HHI – Building a better future
Global Leader

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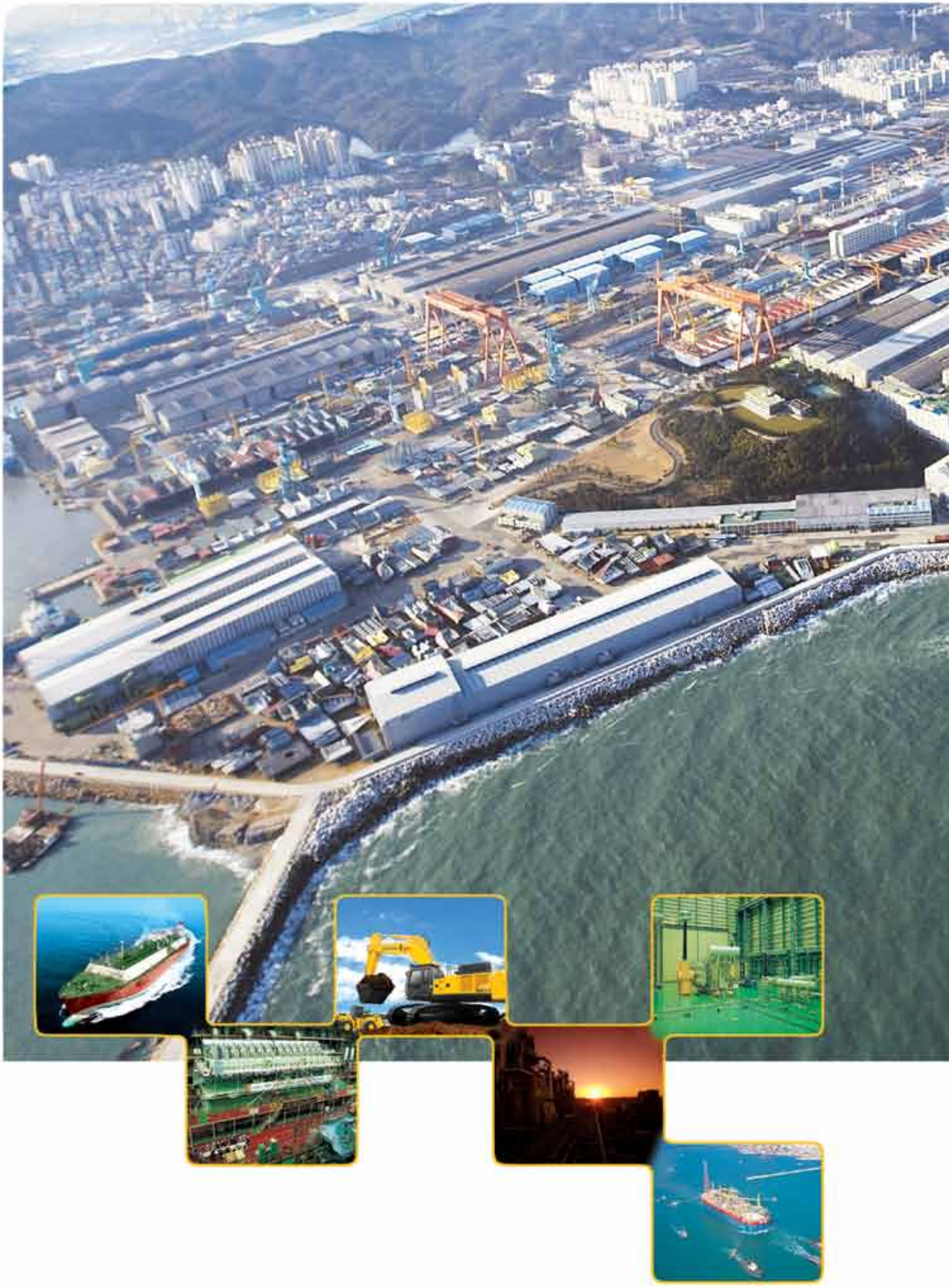
HYUNDAI
CARGO OIL PUMPING SYSTEM

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



Hyundai Heavy Industries pursues the happiness of the global community through its advanced technology

Hyundai Heavy Industries Co., Ltd. (HHI) is well-known throughout the world for its shipbuilding and for manufacturing various kinds of machinery. HHI has seven divisions: Shipbuilding, Offshore & Engineering, Industrial Plant & Engineering, Electro Electric Systems, Construction Equipment, R&D, and Engine & Machinery (HHI-EMD).

HHI-EMD manufactures and supplies different types of industrial-use pumps throughout the world from 1979, 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. HHI-EMD has supplied high quality pumps of the best quality throughout the world, earning an excellent reputation among its clients domestically and abroad. Maintaining this reputation has led to expanding pump production in various fields, including the development of the nuclear power plants.

Our major marine products are: cargo oil & water ballast 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 requirements.

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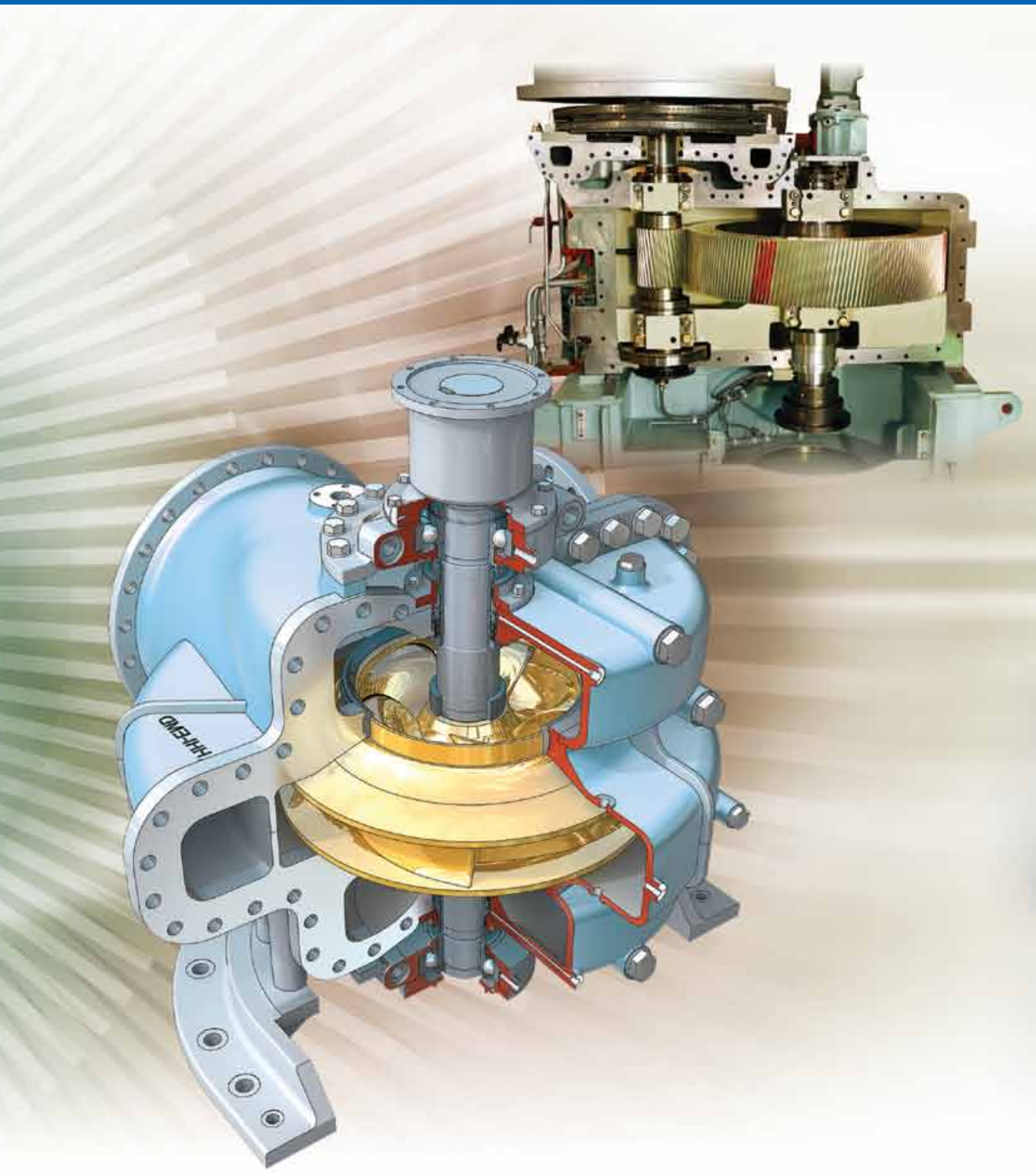
CARGO OIL PUMP



Hyundai Heavy Industries Co., Ltd. (HHI) is a worldwide leader in manufacturing industrial products. As such, the company has supplied a wide variety of pumps including those used in nuclear and thermal power plants since 1979. HHI developed the technical matter gleaned from continuous R&D efforts and experience more than 15 years of producing marine cargo oil pumps and water ballast pumps. The Hyundai cargo oil pumps and water ballast pumps have been supplied to customers since 1995, and these products now enjoy a strong reputation for quality.

Advantages

Material

The improved material, Ni-Al-Bronze, is used for pump casing and impeller. Mechanical properties and corrosion resistance is higher than bronze casting. Life time of casing is long.

Easy Maintenance for Cartridge Type M/Seal

The cartridge-type mechanical seal facilities easy maintenance.

Improvement of Hydraulic Performance

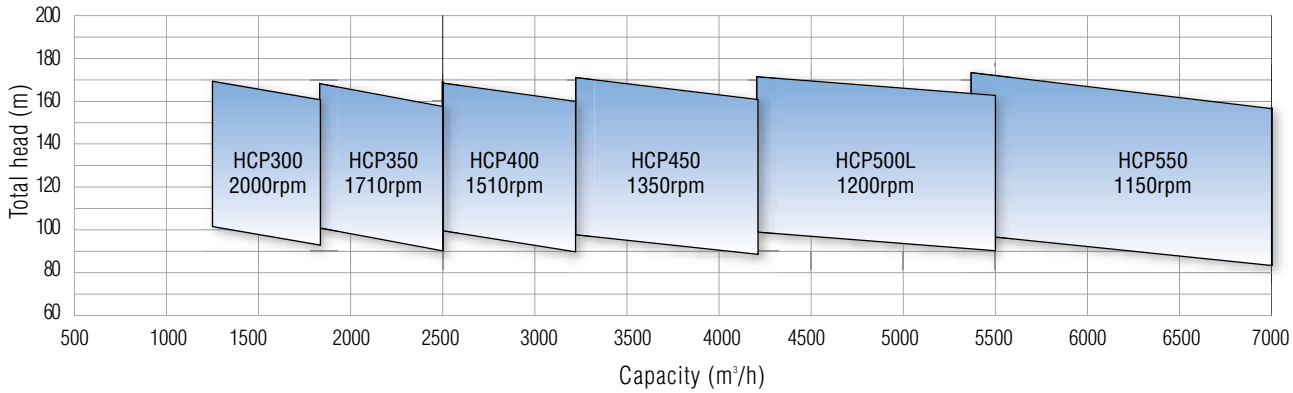
Adoption of high efficiency discharge volute, high performance suction volute and wear ring configuration.

