BARREL BLASTER
OWNER'S MANUAL

CSI 417.831.1411
csidesigns.com

v.05/05b

TABLE OF CONTENTS

1 - Introduction

1.1 DESCRIPTION

The Gamajet E-Z 7 Barrel Blaster is a fluid-driven (turbine-driven) 360° rotary nozzle machine designed for cleaning the interior surfaces of a wide variety of small process and storage barrels, drums or containers with a minimum opening of 1-½ inches (38.1 mm) in diameter. It is powered entirely by the cleaning solution; it requires no electricity, compressed air or lubricant for operation. The Gamajet E-Z 7 is designed primarily for portable service; however, the unit may also be permanently installed in a vessel. If the Gamajet E-Z 7 is permanently mounted inside a tank, we strongly recommend inspecting the unit every few hundred hours of operation. (See Section 3 - Preventative Maintenance for more information.)

<u>WARNING</u>: Under no conditions, whatsoever, should the Gamajet E-Z 7 ever be immersed in anything, unless you have prior approval from Gamajet Cleaning Systems, Inc. Failure to comply with this restriction will void the warranty!!

In order to handle the broadest possible range of applications, the stainless steel Gamajet E-Z 7 is available with dual or triple nozzles, and an extensive selection of nozzle sizes, stators (non-rotating turbine) O-ring material and gear ratios. Gamajet nozzles are available in several interchangeable sizes ranging from 0.050" to 0.100". The Gamajet wash cycle time can be adjusted for special applications by changing the stators and nozzle size. Interchangeable stators and nozzle sizes are available for either low or high pressures and/or flow rates. The performance capabilities of these options are detailed in Appendix D. A complete description of the technical specifications and materials of construction of the Gamajet E-Z 7 is contained in Appendix A.

1.2 INSTALLATION OF NEW MACHINES

1.2.1 ASSEMBLY

Every Gamajet is operationally tested before shipment and is ready to run after unpacking. **No assembly is required prior to use.** The Gamajet has been configured to meet the operating conditions (at the Gamajet, not at the pump) given to us, e.g., pressure, flow, temperature, cycle time, chemical adders, etc.

Note: Any change to the original operating conditions will affect the Gamajet accordingly.

<u>WARNING</u>: Do not force Tee & Nozzle Housing #704 & #705 to rotate. Doing so will damage internal components.

1.2.2 INLET CONNECTIONS

The Gamajet E-Z 7 is supplied with a ½" NPT female inlet connection. It is recommended that the mating male thread should be wrapped with PTFE pipe joint tape prior to mounting. This will minimize any chance of leakage and will make subsequent removal much easier.

1.2.3 MOUNTING

Before mounting the Gamajet E-Z 7, make sure the supply line has been adequately flushed. It should be mounted on a rigid ½" pipe using a 1-1/8" open-end or adjustable wrench. In most applications, the Gamajet E-Z 7 will be mounted with the inlet connection pointing down; however, the Gamajet will function at any orientation. We do not recommend attaching the machine to a hose while in the inverted or horizontal orientation. This form of mounting is not rigid and, thus, will not maintain the Gamajet's position should the unit become unbalanced due to clogging of the nozzles. In addition, we do not recommend using a Triple Nozzle machine with a flexible supply line. The dynamic imbalance of the Triple Nozzle will affect the Gamajet's performance accordingly.

<u>WARNING</u>: When attaching the Gamajet E-Z 7 onto the supply pipe, ALWAYS use the wrench flats on the Inlet Collar at the top/inlet of the unit. Never use a wrench on Stem or Tee Housing to tighten the unit onto the pipe. Doing so risks internally damaging the machine. Please refer to Step 16 in Appendix C.

1.2.4 LOCATION INSIDE TANK

Generally, a single Gamajet should be positioned in the approximate center of the vessel in order to equalize the cleaning radius in all directions. Some vessels may have specific cleaning problems such as coils or heavy deposits such as the liquid level line (bathtub ring). In these situations the Gamajet should be located closer to the difficult area for the best cleaning results.

Tanks with internal mechanisms or structures such as an agitator shaft, impellers or baffles will require careful positioning to minimize the "shadow" on areas which do not receive direct jet impact. Sometimes, more than one machine, or, more than one placement of a single machine, may be necessary to completely avoid shadow problems.

1.2.5 ENTRY OPENINGS

When using the Gamajet E-Z 7, the vessels being cleaned must provide entry openings large enough to avoid interference during insertion and removal. The minimum opening size required for the Gamajet E-Z 7 is 1-½ inches in diameter (38.1 mm) for free-hand installation, and 1-15/16" for fixed-centerline installation.

1.2.6 DRAINAGE

If it is necessary to clean the floor of a vessel, remember that standing liquid will diminish the effectiveness of the jet by covering any soils underneath. Wherever

possible, the tank floor should be pitched toward the drain and the drainage opening should be large enough to eliminate or reduce any liquid buildup or puddling. If gravity alone is insufficient, a scavenger or stripper pump should be connected to the drain to suck out the excess wash fluid. In extreme cases, it may be necessary to use smaller nozzles on the Gamajet, or even to operate it intermittently to allow time for draining.

1.2.7 FILTERS AND STRAINERS

As an accessory, Gamajet sells a strainer to be used in conjunction with the E-Z 7. The main component is a heavy duty Y-Strainer that allows for on-line cleaning of the screen without disassembly of the surrounding plumbing. By simply opening the included ball valve, the heavy particulate that has collected on the screen can be blown-down. The screen can also be visually inspected by simply removing the cover of the strainer and, again, without disassembly of the piping.

If Gamajet's strainer is not used, the systems should be equipped with a filter or strainer that will trap solids **0.004" (100 micron) or larger**. The use of a filter ensures adequate removal of particles and debris that can come from hard water, dirty heating coils, line sediment, and well water. A supply of clean wash fluid to the E-Z 7 and, more importantly, the vessel is a must.

1.2.8 CAPACITY OF SUPPLY PUMP

In the majority of cases a positive displacement (PD) style pump (i.e. a pressure washer, piston pump, plunger pump, and mechanical diaphragm pump) will supply the wash fluid to the Gamajet E-Z 7. PD pumps are fixed volume pumps whose flow rate is dependent upon the speed of the pump; the pumps also have a pressure rating which is the **maximum** operating pressure. **Do not confuse the maximum operating pressure of a PD pump with the actual operating pressure. The actual operating pressure is dictated by the fixed flow rate of the pump, the Gamajet E-Z 7 and the plumbing system**. If a PD pump is used, the Gamajet E-Z 7 should be sized to, first, match the flow capability of the pump and, second, not exceed the pump's maximum operating pressure (taking the plumbing system into account, also).

Centrifugal pumps are not designed for use with the Gamajet E-Z 7, because of the high pressure (300+ psig) and low flow rate (2 to 8 gpm) operating conditions of most applications. If a centrifugal pump must be used it will not damage the Gamajet E-Z 7; however, the life expectance of the pump will be greatly reduced. Please contact Gamajet for consultation before using a Gamajet E-Z 7 with a centrifugal pump.

1.2.9 INITIAL STARTUP

When using a pressure washer to feed the unit, Gamajet strongly recommends running the pressure washer at the beginning of each use, without the E-Z 7 attached, for a period of time of about one minute. Gamajet has noted, through our testing with pressure washers, a high level of dirt in the initial wash fluid. This procedure will lessen the buildup of debris inside the E-Z 7 and potential for premature wear of E-Z 7 components.

Every E-Z 7 that ships is accompanied by a Birth Certificate. This document indicates how the E-Z 7 performed in our testing tank before it shipped based on the operating

conditions supplied to Gamajet. To ensure the longest possible life of the E-Z 7, please verify the operating conditions and, most importantly, the machines cycle time. The cycle time is determined by picking a fixed point inside of a vessel (i.e. bung hole of a wine barrel) as a reference, and timing how long it takes **the same nozzle** to pass back over that fixed point in the vessel. (This, naturally, will not be the exact same spot because the spray pattern is indexing.) This timed value in seconds corresponds directly to the full cycle time in minutes.

1.3 SAFETY

When Gamajets are operating, there should be covers over any tank openings. These covers should be sealed well enough to withstand the full force of the jet striking the cover plate. If the cleaning solution were hot, corrosive, or toxic, a leak would present a serious hazard to any personnel in the immediate vicinity or to any exposed electrical equipment.

<u>WARNING:</u> Any tank-cleaning machine can develop a static electricity charge while in operation. If the tank being cleaned contains a combustible liquid or vapor having a risk of ignition or explosion, it is imperative to have the Gamajet properly grounded.

1.4 MACHINES COVERED BY THIS MANUAL

This version of the Barrel Blaster Owner's Manual applies to machines with the following configurations.

1. Machines that have a serial number BZ100 and higher and, also, have the tapered nozzle housing (as depicted on the front cover).
2. Or, machines (serial number B7400+ and BZ001 to BZ099) that have been upgraded (typically marked with a "Z" at the end of the serial number) with the:
    a. Tapered Nozzle Housing
    b. 723-S and 727-T Rotor Shaft Lower Bearing Housing and Seal
    c. 703-L and 712-L, Strong Stem and Output Shaft.
    d. E-Z 7 Guide Parts: 703-E (or B) and 728-E
3. Or, machines (serial number B7777+) that have been built with the following features:
    a. 723-S and 727-T Rotor Shaft Lower Bearing Housing and Seal
    b. 703-L and 712-L, Strong Stem and Output Shaft

2 - Disassembly, Repair, and Reassembly

2.1 TOOLS REQUIRED

Needle Nose Pliers
0.050", 5/64", 3/32" and 7/64" Hex Keys (Allen Wrench)
Very Small (1.2mm), ¼", & 1/8" Slotted Screwdrivers
#1 Phillips Screwdriver
3/16" Hex Socket, Ratchet, and 2" Socket Extension. Or, 3/16" Nut Driver.
Pliers
Razor Blade
Bench Vise (4-6" jaw opening)
No. 3 Arbor Press (3 ton) or Hammer
Micrometer (0-6" Digital or Dial Calipers)

2.2 GENERAL DISASSEMBLY

Note: The appropriate step(s) in Appendix C is/are indicated at the beginning of each section.

2.2.1 INLET COLLAR

Step - 16

- Loosen the Inlet Collar Set Screw #741 with the 5/64" Hex Key, minimum 2 turns.
- Remove the Inlet Collar #701-S and Stator #709.

2.2.2 BASE ASSEMBLY

Step - 14

- Remove the Socket Head Cap Screws (SHCS) #743 with a 7/64" Hex Key, the Lockwashers #744, and Base #728-E (or 728) from the Tee Housing.
- Remove the Nut #747 with a 3/16" socket and Lockwasher #746 from the Output Shaft #712-L.
- Using needle nose pliers, remove the Idlers Shafts #715, Idler Gear Assemblies #716, and the Output Pinion #711. Be careful not to mare the gears or shafts with the pliers.

2.2.3 STEM CAP AND GEAR TRAIN ASSEMBLY

Step - 14

- Unscrew the SHCS #740 with 3/32" Hex Key, and remove them.
- Pull the Stem Cap #702-S from the Rotor Shaft Bearing Housing #713-S.
- Remove the Gear Train Assembly from the body by tapping on the Ouput Shaft at the Base end of the machine with the handle of a screw driver.

2.2.4 NOZZLE HOUSING

Step - 9, 16

- Unscrew the Name Plate Screw #706 with a ¼" slotted screwdriver.
- Pull the Nozzle Housing #705 off the nose of the Tee Housing.
- Remove the inner Nozzle Housing Bearing & Seal #736. Tip: Use a small slotted screwdriver to get under the flange of #736.

2.2.5 TEE HOUSING

Step - 11

- Using a 1/8" slotted screwdriver, remove the Ring Gear Retaining Ring #721, and pullout the Ring Gear #720.
- Unscrew the Phillips Pan Head Screws #748, and remove the Idler Shaft Base #729. Tip: if the Idler Shaft Base is difficult to remove, screw the SHCS #743 (removed in Step 2.2.2) back into the base and use them for leverage.
- Remove the second set of Phillips Pan Head Screws #748, and pull out the Tee Housing Bevel Gear #717. Be careful not to strip the heads of the screws, they should have a mild thread lock on them.
- Pull the Tee Housing #704, lower Tee Housing Seal #735-S and lower Bearing #735-B from the Stem.

2.3 INSPECTION AND SERVICE OF COMPONENTS

2.3.1 STATOR

Inspect the openings at the top and the veins of the Stator #709 to be sure that they are clear and free of debris.

2.3.2 BASE ASSEMBLY

Steps - 12, 14

- Inspect the Output Pinion #711 and Idler Gear #716 for worn, damaged, or sharp/pointed teeth.
- Check for signs of scoring on the Idler Shafts #715.
- Examine the Idler Gear Bushings #731 on the Idler Gears and the Idler Shaft Bushing #733 on the Base for signs of wear. The inside diameter of the #731 Bushings should not exceed **0.110**". This can be measured with a plug gauge or a #35 drill bit. The inside diameter of the #733 should not exceed **0.103".** If Bushings need to be replaced,

remove them with a small slotted screwdriver or razor blade, then push replacements back into place.

2.3.3 STEM CAP

Step - 14

- Inspect the Small and Large Stem Cap O-rings, #751 and #752, for deterioration (hardening or deformation) or damage and replace if necessary.

2.3.4 GEAR TRAIN ASSEMBLY

2.3.4.1 General Disassembly and Inspection

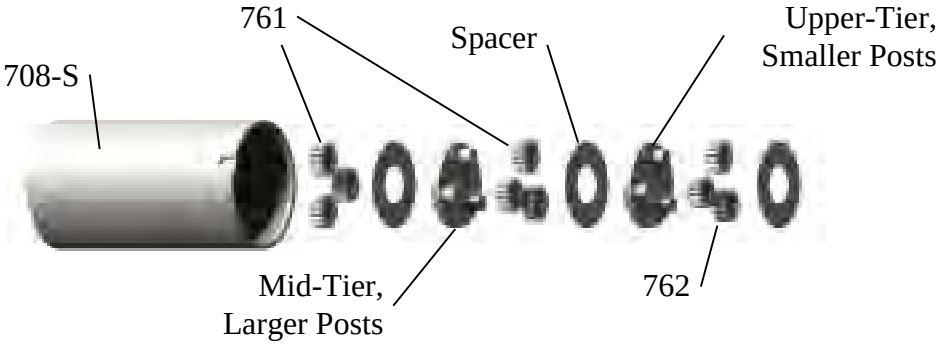
Step - 7

- Unscrew the Nut #747 with a 3/16" socket and remove it with the Lockwasher #746 from the Input Shaft #722.
- Remove the Rotor #710 from #722. Use a slotted screwdriver for assistance.
- Remove the input assembly by pulling and twisting on the Rotor Shaft Bearing Housing #713-S while pushing down on the tip of #722 with your index finger to keep it in place. This is done to prevent the accidental disassembly of the Gearhead, #726 (inside of #708-S). A thin spacer from the Gearhead may stick to the underside of the input assembly. If it does, remove it and place it back on the top of the Gearhead.
- Pull and twist the Output Shaft Seal Housing #714-S from the Gearhead Housing #708-S.
- Loosen the Output Shaft Set Screw #742 with a 0.050" Hex Key. Pull #712-L from the Gearhead assembly.
- If liquid is found in the gearhead, a careful and thorough inspection should be made of the #708-S, #712-L, #713-S, #714-S, #722, #723-S, #724-S, #727-T, #754, and #763-E. If scratched or worn, they will present a possible leak path into the gearhead.

