

# PROPOSAL

Presented To:

**Electricidad de Caracas**

For

**4 x Rolls-Royce Trent 60  
Turbine Equipment**

*Prepared By*

**DERWICK**

**DERWICK ASSOCIATES S.A.**



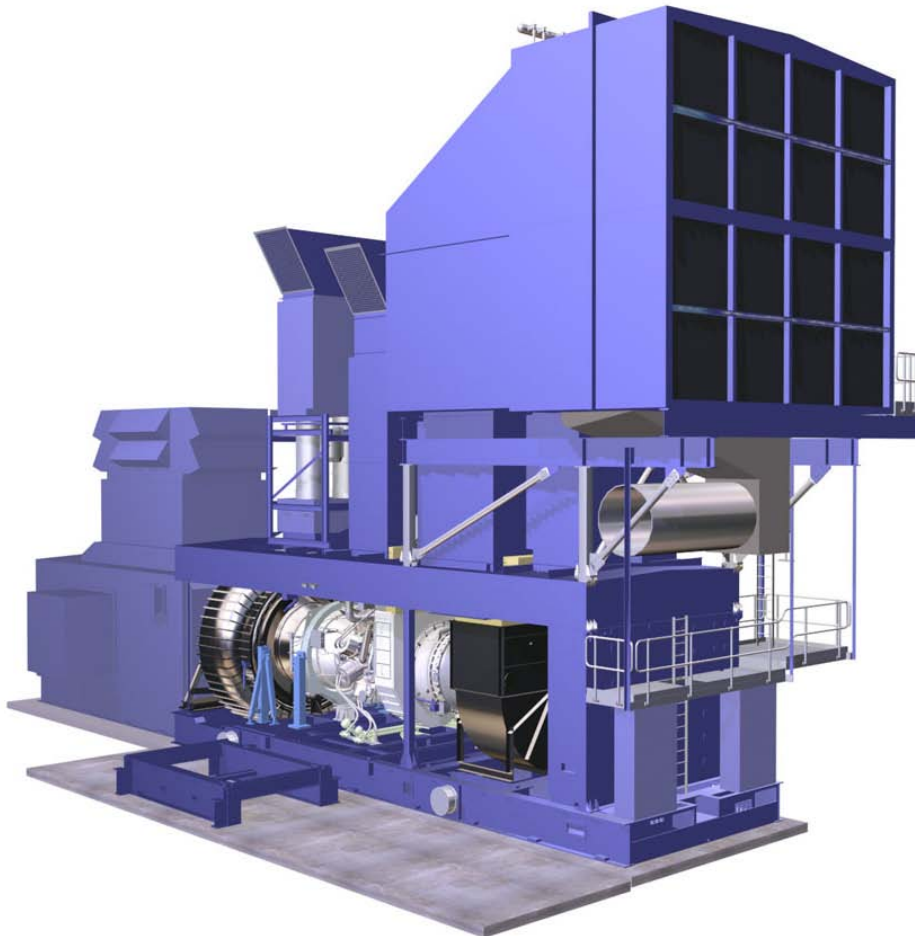
Proposal No. 709-2904-1

November 4, 2009

**This document is privileged and contains confidential information intended for use only by  
EDC**

## Introduction

Derwick Associates (“DA”) is pleased to provide this proposal to Electricidad de Caracas (“EDC”) for Four (4) Brand New Rolls-Royce Trent 60 Gas Turbines.



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## **Trent 60 WLE Power Generation Package**

### **SCOPE OF SUPPLY**

Derwick Associates 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.

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## **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 Derwick Associates 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

- Derwick Associates Phase 1, 2 and 3 for Derwick Associates 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.



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- Project drawings and document list.

### **Options (Budgetary)**

- Availability guarantee - is offered as part of the Long Term Service Agreement
- Generator Rotor Withdrawal tool
- Freight FAS, Port of Export
- MCC / UPS
- Inlet Chiller Coil

**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.





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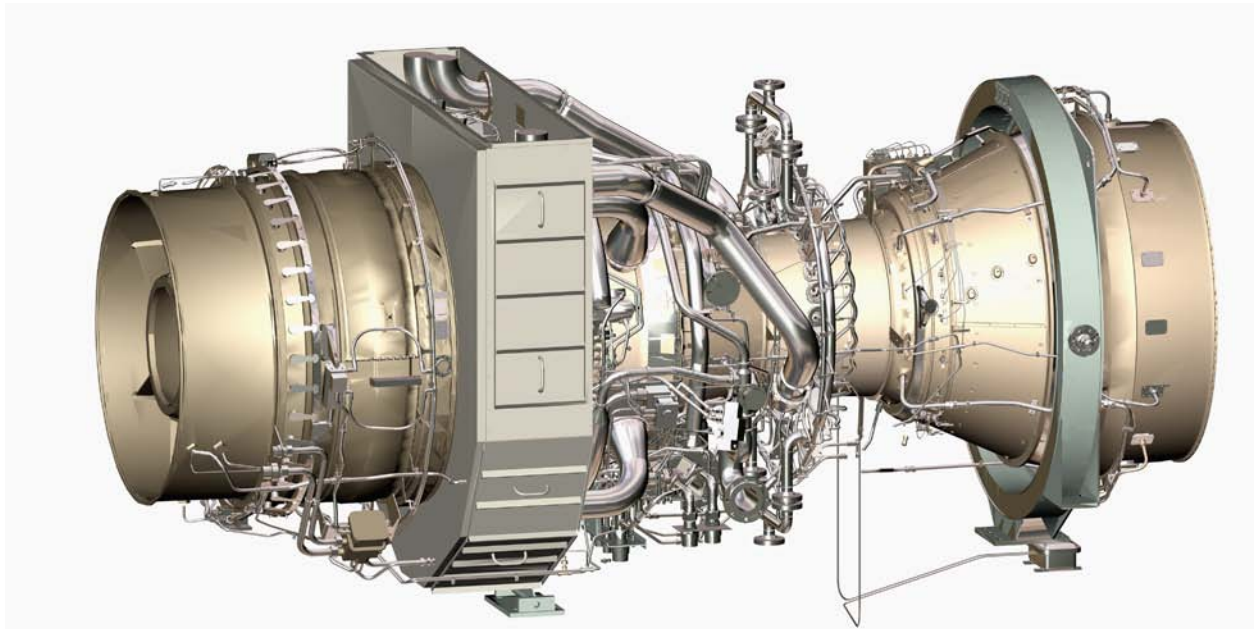
## TRENT 60 POWER GENERATION PACKAGE

