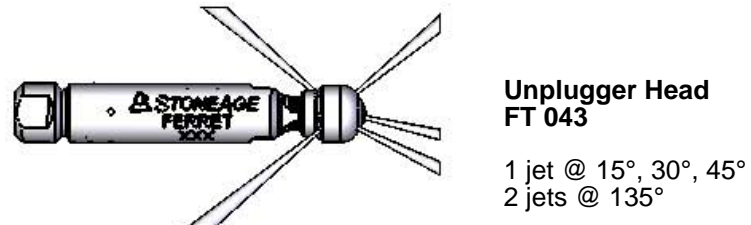
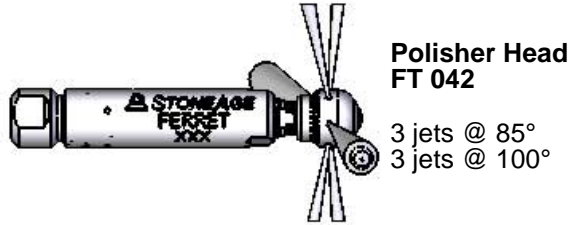


# Ferret Self-Rotary Tube Nozzle (FT-P4)

US Patents 5,964,414 and 6,059,202

The **Ferret** is a self-rotating high pressure swivel designed for tube and pipe cleaning. It has an outside diameter of 0.91 inches (23 mm). It has a leak free high pressure seal and rotation speed control using a thick viscous fluid that limits the rotation speed to around 1000 rpm. It has a 1/4 NPT inlet connection, and can be used up to 15,000 psi with flow rates up to 12 gpm.

Two standard head designs are available; the **Unplugger** head has three forward jets (15, 30 and 45 degrees) and two back jets (135 degrees). The **Polisher** head has six jets at angles of 85 and 100 degrees. Each head is designed for a specific pressure and flow rate, and must be used at the specified pressure to obtain the proper rotation speed. The nozzle heads are wear items that will need to be replaced after 20 to 60 hours, depending on water filtration.



## Operation:

The entire system should be flushed out before installing the Ferret on the end of the hose or stinger. The swivels require a clean water supply for reliable operation; filtration of 25 micron or better is recommended for longer head life. Next install the Ferret and place it down an open tube while the operating pressure is being set. The high pressure seal may leak at low pressure, but should seal completely at operating pressure. The drilled nozzle head will last between 20 and 60 hours; when the jets become worn the cutting rate goes down and if cleaning plugged tubes the tool will hydraulic more frequently, because the jets are not effectively cutting the material into small pieces anymore.

When using rotating nozzles in plugged tubes, the head must not be forced into the deposit, as this will stop the rotation of the tool and impede the cutting ability. When the tool contacts the deposit, allow it to cut away the material and advance at its own rate. If it stops advancing, pull back slightly on the hose to pull the head slightly away from the deposit, in case it is being stopped from rotating by the deposit. This also allows the angled jets to attack the deposit at different places. The hose should be gradually fed back, allowing time for the jets to do their work. This may need to be repeated if the material is particularly difficult in some spots. When polishing tubes with scale, it is possible to allow the nozzle to pass through the tube at incredibly fast rates (operators have been observed passing through a 50 foot long scaled tube in 10 seconds). Unless the deposit is very easy to remove, this will not completely remove the scale. The operator needs to be trained to feed the nozzle through the tube at a rate sufficient to clean the tube.

**Pressure Dump:** The most important safety device when flex lancing is the pressure dump mechanism. The operator nearest the nozzle should have control of the dump valve. If multiple operators will be used, each must have his own dump valve.

**Hose:** The high pressure hose should be as large as possible to minimize the pressure loss thru the hose. The high pressure hose and end fitting should be no larger than the tool to be used on the end of it; if a larger end is used, there is an increased risk of hydraulicking when cleaning plugged tubes.

**Stinger:** A stinger is a rigid piece of pipe or tubing used between the end of the hose and the nozzle. It is typically 2 feet in length, and is primarily a safety device for hand flex lancing. When using stingers, the operator should be trained not to use it as a pry-bar or to bang on the deposit, particularly with rotating tube nozzles, as they may be broken and at the very least will not rotate while forced against the deposit. The coupling connecting the hose to the stinger should be of the slim-line type, and no larger in diameter than the nozzle body; a larger coupling diameter increases the chances of material catching on the coupling and causing hydraulicking to occur.

