



ASA Company

Compressor & Turbine

Knowledge-based Co.

Centrifugal Compressor



- Design & Calculation and Simulation
- Repair & Maintenance
- Reforming & Rebuilding
- Spare parts
- Installation & putting into operation
- Personnel training

oil-free gas Plant gas applications include:

- | | | |
|---------------------|--------------------------|----------------------|
| • Textiles | • Electronics | • Snowmaking |
| • Food and Beverage | • Aerospace | • Power Generation |
| • Automotive | • Industrial Gases | • General Industrial |
| • Pharmaceuticals | • Oil and Gas Refineries | • Petrochemical |
| • Chemicals | • Water Treatment | |

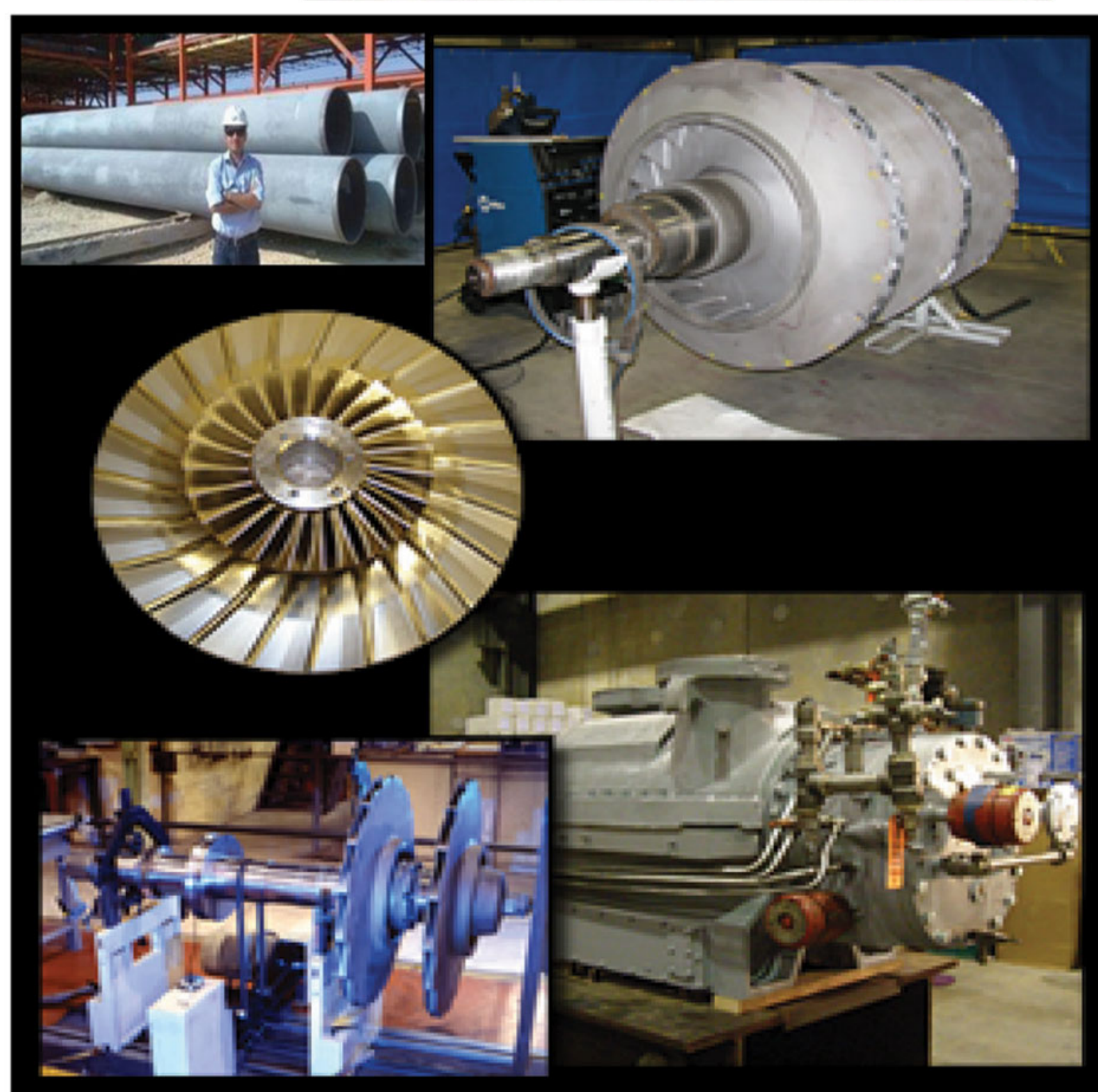
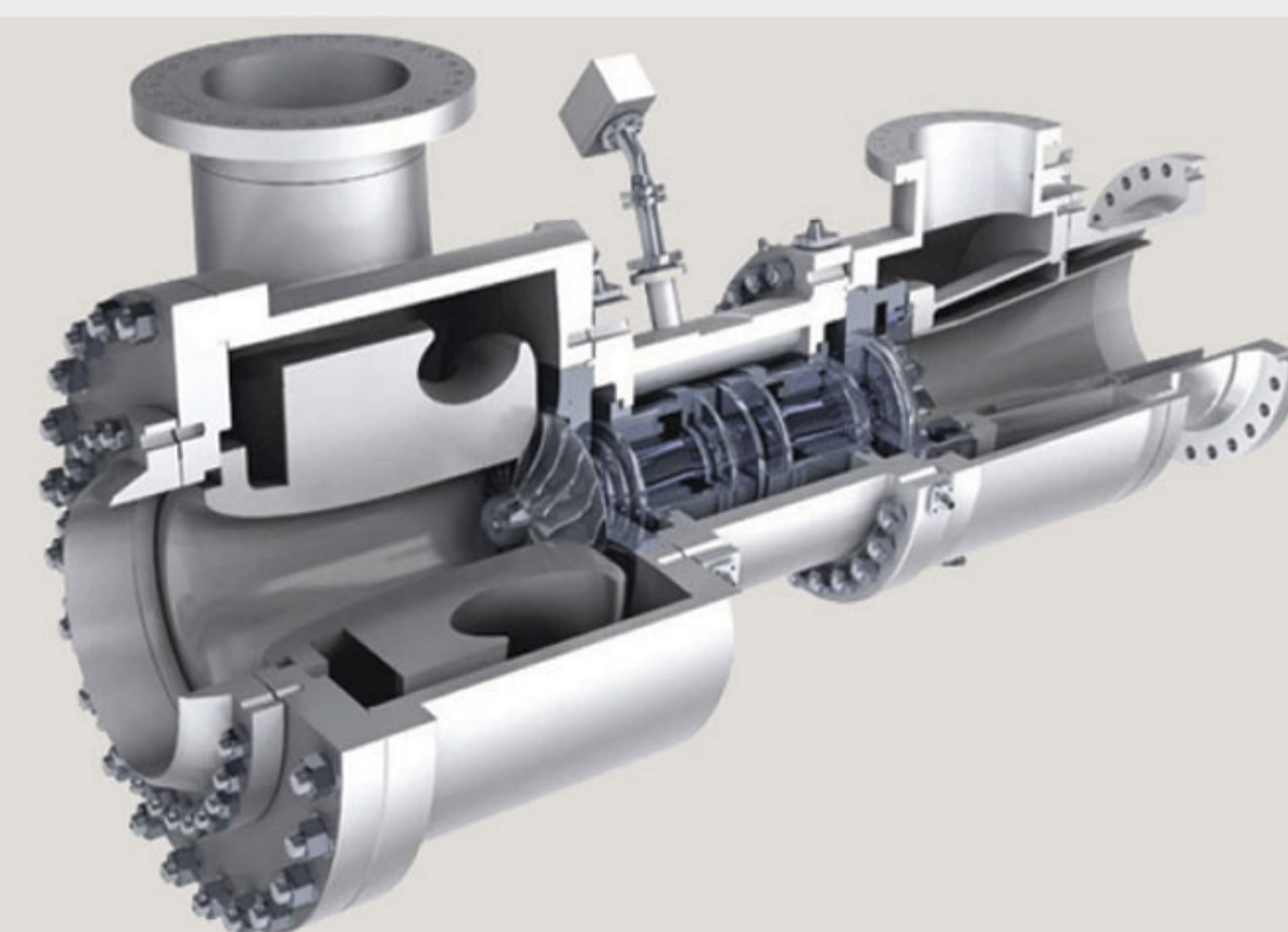
ARAZ SANAT ASIA Co. profile

ARAZ SANAT ASIA company is leading engineering group and manufacturing company in the field of Oil , Gas and Petrochemical industries that ARAZ SANAT ASIA company which was established in 2006. The most skillful and well - trained technical staffs are organized to provide technical services and to utilize the latest tools , including computer aided design techniques for manufacturing basic process equipment of Oil , Gas , Petrochemical , Power plants and all other related industries.

**ARAZ SANAT ASIA
CREATIVE THOUGHT OUTCOME.**



We do what others Can Not



THE ADVANTAGES OF CENTRIFUGAL COMPRESSOR TECHNOLOGY

Integral gear centrifugal compressors represent the latest technology offering significant advantages over outdated, less efficient and more costly compressor designs. These advantages are inherent in the centrifugal design and enhanced even further by ARAZ SANAT ASIA Compression's more than 10 years of centrifugal expertise.

