KAWASAKI GAS TURBINE GENERATOR SETS
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 125 years of manufacturing integrated engineered products.

Its 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. Its products are found on the land, in the sea and in the air.

Of course, by constant attention to production efficiency and through exclusive technologies developed internally, we are continuing to develop technologies related to transportation innovations, national land and marine resources development, space development, environmental controls, new energy development and biotechnology development.

The range of our technologies is greatly expanding to encompass large, diverse projects.
Jet Ski ULTRA260X
A lime-limestone gypsum fuel gas desulfurization plant
Wind Turbine generation plant
Akashi Kaikyo Bridge
High Speed Train "efSET"
Two-stroke marine diesel engine
Gas Engine
Marine steam turbine (UA-type)
LNG Carrier
Submarine
Ninja 1400GTR
Industrial robot
Wheel Loader 82ZV-2
R142A Subway car for NYC
BK117 C-2 type
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 new title for our products..."GREEN Gas Turbines".

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History and Order Record of Kawasaki Gas Turbines

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 : 200 kW Gas Turbine
- **1977**  First Kawasaki Gas Turbine genset : 200 kW delivered
- **1979**  First genset to overseas customer delivered
- **1984**  First Kawasaki Gas Turbine Co-generation system 2x1.0 MW delivered
- **1985**  Accumulated delivery of 1,000th set
- **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
- **2000**  5.5 MW M7A-01D Dry Low NOx type Gas Turbine introduced
- **2000**  Accumulated delivery of 5,000th engine
- **2001**  Experimental ceramic Gas Turbine completed and achieved the world record of 42.1% simple cycle efficiency for the 300 kW class
- **2005**  Overseas sales and service affiliates were established in the U.S., Germany and Malaysia
- **2005**  18 MW L20A Gas Turbine completed
- **2006**  1.7 MW class M1A-17 type Gas Turbine introduced
- **2007**  9ppm (NOx) M7A-03D type Gas Turbine introduced
- **2007**  Accumulated delivery of 10,000th engine
- **2009**  15ppm (NOx) M7A-03D type Gas Turbine introduced
- **2010**  1.7 MW class M1A-17 type Gas Turbine introduced
- **2011**  9ppm (NOx) M7A-03D type Gas Turbine introduced
- **2012**  Accumulated delivery of 10,000th engine
- **2012**  30MW class L30A type Gas Turbine introduced

ISO 9001 / ISO 14001 Certified

Gas Turbine Division is located in Akashi Works. It designs and manufactures the Gas Turbine Co-generation System, and is certified for ISO 9001, which is the international standard for quality assurance, and ISO 14001, which is the international standard for environmental management.

Accumulated number of generator set delivered
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 is 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 is capable of very efficient operation.

**Basic Specifications**

<table>
<thead>
<tr>
<th>Engine Series</th>
<th>Gas Turbine Model</th>
<th>Gas Turbine Generator Model</th>
<th>M1A-13A</th>
<th>M1A-13D</th>
<th>M1A-17</th>
<th>M1A-17D</th>
<th>M1T-13A</th>
<th>M1T-13D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maximum Continuous Electric Output</td>
<td>1,490</td>
<td>1,490</td>
<td>1,690</td>
<td>1,690</td>
<td>2,930</td>
<td>2,930</td>
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<tr>
<td></td>
<td></td>
<td>Heat Rate</td>
<td>kJ/kWe-hr</td>
<td>14,880</td>
<td>15,030</td>
<td>13,550</td>
<td>13,550</td>
<td>15,100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thermal Efficiency</td>
<td>%</td>
<td>24.2</td>
<td>24.0</td>
<td>26.6</td>
<td>26.6</td>
<td>23.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exhaust Gas Temperature</td>
<td>°C</td>
<td>521</td>
<td>531</td>
<td>521</td>
<td>521</td>
<td>521</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exhaust Gas Mass Flow</td>
<td>x10³ kg/hr</td>
<td>29.1</td>
<td>28.8</td>
<td>29.1</td>
<td>29.1</td>
<td>58.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NOx (02 : 15%)</td>
<td>ppm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9 / 15</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approximate Package Dimension (LWH)</td>
<td>m</td>
<td>5.3 x 1.65 x 2.35</td>
<td>6.0 x 1.85 x 2.55</td>
<td>6.0 x 2.4 x 2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approximate Package Weight (dry)</td>
<td>x10³ kg</td>
<td>11</td>
<td>11.5</td>
<td>22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Mark "D" means Dry Low Emission

