

# KAWASAKI GAS TURBINE GENERATOR SETS

## Kawasaki Heavy Industries, Ltd.

[global.kawasaki.com/en/energy/equipment/gas\\_turbines/index.html](http://global.kawasaki.com/en/energy/equipment/gas_turbines/index.html)

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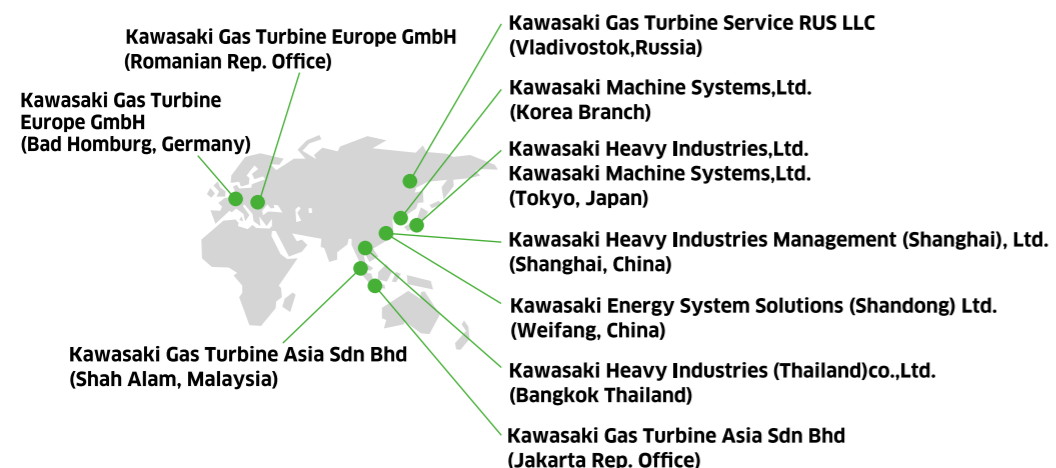
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**Kawasaki Energy System Solutions (Shandong) Ltd.**



### 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.



L30A





L30A Gas Turbine



V2500 Turbofan  
(International Aero Engines AG)



Boeing 787



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.

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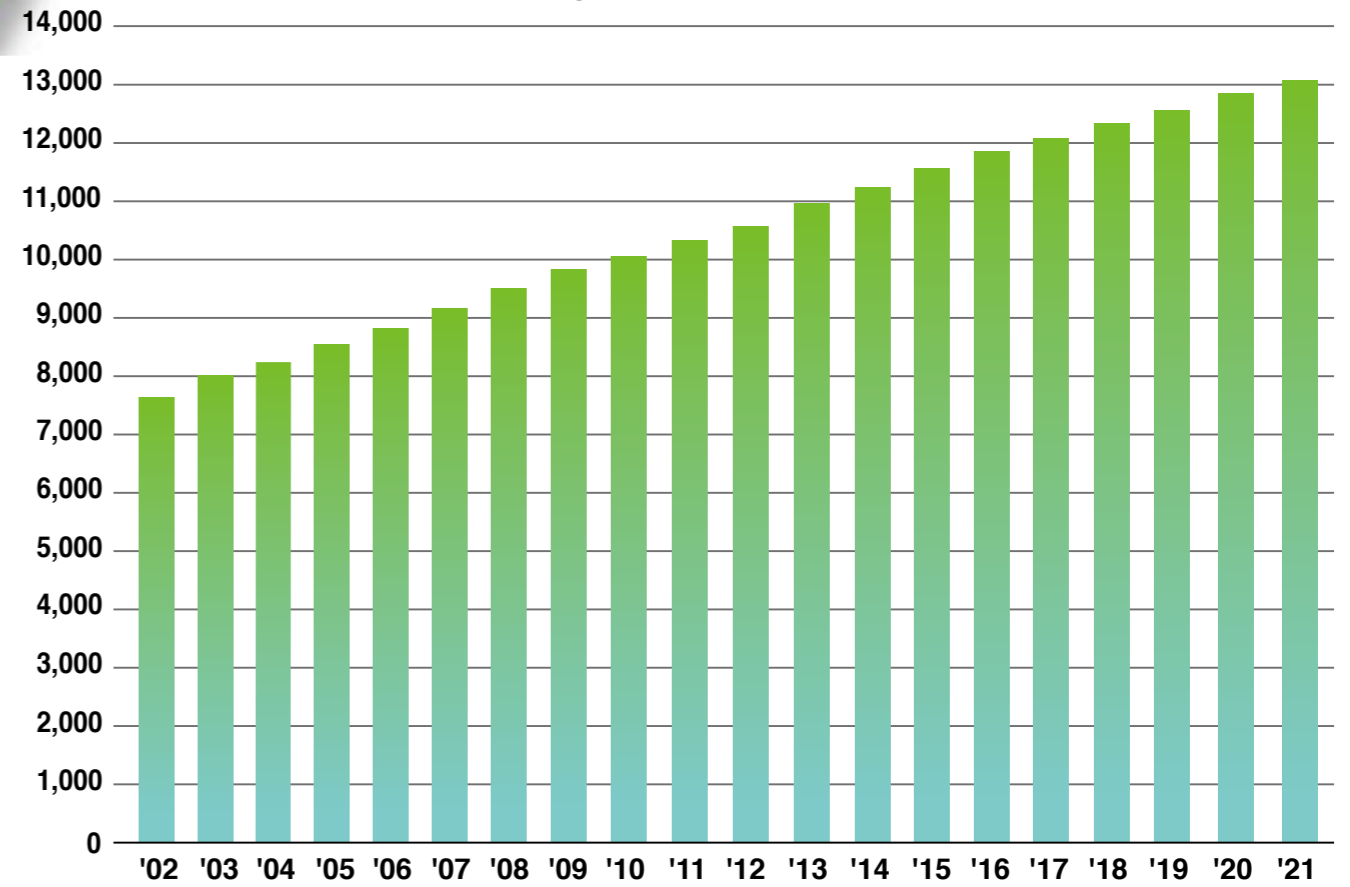
*Kawasaki Gas Turbine places importance on "Efficient Energy Use", "Eco-friendly" and "Reliable Product Care for Total Life Cycle" as a philosophy of our products. To enhance this philosophy, we have introduced a title for our products....."GREEN Gas Turbines".*

