

# **PSD06 Owner's Manual**



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### 1 Introduction

#### **Thank You for Purchasing White Knight Products**

You have purchased a White Knight product that has been designed to our exacting specifications and built by a team of technicians with the highest commitment to quality!

White Knight is the world leader in zero-metal, ultra-high purity pumps and continues to drive the industry with new technology and products. Since the inception of White Knight in 1995, we have been awarded over 14 US design patents and have multiple other patents pending! White Knight currently produces over 30 sizes/models of pumps in varying materials to meet our customers' stringent requirements in numerous applications, including ultra-high temperature re-circulation; high pressure chemical delivery systems, slurry, industrial chemical, and industrial applications.

White Knight has received many prestigious awards for its designs and continues to lead the industry in quality because White Knight controls the manufacturing process from raw materials to finished goods in our facility located in Kamas, UT. This allows us to rigorously manage our quality control process to ensure that our strict cleanliness procedures are always followed and that components are built under consistent methods and conditions for maximum reliability.

Our strict manufacturing process controls include assembling and testing White Knight products in a clean environment. White Knight products also pass a battery of functional tests to ensure operational integrity.

Before installing your White Knight product, please carefully review the product manual. There are many helpful hints and ways to optimize the setup and use of your White Knight product as well as instructions and requirements for installation. In addition, you will also find many accessories in the manual that will enhance the functionality of your White Knight product.

Our team has gone to great lengths to provide you with the highest quality products at the best value and we back them up with excellent warranties and world class support! We hope you agree our products will serve your exacting needs and meet your stringent requirements every time you purchase a White Knight Product.

Sincerely,

White Knight Fluid Handling



# 2 Specifications & Performance

#### 2.1 Pump Specifications

PSD06 Pur	mp Performance	Specification	on¹					
Flow Rate	Theoretical Displacement Per Cycle	Suction Lift Wet	Suction Lift Dry	Sound Pressure <sup>3</sup> dB(a)	Sound Power <sup>3</sup> dB(a)	Max. Size of Passible Solids <sup>4</sup>	Max Operating Temperature	Air Supply Pressure Limits <sup>5</sup>
28 lpm (7.4 gpm)	0.04 L (0.011 gal)	9.5 m (31.2 ft <sup>2</sup> )	3 m (10 ft)	60.2 82.04	54.45 66.1	2 mm (0.08 in)	100°C	30 psi (100 psi)

All tests performed with water at ambient temperatures and PTFE check balls.

- 1. Pump Specifications are subject to change based on configuration ordered
- 2. Suction lift diminishes with wear of pump, minimize suction lift to maximize performance
- 3. dB Level at 100 psi 50 CPM (top) and 100 psi maximum CPM (bottom)
- 4. The passing of solids may shorten the life of the pump
- 5. Minimum startup pressure (Max supply pressure)

#### **STORAGE**

PSD pumps that are not put into operation upon delivery must be stored in an environment where they are protected from moisture, extreme temperatures, UV radiation, vibration, and should be kept clean. White Knight recommends an environment of ambient temperature (between 60° F (15°C) and 80°F (25°C)) with a humidity level below 65%.

#### **Maintenance and Torque Values**

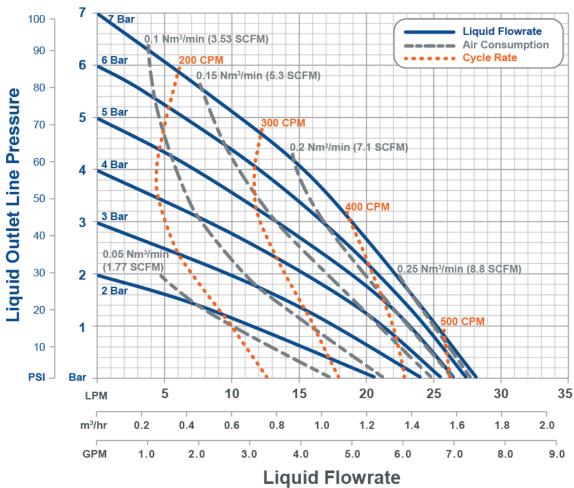
Upon installation of the pump, as well as after a few hours of operating the pump, the head and manifold bolts must be re-torqued. Tie bolts and manifold bolts must be re-torqued to values specified in the table below. Re-torqueing will be required after the pump has set for extended periods of time, run in thermal cycling applications, been dismantled, or when there is a large difference between environmental temperatures and fluid temperatures. See torqueing instructions on page 13.