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

In June 2012, Kawasaki Heavy Industries, Ltd. introduced the new gas turbine named L30A as the flagship of its industrial gas turbine fleet. Based on Kawasaki’s well proven design technology, this machine is said to be the most efficient 30MW gas turbine in the world, combined with very low emission output, high reliability and availability. In addition, due to its modular construction, the L30A allows excellent on-site maintainability.

The L30A is able to provide a very flexible solution for power generation applications such as simple cycle, combined heat & power/ cogeneration and combined cycle power plant.

**Ultimate Solution - 40.1%**
### M7A Gas Turbine Series

<table>
<thead>
<tr>
<th>M7A-01</th>
<th>M7A-02</th>
<th>M7A-03</th>
<th>M7A-02D</th>
<th>M7A-03D</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPB60</td>
<td>GPB70</td>
<td>GPB80</td>
<td>GPB60D</td>
<td>GPB70D</td>
</tr>
<tr>
<td>5,530</td>
<td>6,800</td>
<td>7,810</td>
<td>5,400</td>
<td>6,740</td>
</tr>
<tr>
<td>12,140</td>
<td>11,870</td>
<td>10,720</td>
<td>12,300</td>
<td>11,890</td>
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<td>29.6</td>
<td>30.3</td>
<td>33.6</td>
<td>29.2</td>
<td>30.2</td>
</tr>
<tr>
<td>545</td>
<td>516</td>
<td>523</td>
<td>542</td>
<td>513</td>
</tr>
<tr>
<td>78.3</td>
<td>97.2</td>
<td>98.3</td>
<td>78.3</td>
<td>97.2</td>
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<td>-</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>55</td>
<td>58</td>
<td>60</td>
<td>55</td>
<td>58</td>
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</table>

### L20A Gas Turbine Series

<table>
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<th>L30A</th>
</tr>
</thead>
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<tr>
<td>GPB60D</td>
<td>GPB80D</td>
</tr>
<tr>
<td>18,420</td>
<td>30,120</td>
</tr>
<tr>
<td>10,530</td>
<td>8,970</td>
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<tr>
<td>34.2</td>
<td>40.1</td>
</tr>
<tr>
<td>542</td>
<td>470</td>
</tr>
<tr>
<td>215.3</td>
<td>319.4</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>17.2 x 3.5 x 3.4</td>
<td>21.6 x 6.2 x 5.7</td>
</tr>
</tbody>
</table>

### Installation Example

**Centrifugal Compressor for M1A Gas Turbine Series**

**Axial Compressor for M7A, L20A & L30A Gas Turbine**

**DIFFUSER**
**COMBUSTOR**
**SCROLL**
**INLET AIR**
**OUTPUT SHAFT**
**THRUST BEARING**
**No.1 BEARING**
**No.2 BEARING**
**COMPRRESSOR**
**TURBINE**

**EXHAUST**

**INLET AIR**

2 x GPB180 + 1 x STG GCPP System
**M1A Series Gas Turbine Generator Specifications**

### Nominal Performance
- Elevation: 0 m
- Inlet Air Temperature: 15 °C
- Inlet Air Pressure Loss: 0.98 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 MPaG
- Steam Temperature (Saturated): 177 °C
- Feed Water Temperature: 80 °C
- Blowdown from HRSG: 0%

