Globalization with Green Technology
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Introduction

As one of the leading engine builders in the world, the Engine & Machinery Division of Hyundai Heavy Industries Co., Ltd. (HHI-EMD) has enjoyed its reputation since its beginning in 1978. HHI-EMD has taken up 35% (>50cm Bore) of the world’s market share in diesel engines covering marine and stationary purposes. This shows that the superior quality of HYUNDAI engines has been recognized by customers all over the world. HHI-EMD developed its own specially designed HiMSEN engine as part of ongoing efforts to provide the most practical and highest quality engines to its customers.

Key advantages of the HiMSEN engine include reliability, durability, long service intervals, easy maintenance, economical operation cost, and environmental friendliness.

Based on its leading position in diesel engine production, HHI-EMD has become the forerunner in the sector of diesel power generation as well. A great number of its domestic and overseas diesel power plants have shown superb performance, adding to the HYUNDAI reputation.

The business activities of HHI-EMD have been further expanded into diverse fields of industrial machinery such as Robot & System, Industrial Machinery System, Industrial & Marine Pumps, Marine & Industrial Turbines, Ballast Water Treatment System, Air & Gas Compressors, Marine Gear Box for CP & FP Propellers, and Marine Gears.
ENGINE & MACHINERY

Main Office Zone
- Main Building & Annex

Engine Shop 1 Zone
- Crankshaft Machining Shop 1
- Machining Shop 1-1
- Machining Shop 1-2
- 4-Stroke Engine Ass'y & Test Shop 1
- Forging Shop
- 2-Stroke Engine Ass'y & Test Shop 3
- 2-Stroke Engine Ass'y & Test Shop 1-1
- 2-Stroke Engine Ass'y & Test Shop 1-2
- Propeller Shop 1
- Foundry Shop

Engine Shop 2 Zone
- 2-Stroke Engine Ass'y & Test Shop 2
- Machining Shop 2-1
- Machinery Ass'y Shop

Engine Shop 3 Zone
- Crankshaft Machining Shop 2
- 4-Stroke Engine Ass'y & Test Shop 2
- 2-Stroke Engine Ass'y & Test Shop 1-3
- HiMSEN Global Academy

Industrial Plant Zone
- Machining Shop 2-2
- Propeller Shop 2
- Robot Shop

Yard 2 Zone
- Machining Shop 1-3
Hyundai Heavy Industries Co., Ltd. (HHI) had its ground-breaking ceremony in March 1972. The Hyundai shipyard, located at Mipo Bay in Ulsan on the southeastern coast of Korea, spreads across 1,200 acres with its main production plants and all necessary auxiliary facilities covering over 800 acres. Since the successful construction of its first two 260,000 DWT supertankers in 1974, HHI has built and delivered almost every kind of ship to customers all over the world.

Backed by technology and experience acquired through shipbuilding as well as streamlined modern facilities and highly skilled manpower, HHI has diversified its business activities from shipbuilding into other heavy industrial fields. On this vast compound, HHI operates various business lines: Shipbuilding, Offshore & Engineering, Industrial Plant & Engineering, Engine & Machinery, Electro Electric Systems, Green Energy and Construction Equipment.
HHI-EMD has been supplying "One out of Three" of the world's two-stroke diesel engines for marine propulsion and power generation in pursuit of providing our valuable customers with high quality and more economical products. HHI-EMD's established reputation is supported by its superb performance in marine and stationary diesel engines along with its state-of-the-art facilities such as foundry, forging, machining, crankshaft, and assembly & test shops specializing in manufacturing diesel engines.

Components
- Bed Plates
- Frame Boxes
- Cylinder Heads
- Cross Head Pins
- Cylinder Liners
- Cylinder Frames
- Piston Rods
- Connecting Rods
- CKD/PKD Base Engine Components

Products
HYUNDAI-MAN B&W / HYUNDAI-WÄRTSILÄ / Engine Components
Crankshaft

The Crankshaft Shop can produce semi-built-up crankshafts and monoblock crankshafts, using the most up-to-date CNC and NC heavy-duty crankshaft and crankthrow lathes.

Turbocharger

Based on the most up-to-date technology accumulated through its wealth of experience in manufacturing diesel engines and a wide variety of precision machinery, HHI-EMD produces exhaust gas turbochargers: ABB’s TPL and A type, and MHI’s MET type for turbocharging diesel engines under a technical tie-up with ABB Turbo Systems Ltd. of Switzerland and Mitsubishi Heavy Industries Ltd. of Japan, respectively who themselves have more than 40 years’ experience in the field of designing and manufacturing turbochargers.

Products

2-Stroke Diesel Engine Crankshaft / 4-Stroke Diesel Engine Crankshaft

Products

HHI produces a wide variety of marine propellers, our propellers have a diameter up to 11,000 mm, with maximum unit weight of 114,000 kg, and are made from such materials as manganese bronze and nickel-aluminum bronze. Hyundai employs a comprehensively computerized design, manufacturing, and inspection system for these products.

