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ISO 9001 / ISO14001 Certified
The Energy System Division is located at Akashi Works in Japan. It designs and manu-
factures the Gas Turbine Co-generation System, and is certified for ISO 9001, the
international standard of quality assurance, and ISO 14001, the international standard
for environmental management.
KAWASAKI HEAVY INDUSTRIES, LTD.
An Integrated Engineering Manufacturer Spreading its Interests by Land, Sea and Air.

Kawasaki Heavy Industries, established in 1878, has a history of more than 140 years of manufacturing integrated engineered products. Our business has expanded to include the manufacturing of ships, railway rolling stock, aircraft, gas turbines, many types of industrial plants, steel structures, general machinery, and motorcycles. Our products are found on the land, in the sea and in the air.

By constant attention to production efficiency and through exclusive technologies developed internally, we are continuing to develop additional technologies related to transportation innovations, national land and marine resources development, space exploration development, environmental controls, new energy development, and biotechnology development. The range of our technologies is greatly expanding to encompass large, diverse projects.
History and Order Record of Kawasaki Gas Turbines

Kawasaki Gas Turbine places importance on "Efficient Energy Use", "Eco-friendly" and "Reliable Product Care for Total Life Cycle" as a philosophy of our products. To enhance this philosophy, we have introduced a title for our products...."GREEN Gas Turbines".

"Get Reliable Eco-friendly Energy Now"

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History
1943 Completed the first Gas Turbine engine for aircrafts in Japan
1952 Started overhauling jet engines
1972 Started development of industrial Gas Turbine
1974 Completed first S1A-01 type : 200kW Gas Turbine
1977 First Kawasaki Gas Turbine genset : 200kW delivered
1979 First genset to overseas customer delivered
1984 First Kawasaki Gas Turbine Co-generation system 2x1.0MW delivered
1985 Accumulated sales of 1,000 engines
1988 1.5 MW M1A-13 type Gas Turbine introduced
1993 5.5 MW M7A-01 type Gas Turbine introduced
1995 1.5 MW M1A-13D Dry Low NOx type Gas Turbine introduced
1998 Overseas sales and service affiliates were established in the U.S., Germany and Malaysia
1999 6.5 MW M7A-02 type Gas Turbine introduced
5.5 MW M7A-01D Dry Low NOx type Gas Turbine introduced
Accumulated delivery of 5,000th engine
Experimental ceramic Gas Turbine completed and achieved the world record of 42.1% simple cycle efficiency for the 300kW class
2000 18 MW L20A type Gas Turbine introduced
2001 Akashi Works NO.4 Power Plant GPC180D : 17.6 MW commercial start-up
2005 Start-up Akashi Works Energy Center, which comprises 24.7 MW Combined Cycle and 7.8 MW Flexible Heat and Power Gas Turbine Power Plant
2006 7.7 MW class M7A-03 type Gas Turbine introduced
2007 Received the 100th Order of the M7A Series
2009 15ppm (NOx) M7A-03D type Gas Turbine introduced
2010 Accumulated sales of 10,000 engines
1.7 MW class M1A-17 type Gas Turbine introduced
2011 9ppm (NOx) M7A-03D type Gas Turbine introduced
2012 30MW L30A type Gas Turbine introduced
2014 30MW L30A Low-NOx hydrogen combustion type Gas Turbine launched
2015 Demonstration test of Low-NOx Gas Turbine using mixed hydrogen combustion system
2017 5MW M5A-01D type Gas Turbine introduced

Accumulated Number of Engine sales all over the world
Baseload Model

Basic Specifications

<table>
<thead>
<tr>
<th></th>
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<td>Gas Turbine Model</td>
<td>GPB31S</td>
<td>GPB31D</td>
<td>GPB17T</td>
<td>GPB17D</td>
<td>GPB17S</td>
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<td>2,930</td>
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<td>29.1%</td>
<td>29.1%</td>
<td>29.1%</td>
<td>29.1%</td>
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<td>LHV of Fuel</td>
<td>35.9 MJ/Nm³</td>
<td>35.9 MJ/Nm³</td>
<td>35.9 MJ/Nm³</td>
<td>35.9 MJ/Nm³</td>
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<td>35.9 MJ/Nm³</td>
<td>35.9 MJ/Nm³</td>
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</table>

