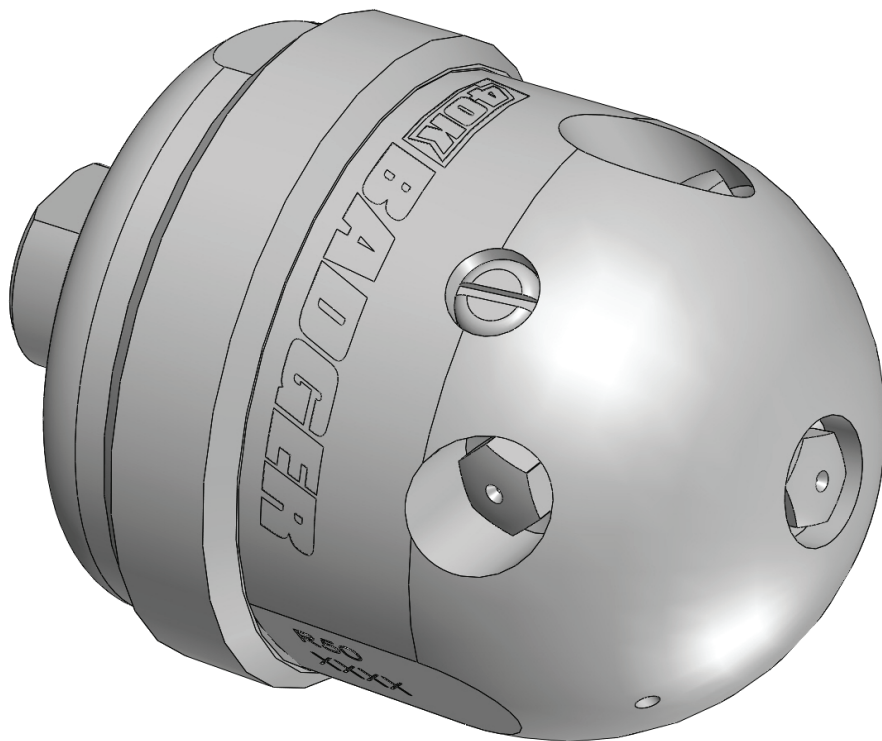


BADGER 4" 40K SELF-ROTARY SWIVEL (BA-H6) USER MANUAL



OVERVIEW

DESCRIPTION:

The Badger™ Rotary Waterblast Nozzle was designed for waterblast cleaning of pipes as small as 4 inch with elbows. The BA-H6 has a 3/8 high pressure female inlet connection and a maximum operating pressure of 43,500 psi (3000 bar). A viscous fluid is used to control rotation speed in the range of 200 to 500 rpm. The Badger™ heads have five S6 ports; one at 15 degrees, two at 100 degrees, and two at 125 degrees

Engraved on each head is R14 or R24; this number is the offset of the head that makes it rotate. The flow range for each head is given in the table; nozzle sizes must be selected to fit within this flow range. If the flow is less than the range shown, the tool will not rotate; if it is more than the range maximum, the tool will rotate too fast and wear out the seals and bearings prematurely.

FLOW RANGE			
PRESS. PSI	R50	R35	R25
43,500 (3000 BAR)	4.5-7 GPM	7-9.5 GPM	9.5-12 GPM

OPERATION:

The first step is to determine the jet sizes. Jet thrust is used to pull the tool through the pipe. An estimate of the amount of pulling force required is useful and depends on the number of elbows and any vertical climbs that must be made. On a horizontal run with no elbows, roughly 1 pound of pull is required for every ten feet. When climbing vertically, the pulling force must equal the weight of the tool and the hose. Typically, larger jet sizes using 40-60% of the total flow are used in the back 125° ports. As little as 10% of the total flow is given to the front jet, because it pushes the wrong direction and is only used to open up blockages. The remaining flow goes to the 100° ports, which do help pull as well, but are mor fuctional for pipe cleaning. Nozzles selected should be matched pairs, except the front jet. When installing nozzles, we recommend using Blue Goop® antisieze.

