

TECHNICAL SPECIFICATION, SCOPE OF SUPPLY

2 x Unused GE built Frame 9171-E 123MW / 50HZ gas turbine

1 x Used GE built Frame 9161-E 116 MW / 50HZ gas turbine

Base mounted, simple cycle, single shaft Frame 9161 / 9171E:

- 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

Accessory Systems and Compartments consisting of the following:

- Heavy duty, oil filled, multi-shaft accessory drive gear case:
 - Drive coupling to turbine shaft
 - Grease filled accessory couplings
 - Engine driven liquid fuel oil supply pump
 - Rotor turning device
- 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
- On base, liquid fuel system suitable for Kerosene Jet A1 fuel. (Off base treatment system deleted from scope)
- Accessory gear driven fuel oil pump
- Simple on base fuel oil filter
- Fuel oil flow divider
- Low pressure atomizing air system
- Accessory gear driven main compressor
- Motor driven booster compressor
- Atomizing air compressor pre-cooler
- On base, Natural Gas fuel system
- Package integrated fire detection system and CO2 protection, for on base equipment.
- 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, atomising 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
- Jacking oil pump
 - On base water, air, gas and fuel oil piping
- Electric starting system generally consisting of:
 - Interface with Mark V Speedtronic turbine control system
 - Electric starting device
 - Torque converter
 - Drive coupling
- Electric Components:
 - All motors (except main starting device) are Totally enclosed fan cooled
 - Terminal boxes and interconnect wiring to be installed with rigid metal conduit
 - Dual compartment AC vent fans (common for gas turbine and accessory compartment)
- Air Inlet System 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
- Instrumentation
 - Enclosures and compartments:
 - All enclosures and compartments are of outdoor weather resistance design and construction
 - Off-base full acoustical weather resistant gas turbine enclosure for outdoor installation limiting near field noise level to 85 db at 1 meter
 - Dual compartment AC vent fans (common for gas turbine and accessory compartment)
 - Control compartment: (Cabinet deleted from the scope)
 - 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 centre
 - 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
- Exhaust System consisting of:

- Side discharge point
- Expansion Joint
- Engine compartment skid foundation hardware kit with drawings package
- Boroscope kit
- Operation, parts and maintenance manuals for the engine auxiliary systems and accessories
- Water injection system

SCOPE OF SUPPLY - GENERATOR AND AUXILIARIES

GENERATOR AND GENERATOR COMPARTMENT CONSISTING OF:

Base mounted, air cooled, two pole 11,000 VAC, 50Hz. Class F insulation, Class B temp rise, armature and rotor winding 0.85 Power Factor (Lagging)

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
- Accessory Systems and Compartments Consisting of:
 - Mark V Speedtronic Turbine control panels generally consisting of:
 - Triple Modular redundant (TMR)
 - Auto/Manual synchronising module with clock function
 - Generator over temperature alarm
 - Droop control
 - Load limiter
 - Generator vibration alarm with read out and trip
 - Electric over-speed protection
 - Manual and pre-selected set-points for generator loading
 - Generator control panel generally consists 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 different lockout
 - Under voltage bus
 - Excitation 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
- Full weather resistant enclosure for outdoor installation

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 reply
- Generator protection and grounding system
- Generator electrical protection equipment
- Neutral grounding equipment
- Neutral grounding transformer with load resistor mounted in terminal enclosure

Lubricating system generally consisting of:

- Generator bearing lube oil piping
- Prefabricated factory fitted lube oil piping
- Armoured flexible piping as permitted
- Lubricating oil piping

Ventilation system:

- Open circuit design
- Cooling airflow ducting

Package integrated fire detection system and CO₂ protection, for the generator

Dual compartment AC vent fans (Negative, common for generator and accessory compartment)

On base full acoustical weather resistant generator enclosure for outdoor installation limiting near field noise level to 85 db at 1 meter

Operation, parts and maintenance manuals for the engine auxiliary system and accessories

On base lightning protection materials

On site and off site technical assistance for erection & commissioning (customer to provide transport, office facilities and accommodation for the deputed person)

EXCLUSIONS

Gas conditioning skid, drain tank, metering etc.

Fuel treatment, tanks, forwarding, filtering system, drain tank etc.

Cooling water system

DM water supply system

Field piping

GT exhaust duct & stack

Generator circuit breaker

Generator transformer, switchgear

6.6kV switchgear

SAT & UAT

Illumination & earthing

UPS

110V DC system
Field power, control & signal cables
Lubricants & first fills
Total Project Eng (except civil engineering input data)

TECHNICAL ASSISTANCE

- 1) Gas Turbine
 - a) Foundation checking
 - b) Sole plates matching and grouting
 - c) Curing
 - d) Placement of GT skid
 - e) Skid centring and levelling
 - f) Alignment
 - 2) Generator and Exciter
 - a) Foundation checking
 - b) Packer plates and foundation plates blue matching
 - c) Placement of generator kid
 - d) Assembly of Exciter/Erection
 - e) Skid centring and levelling
 - f) Pre-alignment of generator and GT
 - g) Grouting
 - 3) Erection of GT & Generator Enclosure
 - 4) Piping Systems
 - a) Fabrication of lube oil piping
 - b) CW piping
 - c) Water was piping
 - d) Steam injection piping
 - e) Water injection piping
 - f) Jacking oil piping
 - g) Lube oil flushing etc.
 - 5) Electrical & Instrumentation
 - a) Erection of Mark-V Panel
 - b) Erection of generator control panel
 - c) Erection of GT MCC
 - d) Erection of <1> station
 - e) Cable lying and termination
 - f) Cable termination checking
 - g) Commissioning
 - 6) Erection & Commissioning
 - a) Not included
- Total shipping weight per one (1) gas turbine package is: 870 tons

SUPPLIER'S RESPONSIBILITY:

- Supply of gas turbine as specified
A detailed scope of supply will be agreed upon with the customer during the negotiation phase.