

ansaldo | energia

STEAM TURBINE OPERATION & SERVICING



STEAM TURBINE SHAFT LINE

Ansaldo Energia has over 100 years of experience in the design, manufacturing and installation of Steam Turbines, and it is a worldwide leader in the power generation industry. We have a comprehensive capability to supply new plants, as well as to offer spare parts and complete maintenance services, with the ability to repair major components, modify existing turbines and retrofit most turbines installed around the world, regardless of the original designer or manufacturer. Our capability covers multi-technology turbines (both impulse and reaction) and a large range of power sizes (up to 1000 MW for a single unit).



Ansaldo Energia services a wide range of steam turbines and applications:

- Fossil-fired steam cycles
- Combined cycles
- Combined heat and power
- Nuclear plants
- Desalination plants
- Geothermal cycles
- Industrial plants
- Solar plants

Type	Series	Power range (MW)	Application
REHEAT	RT30	150-1,000	Combined Cycle, Fossil, Cogeneration Combined Cycles, Fossil, Solar
	MT15	100-300	
NON-REHEAT	MT20	100-350	Combined Cycle, Fossil, Cogeneration Combined Cycle, Fossil, Solar
	MT10	40-250	
GEOTHERMAL	GT	15-150	Geothermal

Steam Turbines portfolio

We Know Our Job

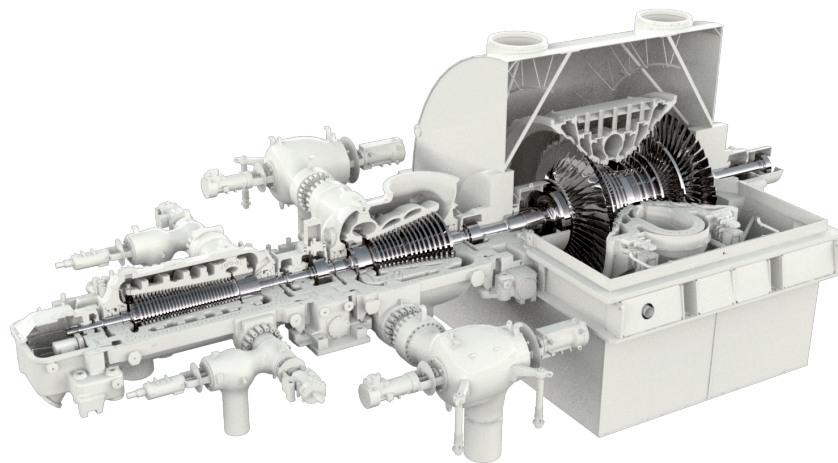
The Ansaldo Energia's know-how and experience as an OEM (Original Equipment Manufacturer) derive from:

- supply and installation of more than 20 non-reheat reaction steam turbines for a total power of 3 GW (according to ABB technology)
- supply and installation of more than 70 reheat reaction steam turbines for a total power of 15 GW (according to ABB technology)
- supply and installation of more than 525 impulse (according to GE technology) and reaction (according to Westinghouse technology) steam turbines for a total power of 74 GW
- supply and installation of more than 30 geothermal units for a total power of 1 GW
- supply of 12 steam turbines for nuclear power plants for a total power of 6 GW
- a total of more than 645 steam turbines and 100 GW installed around the world

Ansaldo Energia Offers the High Industrial Knowledge of an OEM on Every Type of Technology

We build upon our OEM knowledge and leverage our organizational expertise to achieve the know-how to work both on the OEM fleet and on non-OEM steam turbines: in order to achieve these goals, we merge a flexible approach, a pro-active structure and highly specialized competencies over different technologies.

We work with our Customer as a tailored and flexible Partner to manage planned outages and quickly deal with unexpected failures or unconventional service outages. Our goal is to improve reliability, availability, and increase the capacity of your turbine, while reducing future maintenance and operation costs.



RT30: reheat reaction steam turbine, three or more cylinders.

Ansaldo Energia's portfolio of services for steam turbines

Ansaldo Energia's Service organization provides overall and life-cycle technical assistance in the fields of maintenance, high-technology solutions and repairs of steam turbines, with a preventive maintenance program to ensure that Customers are in the best position to achieve optimal operation and reduce costs.

We have the flexibility to work worldwide, due to the availability of portable machinery and dedicated tool sets, used by skilled personnel, in order to offer you the highest level of quality of servicing.

