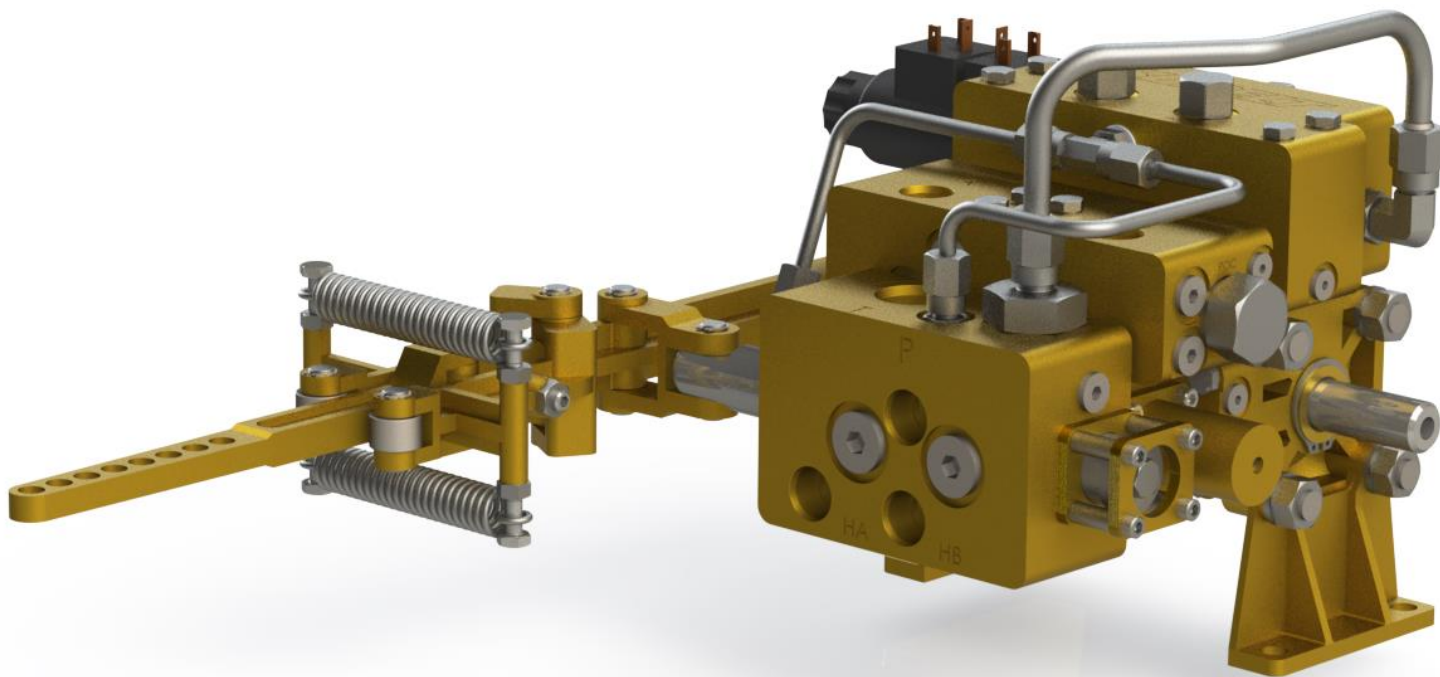




## 7248 FULL FOLLOW-UP POWER STEERING UNIT

### *Owner's Operation, Installation & Maintenance Manual*



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# 1 INTRODUCTION

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## 1.1 CONTACT INFORMATION

### **Kobelt Manufacturing Co LTD.**

*8238 129TH Street  
Surrey, British Columbia  
Canada, V3W 0A6*

Sales Tel: 604-572-3935  
Fax: 604-590-8313  
Email: [sales@kobelt.com](mailto:sales@kobelt.com)  
Website: [www.kobelt.com](http://www.kobelt.com)

For further instructions, please contact our distributors or visit our website.

## 1.2 SAFETY INFORMATION

### 1.2.1 Safety Instructions


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 have training and experience in the safe assembly, installation, commissioning, and operation of the product and where applicable, possess the required trade certificates to undertake this work.)
- Observe all specifications in this manual. If these guidelines are not followed and damage occurs, the warranty will be voided.

---

### 1.2.2 Hazards

Throughout this publication, Warnings and Cautions accompanied by the International Hazard Symbol  is used to alert the user to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly.



#### HIGH PRESSURE FLUIDS

Kobelt's full follow-up power steering unit uses pressurized oil. Ensure all pressure is exhausted and the pressure source locked out prior to performing work.



#### PINCH POINTS

This unit contains numerous pinch points which can cause serious injury. Ensure all power sources are locked out prior to performing work.



#### ELECTRICAL SHOCK

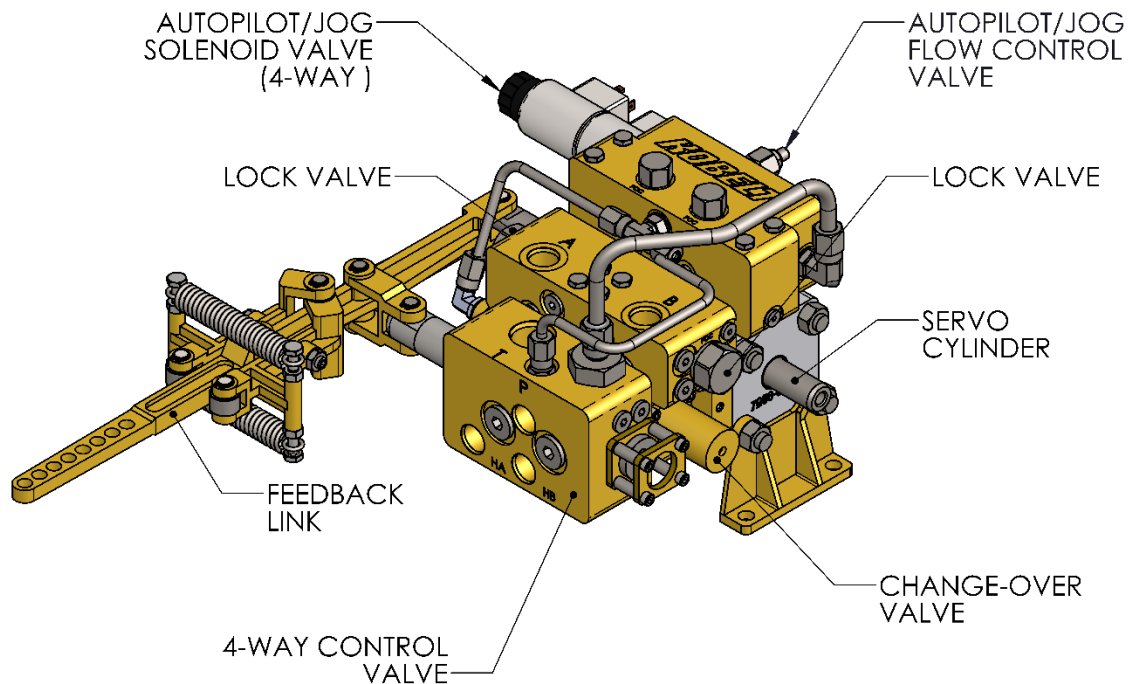
This unit utilizes electrical power. Ensure all power sources are locked out prior to performing work.

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## 1.3 PRODUCT DESCRIPTION

### 1.3.1 Overview

The diagram below depicts the Kobelt 7248 full follow-up (FFU) power steering unit with its major components identified.