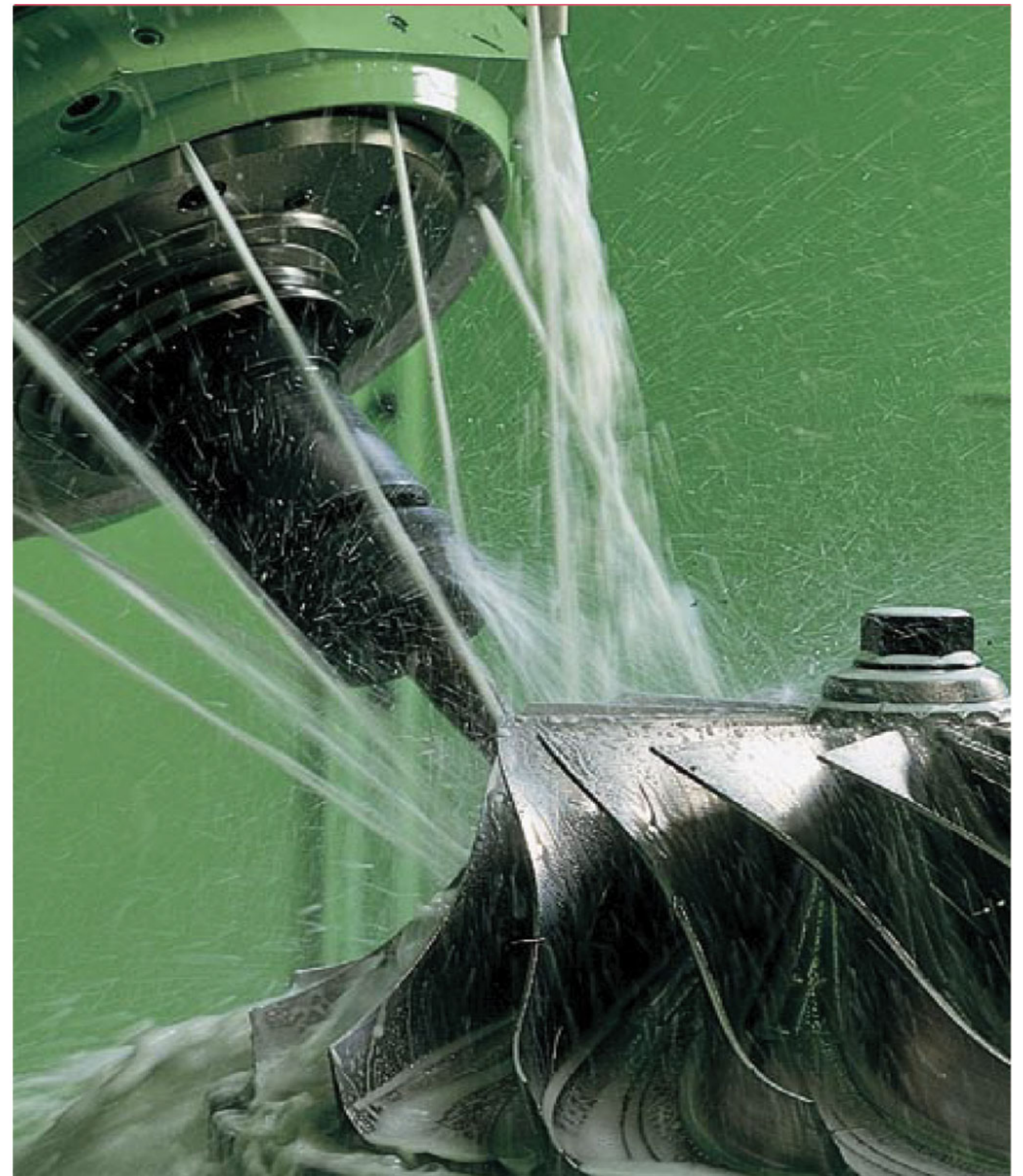


Dedicated Manufacturing Capabilities

ARAZ SANAT ASIA 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-9001:2000 facilities is aimed at improving quality and shortening delivery time.

MANUFACTURING TECHNOLOGY HIGHLIGHTS

- CAD/CAM systems
- Vertical turning centers
- Impeller milling centers – 5-axis
- Horizontal boring centers
- Cell manufacturing and work team techniques
- State-of-the-art testing facilities

