

HC HURRICANE 3D SELF-ROTATING CLEANING TOOL

Description:

The Hurricane 3D Head was designed for cleaning tanks, vessels, autoclaves, ducts and reactor interiors. The tool is capable of working pressures up to 12,000 psi and flow rates of 15 to 80 gpm. The wide range of flow rates is accommodated by the adjustable nozzle arms. The body is filled with a thick fluid that controls rotation speed. The Hurricane completes a cycle after about 10 minutes of operating time, depending on rotation speed. When used in large vessels, extension arms up to 36 inches long can be used to reduce the jet standoff distance. The Hurricane can be hung from the high pressure water hose or by the pulling ring included with the tool.

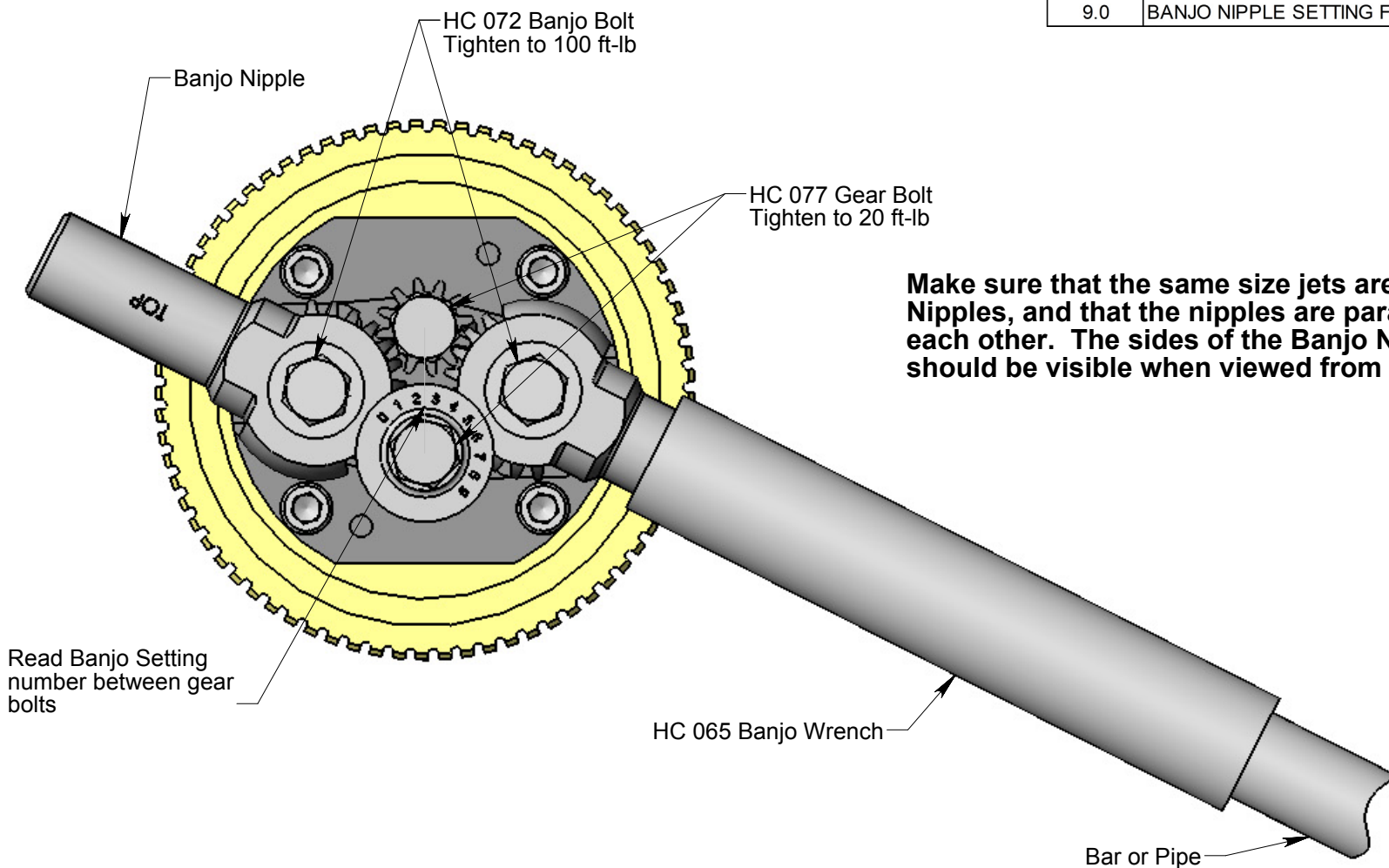
Operation:

Before use, the Hurricane nozzle arms (Banjo Nipples) must be set to match the operating pressure and flow rate or nozzle size. The setting can also be used as a means of adjusting the rotation speed; if faster rotation speed is desired, the setting would be changed to a higher number. The chart on the right shows the correct settings for rotation speeds between 20 and 30 rpm. Make absolutely certain that the two nozzles being used are the same size and in good condition, otherwise the Hurricane will not rotate. If the tool is being run horizontally and will not rotate, the banjo setting should be increased until the tool rotates reliably. To use the chart, first select the operating pressure row from the left. If you know the flow desired but not the nozzle size, select the flow rate column from the top. The box where the pressure and flow intersect will give the correct nozzle size and setting for the Hurricane. If you know the pressure and nozzle size, select the operating pressure row and read across the nozzle sizes in the boxes until you get to the nearest nozzle size, then use the setting in this box for the Hurricane. You can also go up from this box to see what the flow rate will be with these nozzles.

To adjust the Banjo Nipples, remove the Cap (HC 109). Loosen the two Gear Bolts (HC 077) and the two Banjo Bolts (HC 072). Use the Banjo Wrench (HC 065) for leverage. Read the number on the plate that is in line between the two gear bolt heads. Hold the desired setting while tightening the gear bolts and Banjo bolts. It is recommended that you tighten the Gear Bolts to 20 ft-lb and the Banjo Bolts to 100 ft-lb.