⚠ WARNING

Because of the short length of the Badger, the tool can turn around in large pipes and come back at the operator at a high rate of speed. If cleaning larger pipes, a rigid "stinger" should be used between the hose and the tool. It is recommended that the rigid length of the tool including hose end is 1-1/2 times the inside diameter of the pipe being cleaned (see Figure 1).

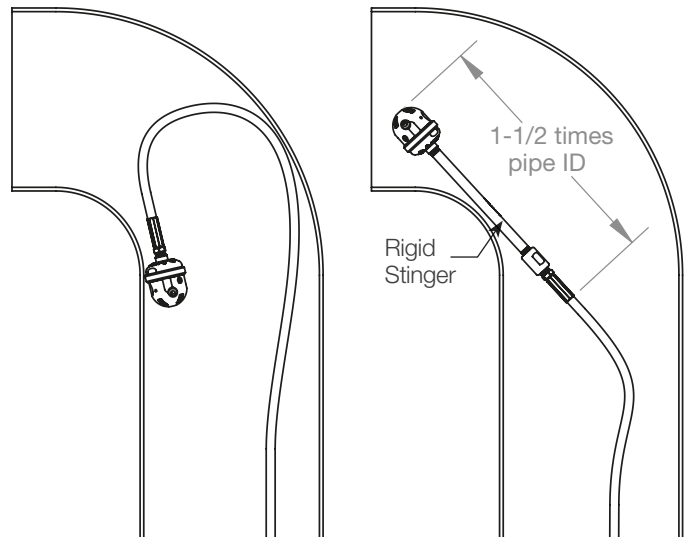
Make sure there is an operator controlled dump in the system, operated by the person closest to the cleaning job. Flush out the high pressure hoses before connecting the Badger. It is recommended that the hose be marked a few feet from the end with a piece of tape so the operator knows when to stop when retracting the tool. Position the tool in the pipe opening. Close the dump and slowly bring up to pressure the first time to make sure no nozzles are plugged and the jet thrust is correct.

The Badger should begin to slowly rotate. Once operating pressure is reached, feed the tool into the pipe to begin the cleaning job. Allow the jets time to do their work by feeding the hose out at a controlled rate. The StoneAge ABX-500 Hose Control Device can be used to achieve consistant feed rates for pipe cleaning. When the work is complete and the tool is isconnected from the hose, blow out all water to prolong the life of the tool. A small amount of oil can be blown into the tool as well as an added measure to maximize tool life.

⚠ WARNING

Operations with this equipment can be potentially hazardous. Caution must be exercised prior to and during machine and water jet tool use. Please read and follow all of these instructions, in addition to the guidelines in the WJTA Recommended Practices handbook, available online at www.wjta.org. Deviating from safety instructions and recommended practices can lead to severe injury and/or death.

FIGURE 1



IMPROPER USE:

Badger will turn around in large diameter pipe
VERY DANGEROUS!

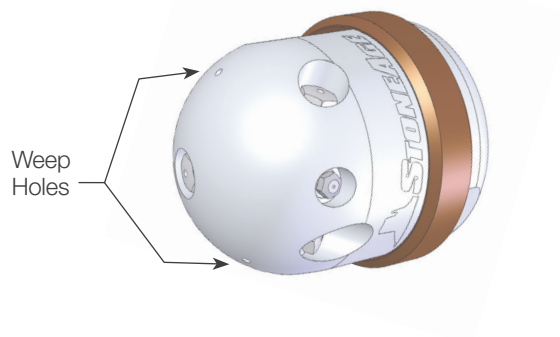
PROPER USE:

Badger with rigid "stinger" to prevent turnaround, still able to pass thru elbows.

TROUBLESHOOTING:

High-pressure seal leak:

The high pressure seal may leak initially at lower pressures, but should pop closed as pressure is increased. A continuous leak at operating pressure from the weep holes indicates the need to replace the HP Seal and Seat. HP Seals wearing out too quickly can be an indication that the HP Seat is installed upside-down, or the tool is rotating too fast (see below for causes). If the tool is leaking, but not over rotating, the BA 600-H6 Seal Kit is required.



