

We build a better future
HYUNDAI
HEAVY INDUSTRIES CO.,LTD.
ENGINE & MACHINERY

HYUNDAI **SUBMERGED CARGO PUMP** HYDRAULICALLY DRIVEN



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Introduction

As one of the leading engine builders in the world, the Engine and Machinery Division of Hyundai Heavy Industries Co., Ltd. (HHI-EMD) has supplied a variety of industrial pumps for Power Plants since 1979 and cargo oil pumps driven by steam turbine for Oil Tankers since 1995, respectively, to the satisfaction of our customers.

HYUNDAI 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 is staffed with a qualified and experienced team of engineers and technicians to design, manufacture and factory test each pump.

HYUNDAI SUBMERGED CARGO PUMPING SYSTEM meets all new international rules and regulations. Our quality system has been evaluated and is registered in accordance with ISO Standards. HHI-EMD is Quality System Certified to ISO 9001.

Contents

- Hyundai Hydraulic Submerged
Cargo Pumping System
- Pump Selection Chart
- Pump Dimension
- Submerged Cargo Pump
- Sectional Drawing
- Installation
- Operation
- Ballast Pump
- Potable Cargo Pump
- Hydraulic Power Package
- Electro-hydraulic Control System
- Hydraulic Piping
- Accessories
- Research and Development
- Overseas Network

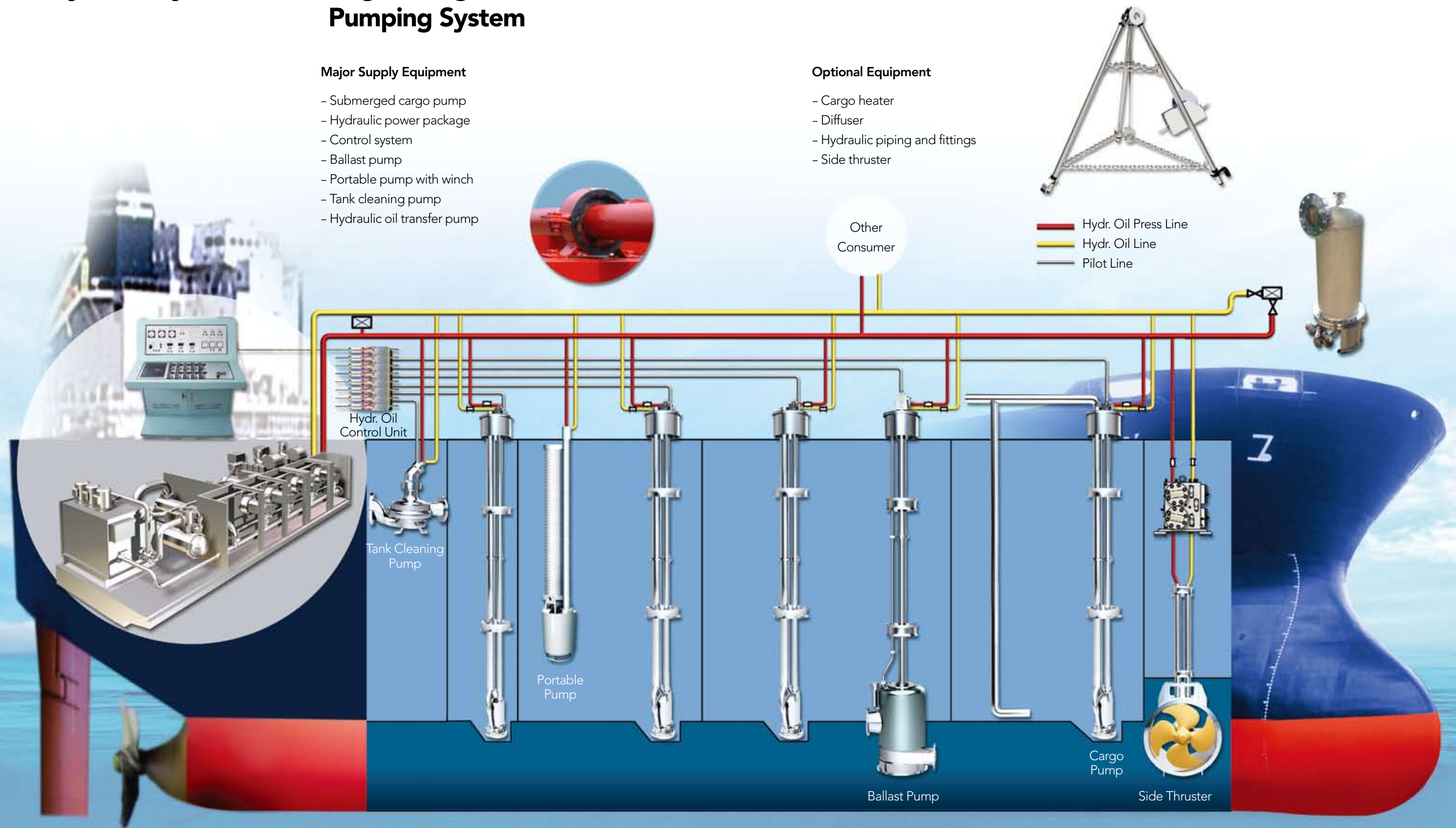
Hyundai Hydraulic Submerged Cargo Pumping System

