

Kawasaki Heavy Industries, Ltd.

global.kawasaki.com/en/energy/equipment/gas_turbines/index.html

Kawasaki Heavy Industries, Ltd. Tokyo Head Office
Tel: +81-3-3435-2579 Fax: +81-3-3435-2592

Kawasaki Machine Systems, Ltd. (Far East Asia)
Tel: +81-3-3435-2977 Fax: +81-3-3435-2592

Kawasaki Machine Systems, Ltd. Korea Branch
Tel: +82-2-527-2201 Fax: +82-2-527-2205

Kawasaki Gas Turbine Asia Sdn Bhd (KGA)
Tel: +60-3-7846-2882 Fax: +60-3-7848-3093

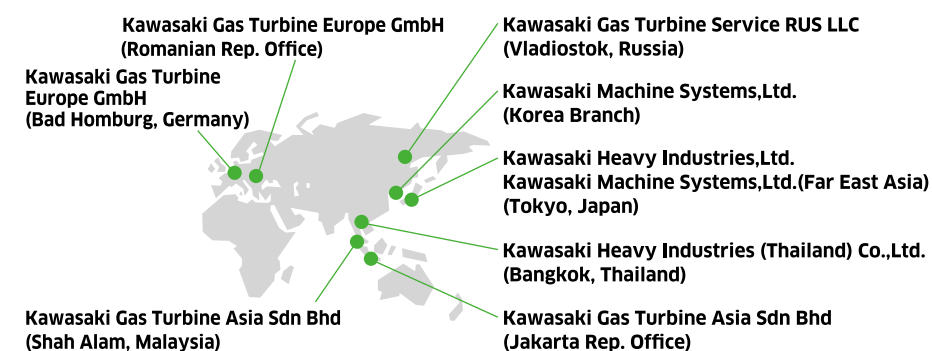
Kawasaki Gas Turbine Europe GmbH (KGE)
Tel: +49-6172-7363-0 Fax: +49-6172-7363-55

Kawasaki Gas Turbine Service RUS LLC
Tel: +7-423-262-0201 Fax: +7-423-262-0202

Kawasaki Heavy Industries (Thailand) Co., Ltd.
Tel: +66-2-163-2840 Fax: +66-2-163-2841

Kawasaki Gas Turbine Asia Sdn Bhd Jakarta Representative Office
Tel: +62-21508-15125

Kawasaki Gas Turbine Europe GmbH, Romanian Representative Office
Tel: +40-374 645915 Fax: +40-374 094901



ISO 9001 / ISO14001 Certified

The Energy System Division is located at Akashi Works in Japan. It designs and manufactures 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 GAS TURBINE GENERATOR SETS



L30A





L30A Gas Turbine



Boeing 787



V2500 Turbofan
(International Aero Engines AG)



Trent1000 Turbofan
(copyright Rolls-Royce PLC)



BK117 C-2 Type



R142A Subway Car For NYC



Industrial Robot



Jet Ski® ULTRA260X



Ninja H2



A Lime / Limestone Gypsum
Flue Gas Desulfurization Plant



Wind Turbine Generation Plant



Akashi Kaikyo Bridge



Wheel Loader 92ZV-2



High Speed Train "efSET"



Marine Steam Turbine
(UA-Type)



Submarine



Two-Stroke Marine
Diesel Engine



Gas Engine



LNG Carrier

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.



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 "

INDEX

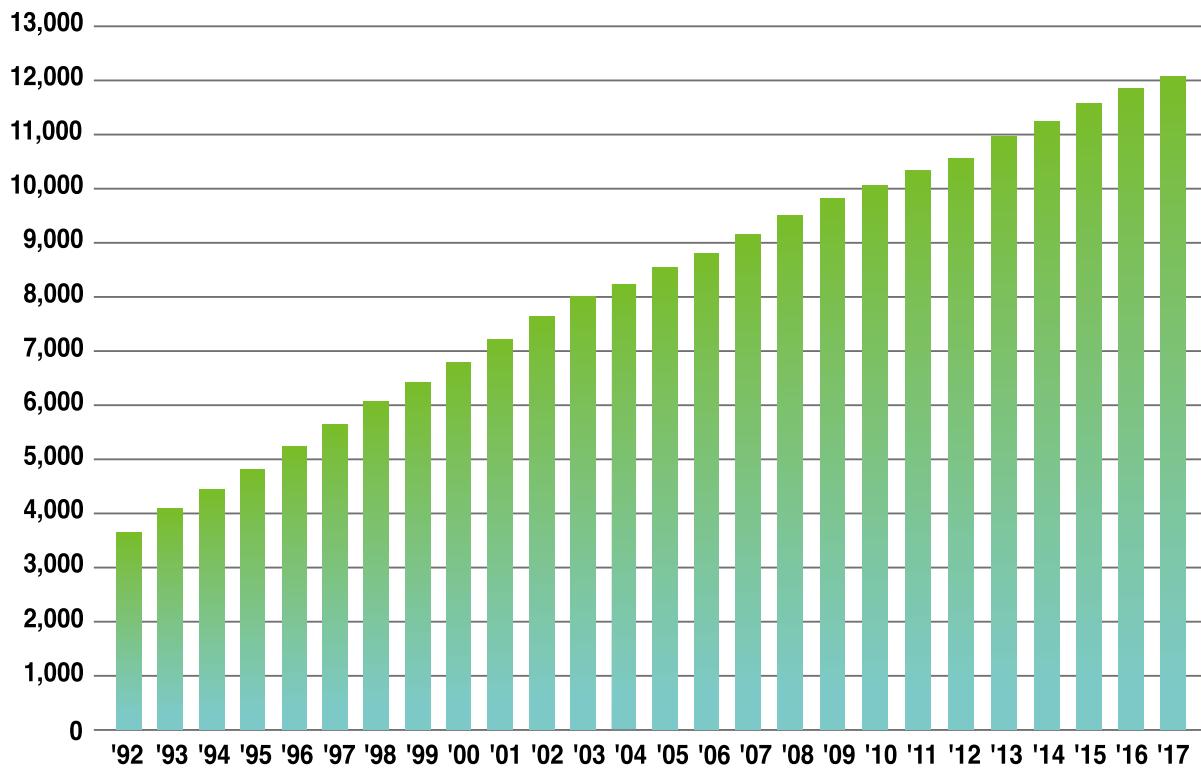
Introduction	1 . 2
History and Order Record of Kawasaki Gas Turbines	3 . 4
Baseload Model	5 . 6
M1A Series Gas Turbine Generator Specifications	7 . 8
M5A Series Gas Turbine Generator Specifications	9
M7A Series Gas Turbine Generator Specifications	10
L20A Series Gas Turbine Generator Specifications	11
L30A Series Gas Turbine Generator Specifications	12
Standby Model Introduction	13
Standby Model (GPS Series)	14
Mobile / Trailer Model (MGP / TGP Series)	15. 16
Kawasaki Techno-Net	17
Installation Examples	18

