SST-500 Steam Turbine
Up to 100 MW

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SST-500 Steam Turbine

Overview

The SST-500 is a single casing, double flow condensing turbine, which can be used as an entire drive or as the low-pressure module of a multiple-casing turboset, directly driven or geared. The turbine is ideal for the handling of large steam volume flows and has the flexibility to operate over a wide range of speed and power.

The SST-500 represents a solution based on long experience of industrial steam turbines, covering industrial applications such as:

- Pump drive (e.g. feedwater pump for large boilers)
- Generator drive
- Compressor drive
- Combined heat & power (CHP or cogeneration) applications
- Waste to energy, e.g. waste incinertors
- Applications which use waste heat, e.g., in steel works or in the chemical/petrochemical industry where waste heat from chemical processes can be used
- Geothermal power plants (SST-500 GEO)

Example for a turbo generator layout of a SST-500 GEO
SST-500 – design features

The SST-500 turbine is a condensing turbine, designed with two steam inlets. The steam flows into the turbine by means of two tangential inlets to equalize thermal and blade stress. Emergency stop valves and control valves are installed in the steam inlet pipes.

Operational flexibility

The steam flows tangentially into the inner casing and then axially to both exhausts. The customized design of the steam path ensures optimized efficiency and reliability. Double-end drive is available, if required, e.g. for booster pump drive.

Designed for reliability

The utilization of selected proven components assures high reliability and easy maintenance. The rotor is made from a single forging. The moving blades with integral shrouds are made from 13% chromium steel. The twisted last stage blades are precision-forged or milled, depending on the blade size. The leading edge of the last two blade rows is flame or laser hardened. The material, manufacturing method and profile of the blades maximize operational reliability.

Labyrinth glands are used to prevent air leakage into the condenser. The sealing steam connected to the inner gland chambers can be controlled manually or automatically as required. The journal bearings are of double-wedge or tilting pad type. The axial position of the rotor is maintained by a double-sided tilting pad axial bearing.

Turbine generator arrangement

The SST-500 turbines are designed for elevated installation on a turboset foundation or a separate skid to a condenser or exhaust piping. One common condenser or two separate condensers can be used. The turbine is supplied assembled on a base frame, or in components, depending on the size. The oil system is installed on a separate skid. In case of a base frame installation, all instrumentation is pre-wired to junction boxes or a local cubicle and installed on the base frame.

Design features

- Proven
- Modular
- Compact
- Proven, customized steam path for optimized reliability with low steam parameters
- Throttle-controlled
- With or without uncontrolled extractions

Customer benefits

- High reliability / availability due to use of proven components
- High efficiency
- Suitable for variable speed mechanical drives
- High standard of quality
- Remote diagnostic system
- Fast and early layout planning
SST-500 GEO for Geothermal Plants

The SST-500 GEO is a derivative of the SST-500 turbine family, optimized for the demanding conditions of geothermal steam cycles. It can be used in geothermal applications with superheated direct steam, single flash or dual flash, offering an outstanding reliability, flexibility and economy of operation.

The SST-500 GEO combines the proven casing and turbine-generator package of the Siemens SST-500 and SST-600 steam turbine with a number of special geothermal features and steam path technologies developed, tested and applied in the geothermal after-market.

Customized Geothermal Steam Path

Each turbine is designed uniquely for the particular resource conditions by adapting the blade path within the standardized casing. Like all Siemens geothermal turbines, the SST-500 GEO is designed with a robust impulse type steam path. At the same time, the inlet nozzles and stop and control valves are sized to suit the steam pressure and mass flow.

Corrosion-resistant materials

The materials of all steam path components are specifically selected according to the particular conditions and the specific steam chemistry of the application to resist corrosion and corrosion-related cracking.

Special Adaptations:

- Materials selection optimization is resource and turbine stage specific.
- LP blades are continuously coupled; HP blades are integrally shrouded.
- Where required, rotor surfaces are coated or IN625 weld cladded.
- All rotor and blade fillets are of generous, low stress design.
SST-500 GEO Design Features:
- Robust impulse design and generous clearances result in sustained efficiency and high reliability
- Proven steam path for optimized reliability with low steam parameters
- Table top installation – down exhaust (up could be possible)
- Advanced highly effective moisture removal techniques
- Ease of maintenance due to inlets in casing lower half

Blades
- Integral shrouds (continuous coupled) to lower alternating stress and resist corrosion-assisted fatigue
- Brazed or laser applied Stellite alloy on last stage
- Modern airfoil shapes to improve turbine efficiency
- Widely spaced nozzles to resist fouling from deposits
- Modern dovetails that reduce peak stress and resist stress corrosion cracking

Materials
Special material selection to meet geothermal specific steam chemistry and to resist corrosion attacks and corrosion-assisted fatigue cracking:
- 12 Cr steam path in the diaphragms
- 2% Cr integral forged rotor; 12% Cr optional
- X-15 & 17-4 blades standard, Titanium and Inconel optional
Mounting the SST-500 turbine on a separate base frame or on the common frame with gearbox enables easy transportation and installation of the turbine at site. The core turbine arrives ready assembled together with the electrical installation, which substantially shortens the time needed for fitting on the foundations as well as connection of the turbine's I&C systems into the plant circuit.

All turbine components are thoroughly tested during the manufacturing process. SST-500 features such as a horizontal split of the inner and outer casing, independently accessible bearings etc. ensure easy and rapid maintenance. Additionally, the SST-500 guide blade carriers enable easy maintainability or further modifications of the steam path. The guide blades are fastened in the inner casing or blade carriers to allow easy and rapid replacement.

Proven Maintenance Concept
Our proven installation and maintenance concept lowers maintenance cost by enabling easy access to the installed components – the turbine, gearbox, generator and auxiliaries. Our service solutions are based on long experience of taking care of a substantial global fleet. This experience is incorporated systematically into our design and manufacturing as well as our service and maintenance practice, making Siemens a reliable partner now and in the future. We are able to provide comprehensive spare-part service, repairs and maintenance solutions designed to increase the reliability and availability of the plant. Our retrofit solutions return turbines to the state of the art even after a normal operating life. Long-term maintenance contracts assure prolonged plant operation at predefined costs.

Remote monitoring
As all SST-500 and SST-500 GEO turbines are prepared for remote monitoring, Siemens offers service contracts for condition-based maintenance, customized for the specific operating status of each machine to reduce outage and overhaul costs. Using the remote monitoring technology, customers are able to get fast telephone advice and secure remote support, online help, advanced troubleshooting and intervention, provided by specialist personnel who know the plant's design and understand its operation.

Reference examples

**Shanghai, China:** Four SST-500, each 19.4 MW, are installed in the coal-fired Waigaoqiao power plant for booster pump drive.

**Neurath, Germany:** SST-500 turbines drive the feed water pumps of the coal-fired units F and G.
SST-500 technical data
- Power output 50 or 60 Hz, up to 100 MW
- Speed range up to 15,000 rpm
- Live steam conditions
  - Pressure up to 30 bara / 435 psia
  - Temperature up to 400°C / 750°F
- Bleeds up to 2 at various pressure levels
- Exhaust steam conditions:
  - Condensing ≤ 1 bar / 14.5 psi

SST-500 GEO technical data
- Power output 50 or 60 Hz, up to 120 MW
- Speed: direct drive (3000 / 3600 rpm)
- Live steam conditions
  - Pressure up to 15 bara / 218 psia
  - Temperature up to 250°C / 482°F
- Exhaust steam conditions
  - Condensing up to 0.4 bara / 5.8 psia