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<thead>
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<td>GPB17D</td>
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<td>1,810</td>
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<td>35.9 MJ/Nm³</td>
<td>35.9 MJ/Nm³</td>
<td>35.9 MJ/Nm³</td>
</tr>
</tbody>
</table>

The Kawasaki GPB Series is designed for baseload applications, for both parallel operation with the grid and island mode operation. In addition, the Kawasaki GPB Series are able to operate in Co-generation service, with automatic operation capability supplying both electricity and heat (steam, hot water, direct heat) by collecting waste heat with a heat recovery steam generator (HRSG), heat exchanger, or dryer, and in Combined Cycle with a steam turbine generator. With high total thermal efficiency, the Kawasaki GPB Series are capable of highly efficient operation.

Features of Kawasaki Gas Turbine Baseload Model
1. Self-developed Gas Turbine Fully Made in Japan
   - Various lineup and reliable installation records all over the world.
2. Very High Durability Industrial Gas Turbine
   - Removable Compressor and Inspection holes on Turbine make the inspection easier.
3. Eco-friendly
   - Kawasaki Gas Turbine has DLE (Dry Low Emission) Compressor. DLE Compressor reduces NOx significantly and cleans exhaust gas.
4. Various Type of Fuel Applicable
   - Whichever fuel, city gas, LNG, Kerosene, light oil, A-type heavy oil, off gas can be selected.
5. Reliable After Service
   - Reliable after service system is available, which satisfies customer’s requirement with spare engines and parts supply system supported by well experienced service persons.

M5A : The Standard Solution for Power Generation

M7A : The Leading Edge – Single Digit Super Low NOx Emission Available !

In 2011, Kawasaki introduced to the market the newest combustion system which realized Single Digit Super Low NOx emission with the M7A-03 gas turbine engine. In many countries and regions, environmental protection requirements and regulations are getting tighter and tighter. In order to meet such requirements and regulations, Kawasaki has developed its new Single Digit Super Low NOx combustion system. Furthermore, Kawasaki will apply this technology subsequently to other engines of its fleet to give the market greater satisfaction and contribute to environmental burden reduction.

L30A : The World’s Most Efficient 30MW Gas Turbine

In June 2012, Kawasaki introduced a new gas turbine named L30A as a flagship model of its industrial gas turbine fleet. Based on Kawasaki’s well proven design technology, this machine is said to be the most efficient 30MW class gas turbine in the world, combined with very low emission output, high reliability and availability. In addition, with its modular system design, the L30A has realized excellent on-site maintainability. The L30A is able to provide a highly flexible solution for power generation and mechanical drive applications.

Ultimate Solution 40.3%
M1A Series Gas Turbine Generator Specifications

Site Condition for Normal Operation
- Elevation above sea level: 0 m
- Ambient Temperature: 15°C
- Ambient Air Pressure: 998 kPa
- Exhaust Gas Pressure Loss: 2.45 kPa
- LHV of Natural Gas Fuel: 35.9 MJ/Nm³ (100% CH4)
- Typical Steam Condition
  - Steam Pressure: 0.83 MPa
  - Steam Temperature (Gatedatured): 177°C
  - Feed Water Temperature: 80°C
  - Blowdown from HRSG: 0%

M1A Series Gas Turbine Specifications

<table>
<thead>
<tr>
<th>Gas Turbine Model</th>
<th>M1A-17</th>
<th>M1A-17D</th>
<th>M1A-17A</th>
<th>M1A-17A-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>GPB17</td>
<td>GPB17D</td>
<td>GPB17A</td>
<td>GPB17AD</td>
</tr>
<tr>
<td>Part Load @ 15°C (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Full Load</td>
<td>1,450</td>
<td>1,450</td>
<td>1,450</td>
<td>1,450</td>
</tr>
<tr>
<td>Exhaust Gas Pressure (kPa)</td>
<td>15,150</td>
<td>15,200</td>
<td>15,300</td>
<td>15,350</td>
</tr>
<tr>
<td>Exhaust Gas Temperature (°C)</td>
<td>524</td>
<td>523</td>
<td>523</td>
<td>523</td>
</tr>
<tr>
<td>Extracted Gas Mass Flow (kg/hr)</td>
<td>28.8</td>
<td>28.5</td>
<td>27.6</td>
<td>27.6</td>
</tr>
<tr>
<td>HRSG Start Up / Trip / Damp / Trip (%)</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
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<tr>
<td>Steam Temperature (°C)</td>
<td>79.1</td>
<td>79.7</td>
<td>79.7</td>
<td>79.7</td>
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<tr>
<td>Elevation above sea level (m)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exhaust Gas Pressure Loss (kPa)</td>
<td>2.45</td>
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<td>2.45</td>
<td>2.45</td>
</tr>
<tr>
<td>Blowdown from HRSG (%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Steam Pressure (MPaG)</td>
<td>0.83</td>
<td>0.83</td>
<td>0.83</td>
<td>0.83</td>
</tr>
</tbody>
</table>
| M1A-17 Series Gas Turbine Series

