

## DRAFT 02-26-07

### SCOPE OF SUPPLY, TERMINATION POINTS, AND EXCLUSIONS

#### Standard Waukesha Power Module Generator set Scope of Supply

Standard genset package scope of supply, generator set package, comprises:

#### Gaseous Fuel Internal Combustion Engine

- **Waukesha VSG11GSI/GSID Engine Generator systems.** As WED – Bulleting 8070-0102,
- Inline 6 cylinder, 11Liter displacement, Natural Gas Engine
- **Rated 150 kW @ 1800 rpm** for continuous duty operation, or
- **Rated 125 kW @ 1500 rpm** for continuous duty operation after adjustment
- Spark-ignited natural gas fuel system
- Dual stage panel type Intake air filtration system
- Actuator - **Woodward – Flo–Tech – ITB** Integrated throttle body and actuator Electronic speed control governor ( $\pm 0.5\%$  steady state frequency regulation), Product Bulleting – 04140B)
- Governor Control – **Woodward 2301D** digital load sharing system. For isochronous parallel operation of multiple units or single units stand alone or in parallel with the utility. Mounted in Control Panel.
- Closed Breather system, mounted and piped
- Gas Regulator, Equimeter, Model: 3243-12, Gas inlet pressure: 0.3 – 3 psi, Mounted, Natural Gas only.
- Asco - Solenoid Valve – Normally closed, for 2” pipe, Not recommended for fuels containing sulfur bearing compound, 24V DC
- Alternator – Motorola, 24V DC, 38 amp @ 1800 rpm. Includes belts and belt guard.
- Jacket Water Pre-heater – Thermostatically controlled, 120 V AC, single phase, 2000 watts, mounted
- REN – Oil level regulator – Mounted on oil pan
- Electrical starter – 24V DC, Delco
- Sens battery charging alternator, 24V DC, 20 amps.
- Horizontal Radiator cooling system (122°F ambient temperature capability) for the Jacket Water and Vertical Radiator for the auxiliary circuit.
- Exhaust Silencer
- Catalytic Converter 3 way – Mirathech + Air fuel Module – Mec2001
- Batteries – 24V, Two 12 volt, 150 A.H., SAE 4D batteries and cable,
- Battery Box – Steel reinforced fiberglass construction with a protective cover.

## Synchronous Generator

- Marathon Electric Alternator, Model: 432RSL4009, 12 leads – re connectable, 60 / 50 Hz, 160 KW @ 80C, Rise. Class H insulation
- Highly efficient synchronous generator operating at 1800rpm
- 480/277v, 3 phase, 60 Hz – (400/230v, 3 phase, 50 Hz)
- Steady state voltage regulation of  $\pm 0.5\%$ , DVR2000E or similar

## Generator Set Enclosure

- Weather resistant outdoor enclosure
- One piece Structural steel sub base assembly
- Full access to all components for serviceability
- Acoustic insulation to provide max noise level of 68dBA @ 7 m
- Fully lockable

## CHP System

- 100% Dump Radiator mounted within enclosure.
- Plate and Frame Heat exchanger for customer proces water systems included in package
- Jacket water heat recovery
- Thermostatic Three way temperature control valve, 175 F.

## System Controls

### **CONTROL PANEL** with:

- **Woodward – EGCP-2**, Generator Master Control for generator control. The EGCP controller provides for the engine auto start/stop and safety controls, as well as voltage & speed raise/lower control. It also controls opening & closing of the breakers. The PLC / EGCP2 does have default set points installed, although these will need to be changed prior commissioning and start up.
- **PLC** – Micro Programmable Logic Controller, Model: **DL06-PLC** from Automation Direct, for package control and sequencing. The PLC in the Cogen module controls several jacket water fan, and engine run signal, some enclosure temperature controls & temperature sensors from engine/genset RTD outputs.
- **Woodward 2301D** digital load sharing system
- Main line Circuit Breaker - MLCB

## Modes of Operation

### Grid Parallel mode of operation

Unit shall act as a regulated current source and supply power to the site loads while connected to the utility grid. The unit is also capable of exporting power back to the utility grid as required/allowed by the local utility. (Additional controls, relays and switchgears may be required – not included in this package – depending of the utility and final destination)

While in Grid Parallel mode of operation the following protective relaying devices will be incorporated: - Refers to the EGCP2 – OEM Manual for full description.