## 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 : 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 1.5MW M1A-13 type Gas Turbine introduced
- 1993 5.5MW M7A-01 type Gas Turbine introduced
- 1995 1.5MW M1A-13D Dry Low NOx type Gas Turbine introduced
- 1999 6.5MW M7A-02 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 18MW L20A type Gas Turbine introduced
- 2005 Start-up Akashi Works Energy Center, which comprises 24.7MW Combined Cycle and 7.8MW Flexible Heat and Power Gas Turbine Power Plant
- 2006 7.7MW 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**  
1.7MW class M1A-17 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



**SUSTAINABLE DEVELOPMENT GOALS**  
17 GOALS TO TRANSFORM OUR WORLD

- 7 AFFORDABLE AND CLEAN ENERGY
- 8 DECENT WORK AND ECONOMIC GROWTH
- 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
- 11 SUSTAINABLE CITIES AND COMMUNITIES
- 12 RESPONSIBLE CONSUMPTION AND PRODUCTION
- 13 CLIMATE ACTION
- 17 PARTNERSHIPS FOR THE GOALS

### Kawasaki Group's Approach to SDGs

Kawasaki Green Product Promotion Activity

M5A-01 gas turbine received technical awards of cogen supporting product.

Green Product Certified were issued by public association.

WE SUPPORT UN GLOBAL COMPACT

# Baseload Model

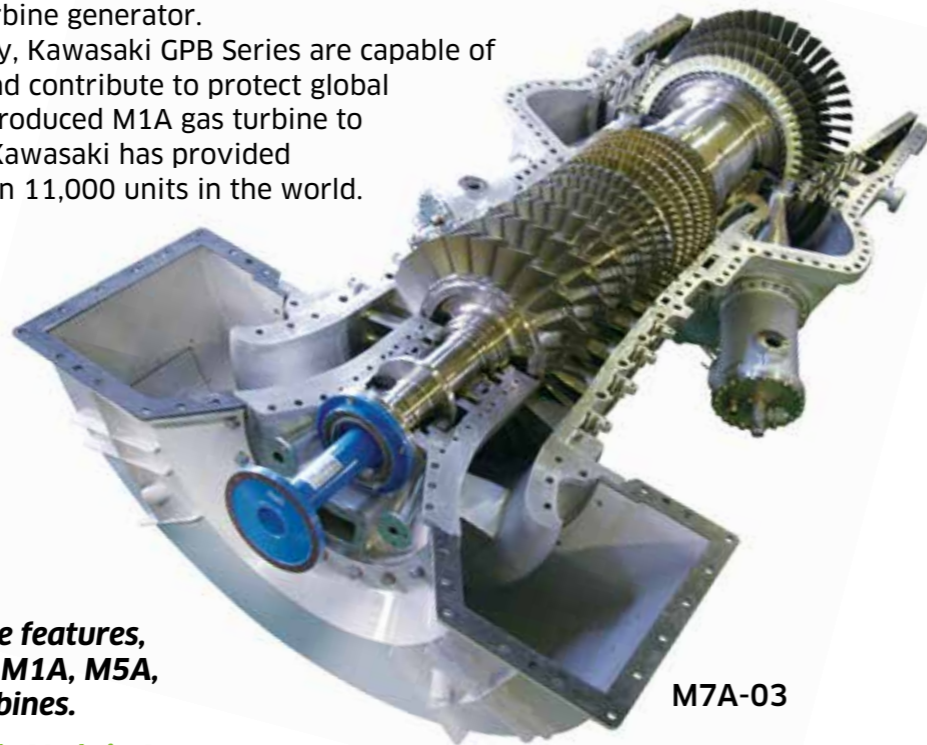
## Basic Specifications

Engine Series	M1A Gas Turbine Series						
	M1A-13A	M1A-13D	M1A-17	M1A-17D	M1T-13A	M1T-13D	
Gas Turbine Model	GPB15	GPB15D	GPB17	GPB17D	GPB30	GPB30D	
Gas Turbine Generator Model							
Maximum Continuous Electric Output	kWe	1,490	1,490	1,810	1,810	2,930	2,930
Heat Rate	kJ/kWe-hr	14,880	15,030	12,830	12,830	15,100	15,240
Thermal Efficiency	%	24.2	24.0	28.1	28.1	23.8	23.6
Exhaust Gas Temperature	°C	521	531	522	522	521	531
Exhaust Gas Mass Flow	x10 <sup>3</sup> kg/hr	29.1	28.8	29.1	29.1	58.2	57.6
NOx (O <sub>2</sub> : 15%)	ppm	-	25	-	9 / 15	-	25
Approximate Package Dimension (L,W,H)	m	5.3 x 1.7 x 2.4		6.0 x 1.9 x 2.6		6.0 x 2.4 x 2.4	
Approximate Package Weight (dry)	x10 <sup>3</sup> kg	14		14		21	

Note: Mark "D" after Gas Turbine Model stands for Dry Low Emission  
**Condition : ISO Rating** 1. Inlet Air Temperature : 15°C 2. Atmospheric Pressure : 101.3 kPa 3. Inlet /Exhaust Pressure Losses : No Duct Loss  
 4. Fuel Type : Natural Gas (100% CH<sub>4</sub>) 5. LHV of Fuel : 35.9 MJ/Nm<sup>3</sup>

The Kawasaki GPB Series are designed for baseload application, in both parallel operation with grid and island mode operation. In addition, Kawasaki GPB Series are able to be operated 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 system generator(HRSG), heat exchanger, or dryer, and in Combined Cycle with a steam turbine generator.

With high total thermal efficiency, Kawasaki GPB Series are capable of saving customer's energy cost and contribute to protect global environment. After Kawasaki introduced M1A gas turbine to co-generation market in 1984, Kawasaki has provided high reliable machines, more than 11,000 units in the world.