**Propeller Shop**

Max. Production: 114 ton in Weight, 11 m in Diameter
Min. Production: 10 ton in Weight, 3 m in Diameter
Machining Equipment: NC Blade Milling M/C x 3 sets
Boss Boring M/C x 3 sets
Riser Cutting M/C x 2 sets
Horizontal Balancing M/C x 2 sets

**Shaft**

Propeller Shaft / Intermediate Shaft

Max. Production: 150 ton in Weight, 2,200 mm in Diameter, 18,000 mm in Length
Min. Production: 300 mm in Diameter, 2,000 mm in Length

**Rudder Stock**

Straight Type

Max. Production: 190 ton in Weight, 2,200 mm in Diameter, 18,000 mm in Length
Min. Production: 300 mm in Diameter, 2,000 mm in Length
**4-Stroke HiMSEN Engine**

HHI-EMD has developed its own specially designed HiMSEN engines incorporating its valuable experience and technical know-how acquired in manufacturing diesel engines for over two decades. The theme “Humans, Technology, and the Future” was synthesized in this new engine. Also, “HiM” means “power,” and “SEN” means “strong” in Korean.

The Hi-Touch concept was introduced to make this truly innovative engine a reality for humanity. It was designed to be the “Most Practical Engine” in regards to both humans and the environment. Through HYUNDAI’s accumulated technology and experience, this new challenge has been successfully realized.

HHI-EMD also has received certificates of New Technology(NT) and Excellent Machine, Mechanism & Materials(IM) for the HiMSEN engines from the Ministry of Commerce, Industry & Energy, Korea. HiMSEN Engines H21/32 and H32/40V were nominated for the international design award of the Federal Republic of Germany after winning Red Dot and International Forum, including Pin Up Design Award 2009. Thus, the HiMSEN is a highly advanced product that shows HYUNDAI’s deep respect for its customers and the environment.

### Products

<table>
<thead>
<tr>
<th>HiMSEN</th>
<th>H17/21V</th>
<th>H17/28(V,E)</th>
<th>H21/32(P)</th>
<th>H25/33(P)</th>
<th>H32/40(V,P)</th>
<th>H35DF(V)</th>
<th>H46/60V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Engine (kW)</td>
<td>Generator (kW)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H17/21V</td>
<td>1500/1800</td>
<td>900/1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H17/28</td>
<td>900/1000</td>
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<td></td>
</tr>
<tr>
<td>H17/28U</td>
<td>900/1000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>H17/28E</td>
<td>900/1000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H21/32</td>
<td>720/750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H25/33</td>
<td>720/750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H25/33V</td>
<td>720/750</td>
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</tr>
<tr>
<td>H32/40</td>
<td>720/750</td>
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</tr>
<tr>
<td>H32/40V</td>
<td>720/750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H35DF(V)</td>
<td>720/750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H46/60V</td>
<td>114/50/60</td>
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</tr>
</tbody>
</table>

**Rated Power for Marine GenSets**

\[ rpm \]

**Cooling Water Supply:** Fresh Water L.T and H.T.

**Fuel Oil Supply:** MDO or HFO (700 cSt at 50°C)

**Lubricating Oil Supply:** SAE 40

**Compressed Air Supply:** 10 to 30 bar for starting and control.

*Engine driven pumps attached: Lub. oil pump, HT/LT-pump*

**Components**

- Cylinder Blocks
- Pistons
- Connecting Rods
- Cylinder Heads
- Piston Crowns
- Cylinder Covers
- Re-engine Services

**Remarks**

- Cooling Water Supply: Fresh Water L.T. and H.T.
- Fuel Oil Supply: MDO or HFO (700 cSt at 50°C)
- Lubricating Oil Supply: SAE 40
- Compressed Air Supply: 10 to 30 bar for starting and control.
- Engine driven pumps attached: Lub. oil pump, HT/LT-pump
**HiMSEN Engine**

Excellent Performance of HiMSEN Propulsion Engine
- Improved Transient Operation with Pulse Charging Turbocharger
- Invisible Smoke with Pulse Charging Turbocharger by Part Load Matching
- Lower Thermal Load engine with Lower Exhaust Gas Temperature
- Low Fuel Consumption
- Low NOx Emission

**Propulsion System**

*Long Term Commitment...*

- To Provide the Market with Reliable, Cost Effective and Earth-Friendly Solution

**Marine Propulsion**

<table>
<thead>
<tr>
<th>Model</th>
<th>rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>H21/32P</td>
<td>3500</td>
</tr>
<tr>
<td>H25/33P</td>
<td>3000</td>
</tr>
<tr>
<td>H32/40P</td>
<td>2500</td>
</tr>
</tbody>
</table>

**Optimized Matching of HiMSEN Propulsion Package**
- HiMSEN H21/32P, H25/33P and H32/40P Engine
- C.P. / F.P. Propeller with shafting
- Pitch and Speed Control
- Load Control
- Shaft Generator
- Auxiliary Machineries

**HiMSEN H21/32P, H25/33P and H32/40P Engine**
- C.P. / F.P. Propeller with shafting
- Pitch and Speed Control
- Load Control
- Shaft Generator
- Auxiliary Machineries

**Application**
- Controllable Pitch Propulsion
- Fixed Pitch Propulsion
- Azimuth Thruster Propulsion
- Pump Drive
- Electric Propulsion

**Marine Gearbox for CP & FP Propellers**

HHI-EMD produces Reverse-Reduction Gearboxes for FPP ships and Reduction Gearboxes for CPP ships. The ranges of the gearboxes for marine transmissions are offered in a range up to 3,000 kW. Design standards & rules: ISO 6336, DIN 3990, AGMA, DNV, GL, KR, etc.

