

DESIGN CALCULATION SHEET

DOCUMENT NO. : 11001-EG-2014-05

PAGE NO. : 1 OF 5

NAME : Bio Gas Generator**MODEL NO. : EG26B****SPECIFICATION : COP 25kWe @ 380V, 60Hz
: 80dB(A) @ 1m**

※ COP : Contineous Operating Power

A	13. 04. 16	Noh G. S.	Kim H. K.	Kim B. N.	Released
REV. NO.	DATE	PREPARED BY	REVIEW BY	APPROVED BY	REMARKS

DESIGN CALCULATION SHEET

DOCUMENT NO. : 11001-EG-2014-05

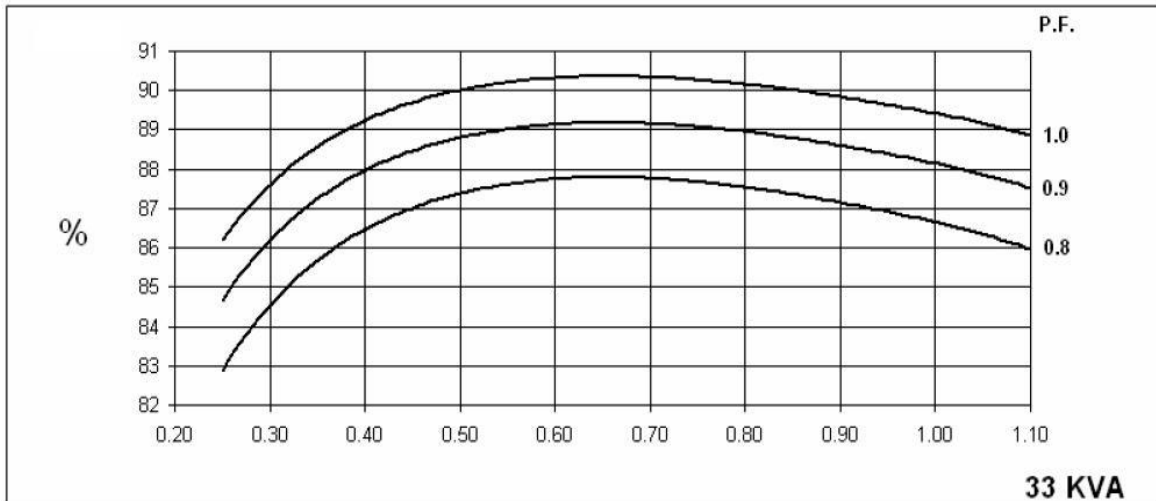
PAGE NO. : 2 OF 5

Generator

Target of Generation Power : 25kWe @ 380V, 60Hz

Generator Model	PI144G
Insulation System	Class H
Protction	IP23
Rated Power Factor	0.8
Stator Winding	Double Layer Concentric
Winding Pitch	Two Thirds
Winding Leads	12
Maximum Overspeed	2,250 rpm
Bearing Non-Drive End	Ball 6309-2RS (ISO)
Weight Comp. Generator	160 kg
WR ² Inertia	0.2196 kgm ²
Cooling Air	0.09 m ³ /sec 191 cfm
Voltage Star	380V
Rated kAV @ COP	35.3 kAV
Rated kWe @ COP	28.2 kWe
Efficiency @ 28.2kWe	86.6%
Efficiency @ 20kWe	87.4%

Three Phase Efficiency Curve (60Hz)



Rating (60Hz)

Class - Temp Rise	Cont. F - 105/40°C			Cont. H - 125/40°C			Standby - 150/40°C			Standby - 163/27°C		
Star (V)	380	400	416	380	400	416	380	400	416	380	400	416
Delta (V)	220	230	240	220	230	240	220	230	240	220	230	240
kVA	32.3	33.3	34.4	35.3	36.4	37.5	37.9	39.1	40.3	38.8	40.0	41.3
kW	25.8	26.6	27.5	28.2	29.1	30.0	30.3	31.3	32.2	31.0	32.0	33.0
Efficiency (%)	87.1	87.2	87.2	86.6	86.7	86.8	86.2	86.3	86.3	86.0	86.1	86.2
kW Input	29.7	30.6	31.6	32.6	33.6	34.6	35.2	36.2	37.4	36.1	37.2	38.3

DESIGN CALCULATION SHEET

DOCUMENT NO. : 11001-EG-2014-05

PAGE NO. : 3 OF 5

Gas Engine

Target of Engine Power : 29 kWm @ 1,800rpm

Engine Power = Generator Power / Generator Efficiency = 25 kW_e / 0.874 = 29 kWm

Engine Model / Maker	D4BB / Hyundai Motor Company
Max. Power	31kWm @ 1,800rpm
Contineous Rated Power	23kWm @ 1,800rpm (Max. Power 74%)
Engine Type	V-type 4 Cycle
	Water Cooled, Turbo charged & Intercooled (water to Air)
Combustion type	Lean Burn, Premixed and Spark Ignition
Cylinder Type	Replaceable Dry Liner
Number of Cylinders	4
Bore X Stroke	91.1 X 100 mm
Total Displacement	2,607 cc
Compression Ratio	11.5 : 1
Firing Order	1-3-4-2
Dry Weight	Approx. 200 kg
Dimension	883 X 645 X 805 mm (L X W X H)
Valve Type	Over Head Camshaft
Number of Valve	Intake 1, Exhaust 1 per Cylinder
Valve Lashes at Cold	Intake 0.25 mm , Exhaust 0.25 mm
Heat Rejection to Coolant	6.3 kcal/sec @ 1,800rpm
Water Flow	65 liter/min @ 1,800rpm

