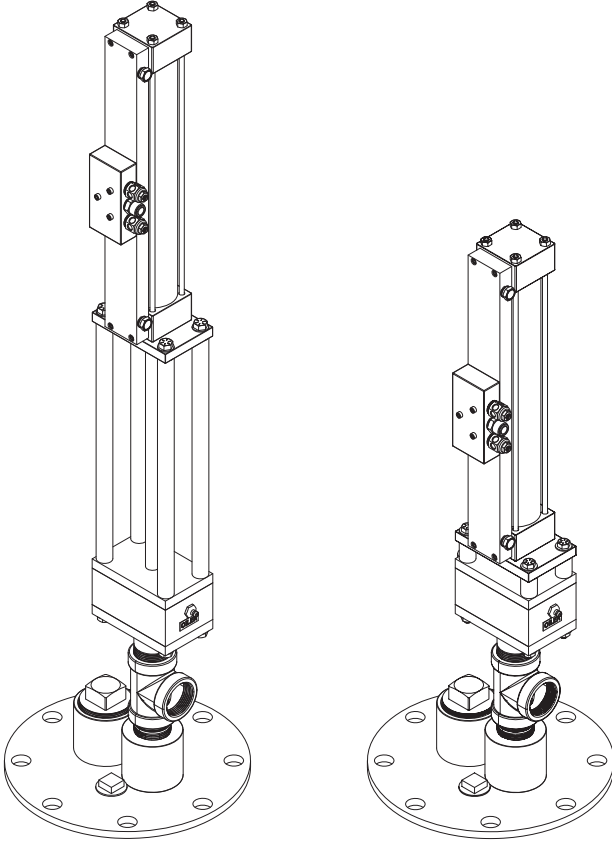


V-2 Pneumatic Piston Pump™

Installation Manual and Operating Instructions



BLACKHAWK
TECHNOLOGY COMPANY

1097 Hill Avenue, Glen Ellyn IL 60137
blackhawkco.com | 630.469.4916

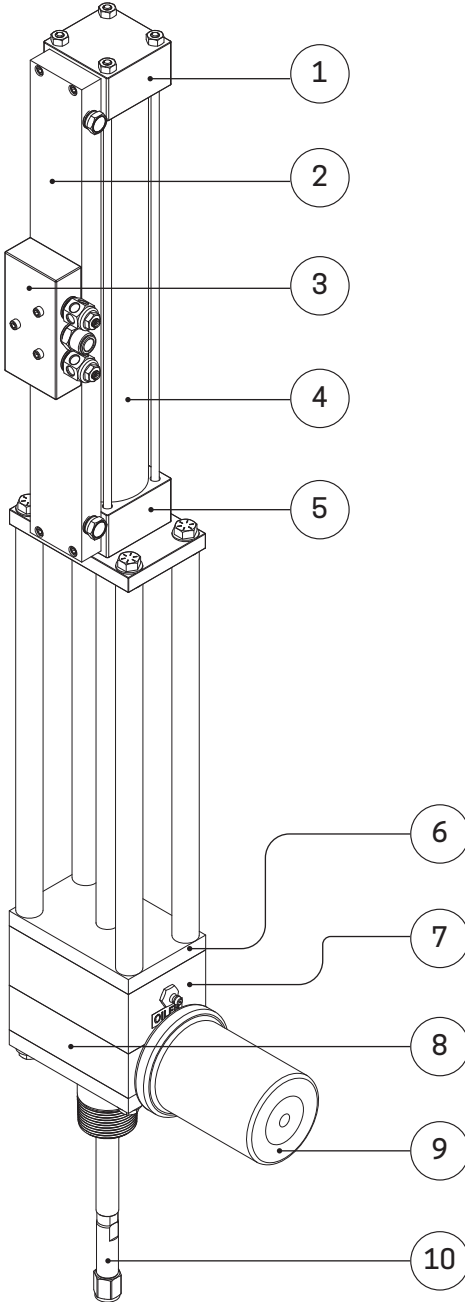


*Scan the QR code above to view further
technical data and documentation for
the V-2 Pneumatic Piston Pump*

Contents

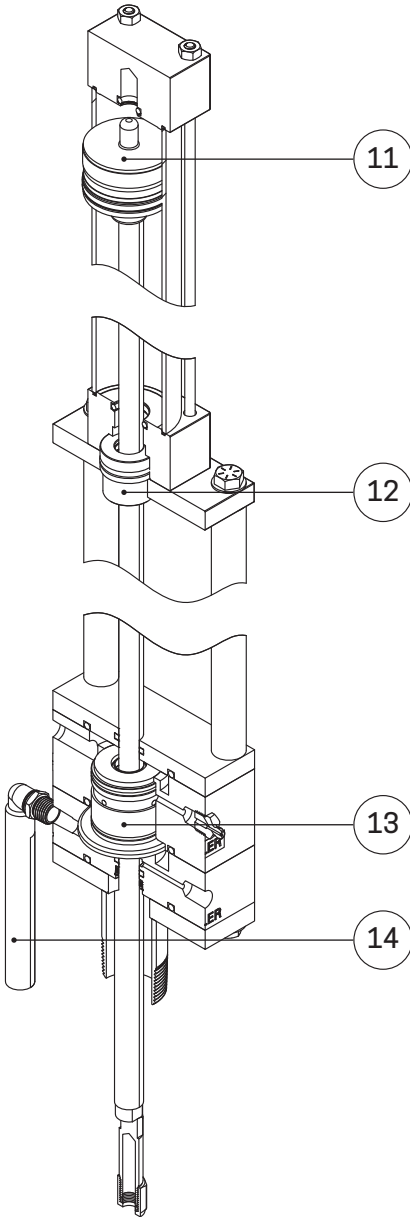
Overview	2
Preinstallation	4
1. <i>Unpack</i>	4
2. <i>Gather tools</i>	4
3. <i>Measure the well depth</i>	5
4. <i>Uncoil the rod</i>	5
5. <i>Choosing the riser pipe</i>	6
6. <i>Lay out the pump system</i>	7
Installation	8
1. <i>Assemble the downhole components</i>	8
2. <i>Install the vanstone flange</i>	8
3. <i>Lower the pump into the well</i>	8
4. <i>Inspect the well seal</i>	8
5. <i>Lower the piston into the well</i>	9
6. <i>Measure length of the rod and cut</i>	10
7. <i>Install the top head driver with ferrule and nut</i>	12
Start Up	14
1. <i>Turn on the actuator</i>	14
2. <i>Complete installation</i>	14
Maintenance	16
Troubleshooting Guide	18
Appendix	20

Overview



Driver Components:

- 1.) Piston Cylinder Cap
- 2.) Manifold
- 3.) Air Valve
- 4.) Piston Cylinder
- 5.) Piston Cylinder Head
- 6.) Splash Plate
- 7.) Stuffing Box
- 8.) Brass Oiler Plate
- 9.) Auto Oiler
- 10.) Driver Rod Connect

**Driver Components:**

- 11.) Drive Piston
- 12.) Nose Seal
- 13.) Stuffing Box Cartridge
- 14.) Drain Hose

Note: See appendix for individual part numbers

Preinstallation

1. UNPACK

- a. Verify the shipment has all the necessary materials that were ordered. If any required material is missing, call (630) 469-4916.
- b. Lay out all materials for installation.

2. GATHER TOOLS

- a. Source all the tools required for installation:
 - (2) Pipe wrenches
 - Adjustable wrench
 - Channel-lock pliers
 - Small vice-grip pliers
 - Ratchet wrench with 1/2" inch socket
 - (4) Open-end wrenches
 - 1/2 inch
 - 9/16 inch
 - 5/8 inch
 - 11/16 inch
 - (1) Allen wrench
 - 6 mm
 - Hacksaw
 - Measuring tape
 - Electrical tape
 - Air-cylinder oil
 - Teflon-type tape
 - Silicone Spray lubricant
 - Dark ink marker
- b. Source all the personal protective equipment required for installation:
 - Eye protection
 - Gloves
 - Additional PPE required by site regulations and requirements

3. MEASURE THE WELL DEPTH

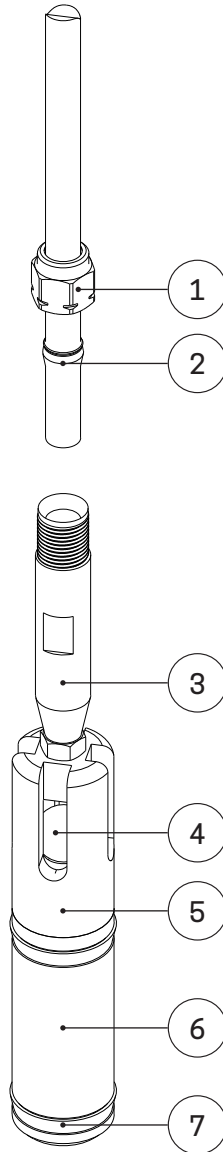
- Verify the depth of the well and record it.
- You will need this information later when measuring the riser-pipe length.

4. UNCOIL ROD

- Carefully uncoil the fiberglass drive rod by walking out the coiled rod uncoiling the rod as you walk.

CAUTION: The rod is under tension, use gloves and eye protection when handling the rod.

- A ferrule and nut are already attached to the rod. They mark the rod's bottom. This is where the piston will be attached.

