OWNER'S MANUAL

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TABLE OF CONTENTS

1 - Introduction

1.1 DESCRIPTION

The Gamajet All-In-One (AIO) is a fluid-driven (turbine-driven) 360° rotary barrel cleaning machine designed to clean the interior surfaces of wine barrels with the bunghole is in the upright position. In addition, it has the unique ability to remove the wash fluid as the barrel is being cleaned. The AIO is powered entirely by the cleaning solution and it requires no electricity, compressed air or lubricant for operation.

<u>WARNING</u>: Under no conditions, whatsoever, should the Gamajet AIO 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 a range of operating conditions, the stainless steel Gamajet AIO is available with four different nozzle sizes, several stators (non-rotating turbine), and O-ring materials. A cut sheet of the Gamajet AIO is contained in Appendix A.

1.2 ICONS USED IN THIS MANUAL

Warning! - The information associated with this icon could cause damage to the machine, barrel with which it is used, or the operator.

Note - A useful piece of information worth remembering.

Assembly/Disassembly Tip - The following information is a tip from Gamajet that will aid you in working on the machine.

1.3 INSTALLATION OF NEW MACHINES

1.3.1 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 #7-404 & #7-405 or Lower Output Shaft #7-420 to rotate. Doing so will damage internal components.

1.3.2 PLUMBING CONNECTIONS

The standard inlet connection for the Gamajet AIO is a ½" NPT female. The vacuum port is 3/8" NPT female. For your convenience, a valve assembly for the inlet, 7-442, comes standard with each AIO. If you elect to use it, the bushing of the assembly threads into the inlet of the AIO, and the inlet to the ball valve is 3/8" NPT female.

It is recommended that the mating male thread be wrapped with PTFE pipe joint tape prior to installation. This will minimize any chance of leakage and will make subsequent removal much easier.

1.3.3 USAGE

Before attaching the supply plumbing to the Gamajet AIO, make sure the supply line has been adequately flushed. Also, ensure that the vacuum line is working before attaching it to the unit's vacuum port.

<u>WARNING</u>: When attaching the Gamajet AIO onto the supply line, ALWAYS apply the wrench to the Collar #7-408 at the top/inlet of the unit. Never use a wrench on any other component to tighten the unit onto the pipe. Doing so risks internally damaging the machine.

As the AIO is inserted into a barrel with its bunghole in the upright position, the bottom foot of the machine will come to rest and support the unit on the opposite side of the barrel. Then, the stopper will center it in the bunghole and prevent any lateral movement. In addition, the stopper know will hold the location of the stopper for future uses.

1.3.4 ENTRY OPENINGS

The Gamajet AIO has been designed to fit through a standard 50mm wine barrel bunghole.

1.3.5 BARREL DRAINAGE

In order to keep the liquid buildup on the bottom of the barrel to a minimum, Gamajet recommends sizing the flow rate for the suction pump to be at least double that of the supply. If the AIO is used in conjunction with the Gamajet Evacublast or Gamavac Systems, the air supply to the suction pump should be capable of delivering 5 SCFM at a minimum of 40 psig.

1.3.6 FILTERS AND STRAINERS

As an accessory, Gamajet sells a strainer to be used in conjunction with the AIO. 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 **0.006" (150 micron, 100 mesh) 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 AIO and, more importantly, the barrel is a must.

1.3.7 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 AIO. PD pumps are fixed volume pumps whose flow rate is dependent upon the rotational speed of the pump; the pumps also have a pressure rating which is the **maximum** operating pressure. **Note: 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 and the Gamajet AIO / plumbing system**. If a PD pump is used, the Gamajet AIO should be sized to, first, match the flow capability of the pump and, second, not exceed the pump's maximum operating pressure (taking the pressure rating of the plumbing system into account, also).

Centrifugal pumps are not designed for use with the Gamajet AIO, because of the high pressure (300+ psig) and low flow rate (4 to 6 gpm) operating conditions of most applications. If a centrifugal pump must be used it will not damage the Gamajet AIO; however, the life expectancy of the pump will be greatly reduced. Please contact Gamajet for consultation before using a Gamajet AIO with a centrifugal pump.

1.3.8 INITIAL STARTUP

Every AIO that ships is accompanied by a Birth Certificate. This document indicates how the AIO performed in our testing tank before it shipped based on the operating conditions supplied to Gamajet. To ensure the longest possible life of the AIO, please verify the operating conditions and, most importantly, the machine's cycle time. The cycle time can be measured by picking a fixed point inside of a vessel as a reference and timing how long it takes the same nozzle to pass back over that point in the vessel. (This, naturally, will not be the exact same spot because the spray pattern is indexing.) To calculate the full cycle time in minutes, multiply this timed value in seconds by 0.75 (3/4).

1.4 SAFETY

When the AIO is operating the Stopper, #7-426, should be firmly inserted into the barrel's bunghole. The Stopper is designed to withstand the full force of the jet striking it, and should create a tight seal. Turn the Locking Knob, #7-439, to hold it in place.

