XQ2000

CATERPILLAR

POWER MODULE
STANDBY 2000 kW
PRIME 1825 kW
50/60 Hz

Frequency	Voltage	Standby kW (kVA)	Prime kW (kVA)
60	480/277	2000 (2500)	1825 (2281)
50	400	1800 (2250)	1600 (2000)

FEATURES

Incorporates a wide range of rugged features. Factory designed, certified prototype tested with torsional analysis. Production tested and delivered in a package ready to be connected to your fuel and power lines. Supported 100% by your Caterpillar® dealer with warranty on parts and labor. Extended warranty available in some areas. The generator set is designed and manufactured in an ISO 9001:2000 compliant facility. Generator set and components meet or exceed the following specifications: AS1359, AS2789, ABGSM TM3, BS4999, DIN6271, DIN6280, EGSA101P, JEM1359, IEC 34/1, ISO3046/1, ISO8528, NEMA MG1-22

RELIABLE, FUEL EFFICIENT DIESEL ENGINE
The compact, four-stroke-cycle Caterpillar 3516B turbocharged-aftercooled diesel engine combines durability with minimum weight while providing dependability and economy. The fuel system operates on a variety of fuels.

CATERPILLAR SR4B GENERATOR
Single bearing, wye-connected, static regulated, brushless, permanent magnet excited, Caterpillar SR4B 826 frame generator designed to match the performance and output characteristics of the Caterpillar diesel engine driving it.

CATERPILLAR COOLING SYSTEM
Sized compatible to rating with energy efficient fan and core. Cooling system 43C ambient operating & vertical discharge radiator for close proximity to buildings.

CAT ON-PACKAGE AUTO PARALLELING CONTROL SYSTEM
Provides single unit stand alone, island mode paralleling with other units, and single unit-to-utility paralleling capability. Operational modes are standby or base load control with soft load/unload and power factor control. Utility/intertie protection features provided by the standard Utility Multi-function Relay (UMR).

EXCLUSIVE CATERPILLAR DIGITAL VOLTAGE REGULATOR (CDVR)
Three-phase sensing and adjustable Volts-per-Hertz regulation give precise control, excellent block loading, and constant voltage in the normal operating range.

SOUND ATTENUATED CONTAINER
Provides ease of transportation and protection. Meets 75 dB(A) at 15 meters or below per SAE J1074 measurement procedure at 110% prime load.

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FACTORY INSTALLED STANDARD EQUIPMENT

SYSTEM	STANDARD EQUIPMENT
Engine	Caterpillar 3516B heavy duty diesel engine Heavy duty air cleaner with service indicator 60-Amp charging alternator Fuel filters – primary and duplex secondary with integral water separator and change-over valve Spin on, full flow oil filters with water cooled oil cooler. Requires API CF-4 lube oil Lubricating oil system including oil drain lines routed to engine rail Jacket water heater Fuel cooler and priming pump Electronic ADEM™ A3 controls 24V electric starting motors with battery rack and cables
Generator	SR-4B brushless, permanent magnet excited, three-phase with Caterpillar digital voltage regulator (CDVR), space heater, 6-lead design, Class H insulation operating at Class F temperature for extended life, winding temperature detectors and anti-condensation space heaters (120/240V 1.2 kW)
Containerized Module	40' ISO high cube container, CSC certified Four (4) sound attenuated air intake louvers and 3 lockable personnel doors with panic release Interior walls and ceilings insulated with 100 mm of acoustic paneling Floor of container insulated with acoustic glass and covered with galvanized steel Side bus bar access door, external access load connection bus bars Shore power connection via distribution block connections for jacket water heater, battery charger, space heaters, and generator condensate heaters Standard lighting 3 AC/4 DC, and one (1) single duplex service receptacle, 1,250 gal fuel tank, UL listed, double wall, 9 hr runtime @ 100 % prime rating External lockable connections for fuel Sound attenuated 75 dB(A) @ 50 ft Four (4) oversized maintenance-free batteries, battery rack and 20-Amp battery charger Critical grade exhaust silencer with side inlet and end outlet Vibration isolators, corrosion resistant hardware and hinges External drain access to standard fluids Two 4.5 kg (10lb) carbon dioxide fire extinguishers Standard Cat decals and painted standard Cat power module white
Cooling	Standard cooling provides 43° C ambient capability (60 Hz) at prime +10% rating Horizontally mounted radiator with vertical air discharge
Generator Controls and Protection	EMCP 3.3 genset mounted controller and wall-mounted auto paralleling controls Automatic start/stop with cool down timer Generator Protection features: 25, 32, 40, 50/51, 27/59, 81 O/U Utility multi-function relay protection features: 25, 27/59, 32, 47, 51, 51N, 81O/U UMR is IEEE1547 compliant in most application Reverse compatibility for interface to legacy power modules 3000A generator circuit breaker Multi-mode operation (island, multi-island and utility parallel), load sharing (multi-unit only) Manual and automatic paralleling capability Metering display: voltage, current, frequency, power factor, kW, WHM, kVAR, and synchroscope
Quality	Standard genset and package factory tested UL, NEMA, ISO and IEEE standards O&M manuals