Diagnostic tools and procedures are available to continuously monitor and check steam turbine parameters, in order to prevent forced outages, detect aging trends and address maintenance activities.

Ansaldo Energia's Service can also provide Clients with in-house or remote personnel training, supported by tailored digital materials.

Steam Turbine Shaft Line offers servicing in the following areas:

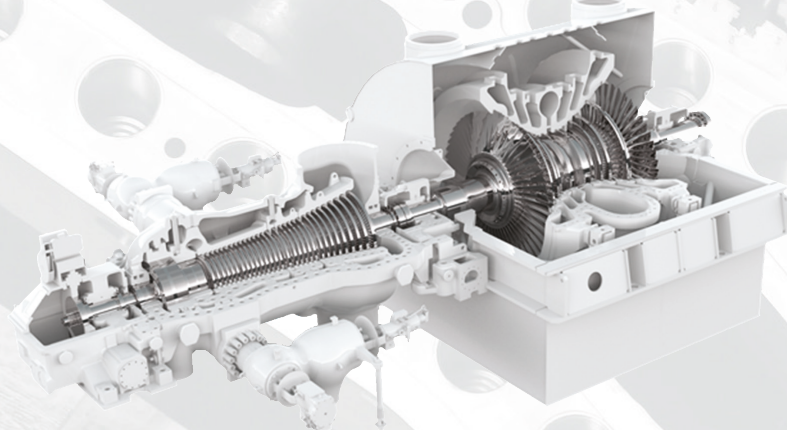
Solutions/Upgrades

- Steam turbine capacity enhancement
- Maintenance and operation optimization
- Entire unit replacement
- Steam turbine rehabilitation
- Auxiliaries renovation
- Control systems improvement (transition from analog to digital)

Repair

The majority of repairs and field activities are completed on-site at the Customer's location. Necessary repairs and/or improvements are completed at our Genoa (Italy) Repair and Manufacturing Facility.

If required, our Abu Dhabi Repair Workshop and Middle East Service Hub (MESH) in Dubai (UAE) can support repair activities with a network of qualified local suppliers.



MT20: non-reheat combined cycle application.

On-site capabilities

- Machining repairs
- Balancing and alignment assessment
- Blading path assessment and repairing
- Blades replacement
- Rotor straightening
- Hot parts assessment

Machining, such as rotor journals lathing, including metal spray to recreate original diameters, main valves tooling (seats), and coupling holes honeying, is possible thanks to fully skilled mechanics/operators and a wide set of portable equipment, such as:

- Drilling machine
- Lathe
- Vertical Turning Lathe
- Line boring
- Horizontal boring and milling

In addition, a special diagnostic tool (Phased Array probes), in-house designed and developed, allows us to get a fast evaluation of rotor free-standing Last Stage Blades, to guarantee safe operation or replace blades before failures should occur.

Maintenance

Steam Turbine Shaft Line provides every type of revision and servicing: from a short inspection to a major overhaul, covering the machine, its auxiliaries (steam seal system, lube oil system) and the control systems, regardless of the technology and the manufacturer.

Pre-outage activities:

- Elaboration of the Scope of Works (SOW)
- Inspection and Test Plan (ITP)
- Planning Elaboration
- Pre-outage meetings
- Method Statement
- Risk assessment
- Tools preparation
- Spares definition

Minor inspection

- Observations during operation: check of safety devices, visual inspection of L-0 blades

Medium inspection

- Accurate observation and check performed of:
- Steam turbine bearings
 - Stop and control valve (main, reheat and third admission)
 - LP last-stage blades
 - Accessible turbine components (endoscopic examination)
 - Turbine control system, oil pumps

Major inspection

- Comprehensive examination of the entire turbine. It includes the opening of all turbine casings



On-site activities:

- On-site mobilization
- Turbine dismantling
- Fact Finding / NDT (Non-Destructive Testing)
- NC (Non-Conformances) report and resolution
- Failure analysis / Trouble shooting
- Remedials implementation
- Turbine re-boxing
- Low-speed in-situ balancing
- Start-up assistance
- On-site demobilization

