STANDARD EQUIPMENT

AIR CLEANER – Single, high efficiency, replaceable element and service indication.
AFR – Air Fuel Ratio control. Included with ESM®. Load based control with continuous feedback. Requires kW input.
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 tanks 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. Rocker arm housing with integrated cooling header.
ELECTRONIC SERVICE PROGRAM (ESP) – Microsoft Windows-based 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. ESMcontinuously monitors combustion performance through individual knock sensors to provide detonation protection. Dual magnetic pickups are used for accurate engine speed monitoring. ESM provides predictive spark plug diagnostics as well as advanced diagnostics of engine and 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. 1-5 psig (7 – 34.5 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 speed-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.
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 and 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 electric driven prelube pump.
OIL PAN – Base type with removable doors. 113 gallons (428 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 pressure ratio, water cooled and oil lubricated. ESM controlled air/gas bypass, and factory set 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.
DOCUMENTATION - The following items are supplied as standard with every order:

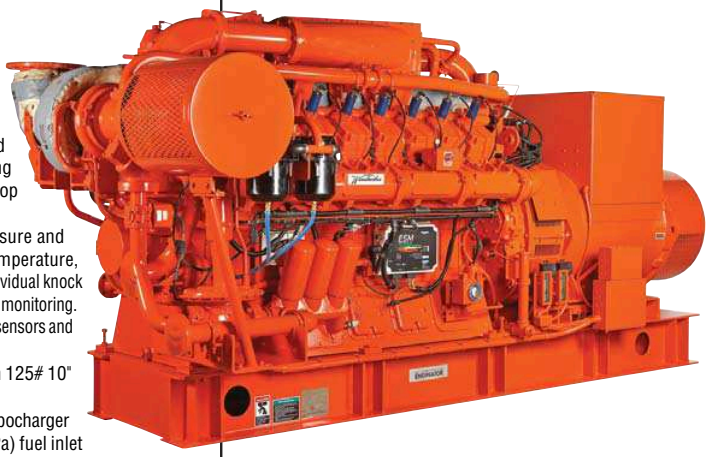
– Electronic notification and access to drawings for review and or approval.
– One Enginator® manual consisting of:
· Engine operation/service manual.
· Engine parts book.
· Generator/voltage regulator instructions.
· Instructions on major items.

Waukesha
POWERING PERFORMANCE

APG1000

APG Gas Enginator® Generating System Featuring ESM® Technology

1000 - 1100 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
5.95″ x 6.5″
(152 x 165 mm)

Compression Ratio
*10:1 / 14:1

Jacket Water System Capacity
68 gal. (258 L)

Auxiliary Water Capacity
14 gal. (530 L)

Starting System
24VDC Electric

Lube Oil System Capacity
113 gal. (428 L)

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

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

Waukesha Engine ISO 9001 CERTIFIED

PERFORMANCE DATA: APG1000 GAS ENGINATOR® GENERATING SYSTEM

HEAT EXCHANGER/ WATER CONNECTION COOLING Intercooler Water: 130°F (54°C)	CONTINUOUS POWER	
	1500 rpm 50 Hz	1800 rpm 60 Hz
kW RATING	**1000 kW**	**1100 kW**
Fuel Consumption Btu/bhp-hr (kW)	5979 (2436)	5988 (2685)
Jacket Water + 1st Stage x 1000 Btu/hr (kW)	1551 (455)	1660 (487)
1st Stage Intercooler x 1000 Btu/hr (kW)	530 (155)	583 (171)
2nd Stage Intercooler x 1000 Btu/hr (kW)	344 (101)	379 (111)
Oil Cooler x 1000 Btu/hr (kW)	495 (145)	544 (159)
Radiation x 1000 Btu/hr (kW)	373 (109)	373 (109)
Exhaust Energy x 1000 Btu/hr (kW)	2137 (626)	2478 (726)
Exhaust Flow lb/hr (kg/hr)	12144 (5509)	13224 (5998)
Exhaust Stack Temperature °F (°C)	740 (393)	756 (402)
Induction Air scfm (nm^3/hr)	2568 (3947)	2919 (4487)
Emissions		
NOx g/bhp-hr (mg/nm^3 @ 5% O_2)	1.2 (500)	1.0 (410)
CO g/bhp-hr (mg/nm^3 @ 5% O_2)	1.5 (695)	1.4 (650)
NMHC g/bhp-hr (mg/nm^3 @ 5% O_2)	0.5 (210)	0.65 (270)
THC g/bhp-hr (mg/nm^3 @ 5% O_2)	3.5 (1480)	2.6 (1100)

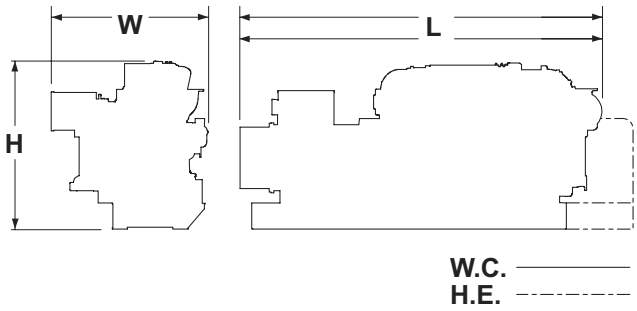
Typical heat balance data is shown. Consult factory for guaranteed data.

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

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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.

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