

# EMERGENCY DIESEL GENERATOR FOR NUCLEAR POWER PLANT & EMERGENCY AND BLACK START DIESEL GENERATOR

**HYUNDAI**  
**POWER PLANT SOLUTIONS**

Optimized, Reliable, Proven  
Solution For EDG & BSDG

# WITH NO EXCEPTION ALWAYS STANDING BY

The EDG for nuclear power plant requires high-level in its quality and stability because electric power has to be immediately supplied when the nuclear power plant is stopped due to emergency accident. This solution requires such sophisticated engineering capability to design complicated logic that HYUNDAI is the very company accommodating the needs with massive experiences.



EDG for Nuclear  
Power Plant

## Why EDG?

Emergency diesel generators are started when the NPP unit is disconnected from the grid. Emergency diesel generators safeguard the power supply to vital consumers such as the reactor cooling system so that a controlled reactor shutdown can be guaranteed.

## Who Is It For?

**Nuclear Power Plant**

## Why Are They Good?

### **1. RELIABILITY AND HIGH PERFORMANCE**

HYUNDAI has been supplying emergency diesel generators(EDGs) for nuclear power plant for more than 30 years. With EDG systems supplied to 6 nuclear power plants, we have not only gained a wealth of experience and expertise, but also gained reputation for products that deliver outstanding reliability and performance.

### **2. CUSTOMIZATION FOR EACH PROJECT**

Since every project has different requirement, HYUNDAI has developed a major NPP-based engineering with specialists capable of handling every aspects of project-specific NPP requirements and matching any customer's complicated needs.

### **3. ENSURING QUALITY STANDARD**

All EDG projects are organized and implemented in line with NPP-related quality standards such as KEPIC QAP and ASME NQA-1. Our EDGs are safety-classified to meet the strictest regulations in the nuclear power industry, with qualifications in line with IEEE 387.

## Scope of Supply

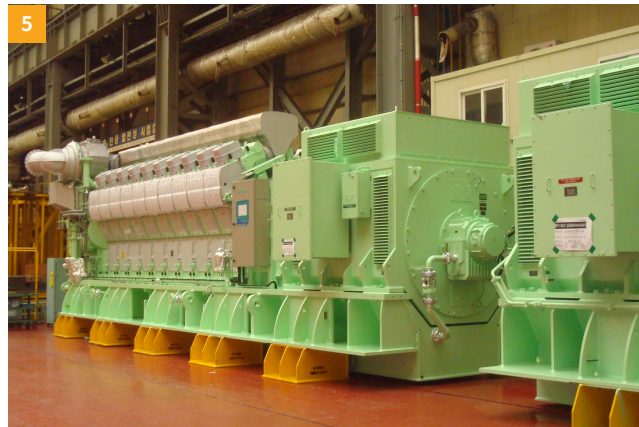
- ① Diesel Generator set
- ② Mech. Aux. equipment
- ③ Elec. Aux. equipment
- ④ I&C Aux. equipment
- ⑤ Supervision of installation & commissioning