		FLOW RATE, GPM							
		15	20	25	30	40	50	60	80
PRESSURE, PSI	12000	#4 Ø.047 9.0	#5.5 Ø.057 6.0	#6.5 Ø.063 4.5	#8 Ø.069 3.5	#12 Ø.082 2.0	#14 Ø.090 2.0	#16 Ø.098 1.5	#23 Ø.115 1.0
	10000	#5 Ø.052 8.0	#6.5 Ø.063 4.5	#8 Ø.069 4.0	#10 Ø.075 3.0	#14 Ø.090 2.0	#16 Ø.098 2.0	#19 Ø.106 1.5	#27 Ø.125 1.0
	8000	#5.5 Ø.057 9.0	#6.5 Ø.063 6.0	#10 Ø.075 4.0	#12 Ø.082 3.0	#14 Ø.090 2.5	#19 Ø.106 2.0	#23 Ø.115 1.5	#31 Ø.135 1.0
	6000	#6.5 Ø.063 8.0	#8 Ø.069 6.0	#12 Ø.082 4.0	#14 Ø.090 3.0	#15 Ø.098 3.0	#23 Ø.115 2.0	#27 Ø.125 1.5	#36 Ø.145 1.0
	4000	#8 Ø.069 9.0	#12 Ø.082 6.0	#14 Ø.090 5.5	#16 Ø.098 4.0	#23 Ø.115 2.5	#27 Ø.125 2.0	#36 Ø.145 1.5	#46 Ø.165 1.0
	2000	#12 Ø.082 9.0	#14 Ø.090 9.0	#19 Ø.106 7.0	#23 Ø.115 5.0	#31 Ø.135 3.0	#41 Ø.155 2.0	#46 Ø.165 2.0	

#4	NOZZLE FLOW RATING NUMBER
Ø.047	NOZZLE DIAMETER FOR PRESSURE AND FLOW
9.0	BANJO NIPPLE SETTING FOR 20 TO 30 RPM



Make sure that the same size jets are used in both Banjo Nipples, and that the nipples are parallel and opposite to each other. The sides of the Banjo Nipples marked TOP should be visible when viewed from above.

For the simplest setup, the Hurricane can be hung from the high pressure hose, or from the pulling ring. The Hurricane will move in a small orbit due to the torque making it rotate. Other means of supporting and positioning the Hurricane include the **Simple Boom**, a plate with a rigid lance on a gimble, and the **Teleboom**, a telescoping and pivoting rigid positioner. There is a **Cage Centralizer** available as well; this will make the Hurricane swing and bounce into things because of the jets hitting the cage ribs, but it does protect the Hurricane and allow it to keep rotating if placed on the floor of a vessel or horizontal duct. If the Hurricane will be used in a very large vessel, or in difficult material removal, use extension arms if possible. These are available as the **HC 088 Extension Kit**, with arm lengths of 18 or 36 inches.

Before beginning operation, make sure all vessel ports are blocked or marked off to prevent personnel contact with water or debris. Once tool is positioned, go to operating pressure; listen for rotation of Hurricane. It is best to leave tool in one position for at least two complete cycles, as the tool will be moving some and will continue to clean beyond the first cycle as new surfaces are hit. When ready to reposition, shut down pump and raise or lower the tool to the next cleaning position.

There are three important items in keeping the swivel in good working condition. First, always operate within the recommended speed range. Operating at higher rotation speeds is detrimental to the swivel components and will reduce their useful life. Second, keep the main body of the swivel full of viscous fluid. The viscous fluid provides bearing lubrication as well as speed control. An insufficient supply of fluid will cause the swivel to rotate too fast. Water in the viscous fluid will cause a loss of speed control and corrosion of the bearings. Third, blow out all internal water passages (nozzles, weep holes, inlet) with compressed air before storing the tool.

Troubleshooting:

If the Hurricane starts to rotate or rotates for a few revolutions and then stops, remove and clean the nozzles, and double check that they are the same size. If you have another set of nozzles, replace the old ones. There are flow straighteners located inside the banjo nipples; use a flashlight to check that no debris is caught behind the flow straighteners. Check that the banjo nipples are parallel to each other and that the setting is correct; it can be increased by another number. Also check that the banjo nipples are not bent.

If the Hurricane will not rotate at all, first check the nozzle size and pressure and the chart above to make sure the setting is correct. If the plastic cover has been removed, check that the lips of the rubber seals (HC 028) around the cover are not pinched between the cover and the gears; this is a common mistake that occurs when the cover halves are placed on the tool without removing the cover seals; also check that the cover halves are not contacting the gears. Check that the banjo nipples are parallel to each other. If the tool is being used horizontally and will not rotate, increase the setting number by 1 to 2 numbers. Rotate the tool by hand; if it feels rough or gritty to turn it probably has bad bearings or other internal damage and needs to be repaired; if the main body has been dented or stamped it can prevent the tool from turning. If the tool has been used in a vessel with lots of debris, check that no debris has built up inside the covers, which will drag on the rotating parts or jam the gears.

Dirty fluid, low fluid, or improper fluid inside the main body will create problems with tool performance and longevity. Typically the tool will rotate faster than desired if the fluid is bad, but if someone tried reducing the setting number to slow down the rotation speed, the tool might not rotate at all or rotate intermittently. Refer to the maintenance instructions on the back of this sheet for checking and refilling the fluid.