### EXCLUSIONS

**Derwick Associates 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.**

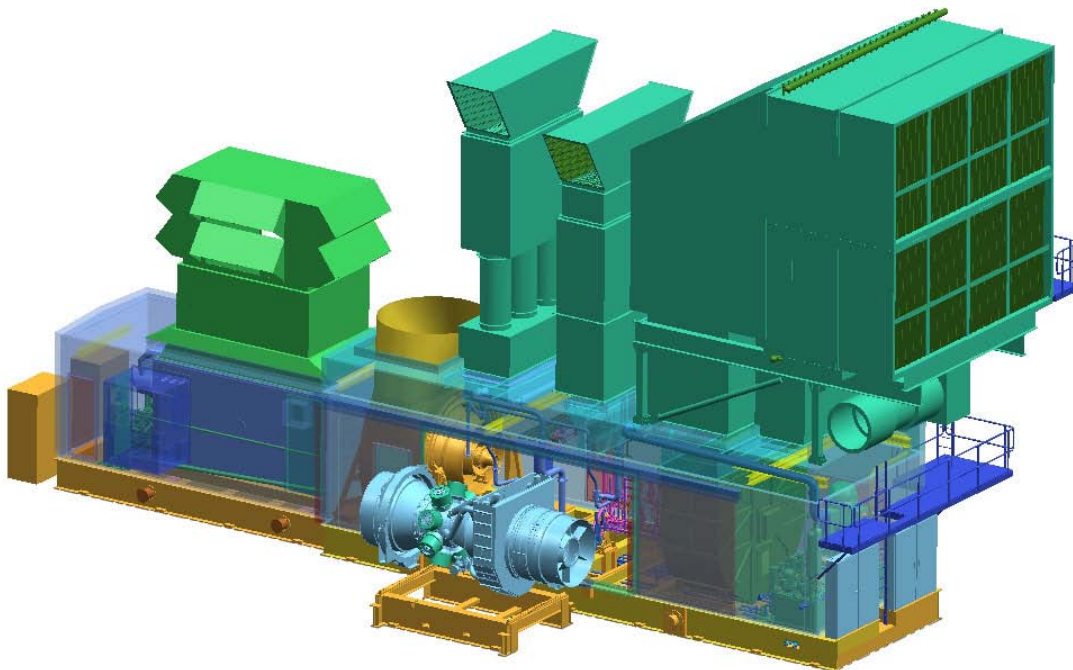
- Site grounding
- Lightning protection
- Compressed air supply
- All auxiliary power supplies
- All first fills
- All fuel supplies, fuel supply and treatment
- Water supply and treatment
- Installation & commissioning labor
- Demolition and/or removal of any existing equipment, structures and concrete.
- 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
- 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.



ATTACHMENT SCHEDULED DATE(S)

Reference	Equipment Description	Scheduled Date
Unit 1,2, 3 & 4	Rolls Royce Trent 60 Brand New (Never Used)	December 15, 2009





## FUEL REQUIREMENTS

### 1 GENERAL

RR gas turbines have the ability to burn a wide range of gaseous fuels as shown in Table 1. These gases present a broad spectrum of properties due to both active and inert components. This specification is designed to define guidelines that must be followed in order to burn these fuels in an efficient, trouble-free manner, while protecting the gas turbine and supporting hardware.

Table 2 identifies the acceptable test methods to be used in determining gas fuel properties.

#### Notes:

1. When considering the use of alternate fuels, provide details of the fuel constituents, fuel temperature, and expected engine usage conditions and operating characteristics to RR for evaluation and recommendations.
2. Values and limits apply at the inlet of the gas fuel control module.

***Design Criteria***

The following table outlines the criteria conditions at the proposed jobsite for the design of the equipment:

Location	TBD
Elevation	TBD
Design Point Ambient Temperature / Relative Humidity	TBD
Primary Fuel Source	TBD
Secondary Fuel Source	TBD
Seismic Design Criteria (BOP Equipment)	TBD
Maximum Wind Speed (Wind Load), MPH	TBD
Near Field Noise at 3 ft horizontal and 5 ft vertical, dBA NOTE 1	TBD
Far Field Noise, dBA NOTE 1	TBD at 400 ft / TBD at 700 ft

NOTE 1: Far field noise is based on single-unit only operation. Multiple units operating at the same time will have an impact on both near and far field noise levels.