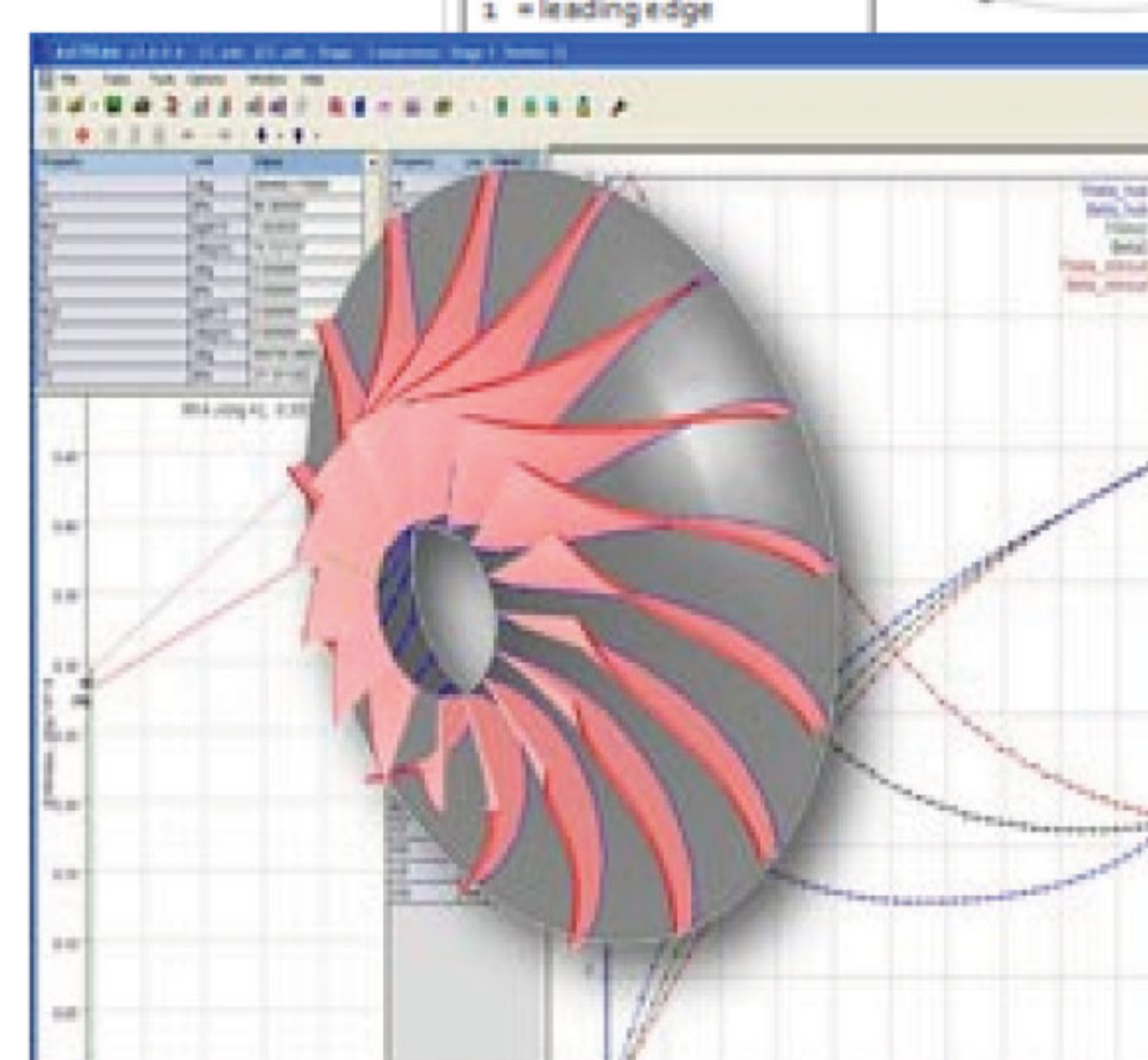
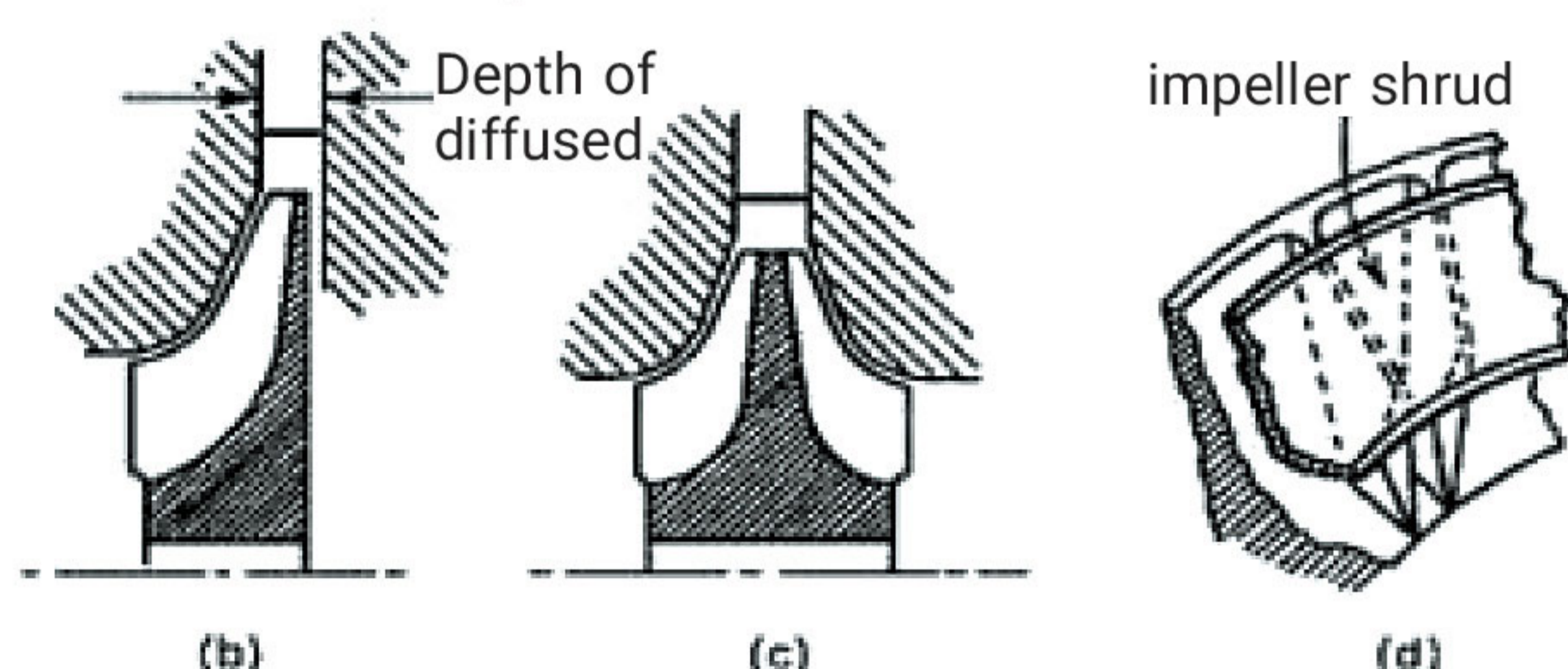
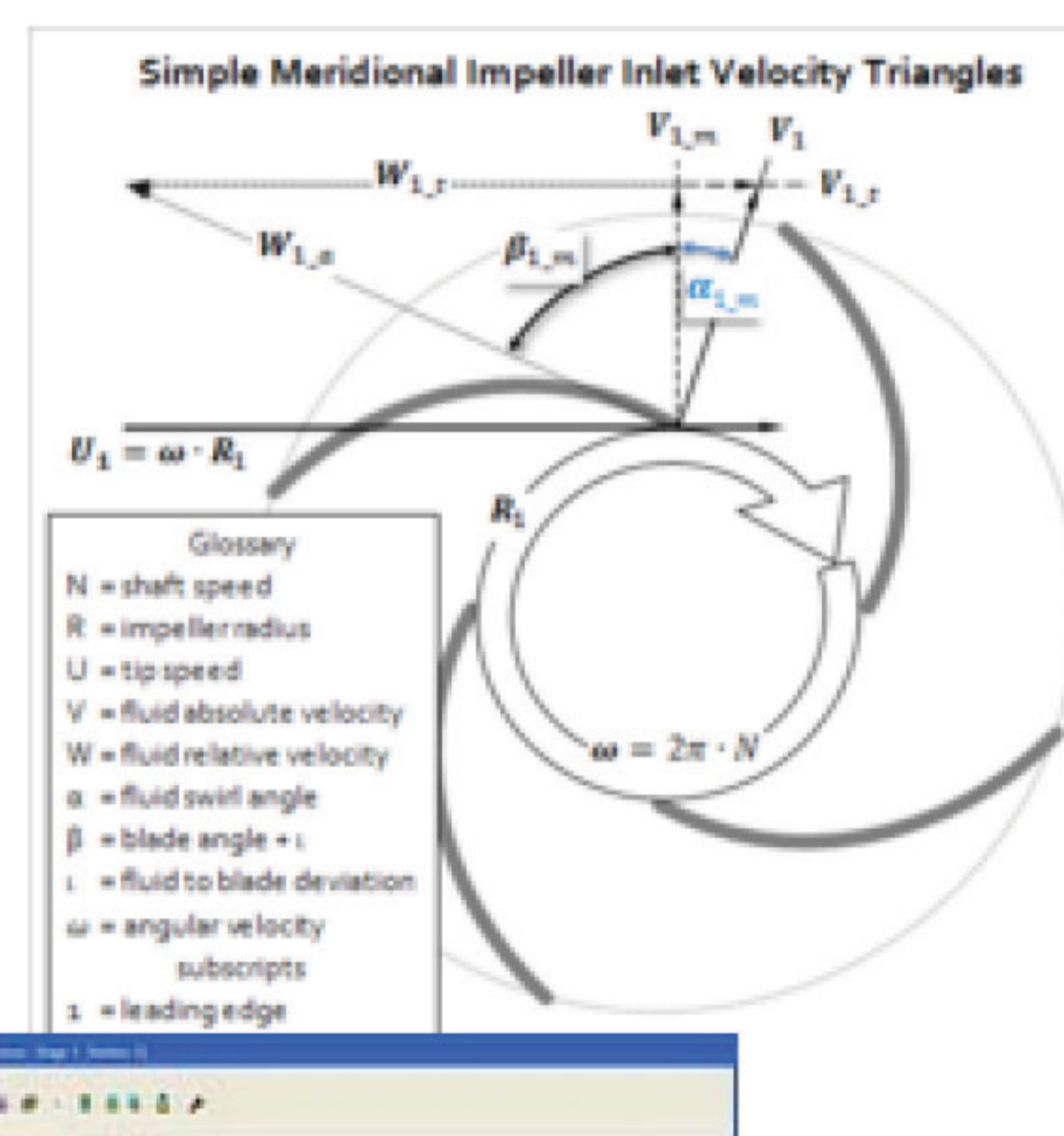
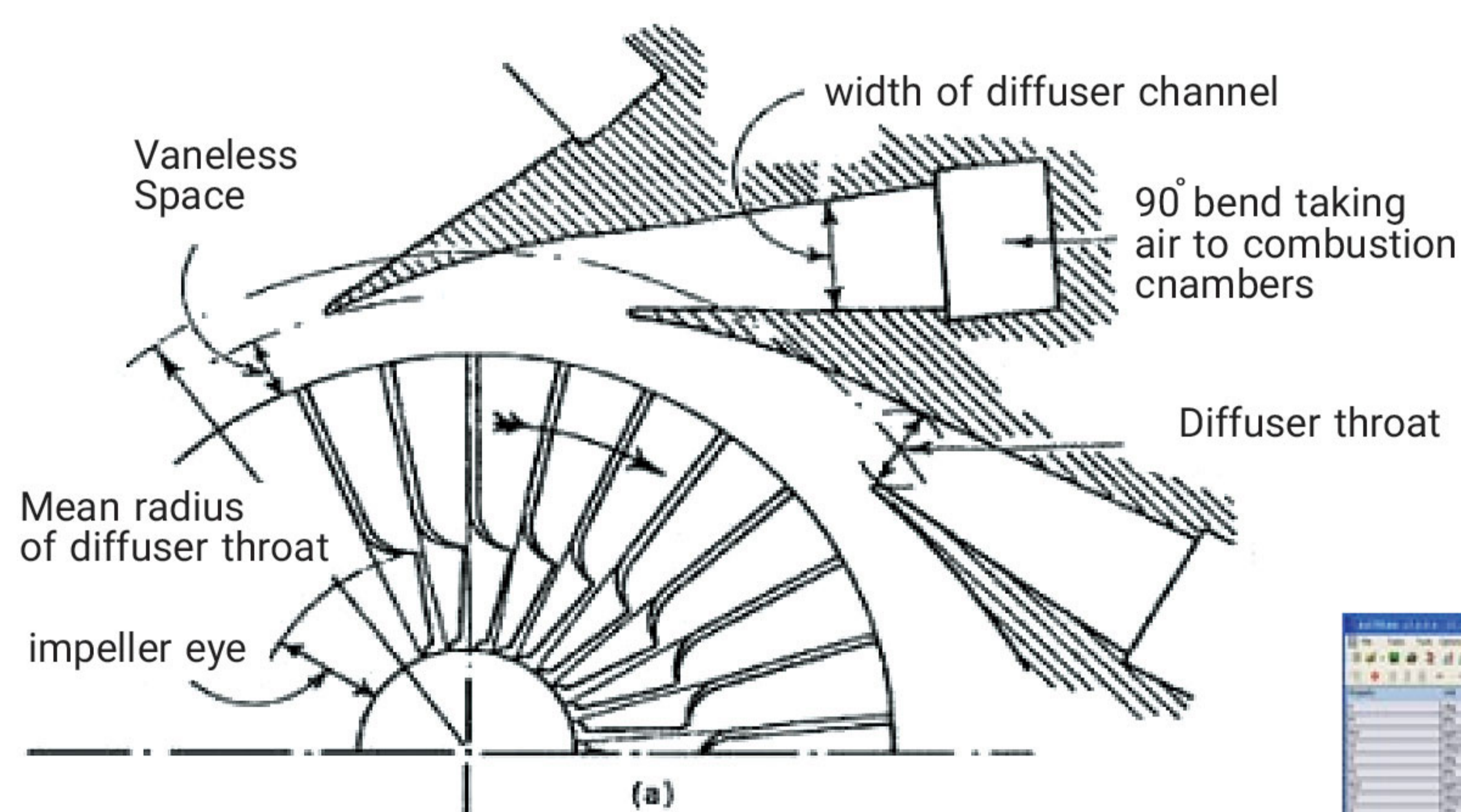
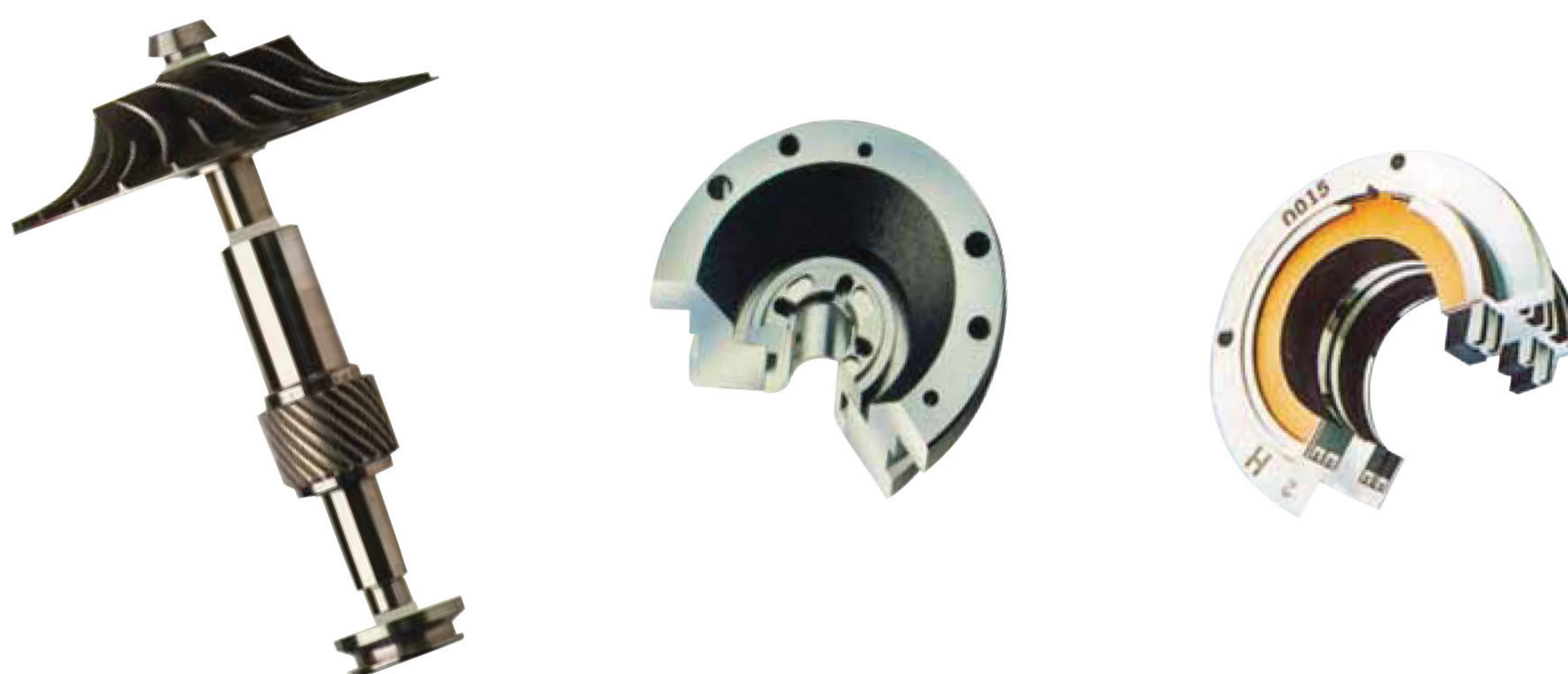


