MITSUBISHI HEAVY INDUSTRIES
ENGINE SYSTEM ASIA

MITSUBISHI BASIC DIESEL GENERATOR SET

TECHNICAL SPECIFICATION

MGS0700R

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1. Generator Set Overview Specification

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

Generator Set	MGS Model		MGS0700R					
	Frequency (Hz)		50		60			
	Voltage [1] (V)		380		380		480	
	Duty		Standby (ESP)	Prime (PRP)	Standby (ESP)	Prime (PRP)	Standby (ESP)	Prime (PRP)
	Rated Output [1] (kVA)		690	625	581.25	512.5	581.25	512.5
	(kW)		552	500	465	410	465	410
Engine	Model		S6R-PTAR		S6A3-PTAA			
	Speed (min^{-1})		1500		1800			
	Output [2] (kWm)		601	545	536	480	536	480
	Fuel Consumption[3] (liter/hr) (% Load)	25%	53	50	39	39	39	39
		50%	83	78	62	62	62	62
		75%	115	106	98	87	98	87
		100%	147	135	129	114	129	114
	Lub.Oil Consumption (liter/hr) 100% Load		0.57	0.52	0.49	0.42	0.49	0. 42
	Cooling System		Closed looped circuit by integral radiator					
Generator	Model (MG-)		HC5F		HC5E		HC5D	
	Phase & Wire		3Phase 4 Wire					
	Power Factor		0.8 lagging					
D/G Set Dimension & Dry Weight	Length (mm)		3600		3600		TBA	
	Width (mm)		1800		1800		TBA	
	Height (mm)		1940		1940		TBA	
	Weight (kg)		5500		5500		TBA	

Generator Set	MGS Model		MGS0700R
	Frequency (Hz)		50
	Voltage [1] (V)		380
	Duty		Continuous (COP)
	Rated Output [1] (kVA)		500
	(kW)		400
Engine	Model		S6R-PTAR
	Speed (min^{-1})		1500
	Output [2] (kWm)		445
	Fuel Consumption[3] (liter/hr) (% Load)	25%	45
		50%	67
		75%	89
		100%	111
	Lub.Oil Consumption (liter/hr) 100% Load		0.42
	Cooling System		Closed looped circuit by integral radiator
Generator	Model (MG-)		HC5E
	Phase & Wire		3Phase 4 Wire
	Power Factor		0.8 lagging
D/G Set Dimension & Dry Weight	Length (mm)		3600
	Width (mm)		1800
	Height (mm)		1940
	Weight (kg)		5900

Note 1 For actual voltage and output, refer to the “Scope of supply” sheet
Note 2 Output at 40°C, 1000m ASL without fan
Note 3 Fuel oil consumption may differ subject to site condition and specification of fuel. Not guaranteed value.

2. RATING DEFINITION

Duty	Overload	Yearly Average Load Factor	Yearly Operating hours	Allowable Average Load Factor for 24 Hours
Standby (ESP)	Not available	Maximum 70%	Maximum 500 hours	1. Maximum 80% 2. 100% in emergency
Prime (PRP)	+10% Overload	Maximum 70%	Unlimited	1. Maximum 80% 2. Overload operation (≤110%) is limited to a maximum of 1 hour per 12 hours 3. Over 90% load operation limited to a maximum of 3 hours per 24 hours
Continuous (COP)	Not available	Maximum 100%	Unlimited	1. Maximum 100%

3. BASIC CONDITIONS

3.1 MEASUREMENT

SI unit shall be the standard unit of measurement to be used on equipment supplied by MITSUBISHI. English shall be the standard language to be used.