	Assembly Torque in-lbs. (kg-cm)
Tie Bolts	20 (23.0)
Manifold Bolts	20 (23.0)

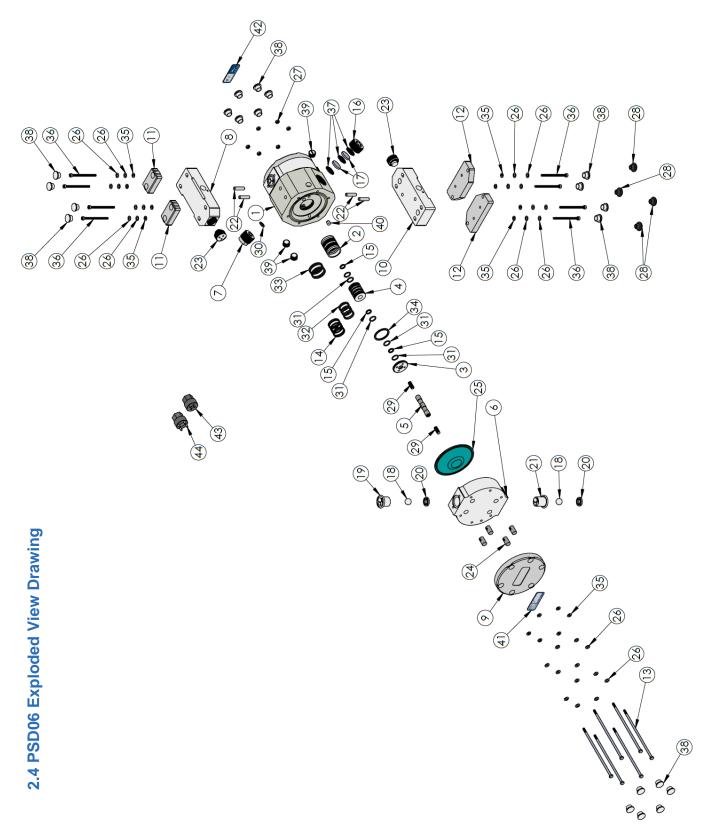


#### 2.2 PSD06 Performance Curves

# **PSD06 Performance Curves**





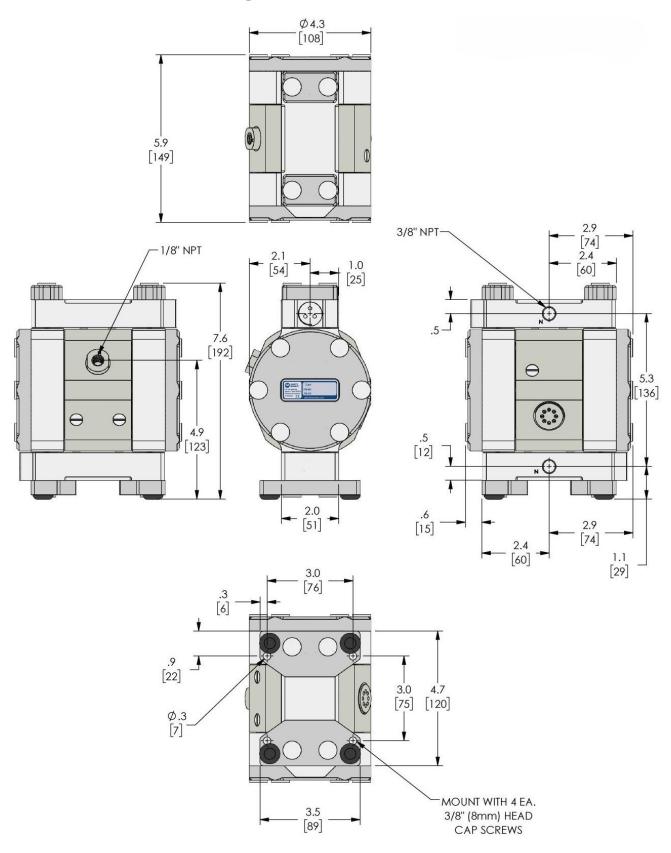




ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	1125-NP-0007	BODY, PSD06	1
2	6550-PT-0004	MAIN SLEEVE	1
3	6600-PT-0001	SLEEVE CAP	2
4	6550-PT-0005	CENTER SLEEVE	1
5	5144-SS-0005	SHAFT, PSD06	1
6	2127-TE-0070	HEAD, PSD06	2
7_N	6060-NP-0003	ADAPTER, INLET, 1/8" NPT	1
8_N	7500-TE-0017	OUTLET MANIFOLD, NPT, PSD06	1
8_X	7500-TE-0021	OUTLET MANIFOLD, BUTTRESS, PSD06	
9	2129-PV-0009	HEAD RETAINER, PSD06	2
10_N	7500-TE-0018	INLET MANIFOLD, NPT, PSD 06	1
10_X	7500-TE-0022	INLET MANIFOLD, BUTTRESS, PSD06	
11	2129-PV-0010	MANIFOLD RETAINER PSD06	2
12	1146-PV-0005	BASE PLATE, PSD06	2
13	10010-SS-0105	TIE HEX BOLT, PSD06	6
14	10050-UH-0009	GLIDE SEAL, PSD04 SLEEVE	6
15	10050-UH-0010	GLIDE SEAL, SHAFT PSD04	4
16	6150-NP-0007	CAP, MUFFLER, QEV 30L & 60L	1
17	6140-FP-0002	BAFFLE POROUS POLY 30/60 L QEV	2
18_T	4100-TE-0009	CHECK BALL- 1/2"	4
19	4142-TE-0010	TOP CHECK CAGE, PSD06	2
20	4135-MP-0011	SEAT, PSD06	4
21	4137-TE-0008	BOTTOM CHECK CAGE, PSD06	2
