



GENESIS 1000™

NATURAL GAS | FUEL AGILE

**1000 kW Standby
900 kW Prime
750 kW Continuous**



DESCRIPTION

Clear Energy Systems introduces the **Genesis 1000™**—the world's smallest and lightest 1MW power generation system. Developed specifically for gaseous fuels, its air cooled, radial engine delivers outstanding electrical efficiency and emissions compliance at low operating costs. With standard enclosure and sound attenuation, advanced monitoring and controls, and optional mobility package, the Genesis 1000™ sets a new standard in mobile and distributed power generation.

COMPONENTS

Advanced Radial Configuration 930TA™ Engine

The proprietary design 930TA has been engineered for robust industrial performance utilizing advanced combustion technology and state-of-the-art alloys, coatings and tolerances. The powerplant delivers high-load capacity, extended maintenance intervals and long service life while retaining all the advantages inherent in its radial design: light weight, high horsepower, low internal friction and excellent operating efficiency. Air cooled and turbocharged, with fewer parts and bearings, the 930's unique combination of features enables the Genesis 1000™ to deliver unprecedented mobility, durability, fuel efficiency and emissions compliance.

Marelli MJB 400 MB4 Three Phase Synchronous Generator

With over 100 years of manufacturing excellence, Marelli Motori is recognized as a leading supplier of generators and electric motors to power generation, industrial, and marine sectors. Latest technologies and highest quality materials assure reliable performance under difficult operating conditions and long life of electrical components and housing.

CES Proprietary Electronic Control Module

Microprocessor-based diagnostic, monitoring and control system integrates engine and alternator controls in a single system employing CAN bus technology. Operator-friendly instrumentation is displayed on-board through a 17" color touch screen monitor or on remote computer via Ethernet connection and proprietary CES software. Controls are suitable for both paralleling and nonparalleling applications, with other gensets and with utility service. Paralleled gensets may be accessed through a single interface. The system is designed for EMC compliance and constructed to meet the most rugged duty cycles for gensets.

FEATURES

Full Turn-Key Functionality

The Genesis 1000™ is spec'd, quoted and shipped as a fully operational unit for most environments and applications. Optional equipment may be ordered to provide additional functionality for specific uses.

Fuel Agility

- Natural gas (pipeline, CNG, LNG)
- Bio gas, landfill gas, flare gas
- LP gas (propane & butane)
- Ethanol

Worldwide Voltages

All standard voltage worldwide at 50Hz and 60Hz: 220v 3-phase, 277v 3-phase, 480v 3-phase, 477v 3-phase, and higher.

Emissions Compliance

Inherently lower and more easily controlled emissions than competitive diesel engines. Meets all applicable current and scheduled EPA, CARB and EU regulations for both spark-ignition and compression ignition engines.

Low Operating Cost

- Fuel cost of natural gas significantly less than diesel.
- Maintenance cost minimized by air cooling, simplified fuel and intake systems, advanced filtration and reduced fluid quantities.
- Overhaul cost and time reduced due to extended service intervals and unique engine design permitting improved access to major engine components and independent cylinder service.

Superior Mobility

Lightweight and compact, the Genesis 1000™ is one-third the size and one-fifth the weight of comparable diesel gensets. The smallest and lightest 1MW power source available easily transports to remote sites or disaster relief locations.

Status & Diagnostics

Comprehensive monitoring of engine and generator performance with predictive maintenance diagnostics. Worldwide network access available.

Full Authority Remote Control

Full control of engine and generator functions at remote computer via Ethernet connection and proprietary software.

Full Turn-Key Solution and Optional Features for Specialized Applications

STANDARD EQUIPMENT

Engine: ARC930TA™

- 9 cylinder, radial configuration, air cooled, 1155kW, constant 2300 rpm, twin turbocharged w/aftercoolers

Fuel System

- Low pressure fuel system requires only 2.0 to 5.0 psi
- Single fuel calibration curve (methane or propane)
- Gas train, gas pressure interlock, air cleaner

Charging and Start System

- 100 amp alternator for battery charging and controller system power
- 24v starting motor
- Lead acid batteries with racks and easy access provision

Lubrication System

- Full flow oil filtering, 30 gallon reservoir, synthetic oil, electric prelube pump, multi-stage oil pressure and scavenging pump, shut down scavenging pump, positive gearbox lubrication, low level oil detection, oil cooler

Cooling System

- High volume hydraulic driven centrifugal fan
- Heavy duty hydraulic motor and pump

Exhaust System

- Fully isolated replaceable bed catalyst and integrated residential grade muffler
- Complete stainless steel piping and fittings

Monitoring System

- Intake manifold pressure, gas pressure, air filter, cylinder head temperature, camshaft, crankcase, ignition coil, knock sensors, dual O2 sensors
- Hydraulic fluid temperature, hydraulic fluid low level, hydraulic fluid pressure
- Oil level switch, oil metal chip sensor, oil pressure sensor, oil reservoir temperature, oil output temperature

Electronic Control Module

- Integrated spark timing control, turbocharger control, speed governing, cylinder knock control, time-stamped full diagnostics reporting system
- Complete engine data display capability
- Genset and engine monitoring and protection including emergency stop, fail to start shut down, permissive start/fuel presence shut down, engine vitals monitoring
- Complete alternator protection and data display
- Complete logs for operational data, including start attempts, starts, running hours and kw hours

Enclosure

- Protective weather enclosure with sound attenuation provides maximum 75 dBA @ 6 feet.