Electrical Efficiency & Fuel Consumption

Power Load Ratio	%	100%	90%	75%	50%
Electrical Power of Generator	kW _e	25	23	19	13
Engine Efficiency	%	35.0%	34.0%	31.0%	29.4%
Generator Efficiency	%	88.8%	89.0%	89.1%	88.5%
Engine Power	kW _m	28	25	21	14
Electrical Efficiency	%	31.1%	30.3%	27.6%	26.0%
Gas Fuel Consumption	Nm ³ /hr	13.5	12.5	11.4	8.0
Total Energy	kW	80	74	68	48

※ Electrical Efficiency : Engine Efficiency X Electrical Efficiency

※ Gas Fuel Consumption : Electrical Power / Electrical Efficiency / (5,136/860)

※ Bio Gas Low Heat Value : 5,136kcal/m³ (CH₄ 60%, CO₂ 40%)

DESIGN CALCULATION SHEET

DOCUMENT NO. : 11001-EG-2014-05

PAGE NO. : 4 OF 5

Cooling System

※ Conditions of the Engine Output Specifications 25kWm

Heat Rejection to Coolant 6.3 kcal/sec @ 1,800rpm

Water Flow 65 liter/min @ 1,800rpm

Capacity of Heat Rejection to Coolant (HT) : $6.3 \times 3600 / 860 = 26.4$ kW

Radiator

Model / Maker DHDR-D4BB / Daeheung Raiator

Type Pipe Expander

Tube / Fin Material Copper / Aluminium

Cap Pressure Max. 0.9 kgf/cm²

Fan Motor Quantity 1

Fan Diameter Ø440 Pusher Type

Fan Motor Spec. 0.75kW

Fan Air Flow Rate 1.48 m³/sec @ 1,800rpm

Working Fluid Ethylen Glycol 50%, Water 50%

Cooling Capacity 30 kW

Water Pump of Coolant

Pump Type Centrifugal type Driven by Crank Pulley (Belt)

Water Flow 65 liter/min @ 1,800rpm

Thermostat

Thermostat Type Wax Pellet

Thermostat Opening Temperature 76.5°C

Max. Allowable Coolant Temperature 95°C

Air Intake System

Max. Allowable Air Intake Restriction

With Clean Filter Element 150 mmAq

With Dirty Filter Element 500 mmAq

Exhaust System

Max. Allowable Exhaust Back Pressure 61 mmAq

Exhaust Gas Flow Rate 5.39 m³/min @ 1,800rpm

Exhaust Pipe Size Normally Acceptable
(Inner Diameter) MoreThan Ø48

Starting Syatem

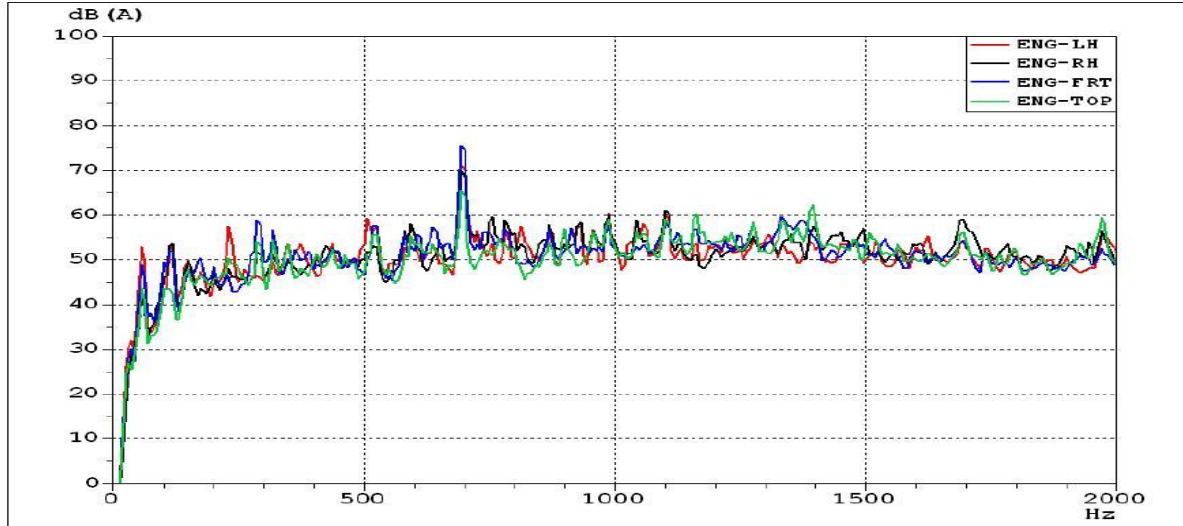
Starter capacity 12V - 2.2kW

Alternator Capacity 12V - 65A

Sound Level

Target of Sound Level : 80dB(A) @ 1m

Engine Nose Level : 82dB(A) @ 1m



Enclosure 투과 후 소음 예측

구분	1/1 Octave Band Center Frequency (Hz)						비고
	63	125	250	500	1000	2000	
주파수	63	125	250	500	1000	2000	
엔진합성음	54	50	58	59	60	60	
A 청감보정치	-26.2	-16.1	-8.6	-3.2	0	1.2	
청감보정후 예상 소음도	27.8	33.9	49.4	55.8	60	61.2	82 dB(A)
Enclosure 투과손실	-2.8	-3.2	-4	-5	-6	-7	
투과손실 후 예상 소음	25	30.7	45.4	50.8	54	54.2	75 dB(A)

거리에 따른 음압(소음)

발전기 설치 대수

1대 (3점음원)

무지향성 점음원 (반자유공간)

※ $SPL = PWL - 10\log(2r^2)$, $PWL = SPL + 10\log(2r^2)$

※ SPL : Sound Pressure Level (음압, 측정값) / ※ PWL : Sound Power Level (음향파워, 계산값)