Major Supply Equipment

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

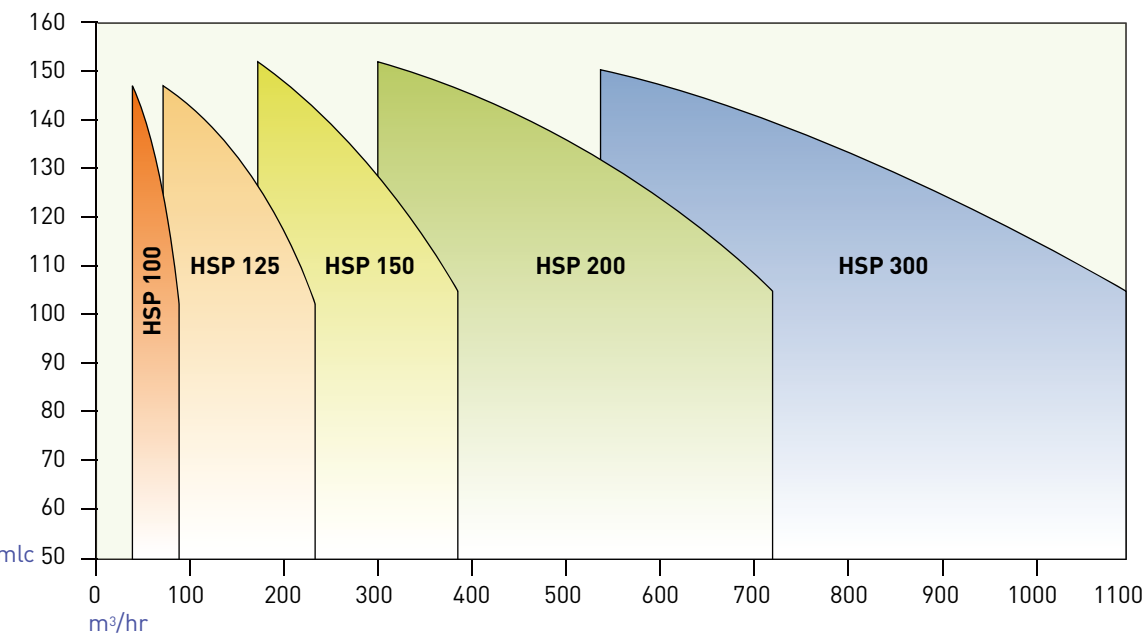
Optional Equipment

- Cargo heater
- Diffuser
- Hydraulic piping and fittings
- Side thruster



Pump Selection Chart

Optimum pump capacities are achieved by selecting high efficiency models for the customer's requirements of flow rates, heads and others. We provide customers with a proposal for a complete **HYUNDAI SUBMERGED CARGO PUMPING SYSTEM** based on customer's information about total tank volume, total discharge rates, total head and others.