Total Quantity of  
**47units**

Total Deliver of  
**328MW**

As of April, 2018

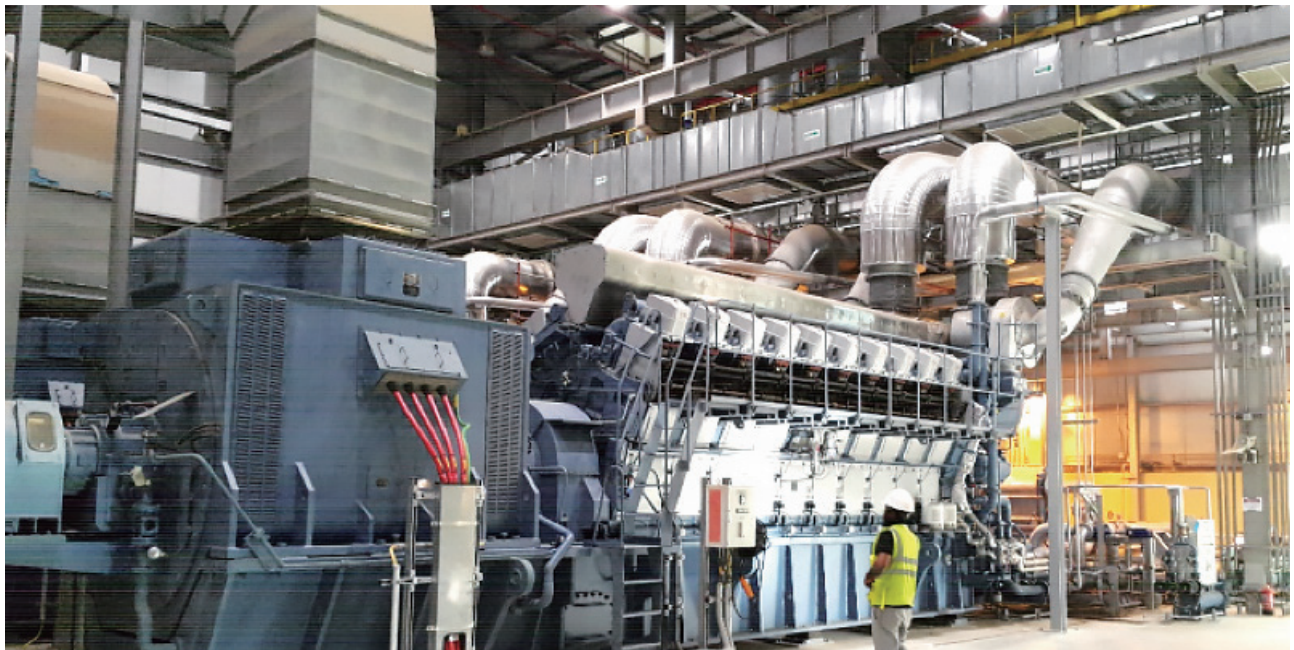
NO.	Project Name	Engine	Quantity	Country	Capacity(MW)	Year
1	60MW KKNPP (EDG)	16H32/40V	10	India	60	2019
2	30MW SKN #5,6 (EDG)	18H32/40V	4	S. Korea	30	2017
3	83.7MW UK HPC (EDG)	20H32/40V	9	UK	84	2016
4	48MW PAKISTAN K2/K3 NPP (EDG)	20H32/40V	5	Pakistan	48	2015
5	78.3MW UAE BARAKAH (EDG)	20H32/40V	9	UAE	78	2011
6	9MW KORI (EDG)	9H32/40	2	S. Korea	9	2010
7	19.2MW EMERGENCY (EDG)	12V240RVR	8	S. Korea	19	1987



Case ① EDG for Thermal Power Plant

# Jeddah South Thermal Power Plant EDG Saudi Arabia

## Customized Emergency Power Solution

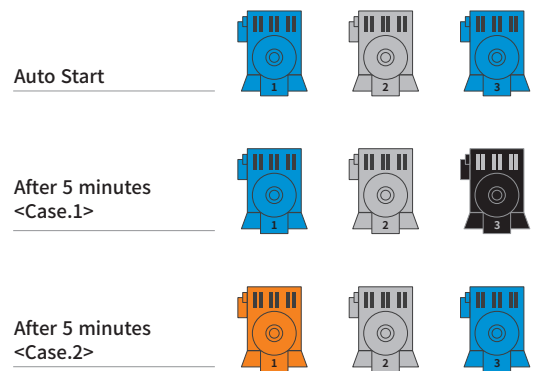


D/G room



Jeddah South Thermal Power Plant Stage-1

Total Output	26MW
Customer	Saudi Electricity Company
Operating Mode	Emergency
Gensets	20H32/40V x 3sets
Fuel	DO
Scope	Genset + Equipment supply + Engineering
Delivered	2016



### Client's special requirements we carried out

When unit #1 or #2 Steam turbine is shutdown, EDG #1(main) and #3 (stand-by) start and synchronize with parallel operation automatically.

<Case. 1> After 5 minute, If EDG #1 has no alarm, EDG #3 will stop automatically.

<Case.2> If there are any alarms in EDG #1 for 5 minutes, EDG #3 will keep running condition.