**Gearbox Ranges**

<table>
<thead>
<tr>
<th>Gearbox Types</th>
<th>Gear Ratio</th>
<th>Engine Power (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPGV (CPP Gearbox)</td>
<td>2.0 ~ 6.0</td>
<td>~ 3,000 kW</td>
</tr>
<tr>
<td>FPGV (FPP Gearbox)</td>
<td>2.0 ~ 6.0</td>
<td>~ 3,000 kW</td>
</tr>
</tbody>
</table>

**Water-Jet Propulsion System**

- Gearbox Ranges
- Marine Gearbox for CP & FP Propellers
- Loader Gearbox Test with HiMSEN Engine (FPGV-660)
- Reverse-Reduction Gearbox for FPP Propulsion System (FPGV-660)

**Water-Jet Propulsion System**

- Water-Jet Model: DS100 - DS300
- Water-Jet Model: DS400 - DS500
Cargo Oil Pumping System

With the latest technologies accumulated from the continuous R&D efforts and experience gained over 30 years of producing various kinds of pumps, HHI-EMD has supplied cargo oil pumps/water ballast pumps with steam turbines since 1995 and these products are now enjoying a good reputation for quality.

Advantages
Compact Size
The improved hydraulic configuration and rationalized structural design have resulted in a compact model that generates less noise and vibration.

Easy Maintenance and excellent sealing performance
The cartridge-type and high grade material for mechanical seal facilities easy maintenance & excellent sealing performance.

Improvement of Hydraulic Performance
Adoption of high efficiency discharge volute, high performance suction volute and wear ring configuration.

Steam Turbines for Marine Pump
HHI-EMD, as a world-wide leader in the fields of manufacturing integrated heavy industrial products, has begun its diversification into supply of various turbines and generators for the application from nuclear and thermal power plants to a variety of mechanical drives under the name of HHI-EMD.

For technical innovation of marine steam turbines, HHI-EMD has developed the technical matter from continuous R&D efforts and experiences gained more than 15 years of turbine production. In order to keep up with an ever increasing needs for clients all over the world, we present a high efficiency turbine for cargo oil pumps and water ballast pumps.

Cargo Oil Pumps & Water Ballast Pumps
Steam Turbine (COPT & WBPT)
Cargo Oil Stripping Pump
Automatic Vacuum Stripping System (AVSS)

Pump Performance Range
Cargo Oil Pump: 1,800 - 6,050 m³/h
Water Ballast Pump: 1,200 - 5,000 m³/h

Submerged Cargo Pumping System
Submerged cargo pumping system based upon hydraulically driven submerged cargo pumps, is used for chemical and product carriers, crude carriers, FPSO units and others.

The system is designed for profitable cargo handling, efficient stripping, and tank cleaning. HHI-EMD uses state-of-the-art computer aided design technology, and it is staffed with a qualified and experienced team of engineers and technicians to design, manufacture and factory test each pump.

Major Components
- Submerged cargo pump
- Hydraulic power package
- Control system
- Ballast pump
- Portable pump with winch
- Tank cleaning pump
- Hydraulic oil transfer pump

Optional Components
- Diffuser
- Side thruster & control block
- Cargo heater

Operation
Discharging
Purging and seal-leakage check
Stripping

Standard Model
CSV-5 / CSV-14 / CSV-18 / RTV
LNG Marine Pump

Main Features

LNG Cargo pumps offers the following advantages:
- Designed for utmost NPSHr performance, which provides the highest storage availability and safe ultimate stripping capability.
- Optimized hydraulic design for the best efficiency.
- Highest reliability and availability with minimum maintenance over a design life of 40 years.

Materials
- Shaft: 17.4 PH Stainless steel
- Standard Bearings: Stainless steel
- Inducer & Impeller: Aluminum alloy
- Housings: Aluminum alloy
- Seal Stators: Bronze-based material

Hydraulic Coverage

Flow rate and head rise nominal capabilities are shown in this chart. Applications below this domain can be met by existing JC Carter LNG cargo pumps. HHJ-JC CARTER-SNECMA can study applications above this domain to fulfill your needs. The safe continuous operating domain ranges from 30% to 120% of the reference flow rate chosen in this operating domain.

Thrusters CP & FP Propeller

HYUNDAI Thrusters can be fitted to a wide range of vessels operating throughout the world. The tunnel thruster is designed to efficiently generate thrust force allowing a ship to maneuver more easily. Thrust system normally consists of a thruster unit with tunnel, hydraulic equipment, a remote control and a prime mover. A long service-life and easy maintenance are key factors in the design of the HYUNDAI Thruster.

Advantages
- Compact Design / Powerful Thrust
- Low Noise, Low Vibration
- Well-balanced Performance(port / starboard)
- Superior Quality / Easy Installation
- Easy Operation / Easy Maintenance
- Reliable System Interface Control
- Rapid Technical Service
- Quality-oriented Feedback Activity

Product Range

HSC / HSF Series

<table>
<thead>
<tr>
<th>Type</th>
<th>Model Specification</th>
<th>Motor Output</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSC (CPP)</td>
<td>1,000 mm – 3,400 mm</td>
<td>300 kW – 4,000 kW</td>
<td>Container Carrier, LNG Carrier, Car Carrier</td>
</tr>
<tr>
<td>HSF (PP)</td>
<td>1,000 mm – 2,000 mm</td>
<td>300 kW – 1,200 kW</td>
<td>Product Carrier</td>
</tr>
</tbody>
</table>

Complete Thruster Packages
- Controller (Aux.)
- Propeller Unit
- Electric Motor
- Controller (Main)
- Hyd. Oil Unit (HPU)
- HPU Starter
- Gravity Tank
- Motor Starter
Hi-GAS™
Hyundai integrated GAs Supply system

Hi-GAS™ Package solution LNG Fuel Gas Supply System

The LNG market is developing rapidly, and the demand for LNG carriers and LNG fueled ships is increasing because LNG is a very attractive solution from an emission and economic point of view. The high efficiency of dual fuel engines has made the engine market the preferred prime mover choice for new projects. HHI-EMD has rich experience in manufacturing both the ME-GI engine and the 4-stroke dual fuel engine HiMSEN.

