

PSB100 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 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 patents for our designs 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; slurry and high pressure chemical delivery systems.

White Knight has been the recipient of multiple prestigious industry awards for its designs and continues to lead the industry in quality because White Knight manufactures products from raw material to finished goods in our own facility located in Kamas, UT. This allows us to rigorously manage our quality assurance process to ensure that our strict cleanliness procedures are always followed and that components are built using consistent methods and conditions to make our products reliable and consistent.

Our strict process controls include assembling and testing our products in a class 100, temperature and humidity-controlled cleanroom. White Knight products also pass functional tests and are then dried with CDA and double bagged in the cleanroom to ensure cleanliness and operational integrity.

Before installing your White Knight product, please carefully review the product manual. There are many helpful hints and ways to optimize the set up and use of your White Knight product as well as instructions and requirements for installation. In addition, there are many accessories in this manual 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 use a White Knight Product.

Sincerely,

Steve Smith
CEO
White Knight Fluid Handling

2. Installation

2.1. Unpacking

After unpacking, verify that no components of the pump have been damaged in shipping. Damage should be reported to the carrier immediately.

In the box, the Pump and a Product Manual will be found, in addition to any accessories ordered with the pump (when possible).

2.2. Tie Bolt Torque

The tie bolts on the pump are tightened before leaving the factory. However, relaxation may occur due to handling, material creep, or other unforeseen events. White Knights recommends that the pump is re-torqued on install, as well as after thermal cycling, or if the pump remains sitting for an extended period of time.

To re-torque the pump:

1. Remove black tie bolt caps from both sides of the pump
2. Apply 60in-lbs of torque to each bolt on the slave head, while holding the master side bolt stationary. A star pattern is recommended.
3. Replace the bolt caps

2.3. Utilities/Hookup

The pump is mounted with four ¼" bolts. It is recommended that the pump be mounted not more than 15° from level to maintain its self-priming ability and pumping efficiency.

Air Inlet: 1/2in FNPT (3/8in Diam. (8mm) supply tube minimum)