M7A-03

**Below is Kawasaki gas turbine features, and is furnished in all units of M1A, M5A, M7A, L20A, and L30A gas turbines.**

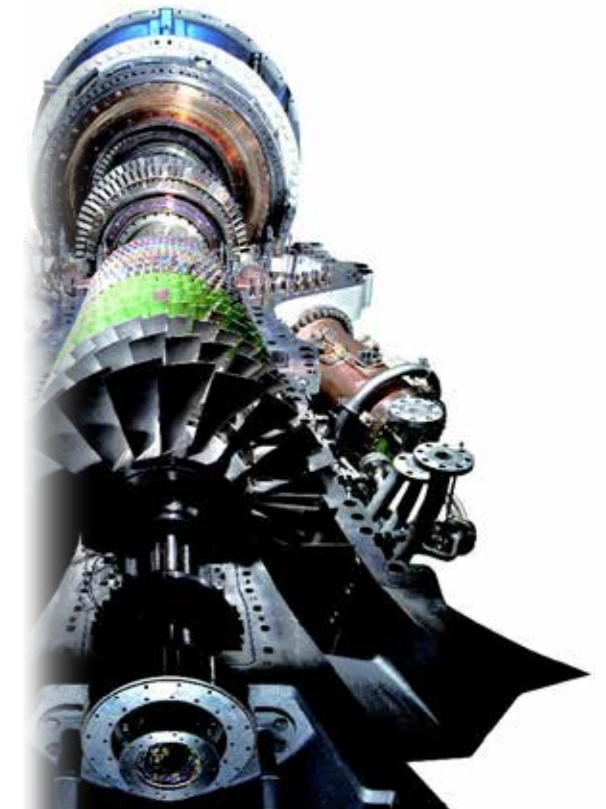
- 1. Self-developed Gas Turbine Fully Made in Japan**  
Very high quality and reliable various lineup with worldwide installation record.
- 2. World Highest-Class Efficiency**  
Kawasaki is proud of the highest efficiency achieved by its own technology.
- 3. Eco-Friendly**  
Kawasaki has developed the lowest NOx emission DLE (Dry Low Emission) combustor. With high total thermal efficiency, Kawasaki gas turbine reduces environmental burden.
- 4. Fuel Flexibility**  
Besides natural gas, other fuels such as LNG, off-gas, Kerosene, and diesel oil can be selected as fuel.
- 5. Reliable After-Service**  
Reliable after service system is available, which satisfies customer's requirement with on-site engine exchange program and parts supply system supported by well-experienced service persons. Removable combustor and inspection holes on gas turbine makes on-site inspection easier.

M5A Gas Turbine Series	M7A Gas Turbine Series		L20A Gas Turbine Series	L30A Gas Turbine Series
M5A-01D	M7A-03	M7A-03D	L20A-01D	L30A-01D
GPB50D	GPB80	GPB80D	GPB180D	GPB300D
4,960	7,800	7,800	18,420	34,380
10,910	10,730	10,730	10,530	8,870
33.0	33.6	33.6	34.2	40.6
523	523	523	542	517
63.2	97.9	97.9	215.3	322.6
15	-	9.9 / 15	15	15
8.7 x 2.4 x 3.5	11 x 2.6 x 3.7		17.4 x 3.5 x 3.4	14.2 x 4.5 x 5.3
41	58		143	155

Kawasaki introduced **Single Digit NOx** DLE combustor with M7A-03 gas turbine to the market in 2011. In many countries and regions, air quality requirement are getting so strict. This super low NOx technology matches such market trend.

In 2012, Kawasaki introduced the largest size gas turbine, L30A, as a flagship model of its industrial gas turbine fleet. Based on Kawasaki state-of-the-art technology, L30A offers **the highest efficiency** of 30MW class gas turbines in the world. In addition, Kawasaki applied modular system design which significantly reduces plant down-time and engine overhaul. L30A is able to provide a highly flexible solution for power generation and mechanical drive application.

M5A-01 gas turbine was developed with the latest and proven technologies of Kawasaki gas turbines, and achieved **highest efficiency** as well as least maintenance needs of its class. GPB50D utilizing M5A-01D gas turbine provides the optimal solution for power generation and co-generation. Its compact package design is also perfect for renewal of existing facilities.



L30A-01



M5A-01

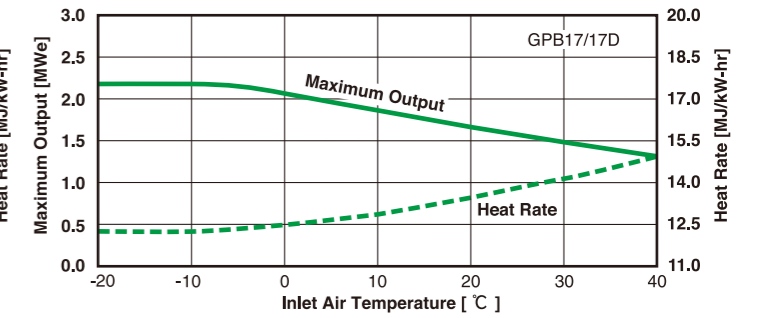
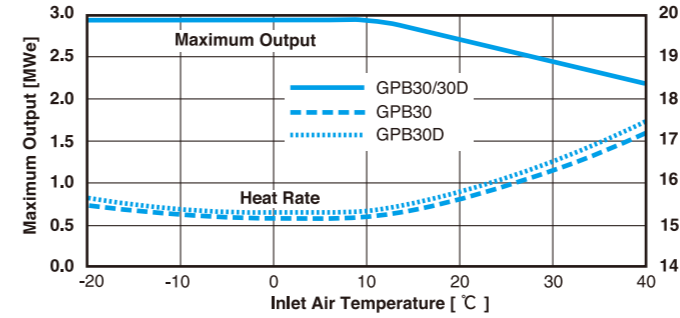
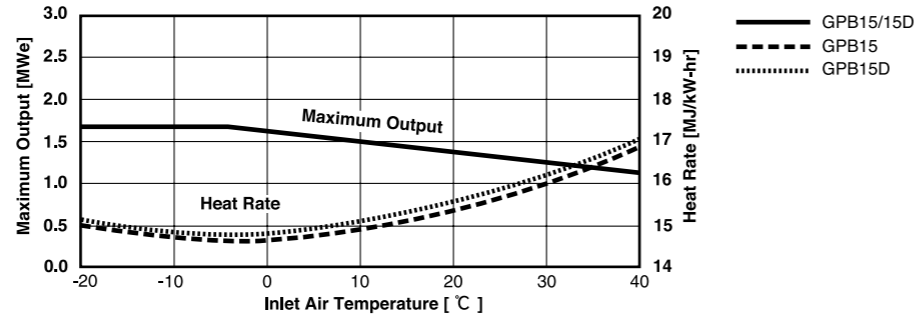
# M1A Series Gas Turbine Generator Specifications

