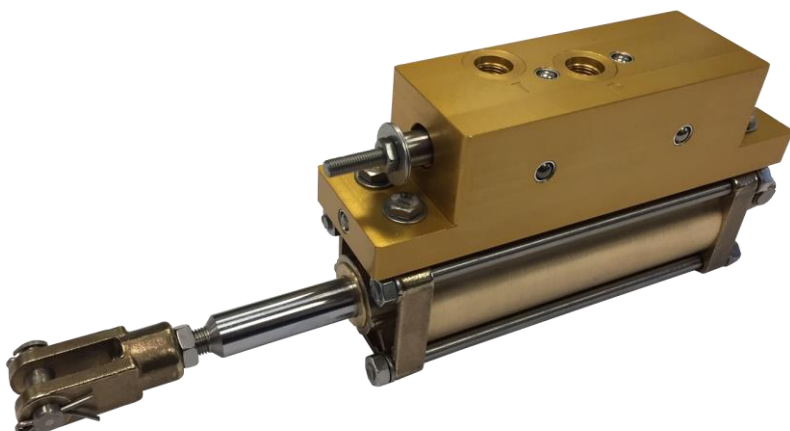


KOBELT

4605 Hydraulic Servo Cylinder

Owner's Operation, Installation & Maintenance Manual



April 2021

Kobelt Manufacturing Co. Ltd.

NOTES:

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

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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.

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	<p>Hydraulic cylinders can produce large forces which can cause injury to human body parts and damage to nearby components. Keep body away from moving parts and pinch points. It is the responsibility of the owner to ensure that the mechanism that the cylinder is connected to can handle the loads that the cylinder produces.</p>
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 WARNING	<p>This product is powered by hydraulic fluid. Consumption and contact with eyes can cause death and blindness. Pressurized fluid jetting out can cause injuries such as hydraulic septicemia. Prior to beginning work on this product always ensure:</p> <ul style="list-style-type: none"> • Safety glasses are being worn. • Pressure has been exhausted and the pressure source has been locked out. • You are qualified to work on hydraulics. <p>Additionally, it is highly recommended that a relief valve set to the maximum pressure of this unit is installed to the pressure line supplying this unit.</p>
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NOTICE	<p>To ensure the product does not get damaged during storage and installation:</p> <ul style="list-style-type: none"> • Store the unit with the cylinder fully retracted. • Ensure all plugs remain in place until unit is ready to be connected to hydraulics.
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2 PRODUCT DESCRIPTION

Controlled by a “push-pull” control but powered by fluid power, the 4605 hydraulic servo cylinder allows the user to produce half-a-ton of force with minimal human effort. This product can be used wherever large forces are needed at fingertip actuation. Possible applications for this unit include waterjet reversing buckets, controlling CP propeller lever mechanisms, controlling mechanical gearboxes, and steering systems. The 4605 is available in 4”, 6”, and 8” strokes and in either 1/4-28 UNF or 3/8-24 UNF threads on the valve spool and is fully compatible with Kobelco’s 2000-series Push-Pull control heads and cables.

The 4605 unit consists of two main subunits, the valve and the cylinder. The operating principles of the cylinder are very simple; pressurized fluid is directed to either end of the cylinder causing it to retract or extend and exert a force on whatever it is connected to. The valve is what is used to control the operation of the cylinder; it takes input from the user via the spool and directs the pressurized fluid where it needs to go to complete the desired action (i.e. extend, retract, or stay in the current position). See Figure 1 below for a depiction of the components.

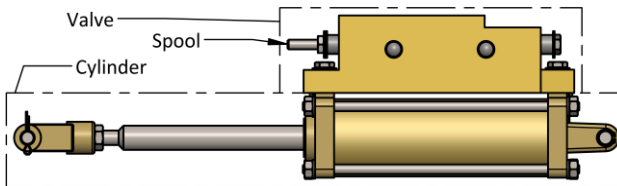


Figure 1: 4605 Components.

This product comes in a few different configurations allowing for a custom-tailored solution to your needs. Refer to Table 1 on the following page for a listing of the models available and their operating parameters.

