

KOBELT

HM450 Accu-Steer Two-Speed Hydraulic Steering Manifold

Owner's Operation, Installation & Maintenance Manual



May 2019

Kobel Manufacturing Co. Ltd.

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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.

Kobel 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



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



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



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



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 HM450 steering manifold is designed to interface hydraulic steering to electric/autopilot control. This manifold can operate with 12 gallons per minute (GPM) input flow. This unit is available in Two Voltage and adjustable flow to suit both standard and custom requirements.

This steering manifold is suitable for steering systems with actuator volumes up to 250 cubic inches (in³).

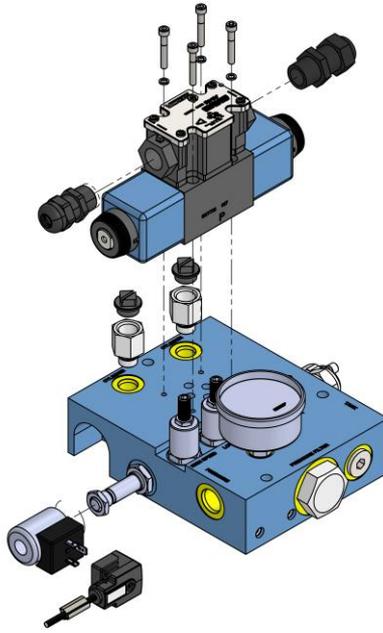


Figure 1: HM450 Overview Diagram

The hydraulic manifold has the following key features:

- Pressure relief cartridge (factory set @ 750 psi)
- Adjustable low-speed and high-speed flow control cartridges
- 4-way directional valve (12 VDC or 24 VDC)
- Pressure gauge
- Valve housing constructed from aluminum with oversized porting
- lock valve to hold rudder in position
- Blue anodized body with laser etched markings

2.1 TECHNICAL DATA

Table 1: HM450 Technical Data

MODEL	HM450-12	HM450S-12	HM450-24	HM450S-24
KOBELT P/N:	600-013	600-015	600-014	600-016
NOMINAL 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. INPUT FLOW RATE	12 GPM [45.4 Lit. /min.]			
MAX. LOW SPEED OUTPUT	4 GPM [15.1 Lit. /min.]			
MAX. HIGH SPEED OUTPUT	6 GPM [22.7 Lit. /min.]			
MAXIMUM ALLOWABLE PRESSURE	<ul style="list-style-type: none"> • A & B PORTS 1000 PSI [70 bar] • T PORT 50 PSI [3.4 bar] 			
RELIEF PRESSURE				
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 1/4" NPT			
OPERATING TEMPERATURE	-14... 122°F [-10... 50°C]			
PRODUCT WEIGHT	16 lbs [7 kg]			

2.1.1 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.

2.1.2 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.

