



DERWICK ASSOCIATES, S.A.
PDVSA SUPPLIER CODE: 350015280
REQUEST FOR QUOTATION (RFQ): 6000335081
4 x Rolls Royce Trent 60

Technical:
Equipment Data Sheets/Specification/Configuration

• Simple Cycle Performance	60Hz60Hz
• Simple Cycle Performance	
• Serial Numbers	80A-191-01/80A-271-01/80A-272-01/80A-331-01
• Output	58 MW
• Heat Rate	8,336 Btu/kWh (8,795 kJ/kWh)
• Efficiency	41%
• Dual Fuel Equipment	
• Mass Flow	981 lb/sec (445 kg/sec)
• Turbine Speed	3600 rpm
• Exhaust Temperature	805°F (429°C)
• Model Designation	Trent 60 WLE
• Fuel Consumption	242 (Liters/Mw-hr)
• Gallons/hr	3,481
• Cubic-Feet/hr	469,193

Descriptive Equipment Information/Configuration:

Derwick Associates S.A. offers the delivery of Four (4) Brand New Rolls-Royce Trent 60 Wet Low Emissions (WLE) Gas Turbine Power Generation Packages, designed in accordance with the specifications outlined in this proposal, comprising of:

Gas Turbine

Trent 60 WLE

- Rolls-Royce Industrial Trent 60 Gas Turbine WLE, Dual Fuel
- On engine mounted lubrication pump and hydraulic starter
- Gas Turbine ignition system consisting of sixteen on-engine igniters with seals, eight on-engine high energy igniter leads - dual circuits and off-engine mounted exciter unit
- On-engine mounted gas fuel injection manifolds.
- On-engine mounted water injection and liquid fuel manifold.

AC Generator

- Two pole, Totally Enclosed Water Air Cooler (TEWAC) AC generator, 11.0 kV +/- 10%, 3 phase, 50 Hz, 0.85 power factor in accordance with IEC 600 34-3, fitted with class "F" insulation and designed for class "B" temperature rises with a brushless exciter.

Gas Turbine Module

Enclosure and Base

- Fabricated weatherproof painted carbon steel baseplate mounted acoustic enclosure (85dB(A) avg. @ 1m) and base for housing the gas turbine, inlet plenum, fuel and oil systems, exhaust volute and enclosure ventilation air systems.
- All internal lighting (main and emergency), maintenance power points, tubing, piping and cabling.
- Maintenance access and features, facilitating engine / module removal (sideways-removal from package) and in-situ maintenance. Anchor points and any special tooling are provided. Mechanical Handling Skid, standard walkways and ladders giving access to the inlet filter house are included.
- Fire protection and gas detection system, complete with thermal detectors and gas sensors for GT enclosure.
- Two-shot CO2 extinguishing system, including storage cylinders, manifold, fire dampers, pipe work to nozzles within the gas turbine compartment, warning lamps, lock-offs, interlocks and high temperature cabling.
- Dry diaphragm flexible coupling shaft including bolts. A separate shaft guard is not required as the coupling shaft is protected by the cone arrangement in the exhaust diffuser.

Combustion Air System

- Self-cleaning (pulsed) combustion air intake filters with first stage coalesce.
- Pulsed cleaning control system fitted on the filter unit. The air required for the pulse cleaning of the filter will be supplied by others.
- Combustion air inlet silencer and ducting, with flexible joints to accommodate thermal movement.
- Steel support structure mounted on the GT base, including access ladder up to the filter units.
- Maintenance features such as anchor points and permanent tooling (internal filter element hoist).
- Radial air intake scroll with compressor water wash supply rings.

Gas Turbine Exhaust System

- Gas turbine exhaust volute exhausting vertically.

Gas Turbine Enclosure Ventilation and Air Handling System

Enclosure Ventilation Intake System

- Air is drawn from the same filter house as the combustion air system. A designated section of the filter house is used to supply air exclusively for ventilation.
- The system includes ducting, silencing and fire dampers.

Enclosure Ventilation Exhaust System

- Three 50% duty AC motor belt driven induced draft ventilation fans.
- Ventilation air exhaust fire dampers, silencer, ducting and weather hood.

Gas Turbine Bleed Air

- Bleed air exhaust ducting and silencer.

Gas Turbine Lube Oil System

- Gas turbine lube oil system including a stainless steel lube oil tank with thermostatically controlled electric heater (common with the hydraulic start system), mist eliminator, engine driven supply pumps, duplex oil filter, simplex water cooled plate oil cooler, stainless steel pipe work and fittings, associated valves and instrumentation.