## Site Condition for Normal Performance

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/Nm<sup>3</sup> (100% CH<sub>4</sub>)

## 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 [x10 <sup>3</sup> 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) [x10 <sup>3</sup> 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 [x10 <sup>3</sup> 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) [x10 <sup>3</sup> 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

Gas Turbine Model	M1A Gas Turbine Series		
	M1A-17/17D		
Gas Turbine Generator Model	GPB17/17D		
Partial Load @ AT 15 °C	100	75	50
Electric Output [kWe]	1,755	1,315	875
Heat Rate [kJ/kWe-hr]	13,120	14,370	17,320
Exhaust Gas Temperature [°C]	526	443	377
Exhaust Gas Mass Flow [x10 <sup>3</sup> kg/hr]	28.8	29.4	29.9
HRSG Steam Output (Typical*1) [x10 <sup>3</sup> kg/hr]	5.0	3.9	2.9
Total Thermal Efficiency [%]	80.4	75.4	67.5
Inlet Air Temperature [°C]	0	15	40
Maximum Continuous Electric Output [kWe]	2,050	1,755	1,305
Heat Rate [kJ/kWe-hr]	12,460	13,120	14,930
Exhaust Gas Temperature [°C]	511	526	560
Exhaust Gas Mass Flow [x10 <sup>3</sup> kg/hr]	31.5	28.8	24.4
HRSG Steam Output (Typical*1) [x10 <sup>3</sup> kg/hr]	5.2	5.0	4.7
Total Thermal Efficiency [%]	78.6	80.4	83.0

## M1A/T-13 Series Standard Package Configuration

### M1A-13A Gas Turbine

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

### M1T-13A Gas Turbine

- Twin M1A GT with Combined Gear Box

### Compressor

- 2 Stage Centrifugal
- Pressure Ratio 9.4:1 (-13A), 9.6:1 (-13D)
- Inlet Guide Vane (IGV) (-13D Option)

### Combustor

- Single Can Combustor
- Single Ignition
- Conventional Diffusion (-13A)
- Water/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

- Variable Frequency Drive (VFD)(M1A)
- Air Starter, DC Motor(M1T)/(M1A Option)
- Turning Motor

### Lube Oil System

- Lube Oil : Synthetic Ester Oil
- Gearbox Driven Main Lube Pump
- DC Motor Driven Pre-Post Lube Pump
- Air Cooled Oil Cooler with Temp. Control Valve
- Water Cooled Oil Cooler(Optional)
- Integral Oil Reservoir : 210 liter (M1A-13A) : 160 liter (M1T-13A)
- Simplex Filter (Option: Duplex Type)
- Oil Mist Separator

### Generator

- Continuous Duty Rating
- Air Cooled Open Drip-Proof Construction
- 3 Phase, 3 Wire (Option : 4 Wire)
- Standard Voltage : 3.3 kV, 6.6 kV
- Power Factor : 90% (Option : 85%, 80%)Lag
- Bearing : Ball (Roller) Bearing
- Lubrication : Grease Pack
- Exciter : Brushless

### 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

### Intake Silencer & Filter

- Painted Carbon Steel (Outer Skin and Structure)
- Stainless Steel Inner Punching Metal Sheet
- 2 Stage Filter
- Pulse Type Self Cleaning Filter (Option)
- Noise Level : 85 dBA at 1m from Filter inlet

### Controls

- Programmable Logic Controller (PLC) (CPU, Power Module : Redundant)
- Gas Turbine and Generator Control
- GT start / shutdown Control
- Speed / kW / Power Factor Control
- Auto Synchronizing and Load Sharing
- Touch Panel Operation
- Ethernet or Serial Communication to DCS/SCADA
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger
- Daily and Monthly Reports

## M1A-17 Series Standard Package Configuration

### M1A-17 Gas Turbine

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

### Compressor

- 2 Stage Centrifugal
- Pressure Ratio 10.5:1 (-17,-17D)
- Inlet Guide Vane (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

- Variable Frequency Drive (VFD)
- (Option : Air Starter, DC Motor)
- Turning Motor

### Lube Oil System

- Lube Oil : Synthetic Ester Oil
- Gearbox Driven Main Lube Pump
- DC Motor Driven Pre-Post Lube Pump
- Air Cooled Oil Cooler with Temp. Control Valve
- Water Cooled Oil Cooler(Optional)
- Integral Oil Reservoir : 240 liter
- Simplex Filter (Option : Duplex Type)
- Oil Mist Separator

### Generator

- Continuous Duty Rating
- Air Cooled Open Drip-Proof Construction
- 3 Phase, 3 Wire (Option 4 Wire)
- Standard Voltage : 3.3 kV, 6.6 kV
- Power Factor : 90% (Option : 85%, 80%)Lag
- Bearing : Ball (Roller) Bearing
- Lubrication : Grease Pack
- Exciter : Brushless

### 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

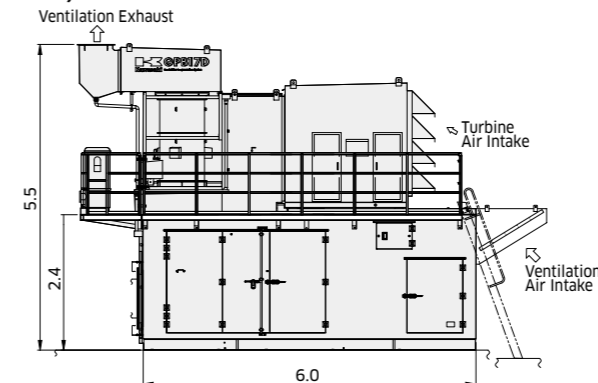
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- Painted Carbon Steel (Outer Skin and Structure)
- Stainless Steel Inner Punching Metal Sheet
- 2 Stage Filter
- Pulse Type Self Cleaning Filter (Option)
- Noise Level : 85 dBA at 1m from Filter inlet

