

GE gas turbine

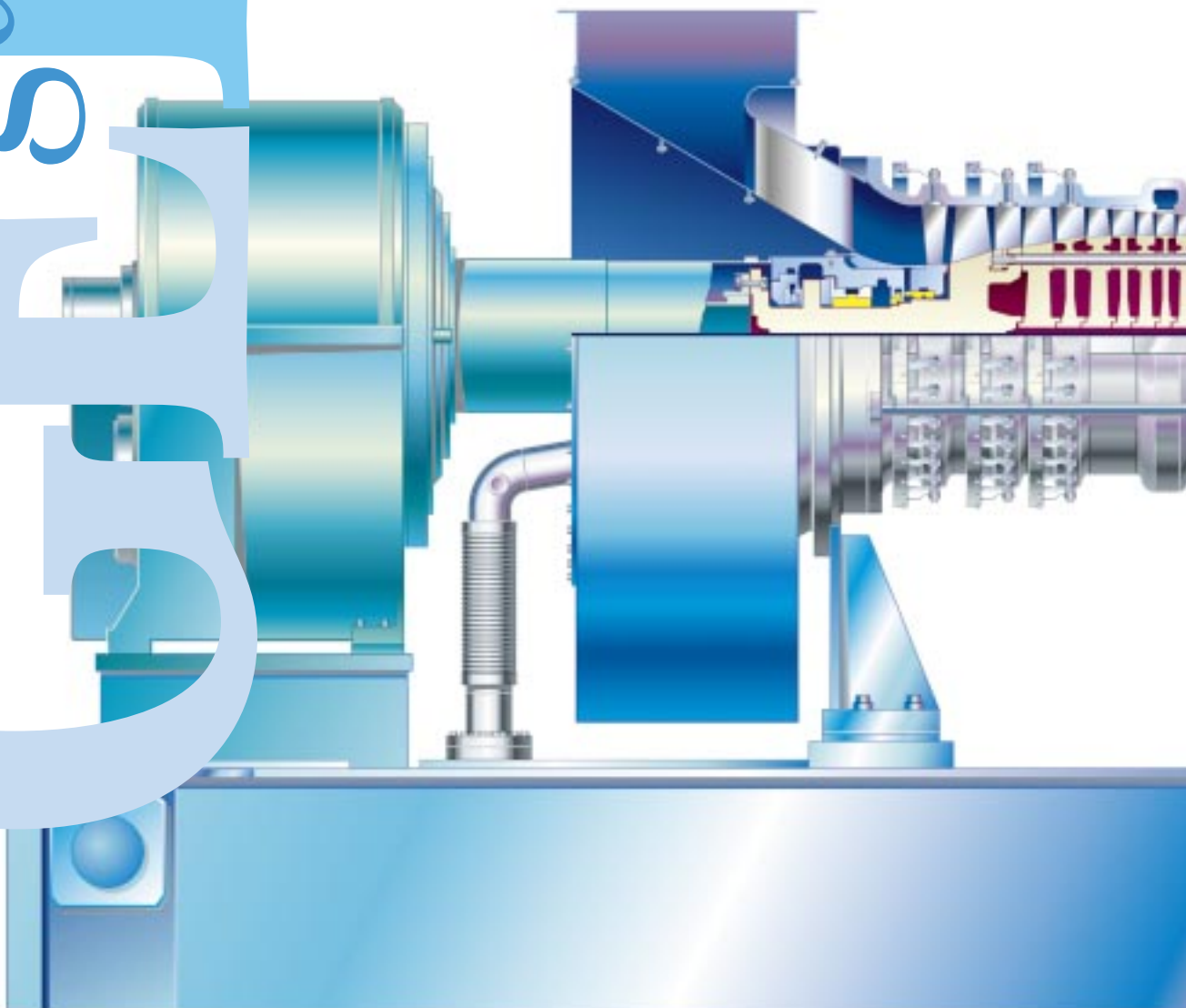
The GE 10 is a 12 MW range heavy-duty gas turbine available in both single-shaft and two-shaft versions. It is the evolution of the field proven PGT10A and incorporates the latest in aerodynamic design in a compact and versatile package arrangement. The design of the GE10 has been highly refined based on the extensive experience gained operating in all types of environments. There are over one hundred units running under conditions raging from the cold of Alaska and Siberia to the heat of the desert and the humidity of the tropics. Its efficiency and operational flexibility make the GE10 a cost-effective choice for all applications.

