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SILLA METAL


Propeller & Shafting System

CEO MESSAGE

Since its establishment in 1975, Silla Metal has grown-up into current Silla Metal Ltd. through continuous technology development and facility modification and expansion. Needless to say, propeller and propulsion shaft system are one of the most essential devices on a ship. In line with this importance, the propeller requires excellent durability and product reliability. We produce the best products that satisfy the importance of these products in accordance with the characteristics of each size and type of vessel such as VLCC, LNGC, Containers, etc. In order to make these high-end products, Silla Metal has been constantly working on research and development and product quality improvement. From the propellers for commercial vessels to the CPP for military and special purpose vessels, Silla Metal promises to manufacture a quality product that exceeds the needs of customers and do its best as a world class propeller manufacturer.

President of SILLA METAL Kim, Hyung-Jin

Silla Metal has inherited the Genes of Silla Kingdom and strives to the excellence of foundry, casting and metalwork.

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QUALITY MANAGEMENT

Silla Metal is producing high-quality marine propulsion system from the factory which has been certified by the world's leading classification such as LR, BV, RINA, ABS, DNVGL, NK, RS, KR, etc. All manufacturing are conducted in an automated plant in head quarter and finish works are done delicately by hand work of the skilled technician having more than 10 years of experience. In order to ensure the highest quality, Silla Metal controls entire process starting from selection of raw material, design, until manufacturing in accordance with ISO 9001 Quality Management System, ISO 14001 Environmental Management System, and OHSAS 18001.

