TECHNICAL SPECIFICATION
OF
MITSUBISHI BASIC DIESEL GENERATOR SET

This specification covers the indoor use MITSUBISHI diesel engine generator set and attached equipment.

	MGS Model	MGS1200B					
	Code Name	5S-7PD	5P-7PD	6S-73PD	6P-73PD	6S-7PB	6P-7PB
Generator Set	Frequency (Hz)	50		60			
	Voltage [1] (V)	380		380		480	
	Duty	Stand-by	Prime	Stand-by	Prime	Stand-by	Prime
	Rated Output [1] (kVA)	1500	1362.5	1581.25	1431.25	1575	1437.5
	(kW)	1200	1090	1265	1145	1260	1150
Engine	Model	S12R-PTA-S					
	Speed (min^{-1})	1500		1800			
	Output [2] (kWm)	1260	1143	1336	1210	1336	1210
	Fuel Consumption [3, 5] (liter/hr)	233	213	256	234	256	236
	Lub.Oil Consumption [4] (liter/hr)	1.15	1.04	1.21	1.10	1.21	1.10
	Cooling System	Closed looped circuit by integral radiator					
Generator	Model	MG-7PD		MG-73PD		MG-7PB	
	Phase & Wire	3Phase 4 Wire					
	Power Factor	0.8 lagging					
D/G Set Dimension & Weight	Length (mm)	4680		4680		4595	
	Width (mm)	2160		2160		2160	
	Height (mm)	2495		2495		2495	
	Weight (kg)	9800		9800		9200	

Note 1 For actual voltage and output, refer to the “Scope of supply” sheet

Note 2 Output at 40 deg C , 1000m ASL with Fan

Note 3 Fuel Consumption at 75% Load

Note 4 Lub. Oil Consumption at 100% Load

Note 5 Fuel Consumption may differ subject to site condition and specification of fuel. Not guaranteed value

RATING DEFINITION

Duty	Stand-by	Prime
Over Load	Not Available	10%
Yearly Average Load Factor	Less than 60%	Less than 60%
Yearly Operating Hours	Less than 100 hours	Less than 500 hours
Allowable Average Load Factor For 24 Hours	1) 80% of Rated Power 2) 100% of Rated Power is available intermittently for less than 12 hours per year.	1) 90% of Rated Power 2) More than 100% of Rated Power is available intermittently for less than 1 hour per 12 hours. (Max. 12 hours per year)

1. BASIC CONDITIONS

1.1 MEASUREMENT

Unit of measurement, weight, and capacity concerning all of the equipment supplied by us, SI unit and English letter are used.

1.2 SHOP TEST

Diesel generator test shall be carried out on the following items at the manufacturer's shop.

(1) Starting and stopping test.

(2) Load test

	0% Load	25% Load	50% Load	75% Load	100% Load	110% Load
Stand-by Rating	5 min	10 min	10 min	10 min	20 min	------
Prime Rating	5 min	10 min	10 min	10 min	20 min	10 min

(3) Governor test.

(4) Insulation and alarm test.

Generator and switchboard test shall be carried out at generator manufacturer's shop. After the test, the test record shall be submitted.

1.3 Applicable standard

To be in accordance with JIS, JEC, JEM, IEC and manufacturer’s standards unless otherwise specified

a) J.I.S. : Japanese Industrial Standards
b) J.E.C. : Standard of the Japanese Electrotechnical Committee
c) J.E.M. : The standard of Japanese Electrical Manufacturers Association
d) I.E.C. : International Electrotechnical Commission
e) I.S.O. : International Organization for Standardization

1.4 GUARANTEE

The guarantee shall be valid for the period of twelve (12) calendar months after completion of commissioning test at site or for the period of eighteen (18) calendar months after B/L date, whichever comes earlier. The guarantee shall cover against manufacturer defect, bad materials and workmanship only, and shall not be applicable to damage sustained through mishandling of the equipment and force majeure. The guarantee shall not be liable for any consequential or resultant loss or damage howsoever occurring. The guarantee shall be subject to the proper maintenance of machinery and equipment according to the maintenance schedule to be submitted separately.

