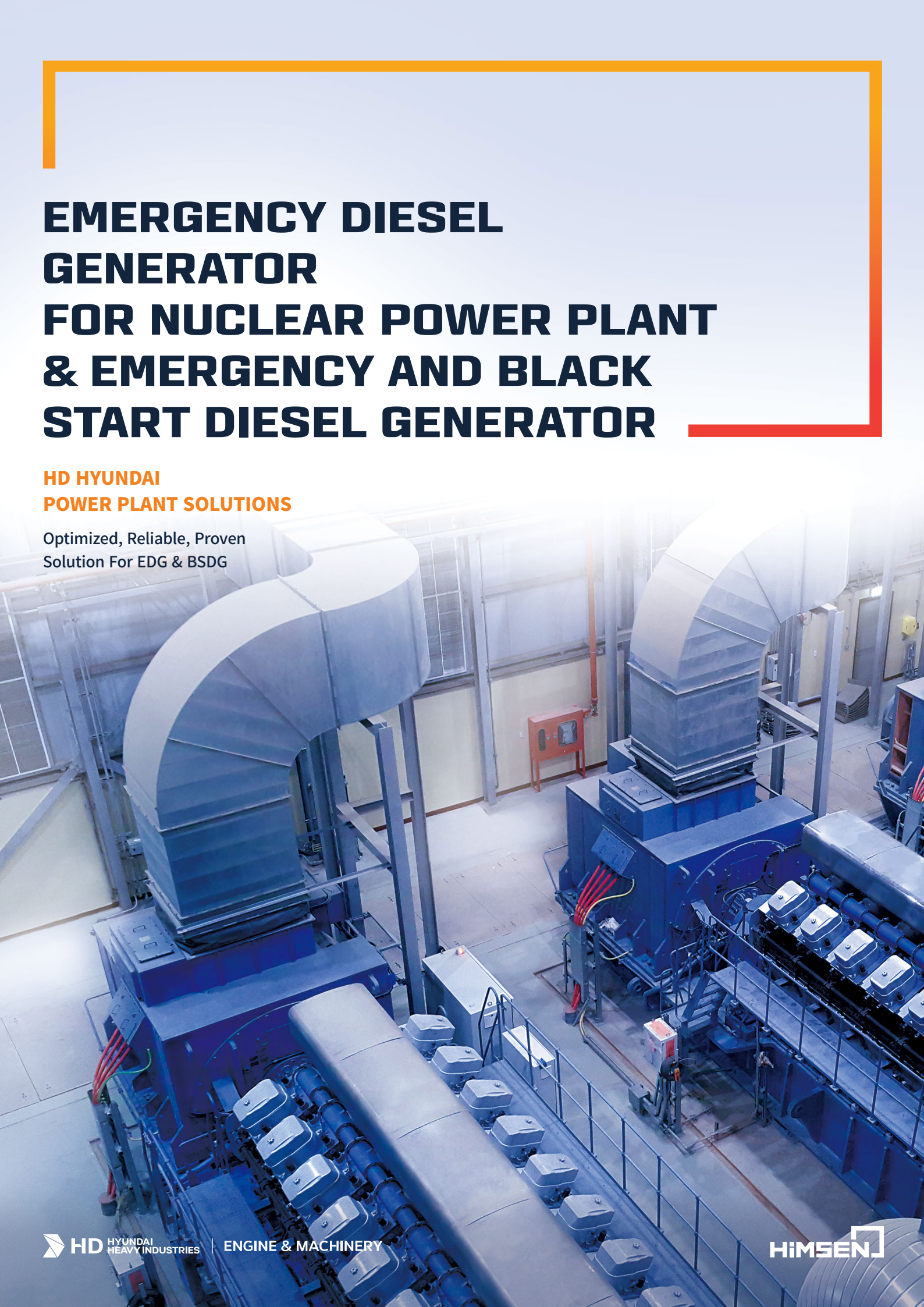
EMERGENCY DIESEL GENERATOR FOR NUCLEAR POWER PLANT & EMERGENCY AND BLACK START DIESEL GENERATOR

HD HYUNDAI
POWER PLANT SOLUTIONS

Optimized, Reliable, Proven
Solution For EDG & BSDG



HD HYUNDAI HEAVY INDUSTRIES | ENGINE & MACHINERY

HiMSEN

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 HD HYUNDAI is the very company accommodating the needs with massive experiences.

