3516C (HD) Offshore Generator Set

1539 ekW (2198 kVA)
1603 bkW (2150 bhp)
60 Hz (1200 rpm)

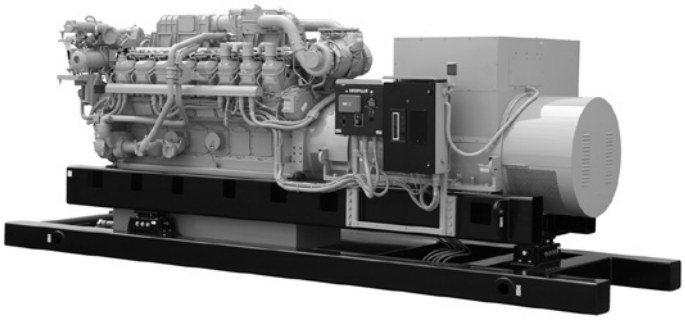


Image shown with optional attachments.

CAT® ENGINE SPECIFICATIONS

V-16, 4-Stroke-Cycle-Diesel

Emissions	EPA Marine Tier 2, IMO Tier II
Bore	170 mm (6.7 in)
Stroke	215 mm (8.5 in)
Displacement	78 L (4764 in^3)
Aspiration	Turbocharged-Aftercooled
Governor and Protection	Electronic ADEM™ A3
Refill Capacity	
Lube Oil System (refill)[1]	405.0 L (107 U.S. gal)
Engine Cooling System	234.7 L (62 U.S. gal)
Oil Change Interval	1000 hours

[1]15° tilt sump

FEATURES

Engine Design
- Proven reliability and durability
- Robust diesel strength design prolongs life and lowers owning an operating costs
- Assembled, tested, and validated as a package to minimize package vibration and maximize component life
- Market-leading power density
- Long overhaul life proven in oilfield applications
- Core engine components designed for reconditioning and reuse at overhaul

Ease of Installation

Engine and generator are mounted to an inner base, which mounts to an outer base assembly with vibration isolators. Installed with an integral drip tray to provide a single lift installation and to reduce the shipyard scope of work complexity.

Safety
- E-stop pushbutton on instrument panel
- Air shutoff and explosion relief valves
- Configurable alarm and shutdown features
- Extra alarm switches available for customer-supplied panel

Improved Serviceability

Large inspection openings allow convenient access to core engine internals

Reduction of Owning and Operating Costs
- Long filter change intervals, aligned with service intervals
- Excellent fuel economy — direct injection electronic unit injectors precisely meter fuel

Custom Packaging

For any petroleum application, trust Caterpillar to meet your exact needs with a factory custom package. Cat® engines, generators, enclosures, controls, radiators, transmissions — anything your project requires — can be custom designed and matched to create a one-of-a kind solution. Custom packages are globally supported and are covered by a one-year warranty after startup.

Testing

Every Cat engine is full-load tested to ensure proper engine performance.

Product Support Offered Through Global Cat Dealer Network

More than 2,200 dealer outlets

Caterpillar factory-trained dealer technicians service every aspect of your petroleum engine

Caterpillar parts and labor warranty

Preventive maintenance agreements available for repair-before-failure options

S•O•S℠ program matches your oil and coolant samples against Caterpillar set standards to determine:
- Internal engine component condition
- Presence of unwanted fluids
- Presence of combustion by-products
- Site-specific oil change interval

Over 80 Years of Engine Manufacturing Experience

Ownership of these manufacturing processes enables Caterpillar to produce high quality, dependable products.
- Cast engine blocks, heads, cylinder liners, and flywheel housings
- Machine critical components
- Assemble complete engine

Web Site

For all your petroleum power requirements, visit www.catoilandgasinfo.com.

STANDARD EQUIPMENT

Air Inlet System
Aftercooler core — corrosion resistant coating
Air cleaners — dual element, installed
Air inlet shutoff

Base Arrangement
Engine and generator three-point mounted into outer base
Oil drain extension
Oil drip pan

Control Panel
J1939 control and rigid rail wiring harness
(meets MCS wiring requirements)

Control System
ADEM A3 electronic control module with electronically controlled unit injectors (24V DC power source required)

Cooling System
To ensure emissions compliance, optional or customer-supplied heat exchangers or radiators must be capable of rejecting enough heat to allow proper operation at worst case site conditions and also must supply 50°C (122°F) SCAC cooling water to the aftercooler inlet, with an SCAC flow rate of at least 200-230 gpm with an ambient temperature of 30°C (86°F) and at site conditions.