### M1A Gas Turbine Series

<table>
<thead>
<tr>
<th>Gas Turbine Model</th>
<th>M1A-13A</th>
<th>M1A-13D</th>
</tr>
</thead>
<tbody>
<tr>
<td>GBP15</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>GPB15D</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>GPB17</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Partial Load @ Alt 15 °C (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Output kW</td>
<td>1,450</td>
<td>1,450</td>
</tr>
<tr>
<td>Heat Rate kJ/kWe-h</td>
<td>524</td>
<td>524</td>
</tr>
<tr>
<td>Exhaust Gas Temperature °C</td>
<td>32.8</td>
<td>32.8</td>
</tr>
<tr>
<td>Exhaust Gas Mass /kW x10⁶ kg/hr</td>
<td>28.8</td>
<td>28.8</td>
</tr>
<tr>
<td>HRSG Steam Output /kW x10⁶ kg/hr</td>
<td>5.0</td>
<td>5.1</td>
</tr>
<tr>
<td>Total Thermal Efficiency %</td>
<td>79.2</td>
<td>79.7</td>
</tr>
</tbody>
</table>

### M1A/T-13 Series

#### Standard Package Configuration

**M1T Gas Turbine**
- Twin M1T GT with Combined Gear Box
- Industrial Single-Shaft
- Rotor Speed: 22,000 rpm

**Compressor**
- 2 Stage Centrifugal
- Pressure Ratio: 9.4 (-13A), 9.6 (-13D)
- Single Can Compressor
- Single Ignition
- Conventional Diffusion (-13A)
- Steam Injection to Diffusion Compressor (-13A Option)
- DLE (Dry Low Emission) (-13D)

**Turbine**
- 3 Stage Axial Turbine
- Flexible Coupling with Shear Pin and Cover

**Reduction Gear Box**
- Epi-cyclic
- Output Speed: 1,500 / 1,800 rpm (50/60 Hz)

### Starting and Turning Motor System
- VFD Motor Drive
- (Option: Air Starter, DC Motor)
- Turning Motor

**Lube Oil System**
- Lube Oil, Synthetic Ester Oil
- Turbine Driven Main Lube Pump
- Pre-Post Lube Pump
- Air Cooled Oil Cooler with Temp. Control Valve
- Water Cooled (Option)
- Integral Oil Reservoir: 210 liter (GBP15) / 160 liter (GBP130)

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

### Enclosed Package
- 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 Insect Screen
- Pulse Self Cleaning Filter (Option)

**Exhaust Silencer and Stack**
- Painted Carbon Steel (Outer Skin and Structure)
- 2 Stage Filter with Insect Screen
- Pulse Self Cleaning Filter (Option)

### Controls
- Microprocessor Based PLC
  (CPU, Power Module: Option Redundant)
- Gas Turbine and Generator Control
  GT start / shutdown Control
- Auto Synchronizing and Auto Sharing
- Touch Panel Operation
- Industrial Ethernet
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger
  Daily and Monthly Reports

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**GPB17 Typical Layout : mm (Reference)**

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M1A-17 Series

**Standard Package Configuration**

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

**Compressor**
- 2 Stage Centrifugal
- Pressure Ratio: 10.5 (-17,-17D)
- Single Can Compressor
- Single Ignition
- Conventional Diffusion (-17)
- DLE (Dry Low Emission) (-17D)
- Available Fuel: Natural Gas

**Turbine**
- 3 Stage Axial Turbine
- Flexible Coupling with Shear Pin and Cover

**Reduction Gear Box**
- Epicyclic
- Output Speed: 1,500 / 1,800 rpm (50/60 Hz)

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

**Lube Oil System**
- Lube Oil: Synthetic Ester Oil
- Turbine Driven Main Lube Pump
- Pre-Post Lube Pump
- Water Cooled (Option)
- Integral Oil Reservoir
- Simpex Filter (Option: Duplex Type)
- Stainless Steel Piping: 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: 0.4kV, 3.3 kV, 6.6 kV
- Power Factor: 90% (Option 85%, 80%)
- Bearing: Ball (Roller) Bearing
- Lubrication: Grease Pack
- IEC Standard, Class F Insulation with F rise
- Exciter: Diverted Field Brushless (Option PMG)

**Enclosed Package**
- 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 Insect Screen
- Pulse Self Cleaning Filter (Option)
- Noise Level: 85 dBA in front of Filter

**Exhaust Silencer and Stack**
- (Option)

**Controls**
- Microprocessor Based PLC
  - CPU, Power Module: Option Redundant
- Gas Turbine and Generator Control
- GT start / shutdown Control
- Speed / kW / Power Factor Control
- Auto Synchronizing and Auto Sharing
- Touch Panel Operation
- Industrial Ethernet
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger
- Daily and Monthly Reports