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

HD 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, HD 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**

Case ①

BARAKAH NPP EDG **U.A.E**

Proven Technology for Complex Nuclear Power Plant

Total Output	78.3MW
Customer	ENEC
Operating Mode	Emergency
Gensets	20H32/40V × 9sets
Fuel	Diesel Oil
Scope	Genset + Equipment
Delivered	2017

Engine Shipment(1)

Engine Shipment(2)

On November 2011, HD HYUNDAI received an order to supply total nine(9) sets of Emergency Diesel Generators and AC Diesel Generator(Engine model : 20H32/40V) from Korea Electric Power Corporation(KEPCO).

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 HD HYUNDAI is the very company accommodating the needs with massive experiences.

Total Quantity of **47units**

Total Deliver of **329MW**

As of June, 2022

NO.	Project Name	Engine	Quantity	Country	Capacity(MW)	Year
1	63MW KKNPP #3.4	16H32/40V	10	India	63	2019
2	30MW SKN #5,6	18H32/40V	4	S. Korea	30	2017
3	83.7MW UK HPC	20H32/40V	9	UK	84	2016
4	48MW PAKISTAN K2/K3 NPP	20H32/40V	5	Pakistan	48	2015
5	78.3MW UAE BARAKAH	20H32/40V	9	UAE	78	2011
6	7MW KORI	9H32/40	2	S. Korea	7	2010
7	19.2MW EMERGENCY	12V240RVR	8	S. Korea	19	1987

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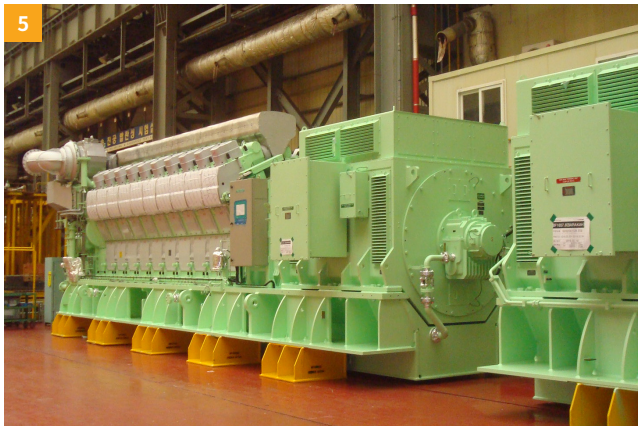

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Emergency & Black Start
Diesel Generator

OPTIMIZED, RELIABLE, PROVEN SOLUTION FOR EDG & BSDG

HD HYUNDAI engine is designed to provide backup power generation for unexpected incidents. This solution requires sophisticated engineering and the ability to model complicated logic, which HD HYUNDAI is very capable of.

Why EDG?

In loss of all internal and external power source, the emergency diesel generators supplies emergency power for safe shutdown and maintain hot standby conditions for quick restarting of main power resources. For safe shutdown, EDG supply power for essential auxiliary equipment.

Why BSDG?

If all of the station's own generators are shut down, station service power should be provided from the grid. However, in the absence of grid power, black start needs to be performed to start immediately at any time.

Who Is It For?

Where emergency power is required such as Combined Cycle Power Plant and other Factories.

Why Are They Good?

1. PROVEN SOLUTION AND HIGH PERFORMANCE

HD HYUNDAI has been supplying EDG & BSDG for more than 130MW in total. We have not only gained a wealth of experience and expertise, but also gained reputation for products that deliver outstanding reliability and performance.

2. OPTIMIZED, RELIABLE, SOLUTION

HD HYUNDAI offers optimized and reliable solution that will meet your requirements no matter what steam turbine, gas turbine manufacturer, size or system(single steam turbine, gas turbine or with cogeneration).
HD HYUNDAI offers a complete turnkey and customized solution based on a modular design and the highest quality standards in the industry.

3. OPTIMIZED LOGIC FOR EACH CUSTOMER

Every project has different requirements. With HD HYUNDAI's highly experienced engineers, we are capable of matching any customer's complicated needs and analyze the site condition for more suitable solutions.