From start to finish, from the factory to the field, in every area, for every employee, quality is the rule. You would expect that from a world class manufacturer such as ARAZ SANAT ASIA Compression. Our objective is to exceed your expectations.



MANUFACTURING ENGINEERING CAPABILITIES

ARAZ SANAT ASIA experts evaluate manufacturing processes by designing and conducting research programs; apply knowledge of product design, fabrication, assembly, tooling, and materials also develop manufacturing processes by studying product requirements, modifying, and testing manufacturing methods and equipment; assure product and process quality by designing testing methods; testing finished- product and process capabilities; establishing standards; confirming manufacturing processes.



Centrifugal & Axial Compressors

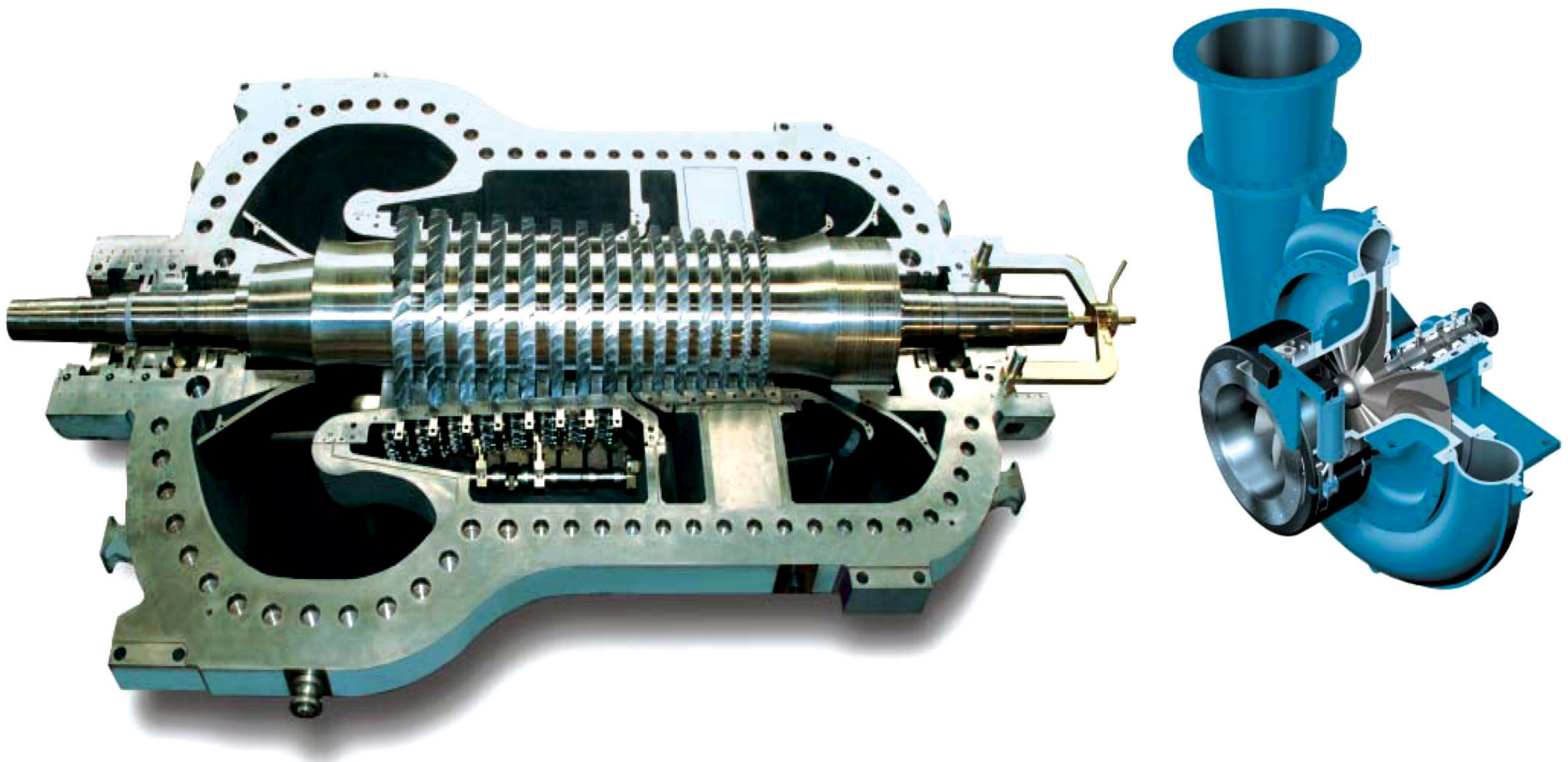
Tradition, Experience and Innovation

ASA's Oil & Gas Business manufactures a complete range of centrifugal compressors for all major compression applications. They are used in oil & gas production, gas transportation, refinery and petrochemical industries, fuel gas boosting and other similar processes.

Specific requirements are met by custom configuring each compressor using standardized advance technology components proven over a wide range of process conditions. This approach delivers reliable, high performance compressors for natural gas, refinery, petrochemical, GTL and LNG applications.