- **Carbon Steel Common Base Frame**
- **Outdoor Carbon Steel, Acoustic Enclosure**
- **Noise Level: 85 dBA at 1 m to the side of Enclosure**
- **Forced Ventilation Fan with Filter and Inlet Screen**
- **Maintenance Stage, Ladder, Beam (Option)**

**Intake Silencer & Filter**
- Painted Carbon Steel (Outer Skin and Structure)
- 2 Stage Filter with Inlet Screen
- Pulse Self Cleaning Filter (Option)
- Noise Level: 85 dBA in front of Filter

**Exhaust Silencer and Stack (Option)**
- Microprocessor Based Programmable Logic Controller (PLC)
- Control Panel: Option (Option)
- Water Cooled (Option)
- 3 Phase 3 Wire (Option 4 Wire)
- Standard Voltage: 0.4 kV, 3.3 kV, 6.6 kV
- Power Factor: 90% (Option 85%, 80%)
- Bearing: Ball Bearing
- Lubrication: Grease Pack
- Exciter: Diverted Field Brushless (Option PMG)

**Lube Oil System**
- Oil Type: Synthetic Esters Oil
- Turbine Drive Main Lube Pump
- Pre-Prod Lube Pump
- Air Cooled Oil Cooler with Temp Control Valve
- Water Cooled (Option)
- Integral Oil Reservoir: 210 liter (GPB17)
- Simplex Filter (Option Duplex Type)

**Compressor**
- Industrial Single Stage
- Rotor Speed: 22,000 rpm
- Standard Voltage: 0.4 kV, 3.3 kV, 6.6 kV
- Power Factor: 90% (Option 85%, 80%)
- Bearing: Ball Bearing
- Lubrication: Grease Pack
- Exciter: Diverted Field Brushless (Option PMG)

**Starting and Turning Motor System**
- Various Frequency Drive (VFD)
- (Option: Starter, DC Motor)
- Turning Motor

**Graphics Monitoring**
- Remote Monitoring (Option)
- Monitoring Graphics
- Historical Trend & Event Logger
- Daily and Monthly Reports

**M1A/17-13 Series Standard Package Configuration**

**M1A-17A Gas Turbine**
- Industrial Single Shaft
- Rotor Speed: 22,000 rpm

**M1A-17D Gas Turbine**
- Industrial Single Shaft
- Rotor Speed: 22,000 rpm

**M1A-17 Series Standard Package Configuration**

**M1A-17 Gas Turbine**
- Industrial Single Shaft
- Rotor Speed: 22,000 rpm

**Compressor**
- 2 Stage Centrifugal
- Pressure Ratio: 10.5 (17-17D)
- (VFD: 17D Option)

**Lube Oil System**
- Oil Type: Synthetic Esters Oil
- Turbine Drive Main Lube Pump
- Pre-Prod Lube Pump
- Air Cooled Oil Cooler with Temp Control Valve
- Water Cooled (Option)
- Integral Oil Reservoir
- Simplex Filter (Option Duplex Type)
- Stainless Steel Pipe: Down Stream of Filter

**Generator**
- Continuous Duty Rating
- Air Cooled Open-Drip Proof Construction
- Water Cooled (Option)
- 3 Phase 3 Wire (Option 4 Wire)
- Standard Voltage: 0.4 kV, 3.3 kV, 6.6 kV
- Power Factor: 90% (Option 85%, 80%)
- Bearing: Ball Bearing
- Lubrication: Grease Pack
- IEC Standard: Oxidized Insulation with F Rise
- Exciter: Diverted Field Brushless (Option PMG)