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 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 300 kW 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 30 MW L30A type Gas Turbine introduced
- 2014 30 MW 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



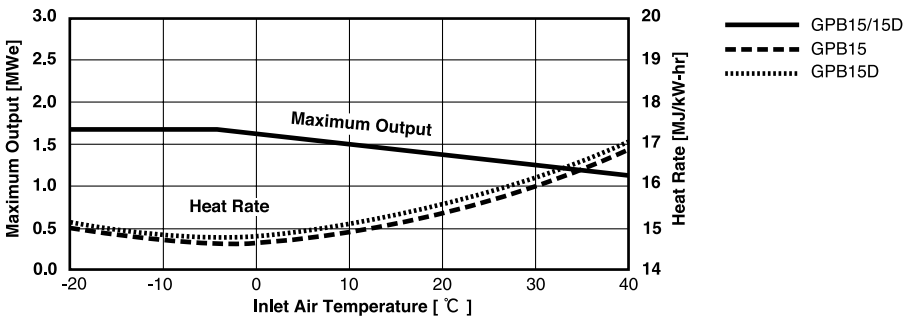
M1A Series Gas Turbine Generator Specifications

Site Condition for Normal Perfor

Elevation above sea level : 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 %



Gas Turbine Model	M1A Gas Turbine Series											
	M1A-13A			M1A-13D			M1T-13A			M1T-13D		
Gas Turbine Generator Model	GPB15			GPB15D			GPB30			GPB30D		
Partial Load @ AT 15 °C	100	75	50	100	75	50	100	75	50	100	75	50
Electric Output kWe	1,450	1,090	730	1,450	1,090	730	2,850	2,140	1,430	2,850	2,140	1,430
Heat Rate kJ/kWe-hr	15,130	16,500	19,750	15,280	16,660	19,900	15,350	16,800	20,190	15,510	16,960	20,370
Exhaust Gas Temperature °C	524	441	368	534	448	374	523	441	370	534	449	375
Exhaust Gas Mass Flow x10³ kg/hr	28.8	29.2	29.6	28.5	29.0	29.4	57.6	58.5	59.2	57.0	58.0	58.8
HRSG Steam Output (Typical*1) x10³ kg/hr	5.0	3.8	2.8	5.1	3.9	2.8	9.9	7.6	5.6	10.2	7.8	5.7
Total Thermal Efficiency %	79.2	73.6	65.4	79.7	74.2	66.1	78.8	73.3	65.2	79.3	73.9	65.9
Inlet Air Temperature °C	0	15	40	0	15	40	0	15	40	0	15	40
Maximum Continuous Electric Output kWe	1,620	1,450	1,120	1,630	1,450	1,116	2,945	2,850	2,210	2,950	2,850	2,190
Heat Rate kJ/kWe-hr	14,690	15,130	16,880	14,810	15,280	17,140	15,150	15,350	17,209	15,290	15,510	17,475
Exhaust Gas Temperature °C	516	524	547	526	534	559	485	523	547	492	534	559
Exhaust Gas Mass Flow x10³ kg/hr	30.9	28.8	25.2	30.7	28.5	24.8	62.1	57.6	50.3	61.7	57.0	49.7
HRSG Steam Output (Typical*1) x10³ kg/hr	5.2	5.0	4.8	5.3	5.1	4.9	9.4	9.9	9.5	9.6	10.2	9.7
Total Thermal Efficiency %	76.5	79.2	82.4	77.8	79.7	82.8	73.4	78.8	82.1	75.7	79.3	82.5

M1A/T-13 Series Standard Package Configuration

M1A-13A Gas Turbine

- Industrial Single-Shaft
- Rotor Speed : 22,000 rpm

M1T-13 Gas Turbine

- Twin M1A GT with Combined Gear Box

Compressor

- 2 Stage Centrifugal
- Pressure Ratio : 9.4 (-13A), 9.6 (-13D)
- IGV (-13D Option)

Combustor

- Single Can Combustor
- Single Ignition
- Conventional Diffusion (-13A)
- Steam Injection to Diffusion Combustor (-13A Option)
- Dry Low Emission (DLE) (-13D)
- Applicable Fuel : Natural Gas, Diesel, Dual Fuel (-13A)

Turbine

- 3 Stage Axial Turbine

Coupling Shaft & Cover

- Flexible Coupling with Shear Pin and Cover

Reduction Gear Box

- Epicyclic (M1A), Parallel (M1T)
- Output Speed : 1,500 / 1,800 rpm (50/60 Hz)

Starting and Turning Motor System

- Various Frequency Drive (VFD)
- (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 (GPB15) : 160 liter (GPB30)
- Simplex Filter (Option: Duplex Type)

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
- 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)

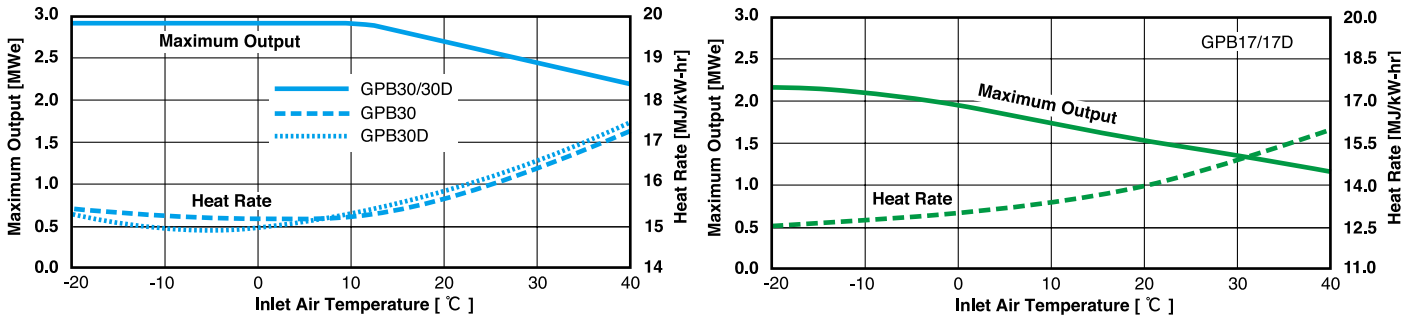
Intake Silencer & Filter

- 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 Programable Logic Controller (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



M1A Gas Turbine Series					
M1A-17			M1A-17D		
GPB17			GPB17D		
100	75	50	100	75	50
1,755	1,315	875	1,755	1,315	875
13,120	14,370	17,320	13,120	14,370	17,320
526	443	377	526	443	377
28.8	29.4	29.9	28.8	29.4	29.9
5.0	3.9	2.9	5.0	3.9	2.9
80.4	75.4	67.5	80.4	75.4	67.5
0	15	40	0	15	40
2,050	1,755	1,305	2,050	1,755	1,305
12,460	13,120	14,930	12,460	13,120	14,930
511	526	560	511	526	560
31.5	28.8	24.4	31.5	28.8	24.4
5.2	5.0	4.7	5.2	5.0	4.7
78.6	80.4	83.0	78.6	80.4	83.0