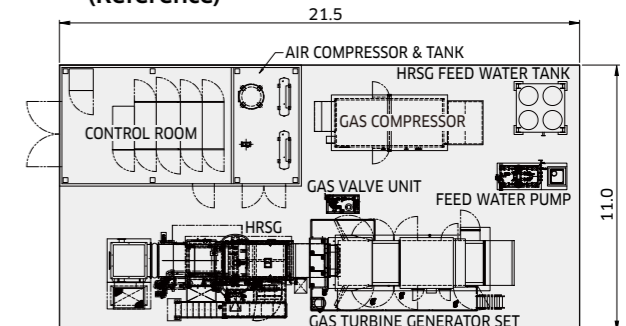
### Controls

- Programmable Logic Controller (PLC) (CPU, Power Module : Redundant)
- Gas Turbine and Generator Control
- GT start / shutdown Control
- Speed / kW / Power Factor Control
- Auto Synchronizing and Load Sharing
- Touch Panel Operation
- Ethernet or Serial Communication to DCS/SCADA
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger
- Daily and Monthly Reports

## GPB17/17D Typical Package Outlook : m (Reference)



## GPB17/17D Typical Layout : m (Reference)



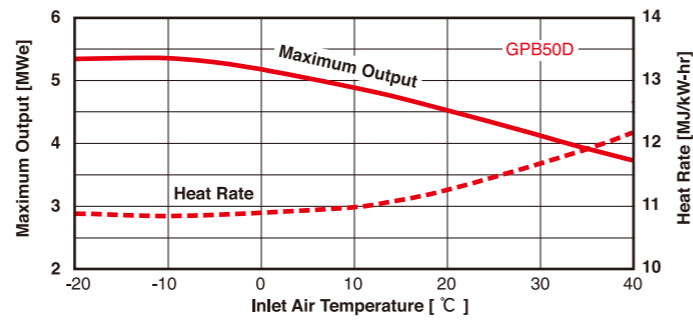
# M5A Series Gas Turbine Generator Specifications

## Site Condition for Normal Performance

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/Nm<sup>3</sup>  
 (100% CH<sub>4</sub>)

## 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 [kWe]	4,715	3,535	2,355
Heat Rate [kJ/kWe-hr]	11,100	12,120	16,080
Exhaust Gas Temperature [°C]	516	523	526
Exhaust Gas Mass Flow [x10 <sup>3</sup> kg/hr]	62.6	52.6	51.5
HRSG Steam Output (Typical*1) [x10 <sup>3</sup> kg/hr]	10.6	9.2	9.1
Total Thermal Efficiency [%]	81.8	82.1	81.0
Inlet Air Temperature [°C]	0	15	40
Maximum Continuous Electric Output [kWe]	5,165	4,715	3,720
Heat Rate [kJ/kWe-hr]	10,890	11,100	12,180
Exhaust Gas Temperature [°C]	506	516	544
Exhaust Gas Mass Flow [x10 <sup>3</sup> kg/hr]	66.5	62.6	54.8
HRSG Steam Output (Typical*1) [x10 <sup>3</sup> kg/hr]	10.8	10.6	10.3
Total Thermal Efficiency [%]	79.9	81.8	85.0

## M5A Series Standard Package Configuration

- M5A-01 Gas Turbine**
  - Industrial Single-Shaft
  - Rotor Speed : 18,000 rpm
- Compressor**
  - 11 Stage Axial Flow
  - Pressure Ratio 15.5:1
  - Inlet Guide Vane (IGV) & 3 Stage Variable Stator Vane (VSV)
- Combustor**
  - 6 Can Combustors
  - Dual Ignition System
  - 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**
  - Epicyclic
  - Output Speed : 1,500/1,800rpm (50/60Hz)

## Starting and Turning System

- Variable Frequency Drive (VFD)

## Lube Oil System

- Lube Oil : Turbine Oil ISO VG32/46
- Turbine Driven Main Lube Oil Pump
- AC Motor Driven Pre-Post Lube Pump
- DC Motor Driven Emergency Post Lube Pump
- Air/Water Cooled Oil Cooler with Temp. Control Valve
- Integral Oil Reservoir : 1,500 liter
- Oil Heater (Option : Cold Weather)
- Simplex Filter (Option : Duplex Filter)
- Oil Vapor Fan

## Generator

- Continuous Duty Rating
- 3 Phase, 3 Wire (Option : 4 Wire)
- Standard Voltage : 6.6 kV, 11.0 kV
- Power Factor : 90% (Option : 85%,80%) Lag
- Bearing : Sleeve Bearing
- Lubrication : Forced Oil Lubrication
- Exciter : Brushless

## 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 and Inlet Screen
- Maintenance Stage, Ladder, Beam

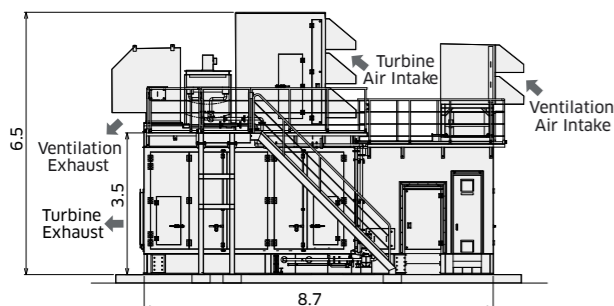
## Intake Silencer & Filter

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

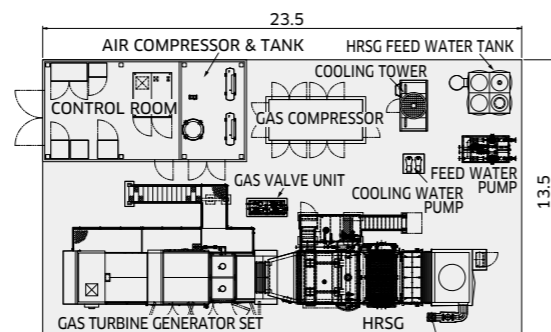
## Controls

- Programmable Logic Controller (PLC) (CPU, Power Module : Redundant)
- Gas Turbine and Generator Control
- GT start / Shutdown Control
- Speed / kW / Power Factor Control
- Auto Synchronizing and Load Sharing
- Touch Panel Operation
- Ethernet or Serial Communication to DCS/SCADA
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger
- Daily and Monthly Reports

■ GPB50D Typical Package Outlook : m (Reference)



■ GPB50D Typical Layout : m (Reference)



