



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



Package supplies of power equipment

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Gas Turbine Power Stations based on licensed MS5002E gas turbine rated at 32 MW

JSC "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.

32 MW Gas Turbine Unit

Gas turbine power plant rated at 32 MW is a high-tech power equipment package produced by "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 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 (36%), prolonged service life, high availability and repairability, low level of harmful emissions ($\text{NO}_x < 18 \text{ ppm}$).

GTU-32 fully conforms with Russian GOST R 29328-92, "Gas Turbine Units to Drive Electric Generators".

Purpose and Field of Application

- The power unit is designed for generation of electric and thermal power;
- It can be used at electric power plants, combined heat and power stations (CHP) or Central Heating and Power Plants (CHPP);
- GTU-32 can be used in Open Cycle and Combined Cycle, with HRSG and steam turbine or just a heat recovery boiler for heat production;
- GTU-32 can be installed in the main building of a power station or in an individual easy-to-assemble hangar-type building.

GTP-32 parts

GTP-32 incorporates the MS 5002E 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 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.

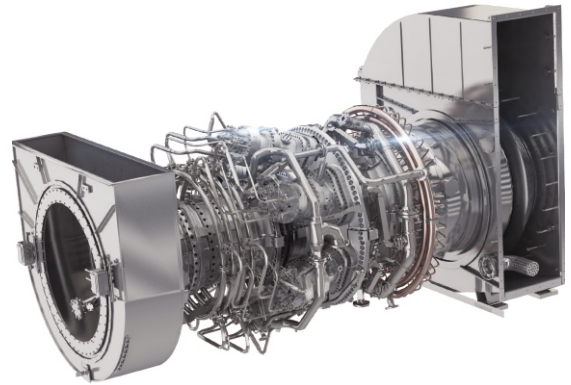


Configuration of the main equipment for GTU – CHPP (Central Heating and Power Plant)

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 advanced design and technologies of its main element, i.e. gas turbine engine;
- service life – no less than 200 thousand EOH;
- extended time between overhauls - no less than 48 thousand EOH (when operating at base load on standard gas fuel);
- highest electric efficiency in its class;
- high economic effectiveness of the plant in various operating modes;
- possibility to repair GT at the Customer's site, without dismantling and shipment to the Manufacturer's facility;
- quick replacement of the GTE owing to lateral roll-out.



32 MW Gas-Turbine Engine,
3D Model

Package supply of the equipment by REP Holding provides:

- optimal layout solutions
 - 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

General technical data

The main technical characteristics of the gas turbine at ISO nominal conditions

Description	Unit	Value
Shaft power	MW	32,0
Turbine efficiency	%	36,0
Exhaust gas flow	Kg/s	102,3
Exhaust gas temperature	°C	508
Pressure ratio	-	17,0
Fuel gas flow ($Q_{PH}=50000$ kJ/kg)	kg/s	1,78
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 ³	≤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	200000
Time between overhauls		48000

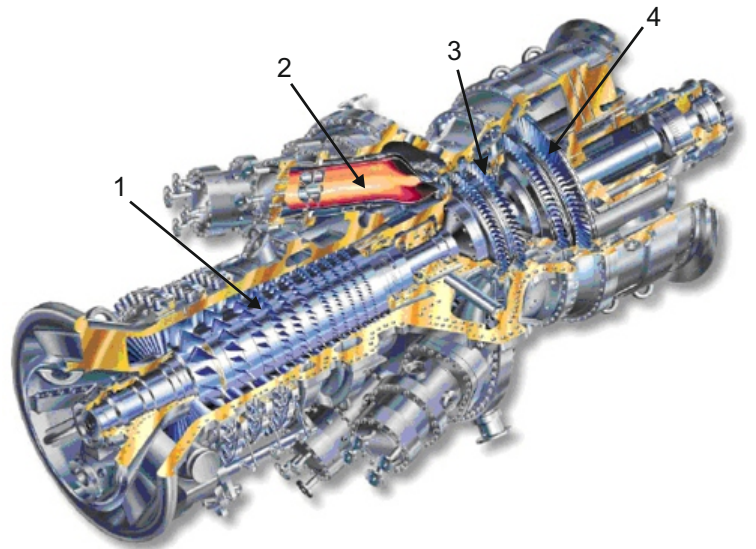
Gas turbine engine parts

Compressor

- Axial, 11 stages, variable IGV and variable guide vanes assemblies of 2 stages
- Casing with a vertical and horizontal splits

