16V228 and 12V228 Enclosed Diesel Generator Sets

For more than 40 years, GE Transportation has designed and built high-performance diesel engines and today is one of the world's largest manufacturers of medium-speed diesel engines. GE's advanced engines and generator sets not only are dependable, long-lasting and efficient, but also perform in the world's most challenging environments.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Sound-attenuated walk-in metal enclosure** | - Enclosure composed of three modules — engine/alternator, auxiliary and electrical — for improved transportability  
  - Engine can be serviced from within the enclosure |
| **GE's heavy-duty four-stroke diesel engine** | - Rugged design optimized for fuel efficiency, long service intervals, low lifecycle costs and low emissions |
| **Optimization** | - Available in fuel optimized and World Bank emissions configurations |
| **Worldwide product support** | - More than 15,000 medium-speed diesel engines in service worldwide  
  - GE's network of parts distribution centers and service representatives are available 24/7 worldwide  
  - A leader in on-time delivery of parts and services |

### Performance Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Limited time running</th>
<th>Prime power</th>
<th>Continuous power</th>
</tr>
</thead>
<tbody>
<tr>
<td>16V228 GSE 50 Hz</td>
<td>3,364 (4,205)</td>
<td>3,084 (3,855)</td>
<td>2,803 (3,504)</td>
</tr>
<tr>
<td>16V228 GSE 60 Hz</td>
<td>3,027 (3,784)</td>
<td>2,775 (3,469)</td>
<td>2,523 (3,154)</td>
</tr>
<tr>
<td>12V228 GSE 50 Hz</td>
<td>2,510 (3,138)</td>
<td>2,301 (2,876)</td>
<td>2,092 (2,615)</td>
</tr>
<tr>
<td>12V228 GSE 60 Hz</td>
<td>2,259 (2,824)</td>
<td>2,071 (2,589)</td>
<td>1,883 (2,354)</td>
</tr>
</tbody>
</table>

16V228 based on 96.5% efficiency alternator. 12V228 based on 96% efficiency alternator. Power factor = 0.8 Emergency standby rating not available for V228 engines.
## Scope of supply

### Enclosed genset equipment

- 16V228 or 12V228 stationary diesel engine
- Base frame
- Brushless alternator with automatic voltage regulator
- Flexible coupling
- Internal fuel oil day tank – 800 U.S. gallons (3,028 L)
- Internal enclosure fluorescent lighting
- 2 electrical convenience receptacles
- Fire detection system

### Basic engine equipment

- Exhaust gas turbocharger, intercooler
- Electronic fuel injection
- Lubricating oil pump (gear-driven)
- Lubricating oil filters in main circuit
- Lubricating oil sump, lubricating oil heat exchanger
- Jacket water pump
- Flywheel for alternator operation, exhaust gas manifold
- Viscous damper
- Segmented camshafts
- Unitized power assemblies
- Water separator

### Engine accessories

- Engine combustion air filter
- Pneumatic air starter motor
- Electronic speed monitoring device including starting and over speed control
- Transducers and switches for oil pressure and temperature
- One thermocouple per cylinder
- Closed crankcase breather system
- Accessory rack

### Documentation

- Operation manual
- Maintenance manual
- Spare parts manual
- Troubleshooting guide
- Installation guide

### Generator set specifications

<table>
<thead>
<tr>
<th>Performance class</th>
<th>ISO 8528 – G2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel tank</td>
<td>UL 142</td>
</tr>
<tr>
<td>Starting air receivers</td>
<td>UL Stamp Certified ASME Pressure Vessels</td>
</tr>
<tr>
<td>Diesel engine</td>
<td>ISO 3046</td>
</tr>
</tbody>
</table>

### Engine specifications

<table>
<thead>
<tr>
<th>Engine speed</th>
<th>1,000 RPM (50 Hz) / 900 RPM (60 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bore</td>
<td>228.6 mm (9 in)</td>
</tr>
<tr>
<td>Stroke</td>
<td>266.7 mm (10.5 in)</td>
</tr>
<tr>
<td>Cylinder configuration</td>
<td>V 16</td>
</tr>
<tr>
<td>Displacement</td>
<td>175L</td>
</tr>
<tr>
<td>Fuel system</td>
<td>Direct injection</td>
</tr>
<tr>
<td>Acceptable fuel</td>
<td>Diesel fuel (ASTM D-975 Number 2 Diesel) Marine diesel oil (MDO) DMA, DMB, DMX, as defined by ISO 8217:2005(E)</td>
</tr>
<tr>
<td>Fuel filter</td>
<td>2 stage solid particle and water separator</td>
</tr>
<tr>
<td>Air cleaner type</td>
<td>2 stage vortex and bag filters</td>
</tr>
<tr>
<td>Lube oil filter type(s)</td>
<td>Low maintenance, dual filtration, auto back flush filter and centrifugal filter</td>
</tr>
<tr>
<td>Standard cooling system</td>
<td>Remote radiator connections</td>
</tr>
</tbody>
</table>
### Alternator specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design</strong></td>
<td>Brushless, 6-pole or 8-pole, 4-wire, drip-proof revolving field</td>
</tr>
<tr>
<td><strong>Stator</strong></td>
<td>5/6 pitch</td>
</tr>
<tr>
<td><strong>Rotor</strong></td>
<td>Two-bearing flexible coupling</td>
</tr>
<tr>
<td><strong>Insulation system</strong></td>
<td>Class F on medium voltage</td>
</tr>
<tr>
<td><strong>Standard temperature rise</strong></td>
<td>Class B -80°C at 50°C ambient</td>
</tr>
<tr>
<td><strong>Number of bearings</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Exciter type</strong></td>
<td>Auxiliary winding</td>
</tr>
<tr>
<td><strong>Phase rotation</strong></td>
<td>A-B-C</td>
</tr>
<tr>
<td><strong>Alternator cooling</strong></td>
<td>Self-ventilated (shaft-mounted fan)</td>
</tr>
<tr>
<td><strong>AC waveform total harmonic distortion</strong></td>
<td>5%</td>
</tr>
<tr>
<td><strong>Standard compliance</strong></td>
<td>IEC 60034 or NEMA MG1</td>
</tr>
<tr>
<td><strong>Accessories</strong></td>
<td>Anti-condensation heater, Stator and bearing thermal monitoring, Star-point mounted CT’s for differential protection</td>
</tr>
</tbody>
</table>

