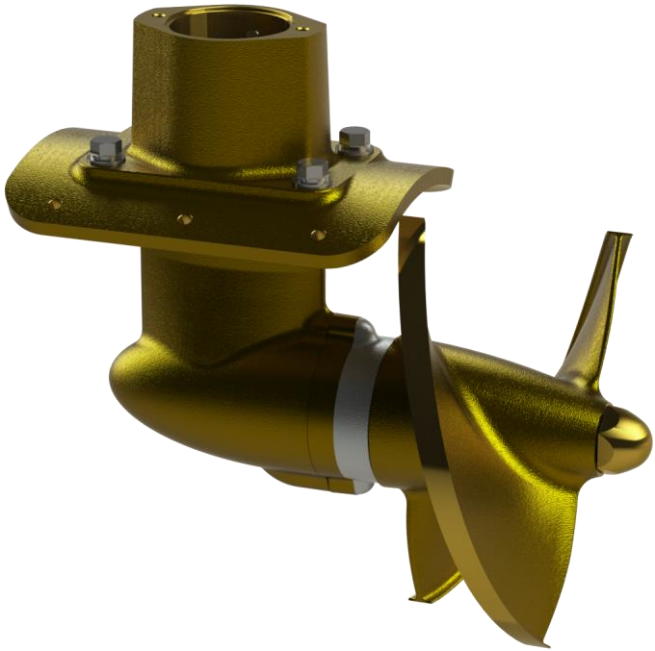
KOBELT

KP12 & KP14 Hydraulic Thrusters

Owner's Manual



KEYPOWER

December 2021

Kobelt Manufacturing Co. Ltd.

NOTES:

RECORD DATA BEFORE INSTALLATION FOR FUTURE REFERENCE	
Model #:	
Serial #:	
Date of purchase:	
Date of installation:	
Motor brand and part #:	

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1 INTRODUCTION

1.1 CONTACT

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This document is intended to clearly present comprehensive product data and provide technical information to assist the end user in design applications. Kobelt reserves the right, without notice, to change the design, or construction, of any products and to discontinue or limit distribution of any products. Kobelt also reserves the right to change, or update, without notice, any technical information contained within this document.

Kobelt recommends that customers visit our website to check for updates to this Manual. Once a product has been selected for use, it should be tested by the user to ensure proper function in all possible applications. For further instructions, please contact our distributors or visit our website.

1.2 SAFETY

1.2.1 Safety Alerts

Throughout this manual, the following symbols, and their accompanying explanation, are used to alert the user to special instructions concerning a service or operation that may be hazardous if performed incorrectly or carelessly. The associated risk levels are stated below.

⚠ DANGER	This symbol indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	This symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	This symbol indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.
NOTICE	This symbol informs the reader of events not related to personal injury but which there is a risk of damage to property or equipment.
SAFETY INSTRUCTIONS	This symbol informs the reader of safety-related instructions or procedures.

1.2.2 Notice to Installer

Disregarding the following safety measures can result in an accident causing severe injury to personnel and damage to material assets.

- Only use the product as directed in this manual.
- Never put the product into service if there is evidence of visible damage.
- Never put the product into service before fully completing installation and commissioning.
- Do not carry out any modifications to the product.
- Only use authentic Kobelt spare parts.
- Observe all local regulations, directives and laws during the installation of this product.
- All installation, commissioning, and maintenance work must only be conducted by qualified personnel. (For the purpose of this manual, qualified personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.)
- Observe all specifications in this manual. If these guidelines are not followed and damage occurs, the warranty will be voided.

1.2.3 Product Hazards

⚠WARNING	The rotating components of the thruster can generate forces that can cause pinch or crush injuries. Keep body parts clear of the thruster when it is operating. Lock out any power sources before working on the thruster.
⚠WARNING	Exercise safety precautions pertaining to hydraulics including: • Wearing safety glasses. • Exhausting pressure and locking out the pressure source. • Being qualified to work on hydraulics.
NOTICE	On standard thruster installations, the mounting saddle installation to the tube should be considered permanent once installed and should not be removed. The leg and propeller assemblies can simply be detached from the saddle when service is required. This ensures the saddle stays sealed and correctly aligned eliminating the need for propeller realignment or saddle resealing.
NOTICE	On transom mounted thruster installations, the mounting plate and saddle installation should be considered permanent once installed and should not be removed. The thruster leg assembly and tube can simply be detached from the rest of the installation when service is needed allowing the mounting plate installation to remain sealed.
NOTICE	To help prevent corrosion, it is strongly recommended to connect the thruster to the vessel's existing bonding system. Consult a marine electrical specialist for advice regarding modifying your vessel's bonding system.

2 PRODUCT DESCRIPTION

2.1 OVERVIEW

The figure below shows a typical tunnel thruster with all of its major components identified. Thrusters are meant to assist in docking, station keeping and maneuvering in tight spaces and are usually installed to an athwartships tunnel that goes through the vessel's hull (tunnel thrusters). Some thruster models are also offered in bolt-on versions which do not attach to a tunnel but instead mount externally to the transom of a vessel. Thrusters are powered by a hydraulic motor which is mounted to the thruster saddle. The direction of thrust can be changed by reversing the direction of oil flow to the hydraulic motor. All thrusters are available in aluminum or bronze versions.

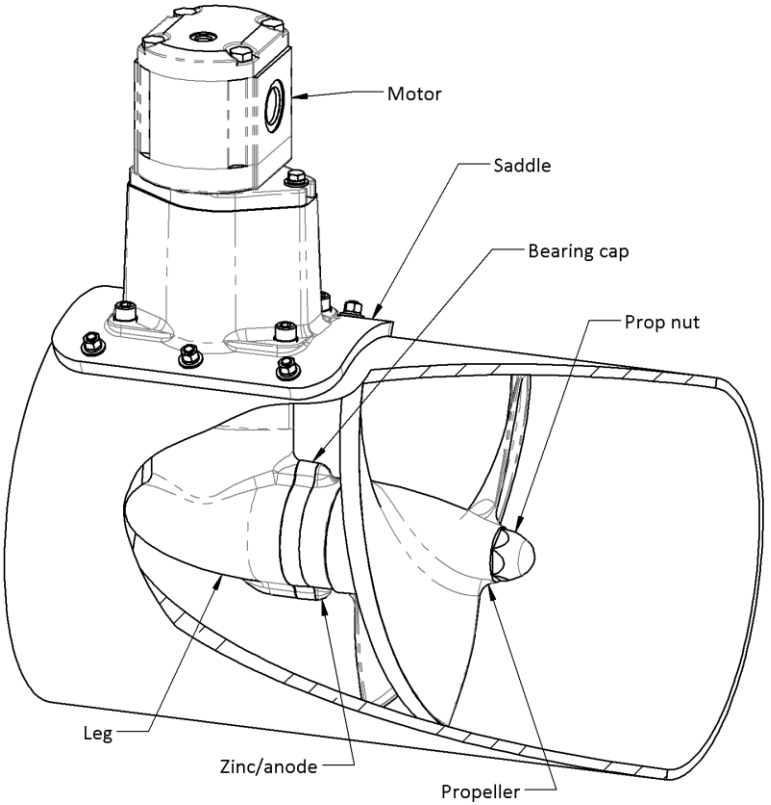
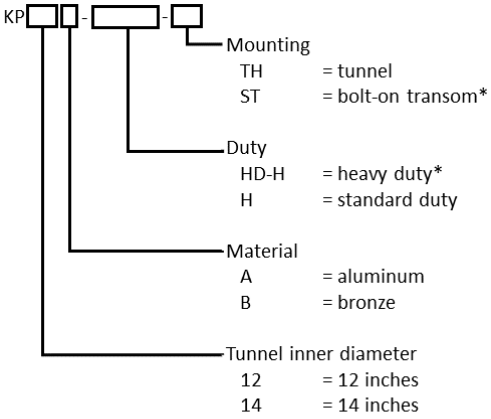


Figure 1 – Names of thruster components

2.2 MODEL CODE KEY



*Option only available in 12-inch thruster size

2.3 TECHNICAL DATA

Your authorized Kobelt distributor typically will also sell you a hydraulic motor that is most compatible with your vessel's existing hydraulic system. Given that there is no "standard" motor, pressure and flow requirements do not depend solely on the thruster model used and will vary from installation to installation. Table 1 below provides examples of possible operating parameters for typical installations. Note that operating parameters are also affected by the vessel's hull and tunnel geometry.

Table 1 - Hydraulic motor operating specifications

Model	Flow	Pressure	Power
KP 12	18 gpm 68 lpm	2,300 psi 172 bar	25 hp 18 kW
KP 12 HD	20 gpm 76 lpm	2,600 psi 179 bar	31 hp 23 kW
KP 14	24.5 gpm 93 lpm	2,600 psi 179 bar	38 hp 28 kW

2.4 PARTS

Detailed parts lists can be found in section 6 of this manual. You should find the following items when you receive your Keypower thruster:

- A completely assembled thruster which consists of
  - Hydraulic motor (sold separately)[1]
  - Saddle
  - Leg subassembly
  - Propeller
  - Prop nut
  - Mounting plate (bolt-on transom thrusters only)
  - Fibreglass tube (bolt-on transom thrusters only)
- Prop puller tool
- Header tank and its mounting hardware
- Installation bolt kit (tunnel thrusters only)
- Template for thruster tube cut (tunnel thrusters only)
- Backing plate (bolt-on transom thrusters only)
- This manual

Kobelt can supply fibreglass, steel and aluminum tubes for your thruster if needed. If supplying your own tube, be aware that the wall thickness must be correct for proper alignment of the thruster; you may be required to build up to the thruster saddle for thinner tubes. Refer to the table below for the required tube dimensions of each thruster size.

Table 2 – Thruster tube dimensions

Model	Tube ID [inches]	Wall Thickness [inches]
KP12 & KP12 HD	12	3/8
KP14	14	3/8

[1] Prior to commencing thruster installation, you should note down the make and model of the motor that has been supplied with your thruster on the space provided on page 1.

3 INSTALLATION AND LOCATION SELECTION

This section has been prepared to assist the owner and the installer in understanding the installation of the thruster to the vessel. All work should be performed by a professional who is competent in marine mechanical installations.

NOTICE	Installation of the thruster involves cutting into the hull of the vessel and improper material use or workmanship can result in property damage, and/or a loss of performance.

Care should be taken when selecting a location for the thruster installation as it can greatly affect the performance of the thruster. A thruster is a low-pressure axial pump whose performance is sensitive to the interference of the influx of water to the propeller and the pressure distribution outside of the vessel's hull. Additionally, the thruster installation can increase the drag of the vessel if due care is not taken in selecting its location. For the reasons mentioned, special consideration must be given so that a hydrodynamically favourable and economically sensible installation is achieved. If the guidelines in this manual are not taken into consideration, then a loss of thrust should be expected. Best results can be achieved by consulting with a naval architect familiar with the vessel.

3.1 TUNNEL THRUSTER LOCATION SELECTION AND INSTALLATION

This section describes the installation of the tunnel and thruster to your vessel. You can either:

- Install the tube to the hull first, and then install the thruster to the tube.
- Make the leg cut out and mounting holes first (steps 1 to 6 in section 3.1.4 on page 13), install the tube to the vessel, then complete the installation by sealing the thruster to the tube (remaining steps in section 3.1.4).