- Over/under voltage
- Over/under frequency
- Reverse power
- Over current

### Grid Isolated mode of operation

Unit shall act as a regulated constant voltage source and supply power to site loads while isolated from the utility grid. Also, the unit shall be capable of starting upon loss of grid with an external start command.

Provides necessary interface for local system operator including the following:

#### **Operational Information**

- Voltage – L-L and L-N
- Amperage – L-L and L-N
- Frequency
- Kilowatt output
- Oil pressure
- Water temperature
- Total operating hours

#### **Alarm Indications**

- Low oil pressure alarm and shutdown
- High water temperature alarm and shutdown
- Engine over speed

## Exclusions

The following items are specifically excluded from the scope of supply

- Electrical or mechanical installation work at the site
- Fuel piping external to the generator skid
- Field Service assistance to assist in any site start up.
  - Re-program the EGCP-2 for the site specific set points
  - Re-program the PLC for the site specific requirements
  - Coordinate set points between the EGCP-2, the PLC, and the engine governor & voltage regulator
  - Provide start-up & commissioning of the Control Panel
- Electrical wiring and control wiring external to the generator skid, and additional control panels, breakers, protective devices according with the local utility.
- Engineering services
- Loading, unloading, and delivery to the site
- Relay coordination studies
- Flicker test or studies
- Emission Test
- Breaker coordination studies
- Harmonic test

## Termination Points

<b>Interface Description</b>	<b>Terminal Point(s)</b>	<b>Interface Responsibility</b>
Combustion air	Air intake filter	From atmosphere at ambient. No Purchaser interface.
Exhaust gas	Exhaust muffler	To atmosphere. No Purchaser interface.
Ventilation	Enclosure ventilation fan	To atmosphere. No Purchaser interface.
Enclosure mountings	Locations on base plate	Civil work to be provided by Purchaser based upon loading data provided by KPC.
Fuel gas	1.5" NPT inlet flange on genset package enclosure	Purchaser to provide fuel gas per KPC spec.
Drains	Drain system flanges on genset package assembly	Purchaser to provide drainage and disposal system.
Electrical power connection	Genset main circuit breaker 480V terminals	Purchaser to provide onward connections from terminals.
Remote monitoring and control	Genset controls system terminals	Purchaser to provide high speed internet access.
CHP	2" NPT connections	2 " NPT inlet and outlet to site heat load
Grounding	Grounding terminal on genset package assembly.	Purchaser to provide suitable arrangements and connections to terminals.