*Figure 1: FFU Nomenclature*

### 1.3.2 Technical Data

For technical data and specifications refer to the relevant data sheets from [www.kobelt.com](http://www.kobelt.com) or the technical drawings in Appendix A if provided.

Model no.:

#### ALL MODELS

1. Hydraulic Power Source:	Pressure Compensated Pump	
2. Recommended Fluid:	ISO VG 32, VI 60 hydraulic oil	
3. Max. Supply Pressure:	1500 PSI	[103 bar]
4. Max. Output Flow Rate:	20 gpm	[74 lpm]
5. Servo Cylinder Displacement	13.2 in <sup>3</sup>	[216 cm <sup>3</sup> ]
6. Weight:	35 lbs	[16 kg]
7. Hose Ports:		
7.1. Helm Lines:	-08 SAE ORB	
7.2. Steering Cylinder Lines:	-08 SAE ORB	
7.3. Supply (Pressure) Line:	-08 SAE ORB	
7.4. Tank Line:	-12 SAE ORB	

---

### 1.3.3 Description of Operation

The Kobelt 7248 full follow-up (FFU) power steering unit reduces the manual effort required to steer the rudders while maintaining necessary steering precision and responsiveness. It receives rudder angle steering commands from a hydraulic pilot signal generated by a helm pump and solenoid valve. The unit will control flow to the steering cylinder to ensure that rudder movement is proportional to the rudder angle steering commands. The power to move the rudder is provided by a steering hydraulic power unit.

The four-way solenoid valve provided with this unit can be controlled by either;

- i. a jog lever,
- ii. electric FFU levers, or
- iii. an auto-pilot.

The coil may be supplied in either 12VDC, 24VDC or 120VAC.

Whether steered by a helm pump or an electric solenoid, pilot pressure is directed to either port of the servo cylinder, depending on the desired steering direction. The servo cylinder, in turn, controls the mechanical 4-way control valve to direct flow from the power steering pump to the correct port of the steering cylinder.

When the rudders have reached the command position the feedback link returns the 4-way control valve to its center position shutting off flow to the steering cylinder. The servo cylinder, 4-way control valve and tiller arm are mechanically interconnected by the feedback link. The feedback link provides the necessary position feedback to permit the unit to correct any differences in motion.

When solenoid valve is energized, the speed of rudder can be set by the adjustable flow control valve.

In the event of main hydraulic pressure failure, the changeover valve will switch over to permit direct control of the steering cylinder by the helm pump. The feedback link is designed with a breakaway feature to mechanically disconnect the FFU power steering unit from the tiller arrangement.

### 1.3.4 Hydraulic Schematic

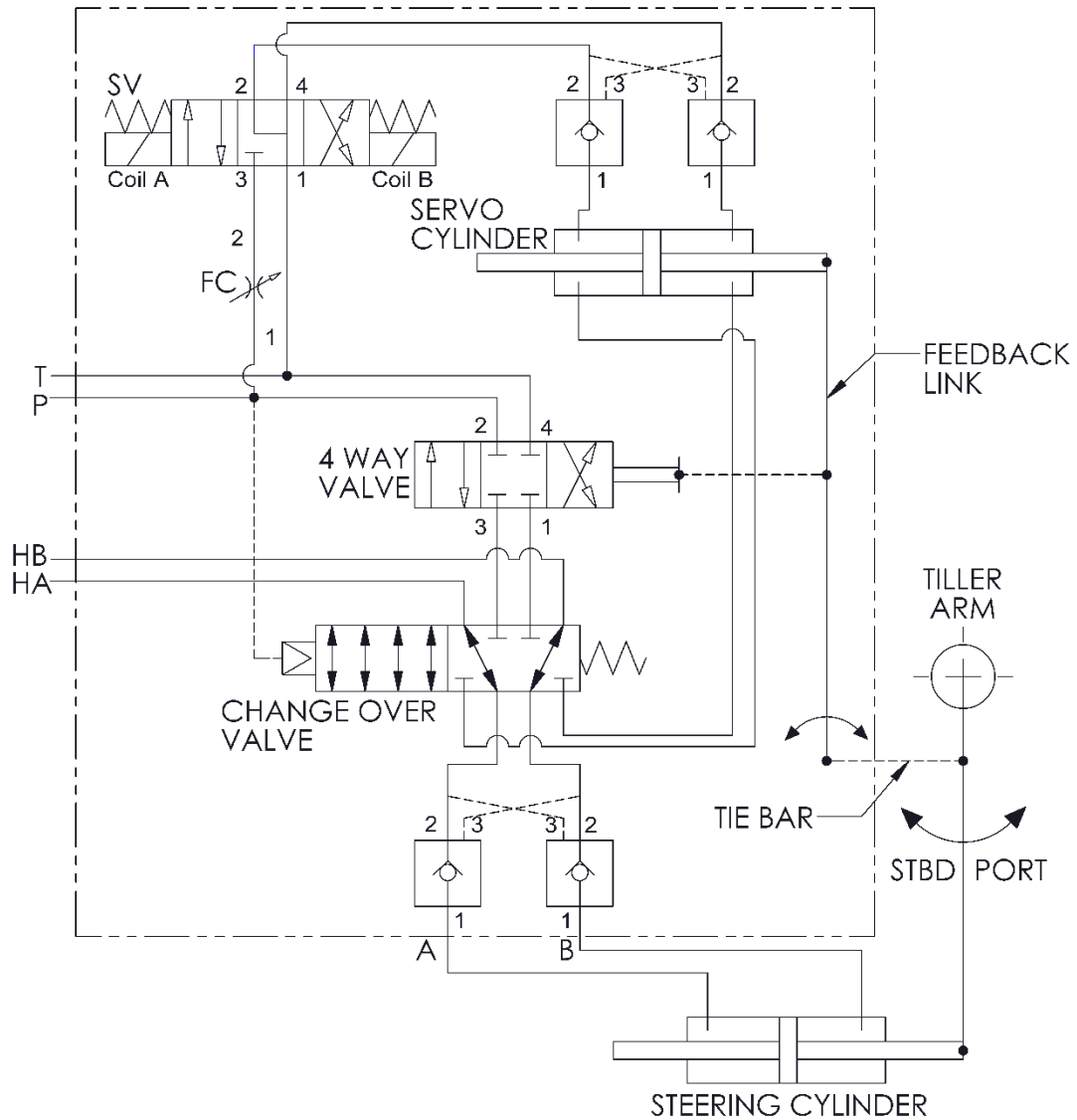


Figure 2: Hydraulic Schematic

#### NOTICE

External flow control should be installing in the pressure line to adjust cylinder speed (see Appendix C)

