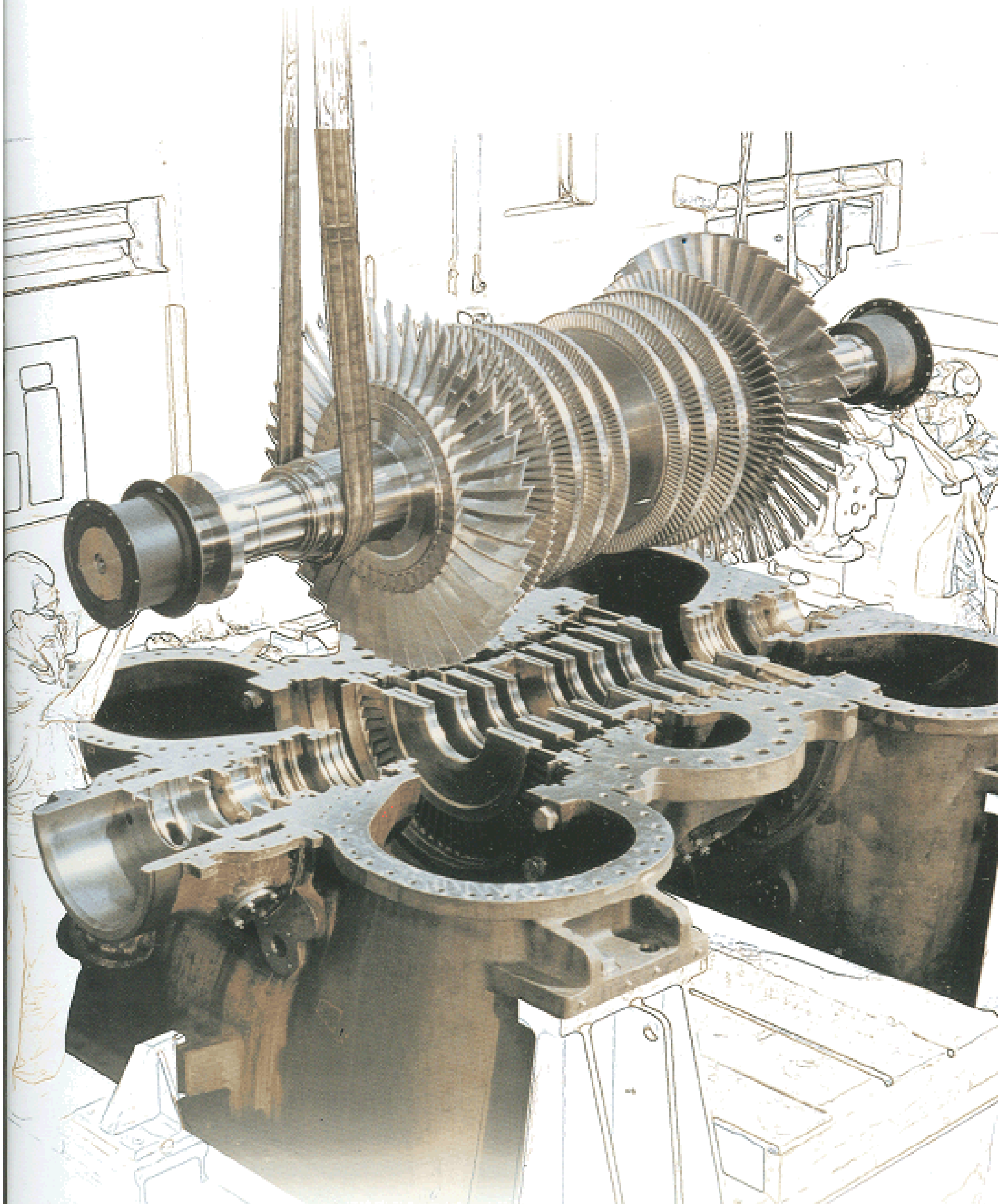
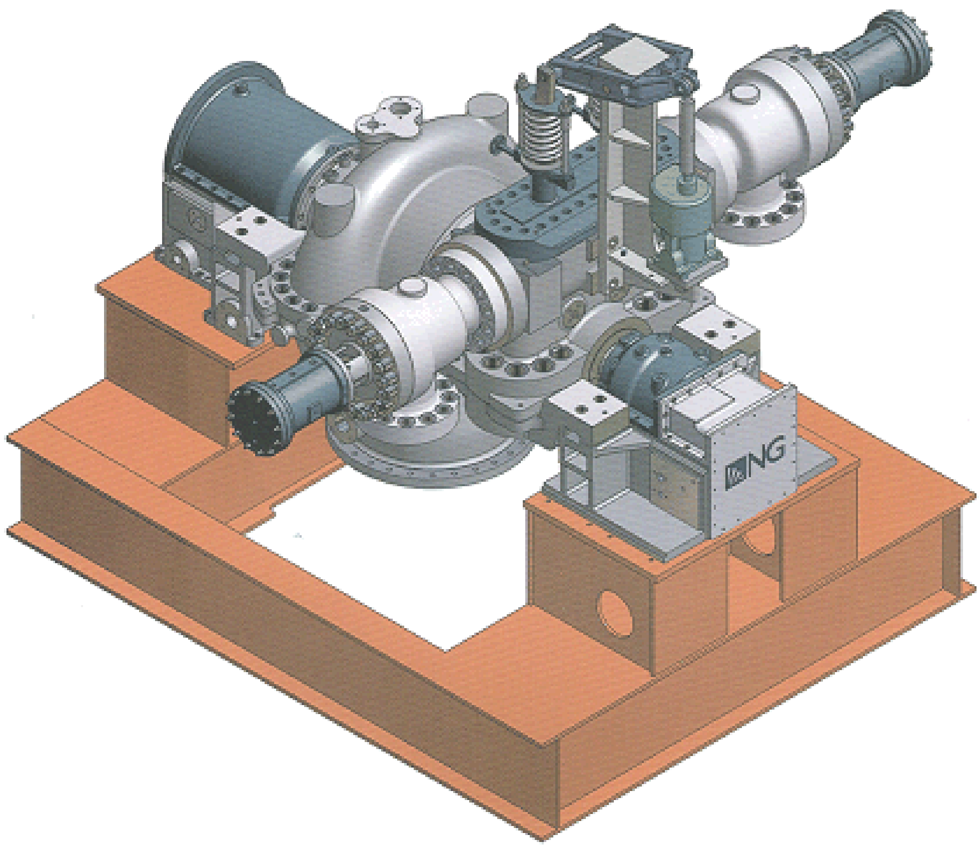