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)
- IGV (-17D Option)

Combustor

- Single Can Combustor
- Single Ignition
- Conventional Diffusion (-17)
- Dry Low Emission (DLE) (-17D)
- Applicable Fuel : Natural Gas, Diesel, Dual fuel

Turbine

- 3 Stage Axial Turbine

Coupling Shaft & Cover

- 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

- Various Frequency Drive (VFD)
- (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
- Simplex 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 : 0.4 kV, 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

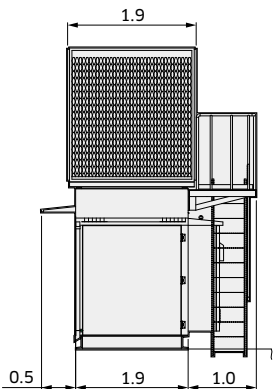
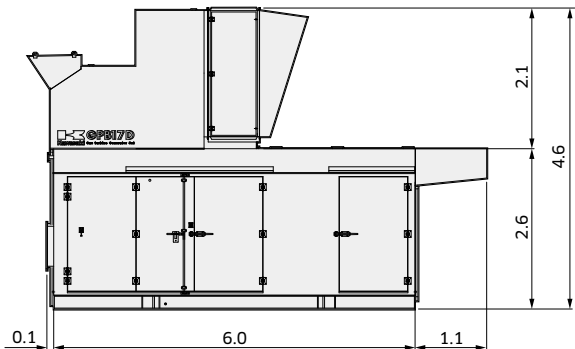
- Painted Carbon Steel (Outer Skin and Structure)
- 2 Stage Filter with Insect Screen
- Pulse Self Cleaning Filter (Option)
- Noise Level : 85 dBA in front of Filter

Exhaust Silencer and Stack (Option)

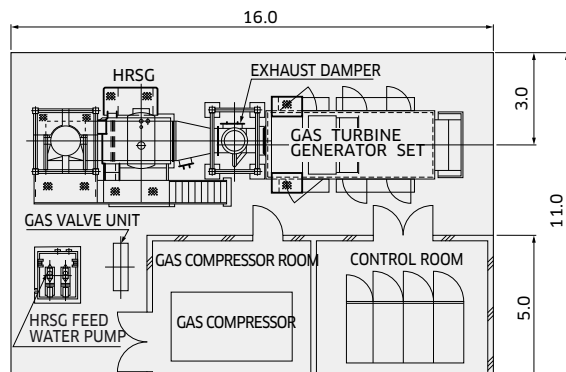
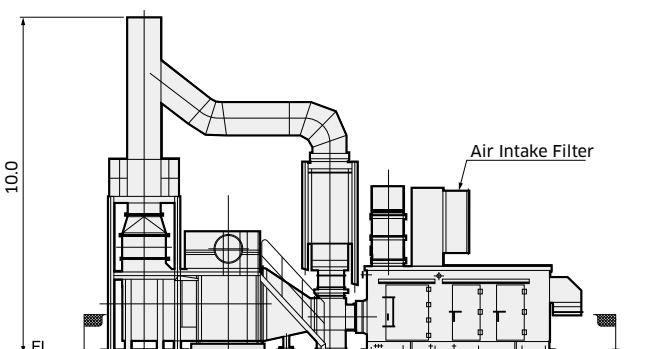
Controls

- Microprocessor Based Programable Logic Controller (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

GPB17 Typical Package Outlook : m (Reference)



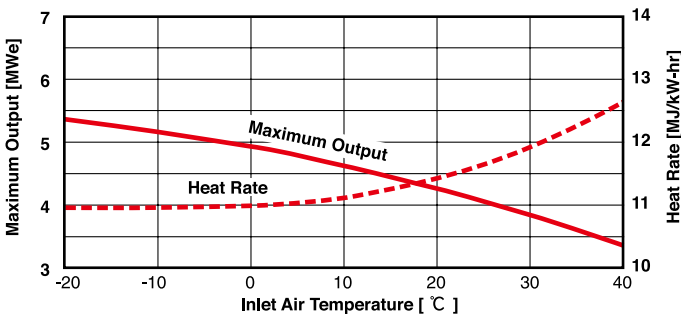
GPB17 Typical Layout : m (Reference)



M5A Series Gas Turbine Generator Specifications

Site Condition for Normal Perfor
Elevation above sea level : 0 m
Inlet Air Temperature : 15 °C
Inlet Air Pressure Loss : 0.98 kPa
Exhaust Gas Pressure Loss : 2.94 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 %



M5A Gas Turbine Series			
Gas Turbine Model	M5A-01D		
Gas Turbine Generator Model	GPB50D		
Partial Load @ AT 15 °C	100	75	50
Electric Output	4,450	3,340	2,225
Heat Rate	11,266	12,502	16,775
Exhaust Gas Temperature	505	533	528
Exhaust Gas Mass Flow	62.1	51.1	51.5
HRSG Steam Output (Typical*1)	9.3	9.1	9.0
Total Thermal Efficiency	77.2	82.0	80.3
Inlet Air Temperature	0	15	40
Maximum Continuous Electric Output	4,930	4,450	3,360
Heat Rate	10,993	11,266	12,648
Exhaust Gas Temperature	495	505	538
Exhaust Gas Mass Flow	66.2	62.1	52.9
HRSG Steam Output (Typical*1)	10.3	9.3	9.3
Total Thermal Efficiency	79.1	77.2	81.9

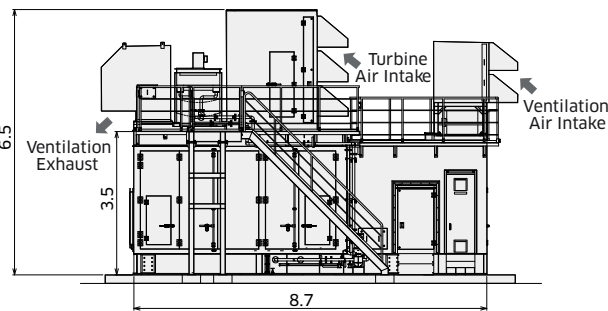
M5A Series Standard Package Configuration

- M5A Gas Turbine**
- Industrial Single-Shaft
 - Rotor Speed : 18,000 rpm
- Compressor**
- 11 Stage Axial Flow
 - IGV & 3 Stage VSV
- Combustor**
- 6 Can Combustors
 - Dual Ignition System
 - Conventional Diffusion
 - Dry Low Emission (DLE)
 - Applicable Fuel : Natural Gas
- Turbine**
- 3 Stage Axial Turbine
- Coupling Shaft & Cover**
- Flexible Coupling with Shear Pin and Cover
- Reduction Gear Box**
- Parallel Shaft