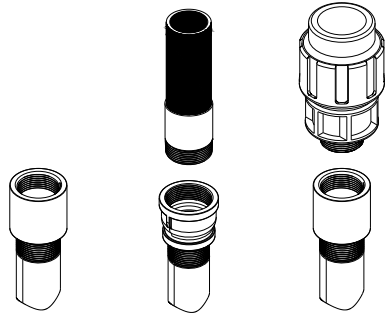
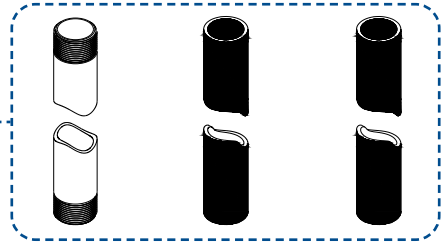
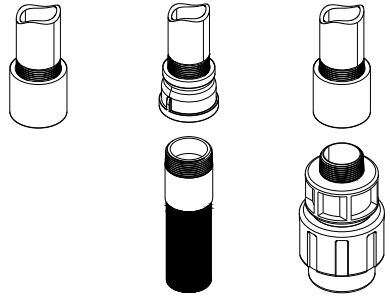


Piston Assembly Components:

- 1.) Rod Connect Nut
- 2.) Rod Connect Ferrule
- 3.) Piston Rod Connect
- 4.) Check Ball
- 5.) Piston Cage
- 6.) Piston Transition
- 7.) U-Cup Seals (x2)

5. CHOOSING THE RISER PIPE

- a. **The riser pipe for the pump will be provided by the customer.**
- b. The manufacturer recommends HDPE DR11 tubing for standard wells or Stainless-Steel pipe for elevated-temperature sites.
- c. Riser pipe diameters and lengths vary, depending on the customer's needs and the depth of the well.
- d. The riser pipe can be connected to the pump system in a number of ways depending on the type of riser pipe used and customer preference.
- e. The manufacturer can provide these connections and recommends the following:
- Threaded NPT stainless-steel connections
 - Heat butt fuse HDPE connections
 - PPE Compression fittings for HDPE pipe (not recommended for wells longer than 100 feet in length)
 - NEVER use glued fittings

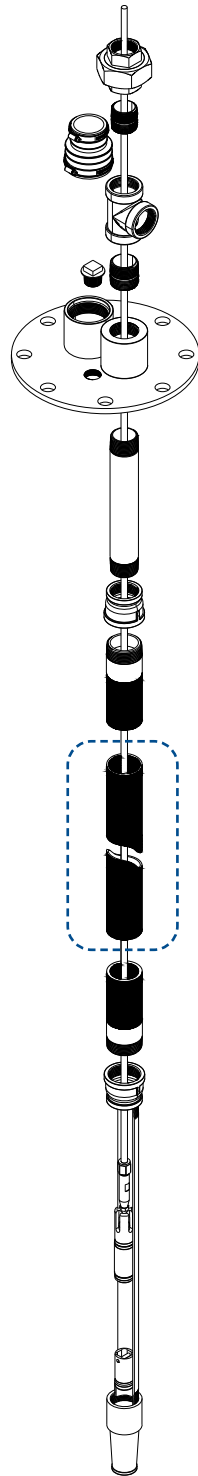


Riser Pipe Connector Types:

- 1.) NPT Threaded Pipe*
- 2.) HDPE Heat Butt Fused*
- 3.) PPE Compression*

6. LAY OUT THE DOWNHOLE COMPONENTS OF THE PUMP SYSTEM

- a. Lay out the pump system.
- b. The well seal will be at the top and a stainless-steel pipe nipple will be threaded into the bottom. The nipple will provide rigidity and quick access to the fiberglass drive rod if it slips down the well.
- c. At the bottom of the pump system is the screen and pump barrel.
 - If the inside diameter (ID) of the riser pipe or the connections is smaller than the piston's diameter, then a pipe nipple will be added to the top of the pump barrel for maintenance purposes.
- d. The middle gap is where you will connect the riser pipe. The length of the riser pipe is dependent on the length of the well, minus the lengths of the pump barrel and the pipe nipples provided.



Installation

1. ASSEMBLE THE DOWNHOLE COMPONENTS

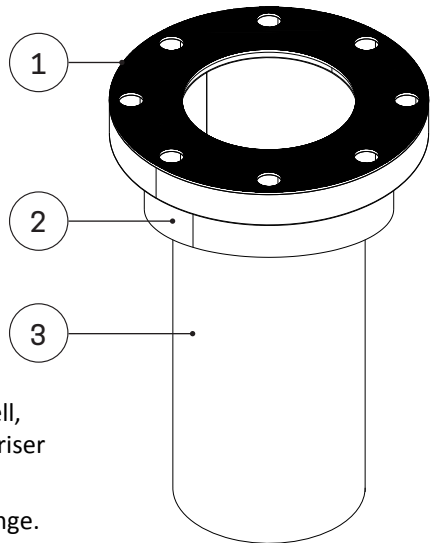
- a. Tightly secure the compression nut to the piston rod connect.
- b. Once the size of the riser pipe is determined, start making your connections.
 - If the inside diameter (ID) of the riser pipe or connections is smaller than the outside diameter (OD) of the piston, the piston must be first inserted into the pump barrel and drive rod inserted through riser pipe, connections and tubing prior to assembly of the downhole.
 - Use plumber's tape on all threaded connections of the riser pipe to ensure the connections do not leak.

2. INSTALL THE VANSTONE FLANGE

- a. Secure the vanstone flange to the top of the well casing.
- b. Place the rubber gasket on top of the vanstone flange.

3. LOWER THE DOWNHOLE COMPONENTS INTO THE WELL

- a. Carefully slide the pump barrel into the well, screen first. Avoid 90 degree bends to the riser pipe.
- b. Line the well seal up with the vanstone flange.
- c. Bolt the well seal to the vanstone flange.
See diagram on next page for reference.



Flange Components:

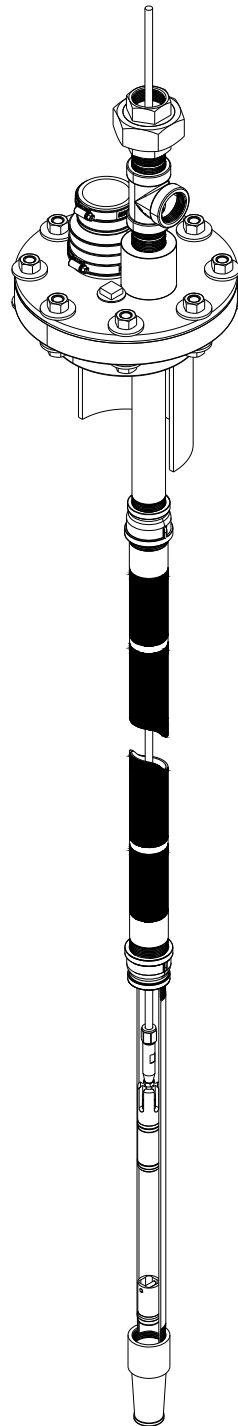
- 1.) Rubber Gasket
- 2.) Vanstone Flange
- 3.) Well Casing

4. INSPECT THE WELL SEAL

- a. Well seals are sized and designed to fit the customer's needs.
- b. There are typically 3 ports on each well seal. One port is the actuator mount. At this port you will install the close nipple and discharge tee.
 - A pipe union can be installed above the tee for ease of future maintenance.
- c. The other two ports can be used for monitoring and drainage. The larger port also can accommodate a gas collection system.

5. LOWER THE PISTON INTO THE WELL

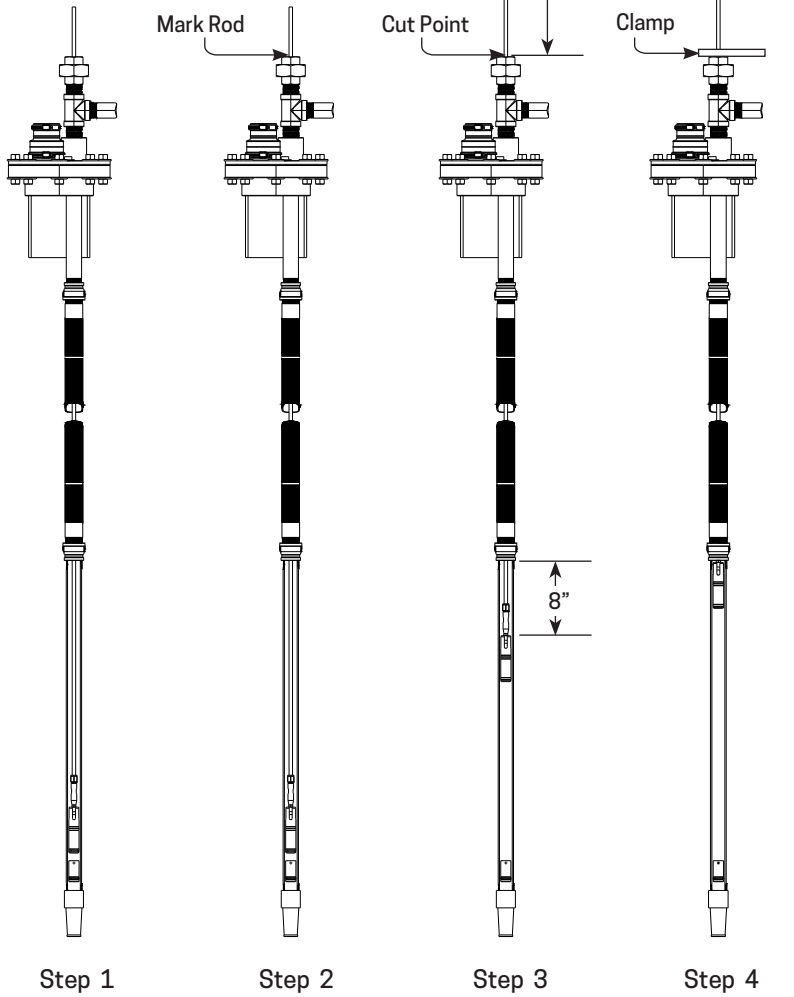
- a. Lower the piston and fiberglass drive rod into the well. Keep lowering the rod until you feel the piston rest at the bottom of the pump barrel.
 - Refer to step 1b if the ID of the riser pipe or connections is smaller than the OD of the piston
- b. Hand pump the drive rod to ensure the piston is pumping liquid. You will start to feel resistance when there is sufficient liquid entering the riser pipe.