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SPECIFICATIONS

GENERATOR

Frame Size	826
Pitch	0.6667
No. of poles	4
Excitation	Static regulated brushless PM excited
Constructions	ingle bearing, close coupled
Insulation	Class H
Enclosure	Drip proof IP22
Alignment	Pilot shaft
Overspeed capability – % of rated	125% of rated
Voltage regulator	3 phase sensing with Volts-per-Hertz
Voltage regulation	Less than ± ½% voltage gain
Wave form deviation	Less than 5% deviation
Telephone Influence Factor (TIF)	Less than 50
Harmonic Distortion (THD)	Less than 5%

CAT 3516B DIESEL ENGINE

3516B, 4-Stroke diesel

Bore – mm (in)	170 (6.7)
Stroke – mm (in)	190 (7.5)
Displacement – L (cu in)	69 (4,210)
Compression ratio	15:1
Aspiration	TA
Fuel system	EUI
Governor type	Caterpillar ADEM™ A3 Control System

TECHNICAL DATA

Materials and specifications are subject to change without notice.

Generator Set Technical Data		50 Hz		60 Hz	
		Standby	**Prime**	**Standby**	**Prime**
Power Rating	kW (kVA)	1800 (2250)	1600 (2000)	2000 (2500)	1825 (2281)
Lubricating System Total oil pan capacity	L (U.S. gal)	401.3 (106)			
Fuel System Generator set fuel consumption 100% Load 75% Load 50% Load Fuel Tank Capacity	 L/hr (gal/hr) L/hr (gal/hr) L/hr (gal/hr) L (U.S. Gal)	 450.5 (119.0) 338.7 (89.5) 232.4 (61.4) 4731 (1250)	 399.8 (105.9) 304.9 (80.6) 214.8 (56.7) 4731 (1250)	 540.6 (142.8) 400.4 (105.8) 278.8 (73.7) 4731 (1250)	 487.9 (128.9) 369 (97.5) 258.6 (68.3) 4731 (1250)
Running Time @ 75% of rating	hours	>13	>12	>10	>11
Cooling System Radiator Capacity	L (U.S. gal)	770 (203)			
Air Requirements Combustion air flow Maximum air cleaner restriction	 m^3/min (cfm) kPa (in H_2O)	 144.2 (5110) 6.2 (24.91)	 132.2 (4683) 6.2 (24.91)	 172.4 (6092) 6.2 (24.91)	 167.8 (5926) 6.2 (24.91)
Exhaust System Exhaust flow at rated Exhaust temperature at rated kW – dry exhaust	 m^3/min (cfm) °C (°F)	 360.0 (12763) 469.1 (876.6)	 326.4 (11471) 456.5 (852.4)	 453.8 (16065) 508.7 (950.7)	 418.2 (14769) 469.6 (877.3)
Generator Set Noise Rating* with enclosure at 15 meters (50 feet)]	dBA	74	74	75	74

RATING DEFINITIONS

Standby – Applicable for supplying continuous electrical power (at variable load) in the event of a utility power failure. No overload is permitted on these ratings. The generator on the generator set is peak prime rated (as defined in ISO852) **at** 30° C (86° F).

Prime – Applicable for supplying continuous electrical power (at variable load) in lieu of commercially purchased power. There is no limitation on the annual hours of operation and the generator can supply 10% overload.