Air Supply: 25-80 PSI (1.4-4.1 bar) Clean Dry Air or nitrogen

Fluid Ports: See Supplier Specifications

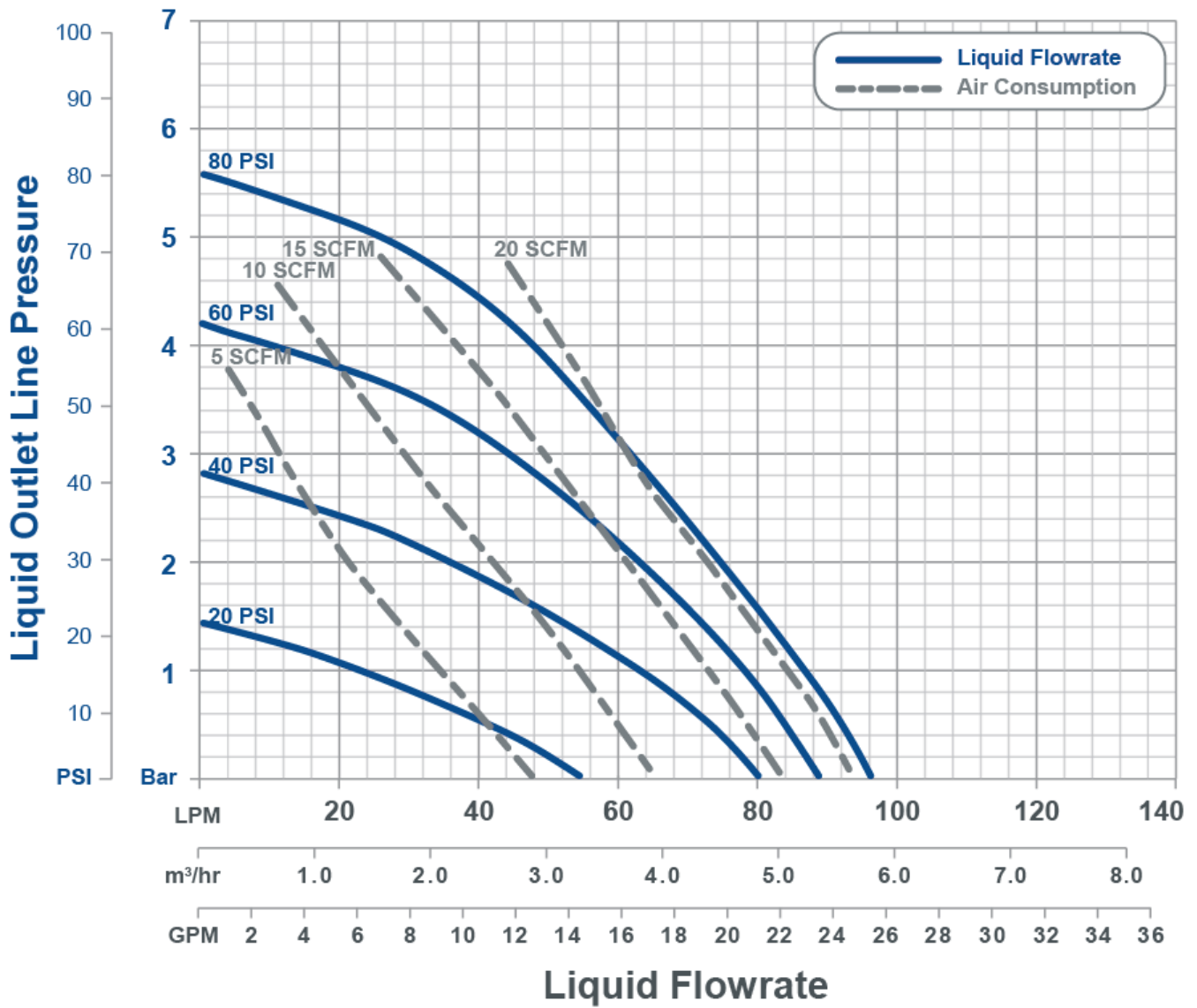
3. Specifications and Performance

3.1. Pump Specifications

PSB100 Pump Specifications					
Flow Rate	Fluid Connection Size ¹	Displacement Per Cycle ²	Max Cycles Per Minute	Fluid Path Materials	Non Fluid Path Materials
25 GPM 94.64 LPM	3/4in	500ml	156	PTFE, PFA	PTFE, PFA, PP, SS, PEEK

1. Standard connection. Additional connection sizes are available
2. Displacement per cycle will vary based on air supply and fluid head pressures

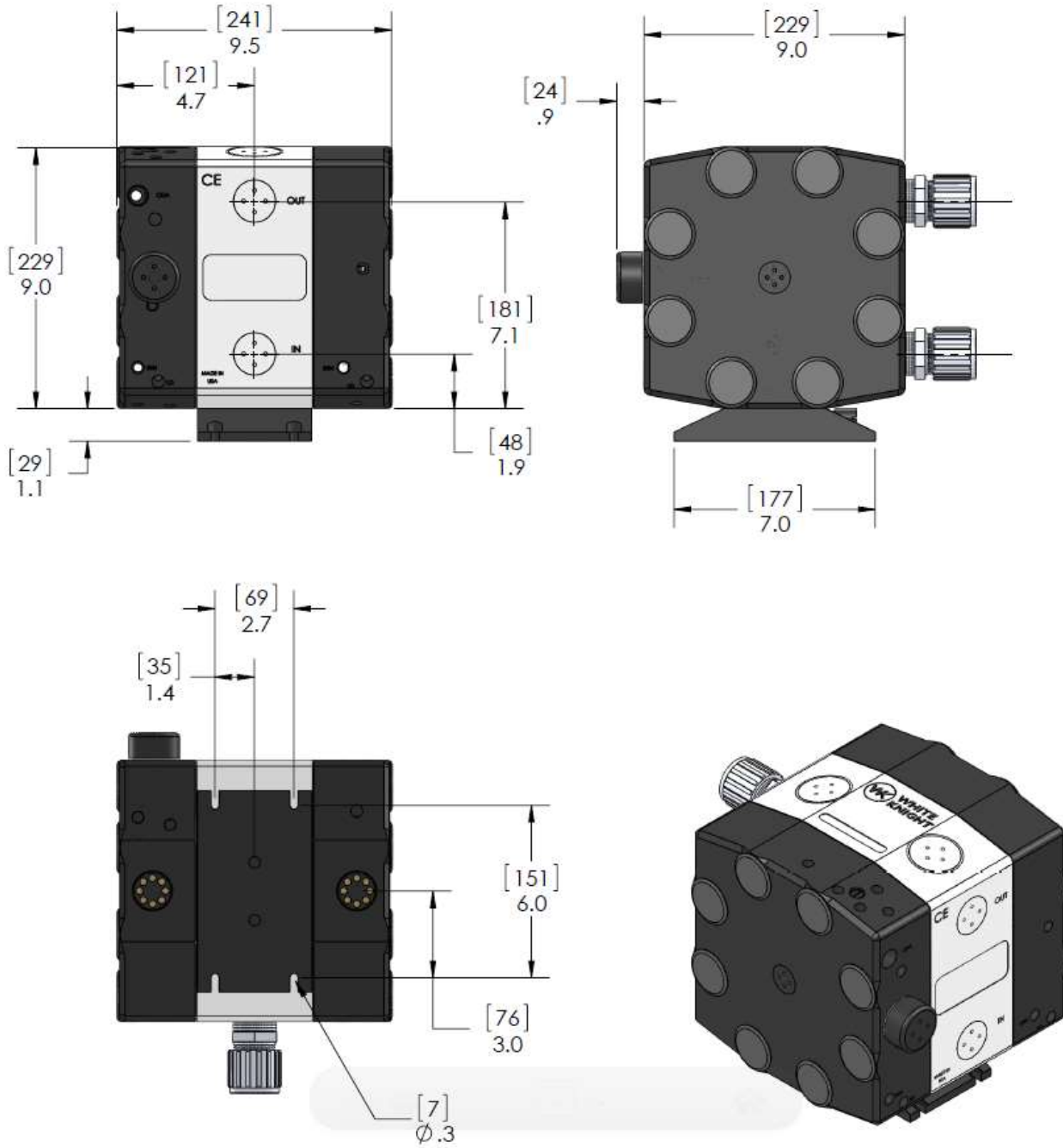
3.2. Performance Curve



Please note that this flow curve represents actual testing with water at ambient temperatures at elevation, and has been mathematically adjusted to represent values at sea level.