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## COMMERCIAL TERMS

### Basis of Pricing

### Validity

This proposal is valid until December 1, 2009.

### Taxes

No sales or use taxes have been included in this quotation. These prices quoted exclude any federal, state or local taxes or fees which may be associated with the export, import or purchase of equipment and/or services.

### Price

Four (4) RR Trent 60 Gas Turbine Generator Set including as described in the scope of supply. All pricing is based on ex-works factory delivery unless otherwise stated.

### All Equipment Subject to Previous Sale

### GTG UNIT

Generators set price (Unit).....US\$ 32,000,000

Generators set price (Four Units).....>.US\$128,000,000

### ***Payment Schedule***

This proposal is based upon receipt of the following progress payments and a Contract Agreement by both Parties by the Validity date Seller may request at any time, Purchaser will demonstrate its financial capability to continue to carry out its obligations under this Contract. This demonstration may require that Purchaser furnish adequate payment security.

	<b>Payment Event</b>	<b>% of Equipment Price</b>
1	At the signature of the Contract	10%
2	At Notice of Readiness to Ship and paid against Seller's invoices before December 30, 2009.	90%

Name: Derwick Associates Services LLC

<b>Instrucciones para transferencias:</b>	
Intermediary Bank: Citibank, N.A. ABA: 021000089 Sucursal: New York Dirección: 111 Wall Street, New York, NY 10043	Beneficiario: International Union Bank, S.A. Cuenta: 36246731 Dirección: Ave. Samuel Lewis, Edif. Omega Piso 5, Apartado 0391 Wtc Panamá, Republica de Panamá  FFC: Davos International Bank/000767-224-001  Ref: Derwick Associates/ 13102362

### **Warranty**

Derwick Associates will provide a one (1) year warranty on the entire gas turbine generator package and any other balance of plant equipment provided.

### **Terms & Conditions**



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This proposal shall be valid for thirty (30) days; provided, however, the obligation to treat this proposal as confidential, and that it cannot be shared with any third party without the prior written consent of Derwick Associates shall survive.

Derwick Associates and EDC will negotiate in good faith to establish general terms and conditions that are usual and customary of the sale of these new equipments.

### **Site Services**

Derwick Associates would be pleased to also provide a proposal for the installation, startup and commissioning of the facility. This would include providing construction supervision as well as startup engineers for all equipment provided.

Derwick Associates can also provide an experienced service representative to assist the operating personnel during the first two (2) months after the equipment goes online.

### **Follow Up**

Please contact the following person at Derwick Associates for information regarding this proposal:

Pedro Trebbau  
Director  
[ptrebbau@derwickssociates.com](mailto:ptrebbau@derwickssociates.com)  
58-412-3007470