Cargo Oil Pump (HCP Model)

• Principal Particulars •

Description \ Model		HCP300	HCP350	HCP400	HCP450	HCP500L	HCP550
Normal capacity (m^3/h)		1800	2500	3000	4000	5000/5500	6050
Total head (m)		150					
Normal speed (rpm)		2000	1710	1510	1350	1200	1150
Rotation		Counter-clockwise from coupling side					
Suction bore (mm)		400	450	500	600	700	700
Discharge bore (mm)		300	350	350	400	500	500
Lubrication of pump bearing & Intermediate shaft bearing		Grease lubrication (sealed type bearings)					
Seal between pump and engine room		Bellows and Rubber ring					
Seal between shaft and stuffing box		Grease with oil seal					
- Amount of grease for S/box lower side (g)		170	240	350	410	440	480
Lubrication of gear coupling		Grease lubrication					
- Amount of grease filled (g)		320	320	480	620	1000	1200
Brand of grease	Stuffing box lower side	Soap base : Lithium, working temperature range : -30 ~ +110˚C (Shell Alvania grease SP or equivalent)					
	Gear coupling	Soap base : Lithium, working temperature range : -30 ~ +110˚C (Shell Alvania grease SP or equivalent)					
Weight (kg)	Pump (Ni-Al-Bronze casing)	880	1140	1680	2490	3330	3600
	Stuffing box unit & Connecting shaft	660	830	1120	1310	1610	1610
	Gear coupling	90	110	150	230	300	350
	Water in casing	330	520	760	1200	1710	1830

• Performance Range •



• Applicable Turbine •

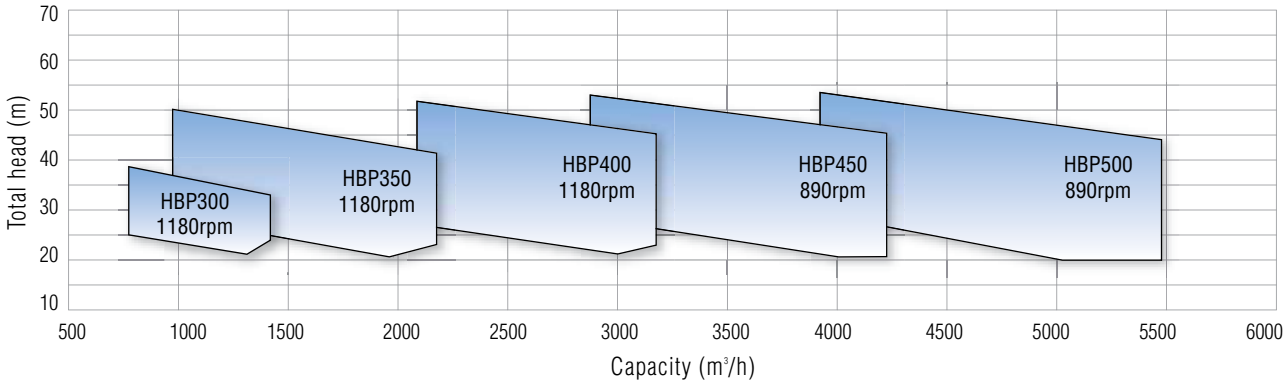
Model	CSV-8	CSV-14	CSV-18	RTV-30
	500kW	900kW	1400kW	1800kW	3000kW

Water Ballast Pump (HBP Model)

• Principal Particulars •

Description \ Model		HBP300	HBP350	HBP400	HBP450	HBP500
Normal capacity (m^3/h)		1200	2000	3000	4000	5000
Total head (m)		30	35	35	40	40
Normal speed (rpm)		1180	1180	1180	890	890
Rotation		Counter-clockwise from coupling side				
Suction bore (mm)		350	400	500	600	700
Discharge bore (mm)		300	350	400	500	500
Lubrication of pump bearing & Intermediate shaft bearing		Grease lubrication (sealed type bearings)				
Seal between pump and engine room		Bellows and Rubber ring				
Seal between shaft and stuffing box		Grease with oil seal				
- Amount of grease for S/box lower side (g)		130	160	320	320	480
Lubrication of gear coupling		Grease lubrication				
- Amount of grease filled (g)		130	160	320	320	480
Brand of grease	Stuffing box lower side	Soap base : Lithium, working temperature range : -30 ~ +110˚C (Shell Alvania grease EP 1 or equivalent)				
	Gear coupling	Soap base : Lithium, working temperature range : -30 ~ +110˚C (Shell Alvania grease EP 1 or equivalent)				
Weight (kg)	Pump (Ni-Al-Bronze casing)	640	830	1170	1690	3060
	Stuffing box unit & Connecting shaft	560	560	660	680	750
	Gear coupling	50	60	70	100	140
	Water in casing	350	560	850	1250	1560

• Performance Range •

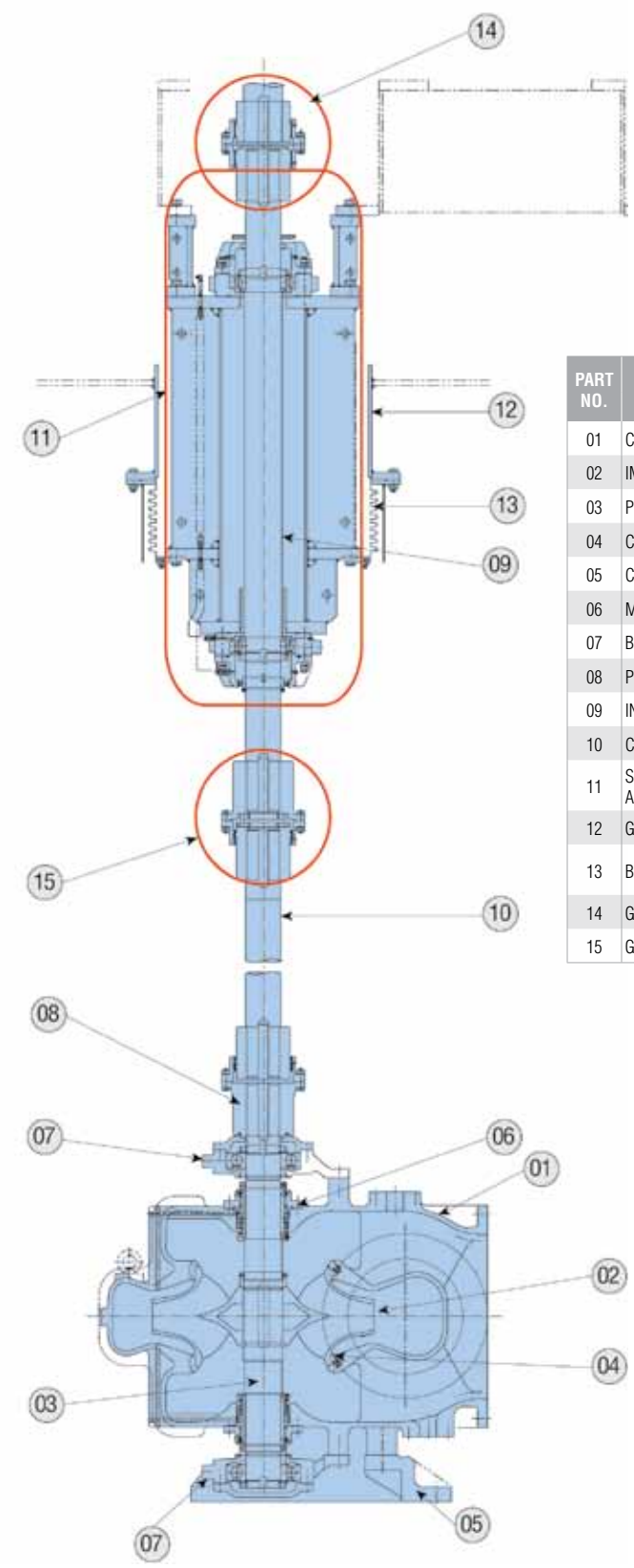


• Applicable Turbine •

Model	CSV-5	CSV-8
	500kW	800kW

Construction & Material

• Construction •

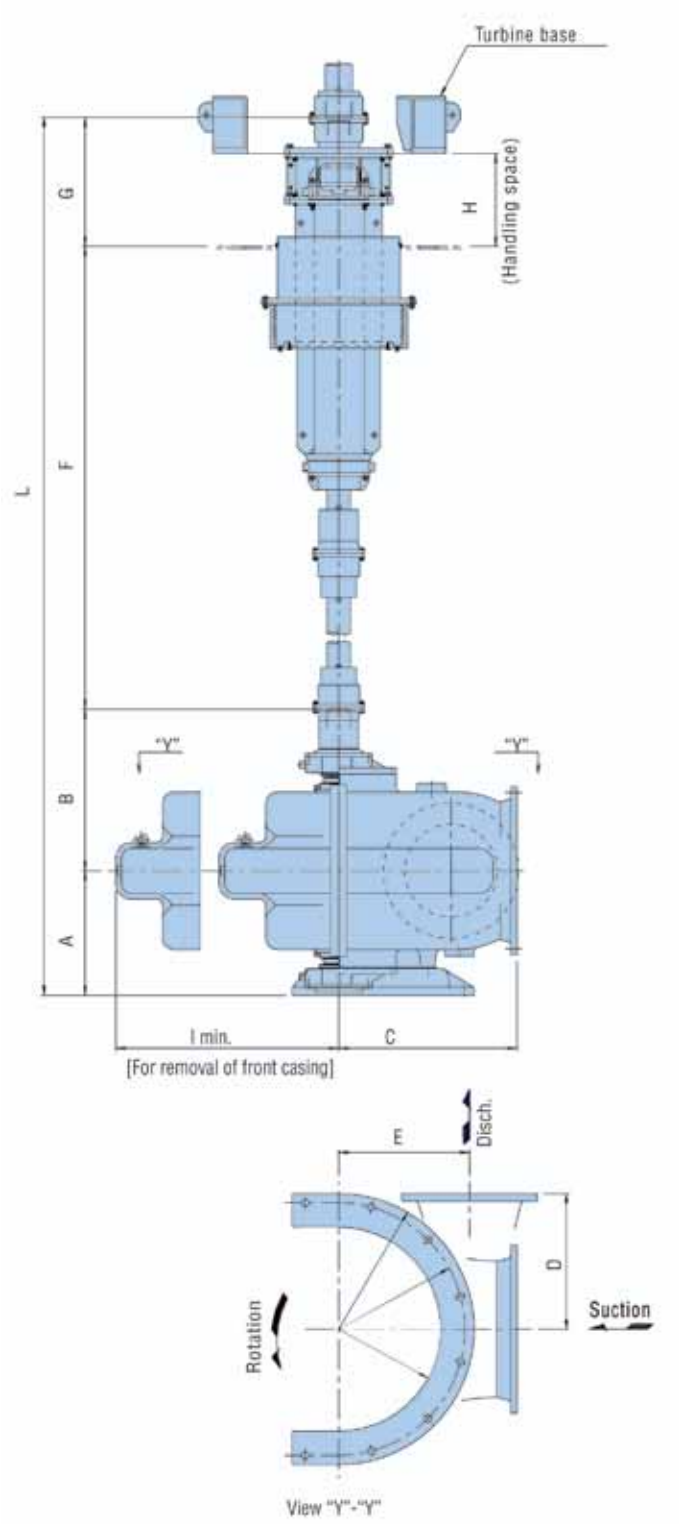


• Standard Material •

PART NO.	DESCRIPTION	MATERIAL			Q'TY
		NAME	JIS	ASTM EQUIVALENT	
01	CASING	NI-AL BRONZE	ALBC3	B148 C95800	1
02	IMPELLER	NI-AL-BRONZE	ALBC3	B148 C95800	1
03	PUMP SHAFT	STAINLESS STEEL	SUS304	AISI 304	1
04	CASING RING	LEADED TIN BRONZE	LBC4	B584 C93800	2
05	CASING SUPPORT	CAST IRON	FC250	A48 No. 40	1
06	MECHANICAL SEAL	STAINLESS STEEL	SUS304	A276 304	2ST
07	BEARING BOX	CAST IRON	FC250	A48 No. 40	2
08	PUMP COUPLING	CARBON STEEL	S45C-N	AISI 1045	1
09	INTERMEDIATE SHAFT	CARBON STEEL	S45C-H	AISI 1045	1
10	CONNECTING SHAFT	CARBON STEEL	S45C-N	AISI 1045	1
11	STUFFING BOX ASSEMBLY	STEEL	-	-	1
12	GUIDE PIPE	STEEL	SS400+STPG	A283 GR. D+E-A	1
13	BELLOWS	S.STEEL+STEEL	SUS304+ SS400	A176 304+ A283 GR. D	1
14	GEAR COUPLING(U)	CARBON STEEL	S45C-N	AISI 1045	1
15	GEAR COUPLING(M)	CARBON STEEL	S45C-N	AISI 1045	1

