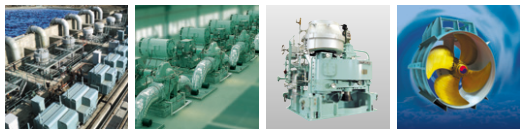
Building a better future
Global Leader

HYUNDAI
PUMPS



A Leader in the High Technology
Pump Industry

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HYUNDAI HEAVY INDUSTRIES CO.,LTD. | ENGINE & MACHINERY

A Leader in the
HIGH TECHNOLOGY PUMP INDUSTRY

Contents

Brief History of HYUNDAI PUMPS

Hyundai Heavy Industries Co., Ltd. (HHI) is well-known throughout the world for its shipbuilding and for manufacturing various kinds of machinery. HHI is made up of seven divisions: Shipbuilding, Offshore & Engineering, Industrial Plant & Engineering, Electro Electric Systems, Construction Equipment, R & D, and Engine & Machinery (HHI-EMD).
HHI-EMD manufactured and supplied different types of industrial-use pumps throughout the world from 1979~1990 under a technical license agreement with Ebara, Japan.
HHI-EMD also manufactures and produces its own pumps, and is continuously developing new and advanced pumps.

Our manufacturing facilities include casting, forging, machining, assembly, and testing shops that are among the best in the world.
HHI-EMD's excellent facilities and skilled manpower translate into high production efficiency.

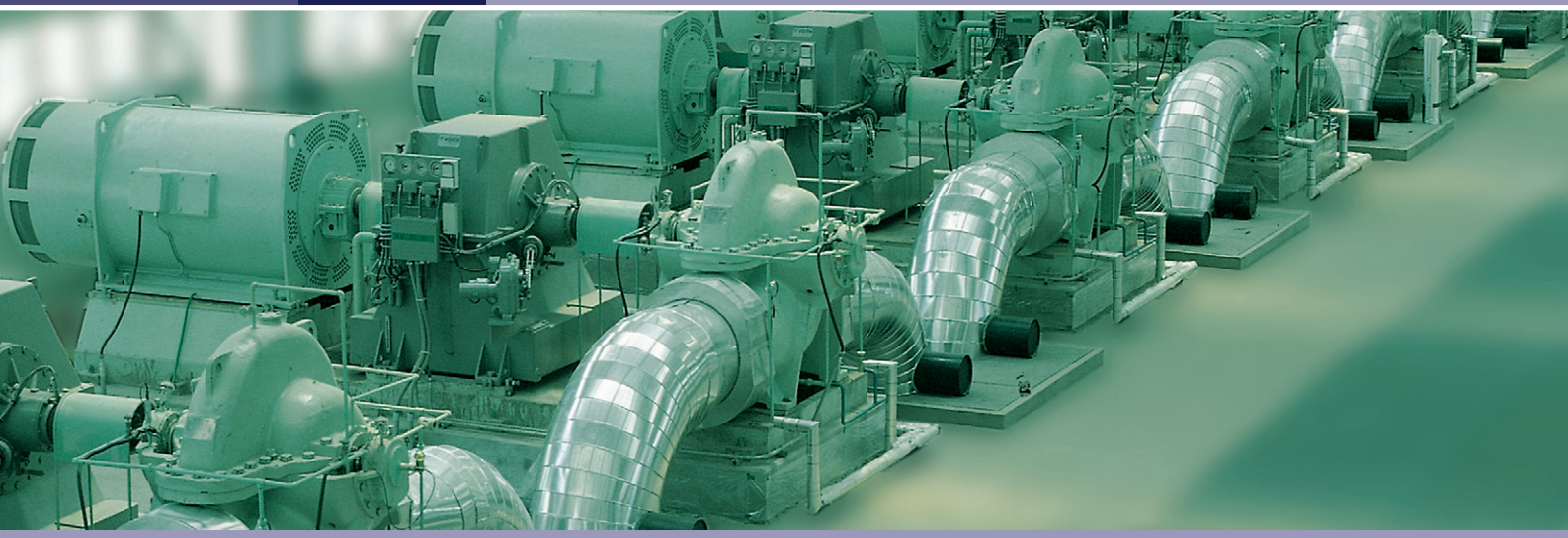
Because HHI-EMD has supplied pumps of the best quality throughout the world, it has earned an excellent reputation among its clients, at home and abroad. Maintaining this reputation has led to the

expansion of pump production to various fields including nuclear power plants. Currently, our major products include circulating water pumps, boiler feedwater pumps, feedwater booster pumps, condensate pumps and sea water lift pumps for thermal and nuclear power plants, brine recycle pumps, sea water intake pumps, brine blow down pumps, distillate and public water pumps for desalination plants, crude transfer/unload/booster pumps, offshore export pumps, seawater lift pumps, vaporized seawater pumps, cooling water pumps for oil, gas, refinery & petrochemical plants, and drainage pumps for flood control, irrigation and intake service, boosting pumps for water supply projects, and dry dock de-watering pumps, and cable free electrical submerged pumps for underground carvern crude oil stockpile.

Our major marine products are: cargo oil & ballast water pumps with steam turbines, hydraulic submerged cargo-pumping systems, side thrusters, and LNG cargo pumps.

We are sure that our quality and price will meet your expectations.

INDUSTRIAL PUMPS



PRODUCTS

Thermal and Nuclear Power Plants
Circulating-Water Pumps
Boiler Feed-Water Pumps
Feedwater Booster Pumps
Condensate Pumps
Sea-Water-Lift Pumps

Oil, Gas, Refinery & Petrochemical Plants
Petrochemical Plants
Crude Transfer/Booster Pumps
Offshore Export Pumps
Vaporized Sea Water Pumps
Cooling-Water Pumps

Desalination Plants
Brine Recycle Pumps
Sea-Water Intake Pumps
Brine Blow-Down Pumps
Distillate Pumps
Tempering and Public Water Pumps