2.1 TECHNICAL DATA

Table 1: 4605 Technical Data

MODEL	4605					
KOBELT PART #	4605-4	4605-6	4605-8	4605-4S	4605-6S	4605-8S
STROKE, CYLINDER	4" 10 cm	6" 15 cm	8" 20 cm	4" 10 cm	6" 15 cm	8" 20 cm
STROKE, SPOOL VALVE	0.62" 15.8 mm					
FORCE OUTPUT, EXTENSION	1160 lbf 5170 N					
FORCE OUTPUT, RETRACTION	1010 lbf 4490 N					
FORCE INPUT	< 5 lbf < 20 N					
MAXIMUM PRESSURE	500 psi 35 bar					
VOLUME	9.8 in ³ 160 mL	14.6 in ³ 240 mL	19.4 in ³ 320 mL	9.8 in ³ 160 mL	14.6 in ³ 240 mL	19.4 in ³ 320 mL
AMBIENT TEMPERATURE	-40 to 140 °F -40 to 60 °C					
WEIGHT	6.6 lbs 3.0 kg	7.8 lbs 3.5 kg	8.9 lbs 4.1 kg	6.6 lbs 3.0 kg	7.8 lbs 3.5 kg	8.9 lbs 4.1 kg
VALVE SPOOL THREAD	1/4-28 UNF			3/8-24 UNF		

NOTICE

Operating outside of the ambient temperature range and above the maximum pressure can result in failure of the unit and will void the warranty.

3 OPERATION

NOTICE

Note the ambient temperature and maximum pressure specified in Table 1: 4605 Technical Data on page 7. Exceeding these values can cause failure of the unit.

The valve takes input from the user mechanically via the spool. Moving the spool valve causes the cylinder to move in the opposite direction the spool (see Figure 2). It takes approximately 3.1 lbs [14 N] of input force to overcome spool friction.

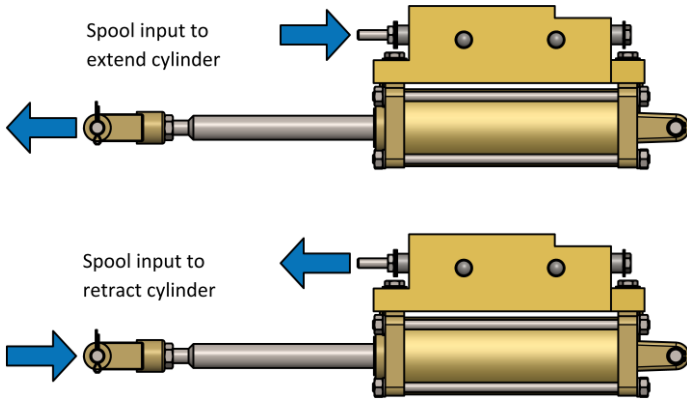


Figure 2: Cylinder Movement Given a Spool Input.

4 INSTALLATION

4.1 MOUNTING

NOTICE

Ensure that the mechanism that the cylinder is attached to can either accommodate the full stroke of the cylinder or is able to withstand the full load that the cylinder produces at maximum pressure; damage and failure of the mechanism can occur if this is not taken into consideration. Note that due to manufacturing tolerances, the strokes can vary up to 0.08" (2 mm) over the nominal value (e.g. a cylinder with a nominal stroke of 4" can have an actual stroke up to 4.08").

