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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.



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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 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.







Akashi Kaikyo Bridge



Marine Steam Turbine (UA-Type)



Gas Engine

ECO-FRIENDLY

EN/HD CI



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

"Get Reliable Eco-friendly Energy Now"

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Sold PRODUCT CARE

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History and Order Record of Kawasaki Gas Turbines

History

1943 Completed the first Gas Turbin
1952 Started overhauling jet engin
1972 Started development of
1974 Completed first S1A-01 typ
1977 First Kawasaki Gas Turbine
1979 First genset to overseas cu
1984 First Kawasaki Gas Turbir
1985 Accumulated sales of 1,0
1988 1.5 MW M1A-13 type Ga
1993 5.5 MW M7A-01 type Ga
1995 1.5 MW M1A-13D Dry L
1998 Overseas sales and service
and Malaysia
1999 6.5 MW M7A-02 type
5.5 MW M7A-01D Dry
Accumulated delivery
Experimental ceramic
42.1% simple cycle eff
2000 18 MW L20A type Gas
2001 Akashi Works NO.4 Pov
2005 Start-up Akashi Works I
Cycle and 7.8 MW Flexib
2006 7.7 MW class M7A-03 ty
2007 Received the 100th Orde
2009 15ppm (NOx) M7A-03D ty
2010 Accumulated calor of

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 2017 5MW M5A-01D type Gas Turbine introduced

Accumulated Number of Engine sales all over the world



ne engine for aircrafts in Japan es ^f industrial Gas Turbine e : 200 kW Gas Turbine e genset : 200 kW delivered ustomer delivered e Co-generation system 2x1.0 MW delivered 00 engines s Turbine introduced as Turbine introduced ow NOx type Gas Turbine introduced vice affiliates were established in the U.S., Germany Gas Turbine introduced Low NOx type Gas Turbine introduced of 5,000th engine Gas Turbine completed and achieved the world record of iciency for the 300 kW class Turbine introduced ver Plant GPC180D : 17.6 MW commercial start-up Energy Center, which comprises 24.7 MW Combined le Heat and Power Gas Turbine Power Plant pe Gas Turbine introduced r of the M7A Series pe 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

Baseload Model

Basic Specifications

Engine Series	M1A Gas Turbine Series						
Gas Turbine Model	M1A-13A	M1A-13D	M1A-17	M1A-17D	M1T-13A	M1T-13D	
Gas Turbine Generator Model	GPB15	GPB15D	GPB17	GPB17D	GPB30	GPB30D	
Maximum Continuos 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 ³ kg/hr	29.1	28.8	29.1	29.1	58.2	57.6	
NOx (02:15%) ppm	-	25	-	9 / 15	-	25	
Approximate Package Dimension (L,W,H) m	5.3 x 1.65 x 2.35		6.0 x 1.85 x 2.55		6.0 x 2.4 x 2.8		
Approximate Package Weight (dry) x10 ³ kg	11		1	1.5	22		

Note: Mark "D" after Gas Turbine Model stands for Dry Low Emission *Condition : ISO Rating* 1. Inlet Air Temperature : 15°C

4. Fuel Type : Natural Gas (100% CH4)

2. Atmospheric Pressure : 101.3 kPa 3. Inlet / Exhaust Pressure Losses : No Duct Loss 5. LHV of Fuel : 35.9 MJ/Nm

M7A, L20A & L30A Gas Turbine

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

■ Gas Turbine Illustration Centrifugal Compressor for M1A Gas Turbine Series M7A OUTPUT SHAFT INLET AIR THRUST BEARING TURBINE No.2 BEARING M1A-17 EXHAUST COMBUSTOR L20A DIFFUSER CROLI INI ET AL No.1 BEARING L30A COMPRESSOR Axial Compressor for

Features of Kawasaki Gas Turbine Baseload Model

1. Self-developed Gas Turbine Fully Made in Japan

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

M5A Gas Turbine Series	M7A Gas Tu	Irbine Series	L20A Gas Turbine Series	L30A Gas Turbine Series
M5A-01D	M7A-03	M7A-03D	L20A	L30A
GPB50D	GPB80	GPB80D	GPB180D	GPB300D
4,710	7,800	7,800	18,420	34,380
11,030	10,730	10,730	10,530	8,930
32.6	33.6	33.6	34.2	40.3
511	523	523	542	502
62.6	97.9	97.9	215.3	333.3
25	25	9 / 15	15	15
8.7 x 2.6 x 3.5	11.5 x 2.8 x 3.6		17.2 x 3.5 x 3.4	21.6 x 6.2 x 5.7
55	58		131	250

M5A : The Standard Solution for Power Generation



M7A : The Leading Edge - Single Digit Super Low NOx emission Available !