Combustion chamber

- Sectional, with 6 liners
- Dry low emission system DLN-2
- 5 fuel burners in each liner with a pre-mix system
- Equipped with flame detectors and ignition devices



1 – Compressor ; 2 - Combustion chamber;
3 – HP turbine; 4 – Free turbine (LPT)

Gas generator turbine

- Axial two-staged, with optimized 3D profiling
- Cooled nozzles and blades with protective coatings

Free turbine

- Axial, 2-stage, without cooling
- Uncooled shrouded nozzles and buckets

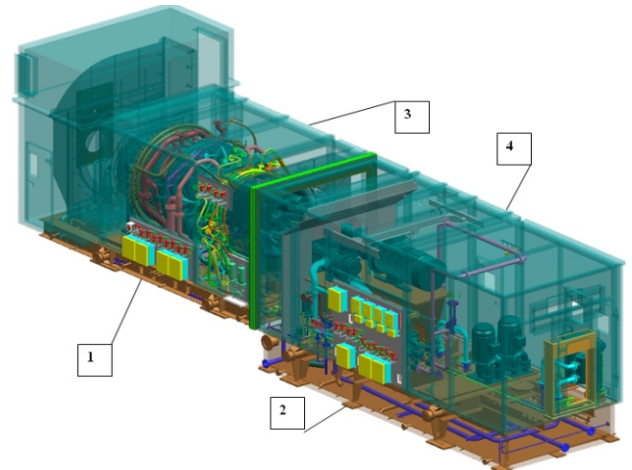
Due to the design the MS 5002E consists of two modules: gas turbine proper on its own base plate and auxiliary base plate with all the systems supporting the GTE operability mounted on it. These systems include starting system, oil supply system and fuel system. Lube oil of Tn-22C type is allowed for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



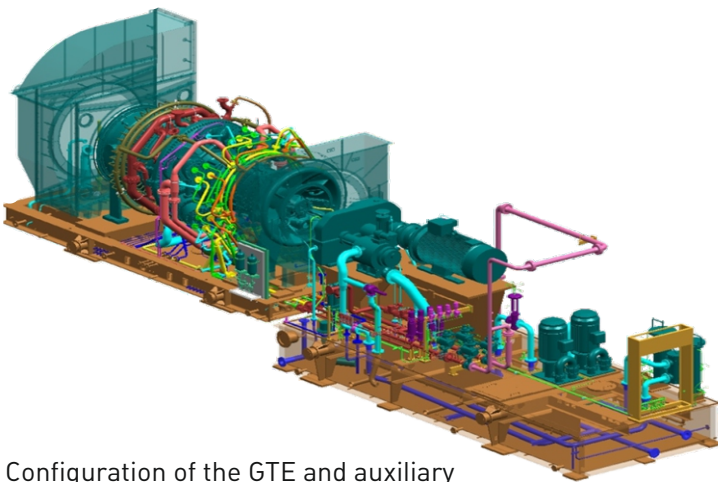
The GTE module with inlet/exhaust ducts (on the left) and auxiliary base plate (on the right) on the REP Holding production site

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. Enclosures are equipped with fire-fighting and explosion safety systems, gas and fire detectors.

