HPU200
Accu-Steer Hydraulic Power Unit

Owner's Operation, Installation & Maintenance Manual

Accu-Steer

September 2019

Kobelt Manufacturing Co. Ltd.

NOTES:

RECORD DATA BEFORE INSTALLATION FOR FUTURE REFERENCE	
Model #:	
Serial #:	
Date of Purchase:	
Date of Installation:	

1 TABLE OF CONTENTS

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	**High Pressure Operation:** This HPU unit generates high pressure hydraulics. Ensure all power sources are locked out prior to performing work.

⚠WARNING	**Equipment Starts Automatically:** HPU units are controlled remotely and may activate suddenly causing bodily harm. Ensure all power sources are locked out prior to performing work.

⚠WARNING	**Disconnect Power:** Turn off power at distribution panel before beginning installation to protect installer from electrical hazards.

⚠CAUTION	**Voltage and Current Compatibility:** Confirm that the power source is compatible with the maximum voltage and current ratings of is product variant. Failure to do so could result in damage or fire.

2 PRODUCT DESCRIPTION

The Accu-Steer Electric Pumpset is designed to interface hydraulic steering with electric/autopilot control. Its compact and rugged construction provides ease of installation along with long life operation. This unit is available in a wide range of voltages and flows for both standard and custom requirements.

HPU series are suitable for vessels from 30' to 150' in length depending on the vessels steering characteristics. Proper pump selection is very important to optimize performance.

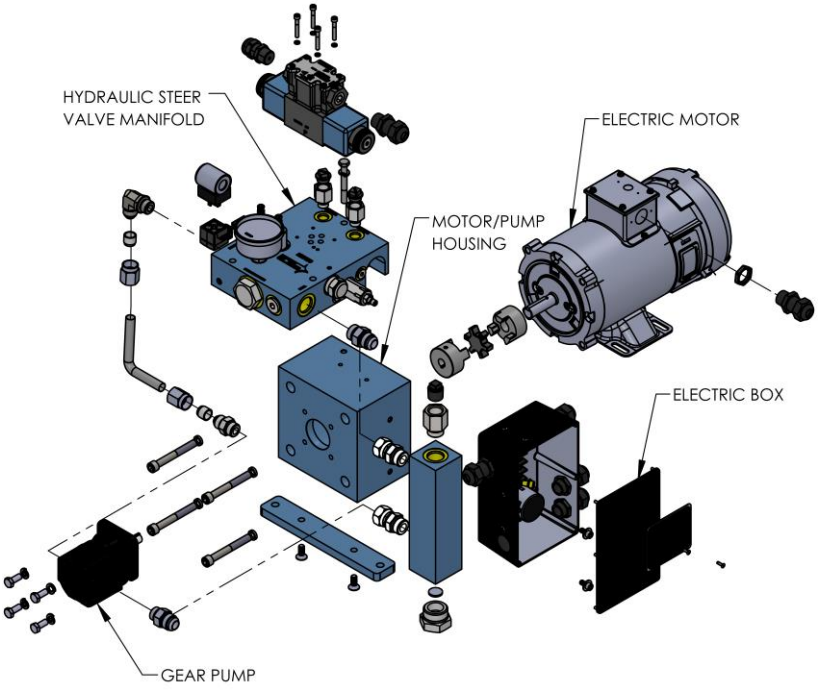


Figure 1: HPU200 Overview Diagram

2.1 COMPONENTS

The Accu-Steer Hydraulic Power Unit is a complete assembly consisting of an electric motor with control box, gear pump, hydraulic control manifold and heavy-duty adapter mount. As the

pump unit is self-contained, installation involves connecting the pump to the steering lines and the electrical control and adjusting the unit to the requirements of the vessel.

2.1.1 Electric Motor

The electric motor is a heavy-duty totally enclosed, fan-cooled unit featuring high efficiency permanent magnet construction, oversized brush gear with easy access, and standard foot and face mountings. The HPU200 is available with 12VDC, 24VDC or 115/230VAC motors.

The electrical junction box provides remote start and protected connections for the solenoid values for port, starboard, and two-speed operation.

2.1.2 Gear Pump

The gear pump is a compact rugged unit which features a cast iron case, hardened steel gears and a high-pressure shaft seal. The suction side of the gear pump is connected to a suction drop manifold. This manifold has oversized porting for low velocity oil flow and air/oil separation.

2.1.3 Hydraulic Steer Valve Manifold

The hydraulic manifold features the following:

- high pressure reusable filter
- pressure relief cartridge
- adjustable high and low flow control cartridges
- high speed solenoid valve
- pressure gauge
- Optional 4-way soft shift solenoid valve
- valve housing anodized aluminum with oversized porting

2.1.4 Motor/Pump Housing

This coupling interfaces all components of the pump set as well as provides a stable foot mount. The unit is machined to ensure accurate coupling of the motor and pump. It houses the flexible drive coupling, which transfers energy from the motor to the pump. The flexible drive coupling provides quiet vibration-free alignment. It is constructed of anodized aluminum.

2.2 TECHNICAL SPECIFICATIONS

Table 1: HPU200 Technical Specifications – DC Configurations

MODEL	HPU200-12	HPU200S-12	HPU200-24	HPU200S-24
KOBELT P/N:	600-140	600-140SS	600-141	600-141SS
NOMINAL MOTOR VOLTAGE	12 VDC		24 VDC	
MOTOR POWER (S1-CONTINUOUS)	0.75 HP		0.75 HP	
MAXIMUM MOTOR CURRENT	58 A		29 A	
NOMINAL SOLENOID VOLTAGE	12 VDC		24 VDC	
SOLENOID MAX. CURRENT	Direction: 2.5 A Speed: 1.7 A		Direction: 1.3 A Speed: 0.9 A	
MAX. OUTPUT	2 GPM [7.6 Lit. /min.]			
MAXIMUM ALLOWABLE PRESSURE • **A & B PORTS** • **T PORT**	1000 PSI [70 bar] 50 PSI [3.4 bar]			
RELIEF PRESSURE	750 PSI [51.7 bar]			
VALVE WITH SOFT SHIFT	NO	YES	NO	YES
SERVICE DUTY	Intermittent: 20% ON / 80% OFF			
RECOMMENDED FLUID	ISO VG 32, VI 60 Hydraulic Oil			
PORT SIZE AT MANIFOLD BODY	-06 SAE ORB			
PORT ADAPTERS	-06 SAE ORB TO 3/8" NPT			
OPERATING TEMPERATURE	14… 122°F [-10… 50°C]			
PRODUCT WEIGHT	66 lbs [30 kg]		60 lbs [27 kg]	

Table 2: HPU200 Technical Specifications – AC Configurations

MODEL	HPU200-115/230-12	HPU200S-115/230-12	HPU200-115/230-24	HPU200S-115/230-24
KOBELT P/N:	600-142	600-142SS	600-143	600-143SS
NOMINAL MOTOR VOLTAGE	115/208-230 VAC			
MOTOR POWER (S1-CONTINUOUS)	0.75 HP			
MAXIMUM MOTOR CURRENT	10.8 A (115 VAC) / 5.4 A (230 VAC)			
NOMINAL SOLENOID VOLTAGE	12 VDC		24 VDC	
SOLENOID MAX. CURRENT	Direction: 2.5 A Speed: 1.7 A		Direction: 1.3 A Speed: 0.9 A	
MAX. OUTPUT	2 GPM [7.6 Lit. /min.]			
MAXIMUM ALLOWABLE PRESSURE • **A & B PORTS** • **T PORT**	1000 PSI [70 bar] 50 PSI [3.4 bar]			
RELIEF PRESSURE	750 PSI [51.7 bar]			
VALVE WITH SOFT SHIFT	NO	YES	NO	YES
SERVICE DUTY	Intermittent: 20% ON / 80% OFF			
RECOMMENDED FLUID	ISO VG 32, VI 60 Hydraulic Oil			
PORT SIZE AT MANIFOLD BODY	-06 SAE ORB			
PORT ADAPTERS	-06 SAE ORB TO 3/8" NPT			
OPERATING TEMPERATURE	14… 122°F [-10… 50°C]			
PRODUCT WEIGHT	62 lbs [28 kg]			

2.2.1 Temperature Limits

The motor temperature has a maximum limit of 248°F [120°C]. Allowing the temperature to exceed this limit will permanently damage the motor windings. The maximum oil temperature limit is 149°F [65°C].

