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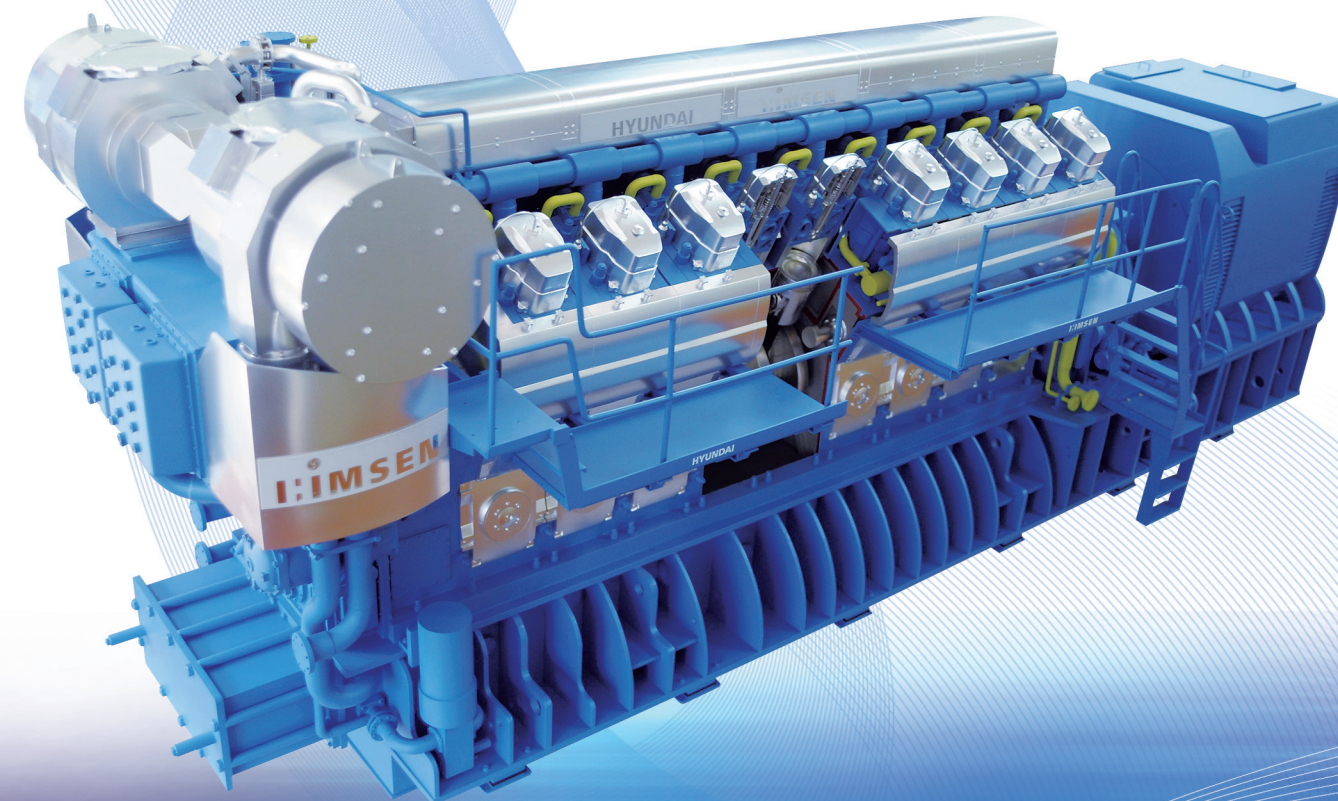
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HiMSEN Gas Engine

Hi-touch Marine & Stationary ENgine

H35/40G(V)

HiMSEN family has been successfully launched into the market since 2001 thanks to support and cooperation from many owners, shipyards and classification societies. We would like to express our sincere gratitude to the everyone involved in this enterprise. And we hope that you have good business with our HiMSEN engines.



Earth Friendly Engine

H35/40G HiMSEN Family..