**Starting and Turning Motor System**
- Various Frequency Drive (VFD)
- (Option: Starter, DC Motor)
- Turning Motor

**Graphics Monitoring**
- Remote Monitoring (Option)
- Monitoring Graphics
- Historical Trend & Event Logger
- Daily and Monthly Reports

**MGP17 Typical Layout**: m (Reference)

**MGP17 Typical Package**
- **Reduction Gear Box**
  - Epoxy (MKA4)
  - Parallel (M1T)
  - Output Speed: 1,500 / 1,800 rpm (50/60 Hz)

- **Starting and Turning Motor System**
  - Various Frequency Drive (VFD)
  - (Option: Starter, DC Motor)
  - Turning Motor

- **Lube Oil System**
  - Oil Type: Synthetic Esters Oil
  - Turbine Drive Main Lube Pump
  - Pre-Prod Lube Pump
  - Air Cooled Oil Cooler with Temp Control Valve
  - Water Cooled (Option)
  - Integral Oil Reservoir
  - Simplex Filter (Option Duplex Type)

- **Compressor**
  - Industrial Single Stage
  - Rotor Speed: 22,000 rpm
  - Standard Voltage: 0.4 kV, 3.3 kV, 6.6 kV
  - Power Factor: 90% (Option 85%, 80%)
  - Bearing: Ball Bearing
  - Lubrication: Grease Pack
  - Exciter: Diverted Field Brushless (Option PMG)
L20A Series Gas Turbine Generator Specifications

**Site Condition for Normal Perfor**
- Elevation above sea level: 0 m
- Intake Air Temperature: 15 °C
- Intake Air Pressure Loss: 0.98 kPa
- Exhaust Gas Pressure Loss: 3.43 kPa (GPB300/360D)
- LHV of Natural Gas Fuel: 35.9 MJ/Nm³

**Typical Steam Condition**
- Steam Pressure: 0.83 MPaG
- Steam Temperature (Saturated): 177 °C
- Feed Water Temperature: 80 °C
- Blowdown from HRSG: 0 %

**Reduction Gear Box**
- Flexible Coupling with Shear Pin and Cover
- Coupling Shaft & Cover
- 3 Stage Axial Turbine
- Diesel (Standby Only) Dual Fuel
- Applicable Fuel: Natural Gas, Dry Low Emission (DLE) (GPB180D)
- Conventional Diffusion (GPB180)
- Dual Ignition System
- 8 Can Combustors
- IGV & 4 Stage VSV
- 11 Stage Axial Flow Compressor
- Rotor Speed: 9,420 rpm
- Industrial Single-Shaft L20A Gas Turbine

**Standard Package Configuration**
- Blowdown from HRSG: 0 %
- Feed Water Temperature: 80 °C
- Steam Temperature (Saturated): 177 °C
- Exhaust Gas Pressure Loss: 3.43 kPa (GPB300/360D)
- LHV of Natural Gas Fuel: 35.9 MJ/Nm³

**Starting and Turning System**
- Various Frequency Drive (VFD)
- Lube Oil System
- Oil: Turbine Oil ISO VG32 (optional VG46)
- Turbine Driven Main Lube Oil Pump
- Pre-Pump Lube Oil Pump
- Emergency Lube Oil Pump
- Water Cooled Oil Cooler with Temp. Control Valve
- Oil Reservoir integrated with Baseplate: 5,900 liter
- Stainless Steel Piping: Downstream of Filter
- Filter
- Oil Vapor Fan
- Generator
- Continuous Duty Rating
- 3 Phase, 3 Wire (Option 4 Wire)
- Voltage: 6.6 kV, 11.0 kV
- Power Factor: 0.90 (Option 85%, 80%)
- IEC Standard, Class F Insulation with F Rise
- Exciter: Brushless PMG
- Enclosed Package
- Carbon Steel Common Base Frame
- Painted Carbon Steel Acoustic Enclosure
- Noise Level: 85 dB at 1 m from the side of Enclosure
- Forced Ventilation Fan with Filter
- Maintenance Stage, Ladder, Beam (Option)