CERTIFICATES



ABS



BV



DNVGL



KR



LR



RS



NK



RINA



ISO 9001



ISO 14001



OHSAS 18001



WPS

SILLA METAL HISTORY



1970's



1980's



1990's



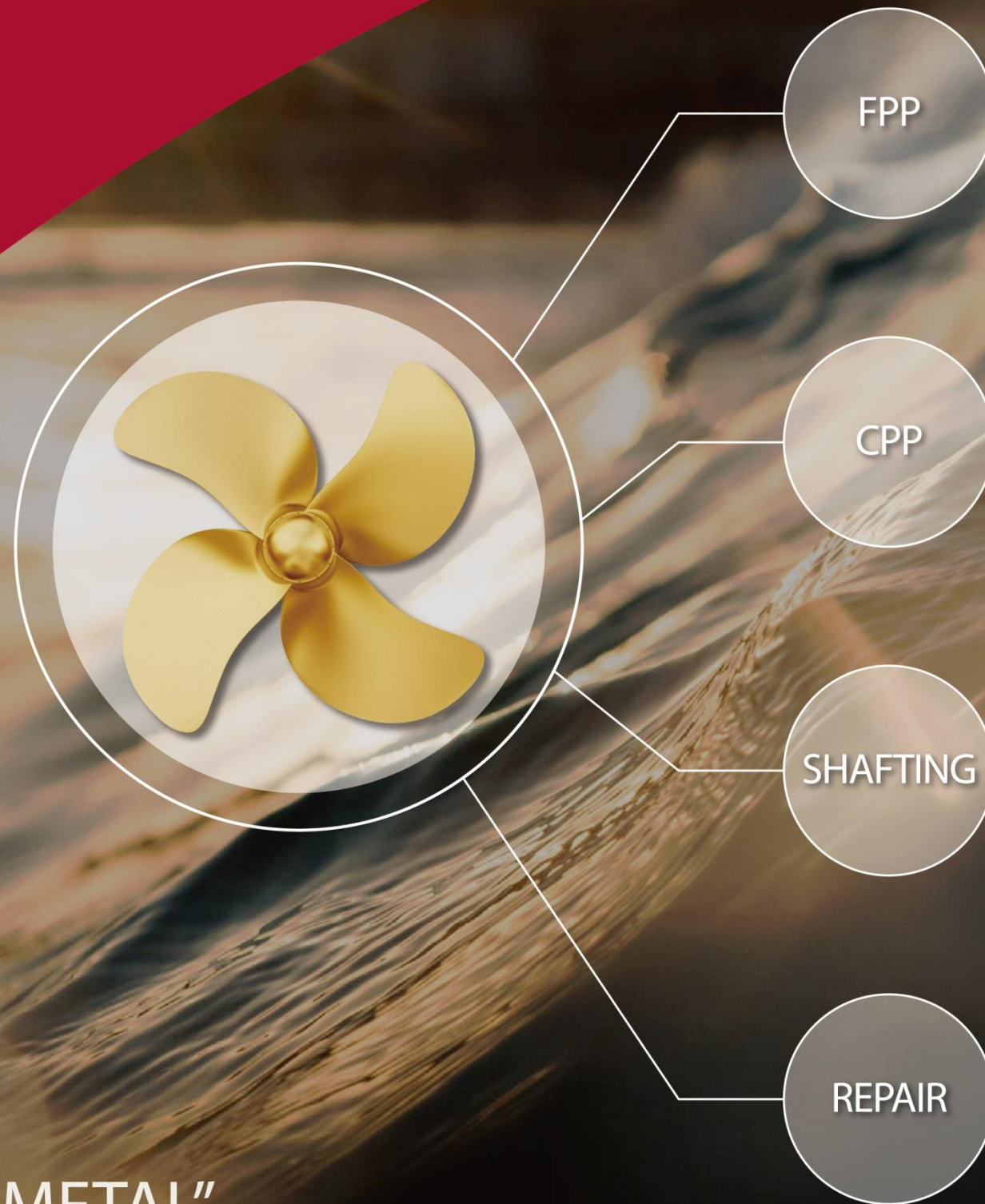
2000's

- 1975.01 SILLA METAL industries established (Namhang-dong, Yeongdo-gu, Busan)
 - 1978.04 Registered as the specialized plant for shipbuilding material by the Commerce-Industry Ministry
 - 1978.06 Registered as the company that supplies to the Navy and to the Marine Police
 - 1979.05 Developed propeller for special high speed small vessel (Ministry of National Defense)
-
- 1981-85 Awarded "Letter of appreciation" from head of the Defense Procurement Agency
 - 1983.08 Registered as the quality improvement company by the Commerce-Industry Ministry
 - 1986.06 Signed technology alliance with Japan's KAMOME concerning propeller technology
 - 1988.07 Incorporation of going business (SILLA METAL CO.,LTD)
-
- 1990.04 Designated as cutting edge technological industry
 - 1990.07 Approval for the KCX.MSC blade development business
 - 1991.09 Signed technology alliance with Germany's SULZER ESCHER WYSS GMBH
 - 1992.07 Awarded commendation "Trade Day" from Minister of the Commerce
 - 1995.10 Produced CPP & HUB for 3,000 Ton class ROKN First destroyer
 - 1995.11 Awarded commendation "Development of outstanding capital goods" from the President of Korea
 - 1997.01 Produced CPP&HUB for 5,000 Ton class destroyer

- 2004.11 Produced CPP & HUB for Large landing ship
 - 2006.07 Produced CPP & HUB for 10,000 Ton class AEGIS vessel
 - 2007.01 Achieved certification of company attached R&D center
 - 2007.06 Selected as the leading company in Busan in the strategic business industry
 - 2007.09 Registered as company specialized in components and materials
 - 2008.09 Established plant No. 2 (Sinpyeong-dong, Saha-gu, Busan)
 - 2008.12 Marine Propulsion (Propeller and Shaft) 3,000 set production
-
- 2012.03 Awarded commendation "Best Taxpayer" from the Minister of Strategy and Finance
 - 2012.04 Registered as Inno-Biz
 - 2012.07 Production of FPP with a weight of 75 Ton
 - 2012.12 Delivered 7.9m Dia. Twin propellers for 170K CBM LNGC
 - 2014.07 Selected as a Root-Technology Company by SMBA
 - 2015.03 Acquired a patent for CPP Hub Assembly
 - 2018.04 Delivered 10.4m Dia. propeller for VLCC
 - 2018.04 Delivered 8.4m Dia. Twin propellers for 180K CBM LNGC
 - 2018.09 Awarded commendation "Development of capital goods" from the Ministry of Trade, Industry and Energy (MOTIE)
 - 2019.01 Delivered 10.6m Dia. propeller for VLCC

BUSINESS AREA

Silla Metal Co., Ltd is a company founded in 1975 producing Propeller and Shafting and it has grown to be the largest scale in the Republic of Korea on single company basis. Up to now, we've delivered more than 3,000 units of propulsions to various types of commercial vessels to worldwide. We are the only company supplying propulsions for ROKN and KCG and have exported our propulsions to a number of foreign navies and coast guards around the world.