## Reference List

Total Quantity of  
**23units**

Total Deliver of  
**138.6MW**

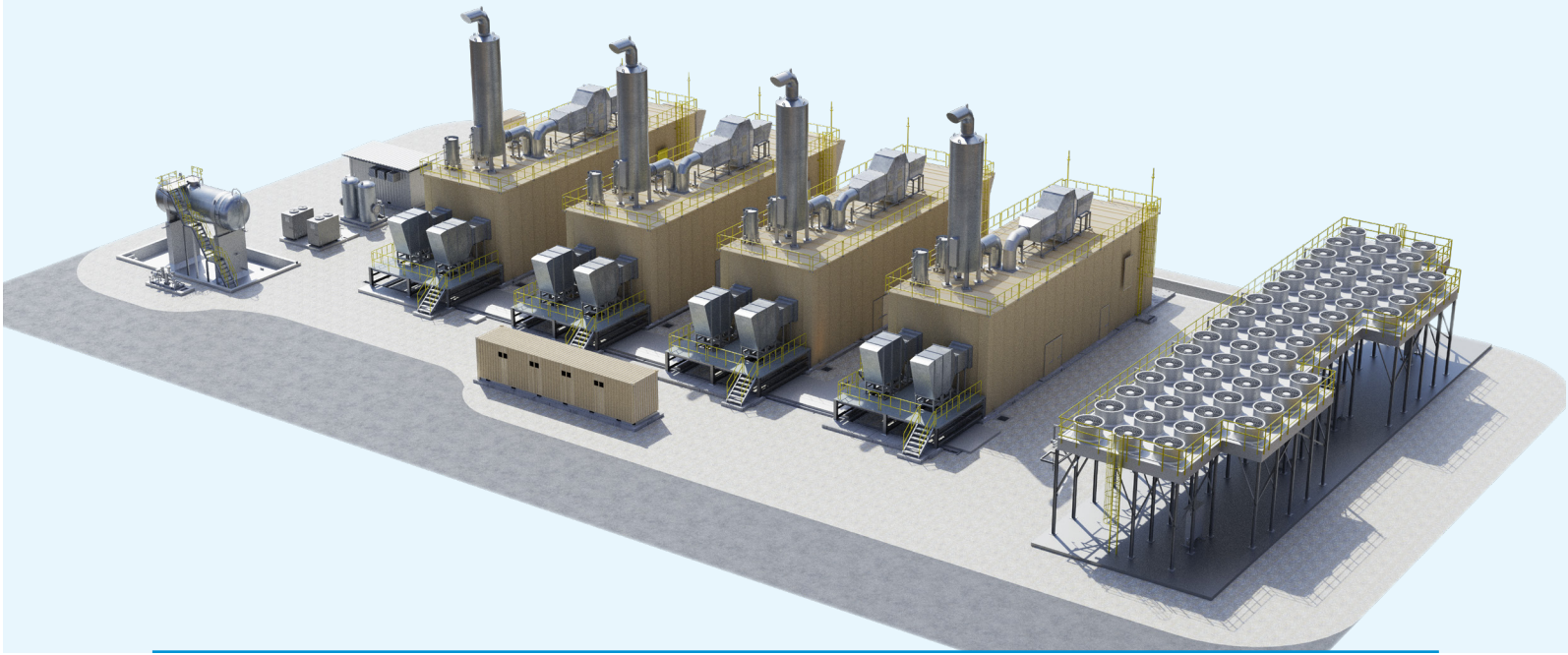
As of Dec, 2018

NO.	Project Name	Engine	Quantity	Country	Capacity(MW)	Year
1	DUBA 24MW BSE DG	18H32/40V	3	Saudi Arabia	24	2017
2	UHP 16MW BSE DG	9H32/40	4	Qatar	16	2016
3	QURAYAT III 6.3MW BSDG	16H32/40V	1	Saudi Arabia	6.3	2015
4	ARAR IV 6.3MW BSDG	16H32/40V	1	Saudi Arabia	6.3	2015
5	JEDDAH SOUTH 26MW EDG	20H32/40V	3	Saudi Arabia	26	2014
6	AZ-ZOUR North 15MW BSE DG	20H32/40V	2	Kuwait	15	2014
7	QURAYAT II 5MW EDG	12H32/40V	1	Saudi Arabia	5	2013
8	WADJH 5MW EDG	12H32/40V	1	Saudi Arabia	5	2013
9	SHAROORAH 4MW EDG	12H32/40V	1	Saudi Arabia	4	2012
10	AZZOUR WDC II 12MW EDG	14H32/40V	2	Kuwait	12	2012
11	RAFHA 5MW EDG	12H32/40V	1	Saudi Arabia	5	2012
12	HAIL 4MW EDG	12H32/40V	1	Saudi Arabia	4	2012
13	HYOSUNG 10MW EDG	14H32/40V	2	Iran	10	2011