>> Design Philosophy

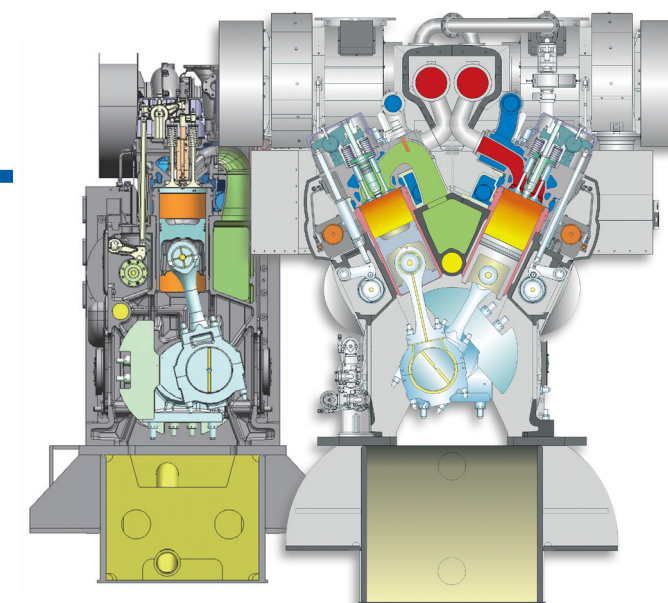
H35/40G of HiMSEN Family has simple and smart design which is suitable for power generation application with gas fuel with high reliability and performance. The key features are:

Economical and Ecological Engine with higher efficiency and lower emission, etc., which is based on the following specific designs;

- Optimized turbocharging with enhanced Miller Cycle.
- Lowest NOx emission with optimized combustion control.

Reliable and Practical Engine

- Number of engine components are minimized for customer preference.
- Most of the components are directly accessible for easier maintenance.

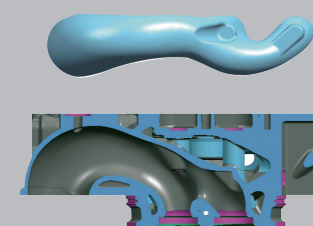


No. of Cylinder In-line type	6, 7, 8, 9
No. of Cylinder V-type	12, 14, 16, 18, 20
Rated Speed	720 / 750 rpm
Power per Cylinder	Cylinder 480 kW
Cylinder Bore	350 mm
Piston Stroke	400 mm
Mean Piston Speed	9.6 / 10.0 m/s
Mean Effective Pressure	20.8 / 20.0 bar
Compression Ratio	12.5 : 1

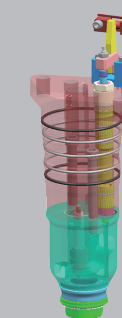
Major Advantages : Smart Electronic Engine Control System with Excellent Reliability

Cylinder Head

- Optimized port design
- High mixture flow

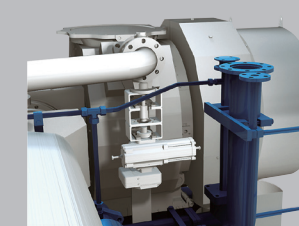


Prechamber



Lambda Control

- Quick response for operation
- Efficiency, NOx control



■ Rated Power of Gen-Set at 100% load

Engine Type	Rated Output (kW)			
	720 rpm / 60 Hz		750 rpm / 50 Hz	
	Engine	Generator	Engine	Generator
6H35/40G	2,880	2,779	2,880	2,779
7H35/40G	3,360	3,242	3,360	3,242
8H35/40G	3,840	3,706	3,840	3,706
9H35/40G	4,320	4,169	4,320	4,169
12H35/40GV	5,760	5,587	5,760	5,587
14H35/40GV	6,720	6,518	6,720	6,518
16H35/40GV	7,680	7,450	7,680	7,450
18H35/40GV	8,640	8,381	8,640	8,381
20H35/40GV	9,600	9,312	9,600	9,312

Remark

- The alternator outputs are calculated for an efficiency of 96.5% ~ 97%.

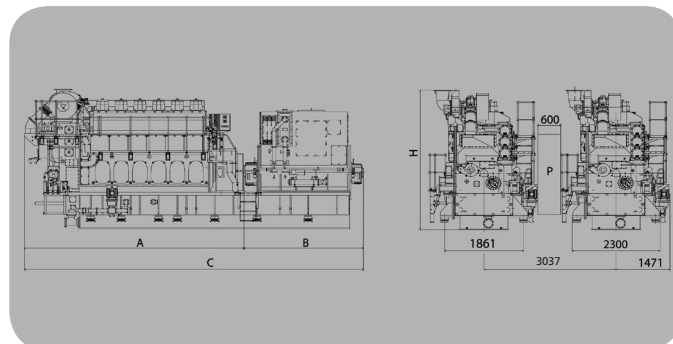
■ Specific Lubricating Oil Consumption: 0.4 g/kWh