FPP



Based on long experience, Silla Metal is custom-making ship propeller suitable for each type of vessel such as VLCC, LNGC, Container Carrier, Tanker, Bulk Carrier, Cruise ship and Special ship.

Our precise and specialized equipment produces propulsions according to the drawing optimally designed for the characteristic of the vessel.

CPP



Our Controllable Pitch Propeller has high accuracy and reliability, and is suitable for each type of vessel, such as Naval vessels, Patrol vessels, and Special purpose vessels.

Our own models are also ready for operation and numbers of global top class CPP manufacturers have also cooperated.

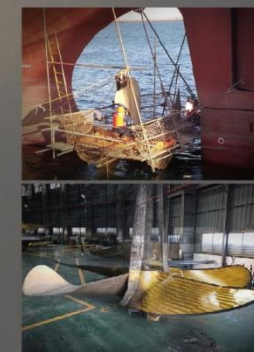
SHAFTING



We are producing Shafting for Water-lubricated System, Oil-lubricated System reflecting the characteristic of the vessel. Furthermore, from the beginning of our establishment, we have produced Propeller and Shaft as a package and maximized the efficiency of the vessel operation.

- Propeller Shaft and Intermediate Shaft
- Hydraulic Nut and Ring
- Coupling Bolt and Nut
- Stern Equipment

REPAIR



Providing periodically cleaning and maintenance service for ship's performance. Long history and numerous experience/know how of repairing the propulsion. Our Service Engineer is always with our product all over the world.

- Propeller edge modification afloat
- Repair for the fracture of propeller blade
- Repair for the large bending of propeller blade

"Launch your dream with SILLA METAL"

“Advancing as the World’s Best Company”

Foundry shop is possessing furnace with the capacity of 150 Tons in total and is able to produce high quality Propeller with the experience on casting and differentiated technology accumulated for 45 years. Propeller machining shop has been operated by automated equipment specialized in the production of Propulsion such as 3-Axis CNC Vertical Turning Centers, 5-Axis CNC Milling Machines, etc. Our products have been produced and supplied to meet various customer requirements in a timely manner by the combination of specialized equipment and high quality craftsmanship over the long period of time.

> PROCESS IMAGE



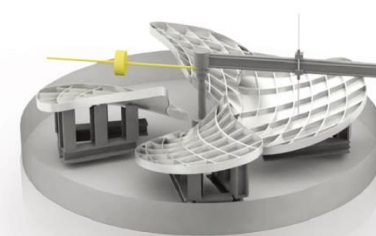
FACILITIES LIST

FACILITY	CAPACITY	Q'ty	MAKER
Furnace	150Tons(Total)	5	KOREA
Lay-Out M/C	X4,000 × Y2,000 × Z1,200	2	KOREA/JAPAN
Pitch Gage	Up to 11,000	13	KOREA
Ladle	100Tons(Total)	7	KOREA
CNC Lathe	Φ1,800 × 12,000(L)	1	KOREA
Heavy Long Lathe	Φ2,000 × 10,000(L)	1	JAPAN
Heavy Long Lathe	Φ2,200 × 12,000(L)	1	KOREA
Heavy Long Lathe	Φ1,300 × 12,000(L)	2	JAPAN
Heavy Lathe	Φ1,200 × 6,000(L)	1	USSR
Heavy Lathe	Φ1,200 × 9,000(L)	1	KOREA
Radial Drilling M/C	30HP × 3,500(L)	1	KOREA
CPP Spin Test M/C	Φ6,000	1	KOREA
Union Boring M/C	130T	1	GERMANY
Floor Boring M/C	150T	2	KOREA/JAPAN
Floor Boring M/C	160T	1	KOREA
Vertical Turning M/C	Φ8,500 × 80Tons	1	KOREA
Vertical Turning M/C	Φ11,000 × 100Tons	1	KOREA
Propeller Blade Milling M/C	Φ8,500 × 80Tons	1	KOREA
Propeller Blade Milling M/C	Φ11,000 × 130Tons	2	KOREA

MANUFACTURING PROCESS

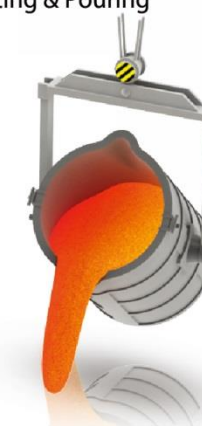
After designing the product in most suitable and efficient way for optimal operating condition, Propellers have been casted with minimum deformation resulted from long-experienced casting technology. High Quality Propulsions have been produced with the automated high accuracy machines.

