

BASIC SPECIFICATIONS

AFR – Air Fuel Ratio control included with ESM[®]. Load based control with continuous feedback. Requires kW input.

BARRING DEVICE – Manual, mounted.

BASE – Engine, generator are mounted and aligned on a welded steel, wide flange base with lifting outriggers. Designed for flexible elastic mounting on isolators. May also be solid mounted.

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

BREATHER – Open, customer to vent from connection on engine.

CAMSHAFTS – Case hardened individual segments (two per bank) bolted together.

CONNECTING RODS – Forged high tensile steel, fully machined and balanced with oil jet piston pin lubrication.

COOLING SYSTEM – Optional design with two separate cooling circuits – Low temperature (LT) second stage circuit for charge air cooler and lube oil cooler and high temperature (HT) circuit for jacket water, cylinder heads, first stage charge air cooler and exhaust system water. Both HT and LT cooling water are circulated by an engine driven twin pump. Standard three (3) circuits (HT, LT & Lube oil) for CHP application using a separate lube oil cooling circuit. HT and LT controlled by a built-in thermostatic valve. Designed for temperature range: LT 45°C (113°F) or LT 55°C (131°F) and HT 100°C (212°F). External lube oil cooler and thermostat, external radiator (or) cooling tower (or) raw water are customer supplied.

CONTROL SYSTEM – Waukesha Engine System Manager (ESM[®]) integrates fuel injection, 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. Logic provided for engine preheat, engine prelube, gas train and exhaust venting.

CRANKCASE – Nodular cast iron, fully ribbed, integral with cylinder frame. Hydraulically fastened main bearing caps. Optimal compact and rigid design including large inspection doors.

CRANKSHAFT – Forged high tensile steel, counterweighted and fully dynamically balanced.

CYLINDERS – Removable wet type cylinder liners, centrifugally cast iron with anti polishing ring.

CYLINDER HEADS – Twelve interchangeable robust design cylinder heads with hydraulically tensioned studs. Grey cast iron. Four valves per head - two intake and two exhaust valve with replaceable intake and exhaust valve seats, stellite-coated seat faces and chromium-plated stems. Water-cooled flame deck and prechamber. Prechamber is heat resistant alloy steel.

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. 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 predictive spark plug diagnostics as well as advanced diagnostics of engine and all ESM sensors and logs any faults into non-volatile flash memory.

EXHAUST SYSTEM – Insulated removable covers for exhaust manifold and turbochargers. Single DIN 250 outlet flange at each turbocharger.

FUEL SYSTEM – Gas is supplied through common pipes running along the engine (DIN 80), with individual feed pipes to each main gas admission valve on each cylinder head. Two common pipes per bank, one for the main and one for the prechamber gas supply. The minimum required gas pressure is 58 psig (4 barG) to the gas train.

GENERATOR – Open, drip-proof, direct connected, synchronous, fan cooled, AC revolving field type, two-bearing generator with AREP excitation system for 300% short circuit sustain and motor starting, cross current compensation, 100 ohm platinum RTD's for the stator windings and both bearings, and 230V single phase, 50/60 Hz generator space heater. TIF and Deviation Factor within NEMA MG-1.32. Voltage: 480V or 4.16kV or 13.8kV, 3 phase, 6 wire Wye, 60 Hz, and 400V or 6.3kV or 11kV, 3 phase, 6 wire Wye, 50 Hz. Temperature rise within NEMA 105° C for continuous duty. Voltage regulation is ±0.5%. All generators are mounted to engine via flexible coupling.

GOVERNOR – Fuel injected. No throttle actuator. Governor tuning is performed using ESP. ESM includes a load-coming feature to high step load engine response to step loads.

IGNITION SYSTEM – Designed for industrial gas engines to achieve long lifetime and reliability. The ignition system is controlled by ESM which automatically controls the ignition timing according to the data received from the engine. Optimizes combustion in every cylinder. The diagnostics feature of ESM can be used to help monitor spark plug life via predictive maintenance.

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

LUBRICATION SYSTEM – Wet oil sump and single lube oil circuit including glass fiber cartridge filters. Centrifugal filter in the bypass to remove fine particles from lubricating oil. Engine connections provided for customer supplied oil cooler and thermostat for CHP applications. Mounted pre-lubrication system with pump for rapid starts. Lube oil level controller.

OIL PAN – Base type.

PAINT – Oilfield Orange.

PISTONS – Composite type with aluminum skirt and a steel crown. Piston gallery cooled via large flow oil jets. The piston skirt and cylinder liner lubricated by piston skirt lubrication through two bores in a groove in the piston skirt.

STARTING SYSTEM – Air starting system includes one air starter with silencer, pressure regulating valve, relay valve and relief valve. Low air consumption and noise level.

TURBOCHARGER – Two (2) single stage, oil lubricated, high pressure ratio turbochargers. ESM controlled wastegate. Front mounted.

VOLTAGE REGULATOR – Automatic type with 3-phase sensing (shipped loose).

WATER CIRCULATING SYSTEM – Engine driven twin pump fitted on free end of the engine. The LT & HT twin pump feeds water directly into the cooling channels of the engine block.

Auxiliary circuit (LT) – Second stage charge air cooler and oil cooler piped in parallel, 45°C (113°F) or 55°C (131°F) inlet water temperature.

Jacket water circuit (HT) – First stage charge air cooler and engine jacket in series, 100°C (212°F) outlet water temperature. Includes jacket water preheater and circulating pump.