Observe the operating temperature range limits as presented in Table 1. Do not operate the unit if the ambient temperature where the unit is located exceeds these limits.

NOTICE	Exceeding these temperatures may result in reduced operational life or damage to the product.

2.2.2 Pressure Range

The normal operating pressure of the unit is 0 to 750 psi. Avoid operating the unit against the rudder stops for prolonged periods of time.

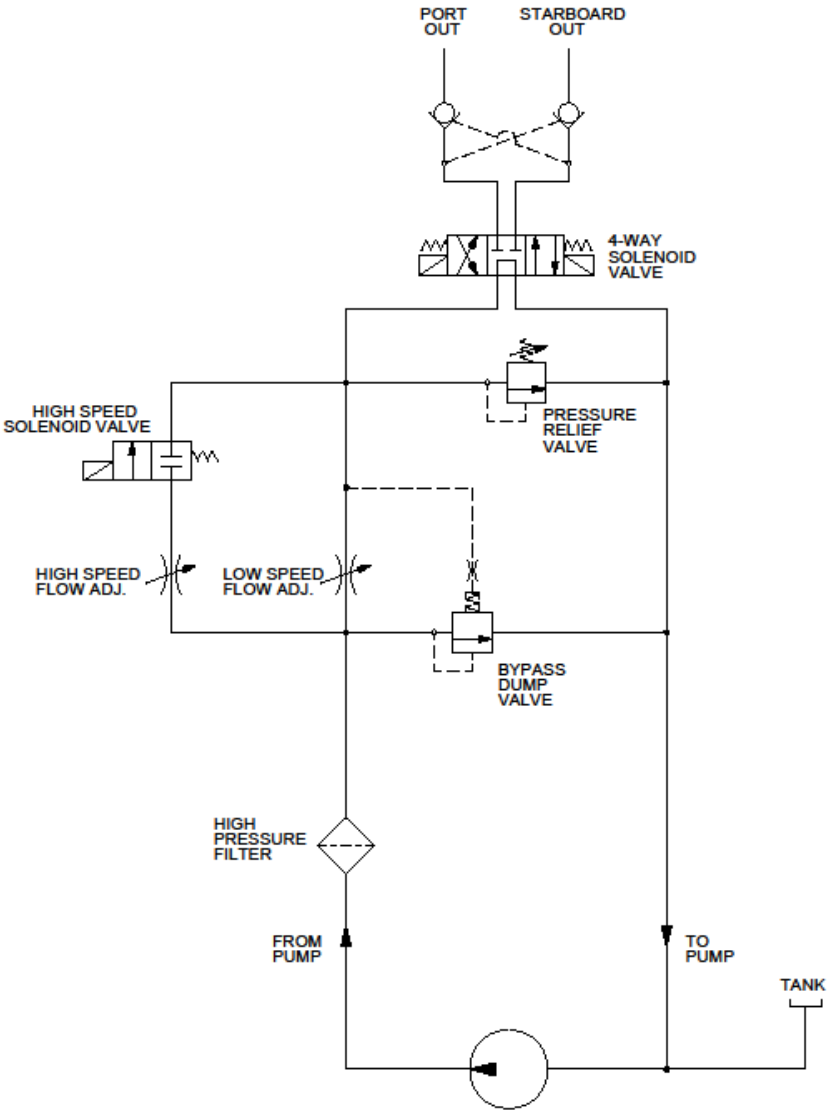


Figure 2: Hydraulic Schematic

3 INSTALLATION

3.1 MECHANICAL

The pump-set must be placed on a horizontal bracket with a solid foundation. It should be close to and below the steering lines for ease of connections and bleeding.

The HPU is equipped with (2) two clearance holes for 3/8” bolts and (4) four holes for 5/16” bolts through the mounting feet. Ensure that the unit is securely fastened to a suitable foundation.

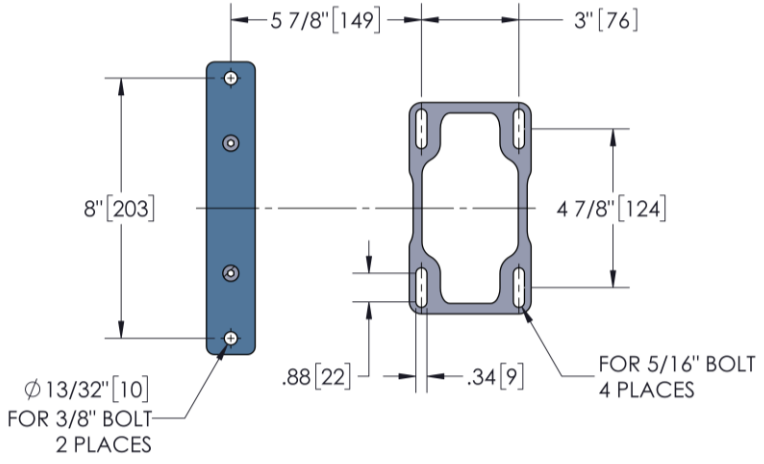


Figure 3: HPU Mounting Pattern

3.2 HYDRAULIC

Three hydraulic connections are required to the pump set. Two lines connect the main steering lines, and the third line to the header tank of interconnect line which compensates for thermal expansion of the oil and self bleeds air from the system.

Flexible hose with a pressure rating of minimum 1500 psi working pressure is recommended for the steering line connections. Flexible hose (min. 250 psi pressure rating) is recommended for the fill/interconnect line. The hose should be minimum 3/8” inner diameter.

A shut-off, or isolation, valves are strongly recommended for all three lines to provide isolation in case of pump set failure.

NOTICE	Ensure the plugs remain in place until the unit is ready for connection.

NOTICE	All piping and hoses must be flushed prior to connection. Failure to do so can result in damaged components and seals.

The two hydraulic ports on the valve block are fitted with 3/8" NPT (National Pipe Thread) adapters. If preferred, the adapters can be removed, and connections can be made directly to the valve blocks -06 SAE ORB ports. When installing the hydraulic fitting in the 3/8" NPT port a pipe thread sealant such as Teflon paste must be used.

NOTICE	All hoses and piping must also be plugged or capped until ready for connection.

The piping to the steering cylinder should be 3/8" nominal size and no more than 1/2" with a suitable wall thickness to safely withstand the operating pressure. The Port and Starboard steering lines should have a pressure rating of 1000 psi minimum. Secure the piping against vibration with pipe clamps spaced every 3 feet [1 m].

The connections to the hydraulic manifold must be made by hoses of suitable rating to accommodate any movements, vibration, or thermal strain.

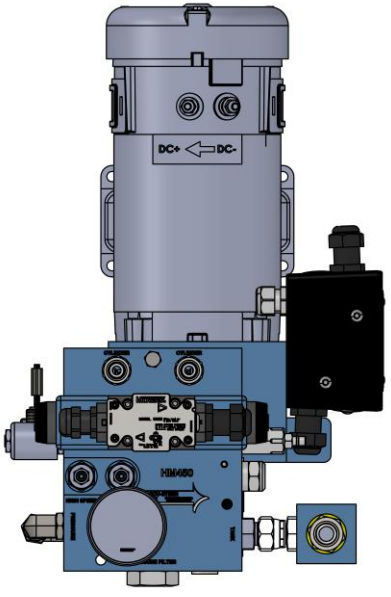


Figure 4: Connections in Top Face of Hydraulic Manifold

(3) three hydraulic connections are required for close loop:

- Connect ports 'CYLINDER' to the (2) two steering cylinder ports. It is not critical to identify which of the steering lines is Port or Starboard as most new autopilots will determine the pump direction and program the drive outputs to suit.
- Connect the 'TANK' port to the to pump suction line with recommended in line filter. (Figure 19)

(4) four hydraulic connections are required for open loop:

- Connect ports 'CYLINDER' to the (2) two steering cylinder ports. It is not critical to identify which of the steering lines is Port or Starboard as most new autopilots will determine the pump direction and program the drive outputs to suit.
- Connect the 'TANK' port to the to pump suction line with recommended in line filter.
- Connect the 'PRESSURE' to the pump. (Figure 20)

3.3 ELECTRICAL

The pump unit is manufactured for operation from 12VDC, 24VDC, or 115/208-230VAC supply voltages. Ensure that the unit has been ordered for the required operating voltage. The electrical junction box contains a terminal strip with connections to the port, starboard, and speed control solenoids located on the manifold.