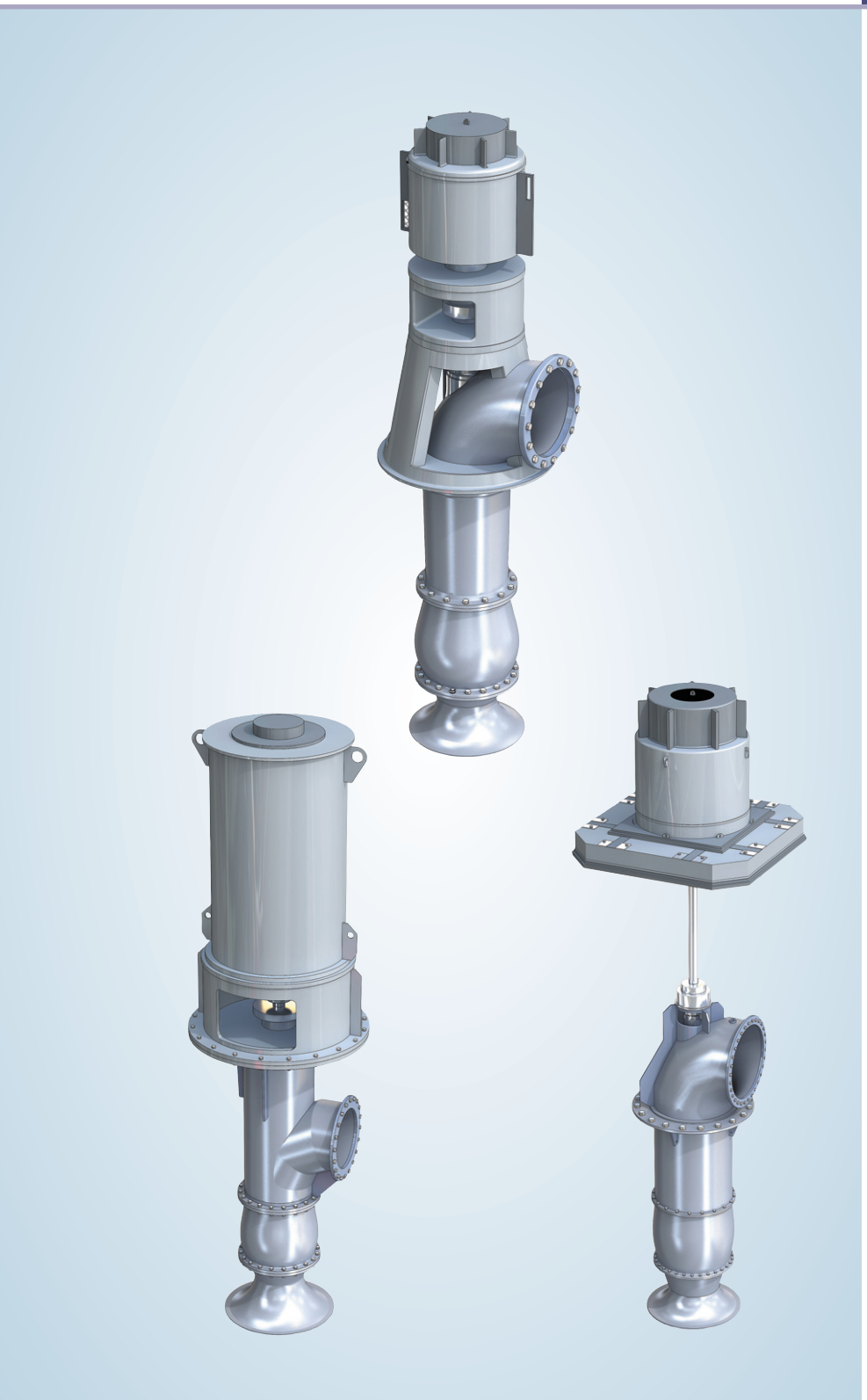
Flood Control
Drainage Pumps

Irrigation & Water Supply Projects
Intake Service Pumps
Boosting Pumps

Dry Docks
De-watering Pumps

VERTICAL MIXED/AXIAL FLOW PUMPS

Constructions



MODEL : VK / VA

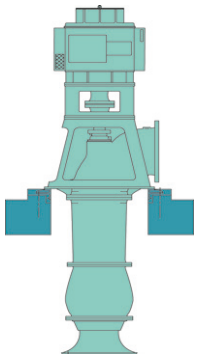
Size: 350 - 3,500mm

Capacity: 1,000 - 93,000 m^3/ h

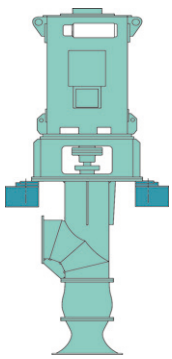
Major Applications

- Power Plant; Cooling-Water Pumps
  Circulating-Water Pumps
  Sea Water-Lift Pumps
- Vaporized Sea Water-Lift Pumps
- Irrigation and Drainage Pumps
- Dock De-watering Pumps
- Influent and Effluent Pumps

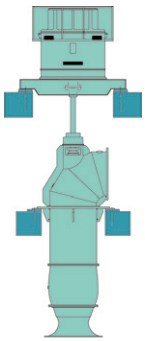
Installations



Discharge nozzle
above floor



Discharge nozzle
below floor



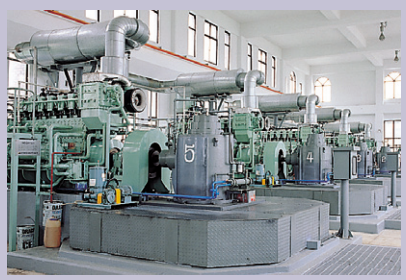
Two-floor
installation

VERTICAL MIXED/AXIAL FLOW PUMPS

Variable Pitch Vane Pump

Applications

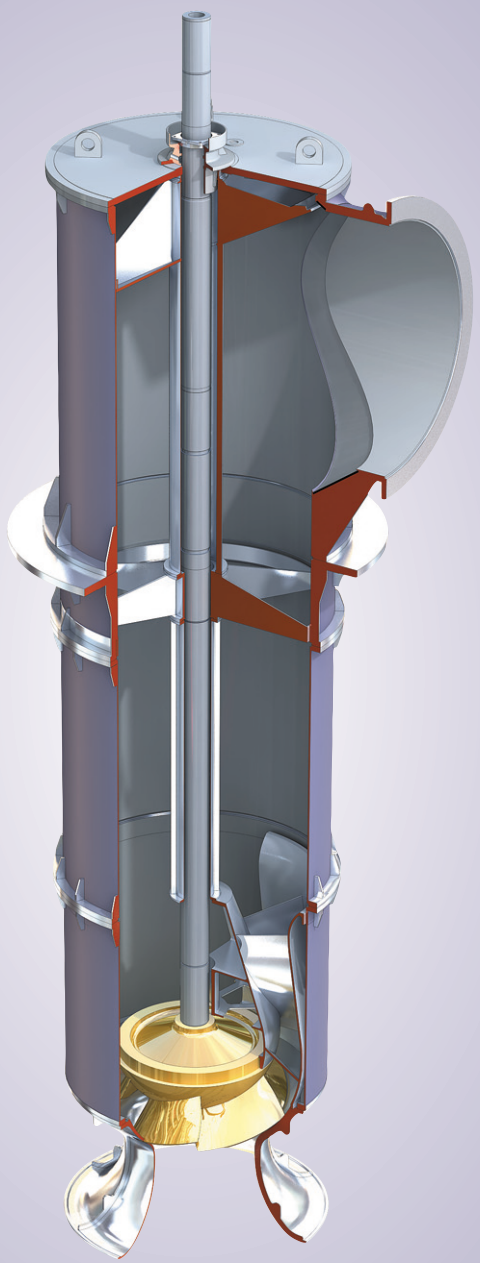
De-watering Pump for Dockyard 1500VKM



Drainage Pump for Drainage Station

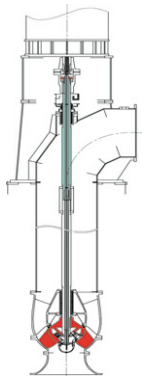
Sea Water Lift Pump for
Thermal Power Station 2000VKNM

Constructions

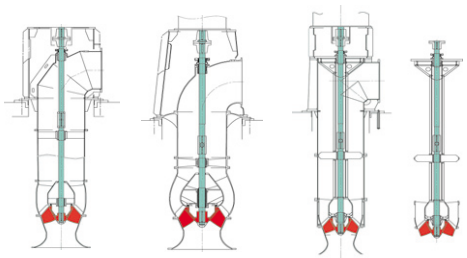


MODEL: VA/VK

Installations



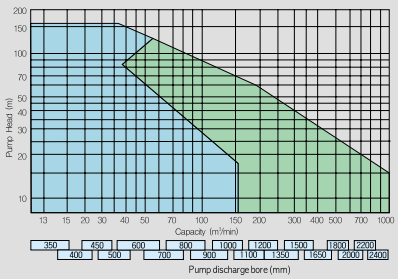
Variable Pitch Vane



Fabrication Casting Pull-out

Hydraulic Coverage

Pumps rating beyond this range are available also



VERTICAL MULTI-STAGE (BARREL) PUMPS

Constructions

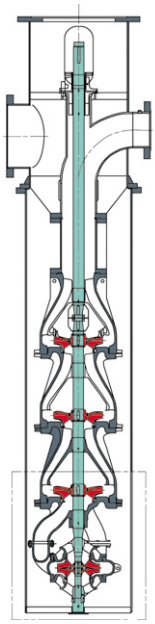
MODEL: VW

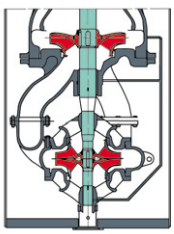
Size: 200 - 1,500mm

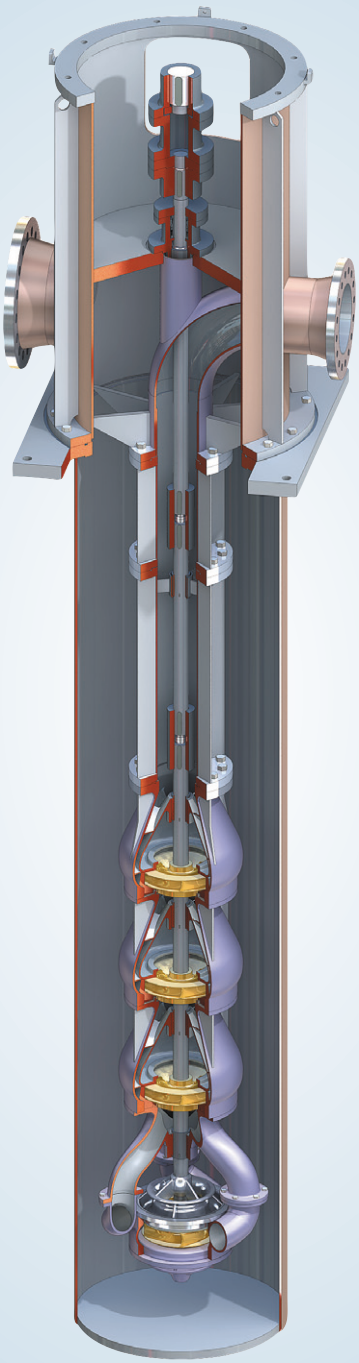
Capacity: 200 - 28,000 m^3 / h

Major Applications

Power Plant; Condensate Extraction Pumps
Hot Water Pumps
Desalination; Brine Recirculation Pumps
Brine Blow-Down Pumps
Distillate Pumps
Pipeline Booster and Product Unloading Pumps







