

INSTALLATION DESCRIPTION, TYPE KS

The purpose of the following manual is mainly to give general information about the propeller equipment at an early stage and before the drawings for the specific unit are available. The manual covers a brief description of the Kamewa Controllable Pitch Propeller, special installation instructions, approximate extent of delivery and basic technical information.

On delivery from us, the propeller equipment is normally assembled, handling and transportation permitting.

Immediately on arrival the equipment must be unpacked and inspected. If there are any complaints, Kamewa shall be informed soonest possible. During storage the equipment must be protected against moisture and dust. During storage and installation, the anti-corrosive protection must be continuously observed. See also enclosed the documents for installation in this manual.

The propeller equipment consists of the following main parts:

1. Propeller with shafting and oil distribution box.
2. Hydraulic system
3. Control system

1. Propeller with shafting and oil distribution box

1.1. Description

The propeller, which is of push-pull rod type, is connected to the tail shaft by means of bolts. The shafting consists of tail shaft, coupling and oil distribution box mounted on an intermediate shaft or on the fore end of the gearbox. The hydraulic cylinder with the piston that moves the push pull rod forward and aft is located either inside the coupling or in the intermediate shaft; the cylinder is connected to the OD box by a hydraulic pipe. If the OD-box is mounted on the intermediate shaft, the oil distribution box does not work as a support bearing for the shafting, but is only connected to the hull by means of a stay, this stay prevents the box from rotating together with the shaft.

The lubrication of the internal parts of the propeller hub shares the stern tube oil, so that the outer stern tube seal is to be designed to permit the oil passes through towards the shaft flange where a couple of holes permit the oil to ingress in the inner part of propeller hub.

The stern tube gravity tank provided a certain oil pressure inside the hub so that, in case of a fail of a blade seal, the oil would go out and not water comes in.

On the on board stretch of the shaft there is a radial hole plugged that, by removing the plug, permit to take samples of the oil inside the hub.

1.2. Installation

1.2.1. Normally Kamewa will neither carry out nor be responsible for the shaft alignment. (Other agreements may be valid. See order specification.) The maximum run out at final shaft indication must not exceed values stated on the instruction 0027-ES

1.2.2. In order to make possible to dismantle the coupling between the propeller shaft and the intermediate shaft there must be sufficient space around the coupling.

1.2.3. The tail shaft with or without propeller is installed and dismantled from astern. This can normally not take place when the rudder is installed.

1.2.4. The length of the shaft line is not adjustable at installation in the ship.

1.2.5. We remind you that the non split protection cover for the shaft flange must be mounted before mounting the shaft in the vessel.

1.2.6. The bolt holes in the foremost shaft flange towards –the shaft, -.the gear or –the engine (all these supplied by shipyard) are usually pre-drilled and must be reamed during mounting on board the vessel. The bolts are delivered oversized to be finalized after the holes are reamed.

1.2.7. When the OD Box is mounted on the forward side of the gearbox it must be prevented to insert the hydraulic pipe inside the secondary shaft of the gearbox before the shaft is in place and usually before the OD Box is assembled.

1.2.8. The push pull rod is inside the shaft from factory

The following parts of the text describe the two different types of OD-box arrangement. Please have a look at the shafting arrangement of this particular case which specify the OD-box arrangement used in the actual case.

Front mounted OD-boxes on gear – Type F

For type of OD-box the OD-box ring rides on the end piece of the twin tube. Pressure oil is transferred through a flexible link system, consisting of pipes and swivels which requires a minimum of space. The movement of the twin is fed back to the control system via a shaft sticking out of the OD-box. This shaft performs an oscillating movement. The electric remote control system is connected to a feed-back box attached to the OD-box.

Shaft mounted OD-boxes – Type A

For shaft mounted OD-boxes – either type the OD-box rides on a torque transferring shaft.

When the OD-box is mounted on the intermediate shaft the OD-box ring rides on an intermediate shaft. The aft end of this intermediate shaft is connected to the propeller shaft by means of a split muff coupling. In the forward end of the intermediate shaft there is a flange connected to a gear flange or to a flange on a solid intermediate shaft.

The movement of the push pull rod system is fed back to the control system via a yoke and a ring sliding on the split muff coupling.