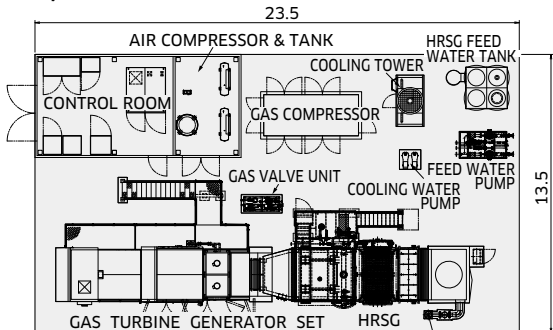
- Starting and Turning System**
- Various Frequency Drive (VFD)
- Lube Oil System**
- Lube Oil : Turbine Oil ISO VG46 (optional VG32)
 - Turbine Driven Main Lube Oil Pump
 - Pre-Post Lube Oil Pump
 - Emergency Lube Oil Pump
 - Air Cooled Oil Cooler with Temp. Control Valve
 - Oil Reservoir integrated with Baseplate : 1,500 liter
 - Carbon Steel Piping
 - 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 Programable Logic Controller (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

■ GPB50D Typical Package Outlook : m (Reference)



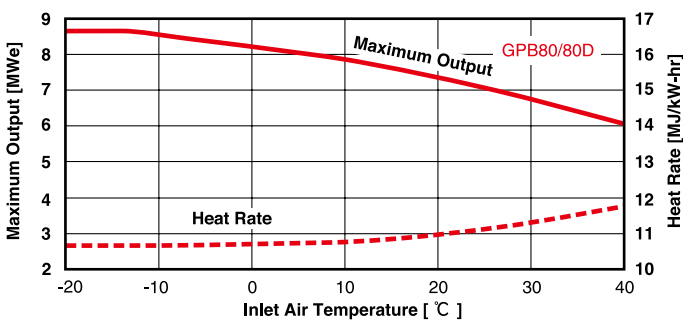
GPB50D Typical Layout : m (Reference)



M7A Series Gas Turbine Generator Specifications

Site Condition for Normal Perfor
Elevation above sea level : 0 m
Inlet Air Temperature : 15 °C
Inlet Air Pressure Loss : 0.98 kPa
Exhaust Gas Pressure Loss : 2.94 kPa (GPB80/80D)
LHV of Natural Gas Fuel (100% CH4) : 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 %



M7A Gas Turbine Series						
Gas Turbine Model	M7A-03			M7A-03D		
Gas Turbine Generator Model	GPB80			GPB80D		
Partial Load @ AT 15 °C	100	75	50	100	75	50
Electric Output	7,660	5,740	3,830	7,660	5,740	3,830
Heat Rate	10,830	11,630	13,580	10,830	11,780	14,230
Exhaust Gas Temperature	525	448	379	525	516	563
Exhaust Gas Mass Flow	97.3	97.0	96.8	97.3	84.3	66.4
HRSG Steam Output (Typical*1)	17.0	13.1	9.7	17.0	14.4	13.1
Total Thermal Efficiency	83.1	78.8	71.9	83.1	82.6	83.8
Inlet Air Temperature	0	15	40	0	15	40
Maximum Continuous Electric Output	8,220	7,660	6,040	8,220	7,660	6,040
Heat Rate	10,690	10,830	11,780	10,690	10,830	11,780
Exhaust Gas Temperature	519	525	554	519	525	554
Exhaust Gas Mass Flow	101.1	97.3	84.0	101.1	97.3	84.0
HRSG Steam Output (Typical*1)	17.2	17.0	16.3	17.2	17.0	16.3
Total Thermal Efficiency	81.5	83.1	86.3	81.5	83.1	86.3

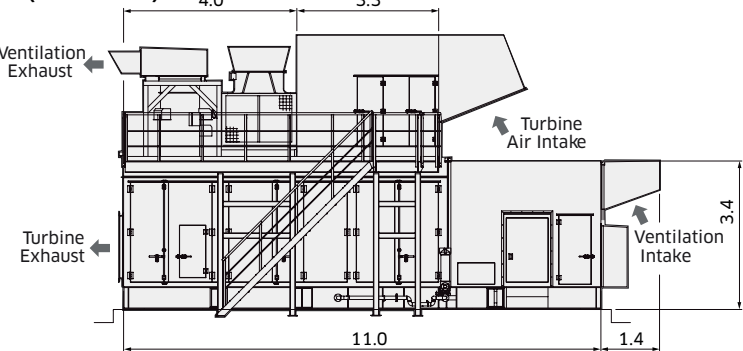
M7A Series Standard Package Configuration

- M7A Gas Turbine**
- Industrial Single-Shaft
 - Rotor Speed : 13,790 rpm (-03/-03D)
- Compressor**
- 11 Stage Axial Flow (-03/-03D)
 - Inlet Guide Vane (IGV) & 3 Stage Various Stater Vane
 - Pressure Ratio : 16 : 1 (-03/-03D)
- Combustor**
- 6 Can Combustors
 - Dual Ignition System
 - Conventional Diffusion (-03) (Option De-NOx : Steam Injection Type)
 - Dry Low Emission (DLE) (-03D)
 - Applicable Fuel : Natural Gas, Diesel (-03/-03D)
- * Notes : Diesel is only for standby use with -03/-03D
- Turbine**
- 4 Stage Axial Turbine
- Coupling Shaft & Cover**
- Flexible Coupling with Shear Pin and Cover