1000MW Nuclear Power Plant

Applications

1000MW × 2 Units / Younggwang Nuclear Power Plant, Units 3 & 4

DOUBLE SUCTION PUMPS

Constructions

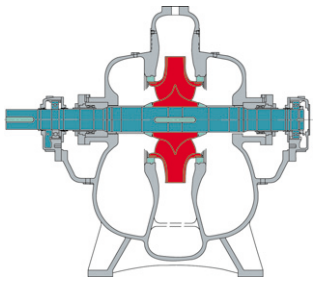
MODEL: HD/ HDR

Size: 200 - 1,800mm

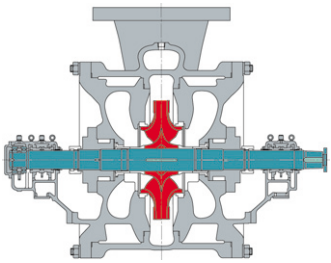
Capacity: 300 - 28,000 m^3/ h

Major Applications

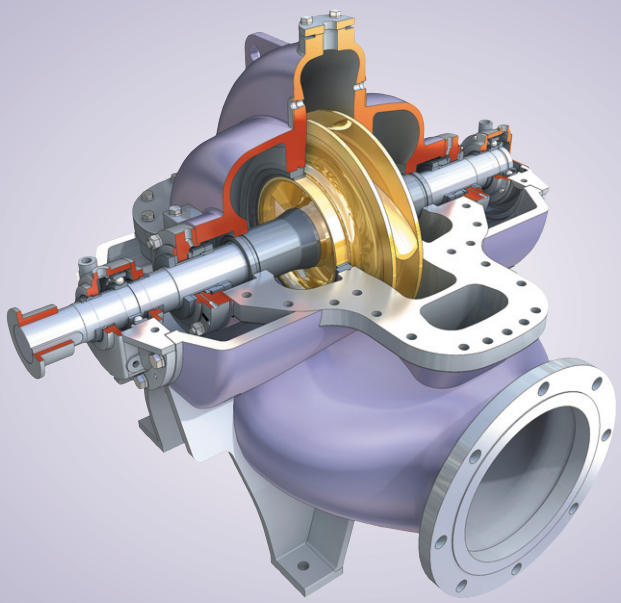
- Water Intake Pumps, Circulating Pumps
- District Heating Pumps
- Feedwater Booster Pumps
- Crude Transfer / Booster Pumps
- Offshore Export Pumps
- General Industries



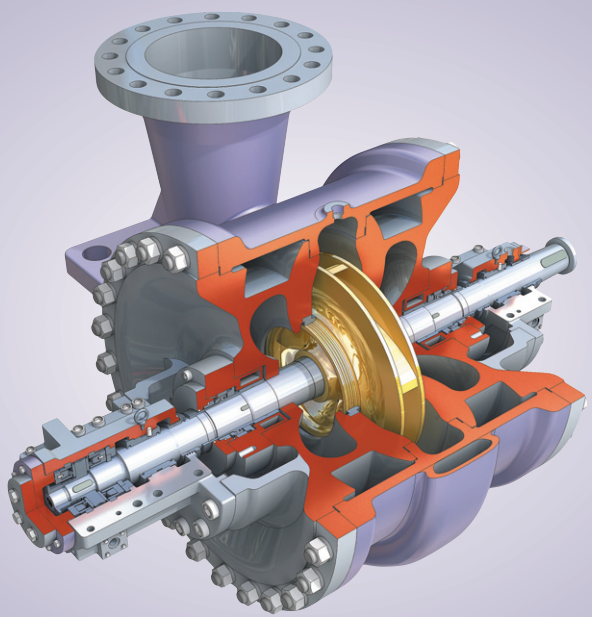
HD: Axial Split



HDR: Radial Split



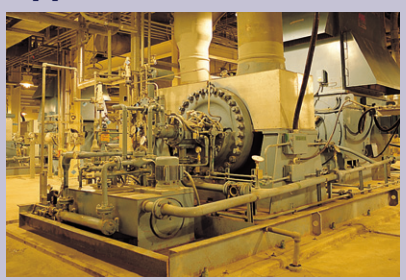
HD



HDR

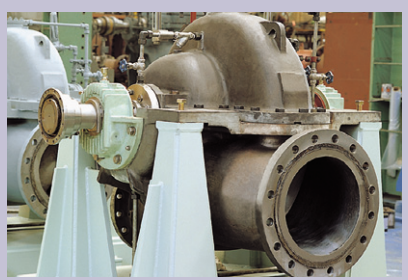
Cooling Water Pump for Petrochemical Plants
Model 1050×750HDM

Applications



Feedwater Booster Pump for
Nuclear Power Plant Model 600 X 400HDRM

Hot Water Supply Pump for
Bundang Model 600 X 400HDM



Center Line Mounted Pump for
Hot Water Supply Service Model 400 X 300HDM

HORIZONTAL HIGH-PRESSURE PUMPS

Constructions

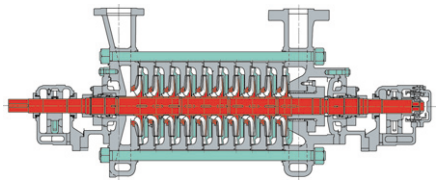
MODEL: HMR/ HMA

Size: 500 - 600mm

Capacity: 40 - 6,000 ㎥/ h

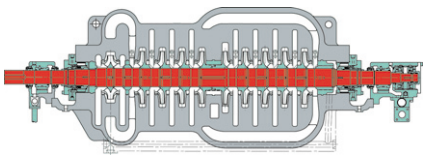
Major Applications

- Boiler Feedwater Pumps
- Water-Injection Pumps
- Steam Generate Pumps
- De-scaling Pumps



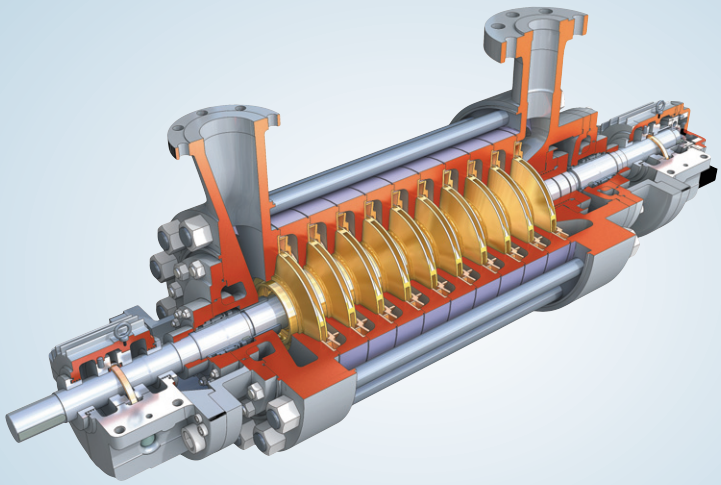
• Max. Flow: 900 ㎥/ h
• Max. Head: 2,000m