6. MEASURE LENGTH OF THE ROD AND CUT

See Rod Cutting Diagram on next page for reference.

- a. Make sure the piston is resting at the bottom of the pump barrel. *See Step 1.*
- b. Mark the rod at the top of the tee or pipe union with a marker. *See Step 2.*
- c. Pull 3 to 4 feet of rod from the well. *See Step 3.*
- d. Wrap tape around the fiberglass drive rod where it meets the tee or pipe union. Clamp vice grips to the tape. **NOTE: This secures the drive rod at the surface and prevents rod from dropping into the well.** *See Step 4.*
- e. From the first mark, measure exactly 20 inches down the fiber glass drive rod and make a second mark. *See Step 4.*
- f. Using the hacksaw, carefully cut the fiberglass drive rod at the second mark. Cut on both sides to ensure the rod does not split. *See Step 4.*
- g. When cut correctly, there will be an 8 inch gap between the top of the piston and the top of the pump barrel, when the piston is in the “up” position of the stroke.



Step 1

Step 2

Step 3

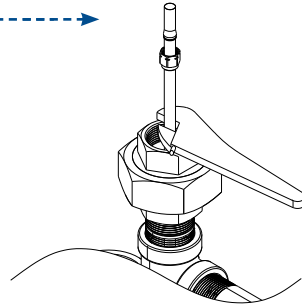
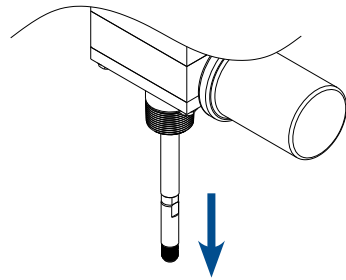
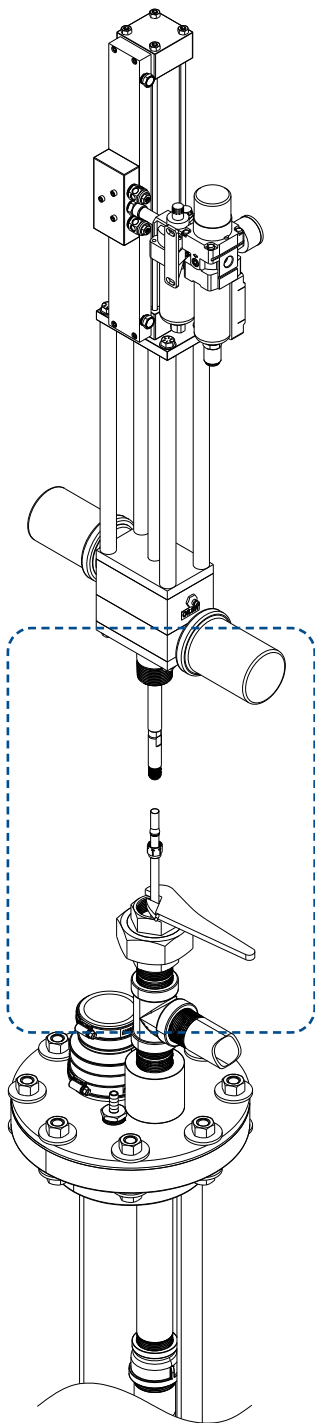
Step 4

Rod Cutting Diagram

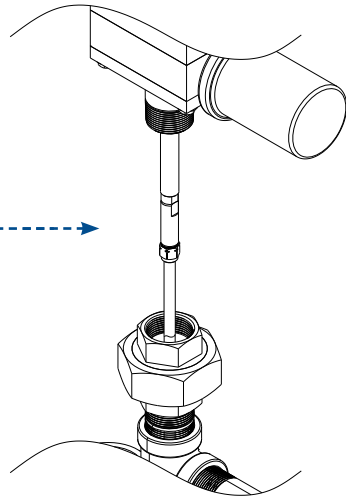
7. INSTALL THE TOP HEAD DRIVER WITH FERRULE AND NUT

See figures on next page for reference.

- a. Retrieve the ferrule and nut from the actuator. They will be loosely fastened to the actuator's rod to motor connect. *See Step 1.*
- b. At the cut end of the fiberglass drive rod, lower the compression nut, facing outward, onto the rod. Then lower the ferrule onto the drive rod. *See Step 1.*
- c. Retrieve the actuator and slide the drive rod into motor connect with the ferrule and nut below it. *See Step 2.*
- d. Tighten the nut and ferrule to the rod to motor connect. Fasten tightly. The ferrule needs to dig itself into the fiberglass drive rod. When done correctly, the ferrule will have mushroomed out and there will be a faint white line where the ferrule has dug into the rod. *See Step 2.*
- e. Remove vice grips and tape from the fiberglass drive rod and lower the actuator into position over the tee or union.
- f. Attach the actuator to the well seal at the tee or union. Secure tightly to prevent leaks.
- g. Attach air supply kit and auto oiler to the actuator, if purchased.
- h. Attach discharge piping to the discharge tee on the well seal.



Step 1



Step 2

Start Up

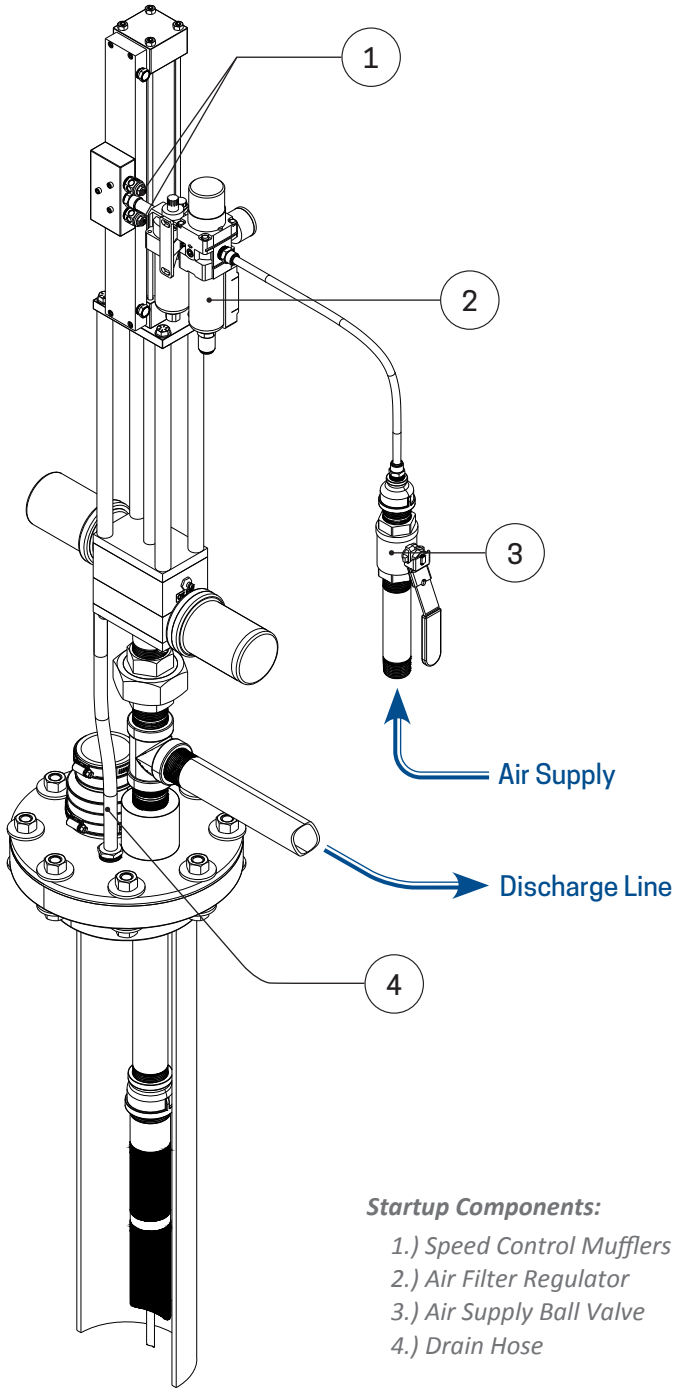
1. TURN ON ACTUATOR

See figure on next page for reference.