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## Attachment

## TRENT 60 POWER GENERATION PACKAGES

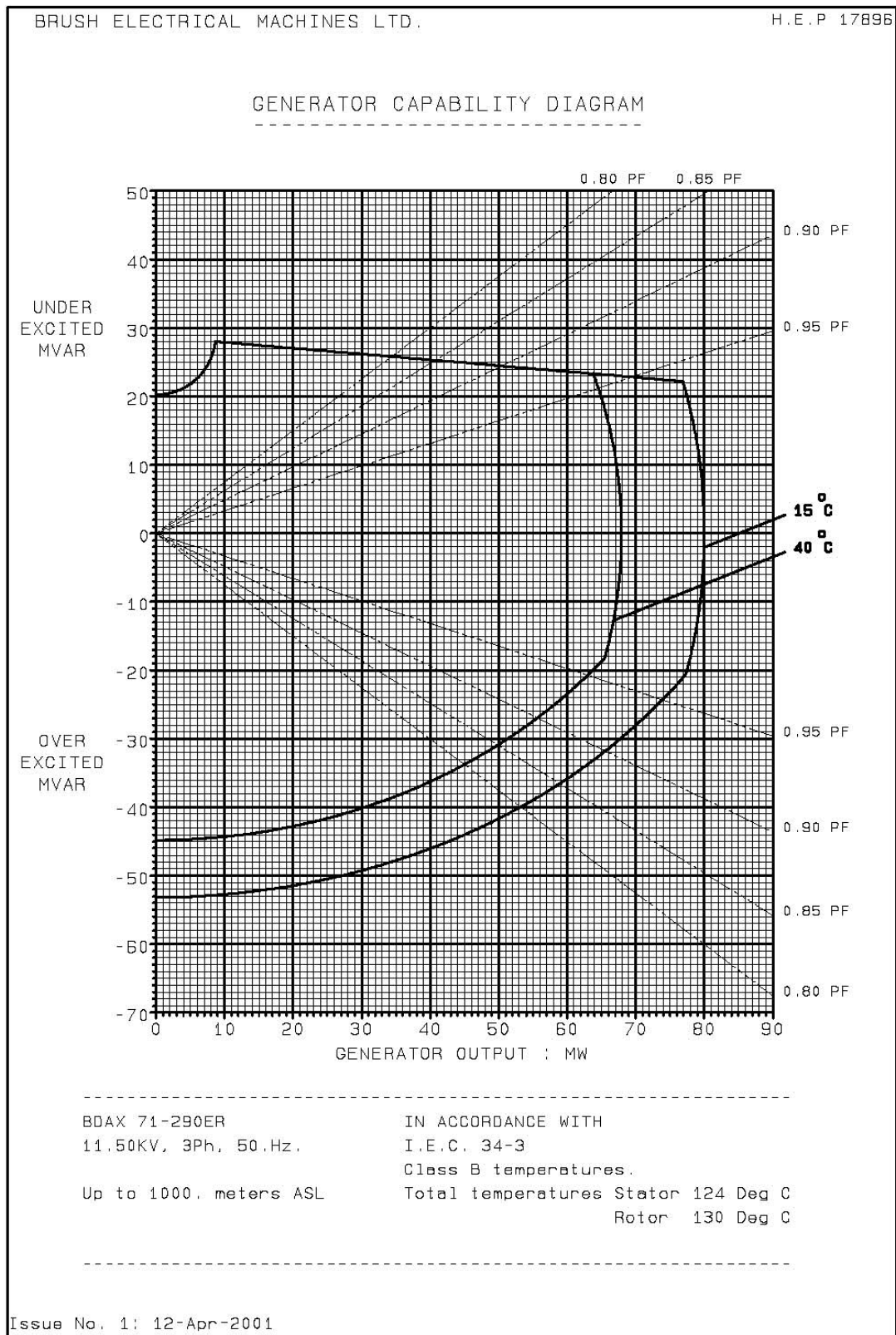
### PERFORMANCE

Expected performance data for the Trent 60 DLE and WLE Gas Turbines is presented in this section, based on ISO conditions;

- • 15C (59F)
- • 60% relative humidity
- • Sea level
- • NOx emission are controlled to 25 vppmd @ 15% O2 in all cases.
- • Natural Gas Fuel

The following data is presented:

- • Trent 60 DLE
  - • Simple Cycle, No losses, 50 Hz (SI Units)
  - • Nominal Emissions (SI Units)
  - • Simple Cycle, 4in inlet / 5 in exhaust losses, including part load data, 50 Hz (SI Units)
  - • 50Hz Generator Capability Curve
  - • Simple Cycle, No losses, 60 Hz (English Units)
  - • Nominal Emissions (English Units)
  - • Simple Cycle, 4in inlet / 5 in exhaust losses, including part load data, 60 Hz (English Units)
  - • 60Hz Generator Capability Curve
- • Trent 60 WLE
  - • Simple Cycle, No losses, 50 Hz (SI Units)
  - • Nominal Emissions (SI Units)
  - • Simple Cycle, 4in inlet / 5 in exhaust losses, including part load data, 50 Hz (SI Units)
  - • 50Hz Generator Capability Curve
  - • Simple Cycle, No losses, 60 Hz (English Units)
  - • Nominal Emissions (English Units)
  - • Simple Cycle, 4in inlet / 5 in exhaust losses, including part load data, 60 Hz (English Units)
  - • 60Hz Generator Capability Curve

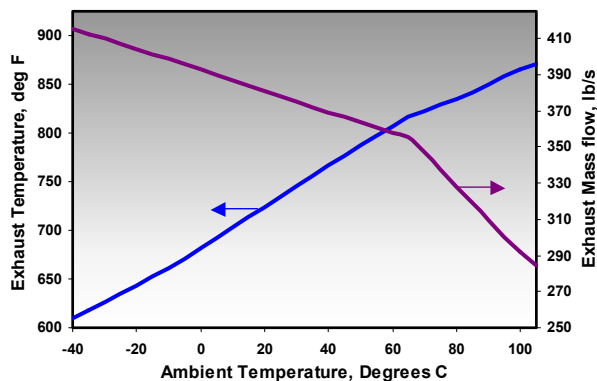
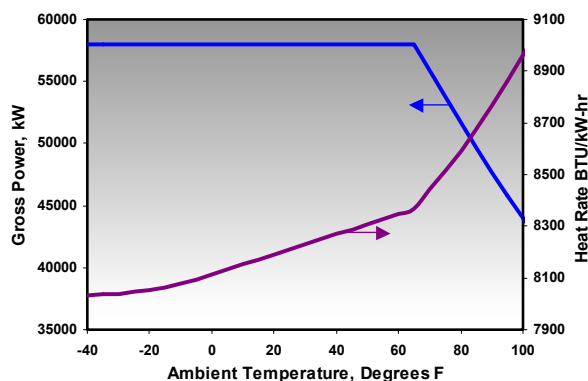