Alternator: Marelli MJB 400 MB4

- Three phase, 4 pole, continuous duty, class H insulation, auxiliary wound, IP 23, synchronous generator

Connection

- Circuit breaker

OPTIONAL EQUIPMENT

Fuel Agility Package

Enables field switching of fuel types. Particularly applicable to remote sites and rental operations. Includes dual calibration curves and/or custom calibrations for site specific bio-gas, bio-methane, flare or landfill gas.

Ethanol Conversion

Exchanges gas train and gas mixer for fuel injectors, fuel pump, fuel filters, and fuel pressure regulator. Includes ethanol calibration curve and ECM injector drivers.

Standby Package

Provides power for standby applications. Includes 10 amp battery charger and oil reservoir heater.

Emergency Start Package

Meets Type 10 standards for emergency start demands. Includes NFPA approved battery charger, certified battery, oil reservoir heater.

Cold Weather Package

Enables startup and operation in extreme cold weather conditions to -40°F (-40°C). Includes 10 amp battery charger, battery heater, oil line and reservoir heaters, insulated oil line and reservoir, multi-grade oil, dual starter motors. Also intermittent auto startup in off-grid conditions.

Extreme Dust Package

Enables continuous operation in desert or other extreme dust environments. Low maintenance cyclone technology air cleaners have no filter and never require replacement.

Parallel Enabled

Allows parallel operation of multiple gensets. Provides paralleling data, functions and protection, also frequency synchronization and voltage matching.

Cogeneration Package

Replaces muffler with customer-specified heat exchangers.

Sound Attenuation Packages

Designed for hospital, film and other environments where extremely quiet operation is demanded. Provides additional enclosure insulation and hospital grade muffler to achieve Critical (65dBA) or Super Critical (55dBA) sound levels.

Mobility Package

Trailer mounting provides the smallest, most portable power source available. Two axle, single wheel trailer is road-ready in 50 states. GPS GeoFence alerts if unit is moved outside designated perimeter.

Predictive Maintenance Monitoring

Engine vibration mapping and real-time oil condition monitoring measures viscosity, clarity and metal ion presence; determines and alerts optimal service interval.

Remote Monitoring and Control

Provides genset monitoring and full authority control at remote computer via Ethernet connection and CES software.

Global Monitoring

CES network services and proprietary software interface allows genset functions to be monitored from any location worldwide.

GENESET SPECIFICATIONS**GENESIS 1000™**

Power Output	Standby	1000 kW	1250 kVA
	Prime	900 kW	1125 kVA
	Continuous	750 kW	928 kVA
Frequencies	60 Hz three phase line-neutral/line-line		50 Hz three phase line-neutral/line-line
Voltages Available	220/380	240/416	277/480
	230/416	255/440	347/600
		2400/4160	230/400 254/440 3810/6600
Fuel Agility	Natural gas (pipeline, CNG, LNG), flare gas, biogas, LP gas (propane/butane), ethanol		
Emissions Compliancy	Exceeds EPA 2010 and CARB 2013 requirements for spark ignition engines. Exceeds EPA Tier 4 2015, EU Stage 4, and TA Luft for compression ignition engines.		
Emissions	CO	< 2.68 g/kWh	< 2.00 g/bhp-hr
	NMHC	< 0.19 g/kWh	< 0.14 g/bhp-hr
	NO _x	< 0.67 g/kWh	< 0.50 g/bhp-hr
	PM	0.00 g/kWh	0.00 g/bhp-hr
Emissions Control	Three-way catalyst, cooled electronic EGR		
Power Performance	Power rating @ 1.0 pf	1008 ekW	
	Power rating @ 0.8 pf	1000 ekW	1250 kVA
	Mechanical power	1155 bkW	1550 bhp
	Electrical efficiency	40-42 %	
Fuel Consumption	100% load	approx. 8.5 MMBtu/hour	
	75% load	approx. 6.4 MMBtu/hour	
	50% load	approx. 4.2 MMBtu/hour	
Cogeneration Exhaust Data	Heat rejection to exhaust	37333 Btu/min	656.5 kW
	Exhaust gas flow rate	4200 scfm	112 Nm ³ /min
	Exhaust stack gas temperature at turbo	1300 °F	704 °C
Frequency Regulation	No load to full load: Isochronous Steady state: +/- 0.5%		
Single Step Load Pickup	Min 25%		
Dimensions	In enclosure	14'10"L x 7'3"W x 7'9"H	4521mm x 2210mm x 2362mm
	No enclosure	14'2"L x 7'3"W x 7'6"H	4318mm x 2210mm x 2286mm
Weight (dry)	Skid mounted	12,500 lbs	5 670 kg
	Skid mounted in enclosure	13,500 lbs	6,123 kg
	Trailer mounted in enclosure	15,000 lbs	6,818 kg