Engine Characteristics

The gas turbine consists of an 11-stage, high flow compressor coupled, for the two-shaft version, to a high speed, single-shaft HP turbine and for the single-shaft version, to a single-shaft HP turbine.

For generator drive applications (single-shaft), the GE 10 is a compact turbogenerator for combined cycle and cogeneration applications. It has an axial discharge of hot gas for use in a HRSG for steam cycle utilization where space is limited.

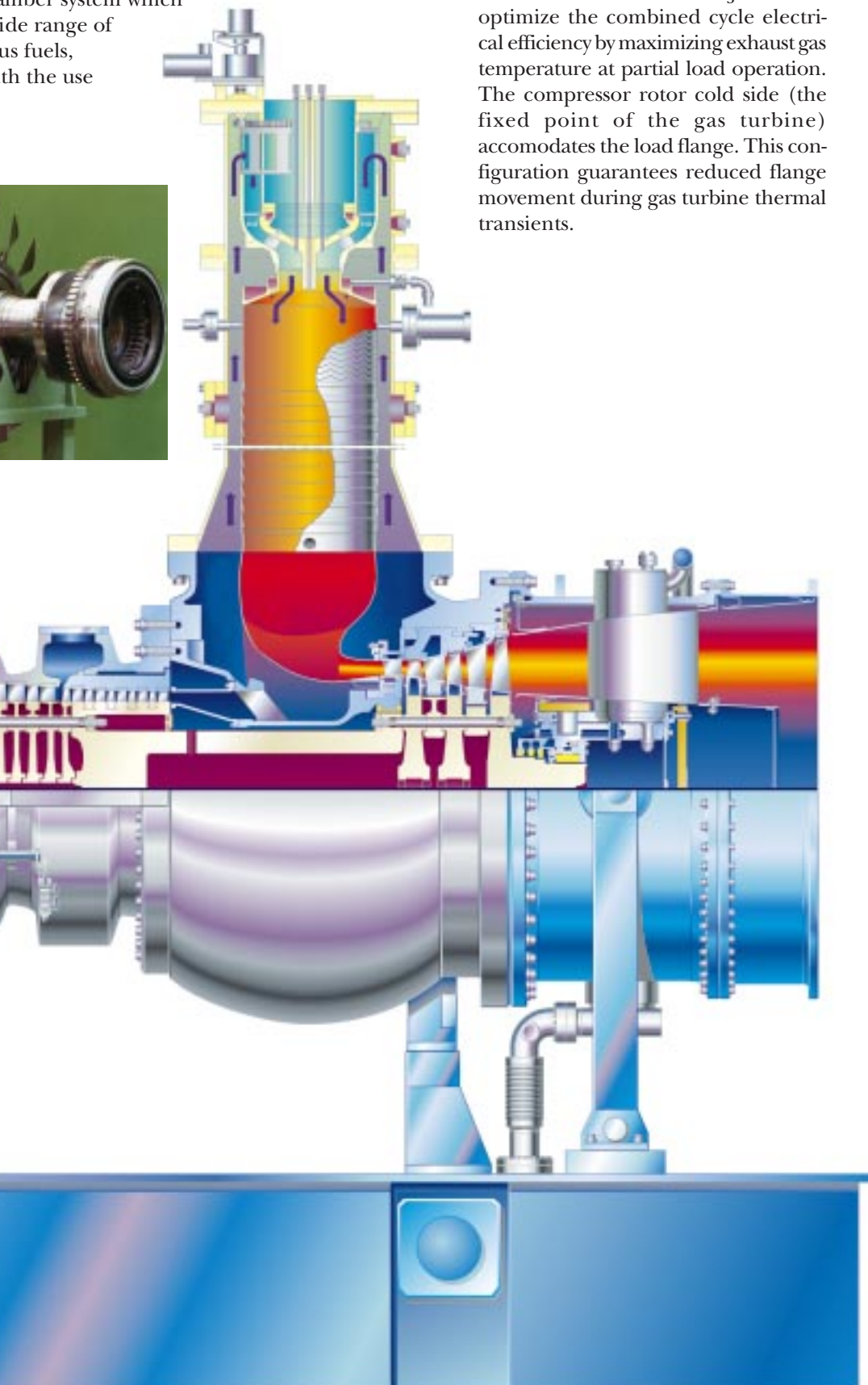
The GE 10 has a single combustion chamber which is rugged, reliable and able to burn a wide range of fuels, from liquid distillates to all gaseous fuels including low BTU gas and residuals with the aid of a special combustion system.