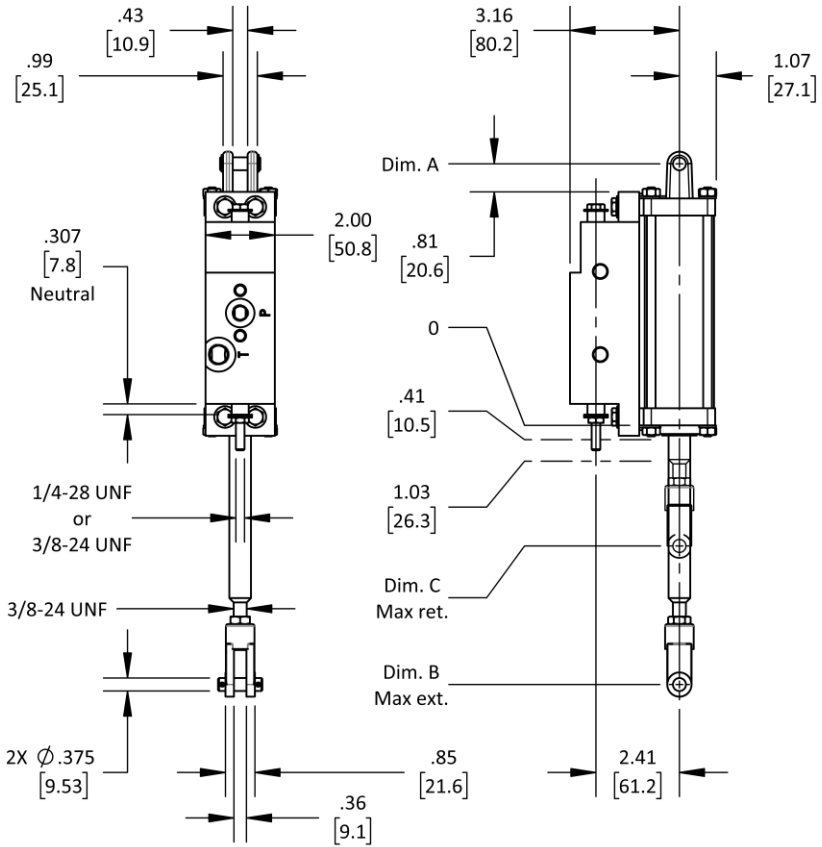
See Figure 3 on the next page for the dimensions of the 4605 hydraulic servo cylinder. The mounting of the 4605 to the mechanism to be controlled should precede the connection of the unit to a source of hydraulic power if possible; for hydraulic installation instructions and related safety information refer to section 4.2 *Hydraulic Installation*.

WARNING

If the cylinder is connected to a hydraulic power source, ensure that pressure has been exhausted and the pressure source has been locked out.

The mounting of the 4605 is done as follows:


1. Remove cotter pins and retaining rings from the clevis pins.
2. Remove the clevis pins from the holes they are in.
3. Align clevis pin holes with mechanism cylinder is to be mounted to. Note that the axial position of the rod end clevis relative to the piston-rod can be adjusted by loosening the jam nut and screwing or unscrewing the clevis and retightening the jam nut.
4. Reinstall clevis pins through both holes.
5. Reinstall cotter pins and retaining rings to clevis pins.
6. Connect the valve to the input mechanism (e.g. a Kobelt Push-Pull control) via the thread on the spool or by another means. Ensure that the spool's neutral position lines up with input device's neutral position to the best of your ability (see Figure 2 for spool neutral positioning). Secure/tighten the connection.
7. Without system pressurization, ensure unobstructed movement of the system for the full stroke of the cylinder.



Stroke	Dim. A	Dim. B	Dim. C
4 [100]	7.55 [191.7]	7.48 [190.0]	3.48 [88.4]
6 [150]	9.55 [242.5]	9.48 [240.8]	3.48 [88.4]
8 [200]	11.55 [293.3]	11.48 [291.6]	3.48 [88.4]

Figure 3: 4605 Dimensions in Inches [Millimetres]