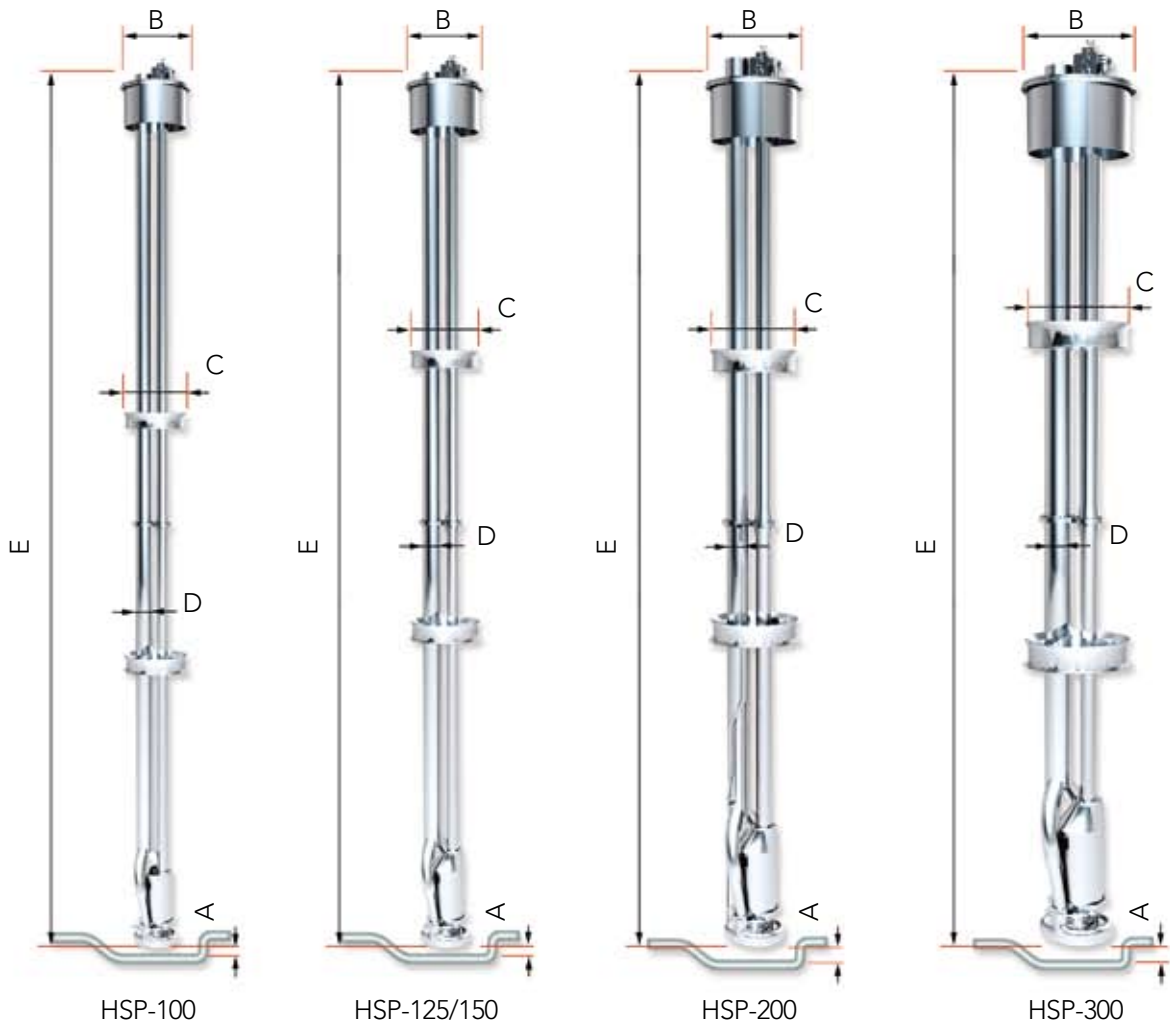
Pump Material

The standard material of **HYUNDAI SUBMERGED CARGO PUMPING SYSTEM** is SUS316L stainless steel, and this will be changed by the kind of frequently transportation cargo or ship specification requirement. This chart shows the material composition of each stainless steel and equivalent national standards.

Description	Standard	Chemical Composition							Equivalent Standard		
		C max.	Si max.	Mn max.	Ni	Cr	Mo	Cu	USA AISI	German WNO	Sweden SS
Standard Acid Resistance	JIS SCS14A (SUS316)	0.08	1.5	1.5	9.0 – 12.0	18.0 – 21.0	2.0 – 3.0		316	1.4436	2343
Standard Acid Resistance Low Carbon Content	JIS SCS16A (SUS316L)	0.03	1.5	1.5	9.0 – 13.0	17.0 – 21.0	2.0 – 3.0		316L	1.4436	2353
Standard Acid Resistance High Nickel Content	SCS23	0.07	2.0	2.0	27.5 – 30.5	19.0 – 22.0	2.0 – 3.0	3.0 – 4.0	3.0		

Pump Dimensions

Pump length E shall be determined by shipyard. Middle support is designed to fix the horizontal movement of pipestack, and the number of the mid supports is determined by considering the pump length.



* Unit : mm

Symbol Model	A	B	C	D	Total Weight (kg) (E=10m)	Weight (/kgf/m)
HSP-100	40	550	460	100	420	24
HSP-125	30	660	550	150	690	45
HSP-150	30	660	550	150	730	45
HSP-200	30	770	660	200	1,100	50
HSP-300	70	930	810	300	1,700	70

Submerged Cargo Pump

HYUNDAI SUBMERGED CARGO PUMP is beneficial to customers providing reliable operation and safety for vessel, efficient cargo stripping and tank cleaning. Pumps are supplied either as one complete set or two parts based on the pump height and for easy installation.



Pressure-flow control (PFC) block

Hyundai Pressure-Flow Control block, PFC can control the speed of hydraulic motor by inlet oil quantity and oil pressure at the remote control panel or at local.

Upper plate

Cargo pumps are installed on the upper support which is tightly welded to upper deck. Flow control valve is assembled on the upper plate and all the pump connection such as discharge pipe, hydraulic oil inlet/outlet pipe line are connected to the upper plate.