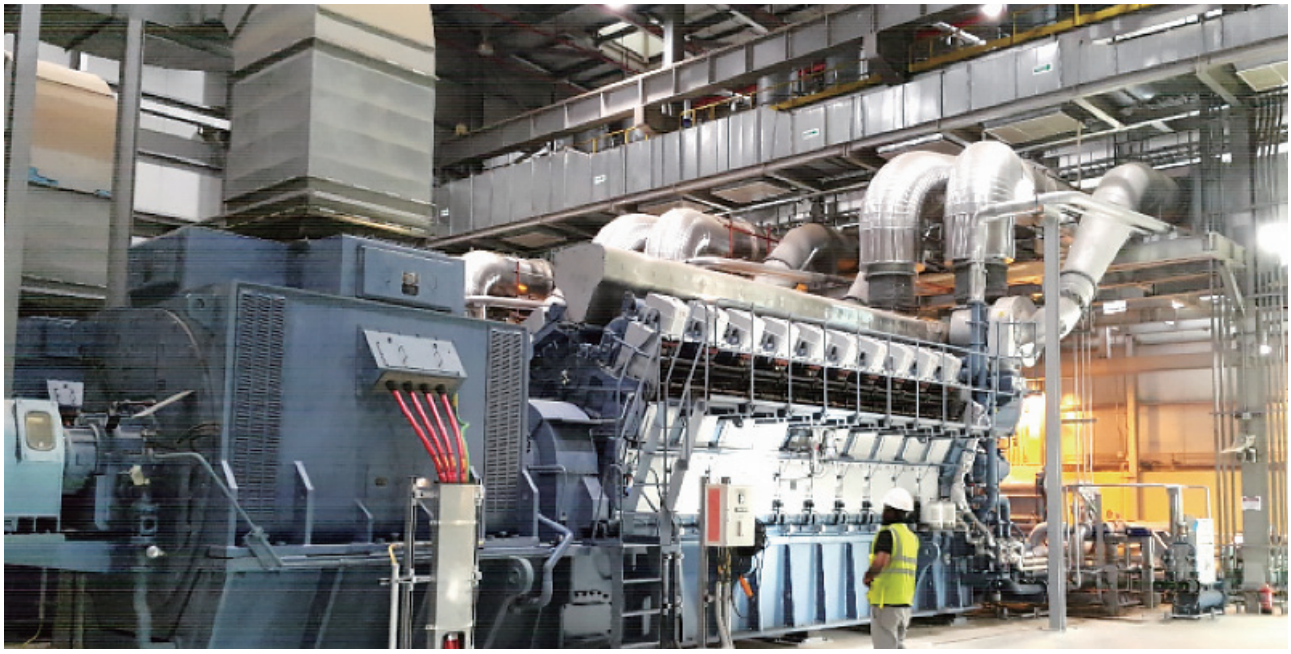
Scope of Supply

1. **Diesel Generator set**
2. **Mech. Aux. equipment**
3. **Elec. Aux. equipment**
4. **I&C Aux. equipment**
5. **Basic & Detail Engineering**
6. **Construction**
7. **Supervision of installation & commissioning**

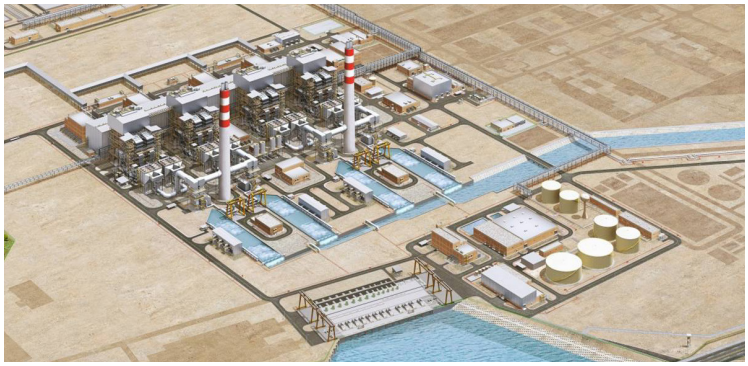
Case ① EDG for Thermal Power Plant

Jeddah South Thermal Power Plant EDG **Saudi Arabia**

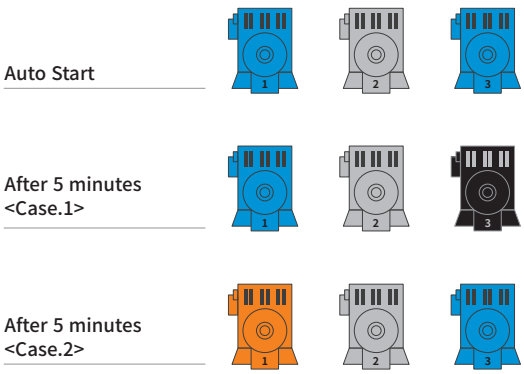
Customized Emergency Power Solution



D/G room



Jeddah South Thermal Power Plant Stage-I



Total Output	26MW
Customer	Saudi Electricity Company
Operating Mode	Emergency
Gensets	20H32/40V x 3sets
Fuel	Diesel Oil
Scope	Genset + Equipment + 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**

