

Gas turbine power stations based on gas turbines rated at 32 MW



Package supply of power equipment

Gas turbine power stations based on MS5002E PIP gas turbine rated at 32 MW

CJSC "REP Holding" is a leading Russian power engineering company, a manufacturer and supplier of new-generation power equipment. It performs engineering design, manufacture and package supply of power and electrical equipment for gas, oil, metallurgical and chemical industry, power generation and integrated power grid.



MS5002E GTU produced by REP Holding

REP Holding offers manufacture and supply of packaged equipment for gas turbine power stations based on gas turbines rated at 32 MW.

Gas turbine power unit rated at 32 MW

Description

Gas turbine power plant rated at 32 MW is a high-tech power equipment package developed and produced by CJSC "REP Holding" for operating conditions of any complexity .

The high-tech simple-cycle gas turbine power plant GTP-32 is built based on the MS 5002E (PIP) gas turbine engine. It is produced by REP Holding under the license of GE Oil & Gas (Nuovo Pignone S.p.A.) and features high efficiency (37%), prolonged service life, high availability and repairability, low level of harmful emissions (NOx<18 ppm).

The main equipment of the plant is unitized to the greatest possible extent and is completed by modular blocks.

Purpose and Field of Application

• The power unit is designed for generation of electric and thermal power;

• It is used at combined heat and power stations (CHP) or Central Heating and Power Plants (CHPP);

• As an option, it can be completed with a heat recovery boiler for concurrent generation of electric and thermal power (co-generation);

• GTP-32 is installed in the main building of the power station or in an individual easy-to-assemble hangar-type building. If necessary (in case of reconstruction) an alternate arrangement of the plant in the existing buildings can be considered.

GTP-32 parts

GTP-32 incorporates the MS 5002E PIP gas turbine engine produced under the license of GE Oil & Gas (Nuovo Pignone S.p.A.), as well as the main and auxiliary equipment developed and manufactured by REP Holding.

- MS5002E PIP gas turbine (GT) (under the license of GE);
- Turbo-generator (TG) for GT;
- Gear box to transmit power from the GT to TG;
- Filter house;
- Heat-recovery boiler (if necessary);
- Fuel gas booster compressor (if necessary);
- Air and gas ductwork;
- Automatic process control system (APCS);
- Electric equipment.



Configuration of the main equipment for GTU – CHPP (Central Heating and Power Plant) rated at 64 MW

1. Gas turbine power plant; 2. Generator with the air cooling system; 3. Oil air-cooler; 4. Exhaust pipe; 5. Air ducts for cycle air and air cooling system; 6. Filter house; 7. Waste - heat recovery boiler

GTP-32 advantages:

- high reliability based on modern design practices and technologies applied in the design of the main element gas turbine engine;
- service life no less than 200 thousand hours;
- prolonged time between overhauls no less than 48 thousand hours (when operating at base load on standard gas fuel);
- the highest electric efficiency in its class;
- high economical efficiency of the plant in various operating modes;
- component parts mainly from Russian manufacturers with a high share of those made by REP Holding (overall packaging, licensed GTE, electric equipment, automation, support systems, piping, metal structures, engineering, service maintenance). The level of the GTP-32 production localization – 95 %;
- a possibility to repair on the Customer's site. The GTU design makes it possible to perform service maintenance on site, without dismantling and shipment to the Manufacturer's facility;
- quick replacement of the GTE owing to lateral roll-out.