Tool will not rotate:

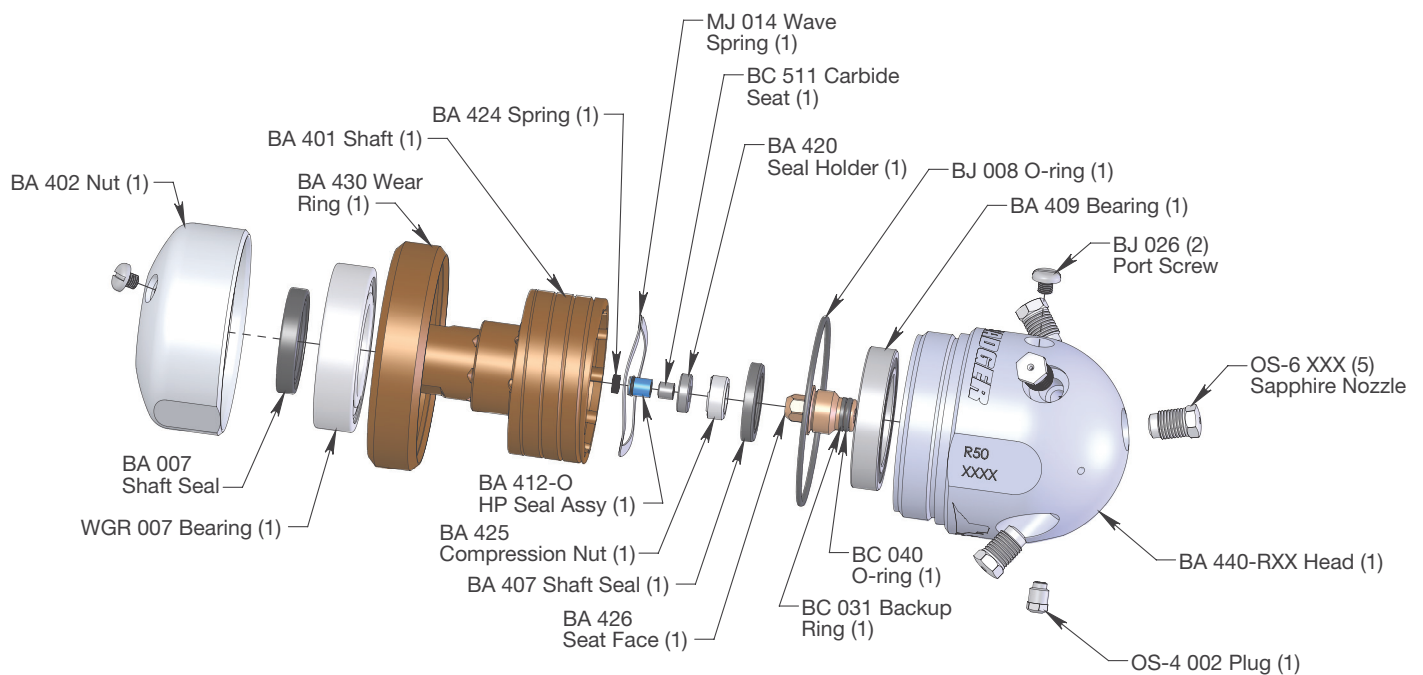
- Check the nozzles for plugging or wear (nozzles have to be removed to check for obstructions).
- Check that the nozzle sizes are correct for the desired flow and that the desired flow matches the head flow range.
- Check that the nozzle sizes are installed in a balanced configuration.
- If the tool feels rough when manually rotating the head, this indicates internal damage and BA 610-H6 Overhaul Kit will be required.