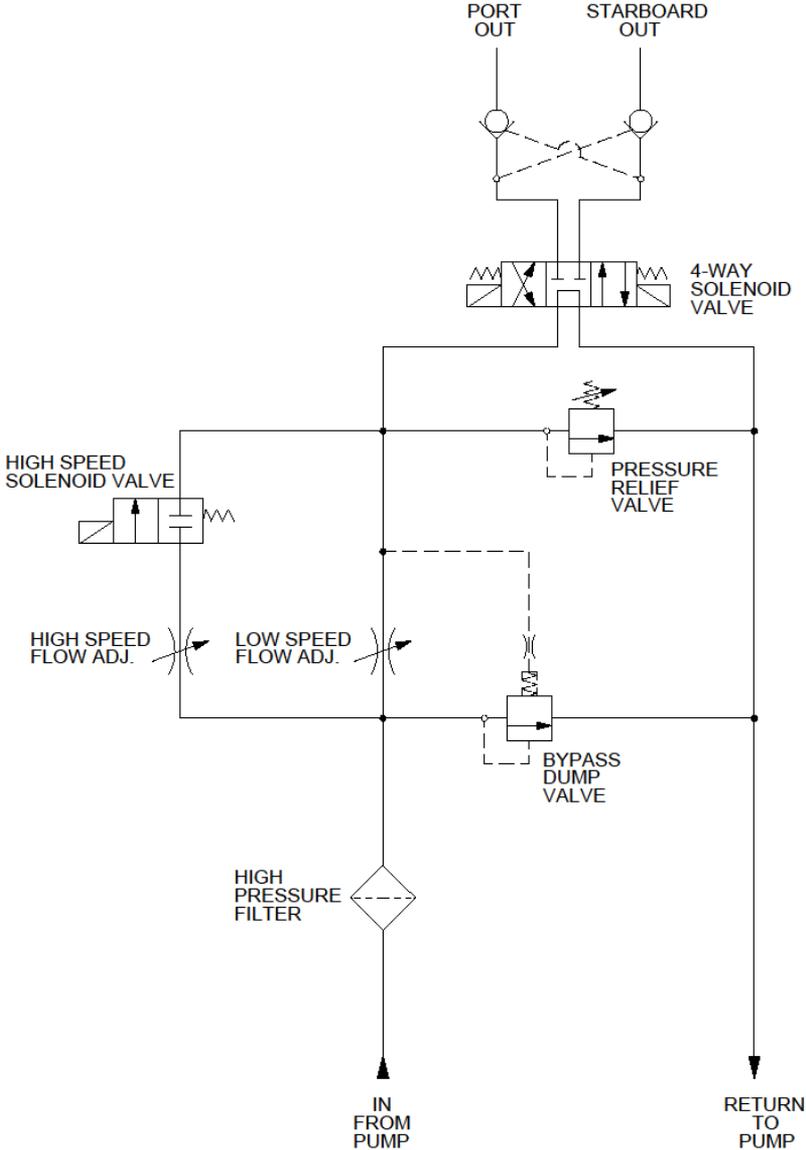


Figure 2: Hydraulic Schematic

3 INSTALLATION

3.1 MECHANICAL

The HM450 can be mounted vertically or horizontally on a solid foundation. It should be mounted in such a way as to facilitate the connection of the hydraulic steering lines.

The HM450 is equipped with (3) three clearance holes for 5/16" bolts through the mounting feet. Ensure that the unit is securely fastened to a suitable foundation.

3.2 HYDRAULIC

Four hydraulic connections are required for the manifold. Two lines connect the main steering lines, and the other two lines connect to the pump unit. Short flexible hoses with a minimum pressure rating of 1500 psi working pressure are recommended for all connections. The short hoses minimize hydraulic shock noise when the manifold is operating. It is strongly recommended that an in-line return hydraulic filter be installed (10 micron). Ensure the filter is capable of the full flow of the pump. This manifold is designed for high flow systems, so it is important to ensure proper cooling is part of the hydraulic system.

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 1/4" 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 1/4" 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.

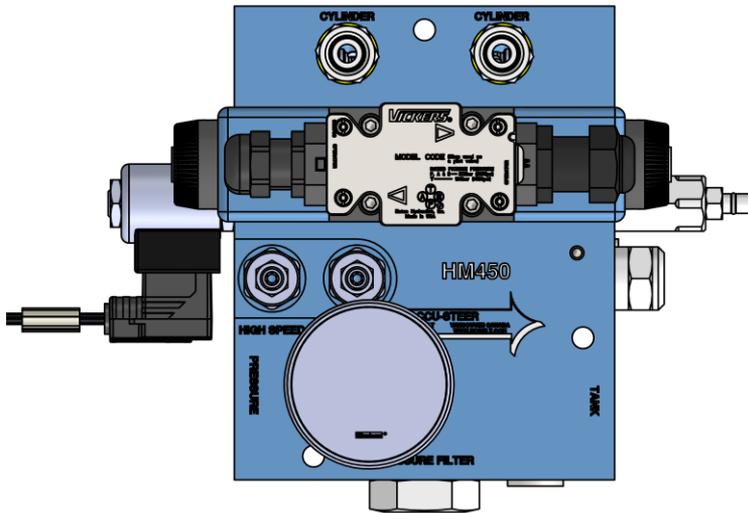


Figure 3: Connections in Top Face of Hydraulic Manifold

(4) four hydraulic connections are required:

- 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.

Shut-off or isolation valves for all (4) four lines are recommended. If the manifold fails, the isolation valves can be shut off and manual steering maintained.

3.3 ELECTRICAL

The electrical connections for this product are located within the solenoid packs electrical junction box and as pigtails exiting from the high-speed solenoid mounted to the side of the product. The solenoid coils are not polarity sensitive and can be configured as either common positive or common negative as required by the installation.