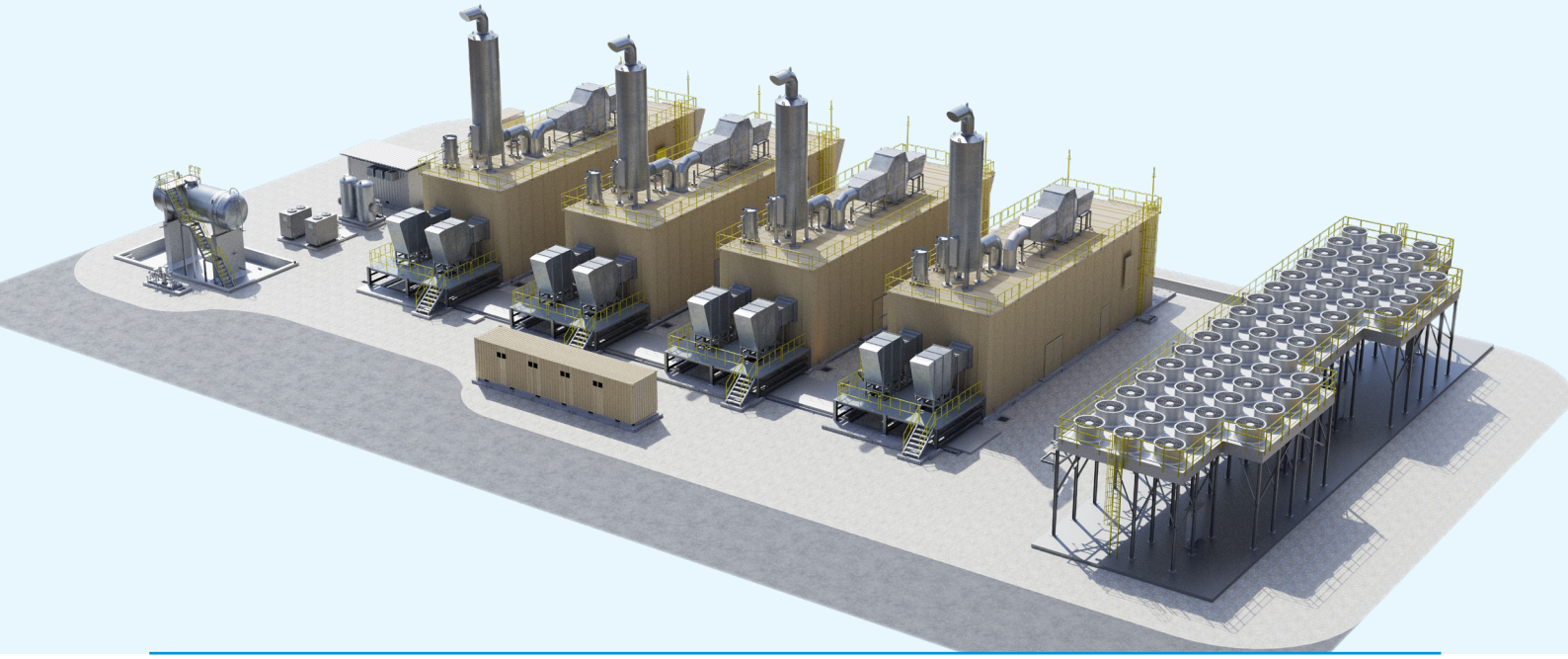
Total Deliver of **138.6MW**

As of June, 2022

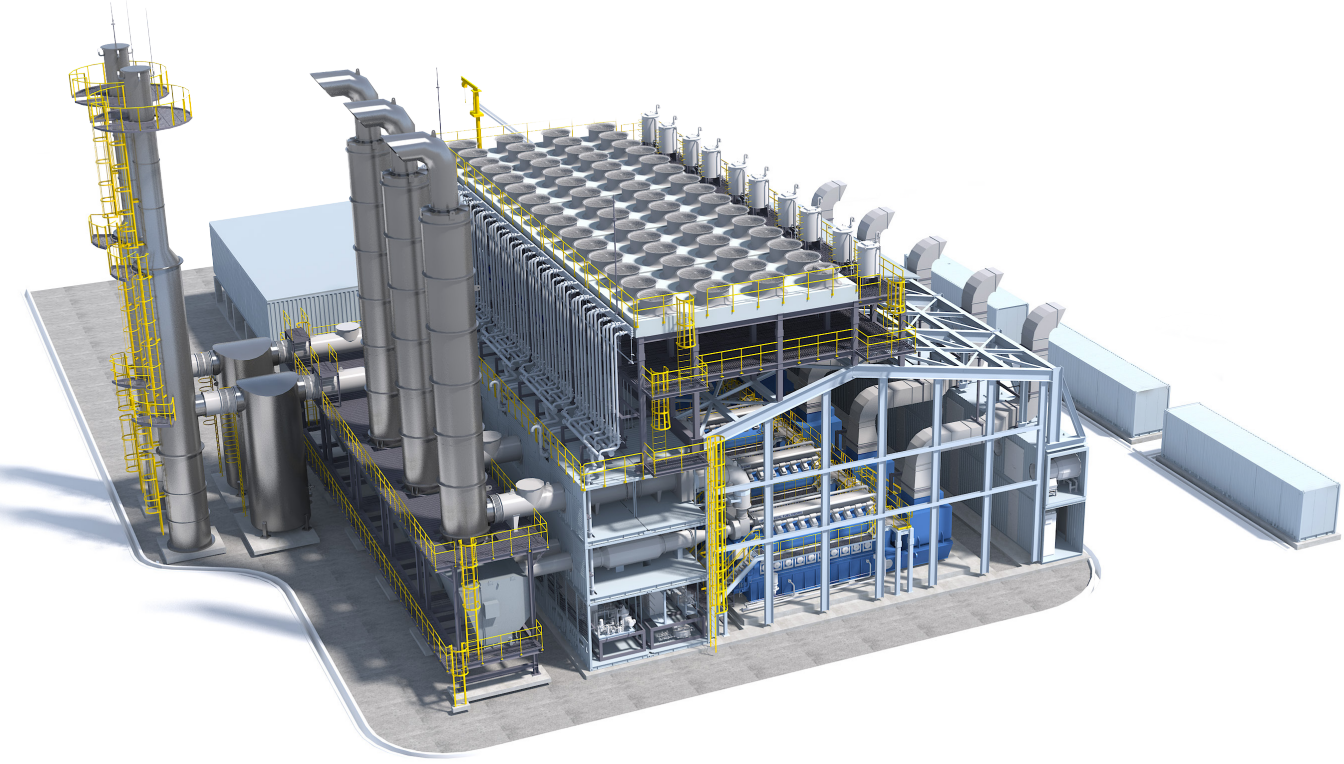
NO.	Project Name	Engine	Quantity	Country	Capacity(MW)	Year
1	DUBA 24MW BSEDG	18H32/40V	3	Saudi Arabia	24	2017
2	UHP 16MW BSEDG	9H32/40	4	Qatar	16	2016
3	QURAYAT III 6.3MW BSDG	16H32/40V	1	Saudi Arabia	6.3	2015
4	ARAR IV 6.3MW BSDG	16H32/40V	1	Saudi Arabia	6.3	2015
5	JEDDAH SOUTH 26MW EDG	20H32/40V	3	Saudi Arabia	26	2014
6	AZ-ZOUR North 15MW BSEDG	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	SHAROURAH 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, HD 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