4.2 HYDRAULIC INSTALLATION

 WARNING	<p>Hydraulic fluid can cause harmful health effects or death. Contact with eyes can cause blindness. Pressurized hydraulic fluid jetting can cause hydraulic septicemia. Due to the harmful health effects of hydraulic fluid and the inherent risks of dealing with high pressure fluids only someone knowledgeable and properly trained in the installation and maintenance of hydraulic systems should work on this system. Observe the following instructions:</p> <ul style="list-style-type: none">• Wear safety glasses.• Prior to working on this product ensure that the pressure has been exhausted and the pressure source has been locked out.• Install a relief valve set to the maximum operating pressure (500 psi/35 bar) and install it to the line supplying pressure to the cylinder.• Clean up any spills.
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NOTICE	<p>Note the general recommendation for hydraulic installation:</p> <ul style="list-style-type: none">• Ensure plugs remain in place until the unit is ready for connection.• All piping and hoses must be flushed prior to connection. Failure to do so can result in damaged components and seals.• All hoses and pipe must also be plugged or capped until they are ready for connection.• Connections to the unit must be able to accommodate the full-movement of the unit (i.e. hard line is unlikely to work and flexible hose will most likely be needed).• Piping must be selected and sized to safely withstand the pressures to operate the unit in the environment that it will be operating in.
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The 4605 cylinder needs to be connected to a source of hydraulic power to function. Supply pressure to the spool valve should be connected to the port marked by a "P". The tank return line should be connected to the port marked by a "T". The pressure port and tank port connections are of the SAE -4 ORB and SAE -6 ORB type, respectively.

5 COMMISSIONING

5.1 HYDRAULIC FILL & BLEED

- Open any valves that are installed to the system.
- Fill the system with an anti-wear petroleum-based fluid appropriate for the service conditions.
- Allow enough time for the cylinder to fill with oil.

5.2 FUNCTIONAL TEST



CAUTION

It is recommended to carry out as much functional testing as possible before leaving dock and after the entirety of the installation has been completed.

Before commencing desired operations with the installed unit(s) functional testing should be conducted to ensure that the 4605 cylinder and the system it is connected to operate as expected. While testing of the system is somewhat application dependent (e.g. proper function for actuating a CP propeller vs a waterjet reversing bucket may be different) some aspects of it can be common. The following is a general outline of a functional test for a 4605 hydraulic servo cylinder; you might need to tailor it to suit your application.

1. Ensure all cotter pins and retaining rings are installed on the clevises.
2. Ensure clevis jam nut and a valve-spool-to-control-cable connection are tight.
3. Without system pressurization, ensure unobstructed movement of the system for the full stroke of the cylinder.
4. Set the input to the spool valve (e.g. control cable) to neutral.
5. Power on the hydraulics supplied the 4605. Verify:
 - The cylinder does not move from its current position. If it does adjust the spool position relative to the input device until cylinder movement stops.
 - There is no leakage occurring.
6. Provide an input to the spool in either direction. Verify that the cylinder is retracting/extending as expected (Figure 2, page 8).
7. Provide an input to the spool in the opposite direction of step 6. Verify that the cylinder is retracting/extending as expected.
8. Go through several different inputs of extend, retract, and neutral and observe if the cylinder is operating as expected.
9. Check for leakage.

6 MAINTENANCE

6.1 PREVENTATIVE MAINTENANCE

- Monthly
 - Inspect connections, spool valve, cylinder, and interface between spool valve and cylinder for leakage.
- Quarterly (4 times a year)
 - Ensure clevis jam nut and valve-spool-to-control-cable connection are tight.
- Every year
 - Lubricate clevis pins.
- Every 5 years
 - Inspect clevis pins. Scoring or wear greater than 0.01" [0.25 mm] requires replacement of pin.

6.2 RECOMMENDED SPARE PARTS

Kobel recommends having one of the repair kits for this product on hand; the part number is 4605-RK.

NOTICE

It is recommended that any required service work on a Kobelt 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 following trouble-shooting guide. In case you are still encountering issues after troubleshooting, please contact Kobelt directly or one of our dealers in your area for assistance.

Table 2: Solutions to Common Problems.

Problem (Issue encountered)	Cause (What it means)	Corrective Action (What to do)
Leakage	Contamination	Replace oil.
	Seal failure	Replace leaking seal. Part number for kit containing replacement seals is 4605-RK.
	Excessive back pressure	Use larger diameter hose. Reduce length of hose. Minimize number of fittings.
	Excessive system pressure	Reduce input pressure. Install pressure relief valve.
Cylinder drifts	Spool is not centered at neutral	Adjust connection between spool valve input device and spool until drifting stops (e.g. adjust the amount that the spool thread is engaged into the push-pull control thread).
	Leakage past piston seal	Replace piston seals. Part number for kit containing replacement seals is 4605-RK.
Moving the valve spool requires lots of effort	Excessive back pressure	Use larger diameter hose. Reduce length of hose. Minimize number of fittings.
Cylinder goes in opposite direction than specified in Figure 2 on page 8 for a given spool input; also, likely to be accompanied with difficulty in moving spool.	Pressure input to valve and tank return line have been mixed up	Ensure that port marked with "P" and "T" are connected to pressure source and tank, respectively.