2.3.4.2 Gearhead & Output Shaft Assembly

Steps - 3, 7

- Inspect the Output Shaft #712-L for signs of scoring and wear, especially in the area of 724-S contact. Replace if worn.
- Using a small slotted screwdriver, ensure that the Gearhead Screws #750 are tight.
- **<u>WARNING:</u> If you suspect that the Gearhead #726 requires service, proceed with**



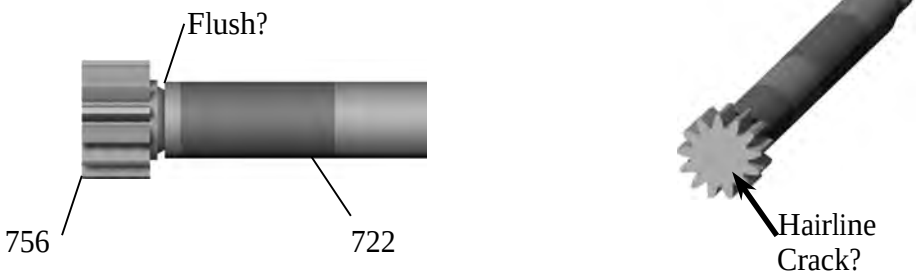
caution. If at any time you do not feel completely comfortable servicing #726, contact Gamajet Cleaning Systems immediately. To eliminate loosing the small internal components, service #726 over a small tray or container. Refer to Section 3.1 for more information.

- Using a needle nose pliers carefully remove the internal components of the #726. Examine the gears of the three different stages for any worn or broken teeth. Also, examine the main internal ring gear for bent or sharp teeth. If any damage is found contact Gamajet immediately. Please note, the gears, 761, at the mid and lower level are interchangeable.

2.3.4.3 Input Assembly

Steps - 1, 4, 5, 7

- Pull #722 and #756 from the Rotor Shaft Bearing Housing #713-S assembly.
- Remove the Rotor Shaft Lower Bearing #727-T from #713-S.
- Inspect the Input Pinion #756 for hairline cracks on the end face or for worn, damaged, or sharp/pointed teeth. #756 should be flush with the shoulder of #722 (circular scoring on the top of the Rotor #710 and underside of Stator #709 is an indication of #756 slippage). Press #756 back onto #722 if it has slipped, or replace if cracked.
- Check for signs of scoring and wear on #722, especially in the area of #723-S contact. Replace if worn.



- Inspect the Rotor Shaft Housing and Rotor Shaft Bearing Housing O-rings, #763-E and #754, for deterioration (hardening, swelling, or deformation) or damage. Replace as needed.
- Remove the Input Shaft Seal #723-S for inspection from the #727-T by, first, removing the Retaining Ring #764. Press down on the middle of the ring's "C" with the small screwdriver so that the #764 is at an angle in the #727-T and only the tips of the "C" remain in the gland. Then, pull up on the tips of the "C" to eject the ring. Now, inspect the #723-S for wear, damage, or deformation. It should be tight on the outside diameter of the #722 and snug on the inside diameter of the #727-T. If the #723-S must be replaced, do not lubricate the new seal's O-ring when installing it into the #727-T.
- Check the Housings, #708-S, #713-S and #727-T, for scoring or scratches in the areas of #723-S, #754 and #763-E contact.
- The Gearhead Pin #758 should be firmly pressed into the #713-S.
- The vent holes of the #713-S should be clear.

2.3.4.4 Output Shaft Seal Housing

Step - 2

- Inspect the Rotor Shaft Bearing Housing O-ring #754 for deterioration (hardening or deformation) or damage and replace if necessary.

- Check the #724-S for wear by placing back onto the Output Shaft #712-L and twisting. There will be a little drag if #724-S is still good. If not, remove the old one by prying it out of the #714-S and replace it.
- Check the Housings, #708-S and #714-S, for scoring or scratches in the areas of #724-S and #754 contact.

2.3.5 NOZZLE HOUSING

Step – 15, 16

- If the unit is a BZ-#### with a tapered Nozzle Housing, inspect the orifices in the #705-DT for debris. The inside diameter must be smooth, round, and free of damage (especially any nicks) for maximum jet impact. If worn or oversized, replace the #705 to achieve the original flow rate and pressure.
- If the unit is a B-####, unscrew the Nozzles #707 with pliers and inspect orifice as mentioned above. Inspect Nozzle O-rings #757 for permanent set or deterioration. Replace if needed.
- Inspect the Nozzle Housing Bevel Gear #718 for wear such as sharp/pointed or worn teeth. If it needs to be replaced, remove the Nozzle Bevel Gear Retaining Ring #719 with a small slotted screwdriver and pry #718 from the Nozzle Housing #705.
- Inspect the Nozzle Housing Bearing and Seals #736 and discard any that are worn or distorted. Clean any deposits from the exterior of #736 and check their fit in the Nozzle Housing Bearing Cups #734. While they should turn freely, #736 should be replaced if the thickness of the **flange** is **0.023",** or less, to avoid shortening the life of the Bevel Gears. The outside of the seal section of #736 should still have a bead, replace if has worn even with the main body of the bearing section. Inspect the interior of #736 for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring), replace as required.
- Clean any deposits from #734 and examine for excessive wear. Light scoring is acceptable, but the Cups should be replaced if they are grooved in the seal contact area. A good maintenance program will require replacing many #734, therefore, it may be worthwhile to make or obtain press tools for pressing #734 out of #705. The press tools are available from Gamajet Cleaning Systems. Before installing new #734, clean the housing bores and remove any burrs resulting from #734 removal. Press them in so that their flanges are flush against #705.

2.3.6 TEE HOUSING

Steps - 9, 10, 11

- Inspect the Tee Housing #704 for damage to the keyway that engages the Ring Gear #720. If the Ring Gear was difficult to remove, check to see if #704 is out-of-round (as the result of an external blow, such as dropping) where the Gear seats.
- Check the water outlets on the nose of #704; they should be free of debris.
- Inspect the Tee Housing Bevel Gear #717 for worn, damaged or sharp/pointed teeth.
- Inspect #720 for worn, damaged or sharp/pointed teeth, and for damage to the key that engages the slot in #704.
- Inspect the Tee Housing Nose O-ring #755 for deterioration (hardening, swelling, or deformation) or damage and replace if necessary.
- Check the Output Shaft Lower Seal #725 for wear, paying close attention to the spring and inside diameter. If the #725 has started to extrude through the #729, replace it.

Place the Output Shaft #712-L through the center of #725 and twist. There will be a little drag if #725 is still good. Replace if necessary.

- Inspect the Tee Housing Bearing and Seals #735, #735-B and #735-S, discard any that are worn or distorted. Clean any deposits from the exterior of #735 and #735-S, check their fit in the Tee Housing Bearing Cups #732. While they should turn smoothly, #735 or #735-B should be replaced if the thickness of the **flange** is **0.045"** or less, to avoid shortening the life of the Bevel Gears. The outside of the seal section of #735 and #735-S should still have a bead. In the case of the #735, replace if has worn even with the main body of the bearing section. Replace the #735-S if it has worn even with the outside diameter of the seal's heel. Inspect the interior of #735 and #735-S for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring), replace as required.
- Clean any deposits from #732 and examine for excessive wear. Light scoring is acceptable, but the Cups should be replaced if they are grooved in the seal contact area. A good maintenance program will require replacing many #732, therefore, it may be worthwhile to make or obtain press tools for pressing #732 out of #704. The press tools are available from Gamajet Cleaning Systems. Before installing new #732, clean the housing bores and remove any burrs resulting from #732 removal. Press them in so that their flanges are flush against #704.

2.3.7 STEM

Step - 8

- Inspect the water outlets of the Stem #703-L, they should be free of debris.
- Check the Output Shaft Lower Bushing #730 by inserting the Output Shaft #712-L into #730 in the opposite direction. There should be a slight drag during insertion, but #712-L should wobble only slightly when rocked back and forth. However, if the spring of the #725 has broken, replace the #730. The #730 can be replaced by pushing it into #703-L. Tap its replacement back into place.
- If the machine has been roughly handled, acting erratically with hot water, or some of the components in the Gearhead #726 have failed, check the #703-L to ensure that it is not bent. If the total run-out is 0.004", or greater, replace the #703-L.

2.4 REASSEMBLY

2.4.1 GENERAL NOTES

- **All parts must be cleaned thoroughly before reassembling.** Any deposits remaining on the parts can cause difficult disassembly the next time the Gamajet needs servicing.
- Unless otherwise stated, apply a dab of a **Teflon-based anti-seize compound** to all threads when reassembling; this will prevent galling of threads and ease any future disassembly.
- To ease installation of all O-rings, they should be lubricated prior to reassembly. A Silicon based lubricant must be used for EP O-rings (standard material, black colored #755). A Lithium-based grease is acceptable, for Viton® O-rings (caramel colored #755). In either case, however, a food grade lubricant may be used.
- Refer to illustrations Appendix C for clarification during reassembly.

2.4.2 TEE HOUSING

Step - 11

- Place the lower Tee Housing Bearing #735-B & Seal #735-S (spring side up) onto the Stem #703-L.
- Push the Tee Housing #704 over it until it is flush and fully seated.
- Place the combo Bearing and Seal #735 over Stem (spring side down) and push it down between #703-L and the Tee Housing Bearing Cup #732. (A large diameter pin will aid in the insertion.) Use the Tee Housing Bevel Gear #717 to full seat the #735.
- Align the through holes of the #717 with the threaded holes in the top of the #703-L. Apply a small amount of a mild thread lock to the four Phillips Pan Head Screws #748 and screw them in, tightening them in a star pattern. (Needle nose pliers will help insert the small screws.) The #704 should not have any axial play.

- Ensure that the Output Shaft Lower Seal #725 is in the Idler Shaft Base #729 (spring side out). Then, repeat the procedure in the previous step for the Idler Shaft Base #729. No thread lock is required for this set of four screws.
- Insert the Ring Gear #720 into the Tee Housing, being sure to align the key and key way of the two components.
- Reinstall the Ring Gear Retaining Ring #721.

2.4.3 NOZZLE HOUSING

Steps - 9, 15, 16

- Place the first Nozzle Housing Bearing & Seal #736 (spring side out) onto the nose of the Tee Housing #704.
- If the unit is a B-#### series, apply a small amount of mild thread lock to the threads of each Nozzle #707 and screw them into the Nozzle Housing #705 with the aid of pliers.
- Using your thumb, push the Nozzle Housing #705 onto the nose of the Tee Housing. **Rotate the Tee Housing Assembly slightly to mesh the Bevel Gears #717 and #718. Failure to ensure that the Bevel Gears have properly mated could damage them.**

- If you have not done so, put the Tee Housing Nose O-ring #755 into the nose of the Tee Housing.
- Push the outer #736, spring first, into the annular space between the nose of the #704 and Tee Housing Cup #734.
- Apply a mild thread lock to the threads of the #706. Then, using a 1/4" slotted screwdriver, screw #706 into #704. Refer to Step 16.

2.4.4 GEAR TRAIN

Steps – 1 to 7, 14

- Reassemble the internal components of the Gearhead #726. Make sure to lightly repack it with grease as it reassembled.
- Check that the Gearhead Screws #750 are tight.
- Place the Output Shaft #712-L over the output shaft of the #726. Align the flat with the Output Shaft Set Screw #742. Gamajet recommends using a new #742 during

reassembly. Using a 0.050" Hex Key, screw into the #712-L. The #742 should fall into the dimple on the output shaft of the #726.

- Check that the #723-S and #764 are inside of, and #763-E is on the #727-T.
- Insert the #722/#756 assembly through the #727-T.
- Push the Rotor Shaft Lower Bearing #727-T into Rotor Shaft Bearing Housing #713-S.
- Ensure that the thin spacer is on the #726 top idler gears.
- Engage the #756 into the #726. This can be made easier by extending the #722 assembly slightly from the #713-S assembly.
- Push the #713-S into the Gearhead Housing #708-S, aligning the Gearhead Pin #758 with the keyway of the #708-S.
- Place the Rotor #710 (Carbide Bearing #739 down) over the Input Shaft #722.
- Using a 3/16" socket, screw the Nut #747 and Lockwasher #746 onto the top of the Input Shaft.
- Place the #714-S assembly (O-ring side first) over the #712-L and push and twist it into the Gearhead Housing #708-S until it is flush and fully seated.
- The captured air will try to push the ends of the assembly off, so, quickly insert this assembly into the Stem #703-L and proceed to the next section.

2.4.5 STEM CAP

Step - 14

- Place the Stem Cap #702-S on the #713-S, making sure the screw holes are aligned.
- Using a 3/32" Hex Key, screw the SHCS #740 into the Stem #703-L. Tighten in a star pattern.

2.4.6 BASE ASSEMBLY

Step - 14

- Place the Output Pinion #711 (round opening down) onto the Output Shaft #712-L.
- Insert the Idler Shafts #715 into their respective holes in the Idler Shaft Base #729.
- Install the Idler Gears #716 (Idler Gear Bushing #731 down) onto the Idler Shafts. Twisting the Tee Housing #704 slightly will help the Idler Gears drop into place.
- Using a 3/16" socket, screw the Nut #747 and the Lockwasher #746 onto the Output Shaft.
- Put the Base #728-E (or, 728) back onto the Tee Housing.
- Using a 7/64" Hex Key, screw the SHCS #743 and Lockwashers #744 into the Idler Shaft Base #729.

2.4.7 STATOR AND INLET COLLAR

Step - 16

- Rotate the Rotor #710 using a small Hex Key. It should spin fairly easily and its veins must not strike the walls of the Stem Cap #702-S. Continue turning the Rotor. The Nozzle and Tee Housing will slowly rotate if every thing has been assembled correctly.
- Insert the Stator #709 into the #702-S.
- Screw on the Inlet Collar #701-S (hand-tight only), and tighten the Inlet Collar Set Screw #754 with a 5/64" Hex Key.

