

NAKASHIMA has **an idea**

One and only propulsion performance

We create the ultimate propellers that support safe and comfortable voyages from our obsession with "Built-to-Order."

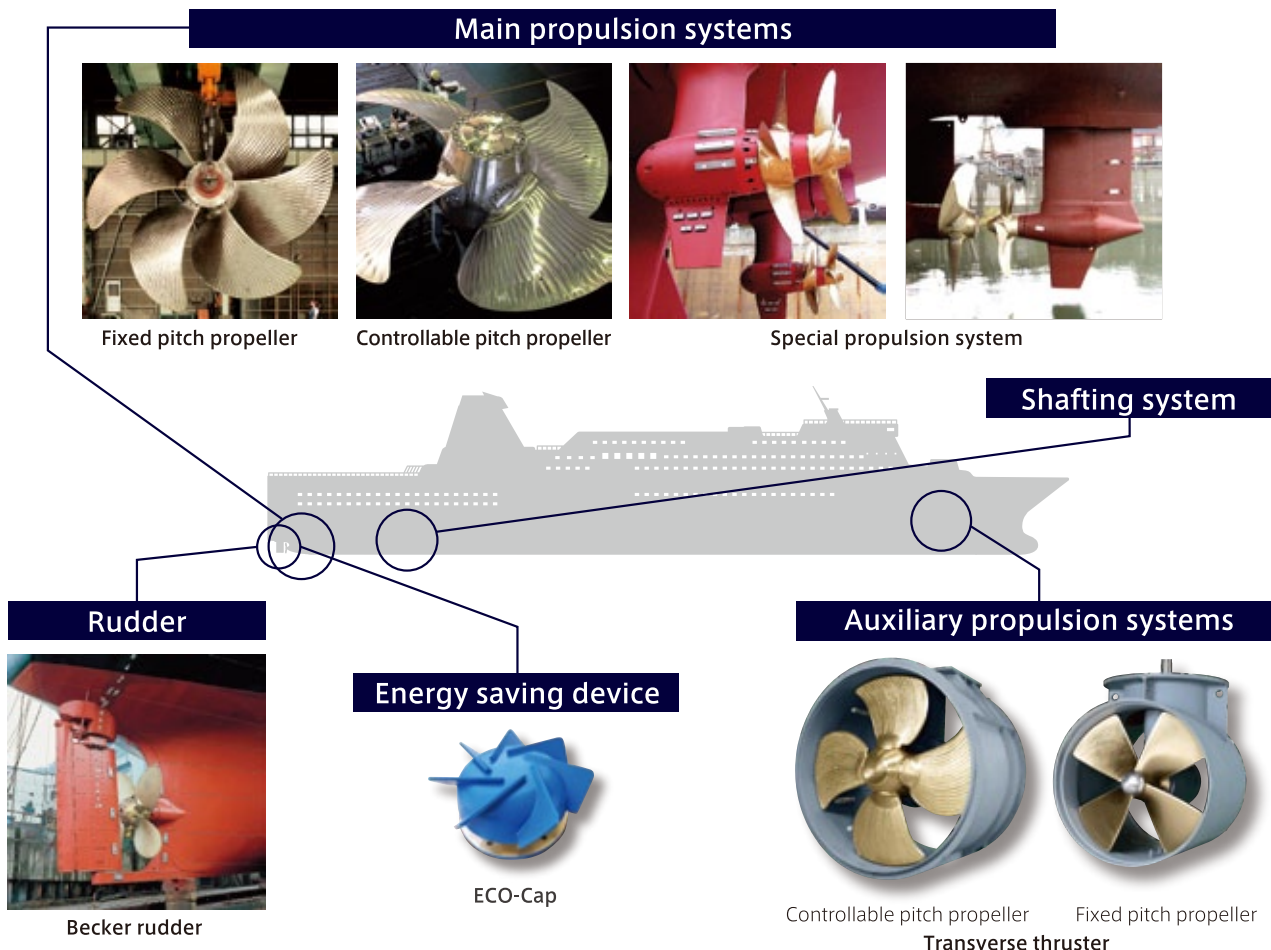
It is an absolute necessity for ships and vessels to exert optimum performance, matching the three elements of hull, engine and propeller. Every propeller that Nakashima manufactures is an "ultimate order-made" propeller, in order to create unique and optimum propellers. The history of Nakashima Propeller is the very history of "Built-to-Order."

The only high-performance propeller in the world created by craftsmanship which can distinguish 1/100 of a millimeter and cutting-edge digital technology.

In order to faithfully reproduce complicated shapes unique to fluidic products held by propellers, craftsmanship and digital technology are integrated in all processes including design, casting, machining, and finish to create high-performance propellers. Digital technology, such as a three-dimensional fluid analysis which indicate complicated flows in numerical values, and CNC blade surface machining equipment for high-precision machining. Skilled craftsmanship, such as hands of expert craftsmen, that can identify differences as small as a hundredth of a millimeter. Nakashima takes pride in its manufacturing using these skills to the fullest extent.

Propulsion Systems for Smooth Voyages

Nakashima Propeller is a comprehensive manufacturer of marine propulsion equipment handling every type of propeller from leisure boat to super-sized tankers at diameters of 12m. We support smooth voyages with a variety of propellers including controllable pitch propellers which can freely operate speed or ahead/astern of ships by controlling the angle of blades, thrusters, and electric propulsion systems.



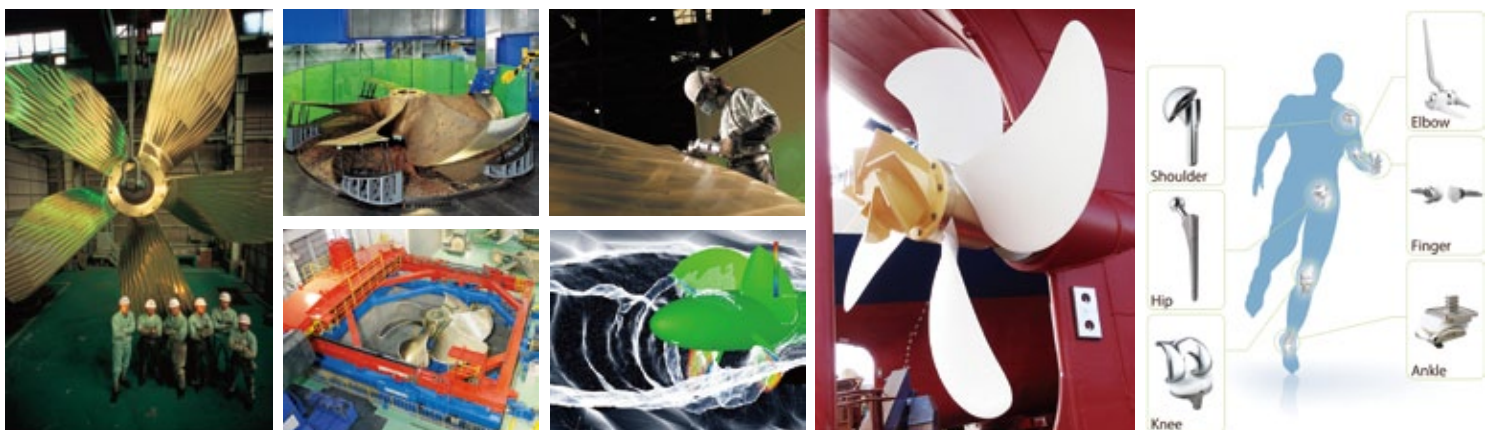
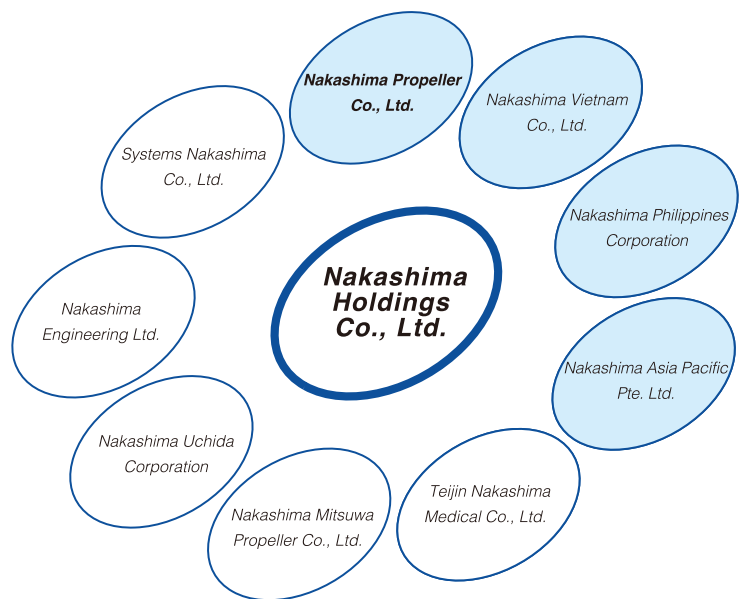
Global Network