The HiMSEN GenSet can use both diesel and LNG on LNG carriers and conventional LNG fueled ships. One of the key components for LNG fueled ships is the LNG fuel gas supply system for both dual fuel engine types.

Hi-GAS is a remarkable design of the LNG fuel gas supply system for dual fuel engines based on high and low pressure supply. This means that Hi-GAS can effectively supply high pressure CNG to the ME-GI engine while also supplying low pressure CNG to the 4-stroke DF GenSet, essentially doing the work of two fuel supply systems.

HHI-EMD can supply complete LNG package solutions for LNG carriers and LNG-fueled ships.
**HYUNDAI NoNOx™ SCR System**

NoNOx™ SCR system designed by Hyundai Heavy Industries

NoNOx™ is brand name of HYUNDAI SCR system, aimed to reduce NOx in exhaust gases. SCR (Selective Catalyst Reduction) is proven technology, which can reduce NOx up to 95% and meet forthcoming IMO Tier III regulation by itself.

PILC (Pillared Inter-Layered Clay) catalyst, specially designed for marine application is adopted, which makes higher de-NOx efficiency and stronger resistance against thermal stresses comparing to conventional type of catalyst.

The state of the art control system is provided based on ACONIS (Advanced Control & Integration System designed by Hyundai Heavy Industries) hardware platform, which makes full automatic control and perfect interface with other system. Control system can be fully integrated to hull AMS (Alarm Monitoring System) if it were based on ACONIS and optimizing of detergent dosing system can be optionally provided in by real time feedback from NOx sensor.

---

**Size & Weight of NoNOx™ standard SCR Chamber**

<table>
<thead>
<tr>
<th>Engine power [kW]</th>
<th>Dimension of SCR Chamber</th>
<th>Weight of SCR chamber Ref. Catalyst [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D [mm]</td>
<td>W [mm]</td>
</tr>
<tr>
<td>-7500</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>-1500</td>
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</tbody>
</table>

The standard SCR Chamber NoNOx™ can meet customer’s requirement for tailor made of SCR chamber if optimized size of chamber is required, besides standard dimension shown above table. Please contact us for more information.
**How HiBallast™ works**

HiBallast is a disinfection system by electrolysis of sea water

- Components: filter, Electrolysis Unit, Neutralization Unit, TRO Sensing Unit
- Required sea water capacity for electrolysis: only 1% of total ballast capacity
- Disinfectants: Sodium Hypochlorite
- Neutralizing agent: Sodium Thiosulfate
- Safety first: No harmful to human & vessel, No dangerous by H₂ gas separation, No risk to ballast tank coating

### Main Features

<table>
<thead>
<tr>
<th>Easy Installation</th>
<th>- No changes of the existing ship design</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Space-saving installation by modularized design, well suitable for retrofit</td>
</tr>
<tr>
<td>Automatic Operation</td>
<td>- Feedback control of each unit with Human Machine Interface</td>
</tr>
<tr>
<td></td>
<td>- Automatic and manual operation</td>
</tr>
<tr>
<td></td>
<td>- Automatic TRC (treatment rated capacity) control</td>
</tr>
<tr>
<td>Economic Operating Cost</td>
<td>- Low fuel cost by low power consumption</td>
</tr>
<tr>
<td></td>
<td>- Long lifetime of electrodes</td>
</tr>
<tr>
<td>Convenient Maintenance &amp; A/S</td>
<td>- Modular type system</td>
</tr>
<tr>
<td></td>
<td>- Easy replacement by engineer / ship crew</td>
</tr>
<tr>
<td></td>
<td>- Global support and worldwide A/S network</td>
</tr>
<tr>
<td>Main Application</td>
<td>- Any type vessel including Oil Tanker, Container, LNG &amp; LPG Carrier</td>
</tr>
<tr>
<td></td>
<td>- Ballast water capacity: 75 ~ 10,000 m³/hr</td>
</tr>
</tbody>
</table>

### Control System Configuration

**Process Configuration**

- Ballasting Operation
- De-Ballasting Operation

**How it works**

- **Disinfect**
  - Produce disinfectant to kill virus, pathogenic bacteria and other organisms smaller than 50μm.

- **Neutralize**
  - In deballasting the solution of sodium thiosulfate is used to convert any remaining residual oxidants into stable reduced form such as chloride and bromide.

In deballasting operation, the system needs to be neutralized prior to the discharge with neutralization agent to avoid environmental damage of the sea water.
**How EcoBallast™ works?**

EcoBallast is an ultra violet disinfection system

- **Components:** Filter, UV Reactor, CIP (Cleaning In Place) Unit
- **Disinfectants:** UV-C light
- **Eco-friendly disinfection process**
- **Safety first:** No harmful to human & vessel

**Process Configuration**

The ballast water is treated during ballasting and once again during de-ballasting.