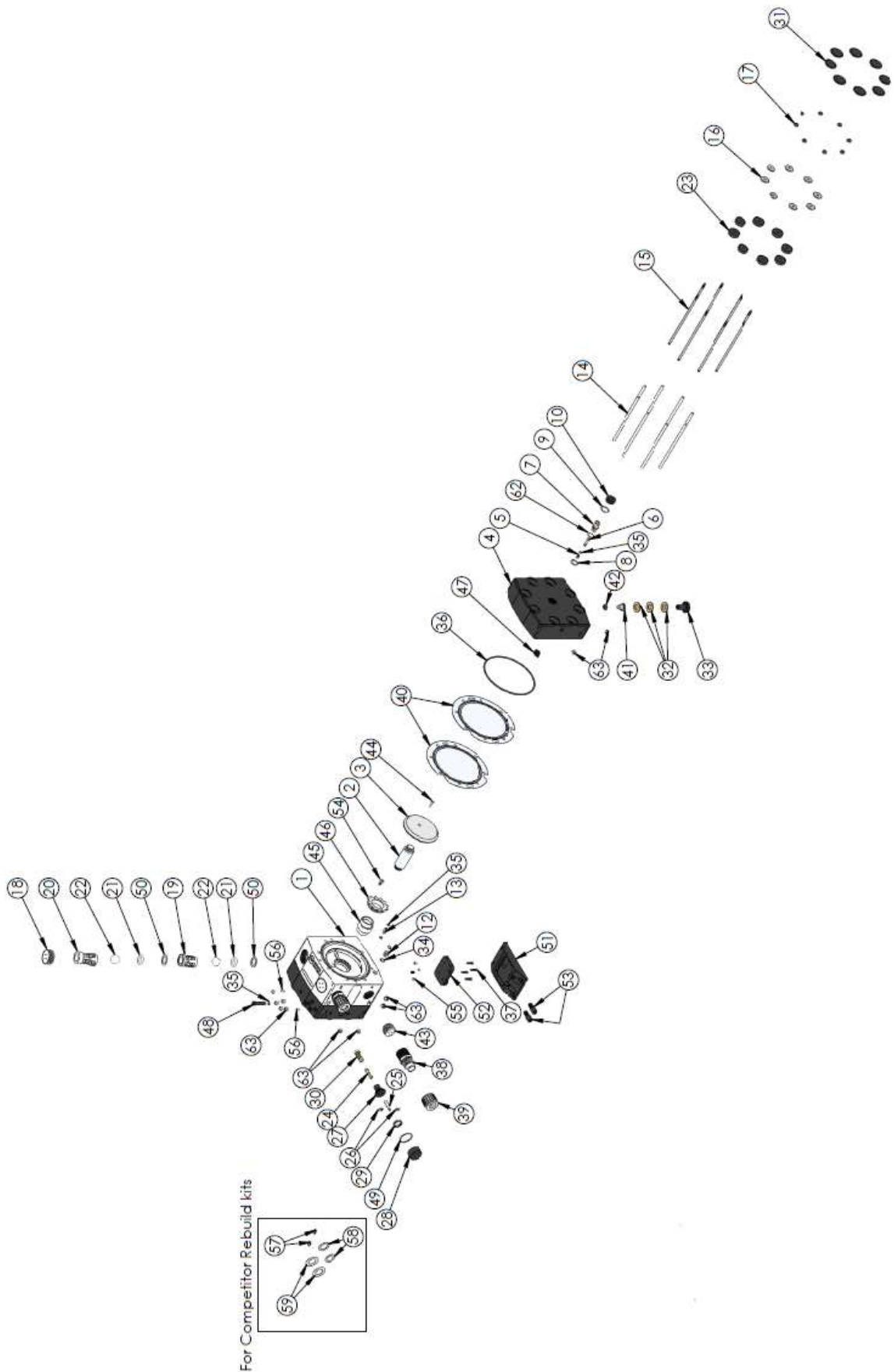
3.3. Dimensional

PSB100



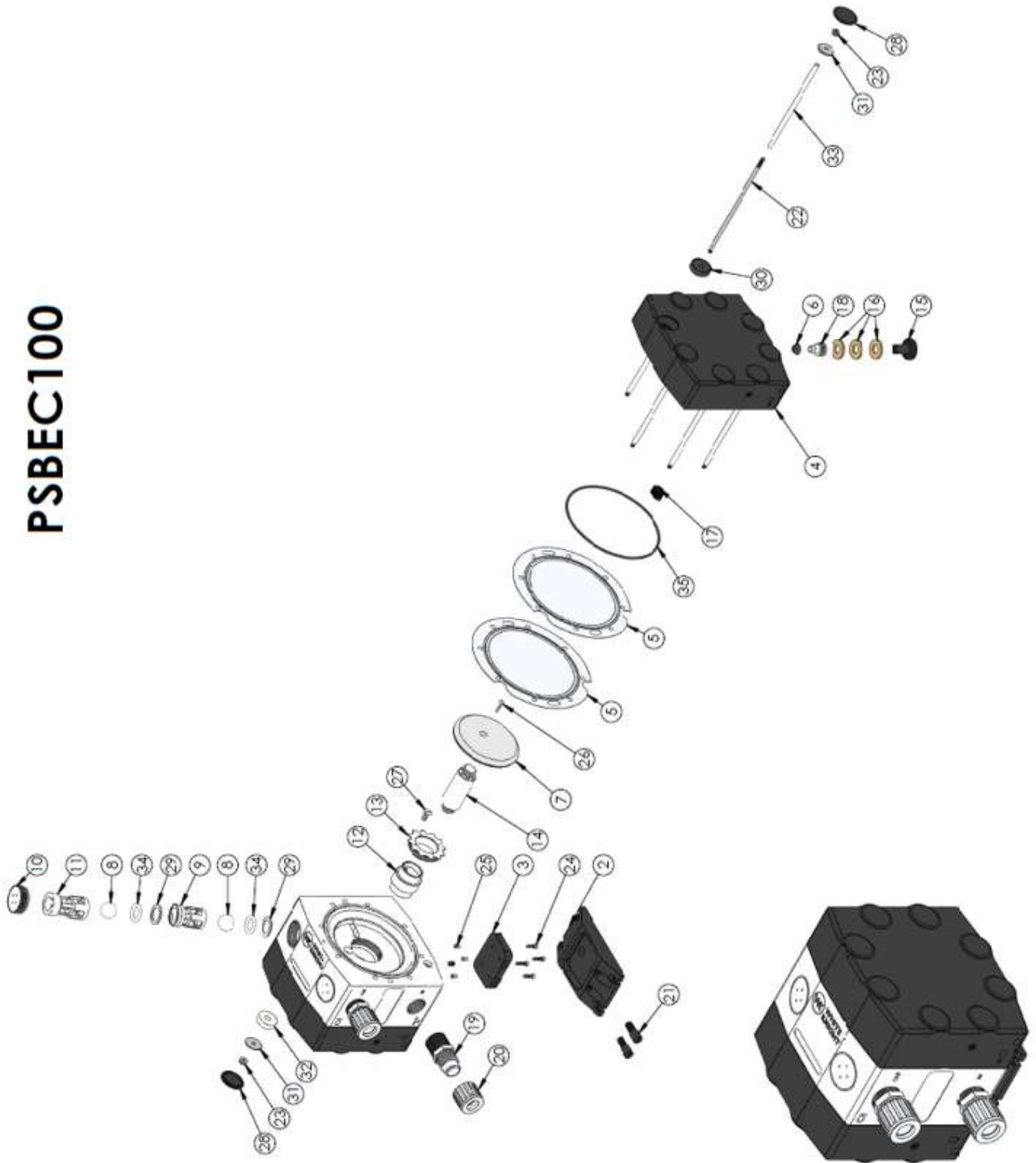
3.4. Exploded Views

PSB100



ITEM NO.	PART NUMBER	DESCRIPTION	Material	QTY.	ITEM NO.	PART NUMBER	DESCRIPTION	Material	QTY.
1	1125-TE-0027	BODY, PSB100	PTFE	1	33	6140-BP-0001	MUFFLER CAP, PSB100	BPP	2
2	5144-PF-0026	SHAFT, PSB100	PFA	1	34	10080-VI-014-75	014 O-RING	FKM	4
3	3300-TE-0001	STRIKE PLATE, PSB100	PTFE	2	35	10080-VI-010-75	010, O-RING	FKM	7
4	2127-BP-0012	HEAD, SLAVE, PSB100	BPP	1	36	10080-VI-262-75	262 O-RING	FKM	2
5	10010-TE-0020	SHIFT PIN SCREW, PSB100	PTFE	2	37	10010-SS-0050	10-32 SCREW, .750 LONG	SS	4
6	2128-PKC-0002	SHIFT PISTON, PSB100	CARBON PEEK	2	38	7200-PF-0010	1" FLARETEK-30GPM	PFA	2
7	2128-PKC-0001	PILOT VALVE SLEEVE PSB100	CARBON PEEK	2	39	7210-PF-0005	1" FLARETEK NUT (PFA)	PFA	2
8	10050-MP-0011	SHIFT PIN INNER CAP WASHER SEAL	MPTFE	2	40	3200-PF-0001	DIAPHRAGM, PSB100	PFA FILM	4
9	10050-MP-0012	SHIFT PIN OUTER CAP WASHER SEAL	MPTFE	2	41	6150-JH-0003	QUICK EXHAUST SEAT, PSB100	UHMW PE	2