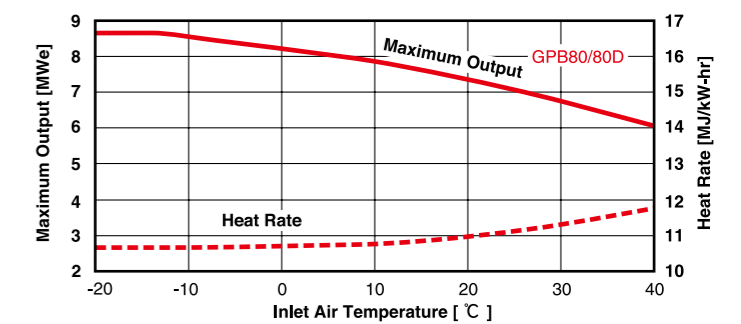
# M7A Series Gas Turbine Generator Specifications

## Site Condition for Normal Performance

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/Nm<sup>3</sup>  
 (100% CH<sub>4</sub>)

## 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 [kWe]	7,660	5,740	3,830	7,660	5,740	3,830
Heat Rate [kJ/kWe-hr]	10,830	11,630	13,580	10,830	11,780	14,230
Exhaust Gas Temperature [°C]	525	448	379	525	516	563
Exhaust Gas Mass Flow [x10 <sup>3</sup> kg/hr]	97.3	97.0	96.8	97.3	84.3	66.4
HRSG Steam Output (Typical*1) [x10 <sup>3</sup> kg/hr]	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 [°C]	0	15	40	0	15	40
Maximum Continuous Electric Output [kWe]	8,220	7,660	6,040	8,220	7,660	6,040
Heat Rate [kJ/kWe-hr]	10,690	10,830	11,780	10,690	10,830	11,780
Exhaust Gas Temperature [°C]	519	525	554	519	525	554
Exhaust Gas Mass Flow [x10 <sup>3</sup> kg/hr]	101.1	97.3	84.0	101.1	97.3	84.0
HRSG Steam Output (Typical*1) [x10 <sup>3</sup> kg/hr]	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-03 Gas Turbine**
  - Industrial Single-Shaft
  - Rotor Speed : 13,790 rpm
- Compressor**
  - 11 Stage Axial Flow
  - Inlet Guide Vane (IGV) & 3 Stage Variable Stator Vane (VSV)
  - Pressure Ratio 16:1
- 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
  - \* Notes : Diesel is only for standby use
- 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

- Variable Frequency Drive (VFD)

## Lube Oil System

- Lube Oil : Turbine Oil ISO VG32/46
- Turbine Driven Main Lube Oil Pump
- AC Motor Driven Pre-Post Lube Pump
- DC Motor Driven Emergency Post Lube Pump
- Air/Water Cooled Oil Cooler with Temp. Control Valve
- Integral Oil Reservoir : 2,750 liter
- Oil Heater (Option : Cold Weather)
- Simplex Filter (Option : Duplex Filter)
- Oil Vapor Fan

## Generator

- Continuous Duty Rating
- 3 Phase, 3 Wire (Option : 4 Wire)
- Standard Voltage : 6.6 kV, 11.0 kV
- Power Factor : 80% Lag
- Bearing : Sleeve Bearing
- Lubrication : Forced Oil Lubrication
- Exciter : Brushless

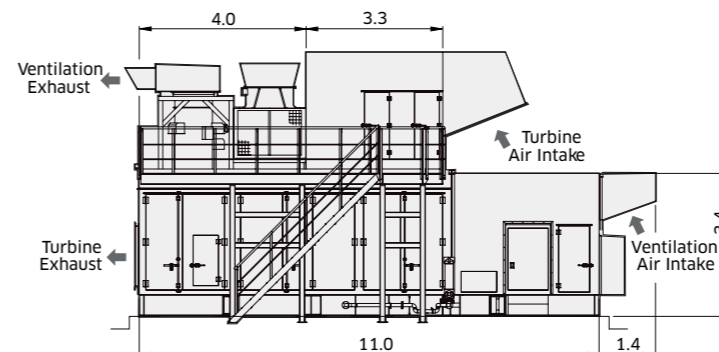
## Enclosed Package

- 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 and Inlet Screen
- Maintenance Stage, Ladder, Beam
- Intake Silencer & Filter**
  - Painted Carbon Steel (Outer Skin and Structure)
  - Stainless Steel Inner Punching Metal Sheet
  - 3 Stage Filter
  - Pulse Type Self Cleaning Filter (Option)
  - Noise Level : 85 dBA at 1m from Filter Inlet

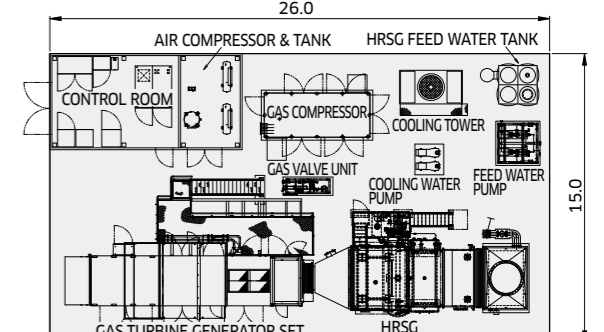
## Controls

- Programmable Logic Controller (PLC) (CPU, Power Module Redundant)
- Gas Turbine and Generator Control
- GT start / shutdown Control
- Speed / kW / Power Factor Control
- Auto Synchronizing and Load Sharing
- Touch Panel Operation
- Ethernet or Serial Communication to DCS/SCADA
- Remote Monitoring (Option)
- Graphics Monitoring
- Historical Trend & Event Logger
- Daily and Monthly Reports

■ GPB80/80D Typical Package Outlook : m (Reference)



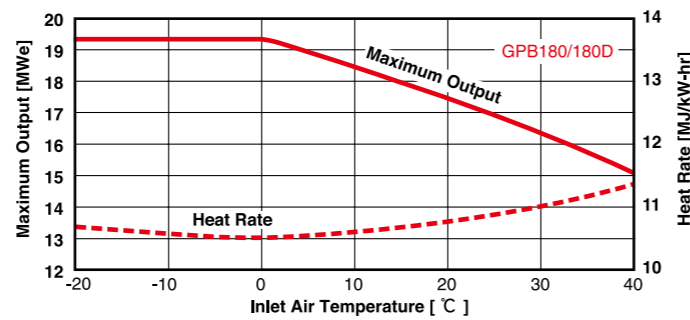
■ GPB80/80D Typical Layout : m (Reference)