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**GPB17 Typical Package Outlook : mm**
(Reference)
**M7A Series Gas Turbine Generator Specifications**

### Nominal Performance

- **Elevation**: 0 m
- **Inlet Air Temperature**: 15 °C
- **Inlet Air Pressure Loss**: 0.96 kPa (GPB80/80D)
- **Exhaust Gas Pressure Loss**: 2.45 kPa (GPB60/60D), 3.43 kPa (GPB70/70D), 2.94 kPa (GPB80/80D)
- **LHV of Natural Gas Fuel (100% CH4)**: 35.9MJ/Nm³

### Typical Steam Condition

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

### GPB60/70/80 Package Layout : mm

- **Ventilation**: 11,000, 3,270
- **Turbine Air Intake**: 3,990
- **Ventilation Exhaust**: 3,990
- **Turbine Exhaust**: 3,420

### M7A Gas Turbine Series

#### Standard Package Configuration

- **M7A Gas Turbine**
  - Industrial Single-Shaft
  - Rotor Speed: 14,000 rpm (-01/-01D), 13,790 rpm (-02/-02D,-03/-03D)
- **Compressor**
  - 12 Stage Axial Flow (-01/-01D), 11 Stage Axial Flow (-02/-02D,-03/-03D)
  - IGV & 3 Stage VSV
  - Pressure Ratio: 13:1 (-01/-01D), 16:1 (-02/-02D,-03/-03D)
- **Combustor**
  - 6 Can Combustors
  - Dual Ignition System (-01/-01D), 3 Stage Injection Type (-02/-02D,-03/-03D)
- **Turbine**
  - 4 Stage Axial Turbine
  - Flexible Coupling with Shear Pin and Cover
  - Reduction Gear Box
  - Epicyclic

#### Starting and Turning System

- VFD Motor Drive
- Lube Oil System
- Lube Oil: Turbine Oil ISO VG32 (VG46: Tropical)
- Pre-Post Lube Pump
- Emergency Lube Pump
- Air Cooled Oil Cooler with Temp. Control Valve
- Water Cooled (Option)
- Integral Oil Reservoir: 2,200 liter
- Oil Heater (Cold Weather Option)
- Stainless Steel Piping: Down Stream of Filter
- Simplex Filter (Duplex Filter: Option)
- Oil Vapor Fan

#### Enclosed Package

- 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)
- 3 Stage Filter with Insect Screen
- Pulse Type Self Cleaning Filter (Option)
- Noise Level: 85 dBA in front of Filter

#### Exhaust Silencer Stack (Option)

- Touch Panel Operation
- Serial Link User Interface (Option)
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger
- Daily and Monthly Reports
### Nominal Performance

- **Elevation**: 0 m
- **Inlet Air Temperature**: 15 °C
- **Inlet Air Pressure Loss**: 0.98 kPa
- **Exhaust Gas Pressure Loss**: 3.43 kPa (GPB180/180D)
- **LHV of Natural Gas Fuel**: 35.9MJ/Nm³ (100% CH4)

### Typical Steam Condition

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

### M7A Gas Turbine Series

<table>
<thead>
<tr>
<th>M7A-02D</th>
<th>GPB70D</th>
<th>M7A-03</th>
<th>GPB80</th>
<th>M7A-03D</th>
<th>GPB80D</th>
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</thead>
<tbody>
<tr>
<td>100</td>
<td>75</td>
<td>50</td>
<td>100</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>6,530</td>
<td>4,890</td>
<td>3,260</td>
<td>7,670</td>
<td>5,750</td>
<td>3,830</td>
</tr>
<tr>
<td>12,090</td>
<td>14,680</td>
<td>18,780</td>
<td>10,820</td>
<td>11,520</td>
<td>13,500</td>
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<td>516</td>
<td>487</td>
<td>494</td>
<td>526</td>
<td>445</td>
<td>377</td>
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<td>97.2</td>
<td>96.8</td>
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<td>84.8</td>
<td>81.7</td>
<td>83.2</td>
<td>86.4</td>
</tr>
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### The Leading Edge – Single Digit Super Low NOx emission Available!