HMR Radial-split diffuser-type multi-stage pump

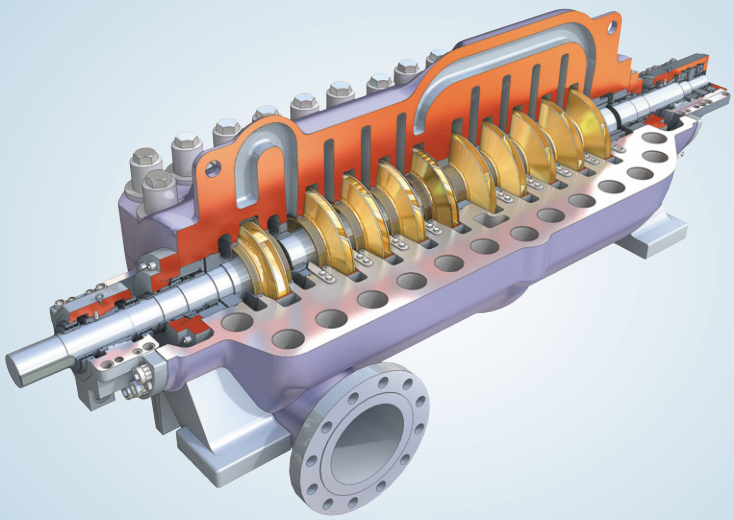


• Max. Flow: 2,000 ㎥/ h
• Max. Head: 1,800m

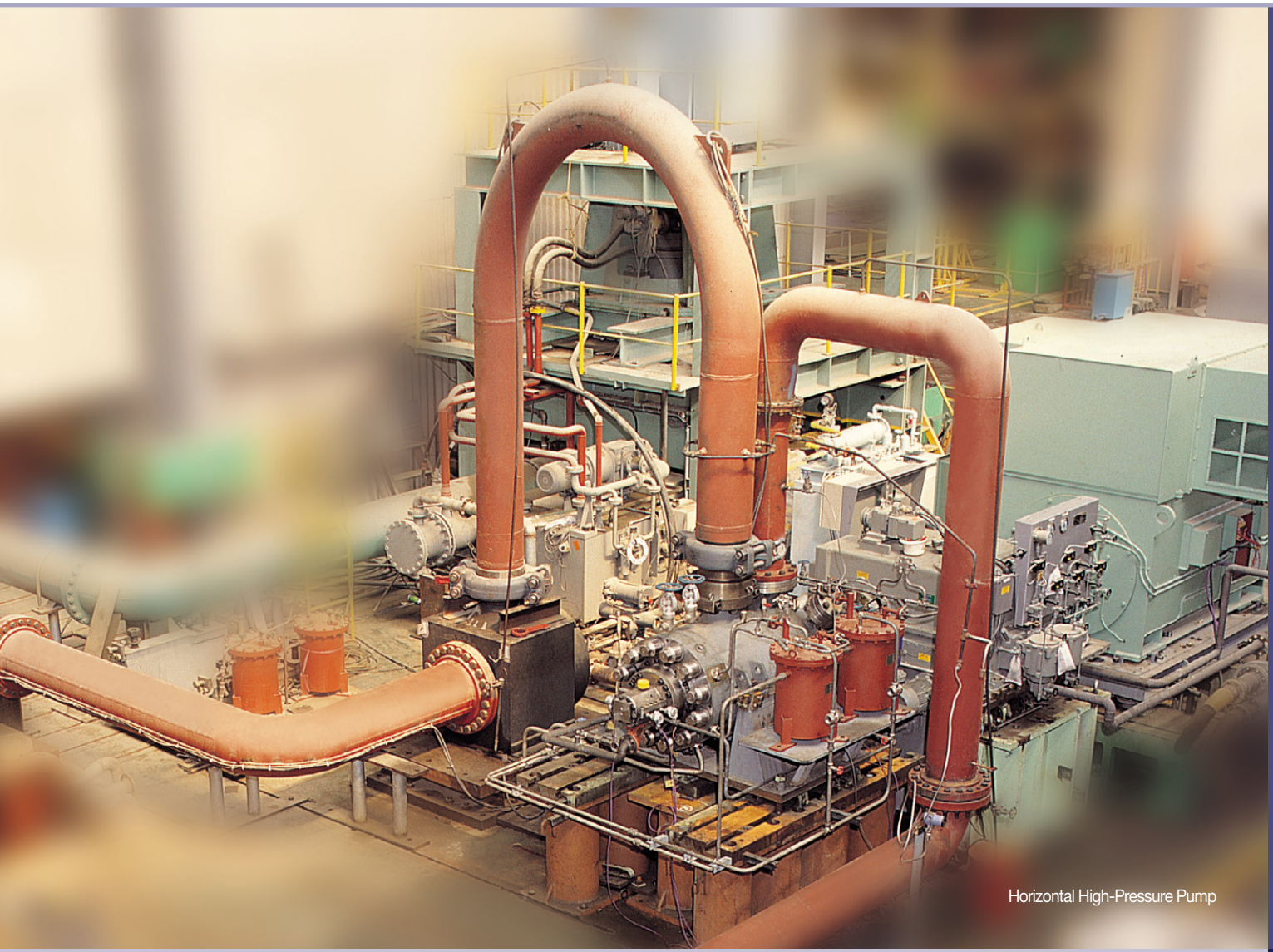
HMA Axial-split volute-type multi-stage pump



HMR

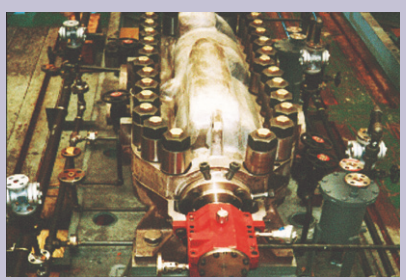


HMA

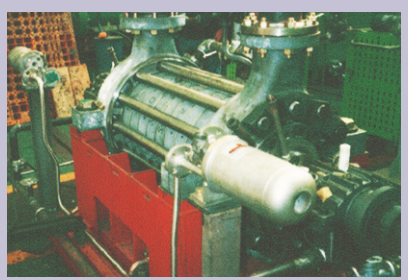


Horizontal High-Pressure Pump

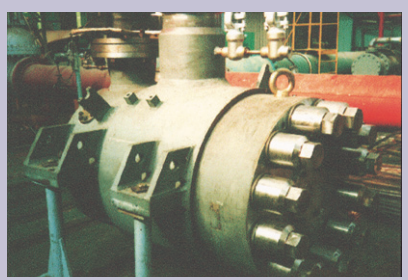
Applications



HMA 200 ×150 - 10STG
For 200MW Combined-Cycle Power Plants



HMR 125 ×100 - 10STG
For 125MW Combined-Cycle Power Plants

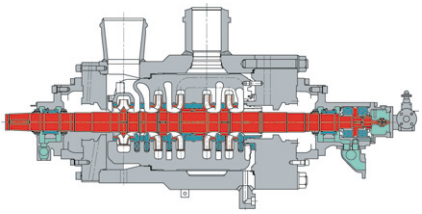


HMB 366
For 500MW Thermal Power Plants

HORIZONTAL HIGH-PRESSURE PUMPS

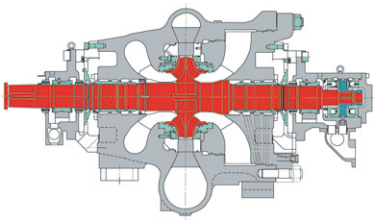
Constructions

MODEL: HMB/ HDR



- Max. Flow: 2,000㎥/h
- Max. Head: 4,000m

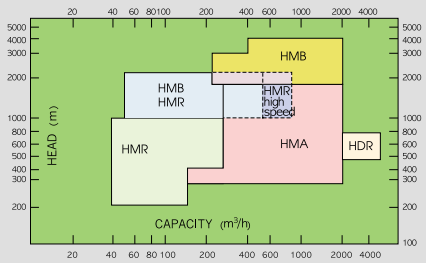
HMB Double-case-type multi-stage pump

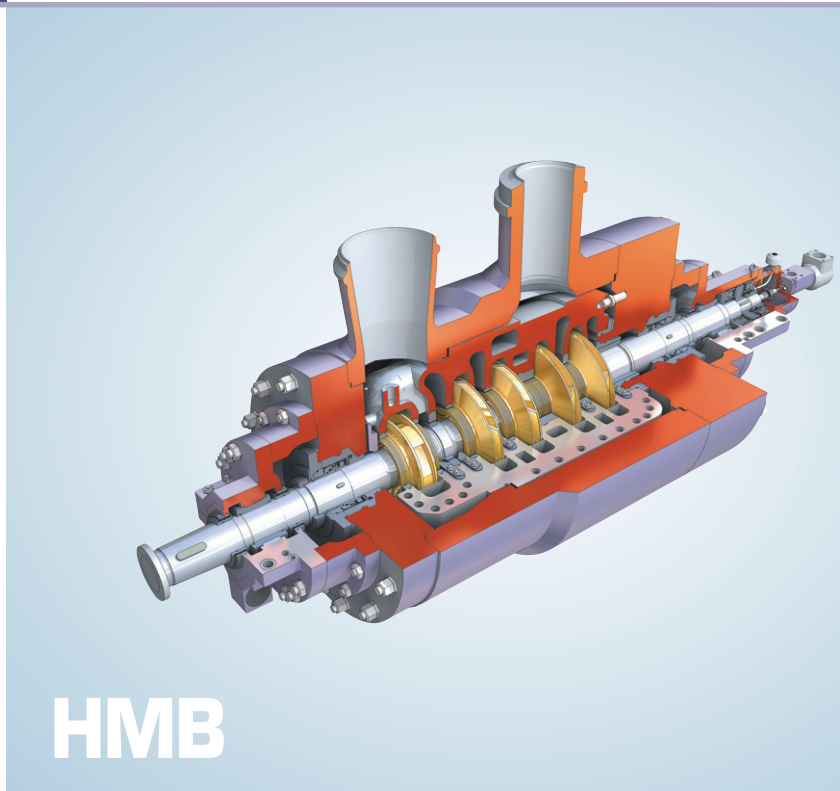


- Max. Flow: 6,000㎥/ h
- Max. Head: 800m

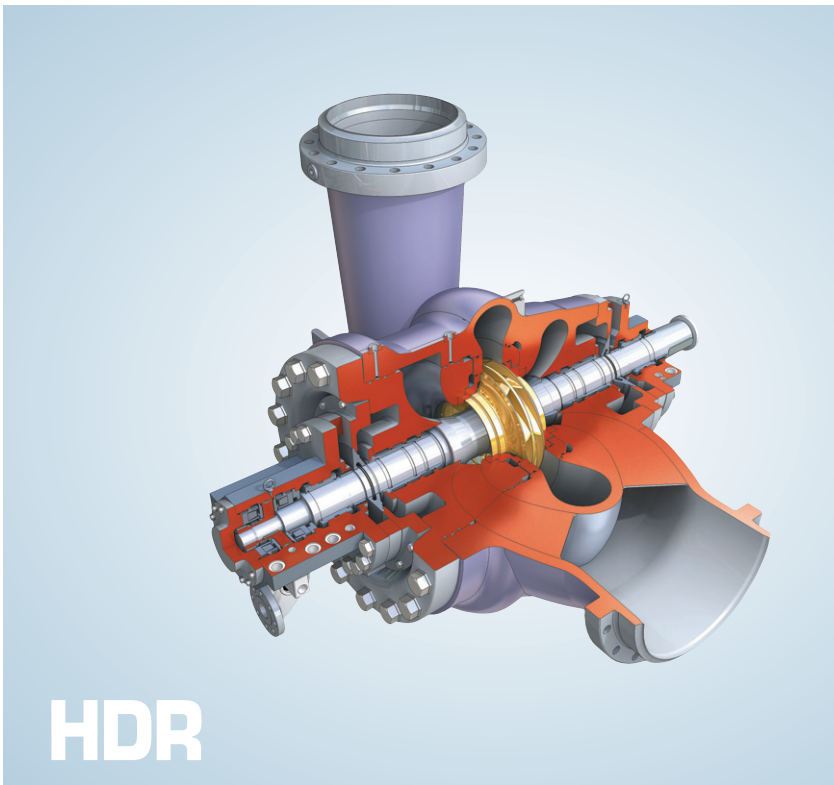
HDR Feedwater Pump for Nuclear Power Plants
- Radial-Split Diffuser Casing