10	6530-BP-0003	SHIFT PIN OUTER CAP, PSB100	BPP	2	42	3200-VI-0001	DIAPHRAGM, Ø .782	FKM	2
11	2127-BP-0013	HEAD, MASTER, PSB100	BPP	1	43	7130-TE-0008	OUTLET PLUG, PSB100	PTFE	2
12	10070-NP-0001	AIR TUBE, SUPPLY	NPP	2	44	10010-TE-0021	SHAFT LOCK SCREW, PSB100	PTFE	2
13	10070-NP-0002	AIR TUBE, SHIFT	NPP	2	45	5143-TE-0009	SHAFT SEAL, PSB100	PTFE	1
14	10070-PF-0016	TIE BOLT SLEEVE	PFA	8	46	5143-TE-0010	RETAINER SHAFT SEAL, PSB100	ddd	1
15	10010-SS-0048	TIE BOLT, PSB100	SS	8	47	6150-BP-0004	AIR DIFFUSER, PSB100	BPP	2
16	10050-SS-0010	TIE BOLT WASHER	SS	16	48	10040-BP-0002	SECONDARY AIR PLUG, PSB100	BPP	1
17	10010-SS-0049	FLANGE NUT, 1/4-20	SS	16	49	10050-MP-0013	SHUTTLE OUTER CAP SEAL, PSB100	MPTFE	1
18	4140-TE-0008	TOP CHECK PLUG, PSB100	PTFE	2	50	10050-MP-0004	CHECK SEAT WEAR WASHER, PSB100	MPTFE	4
19	4137-TE-0009	BOTTOM CHECK CAGE, PSB100	PTFE	2	51	1146-BP-0005	QUICK CHANGE BASE PLATE, PSB100	BPP	1
20	4142-TE-0011	TOP CHECK CAGE, PSB100	PTFE	2	52	1146-BP-0006	QUICK CHANGE ADAPTER PLATE, PSB100	BPP	1
21	10080-TE-317-75	317 O-RING	PTFE	4	53	10010-BP-0011	BASE PLATE SCREW, PSB100	BPP	2