## TRENT 60 POWER GENERATION PACKAGES

### TRENT 60 WLE – 60 HZ PERFORMANCE

#### BASE LOAD RATING CURVE



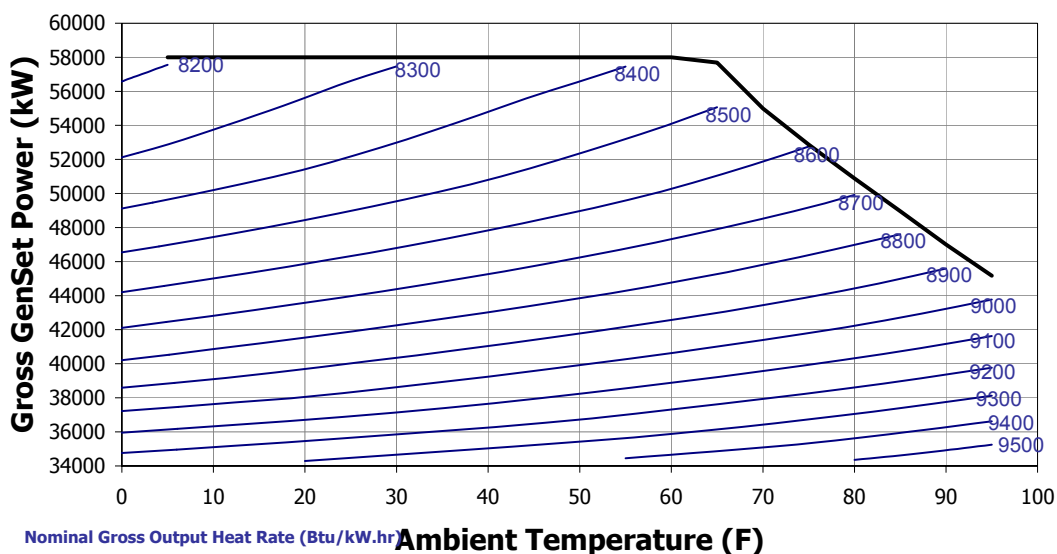
Simple Cycle, Sea level, zero losses, 60% RH, natural gas fuel

#### NOMINAL EMISSIONS

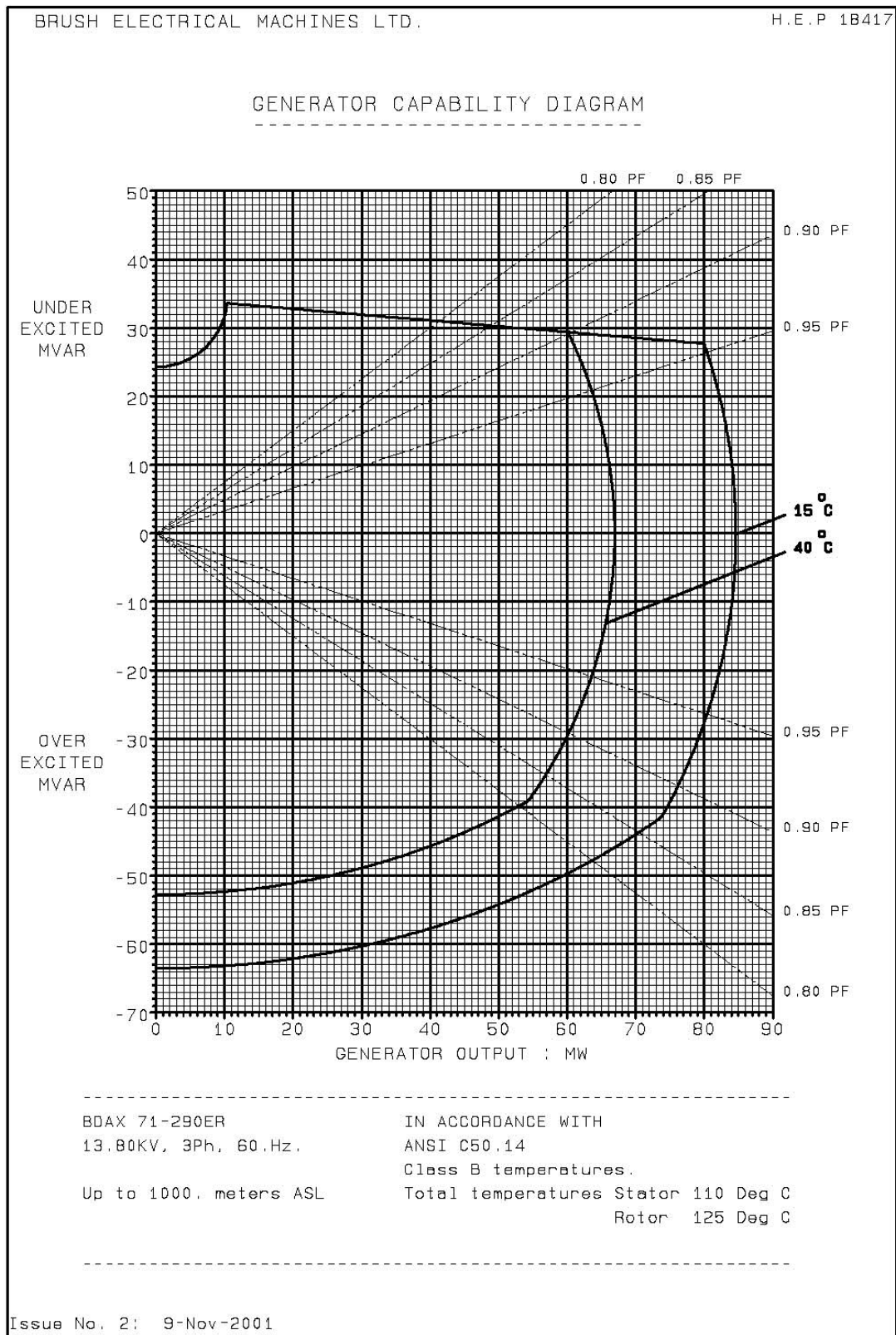
The Trent 60 DLE is capable of the following emission ranges, across the ambient range for base load natural gas operation.