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## 2 INSTALLATION

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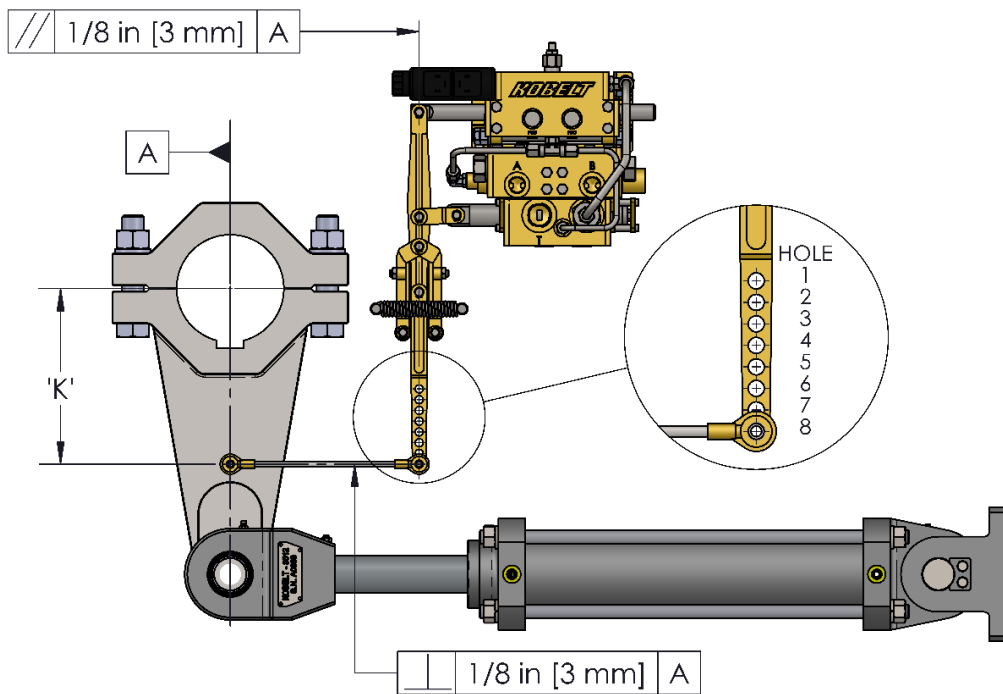
### 2.1 MECHANICAL

The unit must be placed in the steering compartment near the tiller arm. The foundation for the unit should be flat, vibration free and securely attached to the ship's hull. When installing the Kobelt 7248 follow-up power steering unit;

1. Position the unit parallel to the tiller arm at the same elevation as either the top or bottom face,
2. With the tiller arm, servo cylinder and steering cylinder at mid-ship position, ensure that;
  - a. the feedback linkage of the FFU power steering unit is parallel to the tiller arm centerline.
  - b. the tie bar between the tiller arm and FFU power steering unit is square to them both.
  - c. That the center of the tie bar eye lies on the centerline of the tiller arm.
3. Position the mechanical feedback linkage a distance of 'K' from the rudder stock center (reference the table and diagram below).
4. Ensure adequate clearance is provided to allow room for the feedback link to move freely.

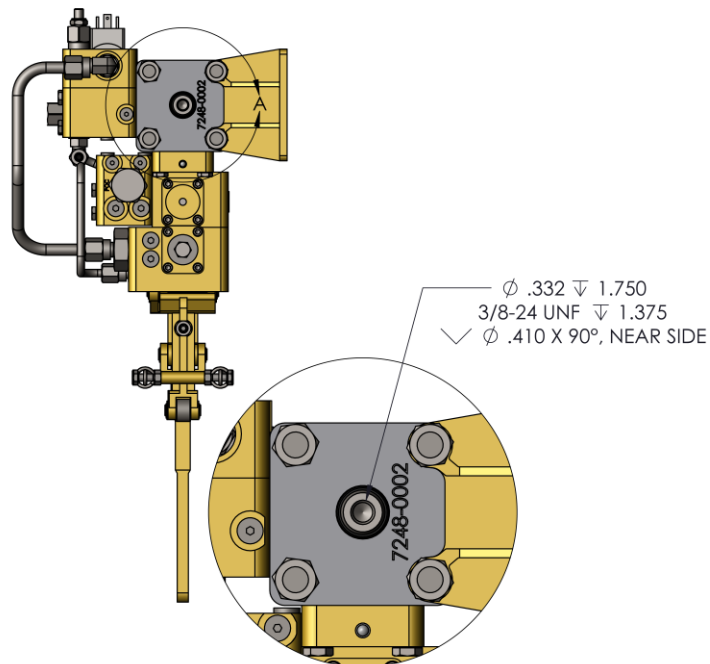
*Table 1: Feedback Link Position*

Link Position (Hole #)	Dimension 'K'			
	35° Rudder Angle		45° Rudder Angle	
	[in]	[mm]	[in]	[mm]
1	4.25	108	3.42	87
2	4.52	115	3.66	93
3	4.79	122	3.90	99
4	5.06	129	4.12	105
5	5.33	135	4.35	110
6	5.60	142	4.57	116
7	5.87	149	4.79	121
8	6.14	156	5.01	127



*Figure 3: FFU unit Positioning Requirements*

When an automatic pilot is installed, the auto pilot feedback unit must be located at the Kobelt servo cylinder and mechanically linked to it. The automatic pilot feedback must not be connected to the rudder stock.



## 2.2 HYDRAULIC CONNECTIONS

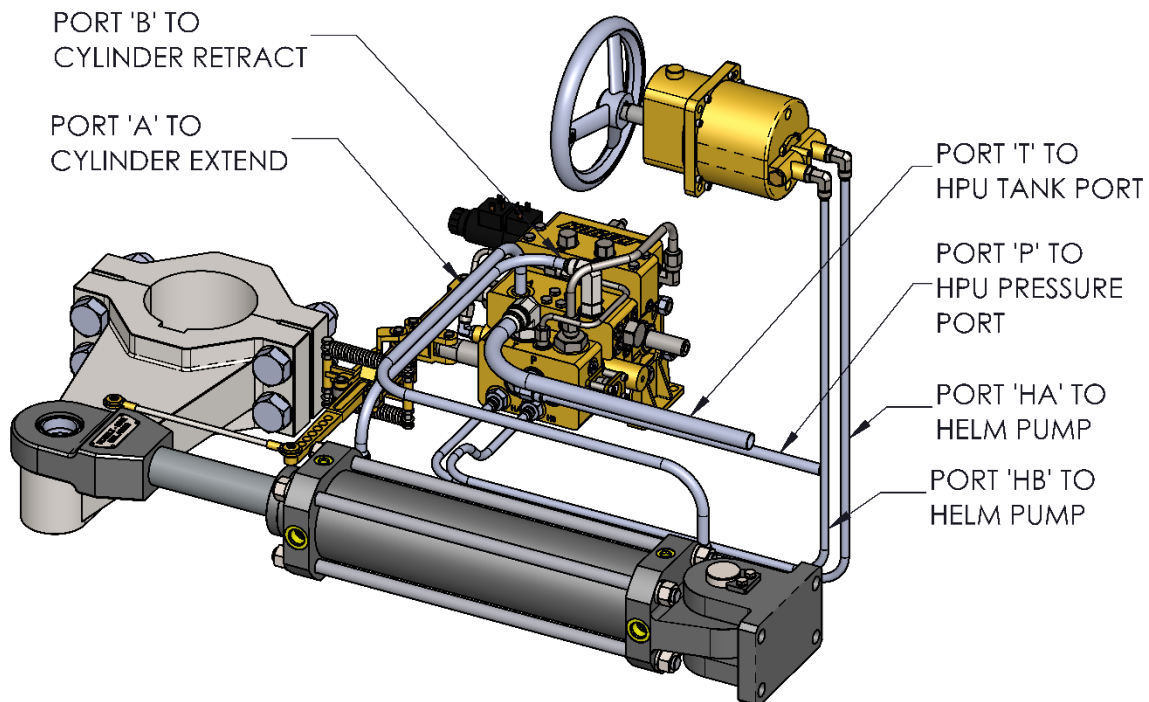
The FFU unit is equipped with ORB ports that are plugged for shipping. Ensure the plugs remain in place until the unit is ready for connection. All hoses and piping must also be plugged or capped until ready for connection. All piping and hoses must be flushed prior to connection. Failure to do so can result in damaged components and seals.

The piping to the steering cylinder must be adequately sized for the anticipated flow. The piping must be selected to safely withstand the operating pressure. Secure the piping against vibration with pipe clamps per the schedule in the table below.