Tool rotates too fast:

A significant increase in rotation speed means that the speed control mechanism in the tool has lost functionality. This can be a result of viscous fluid loss or fluid contamination. Operation of the tool in this state can cause damage to other components and accelerated wear of the high pressure seal. If this occurs, the first step is to flush the tool with new viscous fluid as shown in Figure 2.

AVAILABLE MAINTENANCE KITS:	
BA 600-H6 Seal Kit	Includes parts needed for one seal change
A 610-H6 Overhaul Kit	Includes parts needed for complete tool rebuild; i.e. o-rings, bearings and shaft seals
BA 612-H6 Tool Kit	Includes tools to aid in tool assembly

BA-H6 PART DETAIL:



VISCOUS FLUID FLUSH INSTRUCTIONS:

1. Remove the Port Screws (BJ 026) in the Nut (BA 402) and Head (BA 440-RXX) (see Figure 2).
2. Fill the Syringe (BC 410) with viscous fluid by removing the end near the handle, pulling out the plunger, and pouring the Viscous Fluid (BJ 048-F) in to fill the Syringe Body. With plunger re-installed, purge air out of Syringe hose.
3. Thread the syringe end into the port in the Head, and squeeze fresh Viscous Fluid in until clean Viscous Fluid comes out the port in the Nut. Hold the tool so the port in the Nut is the highest point. If air bubbles come out of the port on the nut, keep flushing new fluid until air bubbles stop.
4. Install Port Screw into Nut first. Remove the Syringe and install the Port Screw in the Head.
5. If tool rotation speed does not slow down to the normal range, a BA 610-H6 Overhaul Kit may be required. See Disassembly and Reassembly instructions on the next page.

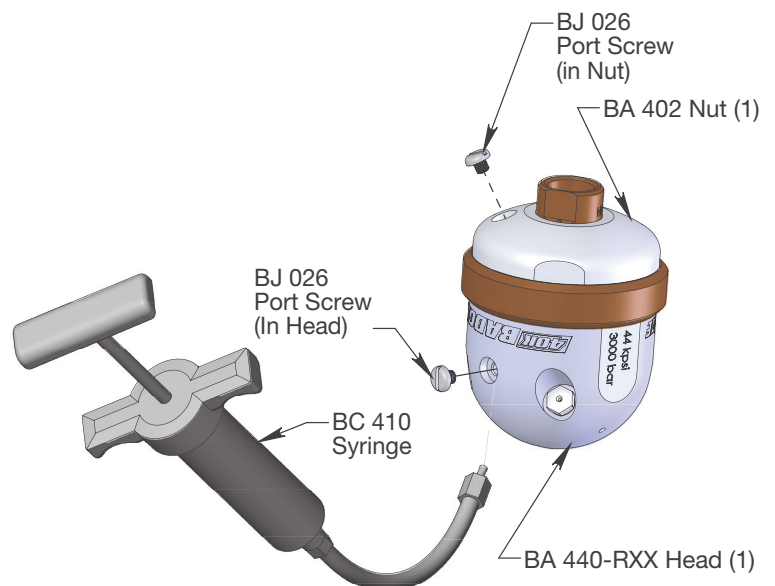


Figure 2: Viscous Fluid Flush

DISASSEMBLY:

1. Place tool in a vice in orientation shown in Figure 4.
2. Remove Port Screw (BJ 026) from Nut (BA 402).
3. Unscrew Nut from Head (BA 440-RXX). Remove Nut and Wear Ring (BA 430).