Nakashima's propellers actively work on the seas of the world. We are developing a reliable global network.

Ships and vessels mounted with propulsion equipment of Nakashima Propeller actively work on the seas of the world. Presently, not only in Japan, but also in various countries around the world, backup systems have been established. The stage has expanded globally through technological cooperation with overseas companies and development of engineers.



“We Go Beyond” is an expression which announces the mission of Nakashima Group who consistently pursues the newest and best products and casts limitless possibilities beyond that into shape. We will aspire to make anything that has not been made or cannot be made yet.



History

NAKASHIMA GROUP

- | | |
|--|--|
| <p>1926 Zenichi Nakashima starts Nakashima Foundry casting copper alloy in Shimoishii, Okayama City</p> <p>1930 Names "Mitsuwa Propeller" as brand name of small-sized propellers and establishes trade mark with three overlapping circles.</p> <p>1938 Company organizes as partnership corporation Nakashima Foundry.</p> <p>1948 Establishes Nakashima Casting Industries Co., Ltd. in response to increases in propeller demand.</p> <p>1952 In preparation for increasingly larger ships and vessels, decided to develop as a large-sized manufacturer.</p> <p>1955 Changes trade mark to Eagle mark.</p> <p>1967 Completes new factory and relocates all departments to Jotokitagata, Joto-gun (currently, Jotokitagata, Higashi-ku, Okayama City). Changes corporate name to Nakashima Propeller Co., Ltd. Business establishment certification based on the Ship Safety Law by the Ministry of Transport.</p> <p>1971 Succeeds in development of keyless propellers.</p> <p>1972 Technical cooperation of controllable pitch propellers and side thrusters with Stone Manganese Marine Ltd., in England.</p> <p>1973 Introduces computers (Large-sized host computer FACOM230-15).</p> <p>1974 Introduces large-sized NC blade surface machining equipment.</p> <p>1978 Technical cooperation of Becker-rudder with Willi Becker in Germany.</p> <p>1981 Develops high skewed propeller. Spins Equipment Design Department off as separate company to establish Nakashima Engineering Ltd.</p> <p>1983 Newly establishes System Department and starts sales of personal computer CAD "ANDES."</p> <p>1984 Develops surface propellers.</p> <p>1985 In order to expand business in the information and communications field, spins System Department off as separate company to establish Systems Nakashima Co., Ltd. Performs CI and changes trade mark to N mark.</p> <p>1987 Utilization of structural analysis and electronic control systems and development of "Melody Bell." As an environmental representation product, Planning and Sales performed by Nakashima Engineering. Receives a manufacturing license for medical devices from the Ministry of Health and Welfare to develop artificial joints made of titanium alloy.</p> <p>1991 Introduced stereolithographic equipment "SOUP." Sales collaboration of thrust equipment including "Pump-jet" and "Rudder-propeller" with Schottel in Germany.</p> | <p>1993 Establishes Nakashima Uchida Corporation, sales company of business equipment through joint capital investment with Uchida Yoko Co., Ltd.</p> <p>1994 Completes private electric generator by cogeneration system. Inaugurates Medical Department.</p> <p>1995 Head works of Nakashima Propeller Co., Ltd. acquires ISO-9001 certification first in the propeller industry field.</p> <p>1996 Completes racing propeller factory in Head office premise of Nakashima Propeller Co., Ltd. Completes new head office of Nakashima Propeller Co., Ltd. Received Nikkei New Office Award.</p> <p>1997 "NICE 80" developed by Systems Nakashima Co., Ltd. as an in-house intranet receives Minister of International Trade and Industry Award as a superior information systems.</p> <p>2000 Technical corporation in manufacture of Model TCT thrusters with Korea KT Electric Co., Ltd.</p> <p>2001 Completes medical building. In celebration of the 75th anniversary, donates a large-sized propeller to Museum of Maritime Science in Higashiyashio, Tokyo.</p> <p>2004 Completes R&D center in Haga Research Park, Okayama City. Medical Business Department acquires ISO-13485 certification.</p> <p>2005 Completes Tamashima Works for manufacturing large-sized marine propellers. Employee, Hisayuki Miyata receives Prime Minister's Award "First Monozukuri Japan Grand Prix." His Imperial Highness visits our factory.</p> <p>2007 Completes factory of Nakashima Vietnam Co., Ltd. in Haiphong City, Vietnam and starts operation.</p> <p>2008 Reorganization of the group with Nakashima Holdings at its core. Split off of the Medical Department to create a separate company called Nakashima Medical Co., Ltd.</p> <p>2009 Nakashima Vietnam Co., Ltd. constructs its second factory in the Dinh Vu Industrial Zone in Haiphong City and begins operation. The Mikado Group merges with Nakashima Holdings.</p> <p>2010 Extends R&D center.</p> <p>2011 Established Nakashima Asia Pacific Pte. Ltd. in Singapore.</p> <p>2012 Mikado Japan Co., Ltd. changed its name to Nakashima Mitsuwa Propeller Co., Ltd. Mikado Philippines Corporation changed its name to Nakashima Philippines Corporation.</p> <p>2013 Business partnerships with Michigan Wheel Marine in USA. Established Nakashima Memorial Foundation.</p> <p>2014 Established Nakashima Medical Technical Center (Thailand) Limited.</p> <p>2015 Nakashima Medical Co., Ltd. changed its name to Teijin Nakashima Medical Co., Ltd.</p> |
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Nakashima Holdings Co., Ltd.

[Founded] May 1926
 [Established] November 1948
 [Capital] 100 million yen
 [Business content] Business related to management of group companies, management and leasing of real properties
 [Location] Jotokitagata 688-1, Higashi-ku, Okayama City 709-0625
 Tel:+81-86-279-5111(main)
<http://www.nakashima.jp>

Nakashima Propeller Co., Ltd.

[Established] November 2008
 [Capital] 110 million yen
 [Business content] Development, manufacture, and sales of marine equipment
 Planning, manufacture, and sales of exterior products
 Development, manufacture, and sales of environment improvement equipment
 [Location] Jotokitagata 688-1, Higashi-ku, Okayama City 709-0625
 Tel:+81-86-279-5111(main)
<http://www.nakashima.co.jp>

Nakashima Engineering Ltd.

