

MAPNA GROUP

TUGA

MAPNA Turbine Engineering and Manufacturing Company

MST-50 Steam Turbines



Introduction

The MST-50 steam turbine is used in dual-pressure combined cycles up to 200 MW. The compact design of this turbine, which consists of a single cylinder containing high/medium and low pressure sections (HP and LP) brings about major competitive advantages including reduced manufacture and maintenance costs, especially in structure and foundation. Other notable features of this series of steam turbines are:

- Ability to be installed and used in turbine halls with high and low ceilings
- Axial/downwards design of the outlet steam path to achieve maximum efficiency and optimized arrangement

Specifications of MST-50/1600, as an example of turbines designed and manufactured in this range, are as follows:

MST-50/1600 Steam Turbine

Knowing the time, money and effort that must be spent on maintenance and overhauls, most customers are eager to buy machines that are robust enough to withstand difficult working conditions and still be able to keep on making electrical power. MST-50/1600 has been designed to meet these requirements with fewer overhauls and more availability. High performance, cleaner power, reliability and simplicity are among the other characteristics of this product, producing 159 MW in combined cycles.



Product Specifications

No.	Parameters	Unit	Value
1	Gross Power Output*	MW	160
2	CCPP Efficiency*	%	52 (with 2 x MGT-70(3))
3	Shaft Speed	rpm	3000
4	Main Steam Flow	kg/s	134
5	Main Steam Pressure	bar	90
6	Main Steam Temperature	°C	520
7	LP Steam Flow	kg/s	18
8	LP Steam Pressure	bara	8.5
9	LP Steam Temperature	°C	230
10	Back Pressure	bara	0.14
11	Max. Allowable Back Pressure (Trip Value)	bara	0.5
12	Application	-	Combined Cycle Power Plant
13	Frequency	Hz	50
14	Weight (Core Turbine)	tonnes	159
15	Dimensions (Length×Width×Height)	m	6.7 x 4.7 x 5

* Standard ISO Conditions

Advantages

- One common outer casing for HP and LP sections
- Shrouds for all the stages of blading, allowing the increase of mechanical and vibrational strengths
- Spring-backed seal segments to eliminate the likelihood of rotor damage in potential presence of friction
- Single outer casing with HP inner casing to minimize heat loss
- Integrated stop and control valves in a single body
- Laser-hardening on the last stage blades for minimal erosion
- High resistance to increased condenser pressure
- Water hood spray decrease windage effects
- Electro-hydraulic actuator for main, supply and bypass valves
- Fully-automated turbine operation to minimize operator errors
- Self-aligned bearing design compatible with any rotor train alignment
- Deep part load operation



Other Features

Highly Resistant to Windage

In case of windage, total number of 9 water spray nozzles in two stages are embedded to lower the exhaust steam temperature so that the turbine can operate at small MCR percentages with no time restrictions. The nozzles come into operation sequentially depending on the exhaust steam temperature.

LP Blades Resistant to High Condenser Pressure

Thanks to the shrouded last stage blades, the steam turbine is highly resistant to condenser pressures of up to 0.5 bar. This is a great bonus if the condenser is not able to maintain the required vacuum mainly during startup and/or in undesired ambient conditions. The shrouds help the long blades to have less flutters due to flow separation.

Hardened Last Stage Blades Surface

The steam passing through the last stage blades contains a certain amount of water droplets which can cause erosion effects. To minimize this, surface hardening is performed using laser beams on a specific portion of the rotary blade surface.

Bearing Dismantling Without Casing Removal

The condenser-side journal bearing can be dismantled through an opening on the exhaust casing without the need to remove the casings. This characteristic is mostly valuable during maintenance, as it rids the customer of the extra effort of dismantling the casing.