(Tolerance: +25% depending on the operating conditions and 100% load)

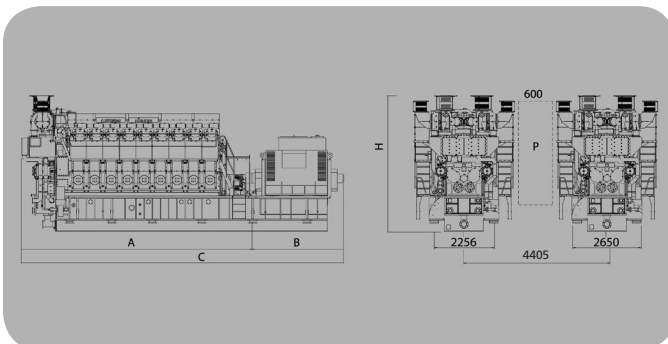
■ Dimensions & Weights

Engine Type	Dimension (mm)				Dry Mass (ton)	
	A	B	C	H	Engine	Gen-Set
6H35/40G	5,760	3,130	8,890	3,959	33.7	68.6
7H35/40G	6,112	3,374	9,486	4,130	38.6	77.1
8H35/40G	6,602	3,594	10,196	4,130	41.5	82.0
9H35/40G	7,092	4,097	11,189	4,130	44.6	89.1
12H35/40GV	6,624	3,760	10,384	4,723	56.0	108.8
14H35/40GV	7,295	3,860	11,155	4,723	63.3	121.3
16H35/40GV	7,914	3,479	11,393	4,723	69.1	130.9
18H35/40GV	8,585	3,859	12,444	4,794	76.3	141.2
20H35/40GV	9,344	3,659	13,003	4,794	84.0	153.9

• L - Type



• V - Type



Remark

P: Free passage between the engines, width 600 mm and height 2,000 mm.

Note) All dimensions and weight are approximate value and subject to change without prior notice.

■ Heat Rate & Electrical Efficiency

		720 rpm / 60 Hz	750 rpm / 50 Hz
Heat rate	In-line type	7,821 kJ/kWhe	
	Vee type	7,780 kJ/kWhe	
Electrical Efficiency	In-line type	46.0 %	
	Vee type	46.3 %	

Remark

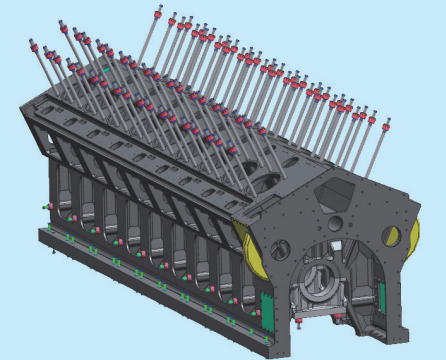
- ISO 3046/1 reference conditions & optimized to TA luft legislation at the reference condition.
- Heat rate & electrical efficiency at generator terminals, without engine driven pumps and with +5% tolerance.
- Fuel gas L.H.V. ≥ 35 MJ/Nm³ with M.N. ≥ 80 .
- Warranted at 100% load only.

>> Engine Block

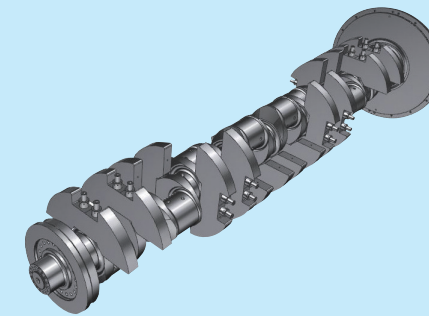
The engine block is made of monoblock cast iron and has the combustion air chamber and lubricating oil channel. There is no need for maintenance normally except for cleaning in side air chamber and outside. And also this is of stiff and reliable to internal and external forces.

The main bearing and main bearing cap for the underslung crankshaft are carried in heavy duty supports tightened hydraulically by two vertical main bearing studs and two horizontal side studs.

There are covers for maintenance and access to the crankshaft including connecting rod and camshaft with swing arm for each cylinder. Furthermore, some of crankcase covers are mounted with relief valves complying with classification societies requirement and these will open if oil vapors in the engine block are ignited.