1. Molding



Sand Mold based on 3D modeling design is precisely made by skillful craftsmen.

2. Melting & Pouring



Dissolved copper alloy is inserted into Sand Mold by gravity of upper part (Total melting capacity : 150 Tons).

3. Propeller Machining



Boss processing is done by CNC Vertical Turning Lathe. Surface of the blade is processed by 5-Axis CNC Milling Machine based on 3D modeling.

4. Shaft Machining



Shaft Machining is done by the CNC Horizontal Lathe with the qualified material.

5. Contact Test



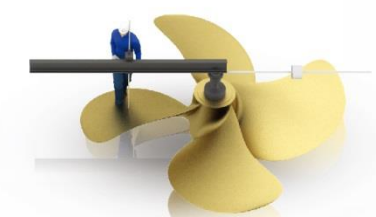
By using actual propeller shaft or cone gauge

6. Finishing with Polishing



Both surface of blade and boss are polished up smoothly by skilled workers.

7. Inspection & Shipment



Balancing, Dimension/Pitch and Surface Inspection are done in the witness of Surveyor.

“Specialized equipment and high quality craftsmanship”

“Newly beginning, we always pursue the best”

FPP (Fixed Pitch Propeller)

Silla Metal's Propeller is designed and manufactured in accord with type and characteristic of vessel, engine type and customer requirement.



FPP (Fixed Pitch Propeller)

- Maximum Diameter: 10.6m
- Maximum weight after processing: 90 Tons
- 120 FPPs yearly capability of manufacturing
- For 45 years with high reputation of performance and quality



4 Blades Propeller



5 Blades Propeller



6 Blades Propeller

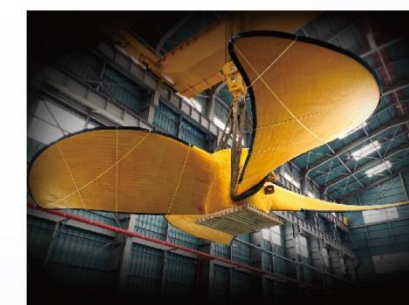


Ducted Propeller



High-Skew Propeller

None of the ship Propeller has same design and it is molded with unique design matching with the purpose of the vessel from the casting stage. Silla Metal has been designing and manufacturing optimum Propeller suitable for the operation condition of the vessel from small boats to large vessels.



SHAFTING

In addition to Propeller and Shaft, Silla Metal can supply all Stern Equipment related with Shafting system. Since Package is supplied together with Propeller to maximize the efficiency of the engine, best operating condition is guaranteed.

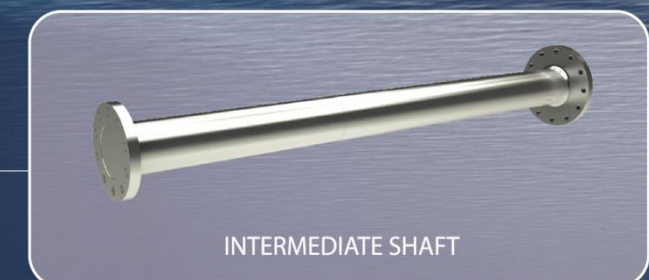
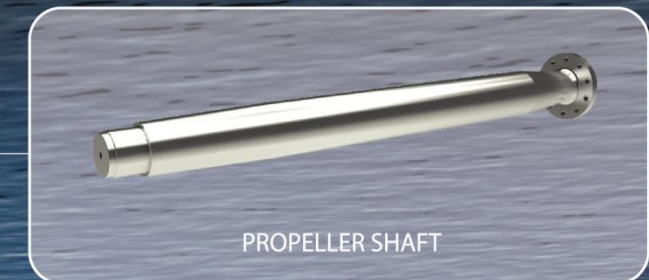
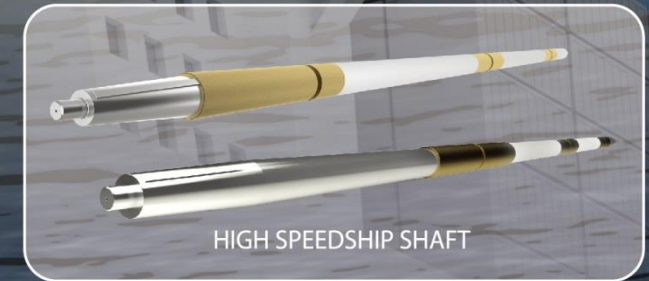
1. Stern Equipment