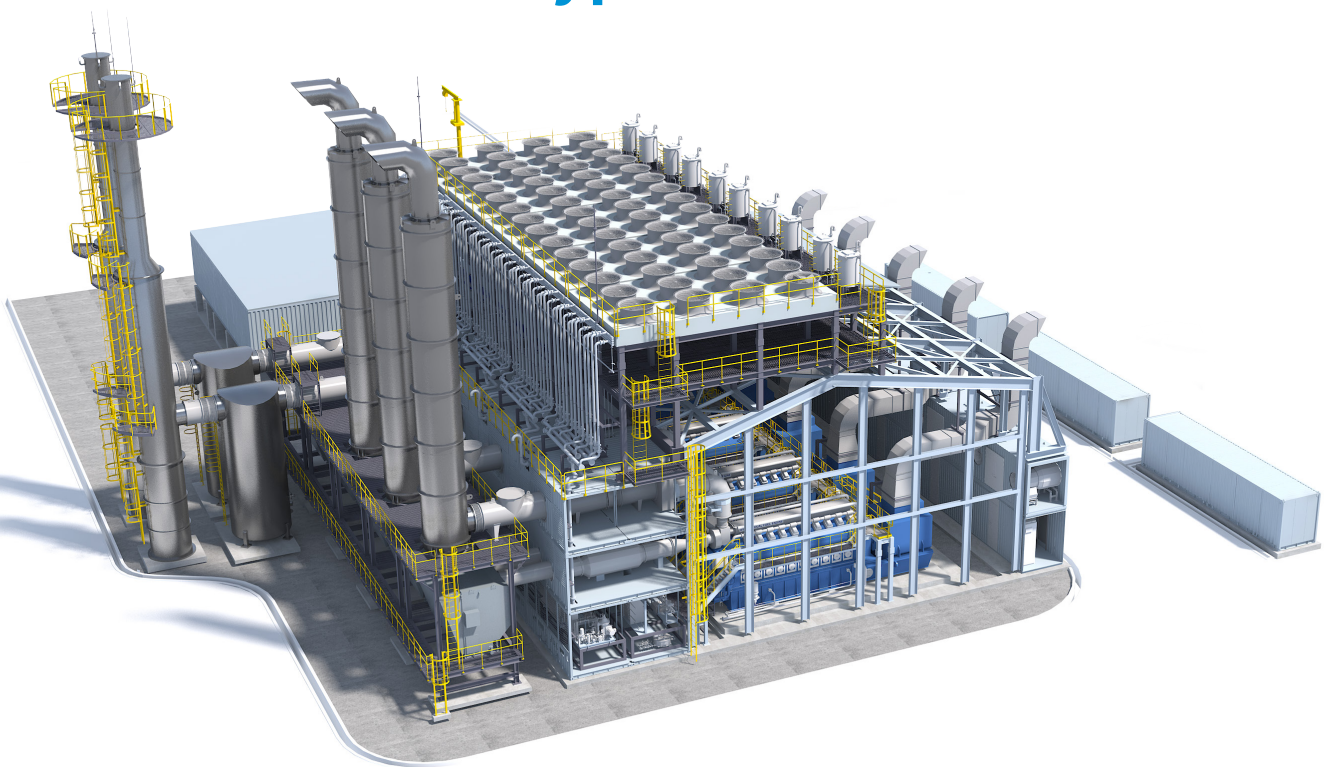


# MODULAR POWER PLANT

## Enclosure Type Power Plant



## Containerized Type Power Plant



# MODULAR DESIGN

‘FASTER, EASIER, AND EVEN BETTER.’