Selection Chart





HMB



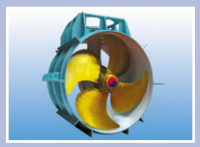
HDR

MARINE PUMPS

PRODUCTS

Cargo Oil Pump & Steam Turbines

Hyundai Hydraulic Submerged Cargo-Pumping System



Hyundai Thrusters
CP & FP Propellers

LNG Marine Pumps
Submerged-Motor Cryogenic Pumps

CARGO OIL PUMPS & STEAM TURBINES

Constructions

Cargo Oil Pumps

MODEL: HCP

Size: 300 - 500mm

Capacity: 1,800 - 6,050 m^3/h

Major Applications

- Cargo Oil Carriers / Product Oil Carriers
- VLCCs

MODEL: HBP

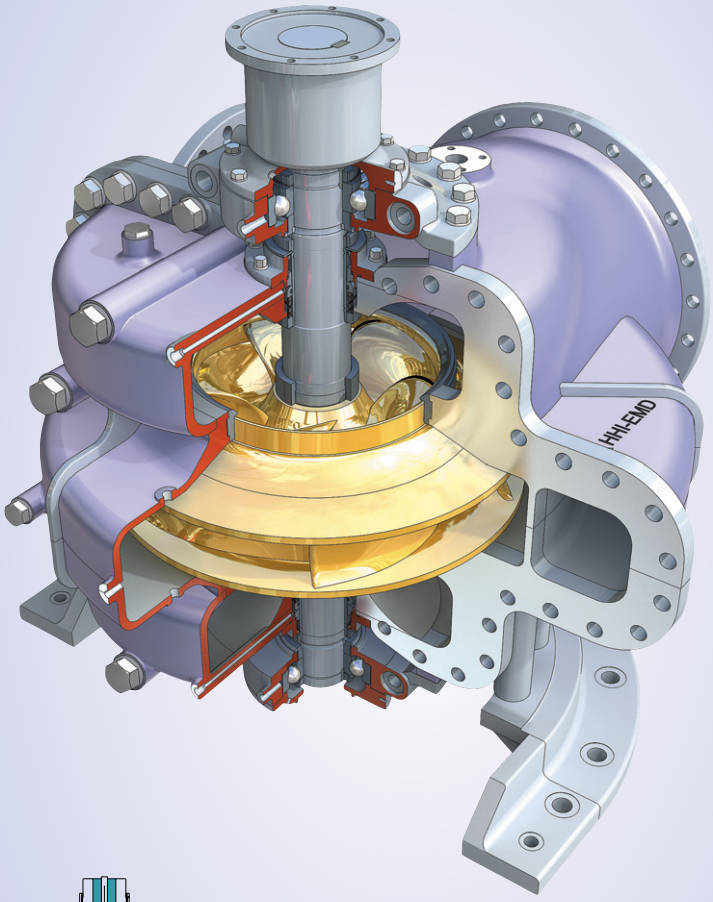
Size: 300 - 500mm

Capacity: 1,200 - 5,000 m^3/h

Major Applications

- Cargo Oil Carriers / Product Oil Carriers
- VLCCs

PARTS	MATERIAL
Casing	Ni-Al Bronze
Impeller	Ni-Al Bronze
Shaft	Stainless Steel
Wear Ring	Leaded Tin Bronze
Bearing Housing	Cast Iron
Mechanical Seal	Stainless Steel



Steam Turbines

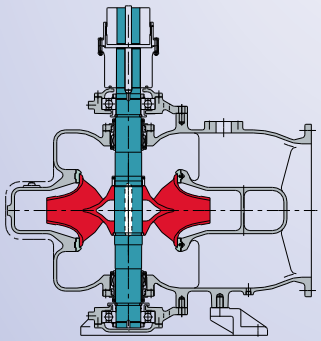
MODEL: CSV/RTV

HCP

Model		CSV-8	CSV-14	CSV-18	RTV
		800kW	1400kW	2000kW	3500kW

HBP

Model	CSV-5	CSV-8
	500kW	800kW



Features

Material

Ni-Al Bronze is used for the pump-casing and impeller. The mechanical properties and corrosion resistance of Ni-Al Bronze are higher than in bronze casting. This significantly extends the casing's life span.

Easy Maintenance

The Flushing-pipe with built-in casing and the cartridge-type seal make maintenance much easier.

Improved of Hydraulic Performance

Adoption of high-efficiency discharge volute, high-performance suction volute, and wear ring configuration has led to an improvement in hydraulic performence.

