

1 Scope, Limits and Exclusion of Supply

1.1 One (1) PG9171E Gas Turbine, Including:

1.1.1 PG9171E Gas Turbine Flange to Flange Module:

- Multi-stages, axial flow compressor
- Modulated inlet guide vanes
- Three-stages turbine
- Multi-chambers combustion system
- Single gas combustion system with standard combustors
- Ignition system with spark plugs and U.V. flame detectors
- Borescope openings for maintenance inspection
- Seismic type vibration sensors on bearing caps for protection
- Proximity type sensors for shaft line displacement monitoring
- Thermocouples for measuring exhaust temperature
- Thermocouples on bearing drains
- Thermocouples on bearing metal
- Exhaust plenums

1.1.2 Gas Turbine Auxiliary Module

- Starting and cooldown system with:
 - MV starting AC motor
 - Hydraulic torque convertor
 - Electro-hydraulic rotor turning device
 - Auxiliary gear box
- Lubricating oil system with:
 - Duplex lube oil filters
 - Duplex lube oil to water heat exchangers
 - Shaft driven main lube oil pump
 - Full flow AC motor-driven auxiliary lube oil pump
 - One (1) partial flow DC motor driven emergency lube oil pump
 - Lube oil tank
 - Lube oil mist eliminator with dual extraction fans

- Lube oil heater
- Hydraulic oil system with:
 - Shaft driven hydraulic oil pump
 - AC motor driven auxiliary hydraulic oil pump
 - Duplex hydraulic oil filters

1.1.3 Package Electrical Equipment Control Compartment (PEECC)

- Turbine control panel
 - including proximitors monitoring
- Local operator interface <HMI> server including: Desktop computer with 24" LCD display, Keyboard & mouse
- Dot matrix printer for local HMI
- ETHERNET interface to the plant DCS via <HMI>, GSM-TCP/IP protocol (local)
- Generator control, excitation, regulation and protection panel with:
 - One (1) digital automatic channel and one (1) digital manual channel
 - One (1) power circuit to feed the exciter field.
 - One (1) digital generator protection relay.
 - Automatic channel back-up
 - Power system stabilizer (PSS) system software
 - Modbus interface
 - Generator protection redundancy
 - Protection settings calculation
 - Generator gross output meter active and reactive power class 0.2 (could be located in the auxiliary cubicle if lack of space in the generator control panel)
- Unit AC/DC Motor Control Center, withdrawable type
- Unit AC/DC sub-distribution panel, non- withdrawable
- Auxiliary cubicle including:
 - Gas detection rack

1.1.4 Off-Base Unit Mechanical Auxiliaries

1.1.4.1 The Inlet Air System

- Up & forward orientation
- Up & side orientation

- Self-cleaning type air filter
- Ducting and inlet silencer
- Supporting steel structure

1.1.4.2 Air Process Unit (for Air Filter Cartridges Cleaning)

- One (1) dedicated air compressor system for pulse air system
- One (1) condensation air dryer, at the inlet of air tank
- One (1) air tanks, for filter cleaning

1.1.4.3 The Side Exhaust System

- 1.6 (5.2 ft) empty duct up to acoustical enclosure outlet
- Insulation under exhaust plenum

1.1.4.4 Gas Fuel Valve Station

- Gas fuel control valves
- Gas fuel speed ratio/stop valve
- Monitoring devices
- Gas fuel module vent system

1.1.4.5 The gas fuel supply forward skid

- Duplex coalescing filter, manual drain
- Heat insulation for duplex coalescing filter
- Shut off and vent valve skid, gas piloting system
- Heat insulation for shut off valve and vent valve skid
- Gas flow meter

1.1.4.6 Fire Protection for Gas Turbine Unit

- One (1) H.P. CO2 bottles rack, Inside a storage container with a ventilation system
- Unit fire protection panel installed in PEECC
- CO2 Bottle charge, HP CO2 bottles only for one CO2 concentration test with

cylinder valves not connected (range storage condition -18°C to 45°C)

1.1.4.7 One Compressor Washing Skid (only one set for this project):

- Water tank 7.5m³ stainless carbon steel
- Water washing pump
- An acoustical enclosure
- Detergent pump

1.1.4.8 88TK Turbine exhaust frame blowers (2×50%)