-3 months

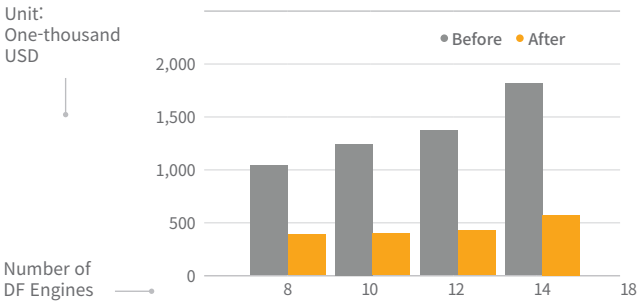
- For 10(Ten) 20H35DF Engines

Construction

-2 months

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

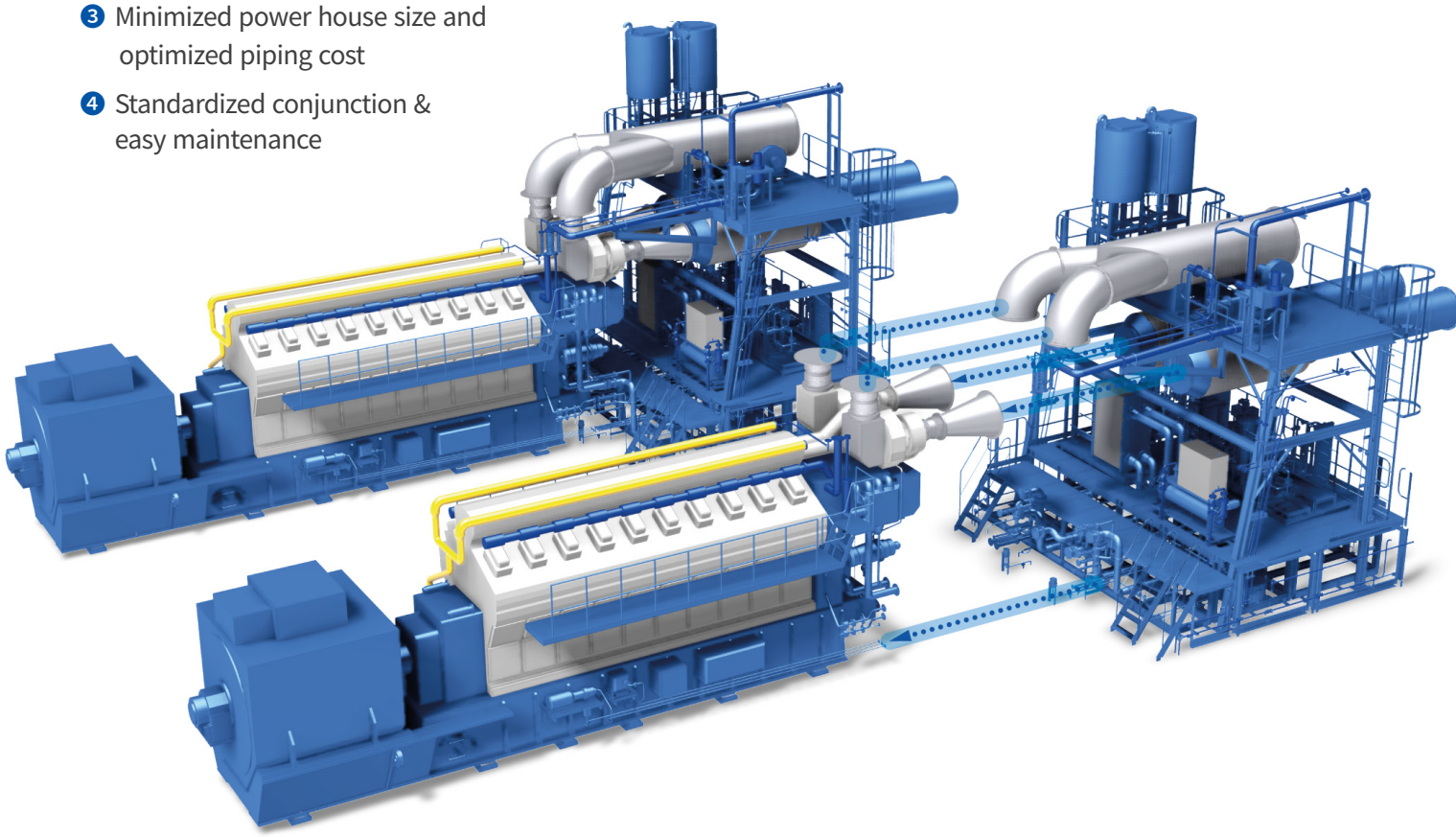
COST SAVING



* 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

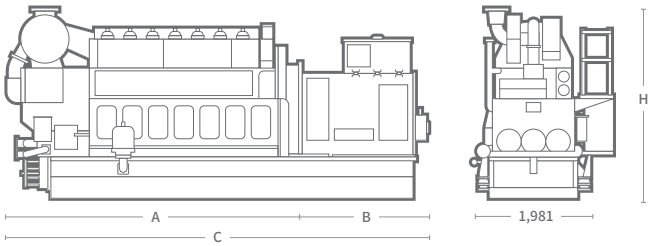


HIMSEN ENGINE LINE-UP FOR STATIONARY GENSETS

'HiMSEN'® is the registered brand name of HD HYUNDAI's own design engine and the abbreviation of 'Hi-touch Marine & Stationary ENgine'.