[Established] February 1981
 [Capital] 20 million yen
 [Business content] Technical consulting and after-sales services of marine propulsion equipment
 Planning, construction, and sales of environment representation products
 [Location] Jotokitagata 688-1, Higashi-ku, Okayama City 709-0625
 Tel:+81-86-279-5111(main)
<http://www.nel.nakashima.co.jp>

Teijin Nakashima Medical Co., Ltd.

[Established] September 2008
 [Capital] 100 million yen
 [Business content] Development, manufacture, and sales of medical equipment
 [Location] Jotokitagata 688-1, Higashi-ku, Okayama City 709-0625
 Tel:+81-86-279-6278(main)
<http://www.teijin-nakashima.co.jp>

Systems Nakashima Co., Ltd.

[Established] April 1985
 [Capital] 10 million yen
 [Business content] Development and sales of CAD/CAM systems and business systems
 Sales of computer related equipment
 [Location] Head office/Jotokitagata 688-1, Higashi-ku, Okayama City 709-0625
 Tel:+81-86-279-7700
 Administrative Headquarter/2-chome, 3-19, Nakashimada-cho, Kita-ku, Okayama City 700-0982
 Tel:+81-86-234-8111(main)
<http://www.systems.nakashima.co.jp>

Nakashima Uchida Corporation

[Established] December 1993
 [Capital] 30 million yen
 [Business content] Sales of office business equipment and OA supplies
 [Location] Haga 5322, Kita-ku, Okayama City 701-1221
 Tel:+81-86-286-9500
<http://www.nuc-ok.co.jp>

Nakashima Mitsuwa Propeller Co., Ltd.

[Established] August 2009
 [Capital] 50 million yen
 [Business content] Development and sales of various marine propellers, equipments and parts
 [Location] 1256-1, Higashitawara, Nabari city, Mie 518-0602
 Tel:+81-595-67-0311
<http://www.nakashima-mitsuwa.com>

Nakashima Vietnam Co., Ltd.

[Established] December 2005
 [Capital] USD 6.88 million
 [Business content] Manufacture of various marine propellers
 [Location] Land Plot CN2.2B, Dinh Vu Industrial Zone
 Hai An Dist., Haiphong, Vietnam
 Tel:+84-31-3614325
<http://www.nakashimavietnam.com>

Nakashima Asia Pacific Pte. Ltd.

[Established] December 2011
 [Capital] SGD 0.5 million
 [Business content] Sales of various marine propellers
 [Location] 8 Temasek Boulevard #32-01B,
 Suntec Tower Three, Singapore 038988
 Tel:+65-6836-5015

Nakashima Philippines Corporation

[Established] February 1989
 [Capital] PHP 110 million
 [Business content] Manufacture of various propellers
 [Location] Cavite Economic Zone, Rosario, Cavite,
 Philippines 4106
 Tel:+63-46-437-2207
<http://www.nakashima-ph.com>

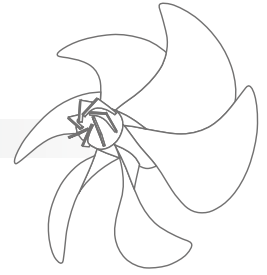
PRODUCT LINEUP

NAKASHIMA PROPELLER

GPX PROPELLER

FIXED PITCH PROPELLER

The latest fixed pitch propeller 4 technologies fuse together



Non Hub Vortex

One of GPX propeller characteristic is Non-hub vortex. Nakashima succeeded to reduce hub-vortex only by advancing their propeller design and technology, which is called NHV technology.



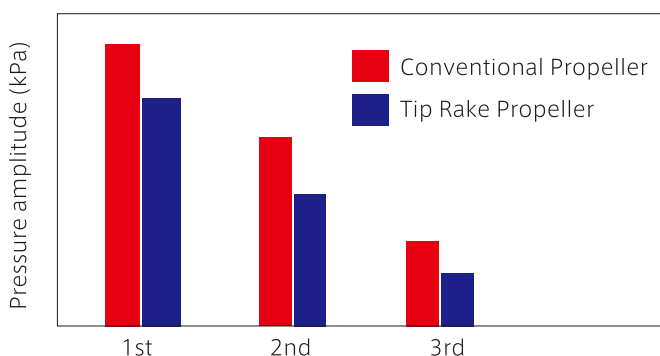
Small Blade Area

In order to increase efficiency, expanded blade area ratio is reduced to the minimum limit. Friction resistance reduction efficiency brought achievement of highest efficiency ever. Below photos clearly show the difference between original and advanced small blade.



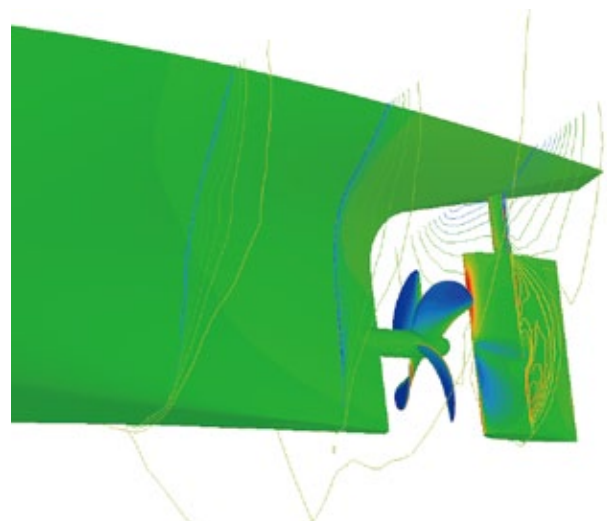
Tip Rake

Tip-rake is one of cavitation decreasing measurement. With mildly-curved propeller tip, it holds down the highly order component of pressure amplitude.



Wake Adapted

Wake distribution differs depends on each vessel type and Nakashima designs propeller so as to suit for each wake distribution. Nakashima aims to improve not only propeller self-efficiency, but also propeller efficiency of astern side. CFD analysis technology is capable for an integrated designing of both propeller and the hull.



Reduction of CO2

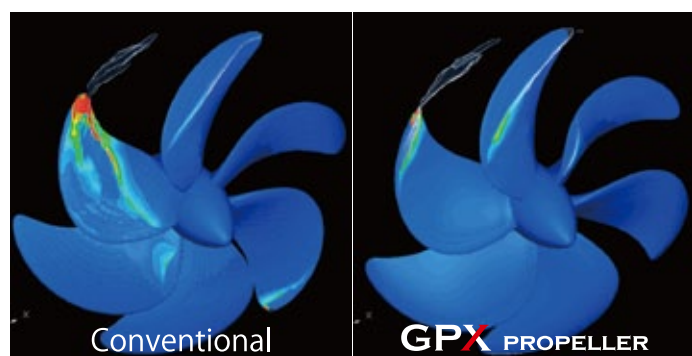
Since the execution of EEDI in January 2013, further improvement of propulsion efficiency has been highly expected. Not only EDDI, but also from the view of reducing GHG and cavitation noise, requested propeller conditions are getting much higher and stricter.



Analysis Technology

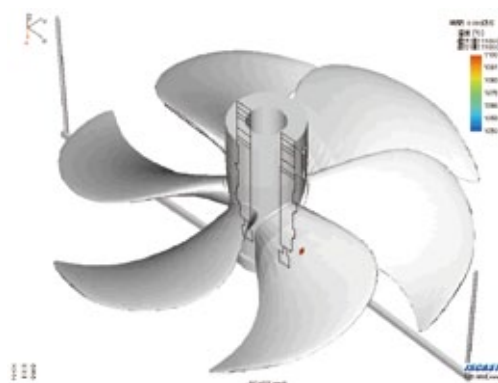
Computational Fluid Dynamics

High accuracy of cavitation simulation by CFD design of small blade area. Nakashima succeeded to increase calculation accuracy by comparing high speed camera shooting at model test and CFD calculation result. Including erosion risk, estimation accuracy of cavitation simulation is quite high and reliable.