- a. Connect air-supply line to the air filter regulator.
- b. Connect drain hose from the stuffing box to the well seal drain port.
- c. Turn on air supply.
- d. Adjust the speed of the strokes using the speed-control mufflers located on the actuator's valve. Each stroke is one up-and-down motion of the actuator's stainless-steel drive rod.
- e. The manufacture strongly recommends the stroke not exceed 40 strokes per minute. This will lengthen seal life and reduce maintenance frequency.

2. COMPLETE INSTALLATION

- a. The pump is now installed and ready for use.



Startup Components:

- 1.) Speed Control Mufflers
- 2.) Air Filter Regulator
- 3.) Air Supply Ball Valve
- 4.) Drain Hose

Maintenance

PERIODIC CHECKS

- Check pump back pressure at the discharge tee.
 - Refer to Appendix, Page 29: “FIGURE 1: Flow Rate vs Depth Per Downhole Type”
- Check liquid discharge rate at the discharge tee.
 - Refer to Appendix, Page 29: “FIGURE 1: Flow Rate vs Depth Per Downhole Type”
- Check air leakages at actuator drive motor.
 - Refer to Troubleshooting, Page 18, Section 1.b: “Air Cylinder Seals Worn Out”
- Check stuffing box drain port for leaks.
 - Refer to Maintenance, Page 16, Section 3: “Replacing Stuffing Box Seals”

REPLACING SEALS IN THE ACTUATOR DRIVE MOTOR

- Refer to V-2 Reconditioning Guide (external document)
- The actuator’s drive motor has a number of seals in it and they will wear over time.
- The cylinder nose seal cartridge, located below the actuator cylinder, is a critical seal.
 - If this seal starts to leak air, pressure cannot be built up in the cylinder and the actuator will not reciprocate. [Replace cylinder seals at this time.](#)

REPLACING STUFFING BOX SEALS

- Refer to V-2 Reconditioning Guide (external document) & various stuffing box / cartridge configurations in Appendix, Pages 22-24
- Stuffing box seals will wear over time.
 - Typical life of the stuffing box seals is about 3 to 6 months.
 - Seal life depends on discharge pressure, stroke speed, grit and temperature of liquid.
 - Once the seals wear, the stuffing box will begin to leak liquid from the drain port. [Replace stuffing box seals at this time.](#)

REPLACING PISTON SEALS

- Piston seals will wear over time.
 - Once the seals wear, there will be a loss of liquid discharge measured at the discharge tee. [Replace piston seals at this time.](#)

LUBRICATION OF STUFFING BOX SEALS

- Grease Zerk Fitting
 - One hand pump of synthetic grease to stuffing box, once a month.
 - **DO NOT** use auto grease gun or over grease, this will cause the stuffing box seals to fail.
- Auto Oiler System
 - Use 6-month auto oiler fitting.
 - Replace oiler cartridge and battery when oiler bladder runs dry.

CAUTION AND RECOMMENDATIONS

- **DO NOT** operate pump with the discharge valve closed or discharge pipe clogged, this will result in stuffing box seal failure.
- **DO NOT** scratch the actuator's drive motor stainless steel piston rod, this will result in premature stuffing box seal wear.
- **DO NOT** use CLR or comparable chemicals on the aluminum components of the actuator drive motor.
- Recommend simple green and/or paint thinner for cleaning.
- Recommend industrial compressed air quality for supply air.
- Recommend back pressure not exceed 50 PSI, higher back pressure at the discharge tee will result in faster seal wear.
- Recommend use of synthetic grease, synthetic spray lubricant, or 3-in-1 oil for lubrication. WD-40 is not recommended.

Troubleshooting Guide

1. DRIVER NOT RECIPROCATING OR STUTTERING WHILE IN USE

a. Air Supply Issues

- Check that the air supply is on.
- Check that all the air supply connections are sound.
- Check that there is between 40 - 120 PSI of air supply pressure, increase air pressure to the driver at the regulator as needed.
 - Refer to Appendix, Page 30: "FIGURE 3: Depth vs Air Supply Pressure Per Down Hole Type"

b. Air Cylinder Seals Worn Out

- The driver's air cylinder seals will wear down and need to be replaced over time.
- Air will most likely be leaking from the cylinder's nose seal cartridge.
 - Refer to Appendix, Page 21: "PART NUMBERS: V-2 Pneumatic Drive Motor Assembly, Part 2"

c. Excessive Back Pressure In Discharge Line

- Verify that the discharge valve is in the open position.
- Relieve pressure in the discharge line.
- Check for and remove any obstructions in the discharge pipe.
- Check maximum Total Dynamic Head (TDH) for the appropriate pumping setup.
 - Refer to Appendix, Page 29: "FIGURE 1: Flow Rate vs Depth Per Down Hole Type"

2. DRIVER RECIPROCATING BUT NOT PUMPING LIQUID

a. Liquid Level In Riser Pipe Insufficient For Discharge

- Liquid level in the riser pipe will take time until it is filled to the level of the discharge tee
- Find the time it takes the liquid to reach the tee
 - Refer to Appendix, Page 29: "FIGURE 2: Liquid Fill Time Per Pump and Riser Pipe Type"

b. Leak In Riser Pipe And/Or Connections

- Remove pump system from the well
- Check riser pipe and connections for leaks
- Tighten all connections

c. Fiberglass Drive Rod Disconnected

- Remove the pumping system from the well
- Verify that the fiberglass drive rod is connected to the driver and to the piston
 - If fiberglass drive rod is separated at the compression fitting, a replacement drive rod ferrule will be required (ferrules cannot be re-crimped)

d. Foot Valve And/Or Piston Check Ball Obstructed

- Remove pump system from the well
- Clear debris from the pump barrel, foot valve, piston, and riser pipe
 - Debris or obstructions can cause the check ball to not be seated properly, preventing a proper seal in either the piston or the foot valve

e. Plugged Bottom Intake

- Perform the glove test (see below) to determine if intake is plugged
- If intake is plugged because it was placed in mud or silt, raise the pump system so that the intake is clear of the mud or silt

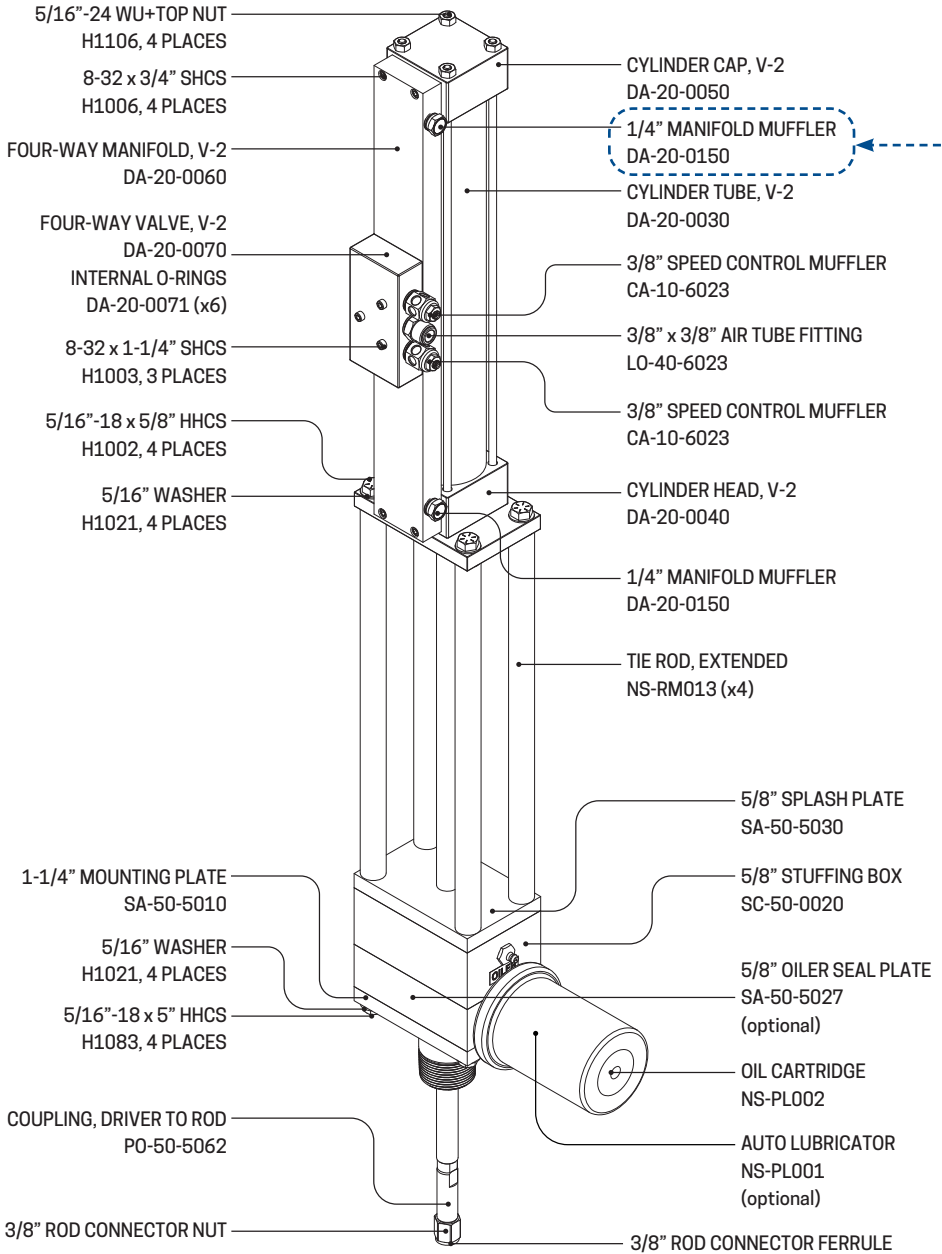
f. The Liquid Level Has Dropped Below The Intake