22	4100-TE-0004	CHECK BALL - 1-1/8"	PTFE	4	54	10010-TE-0022	FLAT HEAD PHILLIPS, .3125-18, .75 LONG	PTFE	1
23	10050-NE-0001	TIE BOLT RUBBER INSERT	CR	8	55	10010-SS-0062	THREADED INSERT 10-32 INTERNAL THREAD	SS	4
24	6560-CE-0006	SHUTTLE SPOOL, PSB100	CE	1	56	10040-NP-0009	.0625 SHIFT AIR ORIFICE	NPP	2
25	6570-PK-0001	SHUTTLE DETENT SPOOL ADAPTER, PSB100	PEEK	1	57	6570-PI-0001	SHUTTLE DETENT LEG, PSB100	PAI	2
26	6570-PK-0003	SHUTTLE DETENT LEG-ROUNDED ENDS	PEEK	2	58	10050-GY-0001	INLET/OUTLET WASHER SEAL, PSB100	GYLON	2
27	6530-BP-0004	SHUTTLE INNER CAP, PSB100	BPP	1	59	10050-GY-0002	CHECK PLUG WASHER SEAL, PSB100	GYLON	2
28	6530-BP-0005	SHUTTLE OUTER CAP, PSB100	BPP	1	60	6140-BP-0002	MUFFLER CAP PLUG, PSB100	BPP	1
29	6570-PK-0002	SHUTTLE RING DETENT, PSB100	PEEK	1	61	10080-VI-123-75	123 O-RING, 75 DUROMETER	FKM	1
30	6550-CE-0006	SLEEVE, PSB100	CERAMIC	1	62	10080-VI-018-75	018 O-RING, 75 DUROMETER	FKM	2
31	10040-BP-0001	TIE BOLT CAP	BPP	16	63	10040-TE-0003	NPT PLUG - 1/4"	PTFE	11
32	6140-PP-0007	MUFFLER FELT BAFFLE, PSB100	NPP	6					