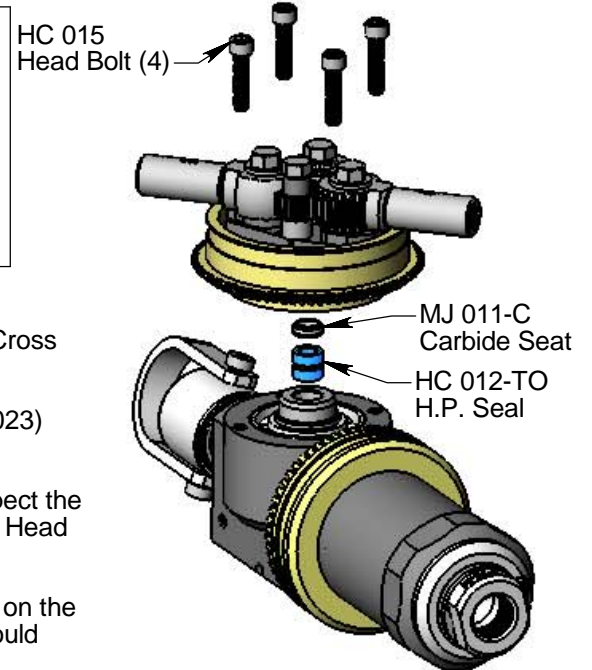
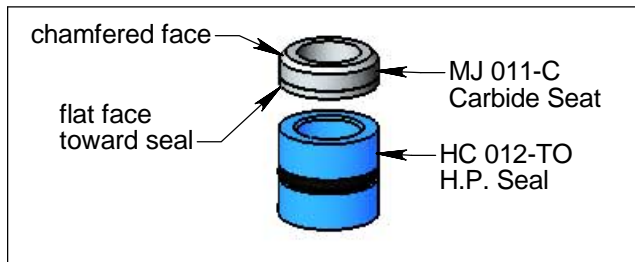
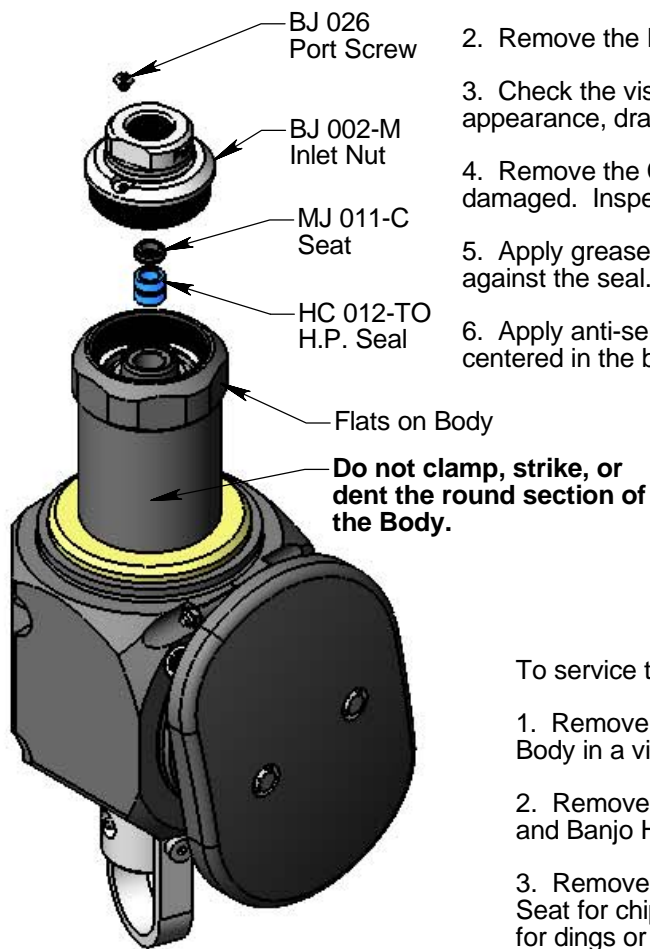
The high pressure seal will often leak at low pressures, below 1000 psi, but the seals will pop shut as pressure is increased. Only if the seals leak continuously at operating pressure do the seals need to be replaced. The other possible location for leaks to occur is around the shaft O-rings (HC 032), located in the angle block (HC 040). If leaks occur at these places, the O-rings must be replaced immediately otherwise the shafts and angle block will erode and need to be replaced. Pipe plugs can be placed in the banjo nipples to allow static pressure testing of the tool to check for these leaks periodically if desired.

HC HIGH PRESSURE SEAL & VISCOUS FLUID MAINTENANCE

The Hurricane has 2 high pressure seals. These seals may leak at tap pressure, but should seal at pressures above 1000 psi. Rotation speed is controlled by a thick viscous fluid in the Main Body. Over time, this fluid may be contaminated with water or lost by leakage thru the shaft seals. Loss or contamination of fluid will result in faster, more difficult to control rotation speeds. If the fluid appears contaminated, it should be poured out and replaced.

To service the viscous fluid and access the high pressure seal in the Main Body:

1. Clamp the Body (HC 003) in a vise, by the flats only. Do not excessively tighten the vise.
2. Remove the Port Screw (BJ 026), unscrew the Inlet Nut (BJ 002-M) from the Body.
3. Check the viscous fluid level; it should cover the Bearing and Wave Springs; if not, add more. If the fluid is black or watery in appearance, drain out and refill. When refilling in this fashion, let tool sit for several hours to allow all air bubbles to escape.
4. Remove the Carbide Seat (MJ 011-C) and the H.P. Seal (HC 012-TO). Inspect the Seat for chips on edges. Replace if damaged. Inspect the face of the Inlet Nut for dings or pits. If damaged, it must be faced or replaced, otherwise the seal will leak.
5. Apply grease to new H.P. Seal and install in bore. Place the Seat on the Seal with the flat side against the seal. The chamfered side should face toward the Inlet Nut.
6. Apply anti-seize to the threads of the Inlet Nut and thread into Body. Make sure the Seat stays centered in the bore of the Shaft. Tighten the Inlet Nut to 120 to 150 ft-lb. Install the Port Screw (BJ 026).

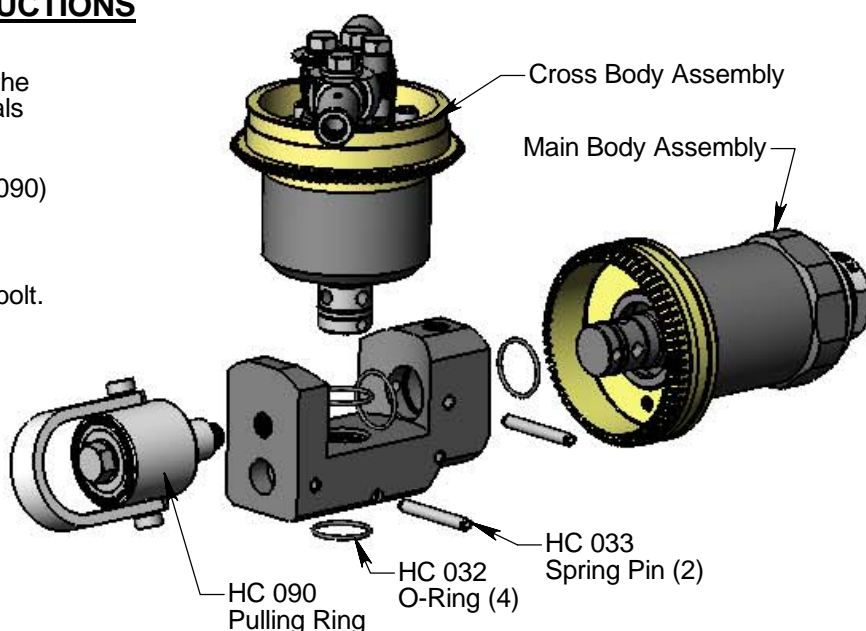


To service the high pressure seal in the Cross Body:

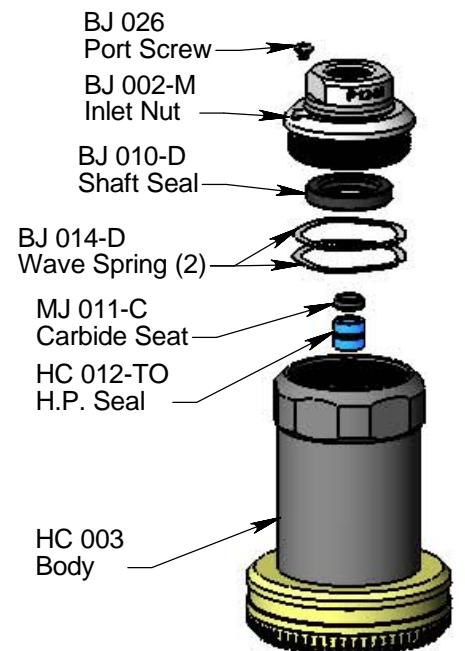
1. Remove the Cap (HC 109) and Cover (HC 027). Clamp the unit by the Cross Body in a vise.
2. Remove the four socket head Bolts (HC 015); lift the Bronze Gear (HC 023) and Banjo Head assembly straight up and off the Cross Body.
3. Remove the Carbide Seat (MJ 011-C) and H.P. Seal (HC 012-TO). Inspect the Seat for chips on edges, replace if damaged. Inspect the face of the Banjo Head for dings or pits. If damaged, it must be faced or replaced.
4. Apply grease to a new H.P. Seal and install in seal bore. Place the Seat on the Seal with the flat face against the seal. The chamfered face of the Seat should face toward the Banjo Head.
5. Install the Banjo Head; make sure the Seat stays centered in seal bore. The Banjo Head with Bronze Gear should sit flush on Cross Body. Install Head Bolts with blue Locktite. Torque to 200 in-lb.

