

Quotation Number IR 245/3 - 9 pages
3 x 3.3 MW 11 kV MWM Gas Power Plant

DATE: 02- September - 2011

Commercial & Technical Proposal
For
10MW - 11 kV
MWM DEUTZ Gas Engine Power Plant

Customer Name :
Project Name :

Location :

Country :
Attention to :

Contact details :

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Tel: +98 121 2229599

Fax: +98 121 3239001

Web: www.AlborzGenerator.com

Email: ba_alborz@yahoo.com

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1.0 10mw GAS GENERATOR POWER PLANT

The Plant consists of 3 x 3.3 MWM Natural Gas Generators:

1.1 Generator Set:

Engine Model	Deutz (MWM) TBG 632 V16 - Original
Continuous Power Output:	4000kVA ;3300kWe @ 25°C
Power Derated To	3900kVA; 3120kWe @ 40°C
Engine Speed:	1000 RPM
Frequency:	50Hz
Governor Type:	Electronic.
Fuel Type:	Natural Gas
Fuel Consumption:	2.25 kWh / kWh
Starting:	Air
Alternator Model:	AVK DIG 156 I/6 or equal - Original
	Brushless,
	Insulation Class H, Temp Rise Class F
	Automatic Voltage Regulator
	Power Factor 0.8
	Enclosure to IP 23 2
	Bearing
	Anti-Condensation Heater
	Winding RTD's (2/Phase)
	Bearing RTD's (1/Bearing)
	Metering CT's
	Differential Protection CT's (10P20)
Rating Continuous	4125kVA, 3300kW at 40°C
Voltage:	11.0kV ±10%
Frequency:	50Hz

The Alternator comprises of a brushless two bearing unit, designed to meet the standards for industrial rotating electrical machines laid down in BSEN60034 and relevant sections of BS5000, IECEN60034, VDE 0530, Nema MG1-22 and CSA C22.2 No. 100.

The Alternator meets the requirements of Lloyds, Germanischer Lloyd, Bureau Veritas, American Bureau of Shipping, Det Norske Veritas or R.I.N.A.

It is of compact design, 6 pole, running at 1000 rpm, self excited with electronic Automatic Voltage Regulator providing voltage regulation within +/- 0.5% of rated output, 6 wire stator, class H insulation, with screen protection providing radio interference suppression to BS1597 and VDE class K, Voltage Transient protection for AVR and rotating diodes.

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2.0 Scope of supply TBG632

2.1 Basic engine TBG632 for natural gas

2.1.1 Crankcase

Single-piece casing in spherical graphite iron, inherently stable due to the depth of the side walls; suspended main bearings, cross-bolted; lateral maintenance apertures; fitted cooling water jacket; wet cylinder liners; crank case vented via electric extractor fan with oil separator which discharges into the open air (supplied loose).

2.1.2 Drive gear

Forged steel crankshaft with welded counterweights, double T-shank connecting rods with inclined toothed mating faces, single-piece light alloy piston with two compression rings, one oil wiper ring.

2.1.3 Cylinder head

Individual cylinder heads with four valves, mixture feed from V-space, exhaust directed via V-space into the high-temperature dry PEARL exhaust manifolds. Spark plugs located centrally in the combustion chambers with intensive plug seat cooling.

2.1.4 Ignition

Microprocessor-controlled high-tension ignition system with low-tension distribution, one ignition coil per cylinder, with no moving parts and therefore no wear; triggered via Hall effect pick-ups at the flywheel and cam shaft, variable ignition timing, ignition energy and distribution controlled by computer on primary side of ignition coils, chamber type spark plugs with Teflon plug connectors.

2.1.5 Mixture formation

Air is drawn into the mixer via paper dry-air filters with visual maintenance indicator and integral air intake preheating via the engine cooling water circuit (supplied separately); gas is supplied via the gas control unit.

Gas/air volume ratio adjusted via the DEUTZ multi-gas mixers.

2.1.6 Mixture charging

The turbocharger draws air and gas from the gas mixers at atmospheric pressure, with inter-cooling of the compressed mixture in a 2-stage mixture cooler (low temperature stage in separate cooling circuit of 400C); rotary throttle valve to control output is positioned after the mixture cooler.