When AC drive motors or large DC drive motors are used, the customer should ensure that their motor protection and starting circuits conform to ABYC recommendations or other applicable local electrical codes. Ensure that the electrical cable used to supply the motor and control connections are sized properly to prevent unreasonable voltage drop.

The solenoids use a common connection Terminal 5 and can be activated by a positive or a negative control signal. The port and starboard manifold coils are connected to Terminals 6 and 7 respectively. The high-speed coil is connected between Terminal 5 and 8. The high-speed coil uses the same polarity control signal as the port and starboard solenoids.

⚠CAUTION	**DO NOT** energize the coil detached from the valves. It may cause them to heat up beyond normal operating temperatures.

Table 3: HPU200 Wiring Connections – DC Motors

HPU200			
Terminal #	**Wire Name**	**Wire Colour**	**Function**
1	MOTOR	Red	Motor Positive
2	MOTOR	Black (Yellow)	Motor Negative
3	RELAY	Red	Start Relay Positive
4	RELAY	Black	Start Relay Negative
5	COIL COM	Green	Common Positive or Negative signal for solenoids coil control.
6	COIL PORT	Red	Positive or Negative signal for PORT direction solenoid coil.
7	COIL STBD	Black	Positive or Negative signal for STBD direction solenoid coil.
8	COIL SPEED	White	Positive or Negative signal for high-speed solenoid coil.

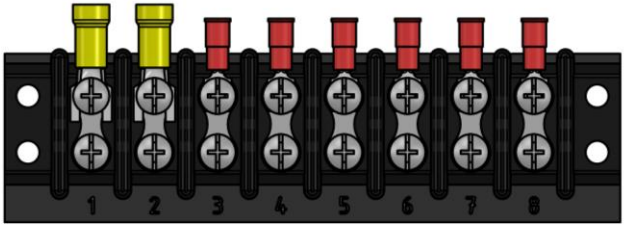


Figure 5: HPU200-DC Terminal Block Diagram

3.3.1 DC Motor Wiring

The following section details the motor wiring for either 12 VDC or 24 VDC motor operation.

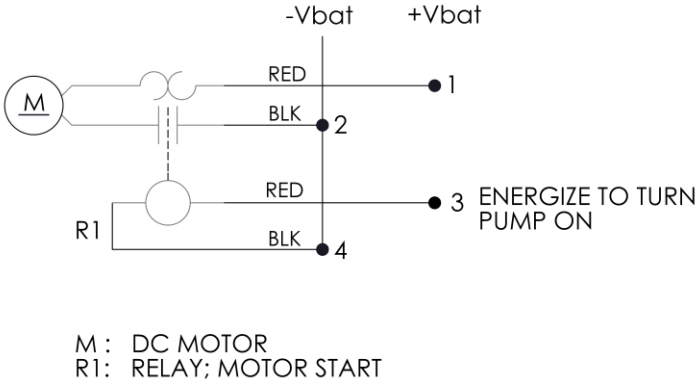


Figure 6: HPU200 DC Motor Wiring Diagram

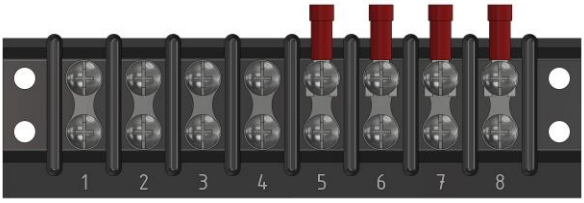


Figure 7: HPU200-AC Terminal Block Diagram

3.3.2 AC Motor Wiring

Motors for AC versions of the HPU200 pump set are not prewired to the terminal box. The installer must make the connections in the motor's terminal box. The following section details the motor wiring for either 115 VAC or 230 VAC operation.

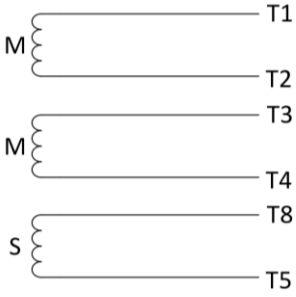


Figure 8: HPU200 AC Motor Wiring Diagram

Table 4: HPU200 Wiring Connections

Voltage	Rotation Direction	L1	L2	Join Together (Short)
115 VAC	CW	T1, T3, T5	T2, T4, T8	--
230 VAC	CW	T1	T4, T8	T2, T3, T5

Note that the AC versions are not supplied with a starting relay nor a circuit breaker. Providing an adequately sized contactor and circuit breaker is the responsibility of the installer.

⚠WARNING	The motor feed circuit must be protected with an adequately sized circuit breaker, disconnect switch and contactor.

3.3.3 Example Connection Diagrams

The following section contains various example methods for connection of the HPU.

NOTICE	It is recommended that installation work is carried out by a Kobelt Partner, authorized service representative, or trained installation technician. Please contact the nearest Kobelt authorized distributor for assistance.

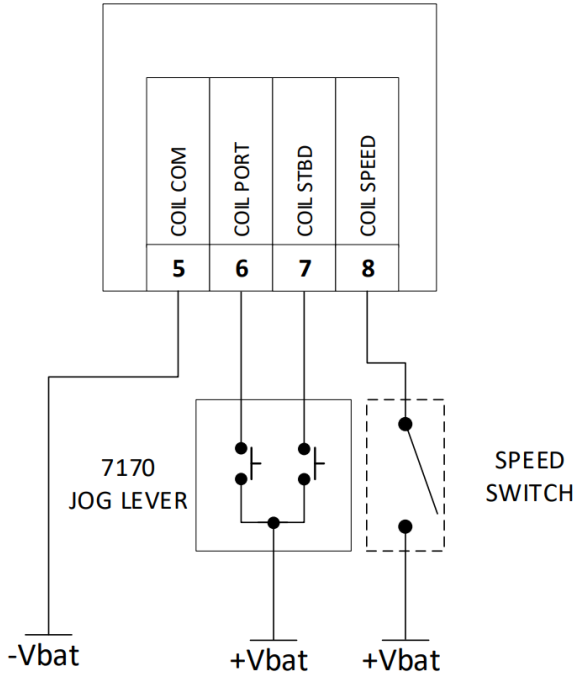


Figure 9: HPU200 Jog Control Diagram, Common Negative

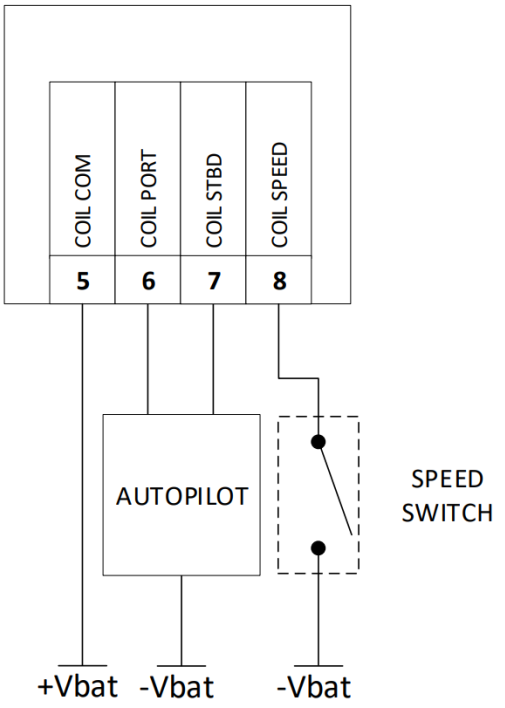


Figure 10: HPU200 Autopilot Wiring Diagram, Common Positive

4 COMMISSIONING

4.1 HYDRAULIC FILL & BLEED

After the hydraulic and the electrical connections have been completed, open all isolating valves, and allow enough time for the pump and lines to fill with oil. Start the pump and observe the pressure gauge. There should be some pressure showing (approx. 40-80psi). If not, check the rotation of the pump motor (clockwise as viewed from the motor end). If the rotation is wrong check the polarity of the power connection to terminals 1 and 2. All pumps are leak and run tested prior to shipment.

