

# Frame 9E 50hz Gas Turbine Generators 185 mw @ ISO

## Frame 9E 50 Hz GTG Overview Combined Cycle 10,000 total hours since Last Overhaul

### SCOPE OF SUPPLY

The Gas Turbine Scope of Supply for Frame 9E gas turbine generator packages includes the items listed below, subject to inspection & verification. Any items identified in the remainder of the Specification relevant to the contracted supply scope of the existing owners, which are not specifically brought out in this section also, is included in the Gas Turbine Scope of Supply under (III ) below.

#### **Gas Turbine:**

Manufacturer	:	GE Genuine
Quantity	:	1
Model number	:	PG 9171 E
ISO Rating	:	123.4 MW
Fuel	:	Dual – Natural Gas & Distillate
Scope	:	Fully packaged units
Sound Level control	:	85 db @ 1 meter
Control system	:	MK V Speedtronic
Starting device	:	Electrical

#### **Generator:**

Make	:	Brush Electric
Quantity	:	1
Nominal power	:	123.4MW
Nominal voltage	:	11 kV
Frequency	:	50 Hz
Power factor	:	0.85
Nominal speed	:	3000 r/min
Exciter	:	Brush-less Excitation (in accordance with National Electricity Code)
Cooling	:	Air cooled
Major items included :		

NOx Control by Water Injection – 42 PPM VD @ 15% O<sub>2</sub> - on Natural gas 65 PPM VD @ 15% on Distillate.

### **III SCOPE OF SUPPLY - GAS TURBINE AND AUXILIARIES**

#### **1. Gas Turbine Engine and engine compartment to consist of the following:**

A Base mounted, simple cycle, single shaft PG9171 - E Gas Turbine generally consisting of:

- Inlet Plenum
- Multistage, axial flow, corrosion protected compressor
- Modulating inlet guide vanes
- Compressor discharge air unit
- Fourteen chamber combustion system
- Dual ignition system
- Three (3) stage power turbine
- Vibration sensors. Seismic (velocity) type
- Thermocouples measuring critical turbine and load temperatures
- Thermocouples measuring bearing lube oil return temperatures
- Exhaust plenum
- Package integrated fire detection system and CO2 protection for the engine
- Special tooling and tackle kit for engine service
- Operation, parts and maintenance manuals for the engine

**2. Accessory systems and compartments to consist of the following:**

- A Heavy duty, oil filled, multi-shaft accessory drive gear case:
- Drive coupling to turbine shaft
  - Grease filled accessory couplings
  - Rotor turning device
- B Load coupling generally consisting of:
- Solid rigid non-lubricated type load coupling with hardware
  - Fabricated coupling safety guard with hardware
  - Full weather resistant enclosure for outdoor installation
- C Blank
- D On base, Natural gas fuel system.
- E On base, on line and off line compressor wash system with piping and nozzles .
- F Package integrated fire detection system and CO2 protection, for on base equipment
- G. Lubricating and hydraulic oil system generally consisting of:
- Engine driven main lubricating oil pump
  - Engine driven main hydraulic oil pump
  - Partial flow DC motor driven emergency lubricating oil pump
  - Full flow AC motor driven (2x100%) hydraulic oil pump
  - Full flow AC motor driven auxiliary lubricating oil pump
  - Dual filters and transfer valve for lubricating oil systems
  - Dual filters and transfer valve for hydraulic oil systems.
  - Two (2) 100% lube oil to water heat exchangers (water to Air fin-fan coolers for lube oil cooling, atomizing air pre-cooling and leg cooling, including circulating pumps, expansion tanks, piping etc. excluded from scope).

- 304 / 321 Stainless Steel feed piping
  - Flexible piping
  - Lubricating oil and hydraulic oil piping in accordance with ANSI B31 – 3 and applicable ASME welding requirements
  - Jacking oil pump
- H. 1000 liter Portable lube oil refining and purification system
- I. On base water, air, gas, and fuel oil piping conform to ASTI B31.3
- J. Electric starting system generally consisting of:
- Interface with Mark V Speedtronic turbine control system
  - Electric starting device
  - Torque converter
  - Drive coupling
- K. Electric components:
- All motors (except the main starting device) are Totally Enclosed Fan Cooled
  - Terminal boxes and interconnect wiring is installed with rigid metal conduit in accordance with NCC Class 1, Group – D, Division – 2 requirements
  - Dual compartment AC vent fans (common for gas turbine and accessory compartment)
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- L. Air Inlet System generally consisting of:
- Up and over orientation design
  - Support system
  - Transition piece from the inlet ducting to inlet plenum
  - Inlet bellows
  - Inlet ducting
  - Inlet silencing system within the inlet ducting
  - Access hatch
  - Air inlet filter system
  - Instrumentation
- M. Enclosures and Compartments:
- All Enclosures and Compartments are of outdoor weather resistant design and construction
- N. Off base full acoustical weather resistant gas turbine enclosure for outdoor installation limiting near field noise level to 85 db at 1 meter.
- O. Dual compartment AC vent fans (negative, common for gas turbine and accessory compartment)