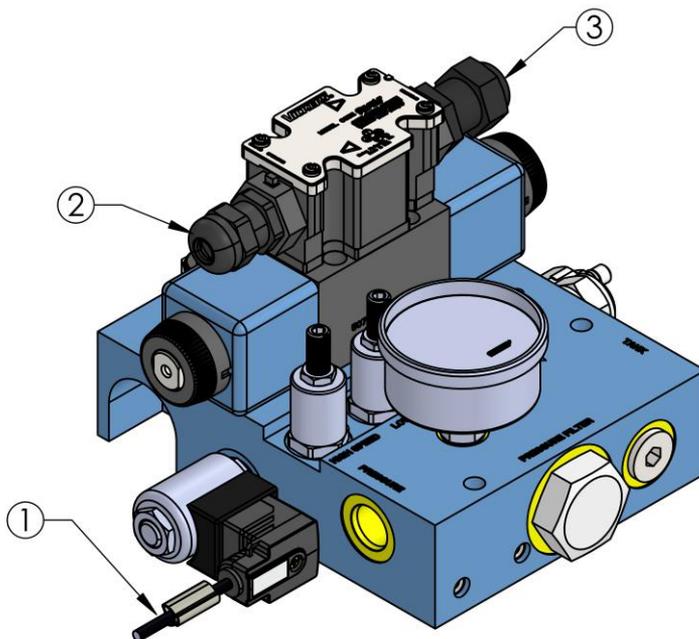


Figure 4: Electrical Connection Locations

The (3) three locations of the solenoid connection wires are shown in Figure 4 above. The corresponding wiring Pair #, wiring size, colour, and arrangement is defined in Table 2 and Figure 5.

Table 2: HM450 Wiring Connections

HM450				
Pair #	Wire Name	Colour	Gauge	Function
1	HS-A	Black	18AWG	High-Speed Coil connection A.
1	HS-B	Black	18AWG	High-Speed Coil connection B.
2	CYL1-A	White	18AWG	Cylinder Port 1 Coil connection A.
2	CYL1-B	White	18AWG	Cylinder Port 1 Coil connection B.
3	CYL2-A	White	18AWG	Cylinder Port 2 Coil connection A.
3	CYL2-B	White	18AWG	Cylinder Port 2 Coil connection B.

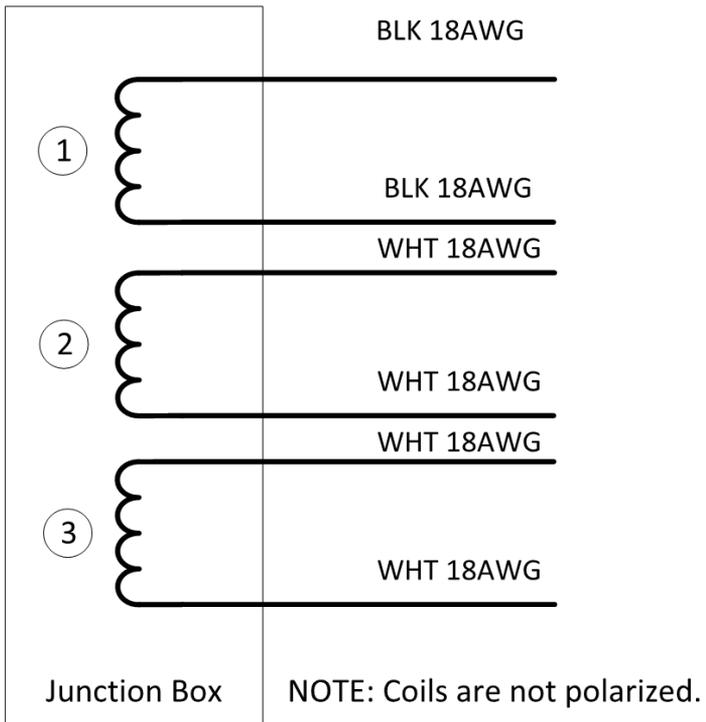


Figure 5: HM450 Electrical Wiring Diagram

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. 40-80 psi). If not, check the rotation of the pump.

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.



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 valve junction enclosure and all pigtail connections have been properly terminated and enclosed before powering on the HM450.