1. MS 5002E turbo-unit on its own base plate
2. Auxiliary baseplate with gas turbine engine support systems:
 - starting system with electric motor and disengaging clutch
 - oil supply system
 - fuel supply system
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 consisting of the turbo-unit and auxiliary base plate with noise-proof and heat-insulating enclosures



Configuration of the GTE and auxiliary base plate (with enclosure removed)

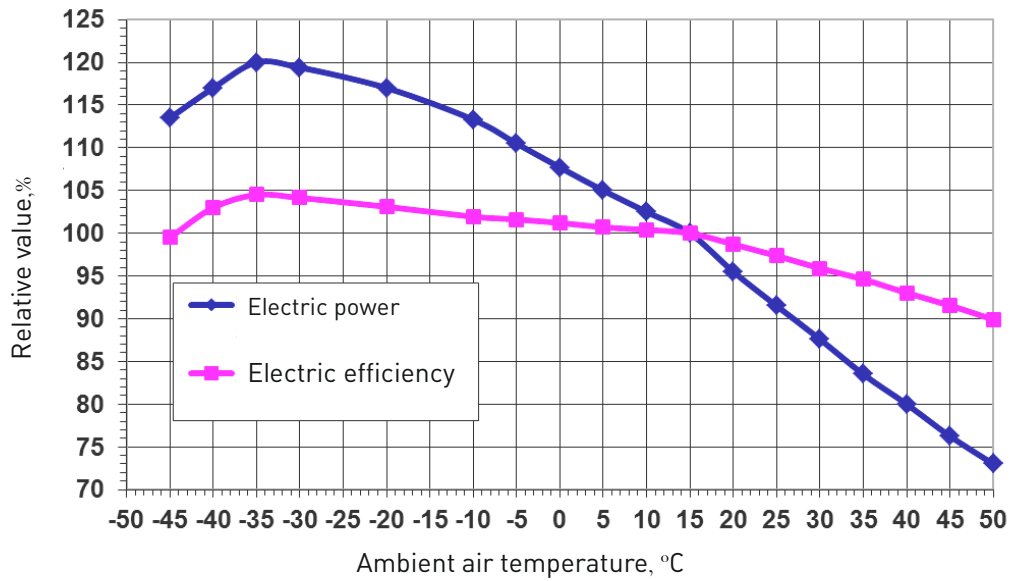
Performance

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

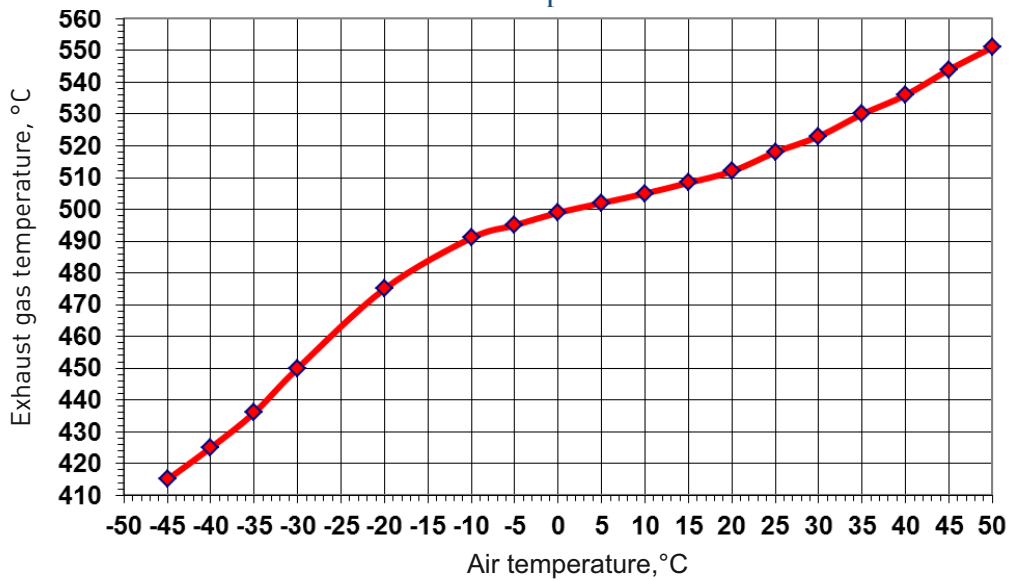
The GTES-32 parameters at the ISO nominal conditions