Note that the following instructions are for tunnel installations only (installing to an athwartships tunnel through the vessel's hull), see section 3.2 on page 15 for bolt-on transom-mounted thruster installation instructions.

3.1.1 Locating the Thruster on Your Vessel

Consider the following when selecting a location to install the thruster:

- Locating the thruster as far forward in the vessel will maximize its effectiveness.
- The propeller's midline should be located as close to the centreline of the vessel as possible. The provided cutting template has the propeller midline location marked on it which will allow you to accurately locate the propeller midline.
- Account for the space the saddle, motor, and any hydraulic fittings and hoses will take up within the vessel. See section 7.1 on page 41 for the thruster's dimensions.
- The thruster can be installed so that the drive components are above the tube, horizontal to the tube or at any angle in between.
- No parts of the thruster are to extend outside of the hull.
- The tunnel's length, vertical positioning, and opening shape all greatly affect thruster performance. Refer to Figure 2 on page 9 and accompanying Table 3 for definitions of these parameters and their recommended values.

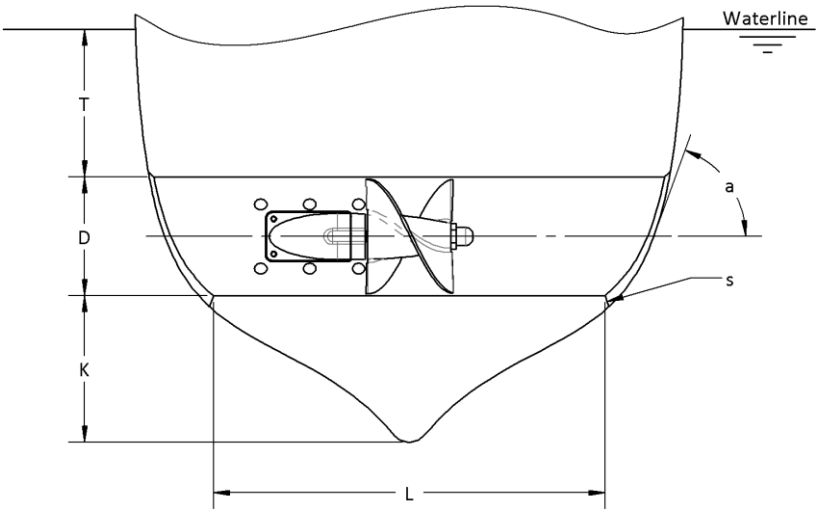


Figure 2 – Thruster tunnel location parameters that affect performance

Table 3 – Recommendations for thruster tunnel location.

Dimension	Recommendation	Consequence if recommendation not met
T	• T ≥ D* • T = 1.5D is best	• Insufficient depth can cause air suction which reduces thrust, increases noise and vibration, and can damage the thruster. • Note that excessive depth can be inefficient and cause excessive roll of the vessel during thruster operation.
L	• L ≥ 2D • L ≤ 6D	• Insufficient length does not allow the flow to stabilize thus decreasing thrust. • Excessive length increases flow resistance thus decreasing thrust.
K	• If L < 3D, then K ≥ D/2 • If L ≥ 3D, then K ≥ D/4	• Circular currents can develop below the hull of the ship which decrease thrust.
a	• Close to 90° as possible	• Greater hull inclination results in decreased thrust (for this reason a bulbous bow makes an excellent location for a thruster).
S	• S ≥ 0.10D • S ≤ 0.15D • Cone (good) or radius (better)	• Insufficient tunnel fairing causes incoming water to be excessively turbulent decreasing thrust. • Excessive fairing will increase the hull drag during normal ahead travel.

*Note this dimension applies to the *lightest* waterline. Vessels used in open seas must also consider the effects of pitch, roll and wave action on the submersion of the thruster.

3.1.2 Protective Grid

Grids are often fitted to thruster installations with the intent of reducing the drag created by the tunnel opening and to prevent the ingression of objects that could potentially damage the thruster. Kobelt recommends consulting with a naval architect to design the protective grid as the optimum design will depend greatly on the shape and operating conditions of your vessel.

NOTICE	It is recommended to consult with a naval architect/shipyard to design a protective grid. The optimum grid design depends highly on the specifics of your vessel. A poorly designed grid can cause a large decrease in thruster performance.

If it is not possible to consult with a professional regarding the design of a protective grid but it is still desired to have one, follow the instructions below for a general installation that will achieve satisfactory performance at best.

- The grid should be made up of two to four equally spaced parallel bars which are interconnected by one perpendicular bar across the centre of the parallel bars (see Figure 4 below).
- Elliptical bars will result in the best performance. Rectangular bars should also result in acceptable performance if cost is a concern. Round and square bars are not recommended under any circumstances as they generally perform poorly.
- The bars should not cover more that 10% of the tunnel area.
- Mount the grid behind the induction cone/radius (see Figure 3 below).

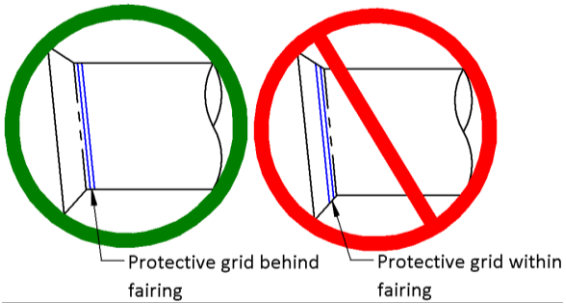


Figure 3 – Recommended location of protective grid

- Angle the parallel bars so they are aligned perpendicular to the flow of water over the hull of the bow in the location of the tunnel (left image in Figure 4). The flow of the water of the hull is typically determined from model tests. If the direction of the flow is not known, mounting the bars 15° relative to the waterline *could* result in *satisfactory* performance (right image in Figure 4).

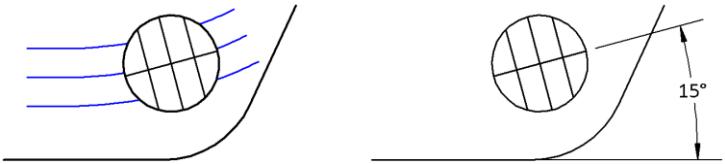


Figure 4 – Orientation of protective grid relative to vessel

3.1.3 Installation of Fibreglass Thruster Tubes

This section has been prepared to assist the owner and installer in understanding the installation of fibreglass thruster tubes. All work should be done by a professional who is competent in marine mechanical installations. The tube can be installed after or before the leg cut-outs and mounting holes have been made (steps 1 to 6 in section 3.1.4 on page 13 instruct how to make the cut out and mounting holes).

1. Determine a suitable location for the thruster using the guidelines described in *3.1.1 Locating the Thruster on Your Vessel*.
2. Cut a hole in the hull large enough in diameter to allow for a fairing with a minimum radius as specified in Table 3 on page 9.
3. Cut the tube to length so that it fits in between the holes cut in the hull. Allow for a gap between the tube and hull for the radius. If the mounting holes and cut-out have already been made, then you must also ensure that the tube length is cut so that the propeller midline is centred as much a possible athwartships.
4. Move the tube to the desired position in the vessel and fix it in place.
5. Fibreglass the tube in place. Fibreglass must cover the entirety of the tube exterior except in the area the saddle will mount to. Fibreglass thickness should be in accordance to the applicable marine standards for the vessel. Refer to Figure 5 on page 12 for an example of a fibreglass tunnel installation.

NOTICE	Under no circumstances should fibreglass be applied to the area of the tube which contacts the underside of the saddle. Any additional thickness in the area of the flange will adversely affect the fit of the thruster assembly.

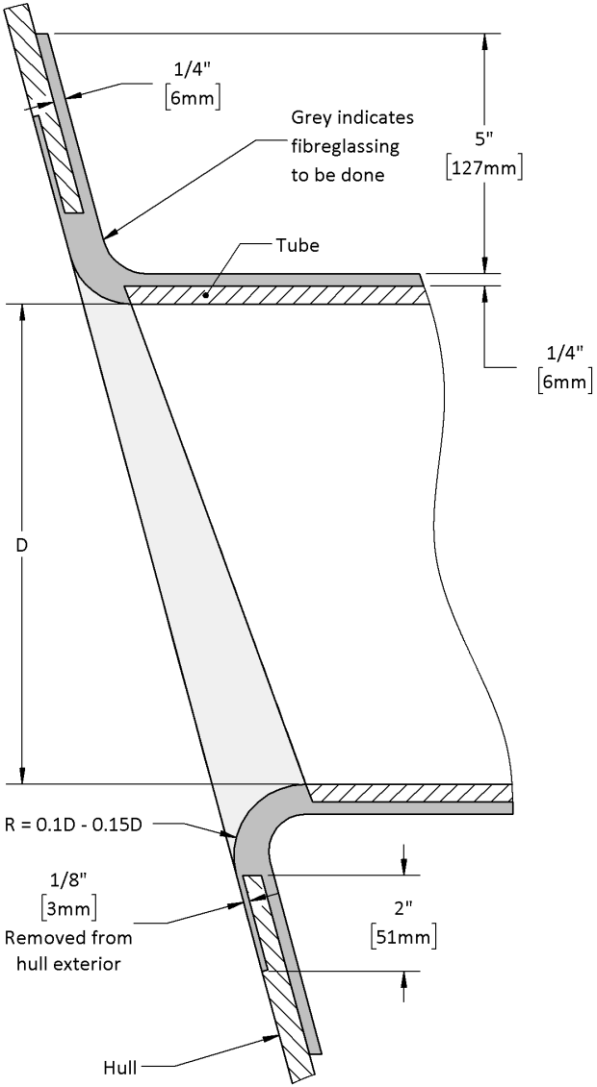
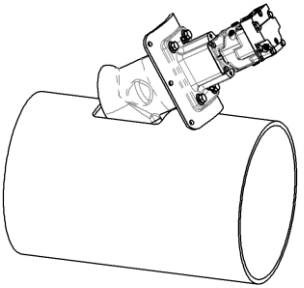


Figure 5 – Thruster tube fibreglassing example

3.1.4 Installing the Thruster to the Tube

This section has been prepared to assist the owner and installer in understanding the installation of the thruster to the tube. All work should be performed by a professional who is competent in marine mechanical installations. The thruster can be installed to the tube before or after the tube has been installed to the hull.

1. Use the provided cutting template to cut the required opening in the tube[2]. Note that the bolt holes are not shown on the cutting template. These are added later.
2. Remove the propeller as directed by the instructions in section *4.3 Propeller Installation and Removal* on page 21 of this manual. Also, refer to that section whenever these steps instruct you to reinstall the propeller.
3. Insert the thruster leg through the opening in the tube as shown below.



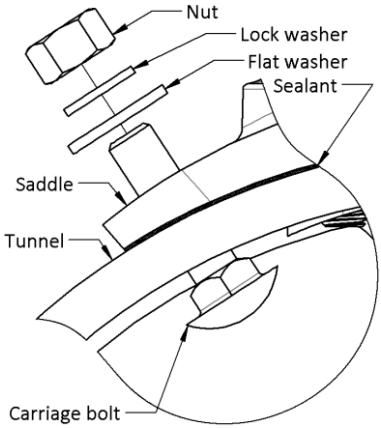
4. Reinstall the propeller and trial-fit the thruster. Check for tip clearance by using wooden shims between the propeller blades and inner surface of the tube to centre and position the thruster.
    - Variations in tube thickness can cause the propeller to sit too close to one side. It may be necessary to shim or grind the area on the tube where the saddle sits.
5. With the thruster properly aligned, match drill six 3/8” holes with the existing saddle mounting holes through the tube.
6. Remove the propeller from the thruster assembly and remove the thruster assembly from the tube, then:
    - Metal tubes: File the holes in the tube so that they are square-shaped.
    - Fibreglass tubes: Increase the size of the holes in the tube to 31/64”

[2] The cutting template can also be downloaded from www.kobelt.com on the KP12 product page.