PSBEC100



ITEM NO.	PART NUMBER	DESCRIPTION	Material	QTY.
1	1125-TE-0027	BODY, PSB100	PTFE	1
2	1146-BP-0005	QUICK CHANGE BASE PLATE, PSB100	POLYPROPYLENE	1
3	1146-BP-0006	QUICK CHANGE ADAPTER PLATE, PSB100	POLYPROPYLENE	1
4	2127-BP-0014	DUAL SLAVE HEAD, PSB100	POLYPROPYLENE	2
5	3200-PF-0001	DIAPHRAGM, PSB100	PFA	4
6	3200-VI-0001	DIAPHRAGM, ϕ .782	VITON	2
7	3300-TE-0001	STRIKE PLATE, PSB100	PTFE	2
8	4100-TE-0004	CHECK BALL- 1-1/8"	PTFE	4
9	4137-TE-0009	BOTTOM CHECK CAGE, PSB100	PTFE	2
10	4140-TE-0008	TOP CHECK PLUG, PSB100	PTFE	2
11	4142-TE-0011	TOP CHECK CAGE, PSB100	PTFE	2
12	5143-TE-0009	SHAFT SEAL, PSB100	PTFE	1
13	5143-TE-0010	RETAINER SHAFT SEAL, PSB100	PTFE	1
14	5144-PF-0026	SHAFT, PSB100	PFA	1
15	6140-BP-0001	MUFFLER CAP, PSB100	POLYPROPYLENE	2
16	6140-PP-0007	MUFFLER FELT BAFFLE, PSB100	POLYPROPYLENE	6
17	6150-BP-0004	AIR DIFFUSER, PSB100	POLYPROPYLENE	2
18	6150-UH-0003	QUICK EXHAUST SEAT, PSB100	UHMW POLYETHYLENE	2
19	7200-PF-0010	1" FLARETEK-30GPM	PFA	2
20	7210-PF-0005	1" FLARETEK NUT (PFA)	PFA	2
21	10010-BP-0011	BASE PLATE SCREW, PSB100	POLYPROPYLENE	2
22	10010-SS-0048	TIE BOLT, PSB100	STAINLESS STEEL	8
23	10010-SS-0049	FLANGE NUT, 1/4-20	STAINLESS STEEL	16
24	10010-SS-0050	10-32 SCREW, .750 LONG	STAINLESS STEEL	4
25	10010-SS-0062	THREADED INSERT 10-32 INTERNAL THREAD	STAINLESS STEEL	4
26	10010-TE-0021	SHAFT LOCK SCREW, PSB100	PTFE	2
27	10010-TE-0022	FLAT HEAD, .3125-18, .75 LONG	PTFE	1
28	10040-BP-0001	TIE BOLT CAP	POLYPROPYLENE	16
29	10050-MP-0004	CHECK SEAT WEAR WASHER, PSB100	PTFE	4
30	10050-NE-0001	TIE BOLT RUBBER INSERT	NEOPRENE	8
31	10050-SS-0010	TIE BOLT WASHER	STAINLESS STEEL	16
32	10060-BP-0001	BUSHING	POLYPROPYLENE	8
33	10070-PF-0016	TIE BOLT SLEEVE	PFA	8
34	10080-TE-317-75	317 O-RING	PTFE	4
35	10080-VI-262-75	262 O-RING	VITON	2

4. Installation and Precautions

4.1. Precautions

High Temperature Operation
Operating the pump at temperatures exceeding 60°C requires periodic tightening of the tie bolt nuts. The time period in between tie bolt nut tightening will be affected by ambient temperature, process fluid temperature as well as any temperature fluctuations (thermal cycling).
Service Schedule
Inspection of the torque placed on the tie bolts should be inspected every 6 months. Select Internal components should be inspected every 12 months
Required Air Flow (White Knight shuttle valve)
Required air flow for the PSB100 pump is 3/8" minimum orifice unrestricted.
Required Air Flow (External Solenoid Valve)
Required solenoid C_v for the PSB100 pump is 1.5 C_v . Using a pump with a reduced C_v will result in reduced flow rates as compared to White Knight published flow curves. Using a pump with a solenoid valve with over 20% greater C_v will result in the pump operating outside its normal operating parameters which will result in reduced pump life and will void the pump warranty.
Liquid Inlet/Outlet
THESE LIQUID PORTS ARE NOT NPT OR ANY OTHER STANDARD. Attempting to use connectors other than those supplied by White Knight will damage the pump, and will void warranty.
Running Dry
Wet shaft pumps use the liquid that they are pumping to lubricate the shaft. Running the pump dry causes it to cycle much faster than normal - accelerating normal wear. Running the pump dry for more than a couple of minutes will damage the pump, and it may cause it to lose its ability to self-prime. For applications requiring dry run situations, White Knight recommends an SD pump model
Supply Pressure Recommendations
The life of your pump may be extended significantly by operating your pump 30%-40% below redline operating supply pressures. A minimal operating supply pressure of 20 PSI is required.
Operating a Pulsation Dampener with a White Knight Shuttle Valve
When using a pulsation dampener with a White Knight shuttle valve driven pump, the air operating pressure of the pump should be at least ten PSI higher than that of the liquid line. Failure to do so may cause the pump to run erratically.
Orientation
White Knight does not recommend installing your pump in any position other than its upright position. Check valves within White Knight high purity pumps are actuated by gravity and/or flow and perform most effectively in the upright position.
Restriction of Liquid Inlet Line
Restricting the liquid supply of the pump forces the pump to work harder than normal and should be avoided when possible. Pumping against a closed liquid inlet will cause serious damage to your pump. All White Knight high purity diaphragm pumps may be controlled by closing off the liquid outlet.