Confirm that the electrical connection so the HM450 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 perform the following function tests:

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

NOTICE

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

6. Operate the pump-set and note the "hard-over" to "hard-over" (HO to HO) time.
7. 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.
8. Confirm the unit develops rated pressure during operation.

5 OPERATION

The HM450 operates as follows:

- Manifold receives oil from an engine or electric driven 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

- 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 3: Recommended Spares

RECOMMENDED SPARES		
QTY	ITEM	KOBELT PART #
1	HM450 REPAIR KIT (12 VDC/24 VDC)	600-013-RK

** Repair kit contains Spring Kit and Filter Kit.*

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 troubleshooting 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 4: Common Solutions

Problem (Issue encountered)	Cause (What it means)	Corrective Action (What to do)
HM does not turn ON	No power to unit.	<ol style="list-style-type: none"> 1. Check that the breaker is ON and has not tripped to the system controlling the solenoids. 2. Check the power is present on the circuit feeding the system controlling the solenoids. 3. Use a Multi-meter to confirm if power is present between at the solenoids when they are being commanded.
	Solenoid is not being energized	<ol style="list-style-type: none"> 1. Test operation of solenoid valve. 2. By-pass flow valve contaminated and stuck open, remove, and clean or replace.
HM turns in the opposite direction then expected	Hydraulic connection lines to Cylinder Ports are reversed	<ol style="list-style-type: none"> 1. Shut off power to the unit control. 2. Reverse the Cylinder port connections, OR, Reverse the control connections to the solenoids.
Steering gear goes hard over	Short circuit in electrical wiring to solenoid	Test wiring and solenoid valve coils.
	Solenoid valve is contaminated	Isolate lines, clean and/or repair the solenoid valve as required.
Pump is noisy	Air is in system	Fill and bleed the hydraulic system to remove air.

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, 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 APPENDIX A: INSTALLATION DIMENSIONS