22	10020-WC-0001	GUIDE PIN, n.25, 1.00	4
23	10040-TE-0019	PLUG, PSD06	2
24	10011-SS-0004	HEAD NUT, PSD04/06	8
25_O	3200-TE-0005	PSD06 DIAPHRAGM	2
26	10050-SS-0009	BELLEVILLE WASHER, Ø.375	40
27	10010-SS-0029	HEX NUT, M4 x 0.7	6
28	10040-NB-0001	FEET RUBBER	4
29	10010-SS-0032	THREADED STUD PSD06, 1/4-28	2
30	10080-EM-012-70	-012 O-RING	1
31	10080-EM-013-50	-013 O-RING	6
32	10080-EM-018-50	-018 O-RING	6
33	10080-EM-020-70	-020 O-RING	4
34	10050-EM-0001	EPDM RING, .0625 THICK	2
35	10050-SS-0008	4 mm WASHER	20
36	10010-SS-0030	SOCKET HEAD BOLT, M4 X 0.7, 60 mm LONG	8
37	6140-PP-0004	MESH, QEV 04 & 05	3
38	10040-PE-0006	CAP PLUG, Ø.470	20
39	10040-TE-0003	NPT Plug - 1/4"	3
40	10020-NP-0011	PIN, Ø.26 X .27 LONG	3
41	19100-PP-0059	CE STICKER FOR PSD04/06	1
42	19100-PP-0055	PRODUCT LABEL FOR PSD06	1
43	12100-PV-0043	MUFFLER TOOL	1
44	12100-PV-0030	SLEEVE WRENCH TOOL	1



# 2.3 PSD06 Dimensional Drawing





# 3 Installation

#### 3.1 Installation Precautions

#### **Required Air Flow and Operating Pressure**

Required Air Flow for the PSD06 is  $\frac{1}{8}$ " minimum orifice unrestricted. An adaptor is included for  $\frac{1}{8}$ "NPT. Max air supply for the PSD06 is 7 Bar (100 PSI).

