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Accu-Steer, Inc.

HIGH-PERFORMANCE HYDRAULIC CONTROL OF STEERING SYSTEMS

Defining
Reliability
through form and function.

(Each unit is completely tested after assembly)

Dedicated to quality high-performance hydraulic control of steering systems for yachts and commercial vessels.

Instruction Manual
PS8

**POWER STEERING
REVERSING PUMPSET MODULE
FURUNO AUTOPILOT**

POWER STEERING REVERSING PUMPSET
MODULE FURUNO AUTOPILOT

PS8

INSTRUCTION MANUAL

This manual is intended as a reference guide for correctly installing and maintaining the **PS8** power assist steering system.

Please take time to read this manual to get a thorough understanding of the reversible pumpset and its relationship to a complete autopilot system.

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1. DESCRIPTION OF THE HRP PUMP/STEERING SYSTEM

Hydraulic steering systems consist of a hydraulic actuator (normally a cylinder) and one or more steering wheel pumps (helm pumps). As the steering wheel (helm pump) is turned in the port direction, hydraulic oil is pumped into the port hydraulic steering line. This oil is directed into the port side of the steering cylinder. As the cylinder moves to port, oil from the starboard side of the cylinder returns to the helm pump through the starboard hydraulic lines.

One end of the cylinder is fixed and the other end is connected to a tiller arm, which is connected to a rudder shaft. With this connection to a tiller arm the linear movement of the cylinder to port is changed to rotary movement, which turns the rudder and steers the vessel to port.

Moving the steering wheel to starboard produces the same reaction with oil being pumped out of the starboard line and returning through the port line. If more than one helm pump is used, a return/fill line must be installed to connect the cases of all the helm pumps together.

If an autopilot is to be installed, the hydraulic reversing pumpset is connected in the same manner as a helm pump with a port, starboard and a return/fill line.

The **Accu-Steer PS8** is designed to be used together with one of the **HRP** pump models (**HRP05**, **HRP11**, **HRP17** or **HRP100**). The **HRP** series are reversing pump units designed to interface a hydraulic steering system with electric or autopilot control. The output flow rate of the pumpset determines the speed of the steering cylinder. The **HRP05** pumpset outputs 0.5 cu in/sec or 8.2 cubic centimeters per second (cc's/sec). The **HRP11** pumpset outputs 1.0 cu in/sec or 16.4 cc's/sec. The **HRP17** outputs 1.6 cu in/sec or 26.3 cc's/sec. The **HRP100** pumpset is adjustable and outputs from 0 to 3.85 cu in/sec or 63.3 cc's/sec.

Most steering cylinders are balanced, which means the volume of oil on both sides of the cylinder is equal. A steering cylinder is balanced when the piston rod of the cylinder protrudes from

both ends. Some cylinders are unbalanced in which the piston rod protrudes from one end only. These are common on some in-board and out-board drives and are usually referred to as side drives or simply unbalanced cylinders. These **Accu-Steer HRP** pumpsets are capable of working with both balanced and unbalanced cylinders. When unbalanced cylinders are used it is recommended that a vented header tank is used to allow for the expansion and contraction from the unbalanced cylinder.

2. TECHNICAL SPECIFICATIONS and APPLICATION

Model Number	HRP 05-12	HRP 11-12	HRP 17-12	HRP 05-24	HRP 11-24	HRP 17-24
Voltage	12 VDC	12 VDC	12 VDC	24 VDC	24 VDC	24 VDC
Output/Sec	0.5 cu in/sec	1.0 cu in/sec	1.6 cu in/sec	0.5 cu in/sec	1.0 cu in/sec	1.6 cu in/sec
Average Motor Amp	3-5	4-6	5-8	2-4	3-5	3-5
Weight	10 lbs 4.5 kgs	10 lbs 4.5 kgs	10 lbs 4.5 kgs	10 lbs 4.5 kgs	10 lbs 4.5 kgs	10 lbs 4.5 kgs

The output flow rate of an electric pumpset determines the maximum speed of the rudder. Under normal conditions a rudder speed of 10 to 16 seconds will provide the best steering results for most autopilot systems. It is therefore important to select the proper pumpset to optimize your autopilot operation.

First determine the volume of your steering cylinder. This is usually indicated in the instruction manual of your steering system. Enclosed at the back of this manual are lists of various steering cylinder manufacturers with their cylinder models and volumes.

If you have to calculate the volume of your cylinder manually you can use the following formula:

$$\text{Volume} = L(D^2 - d^2)\pi \div 4$$

where:

L = length of stroke of cylinder

D = internal diameter of cylinder
d = diameter of piston rod
 $\pi = 3.14$ (Pi)

The rudder speed, hard over to hard over (HOH), is determined by dividing the volume (cubic inches) of the cylinder by the output of the pumpset (cubic inches per second). *For example: a 15 cu in cylinder speed would be approximately 14 seconds HOH using an HRP11 or approximately 9 seconds using and HRP17.*

3. DESCRIPTION OF THE PS8

3.1 GENERAL

The Accu-Steer **PS8** valve block is mounted directly on an **HRP** pump unit. Combined they provide power assist steering capability and autopilot/electric steering hydraulic drive. The **PS8/HRP** unit is installed in the hydraulic steering system between the helm pump(s) and the steering cylinder. If the **PS8** is not in the operational mode the steering oil from the helm(s) passes through to the steering cylinder. When the **PS8** is activated the oil from the helm passes through as before but the oil pressure and direction is sensed and the **HRP** reversing pump is operated in the same direction as the oil flow from the helm pump. As the helm operator turns the helm pump the reversing pump will continue to operate. When the helm wheel is stopped the **PS8** sensors turn off the reversing pump.