- Measure the liquid level of the well
- Extend the the pump system to reach the new liquid level
 - Refer to Appendix, Page 27: "ADDITIONAL OPTIONS: Vertical Stinger Suction Extension"

THE GLOVE TEST

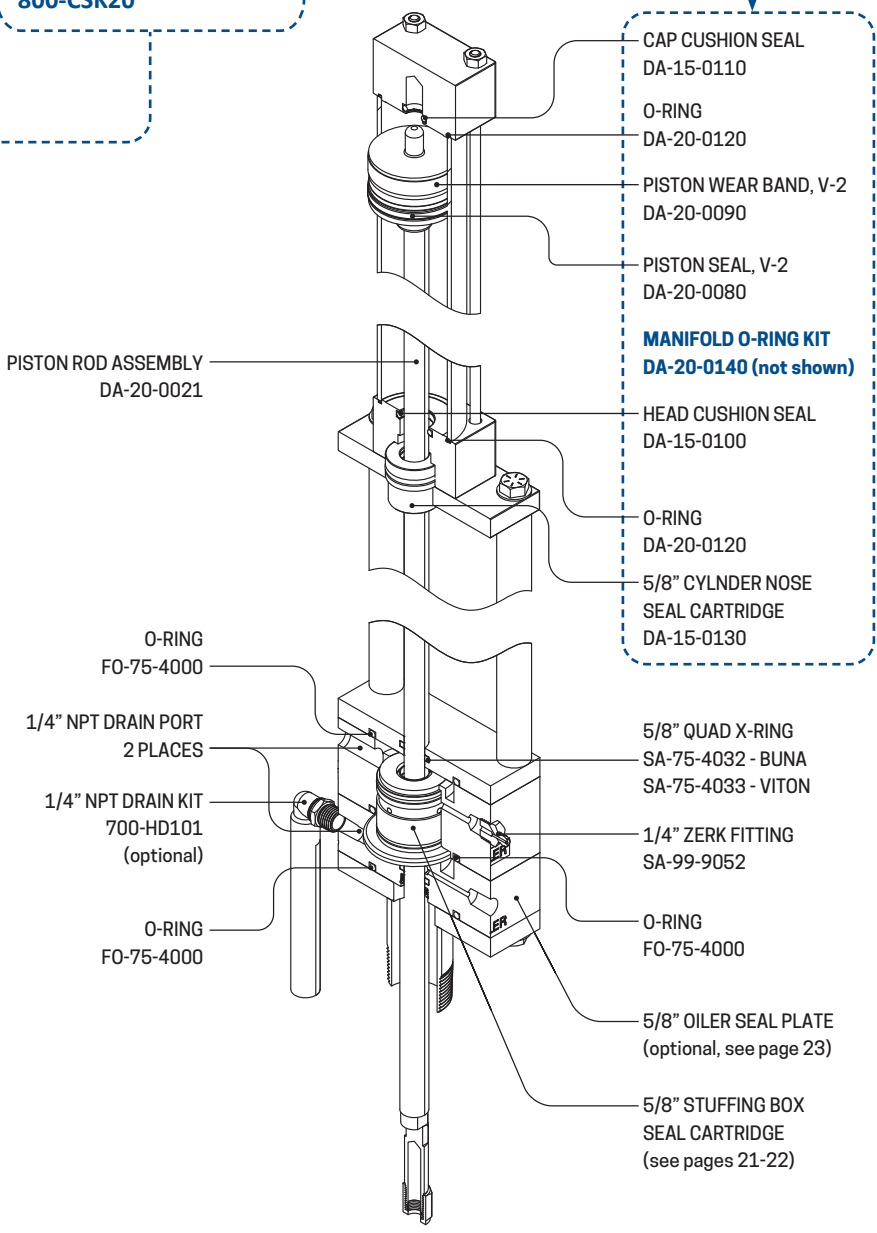
- Remove discharge line from tee
- Firmly wrap a rubber glove around the discharge tee, sealing it with your hand or a rubber band
- If the glove slowly inflates during actuation, then the pump is raising liquid to the surface and displacing the air in the riser pipe
- If the glove breaths in and out then there is liquid in the riser pipe but the pump barrel is clogged
- If the glove does not inflate then refer to issues b-d in the previous troubleshooting section, Section 2 (Leak In Riser Pipe And/Or Connections, Fiberglass Drive Rod Disconnected, Foot Valve And/Or Piston Check Ball Obstructed)

Appendix



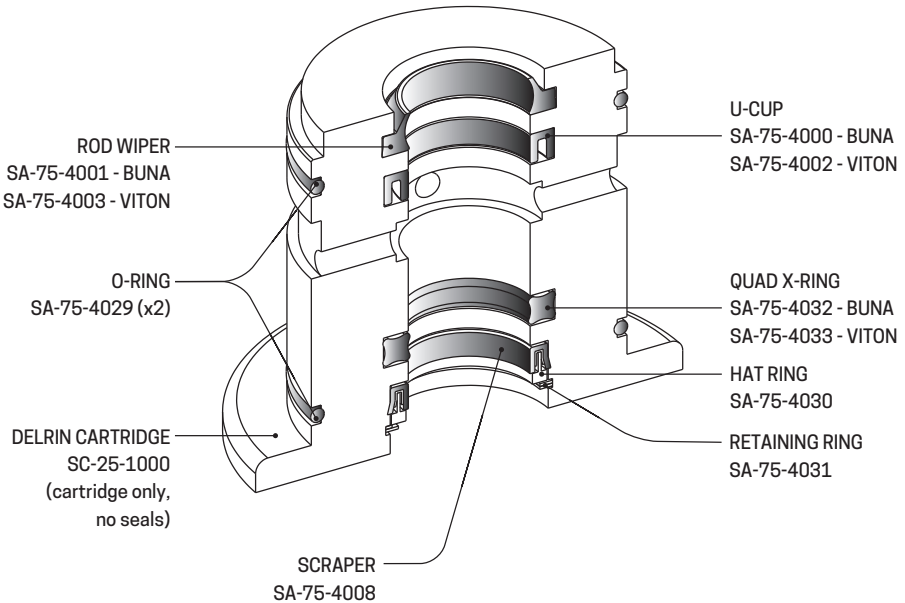
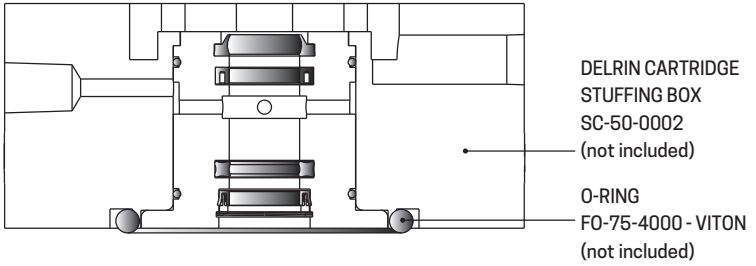
PART NUMBERS: V-2 Pneumatic Drive Motor Assembly, Part 1

Included in an internal cylinder seal kit, part # 800-CSK20



PART NUMBERS: V-2 Pneumatic Drive Motor Assembly, Part 2

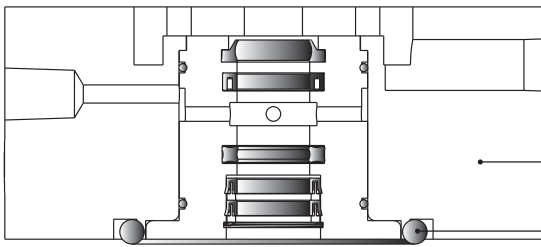
Appendix



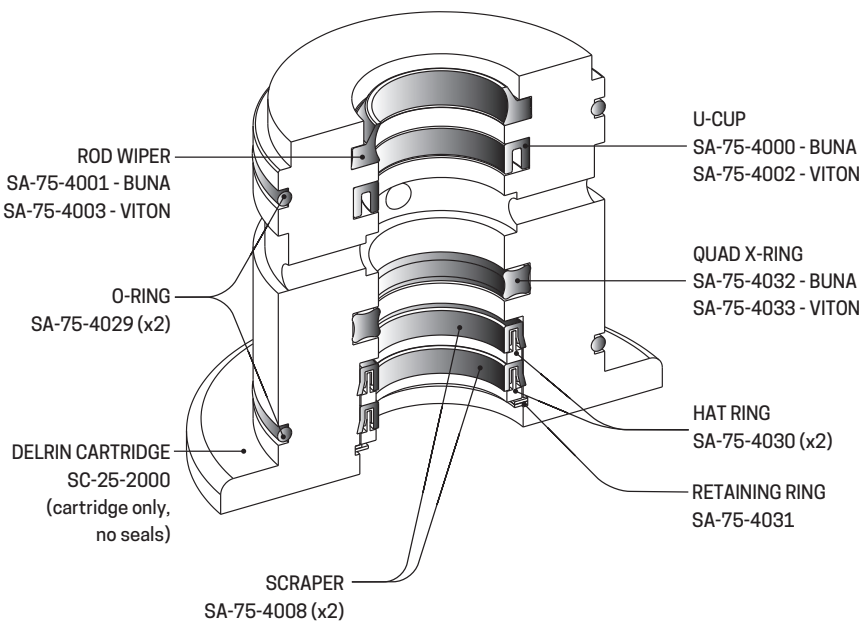
Seal Kits

BUNA SEAL KIT	858-SCHRB
CARTRIDGE WITH BUNA SEALS	859-SCHRB
VITON SEAL KIT	858-SCHRV
CARTRIDGE WITH VITON SEALS	859-SCHRV