NOx	25 vppm (15% O2 corrected, dry)
CO	50 vppm (15% O2 corrected, dry)

#### PART LOAD EFFICIENCY

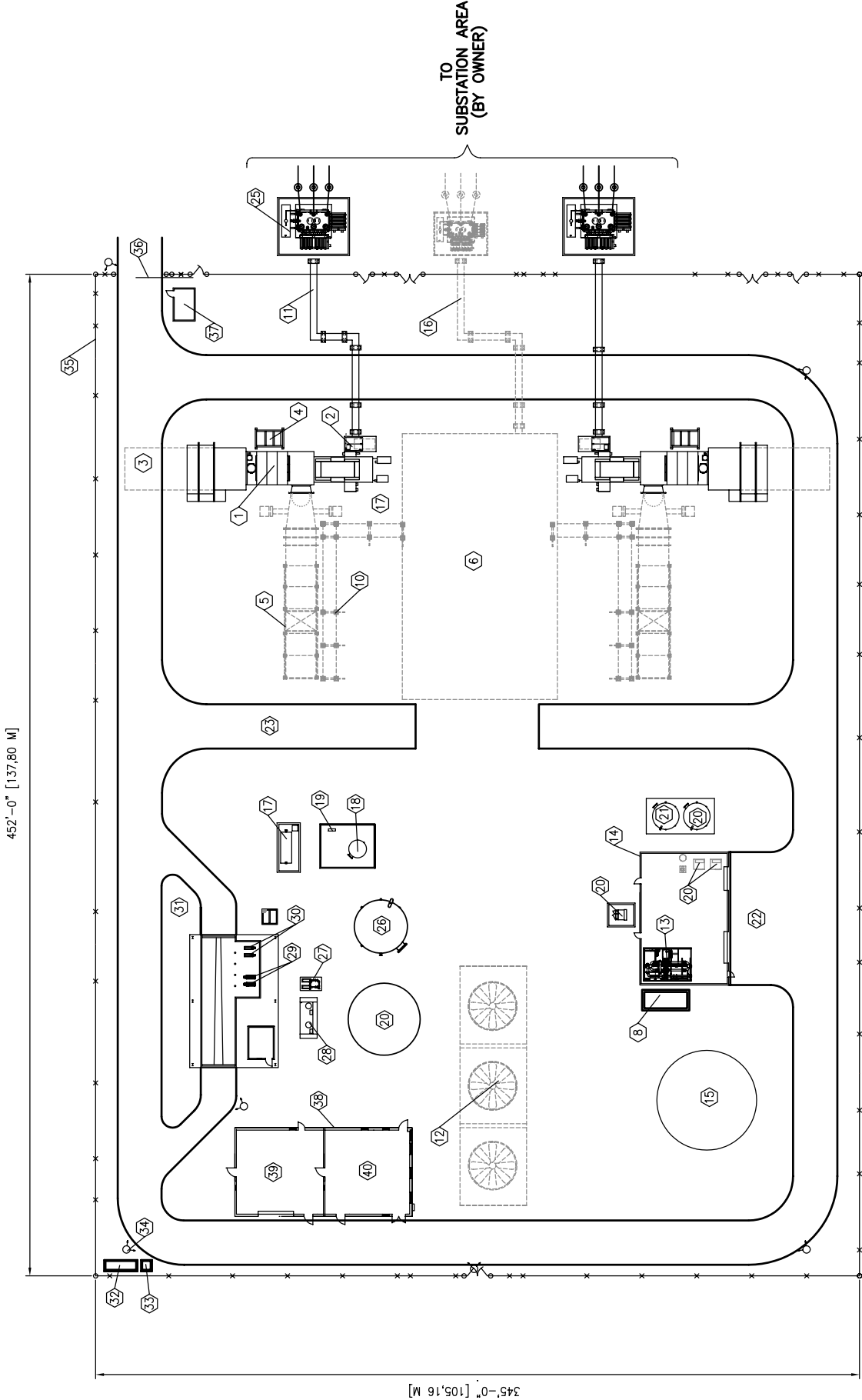


Simple Cycle, Sea level, 4"/5" installation losses, 60% RH, natural gas fuel

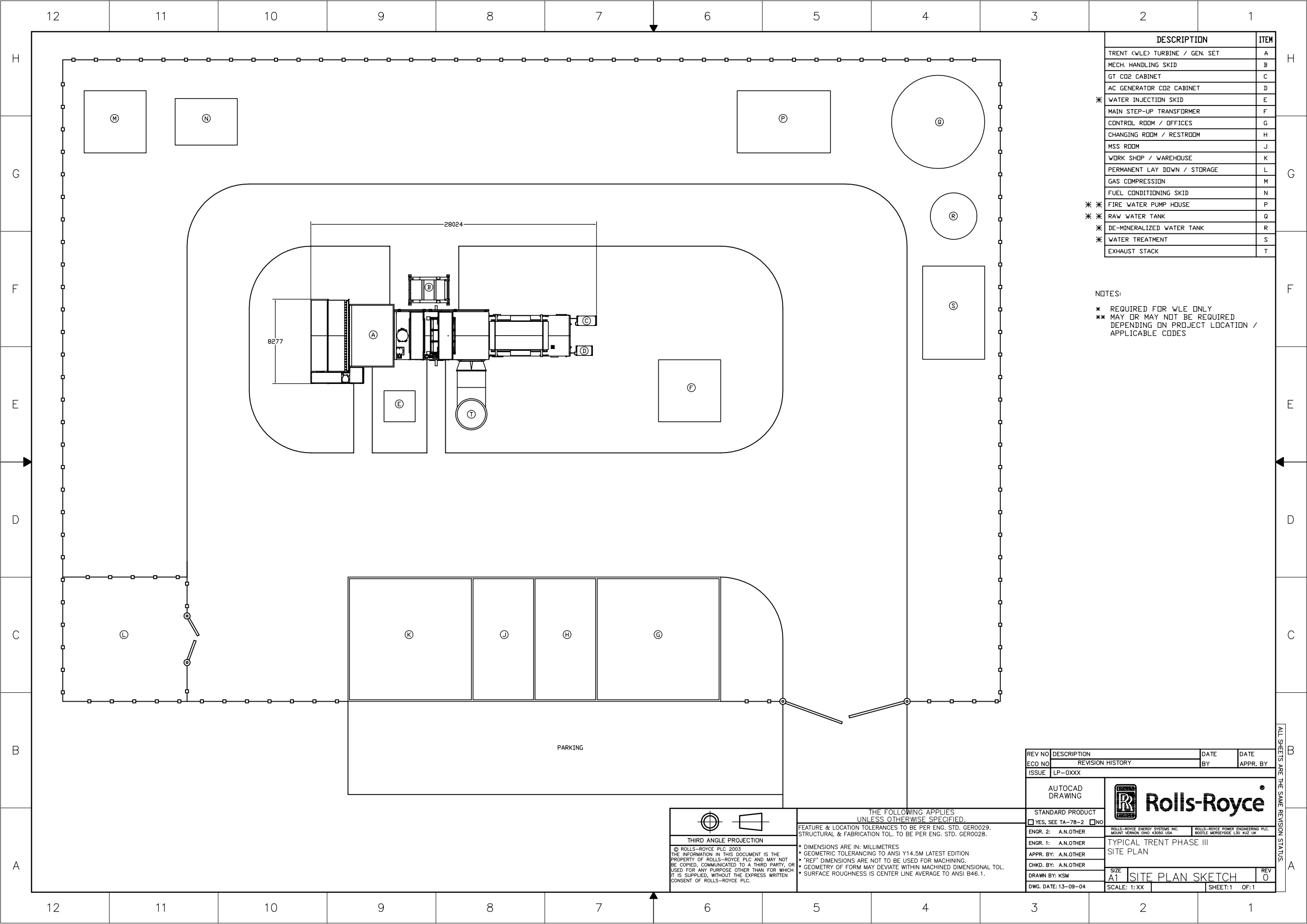


LEGEND:

- 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.



REVISED		CUSTOMER INFORMATION										DRAWN				09/19/08				ProEnergy EPC Services, LLC			
												CHECK				SL				GENERAL ARRANGEMENT PLOT PLAN			
												DESIGN								TWO (2) TRENT 60 GTG SIMPLE CYCLE			
												PROJ ENGR								FUTURE COMBINED CYCLE			
												PROJ MGR								XXXX			
												QA MGR								XXXX			
												SCALE				1"=30'				JOB NO.			
												DESCRIPTION								DWG NO.			
												REVISIONS								SK			
												NO.				DATE				SH NO.			
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DESCRIPTION	ITEM
TRENT (WLE) TURBINE / GEN. SET	A
MECH. HANDLING SKID	B
GT CO2 CABINET	C
AC GENERATOR CO2 CABINET	D