Under Supply of Air

Undersupplying air to a pump will cause it to run erratically or stall. For best results, White Knight recommends running pumps at air pressures slightly above the averaged air consumption curves found on the performance curves graph. Additionally, air supply lines and fittings must meet the minimal ID (inner diameter) requirements published in the installation instructions.

Cross Contamination

PTFE and many other plastics are very porous and may retain chemicals in the pores of the material. Record chemistries used in a pump to avoid cross contamination.

WARNING: Liquids and Gasses Under Pressure



While in a live system, pumps contain pressurized liquids and gasses. All pressure, liquid and air must be eliminated via shut off valves before the pump may be serviced, removed or detached from the system.

WARNING: Potential for High Surface Temperatures



When pumps are operated with high temperature fluids, heat may transfer to the exterior surfaces of the pump. Avoid direct contact with the pump when high temperature fluids are present.

WARNING: Handling of Chemicals



In the event that hazardous chemicals are used in or around the pump, ensure that appropriate personal protective equipment is used before handling. Reference the chemistry's Material Safety Data Sheet (MSDS) for handling instructions or other information specific to that chemical.

WARNING: Noise Potential



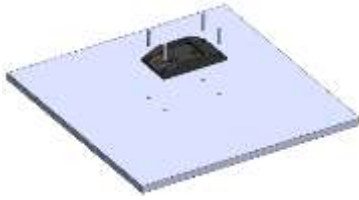
The exiting of exhaust air from the pump will contribute to a work area's noise level. Always operate White Knight pumps with the approved muffler media. When working in noisy conditions, use the necessary ear protection.

4.2. System and Pump Environment Recommendations/Requirements

Oversized Inlet Line
Pumps operate optimally with liquid inlet lines larger than the liquid outlet lines. This reduces strain on the diaphragms and may reduce pulsation in the pump outlet.
Clean Supply Air (CDA)
White Knight high purity bellows pumps require the use of class 2 air for particles and moisture per ISO 8573-1. (Use 10 micron filter, maintain -40° C dew point)
Flammable Solvents
White Knight high purity diaphragm pumps are not constructed from conductive materials. Any system used to pump flammable solvents should be properly grounded to avoid ignition by static charge. 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
Minimizing suction lift in a system reduces pulsation and the potential boiling or outgassing of liquid in the inlet of the pump. Reciprocating pumps are designed to pull suction lift, but pump performance and life will increase when suction lift can be minimized or eliminated.
Abrasive Slurries
Pumping of abrasive slurries will shorten the life of any pump. White Knight high purity pumps are still warranted when used in abrasive applications however; wear of components will be accelerated. Normal wear is not a condition covered by warranty.
Environmental Temperature
This pump is rated to withstand environmental temperatures up to 50°C.

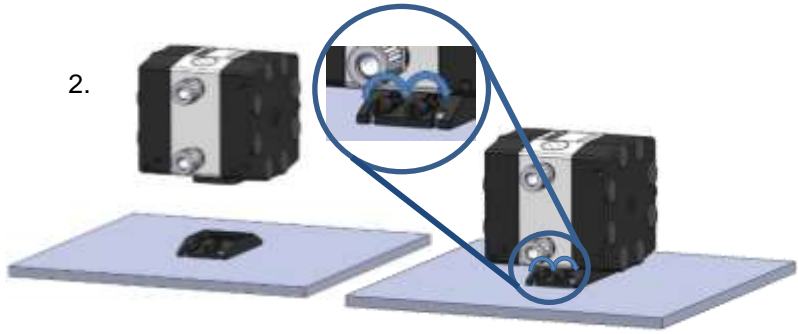
4.3. Installation Instructions

1.



Attach base plate to work space using 4 bolts, in predrilled holes.

2.



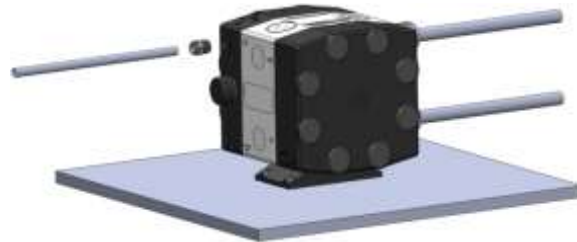
Align pump to base plate and lower onto stand, ensuring base is fully seated. Tighten set screws on front of base.

3.