# L20A Series Gas Turbine Generator Specifications

**Site Condition for Normal Performance**  
 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  
 LHV of Natural Gas Fuel : 35.9 MJ/Nm<sup>3</sup> (100% CH<sub>4</sub>)

**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			
L20A-01/01D			
GPB180 / 180D			
Partial Load @ AT 15 °C	%	100	75
Electric Output	kWe	17,970	13,470
Heat Rate	kJ/kWe-hr	10,690	11,510
Exhaust Gas Temperature	°C	545	517
Exhaust Gas Mass Flow	x10 <sup>3</sup> kg/hr	213	188
HRSG Steam Output (Typical*1)	x10 <sup>3</sup> kg/hr	39.7	32.5
Total Thermal Efficiency	%	84.0	82.4
Inlet Air Temperature	°C	0	15
Maximum Continuous Electric Output	kWe	19,320	17,970
Heat Rate	kJ/kWe-hr	10,500	10,690
Exhaust Gas Temperature	°C	538	545
Exhaust Gas Mass Flow	x10 <sup>3</sup> kg/hr	221	213
HRSG Steam Output (Typical*1)	x10 <sup>3</sup> kg/hr	40.2	39.7
Total Thermal Efficiency	%	82.5	84.0

## L20A Series Standard Package Configuration

**L20A-01 Gas Turbine**  
 - Industrial Single-Shaft  
 - Rotor Speed : 9,420 rpm

**Compressor**  
 - 11 Stage Axial Flow  
 - Pressure Ratio 18.6:1  
 - Inlet Guide Vane (IGV) & 4 Stage Variable Stator Vane (VSV)

**Combustor**  
 - 8 Can Combustors  
 - Dual Ignition System  
 - Dry Low Emission (DLE) (-01D)  
 - Applicable Fuel : Natural Gas, Diesel  
 \*Notes : Diesel is only for standby use

**Turbine**  
 - 3 Stage Axial Turbine

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

**Reduction Gear Box**  
 - Parallel  
 - Output Speed : 3,000/3,600rpm (50/60Hz)

**Starting and Turning System**  
 - Variable Frequency Drive (VFD)

**Lube Oil System**  
 - Lube Oil : Turbine Oil ISO VG32  
 - Turbine Driven Main Lube Oil Pump  
 - AC Motor Driven Pre-Post Lube Pump  
 - DC Motor Driven Emergency Post Lube Pump  
 - Water Cooled Oil Cooler with Temp. Control Valve  
 - Integral Oil Reservoir : 5,900 liter  
 - Oil Heater  
 - Duplex Filter  
 - Oil Vapor Fan

**Generator**  
 - Continuous Duty Rating  
 - Water Cooled  
 - 3 Phase, 3 Wire (Option : 4 Wire)  
 - Standard Voltage : 6.6 kV, 11.0 kV  
 - Power Factor : 85%Lag  
 - Bearing : Sleeve Bearing  
 - Lubrication : Forced Oil Lubrication  
 - Exciter : Brushless

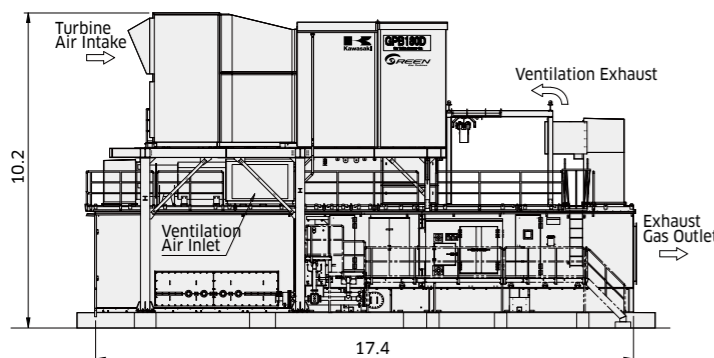
**Enclosed Package**  
 - Carbon Steel Common Base Frame  
 - Painted Carbon Steel Acoustic Enclosure  
 - Noise Level : 85 dBA at 1 m to the side of Enclosure

- Forced Ventilation Fan with Filter and Inlet Screen  
 - Maintenance Stage, Ladder, Beam

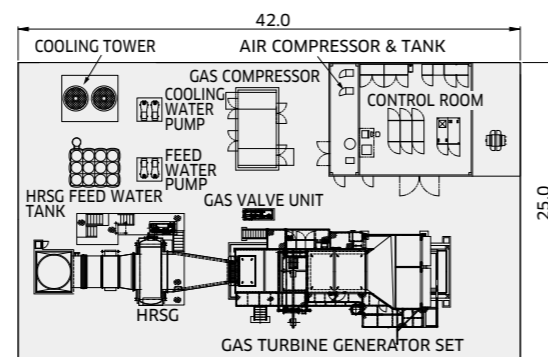
**Intake Silencer & Filter**  
 - Painted Carbon Steel (Outer Skin and Structure)  
 - Stainless Steel Inner Punching Metal Sheet  
 - 3 Stage Filter  
 - Pulse Type Self Cleaning Filter (Option)  
 - Noise Level : 85 dBA at 1 m from Filter inlet

**Controls**  
 - Programmable Logic Controller (PLC) (CPU, Power Module : Redundant)  
 - Gas Turbine and Generator Control  
 - GT start / Shutdown Control  
 - Speed / kW / Power Factor Control  
 - Auto Synchronizing and Load Sharing  
 - Touch Panel Operation  
 - Ethernet or Serial Communication to DCS/SCADA  
 - Remote Monitoring (Option)  
 - Graphics Monitoring  
 - Historical Trend & Event Logger  
 - Daily and Monthly Reports

■ GPB180/180D Typical Package Outlook : m (Reference)



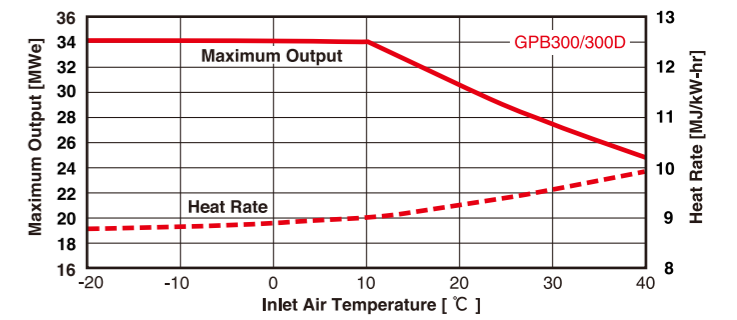
■ GPB180/180D Typical Layout : m (Reference)