3/8"-1/2" tube	1/4" – 1/2" pipe 1/2"-3/4" tube	3/4" pipe 1"-1.25" tube	1" pipe 1.50" tube
3 ft	4 ft	5 ft	6.5 ft

The FFU steering unit is equipped with various sizes of ports. Consult the technical data section of this manual for the specific port data. The connections to the FFU steering must be made by hoses of suitable rating to accommodate any movements, vibration or thermal strain.

The lines from ports "A" and "B" to the main steering cylinder must be connected in accordance with the drawing below. If these lines are incorrectly connected, the FFU steering unit will shift the rudder hard-over to one side and it will remain there. Crossing the lines to the main cylinder will correct this problem.



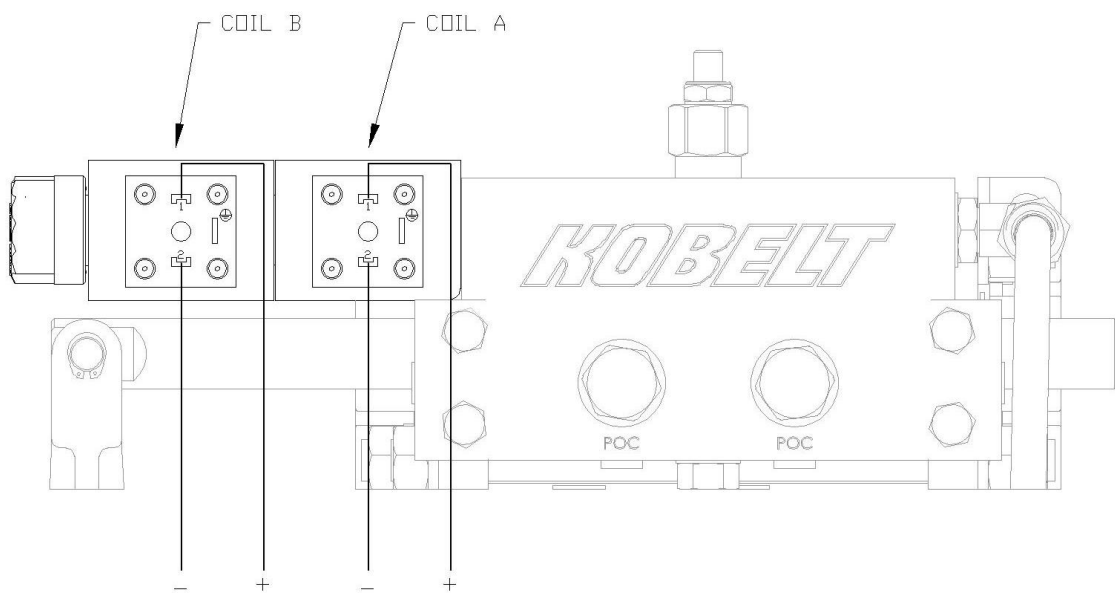
*Figure 4: Piping Diagram (single cylinder)*



Long piping lengths will have a detrimental effect on the response time of the steering unit and should therefore be avoided.

## 2.3 ELECTRICAL CONNECTIONS

The electrical connection to the solenoid valve coils is made through an ISO/DIN 43650, Form A connection. Note that energizing coil A will direct flow from the 'P' port to the 'A' port.



*Figure 5: Coil Assignment*

When installed correctly, it is not necessary to install limit switches to stop the travel of the servo cylinder when operating with a jog steerer. Energizing the solenoid valve while the steering gear is hard over against its stops will not cause any damage to the hydraulic system. The power steering pump(s) will sense the pressure and turn off the oil flow (see section 4).

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## 3 COMMISSIONING

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### 3.1 FLUSHING

Before subjecting the steering system to full hydraulic pressure, the lines must be flushed to an ISO 4406 cleanliness rating of 19/17/14.

### 3.2 INSPECTION & FUNCTION TEST

Before putting the vessel into service perform a quick inspection and function test of the unit:

1. Ensure that all mounting bolts are properly installed.
2. All connection points on the feedback linkage are tight.
3. Operate the unit in manual mode and confirm rudder moves in the correct direction. Reverse the two hydraulic lines to the helm pump if incorrect.
4. Operate the unit in power mode and move the rudder to one extreme. Confirm that the rudder can return. If not, reverse the two hydraulic lines to the steering cylinder(s) and repeat step 3.
5. Operate the unit in Autopilot/Jog mode and confirm correct rudder movement. Switch the coil leads if incorrect.
6. Adjust flow control valve, FC, to set desired rudder speed.

## 4 OPERATION

---

### 4.1 FUNCTIONAL REQUIREMENTS

The HPU providing the hydraulic power to the Kobelt FFU power steering unit must;

1. be a variable displacement piston pump type,
2. supply a mineral based ISO VG32 hydraulic oil to avoid seal compatibility issues,
3. generate up to 1500 psi of pressure,
4. produce a maximum flow of 20 gpm.

In addition, the hydraulic circuit must contain a relief valve flow control set to limit the system pressure to a maximum of 1750 psi.

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## 5 MAINTENANCE

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### 5.1 PREVENTATIVE MAINTENANCE & INSPECTION

Maintenance Schedule

Maintenance Item	Daily	Monthly	Annually	5 years
Check oil level and temperature	✓			
Check hydraulic connections	✓			
Check for oil leaks	✓			
Check mechanical connections	✓			
Check pivot pins			✓	
Inspect valve spool				✓
Inspect actuator rod				✓

### 5.2 RECOMMENDED SPARES

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

1. One seal kit
2. Solenoid coils

Refer to the parts list drawings in Appendix B for a complete list of parts.

### 5.3 TROUBLESHOOTING

Symptom	Cause
Inaccurate steering	Loose linkage pins / Air
Unit 'hunts' for setting	Loose linkage pins / Air
Rudder drifts	Failed lock valve / Air