Compared with traditional design, HYUNDAI's prefabricated modules shorten and simplify the procurement and installation process, even with lower price.

## TIME SAVING

Enable to reduce 5 to 6 months of time in planning and construction.

### Planning



• For 10(Ten) 20H35DF Engines

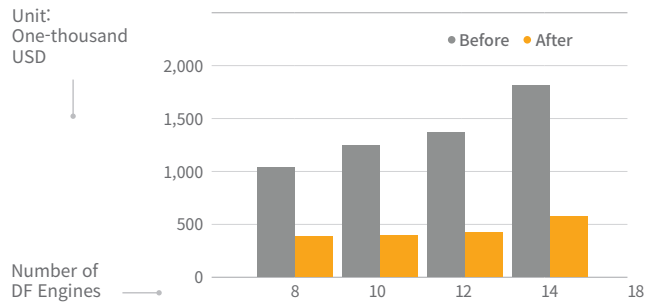
### Construction



• For Engines Inside DG Building + Aux.Equipment + Piping

## COST SAVING

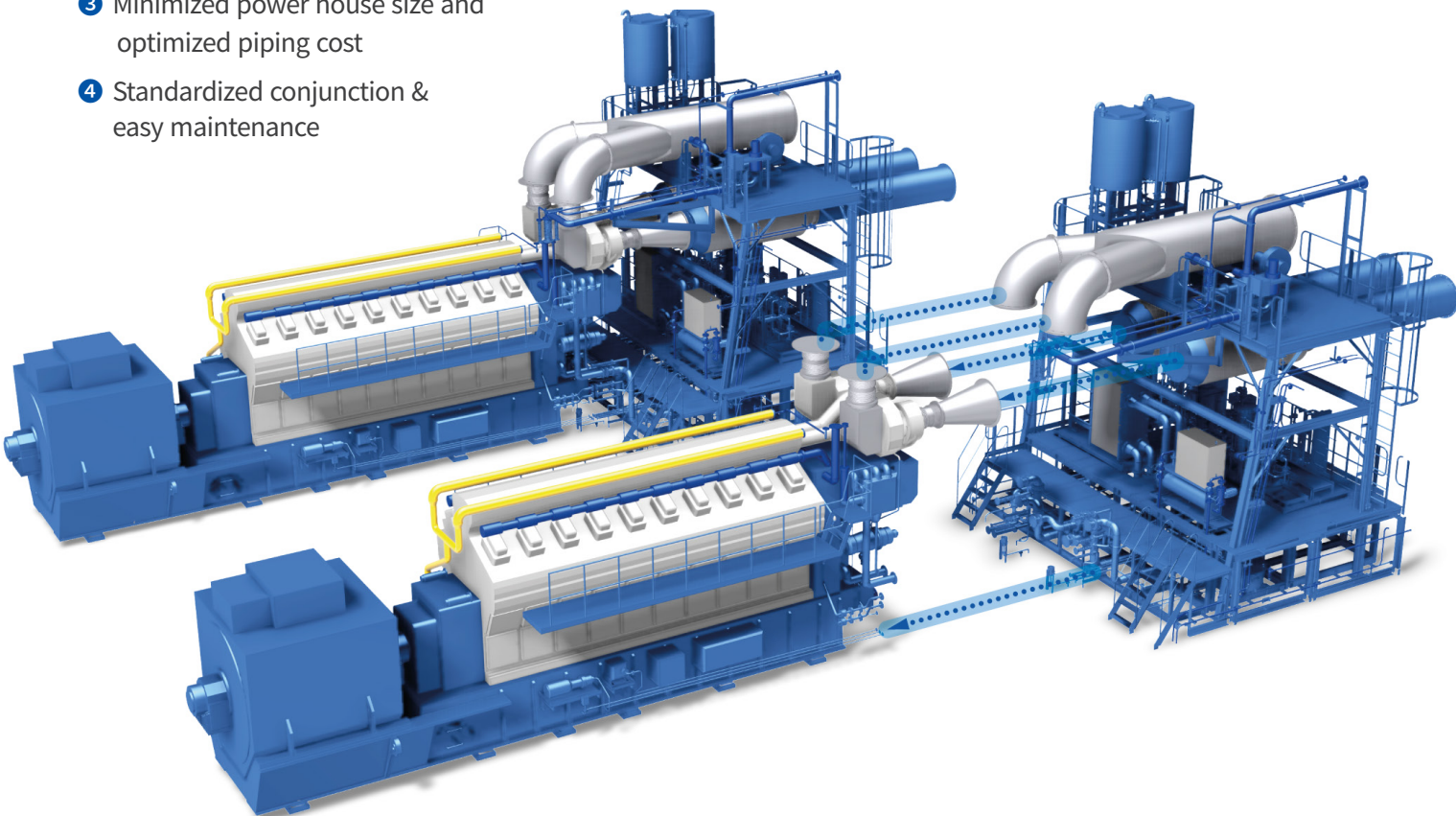
Unit:  
One-thousand  
USD



\* The estimated numbers are for cases where there are IPP/EPC contracts (DF Engine), and it may differ among countries.

## HiMSEN Aux. Module(HAM)

- 1 Faster and simple construction on site
- 2 Consistent control
- 3 Minimized power house size and optimized piping cost
- 4 Standardized conjunction & easy maintenance





# HIMSEN ENGINE LINE-UP FOR STATIONARY GENSETS

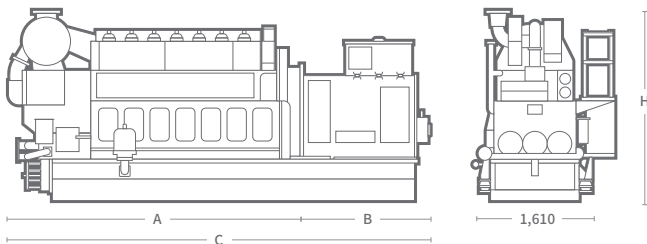
‘HiMSEN’<sup>®</sup> is the registered brand name of HYUNDAI’s own design engine and the abbreviation of ‘Hi-touch Marine & Stationary ENGINE’.



ENGINES