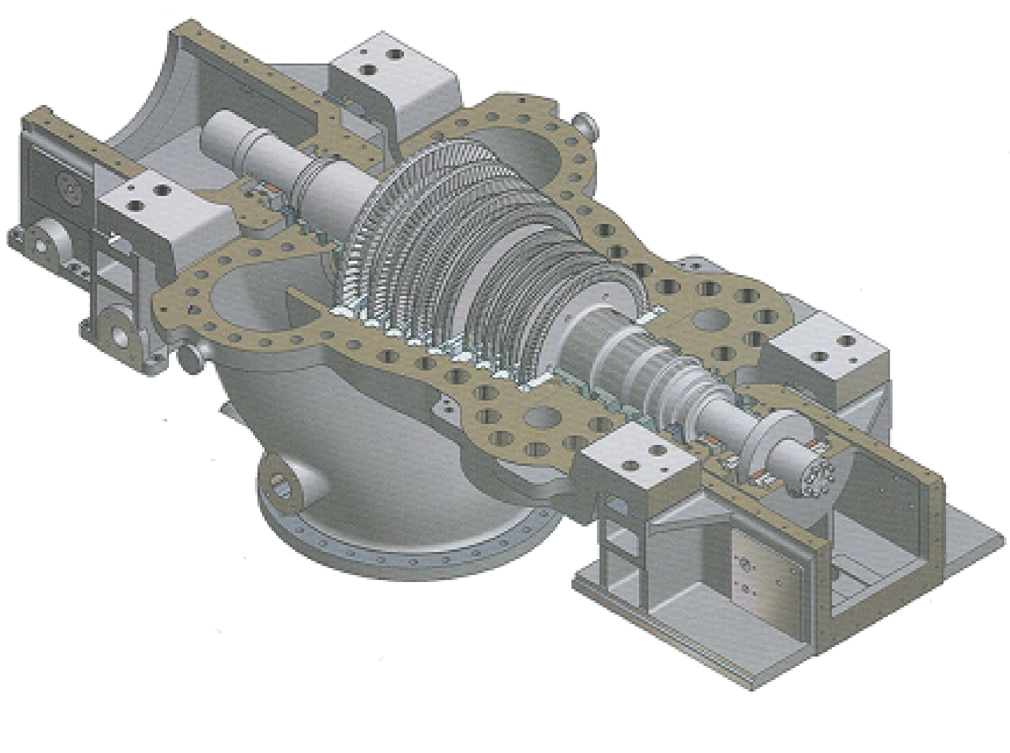
High Performance Multi Stage Turbines
H Series