2 - Disassembly, Repair, and Reassembly

2.1 TOOLS REQUIRED

Needle Nose Pliers
5/64, 7/64" and 9/64" (Ball-Tip) Hex Keys (Allen Wrench)
1/8", and ¼" Slotted Screwdrivers
#1 Phillips Screwdriver
11/32" Hex Socket and Ratchet, or, equivalent Nut Driver.
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

Notes: The appropriate step(s) in Appendix C is/are indicated at the beginning of each section. Also, for simplicity the "7-" prefix to the part number has been eliminated in all of the following instructions.

To prevent damage to the sealing surface, use a pick made from brass when removing O-rings and seals.

2.2.1 TEE HOUSING CAP

Step – 19

- Unscrew the Output Shaft Lower Coupling #416 from the Output Shaft #412 (Step 14).
- Using a 5/64" Hex Key, remove the Output Shaft Jam Screw #455, and, using a 1/8" slotted screwdriver, remove the Output Shaft Set Screw #454 from the Tee Housing Cap #414.
- Unthread the #414 from the Tee Housing #404 (Step 18). **Tip**: The #414 is a Left-Hand Thread.

- Unscrew the Tee Housing Assembly (Step 18) from the Supply Tube (Step 14). **Tip**: Again, this is a Left-Hand Thread.

2.2.2 TEE HOUSING

Step – 18

- Unscrew the Nozzle Housing Cover Plate #406 with a ¼" slotted screwdriver.
- Pull the Nozzle Housing #405 (Step 17) from the nose of the Tee Housing #404
- Unthread and remove the Stem Cap #430 (Step 16). **Tip**: The Stem Cap is a Left-Hand Thread.

- Pull the #404 from the Stem #403 (Step 15).
- Remove the Tee Housing Bevel Gear #417 and the Upper Tee Housing Bearing #431-U by pulling the #417 from the #403.

2.2.3 OUTPUT SHAFT AND SUPPLY TUBE

Steps – 12 and 14

- Pull the Output Shaft #412 (Step 13) from the remainder of the Drive Body.
- Remove the Output Cap #446 (Step 11) by, first, unscrewing the Cap Screws #452 using a 9/64" hex key and, then, pulling it from the Drive Body. **Tip:** A Ball-Tip hex key will help in the removal of the screws.

2.2.4 INLET COLLAR, CAP AND GEARTRAIN

Step - 10

- Remove any plumbing that is connected to the vacuum port of the Housing #444 (Step 9). If this is not done, it will be impossible to remove the Gear Train (Step 8).
- Loosen the Collar Set Screw #9-140 with a 5/64" Hex Key, minimum 2 turns.
- Remove the Collar #408 and Stator #9-109.
- Using a 7/64" Hex Key, remove the Cap Screws #9-138 from the #444 (Step 9).
- Remove the #402 from the body.
- Push the Gear Train (Step 8) from the #444.

2.3 INSPECTION AND SERVICE OF COMPONENTS

2.3.1 STATOR

Step - 10

- Inspect the through holes of the Stator #9-109 to be sure that they are clear.

2.3.2 O-RINGS

2.3.2.1 Housing O-rings

Step - 9

- Inspect the Housing O-rings #458 for deterioration (compression set or hardening) or damage and replace if necessary.

2.3.2.2 Collar O-rings

Step – 10

- Inspect the Small and Large Collar O-rings, #9-142-E and #9-141-E, for deterioration (compression set or hardening) or damage and replace if necessary.

2.3.2.3 Supply Tube and Output Cap O-rings

Steps – 11, 12, 19

- Inspect the Output Cap O-ring #457 for deterioration (compression set or hardening) or damage and replace if necessary.
- Using a 1/8" slotted screwdriver, remove the Supply Tube Retaining Ring #9-119 from the Supply Tube #425.

- Pull the Output Cap #446 from the #425.
- Inspect the Supply Tube O-ring #459 for deterioration (compression set or hardening) or damage and replace if necessary.
- When reassembling, ensure that the opening in #9-119 is aligned with the notch at the end of #425.
- Inspect the Supply Tube Lower O-ring #640-E for deterioration (compression set or hardening) or damage and replace if necessary.

2.3.3 GEAR TRAIN ASSEMBLY

2.3.3.1 General Disassembly and Inspection

Step – 8

- Pull and twist the Vacuum Chamber #438 (Step 7) from the Gearbox #401 (Step 3).
- Remove the Gearhead Lower Bearing Housing #429 (Step 2) from the component to which it stayed attached. If it is the #401, simply pull and twist; if it is the #438, push it out using the Output Shaft #412.
- Unscrew the Rotor Nut #8-545 with an 11/32" socket and remove it with the Lockwasher #8-544 from the Input Shaft #422 (Step 4).
- Remove the Rotor #9-110 (Step 5) from the #422. If needed, use a slotted screwdriver for assistance.
- Ensuring that the Gear Train is oriented with the #422 up, carefully remove the Input Shaft Upper Bearing Housing #428 (Step 1) by holding down the #422 with one finger and pulling and twisting the #428 from the Gear Train. Applying downward pressure on the #422 ensures that none of the internal gearing is dislodged when the #428 is removed.
- Remove the #422 from the #401.
- Inspect the #9-115 for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring), replace as required.