**Available 50 Hz voltages:** 11 kV, 6.6 kV and 3.3 kV

**Available 60 Hz voltages:** 13.8 kV and 4.16 kV

Additional alternator choices available. Check with factory for details.

### Control system operations
- Start/stop
- Synchronizing (live or dead bus)
- Protective relaying (breaker tripping)
- Idle/rated speed control (electronic fuel injection)
- Event monitoring and logging [200+ events]
- Alternator field excitation
- Real and reactive power load sharing
- Hardwire remote control interface
- Off-board communication link — TCP/IP ModBus

### Engine protection
- High-temperature exhaust gas warning
- High-temperature lube oil inlet warning and shut down
- High-temperature water outlet warning
- High-temperature water inlet warning and shut down
- High- and low-fuel temperature warning
- High-temperature manifold air warning
- High-temperature inner cooler water warning
- Low-pressure lube oil pump warning
- Low-pressure lube oil inlet warning and shut down
- High crank case pressure shut down
- Low-pressure water inlet warning and shut down
- Low-fuel press warning
- High-pressure manifold air warning and shut down
- High-temperature pre-turbo warning and shut down
- Low-pressure inner cooler water warning
- Engine main bearing high-temperature shut down
- High-speed turbo warning and shut down
- High-speed engine shut down

### Protective relaying
- 87 — Differential protective relay
- 50 — Instantaneous overcurrent
- 51 — AC time overcurrent relay
- 81 — Frequency relay
- 27 — Under-voltage relay
- 59 — Over-voltage relay
- 47 — Phase-sequence or phase-balance voltage relay
- 46 — Rev. phase or phase-balance current relay
- 40 — Field (over/under excitation) relay
- 24 — Volts-per-hertz relay
- 32 — Directional power relay
- 32R — Reverse power, real and reactive

### Options
- Remote radiator
- Heat recovery solutions
- Cooling system expansion tank
- Switch gear/breaker
- Outdoor NGR (Neutral grounding resistor)
- Auxiliary transformer
- Remote control panel
- Oil and coolant pre-heat system
- Exhaust gas silencer
- Anti-vibration mounts
- Alternator
- Fire suppression system
- Air conditioning unit
Rating definitions
Rating definitions are in accordance with ISO 8528.

Continuous power (COP) — The maximum power which the generating set is capable of delivering continuously while supplying a constant electrical load when operated for an unlimited number of hours per year.

Limited-time running power (LTP) — The maximum power available for which the generating set is capable of delivering for up to 500 hours of operation per year. Load factor may be up to 100%.

Prime power (PRP) — The maximum power which a generating set is capable of delivering continuously while supplying a variable electrical load when operated for an unlimited number of hours per year. Load factor during a 24-hour period is less than 70%.

Emergency standby power (ESP) — The maximum power available during a variable electrical power sequence for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 200 hours of operation per year.

Weight

<table>
<thead>
<tr>
<th>Module</th>
<th>16V228</th>
<th>12V228</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>25,000 lbs (11,340 kg)</td>
<td>25,000 lbs (11,340 kg)</td>
</tr>
<tr>
<td>Engine/alternator</td>
<td>137,000 lbs (62,142 kg)</td>
<td>130,200 lbs (59,058 kg)</td>
</tr>
<tr>
<td>Auxiliary</td>
<td>15,000 lbs (6,804 kg)</td>
<td>15,000 lbs (6,804 kg)</td>
</tr>
<tr>
<td>Total weight</td>
<td>177,000 lbs (80,286 kg)</td>
<td>170,200 lbs (77,201 kg)</td>
</tr>
</tbody>
</table>

Dimensions

<table>
<thead>
<tr>
<th>A Length</th>
<th>648 in (16,459 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B Height</td>
<td>181 in (4,597 mm)</td>
</tr>
<tr>
<td>C Width</td>
<td>154 in (3,912 mm)</td>
</tr>
</tbody>
</table>

Weight represents a set with standard features. Specifications may change without notice.

GE Transportation

Stationary Power

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To learn more, visit getransportation.com.

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