HC DISASSEMBLY INSTRUCTIONS

1. Remove the Cover (HC 027), the Cap (HC 109) and the Cover Seals (HC 028).
2. Remove the Pulling Ring (HC 090) if you want to.
3. Drive out the two Spring Pins (HC 033) using a 1/4 inch drift or bolt.
4. Pull the Cross Body Assembly and the Main Body Assembly out of the Angle Block (HC 040).
5. Remove the four O-Rings (HC 032) from the Angle Block. These must be replaced every time the tool is disassembled.



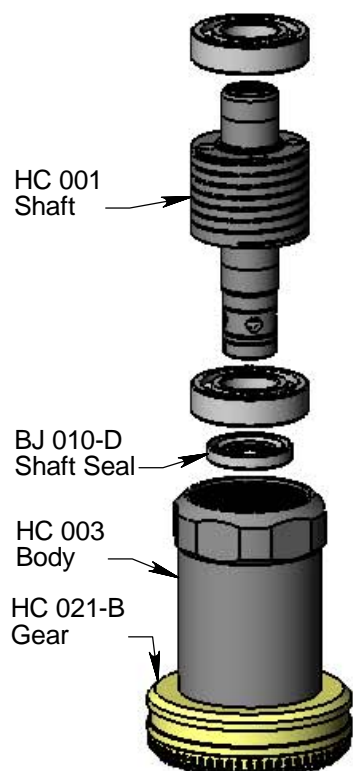
6. Remove the Port Screw (BJ 026) from the Inlet Nut (BJ 002-M).
7. Unscrew the Inlet Nut from the Body (HC 003). Remove the Shaft Seal (BJ 010-D) from the Inlet Nut.
8. Remove the Wave Springs (BJ 014-D).
9. Remove the Carbide Seat (MJ 011-C) and the H.P. Seal (HC 012-TO).



10. Push the Shaft (HC 001) with the Bearings (SG 009) out of the Body (HC 003).

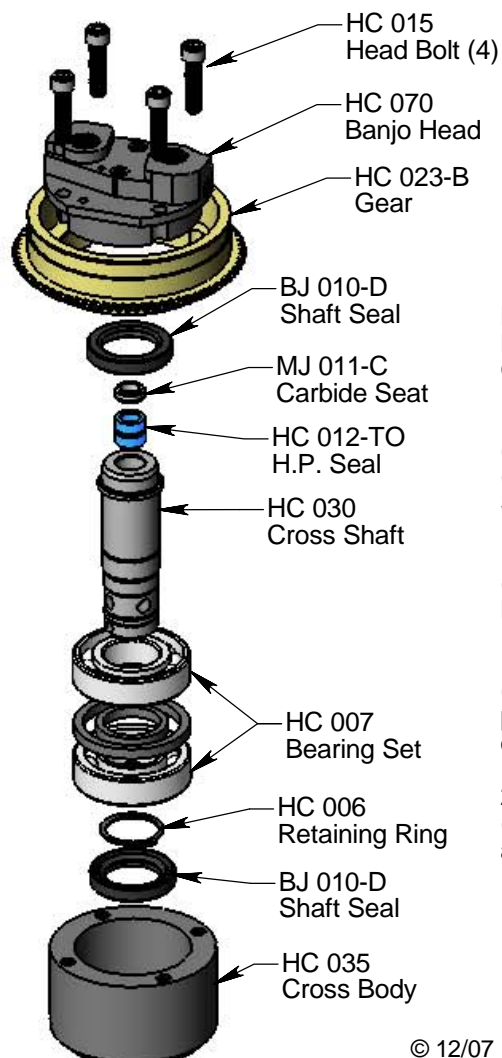
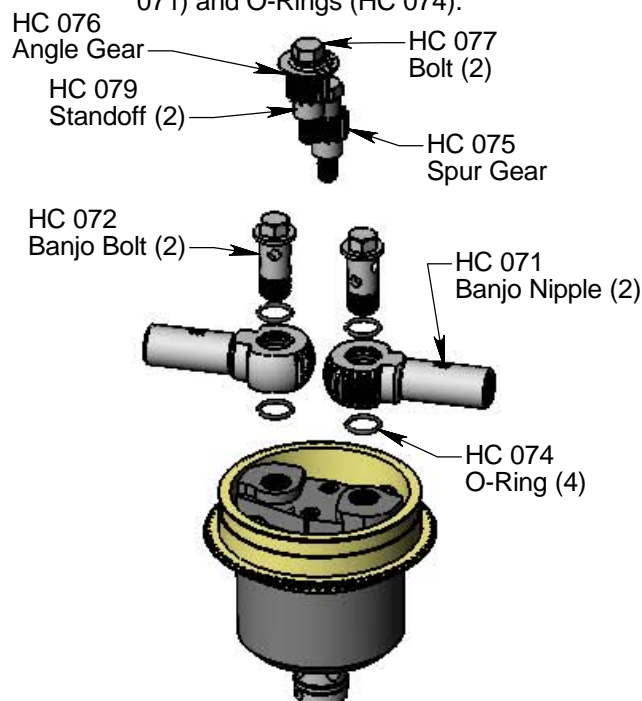
11. Remove the Bearings from the Shaft; be very careful not to raise any dings or burrs on the large grooved diameter of the Shaft.

12. Remove the Shaft Seal (BJ 010-D) from the Body. It is not necessary to remove the Bronze Gear (HC 021-B) from the Body.