8 WARRANTY

Kobel Manufacturing Co. Ltd. (“Kobel”) warrants the Products and Parts manufactured by Kobel 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 Kobel recommendations
- The equipment is installed according to equipment diagrams, specifications and recommendations which Kobel 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 Kobel representative.

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

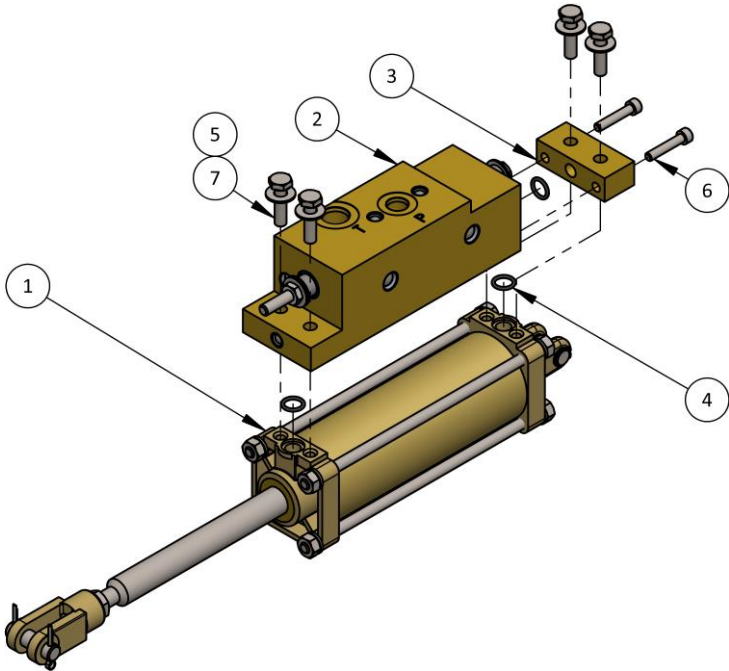
If any part is found to be defective, Kobel will replace said part FOB the Kobel factory provided that any such defective part is returned by the Buyer with freight and applicable forwarding charges prepaid by the Buyer. Kobel’s sole obligation to the Applicant will be to repair or replace the defective part with same or similar product, to a maximum value of the list price of the product or part. The Kobel warranty does not cover labour charges, travel or any other associated expenses.

All Products and Parts manufactured by Kobel, 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.

Kobel will be responsible for all Products or Parts sold by Kobel 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 Kobel warranty.