This completes the reassembly process.

3 - Preventive Maintenance

Note: *A rigorously implemented preventative maintenance program will significantly reduce repair costs over the life of the Gamajet. The foundation of such a program is regularly scheduled inspections to discover and replace worn or damaged parts before they can cause the failure of other, more costly, components. The inspection intervals required will depend on the severity of the application, but a complete internal inspection at 100 hours of operation is recommended initially.*

Note: *Part numbers appearing below may be used to identify parts in Appendix C.*

3.1 STORAGE

The Gamajet should be washed out with clean water after each use to remove any foreign material or soft substances left in the machine that may harden during storage and cause the Gamajet to seize or lock up. A clean water rinse through the Gamajet followed by a short (1 to 2 seconds maximum) air blow down, will purge any residues of chemical cleaners or recirculated wash water that could adversely affect the seals and O-rings during the prolonged contact of storage.

3.2 DAILY INSPECTION

Before every shift, ensure that the Name Plate #706 is tight. The Tee Housing #704 should not have any axial play. If it does, retighten the Tee Housing Bevel Gear Screws #748 that hold down the Bevel Gear #717. Also, the Stator #709 and the orifices in the Nozzle Housing #705 should be inspected for debris. Look into each orifice for signs of debris or build-up. Examine the Stator by loosening the Inlet Collar Set Screw #741 and removing the main section of the machine from the Inlet Collar #701-S. Note: One does not have to remove the Gamajet from the supply pipe when performing this check.

3.3 INTERNAL INSPECTION INTERVALS

The Gamajet should be internally inspected every 100-200 hours of operation, depending on the severity of use, or after a season of use and before the unit is placed into long term (over a month) storage. Regardless, the unit should be inspected after the first 100 hours of operation, or the first season.

3.4 TIPS

All the Bearings, Bushings, Seals and O-rings are wear parts. Ideally, they should all be replaced, **as a group**, every 150-200 hours of operation, depending on the severity of use. At first, an interval of 150 hours is recommended.

For balance and wear uniformity, if just one Bearing or Seal is worn or damaged, replace both it and its mate, not just the worn or damaged part.

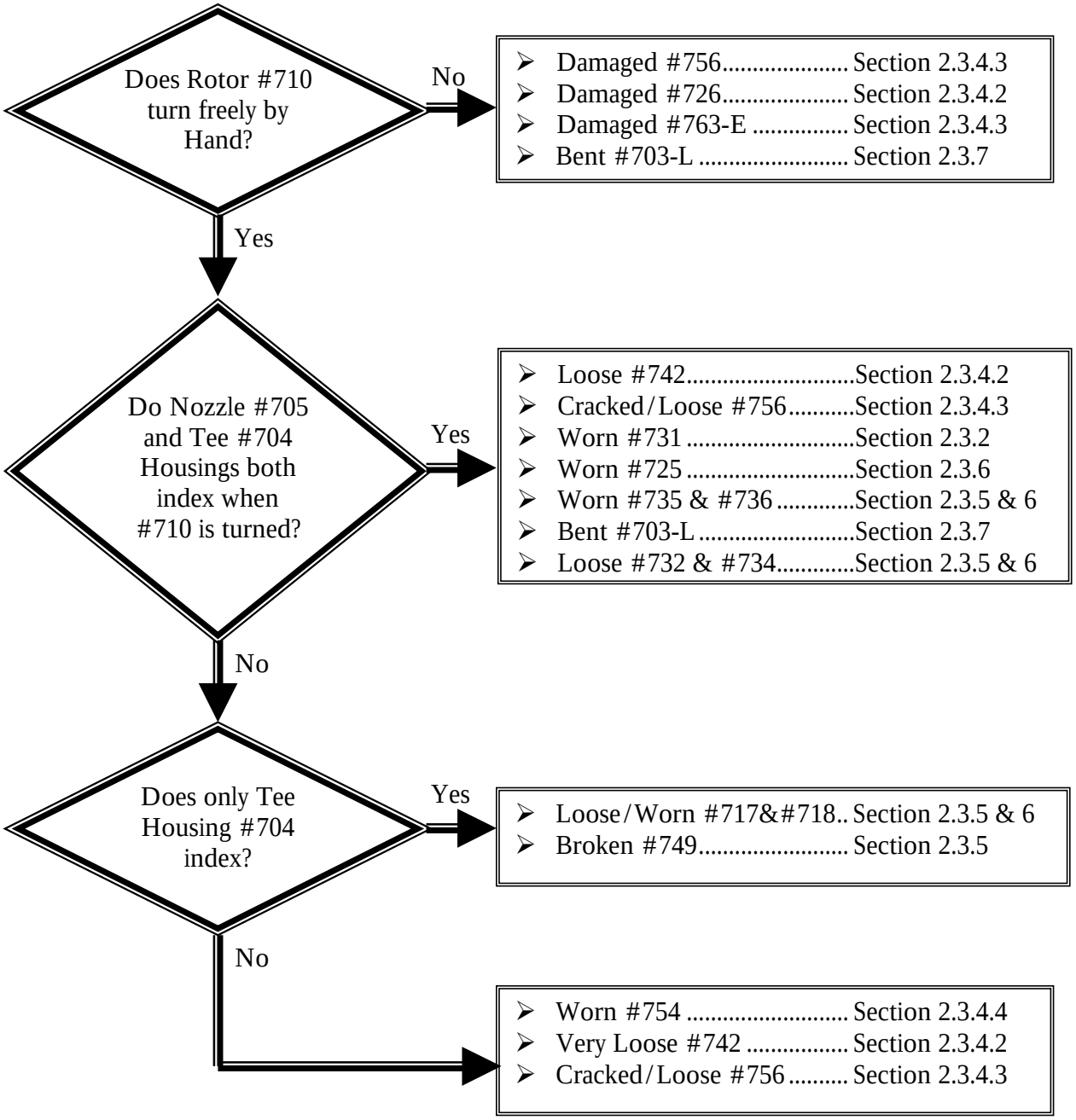
4 - Troubleshooting Guide

Note: *Part numbers appearing below may be used to identify parts in the exploded views in previous sections and Appendix B.*

4.1 MACHINE DOES NOT ROTATE

4.1.1 INSPECTION FLOW CHART FOR MECHANICAL PROBLEMS

All possible causes are listed in order of likelihood.



4.1.2 INSUFFICIENT FLOW

The Gamajet was configured to meet certain operating conditions outlined at the time of the initial sale, such as flow rate (GPM), pressure (PSI), temperature, chemical content of the wash fluid, cycle time, etc. If the Nozzle size is too small and/or the opening at the bottom of the Stator is too large, the Tee Housing will not turn.

Look for restrictions in the fluid supply such as a clogged filter, kinked hose, or deposits in the piping.

4.1.3 TIGHT CLEARANCES

A newly overhauled Gamajet E-Z 7 may fail to operate when first returned to service. If the machine seems otherwise fine, try running it with at least one Nozzle removed. The reduction in pressure and additional flow will invariably be enough to overcome the extra resistance of new Bearings and Seals. Fifteen minutes of operation should loosen the machine to run normally with the Nozzles reinstalled.

4.1.4 DEBRIS INSIDE

Loosen the Inlet Collar Set Screw #741, and remove the Inlet Collar #701-S, then lift out the Stator #709. Look for and remove any debris caught in the vanes of Stator and Rotor #710. Remove any material wound around the Input Shaft #722. In addition, check for any debris caught in the outlet holes of the Stem #703-L, the nose of the Tee Housing #704, and the Nozzle Housing #705.

4.2 CLEANING SOLUTION LEAKAGE

4.2.1 WORN BEARINGS & SEALS

Excessive leakage from the Tee Housing or Nozzle Housing usually indicates worn Housing Bearings and Seals #735, 735-S and #736. Inspect them for wear (sealing lips are worn to a smooth surface) or damaged lips or loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring), and replace as required.

4.2.2 WORN BEARING CUPS

Inspect the Bearing Cups #734 and #732 for excessive wear (grooved or scored), particularly near the inside flange where they contact the Bearings and Seals #735, 735-S and #736. Replace any that show distinct grooves.

4.2.3 WORN STATIC SEAL CONTACT SURFACES

Inspect the Bearing and Seal contact surfaces of the Stem #703-L and the nose of the Tee Housing #704. If these are worn or grooved, new Bearings and Seals will be ineffective. Replace the damaged parts as required.

4.2.4 WORN STEM CAP O-RINGS

Severe leakage between the Inlet Collar #701-S and Stem Cap #702-S may indicate worn or damaged Stem Cap O-rings #751 and #752. Remove the #701-S as described in Section 2, and inspect the O-rings for signs of damage or wear.

4.3 POOR CLEANING PERFORMANCE

4.3.1 INADEQUATE FLOW AND PRESSURE

Check the pressure at the Gamajet inlet under actual operating conditions. The supply piping and hoses must be large enough to handle the flow rate required for the nozzle size being used to ensure adequate pressure.

Insufficient pressure may also result from line losses when the machine is far from the pump, so the line size must be increased accordingly for long runs. Although the Gamajet will rotate at low flow rates, effective cleaning may require considerably more flow. Proper mechanical operation (the unit turns) is NOT the same thing as effective cleaning (the soils have been removed)!

4.3.2 CHEMICAL CONCENTRATION AND TEMPERATURE

Verify that the cleaning solution is the correct compound and in the concentration needed for the deposit being cleaned. If heating is necessary, also check that the solution is at the proper temperature.

4.3.3 PLUGGED ORIFICE

Inspect the orifices in the #705 for debris.

4.3.4 SLOW OR NO ROTATION OF THE HOUSINGS

This will result in partial or erratic washing coverage. Refer to previous sections for more information.

4.3.5 GAMAJET CONFIGURATION

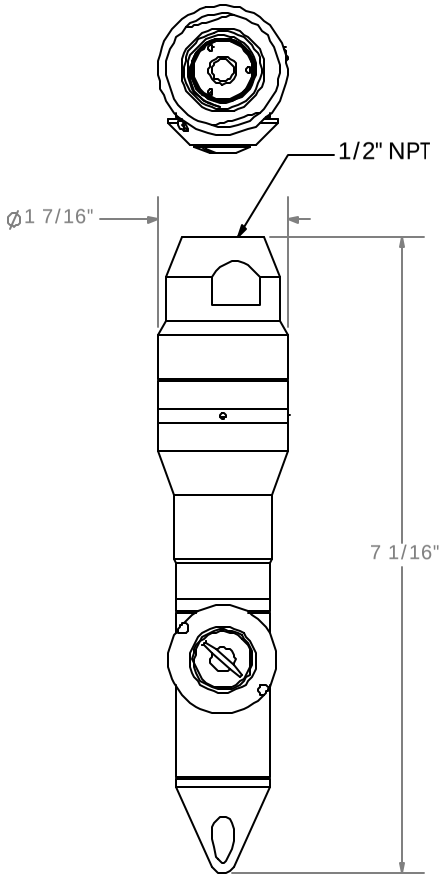
Determine if the deposit being cleaned requires greater jet impact or longer jet dwell time (slower rotation) for more thorough scrubbing. Confirm that the Gamajet nozzle size, turbine, and gearing are correct for the specific application. Refer to the machine's Birth Certificate for specific information regarding its configuration. Contact a Gamajet representative if assistance is required.

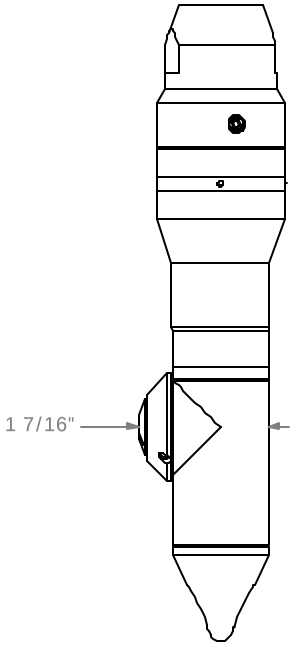
4.3.6 INADEQUATE DRAINAGE

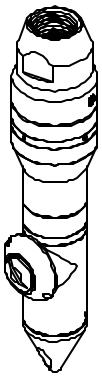
Ensure that the vessel drains the effluent or used wash fluid as fast as it's being sprayed in through the Gamajet. The floor of the vessel should be sloped or pitched toward the drain and the drainage opening should be large enough to gravity-drain the effluent from the vessel. If you still have puddling (build-up of the wash fluid so it covers the floor and shields the residues underneath), use some form of pump to suck out the effluent.

4.4 OWNER'S MANUAL UPDATES

Please visit our web site, www.gamajet.com, for information regarding updates to this manual.







Notes:
- Weight: 1-1/2 lbs.
- Flow Range: 2 to 8 GPM . Ideally, 4 to 5 GPM
- Temperature: 180 °F Maximum
- Designed to fit through a ∅1-1/2" opening that is a maximum of 1" long, if the Supply Line or Entrance Hole are flexible and allow for lateral movement during insertion.
- Rigid Center Line Clearance: 1-15/16"
- Orifice Sizes: range from 0.07 0" to 0.100"

DRAWN	DATE	Rev.	Description
BFG	2/27/02	3	Updated Name of Machine. Added One-Piece Fin.
BFG	01/22/03	4	Updated with Stronger Stem Design.
BFG	03/01/04	5	Changed Nozzle Housing to Tapered Design.
BFG	09/26/05	6	Updated Notes; Mentioned target flow rate.