**Intake Silencer & Filter**
- Painted Carbon Steel (Outer Skin and Structure)
- Stainless Steel Inner Porching Metal Sheet
- 3 Stage Filter with Insect Screen
- Pulse Type Self Cleaning Filter (Option)
- Noise Level: 85 dB at 1 m from Filter inlet
- Exhaust Silencer Stack (Option)

**Controls**
- Microprocessor Based Programmable Logic Controller (PLC)
  - CPU: Power Module (Option Redundant)
- Gas Turbine and Generator Control
- GT Start / Shutdown Control
- Speed / kW / Power Factor Control
- Auto Synchronization and Auto Sharing
- Touch Panel Operation
- Serial Link User Interface (Option)
- SCADA System (Option)
- Redundant Control System (Option)
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger

**L30A Series Gas Turbine Generator Specifications**

**Site Condition for Normal Perfor**
- Elevation above sea level: 0 m
- Intake Air Temperature: 15 °C
- Intake Air Pressure Loss: 0.98 kPa
- Exhaust Gas Pressure Loss: 3.43 kPa (GPB300/360D)
- LHV of Natural Gas Fuel: 35.9 MJ/Nm³

**Typical Steam Condition**
- Steam Pressure: 0.83 MPaG
- Steam Temperature (Saturated): 177 °C
- Feed Water Temperature: 80 °C
- Blowdown from HRSG: 0 %

**Reduction Gear Box**
- Flexible Coupling with Shear Pin and Cover
- Coupling Shaft & Cover
- 3 Stage Axial Turbine
- Gas Generator Turbine: 2 Stage Axial Turbine
- Turbine
- Applicable Fuel: Natural Gas
- Dry Low Emission (DLE) (GPB300D)
- Dual Ignition System
- Combustor
- IGV & 4 Stage VSV
- 14 Stage Axial Flow Compressor
- Power Turbine Rotor Speed: 5,600 rpm
- Gas Turbine and Generator Set

**Starting and Turning System**
- Various Frequency Drive (VFD)
- Lube Oil System
- Oil: Turbine Oil ISO VG32 (optional VG46)
- Motor Driven Main Lube Oil Pump
- Standby Lube Oil Pump
- Pre-Pump Lube Oil Pump
- Emergency Lube Oil Pump
- Water Cooled Oil Cooler with Temp. Control Valve
- Oil Reservoir integrated with Baseplate: 11,700 liter
- Stainless Steel Piping: Downstream of Filter
- Duplex Full Flow Filter
- Oil Vapor Fan

**Generator**
- Continuous Duty Rating
- 3 Phase, 3 Wire (Option 4 Wire)
- Voltage: 15 kV
- Power Factor: 0.90 (Option 85%, 80%)
- IEC Standard, Class F Insulation with F Rise
- Exciter: Brushless PMG
- Enclosed Package
- Carbon Steel Common Base Frame
- Painted Carbon Steel Acoustic Enclosure
- Noise Level: 85 dB at 1 m from the side of Enclosure
- Forced Ventilation Fan with Filter
- Maintenance Stage, Ladder, Beam (Option)

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- Touch Panel Operation
- Serial Link User Interface (Option)
- SCADA System (Option)
- Redundant Control System (Option)
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger

**Daily and Monthly Reports**
- Historical Trend & Event Logger
- Remote Monitoring (Option)
- SCADA System (Option)
- Serial Link User Interface (Option)
- Redundant Control System (Option)
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger
- Daily and Monthly Reports
Standby Model Introduction

**Excellent Features of Kawasaki Standby Gas Turbine Generators Sets**

Kawasaki has installed over 7,000 Standby Gas Turbine Generator Sets rated from 200 kVA to 6,000 kVA worldwide. The reliability of Kawasaki Standby Gas Turbine Generator Sets has allowed to install in Internet Data Centers, Hospitals, and Key Facilities where uninterrupted power is certainly required.