CARTRIDGE SEAL KITS: 5/8" Rod Hat-Ring Cartridge Assembly



- DELRIN CARTRIDGE STUFFING BOX SC-50-0002 (not included)
- O-RING FO-75-4000 - VITON (not included)



- ROD WIPER SA-75-4001 - BUNA SA-75-4003 - VITON

- O-RING SA-75-4029 (x2)

- DELRIN CARTRIDGE SC-25-2000 (cartridge only, no seals)

- SCRAPER SA-75-4008 (x2)

- U-CUP SA-75-4000 - BUNA SA-75-4002 - VITON

- QUAD X-RING SA-75-4032 - BUNA SA-75-4033 - VITON

- HAT RING SA-75-4030 (x2)

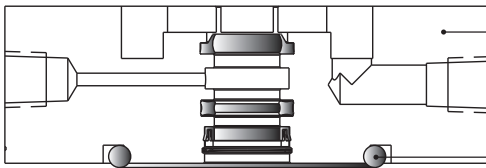
- RETAINING RING SA-75-4031

Seal Kits

BUNA SEAL KIT	858-SCHRSTB
CARTRIDGE WITH BUNA SEALS	859-SCHRSTB
VITON SEAL KIT	858-SCHRSTV
CARTRIDGE WITH VITON SEALS	859-SCHRSTV

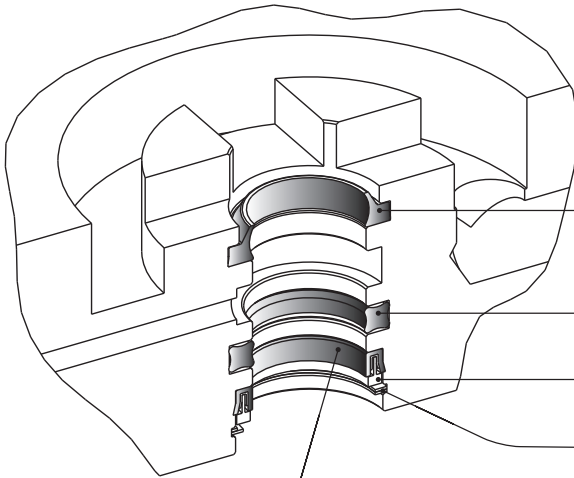
CARTRIDGE SEAL KITS: 5/8" Rod V-Stack Cartridge Assembly

Appendix



BRASS OILER
SEAL PLATE
SA-50-5027

O-RING
FO-75-4000 - VITON
(not included)



ROD WIPER
SA-75-4003 - VITON

QUAD X-RING
SA-75-4032 - BUNA
SA-75-4033 - VITON

HAT RING
SA-75-4030

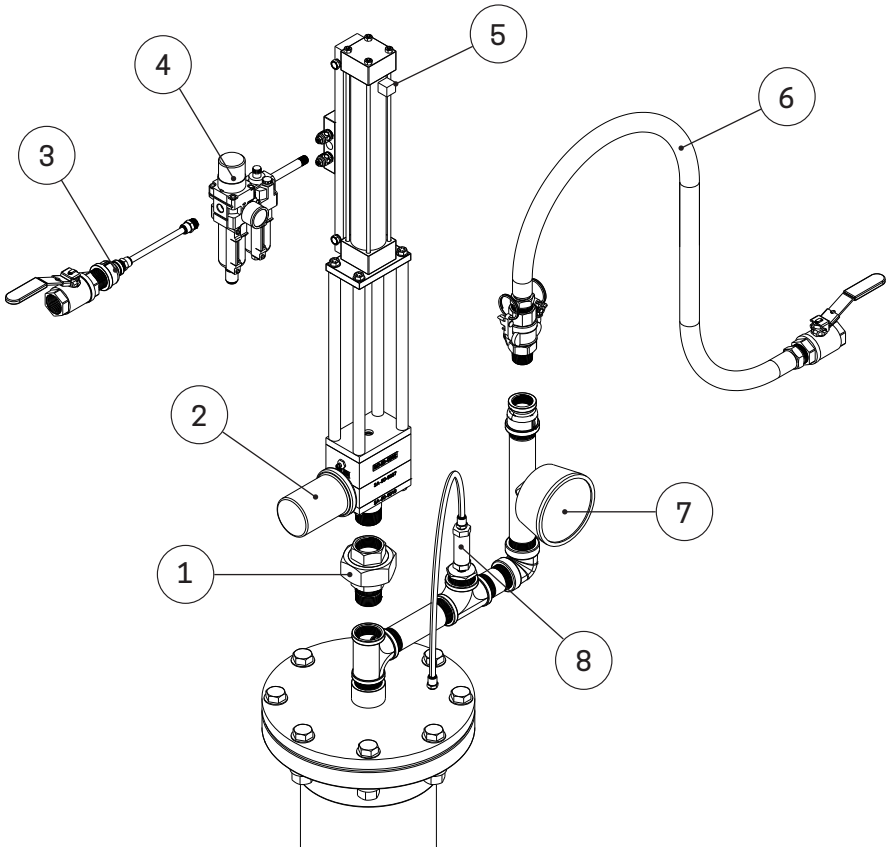
RETAINING RING
SA-75-4031

SCRAPER
SA-75-4008

Seal Kits

BUNA SEAL KIT	858-SOLB
VITON SEAL KIT	858-SOLV

ADDITIONAL OPTIONS: 5/8" Brass Oiler Seal Plate Assembly



Preinstallation

Installation

Startup

Optional Components

1	700-UN001	1-1/4" PIPE UNION ASSEMBLY
2	NS-PL001	AUTO LUBRICATOR
3	700-AS145	AIR PIPING ASSEMBLY
4	700-AS108	AIR SUPPLY KIT
5	NS-N0008	STROKE COUNTER
6	700-AS140	DISCHARGE KIT
7	** VARIES **	FLOW METER
8	NS-FP001	PRESSURE RELIEF VALVE

Maintenance

Troubleshooting Guide

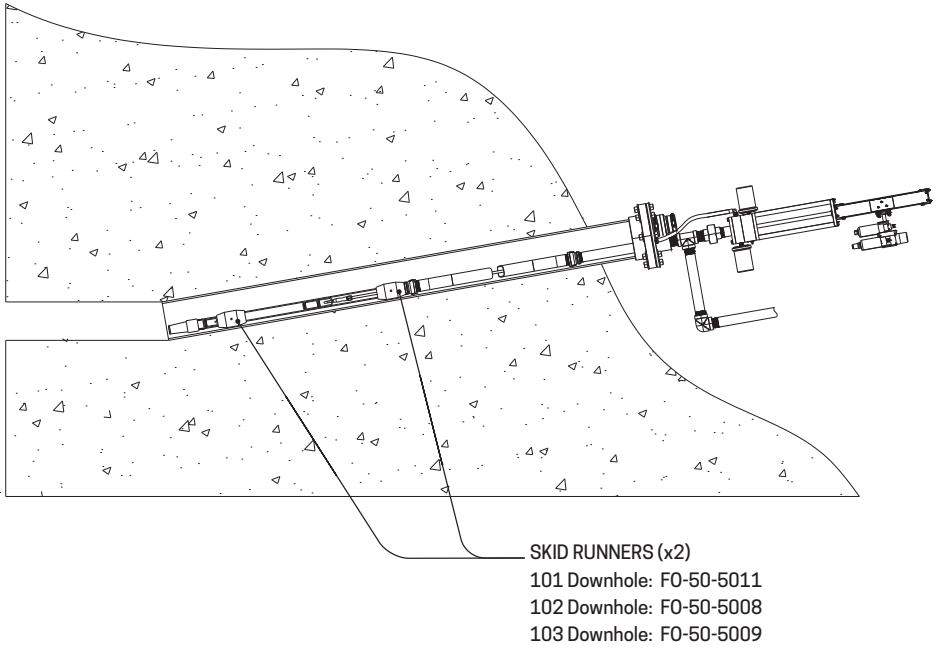
ADDITIONAL OPTIONS: Pneumatic Accessories Guide

Appendix

NOTE:

Blackhawk's unique design allows all its pumps to pump liquid from vertical to near horizontal wells. Skid runners are recommended for wells nearing horizontal orientation. The skid runners ensure that the pump's intake does not rest directly on the well casing.

See note below for selecting correct skid runners based on downhole size.