ENERGY

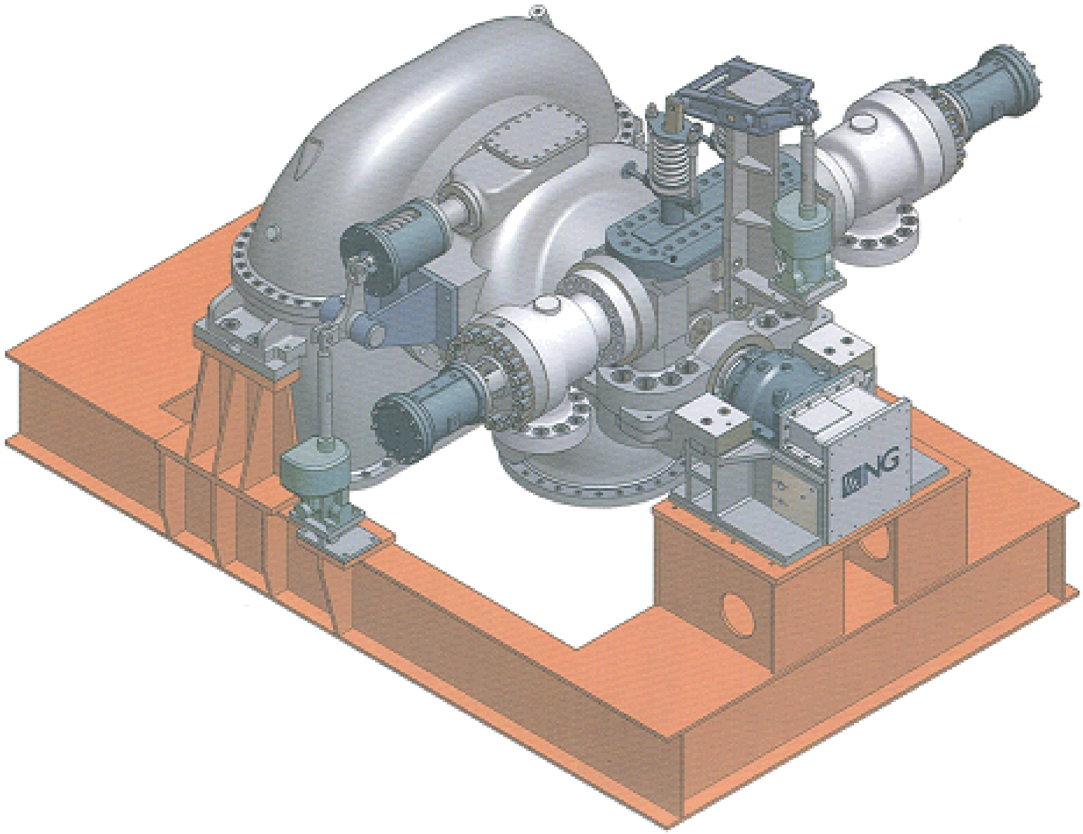


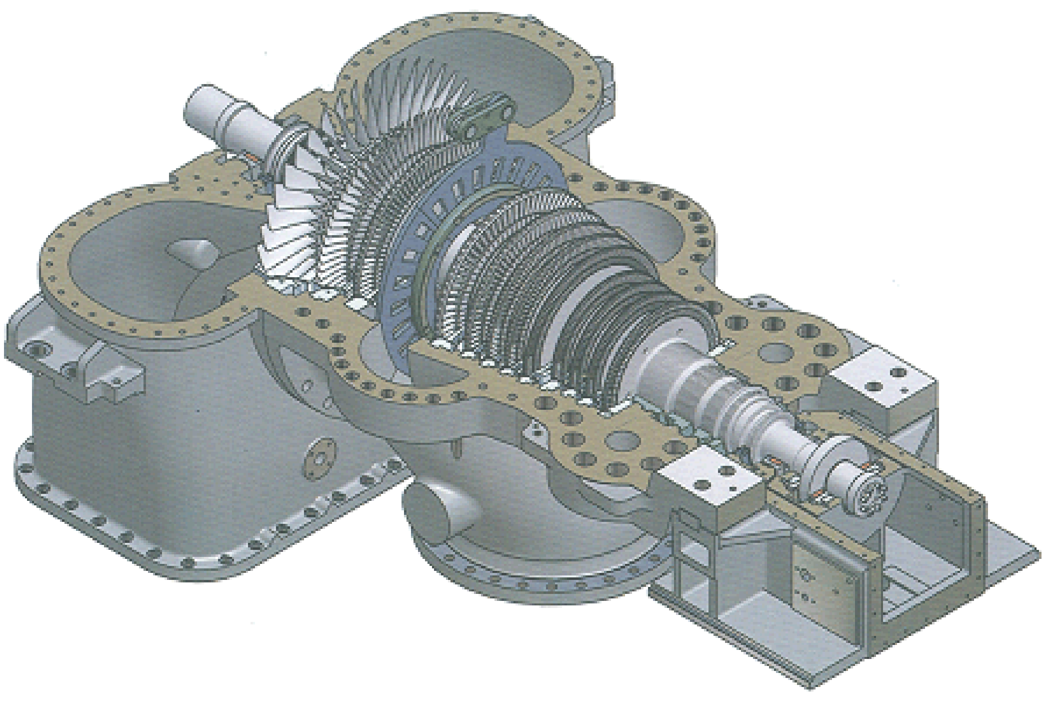
Backpressure Turbine





Condensing Turbine



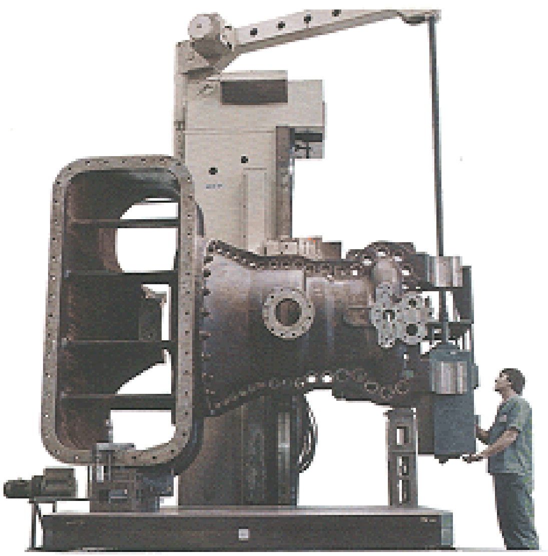


Constructive Features

Turbine Casing

Made in cast steel, horizontal, axially bipartite at its center line.

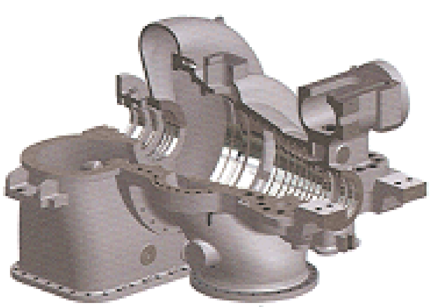
The top casing integrates in the same casting the steam chest, whose control valves are vertically assembled at its superior part.



This is a compact arrangement and has the advantage of minimizing the thermal stresses originated during the rapid start up of the equipment.

Both top and bottom casings are jointed through high alloy studs and bolts, uniform and thermally pre tightened, which assures a perfect sealing.

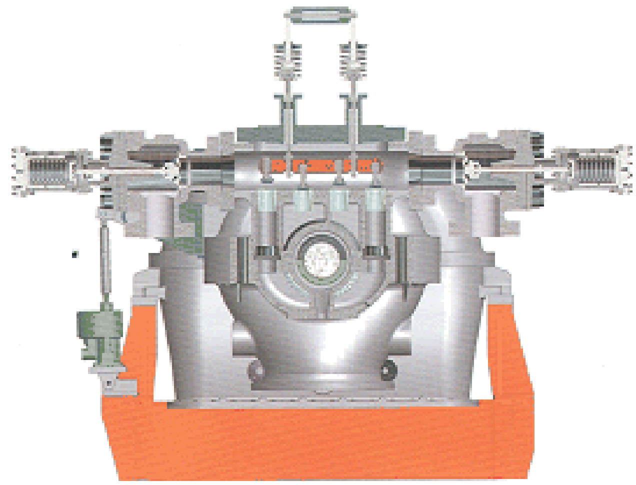
Two supporting arms in the front part of the casing permit its connection to the front bearing housing, by means of a bolting system besides a transversal key, which guarantee the perfect alignment and the suitable thermal expansion of the turbine.