Casting Analysis

Casting and machining processes are the most important part of manufacturing propeller. Nakashima utilizes advanced technology of casting analysis for making mold. With comparison of casting analysis result and the actual casting, Nakashima established reliable casting technology.



Production Technology

High efficiency propeller cannot be manufactured without a reliable and advanced production technology. Nakashima utilizes CNC blade milling machine and produces propeller which reflects the designed dimension. Especially, the important areas that are the leading edge where governs cavitation generation and the trailing edge that influences propeller singing and efficiency are reflecting design details into actual products. As the result, GPX propeller has been proved as a high efficiency propeller not only by model test but also by actual vessel.

Kind of vessel	Efficiency comparison with original propeller(%)		
	Propeller open efficiency	Self propulsion test	Actual (Sea trial)
Chemical tanker	+2%	+4%	+4.5%
Cement carrier	—	—	+7%



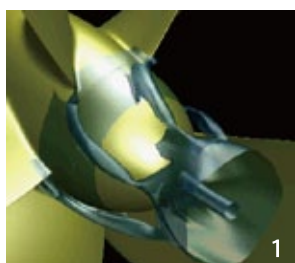
ECO-CAP

ENERGY SAVING DEVICE

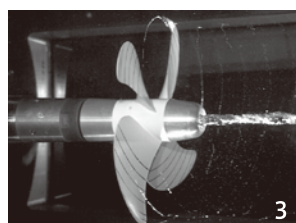
ESD
ENERGY SAVING DEVICES

1~3%
Improve
FOC

Design Newly designed propeller cap for propeller hub vortex reduction



ECO-Cap



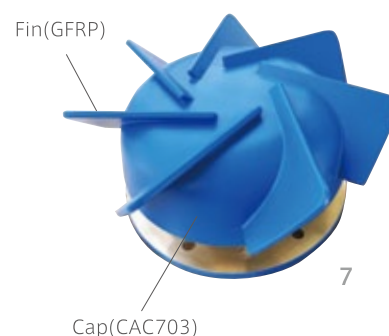
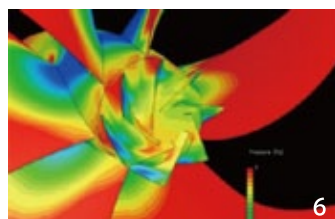
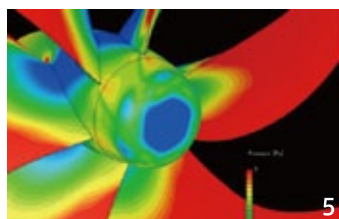
Hub vortex is generated behind a propeller cap by rotational flow (Figure 1).

Because hub vortex is a decrease in efficiency, Nakashima Propeller designed more than 500 different kinds of propeller cap profiles in order to find an optimum profile which reduce hub vortex and increase efficiency. Throughout our development, it found that a propeller cap profile which has several small fins is the most effective. And the propeller cap profile became the prototype of the ECO-Cap (Figure 2).

Reducing propeller hub vortex was confirmed by model test in cavitation tunnel (Figure 3/4).

CFD Analysis

Mechanism for improvement efficiency by ECO-Cap



Pressure distribution behind propeller caps are shown in the above. For the normal propeller cap, pressure distribution is shown in blue color, and the pressure distribution of ECO-Cap is shown in yellow & red colors (Figure 5/6).

Blue is negative pressure area and positive pressure area are colored in yellow & red. In the normal propeller cap, resistance is increased due to negative pressure. On the other hand, in the ECO-Cap, positive pressure generated thrust and therefore thrust increase compared with the normal propeller cap.

Although it depends on a propeller profile, such as blade number, propeller pitch and boss diameter, approximately 1.0-1.3% propeller efficiency were increased in the model tests.

The Reynolds number used in model tests is quite smaller than actual vessels, and models can only generate slight hub vortex. Therefore, energy losses are also small. Hence, it can be predicted that energy loss recovery and improvement efficiency by the ECO-Cap are greater than the model tests.

Actual Ship Verification of FOC in actual vessel

For the ECO-Cap equipped to the actual vessel, quite thin FRP blade was adopted for decreasing resistance purpose and it was installed to the cap body (Figure 7). Using FRP material, it achieved to minimize the weight gap compared to the normal propeller cap.

Moreover, as the result of verification with the actual vessel, Fuel Oil Consumption (FOC) greatly improved by approximately 2.8% before equipping the ECO-Cap.



ULTIMATE RUDDER BULB

ENERGY SAVING DEVICE

ESD
ENERGY SAVING DEVICES

3~6%
Improve
FOC

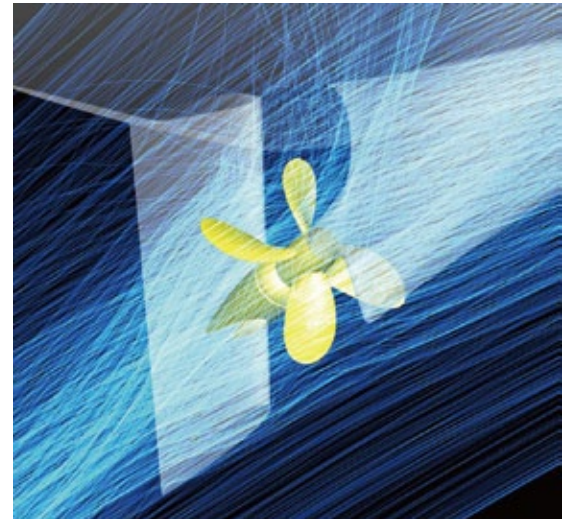
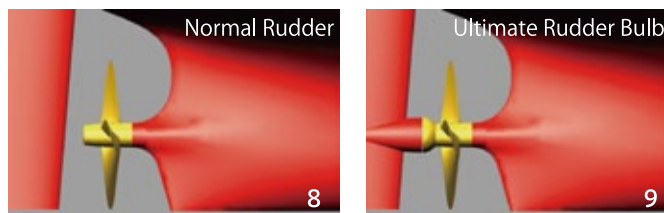
Design

The Rudder bulb closest to the propeller plane

Three factors of efficiency improvement by rudder bulbs are;

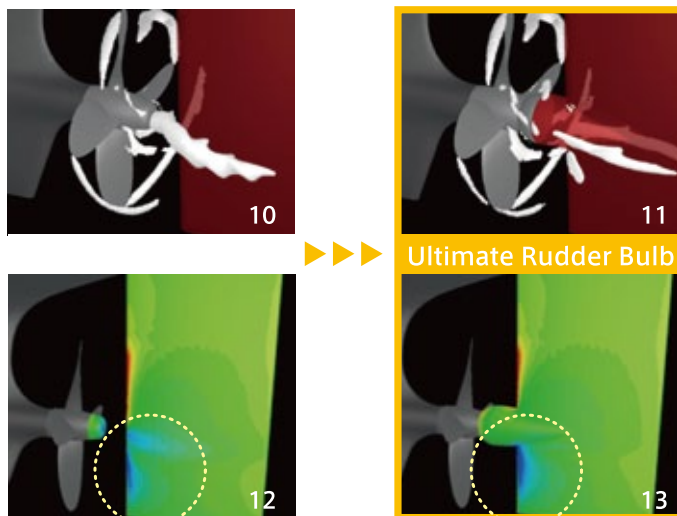
- 1) Reducing hub vortex
- 2) Increasing of wake gain
- 3) Improving interference between propeller and rudder

Generally, a rudder positioned closer to the propeller is considered to have better efficiency. By having a rounded propeller cap propeller, the bulb is capable to be arranged in the closest position to the propeller (Figure 9).