In 2011. Kawasaki introduced to the market the newest combustion system which realized Single Digit Super Low NOx emission with the M7A-03 gas turbine engine.

In many countries and regions, environmental protection requirements and regulations are getting tighter and tighter. In order to meet such requirements and regulations, Kawasaki has developed its new Single Digit Super Low NOx combustion system. Furthermore, Kawasaki will apply this technology subsequently to other engines of its fleet to give the market greater satisfaction and contribute to environmental burden reduction.

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



GPB50D gas turbine generator package offers high efficiency 5MW power utilizing Kawasaki M5A-01D gas turbine developed with the latest and proven technologies.

Its high performance provides the optimal solution for power generation and co-generation. GPB50D's compact package design is also perfect for

renewal projects of existing facilities.



M7A-03D

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

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/Nm
(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										
Gas Turbine Model		M1A-13A			M1A-13D			M1T-13A			M1T-13D	
Gas Turbine Generator Model		GPB15			GPB15D			GPB30			GPB30D	
Partial Load @ AT 15 °C %	100		50	100		50	100		50	100		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 ³ 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 ³ 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		40	0		40	0		40	0		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 ³ 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 ³ 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)

- Drv 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

■ GPB17 Typical Package Outlook : m

(Reference)

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)

1.1 0.1 6.0

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			
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		
		40			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

■ GPB17 Typical Layout : m

- **Reduction Gear Box**
- Epicyclic

(Reference)

- 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

Generator

- Pre-Post Lube Pump

- Water Cooled (Option)

Continuous Duty Rating

Water Cooled (Option)

Lubrication : Grease Pack

Air Intake Filter

- Integral Oil Reservoir

- Lube Oil : Synthetic Ester Oil - Turbine Driven Main Lube Pump

- Air Cooled Oil Cooler with Temp. Control Valve

- Simplex Filter (Option : Duplex Type) - Stainless Steel Piping : Down Stream of Filter

- Air Cooled Open Drip-Proof Construction

- 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

- 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



M5A Series Gas Turbine Generator Specifications



	M5A Gas Turbine Series							
Gas Turbine Model	M5A-01D							
Gas Turbine Generator Model		GPB50D						
Partial Load @ AT 15℃ %	100		50					
Electric Output kWe	4,450	3,340	2,225					
Heat Rate kJ/kWe-hr	11,266	12,502	16,775					
Exhaust Gas Temperature °C	505	533	528					
Exhaust Gas Mass Flow x10 ³ kg/hr	62.1	51.1	51.5					
HRSG Steam Output (Typical*1) x10 ³ kg/hr	9.3	9.1	9.0					
Total Thermal Efficiency %	77.2	82.0	80.3					
Inlet Air Temperature $^{\circ}$	0	15	40					
Maximum Continuous Electric Output kWe	4,930	4.450	3,360					
Heat Rate kJ/kWe-hr	10,993	11,266	12,648					
Exhaust Gas Temperature °C	495	505	538					
Exhaust Gas Mass Flow x10 ³ kg/hr	66.2	62.1	52.9					
HRSG Steam Output (Typical*1) x10 ³ kg/hr	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)

■ GPB50D Typical Package Outlook : m (Reference)



Intake Silencer & Filter

- Painted Carbon Steel (Outer Skin and Structure)

20

30

- Stainless Steel Inner Punching Metal Sheet

12

10

Bai

- 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 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/Nm ³
Typical Steam Condition	

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℃ %	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 ³ kg/hr	97.3	97.0	96.8	97.3	84.3	66.4		
HRSG Steam Output (Typical 1) x10 ³ 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		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 ³ kg/hr	101.1	97.3	84.0	101.1	97.3	84.0		
HRSG Steam Output (Typical*1) x10 ³ 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		



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

Lube Oil System

- Oil Vapor Fan

Generator

- Pre-Post Lube Pump

Emergency Lube Pump

- Water Cooled (Option)

- Continuous Duty Rating

Water Cooled (Option)

Starting and Turning System

- Epicyclic



Enclosed Package - Carbon Steel Common Base Frame

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

- Various Frequency Drive (VFD)

- Lube Oil : Turbine Oil ISO VG32 (VG46 : Tropical) - Turbine Driven Main Lube Pump
- Air Cooled Oil Cooler with Temp. Control Valve
- Integral Oil Reservoir : 2,750 liter - Oil Heater (Cold Weather Option) - Simplex Filter (Duplex Filter : Option)
- Air Cooled Open Drip-Proof Construction
- 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)