13. Remove the two Bolts (HC 077), the Angle Gears (HC 075, 076) and the Standoffs (HC 079).

14. Remove the two Banjo Bolts (HC 072), both Banjo Nipples (HC 071) and O-Rings (HC 074).



15. Remove the four Head Bolts (HC 015); lift off the Banjo Head (HC 070) and Gear (HC 023).

17. Remove the Carbide Seat (MJ 011-C) and H.P. Seal (HC 012-TO) from the Cross Shaft (HC 030).

18. Push the Cross Shaft (with bearings) from the Cross Body (HC 035).

19. Remove the Retaining Ring (HC 006) from the Cross Shaft; press the Bearing Set (HC 007) off of the Cross Shaft.

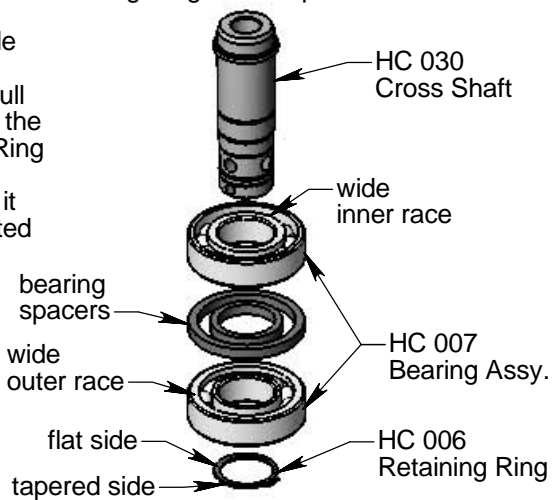
21. Remove the Shaft Seals (BJ 010-D) from the Cross Body and the Banjo Head.

HC CROSS BODY ASSEMBLY INSTRUCTIONS

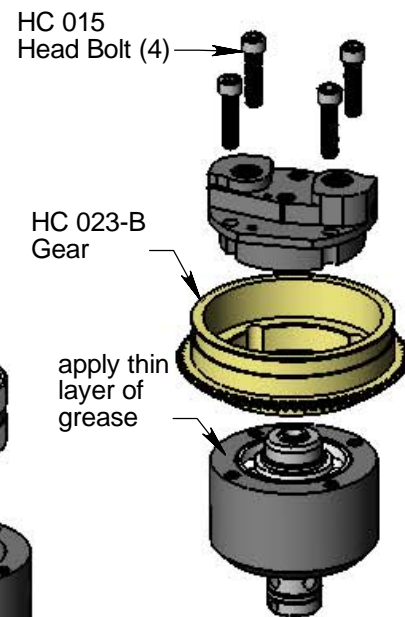
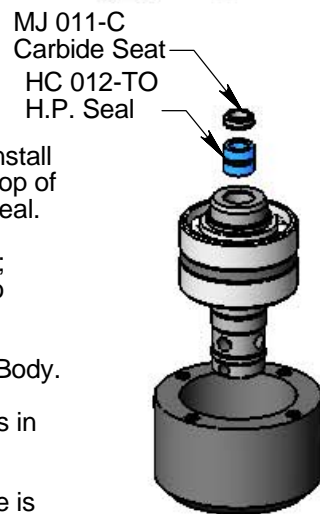
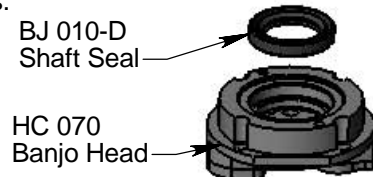
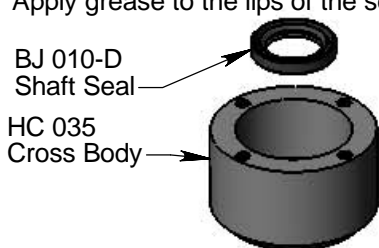
1. Pack Bearings (HC 007) with grease. Press Cross Shaft (HC 030) into first bearing down to shoulder. Note that these are angular contact bearings, and must be installed as shown.
2. Slide on the Bearing Spacers, fill space between with grease.
3. Press on second bearing, oriented as shown.

4. Install tapered Retaining Ring (HC 006) as shown. Note that the Retaining Ring has a tapered side and a flat side.

The flat side faces the bearing. Pull the ears of the Retaining Ring together to make sure it is fully seated in groove.

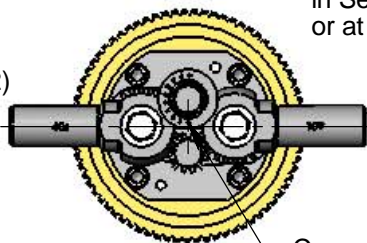
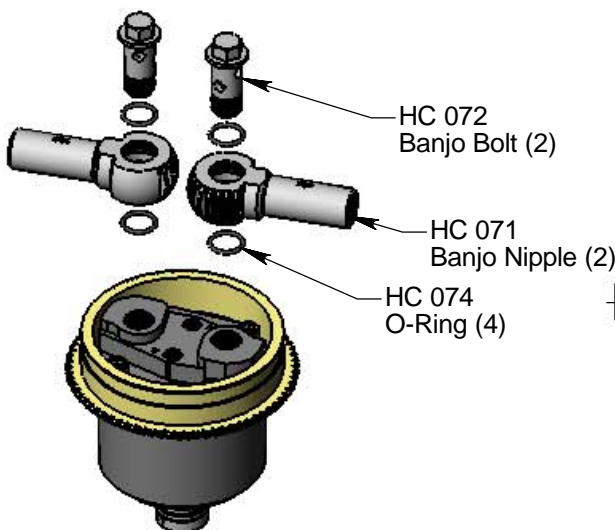


5. Press Shaft Seals (BJ 010-D) into Banjo Head (HC 070) and Cross Body (HC 035). The side of the seals with the spring loaded lip is shown facing up in the illustration. Apply grease to the lips of the seals.
6. Slide Cross Shaft assembly into Cross Body.
7. Apply grease to the H.P. Seal (HC 012-TO) and install in bore of shaft. Place Carbide Seat (MJ 011-C) on top of H.P. Seal, with the flat face of the Seat against the Seal.
8. Push Banjo Head (HC 070) into Gear (HC 023-B); make sure slots in gear align with bolt holes in Banjo Head.
9. Apply a thin layer of grease to the face of Cross Body. Carefully place Banjo Head and Gear on Cross Body; be sure that Carbide Seat stays in bore of shaft.
10. Install the four Head Bolts (HC 015). Blue Loctite is recommended. Tighten to 200 in-lb.



11. Slide one O-Ring (HC 074) onto each Banjo Bolt (HC 072); insert Banjo Bolts thru Banjo Nipples (HC 071). Make sure the side marked TOP will be up when installed on head. Slide second set of O-Rings onto Banjo Bolts up to bottom of Banjo Nipples.

12. Install the two Banjo Bolts and Nipples in the Banjo Head. Do not tighten them yet; point the nipples directly opposite and parallel to each other.