September 2011, Kawasaki Heavy Industries (KHI) 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, requirement for environmental protection and regulations are becoming much stricter. In order to meet such requirement and regulations, KHI has developed the new Single Digit Super Low NOx combustion system. Furthermore, KHI will apply this technology subsequently to other fleet of its engines to give the market greater satisfaction and contribute to reduce environmental burden.

**M7A-03D**

**GPB60/70/80 Typical Layout : mm**

(Reference)
L20A / L30A Series Gas Turbine Generator Specifications

Nominal Performance
- Elevation: 0 m
- Inlet Air Temperature: 15 °C
- Inlet Air Pressure Loss: 0.98 kPa
- Exhaust Gas Pressure Loss: 3.43 kPa (GPB180/180D)
- LHV of Natural Gas Fuel: 35.9MJ/Nm³ (100% CH4)

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

L20A Gas Turbine Series

<table>
<thead>
<tr>
<th>Partial Load @ Alt 15 °C</th>
<th>%</th>
<th>Electric Output</th>
<th>kWe</th>
<th>Heat Rate</th>
<th>kJ/kWe-hr</th>
<th>Exhaust Gas Temperature</th>
<th>°C</th>
<th>Exhaust Gas Mass Flow</th>
<th>x10³ kg/hr</th>
<th>HRSG Steam Output (typical*)</th>
<th>x10³ kg/hr</th>
<th>Total Thermal Efficiency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
<td>17,970</td>
<td></td>
<td>10,690</td>
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<td>213</td>
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<td>84.0</td>
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<td>75</td>
<td>13,470</td>
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<td>50</td>
<td>9,320</td>
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<td>24.5</td>
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<td>77.7</td>
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</tr>
</tbody>
</table>

L20A Series Standard Package Configuration
- L20A Gas Turbine:
  - Industrial Single-Shaft
  - Rotor Speed: 9,420 rpm
- Compressor:
  - 11 Stage Axial Flow
  - IGV & 4 Stage VSV
- Combustor:
  - 8 Can Combustors
  - Dual Ignition System
  - Conventional Diffusion (GPB180)
  - (Option De-NOx: Steam Injection)
  - DLE (Dry Low Emission) (GPB180D)
  - Available Fuel: Natural Gas
- Turbine:
  - 3 Stage Axial Turbine
- Coupling Shaft & Cover:
  - Flexible Coupling with Shear Pin and Cover
- Reduction Gear Box:
  - Parallel Shaft
- Starting and Turning System:
  - VFD Motor Drive

Lube Oil System
- Lube Oil: Turbine Oil ISO VG32 (optional VG46)
- Turbine Driven Main Lube Oil Pump
- Pre-Post 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: Down Stream 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: 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 dBa at 1 m to 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 Punching Metal Sheet
- 3 Stage Filter with Insect Screen
- Pulse Type Self Cleaning Filter (Option)
- Noise Level: 85 dBa at 1 m to Filter inlet

Exhaust Silencer Stack (Option)
- Controls:
  - Microprocessor Based PLC (CPU, Power Module: Option Redundant)
  - Gas Turbine and Generator Control
    - GT start / Shutdown Control
    - Speed / kW / Power Factor Control
    - Auto Synchronizing 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
    - Daily and Monthly Reports

GPB180 Typical Package Outlook: mm (Reference)

![Diagram of GPB180 Typical Package Outlook](image-url)
L30A Gas Turbine Series

### LP300 / 300D

<table>
<thead>
<tr>
<th></th>
<th>L30A</th>
<th>GPB300 / 300D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Output</td>
<td>kWe</td>
<td></td>
</tr>
<tr>
<td>Exhaust Gas Temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Exhaust Mass Flow</td>
<td>x10³ kg/h</td>
<td></td>
</tr>
<tr>
<td>HRSG Steam Output (Typical*)</td>
<td>x10³ kg/h</td>
<td></td>
</tr>
<tr>
<td>Total Thermal Efficiency</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Inlet Air Temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Heat Rate</td>
<td>kJ/kWe-hr</td>
<td></td>
</tr>
<tr>
<td>Exhaust Gas Temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Exhaust Mass Flow</td>
<td>x10³ kg/h</td>
<td></td>
</tr>
<tr>
<td>HRSG Steam Output (Typical*)</td>
<td>x10³ kg/h</td>
<td></td>
</tr>
<tr>
<td>Total Thermal Efficiency</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Maximum Continuous Electric Output</td>
<td>kWe</td>
<td></td>
</tr>
</tbody>
</table>