1.5 PAINTING

Mitsubishi standard (Dark Blue) Munsell 6.0PB 4.4/5.2

1.6 ENVIRONMENT ETC.

Generator sets are designed under the following operating conditions

a) Relative humidity : Max. 85%
b) Ambient temperature : 40deg.C
c) Altitude above sea level : Below 1000 meters

2. DIESEL ENGINE

2.1 Particulars of diesel engine

Engine model	S12R-PTA-S 4 cycle, direct injection, turbocharged, with air cooler
No. of cylinder	12-Vee
Bore / stroke (mm)	170 / 180
Total displacement	49 liter
Compression Ratio	14.0 : 1
Frequency regulation (as generator set)	Temporary ..... 12% (100% throw off) 10% (50% throw in) Permanent .....5% Steady state Frequency band.....±0.25% Other performance with ISO 8528 / V Class G2 governing
Governor	Electrical type
Fuel oil	ASTM D975-1992 diesel fuel oil No.2-D
Fuel injection pump	MHI PS type
Fuel injection nozzle	Hole nozzle type
Fuel feed pump	Forced feeding by piston type pump
Fuel filter	Paper element type
Lubricating oil	API classification Service, “CD” class. SAE No.30
Lubricating system	Forced lubricating by gear pump wet sump system
Lub. oil capacity	180 liter
Lub. oil filter	Full flow paper element type
Lub. oil cooler	Water cooled corrugated type
Water pump	Centrifugal type driven by engine
Turbocharger	Exhaust gas turbine
Air cleaner	Turbo filter type
Starting system	Electric starting Starting motor capacity (DC24V) : 7.5kW×2
Stopping system	Energize to run type solenoid on the fuel linkage

2.2 Engine Instrument

Engine instruments shall be installed in the generator panel.
Engine status are showed by graphical icon and digital indicator on LCD display of the generator panel.

3. AC GENERATOR

The brushless AC Generator coupled with the diesel engine and installed onto a common bed.
The AC Generator provided the following characteristics.

3.1 Particulars of the AC Generator

(1) Standard specification

Type	: Brushless, self excited, self ventilating and rotating field
Protection	: IP23
No. of pole	: 4 pole
Insulation	: Class "H"
Exciter	: Brushless
Bearing	: Single ball bearing

3.2 Characteristics (AC Generator)

(1) Steady state voltage regulation

Voltage Regulation will be ± 0.5% when the load varies between no load and full load at power factors between 0.8 and 1.0 over a prime mover speed range of 4%.

(2) Transient Response

The Instantaneous Voltage Regulation will be within 25% and recoverable to within 3% of the final steady-state voltage in not more than 1sec., when full load at a power factor of 0.4 or less is suddenly applied to the AC Generator running at no load and rated frequency. However engine response may influence on recovery time.

(3) Voltage wave form

The wave form deviation of phase to phase voltage, as checked at the AC Generator terminals, is not greater than 5% at no-load rated voltage.

(4) Unbalanced loading

An acceptable value of negative phase sequence current is approximately 8% of rated current. Up to 25% load imbalance can be tolerated on a continuous basis.

(5) Temperature rise limits

The main windings of the AC Generator are designed for operation to Class H temperature rise limits.

(6) Insulation strength

The dielectric strength of the winding insulation system is checked during manufacture by conducting a High Voltage withstand test.

Main Stator winding : AC 2000V

Main Rotor winding : AC 1500V

(7) Overspeed

The AC Generator is capable of withstanding overspeeds to 125% of the rated speed for two minutes under no load.

(8) Voltage adjustment is typically ± 6% using a remotely connected trimmer.

(9) Terminal box

The large fabricated sheet steel terminal box mounted on the AC Generator accommodates load output terminals and access cover.

4.GENERATOR CONTROL (MGS7310GCP)

4.1 General

Automatic start engine management and instrumentation system module in fabricated cubicle is installed on individual bracket with anti-vibration isolator.