Hydraulic motor

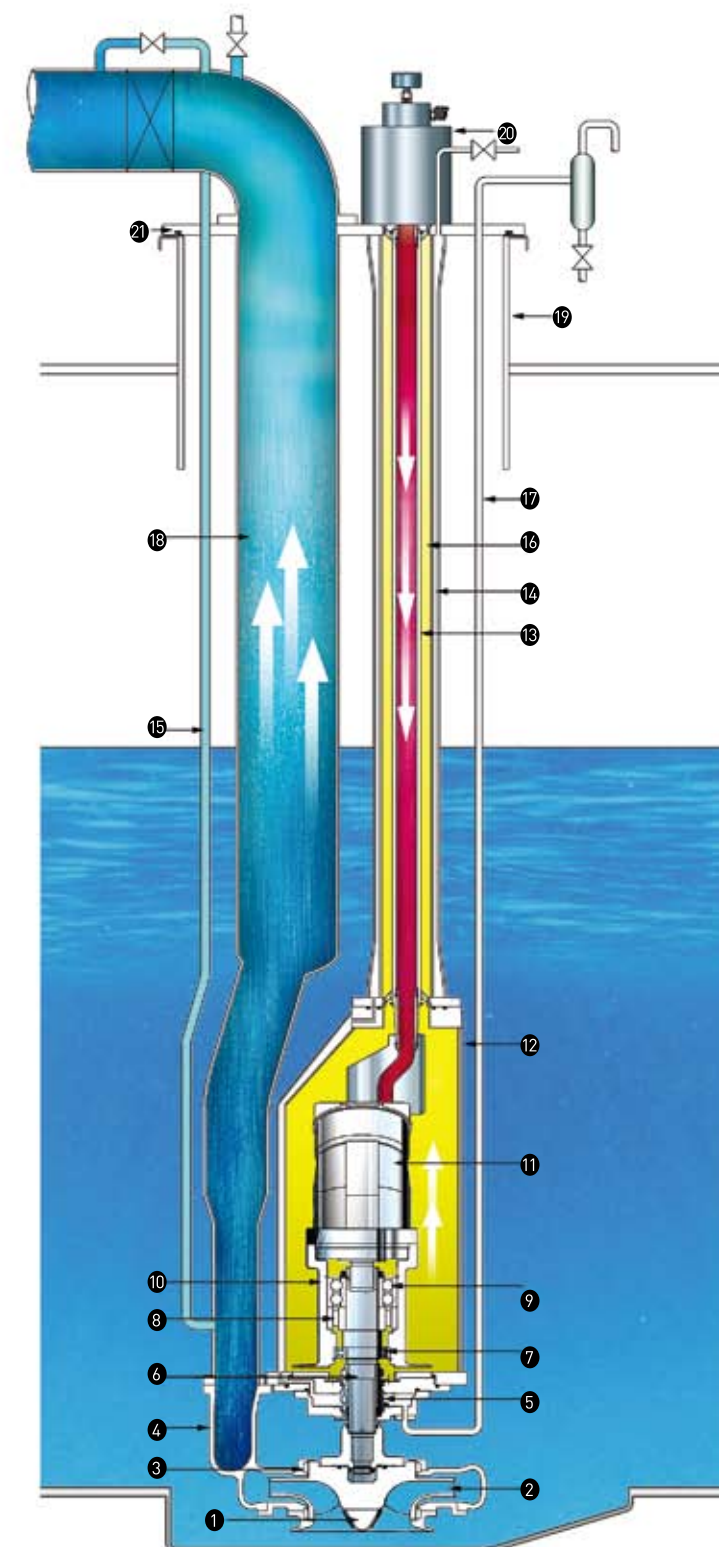
Hydraulic motor is a fixed displacement A2FM of axial piston, bent axis design, suitable for hydrostatic drives in closed circuits. Output speed of A2FM is proportional to input flow and inversely proportional to displacement.

Sealing part

Mechanical seal is our standard sealing device both hydraulic oil side and cargo side for optimal sealing. In any case, Teflon lip seal is applied to the cargo side instead of mechanical.

Sectional Drawing

Pumphead is connected to the pipestack with flanged joint. Hydraulic motor is installed inside the pumphead, and a short pump shaft is supported by two bearings and sealed by two mechanical seals and connected to the pump impeller. The pump consists of a volute casing and a single suction impeller.



Features

- Pump material: Stainless Steel
- Stepless capacity control: Local and remote control
- Anti-rotation brake: Loading through pump
- Concentric hydraulic pipe
- Bearings lubricated by hydraulic oil
- Two mechanical seals against hydraulic oil and cargo side
- Double lip seal against cargo (Option)
- Dry running is available during stripping
- The replacement of wearing parts without disconnecting hydraulic part in tank
- Aux. impeller is adapted for optimal stripping

- 1 Aux. Impeller
- 2 Impeller
- 3 Wear Ring
- 4 Pump Casing
- 5 Mechanical Seal set
- 6 Pump Shaft
- 7 Roller Bearing
- 8 Back Stop
- 9 Ball Bearing
- 10 Bearing Housing
- 11 Hydraulic Motor
- 12 Pump Head
- 13 High Pressure Pipe
- 14 Cofferdam pipe
- 15 Stripping Pipe
- 16 Return Pipe
- 17 Purging Pipe
- 18 Discharge Pipe
- 19 Deck Support
- 20 Pressure Flow Control Block
- 21 Deck Seal Ring

Installation

Location

Cargo pump should be installed at the stern side of each tank of port or starboard to allow optimal cargo discharge.

Suction well

Suitable suction well should be designed for a optimal stripping result. We can submit the suction well design of each pump and provide stainless suction well as optional.