Stern Tube, Stern Tube Seal, Stern Tube Bearing, Coupling, Intermediate Shaft Bearing, Nozzle, Shaft Ground Device, Sleeve, Bracket, Rudder Stock, Propeller Cap, Rope Guard, Hydraulic Nut

2. Other Copper Alloy Casting

PROPELLER CAP

 FSPC	 STRAIGHT
 DIVERGENT	 COMPATIBLE WITH RUDDER BULB



“SILLA METAL has invested continuously in R&D to improve product quality”

“Development of High Efficiency FSPC”

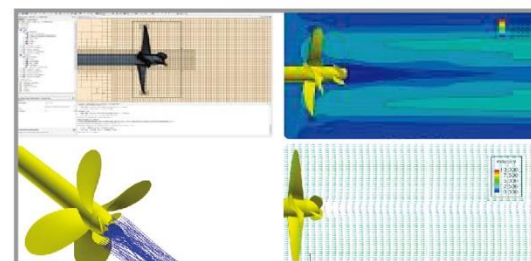
FUEL SAVING PROPELLER CAP



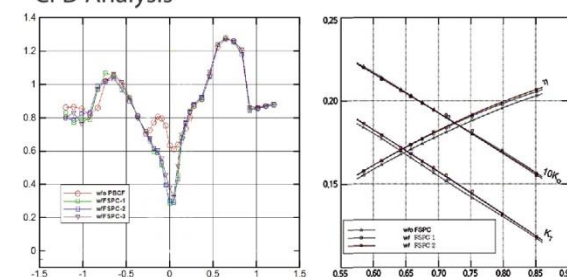
FSPC Advantages

- > Fuel Saving
Fuel Saving Ratio : max. abt. 2~3% at the model test. Sustainable Developing of FSPC for the high efficiency
- > Lower Cost
Lower cost than other energy saving device
- > Easy Installation
Easy installation by the bolts
Easy to replace from conventional propeller cap to FSPC
- > Elimination of Hub Vortex