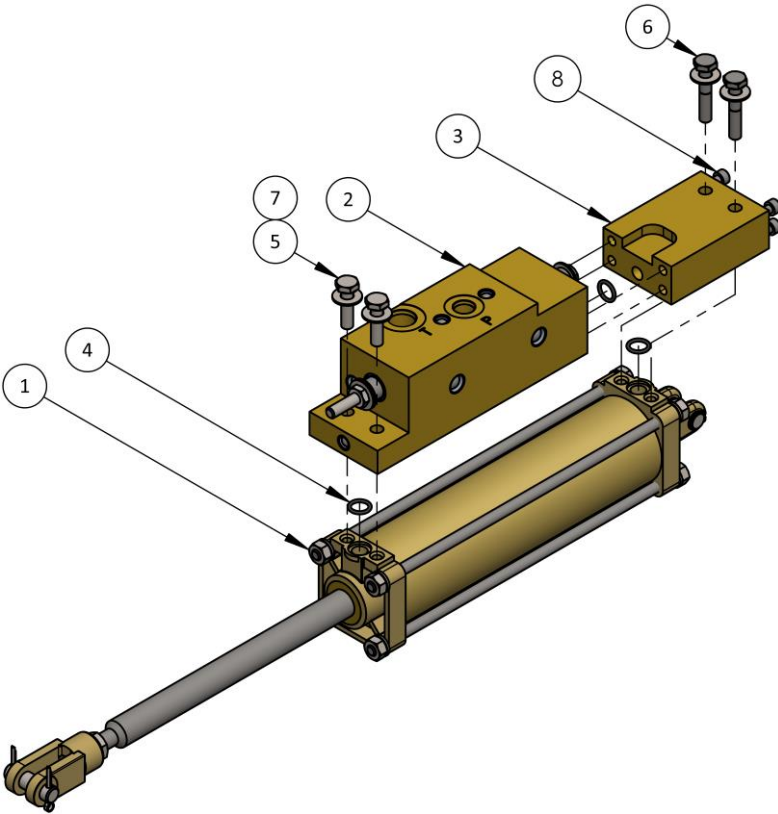
9 APPENDIX A: PARTS LIST

9.1 4605-4 AND 4605-4S PARTS LISTS



Item	Quantity		Part Number	Description
	4605-4	4605-4S		
1	1	1	4605-4-SUB	Cylinder subassembly, 4" stroke
2	1	-	4605-SA	Valve subassembly, 1/4"-28 thread
2	-	1	4605-SA-3/8	Valve subassembly, 3/8"-24 thread
3	1	1	4605-0419	Length adaptor, 4" stroke
4	1	1	4605-RK	Repair kit
5	4	4	1023-0110	Washer, 1/4", SS
6	2	2	1002-0816	Screw, socket head, 10-24 X 1", SS
7	4	4	1001-1016	Screw, hex head, 1/4"-20 X 1", SS

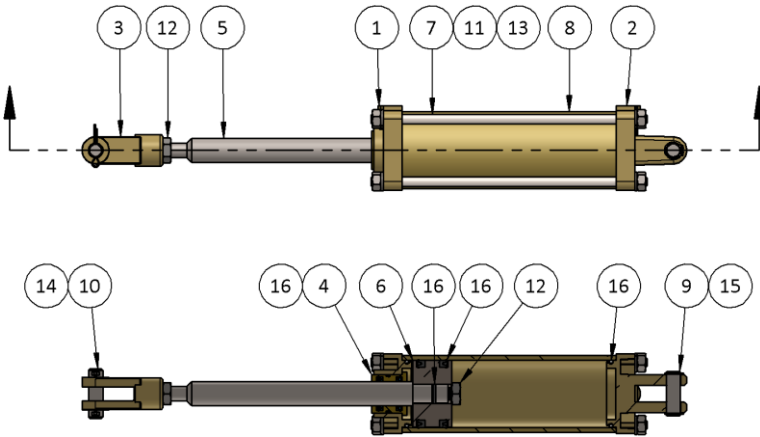
9.2 4605-6, 4605-6S, 4605-8 AND 4605-8S PARTS LISTS



Part numbers and their descriptions are on the next page...

Item	Quantity				Part Number	Description
	4605-6	4605-6S	4605-8	4605-8S		
1	1	1	-	-	4605-6-SUB	Cylinder subassembly, 6" stroke
1	-	-	1	1	4605-8-SUB	Cylinder subassembly, 8" stroke
2	1	-	1	-	4605-SA	Valve subassembly, 1/4"-28 thread
2	-	1	-	1	4605-SA-3/8	Valve subassembly, 3/8"-24 thread
3	1	1	-	-	4605-0619	Length adaptor, 6" stroke
3	-	-	1	1	4605-0819	Length adaptor, 8" stroke
4	1	1	1	1	4605-RK	Repair kit
5	2	2	2	2	1001-1016	Screw, hex head, 1/4"-20 X 1", SS
6	2	2	2	2	1001-1022	Screw, hex head, 1/4"-20 X 1-3/8", SS
7	4	4	4	4	1023-0110	Washer, 1/4", SS
8	4	4	-	-	1002-0848	Screw, socket head, 10-24 X 3", SS
8	-	-	4	4	1002-0880	Screw, socket head, 10-24 X 5", SS