A highly skilled staff of local engineers and technicians provides on-site technical support for installation, commissioning, overhaul, repair and maintenance of our equipment.

Extensive research and development, advanced design procedures, modern manufacturing techniques and first hand on-site experience in compressor operation are behind the success achieved by our compressors.



Centrifugal & Axial Compressors

Compressor Components

Casings

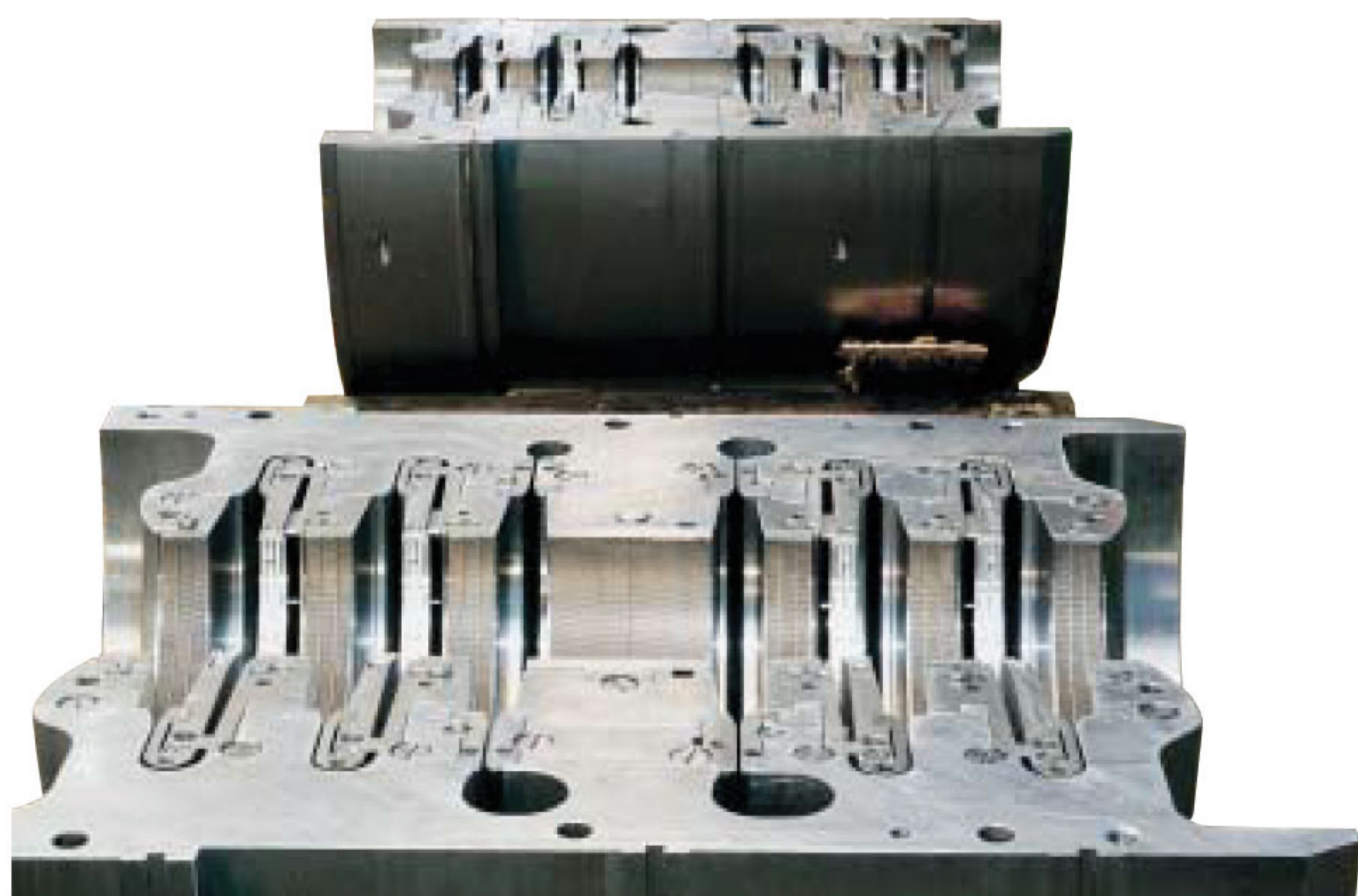
Depending on the compressor family the casings can be

- Horizontally split
- Vertically split

Horizontally-split casings consist of two half casings joined along the horizontal centerline. All connections such as suction and discharge nozzles, side stream nozzles (if any) and oil piping are normally fitted to the lower half so that the upper half becomes an easily removable cover. The casings may be cast-iron or cast or fabricated steel depending on the compressor duty, service temperatures, gas handled and compressor size.

Vertically split casings have different shapes and thickness depending on the pressure rating.

Casings up to 350 bars are steel cylinders with end covers either bolted or secured by shear rings. Nozzles can be welded to the



casing or machined directly.

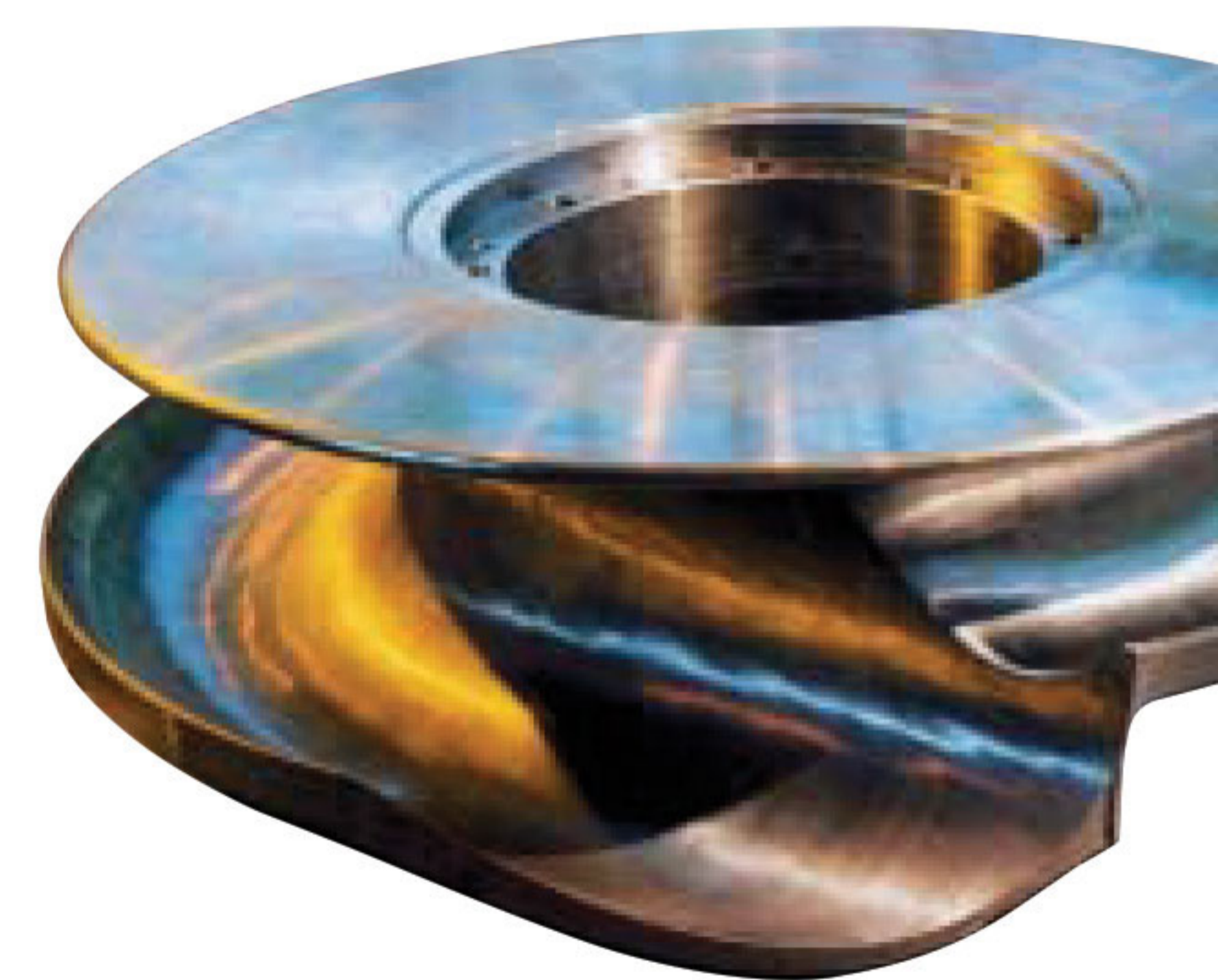
Casings with ratings over 350 bars are cup-shaped forgings with one end cover only. This cover is secured to the casing by a patented shear ring locking device.

Shear rings offer the advantage of being simple to assemble and provide the necessary sealing assurance for very high gas pressures.

By removing the end cover it is possible to remove the rotor diaphragm bundle assembly and to gain access to the internal components without removing the outer casing which remains connected to the plant piping package.