Dimensions

• Dimensions •



• Cargo Oil Pump (HCP) •

MODEL		HCP300	HCP350	HCP400	HCP450	HCP500L	HCP550
Bore	Suc.	400	450	500	600	700	700
	Disch.	300	350	350	400	500	500
A		475	500	560	625	710	730
B		605	640	710	800	900	950
C		575	687	680	870	1010	1060
D		395	460	520	550	770	800
E		370	435	430	560	635	665
F	min.	1515	1645	1935	2037	2127	2127
	max.	3015	3495	4085	4487	4577	4577
G		755	755	725	725	645	645
H		500	500	500	500	400	400
I min.		700	830	930	1100	1250	1300

• Water Ballast Pump (HBP) •

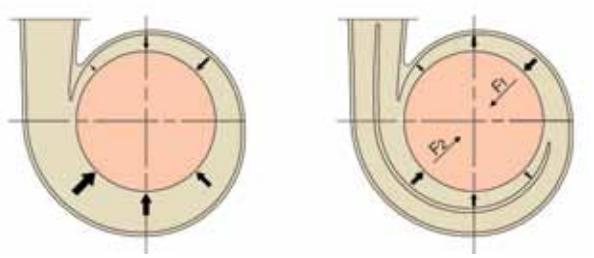
MODEL		HBP300	HBP350	HBP400	HBP450	HBP500
Bore	Suc.	350	400	500	600	700
	Disch.	300	350	400	500	500
A		458	490	535	633	795
B		537	590	650	781	900
C		560	660	780	945	1255
D		365	430	480	610	695
E		320	380	430	556	640
F	min.	1448	1448	1498	1805	1905
	max.	3148	3448	3498	4005	4455
G		770	770	770	755	755
H		500	500	500	500	500
I min.		635	750	830	1000	1150

Features of HHI Marine Pumps

HHI marine pumps are of vertical single stage double suction, double volute centrifugal type that are driven by a vertical steam turbine via intermediate shafts through the bulkhead stuffing box. A stuffing box placed on the bulkhead keeps the engine room gas-tight.

• Pump Casing

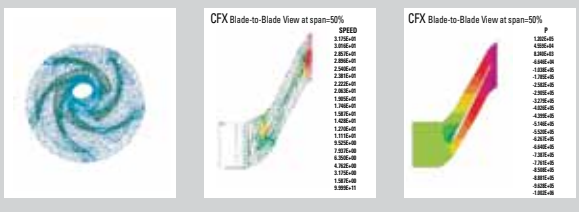
Pump casing is vertically split into two halves at the shaft centerline, and joined surfaces include non asbestos seat packing. The suction and discharge nozzles are both provided in the rear half casing and both are open in the horizontal direction at 90˚ apart, so that dismantling or reassembling can be performed easily without disturbing the suction and discharge pipings.



Double volute minimizes radial thrust. While in a double volute pump, the pressures are not uniform at partial capacity operation, the resulting forces F1 and F2 for each 180˚ volute section oppose and essentially balance each other results in low shaft deflection at all operating points. Low deflection reduces packing wear, ring wear and bearing loading, which ultimately results in sustained efficiency and economy of operation.

• Impeller

The impeller is a double suction type for two reasons. One is to balance the axial hydraulic thrust, the other one is to obtain a good suction performance together with a careful design on the inlet portion of impeller. All of these impeller are the result of modern research and development activity.

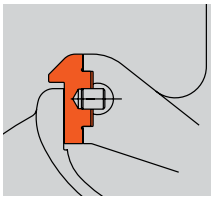


• Pump Shaft

The shaft is supported by two ball bearings at upper and lower points. The impeller is fitted with key and fastened with a nut. This nut is threaded in direction that is counter to pump rotation to prevent from loosening, and fastens with set screw.

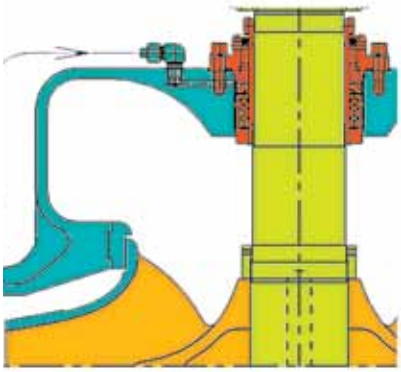
• Wearing Ring

Casing is equipped with wearing rings to keep most proper clearance between casing and rotating impeller. The casing rings are inserted in the grooves of the casing wall, and pinned.



• Shaft Seal

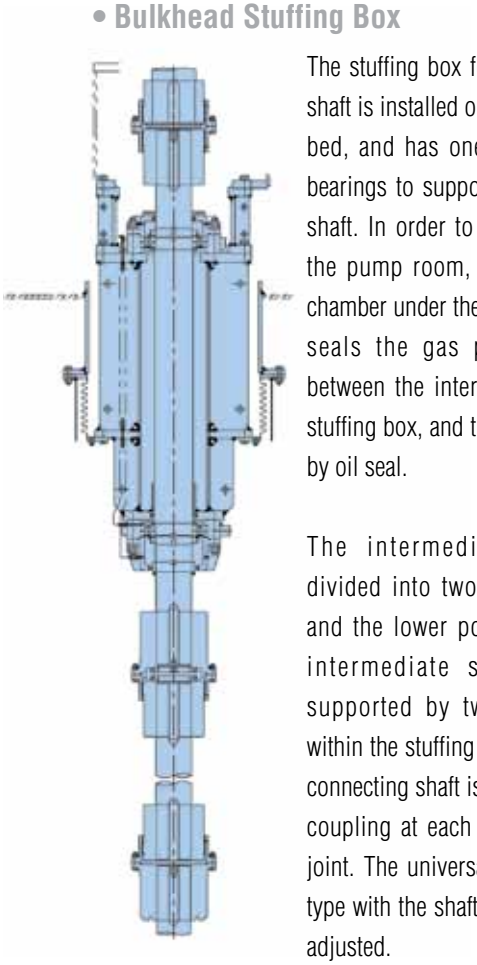
For easy maintenance, Cartridge type mechanical seals are provided to completely prevent the leakage and the ingress of the air. Cartridge type mechanical seal can be replaced without disassembling the front casing.



• Bearing

On the both ends of pump shaft, there are one sealed type ball bearings that have enough capacity against radial and axial loads, conservatively rated at 100,000 hours “plus” bearing life-guarantee maximum life at minimum maintenance cost. These bearings are lubricated by grease.

• Bulkhead Stuffing Box



The stuffing box for the intermediate shaft is installed on the steam turbine bed, and has one sealed type ball bearings to support the intermediate shaft. In order to seal the gas from the pump room, the grease in the chamber under the lower ball bearing seals the gas passing through between the intermediate shaft and stuffing box, and the grease is sealed by oil seal.

The intermediate shafts are divided into two parts, the upper and the lower portions; the upper intermediate shaft is rigidly supported by two ball bearings within the stuffing box, and the lower connecting shaft is coupled with gear coupling at each ends or universal joint. The universal joint is a spline type with the shaft length that can be adjusted.

• Standard Accessories

Item	Q'TY/Pump
Casing drain valve	1 set
Lower and upper intermediate shaft	1 set
Single-type gear couplings for both ends of lower intermediate shaft	2 sets
Gear coupling between upper intermediate shaft and driver	1 set
Bulkhead stuffing box	1 set
Dial type thermometer with capillary tube & bulkhead piece for pump bearings and casing, bulkhead stuffing box bearing	1 set
Root cock for pressure gauge	2 sets
Special assembly tools and spare box	1 set/ship

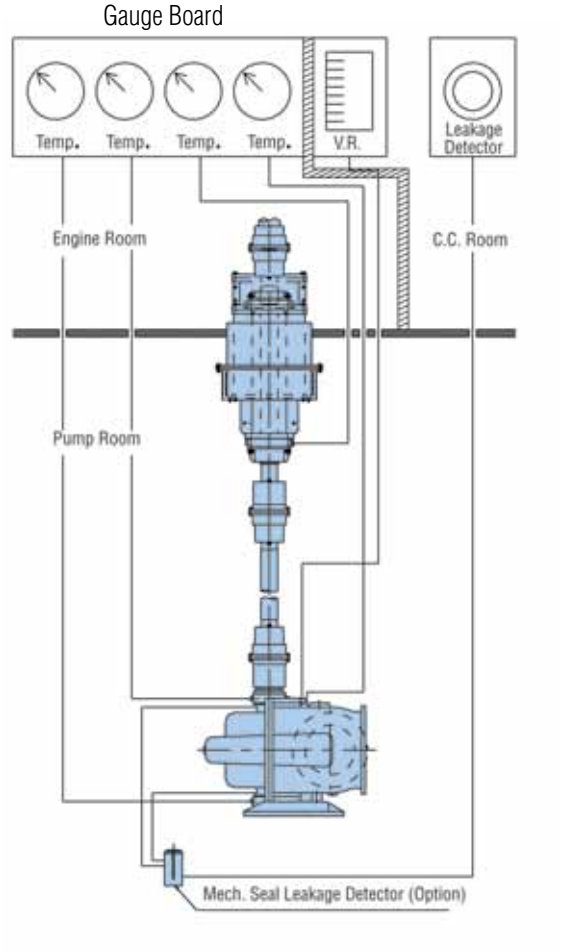
• Spare Parts

Item	Standard	Option
Ball bearing	1 pump set	
Mechanical seal for pump stuffing box	1 pump set	
Oil seal & O-rings	1 pump set	
Coupling bolt, nut, washer and O-ring	1 pump set	
Shaft with impeller, key and nut		1 pump set
Casing ring		1 pump set

• Pump Protection

To prevent any accident such as explosion or for the protection of pump itself, following instruments are provided and shall be displayed at turbine gauge board on the deck. If requested, these operation conditions can be monitored in the control room.