## Liquid Fuel

### H21/32 Bore: 210mm Stroke: 320mm



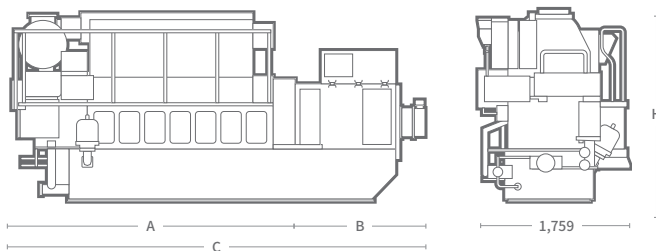
#### Main Data

Speed	900rpm		1,000rpm		Dimension(mm)				Dry Mass(ton)	
	60Hz		50Hz		A	B	C	H	Engine	GenSet
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)						
6H21/32	1,200	1,128	1,200	1,128	3,781	2,180	5,961	2,781	15.1	25.1
8H21/32	1,600	1,512	1,600	1,512	4,453	2,345	6,798	2,911	18.4	29.9
9H21/32	1,800	1,710	1,800	1,710	4,783	2,423	7,206	2,911	19.8	31.9

Based on alternator efficiency of 94~95%.

#### Dimensions

### H21C Bore: 210mm Stroke: 330mm



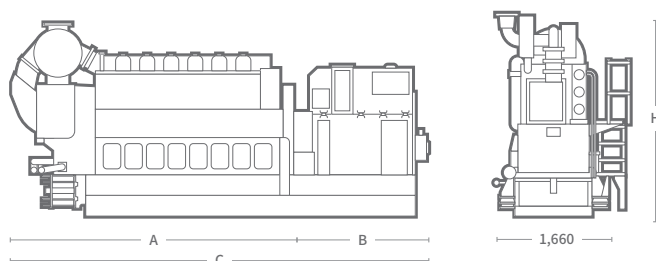
#### Main Data

Speed	900rpm		1,000rpm		Dimension(mm)				Dry Mass(ton)	
	60Hz		50Hz		A	B	C	H	Engine	GenSet
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)						
5H21C	1,200	1,128	1,200	1,128	3,735	2,249	5,984	2,600	14.3	22.1
6H21C	1,440	1,353	1,440	1,353	4,085	2,249	6,334	2,600	16.0	24.9
7H21C	1,680	1,587	1,680	1,587	4,435	2,305	6,740	2,600	17.8	28.3
8H21C	1,920	1,824	1,920	1,824	4,785	2,305	7,090	2,653	19.4	30.2
9H21C	2,160	2,052	2,160	2,052	5,135	2,450	7,585	2,653	21.0	33.6

Based on alternator efficiency of 94~95%.