Flow Analysis



CFD Analysis



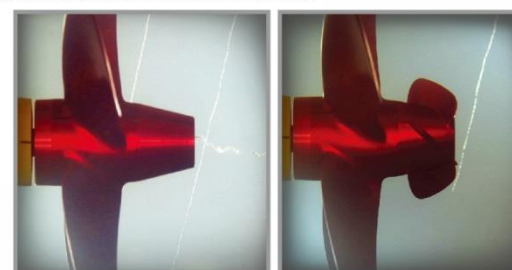
Model Test

Manufacturing of FSPC



Elimination of Hub Vortex

- Reduce the stern vibration & noise
- Reduce the erosion on rudder



Without FSPC

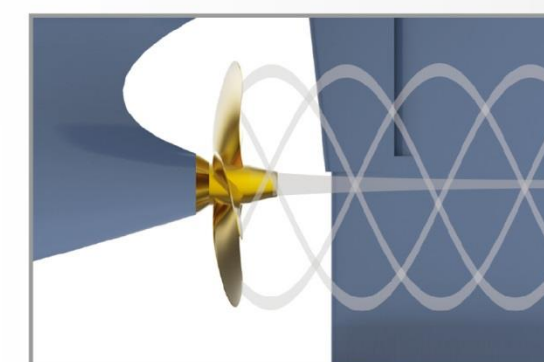
With FSPC

↑ Efficiency Increase

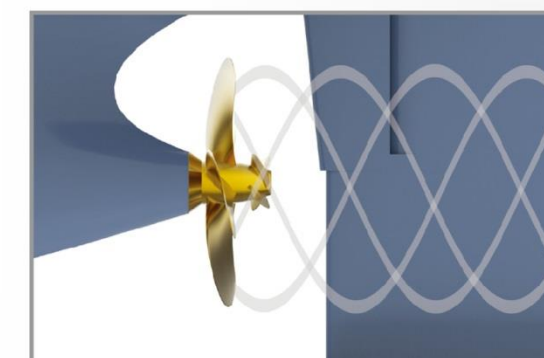
Procedure for the FSPC Development

- 1 FSPC Design : Optimal design
- 2 CFD Analysis : Efficiency Verification by CFD Analysis
- 3 Model Test : Efficiency Verification by Model Test

Visualization



Without FSPC



With FSPC

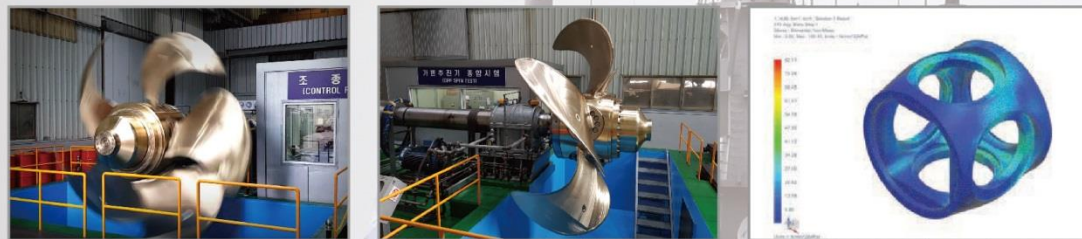
Installation of FSPC



“CPP Specialized for special purpose of ship”

CPP (Controllable Pitch Propeller)

CPP is designed to be able to achieve maximum efficiency mainly when range of sailing speed is wide and loading condition is not constant. Silla Metal's CPP has been used widely for the vessels requiring high mobility from small fishing boats up to the large Aegis destroyer of the Republic of Korea Navy. Silla Metal predicts an outline of controllable pitch propeller system through our legacy design program according to design conditions and result of propeller model test.



Reference list



DDH, DDG	FFG, FF / PCC	LPH, LSF, LST	Coast Guard
KDX-III (3)	FFX Batch-II (8)	LST-II (4)	KCG 1,000 (10)
KDX-II (6)	FFX Batch-I (6)	KLS (3)	KCG 1,500 (9)
KDX-I (3)	KCX (8)	KLP (2)	KCG 2,000 (1)
	PCC (4)	LSX (1)	KCG 3,000 (8)
AOE / ASR, ATS	PKG / PKM	MLS, MHC, MSH	
AOE (2)	PKM (70)	KML (1)	KCG 5,000 (3)
ASR (1)	PGM (2)		
ATS-II (1)			
KAS (1)			
AGX (1)			

Hub Mechanism for Vessel

- Competitive price and High Quality Product

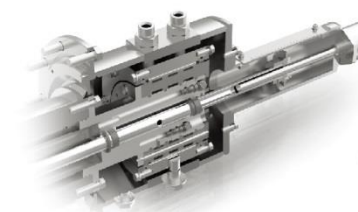
(*) HSCP : Hyundai-Silla CP Propeller

SYSTEM	TYPE	Power Range	Application
SCPD	Double Oil Pipe	1,200 ~ 20,000kW	Naval ship, Coast guard, Tug boat, Fishing Vessel etc.
SCCD	Double Oil Pipe	1,200 ~ 15,000kW	
HSCP(*)	Push-Pull Rod	1,200 ~ 6,000kW	

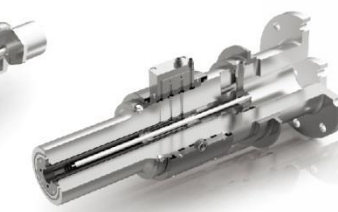


Oil Distribution Box

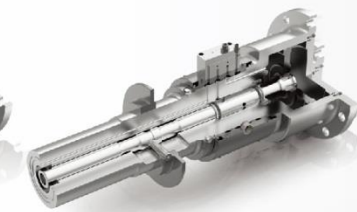
- ADG Series is appropriate type to Medium/High speed engines with reduction gear.
- ADS Series is Shaft Mounting type O.D Box System for Double Oil Pipe type.
- APS Series is Shaft Mounting type O.D Box System for Push Pull Rod type.



