

KOBELT

STEERING SYSTEMS

A PRELIMINARY GUIDE TO HELP YOU GET STARTED





Founded over 45 years ago by Jack Kobelt, Kobelt Manufacturing is an international leader in marine technology, with a commitment to manufacture the finest integrated steering and engine control products on the market today, including custom solutions to fit almost any application.

Jack's legacy has resulted in a global reputation for design and engineering innovations, beautifully machined components of enduring die-cast bronze and stainless steel, plus deliveries and competitive pricing worldwide.

Quality, precision, style and endurance - qualities that make Kobelt products go the distance and stay the course. Rated 5-stars and built to last, every one of them is backed with the best warranty in the industry, along with worldwide sales and support.

Kobelt. Setting new standards in marine controls.

Steering Systems Overview

This steering guide will help to explain the different steering systems available so that you will be more comfortable moving in a direction that is right for you.

Kobelc Manufacturing specializes in hydraulic and electro-hydraulic systems, with the following 4 types to choose from:

- ▶ manual hydraulic steering
- ▶ electric power steering
- ▶ power assisted steering
- ▶ electronic steering

1 Manual Hydraulic Steering
works entirely “by hand” and is dependent solely upon the force/movement of the wheel to push hydraulic oil to the steering cylinder which will direct the vessel.

2 Electric Power Steering
driven by an electric power pack activated by a jog lever which forces the hydraulic oil to the steering cylinder.

3 Full Hydraulic Power Assisted Steering
operates with a power assisted cylinder (or servo cylinder). The oil moves through the servo valve, instead of through the entire cylinder requiring less turns of the wheel. Manual hydraulic back-up is provided in the event of a power failure.

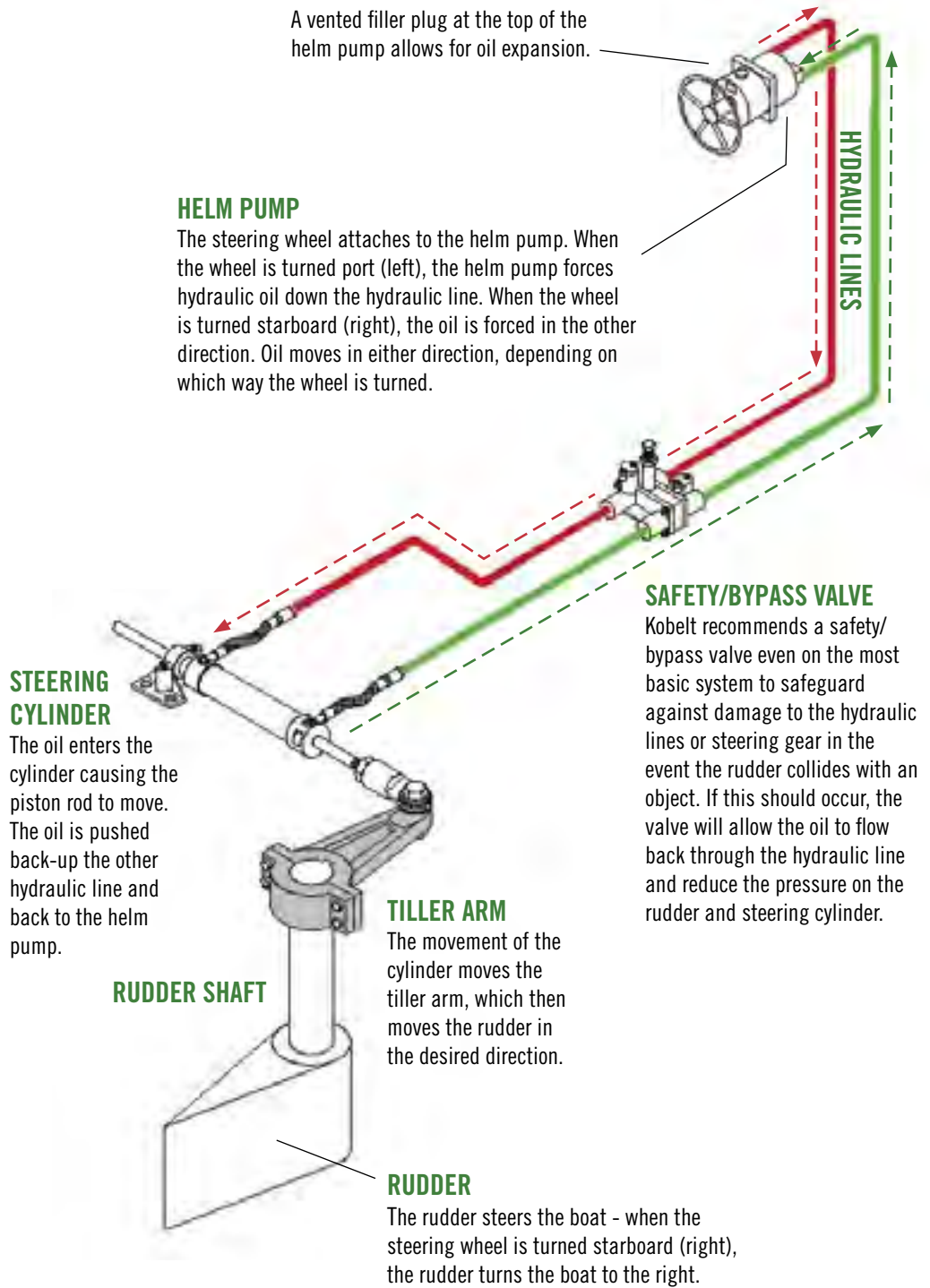
4 Electronic Steering
powered completely by an electronic control system, suitable for large vessels with multiple control stations.