7. At this point it is recommended to apply a marine barrier coat and antifouling paint to the thruster tunnel. The following sub-steps will guide you through that process:
    1. Obtain marine barrier epoxy and antifouling paint that is appropriate for the operating environment of the vessel.
    2. Apply the epoxy barrier coat to the inner diameter of the thruster tube. Refer to the information provided by the epoxy manufacturer for application procedures, recommended thickness, and drying time.
    3. Apply the antifouling paint to the inner diameter of the thruster tube. Refer to the information provided by the paint manufacturer for application procedures, recommended thickness, and drying time.

NOTICE	Paint and coatings can be applied to the thruster as well, however, **nothing should be applied to the zinc anode or the surface on which the anode mounts to**.

8. Apply a generous amount of 3M 5200 marine adhesive sealant (standard or fast cure) on the surfaces where the bottom of the saddle and tube contact each other and the 6x mounting holes. Reinsert the thruster assembly onto the tube. Apply a liberal amount of 3M 5200 to the provided mounting bolt kit fasteners and secure the thruster to the tube (hand tight). Make sure to follow any gap size limits stated in the instructions that are provided with the sealant. See image below for fastener orientation.



9. Reinstall the propeller. Check for tip clearance by using wooden shims between the propeller blades and the inner surface of the tube to centre and position the thruster.
10. Tighten the 6 mounting nuts to 5-10 lbf·ft and remove the shims. Allow for the sealant to cure (refer to the instructions provided with the sealant for cure time).
11. After the sealant has cured, torque the 6 nuts to 20-25 lbf·ft. The mechanical installation of the thruster to the tube is now complete. Note down the make and model of the hydraulic motor on page 1 of this manual if you have not done so already.

3.2 TRANSOM MOUNTED THRUSTER LOCATION AND INSTALLATION

3.2.1 Locating the Transom Mounted Thruster on your Vessel

Consider the following when selecting a location to install the thruster:

- The tube should be centred about the centreline of the vessel as much as possible.[3]
- Account for the space the backing plate, motor, and any hydraulic fittings and hoses will take up within the vessel. See Figure 24 on page 43 for the thruster's dimensions.
- Insufficient submersion can cause air to be sucked into the thruster tube which can result in excessive noise and vibration, decreased thrust, and damage to the thruster. The top of the tube should be at least one tunnel diameter deep from the *lightest* waterline (i.e., T should be greater than D in Figure 6). For vessels operating in open seas an allowance for pitch, roll, and wave action should be added to the minimum submersion recommendation.
- Submerging the thruster too deep to where the tube extends past the bottom edge of the transom is permissible but can cause increased drag during regular ahead travel.
- The transom needs to be flat at the location the thruster mounting plate will be fixed to. Curved surfaces may cause the seal between the mounting plate and hull to fail causing an ingress of water into the vessel.

If you find it challenging to fit the standard tube offering to your vessel, please contact Kobelt Manufacturing and we will try to come up with a custom solution that will work for you.

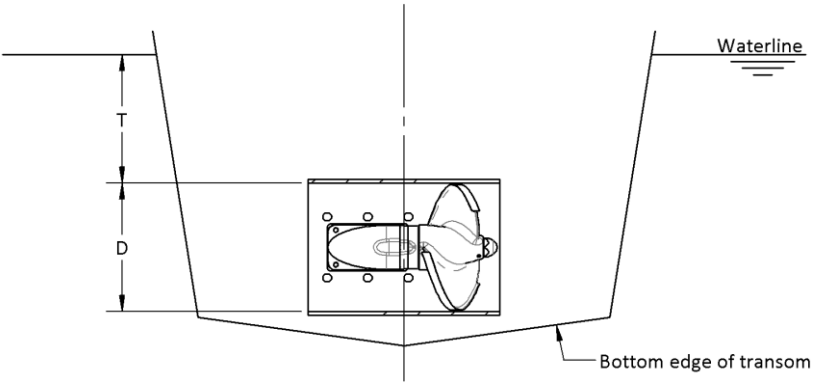


Figure 6 – Transom mounted thruster submersion recommendation

[3] If having to choose between sufficient submersion or centering the tube athwartships, the installation location that ensures more submersion should be used.

3.2.2 Tube Preparation

It is recommended to apply a marine barrier coat and antifouling paint to the tube before installing the thruster to the transom. The steps below will guide you through that process.

NOTICE	Paint and coatings can be applied to the thruster as well, however, **nothing should be applied to the zinc anode or the surface to which the anode mounts to**.

1. Remove the tube as described in section 4.4 on page 22.
2. Obtain marine barrier epoxy and antifouling paint that is appropriate for the operating environment of the vessel.
3. Apply the epoxy barrier coat to the entirety of the thruster tube. Refer to the information provided by the epoxy manufacturer for application procedures, recommended thickness, and drying time.
4. Apply the antifouling paint to the entirety of the thruster tube. Refer to the information provided by the paint manufacturer for application procedures, recommended thickness, and drying time.
5. Reinstall the tube as described in section 4.4 on page 22.

3.2.3 Cutting the Transom

This section instructs how to install transom-mounted thrusters. All work should be done by a professional who is competent in marine mechanical installations. It is recommended to prep the tube as per instructions in the previous section prior to installing the thruster.

When a suitable location has been selected (section 3.2.1 on page 15) for the thruster proceed with the next steps to cut the opening in the transom.

1. Place the thruster backing plate at the desired location and trace the central opening (see Figure 7 on the next page).
2. Remove the plate and cut the transom in the shape of the trace made in step 1.
3. Note that in the case of cored fibreglass hulls a modification must be made. For hull core materials that are soft and cannot withstand the clamping load of the backing and mounting plates, material must be removed from the core and internal hull so that the backing plate can be mounted directly to the external hull. If it is known that the core is strong and firm enough, then the mounting holes can be drilled directly through the core and internal hull (next step) and the backing plate can be mounted directly to the internal hull. In either case, new fibreglass should be laid down to seal-off any exposed hull core. See Figure 8 on the following page for a depiction of this modification.
4. From outside the vessel, fit the thruster-tube assembly through the newly cut hole and from inside the vessel fit the backing plate over the motor. When the placement is satisfactory, remove the thruster and match drill 33/64” size holes through the 14 mounting holes in the backing plate.

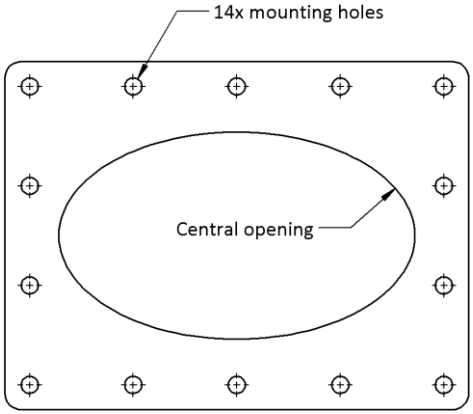


Figure 7 – Backing plate for transom-mounted thrusters

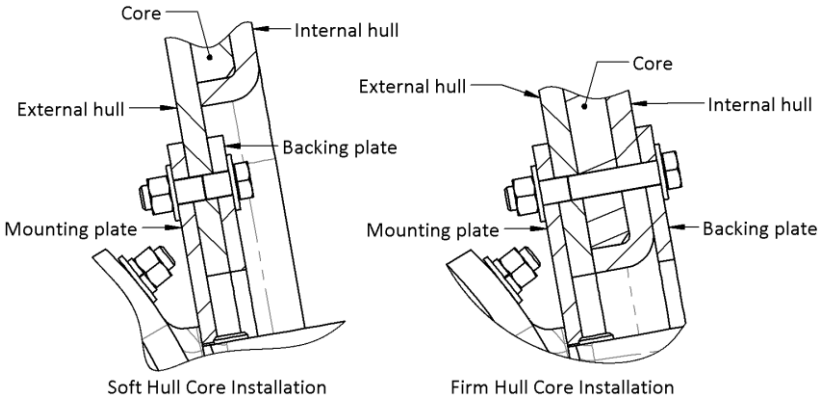


Figure 8 – Installation of transom-mounted thrusters to cored fibreglass hulls

3.2.4 Installing the Thruster to the Transom

This section has been prepared to assist the owner and installer in understanding the installation of transom-mounted thrusters. All work should be performed by a professional who is competent in marine mechanical installations.

1. Figure 9 illustrates this step. Carry out a dry installation to ensure that the mounting plates and thruster assembly properly fit together on the transom. The mounting plate is already bolted and sealed to the thruster assembly. From the outside of the hull, fit the motor end of the thruster through the central opening with the mounting plate placed against the transom. Fit the backing plate over the motor from the inside of the hull, sandwiching the transom between the two plates. Fasten this into place with 3/8" fasteners (316 stainless steel is recommended). Once the dry installation has yielded satisfactory results (plate lies flat on transom and there is no interference with other vessel components) remove the thruster from the transom and continue to next step.

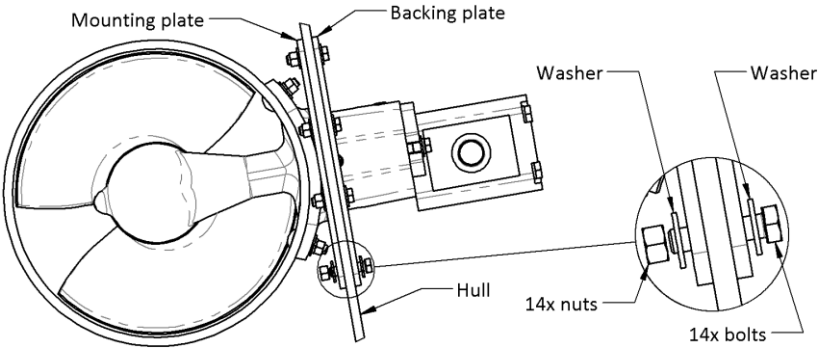


Figure 9 - Thruster fitted onto transom

2. Repeat step 1, but this time apply 3M™ 5200 (regular or fast cure) marine adhesive sealant between the mount plate and the vessel's hull, the fasteners used to fasten the thruster to the transom, and the mounting holes. Refer to the instructions provided with the sealant for information regarding gap size limits and cure time. At this point the mechanical installation of the thruster to the vessel can be regarded as complete. Note down the make and model of the hydraulic motor on page 1 of this manual if you have not done so already.

3.3 LUBRICATING OIL SYSTEM

The thruster needs to be connected to a source of oil to provide lubrication to the gears, bearings, and seals. This can be achieved by either connecting the thruster to an elevated header tank (section 3.3.1) or pumping oil through the thruster assembly (section 3.3.2).

3.3.1 Header Tank Location and Oil Fill Instructions

The distance between the bottom of the header tank and the centreline of the thruster should be at least 1.25 times the distance between the *heaviest* water line and the centreline of the thruster (see figure below); this ensures there is positive pressure within the thruster that prevents the ingress of seawater should a seal failure occur. As shown in the figure, the header tank should be connected to the port that is inline with the tube axis. Continue from step 2 in the instructions in section 4.7.1 on page 25 to complete the oil fill for the thruster.