3.2 SHOP TEST

Following test items shall be carried out as standard manufacturer's shop test for MITSUBISHI diesel generator set

(1) Starting and stopping test

(2) Load test

MGS R Rating	0% Load	25% Load	50% Load	75% Load	100% Load	110% Load
Standby (ESP) Continuous (COP)	5 min	10 min	10 min	10 min	20 min	-
Prime (PRP)	5 min	10 min	10 min	10 min	20 min	10 min

(3) Governor test

(4) Insulation and protection test

3.3 APPLICABLE STANDARD

MITSUBISHI diesel generator set is designed in accordance with JIS, JEC, JEM, IEC, ISO and manufacturer's standards unless otherwise specified.

a) JIS : Japanese Industrial Standards
b) JEC : Japanese Electrotechnical Committee
c) JEM : The standard of Japanese Electrical Manufacturers Association
d) IEC : International Electrotechnical Commission
e) ISO : International Standard Organization

3.4 PAINTING

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

3.5 ENVIRONMENT ETC.

MITSUBISHI generator sets are designed to meet following operating conditions

a) Relative humidity : Max. 85%
b) Ambient Temperature : 5°C ~ 40°C
c) Altitude above sea level : <1000m@40°C

4. DIESEL ENGINE

4.1 PARTICULARS OF DIESEL ENGINE

Engine Model	4 cycle, direct injection, turbocharged with air cooler	
	S6R-PTAR	S6A3-PTAA
No. of cylinder	6 Inline	6 Inline
Bore / stroke (mm)	170 / 180	150 / 175
Total displacement	24.51 liter	18.56 liter
Compression ratio	14 : 1	14.5 : 1

Frequency regulation Transient 10% (100% off load)
7% (*% on load)

	*% on load S6R-PTAR 50Hz	*% on load S6A3-PTAA 60Hz
Standby	40%	40%
Prime (PRP)	47%	47%
Continuous	54%	NA

Steady state Frequency band ±0.25%
Other performance with ISO 8528/V Class G3 governing

Governor Digital Electrical type
Fuel oil Refer to Operation & Maintenance manual
Fuel injection pump MHI PS6 Type
Fuel injection nozzle Hole nozzle type
Fuel filter Paper element type
Lubricating oil Refer to Operation & Maintenance manual
Lubricating system Forced lubricating by gear pump wet sump system
Lub. oil capacity Refer to table

Engine	Rating		
	Standby (ESP)	Prime (PRP)	Continuous (COP)
S6R-PTAR	100 liter		160 liter
S6A3-PTAA	80 liter		Not Applicable

Lub. oil filter Full flow paper element type
Lub. oil cooler Water cooled corrugated type
Coolant Refer to Operation & Maintenance manual
Water pump Centrifugal type driven by engine
Turbocharger Exhaust gas turbine
Air cleaner Refer to table

Type	Rating		
	Standby (ESP)	Prime (PRP)	Continuous (COP)
Turbo filter	Standard		Not Applicable
Paper element	Optional		Standard

Starting system Electric starting
Starter motor capacity : 7.5kW x 1 (DC24V)
Stopping system Energize to run type solenoid on fuel linkage

4.2 ENGINE INSTRUMENT

Engine instruments are installed and connected to the generator panel. Engine status is available on LCD screen and digital indicator of generator panel.

5. AC GENERATOR

Brushless AC Generator coupled with MITSUBISHI engine on rigid common bed is designed to have following characteristics.

5.1 PARTICULARS OF AC GENERATOR

(1) Standard specification

Type	: Brushless, self-excited, self-ventilated and rotating field
Protection	: IP23
Power factor	: 0.8 lagging
No. of pole	: 4 poles
Insulation	: Class H
Exciter	: Brushless
Bearing	: Single ball bearing Note 1

Note 1: Double ball bearing for MG-P80S12 & MG-L52UL16

5.2 CHARACTERISTICS (AC GENERATOR)

(1) Steady state voltage regulation

Voltage regulation shall be within following specification when load varies between no load and full load subject to power factor between 0.8 to unity and engine governing of 4%.

AVR regulation	: ±0.5% Note 2
Generator set	: ±1.0%

Note 2: ±1.0% for MG-HC4 series and MG-HC5 series
±0.25% for MG-P80 series and MG-L50/L52 series

(2) Transient response

The instantaneous voltage regulation shall be within 25% and recoverable to within 3% of the final steady state voltage within 1 second when full load at power factor of 0.4 or less is suddenly applied to AC Generator running at no load and rated frequency. However engine respond may influence the recovery time.

(3) Voltage waveform

The phase to phase voltage waveform distortion measured at terminals shall not exceed 5% at no load, rated voltage.

(4) Unbalance loading

AC Generator is designed to accept negative phase sequence up to 8% of its rated current and able to withstand load imbalance up to 25% on continuous basis.