In addition to the above systems, **hybrid** or **combined** systems are also available. *Please contact our sales department for a custom solution to fit your needs.*



Manual Hydraulic Steering

Here is how it works



A vented filler plug at the top of the helm pump allows for oil expansion.

HELM PUMP

The steering wheel attaches to the helm pump. When the wheel is turned port (left), the helm pump forces hydraulic oil down the hydraulic line. When the wheel is turned starboard (right), the oil is forced in the other direction. Oil moves in either direction, depending on which way the wheel is turned.

STEERING CYLINDER

The oil enters the cylinder causing the piston rod to move. The oil is pushed back-up the other hydraulic line and back to the helm pump.

SAFETY/BYPASS VALVE

Kobelc recommends a safety/bypass valve even on the most basic system to safeguard against damage to the hydraulic lines or steering gear in the event the rudder collides with an object. If this should occur, the valve will allow the oil to flow back through the hydraulic line and reduce the pressure on the rudder and steering cylinder.

TILLER ARM

The movement of the cylinder moves the tiller arm, which then moves the rudder in the desired direction.

RUDDER SHAFT

RUDDER

The rudder steers the boat - when the steering wheel is turned starboard (right), the rudder turns the boat to the right.

BENEFITS

- ▶ produces a smooth & easy method to steer a boat
- ▶ reliable – providing many years of trouble - free steering control
- ▶ simple & inexpensive to install

The diagram shows the most basic manual hydraulic system. However, additional helm stations or another rudder can be added to work in multiple configurations. Kobelc will customize the system to work for your specific vessel's needs.

MANUAL HYDRAULIC STEERING - SYSTEM PARTS

A manual hydraulic steering system must be sized and installed correctly.

STEERING CYLINDER

The first step to building your steering system is to select the correct size of steering cylinder for your boat.



The steering cylinder size is based on the vessel rudder area, boat speed and hull form - a complex calculation that gives the rudder torque for your particular vessel. Kobelt Manufacturing calculates this for you when ordering, helping you select the correct steering cylinder to meet your specific needs.

VALVES

Are you outfitting a sailboat or a motorized vessel?



The answer to this question will determine what kind of valve will be used on your helm pump. Most helm pumps come with a **lock valve** at the back. This valve prevents the oil from returning to the helm pump - holding the rudder in position - until you are ready to change the rudder position. When you are operating a sailboat, however, you will not want this feature. Instead Kobelt can install a **sailing valve** allowing the oil to move continuously through the lines. Sailors and Helmsmen prefer this because then they can “feel” the changing pressure on the rudder as they steer. But with motorized vessels, this is not necessary.