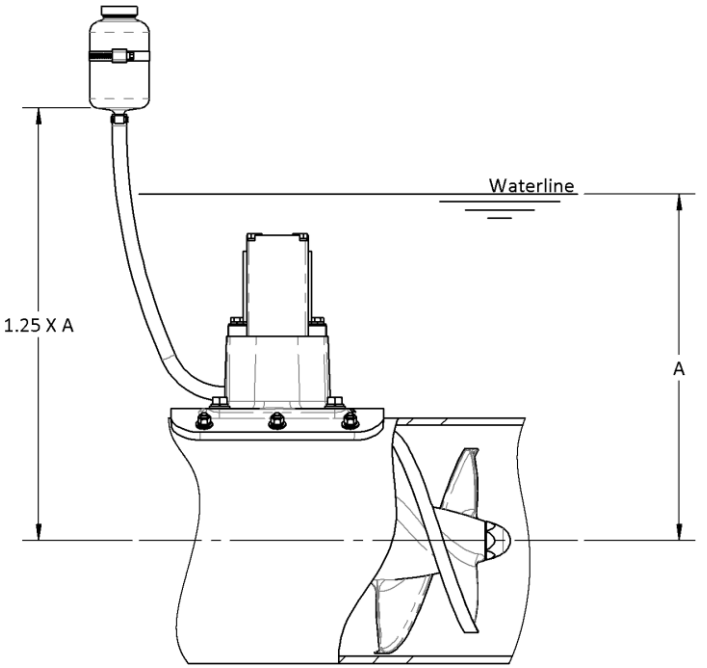


Figure 10 - Required elevation of header tank over the waterline

3.3.2 Circulating Oil Method

Instead of connecting the thruster to a header tank it can be connected to a pump that circulates oil through the thruster. This lubrication method is recommended for station-keeping and other severe commercial applications. In this case, the header tank connection in Figure 10 above should be replaced with a return line to the lube reservoir. Either of the remaining ports on the side of the saddle can be used to connect to the pressure source. Kobelt manufactures a pump (part number: KP426-B) specifically designed for this application that is available for purchase. Use SAE75W-90 synthetic gear oil.

4 MAINTENANCE AND SERVICE

4.1 PREVENTATIVE MAINTENANCE

- Header tank level should be checked daily.
- Check amount of material remaining on zinc anode. Anodes with less than 50% of the original material remaining should be replaced. The interval can vary greatly depending on the operating conditions of the vessel. A vessel in warm water that docks in busy marinas can go through an anode in a week while a vessel in cold unoccupied waters might take a couple months before a replacement is required.
- Replace shaft seal as described in section 4.8 on page 26.
    - 5 years for pleasure boats.
    - 2 years for commercial vessels, parking application.
    - 1000 thruster hours for commercial vessels, station-keeping.
- Replace the oil in the vessel as described in section 4.7 on page 25.
    - The lower of 5 years or 2,000 boat hours, pleasure craft.
    - The lower of 2 years or 1,500 boat hours, commercial boats using the thruster for parking only.
    - 500 thruster hours, commercial boats using the thruster for station keeping.

NOTICE	It is recommended that any required service work on a Keypower thruster be performed by a qualified individual. Please contact the nearest Kobelt authorized distributor for assistance.

4.2 RECOMMENDED SPARE PARTS

As a minimum Kobelt recommends the following spare parts are on-hand:

Table 4: Recommended Spares

Quantity	Part Number	Description
1	KP12X-RK	Repair kit
3	KP12-G-002	Zinc anode

For detailed parts lists see section *6 Parts Lists* of this manual.

4.3 PROPELLER INSTALLATION AND REMOVAL

Remove the propeller by following the instructions in Figure 11 below. You will need a 1-3/4" wrench to remove the prop nut and a 3/16" hex key to loosen the set screw.

NOTICE	Do not use undue force or blows to the propeller to remove it.

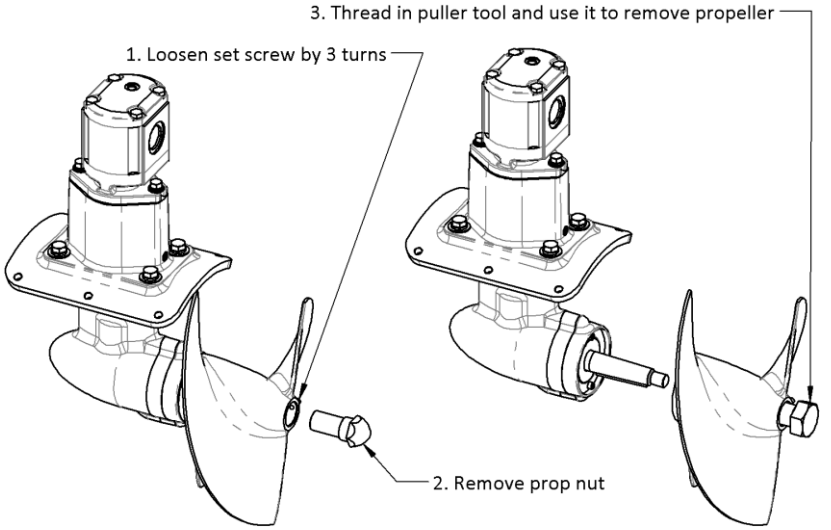


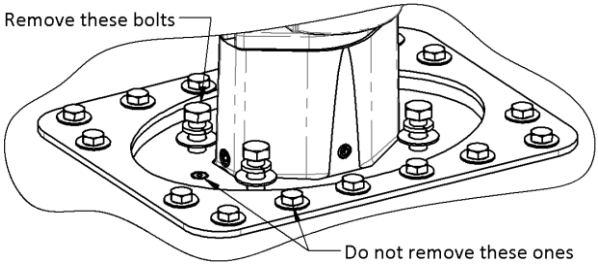
Figure 11 - Propeller removal instructions

To reinstall the propeller replace it on the thruster. Check for tip clearance by rotating the propeller once and ensuring it does not bind anywhere. Next replace the prop nut and torque it to 40 lbf·ft. Lastly, torque the set screw to 114 lbf·in. Rotate the propeller once more to again ensure clearance between the propeller blades and the tunnel.

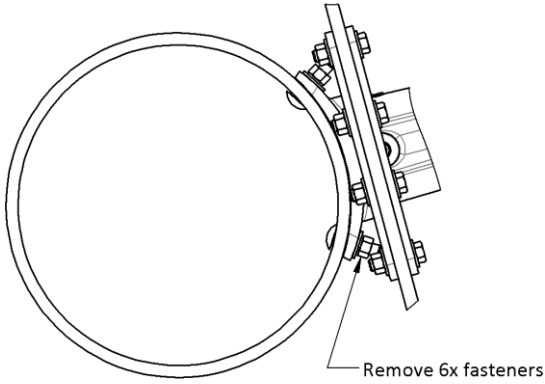
4.4 TRANSOM MOUNT THRUSTER TUBE REMOVAL AND INSTALLATION

The following steps describe how to remove the tube from the thruster assembly:

1. Remove the propeller as described in section 4.3 on page 21.
2. *This step is applicable only if the thruster is already installed to the vessel*. Remove the leg by removing the four hex bolts holding it to the saddle. Do not lose the two O-rings that seal between the saddle and leg. Some oil will dump out of this connection that must be disposed of according to your local environmental regulations.



3. Loosen and remove the six nuts that fix the tube to the thruster assembly.



4. The tube can now be slipped off.

To reinstall the tube:

1. Replace the tube onto the saddle and loosely refasten in six places. The heads of the carriage should be on the inside of the tunnel (see Figure 12 below).
2. *This step does not apply if leg is already installed to the saddle*. Reinstall the leg to the saddle. Do not forget the two O-rings that seal the saddle-leg contact surfaces. Apply silicone sealant to the four fasteners and torque them to 43 lbf·ft.
3. Reinstall the propeller as described in section 4.3 on page 21.
4. With the tube aligned in a position that ensures proper tip clearance, tighten the six fasteners holding the tube to the saddle.
5. Rotate the propeller once again to ensure propeller clearance.

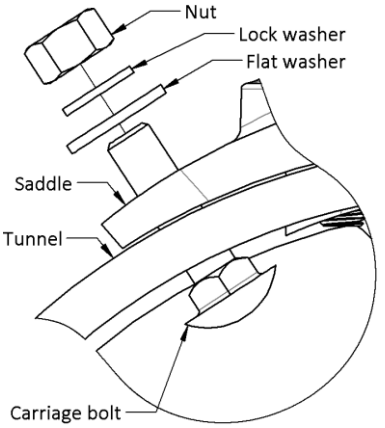


Figure 12 - Tube mounting hardware orientation.

If you are **installing a new tube**, you will have to make a cut out for the thruster leg and drill new holes for the mounting hardware. Follow the instructions in section *3.1.4 Installing the Thruster to the Tube* starting on page 13 up to and including step 6. Complete the installation by continuing from section 3.2.2. You also will likely have to remove the saddle (see Figure 13 for applicable fasteners) from the mounting plate to re-drill the mounting holes; doing so will break the seal between the saddle and the mount plate. Remember to clean and reapply 3M 5200 marine adhesive sealant (follow instructions regarding gap size limits and cure time) to the surface between the mount plate and saddle, and to the fasteners which hold the mount plate to the saddle. There should be no need to remove the mount plate from the vessel's hull at any point.

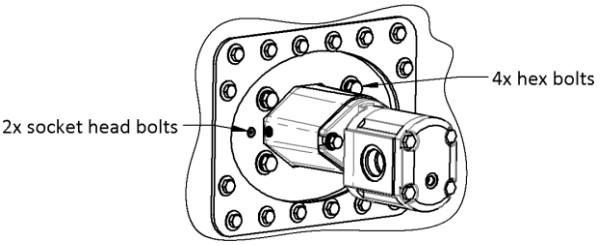


Figure 13 - Fasteners for mounting saddle to mounting plate

4.5 SETTING COUPLING DISTANCE

The coupling connecting the motor output shaft and thruster input shaft are already set to the correct positions when you receive your thruster, however, if ever during the life of your thruster you must remove the coupling from either of the shafts you must reinstall the coupling correctly. Complete the following steps:

1. Make sure that there is a 1/16” clearance between the spider pins and the coupling jaws (shown in Figure 14 below).
2. Torque the set screws to 13 lbf·ft.

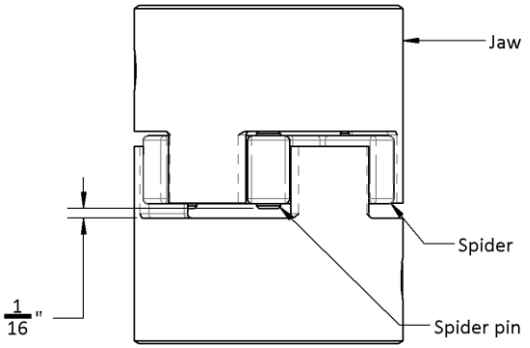


Figure 14 - Jaw coupling installation.

4.6 BEARING CAP REMOVAL & OIL DRAIN

The instructions below describe how the bearing cap is removed. Note that doing this requires you to replenish the oil that is lost during the procedure.