# L30A Series Gas Turbine Generator Specifications

**Site Condition for Normal Performance**  
 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  
 LHV of Natural Gas Fuel : 35.9 MJ/Nm<sup>3</sup> (100% CH<sub>4</sub>)

**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			
L30A-01/01D			
GPB300 / 300D			
Partial Load @ AT 15 °C	%	100	75
Electric Output	kWe	32,360	24,270
Heat Rate	kJ/kWe-hr	9,110	9,660
Exhaust Gas Temperature	°C	519	481
Exhaust Gas Mass Flow	x10 <sup>3</sup> kg/hr	315.8	284.2
HRSG Steam Output (Typical*1)	x10 <sup>3</sup> kg/hr	54.1	43.4
Total Thermal Efficiency	%	84.3	82.4
Inlet Air Temperature	°C	0	15
Maximum Continuous Electric Output	kWe	34,120	32,360
Heat Rate	kJ/kWe-hr	8,890	9,110
Exhaust Gas Temperature	°C	487	519
Exhaust Gas Mass Flow	x10 <sup>3</sup> kg/hr	334.3	315.8
HRSG Steam Output (Typical*1)	x10 <sup>3</sup> kg/hr	51.1	54.1
Total Thermal Efficiency	%	81.6	84.3

## L30A Series Standard Package Configuration

**L30A-01 Gas Turbine**  
 - Industrial Twin-Shaft  
 - Power Turbine Rotor Speed : 5,600 rpm

**Compressor**  
 - 14 Stage Axial Flow  
 - Pressure Ratio 24.9:1  
 - Inlet Guide Vane (IGV) & 4 Stage Variable Stator Vane (VSV)

**Combustor**  
 - 8 Can Combustors  
 - Dual Ignition System  
 - Conventional Diffusion (-01) (Option De-NOx : Steam Injection)  
 - Dry Low Emission (DLE) (-01D)  
 - Applicable Fuel : Natural Gas, Diesel  
 \*Notes : Diesel is only for standby use

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

**Starting and Turning System**  
 - Variable Frequency Drive (VFD)

**Lube Oil System**  
 - Lube Oil : Turbine Oil ISO VG32 (optional VG46)  
 - Motor Driven Lube Oil Pump  
 - Water Cooled Oil Cooler with Temp. Control Valve  
 - Integral Oil Reservoir : 11,700 liter  
 - Duplex Filter  
 - Oil Vapor Fan

**Generator**  
 - Continuous Duty Rating  
 - Water Cooled (Option : Air-to-Air Cooled)  
 - 3 Phase, 3 Wire (Option : 4 Wire)  
 - Standard Voltage : 11.0 kV  
 - Power Factor : 90% (Option : 85%, 80%) Lag  
 - Bearing : Sleeve Bearing  
 - Lubrication : Forced Oil Lubrication  
 - Exciter : Brushless

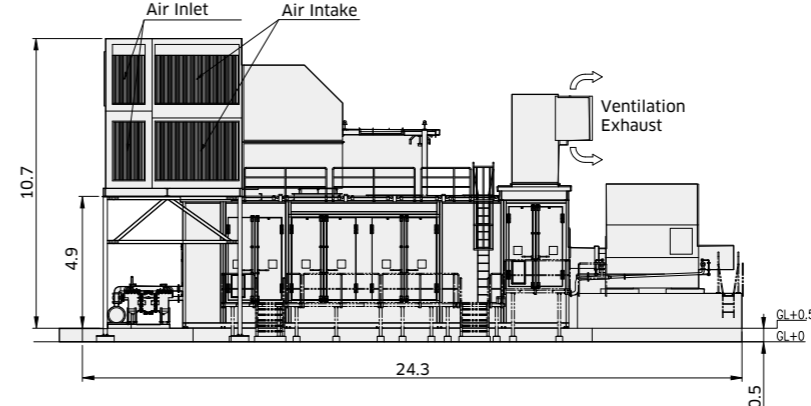
**Enclosed Package**  
 - Carbon Steel Common Base Frame  
 - Painted Carbon Steel Acoustic Enclosure  
 - Noise Level : 85 dBA at 1 m to the side of Enclosure

- Forced Ventilation Fan with Filter and Inlet Screen  
 - Maintenance Stage, Ladder, Beam

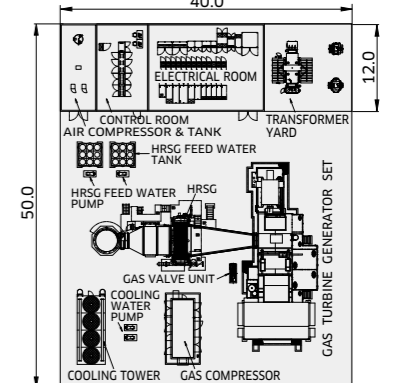
**Intake Silencer & Filter**  
 - Painted Carbon Steel (Outer Skin and Structure)  
 - Stainless Steel Inner Punching Metal Sheet  
 - 3 Stage Filter  
 - Pulse Type Self Cleaning Filter (Option)  
 - Noise Level : 85 dBA at 1 m from Filter inlet

**Controls**  
 - Programmable Logic Controller (PLC) (CPU, Power Module : Redundant)  
 - Gas Turbine and Generator Control  
 - GT start / Shutdown Control  
 - Speed / kW / Power Factor Control  
 - Auto Synchronizing and Load Sharing  
 - Touch Panel Operation  
 - Ethernet or Serial Communication to DCS/SCADA  
 - Remote Monitoring (Option)  
 - Graphics Monitoring  
 - Historical Trend & Event Logger  
 - Daily and Monthly Reports

■ GPB300/300D Typical Package Outlook : m (Reference)



■ GPB300/300D Typical Layout : m (Reference)



# 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

#### 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.

# Installation Examples



## Kawasaki Gas Turbine has been installed to....

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

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

### M1 Series



### M7 Series



**M5 Series Coming Soon!**

### L20 Series