Check that the high-speed solenoid is not activated. Operate the 4-way solenoid valve to check that the port and starboard directions are correct. If they are wrong, reverse connections to Terminals 6 and 7. Check the hard over to hard over speed of the rudder and adjust the low-speed adjustment for the appropriate speed. Clockwise to decrease and counter clockwise to increase. Once the low-speed adjustment is complete activate the high-speed valve and check the hard over to hard over speed. Adjust the high-speed valve to obtain the desired speed. If after the high-speed adjustment is complete you adjust the low speed, the high speed should be rechecked. The pressure relief is factory set (normally 750 psi) and should not require adjustment.

⚠CAUTION	The pressure relief is factory set at 750 psi and should not require adjustment.

4.2 ELECTRICAL CHECK

⚠CAUTION	Ensure that the cover is installed and secured on the value junction enclosure, electrical junction box, motor wiring panel, and all pigtail connections have been properly terminated and enclosed before powering on the HPU200.

Confirm that the electrical connections to the HPU200 pump set have been made correctly and correspond to the requirements of your system installation.

4.3 FUNCTIONAL TEST

⚠CAUTION	The Function Test should be carried out while the vessel is still at dock and before it is taken out to sea after installation has been completed.

After installation and filling has been completed, perform the following function tests:

1. Power ON the HPU
2. Power ON the autopilot (or electronic jog lever).
3. Active the autopilot (or electronic jog lever) to command motion of the HPU.
4. Verify that the rudder position has changed.
5. Set the autopilot to manual mode and operate the pump set to determine if the Port and Starboard directions are correct.
6. If the rudder goes the opposite way than expected.
   a. Reverse the two electrical connections between the solenoids and the autopilot (or electronic jog lever).

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

7. Operate the pump set and note the “hard-over” to “hard-over” (HO to HO) time.
8. Verify that it is in the range of 10 to 16 seconds. Times outside of this range indicate a mismatched pump set for the steering system.
9. Confirm the unit develops rated pressure during operation.

5 OPERATION

The HPU operates as follows:

- Manifold receives oil from pump, and outputs to steering lines. Output flow determining the speed of the rudder.
- Output flow is controlled by flow control valves.
- Pressure relief valve is factory set to approximately 750 psi.
- Excess flow is returned to tank via differential bypass valve.
- pilot operated check valves allow free flow from the inlet port to outlet. Inlet pressure open the opposite side check valve and allows flow comeback. When there is no pressure in lines (directional valve is in center) both check valves are close and holding the load in position.
- By energizing related solenoid on directional valve, flow will be sent to port or starboard.
- Hydraulic in-line filter provides protection for small, high-pressure systems up to 3,000 PSI. By using this filter at the pressure side of a pump, foreign particles 90 microns and larger, such as those created by pump wear, are removed before damage can result to the valving in the system. A sintered bronze element ensures protection against crushing should dirt accumulate and increase pressure drop across the element.

6 MAINTENANCE

6.1 PREVENTATIVE MAINTENANCE

During normal operation of the pump, the high-pressure filter should be checked periodically and changed or washed out if contaminated.

NOTICE	If the speed of the steering system begins to gradually slow down, it is an indication that the filter is plugging.

Check the pressure gauge on the pump, a higher pressure indicates a plugged filter. Isolate the pump hydraulically, remove the filter cap and change or clean the filter. Return the pump to normal operation. If the filter becomes plugged on a regular basis, the steering system should be flushed out and the hydraulic oil replaced.

The brushes on the electric DC motor can be easily checked by removing the access plate and visually inspecting the brushes. Replace the carbon brushes as required and check the internal condition of the motor.

- Monthly (12 times per year)
  - Inspect connections for leaks.
- Quarterly (4 times per year)
  - Verify adequate oil level.
  - Visually inspect wire and cable insulation for splits or damage.
- Every (2) two years
  - Sample and analyze the oil in the steering lines.
  - Drain reservoir and clean out.

6.2 RECOMMENDED SPARE PARTS

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

Table 5: Recommended Spares

QTY	ITEM	KOBELT PART #
1*	HPU200 REPAIR KIT (12 VDC) • Motor Repair kit • Pump Repair Kit • Manifold Repair Kit	600-140-RK 7070-0019-RK 7061-0005-RK 600-013-RK
1*	HPU200 REPAIR KIT (24 VDC) • Motor Repair kit • Pump Repair Kit • Manifold Repair Kit	600-141-RK 7070-0020-RK 7061-0005-RK 600-013-RK
1*	HPU200/300/400 REPAIR KIT (115/230 VAC) • Pump Repair Kit • Manifold Repair Kit	600-142-RK 7061-0005-RK 600-013-RK

*****Select appropriate kit to match voltage of model purchased.

When purchasing spare parts refer to Appendix B: Parts List at the back of this manual for Kobelt component Part Numbers.

NOTICE	It is recommended that any required service work on an Accu-Steer unit be performed by a factory authorized service representative. Please contact the nearest Kobelt authorized distributor for assistance.

7 TROUBLESHOOTING

If you encounter problems with the operation of your product, please refer to the trouble-shooting suggestions before contacting Kobelt for assistance. If the steps below do not resolve your issue, please reach out either Kobelt directly or our Dealers in your area.

Table 6: Common Solutions

Problem (Issue encountered)	Cause (What it means)	Corrective Action (What to do)
Steering gear goes hard over	Short circuit in electrical wiring to solenoid	Test wiring and solenoid valve coils.
	Solenoid valve contaminated	Isolate lines, clean and/or repair the solenoid valve as required.
Steering gear does not respond	Solenoid not being energized	Manually operate the solenoid valve.
	Pump filter plugged due to contaminated	Clean or replace filter.
	No pressure on gauge. Bypass open.	1. Check if bypass valve opens due to contamination. 2. Check if flow valve open 3. Check drive coupling
Pump is noisy	Air is in the system	Fill and bleed the hydraulic system to remove air.
Motor is running but not making pressure	Motor direction is not correct	Reverse motor wires.

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. Kobalt'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, 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.

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.

9 REVISION HISTORY

Table 7: Revision History

Document Revision	Release Date	CO	Author	Revision Summary
F	2025-02-05	01171	SV	• corrected the item 5 description in BOM (page 40)

