BASIC SPECIFICATIONS

AIR CLEANER – Two stage, dry panel type with rain shield and service indicator. Engine mounted.

AFR – Air Fuel Ratio control. Included with ESM®. Load based control with continuous feedback. Requires kW transducer.

BARRING DEVICE – Manual, mounted.

BASE – Engine, generator and optional heat exchanger are mounted and aligned on a welded steel, wide flange base, designed for solid mounting on concrete pad, with lifting outriggers.

BEARINGS – Heavy duty, bi-metal, replaceable, precision type.

BREATHER – Closed system, replaceable element, mounted.

CAMSHAFTS – Two high alloy steel, outboard mounted, roller follower, utilizing Miller Cycle technology.

CONNECTING RODS – Drop forged alloy steel, high angle split, serrated joint, oil jet piston pin lubrication.

COOLING SYSTEM – Choice of three circuit plate and frame heat exchanger with shipped loose expansion tank or flanged connections for remote radiator cooling.

CONTROL SYSTEM – Waukesha Engine System Manager (ESM®) integrates spark timing control, speed governing, detonation protection, start-stop control, diagnostic tools, fault logging and engine safeties. Engine Control Unit (ECU) is central brain of the control system and main customer interface. Interface with ESM is through 25 foot (7.6m) harness to local panel, through MODBUS RTU slave connection RS-485 multidrop hardware, and through the Electronic Service Program (ESP). Customer's connections are only required to the local panel, fuel valve, and for 24V DC power supply. Compatible with Woodward load sharing module. ESM meets Canadian Standard Association Class 1, Division 2, Group D, hazardous location requirements.

CRANKCASE – Alloy cast iron, fully ribbed, integral with cylinder frame. Main bearing caps drilled and tapped for temperature sensors. Does not include sensors.

CRANKSHAFT – Forged steel, nine bearings, oversized connection rod journal area, counterweighted and dynamically balanced.

CYLINDERS – Removable wet type cylinder liners, centrifugally cast.

CYLINDER HEADS – Sixteen interchangeable, valve–in–head type. Four valves per cylinder. Two hard faced intake valves. Two hard faced exhaust valves. Replaceable intake and exhaust valve seats. Mechanical valve lifters with pivoted roller followers. Optimized cooling characteristics and oversized porting.

ELECTRONIC SERVIC PROGRAM (ESP) – Microsoft Windowsbased program provided on CD-ROM for programming and interface to ESM. Includes E-Help for troubleshooting any ESM faults. Serial harness is provided for connection of a customer supplied laptop to the ECU RS-232 port.

ENGINE MONITORING DEVICES – Factory mounted and wired sensors for lube oil pressure and temperature, intake manifold temperature and pressure, overspeed, and jacket water temperature, all accessible through ESM. ESM continuously monitors combustion performance through individual knock sensors to provide detonation protection. Dual magnetic pickups are used for accurate engine speed monitoring. ESM provides advanced diagnostics of engine and all ESM sensors and logs any faults into non-volatile flash memory.

EXHAUST – Insulated exhaust system with dry type manifolds. Single exhaust outlet with 125# 10" (254mm) outlet flange. Front mounted.

FUEL SYSTEM – Single natural gas high efficiency venturi carburetor, mounted directly to turbocharger inlet. One low pressure Fisher 66Z regulator mounted and piped. 1-3 psig (7 – 21 kPa) fuel inlet pressure required. ESM controlled shipped loose fuel shutoff valve.

GENERATOR – Open, drip–proof, direct connected, synchronous, fan cooled, AC revolving field type, 2/3 pitch, single bearing generator with AREP excitation system for 300% short circuit sustain (250% for 50 Hz) and motor starting. TIF and Deviation Factor within NEMA MG–1.32. Voltage: 480/277, 3 phase, 6 wire Wye, 60 Hz, and 400/230, 3 phase, 6 wire Wye, 50 Hz. Temperature rise within NEMA 105° C for continuous duty, within NEMA 130° C for standby duty. Voltage regulation is ±0.5%. All generators are rated at 0.8 power factor, are mounted on the engine flywheel housing, and have multiple steel disc flexible coupling drive.

GOVERNOR – Electronic throttle actuator controlled by ESM with throttle position feedback. Governor tuning is performed using ESP. ESM includes option of a load-coming feature to improve engine response to step loads.

IGNITION SYSTEM – Ignition Power Module Diagnostics (IPM-D) controlled by ESM, with spark timing optimized for varying load conditions. Dual voltage energy levels automatically controlled by ESM to maximize spark plug life and improve starting. The diagnostics feature of ESM can be used to help monitor spark plug life via predictive maintenance. Shielded ignition components meet Canadian Standard Association Class 1, Division 2, Group D hazardous location requirements.

INTERCOOLER – Air-to-water two stage. First stage utilizing jacket water. Second stage is in separate auxiliary water circuit with integral thermostat.

JUNCTION BOXES – Separate AC, I/O junction boxes for engine wiring and external connections.

LUBRICATION SYSTEM – Full pressure, gear type pump, replaceable spin on oil filters, mounted oil cooler, mounted 230 VAC, single phase 50/60 Hz electric driven prelube pump.

OIL PAN – Base type with removable doors. 120 gallons (454 liters) capacity, including filters and cooler.

PAINT – Oilfield Orange.

PISTONS – Aluminum with floating pin, single piece, gallery cooled, Ni-resist insert, two compression and one oil control rings.

STARTING SYSTEM – 24V DC starting motor.

TURBOCHARGER – Single, high efficient, water cooled and oil fed. Air/gas bypass, adjustable wastegate, front mounted.