2.1.7 Control and monitoring

The gas-air mixture is controlled via the mixer positioning motor. Control is executed by the TEM system on the basis of a combination of combustion chamber temperature and output/speed.

2.1.8 Compressed air starter

With attached control unit and flexible compressed air connecting hose.

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2.1.9 Compressed air supply

We include sufficient air storage bottles and electric motor driven compressor and air supply controls, along with a black start diesel powered compressor.

2.1.10 Lubricating oil system

Lubricating oil heat exchanger (supplied loose) for integration in the heating water or mixture cooling circuit dependent on the layout of the plant, automatic oil replenishment into the oil pan by controlled feed from the supply tank, automatic pre-lubrication by electric pump, same pump also used to empty the oil sump.

Bunded oil tanks both of capacity 6000 litres are included, one for clean oil and the other for waste oil. Contents gauges and level alarms are included.

2.1.11 Cooling water connections

Expansion joints with counter flanges for inlet and outlet of jacket water and intercooler.

2.1.12 Cooling water preheating

Electric cooling water preheating 18 kW with electric circulating pump installed at the genset.

2.1.13 Radiators

Without knowing the final layout of the building we have allowed for roof mounted cooling radiators with multiple fans for charge cooling and dump cooling.

2.1.14 Three-phase internal pole synchronous generator

As per VDE 0530, BS5000, IEC34 etc, brushless, self-regulating, self-excited, designed for island and mains parallel operation, electronic voltage regulator and power factor regulator installed in the terminal box, set point adjuster supplied loose for installation in a control panel, 3 x PT100 temperature sensors to monitor winding temperature, 2 x PT100 for bearing temperature supervision, Anti-condensation heaters are fitted.

2.1.15 Genset layout

Gas engine and generator are flexibly coupled, mounted on a common steel base frame. Vibration isolation is via spring elements for mounting on a foundation (provided by customer). Cooling water pre-heater, pre-lubrication pump and lube oil pre-heater (with independent pump) are baseframe mounted.

2.1.16 Cabling

Genset cabled using multi-function rails. Cabling for generator and auxiliaries to be provided by customer.

2.1.17 Paint finish

Paint colour RAL 5010.

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2.1.18 HV Switchgear

Up to 13.8kV Motorised VCB - VC6 - Schneider Electric

GenieEvo metalclad switchgear panels are of the indoor design consisting of rigid steel housings, which comprise a non-withdrawable Vacuum circuit breaker.

This offers a simple and flexible approach to switchgear with a wide choice of options covering all modern consumer applications.

The GenieEvo concept is an evolution from the extremely successful Genie philosophy which offers increased levels of flexibility and greater choice. By allowing separate selection of the switchgear and protection and control modules. GenieEvo extends the concept of Genie by offering a gas free circuit breaker to the product portfolio.

GenieEvo comprises

- ⌘ Cast resin encapsulated MV system
- ⌘ Demountable vacuum circuit breaker
- ⌘ Controlled air, resin encapsulated series disconnecter
- ⌘ Flexible pre-engineered protection and control modules

Protection - Schneider Electric

'Sepam' protection relays offer an extensive and modular solution for generator protection. Typical application, protection by disconnection of the generator, can operate in parallel with network and conforms to engineering recommendation G59/1 1991. Also provides differential protection (87) of strategic generator-transformer units. These include extensive monitoring and control features and are ideally suited for integration into a supervisory system.

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Control panels

2.2.1 DEUTZ TEM-EVO

Supplied as per separate specification for erection in proximity to the genset. Length of cable between gas engine and TEM panel is 8 m. Panel is Rittal type AE1280, colour RAL 7032.

Intelligent terminal strip for installation in auxiliary panel (max. 250 m away from genset panel). Operating Computer Screen with colour LCD display (max. 100 m away from genset panel), for installation in auxiliary panel or external control panel.

2.2.2 ComAp Genset Controller panel

Each set comes with a free standing control panel fitted with the latest ComAp **InteliSysNT** CHP Controller. InteliSysNT is an expandable controller for both single and multiple gen-sets operating in standby or parallel modes, especially in cogeneration (CHP) and other complex applications.