10 APPENDIX A: INSTALLATION DIMENSIONS

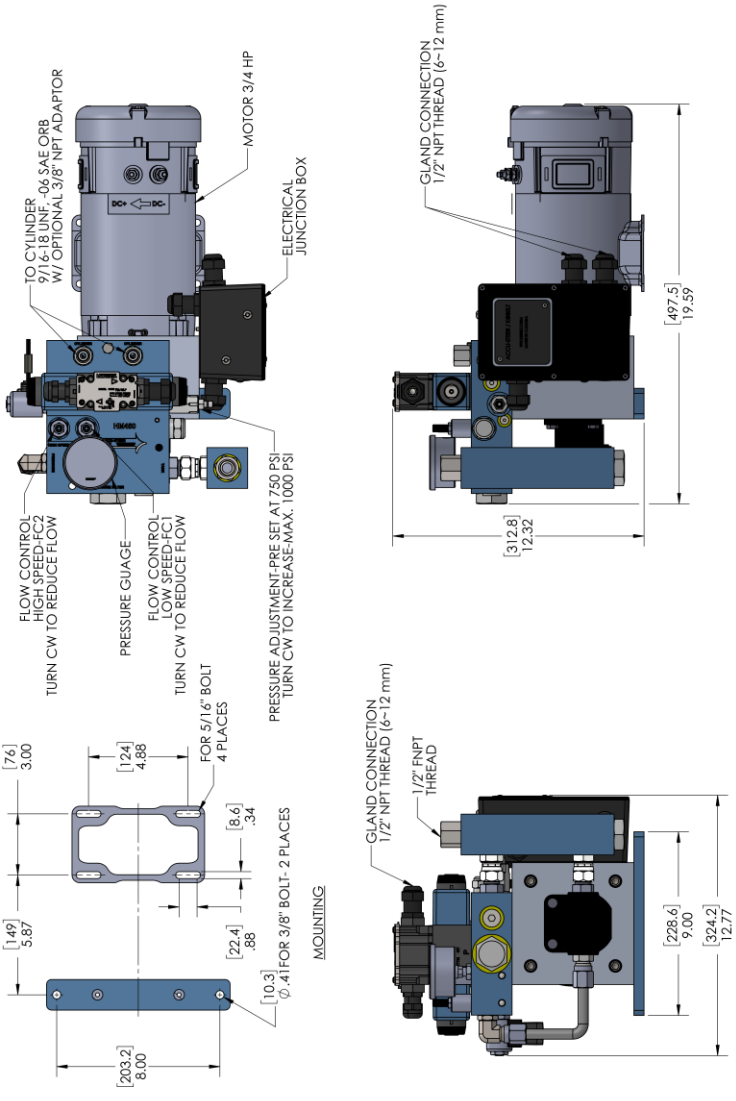


Figure 11: HPU200 Installation Dimensions

11 APPENDIX B: PARTS LIST

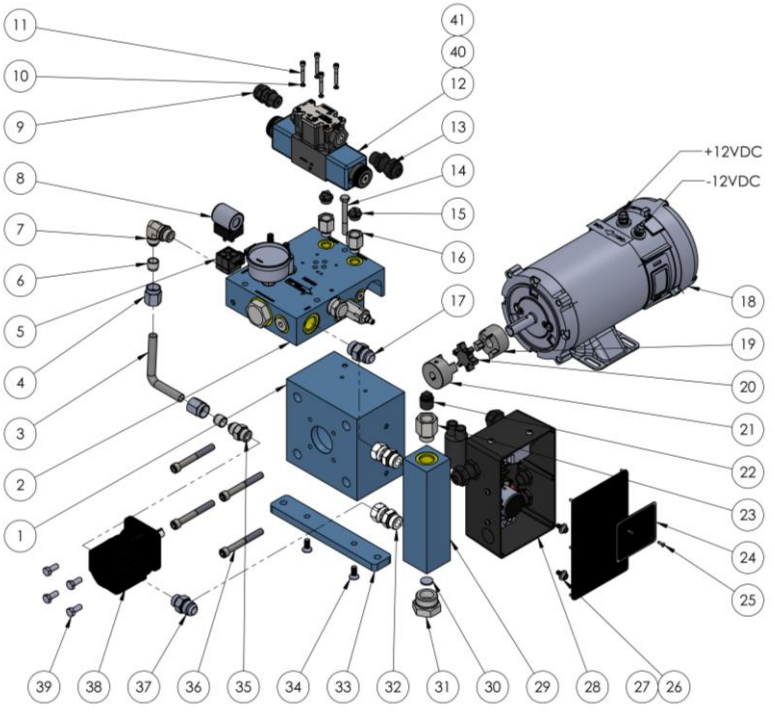


Figure 12: HPU200-12VDC Parts Diagram

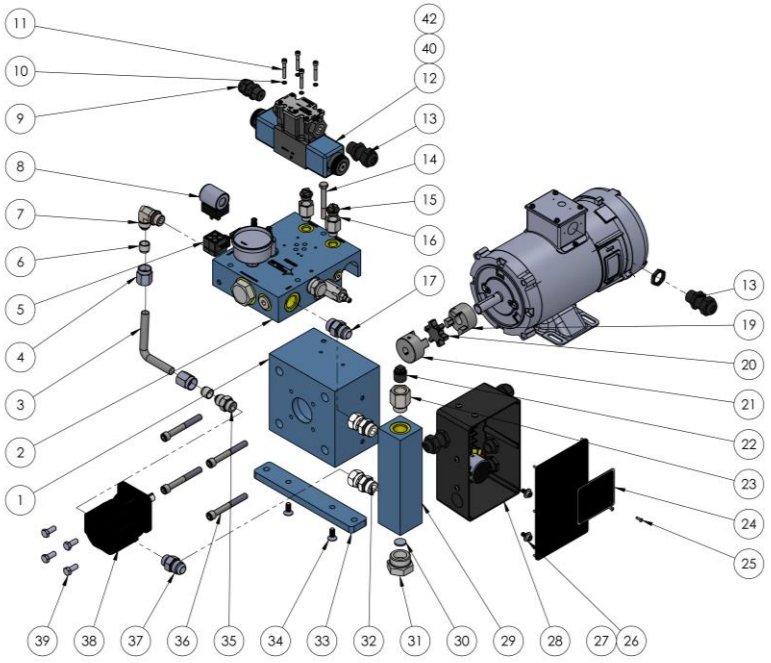


Figure 13: HPU200-24VDC Parts Diagram

*Table 7: HPU200 Parts List for **DC** Configurations*

	Model No.:	HPU200-12 HPU200S-12	HPU200-24 HPU200S-24
ITEM	**DESCRIPTION**		
1	HPU MOTOR/ PUMP ADAPTOR	7001-0030	
2	MANIFOLD	502-406	
3	HPU200 TUBE	201-050	
4	FLARELESS TUBE NUT, 1/2	7039-0630	
5	FLARELESS TUBE FERRULE, 1/2	6014-2001	
6	FLARELESS TUBE FERRULE, 1/2	7039-0631	
7	ELBOW 90, 08 MJIC X 08 MORB	7039-0224	
8	COIL	7024-0007	7024-0008
9	CABLE GLAND, 1/2 NPT	302-054	
10	LOCK WASHER	1023-0408	
11	SOCKET HEAD CAP SCREW, 10-12x 1 1/4	1002-0820	
12	DIRECTIONAL VALVE	7036-0012	7036-0013
13	CABLE GLAND, 1/2 NPT	6009-7840	
14	SCREW, HEX HEAD, 5/16-18 x 2 1/2	1001-1140	
15	PLASTIC PLUG, 3/8 NPT	7039-3043	
16	FITTING, -06 ORB M x 3/8 NPT F	7039-0139	
17	ADAPTOR 10 MORB X 10 MJIC	7039-0126	
18	ELECTRIC MOTOR, 3/4HP	7070-0019	7070-0020
19	COUPLING, JAW, L075 X 5/8 X 3/16	7056-0037	
20	INSERT, COUPLING, L075, BUNA	7056-0025	
21	COUPLING, JAW, L075 X 1/2 BORE	7056-0023	
22	SHIPPING PLUG, 1/2 NPT	7039-3044	
23	ADAPTER, STR, 10 MORB X 1/2 FNPT	7039-0144	
24	HPU NAMEPLATE	701-100	
25	RIVET 1/8 IN	1032-0420	
26	WASHER FLAT 1/4IN	1023-0110	
27	SCREW, SKT HD, 1/4 UNC X 1/2	1002-1008	

28	ELECTRICAL BOX	503-019	503-020
29	HPU SUCTION DROP MANIFOLD	7001-0021	
30	RARE EARTH MAGNET	119-205	
31	PLUG, HEX HEAD, 16 ORB	7039-0679	
32	ADAPTER, STR, 10 MORB X 10 FJIC	7039-0157	
33	HPU FOOT MOUNT PLATE	7057-0011	
34	SCREW, FLAT SKT HD, 5/16-18 UNC X 3/4	1015-1112	
35	ADAPTER, STR, 8 MJIC X 8 MORB	7039-0119	
36	SCREW, SKT HD, 3/8-16 UNC x 3	1002-1248	
37	ADAPTER, STR, 10 MJIC X 08 MORB	7039-0117	
38	GEAR PUMP	7061-0006	
39	SCREW, FLAT SKT HD, 5/16-18 UNC X 3/4	1015-1112	
40	WIRE JOINT, 2#22- 2#16AWG	6009-6601	
41	WIRE JOINT, 4#18- 2#12AWG	6009-6602	
42	WIRE JOINT, 3#14- 4#12AWG	_	6609-6603
43	NUT, CABLE GLAND, ½ NPT	_	302-064