Installation

Deck supports and support rings are installed and aligned on the tank with special devices. Submerged cargo pump is installed on the deck support as shown in the illustrations. Special ring is installed between the deck support and the upper plate to prevent pump vibration and noise down.

The pump will prevent horizontal movement but allow for vertical expansion with the support rings. Hydraulic oil pipe lines, discharge cargo pipe lines and other small pipe lines should be connected to the upper plate.



Location

Suction well

Installation

Operation

Discharging

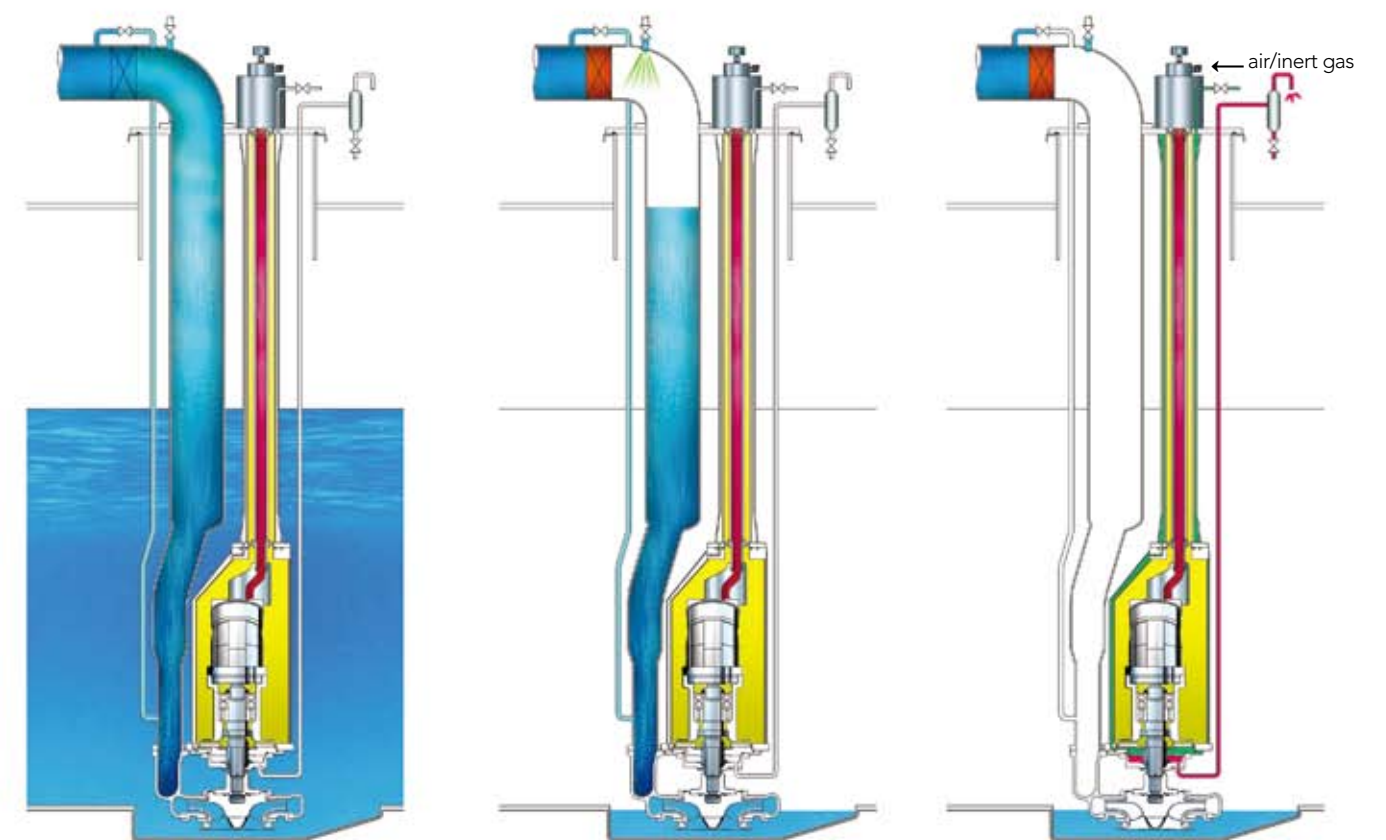
HYUNDAI SUBMERGED CARGO PUMP can be started from the remote control panel or the local control valve. Through the PFC block on the pump top plate, pump always runs at the maximum discharge flow rate without regulating of discharge valve. According to the discharge loads, the pump speed is changed by the hydraulic motor. Hydraulic power package sustains the best operating conditions irrespective of the type of cargos. Power consumption is automatically matched to the discharge situation.

Stripping

When the cargo tank is almost empty, stripping is started to optimal cargo empty. First, reduce the pump speed to suitable speed for stripping and close the discharge cargo valve, and then insert compressed air, inert gas or nitrogen into the pipestack to empty the cargo in pipestack. During stripping, the pump impeller acts as a non-return valve to prevent cargo from returning to tank. Hyundai submerged cargo pumps also satisfy the class regulation for stripping.