- 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



L20A Series Gas Turbine Generator Specifications

Site Condition for Normal Perfor Elevation above sea level



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 x10 ³ kg/hr	213	188	182					
HRSG Steam Output (Typical*1) x10 ³ kg/hr	39.7	32.5	24.5					
Total Thermal Efficiency %	84.0	82.4	77.7					
Inlet Air Temperature $ \mathbb{C} $	0		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 x10 ³ kg/hr	221	213	193					
HRSG Steam Output (Typical*1) x10 ³ 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

■ GPB180 Typical Package Outlook : m (Reference)



Intake Silencer & Filter

Controls

Controller (PLC)

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)

■ GPB180 Typical Layout : m



- Stainless Steel Inner Punching Metal Sheet

- Pulse Type Self Cleaning Filter (Option)

- Noise Level : 85 dBA at 1 m to Filter inlet

Microprocessor Based Programable Logic

(CPU, Power Module : Option Redundant)

Speed / kW / Power Factor Control

Auto Synchronizing and Auto Sharing

Gas Turbine and Generator Control

GT start / Shutdown Control

- Serial Link User Interface (Option)

Redundant Control System (Option)

Historical Trend & Event Logger

Touch Panel Operation

SCADA System (Option)

Graphics Monitoring

Remote Monitoring (Option)

Daily and Monthly Reports

- 3 Stage Filter with Insect Screen

Exhaust Silencer Stack (Option)

L30A Series Gas Turbine Generator Specifications

Site Condition for Normal Perfor Elevation above sea level • 0 m Inlet Air Temperature · 15 ℃ : 0.98 kPa Inlet Air Pressure Loss : 3.43 kPa(GPB300/300D) Exhaust Gas Pressure Loss LHV of Natural Gas Fuel : 35.9 MJ/Nm³ (100% CH4) ical Steam Condition /PaG

ypical Steam Condition	
iteam Pressure	: 0.83 M
steam Temperature (Saturated)	: 177 °C
eed Water Temperature	: 80 °C
Blowdown from HRSG	:0%

	L30A Gas Turbine Series							
as Turbine Model	L30A							
as Turbine Generator Model	GPB300 / 300D							
'artial Load @ AT 15°C %	100		50					
lectric Output kWe	32,360	24,270	16,180					
leat Rate kJ/kWe-hr	9,196	9,845	11,879					
xhaust Gas Temperature °C	509	482	491					
xhaust Gas Mass Flow x10 ³ kg/hr	324.7	289.6	252.4					
IRSG Steam Output (Typical*1) x10 ³ kg/hr	53.8	44.3	40.0					
otal Thermal Efficiency %	83.2	81.8	81.0					
nlet Air Temperature $ \mathbb{C} $	0	15	40					
laximum Continuous Electric Output kWe	34,120	32,360	24,660					
leat Rate kJ/kWe-hr	8,963	9,196	10,117					
xhaust Gas Temperature °C	475	509	550					
xhaust Gas Mass Flow x10 ³ kg/hr	345.3	324.7	272.2					
IRSG Steam Output (Typical*1) x10 ³ kg/hr	50.9	53.8	52.0					
otal Thermal Efficiency %	80.8	83.2	86.4					

- Painted Carbon Steel (Outer Skin and Structure)

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)

GPB300 Typical Package Outlook : m



- - - Continuous Duty Rating

- 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)
- **Reduction Gear Box** Parallel Shaft
- 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

Lube Oil System

- Generator
 - 3 Phase, 3 Wire (Option 4 Wire)

Starting and Turning System

- Standby Lube Oil Pump

Pre-Post Lube Oil Pump



- Various Frequency Drive (VFD)

- Lube Oil : Turbine Oil ISO VG32 (optional VG46) Motor Driven Main Lube Oil Pump

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 Layout : m





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 Coolina 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