### L30A Gas Turbine
- Industrial Twin-Shaft
- Power Turbine Rotor Speed: 5,600 rpm

### Compressor
- 14 Stage Axial Flow
- IGV & 4 Stage VSV

### Combustor
- 8 Can Combustors
- Dual Ignition System
- Conventional Diffusion (GPB300)
- Option De-NOx: Steam Injection
- DLE (Dry Low Emission) (GPB300D)
- Available Fuel: Natural Gas

### Lube Oil System
- Lube Oil: Turbine Oil ISO VG32 (optional VG46)
- Motor Driven Main Lube Oil Pump
- Standby Lube Oil Pump
- Pre-Post 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: Down Stream of Filter
- Duplex Full Flow Filter
- Oil Vapor Fan

### Generator
- Continuous Duty Rating
- 3 Phase, 3 Wire (Option 4 Wire)
- Voltage: 11 kV
- Power Factor: 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 dBA at 1 m to 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 Punching Metal Sheet
- 3 Stage Filter with Insect Screen
- Pulse Type Self Cleaning Filter (Option)
- Noise Level: 85 dBA at Filter inlet

### Exhaust Silencer Stack (Option)

### Controls
- Microprocessor Based PLC
  - (CPU, Power Module: Option Redundant)
- Gas Turbine and Generator Control
  - GT start / Shutdown Control
  - Speed / kW / Power Factor Control
  - Auto Synchronizing 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
- Daily and Monthly Reports

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

### Nominal Performance
- Elevation: 0 m
- Inlet Air Temperature: 15 °C
- Inlet Air Pressure Loss: 0.98 kPa
- LHV of Natural Gas Fuel: 35.9MJ/Nm³ (100% CH4)

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

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- Remote Monitoring (Option)
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- Historical Trend & Event Logger
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### L30A Gas Turbine Series

#### Standard Package Configuration

### L30A Gas Turbine
- Industrial Twin-Shaft
- Power Turbine Rotor Speed: 5,600 rpm

### Compressor
- 14 Stage Axial Flow
- IGV & 4 Stage VSV

### Combustor
- 8 Can Combustors
- Dual Ignition System
- Conventional Diffusion (GPB300)
- Option De-NOx: Steam Injection
- DLE (Dry Low Emission) (GPB300D)
- Available Fuel: Natural Gas

### Lube Oil System
- Lube Oil: Turbine Oil ISO VG32 (optional VG46)
- Motor Driven Main Lube Oil Pump
- Standby Lube Oil Pump
- Pre-Post Lube Oil Pump
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- Maintenance Stage, Ladder, Beam (Option)

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- Stainless Steel Inner Punching Metal Sheet
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- Noise Level: 85 dBA at 1 m to Filter inlet

### Exhaust Silencer Stack (Option)

### Controls
- Microprocessor Based PLC
  - (CPU, Power Module: Option Redundant)
- Gas Turbine and Generator Control
  - GT start / Shutdown Control
  - Speed / kW / Power Factor Control
  - Auto Synchronizing 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
- Daily and Monthly Reports
Excellent Features of Kawasaki Standby Gas Turbine Generators

Kawasaki installed over 7,000 Gas Turbine Generator Sets rated from 200kVA to 6,000kVA in the world. The reliability of Kawasaki’s Stand-by 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, as the low cost gas turbine solution
- **Easy Maintenance**
- **Dual Fuel Capability**
- **Low Noise**, and quite operation
- **Low Vibration**
- **No Cooling Water**
- **High Starting Reliability**, and quick start
- **Light Weight**, and space saving, easy transportation and installation
- **Clean Exhaust Gas**

Example of GPS2000 system configuration for indoor installation

Typical Standby / Gas Turbine Generator Layout

Gas turbine package with exhaust silencer

Internal view of gas turbine package

**The Great East JAPAN Earthquake - Mar.11, 2011**

The Results of Kawasaki Standby Gas Turbine start-up

- **Number of Unit, in the Earthquake Area**
  - 3,092 units

- **Lost Power**
  - 1,035 units

- **Operated**
  - 1,034 units

- **Grid Available**
  - 2,057 units

- **Start-up failures**
  - 1 unit (※)

(※) By external factor out of Kawasaki’s responsibility.