## Troubleshooting:

**Head will not rotate:** First try rotating head by hand and see if it feels rough or gritty to turn. If it does, the tool must be disassembled and repaired. If the tool feels okay, check to see if any nozzles are plugged; even if a nozzle is only partially blocked it can keep the head from rotating. The head must be removed from the tool to properly clean them. If none of these are the problem, the jets may be too worn and the head needs to be replaced.

**Head spins too fast:** Add more fluid; it is best to add a full syringe to flush out the old fluid. This may need to be done as frequently as every 4 hours. If the swivel spins too fast after adding new fluid, check that the head is correct for the operating pressure being used.

**Seal Leak:** The seal may leak initially up to several thousand psi, but should pop closed as pressure is increased. If operating pressure is reached and the seal is leaking continuously, the high pressure seal and seat may need to be replaced. Refer to the maintenance below. Inspect the shaft end face for damage as well.

**Seals wear out quickly:** Replace the Seal Holder (FT 020) and the carbide seat (FT 011-UH).

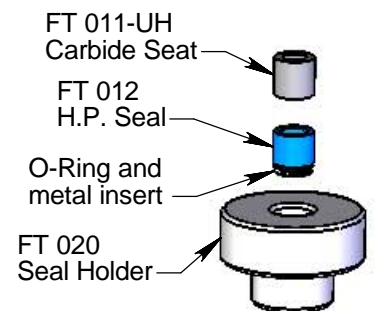
## Maintenance: \*Blow out all water with compressed air before storing tool!

It is very important that the Ferret be kept full of viscous fluid. When the tool begins to dramatically speed up, the fluid should be refilled as shown. This may need to be done as frequently as every 4 hours. If this is not done, the tool will continue to speed up until the bearings fail and need to be replaced.

1. Fill syringe with Viscous Fluid (slow). Clamp swivel by flats upright in vise.
2. Remove Port Screw (FT 026).
3. Thread syringe into Ferret Body, slowly squeeze a full syringe of fluid into the tool; excess fluid comes out weep ports.
4. Remove syringe and install port screw (Make sure the brass washer is on screw).

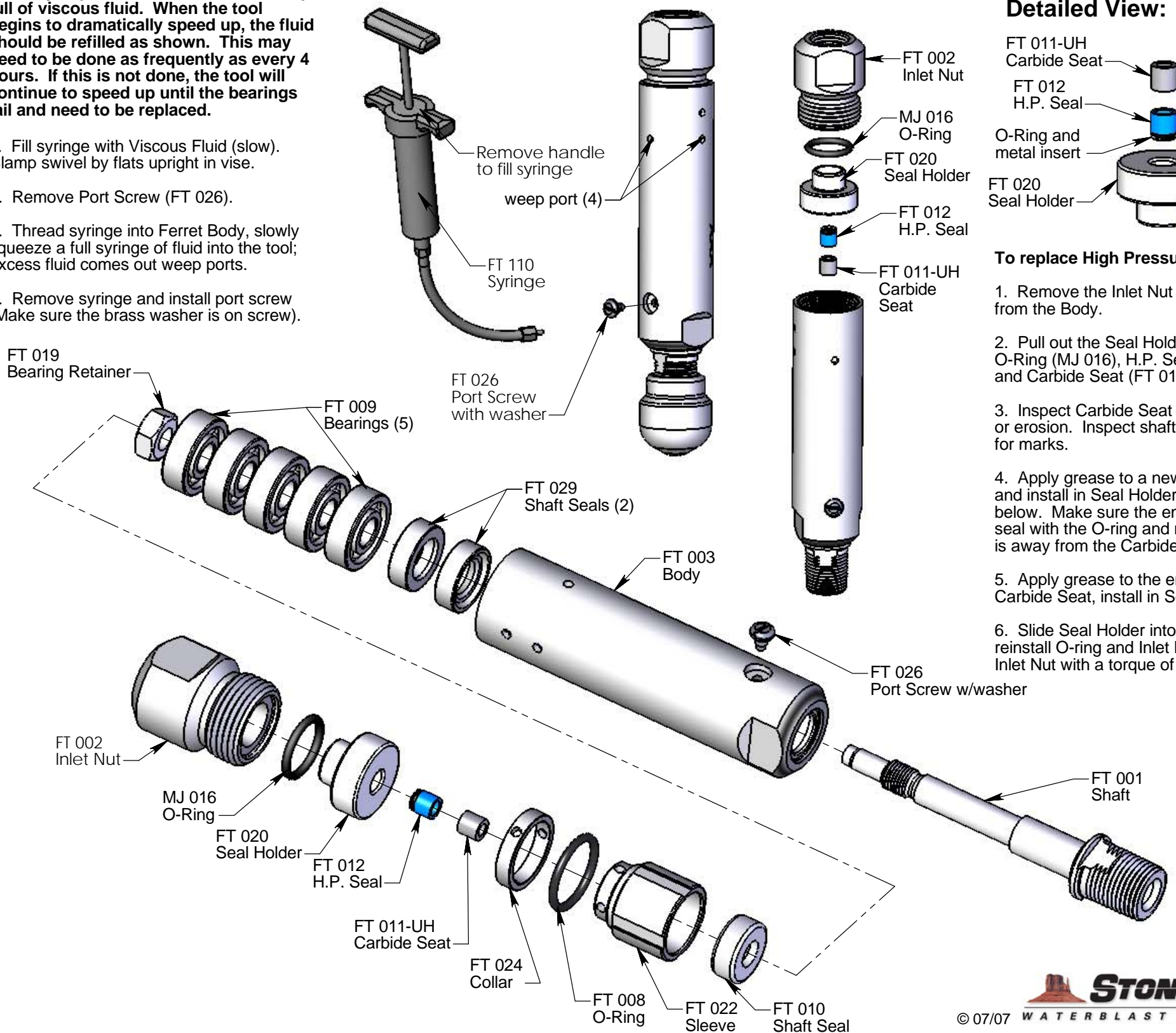
The high pressure seal can be expected to last from 50 to 100 hours, if viscous fluid is added frequently.