#### **Restriction of Liquid Inlet Line**

Restricting the liquid supply of the pump forces the pump to work harder than normal and should be avoided whenever possible, especially when pumping viscous liquids. Attempting to operate the pump against a closed liquid inlet will cause serious damage to the pump, and will void the warranty. If you wish to slow or stop your pump this may be done by closing off the liquid outlet.

#### **Supply Pressure Recommendations**

The life of your pump may be extended significantly by operating your pump 30%-40% below redline operating supply pressures. The use of undersized regulators, valves, and supply lines can decrease pump performance and longevity significantly.

#### Orientation

White Knight does not recommend installing your pump in any position other than its upright position. Check valves within White Knight PSD pumps are actuated by gravity and/or flow and perform optimally in the upright position.

#### **Failure Potential**

It is possible that the diaphragm may fail. In such a situation, it is possible that chemical could enter the air side of the pump, and may even escape through the muffler. In such a situation, the muffler media must be replaced and the air side purged. White Knight recommends the implementation of a one-way valve on the air side to protect air lines from contamination in the event of a diaphragm failure.

#### Muffler

Pump performance may be restricted in the event of a clogged muffler. Regular inspection of air lines and muffler media is recommended to maintain performance.

#### **Product Testing**

Each pump is tested before being packaged for shipment. White Knight recommends the flushing of each pump before servicing if water can contaminate the process.



#### 3.2 PSD Installation Advantages

#### Head Pressure / Dead-Head

White Knight PSD pumps may be controlled by opening and closing the outlet of the pump and may be installed in any head pressure situation up to dead-head. Dead-head occurs when air supply pressure and the liquid line (head) pressure are equal. Dead-head conditions allow for no flow. Under dead-head conditions the PSD will cease to cycle (limiting wear) until conditions change allowing for flow.

#### **Passing Solids**

All damage caused by passing solids (wafer shards, etc.) is coverable under warranty when your pump is used in conjunction with a White Knight Catcher™ pre-pump filter.

#### **Running Dry**

White Knight PSD pumps are capable of running dry without damage other than normal wear to the pump. When a pump is run dry, it cycles faster than normal, accelerating the rate of "normal wear".

#### 3.3 System and Pump Environment

#### Clean Dry Supply Air (CDA)

Operation of the point of 5 PSD06 requires class 4 quality air for particles, moisture, and oils. (maximum particle size 15 microns, 3° C Dew 5 mg/m³) per ISO8573 – 1.

#### **Flammable Solvents**

Any system used to pump flammable solvents should be properly grounded. A test from River's Edge on using isolative pumps to pump flammable liquids indicated that the liquid itself must be grounded and that other procedures should be followed. A copy of the test is available upon request from White Knight.

#### **Pumping Liquids Near Boiling Point**

The boiling point of a liquid is reduced under vacuum (suction) conditions. Due to the vacuum caused by a pump, liquid could boil in the inlet line of the pump when it is not boiling in the tank (or another supply reservoir). Placing the pump as close as possible to the tank and with as little vertical lift as possible (the pump being flooded by gravity is ideal) minimizes boiling in the inlet line. Boiling of the liquid in the inlet line causes a pump to "race" and accelerates the wear of the pump. Boiling liquids may cause cavitation to occur. Damage to wearable or non-wearable components of the pump caused by cavitation is not covered under warranty.

#### **Running a Submerged Pump**

When running the PSD in submerged mode, the exhaust air must be sealed and redirected above the surface of the media. Take care that all pump parts (air side and wet side) are resistant to the media being used. It may be necessary to mount the pump to the bottom of the tank. Operating this pump while submerged requires use of a remote muffler adaptor kit.