A **Safety/Bypass Valve** is an important addition to a steering system. Even if you have a very basic system, this valve could protect your system from damage if your rudder unexpectedly collides with an object.



HELM PUMP

The helm pump is sized to match the steering cylinder. Our quick sizing guide lists the Kobelt helm pump with the corresponding number of steering wheel turns. Three of the five Kobelt helm pumps have adjustable output.



This allows you to select the preferred number of steering wheel turns from hard over to hard over. For any given rudder load, the steering wheel effort increases with the fewer wheel turns that are selected. (In other words, the less wheel turns you select to hard over, the more difficult it is to turn the wheel.) Factors that influence the steering effort are the size of the steering cylinder, the number of steering wheel turns from hard over to hard over and the diameter of the steering wheel.

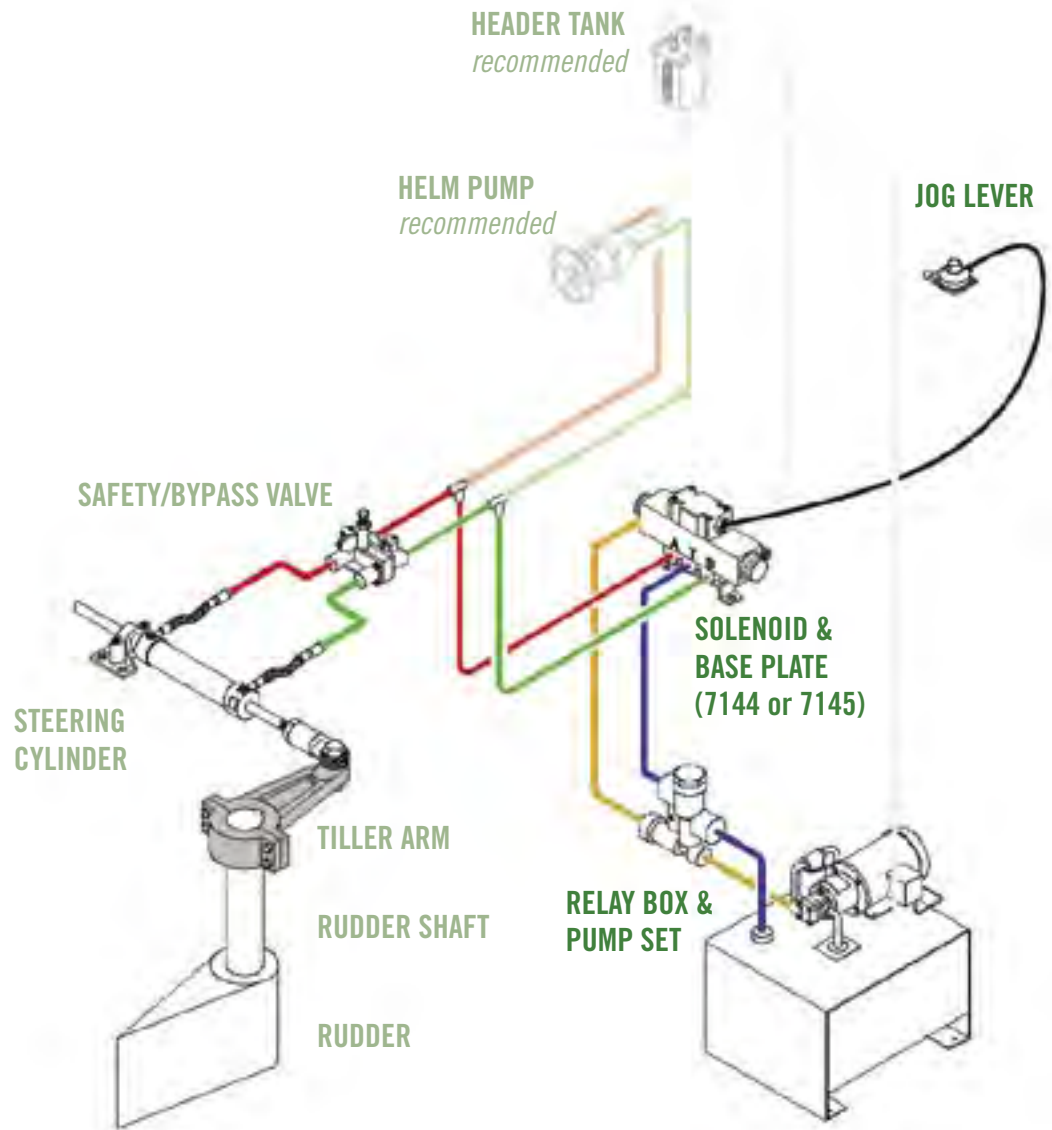
What size of boat works best with this system?