Radiator Cooled Offshore:
Outlet controlled thermostat and housing
Jacket water pump — gear-driven, single outlet
Aftercooler fresh water cooling pump — gear-driven centrifugal
SCAC pump circuit contains a thermostat to keep the aftercooler coolant from falling below 30°C (86°F)
Single water outlet connection

Exhaust System
Dry gas-tight manifolds with thermo-laminated heat shields
Dual turbochargers with thermo-laminated heat shields and watercooled bearing housing
Flexible exhaust fitting/weldable exhaust flange

Flywheels and Flywheel Housings
Flywheel — SAE No. 00, 183 teeth
Flywheel housing — SAE No. 00, SAE standard rotation
Torsional coupling and generator hub

Fuel System
Electronically controlled unit injectors
Fuel filter — LH
Fuel transfer and priming pumps
Flexible fuel lines

Generator
See generator data, page 6

Instrumentation
Graphic unit (Marine Power Display), LH for analog or digital display of: engine oil and fuel pressure, engine water temperature, system DC voltage, air inlet restriction, RH & LH exhaust temperature, oil and fuel filter differential, service meter, engine speed, instantaneous fuel consumption, total fuel consumed
Operator programmable display, monitoring, alarms and shutdowns

Lube System
Crankcase breather — top-mounted
Deep sump oil pan — 1000 hour
Oil drain and valve
Oil filler and dipstick
Oil filter — cartridge-type, LH
Oil pump — gear-type

Protection System
ADEM A3 monitoring system provides engine deration, alarm, or shutdown strategies to protect against adverse operating conditions. Selected parameters are customer programmable. Status available on engine-mounted instrument panel, and can be broadcast through MODBUS to the rig's power management system.

Safety shutoff protection — electrical:
- Oil pressure
- Water temperature
- Overspeed
- Crankcase pressure
- Aftercooler temperature (SCAC only)
- Air inlet shutoff activated on overspeed or emergency stop included

Alarms — electrical:
- ECU voltage
- Oil pressure
- Water temperature (low and high)
- Overspeed
- Crankcase pressure
- Aftercooler temperature (SCAC only)
- Low water level (sensor shipped loose if no mounted expansion tank or radiator)
- Air inlet restriction
- Exhaust stack temperature
- Filter differential pressure (oil and fuel)

Derate — electrical:
- High water temperature
- Crankcase pressure
- Aftercooler temperature
- Air inlet restriction
- Altitude
- Exhaust temperature

Emergency stop pushbutton (on instrument panel)
Alarm switches (oil pressure and water temperature), for connection to customer-supplied alarm panel — unwired

Starting and Control
Air silencer
Air starting motor
Electric start control

General
Lifting eyes — front and rear
Paint — Cat yellow
Vibration damper and guard

ACCESSORY EQUIPMENT

Crankcase explosion relief valves
Duplex fuel and oil filters
Jacket water heaters
Mufflers — spark arresting
Primary fuel filter
Fuel cooler
Pyrometer and cylinder thermocouples
Additional instrumentation:
- Air cleaner restriction (2)
- Intake manifold temperature
- Lubricating oil temperature
- Fuel filter differential

Direct rack control interface, 0-200 mA signal
Marine society and IMO certificates
Bypass centrifugal oil filters
Metal particle detector
Fuel/water separator
15° and 25° tilt capability
Redundant start with selector switch (air-electric, air-air, or electric-electric)
Single-point customer connection
Heat exchanger cooling (front engine-mounted including expansion tank)
Air prelube

GENERATOR

Designed, tested, and sized for SCR drill rig service
90°C over 50°C ambient temperature rise
Form wound stator and rotor
Class insulated using Vacuum Pressure Impregnated (VPI) temperature-resistant materials
Imbedded temperature detectors and generator space heater are standard
Terminal box and copper bus bars for easy, dependable connections
Two-bearing generators
Optional bearing RTDs

RIG BASE

For use with Cat or other manufacturers' generators
Built-in three-point mounting system maintains alignment of engine-generator on uneven surface and from substructure flexing that can twist the base and cause engine-generator misalignment.

DIESEL ENGINE TECHNICAL DATA

3516C (HD) Engine — 1603 bkW (1200 rpm)

ENGINE SPEED (rpm):	1200	RATING:	Prime
COMPRESSION RATIO:	14.7:1	CERTIFICATION:	IMO/EPA MARINE TIER II
AFTERCOOLER WATER (°C):	50	TURBOCHARGER PART #:	307-7553
JACKET WATER OUTLET (°C):	99	FUEL TYPE:	Distillate
IGNITION SYSTEM:	EUI	MEAN PISTON SPEED (m/s):	8.1
EXHAUST MANIFOLD:	DRY		