Gauge Board



Set value of each instruments
(They may be changed upon conditions)

Protection	Set value		Remark
	Alarm	Trip	
Pump casing overheat	75˚C	80˚C	
Pump bearing overheat	85˚C	90˚C	
Stuffing box bearing overheat	85˚C	90˚C	
Discharge high pressure	to be discussed		
Pump vibration high	16 mm/s(rms)	18 mm/s(rms)	Option
Seal leakage	when leaked	-	Option

STEAM TURBINES (COPT & WBPT)

Hyundai Heavy Industries Co., Ltd. (HHI) as a world-wide leader in the fields of manufacturing integrated heavy industrial products, has begun its diversification into the 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.

For technical innovation of marine steam turbines, HHI 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 energy savings from the clients all over the world, we present a high efficiency turbine for cargo oil pumps and water ballast pumps.

Advantages

CSV Model

- High efficiency
- Excellent performance
- Simple construction and easy maintenance
- Compact light weight design
- Dual electric overspeed trip
- separate trip & throttle valve and governing value

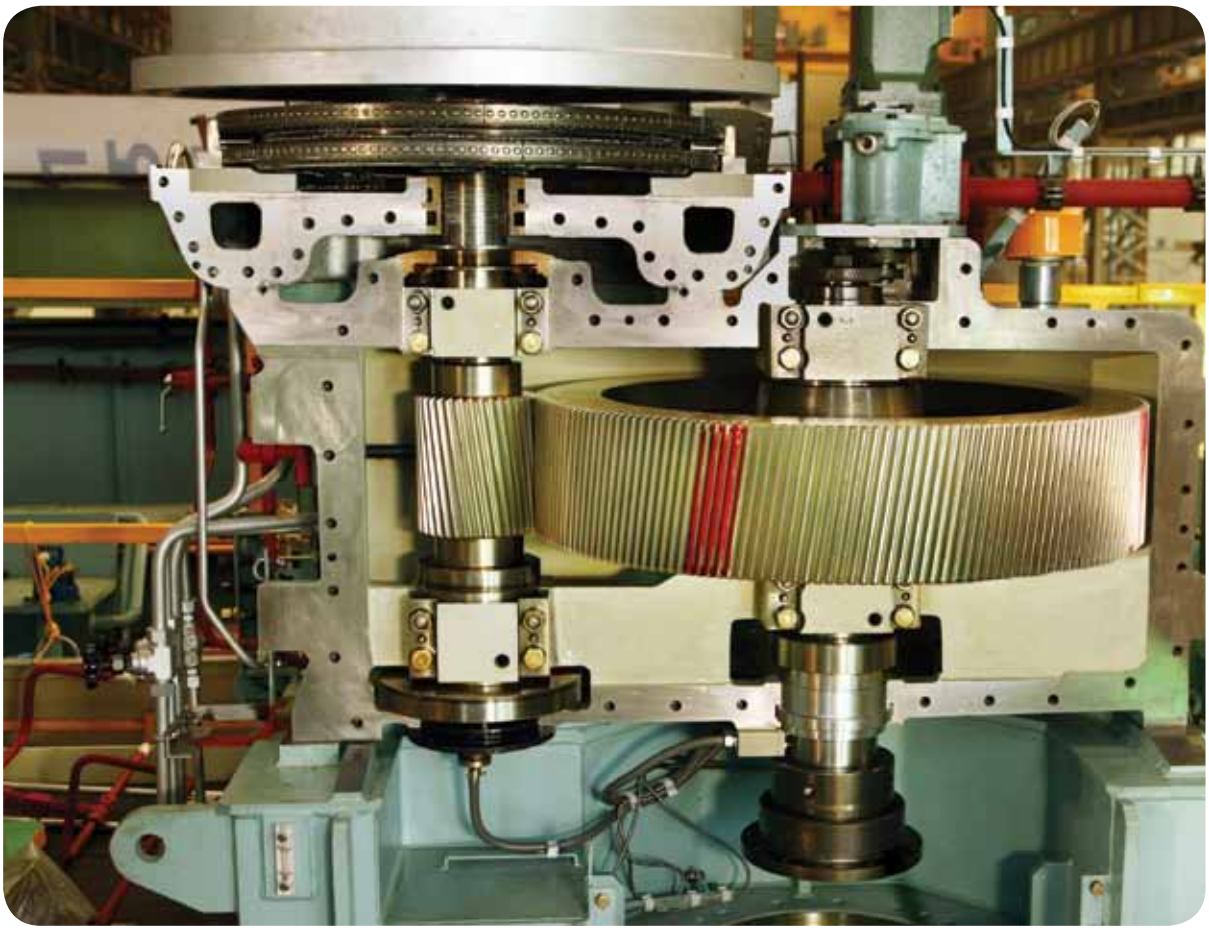
RTV Model

- Compared with single stage type, steam consumption is reduced by about 20% through adoption of high performance nozzle and blade
- Due to reduction of steam consumption, minimization of boiler capacities can be realized
- Safety device with independent trip values achieves high reliability
- Nozzle and blade materials are highly resistant to erosion and thereby enable longer life
- Simple construction facilitates easy maintenance
- Dual electric overspeed trip
- Separate trip and throttle valve and governing valve

Principal Particulars

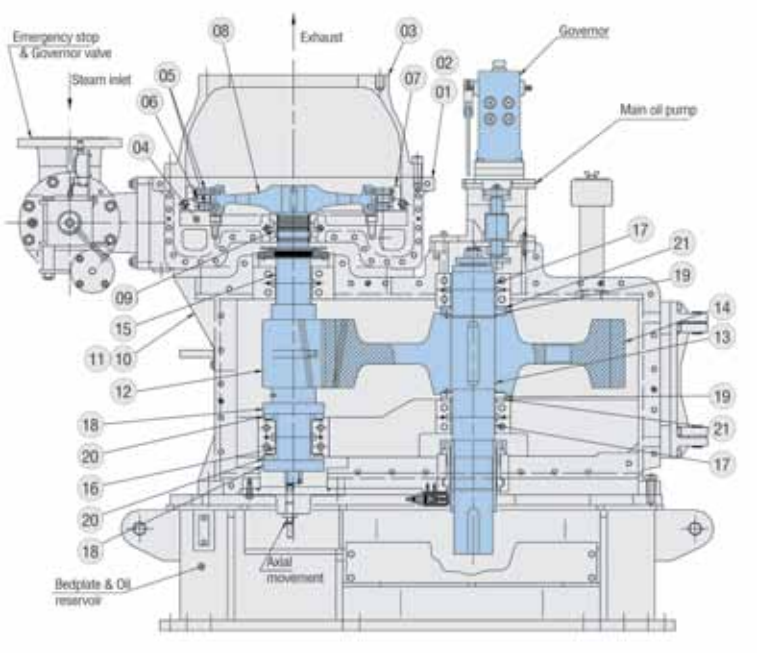
• Principal Particulars •

Item \ Model	CSV-5	CSV-8	CSV-14			CSV-18		RTV-30	
Type	Vertical curtis single stage							Vertical rateau three stage	
Rotating direction of gear shaft	Counter-clockwise viewed from governor side								
Output (kW)	500	900	1400			1800		2000	3000
Max. turbine speed (rpm)	12000	10000	11000			9500		8500	
Gear size	38 x 15	46 x 15	53 x 25	60 x 29	67 x 36	60 x 29	67 x 36	53 x 25	60 x 29
Max. gear shaft speed (rpm)	3500	2000	2100	1850	1550	1850	1550	2500	2000
Max. inlet pressure (kg/cm^2G)	22		30						
Max. inlet temperature (˚C)	350		425						
Max. exhaust pressure (kg/cm^2G)	1.0								
Steam inlet bore (mm)	JIS 20K-65Ø/80Ø	JIS 20K-125Ø	JIS 20K-120Ø/150Ø			JIS 20K-150Ø		JIS 20K-150Ø	
Steam exhaust bore (mm)	JIS 5K-250Ø	JIS 5K-300Ø	JIS 5K-400Ø			JIS 5K-450Ø		JIS 5K-500Ø	
Speed governor	Woodward UG10								
Lubrication system	Forced lubrication (turbine oil VG32)								
Cooling water required	$8m^3/h$ x max. 32˚C		$16m^3/h$ x max. 32˚C					$20m^3/h$ x max. 32˚C	
Weight (kg)	1500	2600	3900	4800	5600	5000	5800	4900	5700



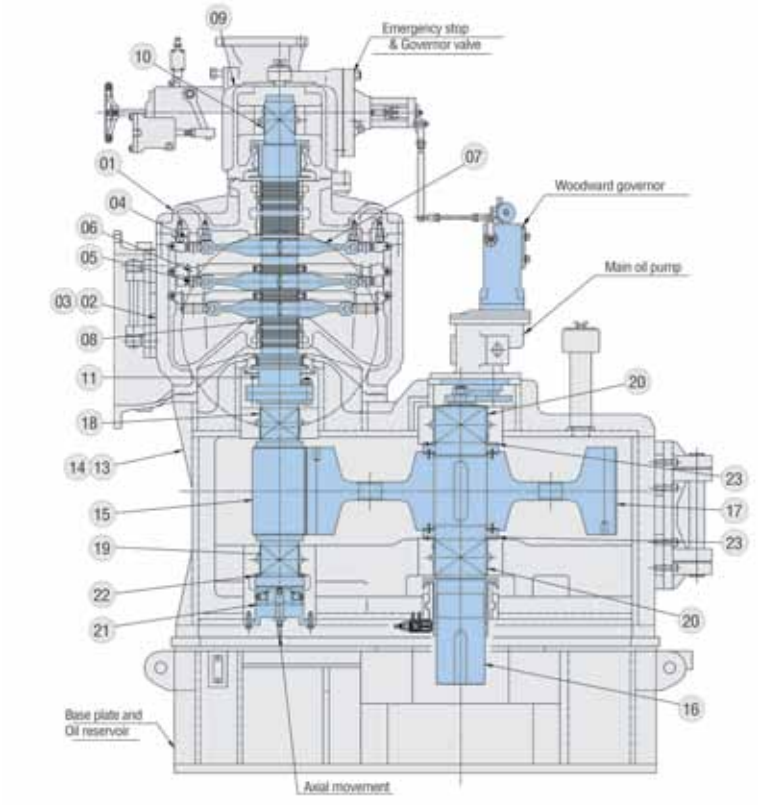
Construction & Material

• Construction •



• Materials (CSV Model) •

Part No.	Name of Part	Material
01	Steam chest	Cast steel
03	Turbine casing	Cast iron
04	Nozzle	Stainless steel (12% Cr)
05	Blade	Stainless steel (12% Cr)
08	Disc	Ni-Cr steel
10	Gear casing	Cast iron
12	Pinion	Ni-Cr-Mo steel
13	Gear shaft	Carbon steel
14	Gear wheel	Carbon steel & S.G Cast iron
15	Bearing	Carbon steel shell & white metal
20/21	Thrust washer	Carbon steel shell & white metal