Liquid Fuel

H21/32 Bore: 210mm Stroke: 320mm

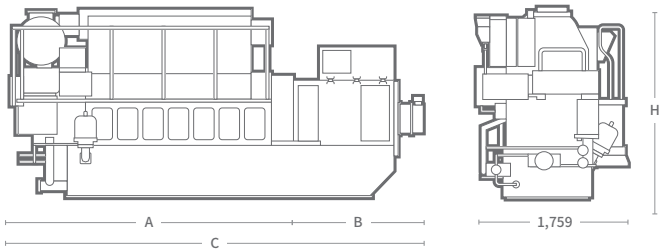


Main Data

Speed	900rpm		1,000rpm		Dimension(mm)				Dry Mass(ton)	
Frequency	60Hz		50Hz							
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)	A	B	C	H	Engine	GenSet
6H21/32	1,200	1,128	1,200	1,128	3,781	1,896	5,677	2,781	13.4	26.1
7H21/32	1,400	1,323	1,400	1,323	4,235	1,900	6,135	2,781	15.1	28.6
8H21/32	1,600	1,512	1,600	1,512	4,453	2,175	6,628	2,911	16.7	29.1
9H21/32	1,800	1,710	1,800	1,710	4,783	2,265	7,048	2,911	18.4	31.7

Based on alternator efficiency of 94~95%.

H21C Bore: 210mm Stroke: 330mm

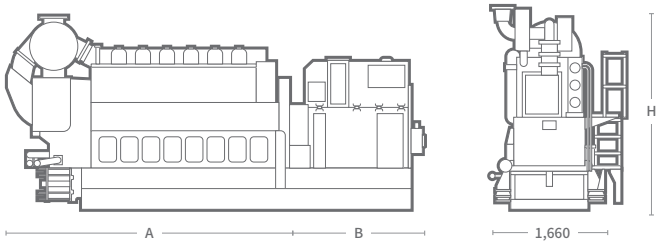


Main Data

Speed	900rpm		1,000rpm		Dimension(mm)				Dry Mass(ton)	
Frequency	60Hz		50Hz							
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)	A	B	C	H	Engine	GenSet
5H21C	1,200	1,128	1,200	1,128	3,735	2,249	5,984	2,600	14.3	22.1
6H21C	1,440	1,360	1,440	1,360	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	2,062	2,160	2,062	5,135	2,450	7,585	2,653	21.0	33.6

Based on alternator efficiency of 94~95.5%.

H25/33 Bore: 250mm Stroke: 330mm

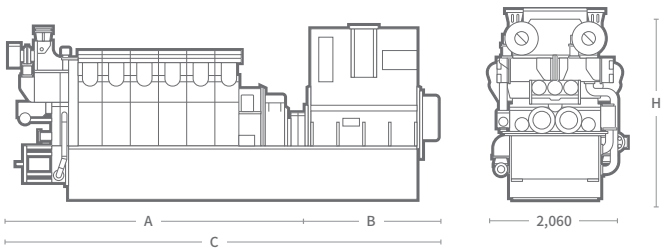


Main Data

Speed	900 rpm		1,000rpm		Dimension(mm)				Dry Mass(ton)	
Frequency	60 Hz		50Hz							
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)	A	B	C	H	Engine	GenSet
6H25/33	1,740	1,661	1,800	1,719	4,414	2,262	6,676	2,961	20.2	29.8
7H25/33	2,030	1,938	2,100	2,005	4,794	2,262	7,056	3,241	22.5	33.9
8H25/33	2,320	2,215	2,400	2,292	5,311	2,340	7,651	3,371	24.1	39.5
9H25/33	2,610	2,505	2,700	2,592	5,691	2,490	8,181	3,371	26.2	45.0

Based on alternator efficiency of 95.5~96%.

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

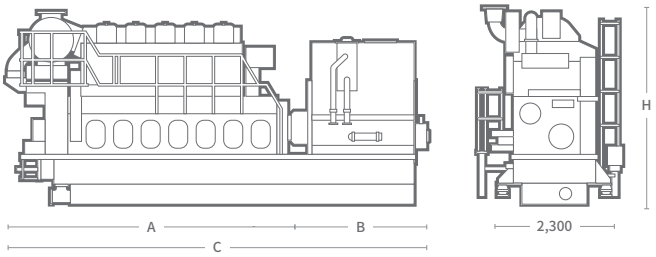


Main Data

Speed	900rpm		1,000rpm		Dimension(mm)				Dry Mass(ton)	
Frequency	60Hz		50Hz							
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)	A	B	C	H	Engine	GenSet
12H25/33V	3,840	3,705	3,840	3,705	5,524	3,334	8,858	3,750	33.5	58.2
14H25/33V	4,480	4,323	4,480	4,323	5,944	3,504	9,448	3,750	36.5	63.4
16H25/33V	5,120	4,940	5,120	4,940	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 96.5~97%.