RATING	NOTES	LOAD	100%	75%	50%
ENGINE POWER	(2)	bkW	1603	1202.3	801.5
BMEP kPa		kPa	2053	1540	1026

ENGINE DATA						
FUEL CONSUMPTION	(NOMINAL)	(1)	g/bkw-hr	210.3	219.4	224.8
AIR FLOW (@ 25°C, 101.3 kPaa)			m3/min	138.9	127.1	96.1
INLET MANIFOLD PRESSURE			kPa (abs)	268.0	232.7	151.2
INLET MANIFOLD TEMPERATURE			°C	58.6	57.3	55.5
EXHAUST STACK TEMPERATURE			°C	435.7	387.5	365.5
EXHAUST GAS FLOW (@ stack temp, 101.3 kPa)			m3/min	344.8	293.3	213.9
EXHAUST GAS MASS FLOW			kg/hr	10150	-	-

ENERGY BALANCE DATA						
FUEL INPUT ENERGY (LHV)	(NOMINAL)	(1)	KW	4006	3135	2141
HEAT REJ. TO JACKET WATER	(NOMINAL)	(3)	KW	618	515	388
HEAT REJ. TO ATMOSPHERE	(NOMINAL)	(4)	KW	133	116	103
HEAT REJ. TO OIL COOLER	(NOMINAL)	(5)	KW	200	157	107
HEAT REJ. TO EXH. (LHV to 25°C)	(NOMINAL)	(3)	KW	1472	1167	817
HEAT REJ. TO EXH. (LHV to 177°C)	(NOMINAL)	(3)	KW	750	550	369
HEAT REJ. TO AFTERCOOLER	(NOMINAL)	(6) (7)	KW	442	340	171

NOTES

1) FUEL CONSUMPTION TOLERANCE. ISO 3046/1 IS 0, + 5% OF FULL LOAD DATA. NOMINAL IS ± 3 % OF FULL LOAD DATA
2) ENGINE POWER TOLERANCE IS ± 3 % OF FULL LOAD DATA.
3) HEAT REJECTION TO JACKET AND EXHAUST TOLERANCE IS ± 10% OF FULL LOAD DATA. (heat rate based on treated water)
4) HEAT REJECTION TO ATMOSPHERE TOLERANCE IS ±50% OF FULL LOAD DATA. (heat rate based on treated water)
5) HEAT REJECTION TO LUBE OIL TOLERANCE IS ± 20% OF FULL LOAD DATA. (heat rate based on treated water)
6) HEAT REJECTION TO AFTERCOOLER TOLERANCE IS ± 5% OF FULL LOAD DATA. (heat rate based on treated water)
7) TOTAL AFTERCOOLER HEAT = AFTERCOOLER HEAT x ACHRF (heat rate based on treated water)

GENERATOR EFFICIENCY

Generator power determined with an assumed generator effeciency of 96% [generator power = engine power x 0.96]. If the actual generator efficiency is less than 96% [and greater than 94.5%], the generator power [ekW] listed in the technical data can still be achieved. The BSFC values must be increased by a factor.

The factor is a percentage = 96% - actual generator efficiency.

GENERATOR TECHNICAL DATA

Cat Drilling Generator*

Specifications

Poles 6
Excitation ..... PMG
Pitch 0.778
Connection ..... Wye
Max. Overspeed (60 sec) 125%
Number of Bearings 2
Number of Leads 6
Number of Terminals 4

Ratings

Power ..... 1833.3 ekW
kVA 2619
pf 0.7
Voltage — L.L. ..... 600 V
Voltage — L.N. ..... 346 V
Current — L.L. ..... 2520 A
Frequency ..... 60 Hz
Speed ..... 1200 rpm

Exciter Armature Data (at full load, 0.7 pf)

Voltage ..... 192.0 V
Current ..... 102.0 A

Temperature and Insulation Data

Ambient Temperature ..... 50°C
Temperature Rise ..... 90°C
Insulation Class ..... F
Insulation Resistance (as shipped) ..... 100 Megaohms (at 40°C)

Resistances

Base Impedence ..... 0.137 ohms
Stator (at 25° C) ..... 0.001 ohms
Field (at 25° C) ..... 1.30 ohms
Zero Sequence R0 ..... 0.00 ohms
Positive Sequence R1 ..... 0.00 ohms
Short Circuit Ratio 0.68

Fault Currents

Instantaneous 3-∅ symmetrical fault current ..... 12,001 amps
Instantaneous L-N symmetrical fault current ..... 13,747 amps
Instantaneous L-L symmetrical fault current ..... 9489 amps

Efficiency and Heat Dissipation (per NEMA and IEC at 95°C)

Load PU	Kilowatts	Efficiency	Heat Rejection
0.25	458.3	90.9%	156,598 Btu/hr
0.50	916.7	94.3%	189,105 Btu/hr
0.75	1375.0	95.1%	241,795 Btu/hr
1.00	1833.3	94.8%	343,214 Btu/hr