Diaphragms

Suction, intermediate and discharge diaphragms create the gas flow path within the stationary components. The suction diaphragm conveys the gas into the eye of the first impeller and can be fitted with adjustable guide vanes to optimize the inlet flow angle. Intermediate diaphragms perform the dual function of forming the diffuser passage (where gas velocity is transformed into pressure) and the return passage to channel gas to the eye of the next impeller. The discharge diaphragm forms the diffuser for the last impeller as well as the discharge volute. The diaphragms are usually horizontally-split.



Centrifugal & Axial Compressors

Compressor Components

Rotors

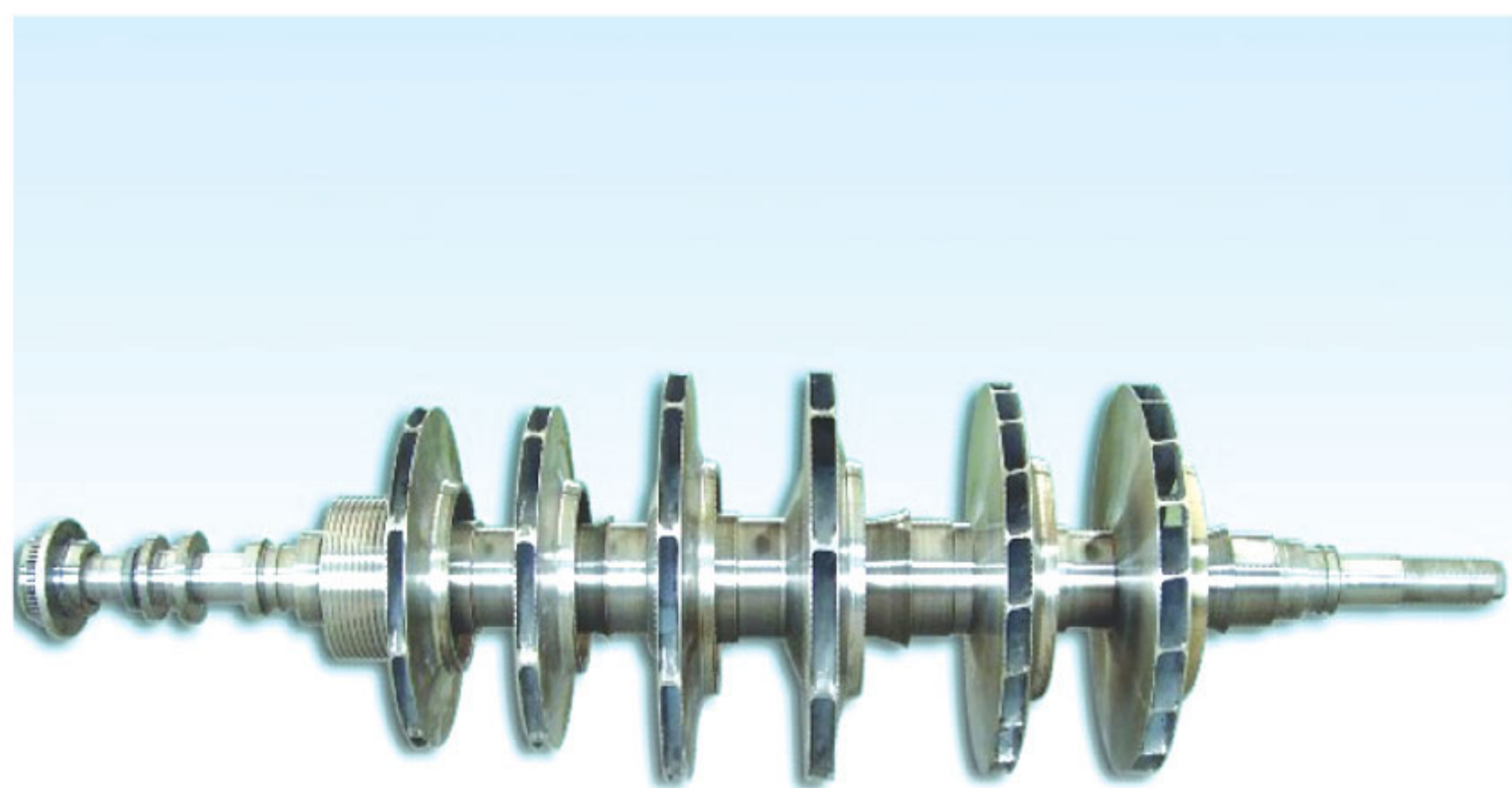
The rotor consists of shaft, impellers, sleeves, balance drum and thrust collar. Impellers are selected from a number of standard families. Each family groups a set of geometrically similar impellers with different flow coefficients to meet specific flow requirements. All geometries have been tested in the company's R & D laboratories. Impellers are shrunk on the shaft. Impellers may be either of the closed or open design. Closed impellers are made of forged steel. Their blades may be welded or brazed to both the disc and the shroud or milled from a solid disc and welded or brazed to the shroud. Solid weld-free impellers produced by milling or electrical discharge machining technology are also available.

The blades are generally back-swept to different angles in accordance with the required performance.

Open impellers are machined from solid forgings.

Each impeller is dynamically balanced and overspeed tested before assembly.

The rotor is balanced after the assembly of each individual component on the shaft.



Seals

Shaft end seals eliminate or minimize the leakage of compressed gas or the entry of air into the compressor casing. Depending on the nature of the gas to be compressed and on the degree of sealing to be achieved, different types of seals may be used.

Labyrinth seals

They are used when the properties and pressure of a gas permit a minimal leakage. The labyrinths are made of light alloy or other corrosion-resistant material and are easily replaceable. The number of teeth and clearance depend on the operating conditions, as well as the geometry (plain, step, ring type, honey-comb, etc.). To minimize leakage, abradable seals are used. In this case the labyrinth teeth are fitted to the rotor and are in contact with an abradable material on the stator.

When no leakage whatsoever is permissible (poisonous or explosive gases, etc.) labyrinth seals are combined with extraction and/or injection systems.



Centrifugal & Axial Compressors

Compressor Components

Dry gas seals

Sealing is ensured by a gas lock created by the grooves machined into a rotating seal fitted on the rotor. Depending on the application it is possible to use gas - taken off the compressor at different levels: first impeller diffuser, intermediate or discharge nozzles or an insert gas.

Hydrostatic and hydrodynamic forces balance to maintain a clearance of a few microns between the rotating seals and the stationary face. This very small clearance reduces gas leakage to a negligible amount.

Extensive experience has been accumulated on dry gas seal systems that have been developed to meet specific process requirements.

Oil seals and mechanical seals are available at request, tend to be replaced by Dry Gas Seals.

Bearings

Hydrodynamic bearings

- Journal bearings

Tilting pad bearings are generally used, and are normally equipped with thermocouples to monitor the bearing temperature.