#### **Temperature**

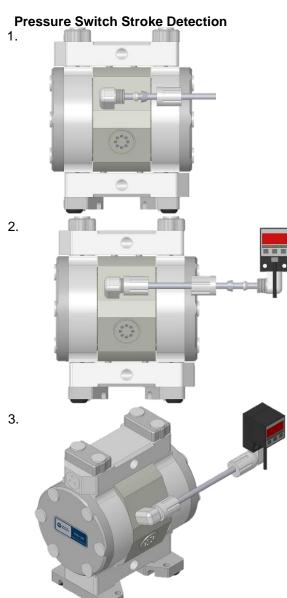
The PSD may be operated safely in low temperature applications. Take care to avoid freezing or crystallization of the fluid inside or outside of the pump. Running the pump at temperatures below freezing may accelerate the wear of the elastomer components within the pump. In applications where the media or pump temperature varies, torque values (tension) of the manifold and head bolts must be monitored. The PSD Series pumps can be operated at temperatures up to 100°C (212° F).



# 3.4 Control and Monitoring Connections

• **PUMP MONITORING:** Pump monitoring can be performed by solid state pressure switch monitoring. This option is described on our website in the accessories section and is available for new orders and for retrofits in the field.





# **Pump Control:**

Run mode and flow rate are two of the items which the **CPT-1** can control/monitor.



#### 3.5 PSD 06 Installation Instructions



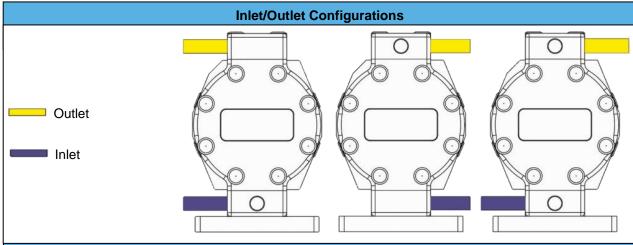
3.

Use appropriate adapter for 1/8" NPT

Fix base plate to work station • with four 3/8" or 10 mm bolts. (Bolts not included.)

Instructions.

- Attach 3/8" liquid fittings to pump. Excessive force may damage threads.
- Ensure airline is free of solids before attaching. Supply air via 1/8" NPT air fitting with flexible connection.



Some configurations require re-orientation of crossover manifolds. See Disassembly and Assembly

**Recommended Set Up** Pressure Gauge Shut off valve Shut off valve Supply Air Discharge Line Filter Regulator Flexible Connection Shut off valve Vacuum Gauge Shut off valve Suction Line Air Dryer Shut off valve Caution: Closing suction line while pump is operating will cause irreversible damage to the pump.



# 4 Pump Service & Rebuilds

# **4.1 PSD Ordering instructions**

#### **Standard Models**

Part Number	Orifice Diameter	Liquid Connections
PSD06TE-OTN	3/8-in	Female NPT (same diameter as orifice)
PSD06TE-OTX00	3/8-in	WK Buttress connections (Fittings sold separately)

Contact support for revision or copy exact information.

#### **Standard Features**

- PTFE Liquid Path
- Polypropylene Body
- PTFE Check Balls
- Over-Molded PTFE/EPDM Diaphragms
- NPT Air Connections
- NPT or WK Buttress Liquid Connections

WK Buttress Connections feature Tongue-and-Groove Seals for improved reliability and reusability.

#### **Compatible Fittings with WK Buttress Connections**

Pump fittings are sold separately. Two fittings are required for operation.