2.3.3.2 Gearhead Internals

Step – 3

Tip: To prevent the internal components of the Planetary Gearhead from unexpected spilling out, make sure that all steps are done with the input side of the assembly facing up.

- Using a #1 Phillips screwdriver, unscrew the Gearhead Screws #9-139 from the Gearhead #413.
- Remove the #413 from the Gearbox #401 by pushing up on the shaft of the #413.

<u>WARNING:</u> If you suspect that the #413 requires service, proceed with caution. If at any time you do not feel completely comfortable servicing #413, contact Gamajet Cleaning Systems immediately.

- Using a needle nose pliers carefully remove the internal components of the #413. As they are removed, be sure to arrange them is such a way that they are reinstalled in the same order as they were removed. Examine the gears of the four 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.

- During reassembly, Gamajet recommends the gearhead be lightly repacked using food-grade grease. Please contact Gamajet for a recommendation.

2.3.3.3 Input Shaft Housing Assembly

Steps – 1, 4, 5, 6

- Inspect the Input Pinion #411 for hairline cracks on the end face or for worn, damaged, or sharp/pointed teeth. #411 should be tight to the Rotor Shaft #422 and the Input Pinion Spacer #447. #447 should not be able to spin on the #422. Press #411 back onto #422 if it has slipped, or replace if cracked or worn.
- Inspected the #447 for signs of wear from contacting the carbide #8-548. Replace if the overall length is **0.123"** or less.
- Check for signs of scoring and wear on #422. Replace if the coating has chipped or cracked.
- The Pin #6-143 should be firmly pressed into the Input Shaft Upper Bearing Housing #428.
- The through holes of the #428 should be clear and free of debris.
- The #8-548 in the Rotor #9-110 and #428 should protrude slightly. In addition, their running surfaces should be smooth, flat, and free of chips and cracks.
- Inspect the Input Shaft Seal #E-867 (inside the Input Shaft Lower Bearing Housing #9-127) for wear by placing the #422 back through it. There will be drag if the #E-867 is still good. If it needs to be replaced, pry out the old #E-867 (using a brass pick), and replace it with a new one. Ensure that the seal is as square as possible to the #9-127 when installing it. The internal spring should be up and visible. Apply even pressure using a flat-faced pin and push until it snaps behind the gland's internal lip.
- Check the Lower Bearing Housing O-ring #642-E and Seal #9-116 for deterioration or damage, replace (using a brass pick to remove the old components) if necessary. The #9-116 should be installed so its internal spring is up and visible.

2.3.3.4 Gearhead Lower Bearing Housing and Output Shaft Assembly

Steps – 2 and 13

- Check the Output Shaft #412 and Output Shaft Coupling #437 for signs of scoring or wear, especially in the area of contact with the Output Shaft Upper Seal #9-120, Output Shaft Mid Seal #451, and Output Shaft Lower Seal #450. Replace if worn.
- Inspect the center bore and top discharge holes of the #412 for any trapped debris. Remove if found.
- Examine the #9-120 for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring). Also, ensure that it still has interference with the #437 by passing the #437 through the center of the seal. There will be a noticeable drag if the seal is still good. If the #9-120 must be replaced, remove the Retaining Ring #9-123 using a small slotted screwdriver and the Upper Seal Spacer #436. Then, pry out the old #9-120 (using a brass pick), and replace it with a new one. The new #9-120 should be installed with the spring facing out and visible after it is installed.
- Check the inside diameter of the Output Shaft Upper Bearing #9-145. It should not be greater than **0.380**". Inspect the face of the #9-145 for signs of wear from contacting the #437. Replace if necessary.

- Check the Bearing Housing Large O-ring #640-E and Small O-ring #456 for deterioration or damage, replace (using a brass pick to remove the old components) if necessary.

2.3.3.5 Vacuum Chamber

Step – 7

- The Pin #E-866 should be firmly pressed into the Vacuum Chamber #438.
- Examine the Output Shaft Mid Seal #451 for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring). Also, ensure that it still has interference with the Output Shaft #412 by passing the #412 through the center of the seal. There will be a slight drag if the seal is still good. If the #451 must be replaced, remove the Retaining Ring #464 using a small slotted screwdriver. Then, pry out the old #451 (using a brass pick), and replace it with a new one. The new #451 should be installed with the spring facing out and visible after it is installed.
- Check the inside diameter of the Output Shaft Mid Bearing #445. It should not be greater than **0.659**". Replace if necessary.
- Inspect the outer through holes that run the length of the part; they should be free of debris.