1.2.9. Lifting devices must be available both outside and inside the vessel. When we deliver special tools for lifting purposes these must be used

1.2.10. The oil distribution box is an arrangement to feed hydraulic oil to the shaft line. The oil distribution box is mounted on the forward end of the gear box (Type F) or somewhere on the shaft line (Type A).

1.2.11. The propeller must be provided with an effective protection against corrosion as follows:

When dimensioning the cathodic protection for the hull, the absorption of current of the propeller also be considered.

The propeller shaft shall be earthed to the hull by means of a slip ring device on the propeller shaft.

For a cathodic protection about 150 mA/m² propeller Surface is needed. If sacrificing anodes of zinc are used, the supplier of these anodes must dimension them so that required current density is obtained. The system shall always be connected also when the vessel is at quay.

If an impressed current system is used, the supplier of this system must locate and dimension the anodes so that required current density is obtained. The system shall always be connected also when the vessel is at quay.

Even if the hull is protected against corrosion by a modern painting system, e.g. 2-component Epoxy, cathodic protection of the propeller is necessary. On vessels where such painting systems are used we recommend that the current density stated above is increase by 25 – 50% as the hull cannot protect the propeller in the same way as when the hull is painted with standard paint.

The cathodic protection does not only protect the propeller but also the hull, which – due to potential difference between hull and propeller – can be exposed to corrosion attacks of the hull plating if the Paint layer is damaged.

1.2.12. Oil-filled stern tubes must be equipped with a proper drain connection so that the water can be drained if any.

This is especially of importance for stern tubes with slope where the water will land up in the lower aft part. In such a case it might be necessary to install a pipe which can be connected to a drain pump.

1.2.13. Prior to launching, the propeller hub must be filled with oil, pressure-tested and placed under pressure from an upper oil tank. Locking of screws and plugs (where applicable) to be checked.

1.2.14. Before launching the vessel – if the shafts have plastic coating – the shafts must be painted with anti-fouling paint. If this is not made, the fouling might harm the plastic coating.

We recommend the following painting program:

- a) The surface is fogged by means of grinding.
- b) Adhesive primer is applied to thickness 50 – 100 μ m.
- c) An anti-fouling paint is used as top paint, with a thickness of min. 300 μ m. The local supplier will recommend a suitable type.

1.2.15. After launching, the vessel must be carefully earthed to the quay so that no leakage currents go through the propeller. The propeller shaft must be earthed to the hull. The contact in the stern tube bearing is not sufficient.

1.2.16. Spare propeller blade is stored on board shall normally be kept below deck. If this is not possible, the blade must be protected against corrosion.

1.2.17. For vessels with long period (more than 6 months) after launching before starting up, the propeller equipment must be protected and handled in accordance with special requirements. Kamewa to be contacted for instructions.

1.3. **Extent of delivery**

In the drawing called MARK & ASSEMBLY is shown our scope of supply.

1.4. **Basic technical information**

We will provide a shafting arrangement drawing, covering main dimensions, shaft dimensions, weight and inertia moments of the propeller. You must send the shafting arrangement to the engine manufacturer for torsional vibration calculations. You are requested to give us permission to start the manufacture.

2. **Hydraulic system**

2.1. **Description**

Electric motor driven or shaft driven pumps transfer the oil for pitch setting via control valves from the oil tank to the oil distribution box. Return line filter is included. Oil cooler for fresh cooling system is normally installed in the power pack. When only electric motor driven pumps are used, we recommend that one of the pumps is connected to the emergency generator for automatic start in case of black-out. The system also serves as a lubrication system for propeller and oil distribution box and is connected to the upper oil tank, or pressure maintaining pump, which keeps a constant static pressure in the propeller hub, in order to prevent water from entering the hub in case of leakage.

2.2. Installation

The hydraulic power pack shall be located close to the OD-Box. Normal height is -0/+2 meters from propeller shaft centre.

At PTO-driven pumps the hydraulic power pack is to be located so that the suction height for the pumps does not exceed 1 m.

2.2.1. Drain pump

For propellers with OD-Box on intermediate shaft a drain pump will be supplied. This shall be located under the OD-box and will return the drain oil to the hydraulic power pack. This pump motor shall be connected all the time. The drain pump is then started and stopped by a level switch in the drain tank.

2.2.2. Electric motors for the oil pumps are supplied as a standard with protection from IP54 (totally enclosed) for horizontal mounting.