- High Performance, and very reliable, with the low cost gas turbine solution
- Easy Maintenance
- Dual Fuel Capability
- Low Noise Operation
- Low Vibration
- No Cooling Water
- High Starting Reliability, and quick start
- Light Weight, and space saving, easy transportation and installation
- Clean Exhaust Gas
- Excellent frequency control, even with large step loads

**Typical Standby / Gas Turbine Generator Layout**

**Basic Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>GPSET500</th>
<th>GPSET1500</th>
<th>GPSET2000</th>
<th>GPSET2500</th>
<th>GPSET3000</th>
<th>GPSET3500</th>
<th>GPSET4000</th>
<th>GPSET5000</th>
<th>GPSET6000</th>
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<tbody>
<tr>
<td>Engine</td>
<td>Electric Output (kW)</td>
<td>600</td>
<td>1,000</td>
<td>1,200</td>
<td>1,600</td>
<td>2,000</td>
<td>2,400</td>
<td>3,200</td>
<td>4,000</td>
</tr>
<tr>
<td>Frame</td>
<td>Frame Size</td>
<td>28,000</td>
<td>28,000</td>
<td>28,000</td>
<td>28,000</td>
<td>28,000</td>
<td>28,000</td>
<td>28,000</td>
<td>28,000</td>
</tr>
<tr>
<td>Drive</td>
<td>Speed (RPM)</td>
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<td>1,480</td>
<td>1,480</td>
<td>1,480</td>
<td>1,480</td>
<td>1,480</td>
<td>1,480</td>
<td>1,480</td>
</tr>
<tr>
<td>Engine</td>
<td>Output</td>
<td>105</td>
<td>105</td>
<td>105</td>
<td>105</td>
<td>105</td>
<td>105</td>
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</tr>
<tr>
<td>Voltage (V)</td>
<td>200-240</td>
<td>200-240</td>
<td>200-240</td>
<td>200-240</td>
<td>200-240</td>
<td>200-240</td>
<td>200-240</td>
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</tr>
<tr>
<td>Frequency (Hz)</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
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<tr>
<td>Altitude</td>
<td>Max.</td>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
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</tr>
<tr>
<td>Duty Cycle</td>
<td>Continuous</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
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</tr>
<tr>
<td>Operation</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Type of Batteries</td>
<td>Valve Regulated Lead-Acid (VRLA) Battery</td>
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<td></td>
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</tr>
<tr>
<td>Starting System</td>
<td>Electrical start with DC motors (Optional: Pneumatic start with air turbines)</td>
<td></td>
<td></td>
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<td></td>
<td>Note</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Output</td>
<td>Up to 40% of ambient temp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Fuel Consumption</td>
<td>All full load</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>15°C, using diesel fuel</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>5% allowance is 5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>3</td>
<td>Other voltage is available as option.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Typical Timing Chart Of Operation**

- **Power Lost Area**
- **The Great East Japan Earthquake (Mar. 11, 2011)**
  On March 11, 2011, the earthquake with 7.9 on the Richter scale hit the East Japan area, causing a blackout that hit about 3 million households in this area. In the area of the blackout, 1,034 units out of 1,035 successfully worked.

- **99.9% Start-up Reliability!**
  Units at Standby: 3,092
  Blackout: 1,035
  No Blackout: 2,057
  Successful startup: 1,034
  Startup failures: 1

**Standby Model (GPS Series)**

Standby generator sets must start and supply power in the event of the loss of power from the utility. These functions depend greatly on the prime-mover of the standby system. Starting and providing power are often the most important than financial conditions such as the initial cost of equipment. Kawasaki standby GPS Series are suitable for standby power supply when utility power fails. All the models are designed for automatic operation (start/power supply/stop) and equipped with alarm/protection systems.
Kawasaki MGP/TGP Series are gas turbine generators mounted on trucks or trailers for mobile application. MGP/TGP integrate all necessary equipment and enable fully automatic operation without the need for external power supply. High durability against vibration and shock, and reliable operation are important for this application. Kawasaki MGP/TGP is designed to fully meet such demands.

Advantages

1. Developed with Vast Field Experience
Gas Turbines on trucks or trailers need to withstand large vibration/shock when the trucks run on roads. Kawasaki meets mobile installation condition with gas turbines experience and technology from Kawasaki aircraft jet engines operating under similar severe environmental conditions.

2. Low Center of Gravity and Large Tumble-down Angle
Thanks to light weight of gas turbines, the center of gravity of MGP/TGP is low, and this makes it possible to have stable maneuverability.