---

## 6 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.

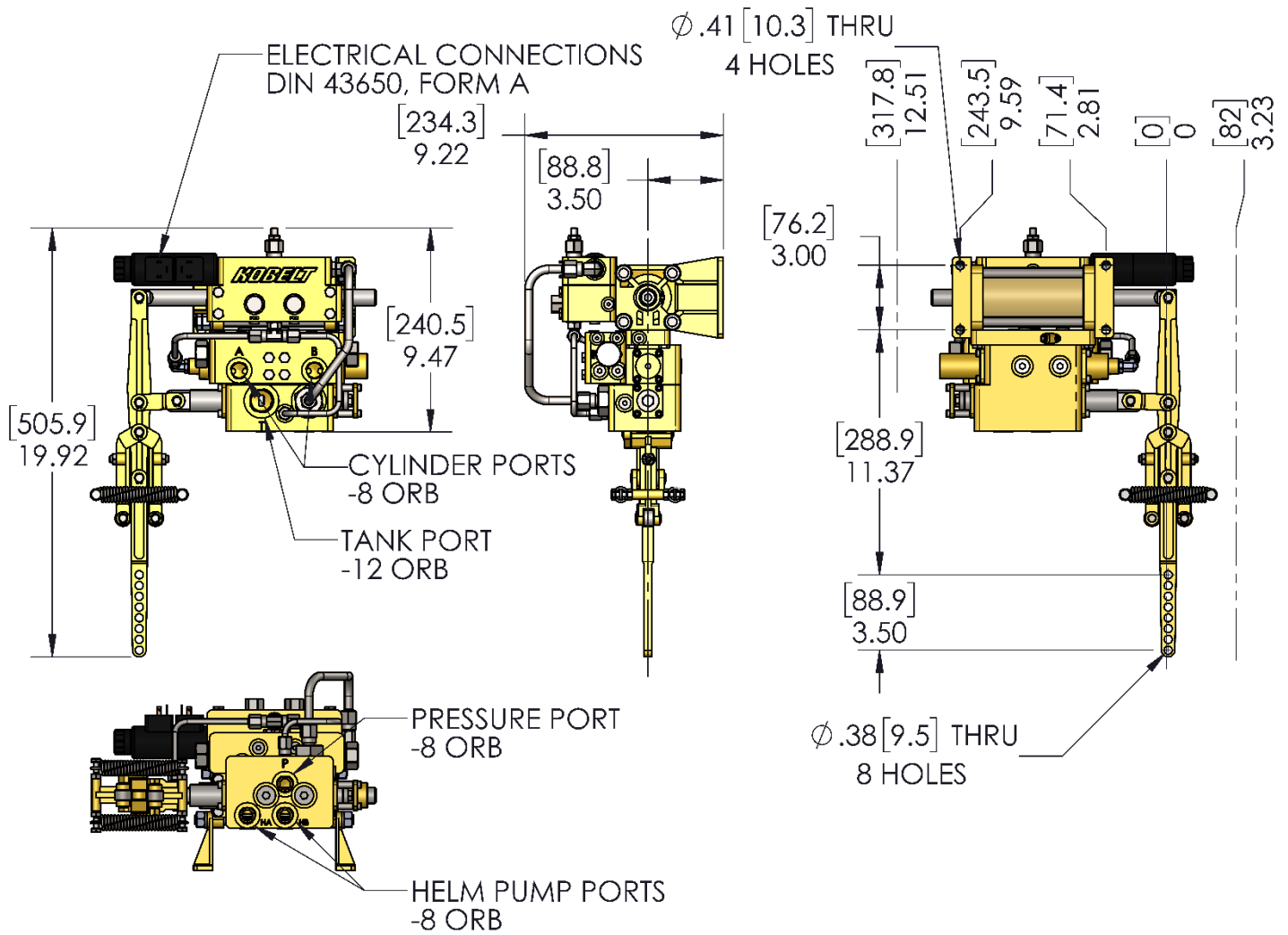
Upon identification of a potential issue or defect with a Kobelt Product or Part, the Warranty Applicant ("Applicant") must immediately contact Kobelt and describe the issue in writing, by letter, fax, email or other electronic conveyance. Kobelt will then assess the cause of the defect, and determine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

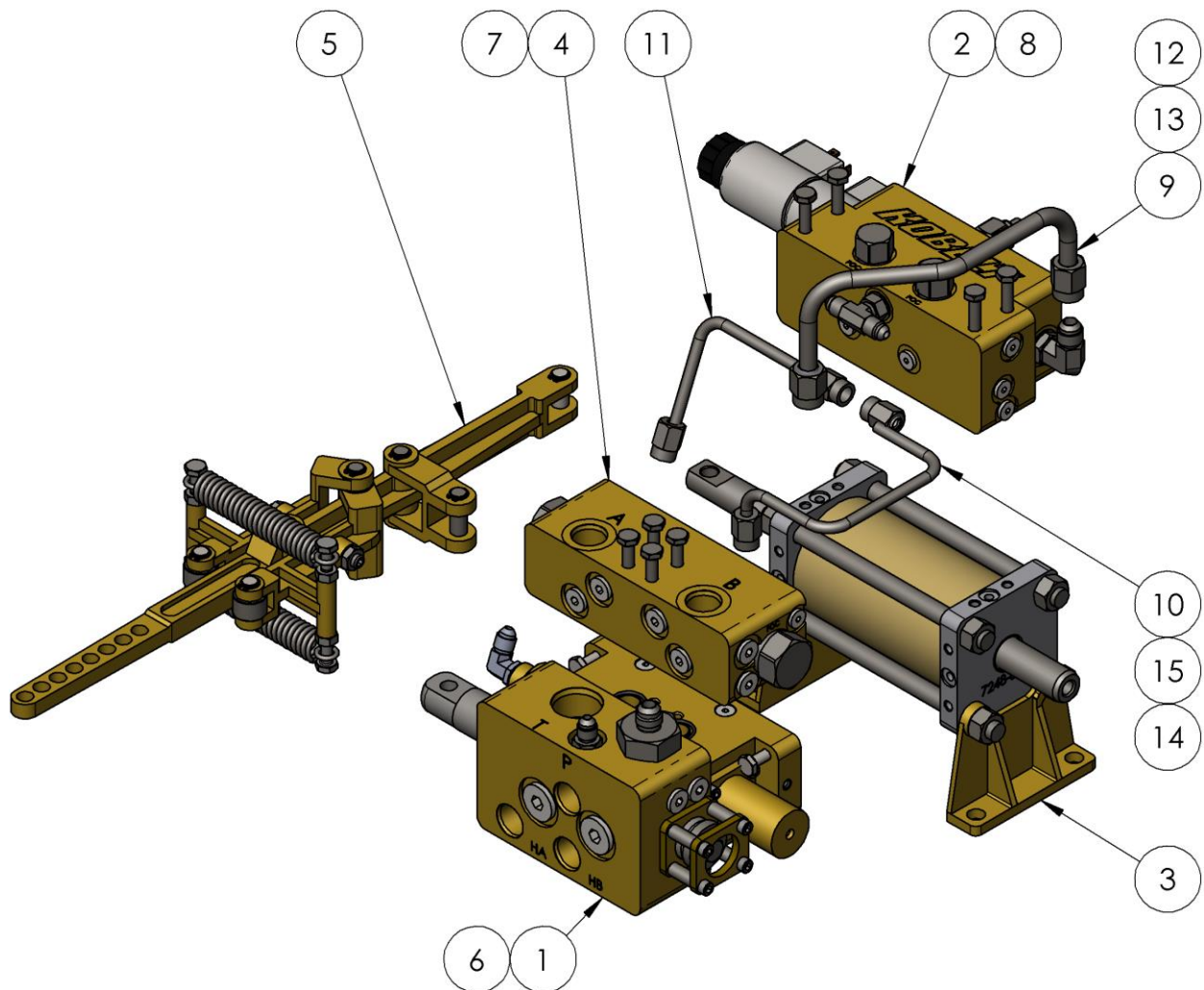
## 7 APPENDIX A: TECHNICAL DRAWINGS



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## 8 Appendix B: Parts List Drawings