CFD Analysis

Recovering energy loss, 6% of efficiency improvement



In the normal rudder (Figure 8), strong hub vortex which triggers energy loss generate from the propeller cap behind toward port side of rudder (Figure 10). Hitting strong hub vortex to the rudder, negative pressure against rudder is reduced and it also increases rudder resistance (Figure 12).

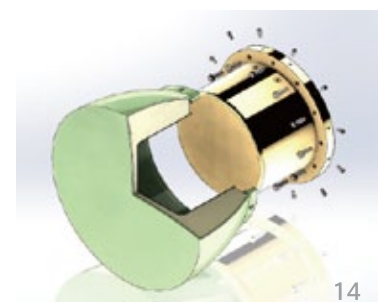
On the other hand, the Ultimate rudder bulb is capable to recover vortex by the bulb head (Figure 11). This also brings increase of negative pressure at rudder's leading edge, and then rudder resistance is reduced (Figure 13).

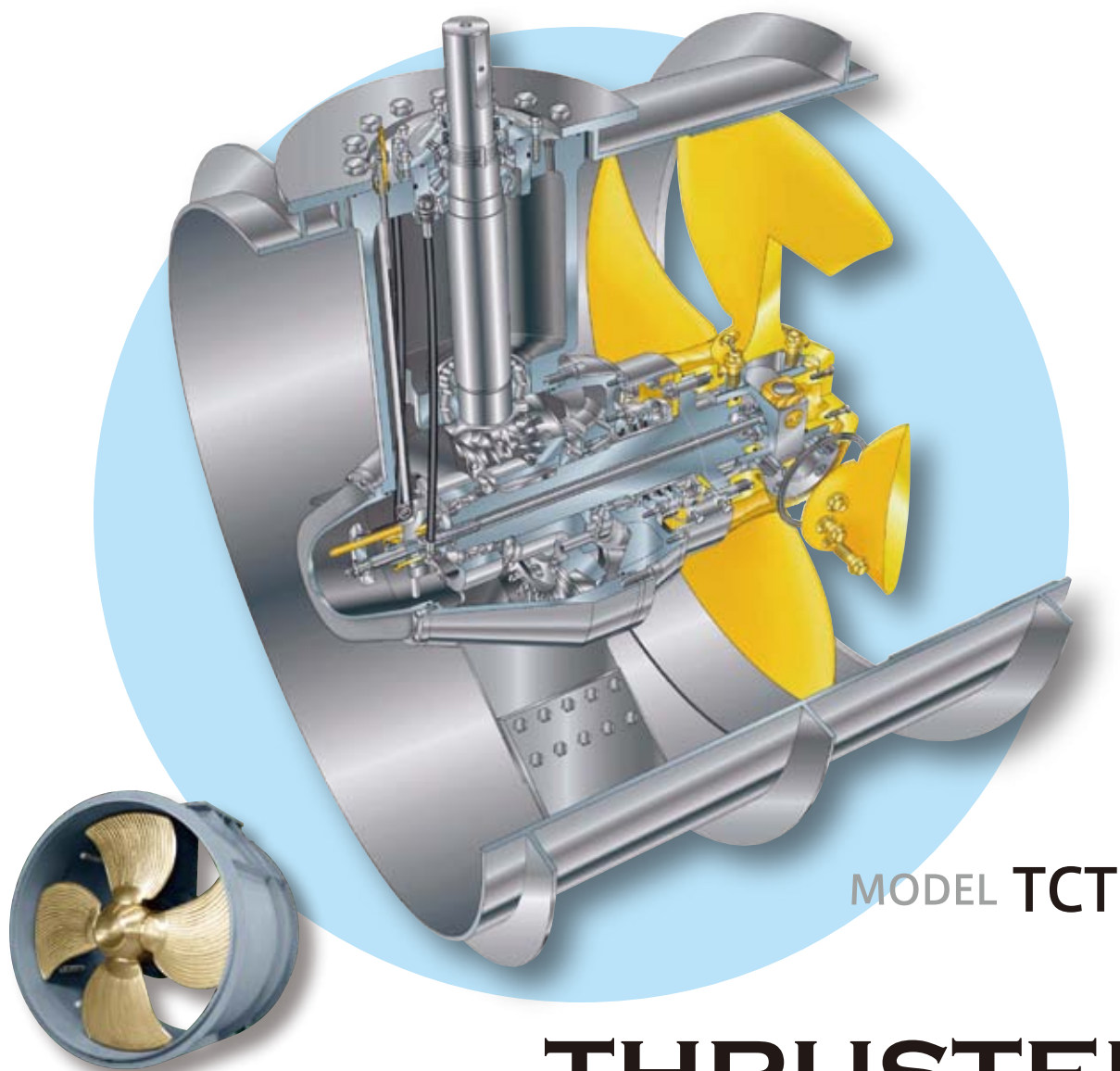
From the above, it was confirmed that hull efficiency can be improved by the Ultimate rudder bulb. From the self-propulsion test result of using 208BC model vessel, more than 5-6% improvement in efficiency was confirmed. In addition, in the model test of changing rudder angle, lift-drag ratio is the same level compared to rudder without bulb.

Maintenance

Easy replacement by new material bulb head

Structure of Ultimate Rudder bulb is equipping FRP material bulb head to copper material nut cover. Bulb head can be easily removed & reinstalled to nut cover by tightening bolts, and it also achieves easy maintenance. (Figure 14) Inside of bulb head is filled by urethane, so grease injection process is unnecessary.





MODEL TCT

THRUSTER

TRANSVERSE THRUSTER

Controllable pitch propeller

Since the first thruster was produced in 1976, we, Nakashima Propeller, have developed and supplied efficient and reliable side thrusters over 6,000 units. Our controllable pitch type, MODEL TCT, features servo cylinder inside the propeller boss and has built up a reputation as the most reliable and efficient for ferries, cargo ships, container ships, naval vessels and offshore supply/support vessels.

MODEL TCT consists of the thruster body, the hydraulic pump unit for pitch change, the remote control system, and the prime mover. Operating the control unit (lever) on the wheel house activates the solenoid valve in the hydraulic pump unit. This then sends pressure oil from the hydraulic pump to the inside of the cylinder (cross head) located within the hub of the thruster. The oil moves the crosshead directly, which in turn gets transmitted to the sliding shoe and crank ring, changing the blade angle accordingly. The propeller pitch is transmitted from the O. T. tube to the feedback transmitter via an angle detection mechanism, which is displayed on the control panel indicator.

RECORD

Container Vessel, PCTC, Ferry, Passenger Boat, AHTS, Semi-Submersible Heavy Lifter

LOW VIBRATION - LOW NOISE



High cavitation performance blade is developed, which contribute to minimum vibration and low noise. High precision gear along with a high assembling accuracy also enhances the silence mechanically.

◀ Observation by tank test

POWERFUL AND COMPACT

MODEL TCT has achieved a compact unit as well as higher thrust through our own research and development promotion for years.

MAINTENANCE AND INSPECTION

Simple structure and the small number of components support durability and reliability. The propeller blade can be easily replaced by removing the blade bolts in the duct. The thruster unit can be taken out from the ship for on shore inspections. Propeller shaft seal adopts a structure of a stern tube seal as main propulsion. Also, the reliable seal ring can be replaced with bonding afloat. Using the same oil for lubrication and for pitch change allows for easier maintenance on board.

※ Environmentally Acceptable Lubricant (EAL) requested by the United States Environmental Protection Agency's (EPA) Vessel General Permit (VGP) is applicable for new building as well as existing models. For details, please consult us.