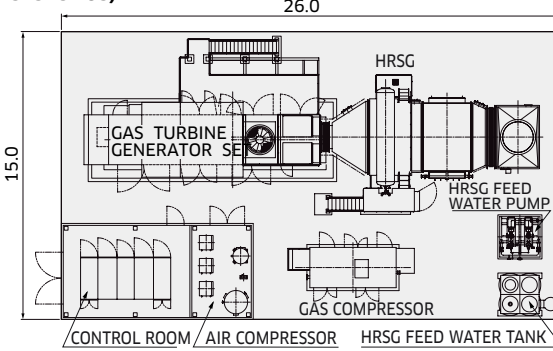
- Reduction Gear Box**
- Epicyclic
 - Output Speed : 1,500 / 1,800 rpm (50/60 Hz)
- Starting and Turning System**
- Various Frequency Drive (VFD)
- Lube Oil System**
- Lube Oil : Turbine Oil ISO VG32 (VG46 : Tropical)
 - Turbine Driven Main Lube Pump
 - Pre-Post Lube Pump
 - Emergency Lube Pump
 - Air Cooled Oil Cooler with Temp. Control Valve
 - Water Cooled (Option)
 - Integral Oil Reservoir : 2,750 liter
 - Oil Heater (Cold Weather Option)
 - Simplex Filter (Duplex Filter : Option)
 - Oil Vapor Fan
- 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, 11.0 kV
 - Power Factor : 90% (Option 85%, 80%)
 - Bearing : Sleeve Type, Oil Bath Lubrication
 - 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
 - Ventilation Fan with Filter and Inlet Screen
 - Maintenance Stage, Ladder, Beam (Option)
- Intake Silencer & Filter**
- 3 Stage Filter with Insect Screen
 - Pulse Type Self Cleaning Filter (Option)
 - Noise Level : 85 dBA in front of Filter
- Exhaust Silencer Stack (Option)**
- Controls**
- Microprocessor Based Programable Logic Controller (PLC) (CPU, Power Module : Option Redundant)
 - Gas Turbine and Generator Control
 - GT start / shutdown Control
 - Speed / kW / Power Factor Control
 - Auto Synchronizing and Load Sharing
 - Touch Panel Operation
 - Serial Link User Interface (Option)
 - Remote Monitoring (Option)
 - Graphics Monitoring
 - Historical Trend & Event Logger
 - Daily and Monthly Reports

■ GPB80 Typical Package Outlook : m (Reference)



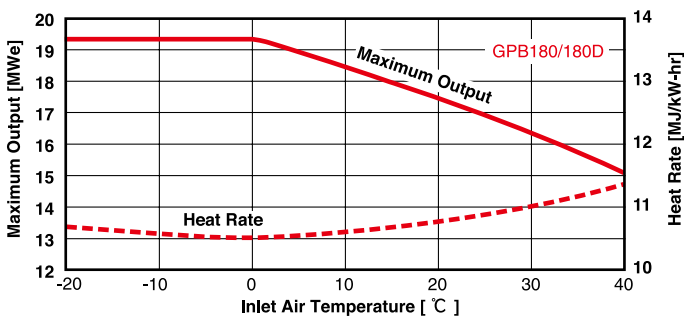
GPB80 Typical Layout : m (Reference)



L20A Series Gas Turbine Generator Specifications

Site Condition for Normal Perfor
Elevation above sea level : 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 : 35.9 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 %



		L20A Gas Turbine Series		
Gas Turbine Model		L20A		
Gas Turbine Generator Model		GPB180 / 180D		
Partial Load @ AT 15 °C	%	100	75	50
Electric Output	kWe	17,970	13,470	8,980
Heat Rate	kJ/kWe-hr	10,690	11,510	13,200
Exhaust Gas Temperature	°C	545	517	443
Exhaust Gas Mass Flow	x10³ kg/hr	213	188	182
HRSG Steam Output (Typical* 1)	x10³ kg/hr	39.7	32.5	24.5
Total Thermal Efficiency	%	84.0	82.4	77.7
Inlet Air Temperature	°C	0	15	40
Maximum Continuous Electric Output	kWe	19,320	17,970	15,080
Heat Rate	kJ/kWe-hr	10,500	10,690	11,380
Exhaust Gas Temperature	°C	538	545	565
Exhaust Gas Mass Flow	x10³ kg/hr	221	213	193
HRSG Steam Output (Typical* 1)	x10³ kg/hr	40.2	39.7	38.8
Total Thermal Efficiency	%	82.5	84.0	86.7

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)
- Dry Low Emission (DLE) (GPB180D)
- Applicable Fuel : Natural Gas, Diesel (Standby Only) Dual Fuel

Turbine
- 3 Stage Axial Turbine

Coupling Shaft & Cover
- Flexible Coupling with Shear Pin and Cover

Reduction Gear Box
- Parallel Shaft

Starting and Turning System
- Various Frequency Drive (VFD)

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

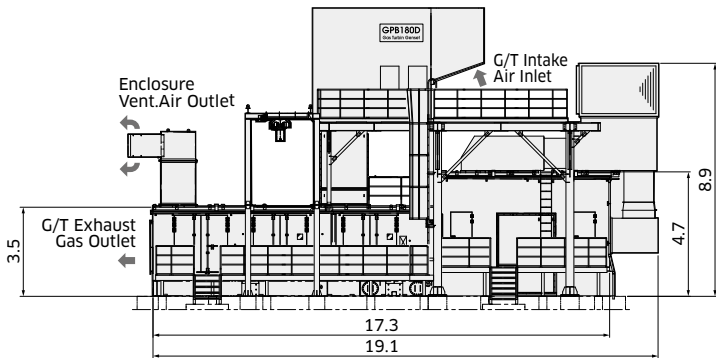
Generator
- Continuous Duty Rating
- 3 Phase, 3 Wire (Option 4 Wire)
- Voltage : 6.6 kV, 11.0 kV
- Power Factor : 90% (Option 85%, 80%)
- IEC Standard, Class F Insulation with F rise
- Exciter : Brushless PMG

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)

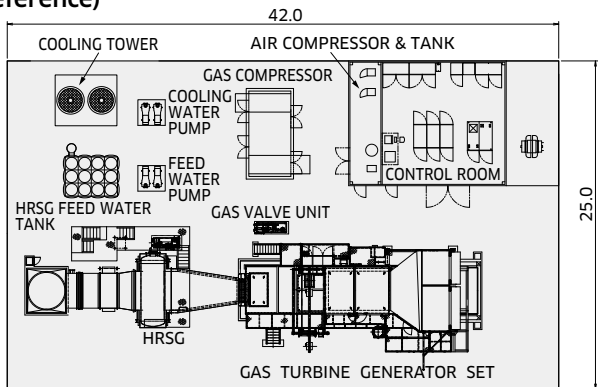
Intake Silencer & Filter
- Painted Carbon Steel (Outer Skin and Structure)
- Stainless Steel Inner Punching Metal Sheet
- 3 Stage Filter with Insect Screen
- Pulse Type Self Cleaning Filter (Option)
- Noise Level : 85 dBA at 1 m to Filter inlet

Exhaust Silencer Stack (Option)
Controls
- Microprocessor Based Programable Logic Controller (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 : m (Reference)



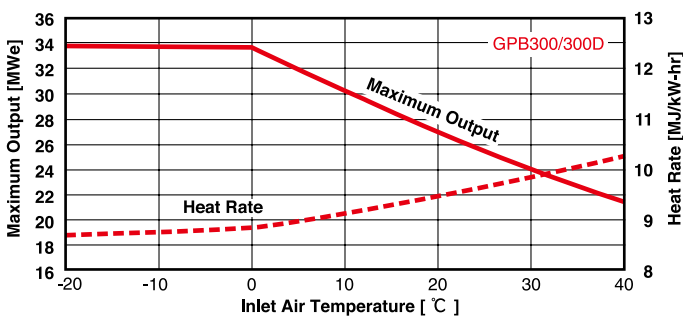
■ GPB180 Typical Layout : m (Reference)