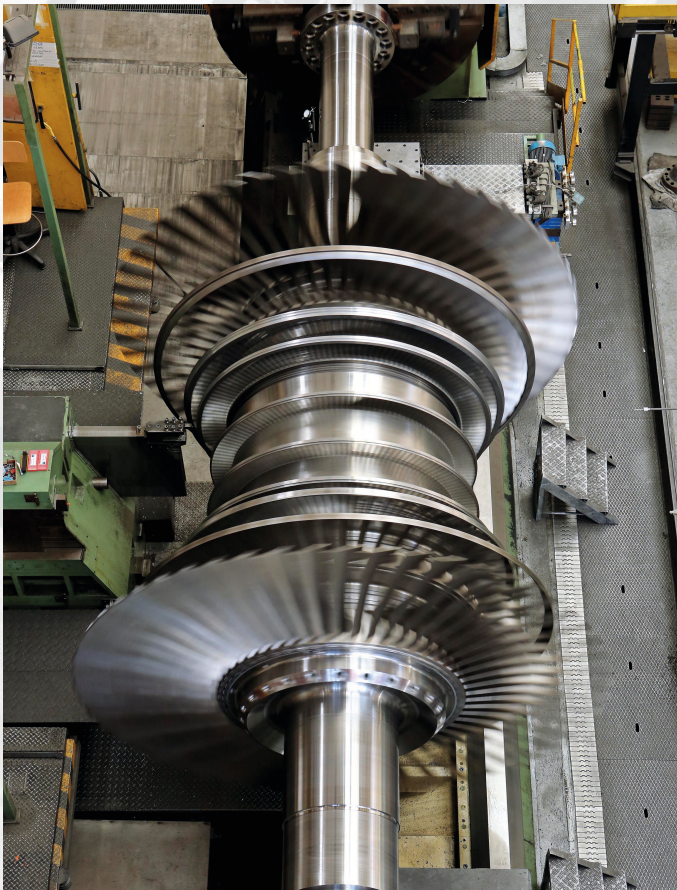
Post-outage activities:

- Final Report
- Engineering feedbacks
- TIL (Technical Information Letters)

In case of fault, fast intervention to diagnose the extent of the issue, a troubleshooting RCA (Root Cause Analysis) and repair are included in the offered services.

Diagnostics

Ansaldo Energia is leader in developing tools and methods to check the operation of steam turbines and to assess the state of mechanical components. Our portfolio includes different tests and analysis aimed to minimize maintenance cost and increase availability of the plant, avoiding the risk of unplanned outages.

**Non-Destructive Testing:**

We continuously develop specifically tailored Non-Destructive Testing (NDT) of the turbine components, in order to avoid long and expensive dismantling of components. We offer high reliability and repeatability of the tests, as well as reduced analysis time.

Life Assessment:

We provide a number of tests to analyze the expected remaining life of capital and strategic components, such as casings and rotors, as well as the characterization of material exposed to high temperature and thermal cycles.

Remote Monitoring:

Ansaldo Energia monitors the health of steam turbine cycles 24/7 by the remote acquisition of vital parameters. The acquired data and specific feedback are returned to the Operator to provide for planning and predictive intervention and optimize the list of necessary spare parts.

Integrated Plant Support

Our Integrated Plant Support (IPS) increases reliability and availability of your steam turbine, while improving plant efficiency and flexibility. The Remote Monitoring & Diagnostics centres of Genoa (I) and Abu Dhabi (UAE) offer:

- 24/7 experts support for data analysis and supervision of plant parameters
- Troubleshooting, event analysis, recommendations through ADA (Advanced Diagnostic Analysis) system for vibrations analysis and Distributed Control System (DCS) connection

Long Term Service Agreements

Ansaldo Energia provides Long Term Service Agreements (LTSA) that incorporate optimized outages planning, state-of-the-art technologies, skilled permanent monitoring and best-in-class expertise in a customizable format which allows:

- Anticipation of technical issues
- Optimization of scheduled and unscheduled interventions and inspections.
- Optimization of spare parts management
- Supply, installation and commissioning of upgrades
- Maintenance and operation day-by-day

Parts

As a Steam Turbine OEM, we manufacture and continually develop capital parts and all other spares, including new blades and welded rotors of large size.


Leveraging today's capacities with a history of knowledge and technological agreements with different manufacturers, Ansaldo Energia is able to supply a wide spectrum of parts for third parties' machines.

As needed, Steam Turbine Shaft Line is able to rapidly implement a Reverse Engineering process, based on a team of well-proven experts in the design of parts and equipped with up-to-date tools for 3D scanning and prototyping.



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