** Part included in standard repair kit. Not sold separately.*

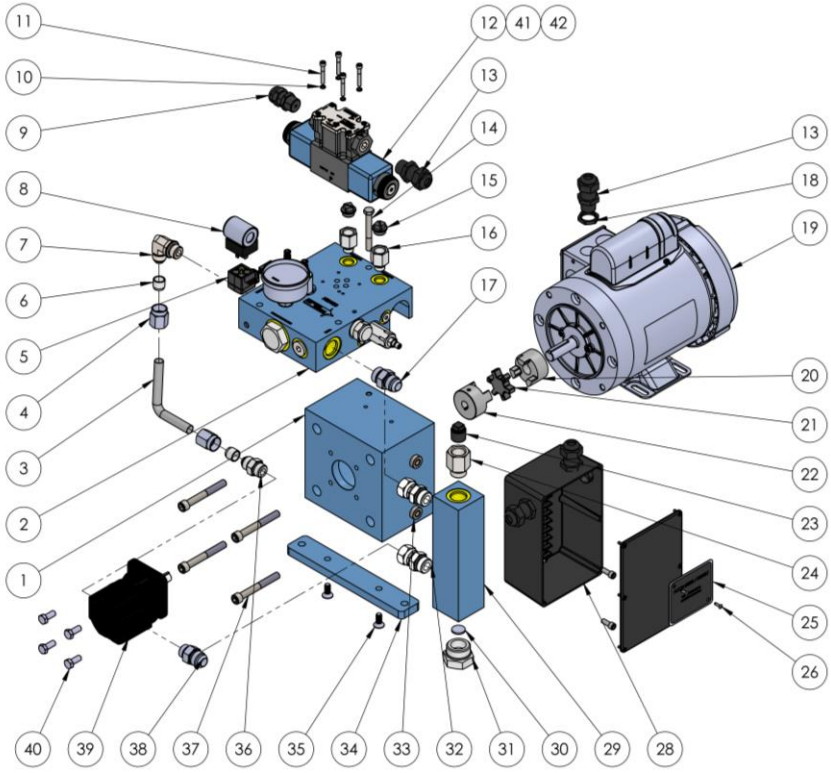


Figure 14: HPU200-AC Parts Diagram

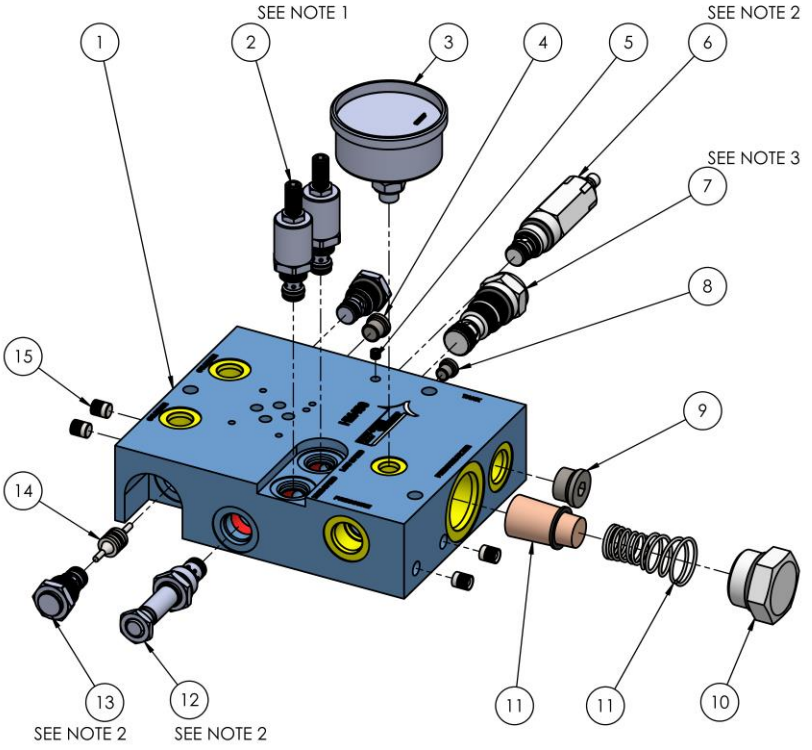
*Table 8: HPU200 Parts List for **AC** Configuration*

	Model No.:	HPU200-115/230-12 HPU200S-115/230-12	HPU200-115/230-24 HPU200S-115/230-24
ITEM	**DESCRIPTION**		
1	HPU MOTOR/ PUMP ADAPTOR	7001-0030	
2	MANIFOLD	502-406	
3	HPU200 TUBE	201-050	
4	FLARELESS TUBE NUT, 1/2	7039-0630	
5	CABLE; 2C+G, DIN43650-A, 20 AWGX1.5M	6014-2001	
6	FLARELESS TUBE FERRULE, 1/2	7039-0631	
7	ELBOW 90, 08 MJIC X 08 MORB	7039-0224	
8	SOLENOID COIL, SIZE 08, DIN CONNECTED	7024-0007	7024-0008
9	CABLE GLAND, 1/2NPT, .197-.472in.	302-054	
10	LOCK WASHER	1023-0408	
11	SOCKET HEAD CAP SCREW, 10-12x 1 1/4	1002-0820	
12	DIRECTIONAL VALVE	7036-0012	7036-0013
13	CABLE GLAND, 1/2 NPT	6009-7840	
14	SCREW, HEX HEAD, 5/16-18 x 2 1/2, 18-8	1001-1140	
15	PLASTIC PLUG, 3/8 NPT	7039-3043	
16	FITTING, STRAIGHT, #06 MALE ORB X 3/8IN FEMALE NPT	7039-0139	
17	ADAPTER, STR, 10MORB X 10 MJIC, STEEL	7039-0126	
18	NUT, CABLE GLAND, 1/2NPT	302-064	
19	ELECTRIC MOTOR, 3/4HP, 115/230 V	310-114	
20	COUPLING, JAW, L075 X 5/8 X 3/16	7056-0037	
21	INSERT, COUPLING, L075, BUNA	7056-0025	
22	COUPLING, JAW, L075 X 1/2 BORE	7056-0023	
23	SHIPPING PLUG, 1/2 NPT	7039-3044	
24	ADAPTER, STR, 10 MORB X 1/2 FNPT	7039-0144	
25	FITTING, ADAPTER, 10 MORB X 1/2 FNPT	7039-0144	
26	HPU NAMEPLATE	701-100	

27	SCREW, SKT HD CAP, 1/4-20 X 5/8, 18-8 SS	1002-1010
28	ELECTRICAL BOX; HPU 200, AC	503-026
29	HPU SUCTION DROP MANIFOLD	7001-0021
30	RARE EARTH MAGNET - .750 X .094 IN	119-205
31	PLUG, HEX HEAD, 16 ORB	7039-0679
32	ADAPTER, STR, 10 MORB X 10 FJIC	7039-0157
33	ROLLER; THROTTLE FOLLOWER - 3/4IN	2543-0109
34	HPU FOOT MOUNT PLATE	7057-0011
35	SCREW, FLAT SKT HD, 5/16-18 UNC X 3/4	1015-1112
36	ADAPTER, STR, 8 MJIC X 8 MORB	7039-0119
37	SCREW, SKT HD, 3/8-16 UNC x 3	1002-1248
38	ADAPTER, STR, 10 MJIC X 08 MORB	7039-0117
39	GEAR PUMP	7061-0006
40	SCREW HEX HEAD, 5/16-18 x 3/4	1001-1112
41	WIRE JOINT, NYLON INS 2#22 - 2#16AWG	6009-6601
42	WIRE JOINT, NYLON INS 4#18 - 2#12AWG	6009-6602

** Part included in standard repair kit. Not sold separately.*

12 APPENDIX C: MANIFOLD ASSEMBLY PARTS



NOTES:
1. TIGHTINING TORQUE: 15 ft-lbs (20.3 Nm)
2. TIGHTINING TORQUE: 25-30 ft-lbs (34-41 Nm)
3. TIGHTINING TORQUE: 35-40 ft-lbs (47-54 Nm)