**Main Features**

- **UV Reactor**
  - High efficiency
  - Unique & robust design
  - Automatic TRC (treatment rated capacity) control
  - Electronic Ballast Device
    - High reliability & efficiency
    - Long lifetime

**Control System Configuration**
**Gas Compressor**

HHR-EMD has added Gas Compressors to its business lines as a new product in 2011 through License Agreement and Collaboration with Mitsubishi Heavy Industries Compressor Corporation (MCO).

### Integrally Geared Centrifugal Compressor

<table>
<thead>
<tr>
<th>Model</th>
<th>2C, 3C and 4C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>up to 17,600 A³/h</td>
</tr>
<tr>
<td>Discharge Pressure</td>
<td>up to 40 Bar A</td>
</tr>
</tbody>
</table>

**Application Service**

- Gas Field Application (Fuel Gas Compressor)
- Industrial Plant
- Simple or Combined Cycle Gas Turbine Power Plant

### Vertically Split Centrifugal Compressor (In-Line Compressor)

<table>
<thead>
<tr>
<th>Model</th>
<th>3V, 4V and 5V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>up to 48,000 A³/h</td>
</tr>
<tr>
<td>Discharge Pressure</td>
<td>up to 150 Bar A</td>
</tr>
</tbody>
</table>

**Application Service**

- Gas Field Application (Offshore / FPSO / Onshore)
- Gas Processing
- Gas Lift
- Gas Treatment
- Gas Injection
- Gas Gathering

### 1250 HP Turbo Air Compressor

- Five (5) units compressor operating in On-san, Korea.

**HTC Configurations & Technologies**

- Horizontally split tilting-pad journal bearing & Taper-land thrust bearing
- High efficient backward leaned impellers, vaned diffusers and scrolls
- Precise rotor balancing according to API standard
- High quality increasing gear pairs (AGMA13 Class, JIS 0 Class - pinion)
- ISO 9001:2008 certified quality management system
- High performance & reliability, robust design
- The state-of-the-art CFD analysis, rotor & gear dynamic analysis enable to assure reliable compressor operation with the lowest vibration level

**Major Features**

- Auto-dual & Modulating operation (Customer can select)
- Easy recognition of operating condition (Graphical view)
- Genius Anti-surge control (4-season mode selection)
- Superior database management (Graphical time history)
- TCP/IP communication with remote control room
- Database auto save & file transfer using USB (max. 6 months)
Prime Mover:

**2-Stroke Diesel Engine**

Ever since HHI-EMD successfully completed a 20MW-class diesel power plant in Jeju, Korea, it has expanded its activities in the power sector and filled a key role in the global power market by completing quality diesel power plants around the world as an EPC contractor.

Recently, HHI-EMD successfully completed a 60MW diesel power plant in Israel, a 50MW and a 36MW diesel power plant in Malaysia, a 200MW diesel power plant in India (the largest diesel power plant in the world using a diesel engine as its prime mover), two 30MW diesel power plants in Mauritius, and a 42MW diesel power plant in Mexico.

Range of 2-Stroke Stationary Engine

<table>
<thead>
<tr>
<th>Diesel Engine</th>
<th>No. of Cylinders</th>
<th>Speed(rpm)</th>
<th>Output(kW)/Cylinder</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYUNDAI-MAN B&amp;W</td>
<td>K90MC-S</td>
<td>9-12</td>
<td>1217.1</td>
<td>1217.1</td>
</tr>
<tr>
<td>HYUNDAI-MAN B&amp;W</td>
<td>K80MC-S</td>
<td>9-12</td>
<td>1147.0</td>
<td>1147.0</td>
</tr>
<tr>
<td>HYUNDAI-MAN B&amp;W</td>
<td>K70MC-S</td>
<td>9-12</td>
<td>1097.0</td>
<td>1097.0</td>
</tr>
<tr>
<td>HYUNDAI-MAN B&amp;W</td>
<td>K60MC-S</td>
<td>9-12</td>
<td>1047.0</td>
<td>1047.0</td>
</tr>
<tr>
<td>HYUNDAI-MAN B&amp;W</td>
<td>L42MC-S</td>
<td>9-12</td>
<td>214.3</td>
<td>214.3</td>
</tr>
</tbody>
</table>

Prime Mover:

**4-Stroke Diesel Engine**

HHI-EMD provides a wide range of services:
- Feasibility study
- Financial resource assistance
- Operation and maintenance
- Training
- Rehabilitation
- Tool and spare parts supply
- Local presence of expert personnel

Range of 4-Stroke Stationary Engine

<table>
<thead>
<tr>
<th>Engine</th>
<th>Type</th>
<th>No. of Cylinders</th>
<th>Speed(rpm)</th>
<th>Output(kW)/Cylinder</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYUNDAI-MAN B&amp;W</td>
<td>H17/28</td>
<td>12-20</td>
<td>180</td>
<td>180</td>
<td>354</td>
</tr>
<tr>
<td>HYUNDAI-MAN B&amp;W</td>
<td>H17/21V</td>
<td>12-20</td>
<td>180</td>
<td>180</td>
<td>354</td>
</tr>
<tr>
<td>HI-MSEN</td>
<td>H17/24G</td>
<td>12-20</td>
<td>180</td>
<td>180</td>
<td>354</td>
</tr>
<tr>
<td>HI-MSEN</td>
<td>H35/40G</td>
<td>12-20</td>
<td>180</td>
<td>180</td>
<td>354</td>
</tr>
<tr>
<td>HI-MSEN</td>
<td>H35/40GV</td>
<td>12-20</td>
<td>180</td>
<td>180</td>
<td>354</td>
</tr>
<tr>
<td>HI-MSEN</td>
<td>H35DF(V)</td>
<td>12-20</td>
<td>180</td>
<td>180</td>
<td>354</td>
</tr>
<tr>
<td>1,500</td>
<td>320</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
</tbody>
</table>