L30A Series Gas Turbine Generator Specifications

Site Condition for Normal Perfor
Elevation above sea level : 0 m
Inlet Air Temperature : 15 °C
Inlet Air Pressure Loss : 0.98 kPa
Exhaust Gas Pressure Loss : 3.43 kPa (GPB300/300D)
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 %



		L30A Gas Turbine Series		
Gas Turbine Model		L30A		
Gas Turbine Generator Model		GPB300 / 300D		
Partial Load @ AT 15 °C	%	100	75	50
Electric Output	kWe	32,360	24,270	16,180
Heat Rate	kJ/kWe-hr	9,196	9,845	11,879
Exhaust Gas Temperature	°C	509	482	491
Exhaust Gas Mass Flow	x10³ kg/hr	324.7	289.6	252.4
HRSG Steam Output (Typical* 1)	x10³ kg/hr	53.8	44.3	40.0
Total Thermal Efficiency	%	83.2	81.8	81.0
Inlet Air Temperature	°C	0	15	40
Maximum Continuous Electric Output	kWe	34,120	32,360	24,660
Heat Rate	kJ/kWe-hr	8,963	9,196	10,117
Exhaust Gas Temperature	°C	475	509	550
Exhaust Gas Mass Flow	x10³ kg/hr	345.3	324.7	272.2
HRSG Steam Output (Typical* 1)	x10³ kg/hr	50.9	53.8	52.0
Total Thermal Efficiency	%	80.8	83.2	86.4

L30A 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)
- Dry Low Emission (DLE) (GPB300D)
- Applicable Fuel : Natural Gas

Turbine
- Gas Generator Turbine : 2 Stage Axial Turbine
- Power Turbine : 3 Stage Axial Turbine

Coupling Shaft & Cover
- Flexible Coupling with Shear Pin and Cover (Reduction Gear and Generator connection)

Reduction Gear Box
- Parallel Shaft

Starting and Turning System
- Various Frequency Drive (VFD)

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

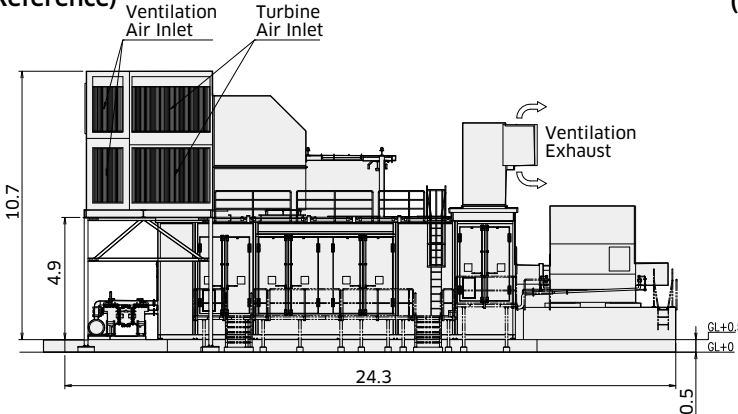
Generator
- Continuous Duty Rating
- 3 Phase, 3 Wire (Option 4 Wire)
- Voltage : 11 kV
- Power Factor : 90% (Option 85%, 80%)
- IEC Standard, Class F Insulation with F rise
- Exciter : Brushless PMG

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)

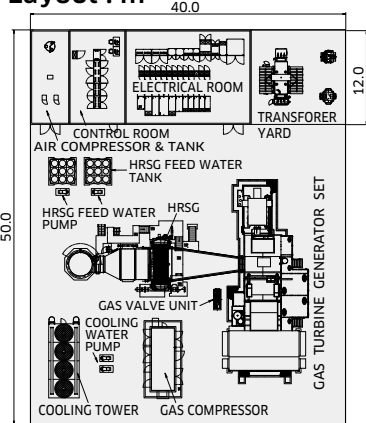
Intake Silencer & Filter
- Painted Carbon Steel (Outer Skin and Structure)
- Stainless Steel Inner Punching Metal Sheet
- 3 Stage Filter with Insect Screen
- Pulse Type Self Cleaning Filter (Option)
- Noise Level : 85 dBA at 1 m to Filter inlet

Exhaust Silencer Stack (Option)
Controls
- Microprocessor Based Programable Logic Controller (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

■ GPB300 Typical Package Outlook : m (Reference)



■ GPB300 Typical Layout : m (Reference)