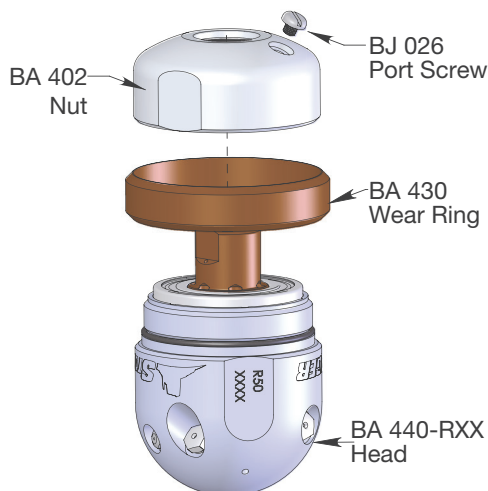


Figure 4: for Steps 1-3

4. Inspect Shaft Seal (BA 007) and remove from Nut if damaged (see Figure 5).

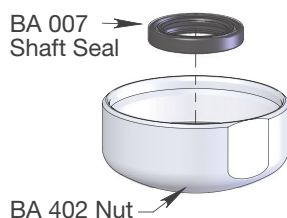


Figure 5: for Step 4

5. Remove Shaft (BA 401) from Head. Pliers or vice grips may be necessary to grab the Shaft as viscous fluid and tool seals can cause a suction force (see Figure 6).

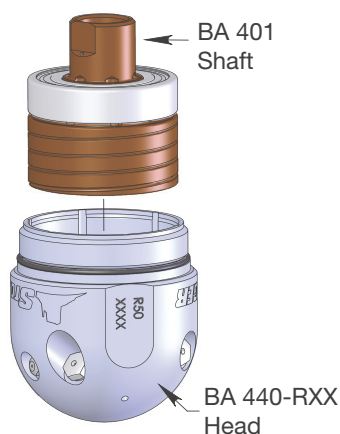


Figure 6: for Step 5

6. Use 3/8" allen key or StoneAge tool BA 483 to remove Compression Nut (BA 425) and set aside.
7. Use a small pick to remove Seal Holder (BA 420) followed by the Carbide Seat (BC 511), HP Seal Assy (BA 412-O), and Spring (BA 424).
8. Wave Spring (MJ 014) can be removed next. If Wave Spring appears flat, replace.

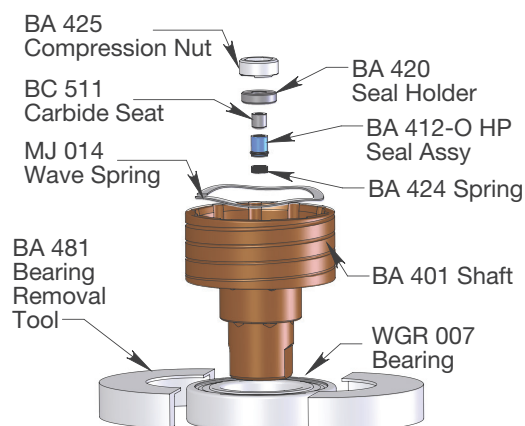


Figure 7: for Steps 6-9

9. Use the Bearing Removal Tool (BA 481) to remove the Bearing (WGR 007).
10. Remove Seat Face (BA 426) from head with 5/16" nut driver or StoneAge tool BA 482.
11. Inspect Backup Ring (BC 031) and O-ring (BC 040) and remove if any damage is suspected.

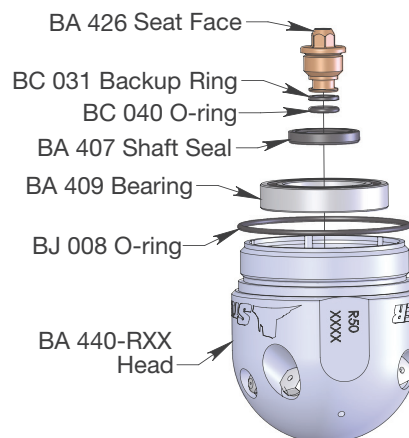


Figure 8: for Steps 10-14

12. Inspect Shaft Seal (BA 407). If damaged, remove the Seal from head.
13. Remove Bearing (BA 409) from inside the Head.
14. Inspect O-ring (BJ 008). If damaged, remove from Head.
15. Let old Viscous Fluid drain from all parts.