4.2 Instruments and control accessories

Instruments are graphical icon on LCD display

a) Generator running indicator
b) Voltage adjuster
c) Frequency adjuster
d) Emergency stop switch
e) Selector switch (STOP / RESET , ACTIVE , PANEL LOCK)
f) Manual start button
g) Manual stop button
h) Common alarm indicator
i) Transfer to generator button (manual mode only)
j) Transfer to main button (manual mode only)
k) Mute alarm button
l) Manual Mode button
m) Auto Mode button
n) Menu navigation buttons
o) Alarm indication on LCD (see 4.3)
p) Status indicator (see 4.5)

q) Value display on LCD

1) Frequency / RPM
2) AC voltage phase
3) AC voltage phase-phase
4) AC Line Current
5) Oil pressure
6) Coolant temperature
7) Oil temperature λ
8) Engine hours run
9) DC battery voltage
10) Generator frequency
11) Generator load / kW
12) Generator load / kVA
13) Power factor / pf
14) Generator load / kVAr
15) Generator load / kWh, kVAh, kVarh
16) Generator phase sequence
17) Generator Nominal
18) Exhaust gas temperature ※λ
19) Winding temperature (U,V,W) ※λ
20) Bearing temperature ※λ

※ These values shall be displayed on the alarm box adjacent to MGS7310GCP
λ Optional item upon request

4.3 Fault operation

Fault operations shall be provided as follows;

Item	Value	Eng. stop	Light Fault	Heavy Fault	Indication
Charge Alternator Failure	19.2V	—	×	—	×
Battery Under Voltage	18V	—	×	—	×
Battery Over Voltage	31.2V	—	×	—	×
Fail to Stop	30sec	—	×	—	×
Generator Over Current	100%**	×	—	×	×
Negative Phase Sequence	8% (1h)	—	×	—	×
Generator Power	105%***	—	×	—	×
Fail to Start	80sec	×	—	×	×
Emergency Stop	—	×	—	×	×
Oil Pressure Low First	400kPa	—	×	—	×
Oil Pressure Low Second	150kPa	×	—	×	×
Coolant Temperature High First	95℃	—	×	—	×
Coolant Temperature High Second	101℃	×	—	×	×
Oil Temperature High[7]	110℃	×	—	×	×
Exhaust Gas Temperature high[7]	550℃	×	—	×	×
Winding Temperature High (U,V,W)[7]	170℃*	—	×	—	×
Bearing Temperature High[7]	80℃	—	×	—	×
Engine Over Speed First	110%	—	×	—	×
Engine Over Speed Second	115%	×	—	×	×
Engine Under Speed First	80%	—	×	—	×
Engine Under Speed Second	60%	×	—	×	×
Generator Over Frequency	110%	—	×	—	×
Generator Under Frequency	85%	—	×	—	×
Generator Over Voltage First	115%	—	×	—	×
Generator Over Voltage Second	130%	×	—	×	×
Generator Under Voltage First	80%	—	×	—	×
Generator Under Voltage Second	70%	×	—	×	×
Oil pressure Sensor Open Circuit	—	×	—	×	×
Loss of Magnetic Pickup Signal	—	×	—	×	×
L.O. Filter Clogged	0.15MPa	—	×	—	×
Electrical Trip[3]	—	×	—	×	×

NOTE : 1. "×" marks are applicable items.
2. "—" marks are not applicable items.
3. Eng stop by Electrical trip signal will be done after Eng cooled.
4. Regarding ＊, in case of "Prime" duty, that value is 150℃
5. Regarding ＊＊,in case of "Prime" duty that value is 110%
6. Regarding ＊＊＊,in case of "Prime" duty that value is 115%.
7. Optional items installed upon request.

4.4 Auxiliary input signals

If the functions as follows are necessary, please input external command signals to the control panel.

(1) Remote start/stop
(2) Electrical trip
(3) CB close status (Generator closed auxiliary)

4.5 Status indicator

(1) Remote start present
(2) Generator ready
(3) LO filter clogged
(4) Electrical trip

4.6 Auxiliary output signals

These signals are output from control panel as 24V DC .

(1) COMMON Shutdown alarm signal (for CB Trip)
(2) kW Overload alarm
(3) Low speed detection
(4) CB close command (pulse)
(5) CB open command (pulse)
(6) AUTO Mode
(7) Common Electrical Trip ※
(8) Energize to stop ※
(9) Common warning ※
(10) Failed to start alarm ※
(11) Over speed shutdown ※
(12) Emergency stop ※
(13) Low oil pressure ※
(14) High water temperature ※

※ Require optional 2157 relay unit

4.7 Operation

Generator control panel has three positions of key switch.
Each position is written in below.