VOLTAGE REGULATOR – Automatic type. Shipped loose.

WATER CIRCUIT – Engine mounted pumps and thermostats.

Auxiliary circuit – Second stage intercooler and oil cooler piping in series, 130° (54°C) inlet water temperature.

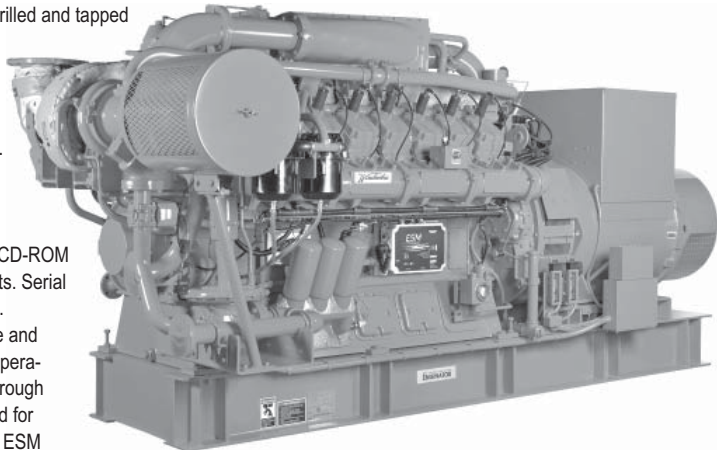
Jacket water circuit – First stage intercooler and jacket water in parallel, 210°F (99°C) outlet water temperature.

Waukesha
POWERING PERFORMANCE

APG1000

APG Gas Enginator®
50Hz Generating System
Featuring ESM® Technology

1000 kW



Enginator shown with options.

Model APG1000
Turbocharged and Intercooled, Sixteen Cylinder, Lean Combustion Gaseous Fueled Enginator

SPECIFICATIONS

Waukesha Engine
16V150LTD
Four Cycle
Lean Burn

Cylinders
V 16

Piston Displacement
2924 cu. in.
(48L)

Bore & Stroke
5.98" x 6.5"
(152 x 165 mm)

Compression Ratio
*10:1 / 14:1

Jacket Water System Capacity
42 gal. (159L)

Auxiliary Water Capacity
8 gal. (30 L)

Starting System
24VDC Electric

Lube Oil System Capacity
120 gal. (454 L)

Dry Weight
30,200 lb. (13,730 kg)

* 10:1 Compression and 14:1 Expansion utilizing Miller Cycle Technology

PERFORMANCE DATA: APG1000 GAS ENGINATOR® GENERATING SYSTEM

HEAT EXCHANGER/ WATER CONNECTION COOLING Intercooler Water: 130°F (54°C)	CONTINUOUS POWER 1500 rpm 50 Hz
RATING @ 0.8 Power Factor	**TA Luft NOx**
KWe	1000
Electrical Efficiency	41.6
Engine Heat Balance BTU/hr x 1000 (kW)	
Fuel Consumption	8203 (2403)
HT Cooling Circuit (Jacket Water + 1st stage intercooler)	1539 (451)
LT Cooling Circuit (2ndt stage intercooler + oil cooler)	750 (220)
Radiation	196 (57)
Exhaust Energy	2072 (607)
Exhaust Stack Temperature °F (°C)	749 (399)
Induction Air SCFM (nm^3/hr)	2437 (3918)
Exhaust Gas Flow lb/hr (kg/hr)	11,642 (5279)
Standard Emissions g/bhp-hr (g/nm^3 @ 5% O_2)	
NOx	1.2 (0.5)
CO	1.5 (0.61)
NMHC	0.5 (0.19)

Typical heat balance data is shown. Consult factory for guaranteed data.

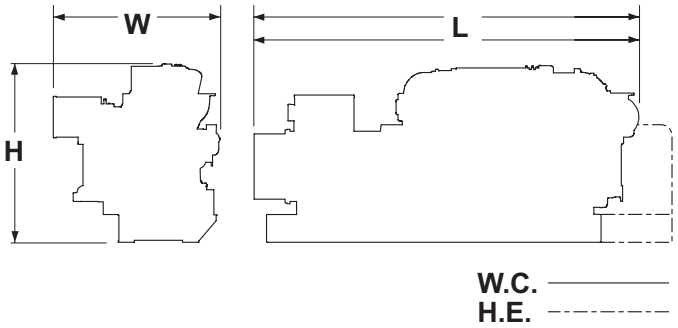
Fuel consumptions based on ISO 3046/1-1995 with a +5% tolerance for commericial quality natural gas having a 900 Btu/ft^3 saturated low heating value.

Continuous Power Rating: The highest electrical power output of the Enginator available for an unlimited number of hours per year, less maintenance.

Rating Standard: The Waukesha Enginator power rating descriptions are in accordance to ISO 8528, DIN6271 and BS5514. It is also valid for ISO 3046/1-1995 with an engine mechanical efficiency of 90% and Tcra (clause 10.0) is limited to ± 10° F (5° C).

*No overload.

Cooling Equipment	L in (mm)	W in (mm)	H in (mm)	Avg. Wt. lb (kg)
Water Connection	191 (4851)	85 (2159)	88 (2235)	30200 (13727)
Heat Exchanger	208 (5283)	85 (2159)	88 (2235)	31200 (14182)



DRESSER
Waukesha

WAUKESHA ENGINE
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Consult your local Waukesha Distributor for system application assistance. The manufacturer reserves the right to change or modify without notice, the design or equipment specifications as herein set forth without incurring any obligation either with respect to equipment previously sold or in the process of construction except where otherwise specifically guaranteed by the manufacturer.