* WATER INJECTION SKID	E
MAIN STEP-UP TRANSFORMER	F
CONTROL ROOM / OFFICES	G
CHANGING ROOM / RESTROOM	H
MSS ROOM	J
WORK SHOP / WAREHOUSE	K
PERMANENT LAY DOWN / STORAGE	L
GAS COMPRESSION	M
FUEL CONDITIONING SKID	N
* FIRE WATER PUMP HOUSE	P
* RAW WATER TANK	Q
* DE-MINERALIZED WATER TANK	R
* WATER TREATMENT	S
EXHAUST STACK	T

NOTES:  
\* REQUIRED FOR WLE ONLY  
\*\* MAY OR MAY NOT BE REQUIRED  
DEPENDING ON PROJECT LOCATION /  
APPLICABLE CODES

REV NO	DESCRIPTION	DATE	DATE
ECO NO	REVISION HISTORY	BY	APPR. BY
ISSUE	LP-0XXX		
AUTOCAD DRAWING			
STANDARD PRODUCT <input type="checkbox"/> YES, SEE TA-78-2 <input type="checkbox"/> NO		ROLLS-ROYCE ENERGY SYSTEMS INC. MOUNT KENNON OHIO 43050 USA	
ENGR. 2:	A.N.OTHER	ROLLS-ROYCE POWER ENGINEERING PLC. BOXTLE MERSEYSIDE L30 4UZ UK	
ENGR. 1:	A.N.OTHER	TYPICAL TRENT PHASE III SITE PLAN	
APPR. BY:	A.N.OTHER		
CHKD. BY:	A.N.OTHER		
DRAWN BY:	KSM	SIZE A1 SITE PLAN SKETCH	
DWG. DATE:	13-09-04	SCALE: 1:XX	REV 0
		SHEET:1	OF:1