Gas Turbine Hydraulic Control System

- Gas turbine hydraulic control oil system comprising of two 100% duty AC motor driven variable displacement pumps, stainless steel tank, oil mist separator, two 100% duty bladder type accumulators, duplex oil filter, simplex water cooled plate oil cooler, stainless steel pipe work and fittings, associated valves and instrumentation.

Gas Turbine Hydraulic Start System

- Gas turbine hydraulic start system comprising of one 100% duty AC motor driven variable displacement pump and fixed displacement charge pump in tandem, stainless steel pipe work and fittings, associated filters, valves and instrumentation.

Gas Turbine Gas Fuel System.

- Gas fuel forwarding system, located to the side of the gas turbine, comprising of metering valves, high speed shutoff valves, last chance strainer, enclosure mounted fuel manifolds, stainless steel pipe work and fittings, associated valves and instrumentation.

AC Generator Module

Enclosure and Base

- Fabricated carbon steel skid and acoustic enclosure housing the AC generator, cooling air system, exciter and line and neutral cubicles. Access doors and hatches for maintenance.
- Two-shot CO2 extinguishing system, including storage cylinders, manifold, fire dampers, pipe work to nozzles within the gas turbine compartment, warning lamps, lock-offs, interlocks and high temperature cabling.

Generator Lube Oil System

- One lube oil system located adjacent/near to the AC Generator base comprising one shaft driven oil pump (mounted on the generator, one AC motor driven auxiliary oil pump, one AC motor driven jacking oil pump, one DC motor driven emergency lube oil pump for run down, duplex oil filter, carbon steel oil reservoir with mist eliminator, vent and thermostatically controlled electric heater, associated pipe work (stainless steel downstream of filters/carbon steel upstream), fittings, valves and instrumentation.

Water Wash System

- One mobile gas turbine compressor cleaning system, suitable for unfired washing. Attachment points for the water wash system are externally located on the outside of the Gas Turbine Base plate.

Liquid Fuel System

- High pressure liquid fuel system comprising one main and one auxiliary AC electric motor driven fixed displacement, bent axis, axial piston pump, metering valves, high speed shutoff valves, stainless steel pipe work and fittings, associated valves and instrumentation. The system is mounted on a freestanding skid to be located adjacent to the gas turbine module.

Water Injection System (for Emissions Control)

- Water injection system comprising three (3) x 33% AC electric motor driven fixed displacement, bent axis, axial piston pumps, stainless steel pipework and fittings, associated simplex filters, valves and instrumentation. The system is mounted on a freestanding skid to be located adjacent to the gas turbine module.

Control System

- Human Machine Interface's (HMI) – To be mounted in the remote control room, shipped loose for installation in the operator's control room. All control systems are accessible remotely via the HMI system.
- Gas turbine control system will be installed in the front of the package on the gas turbine base plate. The following is included in the on-skid Controls Scope of Supply:
 - Package Control System (PCS)
 - Engine Control System (ECS)
 - Fire and Gas Protection System
 - Vibration monitoring for all rotating equipment
 - Temperature monitoring of all rotating equipment
- AC Generator Control/Protection Panel (GCP/GPP) comprising a two bay cubicle with automatic voltage regulator, generator metering and protective relay, automatic and manual synchronizing facility, with synchroscope and check synchronizer, free issued for installation by others.

Special Tools

- Coupling alignment tool, gas turbine transportation stand, lifting beams and slings, packing case, protection cover, blanks and restraints will be supplied to protect the engine during transportation and installation at site. These items remain the property of Energy Parts Solutions and will be returned after installation is complete.

Equipment Testing

- Gas turbine factory test.
- AC Generator factory test
- Sub-system factory flushing and pressure testing.
- Auxiliary motor testing.
- Instrument and power cable insulation and continuity tests.

Training

- Energy Parts Solutions Phase 1, 2 and 3 for Energy Parts Solutions Scope of Supply, based at OEM Training Facility-(OPTIONAL)

Installation & Commissioning

- Lump sum Technical Direction of Installation and Commissioning are offer as an Option.
- One set of special tooling required for the Gas Turbine Generating Package Operation and Maintenance
- ICS Manuals (paper format) in English.

Documentation

- Three sets of O&M Manuals (CD format) in English.
- Project drawings and document list.