### Detailed View:



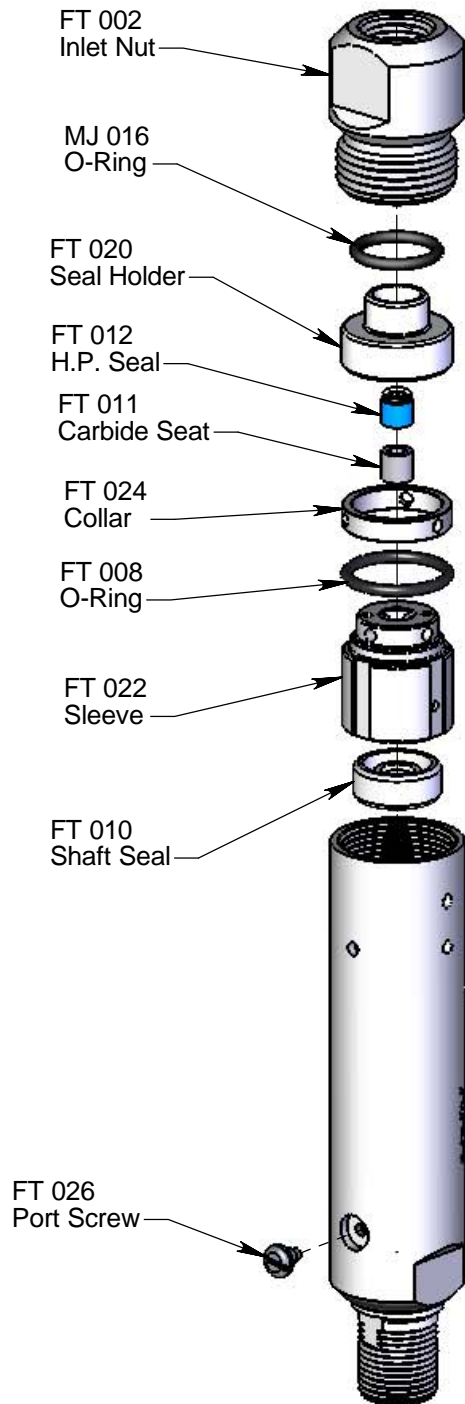
### To replace High Pressure Seal:

1. Remove the Inlet Nut (FT 002) from the Body.
2. Pull out the Seal Holder (FT 020), O-Ring (MJ 016), H.P. Seal (FT 012) and Carbide Seat (FT 011).
3. Inspect Carbide Seat for chips or erosion. Inspect shaft end face for marks.
4. Apply grease to a new H.P. seal and install in Seal Holder as shown below. Make sure the end of the seal with the O-ring and metal insert is away from the Carbide Seat.
5. Apply grease to the end of the Carbide Seat, install in Seal Holder.
6. Slide Seal Holder into Body, reinstall O-ring and Inlet Nut. Tighten Inlet Nut with a torque of 50 ft-lb.