>> Crankshaft



The crankshaft is made of CGF (Continuous Grain Flow) die-forged special alloy steel with high tensile strength. The design of the crankshaft satisfies the requirements of all classification societies.

The crankshaft has a counterweight for balancing the mass forces on each crank web, which is fastened with two hydraulically tensioned studs.

At the free end there is a gear wheel connected to lub. oil, cooling water pumps. A vibration damper will be mounted depending on the result of torsional vibration calculation for each project. At the opposite end (flywheel end) the crankshaft has a gear wheel for camshaft driving and a coupling flange to transmit the engine power.

>> Connecting Rod

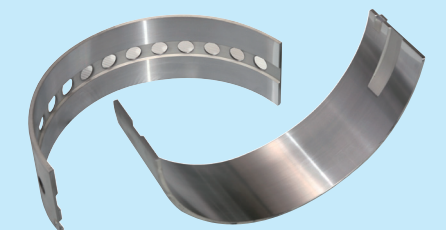
The connecting rod is made of special die-forged steel, which is composed of a three-piece 'marine head' type. All fasteners are tightened by hydraulic tension for better reliability and maintenance. The careful investigation with the advanced finite element analysis has been completed in order to optimize the geometries and enhance the durability.

The 'marine head' type connecting rod can provide the easy maintenance without removing the big end part of connecting rod and cylinder liner which reduces the working time and cost.



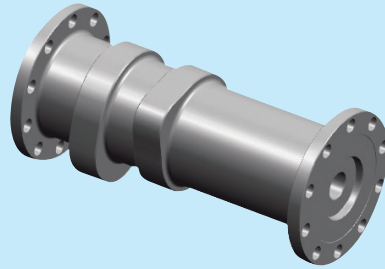
>> Main Bearing

The suitable bearing load and oil film thickness is realized by using of advanced CFD (Computational Fluid Dynamics) analysis and the special running layer with excellent corrosion resistance is applied.



>> Camshaft

The camshaft is of a split type for each cylinder. And each camshaft is jointed by screws. Each piece of camshaft has an intake cam and an exhaust cam. The surface hardening is done for the each cam profile. The gear wheel for driving the camshaft as well as the gear wheel for connection of governor drive are mounted on the flywheel side. The extreme miller timing for intake cam has been applied to reduce NOx emission and prevent knock combustion.

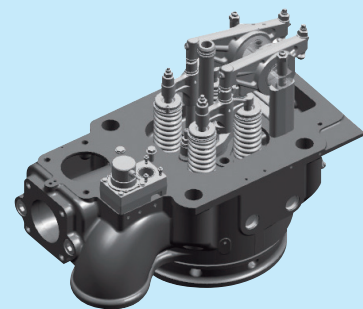


>> Piston & Piston Rings

The piston is of composite type with steel crown and nodular cast iron skirt. Cooling of piston is done by engine's lubricating oil and cocktail shaking principle is applied. It has two compression rings and one spring loaded oil scraper ring. The piston ring grooves are hardened and first compression ring is side-coated for excellent wear resistance and for low fuel consumption.



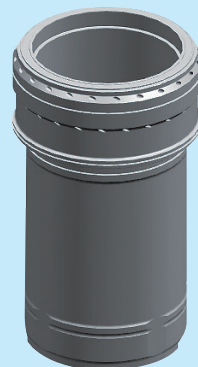
>> Cylinder Head



The cylinder head has been designed taking the thermal load distributions and the optimization of intake air such as swirl and flow coefficient. The cylinder head is made of ductile cast iron and has cast-in passages for cooling water, intake air and exhaust gas. The cylinder head also has drilled holes for supplying lube oil to valve drives from engine block. The robust structure of the cylinder head design provides suitable and uniform sealing between the cylinder head and cylinder liner. The cylinder head unit including rocker arms can be dismantled without removing the all of connections. It is tightened by means of four hydraulic studs which are screwed into the engine block.