ASSEMBLY:

1. Install O-ring (BJ 008) over threads on Head (BA 440-RXX) and into groove.
2. Install Bearing (BA 409) on boss inside of Head (may require light press).
3. Press Shaft Seal (BA 407) into Head in orientation shown in Figure 9. **Grease inner lip.**
4. Install Backup Ring (BC 031) and O-ring (BC 040) into groove on the Seat Face (BA 426) in orientation shown in Figure 10. **Grease around both rings.** Apply anti-sieze on threads prior to installation. Thread the Seat Face into Head and tighten to approximately 10 ft*lbs.

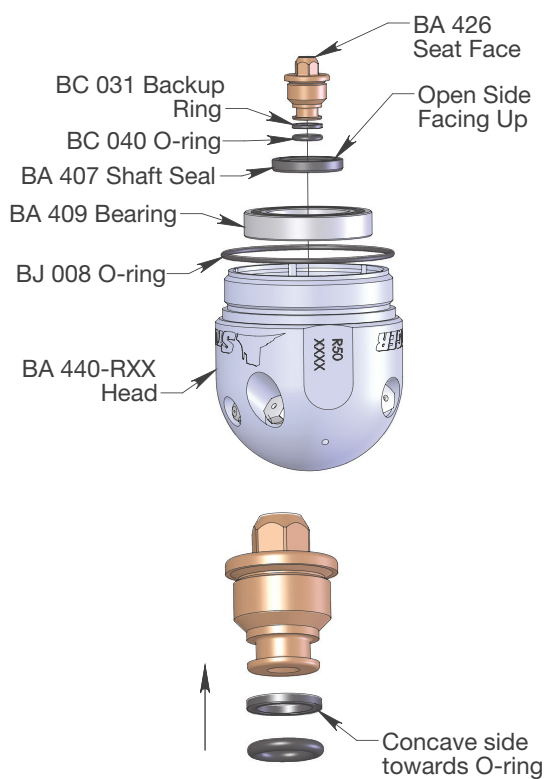


Figure 10: Seat Face and O-rings Detail

5. Press Bearing (WGR 007) onto Shaft (BA 401).
6. Install the high pressure seal stack into the shaft. Start with the Spring (BA 424), followed by the HP Seal Assy (BA 412-O), then the Seal Holder (BA 420). **See Figure 12 for orientation of groove in Seal Holder and direction of HP Seal Assy.** Apply grease to each component when installing to hold them in the shaft.
7. Install Carbide Seat (BC 511) into Seal Holder. **Note orientation of chamfer in Figure 12.** Use grease to hold the Carbide Seat in place.

8. Thread Compression Nut (BA 426) into Shaft. **Tighten to 20 ft*lbs.** Apply anti-sieze to threads prior to installation.
9. Slide Wave Spring (MJ 014) in open end of Shaft down to inner shoulder (see Figure 11).