Description	Unit	Value
Output at generator terminals	MW	31.0
Electric efficiency	%	35.0
Exhaust gas flow	kg/s	102.3
Exhaust gas temperature	°C	508
Fuel gas flow rate ($Q_{pH}=50$ MJ/kg)	kg/s	1.77

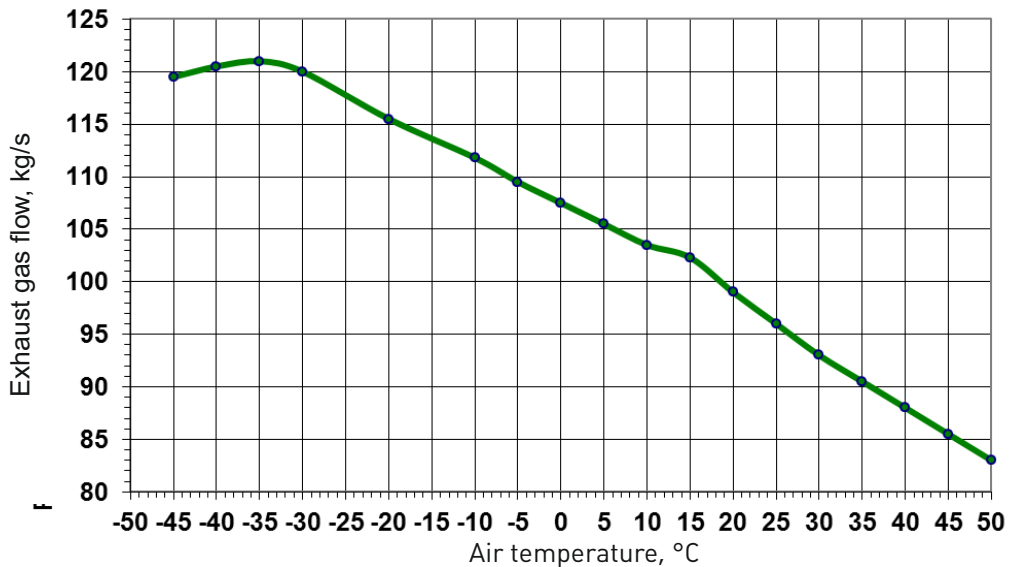
Climatic characteristic of GTU-32
 The values at 100% correspond to the nominal parameters