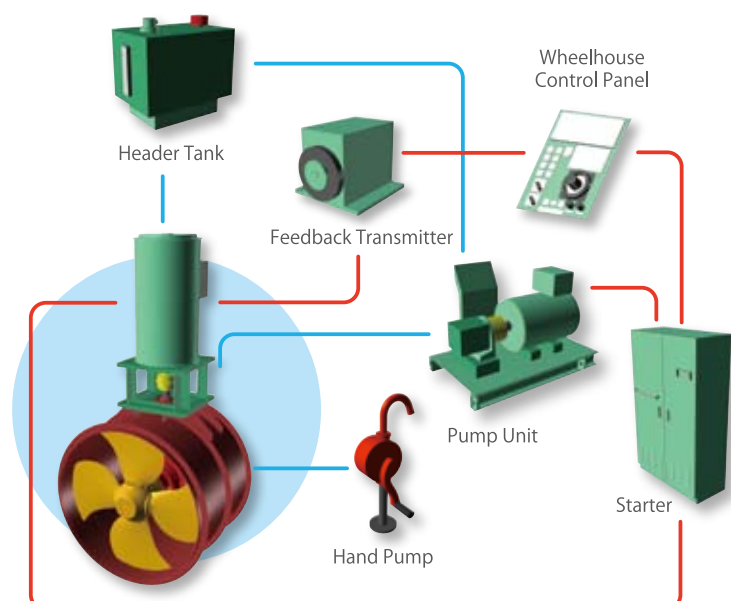
PLANNING SPECIFICATION

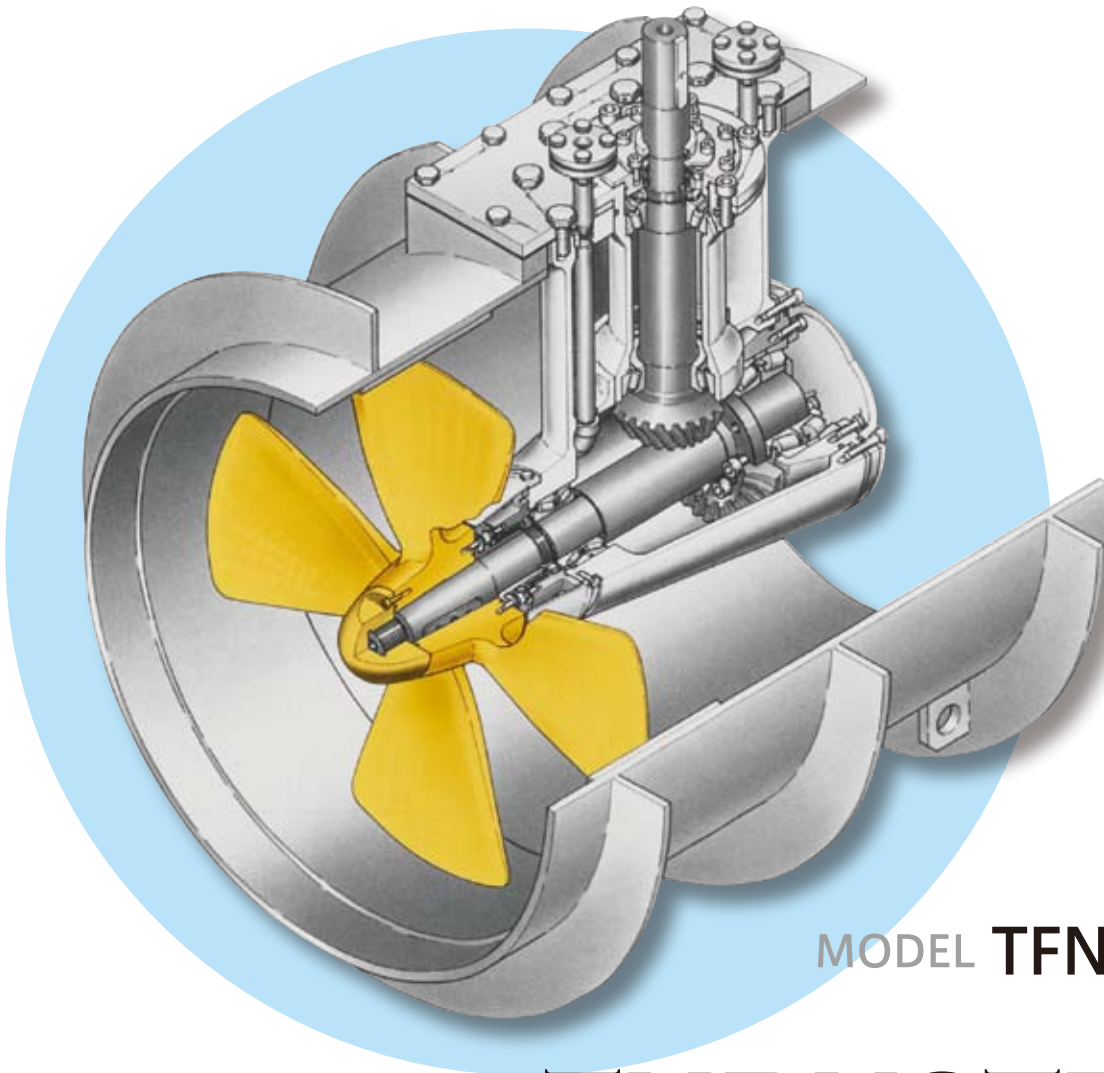
TYPE	Max. Motor Output (kW)	Motor Speed (min ⁻¹)	Propeller Dia (mm)
		60Hz	
TC-70N	115	1,800	700
TC-85N	175	1,800	850
TC-100N	240	1,800	1,000
TCT-105	335	1,800	1,050
TCT-120	425	1,800	1,200
TCT-135	550	1,800	1,350
TCT-150	690	1,800	1,500
TCT-165	825	1,200	1,650
TCT-185	1010	1,200	1,850
TCT-200	1220	1,200	2,000
TCT-220	1500	1,200	2,200
TCT-240	1725	900	2,400
TCT-260	2070	900	2,600
TCT-280	2410	900	2,800
TCT-315	3050	720	3,150

※ Applicable up to 3,500 kW in maximum

※ Specifications may change without notice

ARRANGEMENT





MODEL TFN

THRUSTER

TRANSVERSE THRUSTER

Fixed pitch propeller

Using the fixed pitch propeller-type Model TFN/TFT, the direction and scale of thrust can be easily controlled by the revolution and rotation direction of the prime mover. Since the model can be used with hydraulic motors, electric motors, and diesel engines, it is used on various types of vessels. The Thruster is environmentally friendly because high efficiency is achieved in the entire system due to the use of the propeller most suitable to the prime mover used.

