CAT® GENERATOR SET SPECIFICATIONS

V-16, 4-Stroke-Cycle-Diesel
Emissions .................... IMO Tier II/EPA Marine Tier 2
Bore ................................... 280 mm (11.0 in)
Stroke ................................. 300 mm (11.8 in)
Displacement ......................... 296 L (18,062 in³)
Aspiration ....................... Turbocharged-Aftercooled
Fuel System ................................. EUI
Engine Control .......................... Dual ADEM™ A4
Generator Set Control . Cat® Alarm and Protection System

Refill Capacity
Cooling System .................. 1245 L (329 U.S. gal)
Lube Oil System ................. 1677 L (443 U.S. gal)
Oil Change Interval .................. 1000 hours

FEATURES

Product Design
- Cat C280 engines are type approved by the following marine classification societies:
  - American Bureau of Shipping
  - Bureau Veritas
  - China Classification Society
  - Det Norske Veritas
  - Germanisher Lloyd
  - Lloyd's Register of Shipping
- IMO Tier II emissions certification, GL and CCS approved
- Cat alarm and protection system provides redundancy and the latest technology in generator set control, protection, and operator interface; type approved by the following marine classification societies:
  - American Bureau of Shipping
  - Bureau Veritas
  - China Classification Society
  - Det Norske Veritas
  - Germanisher Lloyd
  - Lloyd's Register of Shipping
  - Russian Maritime Register of Shipping
- Optimized to lower specific fuel consumption at 35% load

Simplified Packaging Concept
- Front-mounted turbocharger configuration allows for simplified rig integration
- Engine design can take up to 38°C coolant to the aftercooler, allowing integration with flexible cooling system designs and reducing installation cost
- Single-point AC and DC connection points at distribution panel
- Ready-to-run package, includes most ancillary equipment
- Few shipped-loose parts simplify handling at installation
- Single-lift handling
- Caterpillar warranty covers all factory package components worldwide

Custom Packaging
For any petroleum application, trust Caterpillar to meet your project needs with custom factory generator sets

and mechanical packages. Cat engines, generators, controls, radiators, and transmissions can be custom designed and matched in collaboration with our local dealers to create unique solutions. Custom packages are globally supported and are covered by a one-year warranty after startup.

Full Range of Attachments
Large variety of factory-installed engine attachments increases application flexibility and reduces installation time.

Testing
- Every unit is full-load tested to ensure proper package performance
- Full range of factory tests and reports are available including performance, torsional-vibration analysis, fuel consumption, engine, and generator special tests

Product Support Offered Through Global Cat Dealer Network
More than 2,200 dealer outlets
Caterpillar factory-trained dealer technicians service every aspect of your Cat 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 and combustion by-products
  - Site-specific oil change interval

Over 80 Years of Engine Manufacturing Experience
- C280 engines incorporate over 20 years of proven component reliability and durability from 3600 engines
- Large field population in offshore applications provides proven performance, reliability, durability, and established worldwide product support network

Web Site
Visit www.catoilandgasinfo.com to learn more.
CONFIGURATION

Product Consist
The engine is a turbocharged, aftercooled, four-stroke-cycle-diesel, electronic unit injection engine with a 280 mm (11 in) bore by 300 mm (11.8 in) stroke. SAE standard rotation is counterclockwise as viewed from the rear of engine flywheel.

Air Inlet System
Fresh water aftercooler, corrosion resistant coated (air side); air inlet shutoff; crankcase breathers, top-mounted; turbochargers (2), front-mounted, oil lubricated

Control System
Dual Cat ADEM A4 electronic engine control module with electronic unit injector fuel system, rigid wiring harness (10 amp 24V power required to drive electronic engine control modules), direct rack control

Cooling System
Gear-driven jacket water (JW) pump, gear-driven separate-circuit aftercooler/oil cooler (AC/OC) pump, front-mounted water connections: JW and AC/OC, 6" ANSI

Exhaust System
Dry, gas tight exhaust manifold; dual turbocharger, front-mounted; dual wastegate; hard shielding – SOLAS compliant

Fuel System
Distillate fuel (requires viscosity ranging from 1.4 cSt to 20 cSt at 38°C); fuel pump, gear-driven; fuel transfer pump (mounted on left-hand side); duplex fuel filters, rear-engine-mounted; electronically controlled unit injectors

Lube System
Centrifugal oil filters and lines with single shutoff – RH mounted on cylinder block inspection covers, serviceable with the engine running; oil pump, gear-driven; oil filler and dipstick – located in base integrated tank; oil pressure regulating valve; crankcase explosion relief valves; duplex oil filter – accessory module mounted; off engine-mounted oil cooler – DTO quote required for package connections; base integrated tank – DTO required