Model	Length in (mm)	Width in (mm)	Height in (mm)	Weight with Lube oil and Coolant lb (kg)	Weight with fuel, lube oil and coolant (kg)
XQ2000	**480 (12,192)**	**97.5 (2,438)**	**114 (2,896)**	**64,000 (29,021)**	**73,000 (33,106)**
Center of gravity	**x = +4,913 +/- 300 mm (from rear of container); y = +788 mm +/- 300 mm (from container floor); z = 0 +/- 150 mm (centerline)**				

STANDARD FEATURES

EMCP 3.3 LOCAL CONTROL PANEL

• Generator mounted EMCP 3.3 provides power metering, protective relaying and engine and generator control and monitoring.
• Convenient service access for Caterpillar service tools (not included).
• Integration with the CDVR provides enhanced system monitoring.
• Ability to view and reset diagnostics of all controls networked on J1939 datalink eliminates need for separate service tools for troubleshooting.
• Real-time clock allows for date and time-stamping of diagnostics and events.
• True RMS AC metering, 3 phase: L-L volts, L-N volts, Phase, Amps, Hz, ekW, kVA kVAR, kWHr, % kW, PF

EMCP 3.3 ENGINE OPERATOR INTERFACE

• Graphical display with positive image, transflective LCD, adjustable white backlight/contrast.
• Digital indication for:
  - RPM
  - DC Volts
  - Operating hours
  - Oil pressure
  - Coolant Temperature
  - Oil Temperature
• Two LED status indicators (1 red, 1 amber).
• Engine cool-down timer
• Engine cycle crank
• Three engine control keys and status indicators (Run/Auto/Stop).
• Lamp test and Alarm acknowledgement keys
• Warnings/shutdowns with indicating lights for:
  - Low oil pressure
  - Overspeed
  - High Oil Temperature
  - Failure to Start (Overcrank)
  - Emergency stop
  - Low Coolant level
• Emergency stop pushbutton
• Display navigation keys including two shortcut keys for Engine Parameters or Generator Parameters
• Fuel level monitoring and control.

GENERATOR PROTECTIVE RELAYING

• Generator protective features
  - Phase over/under voltage (Device 27/59)
  - Over/Under frequency (Device 81 O/U)
  - Reverse Power (Device 32)
  - Overcurrent (Device 50/51) (GCB trip unit)
  - Loss of Excitation (Device 40) (CDVR)

CIRCUIT BREAKER

• 3000A fixed type, 3 poles, genset mounted, electrically operated, insulated case circuit breaker.
• Solid state trip unit for overload (time overcurrent) and fault (instantaneous) overcurrent protection.
• Includes DC shunt trip coil activated on any monitored engine or electrical fault, 100 KA-interrupting capacity at 480 VAC.

VOLTAGE REGULATION AND POWER FACTOR CONTROL CIRCUITRY

• Generator mounted automatic voltage regulator, microprocessor based.
• Manual raise/lower voltage adjust capability and VAR/power factor control circuitry for maintaining constant generator power factor while paralleled with the utility. Voltage and power factor adjustments are performed on the setting screen of the HMI touch screen
• Includes RFI suppression, exciter limiter and exciter diode monitoring.

CURRENT TRANSFORMERS

• CT's rated 3000:5 with secondaries wired to shorting terminal strips.

POTENTIAL TRANSFORMERS

• 4:1 ratio with primary and secondary fuse protection.

BUS BARS

• Three phase, plus full rated neutral, bus bars are sized for full load capacity at 0.8 PF, constructed of tin-plated copper with NEMA standard hole pattern for connection of customer load cables and generator cables.
• Includes ground bus, tin-plated copper, for connection to the generator frame ground and field ground cable.

AC DISTRIBUTION

• Transformer distributes utility voltage for the 16 spaces (minimum) Power Module AC panel board.
• Provides 240 VAC for all module accessories.
• Includes controls to de-energize jacket water heaters and generator space heater when the engine is running.

CONTAINER
• 40’ ISO high cube container, CSC certified
• Painted standard Cat Power Module white
• Sound attenuated air intake louvers
• Floor insulated with acoustic glass and covered by galvanized steel
• Four lockable personnel doors with panic release
• Two fire extinguishers
• External drain access to standard fluids

FUEL TANK
• UL Listed 1250 gallon double walled tank provides 9 hr runtime at prime rating.
• Fuel transfer system

SHORE POWER TWO (2)
• One (1) shore power connection distribution block for jacket water heaters.
• One (1) for generator space, battery charger, and fuel pump.

INTERNAL LIGHTING
• Four (4) internal DC lights with one (1) timer and two switches installed at each side of the container door.
• Three (3) internal AC lights.
• One (1) single duplex service receptacle.