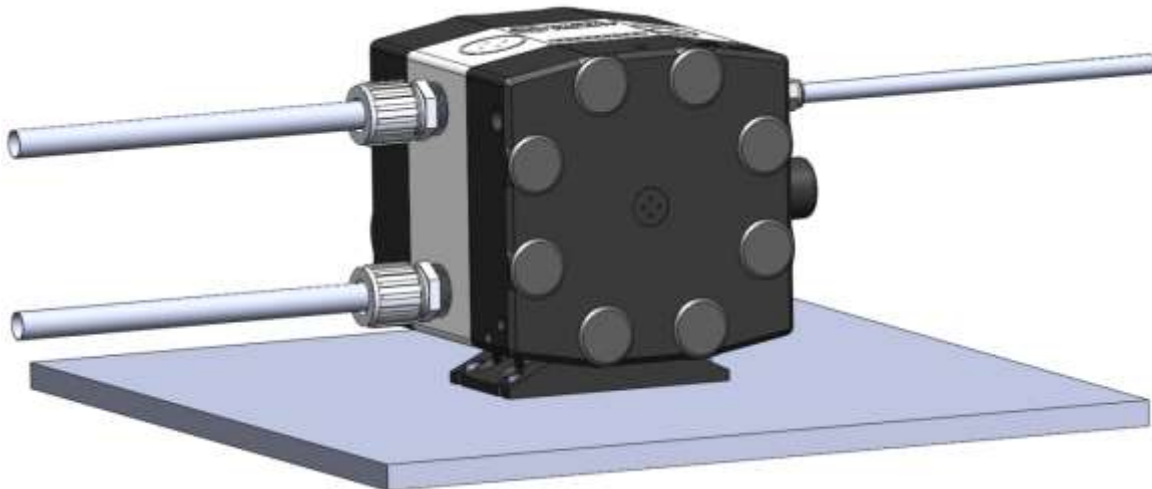


Attach liquid fittings per manufacturer's instructions.

4.



Attach air supply using 1/2in FNPT port (CDA Port) on pump head (for EC options, air must be connected to both heads, and controlled via an external solenoid)



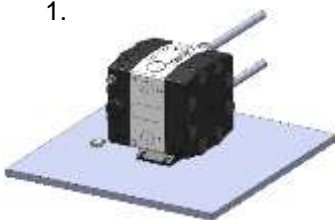
5. Pump Control and Monitoring

- PROGRAMMABLE CONTROLLING: White Knight offers the CPT-1 pump controller as a solution to control a White Knight pump. Run mode, flow rate and leak detection are a few items the CPT-1 controls or monitors.



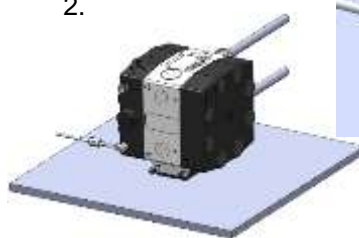
5.1. Pressure Switch Stroke Detection Attachment Instructions

1.



Attach the elbow to the EXH port in the head.

2.



Attach tubing using air gripper assembly

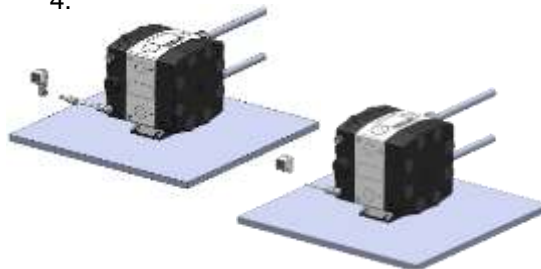


3.



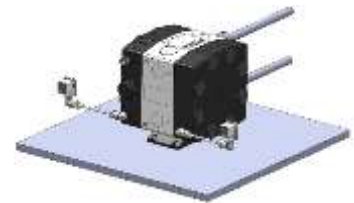
Attach the gripper elbow to the Pressure Switch

4.



Attach pressure switch to tubing

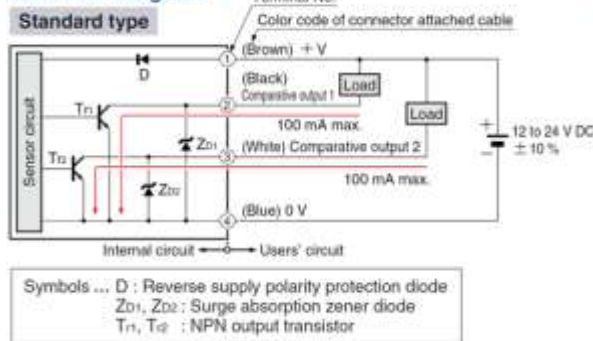
5.



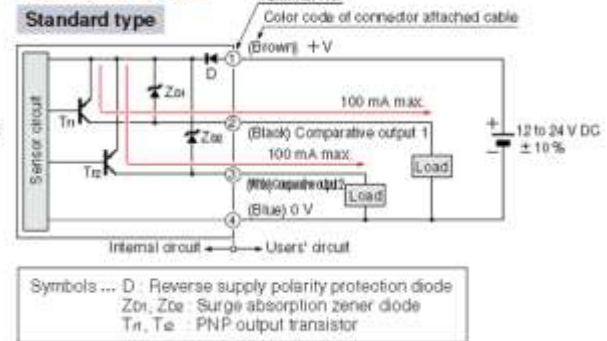
For Dual Pressure Switch, repeat all steps for second head.

5.2. Pressure Switch Stroke Detection Electrical Hookups and Dimensions

NPN I/O circuit diagram



PNP I/O circuit diagram



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