Purging and seal leakage check

The cofferdam of cargo pump should be purged both before and after discharge operation and then check the leakage volume a hecking devices or disassembly of the pump.



Discharging

Stripping

Purging and seal leakage check

Ballast Pump

HYUNDAI SUBMERGED BALLAST PUMPS are installed in one of the ballast tank, and the pump room is not necessary. The pumps are equipped with the self priming system for good operation, installation and easy maintenance.



Feature

- Pump room is not necessary
- Simple installation and maintenance
- Self priming system

Description	Unit	HBP-200	HBP-300	HBP-400
Capacity	m³/h	350	750	1,500
Head	m	25	25	30
Material		Stainless Steel	Stainless Steel	Stainless Steel
Suc. Size	mm	250	350	450
Disch. Size	mm	200	300	400



Portable Cargo Pump

HYUNDAI PORTABLE CARGO PUMP with air motor driven winch is supplied for emergency or stand-by. The winch will be used to lift the portable cargo pump and cargo heater for maintenance.



Description	Unit	HPP-100	HPP-150
Capacity	m³/h	70	150
Head	m	70	50
Material		Stainless Steel	Stainless Steel
Weight	kg	65	80
Hose Size	mm	100	150

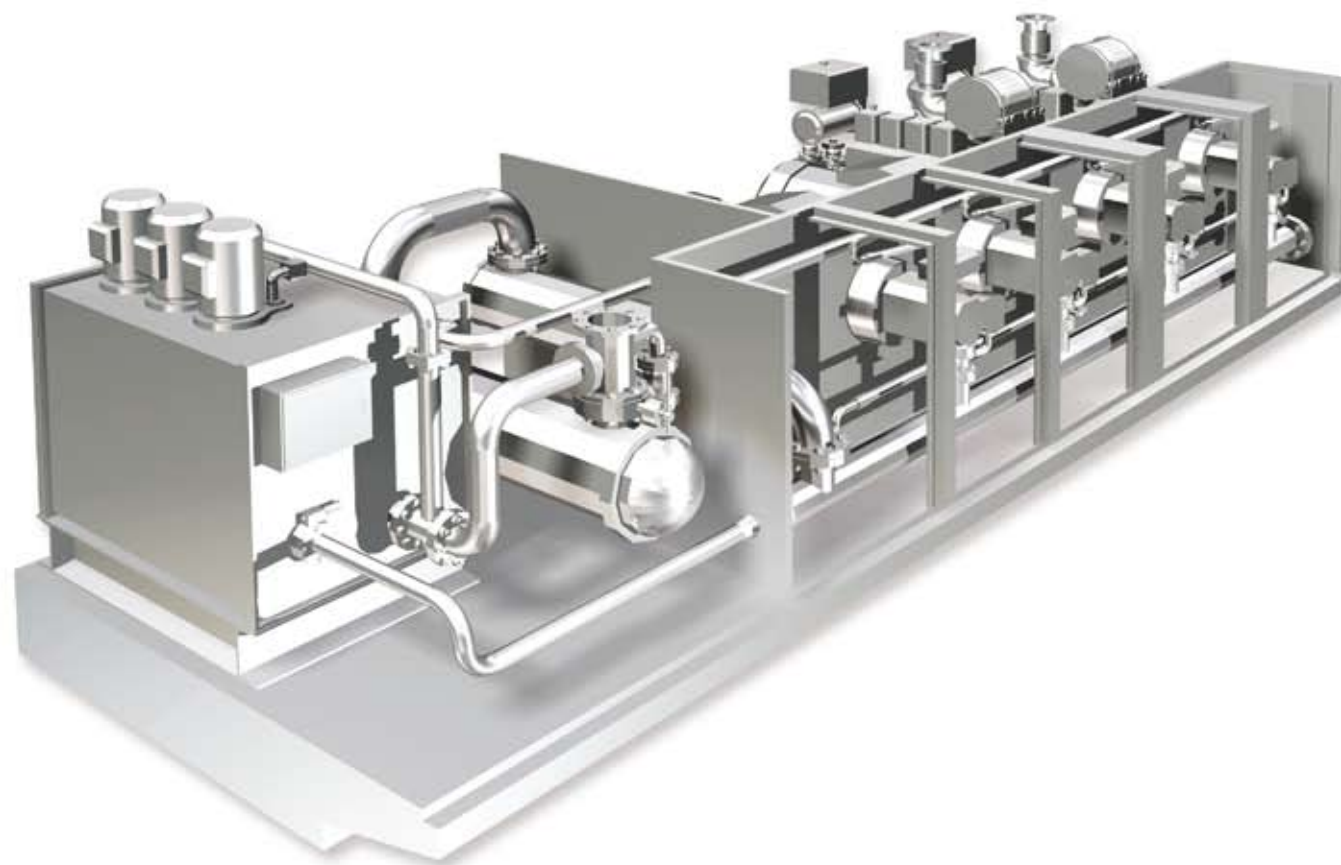
Hydraulic Power Package

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

The main hydraulic pumps are of axial piston type, swash plate design with 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. Maximum 4 starts should be made during an hour and the limit switches on the suction line for each power pack will stop or prevent start of the corresponding power pack only.