Fort George 60MW Diesel Power Plant, Mauritius (HYUNDAI-MAN B&W 9K80MC-S x 2)

60MW BLPC Diesel Power Plant, Barbados (HYUNDAI-MAN B&W 9K80MC-S x 2)

GMR Vasavi 200MW Diesel Power Plant, India (HYUNDAI-MAN B&W 12K90MC-S x 4)

300 MW Global Mall, Brazil (HI-MSEN 9H25/33 X 120)

148 MW Camacari, Brazil (HI-MSEN 9H25/33 X 60)
Packaged Power Station
Prime Mover: HiMSEN Engine

HHI-EMD has developed the Packaged Power Station using HiMSEN engines for captive power such as those used in factories, shopping malls, hotels, rental businesses and so on. The Packaged Power Station, a result of HHI-EMD’s creative and technological prowess, will bring contentment to previously unsatisfied power customers.

Features
- Base Load Operation
- Diesel Oil / Heavy Fuel Oil / Natural Gas Use
- Compact 40-Feet Container Size
- Mobile Type (option)
- Environmentally comfortable
- Low operation and maintenance cost

Applicaiton
- Captive Power
- Rental Business
- Pumping Station
- Isolated Area
- Independent Power Producer

General Specifications

<table>
<thead>
<tr>
<th>Engine Model</th>
<th>6H17/28</th>
<th>6H21/32</th>
<th>6H21/32</th>
<th>6H21/32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine (kW)</td>
<td>1,200</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
</tr>
<tr>
<td>Generator (kW)</td>
<td>1,200</td>
<td>1,600</td>
<td>1,140</td>
<td>1,140</td>
</tr>
<tr>
<td>Total Weight (ton)</td>
<td>24</td>
<td>36</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>Dimension (W x H x L)</td>
<td>2.4mX3.4mX12m (Container Size)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The MCR will be based on ISO condition.
HHI-EMD has supplied various kinds of pumps all over the world with the best quality and timeliest delivery. Accordingly, we have gained an excellent reputation with our clients at home and abroad which has led us to expand our pump production range to various fields, including thermal & nuclear power plants.

Industrial Pump

HHI-EMD has supplied various kinds of pumps all over the world with the best quality and timeliest delivery. Accordingly, we have gained an excellent reputation with our clients at home and abroad which has led us to expand our pump production range to various fields, including thermal & nuclear power plants.

Products

Thermal and Nuclear Power Plant:
- Circulating Water Pump
- Boiler Feed Water Pump
- Feed Water Booster Pump
- Condensate Pump / Seawater Lift Pump
- Concrete Volute Pump

Desalination Plant:
- Brine Recycle Pump / Seawater Intake Pump
- Brine Blowdown Pump / Distillate Pump

Petrochemical Plant:
- Cooling Water Pump

Flood Control:
- Drainage Pump

Irrigation & Water Supply Project:
- Intake Service Pump / Boosting Pump
- Dry Dock / Dewatering Pump

Industrial Steam Turbine
- Horizontal Single-Stage Steam Turbine

Components

- Barrel (Fabrication)
- Shaft (Round Bar)
- Casing (Casting)
Steam Turbine

HYUNDAI-MITSUBISHI Marine Propulsion Steam Turbines

The combination of Hyundai’s and Mitsubishi’s expertise has produced the best quality marine steam turbines.

MS-2 Series marine steam turbines are the typical standard products manufactured by Hyundai under the technical license of Mitsubishi.

HYUNDAI-MITSUBISHI marine steam turbines are the most modern in design and feature both high output and economy, which are essential prerequisites to the successful operation of various kinds of ships.

We are confident that the MS-2 Series steam turbines will satisfy any requirements of their users.

Standard Frames

Output in KPS.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HP Turbine Designation</td>
<td>H-20</td>
<td>H-20</td>
<td>H-22</td>
<td>H-22</td>
<td>H-26</td>
<td>H-26</td>
<td></td>
</tr>
<tr>
<td>Speed in rpm</td>
<td>6700</td>
<td>6700</td>
<td>5950</td>
<td>5950</td>
<td>4850</td>
<td>4850</td>
<td></td>
</tr>
<tr>
<td>LP Turbine Designation</td>
<td>L-14</td>
<td>L-16</td>
<td>L-18</td>
<td>L-18</td>
<td>L-20</td>
<td>L-20</td>
<td></td>
</tr>
<tr>
<td>Speed in rpm</td>
<td>4600</td>
<td>4600</td>
<td>3400</td>
<td>3400</td>
<td>3100</td>
<td>3100</td>
<td></td>
</tr>
<tr>
<td>Main Reduction Gear</td>
<td>Most Suitable Reduction Gear System (Tandem Articulated Type or Dual Tandem Articulated Type)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Thrust Bearing</td>
<td>T-9</td>
<td>T-10</td>
<td>T-12</td>
<td>T-13</td>
<td>T-15</td>
<td>T-17</td>
<td>T-19</td>
</tr>
<tr>
<td>Main Condenser</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Approx. Weight in Ton</td>
<td>210</td>
<td>280</td>
<td>300</td>
<td>320</td>
<td>350</td>
<td>340</td>
<td>400</td>
</tr>
</tbody>
</table>