• Materials (RTV Model) •

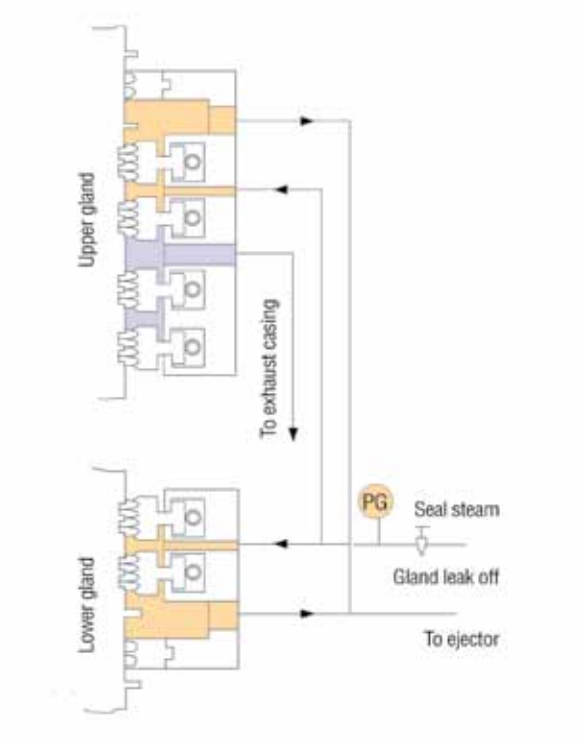
Part No.	Name of Part	Material
01	Steam chest	Cast steel
02	Casing	Cast iron
04	Nozzle	Stainless steel (12% Cr)
05	Blade	Stainless steel (12% Cr)
07	Disc	Ni-Cr steel
09	Bearing box	Cast iron
11	Shaft	Forged steel
13	Gear casing	Cast iron
15	Pinion	Ni-Cr-Mo steel
16	Gear shaft	Carbon steel
17	Gear wheel	Carbon steel & S.G Cast Iron
18	Bearing	Carbon steel shell & white metal
22	Thrust washer	Carbon steel shell & white metal

Features of HHI Turbine

• Turbine Gland

To reduce steam or air leakage from the turbine gland, labyrinth type gland seals made of special Ni-Pb brass for long life are used.

The labyrinth type seal consists of four segments affixed by springs to facilitate safe running in the event of contact with the shaft.



• Journal Bearing

Journal bearings are of the crash type and made of a thin steel-backed shell lined with white metal. The bearings are long life and easily interchangeable.

• Thrust Bearing for Turbine and Pinion (RTV)

The thrust bearing for the turbine and pinion is of the tilting pad type and is able to bear large thrust loads during high speed conditions.

The tilting pad type thrust bearing constantly keeps the thrust distribution by properly adjusting the surface of the thrust pad.

The self-leveling for the thrust force is possible, and the wearing of the pad is small value.

• Main Oil Pump and Governor Drive

The Gear type main oil pump has no seal and enables gland leaked oil to drain directly to the gear casing.

• Emergency Stop and Governor Valve

The emergency stop and governor valve consist of independently movable valves housed in a box type structure. The emergency stop valve provides manual control at start-up, allows independent trip protection and affords remote warming and starting through an optionally available air-operated motor.

Safety Devices

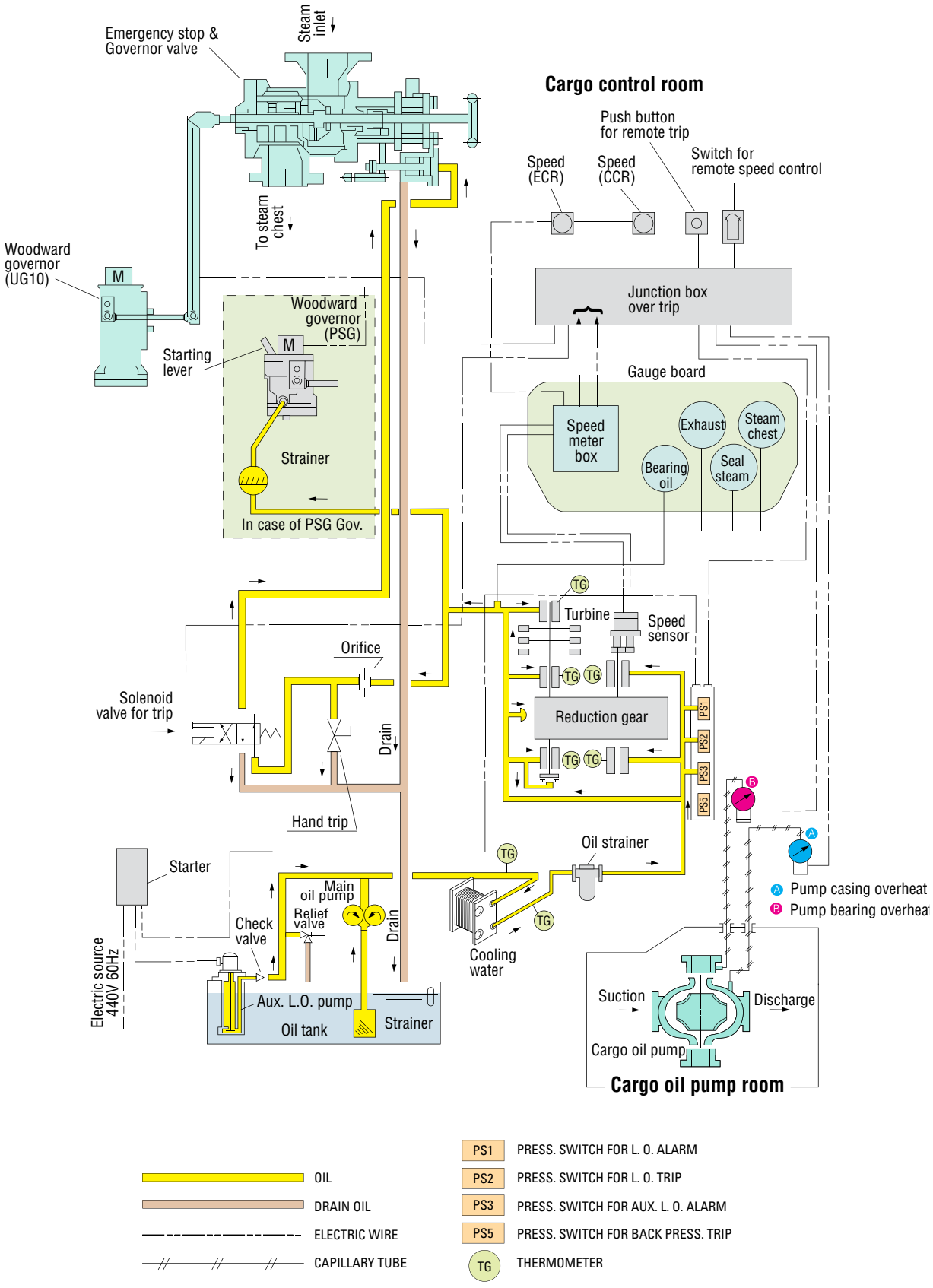
• Accessories •

Item			Standard	Optional	Remarks
Speed governor			•		Woodward made
Remote speed control device		Electric type	•		
		Pneumatic type		•	Air set. Manual loader
Safety device	Emergency overspeed trip	Mechanical type		•	
		Electric type	•		Speed relay
	Low oil pressure trip		•		Pressure switch
	Low oil pressure alarm		•		Pressure switch
	Oil level low alarm		•		
	Excess back pressure trip		•		Pressure switch
	Exhaust sentinel valve		•		
	Hand trip device		•		Push knob
	Remote tripping device	Electric type	•		Air set. Push valve. Pressure switch
		Pneumatic type		•	
	Rotor axial movement device		•		
	Pump casing overheat alarm or trip		•		
	Pump over-discharge pressure trip		•		
	Pump bearing overheat alarm or trip		•		
	Turbine bearing overheat alarm or trip			•	
	Contactor for emergency trip alarm and indicator		•		
Starter for aux. oil pump			•		
Tachometer		Transmitter	•		
		Indicator (Local)	•		Digital type
		Indicator (Remote)	•	•	One set
Replay for running indicator lamp				•	Speed relay
Pressure gauge with gauge board			•		
Thermometer (Oil and bearing)			•		
Lubrication System	Main oil pump		•		
	Aux. motor driven oil pump including motor and pressure switch		•		
	Strainer		•		
	Relief valve		•		
	Oil cooler (Plate type)		•		
	Oil temp. regulating valve			•	
Common bed for turbine and reduction gear			•		

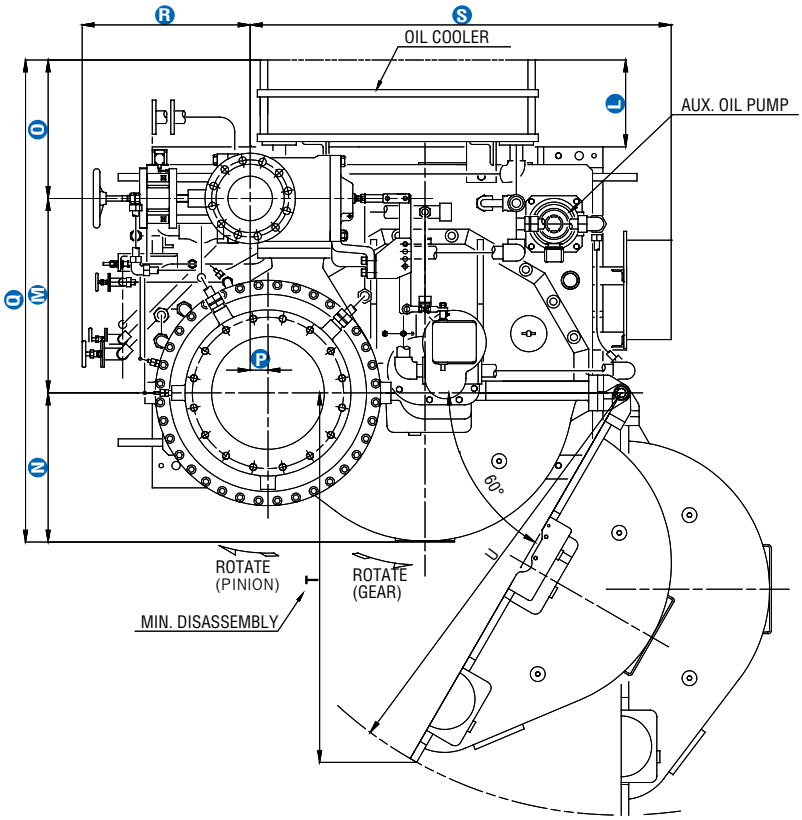
• Standard Spares and Tools •

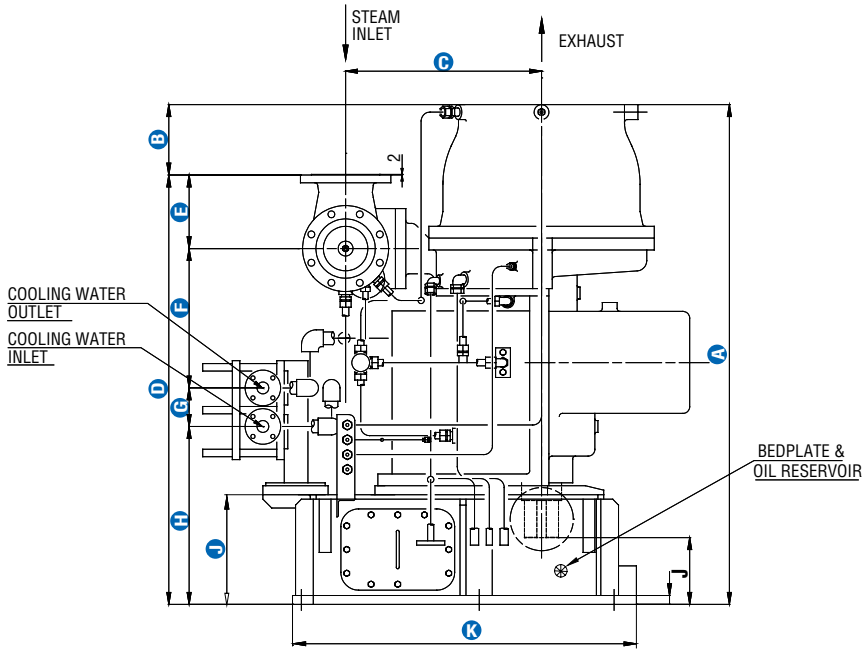
Item	Supply
Bearing for turbine and gear, including thrust bearing pads and liners	1 turbine set
Springs of each size for trip system	1 turbine set
Bush for main oil pump	1 turbine set
Bearings for motor of aux. oil pump	1 turbine set
Level glass for oil tank	1 turbine set
Special gaskets, packings and O-rings	1 turbine set
Bolts for each size filled on turbine and gear casing joints	5% of total number
Special assembly tools	1 set