ENGINE SPECIFICATIONS**ARC930TA™**

Design	9 cylinder, advance radial configuration, 1155kW	
Bore	6.125 in	155.57 mm
Stroke	6.875 in	174.62 mm
Displacement	1820 in ³	29.82 liters
RPM	constant 2300 rpm	
Compressions Ratio	8.75	
Aspiration	Twin turbochargers with aftercoolers	
Cooling Type	Air cooled	
Battery Charging Alternator	100 amp	
Ignition System	Full electronic, multi plug, Individual coil on plug	
Starting Voltage	24 volt	
Fuel System	Stoichiometric feedback control	
Inlet Pressure	Minimum 2 psi	
Exhaust System	Fully insulated replaceable bed catalyst and integrated residential grade muffler	
Air Cleaner Type	Dry replaceable element	
Hydraulic Fluid Capacity	120 gal.	454.24 liters
Lube Oil Capacity	30 gal.	113.56 liters
Lube Oil Filter Type	Full flow filter	
Breather	Closed loop breather	

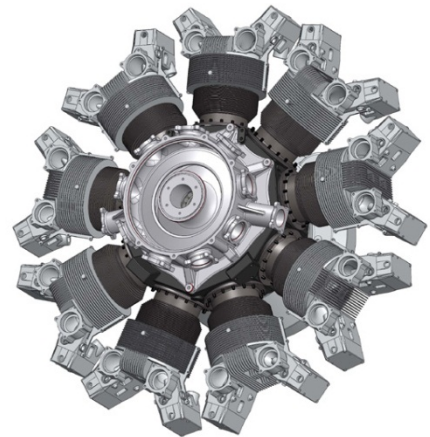
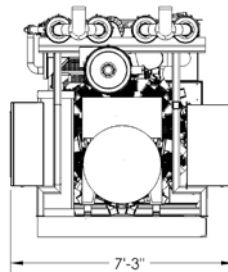
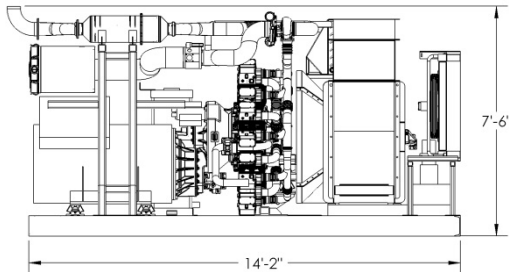
ALTERNATOR SPECIFICATIONS

MARELLI MJB 400 MB4

Design	3 phase, synchronous, continuous duty, auxiliary wound, impregnated & tropicalized
Stator	2/3 pitch
Rotor	Single bearing
RPM	60 Hz @ 1800; 50 Hz @ 1500
No. of Poles	4
No. of Leads	6
Protection Degree	IP 23
Insulation System	Class H
Exciter Type	Self-exciting, brushless
Alternator Cooling	Direct drive centrifugal blower fan
Standard Temperature Rise	105 °C (221 °F) continuous @ 40 °C (104 °F) ambient
Voltage Regulation Accuracy	+/- 0.5% in steady state condition
Voltage Drift	+/- 0.5% for 50 °C ambient temperature change
Operating Temperature Range	-30 °C to +70 °C
Overspeed Capability (% Of Rate)	125%
Total Harmonic Content	< 2% (at no load)
Telephone Harmonic Factor (THF)	< 2% as defined by ICE 60023-1
Radio Interference Compliance	EN 550011 Class B Group 1

MAINTENANCE SCHEDULE

Engine Oil and Filter	As determined by electronic monitoring system; approx. 5000 hrs.
Hydraulic Fluid Filter	At oil change
Air Filter	As determined by electronic monitoring system and operating environment
Alternator Bearing Lubrication	8000 hrs.



DEFINITIONS AND CONDITIONS

Emergency Standby Power (ESP): Output available at a variable load in emergency and standby applications where the genset provides back-up power only during interruption of normal power supply. Operating time not to exceed 200 hours per year. Average power output is 75% of standby power rating. No overload is allowed with this rating. Emergency Standby Power in accordance with ISO8528.

Prime Power (PRP): Maximum output available at a variable load for an unlimited number of hours in lieu of commercially purchased power. Average power output is 80% of the prime power rating. No overload is allowed with this rating. Prime Power in accordance with ISO8528.

Continuous Power (COP): Output available at a constant load for an unlimited number of hours. Typical peak demand is 100% of continuous rated kW for 100% of operating hours. Overload of 10% for a period of 1 hour is permitted in 12 hours of operation. Continuous Power in accordance with ISO8528 and ISO3046.

Data based on **standard conditions** of 77 °F (25 °C) ambient temperature, 29.53 inches Hg (100kPa) barometric pressure, 30% relative humidity (0.3 inches HG/1 kPa water vapor pressure). Ratings also valid for ISO8528 and ISO3046 standard atmospheric conditions. **Fuel consumption** consistent with ISO3046/1-2002. **Emissions data** consistent with CFR Title 40, Parts 1048 and 1060. Typical **heat data** is shown; no guarantee is expressed or implied.

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