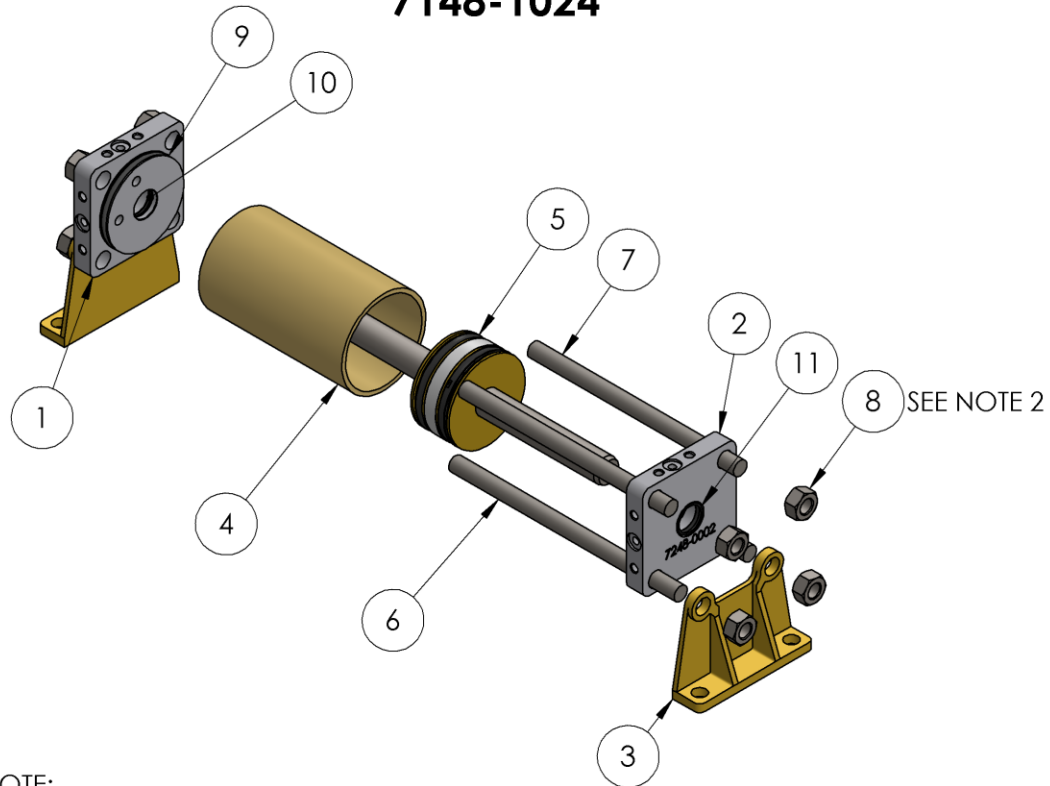
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ITEM	QTY		PART NUMBER	DESCRPTION
	7248-DC12	7248-DC24		
1	1	1	7001-0055-SUB	MANIFOLD SUB-ASSEMBLY
2	1	-	7001-0055-SUB12	MANIFOLD SUB-ASSEMBLY - 12 VOLT DC
2	-	1	7001-0055-SUB24	MANIFOLD SUB-ASSEMBLY - 24 VOLT DC
3	1	1	7148-1024	SERVO CYLINDER SUB-ASSEMBLY
4	1	1	7001-0057-SUB	MANIFOLD SUB-ASSEMBLY
5	1	1	7148-1022	LEVER ARM SUB-ASSEMBLY
6	4	4	1001-1016	SCREW - HEX HEAD; 1/4-20 X 1; 18-8 SS
7	4	4	1001-1036	SCREW - HEX HEAD; 1/4-20 X 2-1/4; 18-8 SS
8	4	4	1001-1048	SCREW - HEX HEAD; 1/4-20 X 3; 18-8 SS
9	1	1	7148-0105	TANK LINE
10	1	1	7148-0106	PILOT LINE
11	1	1	7148-0107	SUPPLY LINE
12	2	2	7039-0633	FLARELESS FERRULE - -06
13	2	2	7039-0632	FLARE NUT - -06
14	4	4	7039-0635	FLARELESS FERRULE - -04
15	4	4	7039-0634	FLARE NUT - -04