Detachable construction requirements.(consisting of IS-NT-BB and IS-Display or InteliVision 8) allows easy installation with the potential for many different extension modules designed to suit individual customer

A built-in synchronizer and digital isochronous load sharer allow a total integrated solution for gen-sets in standby, island parallel or mains parallel. Native co-operation of up to 32 gen-sets is a standard feature.

InteliSysNT supports many standard ECU types and is specially designed to easily integrate new ones.

A powerful graphic display with user-friendly controls allows any user whatever their ability to find the information they need. The display on the basic version is capable of displaying graphical languages.

2.3 Installation parts, supplied loose

- Lubricating oil heat exchanger (plate type for mounting in LT cooling circuit)
- Electric extractor fan with oil separator for crankcase venting, including flexible connection. Differential pressure switch for crankcase venting.
- Paper dry-air filters with integral air intake preheating and flexible air line. Regulating valve for air intake preheating, with electric actuator.
- Expansion joints for flexible gas connection.
- Exhaust expansion joints with clips and weld-on flanges.
- Gas control unit as per DVGW supplied as a compact unit with ball valve, gas filter, manometer, pressure switch, 2 solenoid valves, zero pressure regulator, complete with connecting flanges and counter flanges.
- 1 flexible gas pipe for connection to engine.
- 1 set anti-vibration spring elements.
- 2 solenoid valves with connectors for lubricating oil replenishment (from supply tank).
- Operating instructions and spares parts list (2 copies).
- Exhaust back pressure switch.

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2.4 HV Switchgear - Transformers: 3x4500kva

HV Switchgear suite of 630A breakers, rated 11kV, 25kA for 6 sec busbar, comprising 6 generator incomers, 2 bus section and 4 outgoing feeders

Transformers: 3x4500kva

2.5 Not included

- Power plant building
- Air intake and extraction
- Cabling and ducting
- Pipe work for gas and oil
- Installation & Commissioning

3.0 Price Schedule

1 x 10 MW Power Plant, 11 kV Gas engine Power Plant and HV Switchgear as shown

Total Price { EPC } USD\$

4.0 Terms & Conditions.

Payment	By confirmed irrevocable letter of credit payable in USD\$ in IRAN as follows: 30% with order, 50% when notified that goods are ready for despatch. Part shipments to be allowed
Currency	All prices are in USD\$ 20% after installation
Delivery	9 weeks
Validity	30 days
Origin	UK
Packing	Shrink-wrapped for shipping in standard shipping containers
Warranty	Standard Warranty 7 Months from shipment or 5 months from date of installation whichever is the sooner.

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5.0 Documentation

One (1) Copy of the following standard set of documentation will be supplied with each Generating set:

- 5.1 Operating and Maintenance manual,
- 5.2 Wiring diagram,

All Drawings and Documentation shall be in the English language. Units of measurement shall be in accordance with the SI or metric system.

6.0 Inspection

Inspection will be done by SGS or Lloyds and seller is obliged to coordinate for inspection and pay inspection cost.

7.0 Certificate of Quality

The certificate of quality of the goods could be issued by Lloyds or SGS basis on the quality details and Standard mentioned in this proposal if the Buyer require.

The seller is obliged to coordinate for issuing this certificate. The related proposal with SGS or Lloyds will sign by the Buyer and the cost will be covered by the Buyer.

8.0 Training

Training for installation, operation and maintenance the goods for two persons from the buyer for 7 days in the place of seller is free of charge. All costs of tickets, hotel, food and other expenses are excluded.

9.0 Spare Parts and Service after Sales

The seller is obliged to supply all spare parts and after sales services of the goods to Buyer minimum for 10 years from delivery the goods.