(5) Temperature rise limit

The AC Generator is designed to operate at following temperature rise classification for MGS use.

MGS R Standby (ESP):	Class H Peak
MGS R Prime (PRP):	Class H
MGS R Continuous (COP):	Class F

(6) Insulation strength
The insulation of AC Generator is carefully designed and tested with High Voltage Withstand Test (Hi-Pot) to meet industrial requirement as follow.
Main Stator winding: AC 2000V
Main Rotor Winding: AC1500V

(7) Over speed
The AC Generator is designed to withstand 125% of its nominal speed for 2 minutes under no load condition.

(8) Voltage adjustment
MGS is designed to allow a typical of ±6% voltage adjustment from rated voltage via a remotely connected trimmer.

(9) Terminal box
Terminal box of AC Generator is made of large sheet steel, mounted on AC Generator to accommodate load output terminals via access cover.

6. GENERATOR CONTROL PANEL (MGS8610 MKII)

6.1 GENERAL

The MGS8610 MKII is an automatic start, load sharing and synchronising control module fitted to a well-designed panel made of metal sheet, sit on bracket with anti-vibration isolator to absorb the vibration generated from generator set.

6.2 INSTRUMENTS AND CONTROL ACCESSORIES

Following are list of instruments available on generator panel

a) Generator run indicator
b) Voltage adjuster
c) Frequency adjuster
d) Emergency stop push button
e) Key switch (STOP/RESET | ACTIVE | PANEL LOCK)
f) Manual start button
g) Manual stop/reset button
h) Transfer to generator button (manual mode only)
i) Open generator button (manual mode only)
j) Alarm mute/Lamp test button
k) Manual mode button
l) Auto mode button
m) Menu navigation buttons
n) Remote start present indicator
o) Generator ready indicator
p) Lubrication oil filter clogged indicator
q) Electrical trip indicator
r) Alarm indication on LCD (refer to section 6.3)
s) MGS Status indicator (refer to section 6.6)

t) Generator set parameters displayed on LCD
   1) Engine speed
   2) Oil pressure
   3) Coolant temperature
   4) Oil temperature †
   5) Engine hour run
   6) DC battery voltage
   7) AC voltage, phase-neutral
   8) AC voltage, phase-phase
   9) AC line current
   10) Generator frequency
   11) Generator load (kW, kVA, kVAr)
   12) Generator accumulated load (kWh, kVAh, kVArh)
   13) Generator nominal voltage
   14) Generator nominal frequency
   15) Generator phase rotation
   16) Power factor
   17) Exhaust gas temperature λ
   18) Winding temperature (U,V,W) λ
   19) Bearing temperature λ
   20) Engine crankcase internal pressure ※λ
   21) Communication
   22) Synchronisation

   ※ This value shall be displayed on terminal box adjacent to MGS8610 MKII panel.

   λ Optional item upon request for all MGS excluding continuous model where it is standard item.

   † Optional item upon request for all MGS excluding continuous model and MGS2800R, where it is standard item.

6.3 ALARM LIST

Generator set protection shall be according to following table.