Figure 15: 502-406 Manifold Parts Diagram

Table 9: HM450 Manifold Parts Table

		Part No.:	502-406
ITEM	**QTY**	**DESCRIPTION**	
1	1	HM450 MANIFOLD BODY	7001-0046
2	2	FLOW CONTROL NEEDLE SIZE 07	7044-0012
3	1	PRESSURE GAUGE, 1450 PSI, 04 ORB	7088-0025
4	1	PLUG, HEX SKT, 04 ORB, PLATED STEEL	7039-0661
5	1	EXPANSION PLUG CV173-218S	7039-3054
6	1	RELIEF VALVE	7043-0008
7	1	DIFFERENTIAL PRESSURE SENSE VALVE, 80 PSI	7046-0001
8	1	PLUG, HEX SKT, 02 ORB, PLATED STEEL	7039-0660
9	1	PLUG, HEX SKT, 08 ORB, PLATED STEEL	7039-0663
10	1	PLUG, HEX HEAD, 16 ORB	7039-0679
11	1	REPAIR KIT	600-013-RK
12	1	SOL. VALVE 2 WAY N.C. C-08-2	7048-0012
13	2	CHECK VALVE	7049-0017
14	1	HM LOCK VALVE SPOOL	7006-0005
15	4	EXPANSION PLUG, CV173-343	7039-3055

** Part included in standard repair kit. Not sold separately.*

13 APPENDIX D: ELECTRICAL BOX ASSEMBLY PARTS

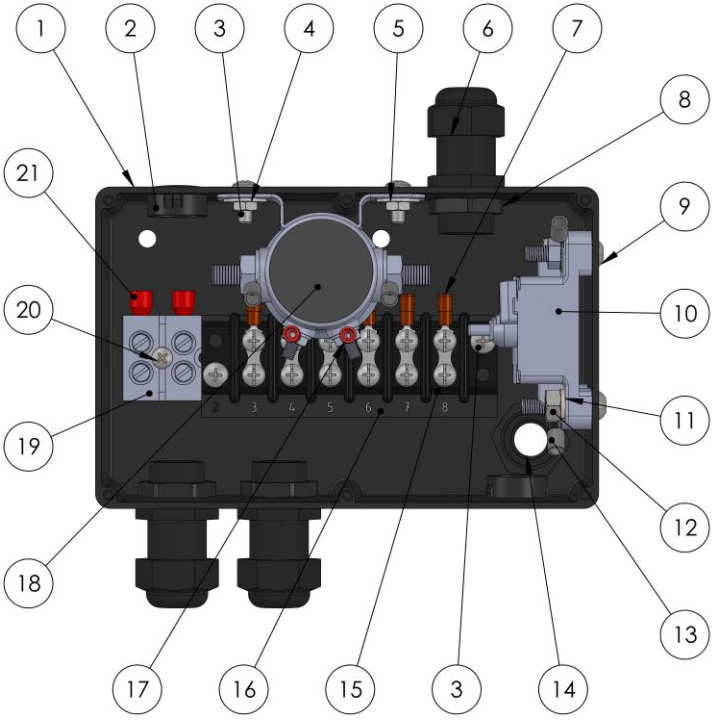


Figure 15: 503-019 ELECTRICAL BOX

Table 10: Electrical Box HPU 200-12VDC Parts Table

		Part No.:	503-019
ITEM	**QTY**	**DESCRIPTION**	
1	1	JUNCTION BOX; HPU 200	300-010-1
2	2	FILLER PLUG 7/8”	200-263
3	4	SCREW, PAN HEAD, #10 UNC X ½, GR 18-8	1012-0808

4	2	NUT, HEX, #10-24, 18-8 SS	1022-0108
5	2	WASHER FLAT 1/4IN 18-8	1023-0110
6	3	CABLE GLAND, 1/2 NPT, .27 - .48 CORD, NYLON	6009-7840
7	6	TERM FORK INS VYL #8 18-22AWG RED	6009-6452
8	4	NUT, CABLE GLAND, 1/2NPT	302-064
9	2	CAP SCREW - BH SKT; 1/4 UNC X 3/4, 18-8	1014-1012
10	1	CIRCUIT BREAKER, 60 A / 30V, AUTO RESET	6009-8112
11	2	LOCK WASHER - SPLIT; 1/4in; SS	1023-0310
12	2	NUT, HEX, 1/4-20, 18-8 SS, ASME B18.2.2	1022-0110
13	4	TERM RING, 1/4IN, 8 AWG	6009-6444
14	1	CABLE GLAND, 1/2 NPT, 0.545 - 0.709IN CORD / NYLON	6001-0275
15	1	TERM BLOCK 6POS 30A 250V	6009-0018
16	1	TERM LABEL 6POS	6009-0015-1
17	2	TERM RING INS VYL #10 18-22AWG RED	6009-6403
18	1	RELAY STARTER SPST 12VDC 85ADC CONT. BRACKET MOUNT	6010-1607
19	1	TERMINAL BLOCK, 2 ROW, 2 POSITION, 85A	6009-0020
20	1	SCREW, PAN HD, PHIL, 8-32 X 1-1/4, 18-8	1012-0720
21	2	FERRULE SHORT INS PP SINGLE 8AWG RED	6009-6559
22	18	CABLE; 2C/8AWG, RED/YEL, UL1426	6014-0208A
23	18	CABLE; 4C/18AWG, SOW EXT CABLE	302-105
24	6	WIRE, STRANDED, TYPE MW, 18 AWG, BLK	6014-0018B
25	6	WIRE, STRANDED, TYPE MW, 18 AWG, RED	6014-0018R
26	1	CABLE SPLITTER, HEAT SHRINK, 2 WIRE, .37-.8in ID	6009-7435
27	2	CONNECTOR BOOT, RIGHT ANGLE	302-080
28	2	TERM RING, 5/16IN, 8 AWG	6009-6445
29	5	WIRE STRAND TYPE TEW 8AWG YEL	6014-0008YEL
30	9	WIRE STRAND TYPE TEW 8AWG RED	6014-0008RED
31	4	HEAT SHRINK 2:1 1/4IN 120C BLK	6009-7469