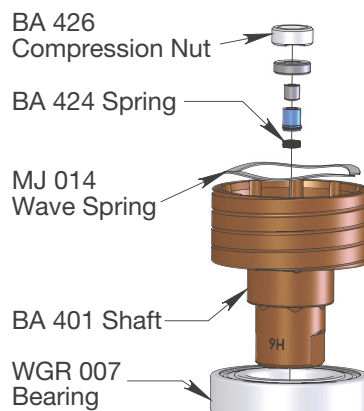


Figure 11: For Steps 5-9

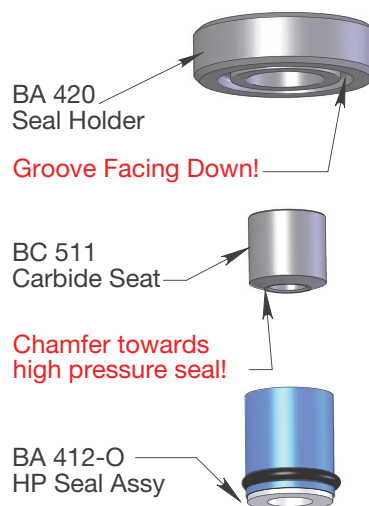


Figure 12: Seat and Seal Detail

10. Detail 10. Place Head in a vice as shown in Figure 13.
Fill inside of Head with Viscous Fluid (BJ 048-F) until it is flush with the top of the Bearing (BA 409) inside the Head. Rock side to side and make sure no air is trapped under Bearing in Head.
11. Slide Shaft into the Head. Push down firmly until Viscous Fluid is forced out of holes in the back of the Shaft.
12. Rotate Shaft clockwise vigorously. Alternate between forcing Viscous Fluid down the holes in the back of the Shaft and rotating Shaft. Repeat until Shaft rotation becomes stiff and no more air bubbles appear when new fluid is forced in. Port Screw (BJ 026) can also be removed from Head and Syringe (BC 410) can be used to force Viscous Fluid in from the bottom to purge air out of tool.

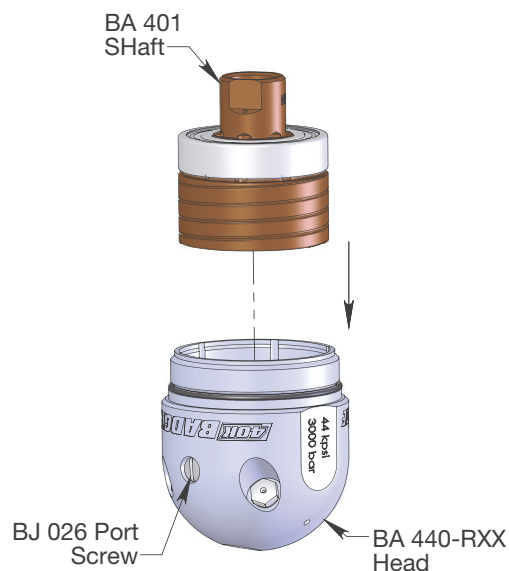


Figure 13: For Steps 10-12

13. Press Shaft Seal (BA 007) into Nut (BA 402). **Grease inner lip of seal** (see Figure 14).

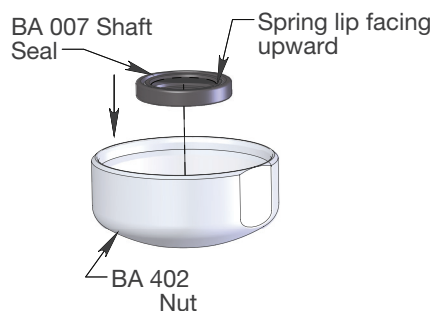


Figure 14: For Steps 13

14. Slide Wear Ring (BA 430) over Head with inner lip down (see Figure 15).
15. Put layer of Viscous Fluid on top of Bearing (WGR 007).
16. Put anti-sieze on threads of Head. Thread Nut onto Head (Port Screw not installed). Tighten Nut to 40 ft*lbs and let excess Viscous Fluid bleed out of Port Screw hole.
17. Install Port Screw into threaded port on Nut.

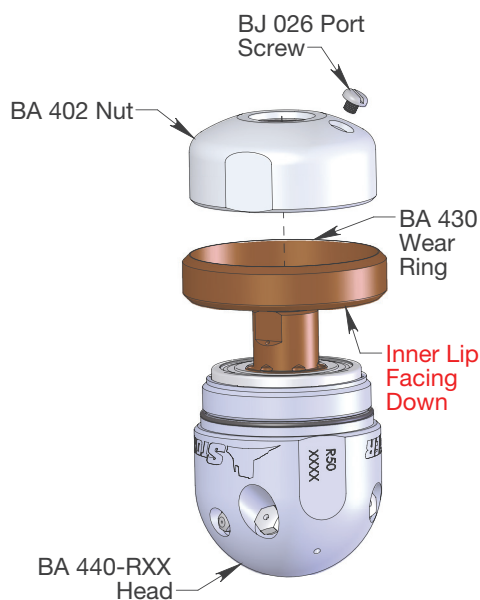


Figure 15: For Steps 14-17

Note: Only use Viscous Fluid filled sealed bearings from StoneAge when performing a complete tool overhaul!



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