2.2.3. Starting equipment for pump motors is normally not included in our delivery, see also Technical Specifications.

2.2.4. The piping installation must be carried out with a minimum of bends and with easy access to the power pack. Piping must not be rigidly connected to the oil distribution box. However, if rigid fitted, compensators or flexible hoses must be used (yard delivery). (Contact classification society for approval.) At OD-boxes type A flexible hoses must always be used. Pressure pipes must be designed for a working pressure according to the piping diagram. The pipes are to be pressured tested in accordance with instructions on the piping diagram.

For pipes up to 1" joints and connections must be made by flared tube fittings or equal. Pipes above 1" must be fitted and connected with flanges.

Pipes built of finished bends and details must not be used, nor pleated bends. The pipes must be joined with flanges or pipe connections.

2.2.5. The stern tube gravity tank must be located above the shaft centre line at a height corresponding to 1,3 – 1,4 times the distance between the shaft centre line and the water line at maximum astern draught. However, the height above the water line must not be less than 2 m.

2.2.6. Before the system is put into operation, pipes and tanks must be thoroughly cleaned. Non galvanized pipes have to be pickled according to the following instructions.

1. Carefully degrease.
2. Wash with water.
3. Pickle in 10 – 15% sulphuric acid at 50 – 60°C during 1 – 1,5 hours. The exact time to be determined though test pickling of a pipe bend that has been bent hot.
4. Neutralize with water, the PH-value of which exceeds 7 and preferably amounts to 9-10. Dip the pipes twice in the neutralizing bath.

5. Protect the pickled pipes immediately by oiling them on the inside and painting on the outside. Furthermore the pipes should be blind flanged to prevent pollution.

The above pickling procedure can be eliminated if the yard use pipes specially intended for cold bending tools. In some cases, however, it is impossible to avoid heat treatment, e.g. when the welding flanges are mounted. Instead of pickling, the welding joint of the flange shall then be carefully ground on the inside and outside.

Before the system is filled with oil, the installation must be checked by a superintendent from Kamewa..

2.2.7. Special instructions are valid for flushing of the oil before start-up.

2.3. Extent of delivery

Piping with flanges, connections, standard valves, electric cables, bases and starting equipment are normally not included in our supply. See also the specification enclosed to our order acknowledgement.

2.4. Basic technical information

For the hydraulic system we will provide a piping diagram including delivery list, dimension drawings for components included in our delivery as well as drawings of oil distribution box with pipings and support. If the pump started is provided by Kamea, we will also provide an electric diagram and main dimensions of it.

3. Control System

3.1. Description

The control system is of digital type with electro-hydraulic actuator for changing of the propeller pitch. When the propeller pitch is controlled, very often the revolutions (rpm) are controlled at the same time, a so-called combinator. The command signals from the control stands are fed to an electronic central unit where they are divided into one pitch and one rpm channel. The pitch command is compared with the pitch response signal from the feed back unit and if there is a discrepancy, the pitch will be changed by means of electro-hydraulic control valves, acting on the hub servo.

The rpm command signal is fed to the governor(s) via an electro-pneumatic converter (pneumatic type) or directly to the rpm governor(s) (electronic type).

If there are annex stands on the bridge and/or an ECR stand, the levers are connected to each other by means of a so-called electric shaft (standard control system), alternatively the levers have to be manually synchronized before transfer of command (basic control system).

In the engine control room normally only the control equipment for pitch setting is included in our delivery.

Normally there is also a load control system integrated in the remote control system, the task of which is to keep the load of the engine(s) to a desired value by automatic fine adjustment of the propeller pitch.

In order to inform about propeller pitch a separate pitch indicating system is used. This system also includes a back up control possibility, to be used if a failure occurs in the ordinary remote control system.

3.2. Installation

See separate installation description.

3.3. Extent of delivery

The scope of our delivery can be seen from the order specification. External electric cables, cable glands etc. are not included in our delivery.

3.4. Basic technical information

3.4.1. Speed governors (of electronic or pneumatic type) shall maintain ordered rpm constant over the operational load range. The governor shall be equipped with receiver for stepless rpm control within the actual service range. The governors are not included in our delivery.

3.4.2. We will send installation documents for the control system showing the extent of our delivery, a cable diagram, dimension/layout sketches for all components delivered by us, an interface list with all I/O:s for connections to other systems as well as a functional description of the systems.

3.4.3. We will also send to you a data sheet for the electronic control which must be filled in with greatest care in applicable parts and be returned to us without delay.