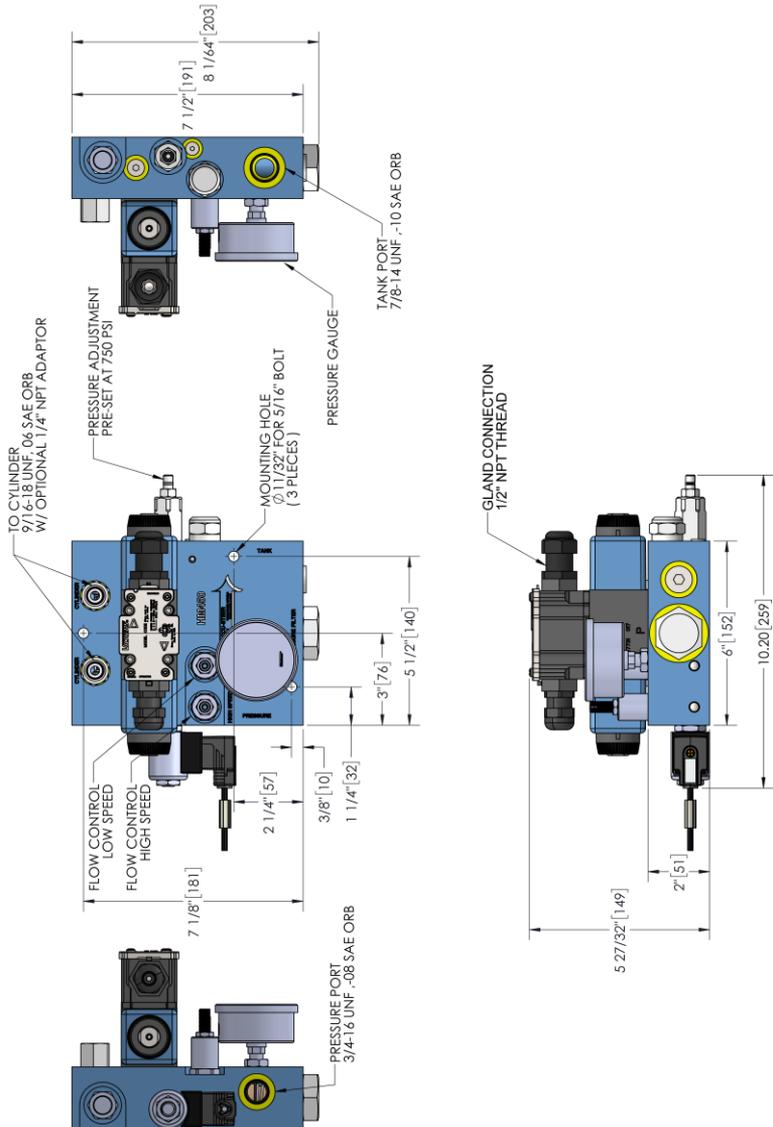


Figure 6: HM450 Installation Dimensions

10 APPENDIX B: PARTS LIST

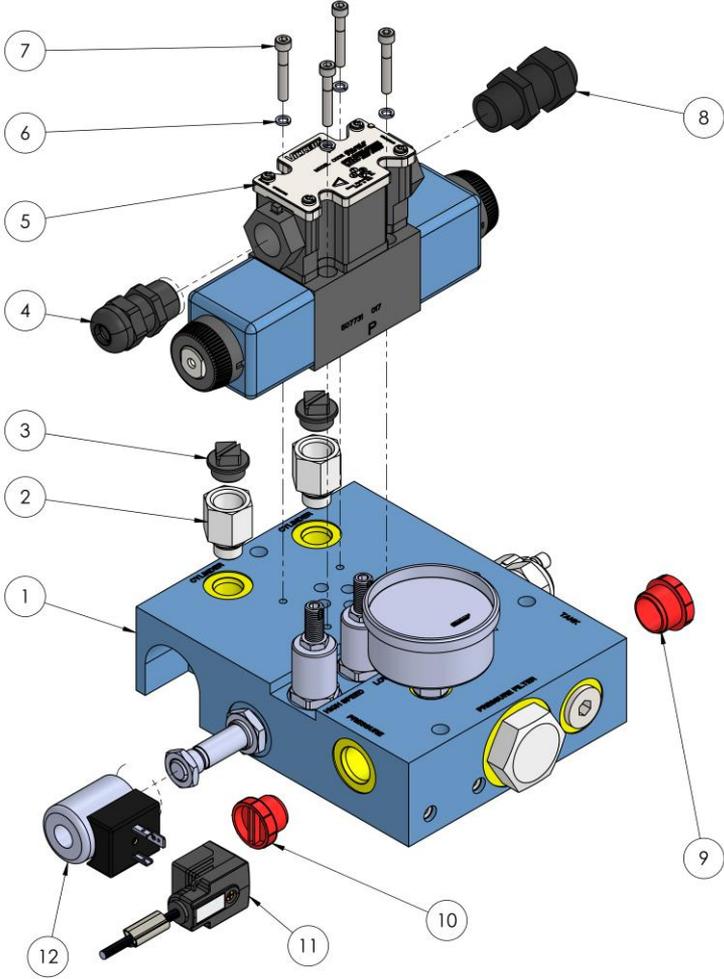
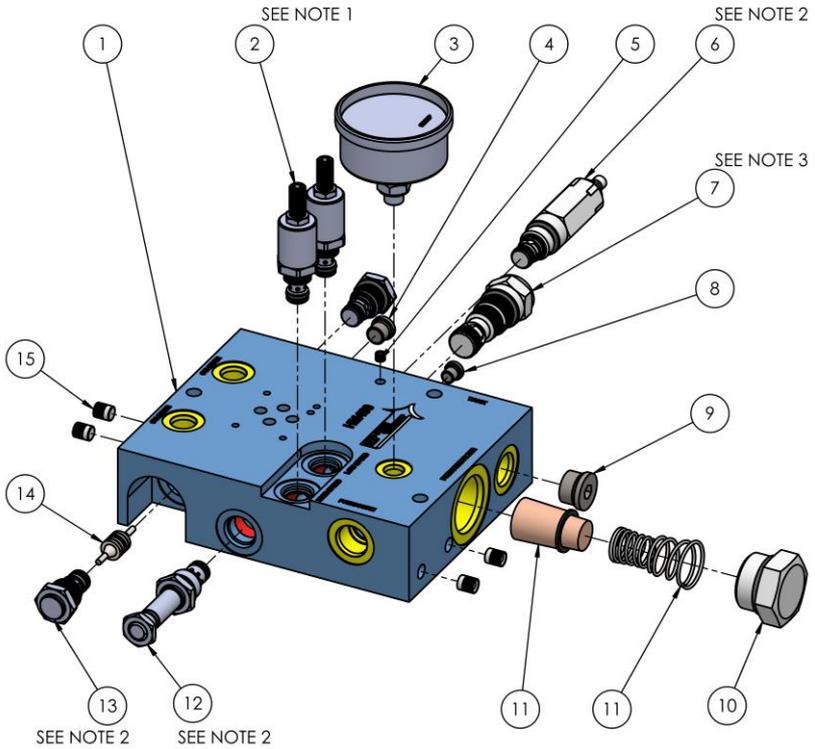