When the turbine is heated, it axially pulls the front bearing housing over a metallic support, fixed on the baseplate and guided by lateral slide rulers to its full extent.

The fixed point in the rotor in relation to the turbine casing is the thrust bearing, assembled at the front part of the rotor, minimizing the relative movement between the stationary and rotating parts of the turbine.

Multi Control Valves



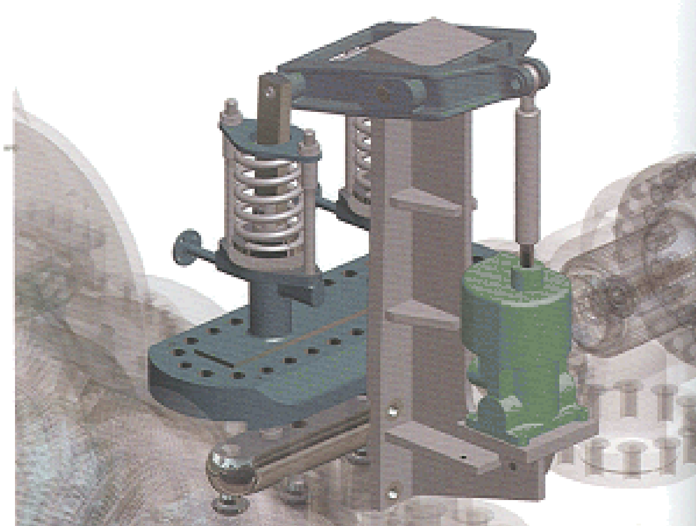
Direct driven through an electric and hydraulic actuator that receives an electronic signal from the digital speed governor, guaranteeing a good performance at partial loads.

There are four control valves, vertically assembled, which eliminates any inconvenient due horizontal support between valve spindle and guide bushes.

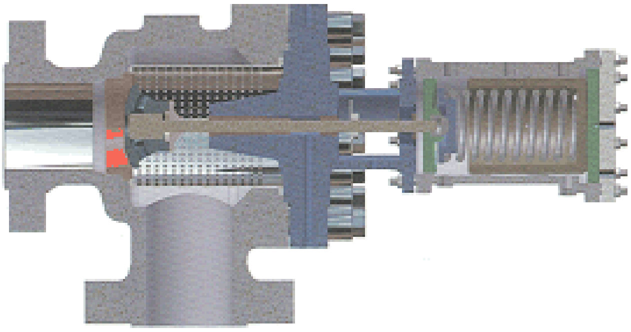
The control valves operate against the action of individual compression springs, which assure an additional protection in case of emergency shuts down.

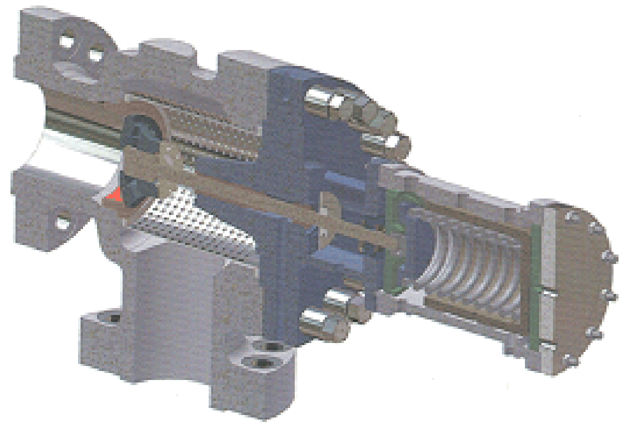
Each valve controls the steam admission for a group of the first stage nozzles, maintaining a suitable pressure at the high pressure casing of the turbine.

During the turbine automatic start the control valves are partially opened to assure that the steam heats the casing in a uniform way.The casing heating minimizes the thermal stresses and the resulting deformations, avoiding the physical contact between rotor shaft and its sealing.



Stop and Emergency Valve





Of the quick shut off type, hydraulic actuated, permits to be tested for free movement with the turbine running, according to API 612 Standard requirements.

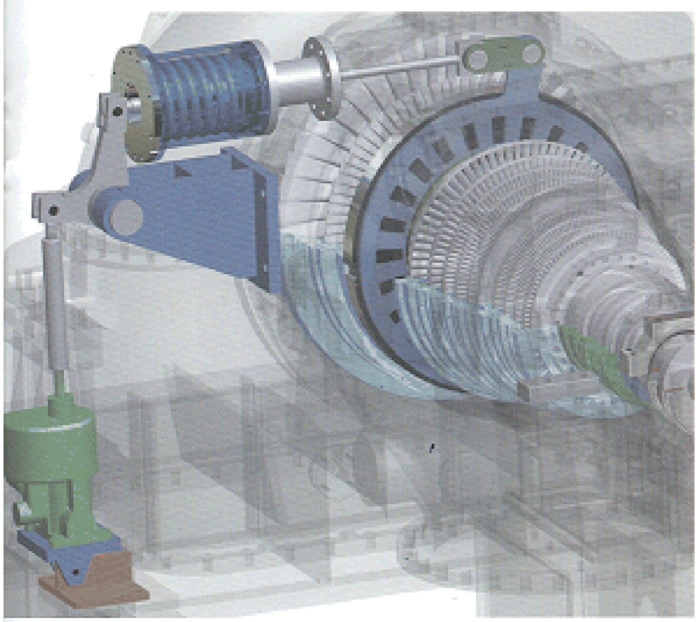
It is mounted on a valve body made in the same casing material and can be removed without to be necessary to disconnect the admission steam piping.

