

1. Technical Schedule

Machine specification	QVT250 BG CHP
reference Fuel	Bio gas 60-80% CH4
Engine	Perkins 4006-23 TRS1
Cylinder arrangement	1-6 T/C and I/C
Running speed	1500 rpm
Alternator	Mecc Alte -
Alternator average efficiency	93.5%
Electrical system	400 v / Three phase / 50 Hz
Rating conditions	Sea level 25oC 80%R

2. There is heat dissipated from the intercooler circuit. As intercooler requires to be operated at 40 degrees C, this heat is generally unrecoverable, and a separate radiator has been included. It is possible to cool the intercooler with secondary cooling water at 70 deg., but this will derate the engine output.

3. General Specification

This machine is a combined heat and power type generating set with the prime mover being a reciprocating engine fuelled by natural gas and driving a synchronous alternator. Heat recovery is fitted on the engine jacket and exhaust.

It is an enclosed unit suitable for mounting in a plantroom.

The engine is started by lead acid battery and starter motor. Once it has fired, it runs up to synchronous speed under control of an electronic governor. When up to speed and stable, automatic synchroniser controls engine speed to allow synchronism with mains grid when a motorised circuit breaker closes to allow the delivery of electricity to site distribution.

Once in parallel, machine gradually loads up to full output.

Voltage is controlled by automatic voltage regulator. Power factor is also controlled. Shutdown functions: -

- Engine faults
 - Low oil level
 - Low coolant levels
- High engine coolant temperature
 - Intercooler faults
- Generator overload (kW and kVAr)
- Overspeed
- Low/High gas pressures

Heat is collected from the engine's oil and the primary cooling water (engine jacket), being given up in water/water heat exchangers to secondary circulating water. Additional heat is recovered from engine exhaust.

Intercooler heat is also collected but is dumped in a local radiator.

Silencing system with stainless steel internals and suitable for residential use is provided.

Machine base frame has drip tray built into it.

Engine is fitted with automatic oil make-up system and separate oil storage tank. An on-board pump is also fitted for oil draining.

The Perkins 4006 engine we are proposing has been in existence for several years and has undergone a continuous process of improvement from its origins as a diesel engine for base load and standby power generation.

The engine, being from the mass-produced field, makes it both cheaper in first cost and in spares costs giving minimum costs of ownership

4. Engine/alternator

Prime movers, though specially developed for gas burning, have as their basis compression ignition engines. With spark plugs, electronic ignition system, modified pistons to give a lower compression ratio and thus freedom from detonation, the resulting engines are extremely tough units with block, heads and bottom end designed for the heavy loads of the CI type of engine and top end able to withstand the higher temperatures of an SI engine.

Engines are directly coupled via flexiplate coupling to single bearing, self-excited alternators.

Engine/alternator assembly is mounted to a substantial steel bedplate with anti-vibration mounts designed for 90% isolation.

Exhaust systems are constructed of mild steel at engine discharge. Downstream of exhaust gas heat recovery, stainless steel is used if condensate is likely.

Engine is fitted with fuel system in accordance with regulations, with duplicated valves, filter, pressure regulator mixture adjustment and carburetor.

5. Heat Recovery System

Three heat recovery units are fitted - intercooler cooling, exhaust heat recovery and the engine jacket and lubricating oil. The engine fuel/air mixture is cooled after the turbocharger by a liquid-cooled circuit. This circuit is fitted with its own pump, thermostat and radiator matrix. Because the intercooler has to operate at a temperature close to ambient, it is not usually possible to recover this heat.

Exhaust gas heat recovery unit is a shell and tube unit fabricated from stainless steel. The exhaust discharge temperature is generally maintained above dew point to prevent condensation and subsequent corrosion damage and to avoid an obvious plume.

Engine coolant is cooled by secondary water which itself then goes on to provide heat to local area.

Thermostats are fitted where necessary to ensure that overcooling does not occur.