- ▶ rudder shaft diameter up to 4.7" (120 mm)
- ▶ steering gear torque up to 10,850 lbs-ft (1500 kgm) - see back for more details on torque
- ▶ steering cylinder displacement up to 180 cubic inch 3000 cm³
- ▶ steering gear pressure up to 700 PSI (50 bar)
- ▶ steering wheel hard over to hard over turns up to 15

Exceeding any of the above upper limits will require very strenuous effort. For steering systems approaching the above upper limits, a power-driven steering system is recommended.

Electric Power Steering

Here is how it works



BENEFITS

- ▶ easily integrated into other steering configurations
- ▶ finger-tip control with minimum effort
- ▶ can be a back-up system or a main source of steering

Basic Terms: **Non Follow-Up** refers to a steering system that activates the rudder as long as the jog lever is held to the request. When the jog lever is moved into the "on" position, the rudder begins to turn and continues to turn until the lever is released or it reaches the limit of its operation.

ELECTRIC POWER STEERING - SYSTEM PARTS

JOG LEVER

7170

This unit is operated by two internal micro switches. The jog lever will override the steering wheel; however, it will not cause any interference with manual hydraulic steering in the event of a power failure.



RELAY BOX AND PUMP SET

7201

This unit is intended for intermittent steering or auto pilot. Continuous use will burn out the small motor; which should not exceed 30amps on a 12V system, or 15 amps on a 24V system. A lock valve is fitted on the pump set to prevent hydraulic feedback from the steering system.



SOLENOID AND BASE PLATE

7144 base (single solenoid) or
7145 base (dual solenoid)

A source of hydraulic pressure is required to activate this unit. By energizing one solenoid valve and setting the flow control for the appropriate speed, the rudder can be operated by directing the flow of oil from a hydraulic power source. It is recommended that pressure compensated pumps be used to reduce heat and for better economy. The 7144 and 7145 can also be used for auto fill to your header tank.