Main and Standby Lube and Lifting Oil Pumps – More Availability

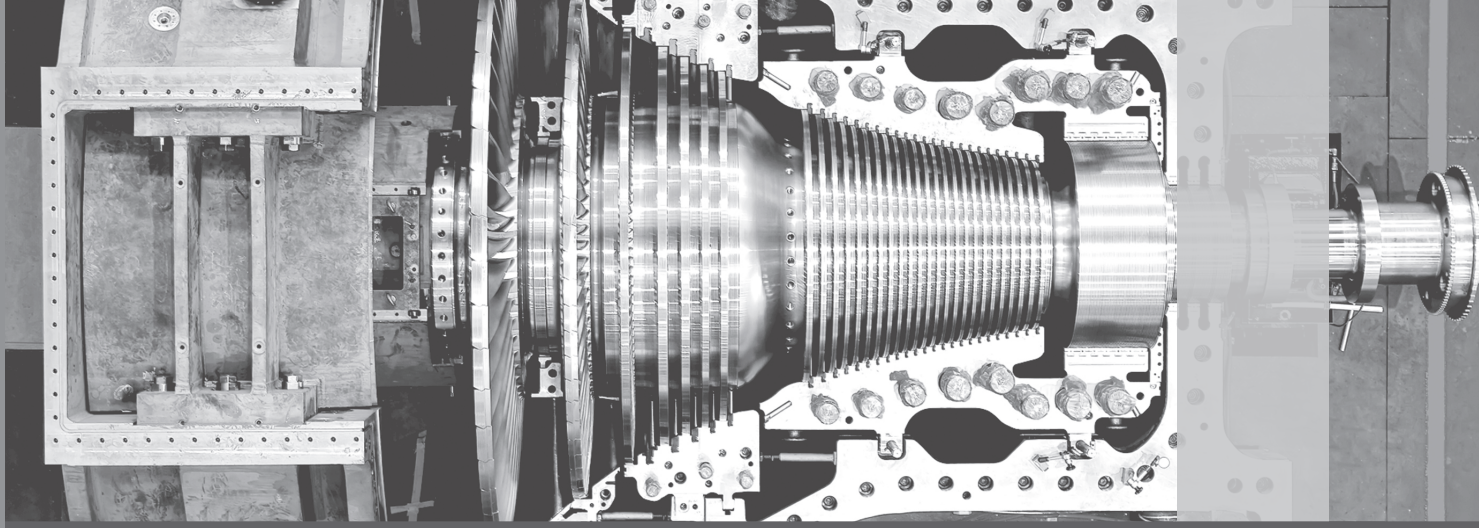
Two 100% oil pumps serve as a safety feature and ensure that the turbine does not run without oil in low and high rotor velocities. The pumps are driven by AC motors.

Minimal Steam Admission Losses

The integrated design of the stop and control valves in a common body eliminates the entering losses. Moreover, the full arc passage upstream from the blading has a special curve that prevents pressure drop. This arc is formed half in the rotor and half in the inner casing.

Shrouds for All the Blades

All turbine blades have shrouds that improve mechanical and vibrational strengths. The shrouds



accommodate seal strips of labyrinth and see-through types depending on the amount of relative thermal expansions of the rotor and casings. The shrouds of the last two stages of rotary blades have a small gap in between in standstill conditions. At full speed, this gap fills in to form a solid ring that allows for higher blade mechanical strength. This keeps the blades' natural frequencies safely far from the working speed. This contributes to a safe change in condenser pressure without causing harm to the blades.

Optimum Design of the Last Stage Blades

The final stages of the LP turbine section are grouped in standardized stages. The difference in rotational speed between blade root and tip accounts for the twisted design of the rotary blades.

Units in Action

Excellent performance of the MAPNA steam turbines has been proven in different power plants. As of the end of 2018, around 8000 MW power units have been put into operation by MAPNA with this machine. Damavand 2800 MW combined cycle power station is the largest plant in the region constructed by MAPNA, which includes 6 steam turbines of this type operating in the same location since 2008. Tishreen, Jandar and Rumaila combined cycles in Syria and Iraq are among the overseas plants that use the MST-50/1600 machine.

Services Offered After Sales

Compared with other machines operating at the same output level, the simplicity of the MST-50/1600 design facilitates the overhaul procedure, allowing for minimum operational delay. The first minor inspection takes place after 25000 EOH of the turbine. The first major inspection or overhaul is recommended after 100,000 EOH. This demonstrates the turbine's high level of availability and reliability. Thanks to the two provided boroscopic holes on the top of the outer casing, the last stage HP blades and first stage of LP ones can be inspected visually while the rotor is rotated by the manual turning gear.

In special cases, an inspector can even enter the turbine via the opening on the exhaust casing through which the condenser-side bearing is normally mounted and dismounted. In this case, the inspection can take place without removing the casings. This enables the inspector to check closely for any probable damage to the last stage rotary blades.