UNLESS OTHERWISE SPECIFIED
* DIMENSIONS ARE IN INCHES
* [ ] DIMENSIONS ARE mm
* DEBURR ALL SURFACES
* FILLET RAD.: 0.015
* TOLERANCES:
.XX ±0.01
.XXX ±0.005
ANGLE ±1°

MATERIAL: Stainless Steel, Elastomers, and Plastics

FINISH (UNLESS OTHERWISE SPECIFIED): 32 Ra

SCALE: Full

GAMAJET CLEANING SYSTEMS, INC.
2485 Yellow Springs Road
Building One
Malvern, PA 19355

TITLE: E-Z 7 Cut Sheet

EQUIPMENT: Gamajet E-Z 7

DWG. NO. ---

SHEET 1 OF 1

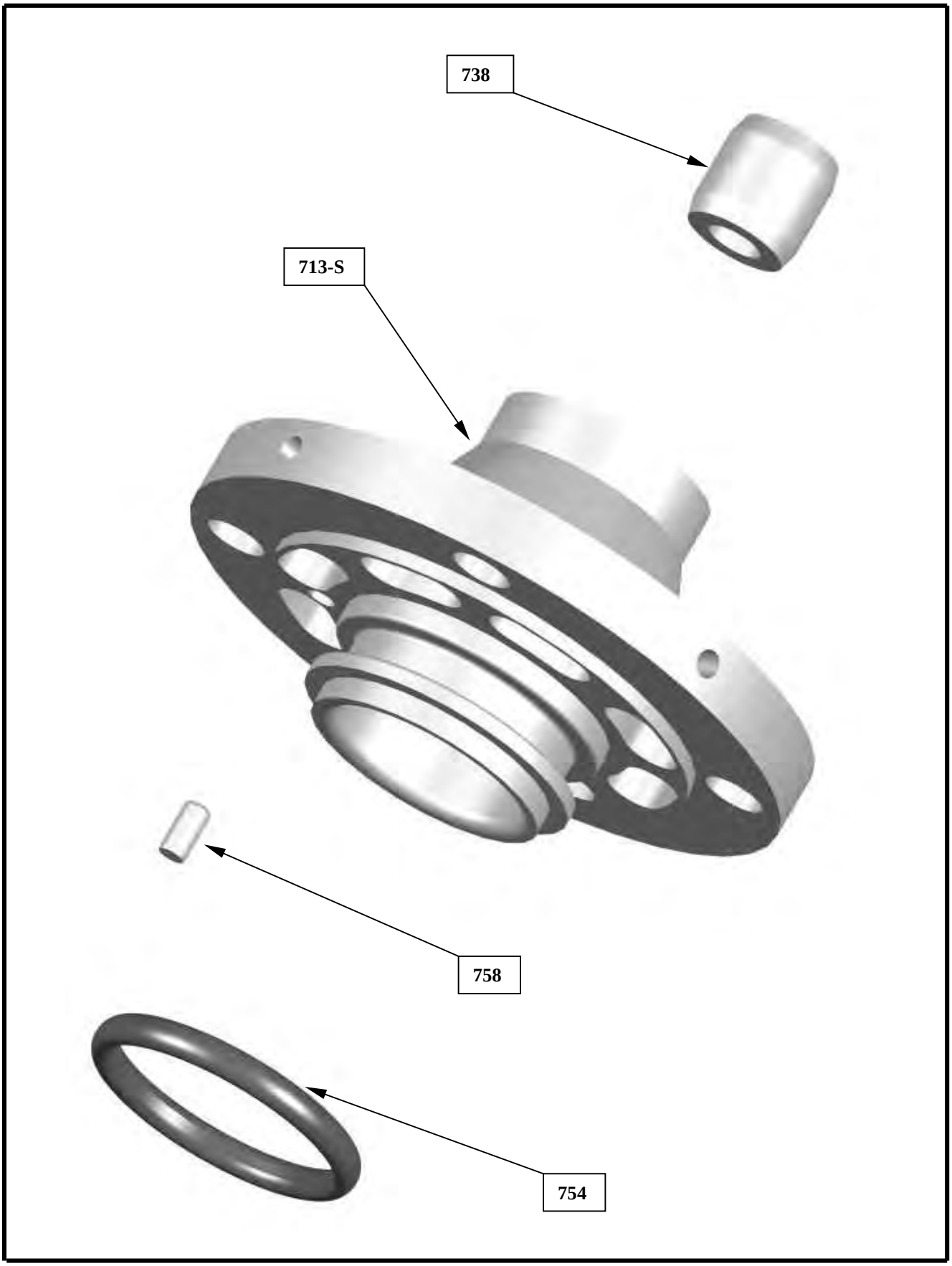
Appendix B –Spare Part List

PART #	PART NAME / DESCRIPTION	QTY.
701-S	INLET COLLAR	1
702-S	STEM CAP	1
703-E	STEM GUIDE (OPTIONAL FOR B-####)	1
703-L	STEM	1
704	TEE HOUSING	1
705-DT	DUAL NOZZLE HOUSING FOR BZ-####	1
705-DN	DUAL NOZZLE HOUSING FOR B-####	1
705-TN	TRIPLE NOZZLE HOUSING FOR B-####	1
706	NAME PLATE	1
707	NOZZLE FOR B-####	1
708-S	GEARHEAD HOUSING	1
709	STATOR	1
710	ROTOR	1
710-AS	ROTOR w/ BEARING (710,739)	1
711	OUTPUT PINION	1
712-L	OUTPUT SHAFT	1
713-S-AS	ROTOR SHAFT BEARING HOUSING w/ BEARING (713-S, 738)	1
714-S	OUTPUT SHAFT SEAL HOUSING	1
715	IDLER SHAFT	2
716	IDLER GEAR	2
717	TEE HOUSING BEVEL GEAR	1
718	NOZZLE HOUSING BEVEL GEAR	1
719	NOZZLE BEVEL GEAR RETAINING RING	1
720	RING GEAR	1
721	RING GEAR RETAINING RING	1
722	INPUT SHAFT	1
723-S	INPUT SHAFT SEAL	1
724-S	OUTPUT SHAFT UPPER SEAL	1
725	OUTPUT SHAFT LOWER SEAL	1
726	GEARHEAD	1
727-T	ROTOR SHAFT LOWER BEARING w/ BEARING	1
728-E	BASE FOR BZ -####	1
728	BASE FOR B - ####	1
729	IDLER SHAFT BASE	1
730	OUTPUT SHAFT LOWER BUSHING	1
731	IDLER GEAR BUSHING	2

732	TEE HOUSING BEARING CUP	2
733	IDLER SHAFT BUSHING	2
734	NOZZLE HOUSING BEARING CUP	2
735	TEE HOUSING UPPER BEARING & SEAL	1
735-B	TEE HOUSING LOWER BEARING	1
735-S	TEE HOUSING LOWER SEAL	1
736	NOZZLE HOUSING BEARING & SEAL	2
740	STEM CAP SCREW	4
741	INLET COLLAR HEX SOCKET SET SCREW	1
742	OUTPUT SHAFT HEX SOCKET SET SCREW	1
743	BASE SCREW	2
744	BASE LOCKWASHER	2
746	ROTOR & OUTPUT PINION LOCKWASHER	2
747	ROTOR & OUTPUT PINION NUT	2
748	T.H.BEVEL GEAR & IDLER SHAFT BASE SCREW	8
749	DRIVE PIN	2
750	GEARHEAD SCREW	2
751-(**E** or V)	STEM CAP SMALL O-RING (**EP** or VITON)	1
751-K	STEM CAP SMALL O-RING (KALREZ)	1
752-(**E** or V)	STEM CAP LARGE O-RING (**EP** or VITON)	1
752-K	STEM CAP LARGE O-RING (KALREZ)	1
754-(**E** or V)	ROTOR SHAFT BEARING HOUSING O-RING (**EP** or VITON)	2
754-K	ROTOR SHAFT BEARING HOUSING O-RING (KALREZ)	2
755-(**E** or V)	TEE HOUSING NOSE O-RING (**EP** or VITON)	1
755-K	TEE HOUSING NOSE O-RING (KALREZ)	1
756	INPUT PINION	1
757-(**E** or V)	NOZZLE O-RING, (**EP** or VITON) FOR B-####	2 or 3
758	GEARHEAD PIN	1
761	MID/OUTPUT STAGE GEARS FOR 726	6
762	INPUT STAGE GEARS FOR 726	3
7-763-E	ROTOR SHAFT HOUSING O-RING (EP)	1
764	INPUT SHAFT SEAL RETAINING RING	1
765	NAME PLATE LOCKWASHER	1

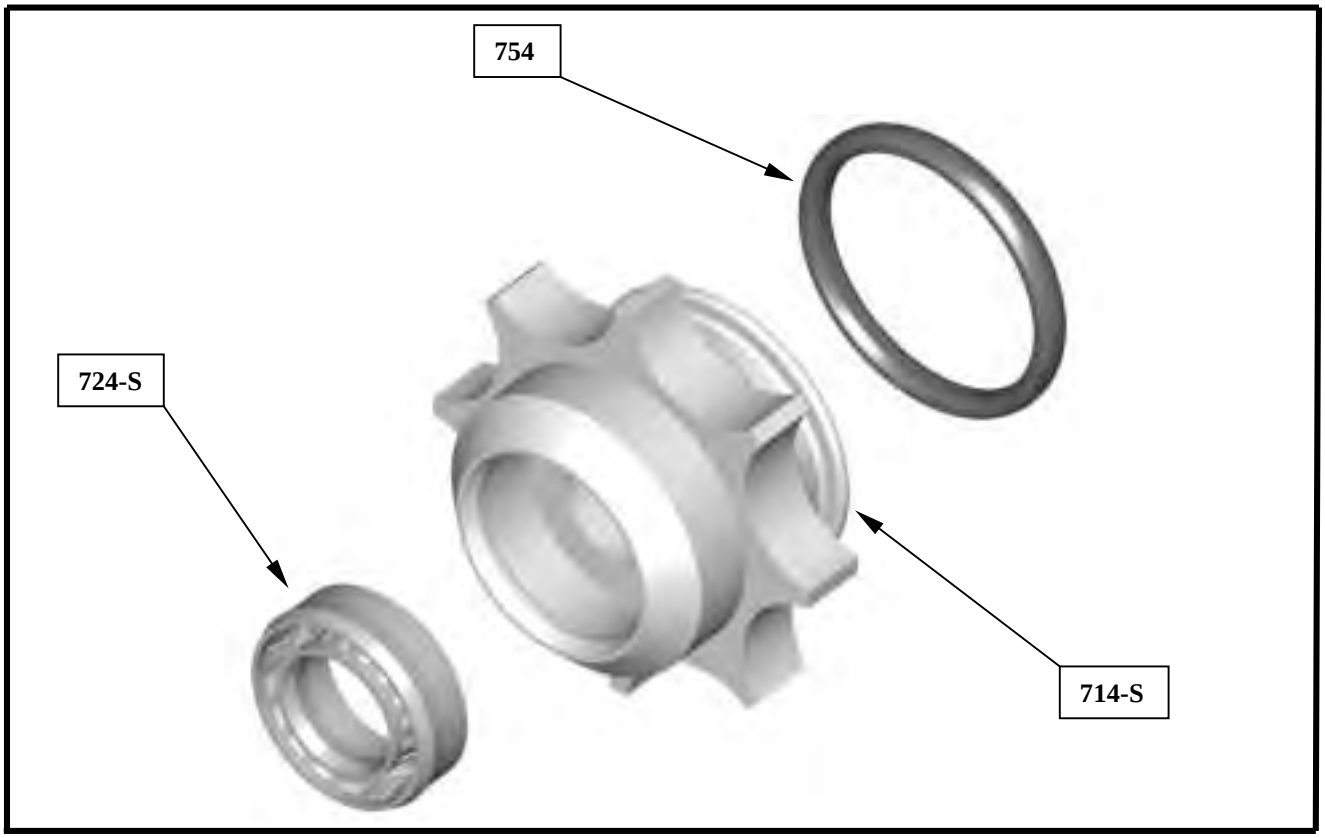
Appendix C – Assembly / Disassembly Steps