#### Dimensions

### H25/33 Bore: 250mm Stroke: 330mm



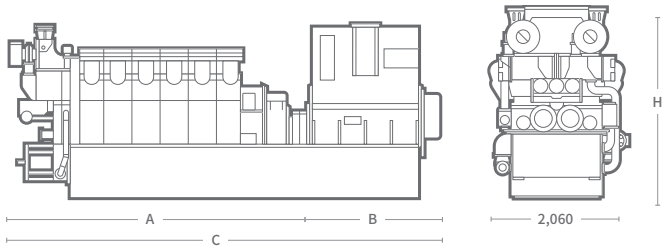
#### Main Data

Speed	900 rpm		1000 rpm		Dimension(mm)				Dry Mass(ton)	
	60 Hz		50 Hz		A	B	C	H	Engine	GenSet
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)						
6H25/33	1,740	1,653	1,800	1,710	4,414	2,262	6,676	2,961	20.2	30.2
7H25/33	2,030	1,928	2,100	1,995	4,797	2,262	7,059	3,241	22.5	32.7
8H25/33	2,320	2,215	2,400	2,292	5,311	2,340	7,651	3,371	24.1	34.9
9H25/33	2,610	2,505	2,700	2,592	5,691	2,490	8,181	3,371	26.2	37.2

Based on alternator efficiency of 95~96%.

#### Dimensions

## H25/33V Bore: 250mm Stroke: 330mm



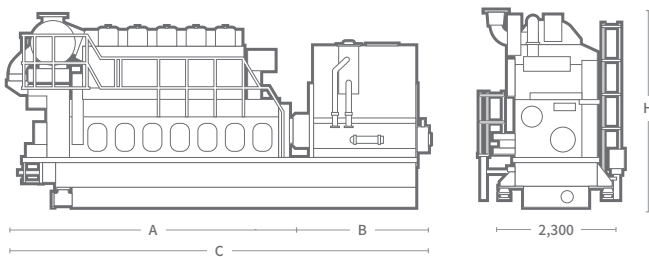
### Main Data

### Dimensions

Speed	900rpm		1000rpm		Dimension(mm)				Dry Mass(ton)	
	60Hz		50Hz		A	B	C	H	Engine	GenSet
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)						
12H25/33V	3,840	3,696	3,840	3,696	5,524	3,334	8,858	3,750	33.5	58.2
14H25/33V	4,480	4,300	4,480	4,300	5,944	3,504	9,448	3,750	36.5	63.4
16H25/33V	5,120	4,915	5,120	4,915	6,364	3,682	10,046	3,750	39.5	69.6
18H25/33V	5,760	5,558	5,760	5,558	6,784	3,772	10,556	3,750	42.5	77.5
20H25/33V	6,400	6,208	6,400	6,208	7,204	3,727	10,931	3,750	45.5	79.5

Based on alternator efficiency of 96-97%.

## H32/40 Bore: 320mm Stroke: 400mm



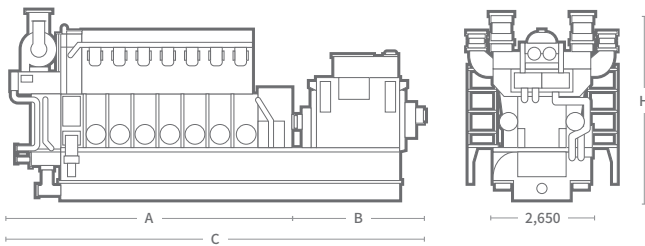
### Main Data

### Dimensions

Speed	720 rpm		750 rpm		Dimension(mm)				Dry Mass(ton)	
	60 Hz		50 Hz		A	B	C	H	Engine	GenSet
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)						
6H32/40	2,850	2,736	2,850	2,736	5,760	3,130	8,890	3,959	33.7	68.6
7H32/40	3,325	3,192	3,325	3,192	6,112	3,374	9,486	4,130	38.6	77.1
8H32/40	3,800	3,648	3,800	3,648	6,602	3,594	10,196	4,130	41.5	82.0
9H32/40	4,275	4,104	4,275	4,104	7,092	4,097	11,189	4,130	44.6	89.1

Based on alternator efficiency of 96%.