1. If connected to an oil circulation system, make sure the lube pump is off before commencing any work.
2. Remove the propeller (see section *4.3 Propeller Installation and Removal* on page 21).
3. Remove the anode by loosening and removing the three screws that hold it to bearing cap.
4. Remove the two socket head screws from the bearing cap.
5. Slowly pull the bearing cap and shaft assembly out. Oil will flow out. Also retain any shims that come out. Dispose of the oil with accordance to your local environmental regulations.
6. It is recommended to use this as an opportunity to inspect the gears, bearings, and seals.
7. Complete any tasks you intended on doing (e.g. replacing the shaft seals).
8. Reinstall in this order:
    a. Any shims that came out.
    b. The shaft sub assembly.
    c. The bearing cap and its screws (torque to 19 lbf·ft).
    d. The anode and its screws (torque to 64 lbf·in).
    e. Propeller (see section 4.3 on page 21 for instructions).
9. *This step is applicable to thrusters that are lubricated via header tank (not via circulating oil).* Continue from step 2 in the instructions in section 4.7.1 on page 25 to refill the oil in the thruster.

4.7 OIL CHANGES

NOTICE	Dispose of any old/excess oil in accordance with your local environmental regulations.

4.7.1 Header Tank Fill Method

1. *This step should be skipped for first-time thruster installation.* Remove the bearing cap from the thruster (instructions are in section 4.6 on page 24) and allow the oil to drain. Reinstall the bearing cap.
2. Remove either of the 1/4" NPT plugs from the ports on the side of the saddle (i.e., the ports not currently connected to the header tank). This will be you oil level indicator port.
3. Fill the header tank with SAE75W-90 synthetic gear oil until oil starts coming out of the oil level indicator port then reinstall the plug removed in the previous step.
4. Continue filling the header tank until it is two thirds full, then replace its cap.

4.7.2 Pump Out Method

This method allows for replacing the lubricating oil without removing the bearing cap and without taking the boat out of the water. This method can be used when it is desired to only replace the oil and not the shaft seal.

1. Disconnect the header tank from the thruster.
2. Connect the port that the header tank was connected to some sort of receptacle that will allow you to collect and examine the oil.
3. Remove either of the 1/4" NPT plugs from the ports on the side of the saddle (i.e., the ports not currently connected to the receptacle). Connect this port to a manual pump.
4. Manually pump SAE75W-90 synthetic oil into the thruster until clean oil starts coming out of the other port.
5. Disconnect the manual pump and reinstall the plug that was removed in step 3.
6. Disconnect the receptacle and reconnect the header tank that was removed earlier. Fill the header tank until it is two thirds full and replace its cap.

4.8 SHAFT SEAL REPLACEMENT

Removing the shaft seal requires removing the bearing cap for which instructions can be found in section 4.6 on page 24. When replacing the shaft seals of the thruster you must orient them face-to-face and you must replace the spring on the outer shaft seal with a -022 O-ring (see Figure 15 below). All the required components are included in repair kit KP12X-RK.

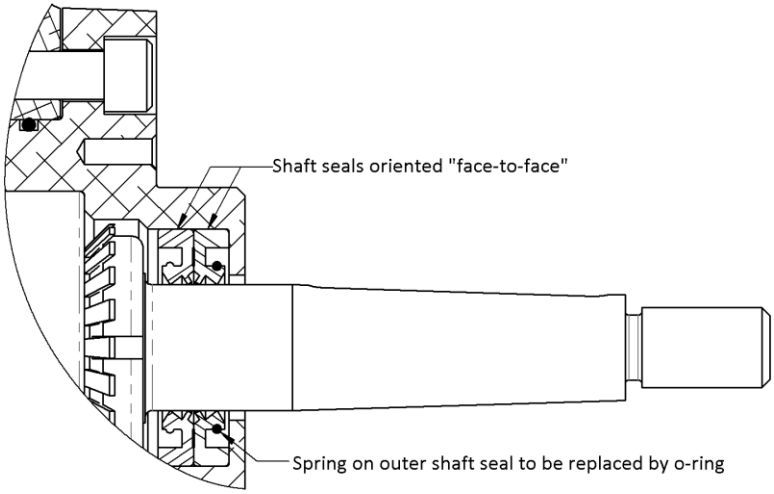


Figure 15 - Shaft seal replacement details

5 HYDRAULICS

⚠WARNING	Observe the following precautions: • Wear safety goggles. • Exhaust all pressure prior to working on hydraulics. • Never run your hand along pressurized lines to look for a leak. • If you are unsure of any of the instructions or unqualified to work on hydraulics you should consult with an expert. • A method of pressure regulation must be implemented in the hydraulic system. See system requirements section. A hydraulic injection injury can result in an amputation of a limb or death, be careful!

5.1 SYSTEM REQUIREMENTS

Hydraulic systems can vary greatly depending on the thruster installation (the thruster size itself, quantity of thrusters, and the displacement of the motor you receive) and other parameters of the vessel (whether other hydraulic machinery is also present). For this reason, it is impossible to provide a general hydraulic schematic for Keypower thruster systems. General requirements of the system include:

- A method of pressure regulation must be implemented in the system.
- The oil must be maintained at a minimum cleanliness level (usually ISO 4406:1999 level 22/18/13).

5.2 INSTALLATION

1. Inspect all fittings and ensure that they have been properly tightened.
2. Ensure that the hydraulic oil reservoir has been filled to the top line on its sight level gauge with system oil.
3. Open all pump suction shut-off valves.
4. Fill all pump cases with system oil through their case drain ports. Fill until the oil level is at least up to the centreline of the pump shaft.
5. With a pan or an absorbent material under the pump, loosen the pump suction connection without completely removing it to let any air out of the pump. Retighten the connection when oil starts to come out of the suction port. Repeat this step for all pumps.
6. Loosen the main pressure outlet port connection without completely removing it. With a pan or an absorbent material under the connection, crank the engine (without starting it) until a steady stream of oil starts flowing from the loosened connection. Stop cranking the engine and retighten the pressure hose connection. Check the oil level in the reservoir and replenish it until the level is at the top line of the sight level gauge. Repeat this step for all pumps.
7. Start one engine and note the pressure reading on the gauge mounted to the main hydraulic manifold. The pressure should read between 250 to 350 psi (17.2 to 24.1 bar) after a few minutes have passed to allow the pressure to stabilize. Shut the engine down.

8. After all residual pressure has left (gauge reads zero) start the second engine if applicable. After allowing a few minutes for the pressure to stabilize, confirm on the main system gauge that the pressure is within 25 psi (1/7 bar) of the reading found in step 7. Shut the engine down.
9. Ensure the vessel is securely moored to mooring points that are substantial enough to withstand the forces generated by the thruster. This must be confirmed for both the bow and stern of the vessel. It is strongly recommended that a person stand on the dock to ensure the mooring ropes remain secure during the run up procedures and that a dangerous vessel condition does not develop.
10. Start any applicable engines and inspect all connections between the pumps and the main system manifold.
11. Using the manual control lever on the manifold for the thruster, shift the control off centre until flow is heard and there is pressure rise shown on the system gauge. Hold the lever in a position that maintains 500-700 psi. The lever should be held until any rattling of hissing noises have ceased (these noises indicate air is being purged from the system). Return the valve to its neutral position. Check the oil level in the reservoir and replenish it until the level is at the top line of the sight level gauge.
12. Repeat step 11, but with the lever shifted in the opposite direction.
13. Check all fittings and connections between the thruster valve section and the thruster motor for leaks.
14. Check the connection and security of all mooring lines.
15. Repeat steps 11 through 14 for any other thrusters if applicable.
16. Test the thruster using the electronic controls. Have someone stationed at the main control manifold to record the pressure at maximum input. Adjust the pressure if necessary. If the thruster force is in the opposite direction of the control lever, reverse the C1 and C2 connections at the appropriate valve section in the main manifold.
17. If applicable, refer to the start up procedures for the vessel's other hydraulic machinery to complete that equipment's installation. Always ensure the oil level is sufficient while doing this.
18. If applicable, refer to the start up procedure for the roll stabilizers in the operations documents to complete the roll stabilizer installation. Always ensure the oil level is sufficient while doing this.
19. Shut down engines. After the pressure has been exhausted, visually and physically check each fitting and connection in the system for weeping oil.
20. Check the oil level in the reservoir and replenish it until the level is at the top line of the sight level gauge.

6 PARTS LISTS

6.1 KP12 TUNNEL THRUSTERS

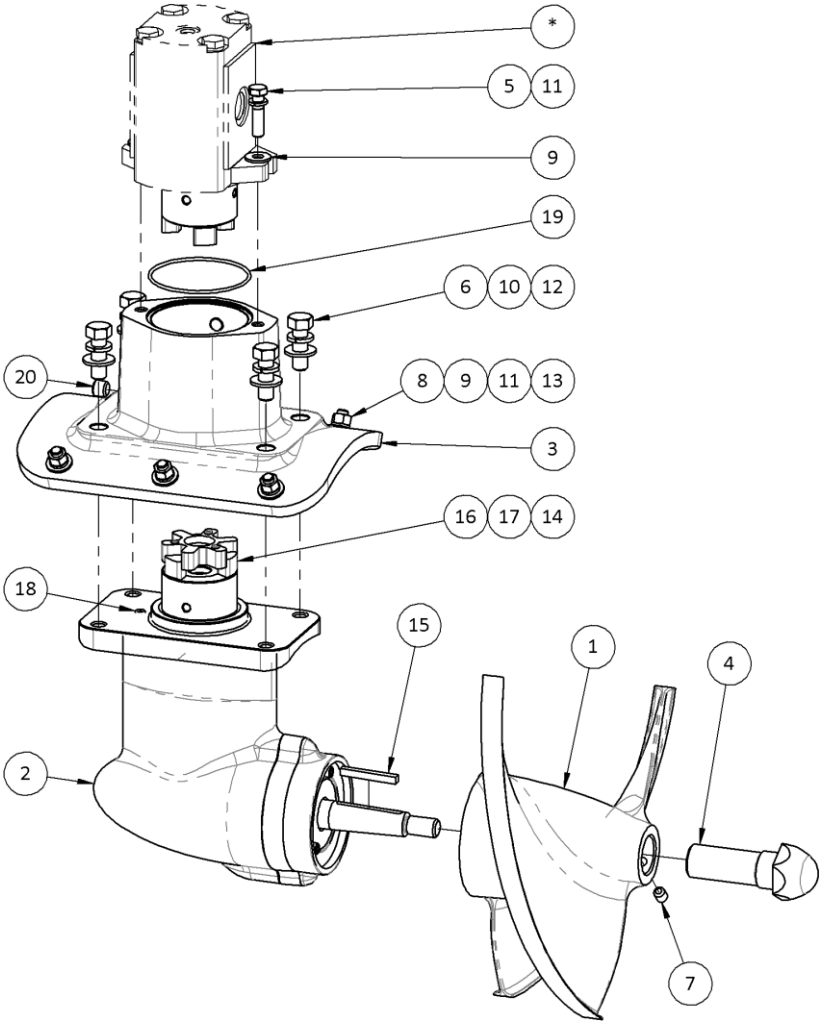


Figure 16 – KP12 hydraulic tunnel thrusters' parts list diagram

Table 5 – KP12 hydraulic tunnel thrusters' parts list

Item	Quantities KP12A-H-TH	KP12B-H-TH	KP12A-HD-H-TH	KP12B-HD-H-TH	Part Number	Description	Notes (pg. 39)
*	1	1	1	1	-	Motor	1, 6, 9
1	1	-	1	-	KP10-E-005-AN	Propeller	3
1	-	1	-	1	KP10-E-006	Propeller	3
2	1	-	-	-	KP12A-LEG_ASSY	Leg assembly	2, 3, 5, 9
2	-	1	-	-	KP12B-LEG_ASSY	Leg assembly	2, 3, 5, 9
2	-	-	1	-	KP12A-LEG-HD	Leg assembly	2, 3, 5, 9
2	-	-	-	1	KP12B-LEG-HD	Leg assembly	2, 3, 5, 9
3	1	-	1	-	KP19-E-005-AN	Saddle	4, 5, 6, 7
3	-	1	-	1	KP19-E-006	Saddle	4, 5, 6, 7
4	1	-	1	-	KP11-G-003-AN	Prop nut	3
4	-	1	-	1	KP11-G-004	Prop nut	3