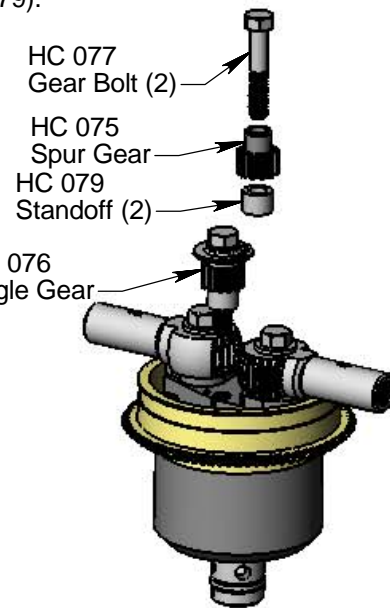
Correct location of 'O' when Banjo Nipples are directly opposite

13. Slide Gear Bolts (HC 077) thru Spur Gear (HC 075) and Angle Gear (HC 076); slide on the Standoffs (HC 079). Apply anti-seize to threads of bolts.

14. Install Spur Gear into Banjo Head, keeping Banjo Nipples parallel and opposite to each other.

15. With the Banjo Nipples parallel and opposite to each other as shown below, install the Angle Gear (HC 076) with the '0' aligned as shown.

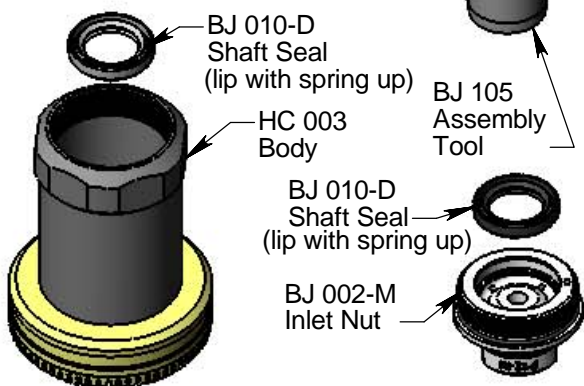
16. The Banjo Nipple setting must be set to match the correct pressure and flow as shown in the chart Angle Gear in Section 3.0. They can be set and tightened now or at some other time before operation.



HC MAIN BODY ASSEMBLY INSTRUCTIONS

1. Install Shaft Seals (BJ 010-D) into the Inlet Nut (BJ 002-M) and the Body (HC 003). An Assembly Tool (BJ 105) is available from StoneAge in the HC 612 tool kit. Apply grease to the seal lips.

2. Place O-Ring (BJ 008) over threads of Inlet Nut.

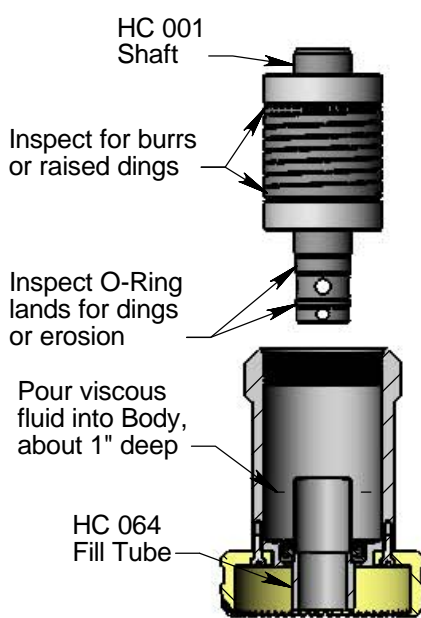


3. Press Bearings (SG 009) onto Shaft (HC 001).

4. Insert Fill Tube (HC 064) through shaft seal in Body, up to the shoulder.

5. Pour viscous fluid into Body, around outside of fill tube, about 1 inch deep.

6. Smear viscous fluid into grooves on Shaft. Slide Shaft with bearings into Body. Let the Shaft push out the fill tube. The viscous fluid should come up to cover the top bearing.



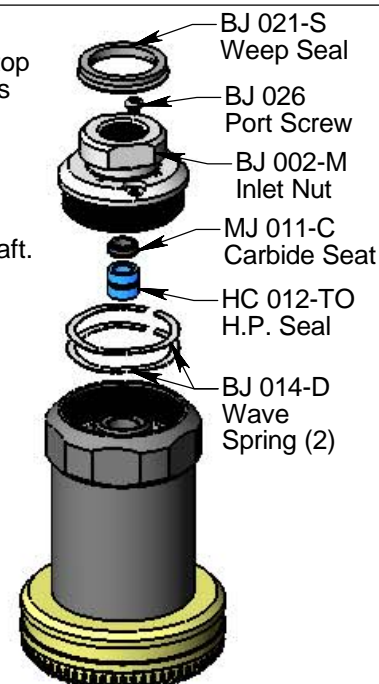
7. Place the two Wave Springs (BJ 014-D) on top of Bearing. Add viscous fluid to cover the wave springs.

8. Apply grease to the H.P. Seal (HC 012-TO) and install in bore of shaft. Place Carbide Seat (MJ 011-C) on top of H.P. Seal, with the flat face against the seal.

9. Apply anti-seize to the threads of the Inlet Nut (BJ 002-M) and thread into Body. Tighten to 120 ft-lb.

10. Install Port Screw (BJ 026) in Inlet Nut.

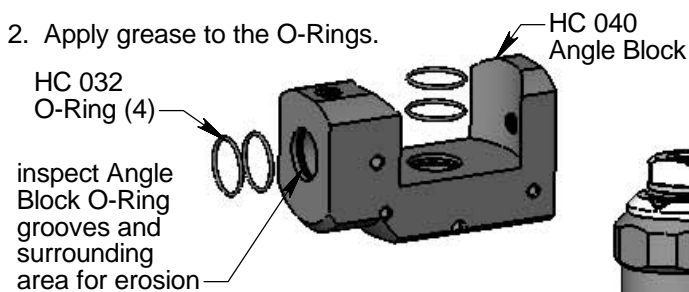
11. Install Weep Seal (BJ 021-S) on Inlet Nut.



HC FINAL ASSEMBLY INSTRUCTIONS

1. Install new O-Rings (HC 032) into the Angle Block (HC 040). Be careful not to cut the O-Rings. (New O-Rings must be installed any time a shaft is removed.)