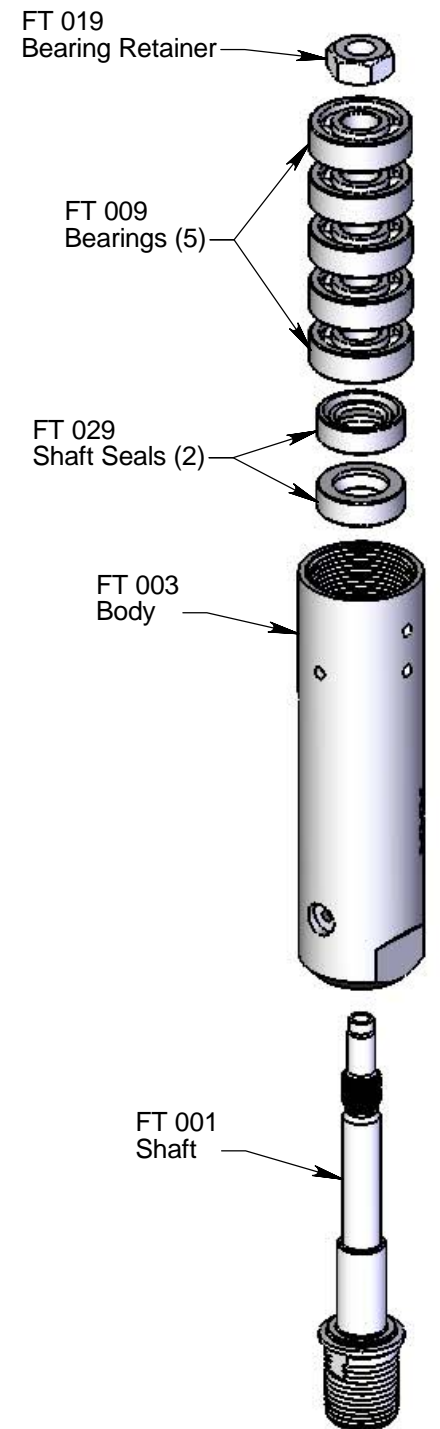


# Ferret Self-Rotary Tube Nozzle

## Disassembly:



1. Unscrew the Inlet Nut (FT 002) from the Body.
2. Pull out the O-Ring (MJ 016), Seal Holder (FT 020), H.P. Seal (FT 012) and Carbide Seat (FT 011).
3. Remove Sleeve (FT 022) using a bent wire or nail inserted in one of the holes. Be careful not to damage the end of the shaft. The Collar (FT 024), O-Ring (FT 008) and Shaft Seal (FT 010) will come out with it.
4. Remove the Shaft Seal (FT 010) from the Sleeve by inserting small pins through the two small holes on top of the Sleeve.
5. Remove the Port Screw (FT 026).
6. Remove the Bearing Retainer (FT 019) using a 7/16" or 11 mm Deep Well Socket.
7. Pull Shaft (FT 001) out of Body.
8. Push Bearings (FT 009) out of Body using a 5/16"  $\phi$  bolt.
9. Remove Shaft Seals (FT 029) from Body.



## Assembly:

1. Press Shaft Seals (FT 029) into Body, using the FT 100 Assembly Tool. Note orientation; the first seal goes in with the lip facing down into body, the second goes in with the lip facing up.
2. Slide Assembly Tool (FT 101) onto Shaft (FT 001). Carefully push the Shaft up through shaft seals into Body. Remove the Assembly Tool. Check that shaft seals are still in place in Body.
3. Push five Bearings (FT 009) into Body (around Shaft) until shaft threads are showing.
4. Thread Bearing Retainer (FT 019) onto Shaft. Tighten to 50 in-lb.
5. Install Shaft Seal (FT 010) in Sleeve (FT 022). The lip of the seal with the spring faces into the Sleeve.
6. Slide Sleeve (FT 022) into Body. The shaft end should stick up thru center.
7. Drop O-Ring (FT 008) into groove around Sleeve, followed by the Collar (FT 024).
8. Insert H.P. Seal (FT 012) and Carbide Seat (FT 011) into Seal Holder. See the Maintenance Section for proper procedure.
9. Place Seal Holder (FT 020) in Body, followed by O-Ring (MJ 016).
10. Apply anti-seize to threads of Inlet Nut (FT 002) and thread into Body. Tighten to 50 ft-lb.
11. Use syringe to fill tool with viscous fluid, as shown in the Maintenance Section. Install Port Screw (FT 026) with washer.