GAMAJET E-Z 7 ASSEMBLY
STEP 1: ROTOR SHAFT BEARING HOUSING ASSEMBLY

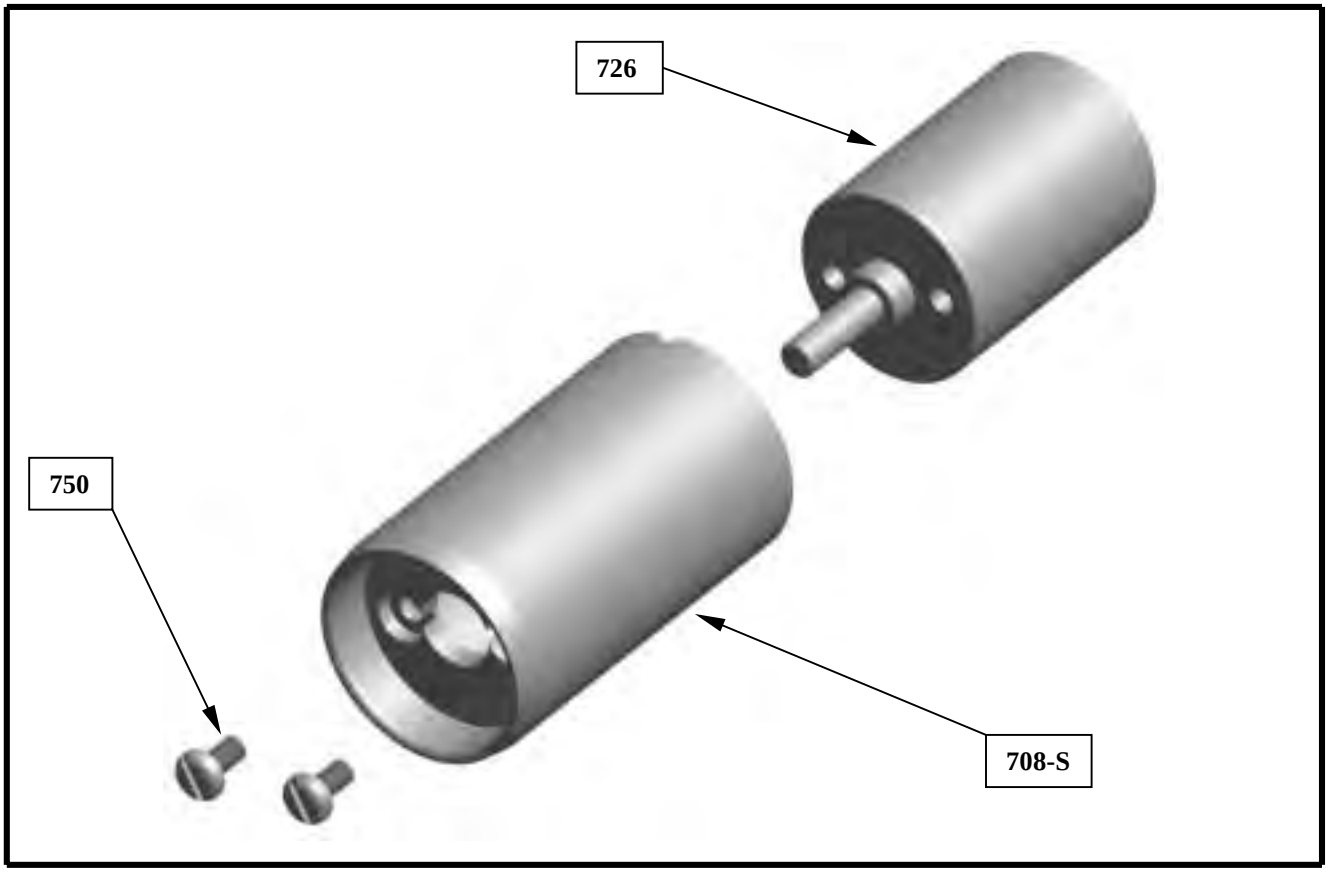


GAMAJET E-Z 7 ASSEMBLY

STEP 2:OUTPUT SHAFT SEAL HOUSING ASSEMBLY

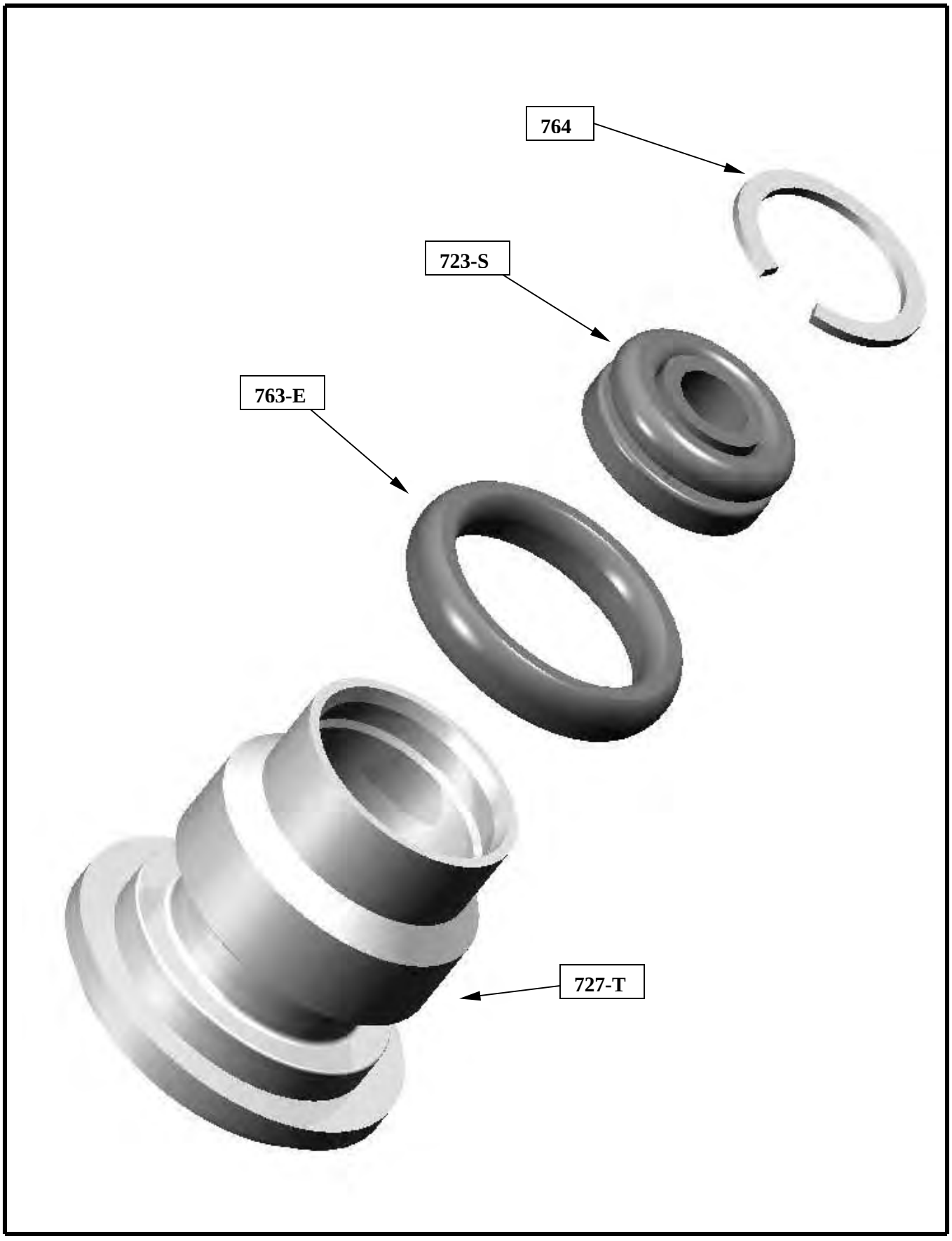


STEP 3:GEARHEAD INSTALLATION



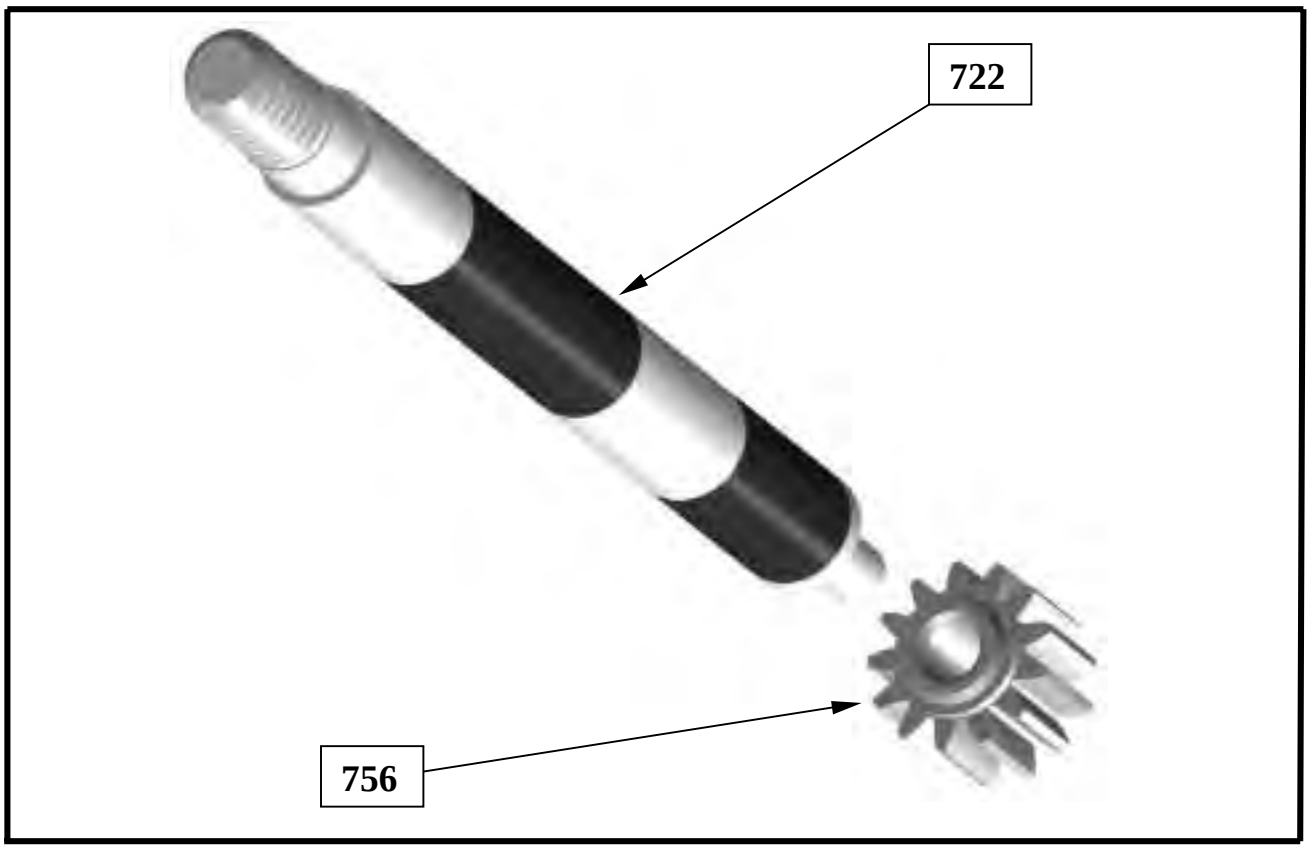
GAMAJET E-Z 7 ASSEMBLY

STEP 4: ROTOR SHAFT LOWER BEARING HOUSING

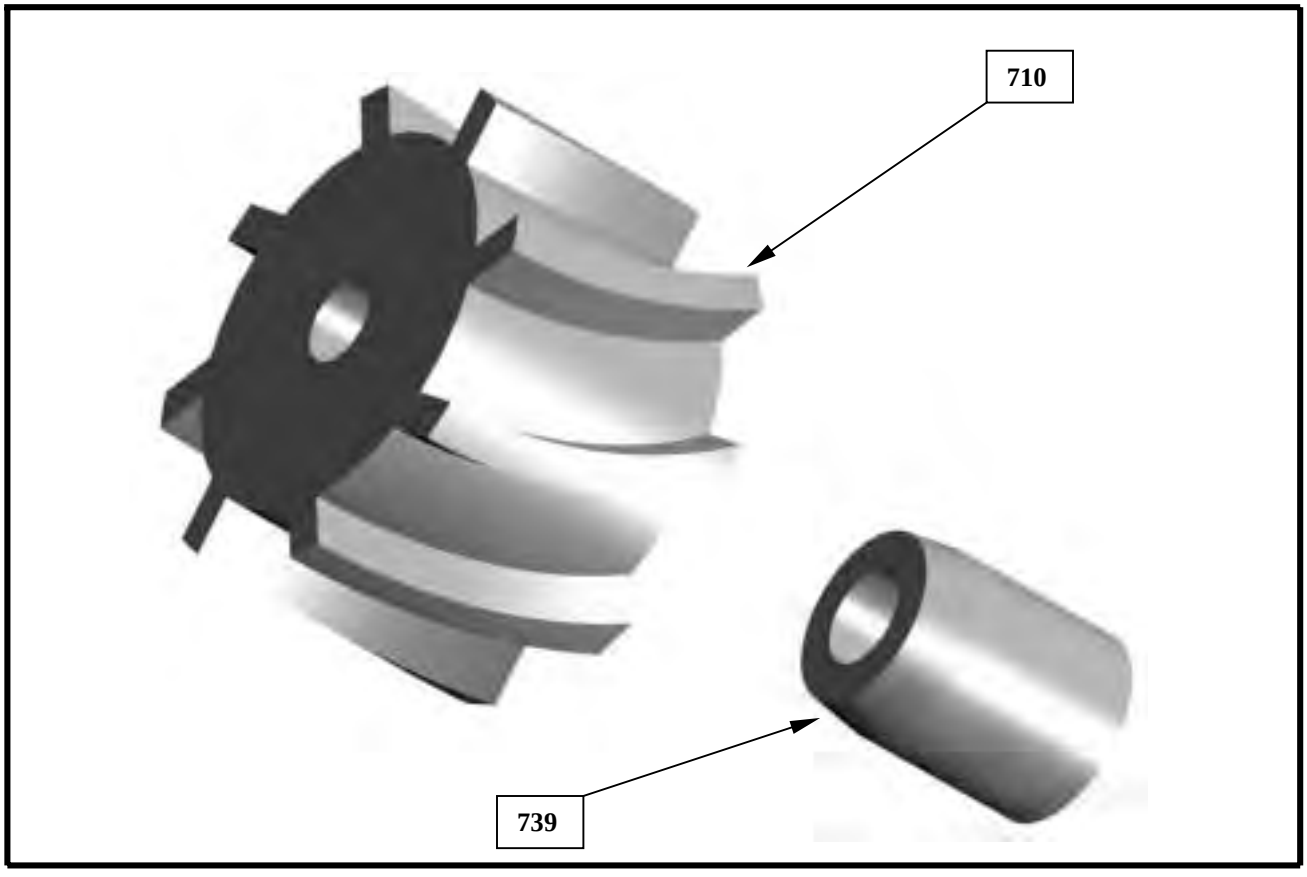


GAMAJET E-Z 7 ASSEMBLY

STEP 5: ROTOR SHAFT ASSEMBLY