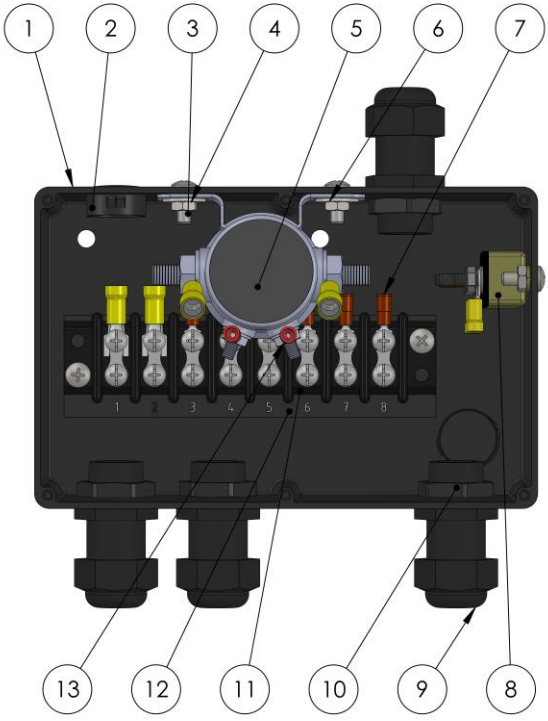


Figure 16: 503-020 ELECTRICAL BOX

Table 11: Electrical Box HPU 200-24VDC Parts Table

		Part No.:	503-020
ITEM	**QTY**	**DESCRIPTION**	
1	1	JUNCTION BOX; HPU 200	300-010-2
2	2	FILLER PLUG 7/8”	200-263
3	6	SCREW, PAN HEAD, #10 UNC X ½, GR 18-8	1012-0808
4	4	NUT, HEX, #10-24, 18-8 SS	1022-0108
5	1	RELAY STARTER SPST 24VDC 85ADC CONT. BRACKET MOUNT	6010-1608
6	2	WASHER FLAT 1/4IN 18-8	1023-0110
7	6	TERM FORK INS VYL #8 18-22AWG RED	6009-6452
8	1	CIRCUIT BREAKER, 60 A / 30V, AUTO RESET	6009-8109
9	4	CABLE GLAND, 1/2 NPT, .27 - .48 CORD, NYLON	6009-7840
10	4	NUT, CABLE GLAND, 1/2NPT	302-064
11	2	TERM RING INS VYL #10 10-12AWG YEL	6009-6423
12	1	TERM BLOCK 8POS 30A 250V	6006-0014
13	1	TERM LABEL 8POS	6009-0015
14	2	TERM RING INS VYL #10 18-22AWG RED	6009-6403
15	2	SPADE TERMINAL #10 YEL, 10-12AWG	6009-6473
16	2	TERM RING INS VYL 5/16IN, 10-12 AWG	6009-6425
17	16	CABLE; 2C/10AWG, RED/BLK	302-100
18	18	CABLE; 4C/18AWG, SOW EXT CABLE	302-105
19	6	WIRE, STRANDED, TYPE MW, 18 AWG, BLK	6014-0018B
20	6	WIRE, STRANDED, TYPE MW, 18 AWG, RED	6014-0018R
21	5	WIRE STRAND TYPE TEW 10AWG BLK	6014-0010B
22	9	WIRE STRAND TYPE TEW 10AWG RED	6014-0010R

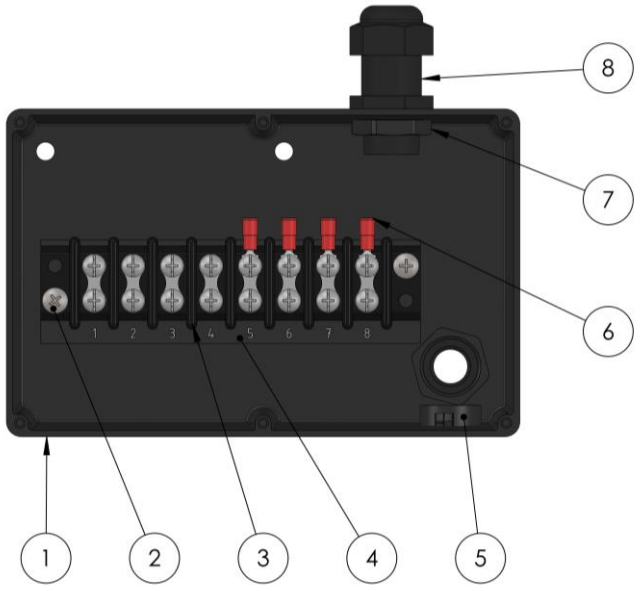


Figure 18: AC ELECTRICAL BOX

Table 12: Electrical Box HPU 200-AC Parts Table

		Part No.:	503-026
ITEM	**QTY**	**DESCRIPTION**	
1	1	JUNCTION BOX; HPU 200	300-010-4
2	2	SCREW, PAN HEAD, #10 UNC X 1/2, GR 18-8	1012-0808
3	1	TERM BLOCK 8POS 30A 250V	6009-0014
4	1	TERM LABEL 8POS	6009-0015
5	1	FILLER PLUG 7/8”	200-263
6	4	TERM FORK INS VYL #8 18-22AWG RED	6009-6452
7	2	NUT, CABLE GLAND, 1/2NPT	302-064
8	2	CABLE GLAND, 1/2 NPT, .27 - .48 CORD, NYLON	6009-7840
9	18	CABLE; 4C/18AWG, SOW EXT CABLE	302-105

14 APPENDIX E: TYPICAL SYSTEM ARRANGEMENT

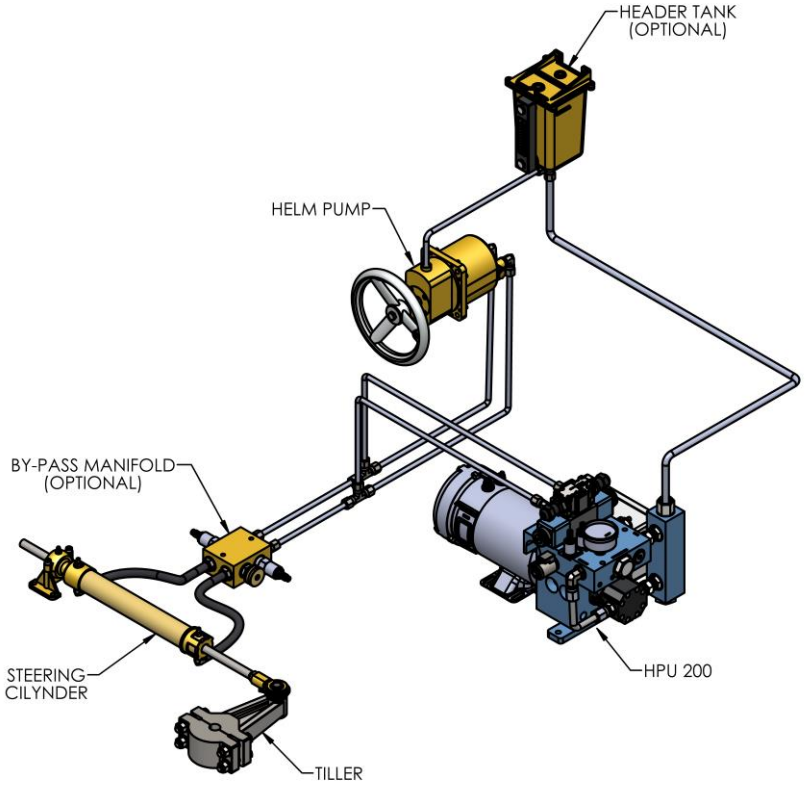


Figure 19: Typical System Arrangement, Closed Loop

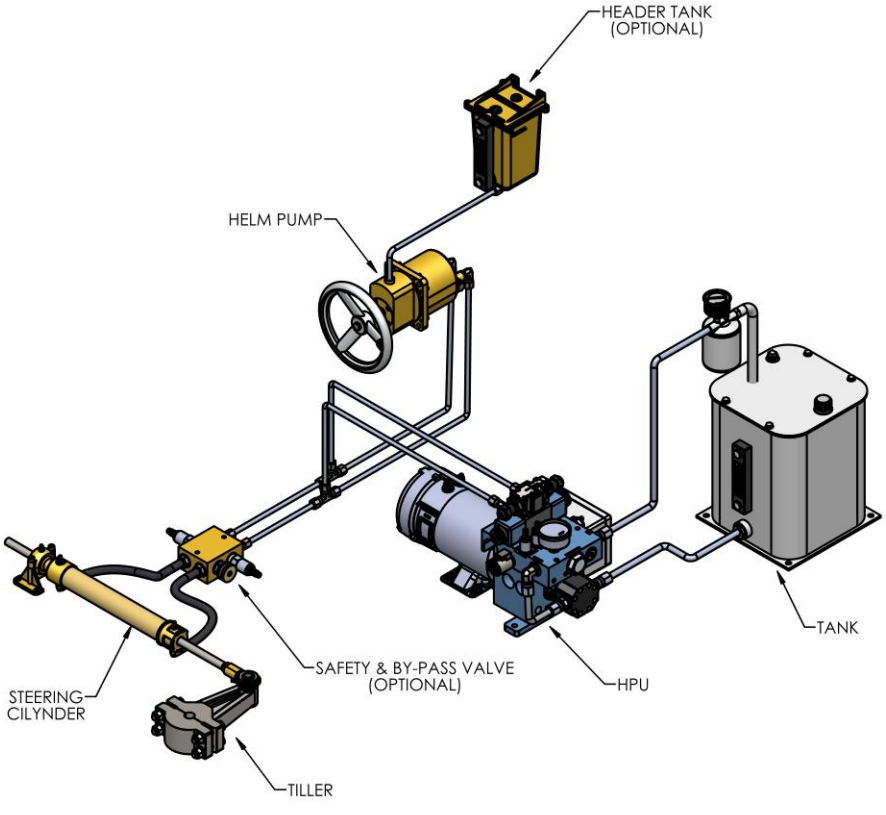


Figure 20: Typical System Arrangement, Open Loop

NOTICE	In this arrangement, the suction block must be removed.

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