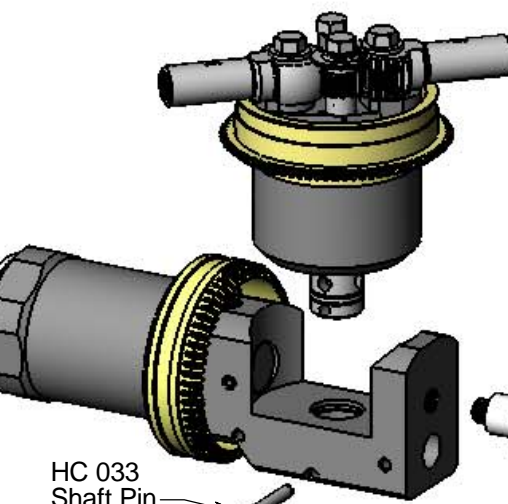
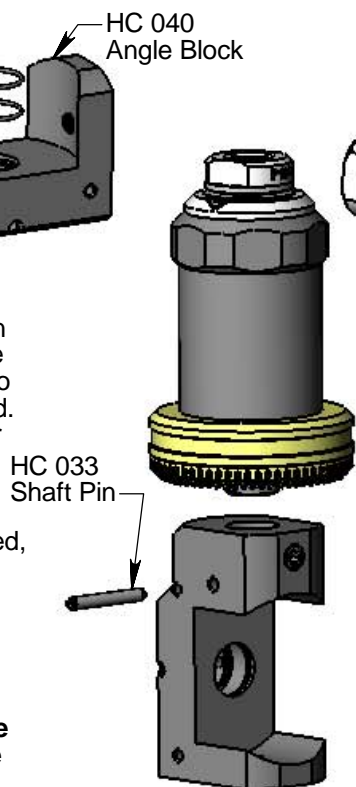
2. Apply grease to the O-Rings.



3. Orient the pin hole in Shaft of Main Body Assembly with the hole in Angle Block; press Main Body Assembly into Angle Block until pin holes are aligned. Use an ice pick or phillips screwdriver to help align the holes.

4. When the pin holes in the Angle Block and Shaft are completely aligned, drive the Shaft Pin (HC 033) into the Angle Block until flush.

Note: if the pin is driven into the Shaft without properly aligning holes, the O-Ring land will be damaged and lead to O-Ring failure and erosion of the Shaft and Angle Block.



7. Install Pulling Ring (HC 090) if it was removed. Use blue Loctite on threads.

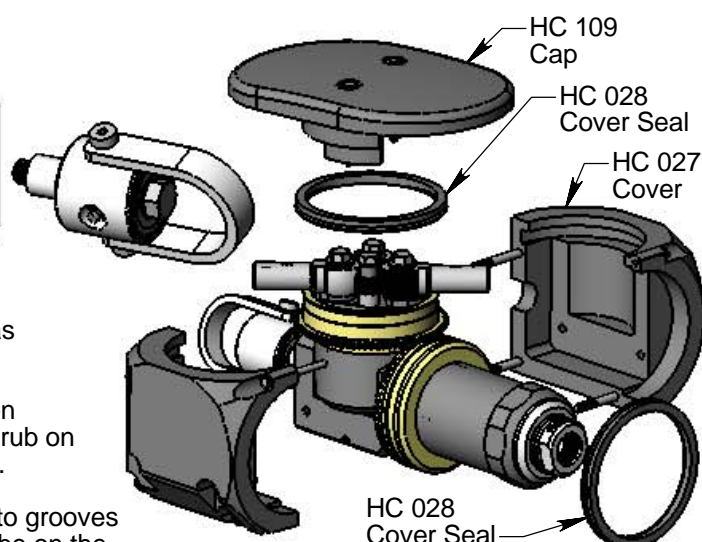
8. Install the Cover (HC 027) halves on assembly. Check that Cover does not rub on gears before and after tightening bolts.

9. Install the Cover Seals (HC 028) into grooves on gears. The lips of the seals should be on the outside of the Cover, not pinched between the gears and cover.

10. Install the Cap (HC 109).

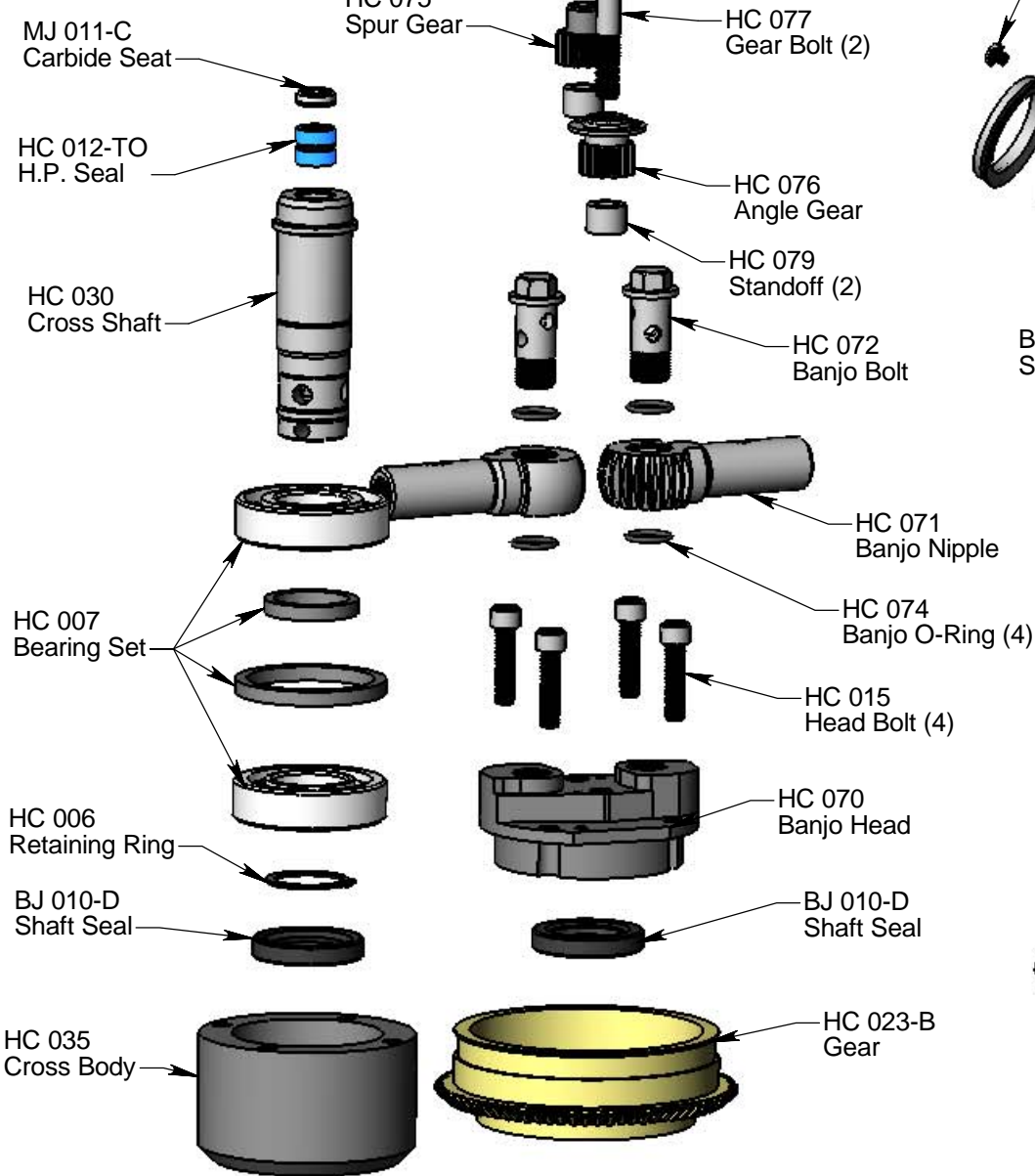
5. Orient the pin hole in the Shaft of the Cross Body Assembly with the hole in the Angle Block; press Cross Body assembly into Angle Block, making sure gear teeth mesh.