Internal View of Gas Turbine Package





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

em				GPS750	GPS1250	GPS1500	GPS2000	GPS2500	GPS3000	GPS4000	GPS5000	GPS6000	
enera	itor Set												
	Electric Outp	out	(kW)	600	1,000	1,200	1,600	2,000	2,400	3,200	4,000	4,800	
	Starting Time	e						Within 40-sec					
	Load Applica	ation Capac	city	100% (Resistive load)									
	Freq. Deviati	on Tran	nsient	Within ± 4.5% (with 100% block load on and off) Within ± 5									
		Steady \$	State					Within ± 0.3%					
	Fuel Type			Kerosene, Diesel			Ke	erosene, Dies	el, Gas (optio	n)			
*2	Fuel Consur	nption (lite	r / hr)	305	525	620	695	1,065	1,245	1,390	1,835	2,050	
as Tu	rbine Turbine Mod	el		S2A-01	M1A-01	M1A-03	M1A-23	M1T-01S	M1T-03	M1T-23	M1T-33A	M1T-33	
	Туре					ŀ	leavy-duty, sir	nple open cyc	le, single-sha	ft			
	Turbine Spe	ed (rpm)	31,500			22,	000			18,	000	
	Output Spee	Output Speed (rpm) 51,500 22,000 1,500 1,500 (60 Hz)											
	Dry Weight		(ton)	1.48	3	.0	3.5	5.	7	6.4	13	3.5	
	Lube Oil Typ	e / Brand			Synth	netic oil / Shell	ASTO-500, N	lobil jet II, Cas	trol AERO 50	00, DP BPTO	2380		
Lube Oil Tank Capacity (approx.L) 66				66	1(00	210	16	60	240	360		
Lube Oil Consumption (liter / hr)				0.08		0.16				0.2			
Lube Oil Consumption (liter / hr) ternator 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 Reg	ulation				Within ±2.5	5% (steady sta	ate from no-loa	ad to full-load,	at pf = 0.8)			
	Excitation S	ystem				В	rushless by A.	C. exciter and	rotating diod	es			
Freq. Deviation Transient Steady State Fuel Type *2 Fuel Consumption (liter / hr) s Turbine Turbine Model Type Turbine Speed (rpm) Output Speed (rpm) Dry Weight (ton) Lube Oil Type / Brand Lube Oil Type / Brand Lube Oil Toyne / Brand Lube Oil Toyne / Brand Lube Oil Toyne / Brand Cutput Lube Oil Consumption (liter / hr) ternator Output Type Output Voltage Regulation Excitation System ee of Batteries Image: Standard Voltage narting System Length (m) Weight (m) Weight (m) Weight (m) Weight (m) Weight (ton) Stackage From Package From Exhaust Silencer Outlet rte: * 1 : Output						6.6kV	0						
artin	g System				Ele	ctrical start wi	th D.C. motors	s (Optional: Pr	neumatic star	with air turbir	nes)		
pe o	f Batteries					\	/alve Regulate	ed Lead-Acid	(VRLA) Batte	rv	,		
enera	tor Set Dime	nsion					0		`	,			
ndoo	r 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		.0		
		Height	(m)	2.1	2	.5	2.6		2.9		3	.6	
		Weight	(ton)	6.8	10.5	11.4	14.7	19.7	20.8	24.6	36.6	39.0	
ise L	evel at 1m From Packa	je				Approx.	85dBA in ope	en air (optiona	l system: 80~	-70dBA)			
	From Exhaus	st Silencer C	Dutlet	Approx. 90dBA (optional system: 85~65 dBA at 1 m with a secondary silencer)									
ote) * 1 : Output : Up to 40°C of ambient temp., 150 m					1p., 150 m ab	ove 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



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

•										
		Model	MGP	MGP	MGP	MGP	MGP	TGP	TGP	TGP
ltem			750	1000	1250	1500	2000	2500	3000	4000
*1	Output	(kW) 40°C	600	800	1000	1,200	1,600	2,000	2,400	3,200
	Fuel					Kerosen	e, Diesel			
Generator Sets	Load Application	on Allowance	100% (Resistance Load)							
	Freq. Deviation	n Transient	Within $\pm 4.5\%$ (with100% block load on and off)							
		Steady State	Within ± 0.3%							
	Fuel	Kerosene	320	490	555	655	735	1,125	1,310	1,465
	Consumption (I/h)	Diesel Oil	305	465	525	620	695	1,065	1,245	1,390
Truck / Trailer Type			Truck					Trailer		
	Dimensions	Max. Length (m)	11.0 12.0					9.9 (not including cockpit)		
	Including	Max. Width (m)								
	Truck	Max. Height (m)	3.4					3.6		
	Total Weight	(ton)	Less Less than 20 Less than 22 tons than 25 tons tons					Less than 33 tons		
Noise Level at	1 m	(dBA)				8	5			

(Note)

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

■ Installation Example



TGP3000



MGP2000



MGP1250



MGP2000

Kawasaki Techno-Net

• Full Time Support

Maintenance Management

- · Predictive services based on trending data and asset maintenance management
- \checkmark What to do \checkmark When to do it \checkmark How to do it \checkmark 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



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....

- Paper Mill
- Food Process

Tire Manufacturer

Data Center

District Heat & Cooling

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



M7 Series











Hospital

College Campus

Oil & Gas AND MORE !!!