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TRENT 60 POWER GENERATION PACKAGE
TERMINATION POINTS

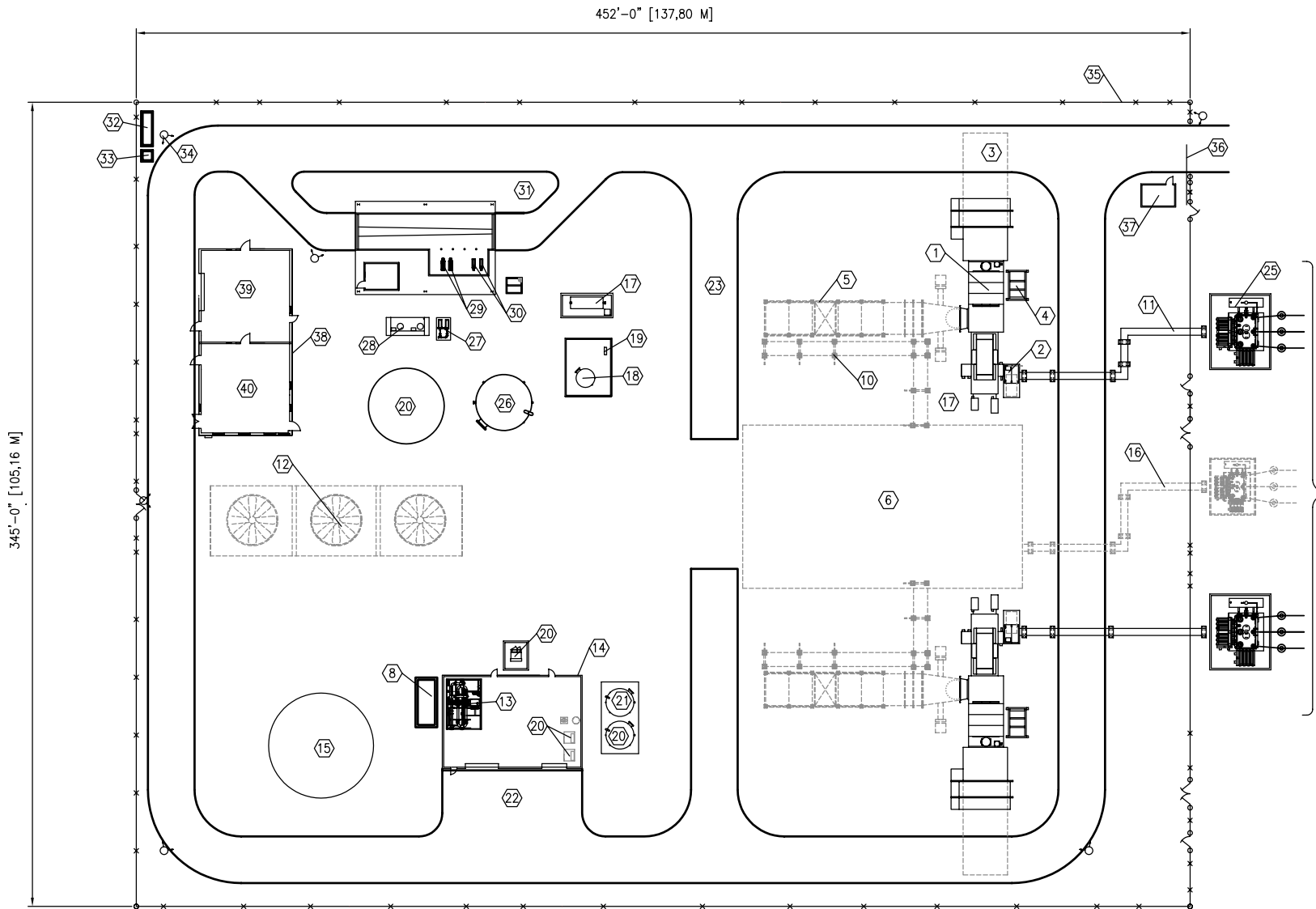
Interface Description	Terminal Points
Combustion Air	Inlet to intake filter house.
Compressed air	Compressed air connection at skid edge.
Exhaust Gas	Transition enclosure wall duct joint. Inlet and outlet flanges of silencer section
Ventilation	Enclosure vents outlets.
Mountings	Locations on skid base plates and all other structural members.
Fuel Gas	Inlet flange on side of base plate and vent flange on the roof of the enclosure.
Instrument Air	Inlet connection on engine base plate.
Lubricants	Filling points at lubricating oil tanks. Drains connections at oil tanks.
Drains	Drains system connections on all skids as necessary.
Grounding	Grounding terminals on skids.
Control and Instrumentation	Serial link connection between HMI and Package mounted control system. GCPP Terminal blocks in control panels and on-skid connections.
HV Electric Power	Line side terminals of AC generator. Neutral terminal of AC generator
Compressor Cleaning	Filling point of wash tanks.
Low Voltage Power	At terminals inside the MCC.