Governing System & Remote Control Diagram



Dimensions CSV Model

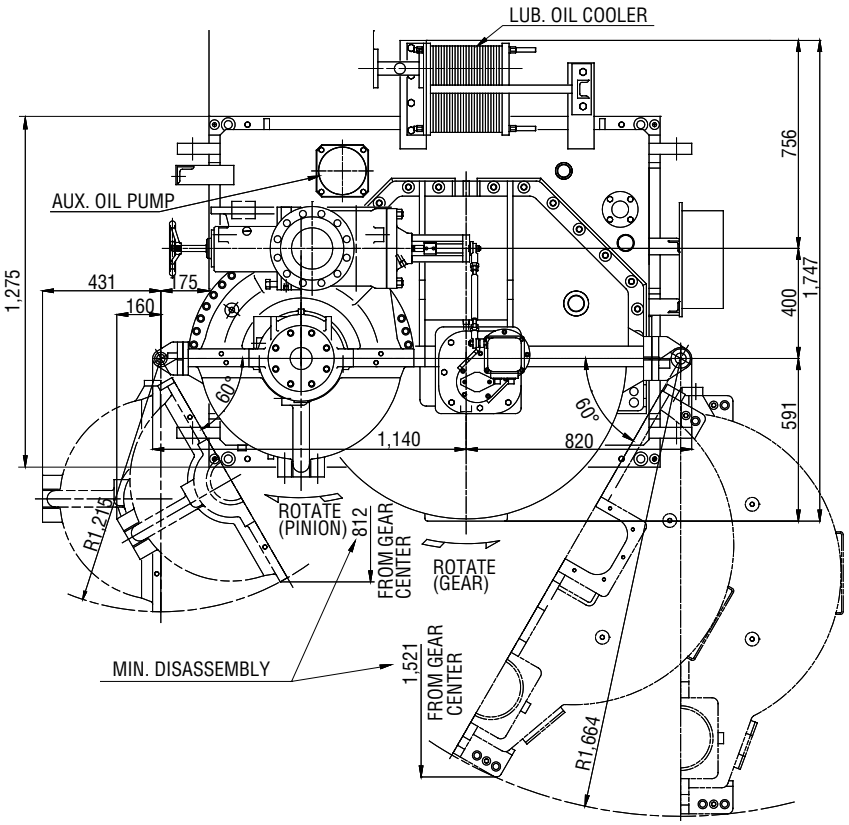


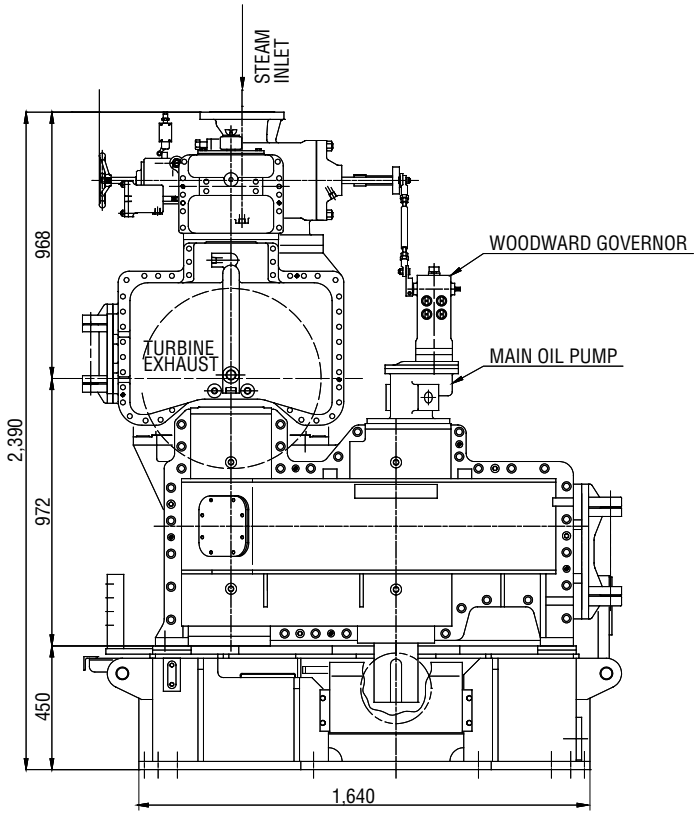


unit: mm

Model	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U
CSV - 5	1,256	101	516	1,155	138	518	130	497	370	880	120	378	388	425	120	1,191	435	1,275	974	1,113
CSV - 8	1,511	210	663	1,301	193	773	130	528	370	1,025	160	470	448	510	110	1,428	538	1,450	1,137	1,298
CSV - 14	1,685	237	661	1,448	248	470	130	600	370	1,520	293	656	503	467	60	1,626	567	1,420	1,246	1,424
CSV - 18	1,633	185	719	1,448	248	470	130	600	370	1,520	293	719	503	405	60	1,626	567	1,420	1,246	1,424

Dimensions RTV-30





CARGO OIL STRIPPING PUMP

Vertical Duplex Steam Driven Stripping pump

Hyundai Heavy Industries Co., Ltd. (HHI) produces a range of light and heavy duty vertical duplex steam driven piston pumps for cargo oil stripping service.

These pumps are carefully designed to give the reliable & efficient service with the minimum of attention.

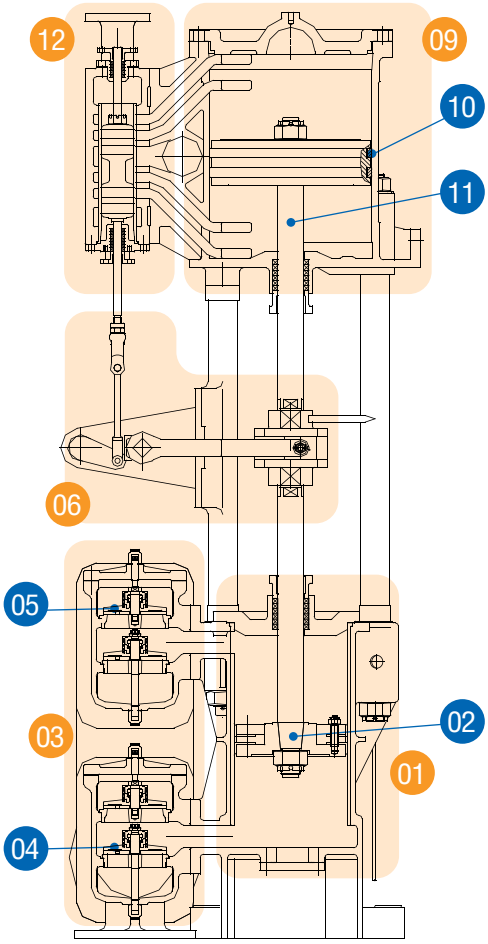
Design Features

- The stripping pumps is designed constructionally robust and compact.
- They can handle efficiently all grades of oils from petrol to viscous liquids under difficult suction conditions.
- Air chambers are fitted on the discharge side to eliminate pipe line vibration.
- Pockets which can collect gas have been avoided.
- The valve areas are large and the valve lift has been kept to a minimum to ensure quick reseating.
- Large covers are provided on the valve box to give easy access to valves for inspection.

Cargo Oil Stripping Pump

• Construction & Materials

The typical sectional view of the pump (Model:CSP) and material list is shown below.

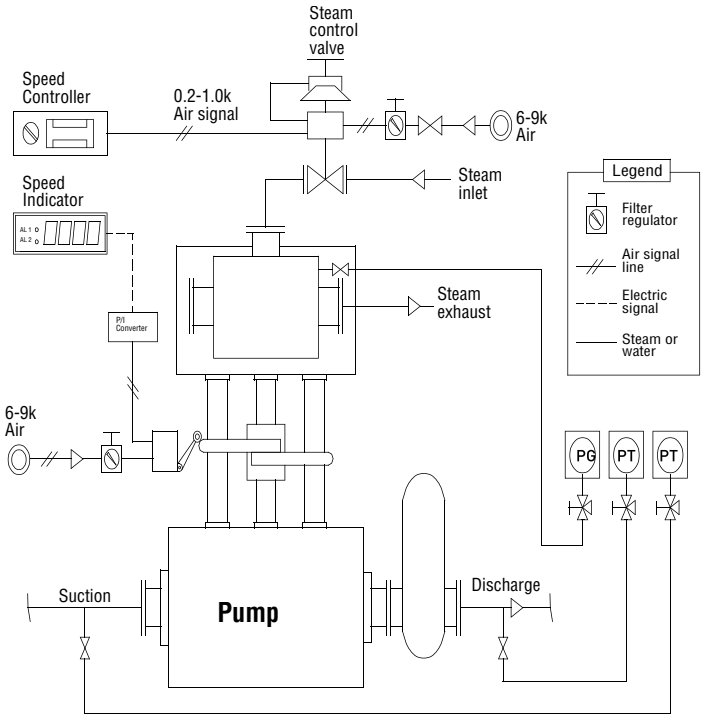


No.	Description	Material	
01	Liquid cylinder	Cast iron	FC200
02	Liquid piston rod	Stainless steel	SUS304
03	Liquid valve chest	Cast iron	FC200
04	Suction valve	Al-bronze	AlB C2
05	Discharge valve	Al-bronze	AlB C2
06	Linkage assembly	-	-
09	Steam cylinder	Cast iron	FC200
10	Steam piston ring	Special cast iron	-
11	Steam piston rod	Carbon steel	S45C
12	Steam chest	Cast iron	FC200

• Remote Control System

The pump speed is controlled by steam valve that is governed by the pneumatic speed controller.

The pump speed is monitored by the pneumatic stroke detector.



• Application

Hyundai CSP pumps are vertical duplex double acting piston pumps designed to be used for cargo stripping service. There are three(3) models covering capacities from 150 m^3/h to 450 m^3/h.