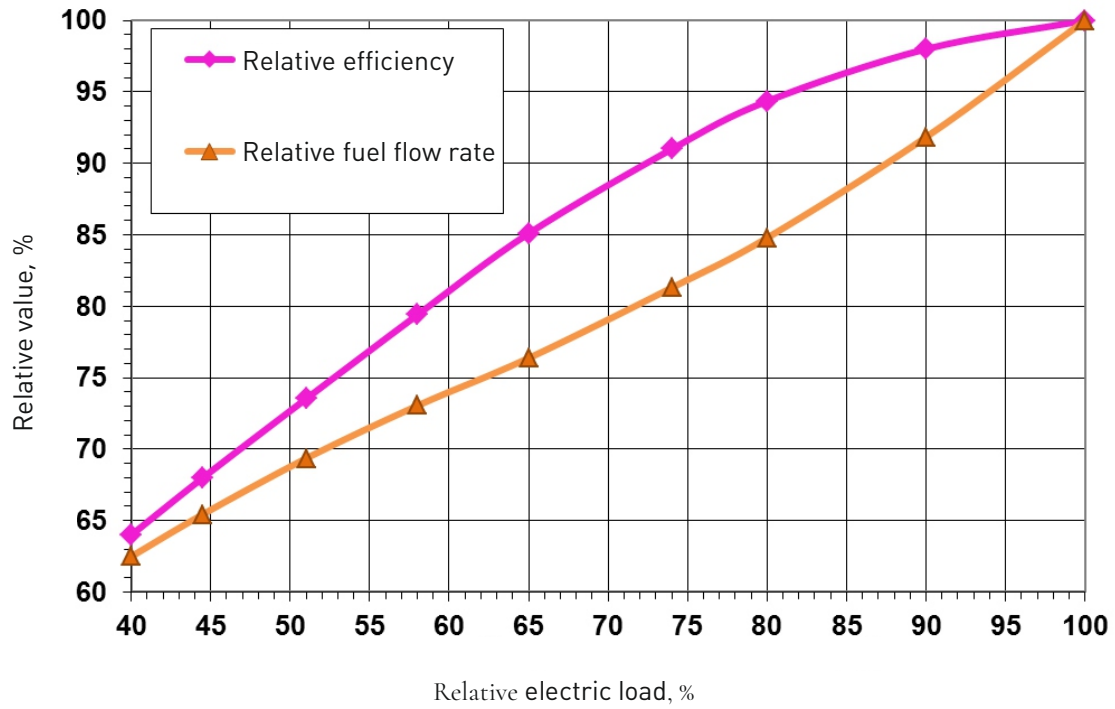
Climatic characteristic of GTU-32
Exhaust temperature



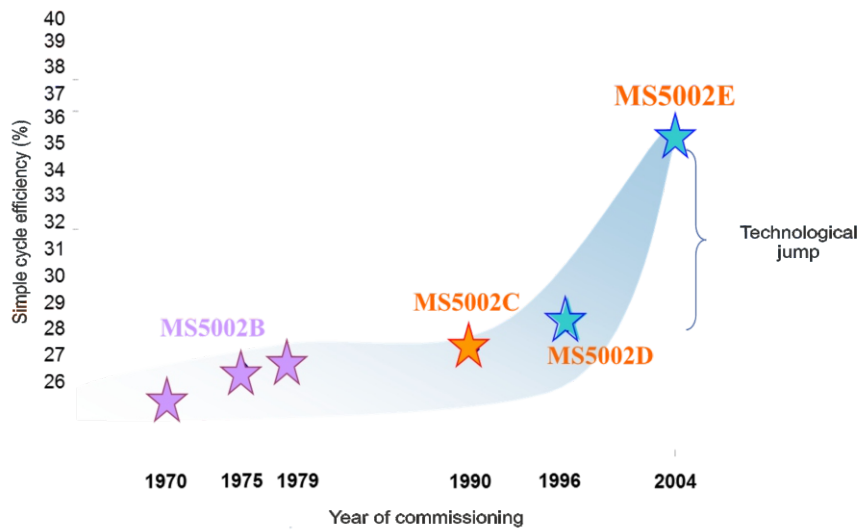
Climatic characteristic of GTU-32
Exhaust flow