Parts above vary depending on thruster configuration.
Parts below are common to all 12-inch tunnel thrusters

Item	Qty	Part Number	Description	Notes (pg. 39)
5	2	1001-1224	Bolt, hex, 3/8"-16 X 1-1/2", F593C	6
6	4	1001-1424	Bolt, hex, 1/2"-13 X 1-1/2", F593C	5
7	1	1016-1208	Set screw, cup point, 3/8"-16 X 1/2", 18-8 SS	3
8	6	1022-0112	Nut, hex, 3/8"-16, F594C	7
9	8	1023-0112	Washer, flat, 3/8", 18-8 SS	7
10	4	1023-0114	Washer, flat, 1/2", 18-8 SS	5
11	8	1023-0312	Lock washer, split, medium, 3/8", 18-8 SS	7
12	4	1023-0314	Lock washer, split, medium, 1/2", 18-8 SS	5
13	6	KP30-A-027	Carriage bolt, 3/8"-16 X 1-1/2", F593 CW1	7
14	1	1305-5216-D	Key, 3/16" sqr. X 1" long, form A, 1018 steel	9
15	1	1305-5632-BE	Key, 1/4" sqr. X 2" long, form B, 316 SS	3
16	2	KP44-G-004	Coupling hub	9
17	1	KP44-G-006	Coupling spider	9
18	1	1101-0009	O-ring, -009, NBR 70D	21
19	2	1101-0152	O-ring, -152, NBR 70D	21
20	3	KP36-A-002	1/4 NPT plug, SS	-

6.2 KP14 TUNNEL THRUSTERS

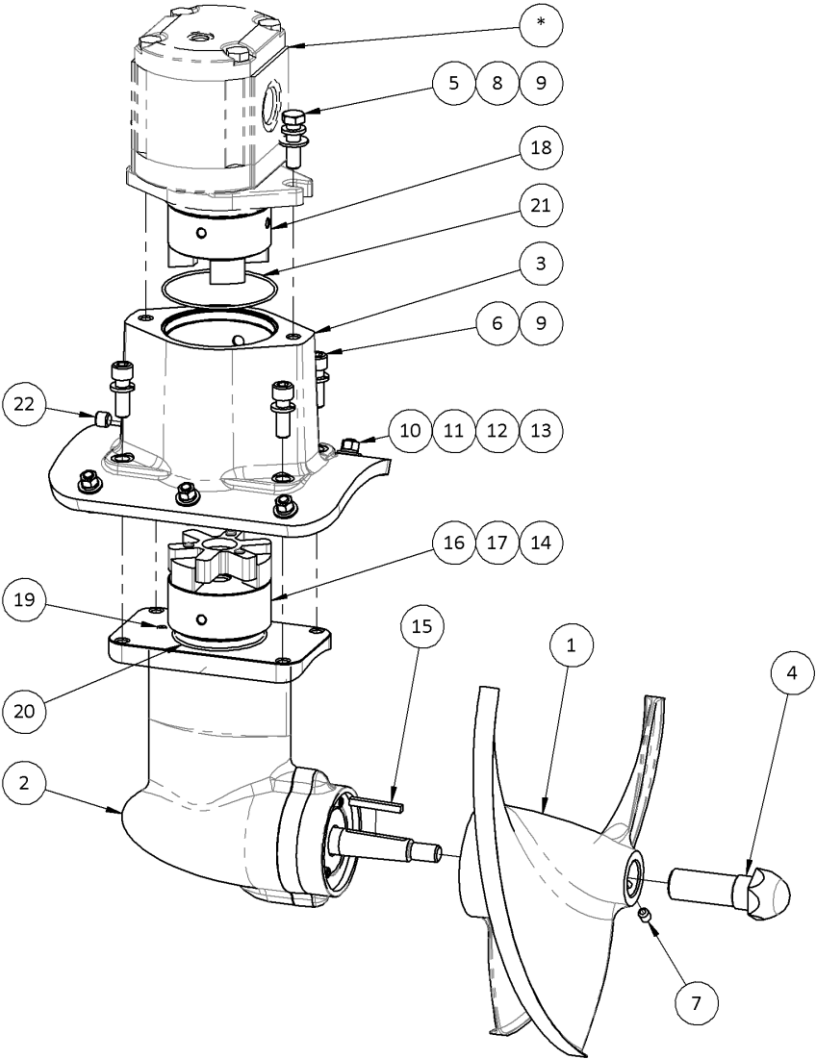


Figure 17 – KP14 hydraulic tunnel thrusters' parts list diagram

Table 6 – KP14 hydraulic tunnel thrusters' parts list

Item	KP14A-H-TH Qty.	KP14B-H-TH Qty.	Part Number	Description	Notes (pg. 39)
*	1	1	-	Motor	1, 6, 9
1	1	-	KP10-F-007-AN	Propeller	3
1	-	1	KP10-F-008	Propeller	3
2	1	-	KP14A-LEG_ASSY	Leg assembly	2, 3, 5, 9
2	-	1	KP14B-LEG_ASSY	Leg assembly	2, 3, 5, 9
3	1	-	KP19-F-007-AN	Saddle	4, 5, 6, 7
3	-	1	KP19-F-008	Saddle	4, 5, 6, 7
4	1	-	KP11-G-003-AN	Prop nut	3
4	-	1	KP11-G-004	Prop nut	3

Parts above vary depending on the thruster configuration.
Parts below are common to all 14-inch thrusters.

Item	Qty	Part Number	Description	Notes (pg. 39)
5	2	1001-1428	Bolt, hex, 1/2"-13 X 1-3/4", F593C	6
6	4	1002-1424	Bolt, socket head, 1/2"-13 X 1-1/2", F837 CW	5
7	1	1016-1208	Set screw, cup point, 3/8"-16 X 1/2", 18-8 SS	3
8	2	1023-0114	Washer, flat, 1/2", 18-8 SS	6
9	6	1023-0314	Lock washer, split, medium, 1/2", 18-8 SS	5, 6
10	6	1022-0112	Nut, hex, 3/8"-16, F594C	7
11	6	1023-0112	Washer, flat, 3/8", 18-8 SS	7
12	6	1023-0312	Lock washer, split, medium, 3/8", 18-8 SS	7
13	6	KP30-A-027	Carriage bolt, 3/8"-16 X 1-1/2", F593 CW1	7
14	1	1305-5216-D	Key, 3/16" square X 1" long, form A, 1018	9
15	1	1305-5632-BE	Key, 1/4" square X 2" long, form B, 316 SS	3
16	1	KP44-F-016	Coupling hub	9
17	1	KP44-J-010	Coupling spider	9
18	1	KP44-J-012	Coupling hub	9
19	1	1101-0009	O-ring, -009, NBR 70D	21
20	1	1101-0152	O-ring, -152, NBR 70D	21
21	1	KP31-J-006	O-ring, -155, NBR 70D	21
22	3	KP36-A-002	1/4 NPT plug, SS	-

6.3 KP12 BOLT-ON THRUSTERS

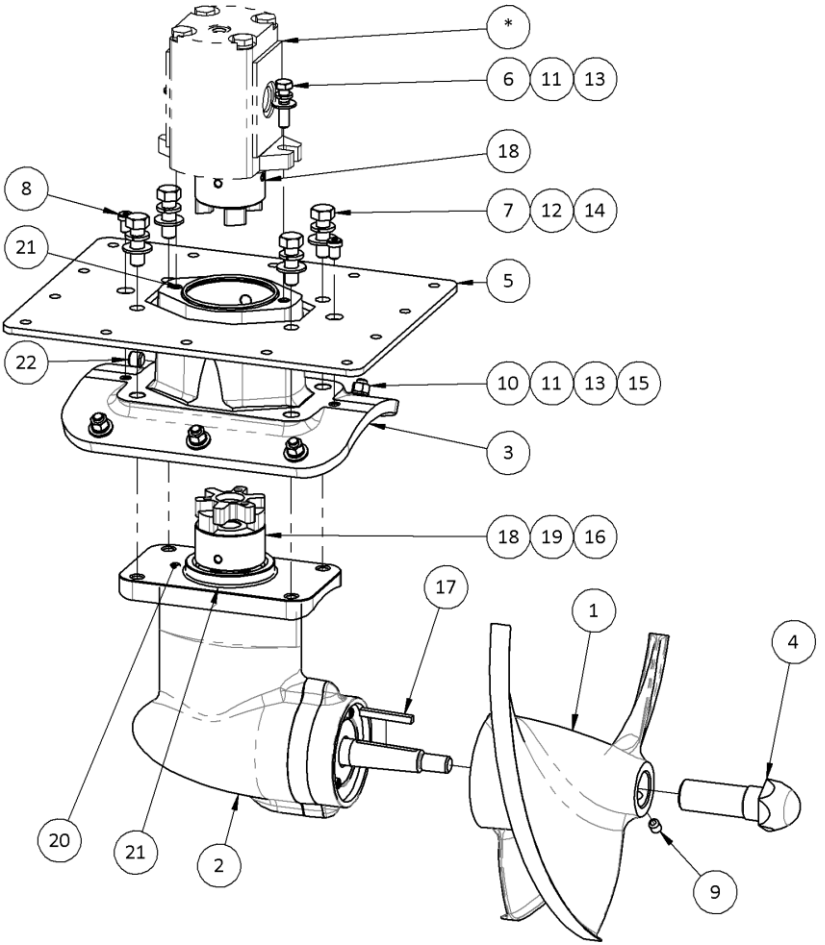


Figure 18 – KP12 hydraulic bolt-on thrusters' parts list diagram

Table 7 – KP12 hydraulic bolt-on thrusters' parts list

Item	KP12A-H-ST Qty.	KP12B-H-ST Qty.	KP12A-HD-H-ST Qty.	KP12B-HD-H-ST Qty.	Part Number	Description	Notes (pg. 39)
*	1	1	1	1	-	Motor	1, 6, 9
1	1	-	1	-	KP10-E-005-AN	Propeller	3
1	-	1	-	1	KP10-E-006	Propeller	3
2	1	-	-	-	KP12A-LEG_ASSY	Leg assembly	2, 3, 5, 9
2	-	1	-	-	KP12B-LEG_ASSY	Leg assembly	2, 3, 5, 9
2	-	-	1	-	KP12A-LEG-HD	Leg assembly	2, 3, 5, 9
2	-	-	-	1	KP12B-LEG-HD	Leg assembly	2, 3, 5, 9
3	1	-	1	-	KP19-E-005-S	Saddle	5, 6, 8, 10, 11
3	-	1	-	1	KP19-E-006-S	Saddle	5, 6, 8, 10, 11
4	1	-	1	-	KP11-G-003-AN	Prop nut	3
4	-	1	-	1	KP11-G-004	Prop nut	3

Parts above vary depending on the thruster configuration.
Parts below are common to all bolt-on thrusters.