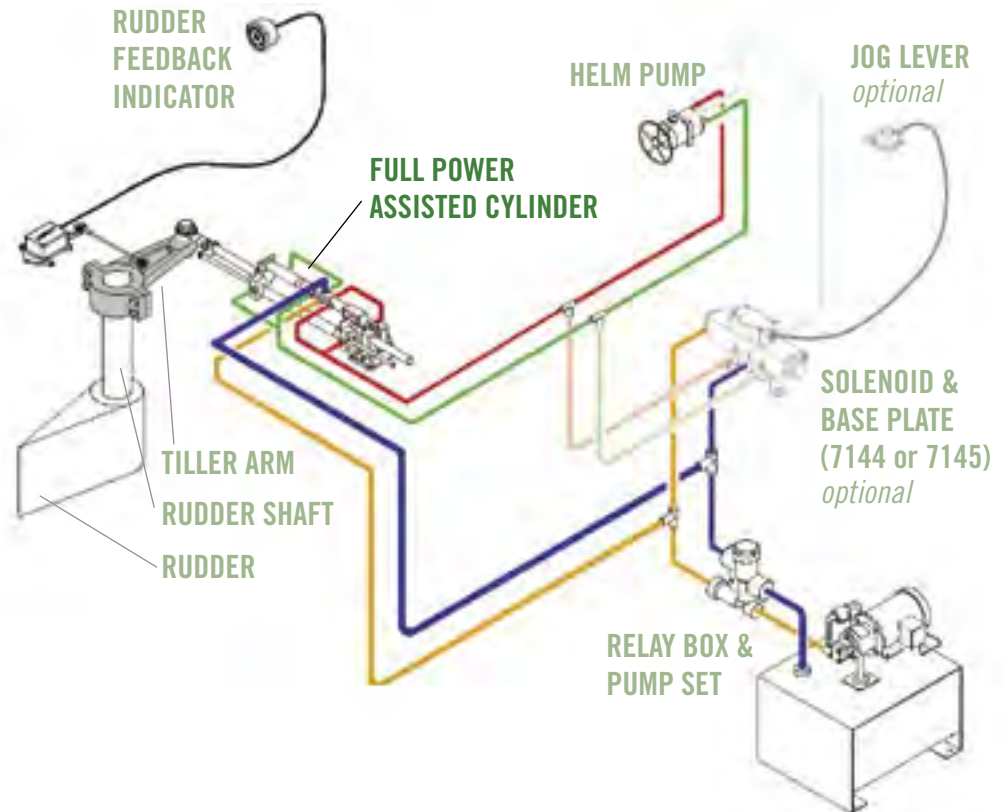
Electric Power Over Hydraulic Steering

While the jog lever is activated a 12 or 24 V signal is sent to a relay box or solenoid valve. The solenoid valve or relay box will then direct the flow of hydraulic oil through a base plate or pump set in the desired direction. Hydraulic oil flow will pressurize either the port or starboard sides of the cylinders, subsequently moving the rudders in the desired direction. Once the jog lever is released, all flow to the cylinders will immediately stop, leaving the rudders in a set position. The rudders will not return to center once the jog lever is released.

Kobelt's electric power steering can be integrated into any of Kobelt's other steering configurations, as well as auto pilot systems. Electric power systems have been used as both a back-up system or as a main source of steering. Electric power steering is usually a single point failure set-up and it is recommended that a manual hydraulic system accompany this configuration.

Full Hydraulic Power Assisted Steering

Here is how it works



BENEFITS

- ▶ very compact and easy to install
- ▶ low maintenance
- ▶ very few and easy steering wheel turns to hard over

The function of a hydraulic power assisted cylinder is to turn manual hydraulic steering into power steering. You will have finger tip control over your rudders at all times with Kobelt's patented servo assisted power cylinders. With a source of hydraulic power, your manual hydraulic system can easily and economically be converted into a luxurious power steering system. Full hydraulic power assisted steering is ideal for large vessels, or commercial ships that may experience high torque on the rudders. Even in the roughest seas you will feel no load on your helm.

FULL HYDRAULIC POWER ASSISTED STEERING - SYSTEM PARTS

FULL POWER ASSISTED CYLINDER

This unit is an extremely compact device and provides the ultimate in simplicity as far as installation and maintenance is concerned. Since the servo cylinder and spool valve is incorporated onto the main cylinder, no additional linkage is needed. This unit is constructed entirely in bronze and

stainless steel and is able to withstand harsh conditions for years of trouble-free service.



How it Works

- ▶ Full hydraulic power assisted steering needs a source of hydraulic pressure to function. When the helmsman turns the helm pump in the desired direction, a servo cylinder attached to the side of the main cylinder will move a spool valve attached to the top of the main cylinder. This valve will direct hydraulic oil from the ship's power pack to the correct side of the main cylinder to coordinate with the helm pump. The rudders will continue to move at a constant speed which is determined by the amount of flow allowed by the system.
- ▶ In this system, the helm pump works only to move the spool valve on top of the main cylinder. The power needed to move the rudders will come from the source of hydraulic pressure, giving the helmsman the feeling there is no load on the wheel.