Fitting Sizes		PSD06TE-OTX00
	1/4 in	14510-PF-0016
Flaretek	3/8 in	14510-PF-0001
Compatible	1/2 in	14510-PF-0002
	3/4 in	14510-PF-0003
	1/4 in	14530-PF-0025
Pillar S-300	3/8 in	14530-PF-0012
	1/2 in	14530-PF-0001
Primelock	1/2 in	14570-PF-0001
Primetock	3/4 in	14570-PF-0002
Tube	3/8 in	7120-PF-0001
Adapter	1/2 in	7120-PF-0002
	3/4 in	7120-PF-0003
Weldable	1/2 in	7300-PF-0001
vveidable	3/4 in	7300-PF-0002



# 4.2 PSD06 Rebuild Kit Ordering Instructions

#### Standard Rebuild Kits

Part Name	Part Number
PSD06 Dry Rebuild Kit	RBPSD06-1
PSD06TE-OT Wet Rebuild Kit	RBPSD06TE-OT
PSD06TE-OT Combined Rebuild Kit	RBPSD06TE-OT-1*

<sup>\*</sup>Combined kits contain all components for the wet kit as well as the dry kit.

#### **Kit Components**

#### Parts Included in RBPSD06-1:

Part Number	Description	Quantity
5144-SS-0005	Diaphragm Shaft for WK Pump, PSD06	1
10010-SS-0032	Threaded Stud for WK Pump, PSD06, SS	2
6140-FP-0002	Baffle, Porous Poly	2
10050-EM-0001	Ring, 0.0625 Thick, PSD04/06	2
10080-EM-013-50	#13 O-ring Seal	4
10050-UH-0010	Glide Seal for PSD04 Shaft	2
10300-XX-0001	PTFE Lubricant, Squeeze Tube	1
14850-PT-0007	PSD04/06 Main Sleeve Assembly	1
14850-PT-0006	PSD04/06 Center Sleeve Assembly	1

#### Parts Included in RBPSD06TE-OT:

Part Number	Description	Quantity
10040-PE-0006	Cap Plug for WK Pump, PSD04/06	20
3200-TE-0005	PTFE Diaphragm for WK Pump, PSD06	2
4100-TE-0009	1/2" Check Ball, PTFE	4
4142-TE-0010	Retainer, Ball, 1/2", PTFE, Top	2
4135-MP-0011	PSD06TE Check Seat	4
4137-TE-0008	Retainer, Ball, 1/2", PTFE, Bottom	2



#### 4.3 Tools

#### Part Name Muffler Cap Wrench Sleeve Cap Tool



Four pin wrench used to remove/install the muffler cap (included with pump). Hex is for use with a 19mm or 3/4" socket drive. (12100-PV-0043)

Part Number	QTY.
12100-PV-0043	1
12100-PV-0030	1



Tool for inserting and removing the sleeve cap (included with pump) (12100-PV-0030)

#### **4.4 Torque Instructions**



Manifold Bolts



Tie Bolts

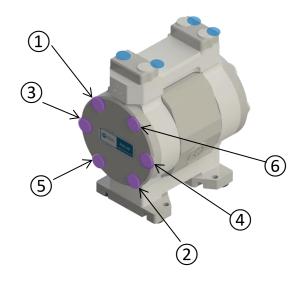
Tie bolts (purple) on both sides must be torqued **before** manifold bolts (blue) on top and bottom.

Torquing of tie bolts should be done in a crossing fashion, as shown at right.

There is no particular order for Torquing manifold bolts other than they must be done after head blots.

Apply Loctite Antiseize Lubricant LB 8012 (or equivalent) to all bolts. This procedure must be followed for assembly and also re-Torquing of bolts.

Assembly Torque	
in-lbs. (kg-cm)	
20 (23.0)	
20 (23.0)	

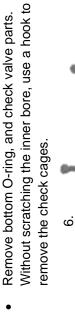








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Use 3 mm Allen Wrench to remove

outlet manifold.



Remove top check valve parts following the

same process described in step 3.

heads, to keep the manifold Reattach manifold bolts to

nuts aligned.

Remove all plastic caps.



Use the appropriate PVC tool to remove the muffler from the pump body.

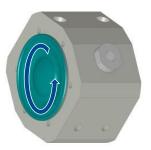


Remove diaphragms by peeling one back

the second diaphragm out with the shaft. and turning it counter-clockwise. Slide

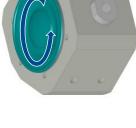


debris from the pump body. Press out the Main Sleeve Assembly; Remove any









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Use 7 mm socket to remove nuts from bolts on one side of head. Remove both retainer

rings and heads.