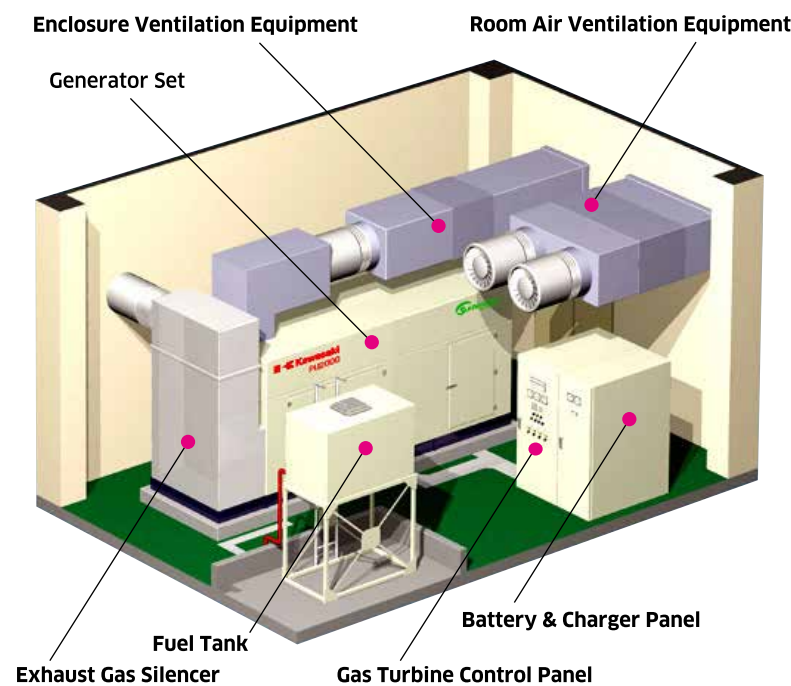
Standby Model Introduction

Excellent Features of Kawasaki Standby Gas Turbine Generators Sets

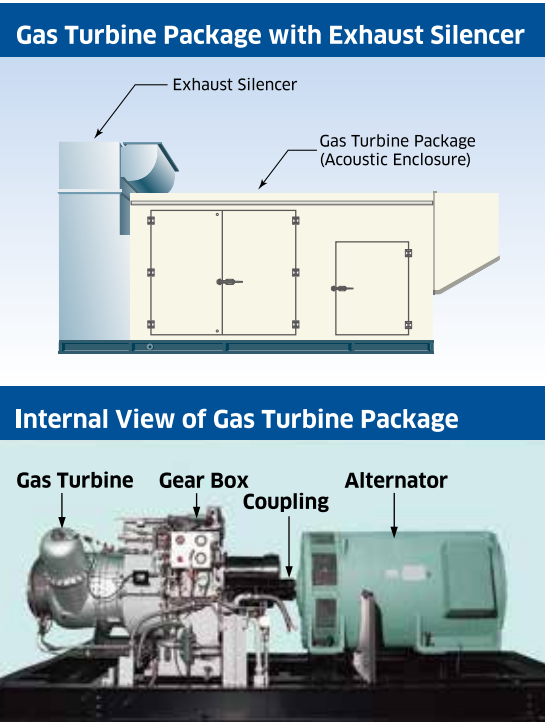
Kawasaki has installed over 7,000 Standby Gas Turbine Generator Sets rated from 200 kVA to 6,000 kVA worldwide. The reliability of Kawasaki Standby Gas Turbine Generator Sets has allowed to install in Internet Data Centers, Hospitals, and Key Facilities where uninterrupted power is certainly required.

- 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

● Example of GPS2000 System Configuration for Indoor Installation



● Typical Standby / Gas Turbine Generator Layout



Standby Model (GPS Series)

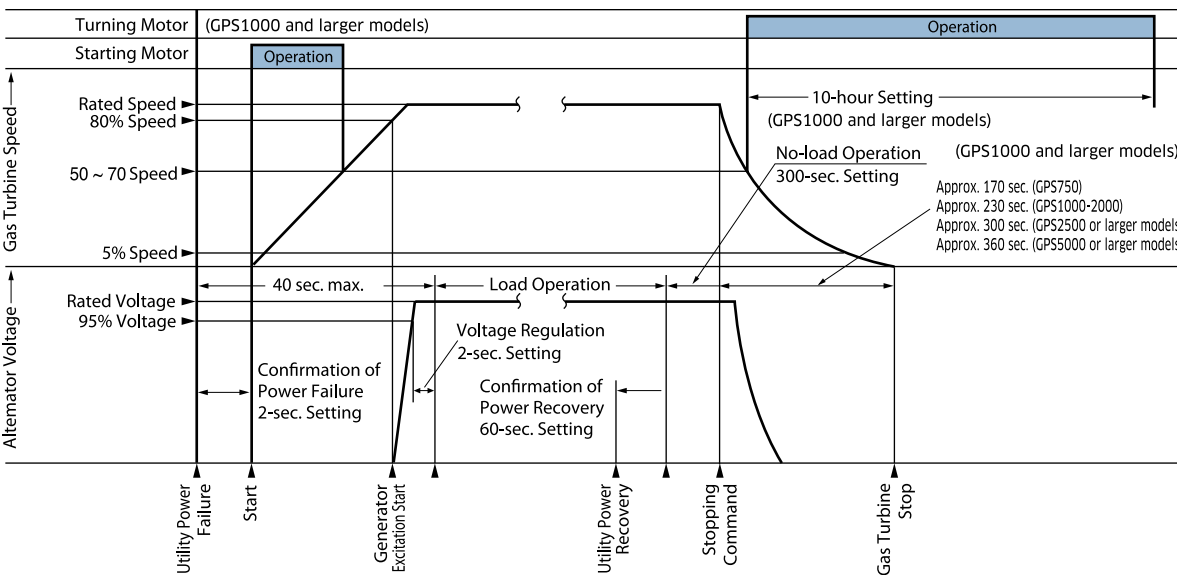
Standby generator sets must start and supply power in the event of the loss of power from the utility. These functions depend greatly on the prime-mover of the standby system. Starting and providing power are often more important than financial conditions such as the initial cost of equipment. Kawasaki 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

Item		GPS750	GPS1250	GPS1500	GPS2000	GPS2500	GPS3000	GPS4000	GPS5000	GPS6000	
Generator Set	* 1 Electric Output (kW)	600	1,000	1,200	1,600	2,000	2,400	3,200	4,000	4,800	
	Starting Time	Within 40-sec.									
	Load Application Capacity	100% (Resistive load)									
	Freq. Deviation	Within ± 4.5 % (with 100% block load on and off)							Within ± 5.0%		
	Steady State	Within ± 0.3%									
	Fuel Type	Kerosene, Diesel		Kerosene, Diesel, Gas (option)							
	* 2 Fuel Consumption (liter / hr)	305	525	620	695	1,065	1,245	1,390	1,835	2,050	
Gas Turbine	Turbine Model	S2A-01	M1A-01	M1A-03	M1A-23	M1T-01S	M1T-03	M1T-23	M1T-33A	M1T-33	
	Type	Heavy-duty, simple open cycle, single-shaft									
	Turbine Speed (rpm)	31,500	22,000						18,000		
	Output Speed (rpm)	1,500 (50 Hz), 1,800 (60 Hz)									
	Dry Weight (ton)	1.48	3.0	3.5	5.7	6.4	13.5				
	Lube Oil Type / Brand	Synthetic oil / Shell ASTO-500, Mobil jet II, Castrol AERO 5000, DP BPTO 2380									
	Lube Oil Tank Capacity (approx.L)	66	100	210	160	240	360				
	Lube Oil Consumption (liter / hr)		0.08		0.16		0.2				
Alternator	Type	3-phase, open screen-protected, brushless, self-ventilated, synchronous									
	Output (kVA)	750	1,250	1,500	2,000	2,500	3,000	4,000	5,000	6,000	
	Voltage Regulation	Within ± 2.5% (steady state from no-load to full-load, at pf = 0.8)									
	Excitation System	Brushless by A.C. exciter and rotating diodes									
* 3 Standard Voltage		6.6kV									
Starting System		Electrical start with D.C. motors (Optional: Pneumatic start with air turbines)									
Type of Batteries		Valve Regulated Lead-Acid (VRLA) Battery									
Generator Set Dimension (Indoor Type)	Length (m)	4.0	4.9	5.4	5.8	6.2	7.7				
	Width (m)	1.6	1.7	1.8	2.5	3.0	3.6				
	Height (m)	2.1	2.5	2.6	2.9	3.6	3.9				
	Weight (ton)	6.8	10.5	11.4	14.7	19.7	20.8	24.6	36.6	39.0	
Noise Level at 1m	From Package	Approx. 85dBA in open air (optional system: 80~70dBA)									
	From Exhaust Silencer Outlet	Approx. 90dBA (optional system: 85~65 dBA at 1 m with a secondary silencer)									

(Note) * 1 : Output : Up to 40°C of ambient temp., 150 m above sea level.
* 2 : Fuel Consumption : At full load, 15°C, using diesel fuel, allowance is 5%.
Diesel Oil : Density 0.83 g/cm³, LHV 42,700 kJ/kg
* 3 : Other voltage is available as option.