ADDITIONAL OPTIONS: Sideslope Downhole Capability

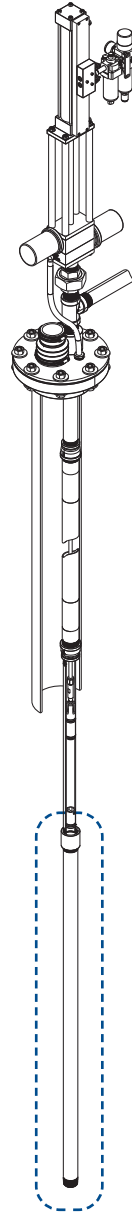
NOTE:

The vertical stinger suction extension is a quick way to add 10 extra feet of suction depth to an already assembled pump system.

INSTRUCTIONS:

- Pull pump system from the well in its entirety.
- Remove intake screen from the bottom of the pump barrel.
- Attach coupling and piping to the bottom of the pump barrel to reach the desired new depth (10 feet MAX).
- Reinstall the pump into the well.

STINGER EXTENSION
10 FEET OF DEPTH

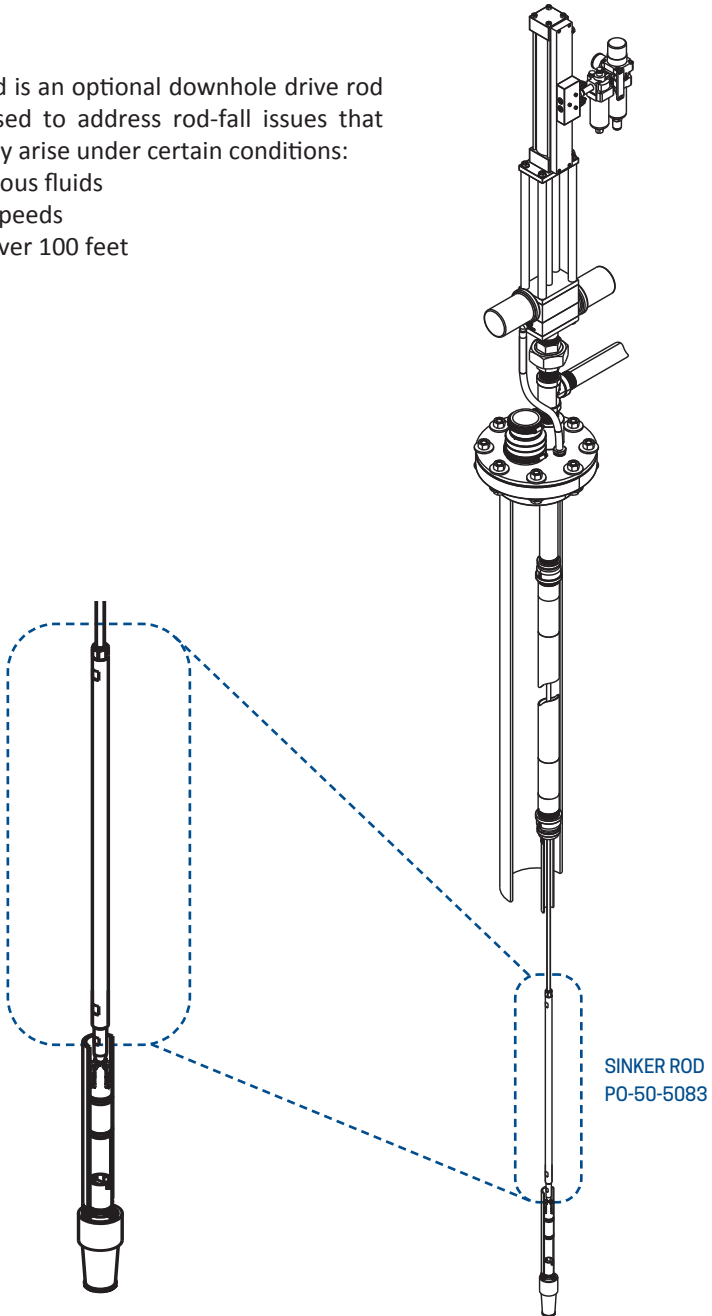


Appendix

NOTE:

The sinker rod is an optional downhole drive rod component used to address rod-fall issues that may potentially arise under certain conditions:

- Pumping viscous fluids
- High stroke speeds
- Well depth over 100 feet



ADDITIONAL OPTIONS: *Sinker Rod*

FLOW vs. DEPTH

V-2 101, 102, and 103

@ 100 PSIG

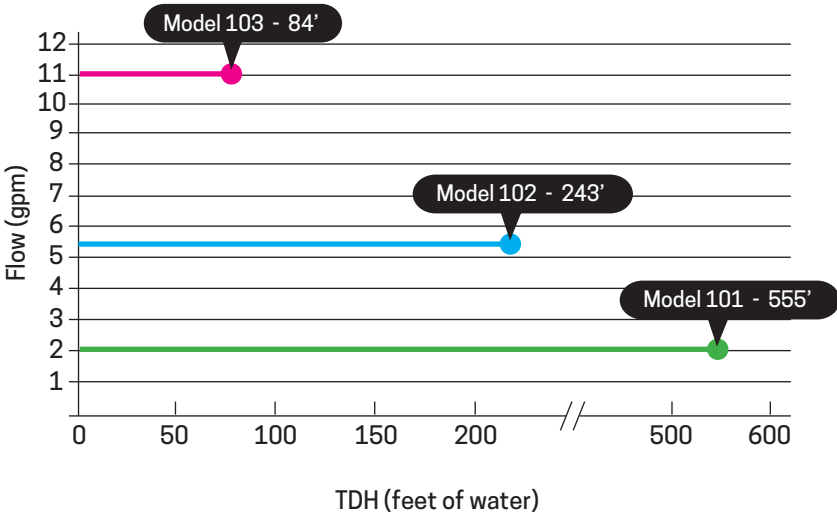


FIGURE 1: Flow Rate vs Depth Per Downhole Type

Liquid Fill Time Per Pump & Riser Pipe Types (Based on 100' well depth)						
Pump Barrel Size	Actuator Type	gpm	Riser Pipe Type and Size			
			HDPE DR 11 Pipe		Schedule 40 Pipe	
			1-1/2"	2"	1-1/4"	2"
101	Apollo	1.10	8:12	13:06	6:32	15:19
	Pneumatic	2.00	4:30	7:12	3:35	8:25
	Anchor	1.35	6:41	10:40	5:19	12:29
102	Apollo	2.70	3:20	5:20	2:39	6:14
	Pneumatic	5.00	1:48	2:53	1:26	3:22
	Anchor	3.27	2:45	4:24	2:12	5:09

FIGURE 2: Liquid Fill Time Per Pump and Riser Pipe Type

Appendix

DEPTH vs. AIR SUPPLY PRESSURE

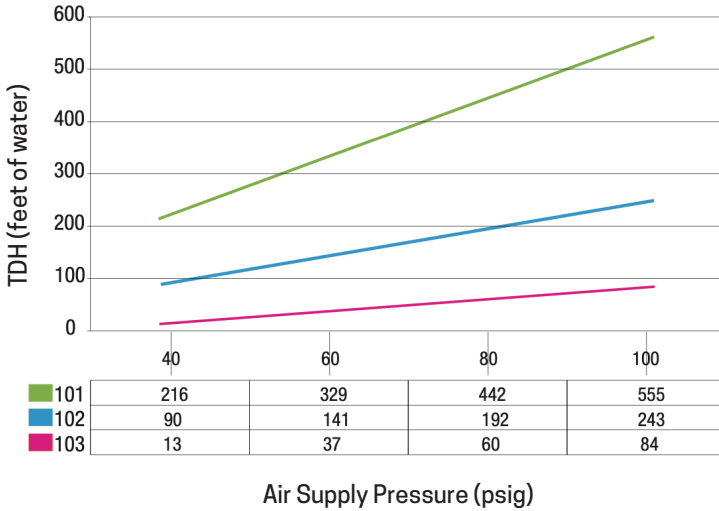


FIGURE 3: Depth vs Air Supply Pressure Per Downhole Type

SCF vs. AIR SUPPLY PRESSURE

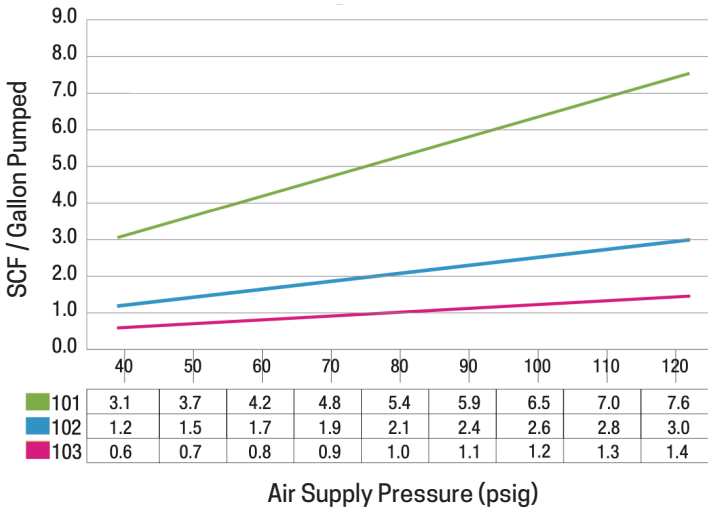


FIGURE 4: SCF vs Air Supply Pressure Per Downhole Type

MAXIMUM OPERATING DEPTH	555 FEET (169 METERS)
MAXIMUM FLOW RATE - PER MIN	UP TO 2.0 US GPM (7.57 LPM)
MAXIMUM FLOW RATE - PER DAY	UP TO 2,880 US GPD (10,900 LPD)
MAXIMUM OPERATING PRESSURE	240 PSIG (BASED ON 100 PSI AIR SUPPLY)
MAXIMUM LIFT	555 FEET OF WATER
STROKES PER MINUTE	5 - 40 SPM
MAXIMUM STROKES PER MINUTE	40 SPM
DISCHARGE PER STROKE	0.05 GALLONS (0.19 LITERS)
TEMPERATURE RANGE	UP TO 140° F / 60° C