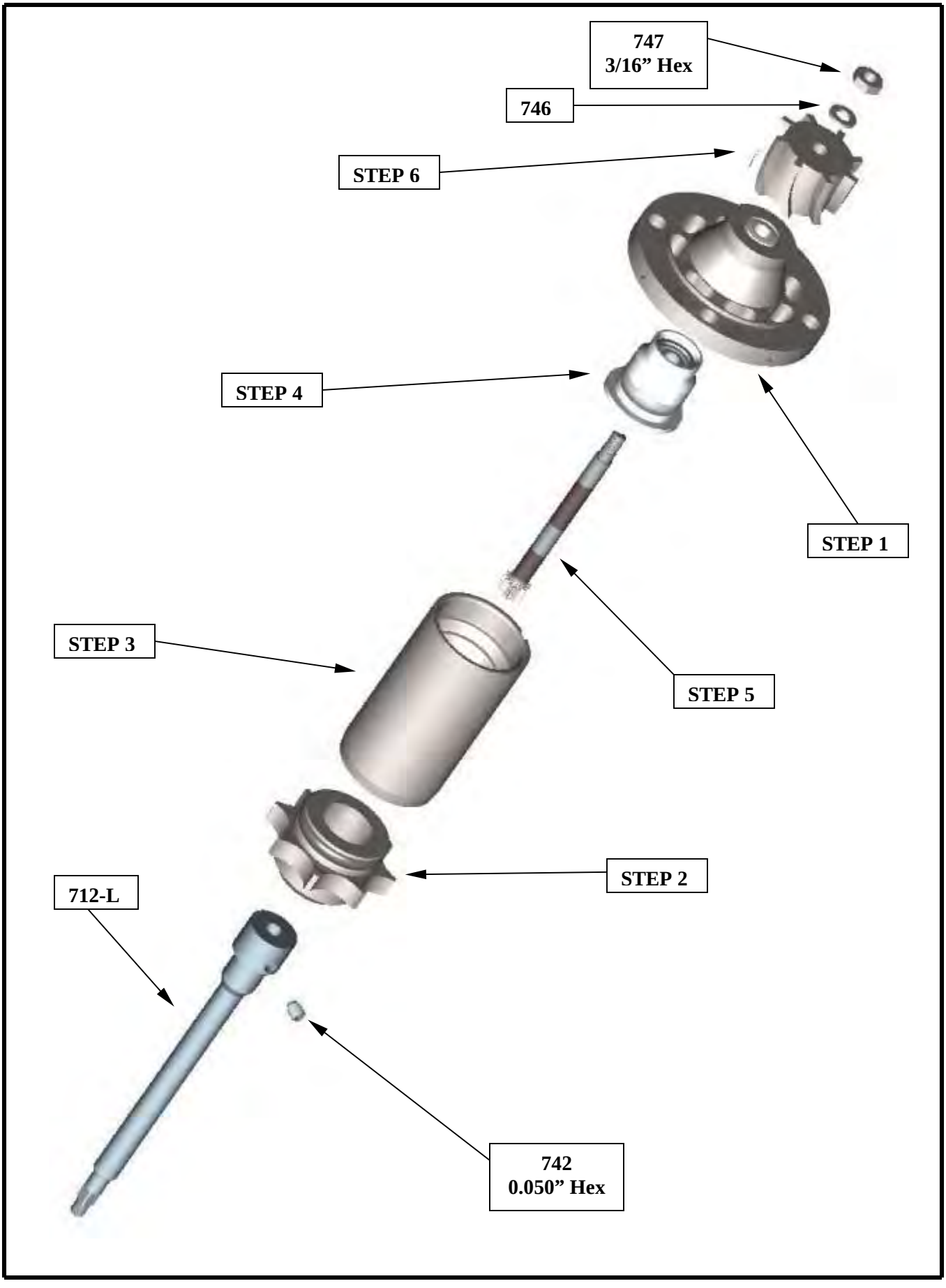


STEP 6: ROTOR ASSEMBLY

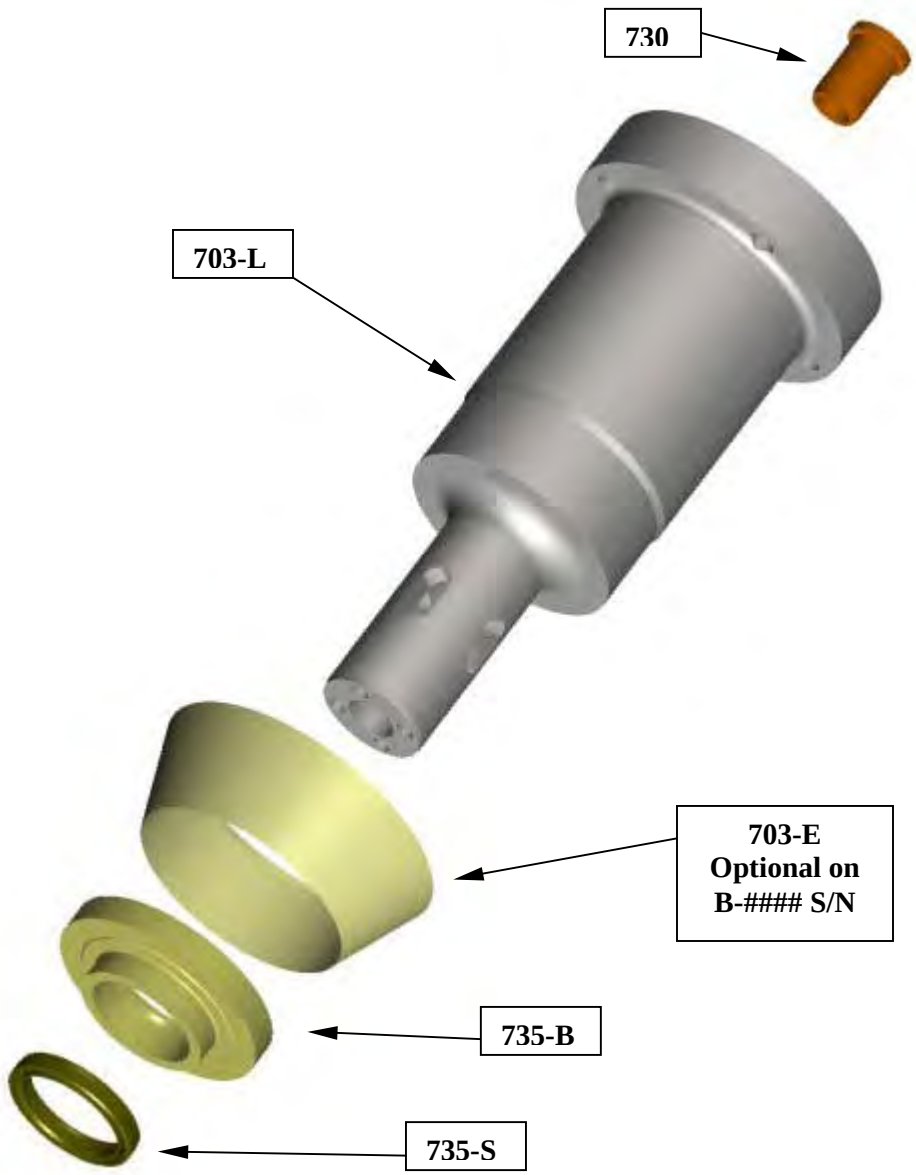


GAMAJET E-Z 7 ASSEMBLY

STEP 7: GEAR TRAIN ASSEMBLY

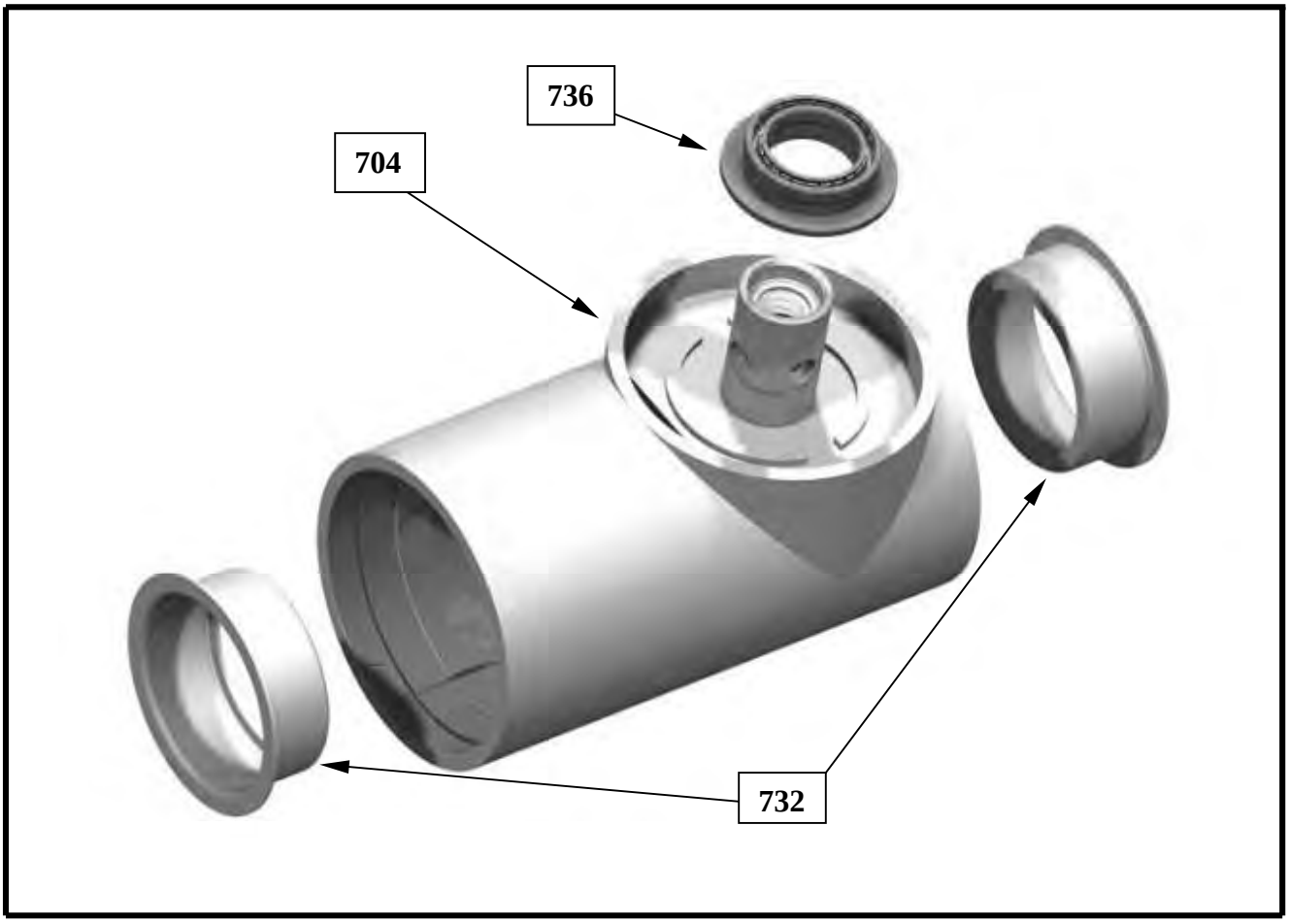


GAMAJET E-Z 7 ASSEMBLY
STEP 8: STEM ASSEMBLY

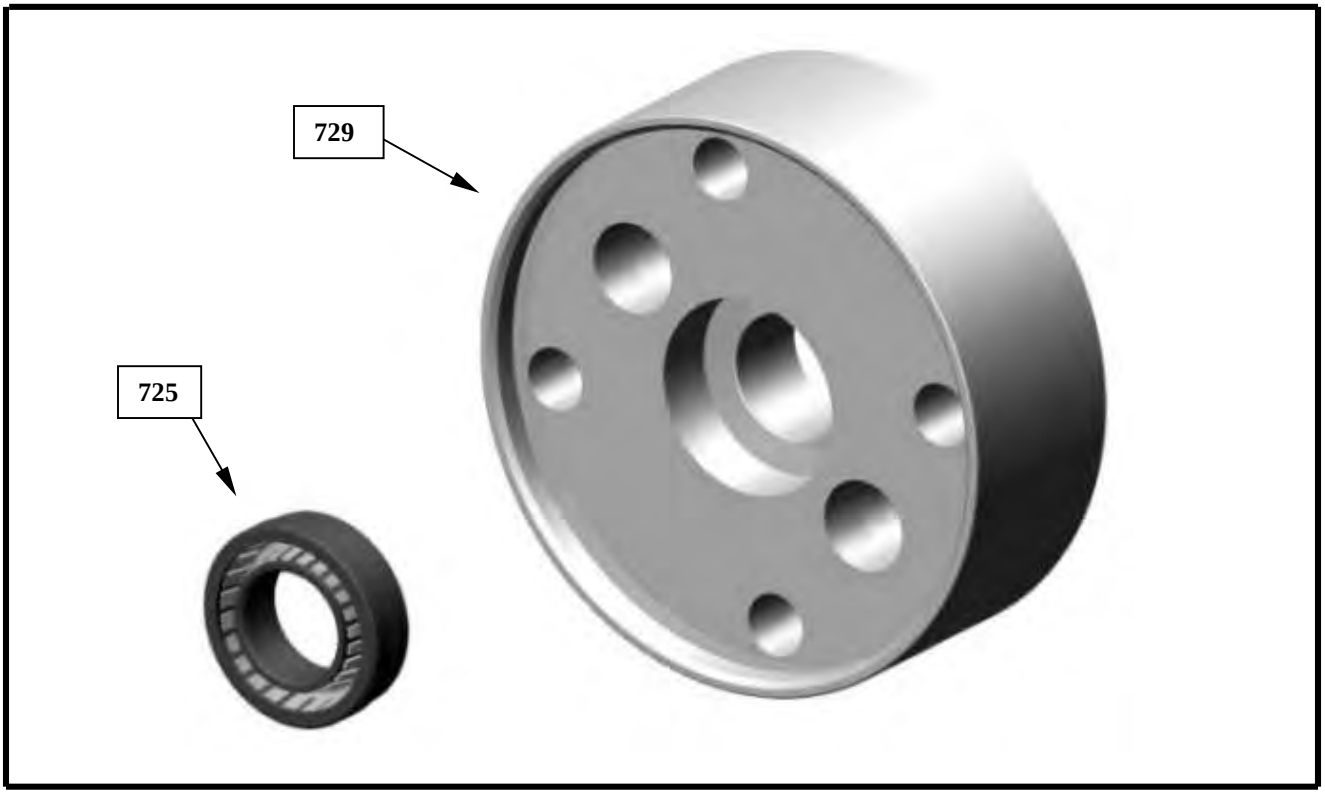


GAMAJET E-Z 7 ASSEMBLY

STEP 9: TEE HOUSING ASSEMBLY

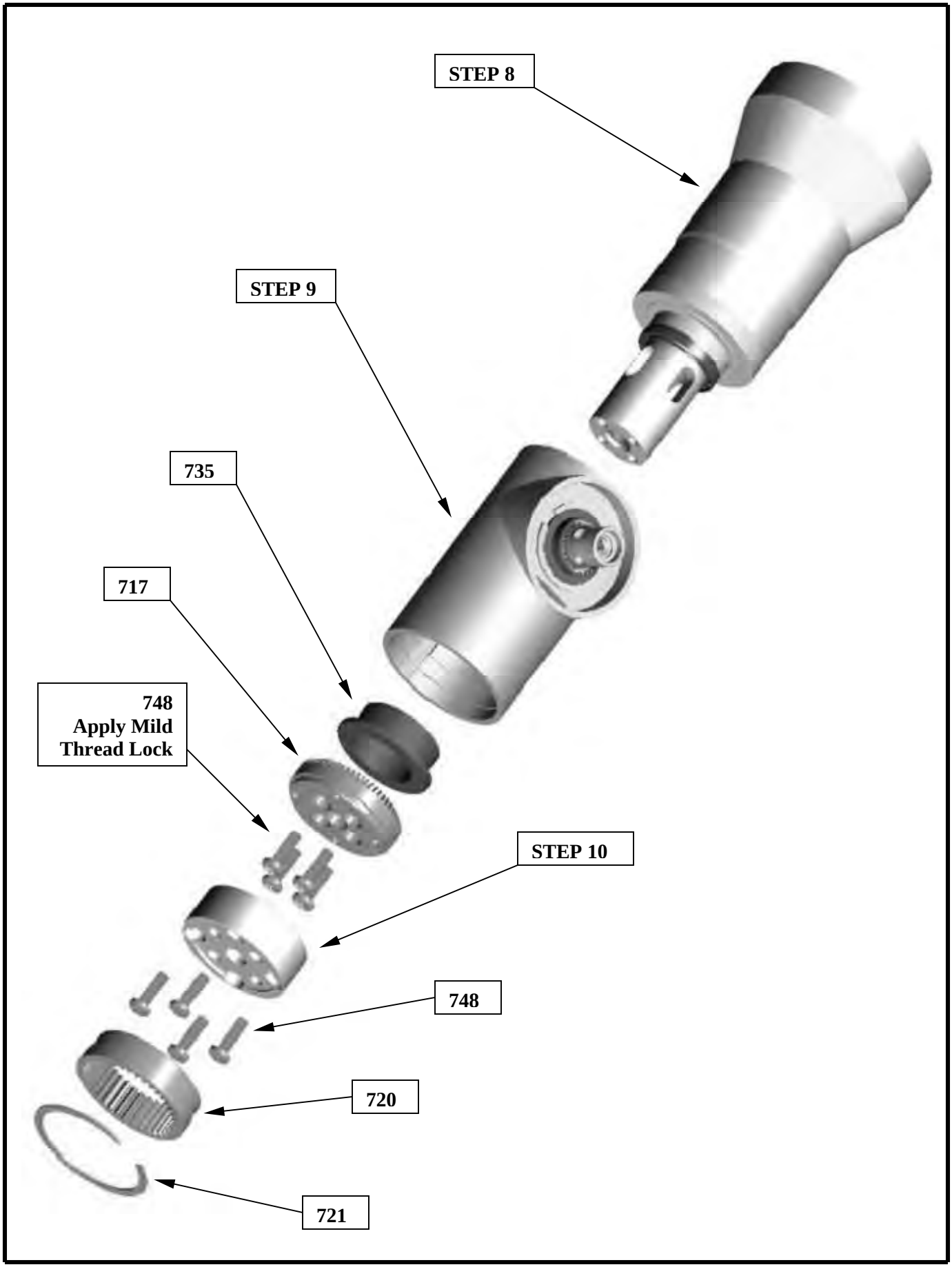


STEP 10: IDLER SHAFT BASE ASSEMBLY



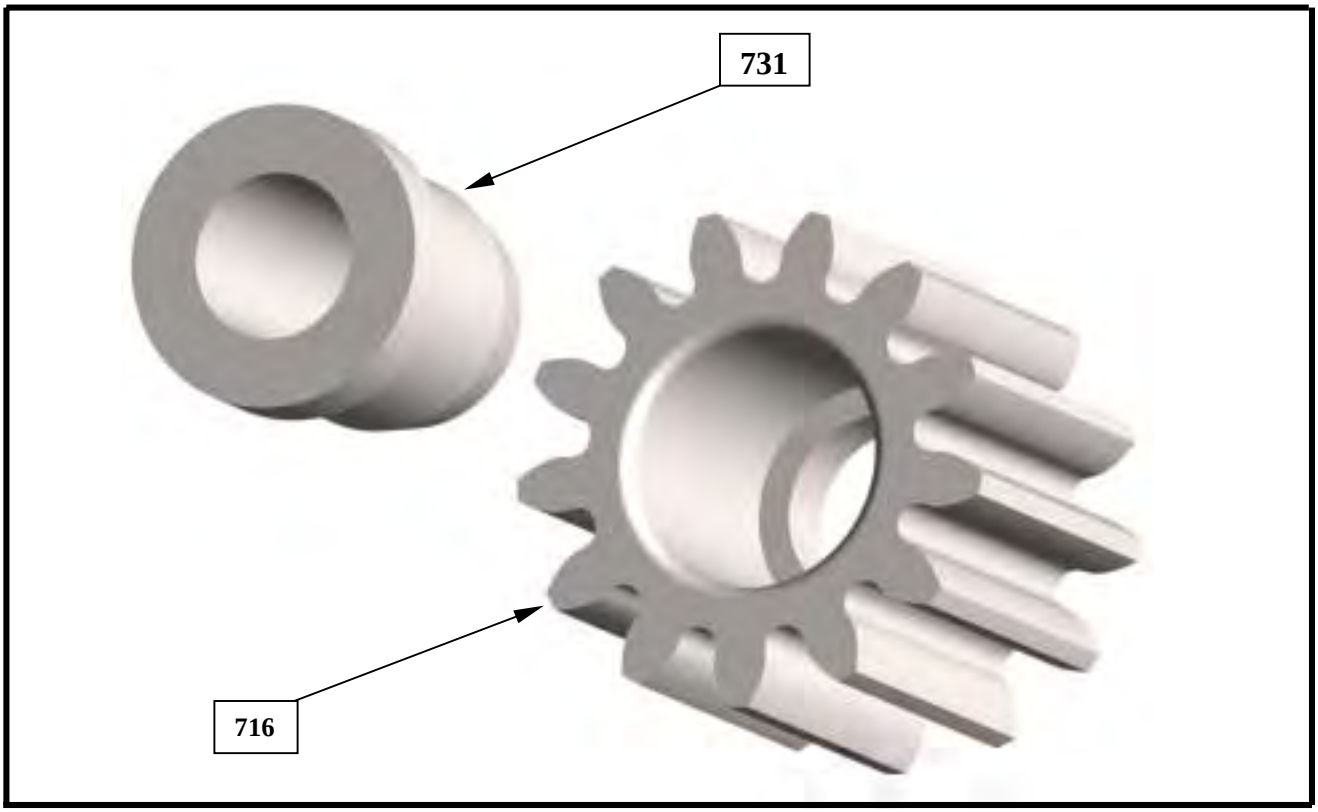
GAMAJET E-Z 7 ASSEMBLY