99.9% Start-up Reliability!
Standby Model (GPS Series)

Standby gensets 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 more 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.

Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>GPS750</th>
<th>GPS1250</th>
<th>GPS1500</th>
<th>GPS2000</th>
<th>GPS2500</th>
<th>GPS3000</th>
<th>GPS4000</th>
<th>GPS5000</th>
<th>GPS6000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator set</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>
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<tr>
<td>Starting time</td>
<td>Within 40-sec.</td>
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<td>Load application capacity</td>
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<tr>
<td>Spark plug</td>
<td>100% (Resistive load)</td>
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<td>Main fuel valve</td>
<td>Within ±0.3%</td>
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<td>Bypass fuel valve</td>
<td>Kerosene, Diesel oil</td>
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<td>Start fuel valve</td>
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<tr>
<td>Fuel type</td>
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<tr>
<td><strong>Fuel consumption (kWh/hr)</strong></td>
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<td>525</td>
<td>620</td>
<td>695</td>
<td>1,065</td>
<td>1,245</td>
<td>1,390</td>
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<td>Turbine model</td>
<td>S2A-01</td>
<td>M1A-01</td>
<td>M1A-03</td>
<td>M1A-23</td>
<td>M1T-01S</td>
<td>M1T-03</td>
<td>M1T-23</td>
<td>M1T-33A</td>
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<td>18,000</td>
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<tr>
<td>Turbine speed (rpm)</td>
<td>1,500 (50 Hz), 1,800 (60 Hz)</td>
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<td>Output speed (rpm)</td>
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<td>Dry weight (kg)</td>
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<tr>
<td>Lube of lube capacity (rpm/l)</td>
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<tr>
<td>Lube of lube consumption (l/min)</td>
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<td></td>
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<tr>
<td>3-phase, open screen-protected, brushless, self-ventilated, synchronous</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Type of batteries</strong></td>
<td>Lead-acid stationary or automotive batteries</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Electrical start with D.C. motors (Optional: Pneumatic start with air turbines)</td>
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<tr>
<td>Lead-acid stationary or automotive batteries (Optional: Alkaline Ni-Cd batteries, others)</td>
<td>4.0</td>
<td>4.9</td>
<td>5.4</td>
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<td>6.2</td>
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<td>Voltage regulation</td>
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<tr>
<td>Excitation system</td>
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<td>2.5</td>
<td>2.6</td>
<td>2.9</td>
<td>3.6</td>
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<tr>
<td>Noise level at 1 m</td>
<td>6.8</td>
<td>10.5</td>
<td>11.4</td>
<td>14.7</td>
<td>19.7</td>
<td>20.8</td>
<td>24.6</td>
<td>36.6</td>
<td>39.0</td>
</tr>
</tbody>
</table>

Note: *Output: Up to 40 °C of ambient temp. 150 m sea level
**Fuel consumption: At full load, 15 °C, using diesel fuel oil, allowance is 5%

Above specifications subject to change without notice.

Typical Timing Chart Of Operation

- **Turning motor**
- **Starter motor**
- **Ignition plug**
- **Main fuel valve**
- **Bypass fuel valve**
- **Start fuel valve**

- **RPM TURBINE SPEED**
- **VOLT GENERATOR VOLT**

- **Utility Supply**
- **Utility Failure**
- **Utility Supply Recover**

- **No load run 300 sec.**
- **Ready to re-start**
- **Load run 170-360 sec.**
- **Bypass fuel valve close**

Note: *Supplied with GPS1250 or larger model.
**70% rpm for GPS250 and GPS500
***70 sec. for GPS250 and GPS500
Kawasaki MGP/TGP Series gas turbines are mounted on trucks or on trailers for mobile generator sets. The MGP/TGP Series generator sets integrate all necessary equipment including fully automatic operation without external energy supply. Better maneuverability, high durability against vibration and shock, and reliable operation are important for this application. Kawasaki MGP/TGP Series are fully designed to meet such demands.