2.3.4 NOZZLE HOUSING

Steps – 17 and 18

- Inspect the orifice openings in the Nozzle Housing #405 for debris. The inside diameter of each opening must be smooth, round, and free of damage (especially any nicks) for maximum jet impact. In order to maintain the original flow rate and pressure, replace the #405 if the openings are deformed or oversized.
- Inspect the Nozzle Housing Bevel Gear #418 for wear such as sharp/pointed or worn teeth. If it needs to be replaced, remove the Bevel Gear Snap Ring #466 with a small slotted screwdriver and pry #418 from the #405.
- Inspect the Nozzle Housing Bearings #433. Clean any deposits from the exterior of #433 and check their fit in the #405. The external ring may be a tight fit with the inside of the #405. Once installed, however, the body of the #433 should turn freely. Also, the internal O-ring should be free from damage, compression set, or deterioration.
- Clean any deposits from inner bore of #405 and examine for excessive wear. Light scoring is acceptable, but the #405 should be replaced if the inside diameter exceeds **0.504"**.

2.3.5 TEE HOUSING AND TEE HOUSING BASE

Step – 18

- Check the water outlets on the nose of the Tee Housing #404; they should be free of debris.
- Inspect the Tee Housing Bevel Gear #417 for worn, damaged or sharp/pointed teeth.
- Inspect the Tee Housing Bearings #431-U and #431-L. Clean any deposits from the exterior of them and check their fit in the #404. The external ring may be a tight fit with the inside of the #404. Once installed, however, the body of the #431 should turn freely. Also, the internal O-ring should be free from damage, compression set, or deterioration.

- Clean any deposits from the internal bore of the #404 and examine for excessive wear. Light scoring is acceptable, but the #404 should be replaced if the inside diameter exceeds **0.928”**.
- Inspect the Tee Housing O-ring #461 for deterioration (compression set or hardening) or damage and replace if necessary.
- Inspect the Nozzle Housing Cover Plate O-ring #463 for deterioration (compression set or hardening) or damage and replace if necessary.

2.3.6 STEM AND STEM CAP

Steps – 15 and 16

- Inspect the water outlets of the Stem #403; they should be free of debris.
- The Pin #440 should be firmly pressed into the #403.
- Examine the Output Shaft Lower Seal #450 for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring). Also, ensure that it still has interference with the Output Shaft #412 by passing the #412 through the center of the seal. There will be a slight drag if the seal is still good. If the #450 must be replaced, remove the Retaining Ring #465 using a small slotted screwdriver. Then, pull out the Output Shaft Lower Bushing #424 along with the old #450 (using a brass pick), and replace it with a new one. The new #450 should be installed with the spring facing down and not be visible after it is installed.
- Check the inside diameter of the #424. It should not be greater than **0.596**”. Replace if necessary.
- Inspect the Stem Cap O-ring #751-E for deterioration (compression set or hardening) or damage and replace if necessary.

2.3.7 FOOT

Step – 20

- Inspect the center bore of the Lower Output Shaft #420 (Step 19) for any trapped debris. Remove if found.
- Verify that the Foot #419 rotates freely about the #420, and can easily move up and down. If no force is applied, the internal spring should fully extend the #419. When compressed, the tip of #420 should be even with the top of the inlet notches of the #419. If any of these items are not the case, or, if there is excessive play in the movement of the #419, further disassembly is required.
- Start by removing the Lower Retaining Ring #434 with the aid of a small screwdriver.
- Pull the #419 back to reveal the Foot Bushings #423 and Spring #432.
- If the #432 has failed, replace it.
- If the inside diameter of the #423 exceeds **0.680”**, or, the outside diameter is less than **0.990”**, or, the length is less than **0.230”**, replace them.

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 to be serviced. Also, it may cause misalignment of parts and the potential for premature failure.

- 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. A lithium-based grease is acceptable for Viton® O-rings, however.
- Refer to the illustrations in Appendix C for clarification during reassembly.

2.4.2 GEAR TRAIN

Steps – 1 thru 8

- Install the Planetary Gearhead #413 back into the Gearbox #401.
- After aligning the screw holes, thread the Gearhead Screws #9-139 back into the #413 using a #1 Phillips screwdriver. Make hand tight.
- Press the Gearbox Seal #9-115 onto the Input Shaft Upper Bearing Housing #428. The seal's internal spring should be toward the part and not visible.
- Insert the Input Shaft #422 through the Input Shaft Lower Bearing Housing #9-127.
- Insert the #9-127 into the #428.
- To ease installation of this assembly into the #413, extend the #422 slightly so the engagement of the Input Pinion #411 with the top gears of the #413 is visible. Once they are engaged, push the #428 assembly into the #401, making sure to align the Pin #6-143 with the slot in #401,
- Place the Rotor #9-110 over the end of the #422.
- Install the Lockwasher #8-544 and Nut #8-545 using an 11/32" socket. Hold the #9-110 stationary with a pair of pliers while tightening the #8-545.
- Push the Gearhead Lower Bearing Housing #429 into the #401.
- Install the Vacuum Chamber #438 onto the #429.