3. Compact Integration
MGP/TGP incorporate all necessary equipment, including fuel tank, batteries, exhaust silencer, cable reel, etc., inside a compact aluminum enclosure. This feature enables easy maintenance.

4. Blackout Start Capability
MGP/TGP can start up and supply electricity without any external utility supply, such as electric power and fuel.

Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>MGP2000</th>
<th>MGP1250</th>
<th>MGP2000</th>
<th>MGP1250</th>
<th>MGP1250</th>
<th>MGP1250</th>
<th>MGP1250</th>
<th>MGP1250</th>
<th>MGP1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output (kW)</td>
<td>1,200</td>
<td>1,600</td>
<td>1,000</td>
<td>1,600</td>
<td>1,000</td>
<td>1,600</td>
<td>1,000</td>
<td>1,600</td>
<td>1,000</td>
<td>1,600</td>
</tr>
<tr>
<td>Fuel</td>
<td>Diesel</td>
<td>Diesel</td>
<td>Diesel</td>
<td>Diesel</td>
<td>Diesel</td>
<td>Diesel</td>
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<td>Diesel</td>
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<tr>
<td>Generator Set</td>
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<tr>
<td>Load Application Allowance</td>
<td>Within ±2%</td>
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<tr>
<td>Freq. (Deviation Transient)</td>
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<tr>
<td>Fuel Consumption (L/h)</td>
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<tr>
<td>Kerosene, Diesel</td>
<td>250</td>
<td>490</td>
<td>555</td>
<td>665</td>
<td>726</td>
<td>1,125</td>
<td>1,310</td>
<td>1,485</td>
<td>1,065</td>
<td>1,245</td>
</tr>
<tr>
<td>Truck / Trailer</td>
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</tr>
<tr>
<td>Type</td>
<td>Truck</td>
<td>Trailer</td>
<td>Truck</td>
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<td>Trailer</td>
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<td>Trailer</td>
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<tr>
<td>Dimensions</td>
<td>Max. Length (m)</td>
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<td>12.0</td>
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<td>Max. Width (m)</td>
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<td>Max. Height (m)</td>
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<tr>
<td>Total Weight (ton)</td>
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</tr>
</tbody>
</table>

Installation Example

- TGP300D
- MGP2000
- MGP1250
Kawasaki Techno-Net

- Full Time Support
- Maintenance Management
  - Predictive services based on trending data and asset maintenance management
    - What to do ✓ When to do it ✓ How to do it ✓ Who’s to do it
- Improvement of Availability and Quality of Maintenance
  - Minimum down time and good quality with adequate maintenance strategies and execution.
- Remote Maintenance System by a GT Expert
  - Proven effectiveness by most Kawasaki remote maintenance users
  - Fleet wide analysis

Techno-Net system continuously monitors the Gas Turbine Plant in any region of the world

Three main features of Techno-Net system

<table>
<thead>
<tr>
<th>Global remote monitoring</th>
<th>Preventing serious failures</th>
<th>Maintenance management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote monitoring through the internet</td>
<td>Enforced monitoring and diagnosis</td>
<td>Adequate management of maintenance</td>
</tr>
</tbody>
</table>

Three main features of Techno-Net system

- Global remote monitoring
- Preventing serious failures
- Maintenance management

Connection of centers through the internet

Communications through the telephone net / internet between customer and the centers

Internet / Intranet

- The Kawasaki World Business Center in the USA, Germany, Malaysia, China, Korea and Japan are connected by the Internet and by the KHI intranet to monitor gas turbines remotely and globally.

Attended monitoring

- All system data is monitored and recorded hourly, as well as all start signals and first out malfunction signals.
- Predictive and preventative maintenance is accomplished by analysis of thermal cycles and unit vibration.

Installation Examples

Kawasaki Gas Turbine has been installed to....

- Data Center
- Paper Mill
- Food Process
- College Campus
- Tire Manufacturer
- District Heat & Cooling
- Hospital
- Oil & Gas
- AND MORE !!!

In 2010 Kawasaki accumulated 10,000th Kawasaki Gas Turbine Engines in all over the world !!!

M1 Series

M7 Series

L20 / L30 Series

AND MORE !!!