The valve body is provided internally with a stainless steel steam strainer upstream to the stop and emergency valve for the protection against foreign material entrance, coming from the admission steam piping.

The opening of the stop and emergency valve is done automatically and in a such way that the turbine have the speed ramp strictly according the starting curve specified by NG. The speed ramp is configured on the turbine speed governor, so that it does not depend on the operator action to start.

In any emergency situation, the stop and emergency valve operates automatically, closing the steam admission to the turbine and stopping it safely.

Controlled Extraction Valve

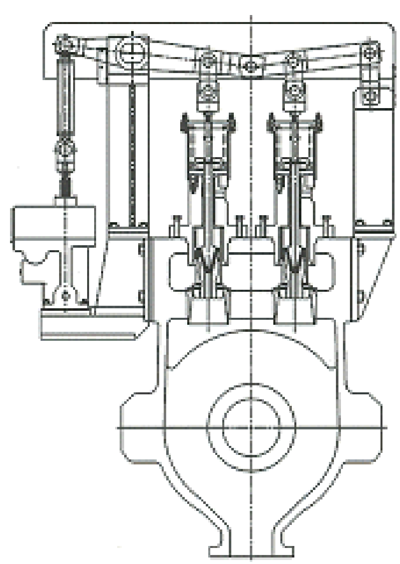


The gate type, for low extraction pressures

The H Series turbines can be fitted with controlled extraction valves for up to 95% of the total admission steam flow.

Two types of controlled extraction valves are possible:

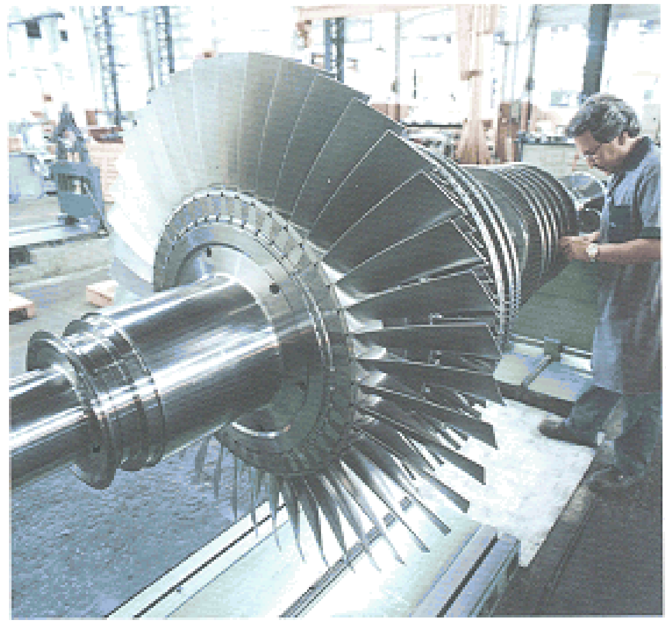
The vertical type, for high and medium extraction pressures



Rotor

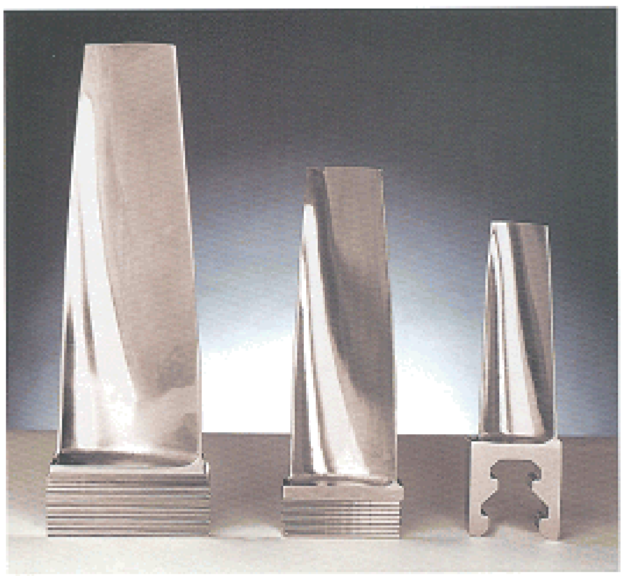
Of the integral type, made in high alloy forged steel, ultrasonic tested and dynamically balanced.

The rotor is balanced at each stage of the blading assembly process, with a high degree of precision, which assures a smooth functioning and a long useful life to the equipment.



Advanced Blade Technology

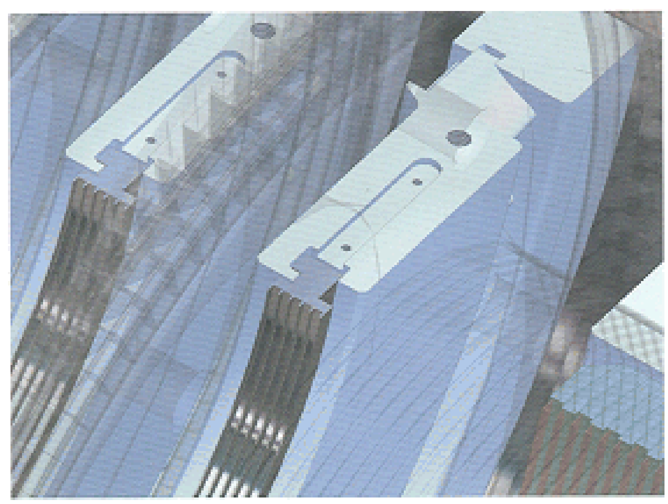
The various blade profiles were developed through the most modern technology using three dimensional finite elements analysis, which assures the development of projects mechanically optimized, with the most efficient thermodynamic energy conversion.