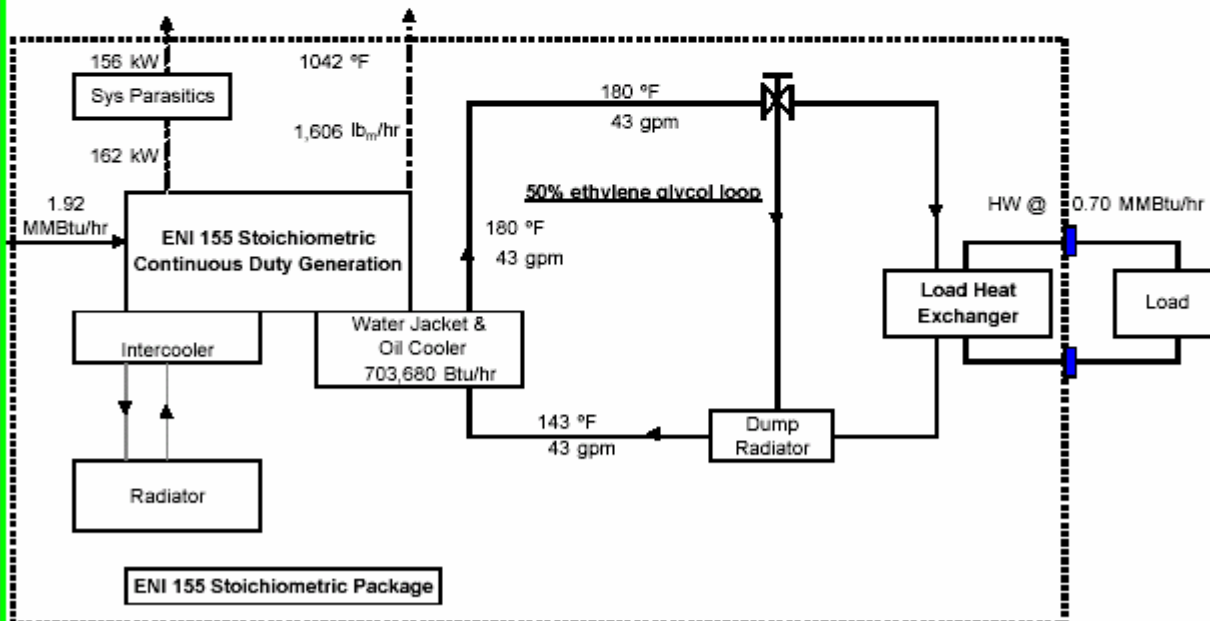
		EM-100-01000	
Net Electrical Output @ 0.8 power factor	kW	with CHP 156	150 Power Only
Net Electrical Efficiency <sup>1</sup>	%	(JW only) 28%	27%
Pkg Efficiency w/ Thermal Recovery	%	64%	
Heat Rate (Net, LHV)	Btu/kWh (kJ/kWh)	12,300 (12,977)	12,800 (13,505)
Engine/Generator Type		Continuous Duty Synchronous	
BHP (shaft) @ ISO	hp (kW)	239 (178)	
RPM	rpm	1800	
Output voltage		480/277 Volts, 3 Phase, 60 Hz	
<b>Emissions @ ISO</b>	NO <sub>x</sub>	g/bhp-hr 0.15	
	CO	g/bhp-hr 0.60	
	NMHC	g/bhp-hr 0.15	
	THC	g/bhp-hr 0.38	
Noise Level	dBA	68 dBA @ 7 meters	
Operating Capability		Blackstart capable in either isolated or grid parallel operation	
Power Quality	THD	Meets IEEE 519	
	Load Unbalance	%	
	Voltage Regulation Adjustment	%	
	DC Current Injection	%	
Fuel Supply <sup>2</sup>	Types	Natural Gas	
Fuel (LHV/HHV)	MMBtu/hr (GJ/hr)	1.919 (2.025)	/ 2.109 (2.225)
	ft <sup>3</sup> /hr (m <sup>3</sup> /hr)	2,109	(60)
Minimum Supply Pressure	psig (bar)	0.50 (0.03)	- 15.00 (1.03)
Fuel Standard (LHV/HHV)	Btu/ft <sup>3</sup> (kJ/m <sup>3</sup> )	910 (33,906)	/ 1,000 (37,259)
Enclosure	Height	in (mm)	126 (3,200)
	Length	in (mm)	204 (5,182)
	Width	in (mm)	76 (1,930)
	Weight	lbs (kg)	15,000 (6,804)
		Completely weatherproof for outdoor installation	
Warranty		18 months from delivery or 1 year from initial start up whichever occurs first. Option to purchase extended warranty.	

Notes: These specifications represent the design data as of the publication date listed in the lower righthand corner and may change without notice. Please contact your sales representative for the most current specifications.

1. All data based on ISO standard conditions of 29.54"Hg barometric pressure, 77F ambient & induction air temperature, 30% relative humidity.
2. Fuel Standard: dry natural gas, 910 Btu/ft<sup>3</sup> lower heating value (LHV).

Exhaust Flow	lb/hr (kg/hr)	1,606 (728)
Exhaust Temperature	°F (°C)	1,042 (561)
Jacket Water Flow	gpm (L/min)	43 (163)
Jacket Water Temperature (Out)	°F (°C)	180 (82)
Jacket Water Temperature (In)	°F (°C)	147 (64)
Oil Cooler Water Flow	gpm (L/min)	43 (163)
Oil Cooler Inlet Temperature	°F (°C)	143 (62)
Auxiliary Circuit Heat Rejection	MMBtu/hr (kWth)	0.087 (26)
Heat Gain from Water Jacket	MMBtu/hr (kWth)	0.616 (180)
Heat Gain from Oil Cooler	MMBtu/hr (kWth)	0.087 (26)
<b>Total Heat Recovery</b>	<b>MMBtu/hr (kWth)</b>	<b>0.703 (206)</b>
<b>CHP Options:</b>		
Hot Water	Flow Rate	gpm (L/min)
	Temp IN	°F (°C)
	Temp OUT	°F (°C)
		77 (292)
		138 (59)
		159 (70)

### CHP Capability @ 100% load



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