STEP 11: BODY ASSEMBLY



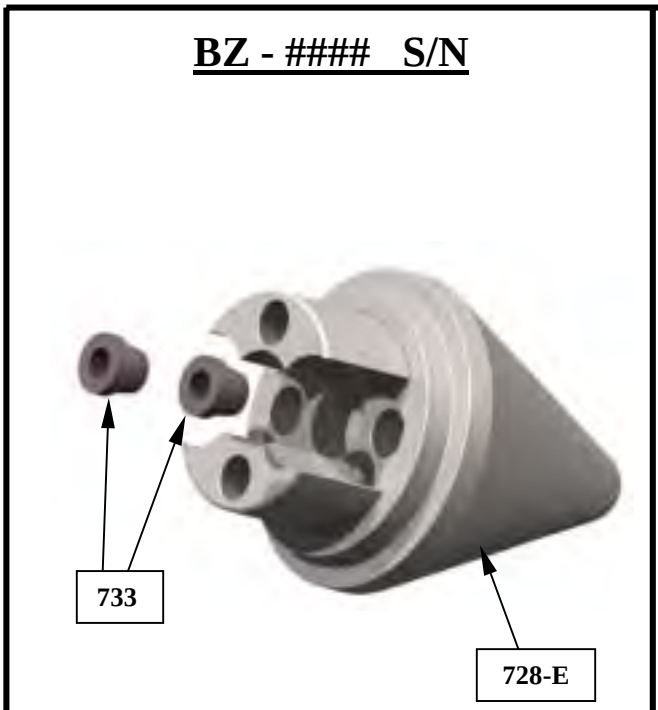
GAMAJET E-Z 7 ASSEMBLY

STEP 12: IDLER GEAR ASSEMBLY

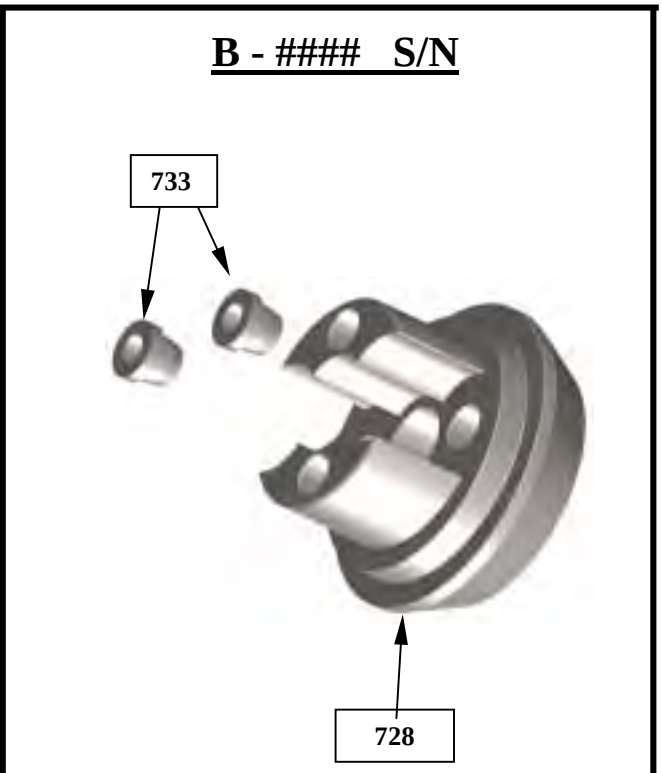


STEP 13: IDLER SHAFT BASE ASSEMBLY

BZ - #### S/N

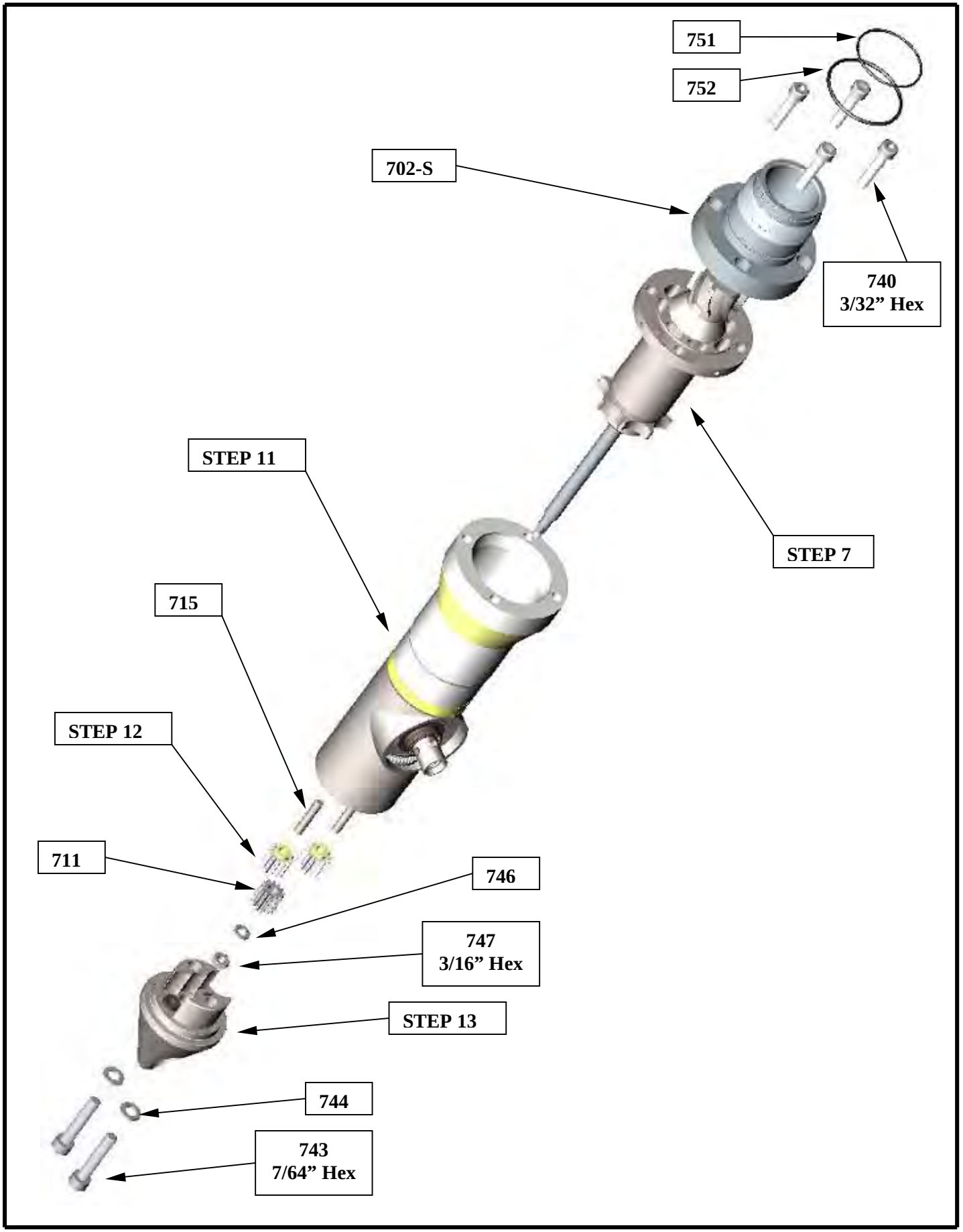


B - #### S/N



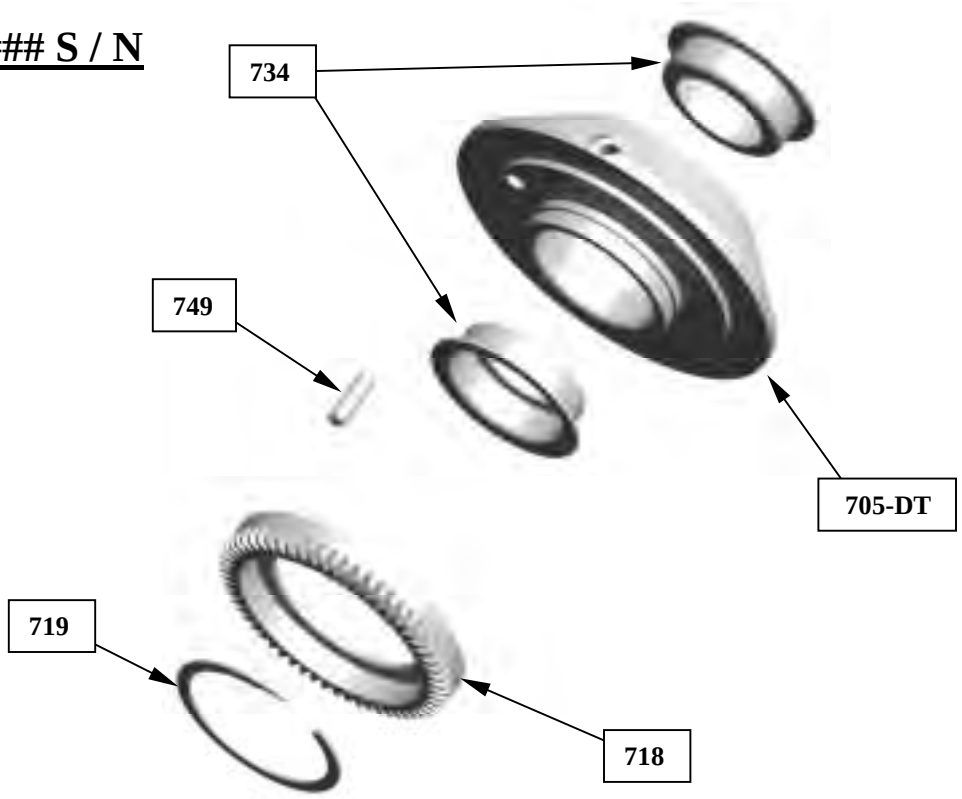
GAMAJET E-Z 7 ASSEMBLY

STEP 14: INSTALLING GEAR TRAIN INTO BODY

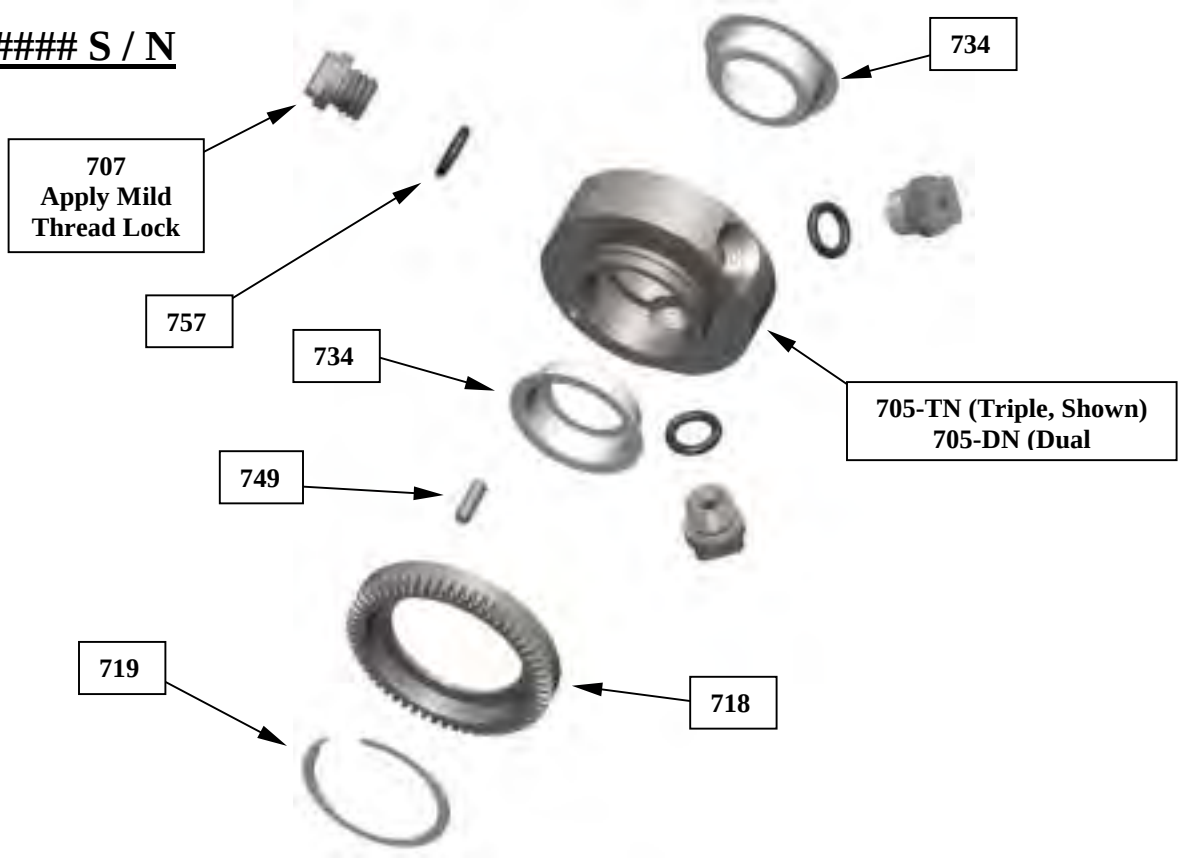


GAMAJET E-Z 7 ASSEMBLY
STEP 15: NOZZLE HOUSING ASSEMBLY