H32/40 Bore: 320mm Stroke: 400mm

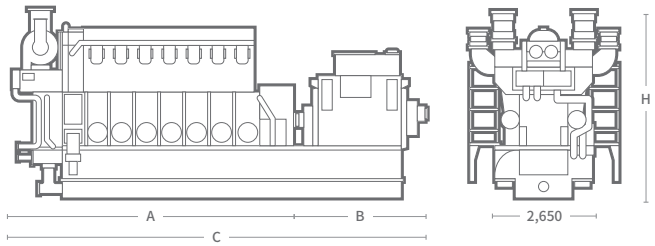


Main Data

Speed	720rpm		750rpm		Dimension(mm)				Dry Mass(ton)	
Frequency	60Hz		50Hz							
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)	A	B	C	H	Engine	GenSet
6H32/40	3,000	2,880	3,000	2,880	5,055	3,490	8,545	3,759	33.7	65.2
7H32/40	3,500	3,360	3,500	3,360	5,545	3,490	9,035	3,882	38.6	72.6
8H32/40	4,000	3,860	4,000	3,860	6,035	3,785	9,820	4,132	41.5	78.6
9H32/40	4,500	4,342	4,500	4,342	6,525	3,685	10,210	4,132	44.6	82.7

Based on alternator efficiency of 96~96.5%.

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

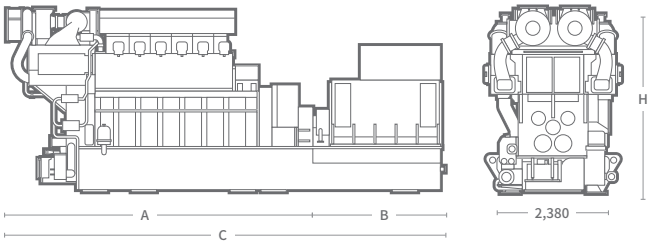


Main Data

Speed	720rpm		750rpm		Dimension(mm)				Dry Mass(ton)	
Frequency	60Hz		50Hz							
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)	A	B	C	H	Engine	GenSet
12H32/40V	6,000	5,790	6,000	5,790	6,624	3,760	10,384	4,723	56.0	108.8
14H32/40V	7,000	6,790	7,000	6,790	7,295	3,860	11,155	4,723	63.3	121.3
16H32/40V	8,000	7,760	8,000	7,760	7,914	3,479	11,393	4,723	69.1	130.9
18H32/40V	9,000	8,730	9,000	8,730	8,585	3,859	12,444	4,794	76.3	141.2
20H32/40V	10,000	9,700	10,000	9,700	9,344	3,659	13,003	4,794	84.0	153.9

Based on alternator efficiency of 96.5~97%.

H32CV Bore: 320mm Stroke: 450mm

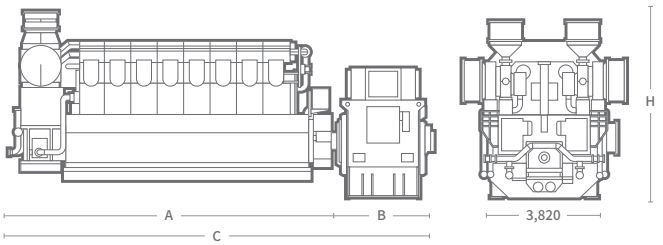


Main Data

Speed	720rpm		750rpm		Dimension(mm)				Dry Mass(ton)	
Frequency	60Hz		50Hz							
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)	A	B	C	H	Engine	GenSet
12H32CV	7,200	6,984	7,200	6,984	7,526	3,900	11,426	4,362	78.0	121.2
14H32CV	8,400	8,148	8,400	8,148	8,126	4,100	12,226	4,362	88.0	137.9
16H32CV	9,600	9,312	9,600	9,312	8,726	4,300	13,026	4,448	96.0	152.6
18H32CV	10,800	10,476	10,800	10,476	9,326	4,500	13,826	4,448	106.0	169.3

Based on alternator efficiency of 97%.

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



Main Data

Speed	600rpm		600rpm		Dimension(mm)				Dry Mass(ton)	
Frequency	60Hz		50Hz							
	Eng.(kW)	Gen.(kW)	Eng.(kW)	Gen.(kW)	A	B	C	H	Engine	GenSet
12H46/60V	13,800	13,455	13,800	13,455	10,610	3,474	14,084	5,611	193.0	243.9
16H46/60V	18,400	17,940	18,400	17,940	12,610	3,724	16,334	5,611	235.2	296.7
18H46/60V	20,700	20,182	20,700	20,182	13,610	3,767	17,377	5,895	260.3	334.3

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.

RELIABLE & POWERFUL SUPPORT AROUND THE WORLD

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- 24/7, Immediate Support

Customer Service

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