Overspeed Trip System

The overspeed protection of the turbine is normally done by the electronic and digital Woodward Protech 203 system, of the triple redundancy.

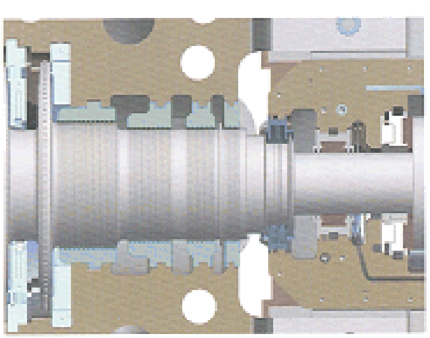
Optionally, a mechanical type overspeed trip device can also be installed.



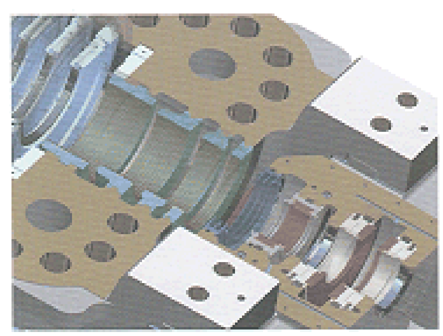
Shaft Sealing of Steam

Through metallic labyrinth rings, made in stainless steel, fitted with an extraction gland steam system.

The sealing between the stages is done by floating type labyrinths assembled on the diaphragms, which maintain an effective shaft sealing and are easily replaced.



The external sealing can be made by both floating type labyrinths or sealing strips mounted on rotor shaft and sealing bushes.



Turbine Bearings

Both thrust and journal bearings are of the tilting pad type, being the pads covered with white metal, guaranteeing high dynamic stability for the turbine rotor.

The thrust bearing are capable to bear the axial thrust in both directions.

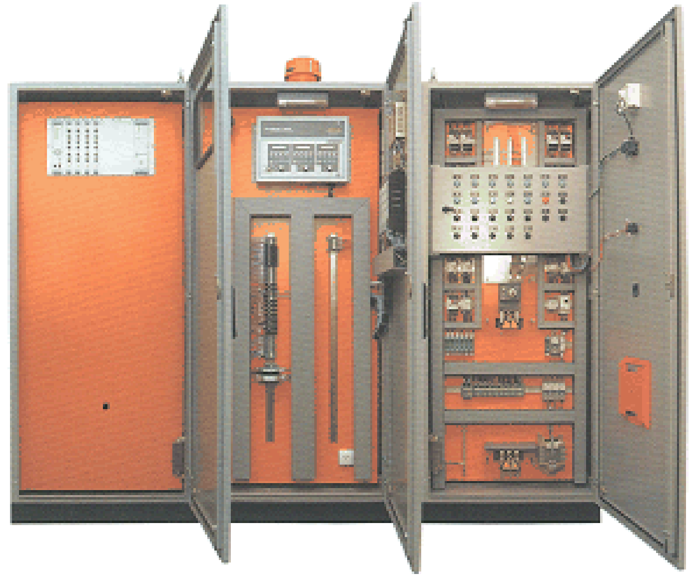
Oil System

Of the forced feed type, consists of a centralized unit, supplying oil for the common lubrication of turbine, gearbox and driven equipment, besides to supply oil for the turbine control oil circuit and including:

- Oil reservoir with level gauge, vent and drain
- Twin oil cooler with change over valve
- Duplex oil filter for the lube oil system
- Duplex oil filter for the control oil system
- Gearbox low speed shaft driven main lube and control oil pump
- AC electric motor driven auxiliary lube and control oil pump
- DC electric motor driven or auxiliary steam turbine driven coast down emergency oil pump
- AC electric motor driven barring and lifting device oil pump
- Oil mist extraction fan
- Pressure relief, control, check and block valves, orifice plates and flow gauges at bearing housing drain piping
- Oil piping

Control Panel

Specially design and manufactured under the most exigent applicable standards, includes all the necessary equipment and functions for the turbine and gearbox unit supervision, control and protection, as for example:



- Axial displacement and relative vibration monitoring at the bearing adjacent region of the rotor shaft
- Programmable Logic Controller – PLC
- Digital speed governor
- Digital overspeed trip system
- Human-machine interface (HMI) including all alarm and shut down functions for the supervision, control and protection of turbine and gearbox unit
- Independent and redundant shut down circuit, permitting the total turbine and gearbox protection, even in the eventual and accidental loose of the PLC logic
- Lube oil pumps automation
- Oil pumps control switches

- Possibility for the complete shut down circuit test during turbine normal operation
- Admission steam pressure control
- Extraction steam pressure control
- Exhaust steam pressure control
- Permission for the generated power control
- Frequency control
- Interconnection with digital control systems – SDCD

Service

Permanent factory and technical assistance teams for 24 hours per day attendance

Turbine user technical assistance

Technical group, including mechanical, electrical and electronic engineers, supervisors and assemblers experts for field services attendance as for example:

- Technical assistance to the user
- Problem solutions and repair
- Parts and components replacement
- Equipment monitoring
- Functioning evaluation
- Retrofit studies
- Plant and process studies
- Disassembly and reassembly
- New equipment erection
- Comissioning and tests
- Start up

Erection, Tests, Comissioning and Start up Supervision

Our team of technicians and engineers can supervise the installation of new turbines and their auxiliary systems, including the following activities:

- Checking and preparation of the civil base of foundation, before receive the equipment
- Equipment location and erection on the base of foundation
- Equipment leveling and pre-alignment
- Complete oil piping pickling
- Oil, water and condensate piping interconnection
- Local instrument and panel interconnection
- Final alignment
- Steam piping blowing supervision
- Turbine admission, extraction and exhaust flanges forces and moments evaluation
- Comissioning of complete oil, steam, electrical, governing, safety and protection steam systems
- Start up and performance evaluation
- Load rejection test follow up
- Assisted operation
- Maintenance and operation personnel training

ISO 9001:2000 Qualification

CERTIFICATE OF COMPLIANCE

This is to certify that the Quality Management System of:

NG METALÚRGICA LTDA.

has been assessed by ABS Quality Evaluations, Inc. and found to be in compliance with the requirements set forth by:

ISO 9001:2000

The Quality Management System is applicable to:

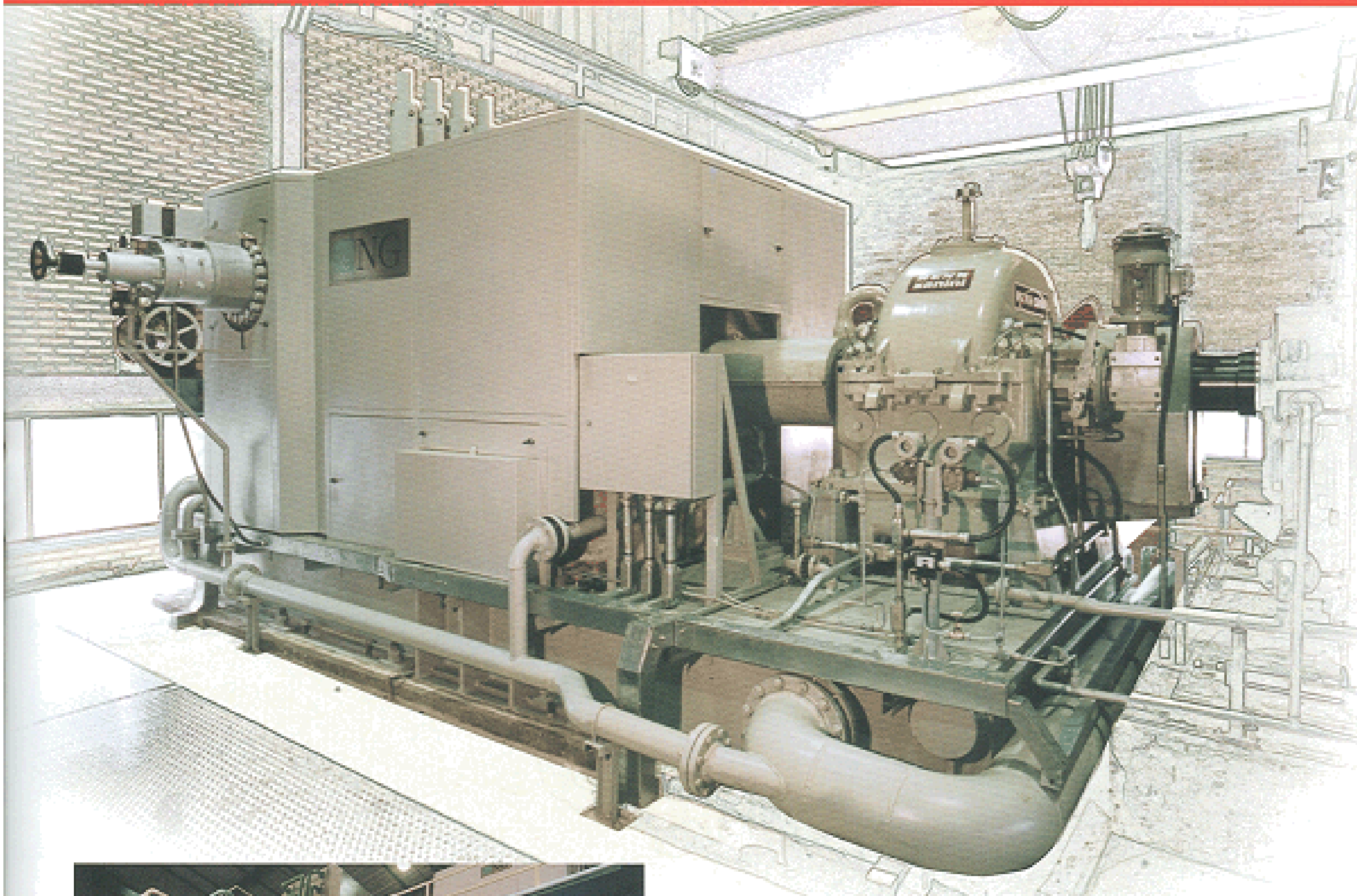
DESIGN AND MANUFACTURE OF STEAM TURBINE AND HIGH-SPEED REDUCTION GEAR

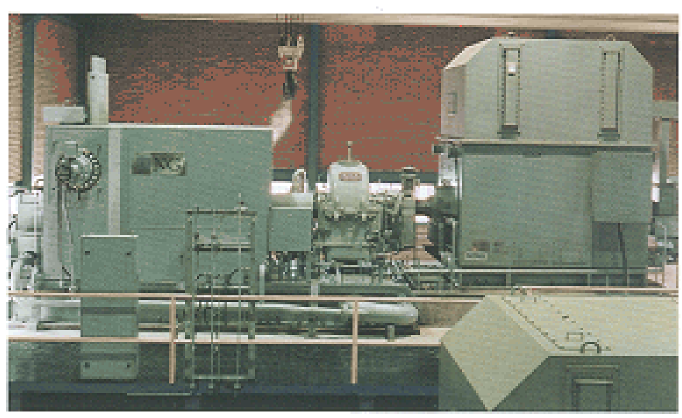
Constantly at your side

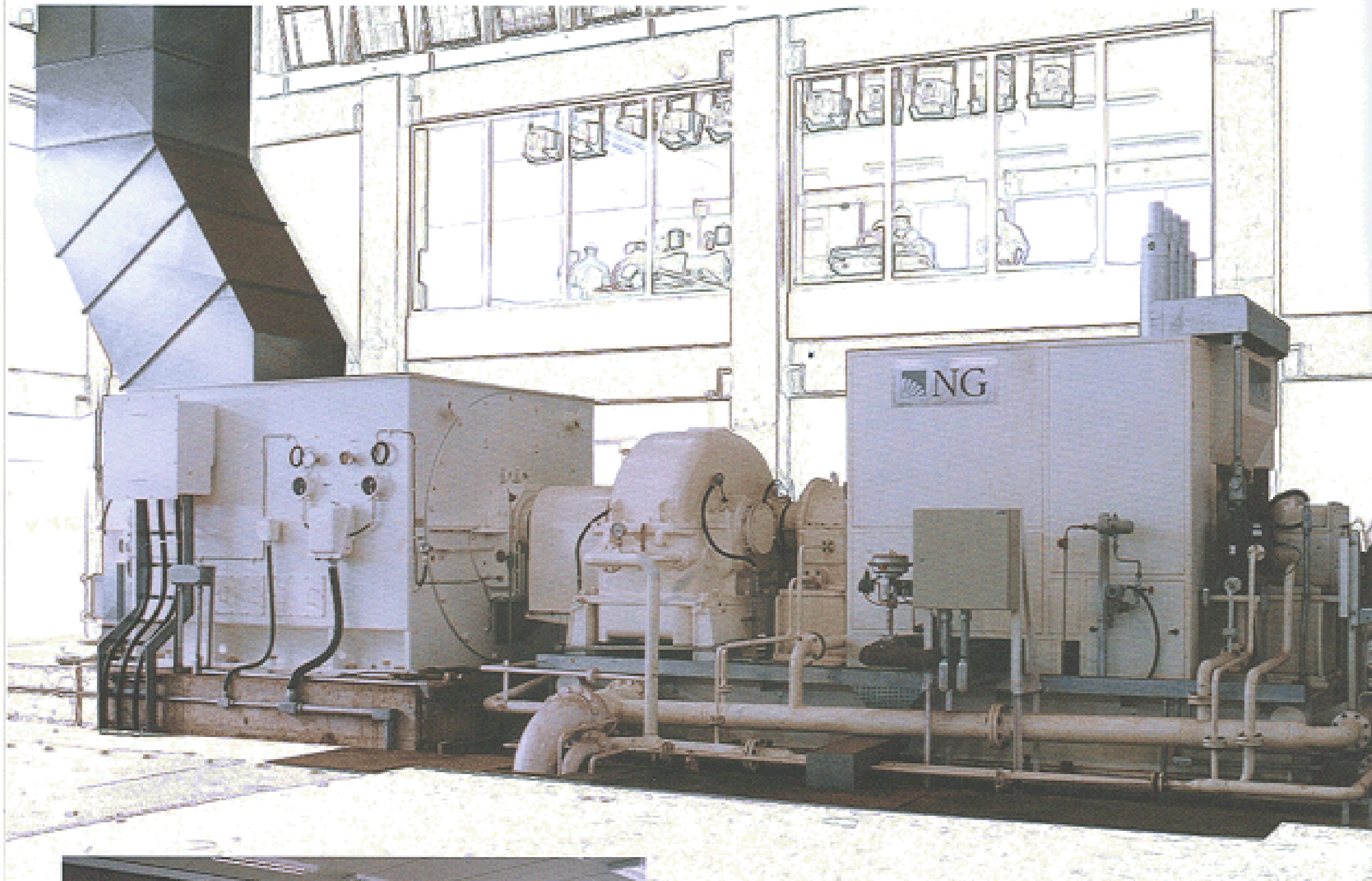
Client Training

Training program			
Maintenance		Operation	