Hydraulic cooling-filtering-heating unit properly control the viscosity, cleanness, temperature of the hydraulic working oil and help to keep the purity of the hydraulic working oil and increase system reliability.



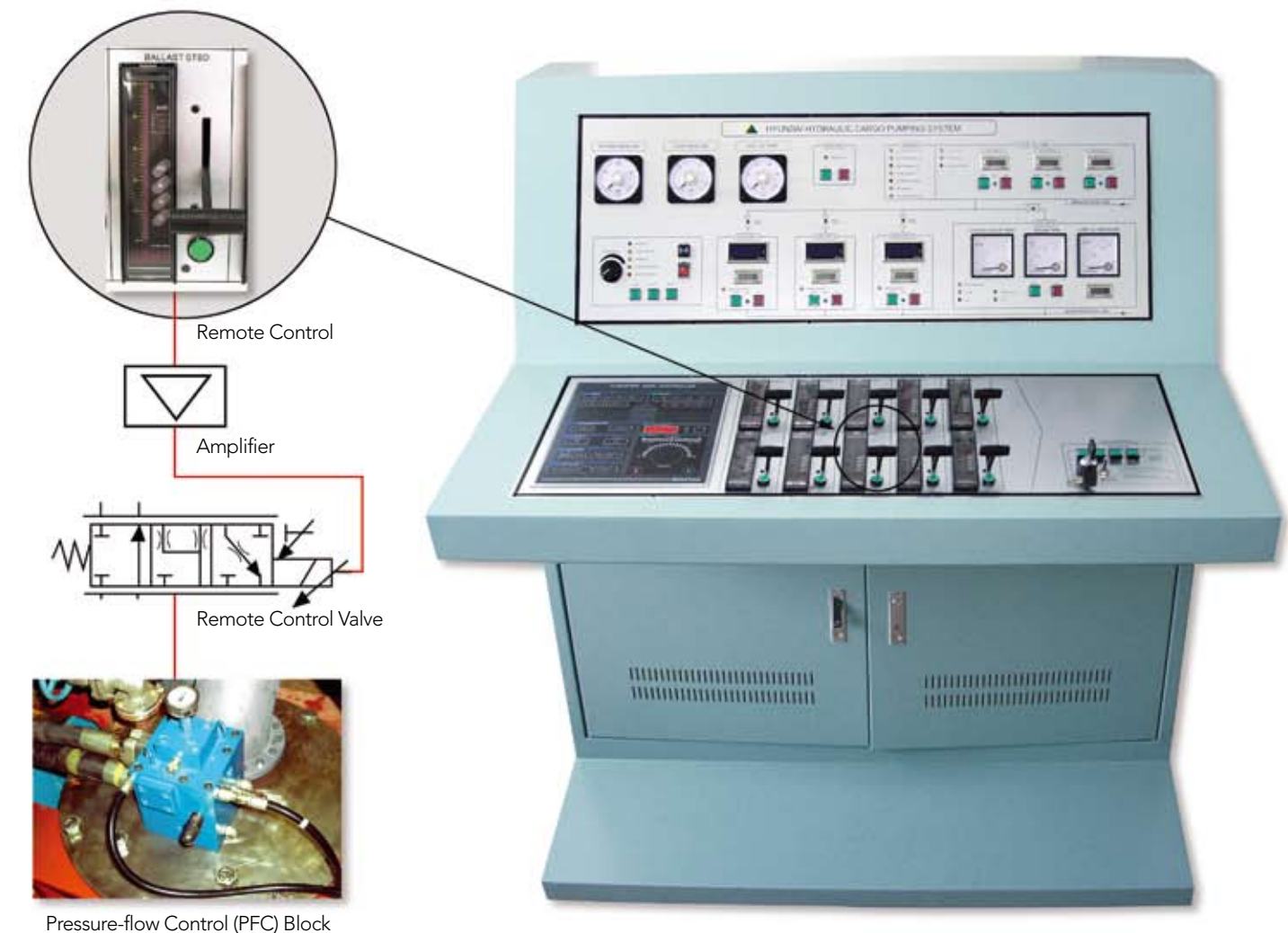
Electro-hydraulic Control System

The Independent load control of cargo pumps and side thruster connected to main close loop hydraulic system is generally arranged both remotely and locally.

HYUNDAI SUBMERGED CARGO PUMPING SYSTEM is controlled by a Programmable Logic Controller (PLC) installed inside the control panel. The PLC is programmed by HHI and provides the logic for 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 located in a safe area, 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 be interfaced to any central ship computerizing systems.



Hydraulic Piping

HYUNDAI HYDRAULIC PIPING covers full range of materials, components and services from engineering to testing, installation and commissioning of a complete piping system. We supply customers with hydraulic piping as prefabricated spools. Prefabrication provides the basis for a fast and easy, high quality installation of even the most complex piping systems.