2.4.3 DRIVE BODY

Step - 10

- Place the Input Cap #402 onto the Gear Train (Step 8). **Tip:** Turn this assembly upside down with the #402 resting on the table.
- Invert the Housing #444 (Step 9) and drop it over the Gear Train. Ensure that the vacuum port of the #444 is aligned with the opening in the Vacuum Chamber #438. Press on the bottom of the #444 until its top comes to rest on the #402.
- Screw the Cap Screws #9-138, using a 7/64" Hex Key, and Lockwashers #8-552 into the #444. Hand-tighten in a star pattern.
- Place the Stator #9-109 into the #402.
- Thread the Collar #408 onto the #402 until is stops and captures the #9-109.
- Tighten the Collar Set Screw #9-140 using a 5/64" Hex Key.

2.4.4 SUPPLY TUBE AND OUTPUT SHAFT

Steps – 12 and 14

- Align the notch at the end of the Supply Tube #425 with the pin in the Vacuum Chamber #438, and push the Output Cap #446 into the Housing #444.
- Screw the Cap Screw #452 and Lockwasher #8-544 into the #444 using a 9/64" Hex Key. Hand-tighten in a star pattern. **Tip:** A Ball-Tip hex key will help in the installation of the screws.

- Insert the Output Shaft #412, Coupling #437 first, into the end of the #425. There will be a slight resistance as it passes through each seal. The shaft is fully installed when the #437 comes to rest on the Output Shaft Upper Bearing #9-145 (Step 2). Look through the vacuum port of the #444 to ensure that this is the case. Twisting the #412 may be necessary to align the #437 with the Gearhead #413 (Step 3).
- Ensure that the Stopper #426 is on the #425.

2.4.5 TEE HOUSING

Step - 18

- Slide the Tee Housing Bevel Gear #417 over the end of the Stem #403 (Step 15). Align the hole in the #417 with the Pin #440.
- Place the Upper Tee Housing Bearing #431-U onto the #403. Lubrication of the internal O-ring is recommended. **Tip:** To prevent the internal O-ring from being cut by the windows in the #403, twist the #431-U as is slides over the #403.

- Push the Tee Housing #404 over it until it is flush and fully seated. If a new #431-U has been installed, there will be a slight resistance as the external ring of this part is inserted into the #404.
- Place the Lower Tee Housing Bearing #431-L over the #403 and push it down into the annular space between the #403 and #404. Lubrication of the internal O-ring is recommended.
- Thread the Stem Cap #430 onto the end of the #403. This is a Left-Hand Thread.
- Push the first Nozzle Housing Bearing #433 onto the #404. Lubrication of the internal O-ring is recommended. Again, to prevent the internal O-ring from being cut by the windows in the #404, twist the #433 as it slides over the #404.
- Push the Nozzle Housing #405 (Step 17) onto the nose of the #404. If a new set of #433 has been installed, there will be a slight resistance as the external ring of the #433 is inserted into the #405.
- **Rotate the Tee Housing Assembly slightly to mesh the Bevel Gears #417 and #418. Failure to ensure that the Bevel Gears have properly mated could damage them.**

- Place the second #433 onto the nose of the #404, push it into the annular space between the #404 and #405. Lubrication of the internal O-ring is recommended.
- Thread the Nozzle Housing Cover Plate #406 into the nose of the #404 using a ¼" slotted screwdriver.

2.4.6 TEE HOUSING CAP

Step - 19

- **Tip:** Before installing the Stem #403 (Step 18), mark the threads of the Output Shaft #412 (Step 14) with a magic marker just above the flat on the #412. This will make it easer to align the Set Screw #454 with the flat.

- Screw the Stem #403 (Step 18) onto the Supply Tube #425 (Step 14). This is a Left-Hand Thread.
- Thread the Tee Housing Cap #414 into the Tee Housing #404 (Step 14). Again, this is a Left-Hand Thread.
- Align the setscrew hole on the #414 with the flat on the Output Shaft #412 (Step 14). Install the Output Shaft Set Screw #454 using a 1/8" slotted screwdriver.
- With the aid of a 5/64" Hex Key, screw the Output Shaft Jam Screw #455 into the same hole. Hand tighten.

- Finally, thread the Output Shaft Lower Coupling #416 onto the end of the #412.

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 will also wash out any residues of chemical cleaners that could adversely affect the seals and O-rings during prolonged contact in storage.

3.2 EXTERNAL INSPECTION INTERVALS

Before every shift, the Stator #9-109, the orifices of the Nozzle Housing #405, and the vacuum pathway should be inspected for debris. Examine the #9-109 by loosening the Collar Set Screw #9-140 and removing the Collar #408. To inspect the vacuum pathway, remove any plumbing from the vacuum port of the Housing #444. Shine a light into the port while looking into the end of the Lower Output Shaft #420.