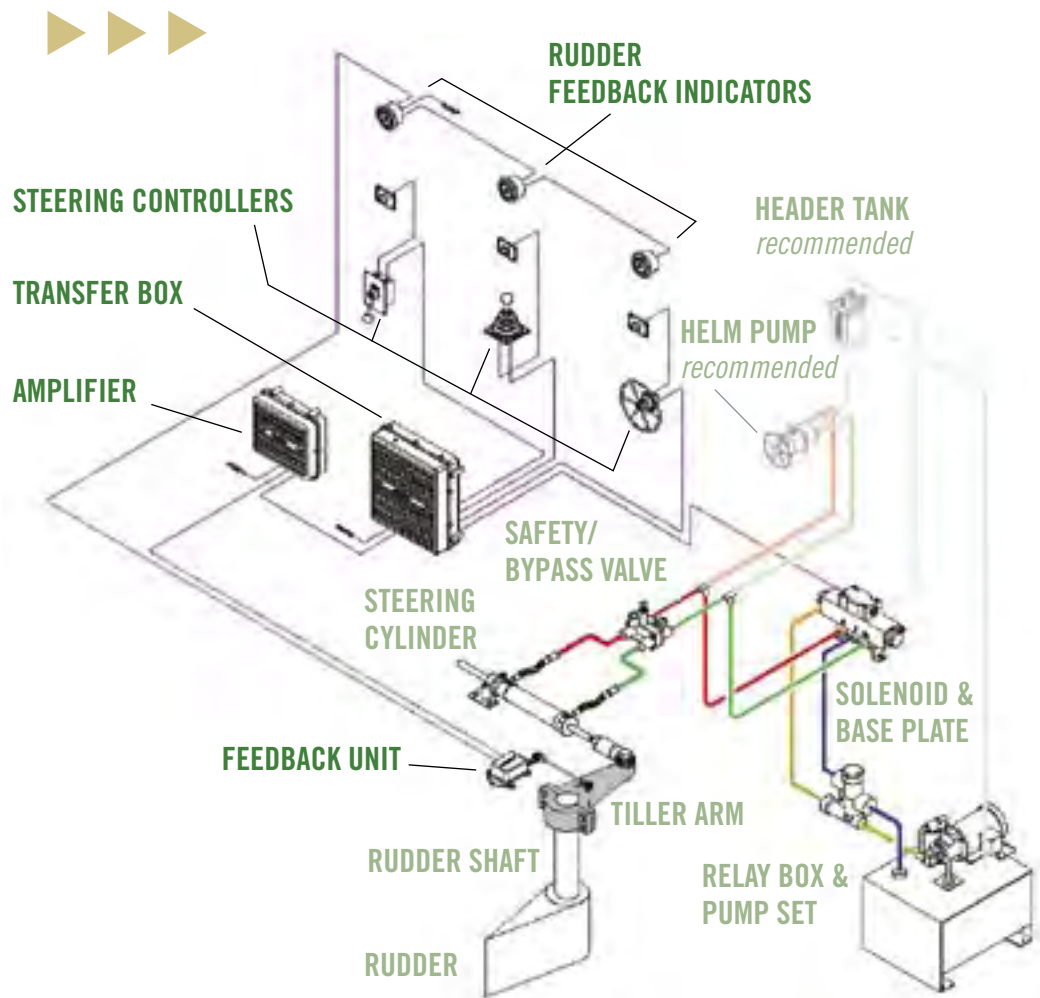
This is especially helpful when running very large steering cylinders which may become hard to control in rough seas.

▶ IN CASE OF EMERGENCY

In the event of a power loss your hydraulic power assisted cylinders will act as manual hydraulic steering cylinders. Once there is no longer hydraulic pressure on the spool valve, it will become deactivated allowing manual hydraulic flow from the helm pump to reach the main cylinder. You will immediately notice the full load of the steering gear on your wheel, giving you manual hydraulic back-up control. Once power is restored, the spool valve on the main cylinder will automatically engage and power assisted steering will become operational.

Electronic Steering

Here is how it works



Electronic Steering Advantage

BENEFITS

- ▶ offers unlimited options
- ▶ faster reaction time for steering gear
- ▶ cost efficient to install even the most complex systems

Kobel's electronic steering offers unlimited options that can satisfy even the most advanced systems. Unlike non follow-up electric over hydraulic steering (steering configuration 2), the helmsman can set desired coordinates with little or no corrections. The amplifier will simply follow-up with your commands, positioning the rudders accordingly. This is ideal for larger vessels that may have slower reacting steering gear. Whichever direction your control lever is positioned is the same direction your rudders will be positioned. (For example, when using electric steering, even though your jog lever is put back to center, this does not mean your rudders are necessarily centered. When your electronic control lever is set to center, your rudders will also follow back to center with an electronic steering set-up.)