Cargo Oil Pump

Steam Turbine

HYDRAULICALLY DRIVEN

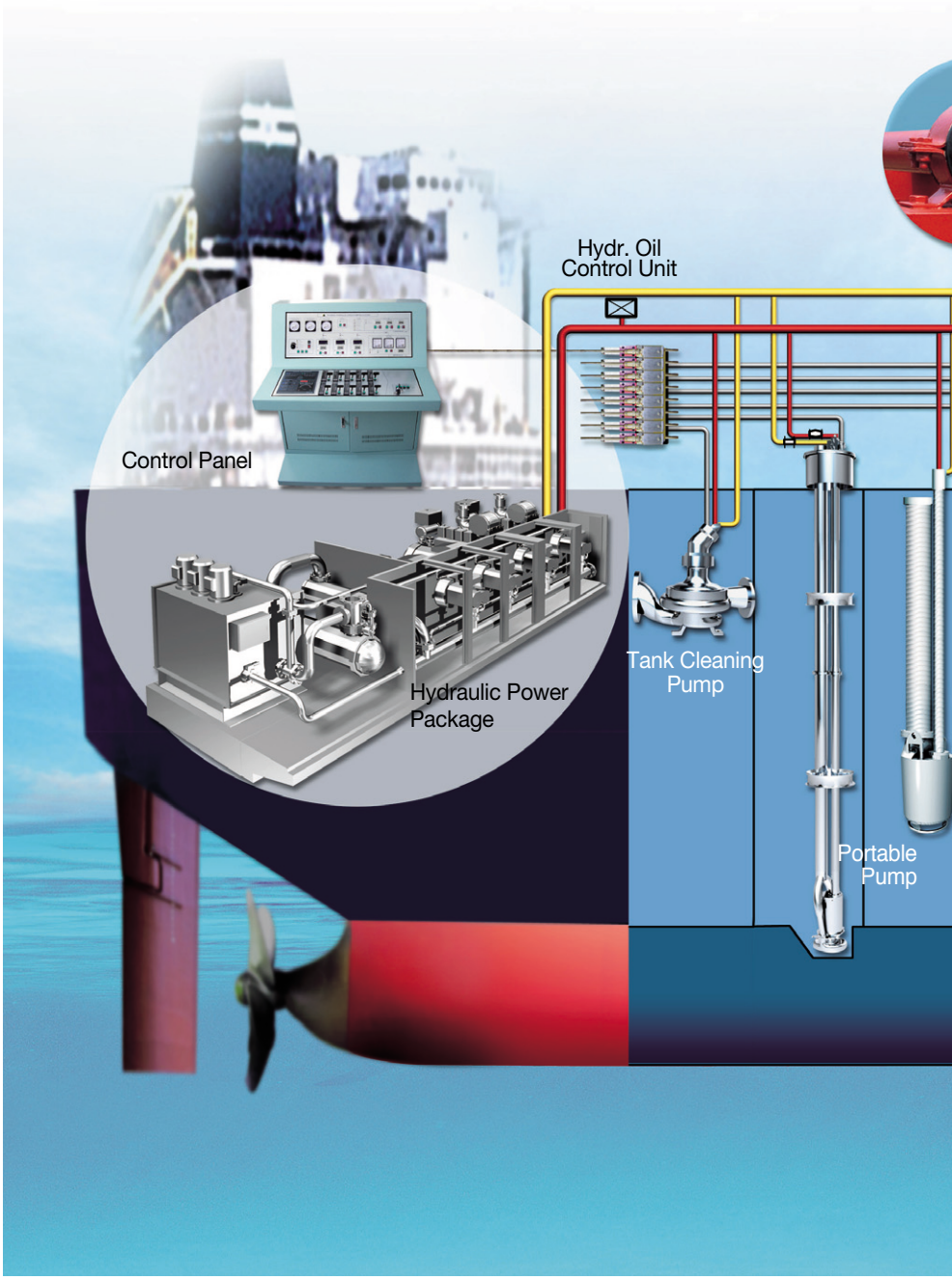
SUBMERGED-CARGO-PUMPING SYSTEM

Major Components

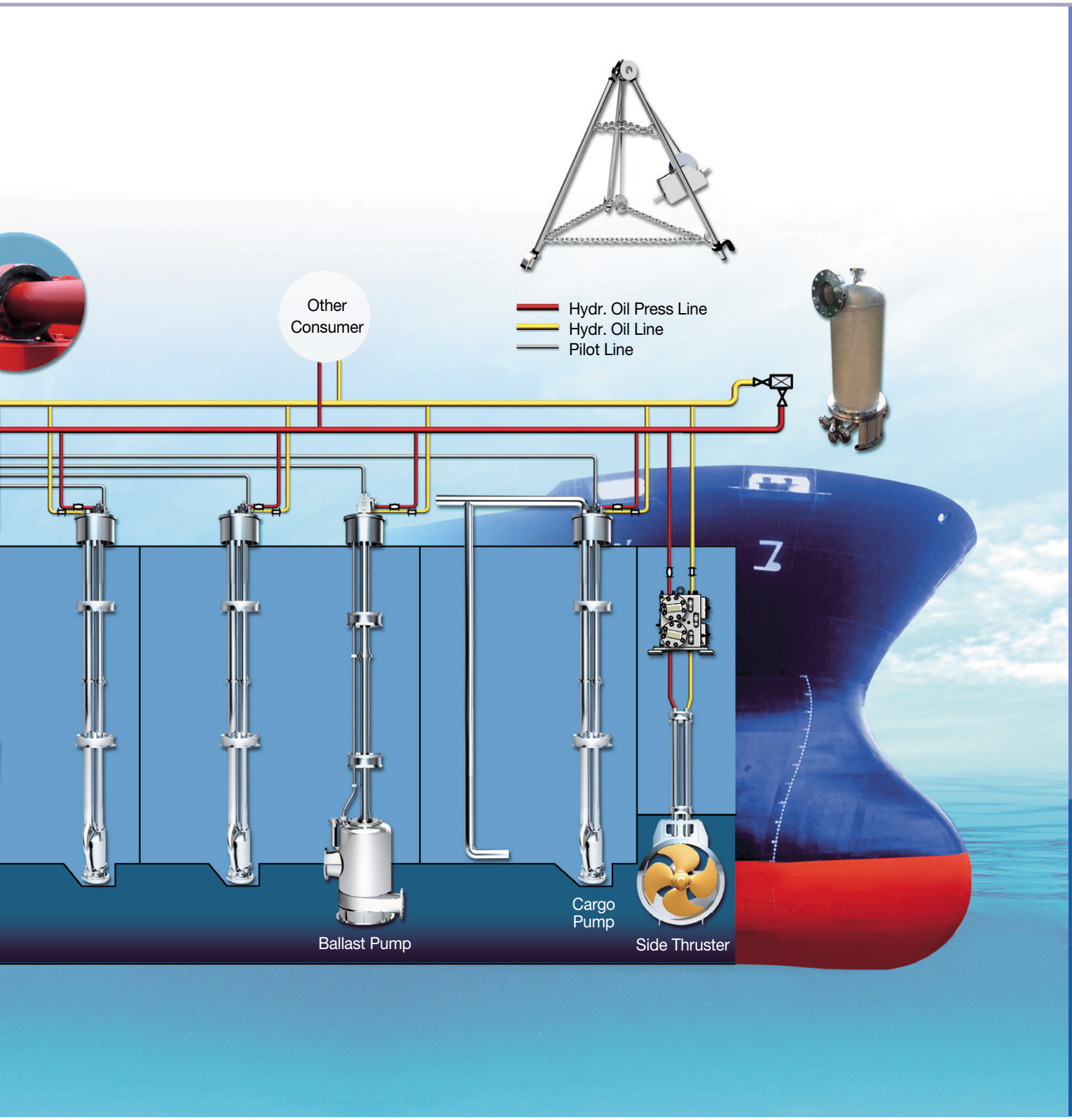
- Submerged cargo-pump
- Hydraulic power package
- Control system
- Ballast pump
- Portable pump with winch
- Tank-cleaning pump
- Hydraulic oil transfer-pump
- Hydraulic piping and fittings

Optional Components

- Diffuser
- Side thruster & control block
- Cargo heater



HYDRAULICALLY DRIVEN SUBMERGED-CARGO-PUMPING SYSTEM

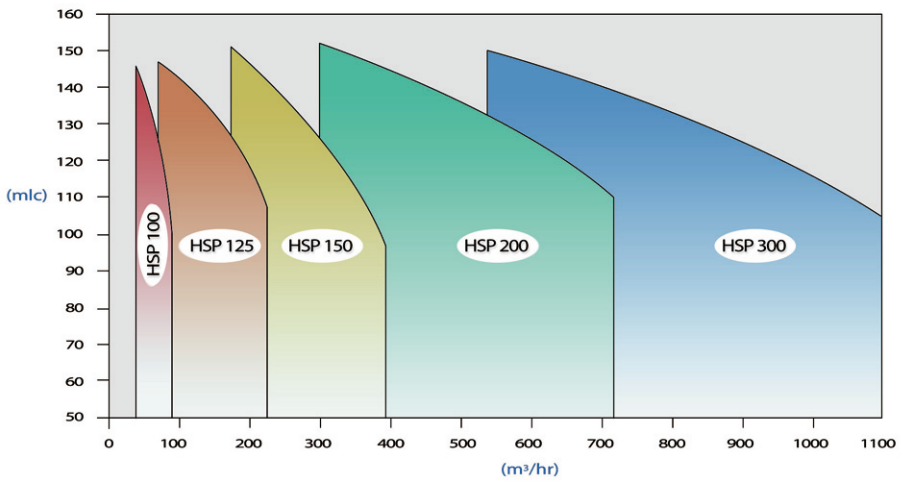


HYDRAULICALLY DRIVEN

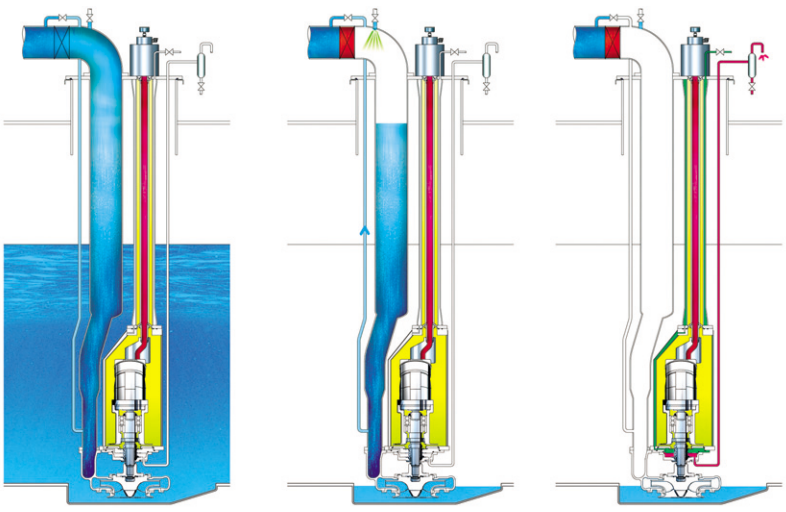
SUBMERGED-CARGO-PUMPING SYSTEM

Pump Selection Chart

Optimum pump capacities are achieved by selecting the best possible model based on the client required flow rate, head, and other variables. We provide clients with a proposal for a complete **HYUNDAI SUBMERGED-CARGO PUMPING SYSTEM** based on the customer's total tank volume, total discharge rates, total head, and other factors.



Operation

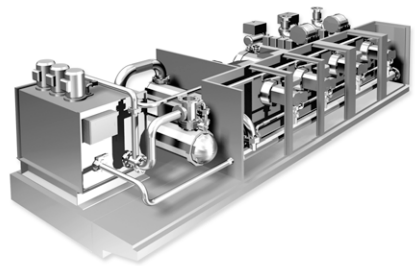


Discharging | Stripping | Purging and seal-leakage check

Hydraulic Power Package

HYUNDAI's HYDRAULIC POWER PACKAGE is a central hydraulic ring-line system in a closed loop where hydraulic pumps deliver oil to a main pressure line. The hydraulic pack consists of the main hydraulic pump, an electric motor, and/or a diesel engine, a feed pump, cooling-filtering-heating units, a control valve and additional components.

The main hydraulic pumps are an axial piston-type, with swashplate design and variable displacement. The pump displacement (swivel angle) is hydraulically controlled via the pressure regulator on each pump.



The power packs can be started in any sequence. A maximum of 4 starts should be made in an hour, and the limit switches on the suction line for each power pack will stop or prevent the start of the corresponding power pack only.

The hydraulic cooling-filtering-heating unit controls the viscosity and temperature of the hydraulic working oil helping maintain the oil's purity and increasing system reliability.

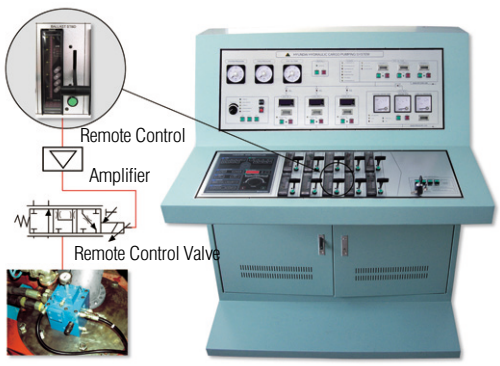
Electro-Hydraulic Control System

The independent load control of cargo pumps and side thrusters connected to the main close-loop hydraulic system is generally arranged both remotely and locally.