Item \ Model	CSP200	CSP300	CSP400
Capacity (normal) (m^3/h)	200	300	400
Total pressure (max.) (kg/cm^2G)	15.0	15.0	15.0
Suction head (m)	-5		
Working steam pressure (kg/cm^2G)	18 (max.)		
Exhaust steam pressure (max.) (kg/cm^2G)	1.5		
Steam cylinder bore (mm)	450	540	620
Liquid cylinder bore (mm)	310	370	425
Stroke length (mm)	440	450	480
No. of double stroke (nor.)	30	30	30
Suction bore (mm)	200	250	300
Discharge bore (mm)	200	250	300
Steam inlet bore (mm)	80	80	100
Steam exhaust bore (mm)	125	125	150
Application range (m^3/h)	150 - 240	250 - 340	350 - 450

• Test & Quality Management

- Major pressure containing part castings are made at foundries approved by the world wide classification societies.

- All pressure containing parts are hydrostatically tested at 1.5 times of design pressure.

- Each pump assembly shall be tested according to the design conditions at CSP pump test facility.

- Special cast iron piston rings are supplied from the qualified engine piston ring makers.

AUTOMATIC VACUUM STRIPPING SYSTEM (AVSS)

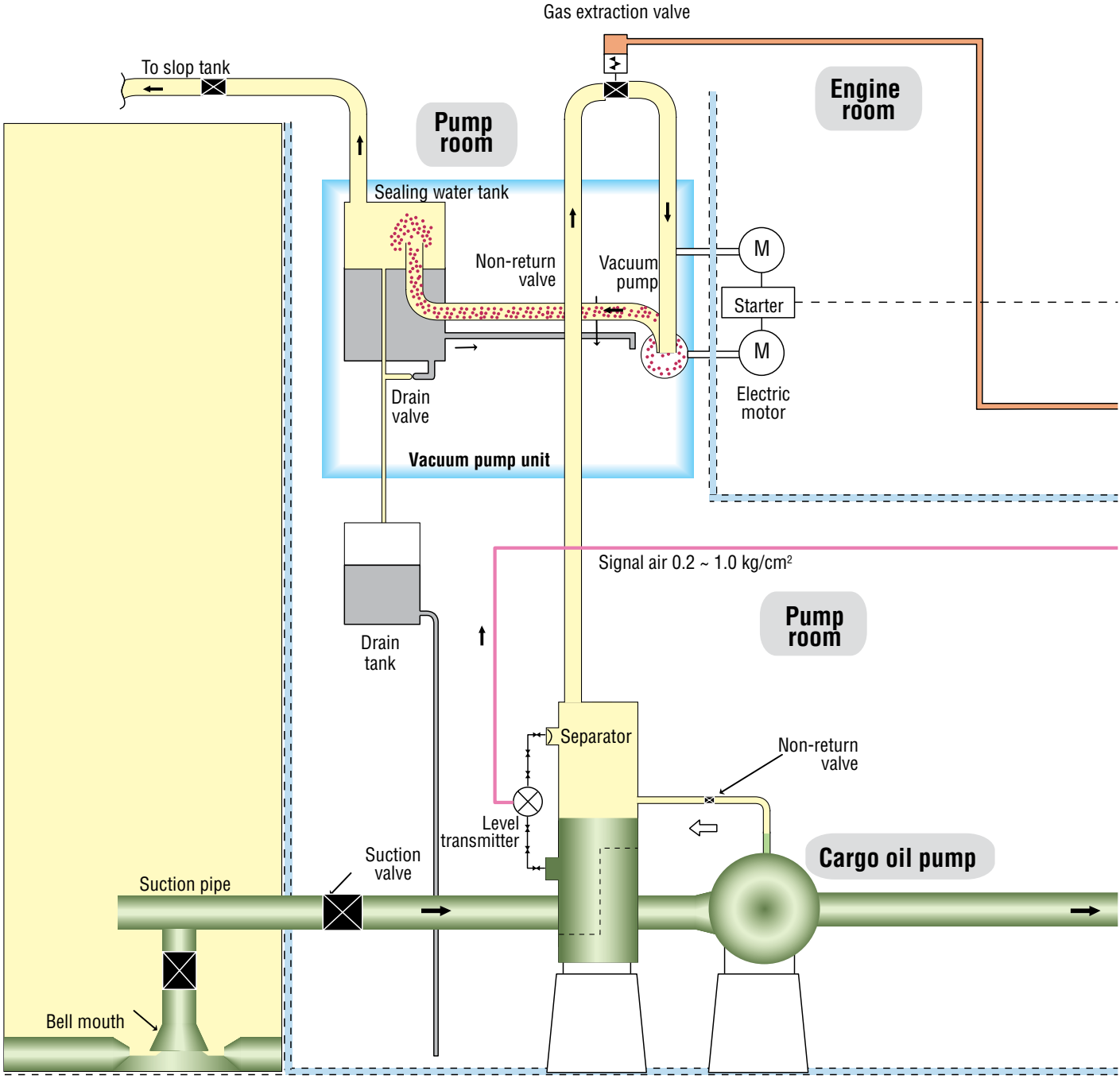
System Features

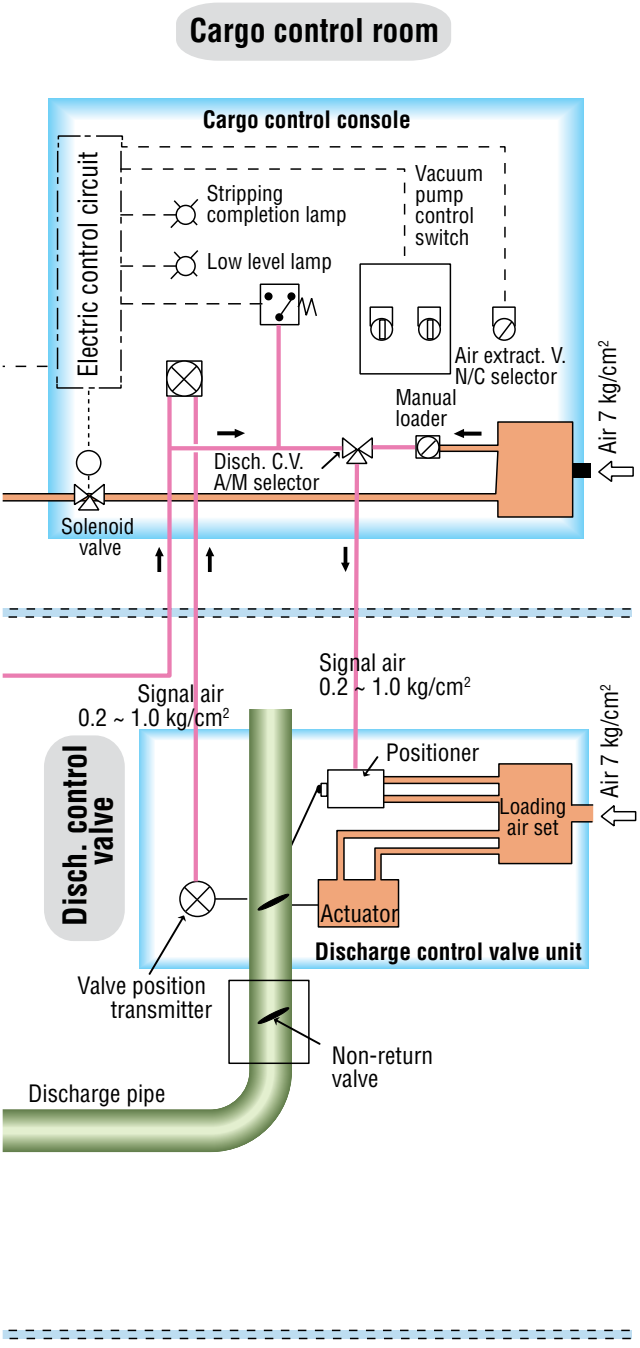
Hyundai Automatic Vacuum Stripping System (AVSS) helps the cargo oil pump operate as low as possible and can save unloading time. With this AVSS, the cargo oil pump operates at cavitation-free condition and carries out best performance in its operation range.

- Higher stability
- Flexible user (operator) interface
- Compatible with upper level program & open connectivity

Automatic Vacuum Stripping System (AVSS)

• Control System •





• The basic operation is as follows :

1. Turn on the PLC

2. After starting the cargo oil pump the cargo control console :
   - Set the gas extraction valve switch to “NOR”
   - Set the vacuum pump switch to “AUTO”
   - Set the discharge output valve to “AUTO”

3. While the liquid level in the cargo oil tank is high, the cargo oil pump located at the bottom of the vessel performs the unloading work at the best condition because of its high suction pressure. Therefore this vacuum stripping system is not operated under this condition.

4. After unloading for a certain time, the liquid level in the cargo oil tank falls down and the suction pressure of the cargo oil pump is also decreased. Vapor generated in the oil itself is sucked into the separator through the suction mouth of the cargo oil tank. The vapor mixed with oil is accumulated at the top of the separator by specific gravity difference between oil and vapor. Consequently, the separator level begins to fall.

5. When the oil level in the separator lowers to 50%, the bypass valve is set to close and gas extraction valve is set to open by a signal air sent from the level transmitter. At the same time, vacuum pump continuously runs and the discharge control valve is throttled.

6. When the vapor is extracted by the vacuum pump, the separator level rises again and if it reaches 70%, the vacuum pump continuously runs, the gas extraction valve is closed, the bypass valve is opened and the discharge control valve is opened.

7. The unloading is proceeding repeatedly as mentioned above to prevent the vapor entering into the cargo oil pump whenever the vapor is accumulated in the separator.

8. If the level in the cargo oil tank lowers further, the level around the bell mouth fluctuates heavily and a lot of gas is sucked. While the separator level falls to below 5% by extremely decreasing the liquid level in the cargo oil tank, the alarm lamp indicating low separator level is displayed on the control unit. This means unloading work enters into stripping stage.

9. If this conditions is continued about 3 minutes, the finish of stripping lamp in red on the console flickers with buzzing and shows the completion of the unloading work.

10. After finishing stripping, the selector is set at “COP STOP” and the cargo oil pump is automatically stopped. Whereas it keeps on running, while at “COP RUN”.

Principal Components

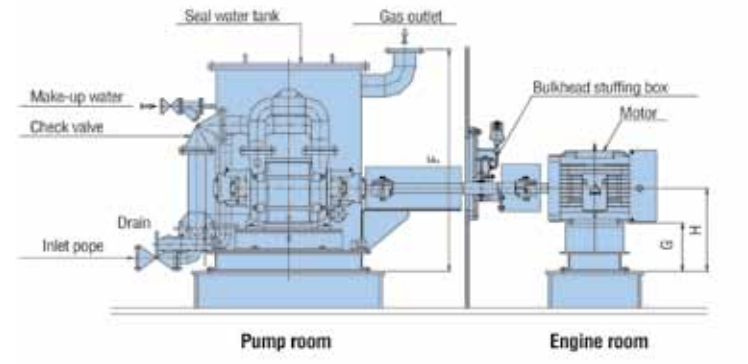
• Vacuum Pump Unit

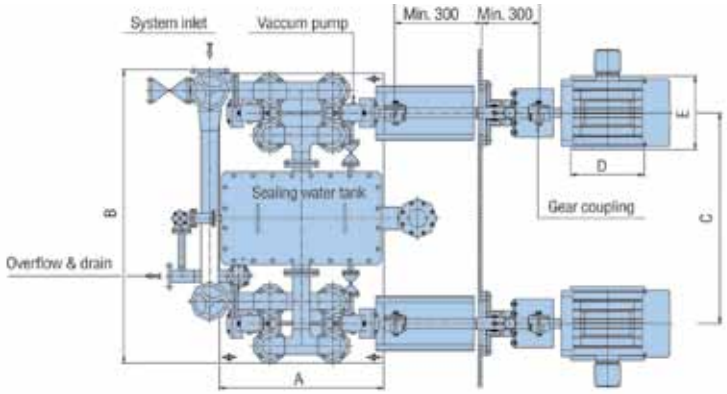
The vacuum pump unit is composed of vacuum pump, motor, local starting panel, sealing water tank and by-pass valve. The separated gas in the separator is discharged to the slop tank by the vacuum pump.