3.2 MOTOR

The electric motor has the following features:

- Ignition protected (UL 1500 and SAE-1171)
- Ball bearing shaft supports both ends
- Extended motor shafting eliminating the pump/motor coupling
- Machined pilot bore ensuring aligned pump/motor adapter mounting
- Cushioned foot mounts for quiet operation

3.3 PUMP

The reversing gear pumps (**HRP**'s) use gerotor style pump unit. The gerotor gear was used because of its quiet operation and

its efficient pumping capabilities.

The gears are driven directly from the extended motor shaft thereby eliminating the need for a pump/motor shaft coupling.

The shaft is supported by the motor ball bearing on one side and a bronze bushing on the other side.

The gerotor pump is a two-piece gear assembly with an eccentric ring. Proper clearances and alignments are maintained through CNC precision machining.

Valve block sealing is accomplished using O-ring style seals.

The shaft seal is accomplished using a rubber shaft seal rated at 50 psi. This shaft seal is connected to the tank/return line pump chamber. If this tank port is connected to a steering line or is over pressurized it may cause this seal to fail. See the installation instructions for more details.

3.4 VALVE BLOCK and VALVES

The valve block is an aluminum block, precision machined to house the valves, direct the oil and serve as the endplate for the gear pump. The pump end plate is referenced to the valve block with locator pins to ensure the proper alignment.

The suction make-up valves are located between the return line port and the pump output internal ports. These allow the pump to “breathe” properly in the event of air from the steering lines entering the pumpset.

The output check valves are part of what is called a lockvalve assembly. The lockvalve assembly consists of two output check valves and a lockvalve spool. In the non-running position the spring operated check valves remain closed, isolating the pump from the steering system. The spring action of the check valves holds the lockvalve spool in the mid-closed position.

The end plate houses the pump shaft guide and aligns the pump.

4. INSTALLATION

4.1 MECHANICAL

The **PS8/HRP** pumpset must be mounted on a horizontal shelf

or bracket with a solid foundation. The pump can be bolted or screwed down with the motor foot bracket. The foot bracket is fitted with anti-vibration mounts to maintain the quiet operation of the pumpset. The pumpset should be close to and below the steering lines for ease of connections and bleeding.

4.2 HYDRAULIC

Before connection to the hydraulic lines, ensure all the hydraulic lines in the steering system are clean and free of any contaminating particles, which could enter the pump and cause it to fail.

Most steering manufacturers have recommended hydraulic oils to be used in their systems. The **HRP** pumpsets are compatible with these oils. Most manufacturers use an ISO #32 or ISO #10 type of oil.

Five hydraulic connections are required to the **PS8/HRP** pumpset. Two lines connect the helm pump(s) to the **PS8** and two lines connect the **PS8** to the steering cylinder.

It is critical to identify which of the steering lines is port or starboard and to maintain this identification throughout. The **PS8** is labeled HELM "A", HELM "B" and CYL "B". The additional line, interconnect/fill line, connects the **PS8/HRP** unit to the header tank or helm pump case. This fill line is critical, as it provides make up oil and allows the pumpset to vent any air, which may enter the pumpset from the steering lines. It is recommended that flex hose be used for all lines to prevent any pump noise from being transmitted to the steering system. The port and starboard steering lines should have a pressure rating of 1000 psi minimum; where the fill/interconnect line is a non-pressurized line.

All hydraulic connections on the **PS8** valve block are 7/16"-20 UNF (ORB -04) threads and are fitted with adapter to 1/4" NPT (National Pipe Thread). If installers prefer the adapters can be removed and connections can be made directly to the valve block. When installing the hydraulic fitting in the 1/4" NPT connection a pipe thread sealant such as Teflon paste must be used.

NOTE OF CAUTION: *It is important that the port or starboard line does not become crossed with the fill/interconnect line as*

*this could cause high pressure to be introduced into the pumps tank cavity. In steering systems where the fill/interconnect line is pressurized (e.g. Hynautics or Teleflex) the recommended operating pressure is approximately 20 to 25 psi. The shaft seal on the **HRP** pumpsets is rated at 50 psi and is well within the pressure range of these steering systems. Over-pressurizing these steering systems and causing a shaft seal failure will void the warranty of the pumpset.*

4.3 ELECTRICAL

The power (12 or 24 VDC) is connected to the junction box on the **PS8/HRP** unit. The positive connection is B+ and the negative connection is COMMON. If an autopilot is installed with the **PS8/HRP** unit the connections are as follows.

5. PREPARATION and TESTING

5.1 HYDRAULIC FILLING AND TESTING

When installing a pumpset it is recommended that the system be flushed to ensure that the oil is clean and free of contamination throughout the hydraulic steering system.

After the hydraulic and electrical connections have been made, allow sufficient time for the pump and the lines to fill with oil. Operate the pumpset and note the HOH time. This time varies with the type of steering system and autopilot used.

5.2 TESTING

Most new autopilot systems will perform this test during their dockside set-up procedures.



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