BATTERY CHARGER AND BATTERIES
• 24 VDC/20A battery charger with float/equalize modes and charging ammeter.
• Maintenance free batteries.

ON-PACKAGE PARALLELING CONTROL SYSTEM
• Cat On-Package Paralleling controls are intended for automatic or manual paralleling with a utility power source as a load management system, with provisions for standby operation feeding an isolated load network. For Standby operation, the generator operates as an isochronous machine isolated from the utility supply. The controls allow for automatic operation, initiated locally or remotely by the customer’s SCADA system.
• Operator controls are conveniently mounted on the generator doghouse next to the EMCP 3.3 while the Generator Paralleling Control (GPC) and Utility Multi-Function Relay (UMR) are wall-mounted nearby
• GPC provides Generator/Bus metering display and LED synchroscope
• GPC performs all the necessary functions for paralleling: auto synchronization, load sharing, utility baseload control w/ soft load & soft unload, and utility PF control.
• The simple to use Operator Controls include:
  - Local start/stop control switch (for auto mode)
  - Generator voltage and frequency adjust
  - Generator Breaker control switch
  - Lockout Relay (86), manual reset type
  - Base-load Select Switch and Potentiometer
  - Indicating lights for:
    Auto start
    Dead bus close permissive
    Utility Transfer Trip
    Utility breaker closed
• Fail to parallel circuit with (field adjustable) timer delay causes shutdown if the breaker fails to close automatically
• Allows for customer utility-transfer-trip signal (dry contact) and utility breaker status signal (dry contact)
• Basler Utility Multi-function Relay (UMR) IPS-100 provides the following utility/intertie protection features:
  - Synch Check (Device 25)
  - Phase under voltage, 2 stage (Device 27)
  - Reverse Power (Device 32)
  - Negative sequence overvoltage (Device 47)
  - Phase time overcurrent (Device 51)
  - Neutral overcurrent (Device 51N)
  - Phase overvoltage, 2 stage (Device 59)
  - Under frequency, 2 stage (Device 81U)
  - Over frequency (Device 81O)

MODES OF OPERATION

• Provides for single unit stand-alone operation, island mode paralleling and load sharing with other power modules, and single unit-to-utility mode paralleling for base load control (with open transition between paralleling modes)
• Island mode paralleling features:
- Lead unit select control allows single unit to connect to a dead bus
- Auto synchronization (voltage & phase matching)
- Load sharing (kW) analog signal (like units & legacy compatible)
- Load sharing (kVAR) analog signal (like units only)

• Utility mode paralleling features:
- Auto synchronization (voltage & phase matching)
- Base-load control (selectable: programmable set-point or potentiometer adjust)
- Soft load/unload (programmable, shared set-point)
- Power Factor control (programmable set-point)

SINGLE UNIT STAND-ALONE AND MULTI-UNIT ISLAND OPERATION
1. Utility Standby Mode (Normal)
a. The utility is providing power for the plant loads.
b. The PM Generator breaker is open.
c. The PM is in automatic standby mode to respond to a utility failure.
2. Emergency Mode (Emergency)
a. Utility Failure
1) The customer protective relaying senses a utility abnormal condition.
2) A run request is sent to the PM Generator plant.
3) The lead unit reaches rated voltage and frequency and is closed to the bus. This function is performed via the lead unit select jumper and interconnect wiring between the Power Modules.
4) In Multi-Unit Island Mode, the remaining PM Generators are paralleled to the bus as they reach rated voltage and frequency.
5) Plant load is transferred to the Power Modules, which share load equally via load share lines.

SINGLE UNIT BASE LOAD OPERATION
1. Utility Mode (Normal)
a. The utility is providing power for the plant loads.
b. The PM is in auto mode and the generator breaker is open.
c. The PM is interconnected to the utility breaker aux contact, lead unit jumper is not installed and load share lines are not connected
d. The Paralleling controls automatically detect utility parallel mode when the utility aux contact is closed.
e. GPC is programmed to the desired Base-load level, ramp times, and PF control
2. Base Load Mode
a) Unit receives remote run request and starts
b) Unit reaches rated voltage and frequency.
c) UMR performs sync-check to permit generator breaker to close.
d) Unit ramps to Base-Load set-point at programmed ramp time.
5) Unit continues to run until either a remote run request is removed, the unit is stopped at control panel, or a utility failure is detected.

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