10.0 Document negotiation

Negotiation Documents for Letter of Credit that shall be issued or confirmed by the buyer's Bank are including as following:

- 10.1 Shipping documentation (Bill of Lading).
 - 10.2 Certificate of Origin for all generating sets subject to this proposal.
 - 10.3 Packing list.
 - 10.4 Inspection certificate or report from SGS or Lloyds for all generating sets.
 - 10.5 Certificate of warranty for all generating sets issued by the seller. 10.6 Test certificate for generating sets.
 - 10.7 Commercial Invoice for each shipment confirmed by the local chamber of commerce. 10.8
- All equipment's shall be new and made of the year 2010 and 2011 and certificate from SGS.

11.0 Enclosure

Technical data 50 Hz TBG 632 V16, Natural gas, 500 NOx
Technical data 50 Hz - Natural gas applications ...
TBG 632 V16 ...

..TBG 632 V16 Erdgas 500 NOx
..n_mwm_tbg632_0509[1]
...Schematic Plan

➤ Please find below details of what work was carried out as part of the E50 service plus the variations and testing. Hold

itch #1 - 2200071

All 16 cylinder heads replaced by service exchange cylinder heads from the Deutz German Xchange centre. All associated valve gear re-assembled and set to the correct clearances.

All 16 combustion spaces cleaned and checked.

Both intercoolers completely stripped and rebuilt using all new gaskets and seals. All aluminium covers, top and bottom, have been replaced using cast covers.

Both gas mixers cleaned, checked and lubricated. Control of both gas mixers checked correct and tested from the TEM with full travel. Limit switches set up correct.

New oil filters, seals and O rings fitted.

New air filters and spark plugs have been supplied but not fitted to prevent damage in transit. Old filters and plugs re-fitted to the engine to prevent dirt ingress to engine.

All old oil drained from engine.

Oil filter housing bracket on A bank has been replaced due to the original being badly cracked. Intercooler and jacket water system pressure tested to 4.5 bar with no leaks.

Both turbo chargers type RR221 -14 have been returned to the manufacturer for overhaul. The details of which have been supplied on a previous report.

New control batteries have been fitted to the generator control panel.

All associated pumps and fan motors associated with the generator have been run under electrical power and proved correct.

Throttle has been calibrated through the TEM system. All engine sensors are indicating correct back to the TEM system.

The TEM CPU has been upgraded to version 2.29, and the operating terminal has been upgraded to the latest touch screen version.

The TEM system has been re-installed with all the original commissioning parameters and additional 24 messages .

Holditch #2 - 2200093

All 16 cylinder heads replaced by service exchange cylinder heads from the Deutz German Xchange centre. All associated valve gear re-assembled and set to the correct clearances.

All 16 combustion spaces cleaned and checked.

Both intercoolers completely stripped and rebuilt using all new gaskets and seals. All aluminium covers, top and bottom, have been replaced using cast covers.

Both gas mixers cleaned, checked and lubricated. Control of both gas mixers checked correct and tested from the TEM with full travel. Limit switches set up correct.

New oil filters, seals and O rings fitted.

New air filters and spark plugs have been supplied but not fitted to prevent damage in transit. Old filters and plugs re-fitted to the engine to prevent dirt ingress to engine.

All old oil drained from engine.

Intercooler and jacket water system pressure tested to 4.5 bar with no leaks.

Both turbo chargers type RR221 -14 have been returned to the manufacturer for overhaul. The details of which have been supplied on a previous report.

New control batteries have been fitted to the generator control panel and a new battery charger.

All associated pumps and fan motors associated with the generator have been run under electrical power and proved correct.

Throttle has been re-calibrated through the TEM system. All engine sensors are indicating correct back to the TEM system.

The TEM CPU has been upgraded to version 2.29, and the operating terminal has been upgraded to the latest touch screen version.

➤ The TEM system has been re-installed with all the original commissioning parameters and additional 24 messages

Holditch #3 - 2200100

All 16 cylinder heads replaced by service exchange cylinder heads from the Deutz German Xchange centre. All associated valve gear re-assembled and set to the correct clearances.

All 16 combustion spaces cleaned and checked.

Both intercoolers completely stripped and rebuilt using all new gaskets and seals. All aluminium covers, top and bottom, have been replaced using cast covers.

Both gas mixers cleaned, checked and lubricated. Control of both gas mixers checked correct and tested from the TEM with full travel. Limit switches set up correct.