・STOP / RESET : Engine stop and controller reset operation are available.

・ACTIVE : Auto and manual mode can be selected by auto and manual button on controller.

・PANEL LOCK : Even if auto or manual button is pushed, mode selection is not applicable.

Engine start and stop shall be done by operator. When engine trouble occurred engine should be stopped by generator panel automatically.
Remote start and stop control are available, when auto mode is selected by auto mode button.

5. LIMITING REQUIREMENT FOR FUEL OIL, COOLANT AND LUBRICATION OIL

5.1 Fuel system

Fuel to meet ASTM D975 grade No.2-D or BS2869 class A or JIS K-2204. (APPENDIX-1)

Fuel tank and fuel pipes to be free of dirt, water or other foreign substances.

5.2 Cooling system

Coolant to meet the coolant specifications. (APPENDIX-2)

5.3 Lubrication system

Engine oil to meet API service classification CD or CF. (APPENDIX-3)

Do not use CE and CF-4 lube oils for Mitsubishi high-speed diesel engines.

- End of Specification -

APPENDIX-1

Limiting Requirements for Mitsubishi Diesel Fuel oils

Property	Limit	Remarks
Flash point	50℃,min.	
Distillation temperature, 90% point	380℃,max.	
Pour point	6℃,min. below the lowest atmospheric temperature	
Cloud point	Below the lowest atmospheric temperature	
Carbon residue on 10% residuum	1.0% by weight, max.	
Cetane number	45, min.	
Kinematic viscosity	2.0×10^{-6} m^2/s, min.(30℃) 8.0×10^{-6} m^2/s, max.(50℃) 10.5×10^{-6} m^2/s, max.(40℃) 16.0×10^{-6} m^2/s, max.(30℃)	
Sulfur	0.5% by weight, max.	
Water and sediment	0.1% by volume, max.	
Ash	0.03% by weight, max.	
Copper strip corrosion at l00℃,3hrs	No.3, max.	ASTM No.3 JIS K2531 No.3
Gravity, 15/4℃	0.80 to 0.87	Reference

ASTM D975-1992 diesel fuel oil No.2 - D or BS2869-1970 engine fuels class A and JIS K-2204-1988 gas oil type 2 or type 3 is appropriate.

APPENDIX-2

Coolant Specifications

Item	Chemical symbol	Unit	Recommend limit	Main malign effect	
				Corrosion and rust	Scale formation
pH(25℃)	- -	- -	6.5 to 8.5	○	○
Electrical conductivity (25℃)	- -	μS／cm	<400	○	○
Total hardness	CaCO3	ppm	<100	- -	○
M alkalinity	CaCO3	ppm	<150	- -	○
Chlorine ion	Cl^-	ppm	<100	○	- -
Sulfuric acid ion	SO_4^{2-}	ppm	<100	○	- -
Total iron	Fe	ppm	<1.0	- -	○
Silica	SiO_2	ppm	<50	- -	○
Residue from evaporation	- -	ppm	<400	- -	○

This specification indicates the limitation for the new water.
Never use raw water alone as coolant water treatment with rust inhibitor or ethylene glycol base antifreeze is required.(Antifreeze is preferred.)
Maintain the antifreeze concentration more than 30% against corrosion.

APPENDIX-3

Recommended Lubricating Oil

Manufacturer	Brand name
Nippon Oil	HD S-3 Engine oil
Caltex	DELO Gold or Silver
Cosmo	Cosmo Diesel CD 30
Esso	Essolube D-3
General	General Gemico Super S-3
Idemitsu	Apolloil Diesel Motive Custom
Kygnus	Mighty oil S-3
Kyodo	Kyoseki Delmate D
Mobil	Mobil Delvac 1300 series
Showa-Shell	Shell Rimula X White Parrot Super

Remark : 1) When using those listed above, they should be confirmed as API service classification “CD”, “CF”. Some countries have them as “CF-4” and other. In care of that, please do not use them.

2) When using other oils than those listed above, they should be in API service classification “CD”, “CF” and meet the requirements of MIL-L-2104C.

3) Do not use CE and CF-4 lube oils for Mitsubishi high-speed diesel engines.