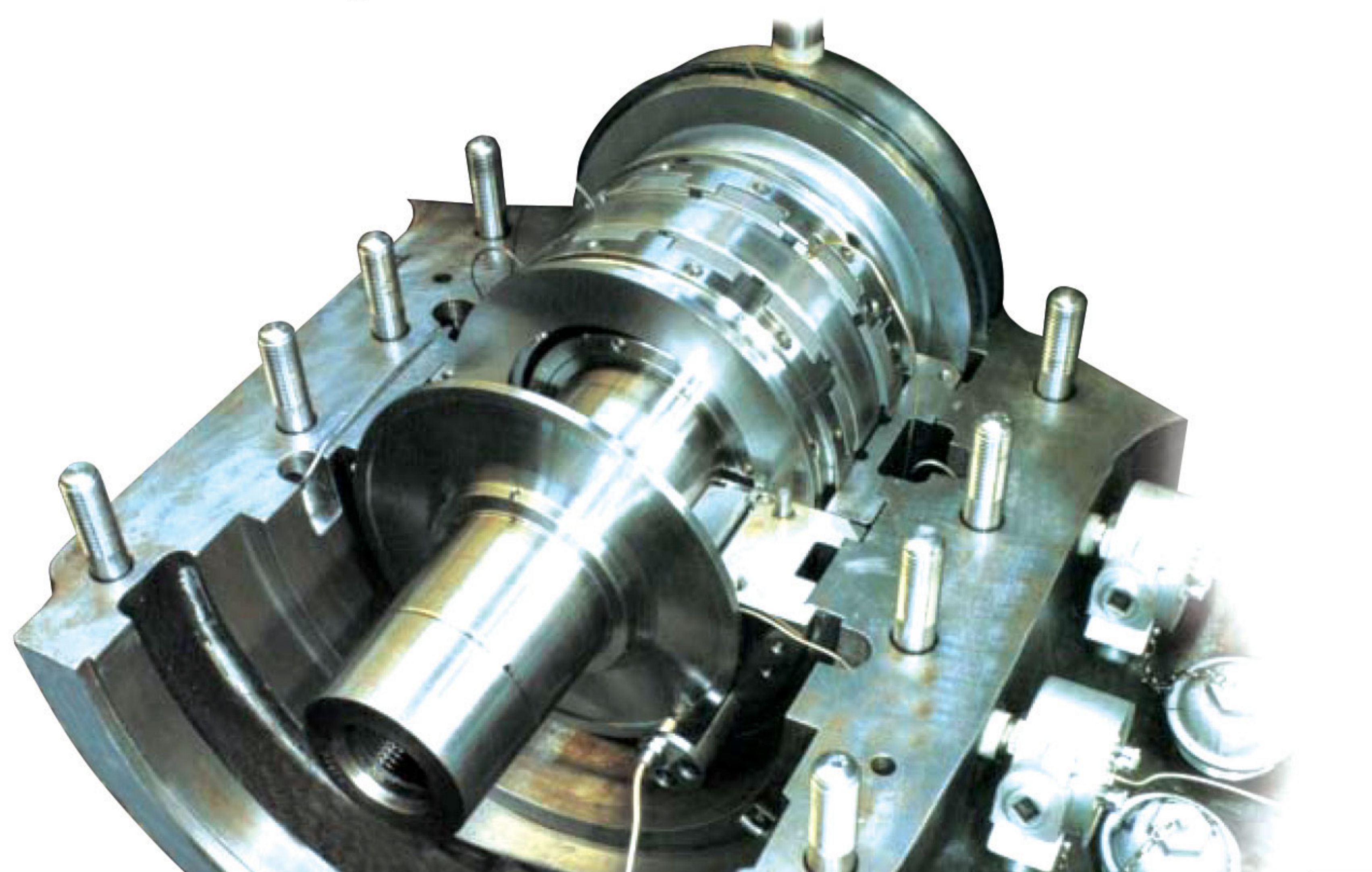
- Thrust bearings

Double-acting, tilting pad bearings with an equalizing device are typically installed. The bearing pads can be fitted with thermocouples for temperature monitoring and with load cells in high pressure applications to measure axial thrust.

Active magnetic bearings

In recent years several machines have been equipped with active magnetic bearings. Operating on the principle of electromagnetic suspension, the active magnetic bearings perform the same functions as hydrodynamic journal and thrust bearings with two main advantages:

- reduced mechanical losses owing to the absence of friction
- adjustable axial and radial position and stiffness of the rotor and damping characteristics of the bearings.



Centrifugal & Axial Compressors

Oil and Gas Seal Systems

Oil systems

Pre-engineered solutions, designed in accordance with API 614 are implemented for continuous compressor operation. Integrating the experience from the large number of units in operation ensures high reliability and short cycle times.

The oil system can be a separate console or be integrated with the compressor base plate for compact packages that are easy to install on-shore or off-shore including special criteria for FPSO applications.

The lube oil system provides lube oil to the radial and thrust bearing of the compressor, to the gear box, and to the driver (except for some gas turbines).

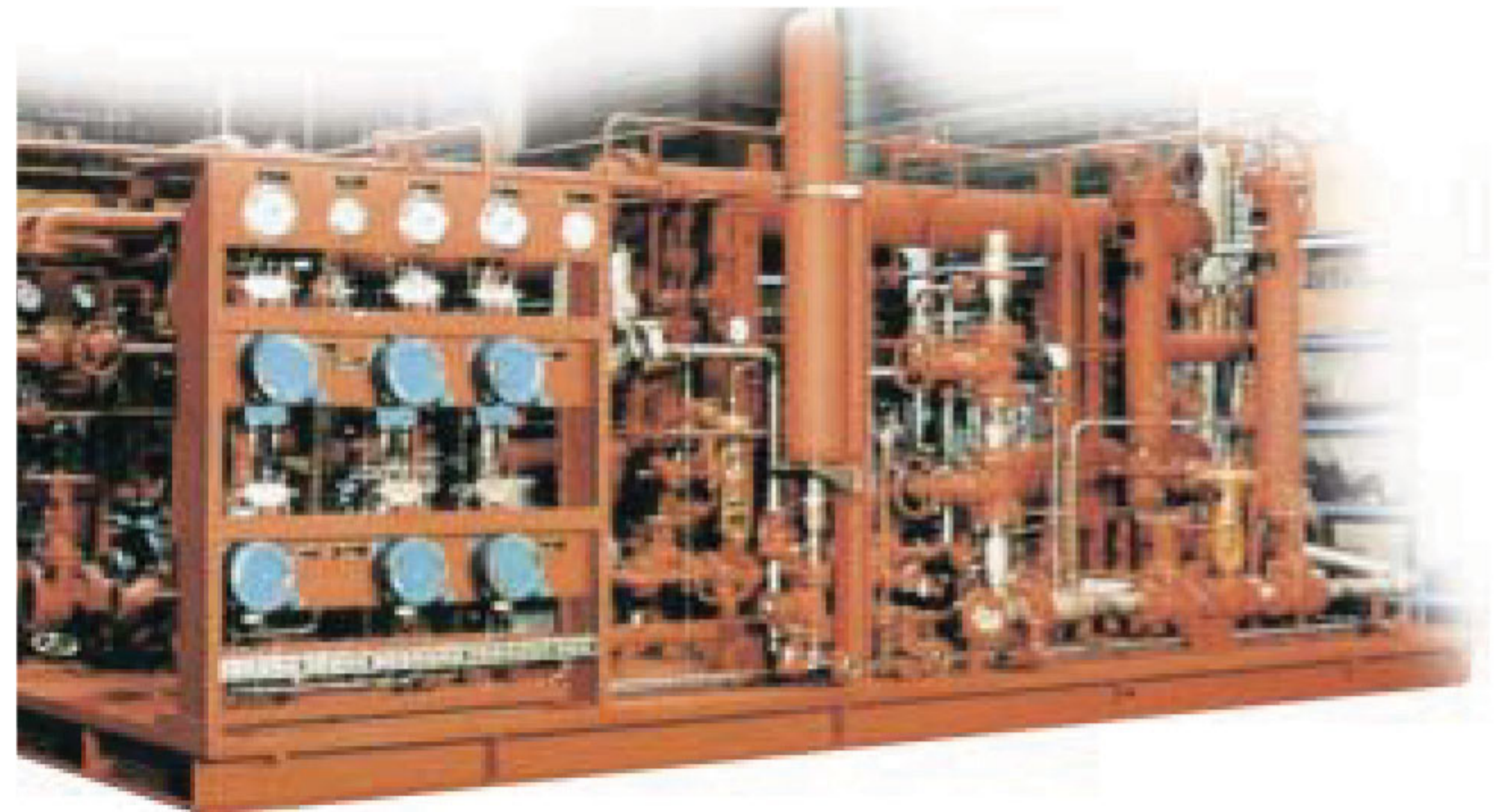
A seal oil system supplying filtered oil to the liquid film rings or to mechanical type seals at the required pressure and temperature can be provided upon request.

The seal oil system may also be combined with the lube oil system. In this case the same oil reservoir is used for both functions.

Gas seal systems

These systems are available to cover the needs of the different Dry Gas Seal configurations.

They provide, as a sub assembly, the required buffer gas for the primary, secondary and tertiary seals, and the instrumentation to properly monitor the seals.



Centrifugal & Axial Compressors

Control Systems

With extensive experience as a manufacturer of compressors and all types of drivers, and engineering and field services for compression stations, our specialized teams develop systems to control the equipment packages and the associated auxiliaries or processes as required.

Integrated Driver-Compressor Control system is a complete integrated solution, providing protection and monitoring to maximize the security of the compressor against potentially harmful surge conditions, while enhancing process efficiency and availability. This integrated control system provides critical process control for the entire compression train, its auxiliaries and related process equipment. Compatible with a variety of drivers and compressors.

Simplex, Dual, and TMR control system redundancy options are available.

Combining the driver and load compressor control in a single platform provides advantages to the customer:

- Common spares for both driver and compressor control systems reduce the overall inventory requirements
- A smaller physical footprint means that compressor control hardware can be included in the same cabinet as the driver control hardware.
- The same Technical Advisor can handle commissioning and startup of both the compression train and driver.
- Common software tools and diagnostics for maintenance of driver and compressor controls simplify maintenance and uprates, and also reduce startup time and cost.
- Training time and costs are reduced with a single control system used for both driver and compressor controls. This applies to both initial and on-going training costs over the life of the control system.

Anti-surge protection and process control

Anti-surge control algorithms implemented within the integrated control system are based on the knowledge acquired through our expertise as a leading compressor manufacturer and experience on thousands of applications. Different control strategies are available to meet the needs of the application. All provide both closed and open loop controls to better react to small and large process disturbances. Different process control and load bearing functions can be provided.

Dynamic simulation

Dynamic simulations ranging from a single loop to a more complete process configuration are possible to define anti-surge valves, hot by pass requirements, piping optimization for improved compressor protection and starting conditions for electric motor drives.



Centrifugal & Axial Compressors

Test Facilities

Centrifugal compressors are carefully tested throughout the manufacturing process in order to guarantee a perfect match to their design criteria and to assure long lasting, continuous operation.

The following tests are typically carried out on components and assembled machines:

- casing: hydraulic pressure test
- impellers: ultrasonic and dye penetrant liquid tests; over speed testing
- impellers/rotors: over-speed testing
- mechanical run test

Optional tests may be performed based on the specific job requirements. For example:

- performance tests (with air or other gases in an open or closed loop)
- full load - performance tests (including flammable gases) to check rotor stability and the performance of the machine
- mechanical string test.

Numerous indoor and outdoor test beds together with a sophisticated system for data acquisition and processing of test results.

We have the largest and most complete testing capability in the industry to perform tests under actual load and pressure conditions (including LNG and re-injection) for trains driven by gas turbines or electric motors.