Technical schedule gives typical heat recovery figures, with a tolerance of 7%. The different sources of heat can be separately recovered and used in independent circuits if necessary. If this option were of interest, extra cost may be implied. In particular, the exhaust heat recovery unit can be used for heating alternative fluids.

Heat dump system consists of electric fan cooled radiators suitable for outdoor mounting. Control of the heat dump system is given from the panel logic controller using fan starters, temperature probe and 3 port valve.

Pipework is generally carried out using BS 1387 pipe for threaded pipe using BS21 threads up to 50 mm, for larger pipe, welded with fittings to BS 1965.

5.1 Gas Train

The gas train is designed in accordance with British Regulations for gas supply. From an isolating ball valve, gas flows via a 5-micron filter to duplicated solenoid valves. From the valves, gas passes to a zero-pressure regulator which maintains a constant supply pressure into the gas/air mixing system. This valve will therefore compensate for: -

- Variations in atmospheric pressure
- Variations in inlet gas pressure (within the design range)
- Variations in flowrate which will affect pressure losses in the gas train
- Variations in air pressure due to blocking of air filter in service

The solenoid valves fail closed and the majority of engine and electrical faults will close these valves.

The gas train is also fitted with high and low gas pressure switches

5.2 Control Panel

The machine is controlled from its own panel.

The machine is controlled by a proprietary engine control module based on programmable logic controller with all machine operations automatic. Removal of the call to run signal will allow the machine to go through its shut down cycle and stop. The control module uses available software which can be accessed via dongle. Customer variations to control system can be easily accommodated, though warranty will be void if alterations are made during warranty period.

All instrumentation is provided on the front panel in the form of an LCD panel which continuously reports on machine operational state and gives a readout of any shutdown functions.

Ancillary items fitted within the control panel: -

- Static battery charger
 - Starter circuits for all auxiliaries
 - Motorised CB
 - Current transformers
 - Governor controller

5.3 Secondary c.w.

Flanged terminations at enclosure wall or roof. Secondary circulating water pump not included at present pending decision on machine location and pressure drop in associated pipework.

5.4 Gas

Termination at enclosure wall. Gas to be maintained in the pressure range 50 to 100 mbar under all conditions of loading.

5.5 Electricity

Connection at 400 v / 3 ph / 50 Hz to outgoing ways of MCB by others. Any connections for SCADA, call-to-run etc. by others.

5.6 Engine exhaust

Exhaust silencer loose supply for installation by others in site run exhaust system.

5.7 Condensate

By maintaining exhaust temperature above dewpoint, condensate is minimised, though it may be formed at startup and after shutdown. No condensate collection has been included.

6. Options and summary of supply scop

Acoustic enclosure	Rated at 65dB 1m unless otherwise stated	Not included
ISO container acoustically lined		Included
Stainless steel silencer		Included
Bulk Lub. Oil tank and auto fill		Not included
Alternator rated to class F temperature rise		Included
Power factor regulator		Included
Gas Train (UK standard)		Included
Low engine water level switch		Included
Low sump oil level protection switch		Included
Secondary water pump		Not included
Exhaust heat recovery		Included
Heat dump system	Horizontal table top radiator	Included
Gas pressure booster		Not included
Gas metering		Not included
Electric meter		Included
Heat meter		Not included
Gas detection system		Not included
Control panel	Synchronising panel Inc G59 relay	Included
Battery trickle charger		Included
Remote monitoring	GSM Based and signal dependant on area	Included
Automatic mains failure changeover panel		Not included
Tests	Engine test at manufactures works (unwitnessed)	Included
	Alternator test at manufactures works (unwitnessed)	Included
	Panel function tests (works)	Included
	Generator package test on Natural gas	Included
	Site test and commissioning	Not included
Delivery		Not included
Unloading and placing		Not included
Mechanical installation		Not included
Electrical installation		Not included