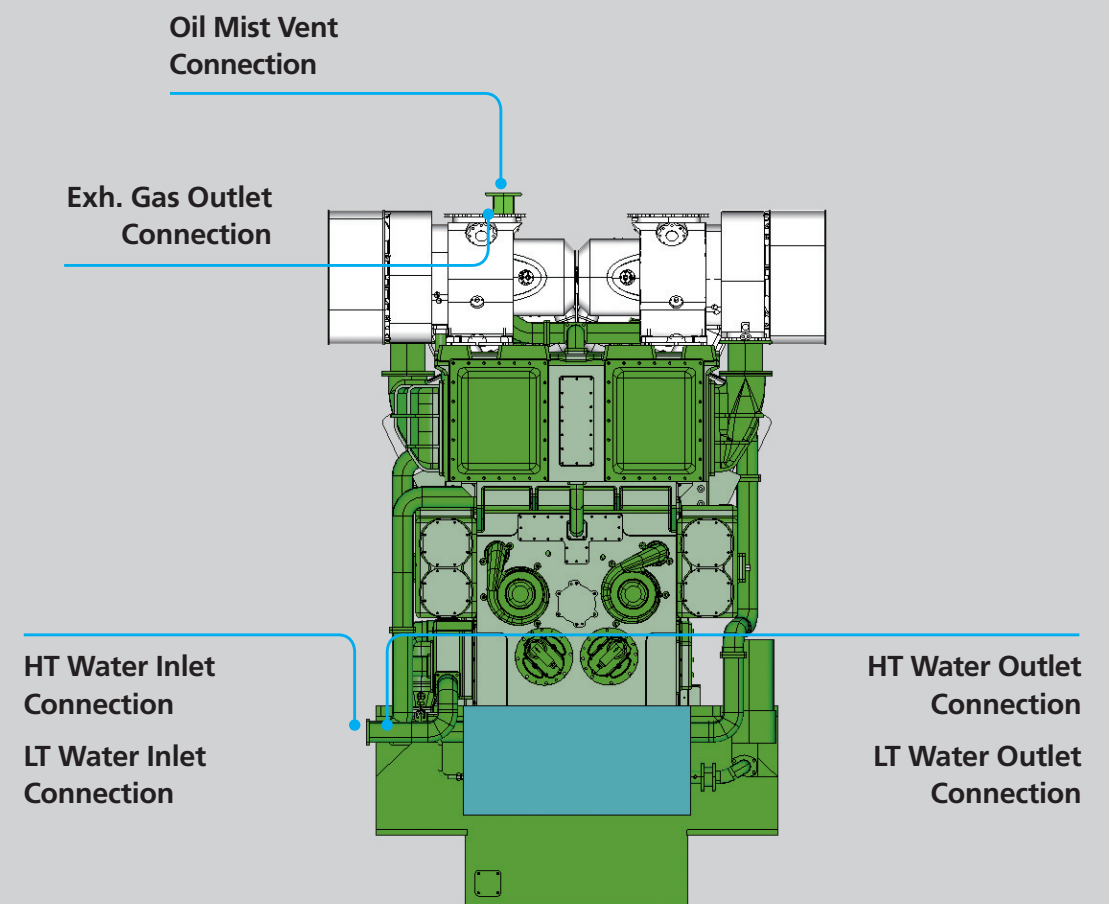
>> Cylinder Liner & Flame Ring

The cylinder liner is made by centrifugally cast of a special cast iron for good wear resistance and high strength and fitted in a bore in the engine block. The liner is fixed by cylinder head and seated on the engine block. The wall thickness of top part for liner is optimized for both the resistance from the combustion force and the effective cooling. The lower part of the liner is uncooled in order to maintain the suitable temperature for preventing the cold corrosion. So there is no water in the engine block. The honning specification of the inner surface is stricter than diesel's one to prevent the hot spot that may occur an abnormal combustion. To reduce bore polishing and lubricating oil consumption, the flame ring is fitted on the top of the cylinder liner.



>> Front End Block

The front end block is located on the free end of the engine. Pipes for cooling water and lubricating oil system as well as pumps are modularized to simple casting structure. The modularized front end block provides the direct accessibility and the easy maintenance for auxiliary parts.