Centrifugal & Axial Compressors

Service

ASA's Oil & Gas business provides a complete set of services to support the entire centrifugal & axial compressor product line. We offer an extensive portfolio of proactive and interactive service products such as condition-based maintenance, Conversions, Modifications and Uprates (CM&Us) and Contractual Service Agreements (CSAs) complementing the traditional service offerings of OEM spare parts, repairs, and field services.

Our innovations are not limited to mechanical engineering. We have developed business solutions such as remote monitoring & diagnostics to help drive customer value by providing higher equipment reliability, availability, and productivity at a predictable cost.

Global Services engineers are backed up by our new product design engineering groups and by the ASA Global Research Center - hundreds of creative minds working to provide the high-tech products and business solutions for the 21st century.



Centrifugal & Axial Compressors

Training

ASA's Oil & Gas business offers Training for the Operation and Maintenance of our complete line of machinery and equipment.

This Training can be provided either at the client's site or at the Learning Center located at ASA Co. Instructors are field-seasoned experts who combine their understanding of theory with practical experience.

The quality training that they provide is a prerequisite for improving the skills of operating and maintenance personnel, to ensure safety, and superior equipment efficiency and availability.

Courses and documentation are designed to meet Customer needs, focusing on the GE machinery and equipment actually installed at their sites.

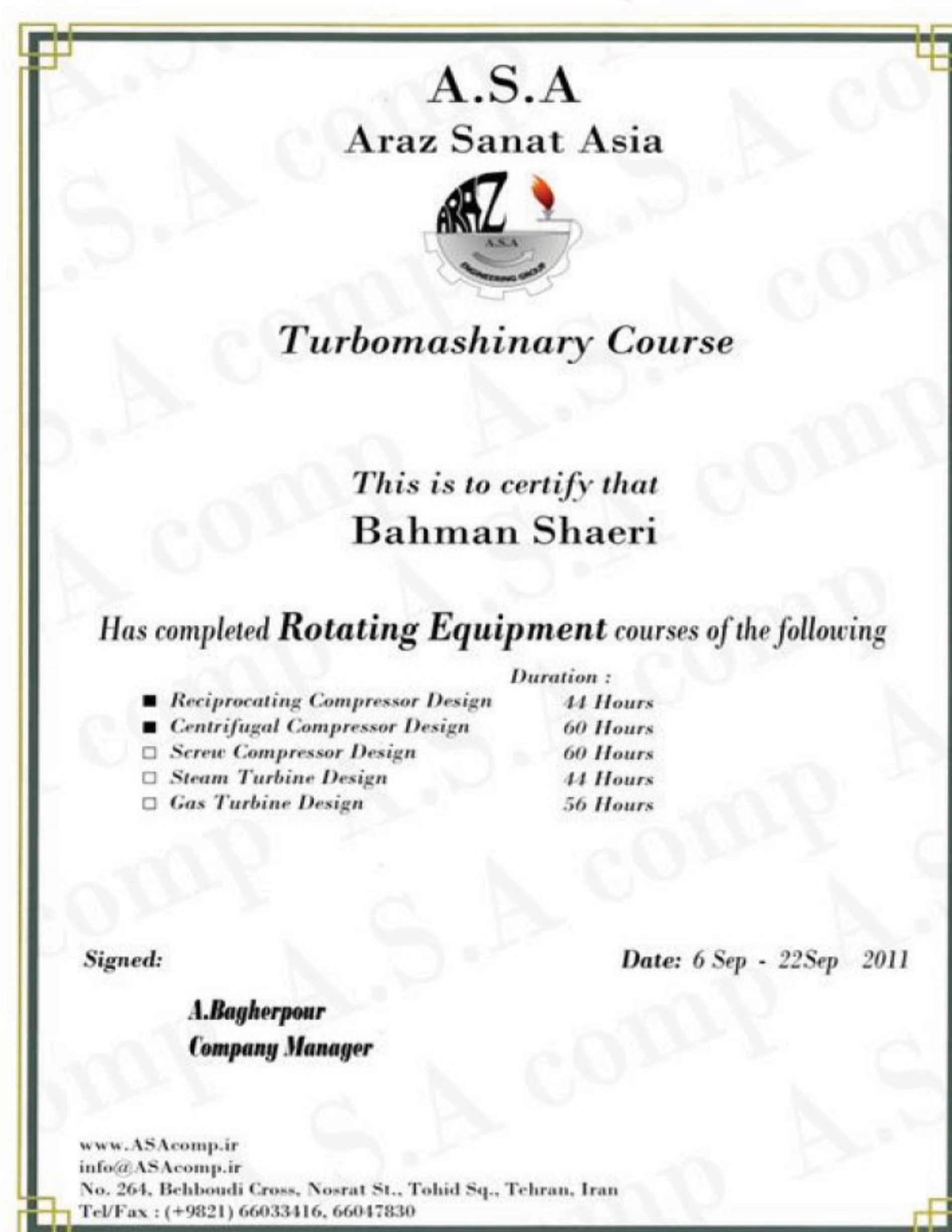
Traditional training tools are augmented with computer-based training and interactive multimedia technology.

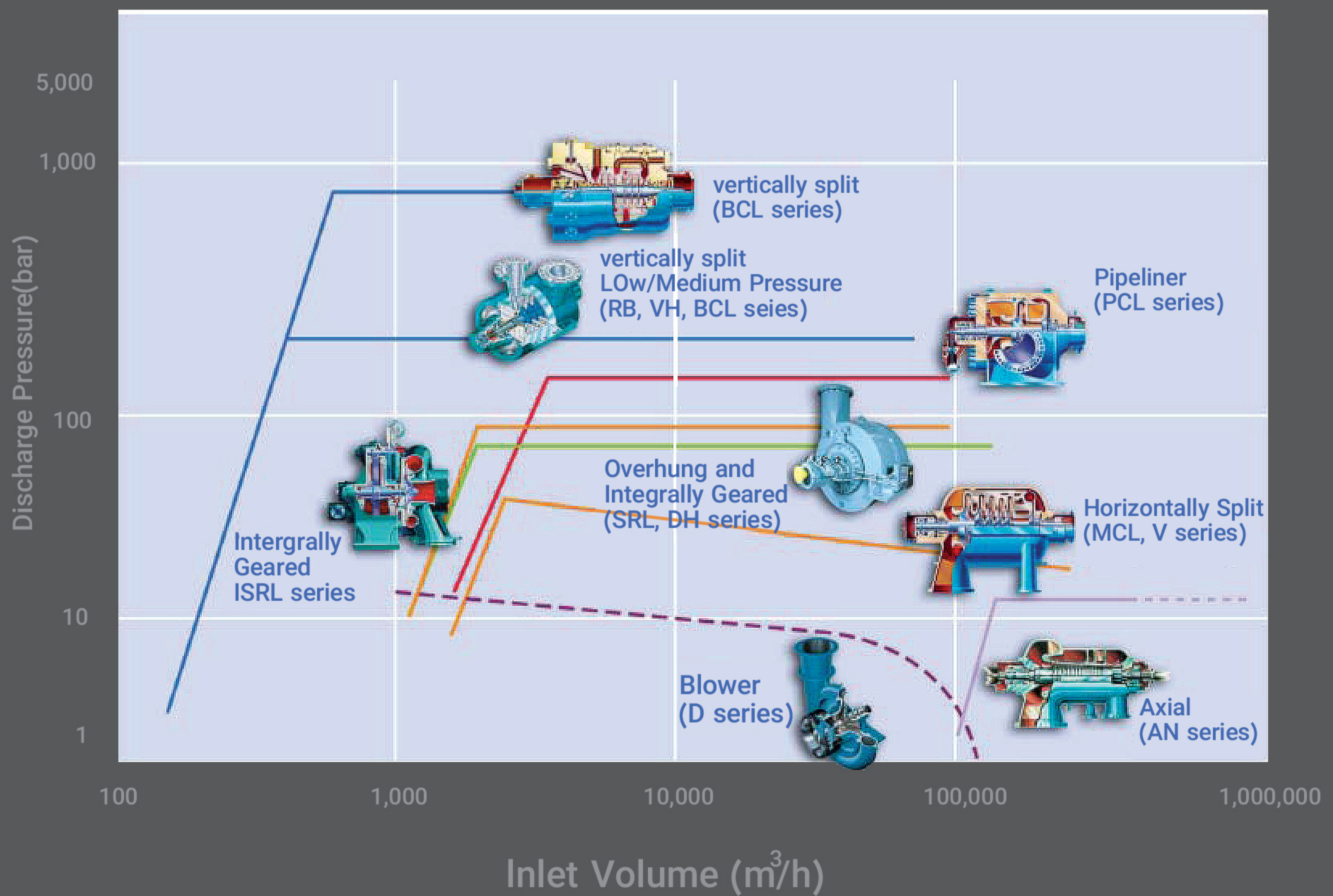
TRAINING SOLUTIONS:

- For all level in your organization
- Tailored for your specific needs
- Prescheduled offerings or on request
- Provided in various languages
- Formal classroom training and interactive learning

COVERED EQUIPMENT

Nuovo Pignone, Thermodyn, Rotoflow, Bently Nevada and other GE equipment.





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