6. When pin holes are completely aligned, drive in the Shaft Pin until flush with the Angle Block.

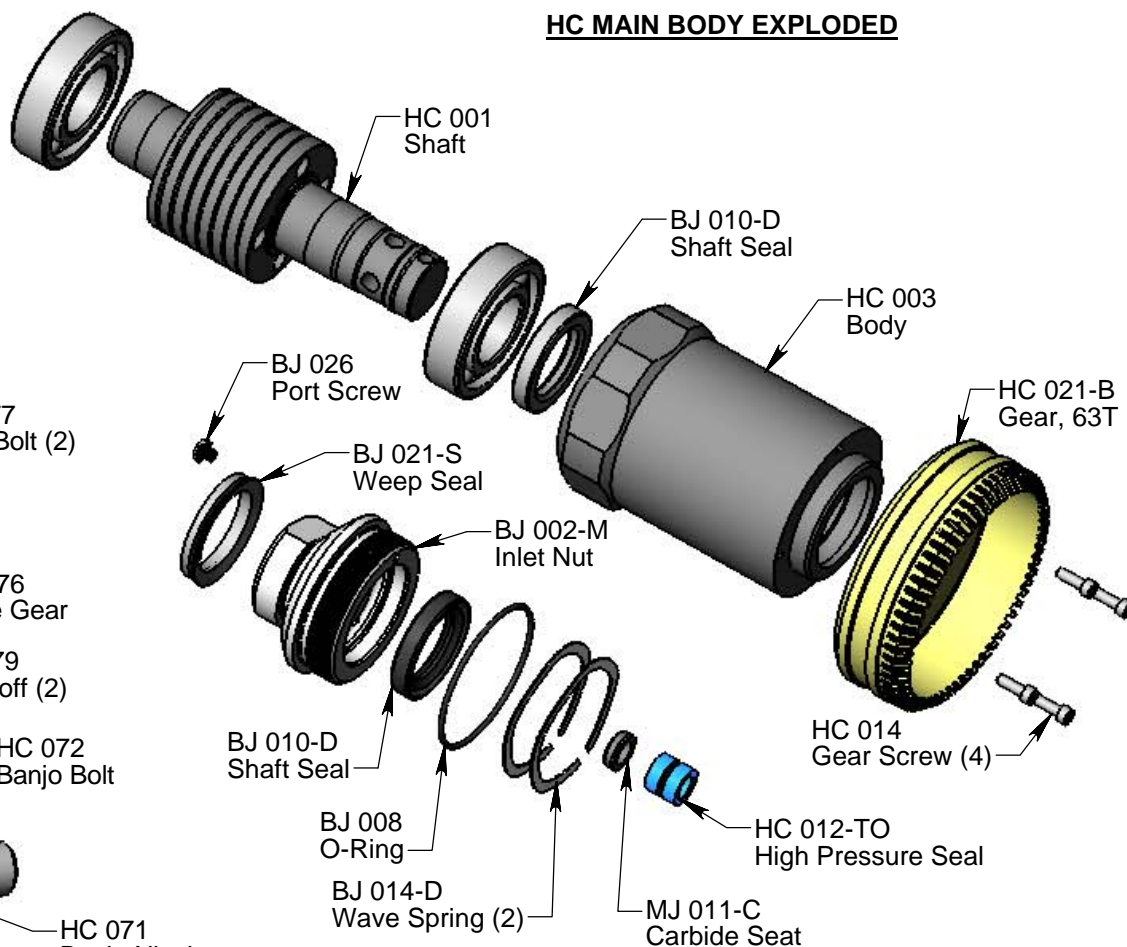


HC EXPLODED ASSEMBLY DRAWINGS

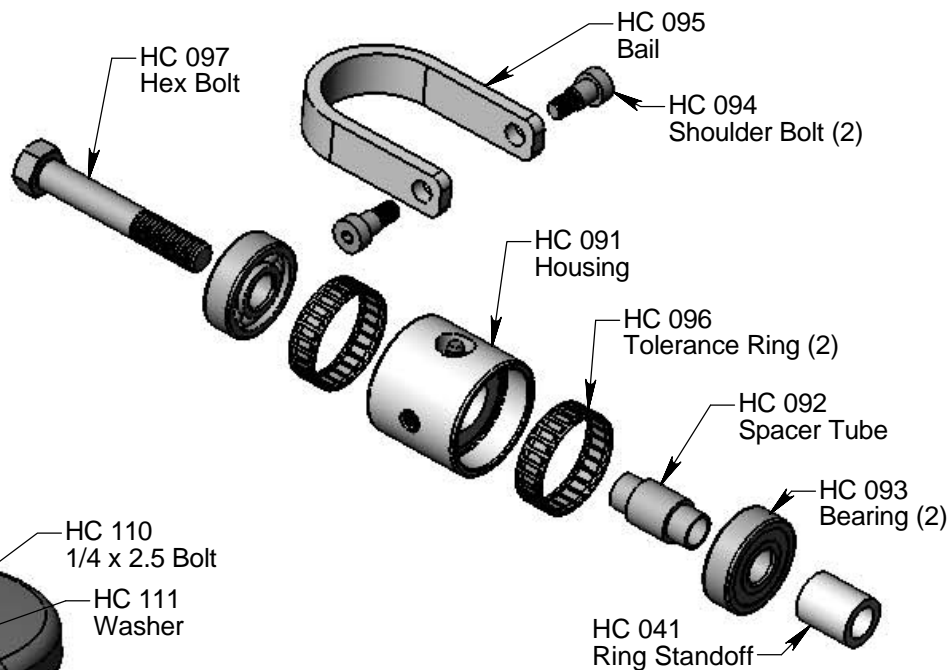
HC CROSS BODY EXPLODED



HC MAIN BODY EXPLODED



HC 090 PULLING RING EXPLODED



HC FINAL ASSEMBLY EXPLODED