>> Air and Exhaust Gas System

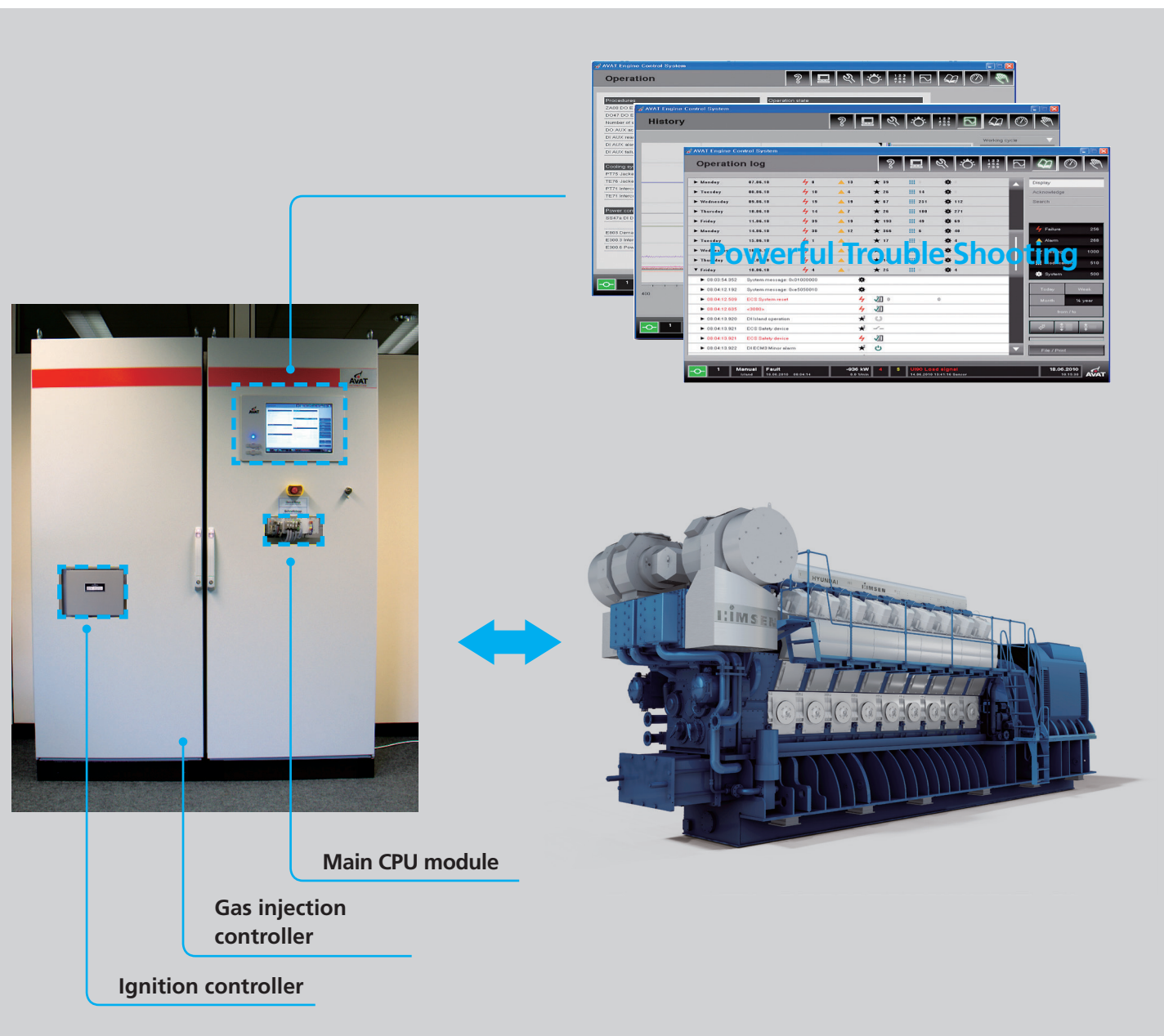
The new generation turbocharger with high compression ratio, fulfills the economical and environmental demands. The MPC (Modular Pulse Converter) exhaust system is applied by considering better performance within the limited space of Vee-type engine. The compact 2-Stage charge air cooler with a large cooling surface is applied and the charge air receiver is designed for the minimum pressure variation and the excellent breathing of engine.

>> Engine Automation

H35/40G(V) Gen-sets provide automation system for engine safety, control and indicating based on programmable logic controller. The system is independently installed in each engine and also can be connected to the remote system, for example main switch board of engine control room via hard wired communication cables.

In addition to fulfill the reliable operation under the environmental legislation and optimum combustion, following functions should be conducted by ECS.

- Safety / Monitoring
- Start / stop control
- Speed / power control
- Air fuel ratio control
- Knock detection / control
- Gas regulating unit control



Plant Power



- HHI Office
 Cooperative Repairer
- HHI-EMD Direct Service Center
 Spare Parts Depot
- Authorized Repairer
 Parts Sales Agent