Time Constants

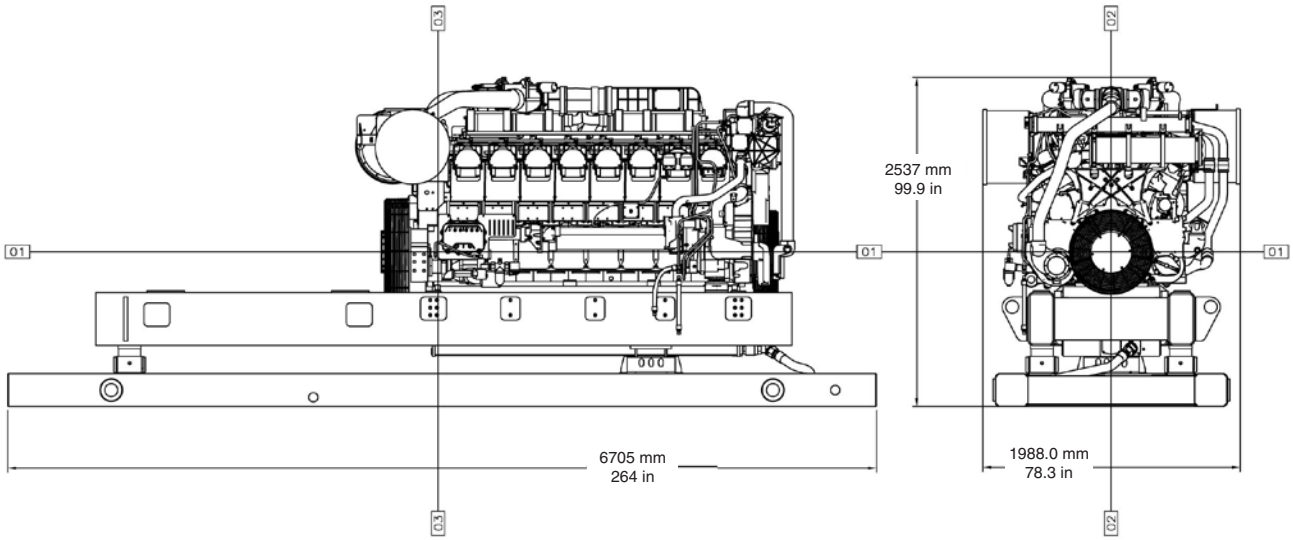
OC Transient — Direct Axis	T'DO	2.955 sec
SC Transient — Direct Axis	T'D	0.557 sec
OC Subtransient — Direct Axis	T"DO	0.030 sec
SC Subtransient — Direct Axis	T"D	0.022 sec
OC Subtransient — Quadrature Axis	T"QO	0.015 sec
SC Subtransient — Quadrature Axis	T"Q	0.004 sec
Armature SC	TA	0.079 sec

Reactances

		Saturated		Unsaturated	
		Per Unit	Ohms	Per Unit	Ohms
Subtransient — Direct Axis	X"D	0.210	0.0	0.250	0.0
Subtransient — Quadrature Axis	X"Q	0.280	0.0	0.330	0.0
Transient — Direct Axis	X'D	0.280	0.0	0.320	0.0
Transient — Quadrature Axis	X'Q	0.820	0.1	0.990	0.1
Synchronous — Direct Axis	XD	1.470	0.2	1.780	0.2
Synchronous — Quadrature Axis	XQ	0.820	0.1	0.990	0.1
Negative Sequence	X2	0.250	0.0	0.290	0.0
Zero Sequence	X0	0.090	0.0	0.110	0.0

*Other generators are available.

DIMENSIONS



Dimensions and Weight		
Length	6705 mm	264 in
Width	1988 mm	78.3 in
Height	2537 mm	99.9 in
Weight – dry	18 800 kg	41 400 lb

Note: Dimensions are dependent on generator and options selected. See general installation drawings for detail.

Note: Weight includes engine, generator, base, coupling, and all auxiliary components. Weight may vary depending upon individual configuration.

RATING DEFINITIONS AND CONDITIONS

Rating Definition — Maximum Continuous Rating (MCR) following reference conditions according to the International Association of Classification Societies (IACS) for main and auxiliary engines. An overload of 10% is permitted for one hour within 12 hours of operation.

Conditions are based on SAE J1995 standard conditions of 100 kPa (29.61 in Hg) and 25°C (77°F). These ratings also apply at ISO3046/1, DIN6271, and BS5514 standard conditions of 100 kPa (29.61 in Hg), 27°C (81°F), and 60% relative humidity. Ratings are valid for air cleaner inlet temperatures up to and including 60°C (140°F).

Fuel Consumption — 5% tolerance and based on fuel oil of 35° API [16°C (60°F)] gravity having an LHV of 62 780 kJ/kg (18,390 Btu/lb) when used at 29°C (85°F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal). Fuel consumption is shown with all engine-driven oil, fuel, and water pumps.