Itm	Qty	Part Number	Description	Notes (pg. 39)
5	1	KP12-STERNPL-MP	Mounting plate	10, 13
6	2	1001-1224	Bolt, hex, 3/8"-16 X 1-1/2", F593C	6
7	4	1001-1424	Bolt, hex, 1/2"-13 X 1-1/2", F593C	5
8	2	1002-1208-L	Bolt, low socket, 3/8"-16 X 1/2", 18-8	12
9	1	1016-1208	Set screw, cup point, 3/8"-16 X 1/2", 18-8	3
10	6	1022-0112	Nut, hex, 3/8"-16, F594C	8
11	8	1023-0112	Washer, flat, 3/8", 18-8 SS	8
12	4	1023-0114	Washer, flat, 1/2", 18-8 SS	5
13	8	1023-0312	Lock washer, split, medium, 3/8", 18-8 SS	8
14	4	1023-0314	Lock washer, split, medium, 1/2", 18-8 SS	5
15	6	KP30-A-027	Carriage bolt, 3/8"-16 X 1-1/2", F593 CW1	8
16	1	1305-5216-D	Key, 3/16" sqr. X 1" long, form A, 1018	9
17	1	1305-5632-BE	Key, 1/4" sqr. X 2" long, form B, 316 SS	3
18	2	KP44-G-004	Coupling hub	9
19	1	KP44-G-006	Coupling spider	9
20	1	1101-0009	O-ring, -009, NBR 70D	21
21	2	1101-0152	O-ring, -152, NBR 70D	21
22	3	KP36-A-002	1/4 NPT plug, SS	-
23	1	.TUBE-FG-12015	Thruster tube	11
24	1	KP12-STERNPL-BP	Backing plate	-

*Items 23 and 24 are not shown in parts list diagram (Figure 18).

6.4 LEG SUBASSEMBLY

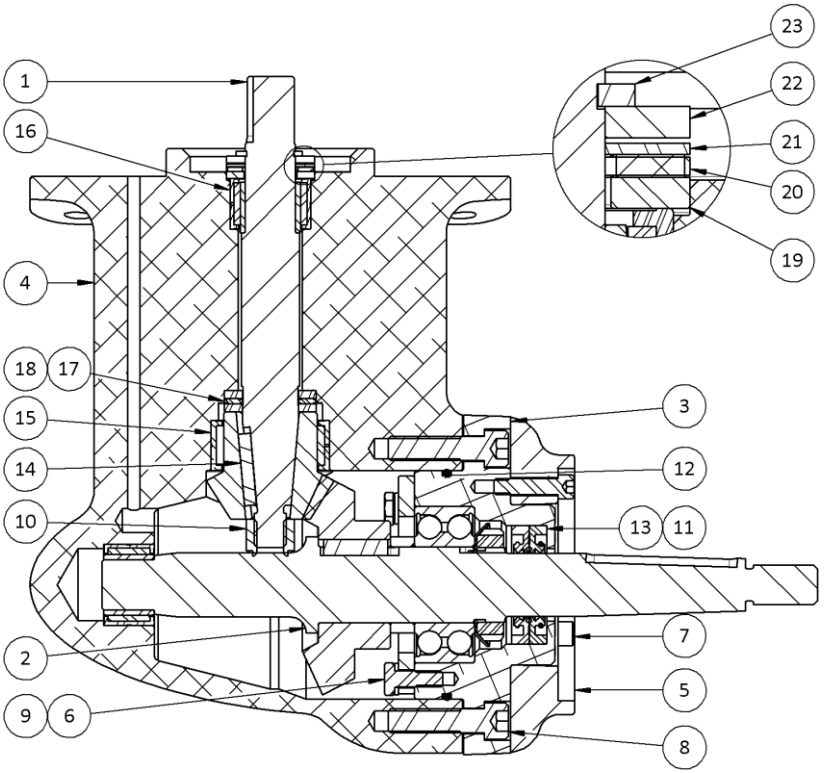


Figure 19 – KP12 & KP14 leg subassemblies' parts list diagram

Table 8 – KP12 & KP14 leg subassemblies' parts lists

Item	KP21A-LEG_ASSY QTY	KP12A-LEG-HD QTY	KP12B-LEG_ASSY QTY	KP12B-LEG-HD QTY	KP14A-LEG_ASSY QTY	KP14B-LEG_ASSY QTY	Part Number	Description	Notes (page 39)
1	1	-	1	-	-	-	KP13-E-004	Pinion shaft	15
1	-	1	-	1	-	-	KP13-E-005	Pinion shaft	15
1	-	-	-	-	1	1	KP13-F-005	Pinion shaft	15
2	1	-	1	-	-	-	KP13-S12-SUB	Shaft sub.	16
2	-	1	-	1	1	1	KP13-S14-SUB	Shaft sub.	16
3	1	1	-	-	1	-	KP15-G-003-AN	Bearing cap	15
3	-	-	1	1	-	1	KP15-G-004	Bearing cap	15
4	1	1	-	-	-	-	KP17-E-005-AN	Leg	15
4	-	-	1	1	-	-	KP17-E-006	Leg	15
4	-	-	-	-	1	-	KP17-F-007-AN	Leg	15
4	-	-	-	-	-	1	KP17-F-008	Leg	15

Parts above vary depending on the thruster leg configuration.
Parts below are common to all thruster legs.

Item	Qty	Part Number	Description	Notes (page 39)
5	1	KP12-G-002	Zinc	-
6	5	1001-1012	Bolt, hex, 1/4"-20 X 3/4", F593C	18
7	3	1002-1016	Bolt, socket head, 1/4"-20 X 1", F837 CW	18
8	2	1002-1224	Bolt, socket head, 3/8"-16 X 1-1/2", F837 CW	17
9	5	1023-0310	Lock washer, split, medium, 1/4", 18-8 SS	-
10	1	KP43-G-002	Lock nut, top lock, 1/2"-13; grade C	-
11	1	1101-0022	O-ring, -022, NBR 70D	21
12	1	1101-0152	O-ring, -152, NBR 70D	21
13	2	KP22-G-003	Shaft seal	20, 21
14	1	1305-5218-BD	Key, 3/16" square X 1-1/8" long, form B, 1018	-
15	1	KP33-G-006	Bearing	-
16	1	KP33-G-013	Bearing	15
17	1	KP33-G-014	Bearing	-
18	2	KP33-G-015	Bearing washer	15
19	1	KP33-G-017	Bearing washer	15
20	1	KP33-G-018	Bearing	-
21	1	KP33-G-019	Bearing washer	15
22	1	KP33-G-020	Bearing washer	15
23	1	KP34-G-001	Snap ring, external, 3/4" shaft X .078 thick	15

Also see note 14 on page 39 which is applicable to the entire leg assembly.

6.5 SHAFT SUBASSEMBLY

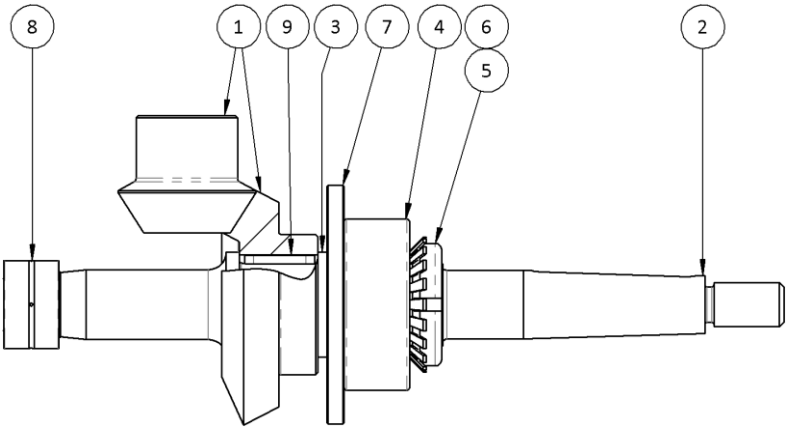


Figure 20 - Shaft subassembly parts list diagram

Table 9 - Shaft subassembly parts list

Item	KP13-S12-SUB QTY	KP13-S14-SUB QTY	Part #	Description	Notes (p 39)
1	1	-	KP14-G-004	Gear set	15
1	-	1	KP14-G-005	Gear set	15
2	1	1	KP13-G-007	Propeller shaft	-
3	1	1	KP16-G-001	Bearing spacer	15
4	1	1	KP33-G-012	Bearing	15
5	1	1	KP33-G-008	Bearing lock nut, N06	19
6	1	1	KP33-G-009	Bearing lock washer, W06	19
7	1	1	KP18-G-003	Retainer plate	-
8	1	1	KP33-G-013	Bearing	-
9	1	1	1305-5316-D	Key, 1/4” sq. X 1” long, form A, 1018 steel	-

6.6 ACCESSORIES

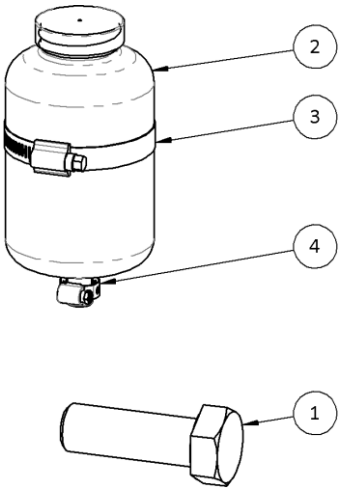


Figure 21 - Other KP thruster components

Table 10 - Accessory parts

Item	Qty	Part #	Description
1	1	1041-002030	Puller tool*
2	1	KP-30114	Header tank
3	1	KP-30117	Header tank mounting bracket
4	1	KP-30123	Hose clamp

*The puller tool is simply a 1-1/4”-7 UNC X 3” long hex bolt.

6.7 PARTS LISTS NOTES

1. Note that the motor is not standard across thruster installations and is typically selected to best fit your existing hydraulic system. Therefore, there is no standard part number for ordering a motor replacement. If a replacement motor is needed, read the manufacturer and part number information on the motor and provide it to your nearest authorized Kobelt distributor for further assistance. Additionally, you may have already noted the motor make and model on page 1 of this manual.
2. Leg assembly parts lists are on page 35.
3. See section 4.3 on page 21 for propeller removal and installation instructions.
4. For tunnel thrusters, saddle reinstallation requires resealing the saddle to the tube (section 3.1.4 on page 13) and may require resetting the coupling distance (section 4.5 on page 24). Note that the tunnel mounting holes may need some modifying as well.
5. For the fasteners that mount the leg to the saddle, follow the instruction below that applies to your thruster:
    a. KP12 tunnel thrusters: Apply silicone sealant to the fasteners and torque them to 43 lbf·ft.
    b. KP12 bolt-on thrusters: Apply silicone sealant to the fasteners and torque them to 43 lbf·ft.
    c. KP14 tunnel thrusters: Apply silicone sealant to the fasteners and torque them to 28 lbf·ft.
6. For the fasteners that mount the motor to the saddle, follow the instruction below that applies to your thruster:
    a. KP12: Torque to 19 lbf·ft.
    b. KP14: Torque to 54 lbf·ft.
7. Apply 3M 5200 marine adhesive sealant to the fasteners that mount the saddle to the tube and torque them to 19 lbf·ft. Observe any requirements regarding gap sizes and cure time.
8. Torque the fasteners that mount the saddle to the tube to 19 lbf·ft.
9. See section 4.5 on page 24 for instructions for setting coupling distance.
10. Clean contact surfaces between saddle and mounting plate and reapply 3M 5200 sealant. Observe any requirements regarding gap sizes and cure time. The mounting holes in thruster tube might also need modifying.
11. See section 4.4 on page 22 for instructions of how to remove and install the tube.
12. Apply 3M 5200 marine sealant and torque to 9 lbf·ft. Observe any requirements regarding gap sizes and cure time.
13. Replacing the mounting plate requires resealing the surface between the plate and the hull of the vessel and the fasteners holding them together with 3M 5200 marine adhesive sealant. Observe any requirements regarding gap sizes and cure time.
14. When taking apart the leg assembly be careful to not lose any shims you may find and do not forget to reinstall them when putting the unit back together. Failure to do so can cause the gears to mesh improperly reducing their life.
15. Replacing this part requires re-shimming of the gear set. Please consult your nearest authorised Kobelt representative for further assistance.
16. If replacing the entire shaft subassembly then note 15 above applies. For individual parts see shaft subassembly's parts list on page 37.
17. Torque to 19 lbf·ft.