HYUNDAI's SUBMERGED CARGO PUMPING SYSTEM is controlled by a Programmable Logic Controller (PLC) installed inside the control panel. The PLC is programmed by HHI and ensures safe operation and easy maintenance of the control system

The control panel contains a potentiometer and pressure gauge for each pump, for stepless independent load control. Electrical connections run between the control panel and a proportional valve/amplifier where the electronic control signals are transformed into hydraulic signals.

Only hydraulic pilot lines run between the proportional valve/amplifier and the individual pumps. This control system can interface with any central ship computerizing systems.



Pressure-flow Control (PFC) Block

THRUSTERS CP & FP PROPELLERS

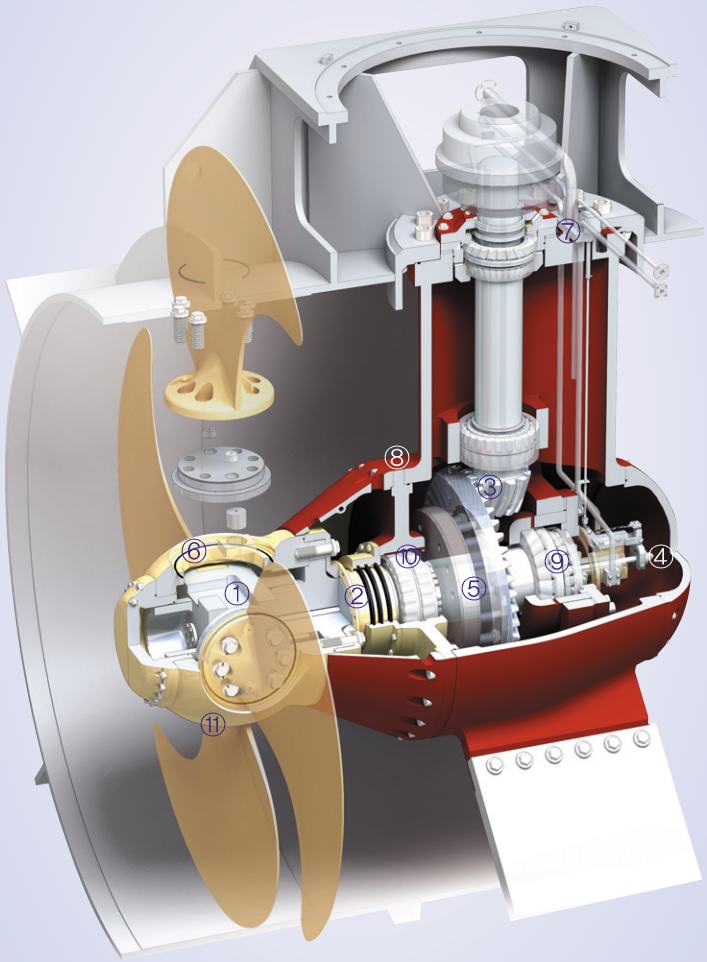
Features

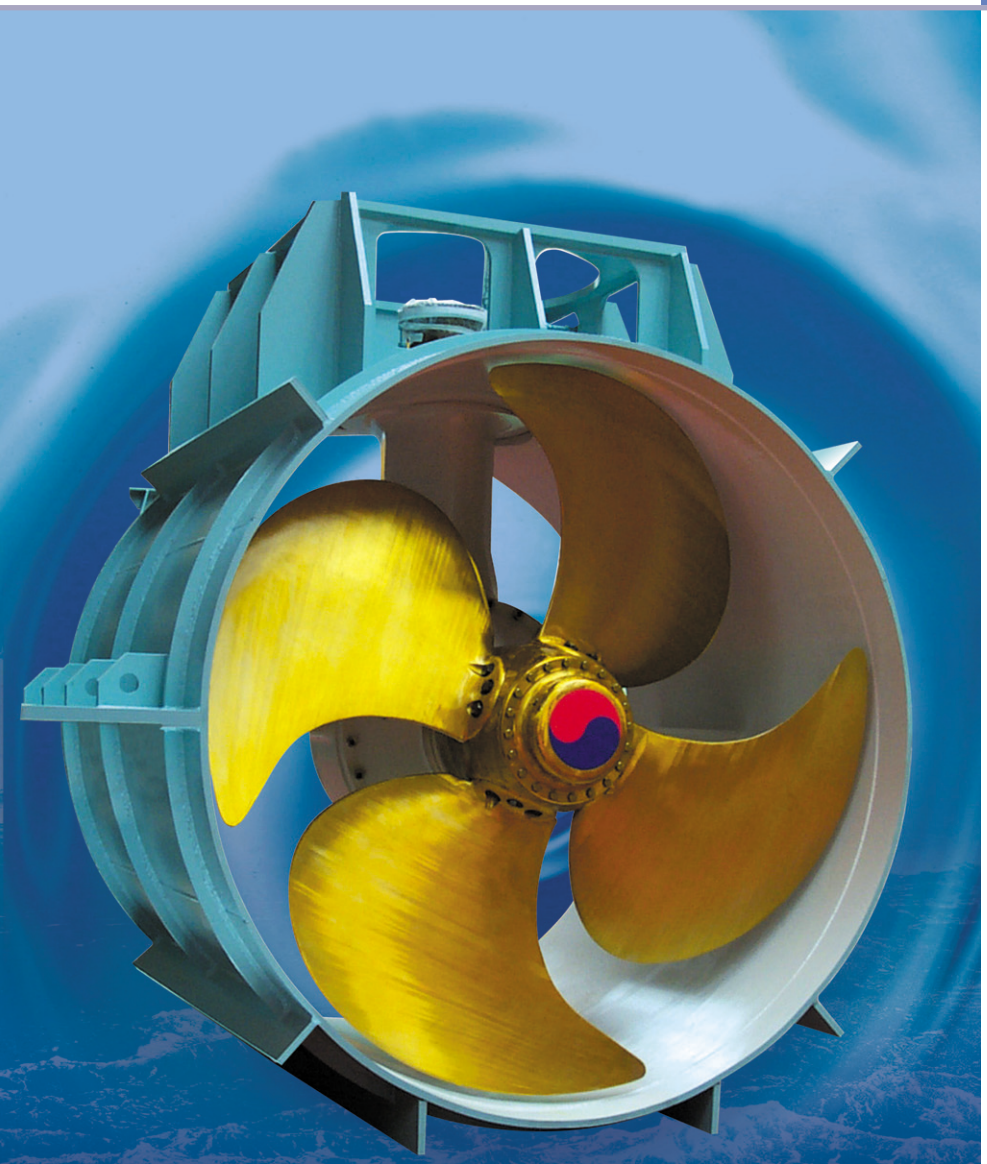
HYUNDAI THRUSTERS can be fitted to a wide range of vessels operating throughout the world. The tunnel thruster is designed to efficiently generate thrust force, allowing a ship to maneuver more easily. Thrust system normally consists of a thruster unit with tunnel, hydraulic equipment, a remote control and a prime mover.

A long service-life and easy maintenance are key factors in the design of the **HYUNDAI THRUSTER**.

Main Data

① Rigid crank & sliding block mechanism for smooth & accurate pitch control
② Patented, proven seal assembly
③ Precision spiral bevel gear set with optimum tooth contact pattern to ensure long lifetime and low noise
④ Robust bearing arrangements made jointly with bearing manufacturer
⑤ Dynamic balanced rotor assembly for stable operation
⑥ Double-acting quad-ring to prevent seal from leakage
⑦ Integrated piping arrangement
⑧ Streamlined shape to ensure stable flow
⑨ Simplified feedback mechanism to increase reliability
⑩ Internal lub. oil flow passage for self-lubricating action
⑪ Optimized propeller for maximum thrust based on experience, CFD, and model tests





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

System Configuration

HYUNDAI THRUSTER systems consist of a thruster unit with tunnel, hydraulic equipment for pitch control, a gravity tank, a remote control, feedback device, and the electrical driver with starter.
Operating the pitch control dial mounted on the remote control in the wheel house or wing-side actuates the solenoid valve inside the hyd. pump unit, then pressurized oil moves the cross head (piston) directly.

The actuating force of the piston is converted into torque by a sliding shoe mechanism, changing the pitch angle of the propeller blade accordingly.

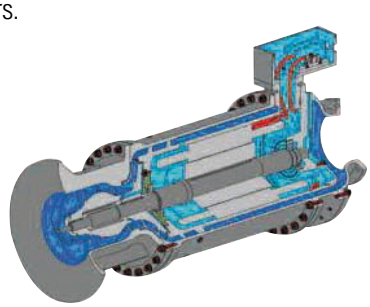
The pitch-angle adjustment of the propeller is transmitted from the cross head to the angle transmitter via chain.
The angle transmitter converts the mechanical stroke into an electrical feedback signal displayed on the control board.

LNG MARINE PUMPS SUBMERGED-MOTOR CRYOGENIC PUMP

Main Features

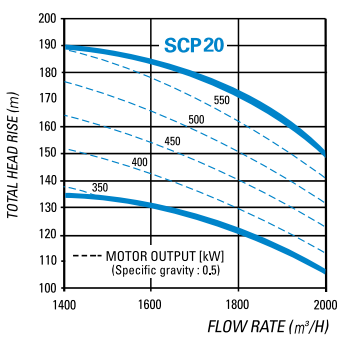
LNG Cargo pumps offer the following advantages:

- 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.