The pipe material selection is based on customer's specification and/or our recommendation. The use of cold drawn pipes and tubes is recommended and all pipes are cold worked because of both quality and cleanliness reasons. This gives a smooth internal surface, which in turn reduces the pressure drop.

The piping system is designed in accordance with customer's design requirements as well as the applicable standards, codes, rules and regulations. If required, a computer-aided FEM-analysis can be performed to determine stresses in flanges and supports in the piping system.

In order to isolate hydraulically driven equipment and connected piping from ship structure, resilient supports that are featured by rubber pads are used. Resilient bulkhead penetration sealing system is excellent for vibration dampening and reduction of noise. It employs intumescent materials in bulkhead adapters and allows to make the penetrations of pipes gastight in a safe way.



Cargo Heater

Cargo heater is of Shell & Plate type and is extremely efficient due to the high turbulence created by the complex geometry of each plate passage. The high turbulence leads to much higher heat transfer co-efficient than conventional heat exchangers which in turn means that less heat transfer surface is required to perform a given duty.

The high technically designed plate arrangement makes high turbulent flow and keeps heating surface clean. This kind of self-cleaning function gives the advantage of the increased life time and the reduced maintenance cost. The shell cover can be removed easily and heating elements can be checked and clean easily.

The cargo heater is designed, manufactured and tested in accordance with all requirements of shipyard, ship-owner and class societies.



Diffuser

Certain cargos contain sediments which may deposit on the tank during voyage.

The diffuser is installed on the drop line to circulate the cargo not to be settled.

The port quantity and nozzle size are determined based on the cargo tank size and cargo type.

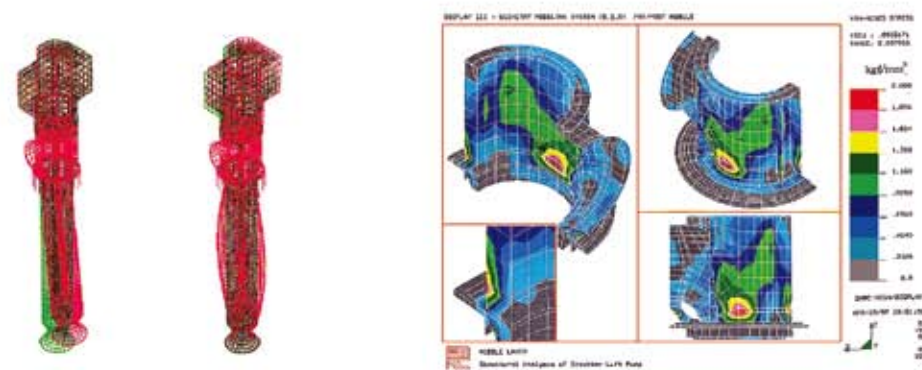


Research and Development

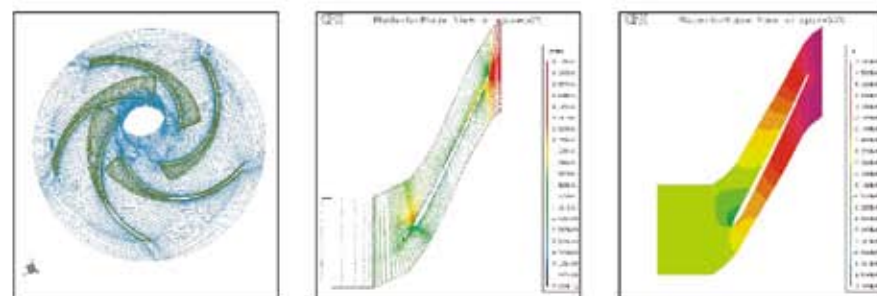
HHL operates four renowned in-house institutes. They have all kinds of hydrodynamic facilities and are equipped with advanced analyzing equipment and powerful simulation facilities. The comprehensive R & D activities of the institutes comprise all pre-production phases including computer-aided design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

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

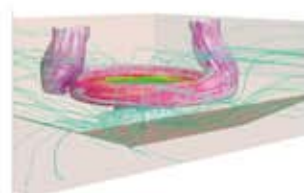
They play a vital role in the advancement of production technologies such as welding, casting, and plastic deformation and so on.



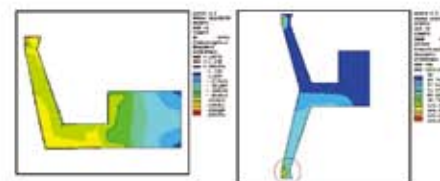
Vibration / Structure analysis



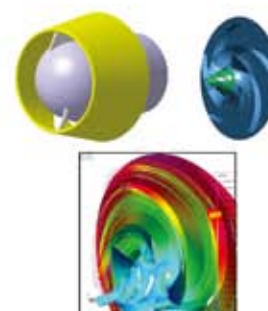
Development of impeller design by CFD analysis



Development to design optimal suction well for improved stripping



Structure analysis for lip seal



Flow field analysis for aux. impeller