## 7148-1024

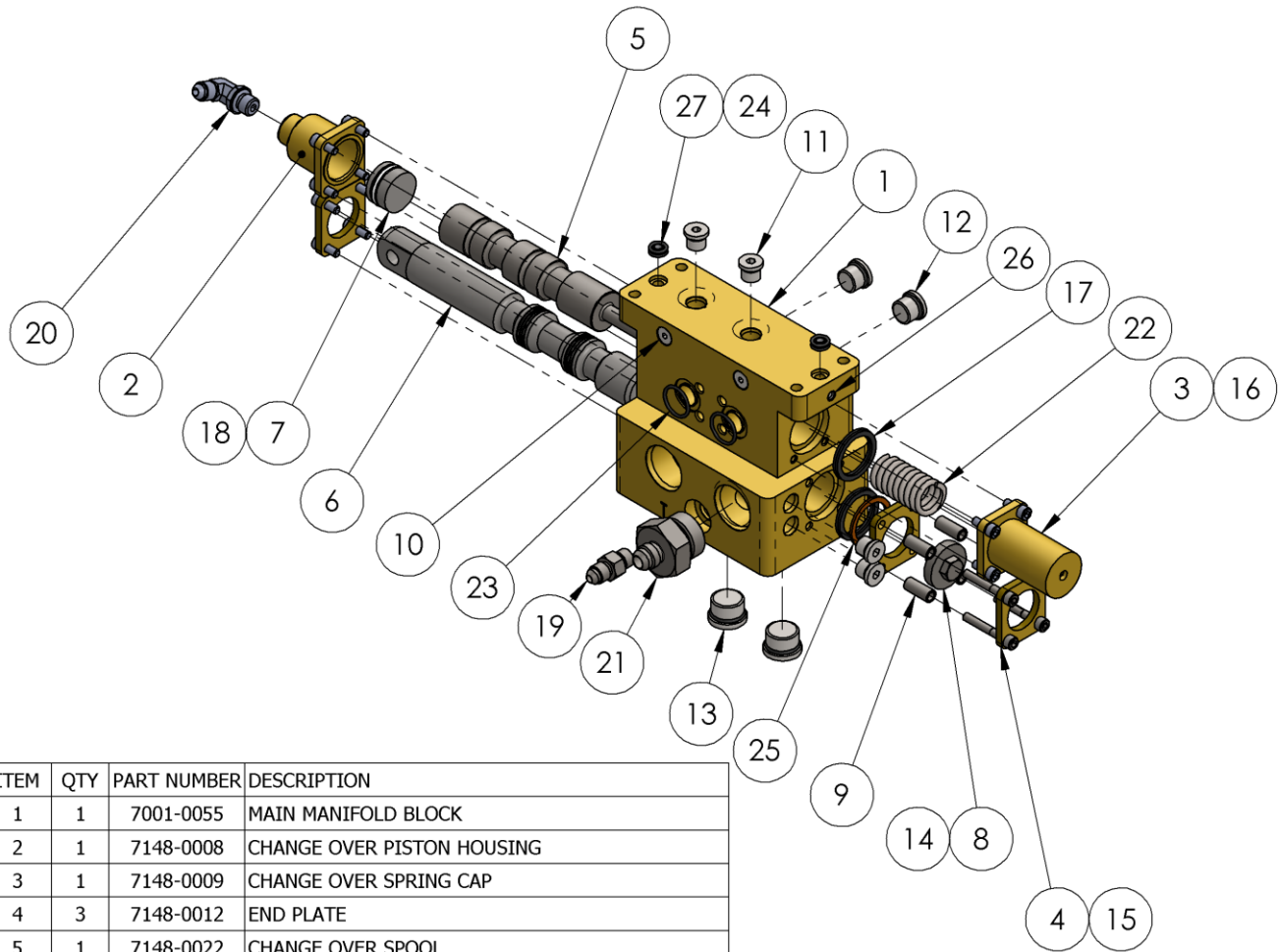


**NOTE:**

1. INSTALL SEALS WITH WHITE ASSEMBLY GREASE
2. APPLY LOCTITE 242 & PRELOAD TO 30 FT-LBS

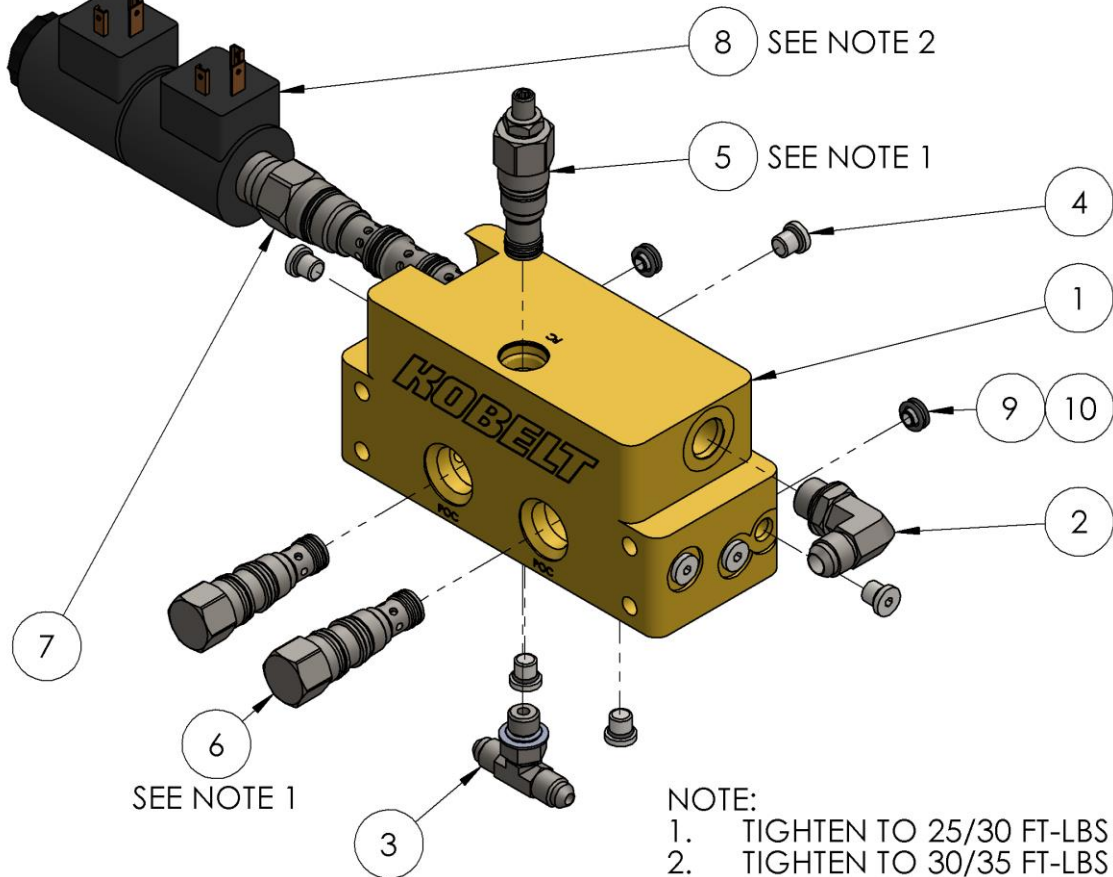
NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	7248-0001	END CAP, SERVO CYLINDER, LH
2	1	7248-0002	END CAP, SERVO CYLINDER, RH
3	2	7148-0015	MOUNTING FOOT
4	1	7148-0020	CYLINDER, FFU STEERING
5	1	7148-1023	7148 PISTON ROD SUB-ASSEMBLY
6	2	7148-0056	TIE ROD, LONG
7	2	7148-0057	TIE ROD, SHORT
8	8	1022-0163	NUT, HEX, 7/16 UNF, 18-8
9	2	1101-0228	O-RING, 2-228, NBR70
10	2	1102-0007	U-CUP, 1 OD x 3/4 ID x 1/8 H
11	2	1102-6012	ROD WIPER; 3/4in, AN STYLE, AU90

## 7001-0055-SUB



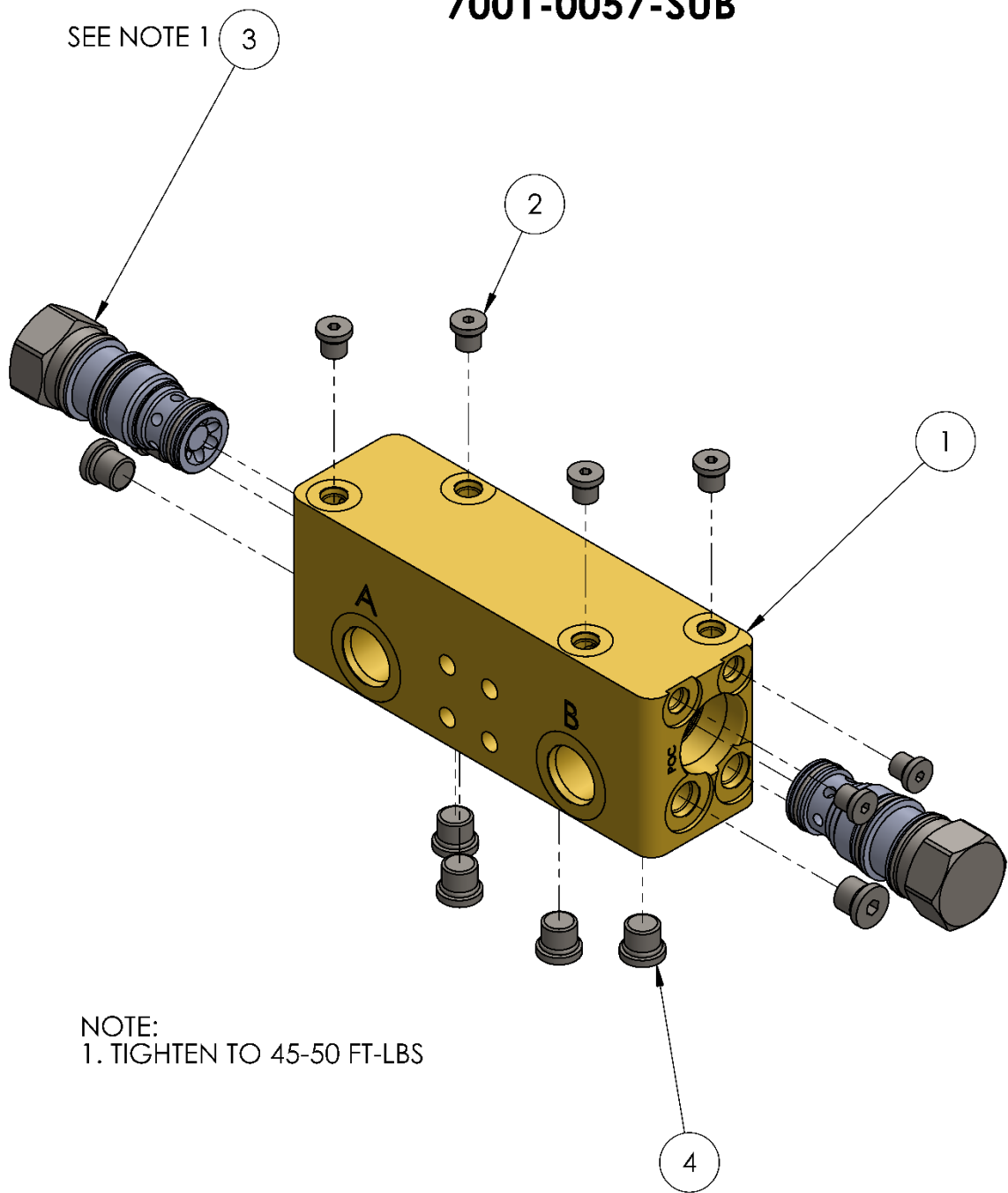
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	7001-0055	MAIN MANIFOLD BLOCK
2	1	7148-0008	CHANGE OVER PISTON HOUSING
3	1	7148-0009	CHANGE OVER SPRING CAP
4	3	7148-0012	END PLATE
5	1	7148-0022	CHANGE OVER SPOOL
6	1	7148-0023	MAIN VALVE SPOOL
7	1	7148-0026	CHANGE OVER PISTON
8	1	7148-0028	STOP WASHER
9	4	7148-0029	SPACER
10	4	7039-0660	PLUG - HEX SKT; #02 ORB
11	4	7039-0661	PLUG - HEX SKT; #04 ORB
12	2	7039-0662	PLUG - HEX SKT; #06 ORB
13	2	7039-0663	PLUG - HEX SKT; #08 ORB
14	1	1001-1110	SCREW - HEX HD; 5/16-18 X 5/8; 18-8 SS
15	4	1002-0822	SCREW - SKT HD; #10-24 X 1-3/8; 18-8 SS
16	12	1002-0808	SCREW - SKT HD; #10-24 X 1/2; 18-8 SS
17	4	1102-2010	U-CUP
18	1	1102-2007	U-CUP
19	1	7039-0116	ADAPTOR - STRAIGHT; #04 M-JIC X #04 M-ORB
20	1	7039-0232	ADAPTOR - 90°; #04 M-JIC X #04 M-ORB; SS
21	1	7039-0156	ADAPTOR - STRAIGHT; #06 M-JIC X #12 M-ORB
22	1	1201-0169	SPRING- SPOOL RETURN
23	2	1101-0017	O-RING - -017
24	4	1101-0011	O-RING - -011
25	2	1109-1000-18	U-CUP BACK-UP RING
26	4	7039-3058	EXPANSION PLUG
27	2	7148-0104	O-RING COLLAR