3.3 INTERNAL INSPECTION INTERVALS

An interval of 100 hours is recommended initially. If all of the components are found to be in acceptable condition after the first 100 hours, the Gamajet may then be inspected and routine preventive maintenance should be performed every 400 to 600 hours of operation, depending on the severity of use. Gamajet recommends the following service schedule during the inspections:

Every inspection (about 500 hours):

- Clean and Repack the Gearhead, 7-413
- Replace the Dynamic Seals: E-867, 7-451, 7-450
- Inspect the Foot Spring, 7-432

Every other inspection (about every 1000 hours):

- Replace all Plastic Bearings and Bushings
- Replace all Static and Dynamic Seals
- Replace all O-rings
- Replace the Foot Spring, 7-432

Every fourth (4^{th}) inspection (about 2000 hours):

- Replace worn Housings and Shaft: 7-412, 7-405 and 7-404.

3.4 TIPS

All the Bearings, Bushings, Seals and O-rings are wear parts. 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

4.1 MACHINE DOES NOT ROTATE

4.1.1 LONG TERM STORAGE

If the unit has not been used for over a month, it may be reluctant to initially start because of the natural "set" that occurs with the dynamic parts. To remedy this, loosen the Collar Set Screw #9-140, remove the Collar, #408, and lift out the Stator #9-109. Using something thin, such as a small hex key or a paper clip, manually rotate the Rotor #9-110 in the clockwise direction for 20 to 30 revolutions. The #9-110 should become progressively easier to rotate as you spin it. If so, reassembly the unit and attempt to operate it.

4.1.2 DEBRIS INSIDE

Loosen the Collar Set Screw #9-140, remove the Collar #408, and lift out the Stator #9-109. Look for and remove any debris caught in the Stator and the vanes of the Rotor #9-110. Remove any material wound around the Input Shaft #422. In addition, check for any debris caught in the outlet holes of the Stem #403, the nose of the Tee Housing #404, and the Nozzle Housing #405.

4.1.3 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.

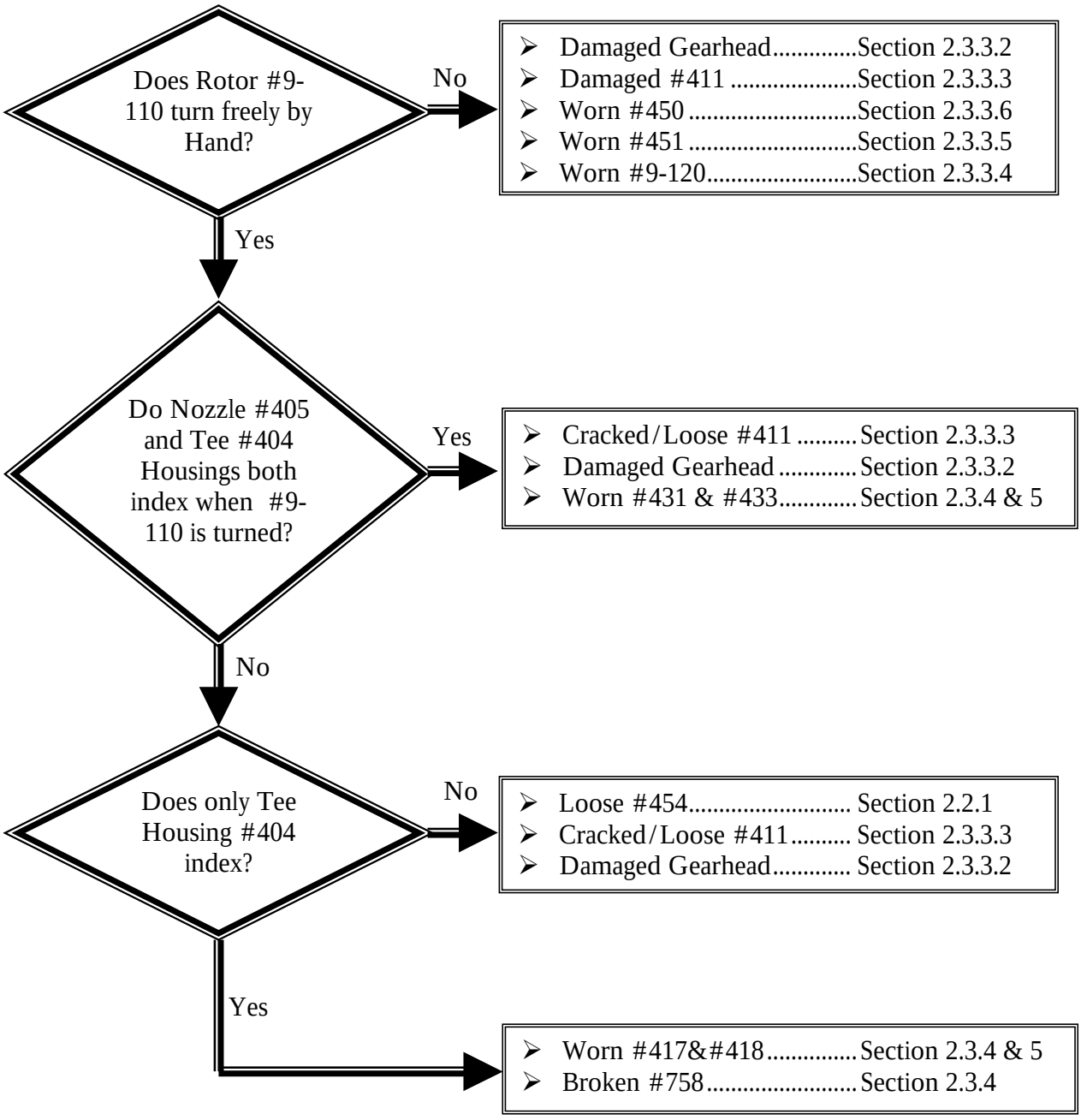
Look for restrictions in the fluid supply such as a clogged filter, kinked hose, or deposits in the piping.