Equipment Origin

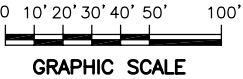
The Rolls Royce Trent 60 is manufactured in Montreal, Canada and packaged in Mount Vernon, Ohio.

The Generator is manufactured in Fern, Germany

Drawings



- LEGEND:**
- ① ROLLS ROYCE TRENT 60 GAS TURBINE GENRATORS.
 - ② 15 KV SWITCHGEAR.
 - ③ GENERATOR REMOVABLE AREA.
 - ④ TURBINE REMOVABLE AREA.
 - ⑤ HRSG (FUTURE).
 - ⑥ STEAM TURBINE GENERATOR (FUTURE).
 - ⑦ STEAM TURBINE BUILDING (FUTURE).
 - ⑧ EMERGENCY GENERATOR.
 - ⑨ AUXILIARY TRANSFORMER (480 V).
 - ⑩ PIPE RACK (FUTURE).
 - ⑪ OVERHEAD CABLE TRAY.
 - ⑫ COOLING TOWER WITH CHEMICAL INJECTION (FUTURE).
 - ⑬ FIRE WATER SKID.
 - ⑭ WATER TREATMENT BUILDING.
 - ⑮ RAW/FIRE WATER TANK (300.000 GALS).
 - ⑯ OVERHEAD CABLE TRAY (FUTURE).
 - ⑰ OILY WATER SEPARATOR.
 - ⑱ WASTE OIL TANK (5,000 GALS).
 - ⑲ WASTE OIL OFF-LOAD PUMP.
 - ⑳ LIQUID FUEL TANK (RAW-100,000 GALS).
 - ㉑ DEMIN WATER TANK (2-21,000 GAL EACH).
 - ㉒ PARKING AREA.
 - ㉓ PAVED ROAD.
 - ㉔ AIR INSTRUMENT PACKAGE.
 - ㉕ STEP-UP TRANSFORMER.
 - ㉖ LIQUID FUEL DAY TANK (CLEANED-50,000 GALS).
 - ㉗ LIQUID FUEL TRANSFER PUMP.
 - ㉘ LIQUID FUEL CENTRIFUGE PACKAGE.
 - ㉙ LIQUID FUEL FORWARDING PUMP.
 - ㉚ LIQUID FUEL OFF-LOAD PUMP.
 - ㉛ LIQUID FUEL OFF-LOAD AREA.
 - ㉜ GAS METER RUN
 - ㉝ ESD VALVE.
 - ㉞ LIGHTING POLE.
 - ㉟ PLANT FENCE.
 - ㊱ GATE.
 - ㊲ GUARD HOUSE.
 - ㊳ OFFICES/CONTROL/MAINTENANCE BUILDING.
 - ㊴ OFFICE CONTROL ROOM.
 - ㊵ WAREHOUSE AREA.



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Trent 60 Power Generation Package

We certify that our quotation complies with all your inquiry, documents and specifications except for the following:

EXCLUSIONS

Derwick Associates, S.A. does not accept responsibility for items or aspects of equipment which are outside the Scope of Supply defined above. The following items are excluded from this proposal, unless offered as an option.

- Site grounding
- Lightning protection
- Compressed air supply
- All auxiliary power supplies
- All first fills
- All fuel supplies, fuel supply and treatment
- Water supply and treatment
- Installation & commissioning labor
- Demolition and/or removal of any existing equipment, structures and concrete.
- Installation tooling
- Instrumentation for site Performance Testing
- Site facilities
- Fire sprinklers or other fire protection devices which may be required by insurance regulations.
- Motor Control Center (Budgetary Option)
- Battery Back Up System (Budgetary Option)
- Switchgear
- Transformers (Auxiliary & Main)
- Control system housing, external to gas turbine package enclosure mounted equipment
- Control System integration with existing DCS
- Black Start Diesel GenSet
- AC Generator Rotor Withdrawal
- Fiscal metering
- Site facilities
- Operating and strategic spares
- Civil engineering design, embedment and works
- Grout
- Erection of equipment
- Civil engineering design of any kind

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- All interconnecting pipe work and cabling, beyond termination points, including:
 - All wiring and piping to and from skids
 - Local Lighting
 - Stack Lighting, Grounding Protection System
 - Unloading at site
 - Import Duties and Taxes
 - Any and all permits or special clearances required by any government agency. This includes air pollution permits as well as Local building permits, construction permits, etc.