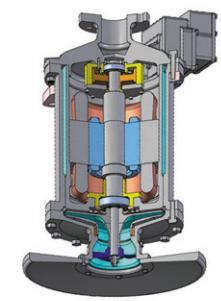
Hydraulic Coverage

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. HHI-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



Spray Pumps

A vertical, 3560 rpm centrifugal pump, with integral 440V, 3-Phase, 60Hz, 2-Pole, submersible 35kW electric motor.
The pump is configured with a balance drum as a fixed, in-tank, stripping and spray pump. JC Carter has supplied more than 160 of these pumps for LNG carriers.



Emergency Pumps

A vertical, 3560rpm centrifugal pump, with integral 440V, 3-Phase, 60Hz, 2-Pole, submersible 200kW electric motor. The pump is configured with a balance drum as a removable, in-tank emergency pump.

- Optimized design for columns that are 16 inches diameter, can be installed in 24 inches or 16 inches pump columns.
- Benefits:
  - **Reduced column cost if adapted to dia. column 16 inches**
  - **Reduced size and weight, easier to handle**

Fuel Pumps

A vertical, centrifugal pump with integral 440V, 3-Phase, 60Hz, 2-Pole, submersible 10kW electric motor.

- The pump is configured as a fixed, in-tank, gas-fuel supply pump

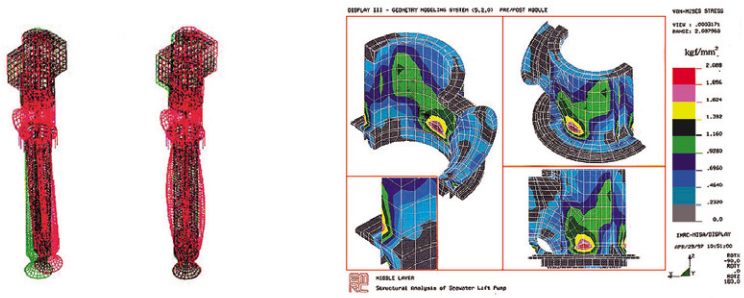
A dedicated fuel pump (15 m^3/h at 140 to 230 m) with the latest inducer-design to ensure good pump behavior with the lowest possible LNG level despite wave induced motion during sea voyages.

RESEARCH AND DEVELOPMENT

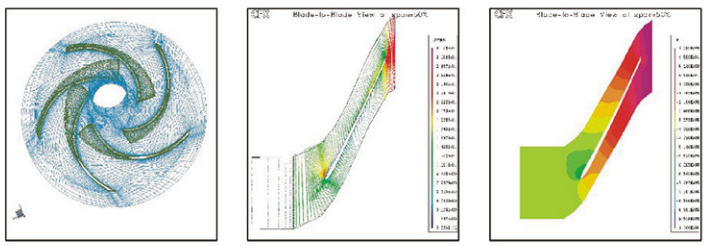
HHI operates four renowned in-house institutes that have various hydrodynamic facilities equipped with advanced analyzing equipment and powerful simulation facilities. The comprehensive R & D activities of the institutes comprise all pre-production phases including computer-aided design and the following:

- Performance simulation of pumps and industrial machinery
- Flow dynamic analysis
- Structure analysis
- Analysis of noise and vibration

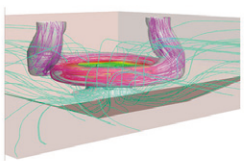
R&D plays a vital role in the advancement of production technologies such as welding, casting, plastic deformation, etc.



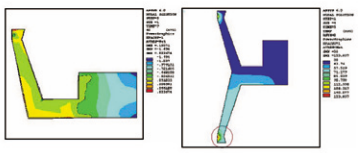
Vibration/Structure analysis



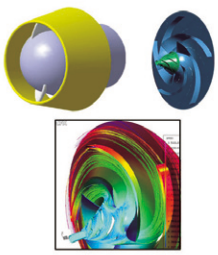
Development of impeller design through CFD analysis



Development to design optimal suction well for improved stripping



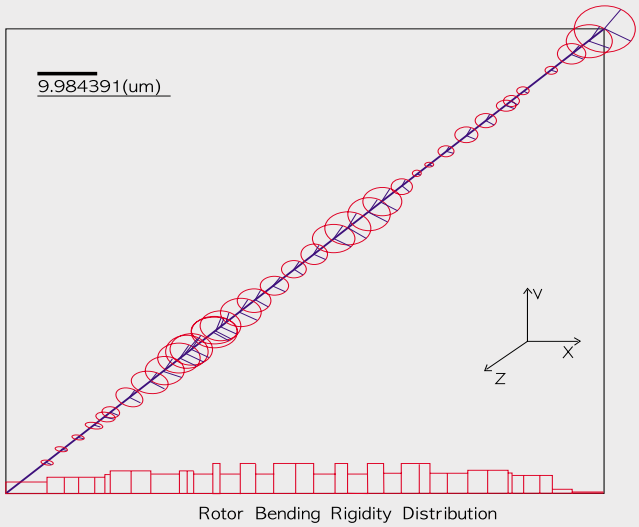
Structure analysis for lip seal



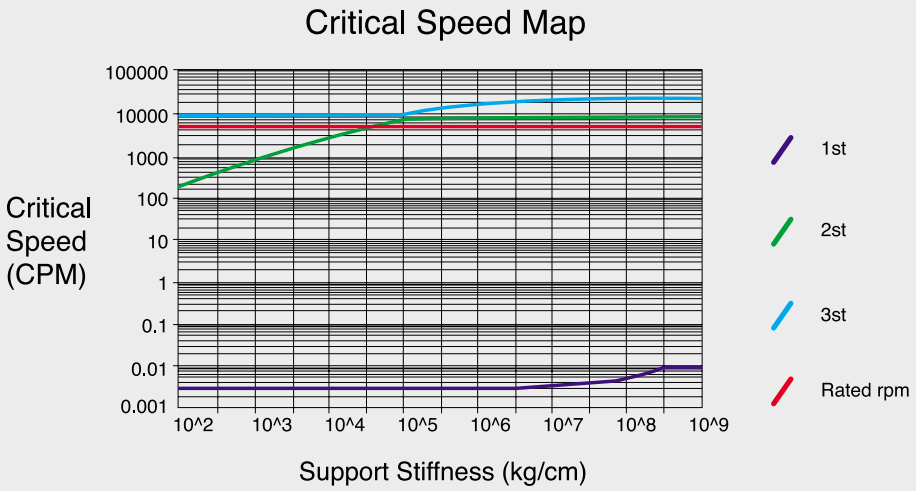
Flow field analysis for aux. impeller

COMPUTATIONAL ANALYSIS

Damped Unbalanced Response Analysis In accordance with API 610



Natural Frequency Analysis



TEST FACILITIES FOR HYUNDAI PUMPS

DESCRIPTION	FACILITIES	SPECIFICATIONS	Q,TY
Test Capacity	**1) Weir Test**		
	- Horizontal-Type	Max. Flow Rate 93,240 m^3/hr	
	- Vertical-Type	Max. Flow Rate 93,240 m^3/hr	
	2) Closed-Loop Test		
	- Horizontal-Type	Max. Flow Rate 7,200 m^3/hr	
	- Vertical-Type	Max. Flow Rate 7,200 m^3/hr	
	- Horizontal High-Pressure	Max. Flow Rate 5,100 m^3/hr	
Mechanical	**Suppressed Rectangular Weir**	Width 6m, 62,160 m^3/hr	2
	Suppressed Rectangular Weir	Width 3m, 31,080 m^3/hr	2
	Functional Test Equipment		
	1) Ultra-High-Pressure Pump	5,100m3/hr ×400kg/cm^2	1
	- Motor for Shop Test	20,000kW ×60Hz ×3 Φ	1
	- Fluid Coupling	20,000kW(3,200-7,200 rpm)	1
	2) High-Pressure Pump	7,200m3/hr ×50kg/cm^2	1
	3) Horizontal Pump	20kg/cm^2	3
	4) Vertical Pump	20kg/cm^2	4
	5) Marine Pump	20kg/cm^2	1
	6) Model Test Equipment	900 m^3/hr ×150kg/cm^2	1
	Others		
	1) Hydrostatic Test Equipment	1,000kg/cm^2, 50kg/cm^2	2
	2) Balancing Machine	Φ 3,000 ×4,500 ×7,000K	3
Electrical	**Control Desk**	Monitoring System, Measuring System Pump/Motor/Valve Control	2
	Data Logger	40CH kW V A PF Hz (Power Measuring)	1
	Analyzing Recorder	12CH kW V A PF Hz (Power Measuring)	2
	Motor-Generator Set	3,500kVA ×6.6-3.3kV ×50Hz	1
		10,000kVA ×11-6.6kV ×50Hz	1
	Transformer	7,000kVA ×13.8kV/6.6-3.3kV, etc.	5
	Auto-Transformer	5,200kW ×13.8kV ×80-65-50%TAP, etc.	5
	Torque Meter, Vibration Meter		5

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