Item	Value	Light Fault	Heavy Fault	Engine Stop	Indication
Battery over voltage	31.2V	O	-	-	O
Battery under voltage	18V	O	-	-	O
Bearing temperature high [8]	80°C	O	-	-	O
Charge alternator failure	19.2V	O	-	-	O
Coolant level low [8]	-	O	-	-	O
Coolant temperature high, Warning	95°C	O	-	-	O
Coolant temperature high, Shutdown	101°C	-	O	O	O
Electrical trip [3]	-	-	O	O	O
Emergency stop	-	-	O	O	O
Engine crankcase internal pressure high [8]	1.5kPa	-	O	O	O
Engine over speed, Warning	110%	O	-	-	O
Engine over speed, Shutdown	115% [4]	-	O	O	O
Engine under speed, Warning	80%	O	-	-	O
Engine under speed, Shutdown	60%	-	O	O	O
Exhaust temperature high [8]	550°C	O	-	-	O
Fail to start	-	-	O	O	O
Fail to stop	30 sec	O	-	-	O
Fail to Synch, Warning	1 min	O	-	-	O
Generator over current	NOTE 7	-	O	O	O
Generator over frequency, Warning	110%	O	-	-	O
Generator over frequency, Shutdown	115% [4]	-	O	O	O
Generator under frequency, Warning	85%	O	-	-	O
Generator under frequency, Shutdown	60%	-	O	O	O
Generator over voltage, Warning	115%	O	-	-	O
Generator over voltage, Shutdown	130%	-	O	O	O
Generator under voltage, Warning	80%	O	-	-	O
Generator under voltage Shutdown	70%	-	O	O	O
Generator overload	109%	O	-	-	O
Generator low load	30% (1h)	O	-	-	O
Generator Reverse Power	8% (10sec)	-	O	O	O
Loss of magnetic pickup signal	-	O	-	-	O
L.O filter clogged	0.15MPa	O	-	-	O
Mag. pickup open circuit	-	O	-	-	O
MSC Link Failure	-	O	-	-	O
Negative phase sequence	8% (1h)	O	-	-	O
Oil pressure low, Warning	400kPa [5]	O	-	-	O
Oil pressure low, Shutdown	150kPa	-	O	O	O
Oil pressure sender open circuit	-	-	O	O	O
Oil temperature high, Warning [6,8]	105°C	O	-	-	O
Oil temperature high, Shutdown [6,8]	110°C	-	O	O	O
Winding temperature high (U,V,W) [8]	NOTE 7	O	-	-	O

NOTE:

1. “O” marks are applicable items.
2. “-“ marks are not applicable items.
3. Engine will stops after cooling down in the event of electrical trip.
4. This value is 112% for MGS2800R
5. This value is 350kPa for MGS1100R (60Hz).
6. This item is standard for MGS2800R
7. Refer to table below for respective alarm trip setting value

Items	Standby (ESP)	Prime (PRP)	Continuous (COP)
Generator over current	102%	112%	100%
Winding temperature	170°C	120°C	120°C

8. This item is optional, installed upon request for all MGS except for Continuous model where it is standard items.

6.4 AUXILIARY INPUT SIGNALS

Following are inputs to control panel catered to fulfil customer's basic need.

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

6.5 AUXILIARY OUTPUT SIGNALS

Following are outputs (DC 24V) from control panel available for customer.

1. CB open command (pulse)
2. CB close command (pulse)
3. Common shutdown
4. Common warning
5. kW overload
6. System in auto mode
7. Low speed detection
8. Audible alarm (only when audible alarm is installed)
9. Common electrical trip *
10. Energize to stop *
11. Fail to start alarm *
12. Common alarm *
13. Fail to start alarm *
14. Over speed shutdown *
15. Emergency stop *
16. Oil pressure low shutdown *
17. Coolant temperature high shutdown *

* require optional 2157 expansion relay unit

6.6 MGS STATUS INDICATOR

Following status will be indicated on LCD reflecting MGS status

1. Generator at rest
2. Generator available
3. On load
4. Generator stopping
5. Cooling down
6. Generator stopped
7. Generator lock out

6.7 OPERATION

MGS8610MKII generator control panel is pre-installed with a 3 position key switch. Description of each position is as follow.

- STOP/RESET:
  Engine in stop mode and MGS8610 MKII controller is reset.
- ACTIVE:
  All buttons on MGS8610 MKII is available for operator to control
- PANEL LOCK:
  Function of all buttons are disabled except for navigation buttons.

Start or stop of MGS operation may be performed by operator from control panel in MANUAL MODE. Alternatively, it could be performed remotely by system via remote start/stop signal in AUTO MODE. Should fault condition occur, MGS8610 MKII control panel will stop the MGS automatically.

7. REQUIREMENT FOR FUEL OIL, COOLANT AND LUBRICANT OIL

7.1 FUEL SYSTEM

Fuel to meet the fuel specifications. Refer to Operation & Maintenance manual.
Fuel tank and fuel pipes to be free of dirt, water or other foreign substances.

7.2 COOLING SYSTEM

Coolant to meet the coolant specifications. Refer to Operation & Maintenance manual.

7.3 LUBRICATING SYSTEM

Engine oil to meet the engine oil specifications. Refer to Operation & Maintenance manual.
Do not use CE and CF-4 lubrication oil for MITSUBISHI high-speed diesel engines.

- End of Specification -