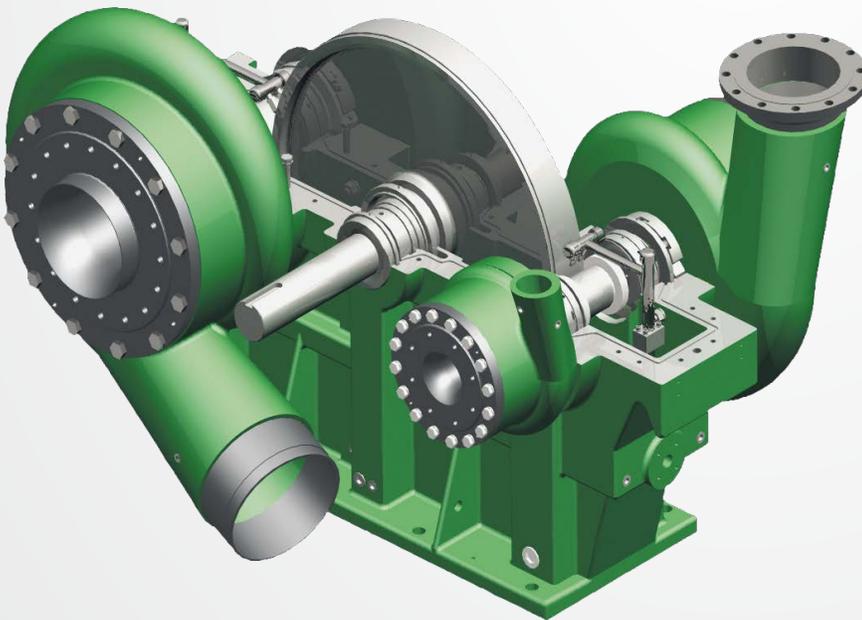
- Preliminary design – sizing and performance prediction
- Detailed blade shape design
- Analysis using 3D Unsteady Navier-Stokes flow modeling

Mechanical Analysis

- FEA – stress and resonance calculations
- Rotordynamics – bearing and vibration analysis
- Mechanical design – solid modeling

Comprehensive Testing

To guarantee performance, all MSG and MSG TURBO-AIR compressor designs are tested for aerodynamic and mechanical performance. Our flexible test stand uses variable speed drives to simulate various mole weight applications. All gas compressors are tested in accordance to ASME PTC-10 Type II standards. Test observation is available upon request. A full set of mechanical and aerodynamic performance data also can be provided.



DEDICATED MANUFACTURING CAPABILITIES

Ingersoll Rand's manufacturing facilities are among the most advanced in the industry, utilizing leading technology, operated by an experienced and skilled workforce. Everything we do at our ISO-9001:2008 facilities is aimed at improving quality and shortening delivery times.

MANUFACTURING TECHNOLOGY HIGHLIGHTS

- CAD/CAM systems
- Vertical turning centers
- Impeller milling centers – five-axis
- Horizontal boring centers
- Cell manufacturing and work team techniques
- State-of-the-art testing facilities

Comprehensive Quality

From start to finish, from the factory to the field, in every area, for every employee, quality is the rule. You can expect that from a world-class manufacturer such as Ingersoll Rand. Our objective is to exceed your expectations.



Our Quality Policy

The key elements of Ingersoll Rand's quality policy are:

- Exceeding customer expectations
- Providing products that equal or exceed industry and government standards
- Providing our customers with the best value
- Focusing on long-term customer satisfaction
- Striving for continuous improvement
- Understanding that quality is everyone's job

Our Quality Program

ISO-9001:2008 CERTIFIED QUALITY MANAGEMENT SYSTEM

- Systematic approach to continuous improvement
- 15 trained ISO internal auditors

ISO-14001:2004 CERTIFIED ENVIRONMENTAL MANAGEMENT SYSTEM

- Dedication to reducing and eliminating waste
- Providing a healthy and safe work environment for all employees
- Meeting or exceeding all environmental, health and safety regulatory requirements

ISO 8573-1 CLASS 0 CERTIFIED OIL-FREE AIR

- MSG TURBO-AIR centrifugal compressor product line was certified in 2009
- Oil contamination is virtually eliminated by virtue of the compressor design

SUPPLIER QUALITY MANAGEMENT

- Maintain an approved vendors list
- New suppliers reviewed and evaluated prior to supply chain integration
- Supplier quality performance tracked through the non-conforming product database within our business system
- Periodic supplier performance evaluations

SIX SIGMA TRAINING

- Addressing customer critical to quality issues
- Process and product improvements that are most beneficial to our customers
- Training in sophisticated problem-solving tools

CERTIFICATIONS

API, CE, PED, ATEX, China Code Pressure Vessel Certification, GOST, KOSHA, ASME, and more.



ADDED QUALITY ASSURANCE FROM ADVANCED TESTING FACILITIES

To guarantee performance to both customer and manufacturer specifications, every MSG and MSG TURBO-AIR design is fully tested for aerodynamic and mechanical performance by highly skilled technicians before leaving the factory.

NINE TEST STANDS

Our test facility in Buffalo, N.Y., includes nine test stands.

- Variable speed drives to simulate actual operating speed requirements of the ASME PTC-10 Type 2 test
- Package testing of machines up to 8200 kW (11,000 hp)
- The test stands are separated into three separate bays, allowing one machine to be set up while another is tested
- Computer controlled cooling towers are used to simulate coolant conditions
- A test stand lubrication system supplies machines with required oil pressure regardless of the test speed, and monitors oil conditions for mechanical loss verification
- Recirculation coolers are available for closed-loop testing

Testing for Process Gas Compressors

Closed-loop testing with a simulated mole weight gas mixture is standard for process gas compressors. Nitrogen/helium mixtures are used for fuel and lower mole weight gas compressors, and CO₂/nitrogen mixtures are used for higher mole weight compressors.

Test Center Computerized Control Room

The test center control room provides computer control of cooling water, input speed and lubricating oil supply.

- Aerodynamic testing through use of finely calibrated pressure and temperature instruments
- Vibration monitoring
- Vibration frequency analysis
- 110% overspeed

Testing Observation and Documentation

Test observation and performance data are available upon request.

- Documentation can be provided for full operating tests to identify capacity, pressure, temperature and horsepower
- Vibration data for both steady state and coast down operation are recorded to verify rotor critical speed and response



The test center control room provides computer control of cooling water, input speed and lubricating oil supply



Multi-stage carbon monoxide compressor being prepared for closed-loop testing

Aftermarket Services and Support

How else can we prove our commitment to your total satisfaction? By providing the industry's most comprehensive resource for top-notch aftermarket products, engineering solutions and field service. If you ever have a question or problem, Ingersoll Rand's extensive network of highly skilled technicians and authorized representatives is at your service.





Installation and Startup

- Machine commissioning services
- Diagnostic and troubleshooting services
- Vibration analysis and trending
- Extended warranty and preventative maintenance programs

Elite Technical Support

- Installation and operation support
- Our goal is to help keep your unit running

Technical Training

- Comprehensive training seminars for you and your personnel
- Instructions on a variety of topics, including courses with hands-on training
- Courses can be tailored to your needs at one of our global training centers

Repair Expertise

- State-of-the-art equipment for turnkey repairs
- Complete documentation packages
- Strategic repair center locations to serve a broad customer base, including Buffalo, N.Y.; Houston, Texas and Milan, Italy.

Exceptional Parts

- Genuine parts produced in the same facility for more than 60 years
- Extensive inventory in strategic locations around the world, backed by our written warranty
- Cross-checked against engineering records to ensure correctness