With electronic steering an unlimited number of stations may be utilized by using a transfer box, as described in the multi-station section. Electronic steering also brings the luxury of finger tip control over even the largest steering cylinders. With a manual hydraulic system, large cylinders may be hard to turn especially in the rough seas. With Kobelt's electronic steering, you will have complete control in all conditions. Kobelt electronic steering can be integrated with your auto pilot system with the simple installation of an amplifier transfer box.

Electronic steering also brings you a cost efficient way to install the most complex systems. You can eliminate costly installation of hydraulic piping to each station with easier to install electric cabling. Electronic installation is ideal for catamarans which present numerous problems for full hydraulic steering, such as rudder synchronization.

HOW IT WORKS

Kobel's electronic steering centers around an amplifier, which accepts command from a variety of controllers. Once the command is received the amplifier coordinates this signal to adjust the rudder in the desired position. When your steering controller is engaged to either port or starboard, the amplifier will activate a solenoid, normally attached to a base plate, to disperse oil to the steering cylinders and position them in the desired direction. The rudder feedback unit, connected to the tiller arm close to the steering cylinders, will then send a signal to the amplifier indicating the current position of the rudders. The amplifier then compares the respective command and feedback signals from the controller. If the signals are not equal, the amplifier applies directional control through the solenoid to move the rudder in the correct direction. Once these signals match, the amplifier will stop the solenoid from dispersing oil and the rudders stop.

MULTIPLE STATIONS

In cases where multiple stations are needed a station transfer box is required. This is because the amplifier only reads one signal at a time and connecting multiple controllers to one amplifier may cause failures. The station transfer box ensures only one signal is sent to the amplifier at a time. If you have an auto pilot, this must be treated as a new station and should go through your station transfer box to avoid failure.

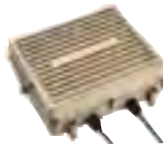
IN CASE OF EMERGENCY

In many cases vessels are required to have back-up steering to conform to regulation standards or just for reassurance. With Kobelt's electronic steering you can have either electronic back-up with the installation of a second amplifier and/or station transfer box; also, manual hydraulic steering, which can be activated by simply deactivating the electronic steering by way of a shut-off switch; as well, an electric non follow-up steering jog lever can be installed directly to the solenoid. Any combination of these systems can be used to eliminate single point failures, as well as provide reliable back-up in emergency situations.

ELECTRONIC STEERING - SYSTEM PARTS

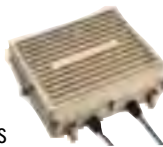
AMPLIFIER

This unit is designed to accept the command signal from Kobelt's many steering controllers and coordinates the desired rudder position with Kobelt's feedback units. The amplifier will activate a solenoid which will then disperse hydraulic fluid to the cylinders. This model can be located anywhere aboard ship, even in the steering compartment, since it is water-tight.



TRANSFER BOX

The transfer box is used as a central source for all of your electronic steering controllers. The transfer unit will ensure only one signal reaches the amplifier at a time, eliminating the possibility of signal interference. It is recommended that all steering controllers be equipped with station select switches including your auto pilot.



STEERING CONTROLLERS

Whether you need a steering wheel, joy stick or jog lever, Kobelt has a variety of quality steering controllers. Each controller model

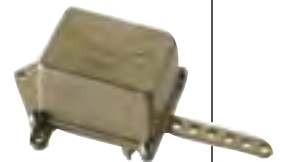


comes with many options, both aesthetically and functionally. All of Kobelt's steering controllers are made in bronze and stainless steel for years of trouble-free service.



FEEDBACK UNITS

Rudder feedback units are mechanically connected to the rudder stock. Their purpose is to feed back the rudder position to the amplifier, which is then compared to the signal from the steering controller. There are many functional options for Kobelt rudder feedback units. A rudder indicator can also be connected so the helmsman can see which position the rudders are in.

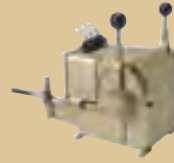


RUDDER FEEDBACK INDICATORS

Indicators will continuously monitor the movement and position of the rudders. Indicators are equipped with a translucent display, optional dimmer switch and waterproof face.



ELECTRONIC CONTROLS



PUSH-PULL CONTROLS



DISC BRAKES



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