- 2*valve (one direction)
- 2*63TK
- Piping
- Enclosure

1.1.4.9 One (1) Single Fan Single Filter Oil Mist Eliminator

- Single Filter
- Single Fan
- Valve

1.1.4.10 Gas Turbine Packaging

- Lagging and enclosures
 - Enlarged acoustical enclosure around gas turbine and accessory compartments
 - Gas valves cabinet in the auxiliary compartment
 - Compartment ventilation and heating
 - Dual vent fans (2 x 100%)
 - Simple heating system (1 x 100%)
- Gas detection system
 - Turbine compartment
 - Gas valves cabinet
- Fire detection and protection system with:
 - Thermic detectors

1.1.4.11 Couplings

- Flexible gear (oil filled) auxiliary coupling
- Rigid load coupling

1.2 One (1) Generator Frame, Including

1.2.1 General Information

- Totally enclosed water-to-air cooled (TEWAC) generator
- Outdoor installation
- 50 Hz generator frequency
- Generator voltage 13.8kV
- 0.85 power factor (lagging)
- Class “F” armature and rotor insulation
- Class “B” temperature rise, armature and rotor winding
- Generator bearings
 - Bearing support
 - Hydrodynamic journal bearings
 - Roll out bearing capability without removing rotor
 - Insulated bearings at non drive end
- Monitoring Devices
 - Seismic vibration detectors
 - Two detectors at drive end, one at non drive end
 - Proximity vibration probes
 - Two probes per bearing at 45° angle
- Generator Field
 - Indirectly cooled field
 - Two-pole field
 - Fully interconnected amortizes winding

1.2.2 Generator Air Cooler

- Cooler assembly shipped separate
- Generator Air cooler configuration
 - Four (4) vertically mounted coolers
 - Coolers located on generator bottom
 - Cooler piping connections on side as viewed from non-drive end
 - Single wall cooler tubes

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- Raised cooler face flanges
 - Plate fins
 - Generator gas cooling system characteristics
 - Generator capacity with one section out of service 100% with Class "F" rise
 - Design cooler pressure - 6.9 bar
 - Coolant - water, containing up to 33% ethylene glycol by volume
 - Fouling factor 0.00009 m².°K / W (0.0005 hr.°F.ft² / BTU)
 - Generator gas cooler construction materials
 - 90-10 copper-nickel tubes
 - Carbon steel tube plates with epoxy or polyamide coating
 - Carbon steel water box and coupling flanges with epoxy or polyamide coating
 - Aluminum cooler tube fins

1.2.3 Generator Lube Oil Systems and Equipment

- The connections are located at left side of the generator view from the turbine end, at right side if you are looking from the collector end
- Bearing lube oil system
 - Generator lube oil system integral with turbine
 - Pre-fabricated factory fitted lube oil pipe
 - Sight flow indicator
- Lube oil system piping materials
 - Oil feed pipe
 - Oil drain pipe
 - Welded oil piping
- Lube oil system pressure monitoring
 - Two (2) low oil pressure transmitters
- Jacking oil system pressure monitoring
 - Two (2) pressure transmitters
 - 2*100% jacking oil pump
 - Bearing oil inlet regulation valve

1.2.4 Generator Temperature Devices

- Stator winding temperature devices
 - 100 ohm platinum RTDs (resistance temperature detector)
 - Dual element RTDs
 - RTDs fitted with overvoltage protection

- Twelve (12) stator slot RTDs
- Air path temperature devices
 - 100-ohm platinum gas path RTDs
 - Single element temperature sensors
 - Two (2) cold gas
 - One (1) hot gas
- Bearing temperature devices
 - 100-ohm platinum RTDs Single element temperature sensors
 - Two (2) bearing metal temperature sensors per bearing
- Exciter temperature devices
 - 100-ohm platinum RTDs
 - Single element temperature sensors
 - Exciter air outlet temperature sensor
- Lube oil system temperature devices
 - 100-ohm platinum RTDs Single element temperature sensors
 - One (1) bearing drain temperature sensor per drain

1.2.5 Generator Packaging, Enclosures, and Compartments

- Paint and preservation
 - Finish painted for use in non-corrosive environments
- Generator enclosure
- Foundation hardware
 - Generator shims
 - Generator anchor pin - drive end
 - Generator guide block - non drive end

1.2.6 Electrical Equipment

- Heaters
 - Generator stator heaters
- Field earth fault monitor
 - Generator mounted, Brush rotor earth fault monitor
- Jacking oil system pump motor
 - 16kW, 1450 rev/min, 380 volts, 3 phase, 50 Hz induction motor