P. Control Compartment:

- Mark V Speedtronic turbine control system
- Triple Modular Redundant (TMR) configured
- Engine control panel with interface and digital displays
- Engine vibration alarm with readout and trip
- Motor control center
- 125 VDC acid/lead maintenance free battery system
- Battery charger and DCDB
- Engine compartment and auxiliary compartment fire detection system
- Full weather resistant enclosure for outdoor installation

Q. Exhaust system consisting of:

- Side discharge point
- Expansion Joint

R. Engine compartment skid foundation hardware kit with drawings package

S. Borescope kit

T. Operation, parts and maintenance manuals for the engine auxiliary systems and accessories

U. Water injection system

**SCOPE OF SUPPLY – GENERATOR AND AUXILIARIES**

**1. Generator and generator compartment consisting of:**

- A. Base mounted, BRUSH ELECTRIC air cooled, two pole 15,000 VAC , 50 Hz. Class F insulation. Class B temp rise, armature and Rotor winding 0.85 Power Factor (Lagging)
- B. Generator generally consisting of:
- Foundation frame
  - Stator housing with top terminals
  - Direct coiled two – pole field with finger type amortisseurs
  - Rotor with generator air cooling fan
  - End shield bearing support
  - Elliptical journal bearings
  - Two vibration sensors. Seismic (velocity) type
  - Built in winding temperature – sensing devices
  - Operation, parts and maintenance manuals for the generator

**2. Accessory systems and compartments consisting of:**

- A. Mark V Speedtronic Turbine control panels generally consisting of:
- Triple modular redundant (TMR)
  - Auto/Manual synchronizing module with clock function
  - Generator over temperature alarm
  - Droop control
  - Load limiter
  - Generator vibration alarm with read out and trip
  - Electrical over-speed protection
  - Manual and pre-selected set points for generator loading
- B. Generator control panel generally consisting of:
- Generator control panel instrumentation
  - Digital multi-meter, generator
  - Digital multi-meter, bus
  - Exciter voltage and amp meter
  - Field voltage and amp meter
  - Watt/Var transducer into Mark V ( 4 – 20 MA)
  - Automatic voltage regulator (Digital type)
  - Generator control panel relays
  - Generator differential lockout
  - Under voltage bus
- C. Excitation in accordance with the National Electricity Code generally consisting of:
- Brushless type main exciter designed with slip rings for conventional rotor ground fault relay.
  - Brushless type auxiliary exciter
  - Interface with Mark V Speedtronic turbine control system.
- D. Full weather resistant enclosure for outdoor installation.
- E. Generator and system protection devices consisting of:
- Digital generator protection system
  - Generator differential detection
  - Current unbalance detection
  - Loss of excitation detection
  - Reverse power detection
  - Stator ground detection
  - Over voltage detection
  - Under voltage detection
  - Voltage transformer fuse failure detection
  - Detected system fault relay
  - Generator protection and grounding system
  - Generator Electrical protection equipment
  - Neutral grounding equipment

- Neutral grounding transformer with load resistor mounted in terminal enclosure
- F. Lubricating system generally consisting of:
- Generator bearing lube oil system
  - Prefabricated factory fitted lube oil piping
  - Armored flexible piping as permitted
  - Lubricating oil piping in accordance with ANSI B31-3 and applicable ASME welding requirements
- G. Ventilation system:
- Open circuit design
  - Cooling airflow ducting
  - Self-cleaning filters
- H. Package integrated fire detection system and CO2 protection, for the generator.
- I. Dual compartment AC vent fans (Negative, common for generator and accessory compartment).
- L. On base full acoustical weather resistant generator enclosure for outdoor installation limiting near field noise level to 85 db at 1 meter.
- M. Operation, parts and maintenance manuals for the engine auxiliary systems and accessories.
- N. On base Lightning protection materials.
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Complete combined cycle package, details @ site except as noted below & in the photo.

Steam Turbine: LCZ60-5.7/1.57/0.58

Steam Turbine Generator: QFW-60-2 60 MW , 50 hz

HRSG:: NEMS , Triple pressure