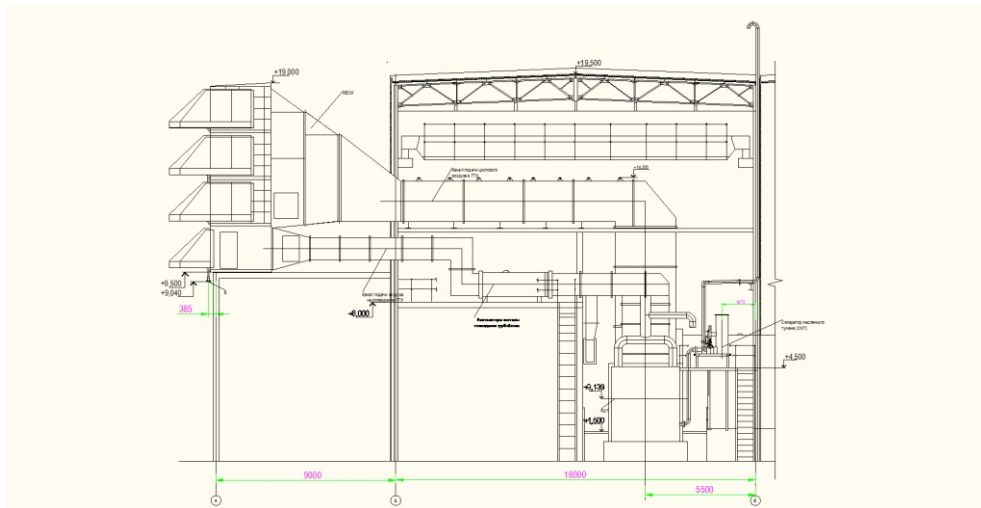
Performance characteristic of GTP-32 (t=15°C)
The values at 100% correspond to the nominal parameters



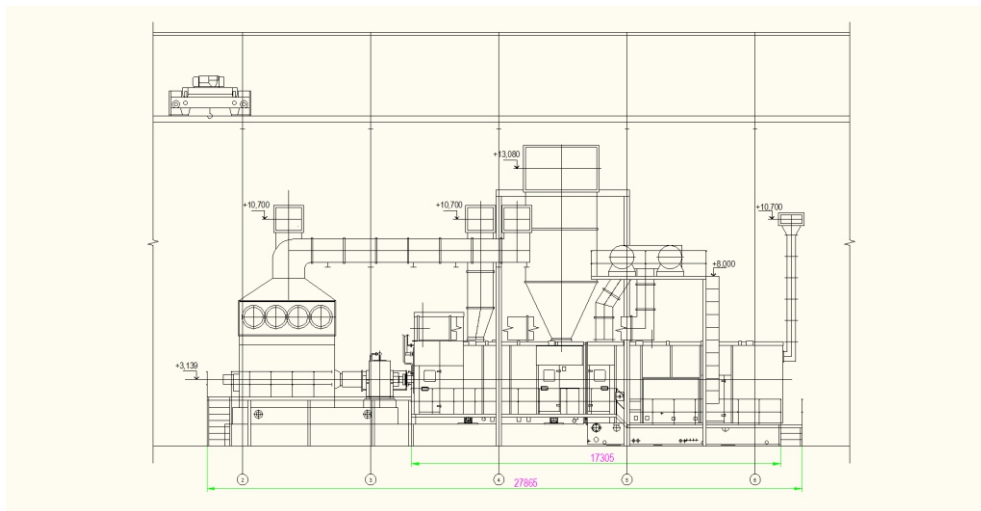
Development of the MS5002 family turbine



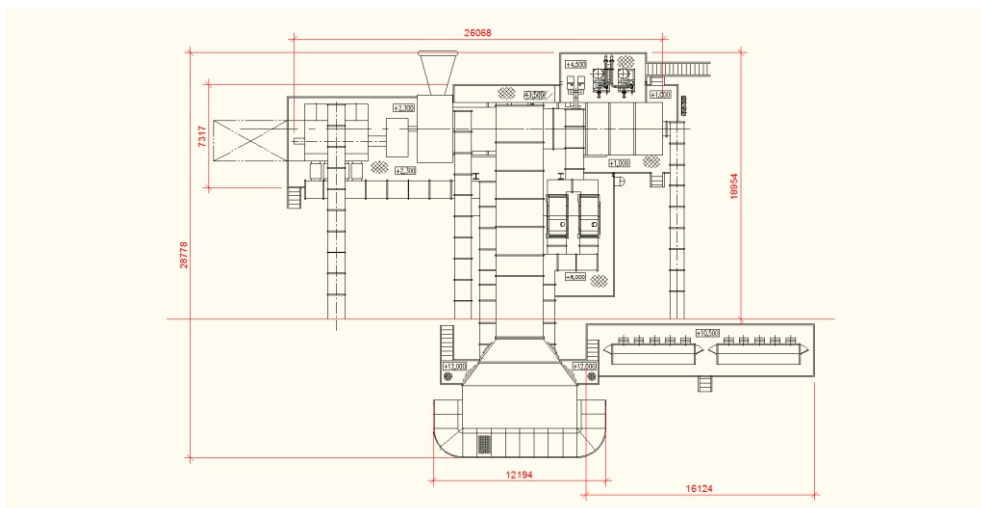
Configuration of the main equipment for GTU-32 power unit