## H32/40V Bore: 320mm Stroke: 400mm



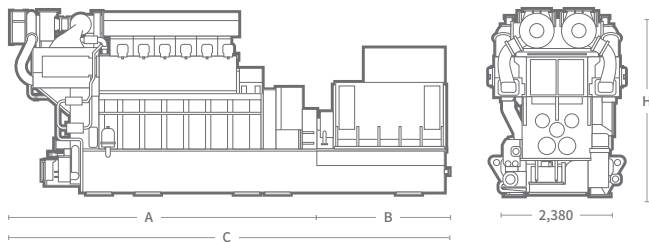
### Main Data

### Dimensions

Speed	720rpm		750rpm		Dimension(mm)				Dry Mass(ton)	
	60Hz		50Hz		A	B	C	H	Engine	GenSet
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)						
12H32/40V	5,700	5,500	5,700	5,500	6,624	3,760	10,384	4,723	56.0	108.8
14H32/40V	6,560	6,450	6,560	6,450	7,295	3,860	11,155	4,723	63.3	121.3
16H32/40V	7,600	7,372	7,600	7,372	7,914	3,479	11,393	4,723	69.1	130.9
18H32/40V	8,550	8,293	8,550	8,293	8,585	3,859	12,444	4,794	76.3	141.2
20H32/40V	9,500	9,262	9,500	9,262	9,344	3,659	13,003	4,794	84.0	153.9

Based on alternator efficiency of 96.5%.

## H32CV Bore: 320mm Stroke: 450mm



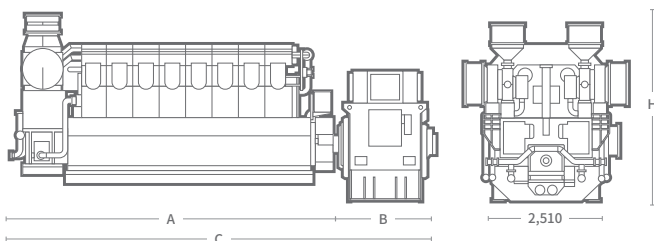
### Main Data

### Dimensions

Speed	720rpm		750rpm		Dimension(mm)				Dry Mass(ton)	
	60Hz		50Hz		A	B	C	H	Engine	GenSet
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)						
12H32CV	7,200	6,948	7,200	6,948	7,526	3,900	11,426	4,362	78.0	121.2
14H32CV	8,400	8,106	8,400	8,106	8,126	4,100	12,226	4,362	88.0	137.9
16H32CV	9,600	9,264	9,600	9,264	8,726	4,300	13,026	4,448	96.0	152.6
18H32CV	10,800	10,422	10,800	10,422	9,326	4,500	13,826	4,448	106.0	169.3

Based on alternator efficiency of 96.5%.

## H46/60V Bore: 460mm Stroke: 600mm



### Main Data

### Dimensions

Speed	600rpm		600rpm		Dimension(mm)				Dry Mass (ton)	
	60Hz		50Hz		A	B	C	H	Engine	GenSet
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)						
12H46/60V	14,400	14,040	14,400	14,040	10,410	3,627	14,037	4,975	205.3	256.4
16H46/60V	19,200	18,720	19,200	18,720	12,410	3,724	16,134	4,975	227.8	286.6
18H46/60V	21,610	21,060	21,600	21,060	13,410	3,625	17,035	5,288	239.0	313

Based on alternator efficiency of 97.5%.

- 1) Depending on alternator.
  - 2) Without common base frame.
  - 3) With common base frame & alternator (Maker: HHI-EES).
- Note) All dimensions and weight are approximate value and subject to change without prior notice.