## 7001-0056-SUB



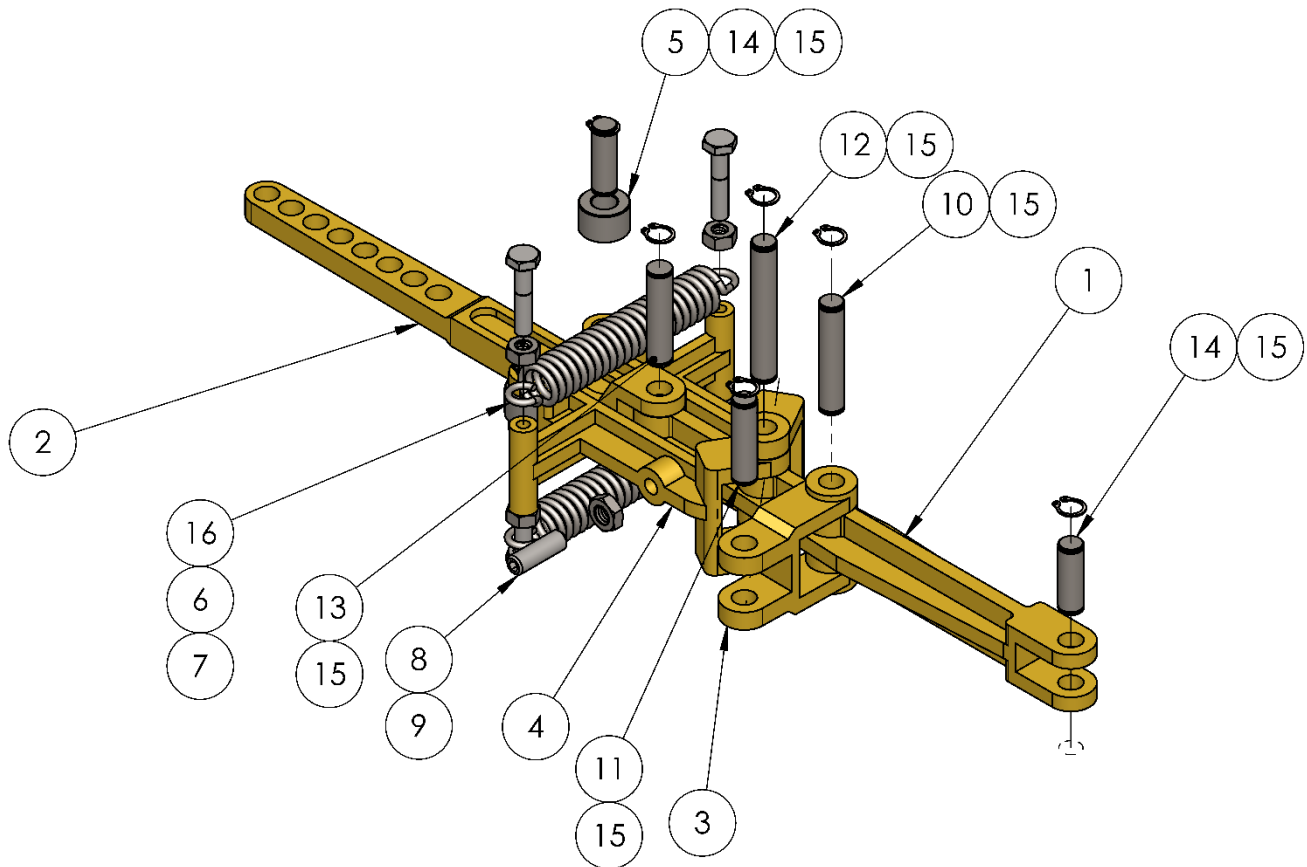
ITEM	QTY		PART NUMBER	DESCRIPTION
	7001-0056-SUB12	7001-0056-SUB24		
1	1	1	7001-0056	MANIFOLD BLOCK
2	1	1	7039-0229	ADAPTOR - 90°; #06 M-JIC X #06 M-ORB
3	1	1	7039-0416	ADAPTOR - TEE; #04 M-JIC X #04 M-JIC X #04 M-ORB
4	11	11	7039-0660	PLUG - HEX SKT; #02 ORB
5	1	1	7044-0004	FLOW CONTROL VALVE
6	2	2	7045-0007	CHECK VALVE
7	1	1	7048-0016	SOLENOID VALVE
8	-	2	7024-0004	SOLENOID - 28 VDC
8	2	-	7024-0005	SOLENOID - 14 VDC
9	4	4	1101-0011	O-RING - -011
10	2	2	7148-0104	O-RING COLLAR

# 7001-0057-SUB



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	7001-0057	7148 LOCK VALVE BLOCK
2	6	7039-0660	PLUG, HEX SCKT, 2 ORB, PLATED STEEL
3	2	7045-0004	PO Check_ 30 GPM
4	8	7039-0661	PLUG, HEX SKT, -04 ORB, PLATED STEEL

## 7148-1022



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	7148-0016	FEED BACK LEVER ROD END
2	1	7148-0017	OUTPUT FEED BACK LEVER
3	1	7148-0018	LINK
4	2	7148-0019	TOGGLE LINK
5	2	7148-0044	ROLLER
6	4	1001-1020	SCREW, HEX HD, 1/4-20 X 1-1/4
7	4	1022-0110	NUT, HEX, 1/4-20 UNC, SS
8	2	1016-1116	SET SCREW, CUP, 5/16 UNC X 1, 18-8
9	2	1022-0211	NUT, JAM, 5/16-18 UNC, SS
10	1	1025-0330	CLEVIS PIN, 3/8 x 1.902
11	1	1025-0322	LINK PIN, 3/8 x 1.426
12	1	1025-0339	TOGGLE PIN, 3/8 x 2.409
13	1	1025-0326	HINGE PIN, 3/8 x 1.280
14	3	1025-0318	ROLLER PIN, 3/8 x 1.162
15	14	1029-1037	SNAP RING, EXT, 3/8 SHAFT
16	2	1202-1007	SPRING, EXTENSION, .72OD X .105 WIRE, SS

## 9 APPENDIX C: TYPICAL SYSTEM ARRANGEMENT