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Compressor

The compressor uses a high performance, eleven-stage axial flow design with a 15.5:1 pressure ratio and transonic flow conditions derived from GE Aircraft Engine aerodesign technology. The rotational speed is 11000 rpm with a mass flow of 47 Kg/s. The first three rows of stator blades are adjustable to optimize the combined cycle electrical efficiency by maximizing exhaust gas temperature at partial load operation. The compressor rotor cold side (the fixed point of the gas turbine) accommodates the load flange. This configuration guarantees reduced flange movement during gas turbine thermal transients.

Turbine

The GE10 is available in both single and two-shaft configurations.

Single-shaft version. The single-shaft version is used primarily for power generation applications. The turbine consists of three reaction stages. The first two-stages use the proven design of the previous PGT10A HP turbine; cooling is provided by air bled from the axial compressor. The second and third stages have interlocked shrouds to limit tip leakage and blade vibrations.

Two-shaft version. The two-shaft version is used primarily for mechanical drive applications. The turbine consists of four reaction stages. The first two stages or High Pressure Turbine are used to drive the axial compressor and are cooled by air bled from the axial compressor. The Low Pressure Turbine is a double stage, high-energy turbine, with variable first stage nozzles, which allow maximum flexibility for mechanical drive service.

Lubrication and Bearings

The on-base integrated lubrication system feeds the gas turbine, the speed reduction gear and the driven equipment. The lube oil tank is integral with the gas turbine baseplate; the main lube oil pump is mechanically driven by the gearbox. An AC electric motor driven pump guarantees pre-post lubrication during normal operation; a DC electric motor driven pump is provided for emergency backup. In the standard package configuration, the oil is cooled by an air cooler; a water cooler can be provided upon customer request. The thrust and journal bearings are of the tilting pad type.

Combustion

The combustion system consists of a single, slot-cooled combustion chamber assembly that permits easy maintenance of the hot gas path. This combustion chamber is able to burn a wide range of fuels, from liquid distillates to residuals, to all gaseous fuels, including low BTU gas, with the use of a special combustion system.

Emission Control

The GE 10 combustion system is available in both conventional and in DLE configurations. GE Oil & Gas Nuovo Pignone's dry low emissions system guarantees operation at 25 ppmv NO_x with a simple, field proven design. Ongoing combustion system development will deliver further reduction of emission levels in the future. The GE 10 can also utilize steam and water injection for NO_x reduction and power augmentation.

Starting System

The starting system can be electro-hydraulic or VFD driven.

In the first case it consists of an hydraulic motor driven by high pressure oil supplied by an AC motor driven pump. If black start-up capability is required, the pump can be driven by a diesel engine.

For VFD, a variable frequency MCC drives an AC motor.



GE 10 Control System

The GE 10 control system implementation is standardized to assure a high degree of integration between the turbine and the generator package. Programmable modules simplify implementation of control and protection requirements to tailor the control system to the application needs.

Package GE10-2

The GE10-2 package is designed specifically for mechanical drive applications and is optimized to minimize plant dimensions and to reduce maintenance cost and time. In the standard configuration, the auxiliaries are installed on a separate baseplate permanently joined to that of the gas turbine to form a single lift on which the sound-insulated enclosure is mounted.

Package dimensions are:

$L \times W \times H = 11m \times 3m \times 3.9m$.

The other modules completing the supply are: the oil/air exchangers, the air intake filter chamber, the suction duct (vertical suction) and the exhaust system (axial exhaust). The enclosure guarantees a sound pressure level lower than 85 dBA at 1 m. The acoustic design meets ISO NR 50 limits at 100 m.