Components

- HP/IP Turbine Casing
- LP Turbine Casing
- Blade
- Dynamic Balancing Test
- Rotor Shaft

Hyundai Robot System for Car Body Shop
**Industrial Robot**

Human-like touch and flexible operation couples precision and lifelong stability

**Features**
- Wide Working Envelope, High Speed, High Reliability
- Easy and Simple Operation with programming Language Similar to BASIC
- Easy Maintenance Using On-line Display Function
- Advanced Control Technology with Dynamic, Vibration Suppression
- Safety with ANSI/RIA15.6_1999 and CE Directives
- Compatibility and Connectivity with Field Bus, Ethernet, Serial Communication

**Products**
- Press / Conveyor System / Iron & Steel Line
Press
HHI-EMD is a reliable partner to the users of presses with automatic systems suitable for easier maintenance, smoother operation, and higher productivity.

Conveyor System
HHI-EMD has supplied various kinds of Conveyor Systems with high quality and reliable services along with our accumulated experience and technology since 1983.

- Electric Monorail System
- Skillet Conveyor
- Power & Free Conveyor
- Overhead Shuttle
- Floor Shuttle
- Rail Guided Vehicle
- Slat Conveyor
- Free Flow Conveyor

Iron & Steel Line
HHI-EMD makes a feature of the state of the art design of the system as well as the manufacturing technology of the equipment from HHI’s excellent production facilities.

Business Lines
- CGL (Continuous Galvanizing Line)
- CCL (Continuous Color coating Line)
- SPML (Skin Pass Mill Line)
- Rolling Mill Line
- Pickling Line
- Coil Blanking Line
- Strip Finishing Line
- Torpedo Ladle Cars, Ladle Cars

Business Lines
- Destacker
- Robot System Inter Presses
- Servo Transfer Feeder
- Auto Palletizer
- Exit Conveyor

Business Lines
- Tandem Press Line
- Transfer Press Line
- Die Tryout
- Blanking Press Line
- Transfer Press Line
- Die Tryout
- Blanking Press Line

Business Lines
- CHS (Chassis Line)
- Trim & Final Line
- Painted Body Storage

Business Lines
- Color Coating Line (CCL)
- Continuous Galvanizing Line (CGL)
- Pickling & Cold Mill Line (PLC&M)
- Torpedo Ladle Car
Skin Pass Mill Line

<table>
<thead>
<tr>
<th>Description</th>
<th>Hot Strip Process Line</th>
<th>Cold Strip Process Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Hydraulic push up type</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>Width: 600 – 2,000 mm</td>
<td>Thickness: 0.2 – 2.3 mm</td>
</tr>
<tr>
<td></td>
<td>Width: 600 – 2,000 mm</td>
<td>Width: 600 – 1,600 mm</td>
</tr>
<tr>
<td></td>
<td>Weight: Max. 35 ton</td>
<td>Weight: Max. 35 ton</td>
</tr>
<tr>
<td>Production Capacity</td>
<td>1,000,000 tonyear</td>
<td>250,000 tonyear</td>
</tr>
<tr>
<td>Roll Size</td>
<td>Work Roll: Ø570–Ø630 mm</td>
<td>Work Roll: Ø460–Ø600 mm</td>
</tr>
<tr>
<td></td>
<td>Back up Roll: Ø1,100–Ø1,200 mm</td>
<td>Back up Roll: Ø730–Ø1,000 mm</td>
</tr>
<tr>
<td>Rolling Speed</td>
<td>1.2≥t≥3.2 mm: 600 mpm</td>
<td>0.2≥t≥0.6 mm: 180 ~ Max. 200 mpm</td>
</tr>
<tr>
<td></td>
<td>3.2≥t≥5.5 mm: 300 mpm</td>
<td>0.8≥t≥1.0 mm: 135 ~ 85 mpm</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>1.2≥t≥1.6 mm: 90 ~ 53 mpm</td>
</tr>
<tr>
<td>Threading</td>
<td>Threading: 30 mpm</td>
<td>Threading: 60 mpm</td>
</tr>
<tr>
<td>Rolling Force</td>
<td>Max. 1,500 ton</td>
<td>Max. 500 ton/1,000 ton</td>
</tr>
<tr>
<td>Elongation</td>
<td>Max. 4%</td>
<td></td>
</tr>
</tbody>
</table>

Forging Shop

The Forging Shop is equipped with four forging press including two 10,000-ton press which can produce various forgings up to 150 tons in unit weight. The Forging Shop can produce 81,500 tons of forgings annually.

Foundry Shop

The Foundry Shop can produce 66,000 tons of castings annually. The modern melting facilities include 1 unit of 24 tons and 1 unit of 20 tons of a medium-frequency induction furnace to produce various kinds of castings. To produce the best quality products with high reliability, the Foundry Shop is equipped with computerized facilities that allow an integrated production control system that ranges from raw materials to machining, assembling and testing.
Our target is to provide the quickest and most precious technical support and parts supply towards the customers.

We do our utmost to minimize the trouble and inconvenience from the ship owners which might be occurred due to the damage caused by the accident.

Easy Access to Engine CS Department

Regardless of the guarantee period whether it is over or not, HHI will make it a rule to support the clients with immediate service in the order of the receipt by e-mail or through homepage. But, considering its seriousness of the damage or the schedule of the vessel, the provision timing of our technical support including repair may be adjusted.