FEATURES

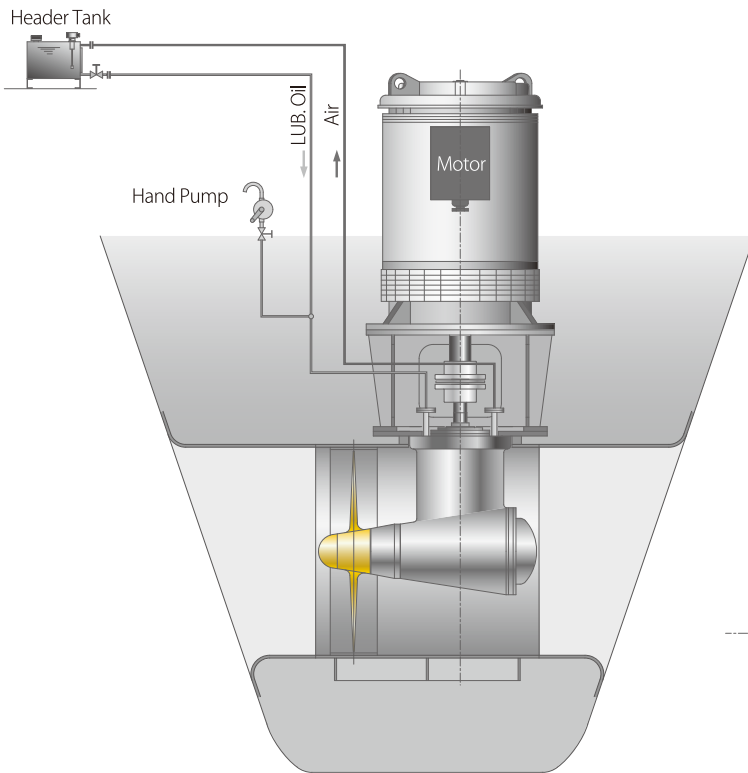
1. Since the model is a fixed pitch propeller type, it has a simplified structure allowing easy maintenance and inspection.
2. Since the entire system has a simplified structure, it can be easily mounted on vessels and used on various types of vessels.
3. Due to the oil bath structure inside, inspections and lubrication oil is no required for maintenance and a gravity tank prevents sea water' s entrance.
4. Thruster body itself is located inside a duct and each end of duct can be connected to the hull by welding. On the other hand, TFN-50S or smaller models adopt bolted-connections for easier maintenance then, the thruster body is able to be dismantled and lifted up inboard.

RECORD

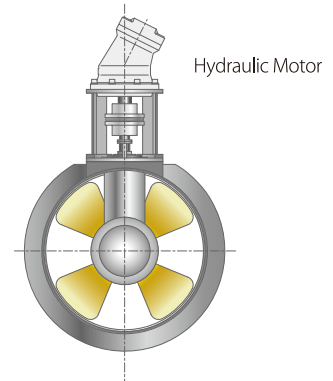
Cargo vessel, Ferry, Fishing vessel, AHTS, Semi-Submersible Heavy Lifter

ARRANGEMENT

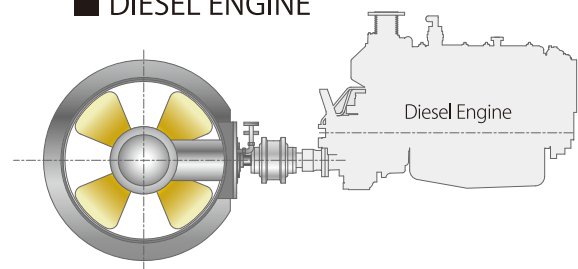
■ ELECTRIC MOTOR



■ HYDRAULIC MOTOR



■ DIESEL ENGINE



MODEL TFN

Mainly suitable for 400 kW or less

PLANNING SPECIFICATION

TYPE	Max. Motor Output (kW)	Motor Speed (min ⁻¹)	Propeller Dia (mm)
		60Hz	
TFN-25S	45	1,800	430
TFN-50S	57	1,800	500
TFN-75S	83	1,200	600
TFN-100S	132	1,200	750
TFN-150S	170	1,200	850
TFN-200S	235	1,200	1,000
TFN-300	335	1,200	1,150
TFN-400	400	1,200	1,300

※ Specifications may change without notice



MODEL TFT

Mainly suitable for 400 kW or over

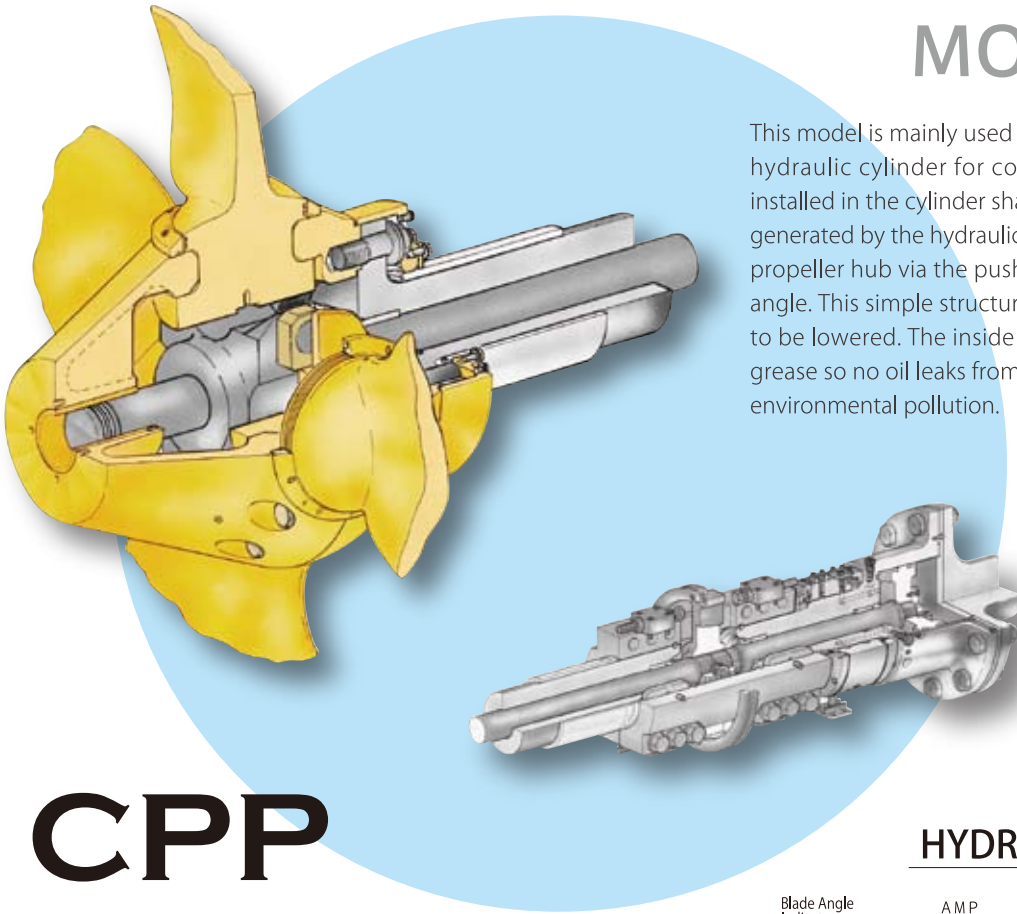
PLANNING SPECIFICATION

TYPE	Max. Motor Output (kW)	Motor Speed (min ⁻¹)	Propeller Dia (mm)
		60Hz	
TFT-135	550	1,800	1,350
TFT-150	690	1,800	1,500
TFT-165	825	1,200	1,650
TFT-185	1010	1,200	1,850
TFT-200	1220	1,200	2,000
TFT-220	1500	1,200	2,200
TFT-240	1725	900	2,400
TFT-260	2070	900	2,600
TFT-280	2410	900	2,800
TFT-315	3050	720	3,150