**Particular Advantages**

1. **Developed with vast field experience**
   Gas turbines on trucks or on trailers receive large vibration and shock when they run on roads. Kawasaki industrial trailer mounted gas turbines are incorporated with the experience and technology from Kawasaki aircraft jet engines which are operated under such severe environmental conditions.

2. **Low center of gravity and large tumble-down angle**
   Due to light weight of gas turbines, the center of gravity of gensets is lower and this makes it possible to have stable maneuverability.

3. **Compact integration**
   All necessary equipment is incorporated in the gensets, including the fuel tank, batteries, exhaust silencer, cable reel, etc., with a compact aluminum enclosure. Thus, there is easy maintenance of the gensets.

4. **Black start capability**
   Without external supply of electric power, fuel oil, etc., it can start-up and supply electricity.

---

**MGP series generator set**

**TGP series generator set**
# MGP/TGP Series Specifications

## System Specifications (Typical)

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>MGP 750</th>
<th>MGP 1000</th>
<th>MGP 1250</th>
<th>MGP 1500</th>
<th>MGP 2000</th>
<th>TGP 2500</th>
<th>TGP 3000</th>
<th>TGP 4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>output (kW) 40 °C</td>
<td></td>
<td>600</td>
<td>800</td>
<td>1000</td>
<td>1,200</td>
<td>1,600</td>
<td>2,000</td>
<td>2,400</td>
<td>3,200</td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Load Application allowance</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Freq. Deviation Transient</td>
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<tr>
<td>Freq. Deviation Steady State</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel Consumption (l/h)</td>
<td></td>
<td>320</td>
<td>490</td>
<td>555</td>
<td>655</td>
<td>735</td>
<td>1,125</td>
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<td>1,465</td>
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<tr>
<td>Type</td>
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<tr>
<td>Dimensions Max. Length (m)</td>
<td>Truck</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Including Max. Width (m)</td>
<td></td>
<td>12.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Height (m)</td>
<td></td>
<td>3.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Weight (ton)</td>
<td></td>
<td>3.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise Level at 1 m (dBA)</td>
<td>Less than 20 tons</td>
<td>Less than 22 tons</td>
<td>Less than 25 tons</td>
<td>Less than 45 tons</td>
<td>85</td>
<td></td>
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</tr>
</tbody>
</table>

Note

(1) Output : Up to 40 °C of ambient temp., 150 m sea level
(2) Other models are available. Output range is between 150 kW and 3,200 kW.

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### Installation Example

- **TGP4000 trailer set**
- **MGP2000 mobile set**
- **MGP1250 mobile set**
**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 GTExpert**
  - Proven effectiveness by most Kawasaki remote maintenance users
  - Fleet wide analysis

**Techno-Net system monitors Gas Turbine Plant in any region of the world for all the time**

**Three main roles of Techno-Net system**

- **Global remote monitoring**
  - Remote monitoring through the Internet
- **Preventing serious failures**
  - Enforced monitoring and diagnosis
- **Maintenance management**
  - Adequate management of maintenance

**Connection of centers through the internet**

**Internet/Intranet**
- The world business centers in the USA, Germany, Malaysia, and Japan are connected by the Internet and by the KHI intranet and monitor gas turbines remotely and globally.

**Attended monitoring and diagnosis**
- 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.
Kawasaki Gas Turbine has been installed to:
- Data Center
- Food Process
- Tire Manufacturer
- Paper Mill
- College Campus
- District Heat & Cooling
- Hospital
- Oil & Gas

AND MORE!!!

GUIANA HIGHLANDS
GPB30  Venezuela (Oil and Gas)

RAKAPOSHI PEAK
GPB70D  Pakistan (Paper Mill)

SCHWARZWALD
GPB80  Germany (Paper Mill)

GPB180  Portugal (Electrical Power Company)

NAZARETH