4.1.4 TIGHT CLEARANCES

A recently overhauled Gamajet AIO may fail to operate when first returned to service. If the machine seems otherwise fine, try running it with the Nozzle Housing #405 removed (So as not to loose it, be sure to remove the Nozzle Housing Cover Plate O-ring #463, as well). The reduction in pressure and additional flow will invariably be enough to overcome the extra resistance of new Bearings and Seals. Twenty minutes of operation should loosen the machine to run normally with the #405 reinstalled.

4.1.5 INSPECTION FLOW CHART FOR MECHANICAL PROBLEMS

All possible causes are listed in order of likelihood.



4.2 MACHINE DOES NOT EVACUATE THE BARREL

4.2.1 BLOCKED VACUUM PATHWAY

Inspect the internal vacuum pathway by removing any plumbing from the vacuum port of the Housing #444. Shine a light into the port while looking into the end of the Lower Output Shaft #420. If any objects are seen, attempt to remove them by, first, using a

shot of compressed air into the port. If it cannot be dislodge using this method, disassembly is recommended.

If nothing is found inside of the machine, inspect any filters, hoses, or other plumbing between the AIO and the vacuum pump.

4.2.2 UNDERSIZED VACUUM PUMP

As stated in Section 1.3.6, Gamajet recommends sizing the flow rate for the suction pump to be at least double that of the supply. If the AIO is used in conjunction with the Gamajet Evacublast or Gamavac Systems, the air supply to the suction pump should be capable of delivering 5 SCFM at a minimum of 40 psig.

4.3 CLEANING SOLUTION LEAKAGE

4.3.1 WORN BEARINGS

Some leakage from the Tee Housing / Stem and Tee Housing / Nozzle Housing joints is normal. If the flow rate has noticeably increased, or, the pressure decreased, check the condition of the Tee and Nozzle Housing Bearings, #431 and #433, respectively. Specifically, examine the condition of the external ring and internal O-ring.

4.3.2 WORN HOUSING

Inspect the internal bores of the Nozzle #405 and Tee #404 Housings for excessive wear (grooved or scored). Replace any that show distinct grooves.

4.3.3 WORN DRIVE BODY O-RINGS

Although some leakage from components positioned inside of the barrel is normal, it is not for components that make up the external Drive Body.

Leakage between the Collar #408 and Cap #402 may indicate worn or damaged Collar O-rings #9-141 and #9-142. Remove the Collar as described in Section 2, and inspect the O-rings for signs of damage or wear.

If the leak is noticed from the lower section of the Drive Body, inspect the Output Cap O-ring #457 and Supply Tube O-ring #459 as described in Section 2.

4.4 POOR CLEANING PERFORMANCE

4.4.1 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. If this is the case, 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)! Contact Gamajet if assistance is required.

4.4.2 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.

4.4.3 PLUGGED NOZZLE ORIFICE

Inspect the orifices of the Nozzle Housing for debris.