Instrumentation
Cat Alarm and Protection System
Features:
- 145 mm (5.7") color monitor to display all engine parameters and alarm annunciation, alarms annunciated with a time and date stamp
- Annunciation of all engine shutdowns, alarms, and status points
- Start/prelube control switch and emergency stop button
- Selection of local/remote control of engine
- Customer connections at terminal blocks inside panel
- Equipped for remote communication MODBUS RS485 and MODBUS TCP
- Two configurable relay outputs
- All engine sensors are monitored by the ECU or the Cat alarm and protection system
- The panel can display all engine parameters

Starting System
TDI dual air starting motors, LH rear; shutoff valve; two integrated relay valves with built-in screen #40 mesh and solenoid; air pressure sensor, monitored by Cat alarm and protection system – requires customer wiring; maximum operating (dynamic) pressure: 10 bar (150 psi); maximum static pressure: 14 bar (200 psi); 3-inch ANSI flange customer connection; requires customer-provided 3-inch supply air line from receiver or regulator to air starter and flex connection; if regulator is used, Cv of 40 or greater is required
ATTACHMENTS

Emission Certification
GL and CCS approved IMO certificate — includes statement of compliance or Engine International Air Pollution Prevention (EIAPP) certificate, supplied by the Recognized Organization (RO) where available, and technical file to be kept on board per IMO regulations.

Marine Society Certifications
Societies currently granting approval to C280 engines are: ABS, BV, CCS, DnV, GL, LRS

Marine Society Requirements
Spray shielding to meet SOLAS regulations for flammable fluids

European Certifications
Declaration of Incorporation for EU Machinery Safety Directive and EU Low Voltage Safety Directive

Air Inlet System
90° adapter and straight adapters for air inlet to turbocharger
Air cleaners
Air cleaners with Cat dry paper filter elements (approximately 99.9% efficient at filtering SAE fine dust)
*Soot filter
*Air cleaner support bracket

Cooling System
Jacket Water Thermostat Options:
- 90°C thermostat, direct connection to expansion tank
- 90°C thermostat, for remote mounting
- 90°C thermostat, fully automatic 3-way with manual override
- Customer-provided thermostat

AC/OC Thermostat Options:
- 32°C thermostat, remote mounted
- 32°C thermostat, fully automatic, 3-way with manual override
- Customer-provided thermostat

Expansion Tank Options:
- Remote-mounted expansion tank
- Accessory-module-mounted expansion tank
*Jacket water heaters
*ANSI connection adapters

Fuel System
*Manual fuel priming pump
*Duplex primary fuel strainer

Lube System
Redundant prelube with continuous electric prelube
Intermittent air prelube backup
Electric continuous prelube pump
*Lube oil heater

Protection System
Flywheel and damper guards
*Cylinder pressure relief valve
*Spray shielding
*Oil mist detector

Starting System
Pressure reducing valve

Mounting System
Design-To-Order (DTO) base
*Vertically-restrained vibration isolators and weld plates

General
Generator panel
Torsional coupling
Engine barring device options:
- Manual 50:1
- Electric 400V
- Electric 480V
*Accessory module — Front mounted for mounting expansion tank, heat exchanger, instrument panel, annunciator panel, alarm and shutdown contactors, and fuel strainer
*Engine testing — full-load tested, fuel consumption test, rated speed performance test, overload test, minimum power setting, peak firing pressure test, turbo work certificates, crankshaft work certificates, standard and project-specific witness testing
*Spare parts kit
*Engine lifting eyes

Literature
*Project-specific installation drawings
*Electrical schematics and P&ID drawings

*Indicates an optional attachment
C280-16 OFFSHORE GENERATOR SET

5500 ekW  60 Hz

PRELIMINARY

DIESEL ENGINE TECHNICAL DATA

C280-16 Engine — 5730 bkW (900 rpm)

<table>
<thead>
<tr>
<th>Genset 60 Hz</th>
<th>60 Hz</th>
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<tbody>
<tr>
<td>ENGINE SPEED (rpm):</td>
<td>900</td>
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<tr>
<td>COMPRESSION RATIO:</td>
<td>12.6 : 1</td>
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<tr>
<td>AFTERCOOLER WATER (°C):</td>
<td>38</td>
</tr>
<tr>
<td>JACKET WATER INLET (°C):</td>
<td>90</td>
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<tr>
<td>IGNITION SYSTEM:</td>
<td>EU</td>
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<tr>
<td>EXHAUST MANIFOLD:</td>
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<tr>
<td>FIRING PRESSURE @ 100% load (kPa):</td>
<td>17300</td>
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<tr>
<td>LOAD 110% 100% 75% 50% 25%</td>
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<tr>
<td>ENGINE POWER(1)</td>
<td>bkW</td>
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<tr>
<td>GENERATOR POWER(2)</td>
<td>ekW</td>
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<tr>
<td>DEMP</td>
<td>kPa</td>
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ENERGY BALANCE DATA