THIRD ANGLE PROJECTION

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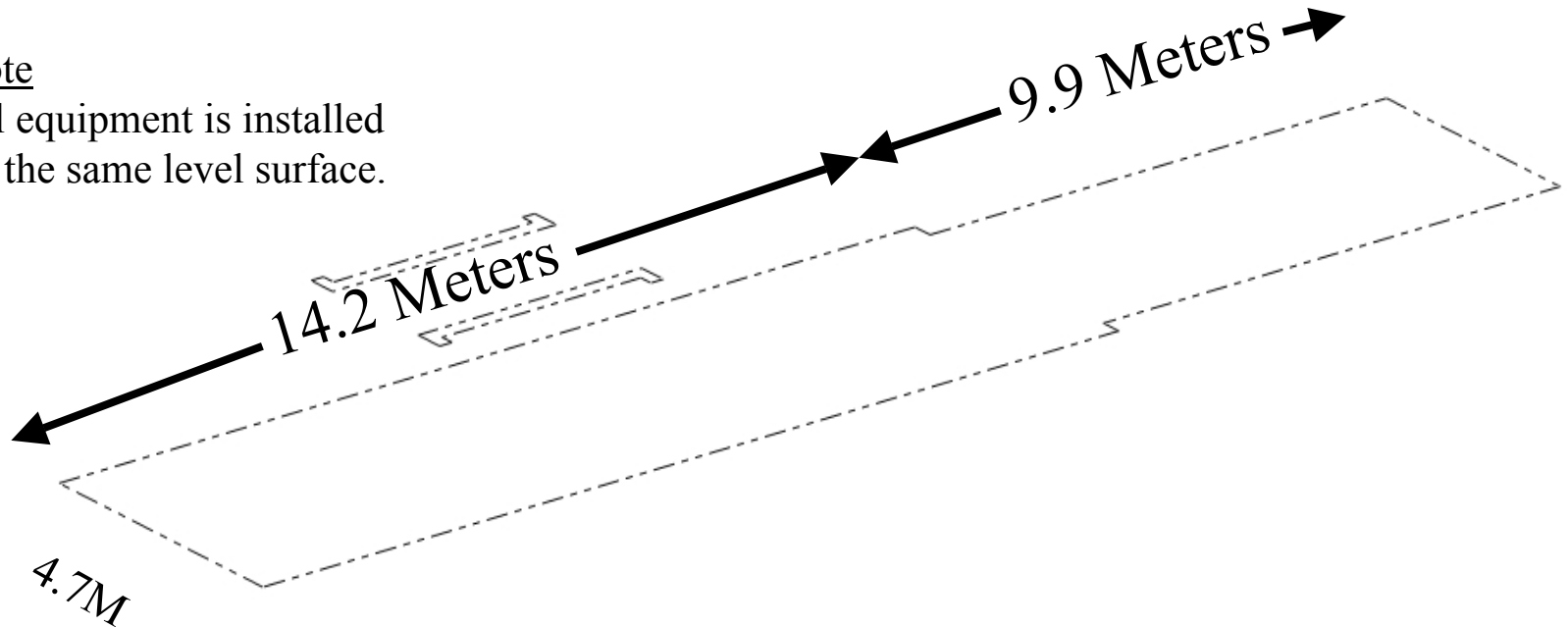
FEATURE & LOCATION TOLERANCES TO BE PER ENG. STD. GER0029.  
STRUCTURAL & FABRICATION TOL. TO BE PER ENG. STD. GER0028.

ALL SHEETS ARE THE SAME REVISION STATUS.

# Trent 60 GenSet Installation Footprint

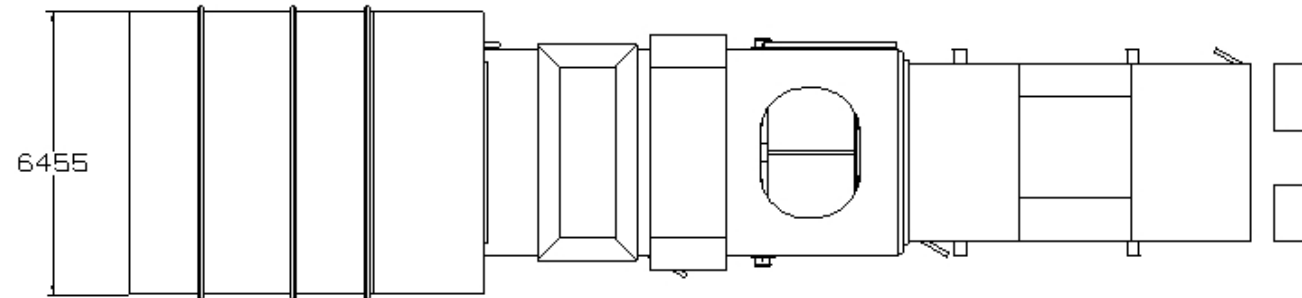
## Note

All equipment is installed  
on the same level surface.





# Trent 60 GenSet Outline and Foundation



## Estimated Weight

GT Skid - 66,000 KG  
GT Package Roof-35,000  
KG  
GT Engine - 13,600 KG  
Filter - 25,000 KG  
Generator Skid - 106,000 KG