New oil filters, seals and O rings fitted.

New air filters and spark plugs have been supplied but not fitted to prevent damage in transit. Old filters and plugs re-fitted to the engine to prevent dirt ingress to engine.

All old oil drained from engine.

Intercooler and jacket water system pressure tested to 4.5 bar with no leaks.

Both turbo chargers type RR221 -14 have been returned to the manufacturer for overhaul. The details of which have been supplied on a previous report.

New control batteries have been fitted to the generator control panel.

All associated pumps and fan motors associated with the generator have been run under electrical power and proved correct.

Throttle has been re-calibrated through the TEM system. All engine sensors are indicating correct back to the TEM system.

The TEM CPU has been upgraded to version 2.29, and the operating terminal has been upgraded to the latest touch screen version.

The TEM system has been re-installed with all the original commissioning parameters and additional 24 messages

Please find below details of the repairs carried out on each turbocharger by serial number as part of the E50 services . HT

428704, 428705, 428706,428707

Turbine casing replaced on all four above serial numbers, due to cracks which have formed in the involute section of the

The compressor wheels have been dressed up on each of these turbo's.

turbine casing. Large parts of the casing has broken away as a consequence on all four turbine casings.

As a result of the cracked turbine casing breaking away, the turbine blades have sustained foreign object damage on all four turbochargers. This has caused an in balance resulting in excess wear to the shaft, requiring the shafts to be replaced as a consequence on the four above turbo's.

All four of the above turbochargers have had the normal service parts exchanged, piston rings, O seals etc. HT 428708

Turbine casing replaced due to cracks which have formed in the involute section of the turbine casing. Large parts of the casing has broken away as a consequence on the turbine casing.

As a result of the cracked turbine casing breaking away, the turbine blades have sustained foreign object damage. The compressor wheel has been dressed up.

The above turbocharger has had the normal service parts exchanged, piston rings, O seals etc. HT 428709

Turbine casing replaced due to cracks which have formed in the involute section of the turbine casing. Large parts of the casing has broken away as a consequence on the turbine casing.

As a result of the cracked turbine casing breaking away, the turbine blades have sustained severe foreign object damage which has resulted in the replacement of the compressor wheel.

The above turbocharge has had the normal service parts exchanged, piston rings, O seals etc.

EXHIBIT A TO THE BILL OF SALE

THE EQUIPMENT

Quantity	Description
3	Deutz MWM TBG632V16 gas engine
3	A Van Kalk type DIDRN 150/140 n/6 11kV, 50Hz Alternator
3	Acoustic rooms
3	Engine Control Panel and 48V DC switchgear battery charger unit
3	Exhaust and silencers to stacks (e)
3	Forced draft water cooling system
1	11kV, 230MVA HV switchgear suite comprising 3 generator incomer SF6 circuit breakers (f)
1	Motor control centre
3	Fuel gas trains (a)
1	Clean Lube oil tank
1	Dirty oil tank
1	Set of manuals
1	Central compressed air system
1	Fire and gas detection system

Excluded Assets:

- (a) The following sections of the fuel trains are not the property of the Seller and are excluded
- Transco Skid mounted hut for housing meter
 - Transco pipe to mixing train
 - Mines gas pipe and mixing valves to mixing train labelled "Green Gas property"
- (b) Midlands Electricity Connection box 3 is MEB property.
- (c) All equipment in the transformer room.
- (d) All equipment in the workshop area.
- (e) The scaffolding under the silencers.







30 480 kg
67 200 lbs
4 000 cu ft
8 680 lbs

2.9m
9'6"

MAX. GROSS TARE
30 480 kg
67 200 lbs
4 000 cu ft
8 680 lbs

26 460 kg
58 340 lbs
76.3 m³
2 694 cu ft

CAUTION
SHOULDER

MAX. PAYLOAD CUBE
26 460 kg
58 340 lbs
76.3 m³
2 694 cu ft

480174 4
4351

NOSU 4617040

0480 KSS
2260 LSS
3800 KSS
8380 LSS
6680 KSS

MAX. GROSS
30 480 kg
67 200 lbs

4V
4-274