FIGURE 5: Performance Data - 101 Downhole

MAXIMUM EXTERNAL DIAMETER	1.9 INCHES (4.83 CENTIMETERS)
TOTAL CYLINDER LENGTH	38 INCHES (96.5 CENTIMETERS)
CONNECTION TO RISER PIPE	1.25 INCHES (3.18 CENTIMETERS)
RECOMMENDED INTERNAL BORE-HOLE DIAMETER	2 - 3 INCHES (5.08 - 7.62 CM) OR GREATER
WEIGHT OF CYLINDER	8 POUNDS (3.63 KILOGRAMS)
DISCHARGE SIZE	1.25 INCHES NPT (3.18 CENTIMETERS)
INSTALLATION	ANY ANGLE FROM VERTICAL TO HORIZONTAL
DRIVER WEIGHT	35 POUNDS (15.8 KILGRAMS)
DRIVER ROD WEIGHT	12 LBS PER 100 FT (3.7 KG PER 100 M)
FOOT VALVE ASSEMBLY WEIGHT	8 POUNDS (3.6 KILOGRAMS)
MINIMUM WELL CASING SIZE	2 INCHES (5.08 CENTIMETERS)
PNEUMATIC AIR CONNECTION	3/8 INCH NPT THREADS, 3/8 INCH O.D. TUBING

FIGURE 6: Technical Data - 101 Downhole

Appendix

MAXIMUM OPERATING DEPTH	243 FEET (74 METERS)
MAXIMUM FLOW RATE - PER MIN	UP TO 5.4 US GPM (20.4 LPM)
MAXIMUM FLOW RATE - PER DAY	UP TO 7,700 US GPD (29,400 LPD)
MAXIMUM OPERATING PRESSURE	105 PSIG (BASED ON 100 PSI AIR SUPPLY)
MAXIMUM LIFT	243 FEET OF WATER
STROKES PER MINUTE	5 - 40 SPM
MAXIMUM STROKES PER MINUTE	40 SPM
DISCHARGE PER STROKE	0.125 GALLONS (0.48 LITERS)
TEMPERATURE RANGE	UP TO 140° F / 60° C

FIGURE 7: Performance Data - 102 Downhole

MAXIMUM EXTERNAL DIAMETER	2.9 INCHES (7.37 CENTIMETERS)
TOTAL CYLINDER LENGTH	38 INCHES (96.5 CENTIMETERS)
CONNECTION TO RISER PIPE	2 INCHES (5.08 CENTIMETERS)
RECOMMENDED INTERNAL BORE-HOLE DIAMETER	3 - 4 INCHES (7.62 - 10.16 CM) OR GREATER
WEIGHT OF CYLINDER	10 POUNDS (4.53 KILOGRAMS)
DISCHARGE SIZE	2 INCHES NPT (5.08 CENTIMETERS)
INSTALLATION	ANY ANGLE FROM VERTICAL TO HORIZONTAL
DRIVER WEIGHT	35 POUNDS (15.8 KILOGRAMS)
DRIVER ROD WEIGHT	12 LBS PER 100 FT (3.7 KG PER 100 M)
FOOT VALVE ASSEMBLY WEIGHT	10 POUNDS (4.53 KILOGRAMS)
MINIMUM WELL CASING SIZE	3 INCHES (7.62 CENTIMETERS)
PNEUMATIC AIR CONNECTION	3/8 INCH NPT THREADS, 3/8 INCH O.D. TUBING

FIGURE 8: Technical Data - 102 Downhole

MAXIMUM OPERATING DEPTH	84 FEET (25.6 METERS)
MAXIMUM FLOW RATE - PER MIN	UP TO 11.0 US GPM (41.6 LPM)
MAXIMUM FLOW RATE - PER DAY	UP TO 15,840 US GPD (59,960 LPD)
MAXIMUM OPERATING PRESSURE	36.4 PSIG (BASED ON 100 PSI AIR SUPPLY)
MAXIMUM LIFT	84 FEET OF WATER
STROKES PER MINUTE	5 - 40 SPM
MAXIMUM STROKES PER MINUTE	40 SPM
DISCHARGE PER STROKE	0.275 GALLONS (1.04 LITERS)
TEMPERATURE RANGE	UP TO 140° F / 60° C

FIGURE 9: Performance Data - 103 Downhole

MAXIMUM EXTERNAL DIAMETER	3.9 INCHES (9.9 CENTIMETERS)
TOTAL CYLINDER LENGTH	38 INCHES (96.5 CENTIMETERS)
CONNECTION TO RISER PIPE	2 INCHES (5.08 CENTIMETERS)
RECOMMENDED INTERNAL BORE-HOLE DIAMETER	4 - 5 INCHES (10.62 - 12.7 CM) OR GREATER
WEIGHT OF CYLINDER	12 POUNDS (5.4 KILOGRAMS)
DISCHARGE SIZE	3 INCHES NPT (7.62 CENTIMETERS)
INSTALLATION	ANY ANGLE FROM VERTICAL TO HORIZONTAL
DRIVER WEIGHT	35 POUNDS (15.8 KILOGRAMS)
DRIVER ROD WEIGHT	12 LBS PER 100 FT (3.7 KG PER 100 M)
FOOT VALVE ASSEMBLY WEIGHT	20 POUNDS (9.1 KILOGRAMS)
MINIMUM WELL CASING SIZE	4 INCHES (10.16 CENTIMETERS)
PNEUMATIC AIR CONNECTION	3/8 INCH NPT THREADS, 3/8 INCH O.D. TUBING

FIGURE 10: Technical Data - 103 Downhole

Limited Warranty

Pumps (excluding seals) manufactured by Blackhawk Technology Company (Blackhawk) are warranted, to the original user only, to be free of defects in material and workmanship for one year from the date of invoice.

Terms and Conditions

Final delivery date will be determined at time of order. All prices are in U.S. dollars, F.O.B. Glen Ellyn, IL USA. A copy of Buyers Purchase Order is required at time of order. "Delivery time on all specials will be determined after receipt of order." Terms are Net 30 days. Total quoted price does not include freight charges. Freight will be prepaid and added to Blackhawk Technology's final invoice to buyer. A service charge of 1.5% per month will be applied to all past-due invoices. Pricing is valid for 30 days. Notwithstanding anything contained herein to the contrary, the parties agree that the terms and conditions set forth in the limited warranty of Blackhawk Technology Company shall supersede any of the terms and conditions otherwise set forth.

Blackhawk's liability under this warranty shall be limited to repairing or replacing at Blackhawk's option, without charge, F.O.B. Blackhawk's factory, any product that Blackhawk manufactures. Blackhawk will not be liable for any costs of removal, installation, transportation or any other changes that arise in connection with a warranty claim. Products that are sold but not manufactured by Blackhawk are subject to the warranty provided by manufacturer of said products and not by Blackhawk's warranty. Blackhawk will not be liable for damage or wear to said products by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Blackhawk's printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to Blackhawk together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, contact will be made to Blackhawk for instructions prior to return of defective product. Any defective product to be returned to Blackhawk must be sent freight prepaid; documentation supporting the warranty claim/or a return Material Authorization must be included if so instructed.

Blackhawk will not be liable for any incidental or consequential damages, losses, or expenses arising from installation, use, or any other causes. There are not expressed or implied warranties, including mechanical ability of fitness for a particular purpose, that extend beyond those warranties described or referred to above.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, and some jurisdictions do allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights that vary from jurisdiction to jurisdiction.

In the event of perceived failure of a Blackhawk Technology Company product, please follow this warranty claim procedure:

1. Verify that the problem is due to the suspected product and not another part of the system. You may call Blackhawk technical support for advanced troubleshooting assistance.
2. If you confirm that a Blackhawk product is defective, detail in writing the exact nature of the failure.
3. The product must be accompanied by notation of a dated proof of purchase, installation date, failure date and supporting installation data that are satisfactory to Blackhawk.
4. Return the product, the written description of the failure, and supporting notation to Blackhawk's home office, 1097 Hill Avenue, Glen Ellyn IL 60137, along with your address and a daytime phone number. Purchaser must prepay all delivery costs or shipping charges, as well as any other charges encountered in shipping any defective Blackhawk product under this warranty policy. No shipment will be accepted collect.
5. Any return from Blackhawk will be sent via Blackhawk's preferred shipping agent. Special shipping arrangements are available at the customer's expense.