ADG Series



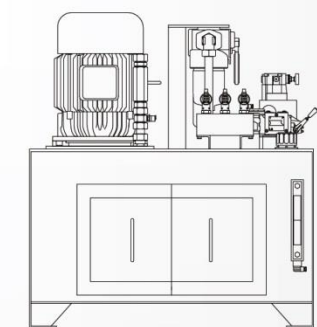
ADS Series



APS Series

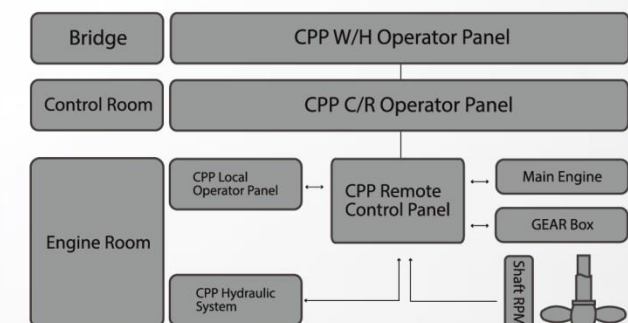
CPP Hydraulic System

- Monitoring system for oil leakage detection of shaft line
- Low oil pressure inside the Hub for risk reduction of oil leakage
- Quick response against emergencies
- High Efficiency Hydraulic System



CPP Control System

The CPP Propulsion Control System fulfills the rules of the classification societies and includes remote control, safety, pitch indication, RPM indication and a back-up pitch control system. Operator Panels can be supplied for bridge fore, bridge aft, bridge wings and control room. Operator panels are equipped with a combined pitch and RPM setting lever and a display to select various operator modes and to indicate pitch, engine RPM, shaft RPM and motor load.



World-wide class propulsion manufacturer

Silla Metal supports the development of potential capacity of each individual employee and fosters talented people with passion, harmony and professionalism. We value the trust with customer resulted from high quality, competitiveness and global service. Furthermore, we are leading the way to development of next generation technology such as high efficiency Propeller, energy saving device, new-generation propulsion system and so on.

Performance improvement of current products and development of next generation's leading technology.



Establishment of global brand being one step ahead of others in quality, price, service and product development.

Nurture of talent with passion, harmony, and expertise by developing and fulfilling potential.



FACTORIES

Silla Metal is handling all manufacturing processes from the casting of propeller to machining, finishing and final inspection. It is equipped with flexible production system to reflect the diverse needs of customers immediately and has been producing its own high quality propeller under the unified production management.

- A Propeller Machining Shop**
It contains 3-Axis CNC Vertical Turning Center and 5-Axis CNC Milling Machine which makes precision machining of large propeller possible and so on.
- B Foundry Shop**
It is a shop where Silla Metal's technology and experience are integrated and large dimensional casting is done here based on precision casting technology. It has 5 units of Furnace (Total melting capacity 150 Tons), small Molding shop and large Molding shop, etc.
- C Shaft Machining Shop**
Silla Metal has CNC Horizontal Lathe which can make precision machining.
- D Grinding Shop**
This is a shop where Propeller surface machining is done after processing is done with CNC Milling Machine. Skilled workers with more than 10 years of service experience do completion work of Propeller by utilizing 3-Dimensional Measurement System, Pitch Gauge and Static Balancing Test Machine.
- E Propeller Machining Shop**
It is a shop equipped with CNC Vertical Turning Lathe, 5-Axis CNC Milling Machine, CNC Horizontal Boring Machine and so on.



OVERVIEW

Company Name	SILLA METAL CO.,LTD	No. of Employees	70
Business Field	Marine Propulsion	Address	#34, NokSanSandan 17-Ro 14Beon-gil, Gangseo-gu, Busan, 46751, Korea
Product	FPP, CPP, Shafting, Repair & Maintenance	Telephone	+82-51-831-5991~8
Established Date	January 1, 1975	Fax	+82-51-831-5990
		E-mail	sales@sillametal.com
		Homepage	www.sillametal.com