Figure 7: HM450 Parts Diagram

Table 5: HM450 Parts List

		Model No.:	HM450-12	HM450-24
		Part No.:	600-013	600-014
ITEM	DESCRIPTION			
1	MANIFOLD	502-406		
2	FITTING, -06 ORB M x 3/8 NPT F	7039-0139		
3	PLASTIC PLUG, 3/8 NPT	7039-3043		
4	CABLE GLAND, 1/2 NPT, .19-.48 IN	302-054		
5	DIRECTIONAL VALVE	7036-0012	7036-0013	
6	LOCK WASHER	1023-0408		
7	SOCKET HEAD CAP SCREW	1002-0820		
8	CABLE GLAND, 1/2 NPT, .27-.48 IN	6009-7840		
9	SHIPPING PLUG, -10	7039-3157		
10	SHIPPING PLUG, -08	7039-3156		
11	6014-2001	CABLE; 2C + G, DIN 43650-A, 20 AWG		
12	COIL, DIN TYPE	7024-0007	7024-0008	
13	TERM RING INS VYL #8 18-22AWG	6009-6402		

11 APPENDIX C: MANIFOLD ASSEMBLY PARTS



NOTES:

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

Figure 8: 502-406 Manifold Parts Diagram

Table 6: 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

12 APPENDIX D: TYPICAL SYSTEM ARRANGEMENT

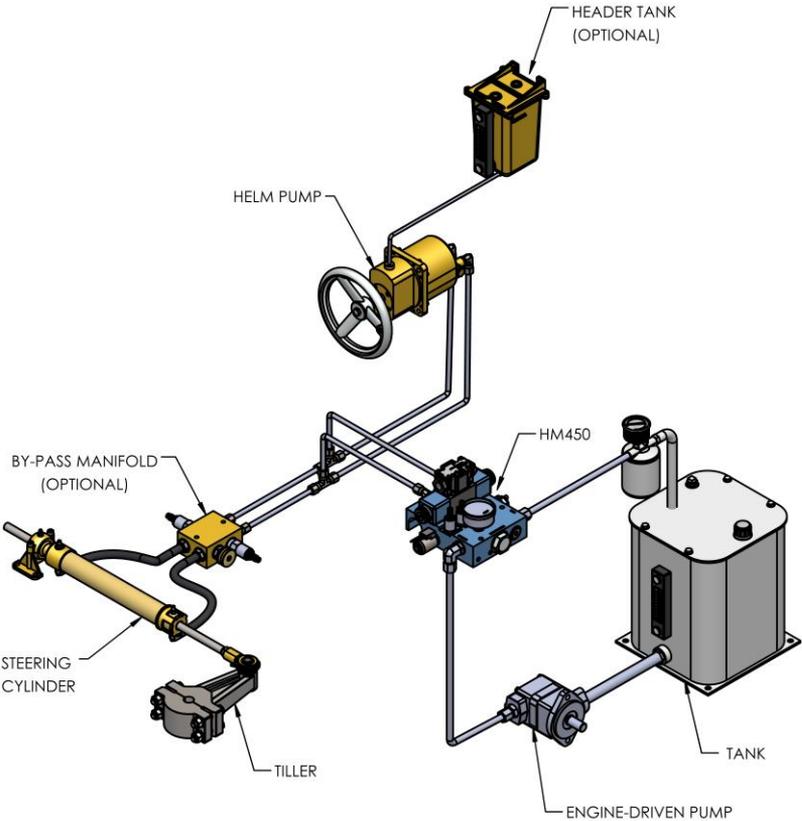


Figure 9: Typical System Arrangement

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