In addition, MAPNA Turbine Company offers the following services after sales.



Provision of spare parts for turbine and auxiliaries

Our own manufacture, as well as reliable network of spare parts suppliers enables us to satisfy individual client demands, including capital spares, as per order.

Fast-track supply of spares

Our spacious warehouses and continuous production of the machine allow us to supply spare parts at short notice. In addition, by providing consumable materials and strategic components from our production line, we can quickly assist clients in case of unpredicted or sudden outages and overhauls.

Long-term supply and support agreements

We offer long-term contracts for various types of support and service.

Supervision with installation and commissioning

Installation and commissioning of turbines and auxiliaries are performed by skilled personnel under our direct supervision. Personnel can also be made readily available on and off the client site until the end of the guarantee period of the last unit in the power plant.

Technical consultation services for end users

Our experienced and knowledgeable technical and engineering team is available for consultation at any time.

Training of end-user staff

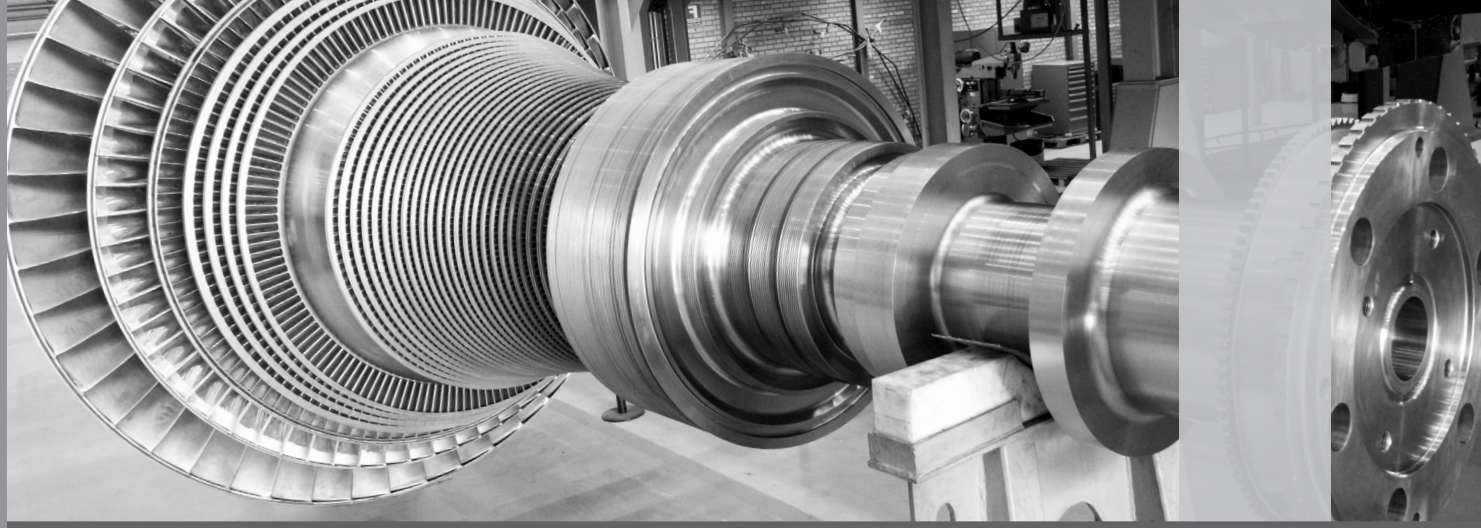
We offer several training courses for new staff on site, such as general power plant knowledge, operation, maintenance, and some special training, such as firefighting.

Performing inspections and overhauls

Our experienced maintenance personnel can perform turbine inspections and overhauls thoroughly.

Fabrication and repair of turbine special parts

Thanks to our state-of-the-art machineries and skilled manufacturing personnel, we can provide fabrication and repair of special parts for our MST-50/1600 machines.



Execution of performance test

We have already executed and assisted performance tests of many MST-50/1600 units.

Research and Development

Customer needs and new markets are what drive our investment in research and development. MAPNA Turbine (TUGA) is now heading towards more diversity in products as well as improving flexibility and efficiency of the plant for different applications and requirements. Our development programs aim towards the goal of offering a diverse portfolio that provides value for our customers.

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