18. Torque to 64 lbf·in.
19. Lock nut is 1.76”/45mm in diameter and requires hook-type spanner wrench to tighten. Bend lock washer tab into lock nut slot after tightening the lock nut.
20. Outer most shaft seal’s spring gets replaced by an O-ring (see section 4.8 on page 26 for detailed instructions). All are provided in the repair kit.
21. Part is included in repair kit that can be purchased from your authorized Kobelt distributor. Repair kit part number is KP12X-RK.

7 TECHNICAL DRAWINGS

7.1 TUNNEL THRUSTERS

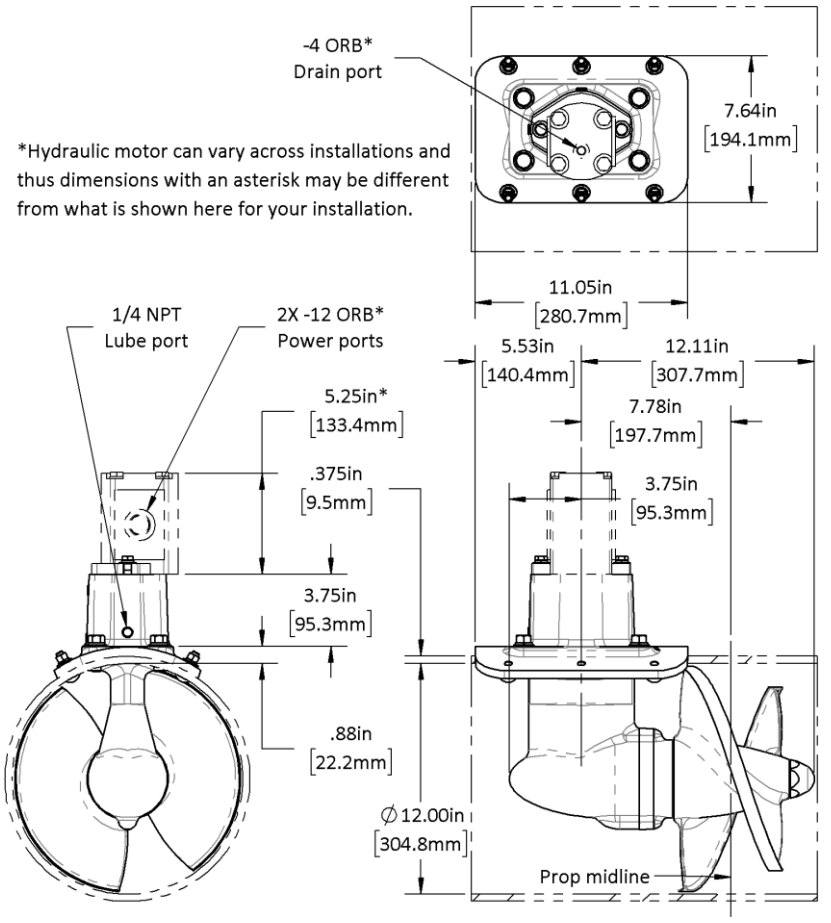


Figure 22 – KP12 & KP12 HD tunnel thruster dimensions

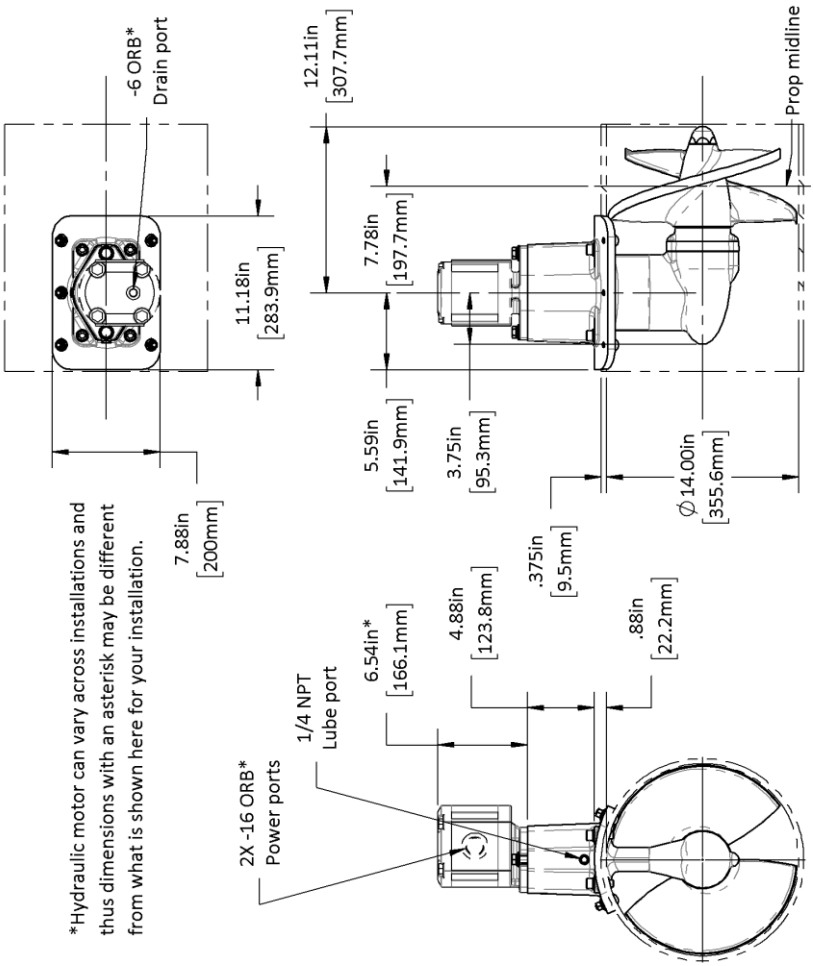


Figure 23 – KP14 tunnel thruster dimensions

7.2 TRANSOM-MOUNTED HYDRAULIC THRUSTERS

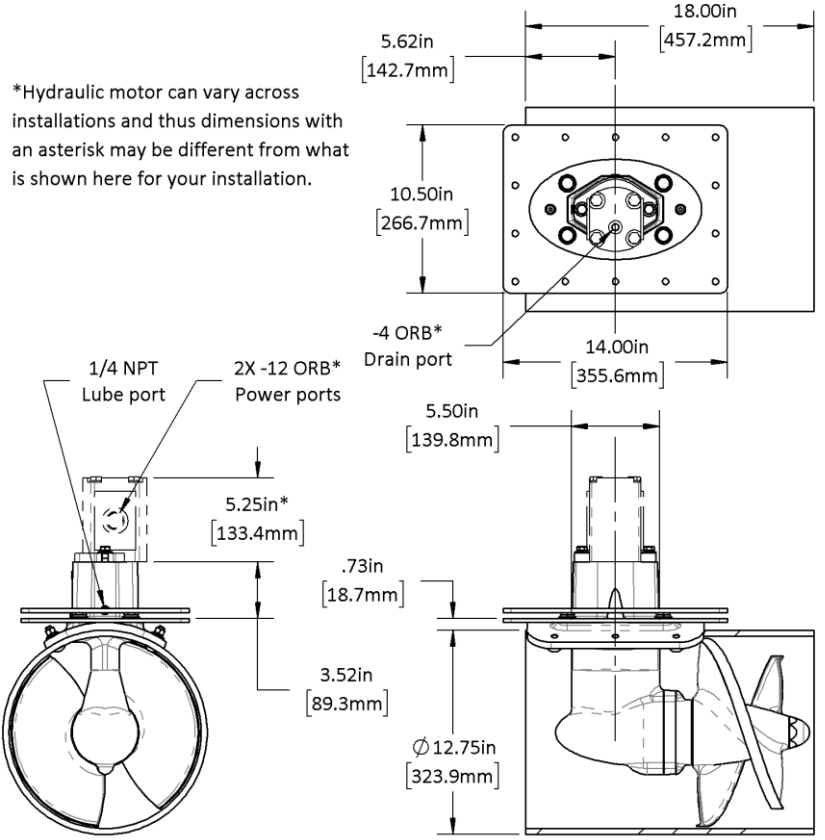


*Figure 24 - Transom mounted KP12 & KP12 HD thruster dimensions**

***Note:** Figure depicts standard tube offering. If it is incompatible with your vessel, please contact Kobelt Manufacturing and we can try to come up with a custom solution for you.

8 WARRANTY

Kobelt Manufacturing Co. Ltd. ("Kobelt") warrants the Products and Parts manufactured by Kobelt to be free from defects in workmanship or material and that said products are designed mechanically and functionally to perform to specifications.

This warranty is effective providing:

- The equipment is used within the intended operating conditions and in accordance with Kobelt recommendations
- The equipment is installed according to equipment diagrams, specifications and recommendations which Kobelt has provided

This warranty becomes invalid if the factory supplied serial number has been removed or altered on the product. This warranty does not cover cosmetic damage or damage caused by an act of God, accident, misuse, abuse, negligence or modification of any part of the product. This warranty does not cover damage due to improper operation or maintenance, connection to inappropriate equipment or attempted repair by anyone other than an authorized Kobelt representative.

Upon identification of a potential issue or defect with a Kobelt Product or Part, the Warranty Applicant ("Applicant") must immediately contact Kobelt and describe the issue in writing, by letter, fax, email or other electronic conveyance. Kobelt will then assess the cause of the defect and determine warranty applicability and appropriate remediation.

If any part is found to be defective, Kobelt will replace said part FOB the Kobelt factory provided that any such defective part is returned by the Buyer with freight and applicable forwarding charges prepaid by the Buyer. Kobelt's sole obligation to the Applicant will be to repair or replace the defective part with same or similar product, to a maximum value of the list price of the product or part. The Kobelt warranty does not cover labour charges, travel or any other associated expenses.

All Products and Parts manufactured by Kobelt, with the exception of brake discs and pads, are subject to a warranty against manufacturer's defects in materials or workmanship for a period of two (2) years from the date of purchase. Thrusters and brake discs are subject to a one (1) year warranty period, and brake pads and linings are not covered by warranty.

Kobelt will be responsible for all Products or Parts sold by Kobelt but manufactured by 3rd party manufacturing companies. However, these products and parts are subject to applicable 3rd party warranties and may not be the same as the Kobelt warranty.

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