Introduction **NG Company** ***Product portfolio*** ***Steam turbines*** General ▪ Backpressure ▪ Condensing ▪ Extraction ***Turbine description*** Casing Rotor Diaphragms Bearing housing Bearings Barring system Steam and oil gland systems Couplings ***Instrumentation Diagram (P&I)*** General ▪ Diagram explanation ▪ Instrumentation ***Steam system (P&I)*** Steam and condensate diagram Sealing system Steam draining system Valves Steam system maintenance Protection system (alarm and shut down) Troubleshooting	***Oil system (P&I)*** Lube oil diagram Control oil diagram Control valves Pumps and filters Oil system maintenance Protection system (alarm and shut down) Troubleshooting ***Preventive Maintenance*** Basic aspects Operating data Inspections during operation ***Corrective Maintenance*** Basic aspects Overhaul schedule Revision intervals Preparation for the overhaul ***Spare parts*** Start up Two years operation	***Instrumentation Diagrams (P&I)*** Steam and condensate systems Lube and control oil systems ***Protective and safety equipment and instruments*** Overspeed trip Stop and emergency valve Temperature switches Pressure switches Solenoid valves Vibration and axial displacement monitoring ***Turbine Inspection*** Drainage of steam lines Check of alignment Check of clearances Check of bearings	***Operation*** Typical start up procedure Thermal distribution Operational aspects Typical shut down procedure ***Troubleshooting*** ***Operation under an emergency situation*** ***Evaluation***

Installations



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