9.3 4605-4-SUB, 4605-6-SUB AND 4605-8-SUB PARTS LISTS



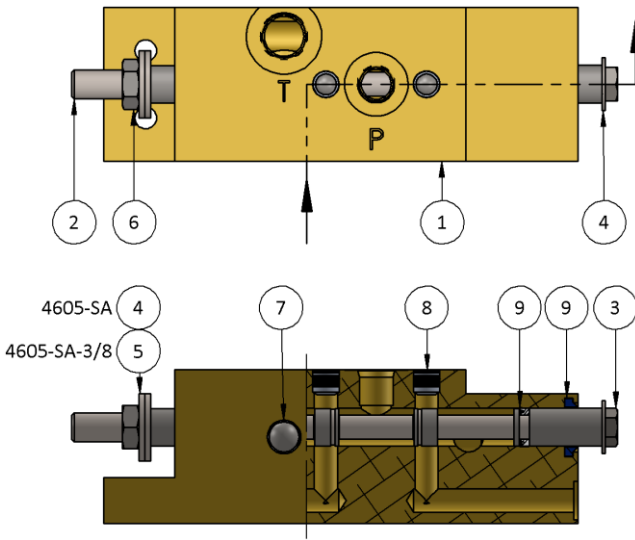
Item	Quantity			Part Number	Description
	4605-4-SUB	4605-6-SUB	4605-8-SUB		
1	1	1	1	4605-0005	End cap, rod end
2	1	1	1	4605-0006	End cap, swivel end
3	1	1	1	4605-0007	Clevis
4	1	1	1	4605-0008	Bushing
5	1	-	-	4605-0009	Rod, 4" stroke
5	-	1	-	4605-1009	Rod, 6" stroke
5	-	-	1	4605-2009	Rod, 8" stroke
6	1	1	1	4605-0010	Piston
7	4	-	-	4605-0412	Tie rod, 4" stroke
7	-	4	-	4605-0612	Tie rod, 6" stroke
7	-	-	4	4605-2012	Tie rod, 8" stroke
8	1	-	-	4605-0413	Tube, 4" stroke
8	-	1	-	4605-1013	Tube, 6" stroke
8	-	-	1	4605-2013	Tube, 8" stroke
9	1	1	1	1025-0318	Pin
10	1	1	1	6112-0010-S	Pin

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Continued from previous page...

Item	Quantity			Part Number	Description
	4605-4-SUB	4605-6-SUB	4605-8-SUB		
11	8	8	8	1022-0160	Nut, hex, 1/4"-28, SS
12	2	2	2	1022-0262	Nut, hex jam, 3/8"-24, SS
13	8	8	8	1023-0310	Washer, lock, 1/4", SS
14	2	2	2	1026-0312	Cotter pin, 3/32" X 3/4", SS
15	2	2	2	1029-1037	Retaining ring, external, 3/8", SS
16	1	1	1	4605-RK	Repair kit

9.4 4605-SA AND 4605-SA-3/8 PARTS LIST



Item	Quantity		Part Number	Description
	4605-SA	4605-SA-3/8		
1	1	1	4605-0018 ¹	Valve manifold
2	1	-	4605-0011 ¹	Valve spool, 1/4"-28 thread
2	-	1	4605-1011 ¹	Valve spool, 3/8"-24 thread
3	1	1	1001-1008	Screw, hex head, 1/4"-20 X 1/2", SS
4	3	1	1023-0111	Washer, 5/16", SS
5	-	2	1023-0112	Washer, 3/8", SS
6	1	-	1022-0260	Nut, hex jam, 1/4"-28, SS
6	-	1	1022-0262	Nut, hex jam, 3/8"-24, SS
7	3	3	200-943 ²	Expansion plug
8	3	3	7039-3056 ²	Expansion plug
9	1	1	4605-RK	Repair kit

¹ Valve spool and manifold must be replaced together.

² Requires special tool to install. Contact your nearest Kobelt representative for assistance.

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