Package supply of the equipment by REP Holding provides:

- reduction of the main and auxiliary equipment costs as the major part of it is manufactured directly at production facilities of CJSC «REP Holding»
- application of modern technical solutions
- operating costs reduction
- maximum operational reliability of all the parts of the gas turbine power plant
- reduction of the equipment delivery time
- full package of service maintenance

General technical data

The main technical characteristics of the gas turbine (MS 5002E PIP) (at ISO nominal conditions)

Description	Unit	Value
Shaft power	MW	33.77
Turbine efficiency	%	37.0
Exhaust gas flow	Kg/s	102.5
Exhaust gas temperature	oC	518
Pressure ratio	-	17.4
Fuel gas flow (Q _{pH} =50000 kJ/kg)	kg/s	1.825
Gas generator rotor speed, maximum	rpm	7500
Output shaft speed, nominal	rpm	5714
Emission (at 15% O_2 in dry combustion products):		
- nitric oxide	mg/m^3	≤40
- carbon oxide	mg/m°	≤38
Overall dimensions of the engine (LxWxH)	t	17.5 x 4.4 x 4.7
Mass of the gas turbine unit on the base plate	t	70
Dry mass of the engine with the auxiliary base plate (without enclosure and piping)	t	132
Specified service life	h	20000
Time between overhauls		48000

Gas turbine engine parts:

Compressor:

 Axial, 11 stages, variable IGV and variable guide vanes assemblies of 2 stages

- Casing with a vertical split

Combustion chamber:

- Sectional, with 6 liners
- Dry low emission system DLN-2
- 5 fuel burners in each liner with a premix system

Gas generator turbine:

- Axial, two stage
- Monochrystal 1st st. rotor blade
- Cooled nozzles and blades with protective coatings

Free turbine

- Axial, 2-stage, without cooling

In terms of design the MS 5002E PIP consists of two modules: gas turbine proper on its own base plate and auxiliary base plate with all the systems supporting the GTE operability mounted on it: starting system, oil supply system and fuel system. Lube oil of Tn-22C type is allowed for use.

1 – Compressor ; 2 - Combustion chamber;

3 – HP turbine; 4 – Free turbine (LPT)



The GTE module with inlet/exhaust ducts (on the left) and auxiliary base plate (on the right) on the REP Holding production site

To reduce the noise level and to provide heat balance the GTE and the auxiliary base plate are covered with the noise-proof and heat-insulating enclosures that are also designed for arrangement of the lighting system, instrumentation and el. equipment required to provide the system functioning.

1. MS 5002E PIP turbo-unit on its own base plate

2. The auxiliary base plate with the starting, oils supply and fuel systems

3. Noise-proof and heat-insulating enclosure of the GTE

4. Noise-proof and heat-insulating enclosure of the auxiliary base plate





Configuration of the MS 5002E PIP consisting of the turbo-unit and auxiliary base plate with noise-proof and heat-insulating enclosures

Performance

The gas turbine power unit can be operated at the ambient air temperature from -55 to +50 °C.

Description	Unit	Value
Output at generator terminals	MW	32.7
Electric efficiency	%	35.8
Exhaust gas flow	kg/s	102.5
Exhaust gas temperature	°C	518
Fuel gas flow rate (QpH=50 MJ/kg)	kg/s	1.825

The GTES-32 parameters at the ISO nominal conditions



Climatic characteristic of GTP-32 The values at 100% correspond to the nominal parameters













Development of the MS5002 family turbine







GTP - 32, side view



GTP - 32, front view



GTP - 32, top view

Reference List of GPA-32 "Ladoga" based on MS5002E GTU

Delivery sites

Compressor stations of gas trunk lines "Bovanenkovo-Ukhta", "South Stream" and other reconstruction and new construction projects of OAO "Gazprom".

The total volume of supplies for OAO "Gazprom" within the period from 2009 to 2014:

- 38 GPA-32 "Ladoga" units driven by MS5002E GTU
- 26 GPA-32 "Ladoga" units have been shipped to the compressor stations of the 1st and 2nd lines of the "Bovanenkovo-Ukhta" gas trunk line and to the sites under reconstruction, 13 units are in operation
- since December 2013 the installation of the units has been started at CS "Russkaya", "South Stream" gas trunk line.



GPA-32 "Ladoga" at CS-8 "Chikshinskaya", "Bovanenkovo-Ukhta" gas trunk line

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