The vacuum pump is started and stopped automatically on the completion of stripping.

A by-pass valve is installed at the suction side of the vacuum pump in order to prevent the vacuum pump motor from frequent operation in a short time. This by-pass valve counteracts gas extraction valve.

According to the separator level, the by-pass valve is opened to hold a certain vacuum while gas extraction valve is closed, the by-pass valve is closed while gas extraction valve is opened.





* Unit : mm

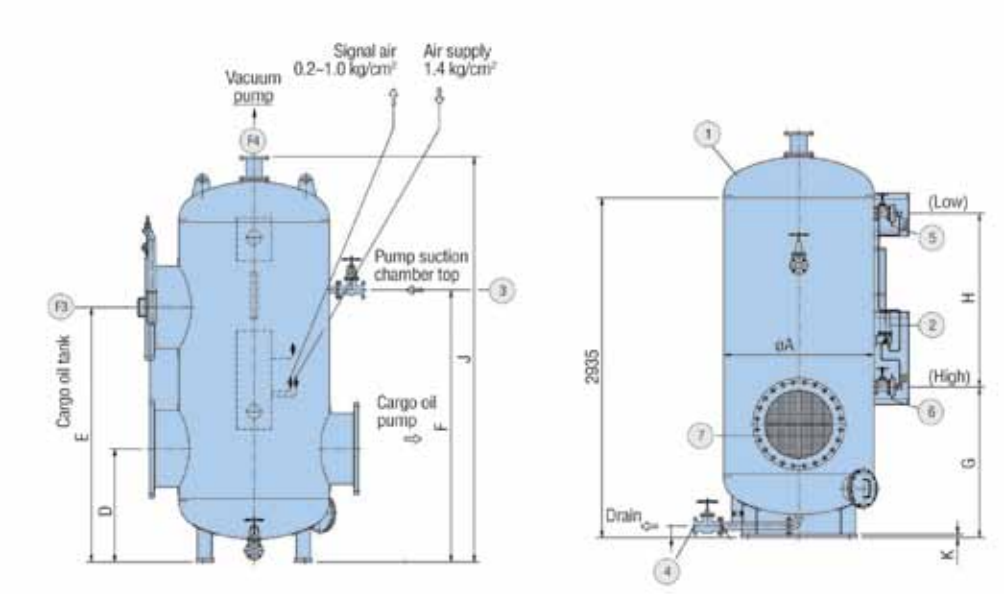
Description \ Model		AVSS25	AVSS30	AVSS35	AVSS40	AVSS45	AVSS50	AVSS55
Application scope (separator)		HCP250	HCP300	HCP350	HCP400	HCP450	HCP500	HCP550
Separator volume		0.7	1.0	1.5	2.0	3.0	4.0	6.0
Vacuum pump type		Water ring						
Max. capacity (m^3/h/set)		320				630		
max. vacuum (mmHgV)		550				550		
Motor		11 kW x 1190 rpm x 2 sets				22 kW x 1190 rpm x 2 sets		
Sealing water tank (m^3)		0.27				0.37		
Weight (kg)		1470				1910		
Dimension	System inlet / outlet	100A				125A		
	A	1230				1460		
	B	1640				1760		
	C	1140				1200		
	D	700				800		
	E	360				400		
	F	1150				1285		
	G	200				200		
	H	360				380		

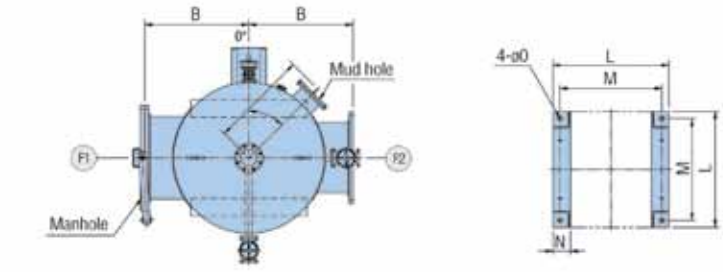
* Note : Value type and dimensions are only for reference.

* unit : mm

• Separator Unit

This is a tank to separate the gas by specific gravity difference in the cargo oil coming from the suction bell mouth of the cargo oil tank. The separated gas is discharged to the slop tank through extraction pipe by the vacuum pump.





No.	Description	Material
1	Separator	Rolled steel
2	Level transmitter	-
3	Lift check valve	Cast iron
4	Drain valve	Cast iron
5/6	Globe valve	Stainless steel
7	Latticed screen	Stainless steel

Model	F1/F2	F3	F4	øA	B	C	D	E	F	G	H	I	J	K	L	M	N	øO	VOL (m³)	WGT (kg)
AVSS25	300A	300A	80A	620	450	450	650	1600	1750	1000	1300	2450	2700	30	420	320	110	27	0.7	400
AVSS30	400A	350A	80A	740	525	470	730	1700	1850	1070	1350	2570	2850	30	540	440	110	27	1.0	500
AVSS35	450A	450A	80A	870	600	500	770	1800	1950	1100	1450	2700	3000	30	670	570	110	27	1.5	700
AVSS40	500A	500A	80A	1000	700	530	830	1900	2050	1180	1500	2830	3150	32	700	570	140	32	2.0	900
AVSS45	600A	600A	80A 100A	1150	750	560	900	2050	2200	1260	1650	3060	3400	32	850	420	140	32	3.0	1200
AVSS50	700A	700A	100A	1300	900	590	980	2200	2350	1340	1800	3290	3680	36	1000	850	160	39	4.0	1500
AVSS55	800A	800A	100A	1460	1000	620	1060	2400	2550	1420	2050	3620	4050	36	1160	1010	160	39	6.0	1900

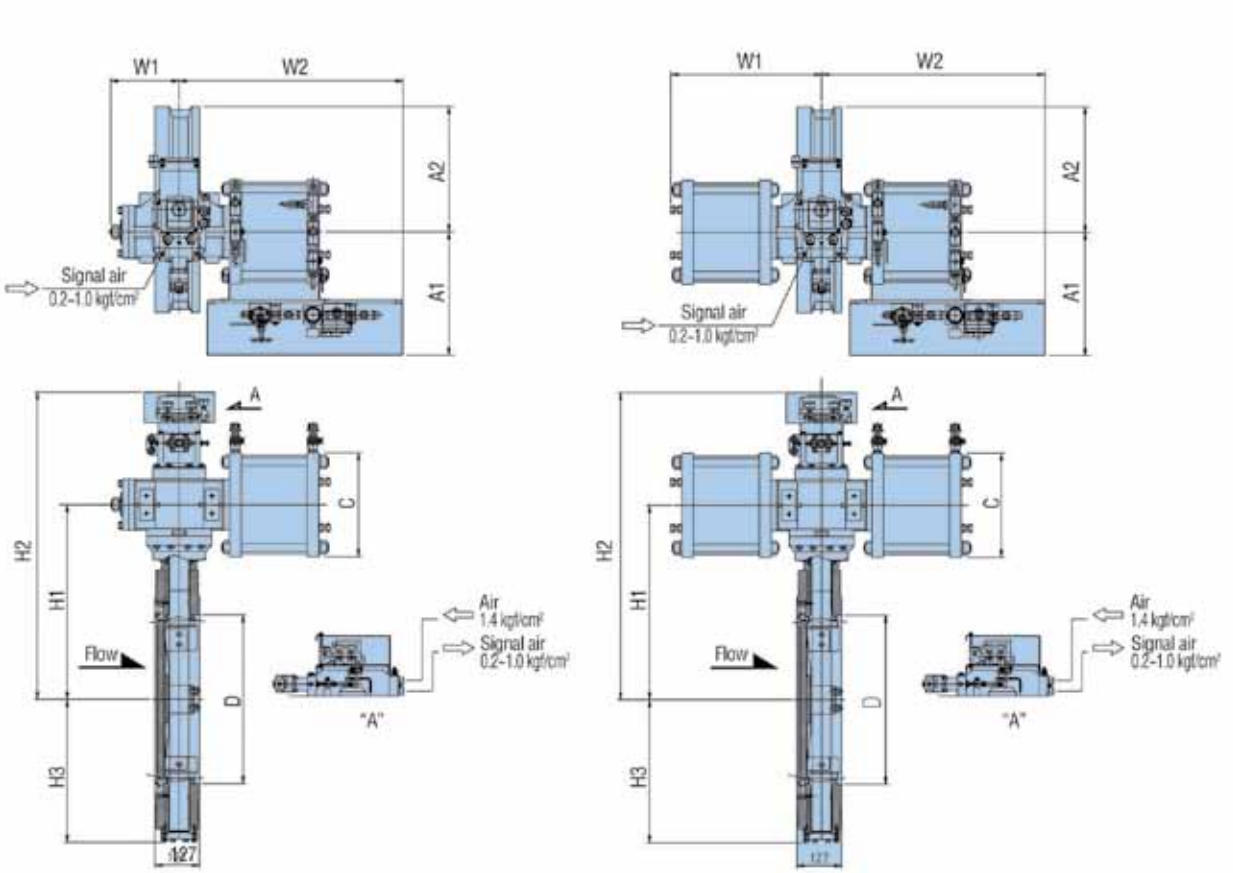
* Note : Value type and dimensions are only for reference.

* unit : mm

Principal Components

• Discharge Control Valve Unit

The discharge control valve regulates discharge flow rate of cargo oil pump as a butterfly valve driven by single or double acting pneumatic actuator. The valve opening regulation is possible to be both manual and automatic operation in the control unit. Furthermore, under emergency situation (in case input signal of the poisoner is failed), the valve is controlled to be fully opened by changing the position of the three-way valve to "emergency" at local. On the auto mode, the valve opening is regulated by the separator level.



Model	øD	L	W1	W2	H1	H2	H3	A1	A2	C	wgt (kg)
300A	310	78	180	43	815	530	265	470	197	Ø280	205
350A	342	78	180	430	895	580	300	470	220	Ø280	250
400A	380	102	180	430	920	600	350	470	247	Ø280	325
450A	434	114	430	430	940	620	375	470	280	Ø280	380
500A	482	127	430	430	975	670	405	470	295	Ø280	430
550A	535	154	480	480	1025	710	435	470	335	Ø280	570
600A	602	154	630	630	1240	460	470	535	360	Ø340	690
650A	650	165	630	630	1280	795	500	535	370	Ø	

* Note : Value type and dimensions are only for reference.

* unit : mm

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