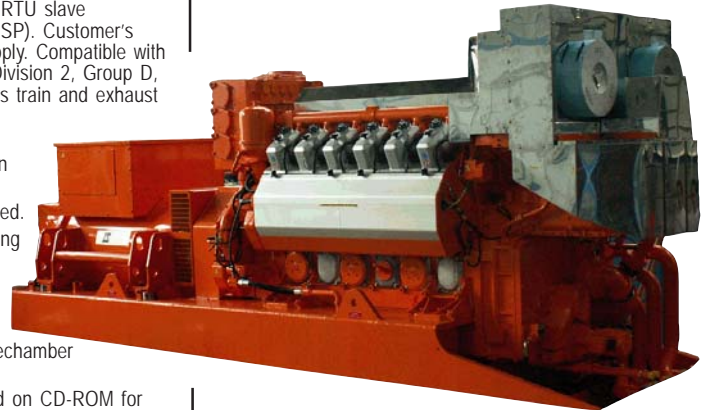


Waukesha

POWERING PERFORMANCE

APG2000

Gas Enginor[®] Generating System Featuring ESM[®] Technology
1860 - 2100 kW



Engine shown with options.

Model APG2000 Turbocharged and Intercooled, Lean Combustion Gas Fueled Enginor

SPECIFICATIONS

Cylinders	Starting System
V 12	Air Starter
Piston Displacement	Dry Weight
6682 cu. in. (109.5 L)	60,000 lb. (27216 kg)
Bore & Stroke	
8.7" x 9.4" (220 x 240 mm)	
Compression Ratio	
11:1	
Jacket Water System Capacity	
92 gal. (348 L)	
Lube Oil Capacity	
159 gal. (600 L)	



PERFORMANCE DATA: APG2000 GAS ENGINATOR® GENERATING SYSTEM

Intercooler Water: 113°F (45°C)		CONTINUOUS POWER	
		1200 rpm 60 Hz	1500 rpm 50 Hz
kW RATING			
KWe @ 1.0 Power Factor		1895	2140
KWe @ 0.8 Power Factor		1875	2115
Electrical Efficiency @ 1.0 Power Factor (%)		42.7 ²	41.4 ²
Electrical Efficiency @ 0.8 Power Factor (%)		42.2	40.8
BMEP PSI (Bar)		258 (17.8)	232 (16)
Emissions		TA Luft *	
Engine Heat Balance	BTU/hr x 1000 (kW)	60 Hz	50 Hz
Fuel Consumption - LHV		15174 (4443) ²	17681 (5177) ²
HT Total Cooling Circuit		1974 (578)	2365 (693)
Jacket Water		1290 (378)	1560 (457)
Charge Air HT - 1 st pass intercooler		648 (190)	805 (236)
LT Total Cooling Circuit (with internal LOC)		1505 ³ (441) ³	1686 ³ (494) ³
Charge Air LT - 2 nd pass intercooler		747 ⁴ (219) ⁴	608 ⁴ (178) ⁴
Lube oil circuit		758 (222)	1079 (316)
Exhaust Energy		4556 ⁵ (1334) ⁵	5557 ⁵ (1627) ⁵
Radiation and Generator Ventilation		700 (205)	799 (234)
System Flow Data		60 Hz	50 Hz
Water Cooling Circuits			
HT Flow - gpm (m ³ /h)		260 ⁶ (59) ⁶	260 ⁶ (59) ⁶
LT Flow with internal LOC - gpm (m ³ /h)		216 ⁶ (49) ⁶	216 ⁶ (49) ⁶
LT Flow with external LOC - gpm (m ³ /h)		44 ⁶ (10) ⁶	44 ⁶ (10) ⁶
Lube oil flow - gpm (m ³ /h)		207 (47)	207 (47)
Suction air flow - lb/s (kg/s)		8 (3.48)	9 (3.86)
Exhaust gas flow - lb/s (kg/s)		8 (3.58)	9 (3.97)
Exhaust temperature - °F (°C)		666 (352)	716 (380)

NOTES:

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

Rating Standard: The 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 T_{cr} (clause 10.0) is limited to ± 10° F (5° C).

1 No overload available.

2 Fuel consumption per ISO 3046/1 +5 %. Includes engine-driven pumps

3 LOC = Lube Oil Cooler

4 For engines with external LOC, charge air LT is LT total rejection

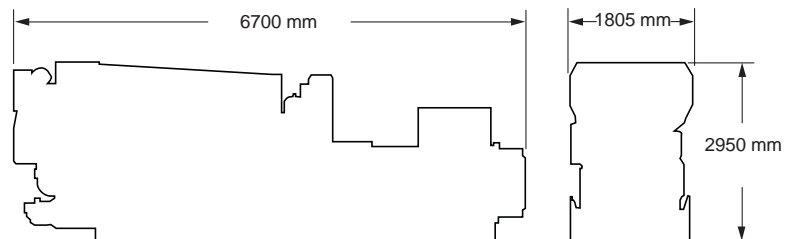
5 Heat rejection based on cooling exhaust gas to 25°C

6 HT and LT Water Flow for 1.5 bar External Pressure Drop

LT water temperature of 55°C available for hot climates

* ½ TA Luft emissions available upon request

Typical heat balance data is shown, however no guarantee is expressed or implied. Consult your Waukesha Engine Application Engineering for system application assistance.



Waukesha

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