| FUEL INPUT ENERGY (LHV)(1) (NOMINAL) | kW | 14510 | 13167 | 9958 | 7117 | 3948 |
| HEAT REJ. TO JACKET WATER(3) (NOMINAL) | kW | 1108 | 1006 | 818 | 637 | 401 |
| HEAT REJ. TO ATMOSPHERE(4) (NOMINAL) | kW | 290 | 263 | 199 | 142 | 79 |
| HEAT REJ. TO OIL COOLER(5) (NOMINAL) | kW | 578 | 555 | 470 | 380 | 371 |
| HEAT REJ. TO EXH (LHV to 25 deg C)(6) (NOMINAL) | kW | 4481 | 4129 | 3186 | 2375 | 1552 |
| HEAT REJ. TO EXH. (LHV to 177 deg C)(7) (NOMINAL) | kW | 2757 | 2528 | 1753 | 1389 | 909 |
| HEAT REJ. TO AFTERCOOLER(9) (NOMINAL) | kW | 1830 | 1661 | 1333 | 617 | 121 |

ALTITUDE DERATION FACTORS

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<tr>
<th>ALTITUDE (METERS)</th>
<th>0</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR TO TURBO (°C)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.98</td>
<td>0.96</td>
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AFTERCOOLER HEAT REJECTION FACTORS

<table>
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<th>ALTITUDE (METERS)</th>
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<th>30</th>
<th>35</th>
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<th>45</th>
<th>50</th>
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</tr>
</thead>
<tbody>
<tr>
<td>AIR TO TURBO (°C)</td>
<td>1.00</td>
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</table>

CONDITIONS AND DEFINITIONS

STANDARD REFERENCE CONDITIONS OF 25°C, 100 KPA, 30% RELATIVE HUMIDITY AND 150M ALTITUDE AT THE STATED AFTERCOOLER WATER TEMPERATURE. CONSULT ALTITUDE CURVES FOR APPLICATIONS ABOVE MAXIMUM RATED ALTITUDE AND/OR TEMPERATURE. PERFORMANCE AND FUEL CONSUMPTION ARE BASED ON 35 API, 16°C FUEL HAVING A LOWER HEATING VALUE OF 42,789 MJ/KG.

USED AT 23°C WITH A DENSITY OF 838.9 g/liter.

NOTES

1) FULL CONSUMPTION TOLERANCE: ISO 3046/1 IS 0 ± 5% 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 ±5% OF FULL LOAD DATA. (Heat rate based on treated water)
5) HEAT REJECTION TO 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 ACHRR (Heat rate based on treated water)

TOTAL DERATION FACTORS:

This table shows the deration required for various air inlet temperatures and altitudes. Use this information to help determine actual engine power for your site. The total deration factor includes deration due to altitude and ambient temperature, and air inlet manifold temperature deration.

AFTERCOOLER HEAT REJECTION FACTORS:

Aftercooler heat rejection is given for standard conditions of 25°C and 150 m altitude. To maintain a constant air inlet manifold temperature, as the air to turbo temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor to adjust for ambient and altitude conditions. Modify this factor by the standard aftercooler heat rejection factor.

GENERATOR EFFICIENCY:

Generator power determined with an assumed generator efficiency of 88% (generator power = engine power x 0.88). If the actual generator efficiency is less than 90% and greater than 85%, the generator power factor (kW) listed in the technical data can still be achieved. The BHP-C values must be increased by a factor of 1.027. The factor is a percentage of 88% - actual generator efficiency.

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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.

Fuel consumption has a tolerance of +5% and is based on fuel oil of 35° API [16°C (60°F)] gravity having an LHV of 52 780 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 shown with all oil, fuel, and water pumps, engine driven.

Dimensions and Weight

<table>
<thead>
<tr>
<th>Dimensions and Weight</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>10 283 mm (404.8 in)</td>
</tr>
<tr>
<td>Width</td>
<td>2800 mm (110.2 in)</td>
</tr>
<tr>
<td>Height</td>
<td>4092 mm (161.1 in)</td>
</tr>
<tr>
<td>Weight — dry</td>
<td>66 000 kg (145,505 lb)</td>
</tr>
</tbody>
</table>

Note: Dimensions are dependent on generator and options. See general dimension drawings for details.

Note: Weight includes engine, generator, base, coupling, water/lube oil heater, generator lubrication module, and piping. Weight may vary depending upon individual configuration.