GTU - 32, side view



GTU - 32, front view



GTU - 32, top view

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

GPUs-32 "Ladoga" are widely used in Oil&Gas reconstruction and new construction projects. To date, 71 units have been manufactured at REP Holding production facilities. They are being successfully operated at Russian compressor stations: on the gas trunk line from Yamal Bovanenkovo field to Ukhta, on reconstruction sites - the "Gryazovets" and "Vavozhskaya" stations, in particular. Within the frame of existing contracts the units are being utilized in the following construction projects: "Power of Siberia" gas trunk line and Amur GPP, the "Sakhalin-2" project, "Turkish Stream", "Novy Port", CS "Portovaya" LNG, etc.

Type of equipment	Client	Delivery site	Qty, units	Year of manufacture
GPU-32 "Ladoga"	Gazprom	Reconstruction of Pilot Compressor Station at the CS "Gryazovets"	1	2009
GPU-32 "Ladoga"	Gazprom	Reconstruction of the CS "Vavozhskaya"	1	2010
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-8 "Chikshinskaya", compressor department 1	1	2010
GPU-32 "Ladoga"	Gazprom	Reconstruction of the CS "Vavozhskaya", department No. 1, gas pipeline Yamburg-Tula-1	1	2011
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-8 "Chikshinskaya", compressor department 1	3	2011
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-9 "Maloperanskaya", compressor department 1	4	2011
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-6 "Intinskaya", compressor department 1	2	2011
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-6 "Intinskaya", compressor department 1	2	2012
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-7 "Syninskaya", compressor department 1	4	2012
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-6 "Intinskaya", compressor department 2	3	2013
GPU-32 "Ladoga"	Gazprom	CS "Russkaya", "South Stream" gas pipeline	5	2013
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-7 "Syninskaya", compressor department 2	3	2014
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-9 "Maloperanskaya", compressor department 2	3	2014
GPU-32 "Ladoga"	Gazprom	Gas trunk line Bovanenkovo-Ukhta, CS-8 "Chikshinskaya", compressor department 2	3	2014
GPU-32 "Ladoga"	Gazprom	CS "Russkaya", South Stream gas pipeline	2	2014
GPU-32 "Ladoga"	Gazpromneft	CS "Novy Port"	4	2015
GPU-32 "Ladoga"	Gazprom	CS "Russkaya", "South Stream" gas pipeline	7	2015
GPU-32 "Ladoga"	Gazpromneft	CS "Novy Port"	4	2016
GPU-32 "Ladoga"	Gazprom	CS-7-A "Zeyskaya", the "Power of Siberia" project	3	2017
GPU-32 "Ladoga"	Sakhalin Energy Investment Company	Sakhalin-2	3	2018
GPU-32 "Ladoga"	NIPI NG Peton	LNG production, storage and shipment Complex, CS "Portovaya"	2	2018
GPU-32 "Ladoga"	Gazprom	Nord Stream 2 gas pipeline, Slavyanskaya CS	4	2019
GPU-32 "Ladoga"	CPECC	Amursky GPP	6	2019
Total			71	

*As of January 2020

JSC "REP Holding"
51, Lit. AF, Obukhovskoy Oborony pr.
Tel.: +7 (812) 372 58 80; +7 (812) 372 58 81

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