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10.



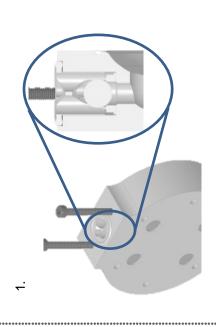
Glide Seal and O-ring on the ID of the Caps Tool included with the pump. Remove the Remove the Sleeve Caps using the PVC

Servicing of Pump

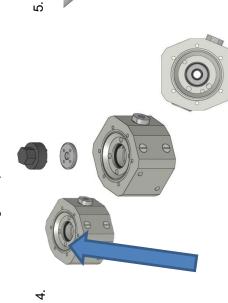
Before servicing the pump verify that the pump has been drained and purged so as to minimize the potential of physical damage and maximize the safety of service personnel. რ

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# 4.6 Assembly Instructions



 Assemble Top Check; first insert top check seat, then ball, then top check cage. Repeat for both heads



Replace O-ring in seat for Air Sleeve Cap. Apply Loctite 425 or equivalent to threads on cap. Attach a cap to the pump using the appropriate PVC tool included with the pump.



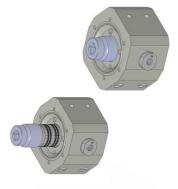
all diameters. Replace O-ring in face of Caps

Replace muffler media and attach to pump body. Order

of muffler media is critical.

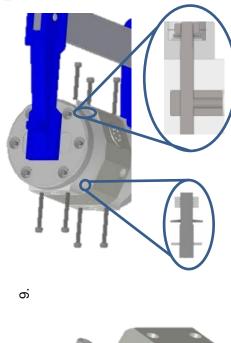


Lubricate O-rings on main sleeve assembly. Spread lubricant evenly across the O-rings. Clear any holes blocked with lubricant.



Press Main Shaft Assembly into Body. Take care that the O-rings do not displace themselves from the main sleeve assembly.





Thread tie bolts onto head retaining rings, align head side 1, body, head side 2, and retaining Washer order is critical. DO NOT TIGHTEN. ring 2 onto tie bolts and clamp together. Apply antiseize lubricant to each tie bolt

customize the direction of the liquid inlet The manifolds may be rotated 180° to

and outlet

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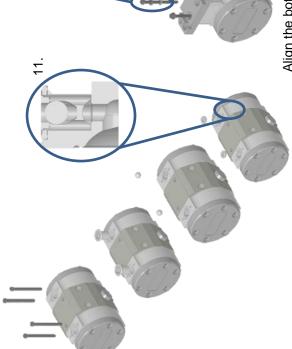
shaft is firmly attached - no gap. Pass into Remove Thread cover on diaphragm, and attach to the pump shaft. Verify that the φ.

Apply Loctite 242 (or equivalent) to both

ends of each threaded stud

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pump body, and attach other diaphragm. second cap, and attach the second cap per instructions in step 4. Tighten until Replace O-ring in groove for the cap bottoms out.



direction of washers. Repeat for top manifold. DO cages, balls, and seats. In that order. Remove the manifold bolts from the heads, and insert bottom check

**NOT TIGHTEN** 

Align the bottom manifold, and bottom manifold antiseize lubricant to each bolt). Note order and retainers, and attach with manifold bolts (apply

torque instructions. Replace all Return to page 15 and follow bolt covers.

6.



# **5 Accessories**

Remote Muffler Adaptor Kit- (Not included with pump.) Required if pump is to be submerged.

#### Pump Catcher™

- Inline options available.
- Large through holes to avoid loading.
- Filter may be removed without removing the **Catcher™** from the pump or the line.
- If a pump were damaged by passing solids while using the Catcher™ it would be repaired under warranty.

#### **Control & Monitoring Options**

#### **Stroke Detection**

Solid State Pressure Switch SP1

#### **Leak Detection**

Conductivity Leak Detection LC0

Control Options – Run mode and flow rate are a few of the items which the CPT-1 can control/monitor.