※ Specifications may change without notice

MODEL XS

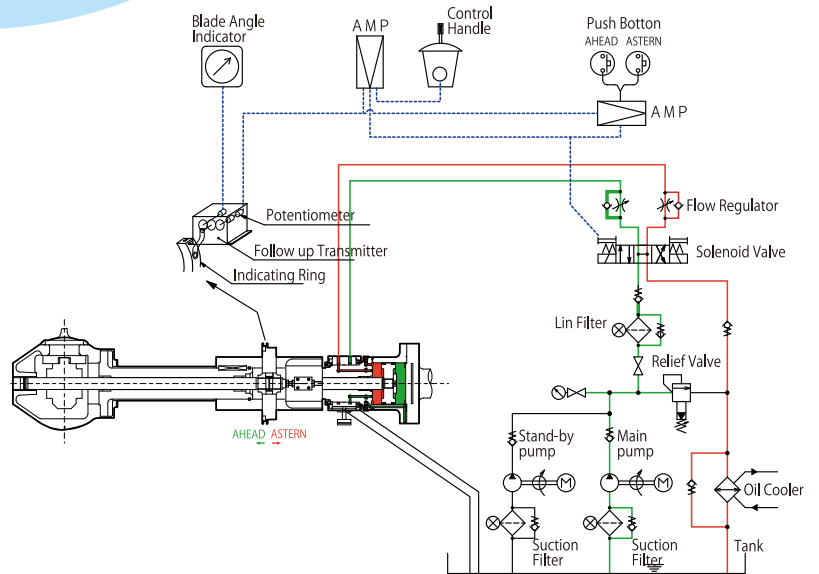
This model is mainly used in mid to small-size vessels. A hydraulic cylinder for controlling the blade angle is installed in the cylinder shaft inside the vessel. The force generated by the hydraulic cylinder is transmitted to the propeller hub via the push/pull rod to adjust the blade angle. This simple structure enables maintenance costs to be lowered. The inside of the hub is lubricated with grease so no oil leaks from it, eliminating concerns over environmental pollution.



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HYDRAULIC POWER UNIT



CONTROLLABLE PITCH PROPELLER

The controlling blade angle enables the vessel to move forward or backward and stop more easily. When used with a side thruster, controllable pitch propellers are convenient when vessel speed needs to be changed frequently when entering or leaving port, leaving shore, or docking. In the case of an emergency stop, this type of propeller can immediately respond from full forward to full reverse movement.

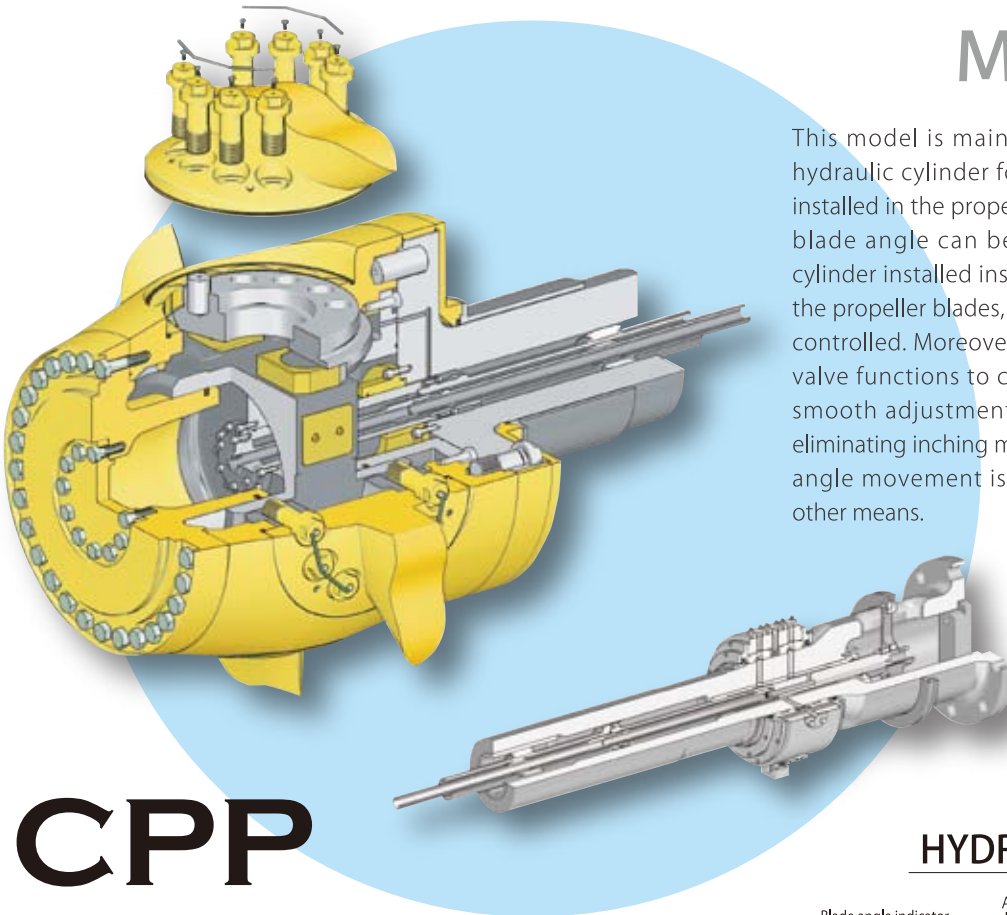
Since the blade angle can be regulated, vessel speed can be freely adjusted with the engine running at the most efficient load. Use of a controllable pitch propeller can reduce fuel and NOx emissions.

RECORD

Tanker, Ferry, Tugboat, Fishing vessel, Workvessel

MODEL XL

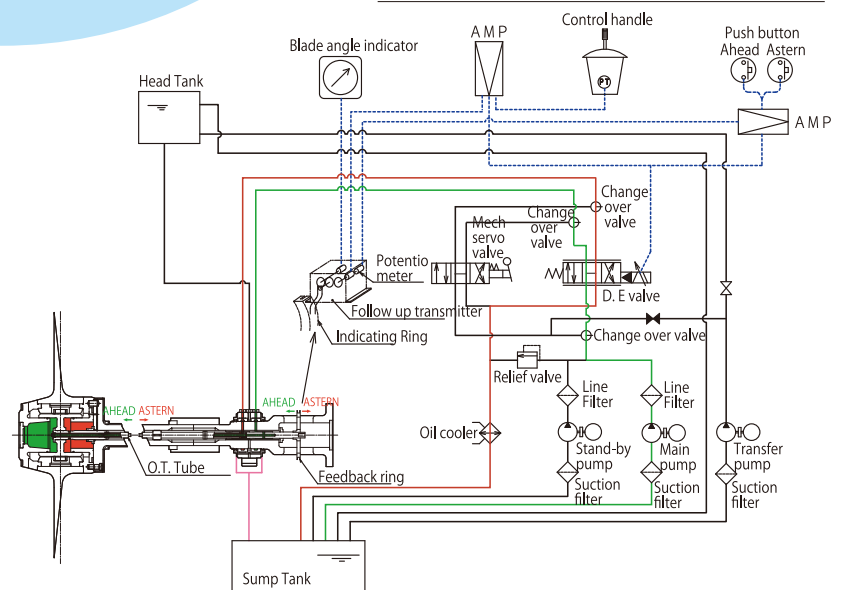
This model is mainly used in large size-vessels. A hydraulic cylinder for controlling the blade angle is installed in the propeller hub outside the vessel. As the blade angle can be adjusted using the hydraulic cylinder installed inside the propeller hub that moves the propeller blades, the blade angle can be accurately controlled. Moreover, since the flow direction control valve functions to control the blade angle, fine and smooth adjustment of the blade angle is possible, eliminating inching movement, even when a slow blade angle movement is specified by a time program or other means.



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HYDRAULIC POWER UNIT



Model XS / Model XL

FEATURES

1. Enables efficient operation of the main engine output and minimization of fuel consumption.
2. Efficient operation, high stopping performance, and shorter time spent when leaving the shore or docking due to continuous movement from full forward to full reverse.
3. Reduced fuel consumption by operation at the optimum efficiency point where propulsion efficiency, fuel consumption of the main engine, and other factors are comprehensively considered.
4. Enables the required vessel speed or thrust force to be obtained, even on vessels where load conditions vary greatly such as trawlers and towing vessels.
5. Avoidance of overtorque condition of the main engine by reducing the propeller pitch angle during operation in rough weather compared to regular operation.

NAKASHIMA PROPELLER

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