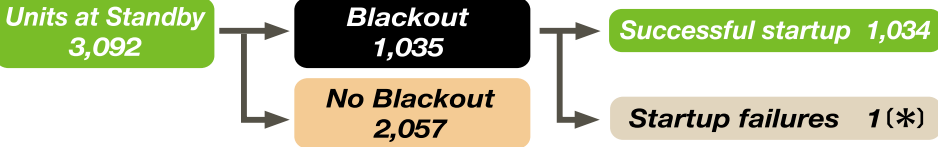
● Typical Timing Chart Of Operation



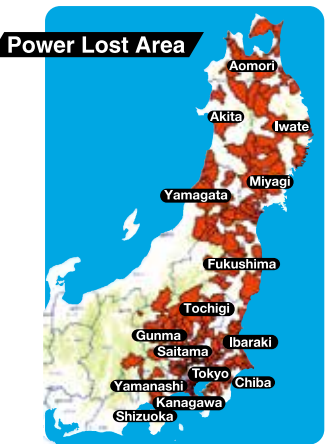
99.9% Start-up Reliability!

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.



(*) Due to improper maintenance by its owner.



Mobile / Trailer Model (MGP / TGP Series)

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

Item		Model		MGP 750	MGP 1000	MGP 1250	MGP 1500	MGP 2000	TGP 2500	TGP 3000	TGP 4000
Generator Sets	* 1 Output (kW) 40°C			600	800	1000	1,200	1,600	2,000	2,400	3,200
	Fuel			Kerosene, Diesel							
	Load Application Allowance			100% (Resistance Load)							
	Freq. Deviation	Transient		Within ± 4.5% (with 100% block load on and off)							
		Steady State		Within ± 0.3%							
	Fuel Consumption (l/h)	Kerosene		320	490	555	655	735	1,125	1,310	1,465
Truck / Trailer		Diesel Oil		305	465	525	620	695	1,065	1,245	1,390
	Type			Truck					Trailer		
	Dimensions	Max. Length (m)		11.0				12.0		9.9 (not including cockpit)	
	Including	Max. Width (m)		2.5							
	Truck	Max. Height (m)		3.4					3.6		
	Total Weight	(ton)		Less than 20 tons	Less than 22 tons				Less than 25 tons	Less than 33 tons	
Noise Level at 1 m		(dBA)		85							

(Note)
* 1 : Output : Up to 40°C of ambient temp., 150 m above sea level.

Installation Example



TGP3000



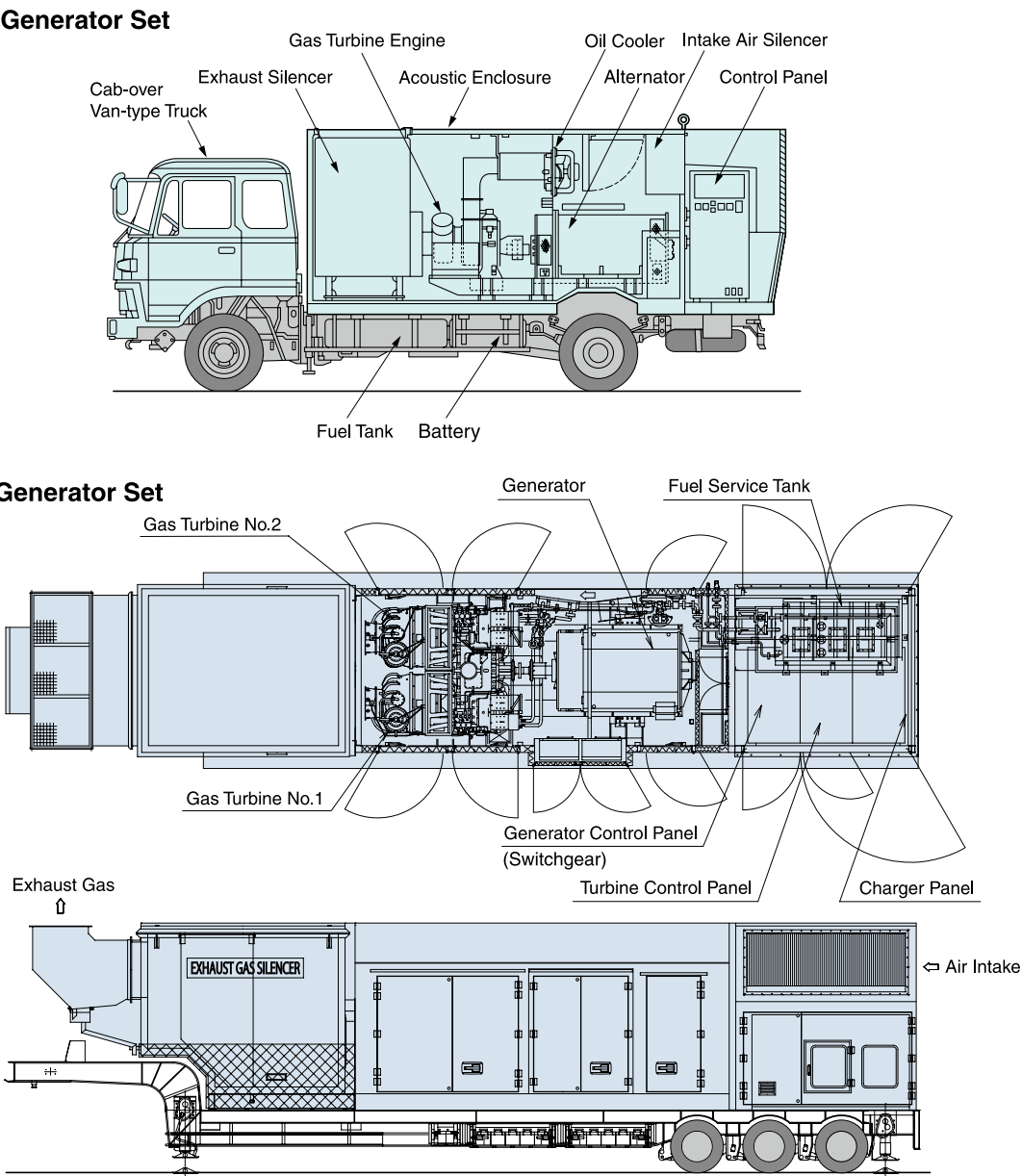
MGP1250



MGP2000



MGP2000



● 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

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 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.



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 !!!**

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

M1 Series



GPB15D USA



GPB30 SOUTH KOREA



GPS4000 USA

M7 Series



GPB80D MALAYSIA



GPB70 JAPAN



GPB60 GERMANY

L20 / L30 Series



GPB180 PORTUGAL



GPB180 x3 IRAN



GPB180 JAPAN



GPB300 JAPAN