# **6 Warranty**

White Knight Fluid Handling, Inc. follows strict procedures in all phases of manufacturing, assembly, and testing to ensure reliability of its products. Each pump is individually tested to assure its functional operation integrity.

White Knight Fluid Handling, Inc. warrants the PSD06 pump, subassemblies and components to be free from defects in materials and workmanship to one year from date of start-up or 18 months from the date of shipment whichever applies. Failures due to misuse, abuse or any unauthorized disassembly of a White Knight® pump will nullify this warranty.

The PSD06 pump is warranted for up to 100 PSI air supply pressures. It is not covered under dry run condition. Wearable parts are not covered.

Due to the broad and ever-evolving applications for usage of White Knight® pumps we cannot guarantee the suitability of any pump component or subassembly for any particular or specific application. White Knight Fluid Handling, Inc. shall not be liable for any consequential damage or expense arising from the use or misuse of its products in any application. Responsibility is limited solely to the replacement or repair of defective White Knight® pumps, components or subassemblies. All options to rebuild or replace aforementioned items shall remain under the judgment of White Knight Fluid Handling, Inc. Decisions as to the cause of failure shall be solely determined by White Knight Fluid Handling, Inc.

Prior written, faxed or emailed approval must be obtained from White Knight Fluid Handling, Inc. before returning any pump component or subassembly for warranty consideration.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING ANY WARRANTIES OF SUITABILITY FOR ANY PARTICULAR PURPOSE. NO VARIATIONS OF THIS WARRANTY BY ANYONE OTHER THAN THE PRESIDENT OF WHITE KNIGHT FLUID HANDLING IN A SELF-SIGNED AGREEMENT SHALL BE HONORED OR CONSIDERED LEGALLY BINDING.



# 7 Certificate & Declaration of Conformity



# CERTIFICATE & DECLARATION OF CONFORMITY FOR CE MARKING

#### Company contact details:

White Knight Fluid Handling Inc. 187 E. 670 S., Kamas, Utah, 84036, USA

#### White Knight Fluid Handling Inc. declares that their:

Bellows Pump Line

PSA030, PSA060, PSA140, PSH030, PSH060, PSH140, PSU030, PSU060, PSU140, PSA025, PSA050, PFA030, PFA060, PFA140, PFH030, PFH060, PFH140, PFU030, PFU060, PFU140, PXA030, PXA060, PXA140, PXH030, PXH060, PXH140, PXU030, PXU060, PXU140

Diaphragm Pump Line (Non Conductive)
PSD04TE, PSD06TE, PSD08TE, PSD16TE, PSD24TE, PSD04UH, PSD06UH, PSD08UH, PSD16UH, PSD24UH

Diaphragm Pump Line (Conductive)
PSD04TC, PSD06TC, PSD08TC, PSD16TC, PSD24TC, PSD04UC, PSD06UC, PSD16UC, PSD24UC

Legacy Pump Line
PLS30, PLS60, PLS120, PLX30, PLX60, PLX120, PX30, PX60, PX120, PLF30, PLF120

Metering Pumps PPM100, PEM100, PEM050

> Plastic Pumps PHC40-2, PPMC300

#### are classified within the following EU Directives as applicable:

Machinery Directive 2006/42/EC Low Voltage Directive 2014/35/EU Electromagnetic Compatibility Directive 2014/30/EU RoHS 2 Directive 2011/65/EU

and further conform with the following EU Harmonized Standards as applicable: EN 809:1998+A1:2009 EN 60204-1:2006 + A1:2009 EN 61000-6-2:2005 EN 61000-6-4:2007+A1:2011

Position of signatory: Product Manager Name of Signatory: Cory Ammon Simmons Signed below: on behalf of White Knight Fluid Handling Inc.





## **White Knight Support**

187 E. 670 S. Kamas, UT 84036 Phone: 435.783.6040 Toll Free: 888.796.2476

Fax: 435.783.6128

support@wkfluidhandling.com

https://wkfluidhandling.com/support/