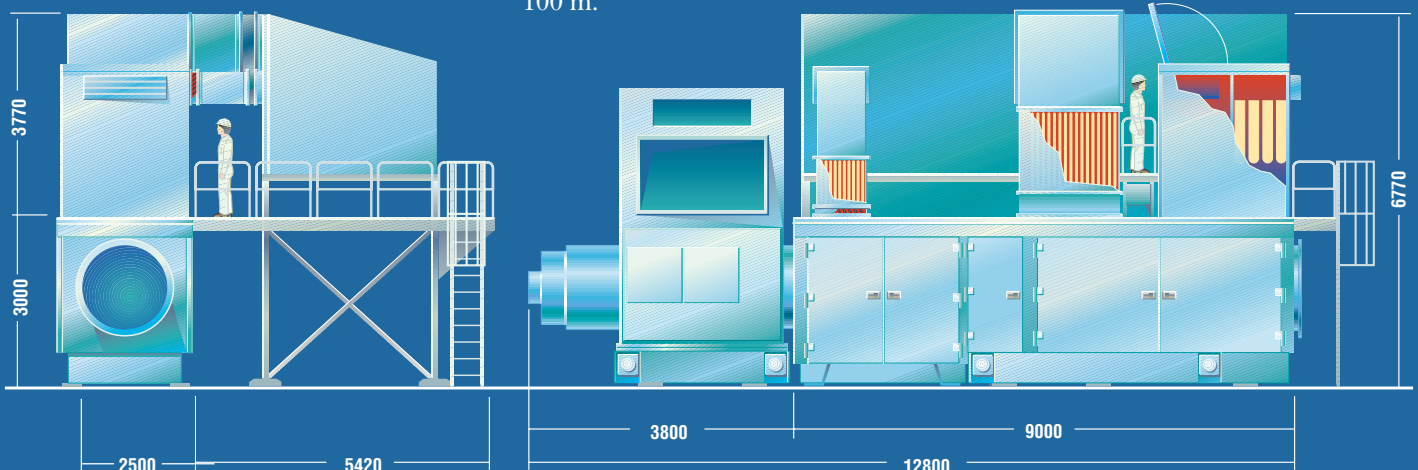
Package GE10-1

The GE10-1 package is designed specifically for power generation applications and is optimized, to minimize plant dimensions and to reduce maintenance cost and time, in the standard configuration, the speed reduction gear is mounted on the gas turbine baseplate. The auxiliaries are installed on a separate baseplate permanently joined to that of the gas turbine to form a single lift on which the sound-insulated enclosure is mounted.

Package dimensions are:

$L \times W \times H = 9m \times 2.5m \times 3m$.

The electric generator is installed on a concrete foundation to limit overall shipping dimensions. The genset overall length is about 13m. The other modules completing the supply are: the oil/air exchangers, the air intake filter chamber, the suction duct (vertical suction) and the exhaust system (axial exhaust). The enclosure guarantees a sound pressure level lower than 85 dBA at 1 m. The acoustic design meets ISO NR 50 limits at 100 m.



Global Services

The GE10 maintenance can be carried out both "on-site" or at an authorized workshop where the entire engine can be shipped while a lease engine may temporarily replace it at site. The engine is provided with borescope holes for periodic inspections of internals and the combustion chamber can be disassembled without the removal of any engine casing. Enclosure doors permit the engine to be removed without dismantling panels and a backup engine can be quickly installed to minimize plant shutdown times. GE Oil & Gas places the highest

priority on engineering & field assistance, in order to continuously upgrade our technology and tailored solutions & support each machine.

The Global Services Portfolio includes:

- Comprehensive training by highly qualified experts using a combination of traditional and modern interactive training materials and tools supplemented by our manufacturing, testing and repair facilities.
- Remote Monitoring and Diagnostics (RM&D) for accurate and continuous assessment of your equipment condition and maintenance planning to maximize your plant output. It is equivalent to having a

team of experts in your plant 24 hours a day, 7 days a week.

- A Customer Care Center for a direct link to GE Oil & Gas. Call any time to get technical support or information about products, offerings and orders.

- An inventory of GE Oil & Gas Services capital parts available to satisfy emergency needs, including complete module.

- GE Oil & Gas qualified regional service shop guaranteeing quality repairs and reducing turnaround time.

- Contractual Service Agreements, to supply at a predetermined cost and on a priority basis, maintenance services.

Applications



Some installations:
1 - Cremona (Italy)
2 - Florida (USA)
3 - Lucca (Italy)
4 - Odidi (Nigeria)
5 - Hidalgo (Spain)
6 - Nihhon Kogyo Kita (Japan)



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GE10

GAS TURBINE



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