BZ - #### S / N

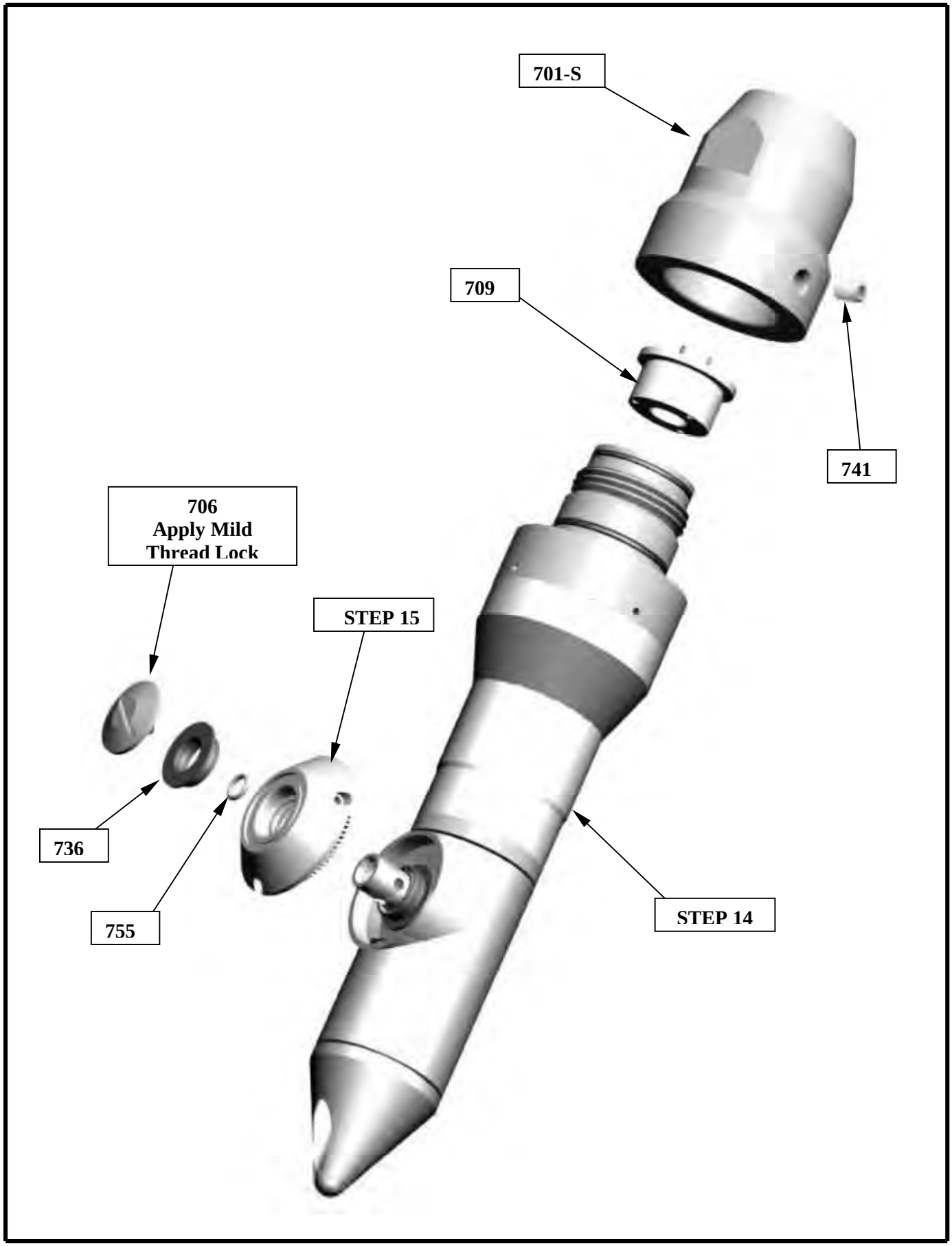


B - #### S / N



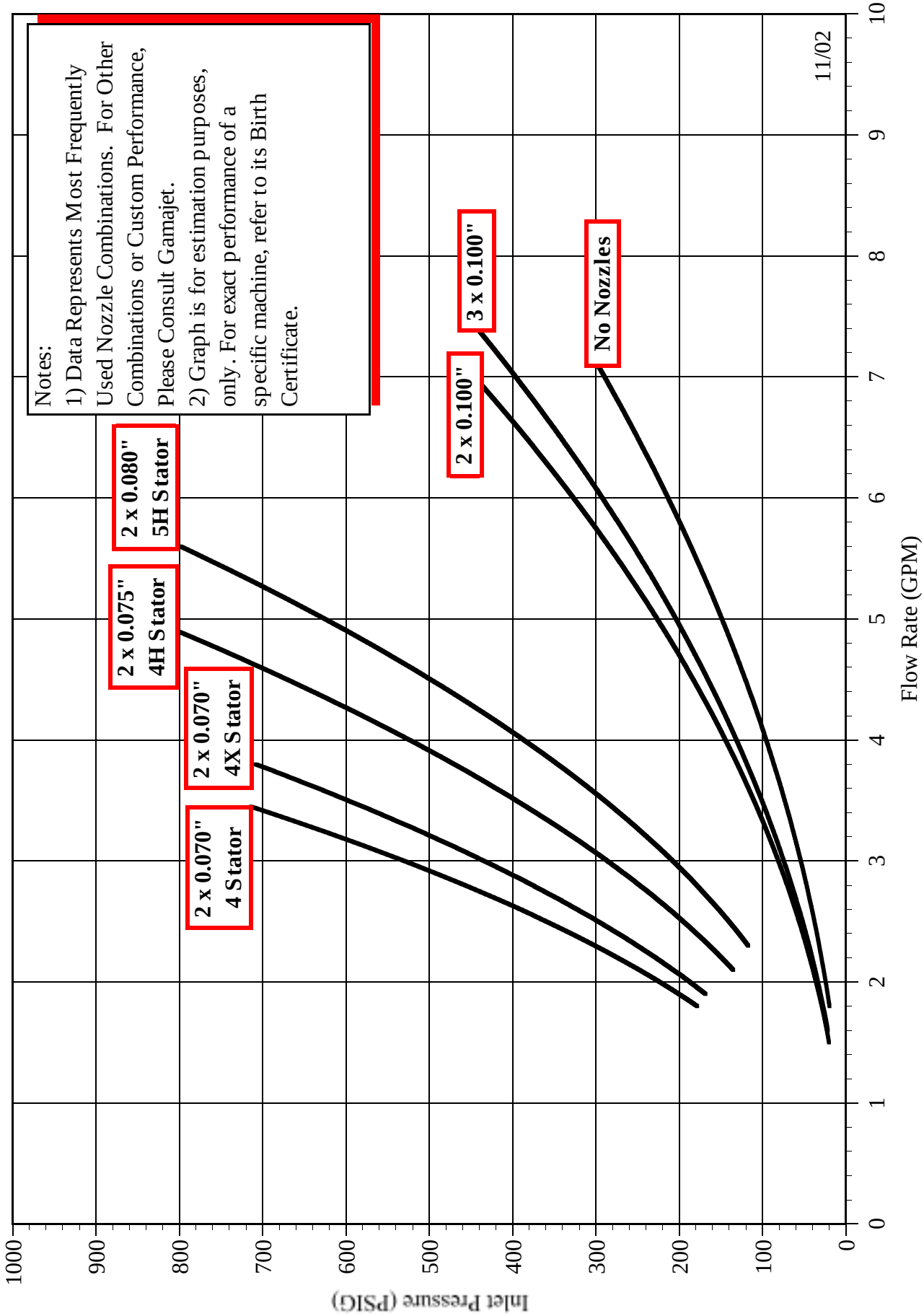
GAMAJET E-Z 7 ASSEMBLY

STEP 16: COMPLETING THE ASSEMBLY

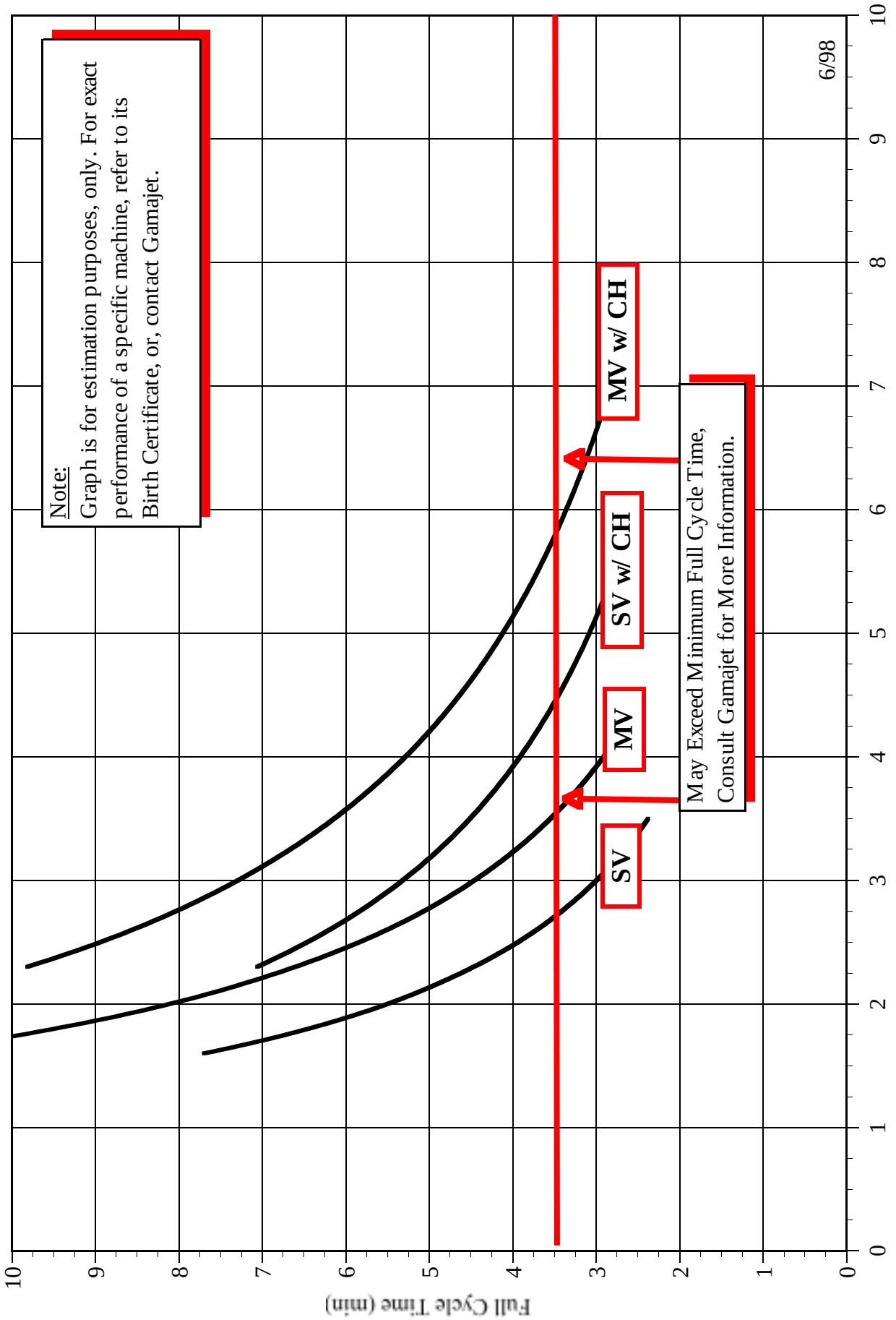


Appendix D – Performance Curves of Common Configurations

Gamajet E-Z 7 - Flow Rate vs. Inlet Pressure



Gamajet E-Z 7 - Flow Rate vs. Full Cycle Time - 0.100" & No Nozzles



Gamajet E-Z 7 - Flow Rate vs. Full Cycle Time - 0.070" - 0.080" Nozzles