Genuine Spare Parts Purchase Guide

HHI’s authorized sales agents will supply the clients with the original genuine spare parts at the competitive condition in aspect of price, delivery time and quality etc. Please do not hesitate to contact our sales agent with the inquiry or questionnaire.

Technical Support

After the guarantee period is expired or in case that the free support is limited even during the guarantee period due to special reason, we also provide the technical support including supervision, reconditioning, conversion, retrofit of alpha cylinder lubricator and technical consultancy etc.

Global Service Network

HHI is very proud of its well organized global service network which is efficiently and systematically designed to meet every requirement of the clients. HHI’s direct service centers are established at Rotterdam, Singapore, and Havana in Cuba.
HiMSEN Global Academy

HiMSEN Global Academy offers tailored programs that deliver expertise to engine operators in power plants and vessels.

We teach the purpose of main components, engine performance theory, engine operation & maintenance, electrical systems, and engine control systems. Courses also include hands-on training programs.

The goal of HiMSEN Global Academy is to train engine operators and maintenance staffs of HiMSEN engines and support their safe operation.

We promise that you will learn everything about our HiMSEN engine for power plants and vessels when you graduate from our HiMSEN Global Academy.

For more information, please contact Engine Customer Service Department through our email *engineci@hhi.co.kr*.

Quality Management System

The Quality Management System of the HHI-EMD has the primary goal of supplying products and services, ranking among the best in the industry, in total compliance with both contractual and regulatory requirements.

To fulfill this primary goal, and to continue to offer the quality on which our strong reputation has been built, combined efforts are required from our quality assurance, engineering, and production personnel.

It is the policy of HHI-EMD to constantly maintain an effectively and efficiently documented Quality Management System, complying with the requirements of International Standards (ISO9001, KS A9001) and customer contractual requirements.

The basic policies developed and documented within the Quality Management System must be adhered to by all HHI-EMD personnel.

The QM Manager, through Quality Awareness Training, should ensure that new/ existing personnel are aware of the objectives and philosophy of the Quality Policy being implemented within the company.

Approval Status of Quality Management System

<table>
<thead>
<tr>
<th>Product or Service Ranges</th>
<th>Certifying Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear Diesel Generator (Class 1E), Pump and Butterfly Valve</td>
<td>Qualification Approval (KERC)</td>
</tr>
<tr>
<td>Forging Shop</td>
<td>Works Approval (ABS, BV, CCS, DNV, GL, KR, LR, NK, RINA)</td>
</tr>
<tr>
<td>Casting Shop</td>
<td></td>
</tr>
<tr>
<td>Propeller</td>
<td></td>
</tr>
<tr>
<td>Semi built-up Crankshaft</td>
<td></td>
</tr>
<tr>
<td>Solid Crankshaft (TR Forging Crankshaft)</td>
<td></td>
</tr>
<tr>
<td>Welding Workshop &amp; Overlay Welding on Cylinder Cover</td>
<td>Works Approval (GL)</td>
</tr>
</tbody>
</table>
Research & Development

HMRI (Hyundai Maritime Research Institute)
Inaugurated in 1984, HMRI integrates all major hydrodynamic facilities under one roof.
The comprehensive R&D activities of HMRI comprise all pre-production phases including computer-aided hull/propeller/engine design and manufacturing.
Also HMRI’s research activities include topics such as the following: Optimum Hull Form Development / Resistance & Propulsion / Seakeeping & Maneuvering Offshore Engineering / Structure Analysis / Noise & Vibration

HIRI (Hyundai Industrial Research Institute)
HIRI was established in 1983 to improve HHI’s productivity and quality in welding.
It plays a vital role in the advancement of production technologies such as welding, casting, plastic deformation, engine performance simulation, flow dynamic analysis, and other material processing methods including development of automatic production facilities.
HIRI is equipped with advanced analyzing equipment and powerful simulation facilities for developing new concepts in design and production technology.

HEMRI (Hyundai Electro-Mechanical Research Institute)
HEMRI, a cradle of technical innovation in the 21st century, is continuously making efforts to secure the company’s distinctive core technologies.
It also supports production with advanced technological assistance in solving technical problems.

Frontier Technology Institute
The Techno Design Institute’s main roles are in coordinating design development and supporting optimal design technologies by supplying new designs for various products and constructions.
Furthermore, the Techno Design Institute contributes to the creation of a new culture of enterprises and actualizes high-value business by obtaining its own design technologies.

HHI-EMD, 15 World Top-Class Products (2001~2011)
Since 2001, with the support of Korea’s Ministry of Knowledge Economy to promote exports, the World-Class Product Award has been given to domestic products which are ranked within the top five in the global market, have a market share over 10%, and market volume of over USD 50 million.
HYUNDAI
HEAVY INDUSTRIES CO., LTD.
ENGINE & MACHINERY

1000, Bangeojinsunhwan-doro,
Dong-gu, Ulsan, Korea

Marine Engine & Equipment
Tel.: +82-52-202-7291/7281
e-mail: k110@hhic.co.kr / k150@hhic.co.kr

Eco/Turbo Machinery
Tel.: +82-52-202-7336
e-mail: k220A@hhic.co.kr

Engine Power Plant
Tel.: +82-52-202-7301
e-mail: k120hhic@hhic.co.kr

Hydraulic Machinery
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e-mail: pump@hhic.co.kr

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e-mail: robot@hhic.co.kr

Customer Service
Tel.: +82-52-202-7411
e-mail: K190A@hhic.co.kr

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