4.4.4 SLOW OR NO ROTATION OF THE HOUSINGS

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

4.4.5 GAMAJET CONFIGURATION

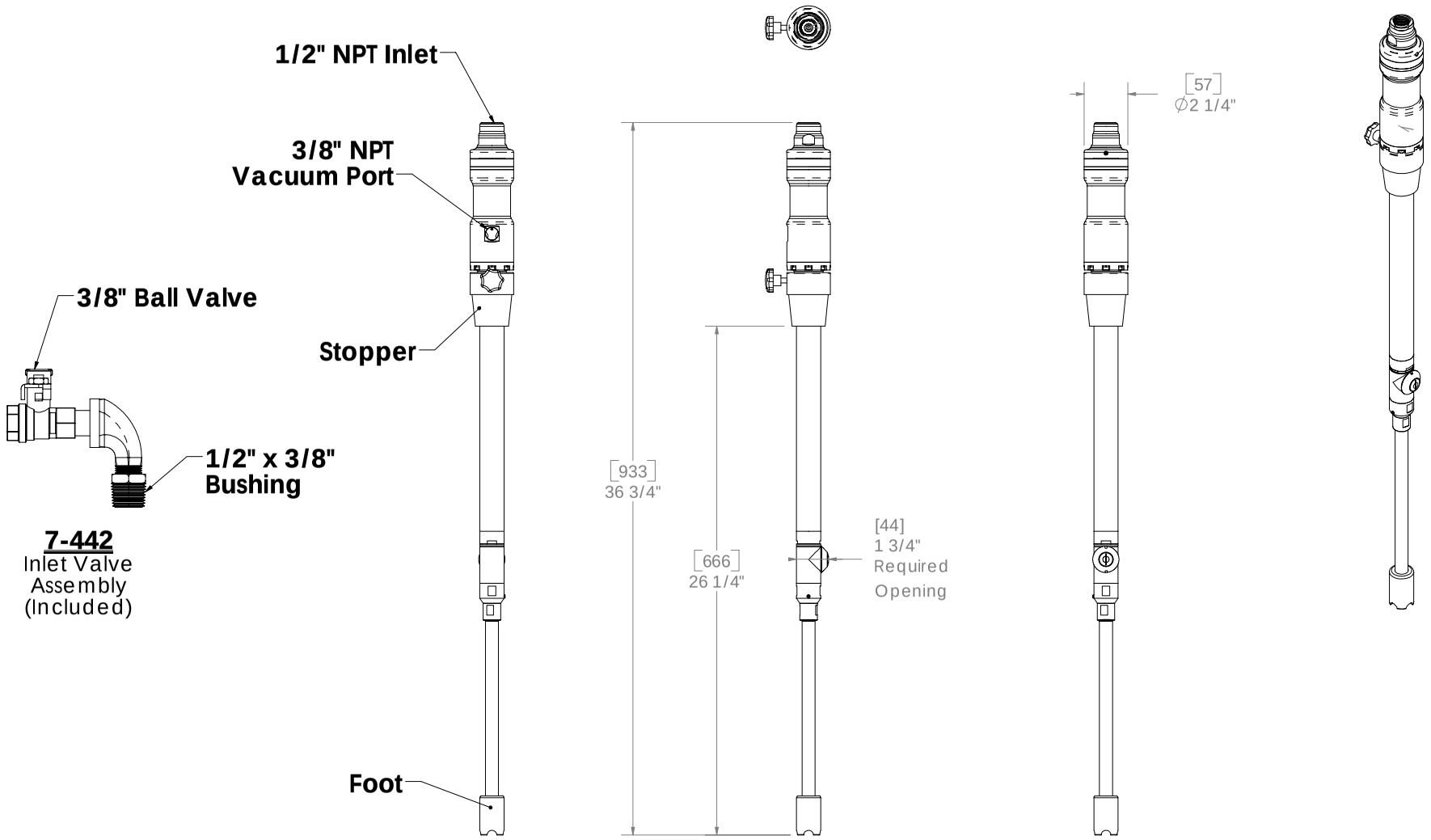
Determine if the deposit being cleaned requires greater jet impact or longer jet dwell time (slower rotation) for more thorough scrubbing. Confirm that the Gamajet nozzle size, turbine, and gearing are correct for the specific application. Refer to the machine's Birth Certificate for specific information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

4.4.6 INADEQUATE DRAINAGE

As stated in Section 1.3.6, Gamajet recommends sizing the flow rate for the suction pump to be at least double that of the supply. If the AIO is used in conjunction with the Gamajet Evacublast or Gamavac Systems, the air supply to the suction pump should be capable of delivering 5 SCFM at a minimum of 40 psig.

4.5 OWNER'S MANUAL UPDATES

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



Notes:

- Weight: 10-1/2 lbs. (4-3/4 kg.)
- Flow Range: 4 to 6 (US)GPM (15 to 23 lpm)
- Pressure: 100 to 1000 PSI (7 to 70 bar)
- Temperature: 180˚F (82˚C) Maximum
- Designed to fit through a ∅50mm bung hole.
- Orifice Sizes: range from 0.070" to 0.080"

DRAWN	DATE	Rev.	Description
BFG	11/29/04	1	New Drawing
BFG	06/15/05	2	Added Inlet Valve Assembly, 7-442

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: All-In-One Cut Sheet

EQUIPMENT: Gamajet All-In-One

DWG. NO. ---

SHEET 1 OF 1

Appendix B –Spare Part List

GAMAJET AIO Complete Bill Of Materials		
Part Number	**Name**	**Qty/Unit**
7-401	Gearbox	1
7-402	Input Cap	1
7-403	Stem	1
7-404	Tee Housing	1
7-405	Nozzle Housing	1
7-406	Nozzle Housing Cover Plate	1
7-408	Collar	1
7-411	Input Pinion	1
7-412	Output Shaft	1
7-413	Planetary Gearhead	1
7-414	Tee Housing Cap	1
7-416	Output Shaft Lower Coupling	1
7-417	Tee Housing Bevel Gear	1
7-418	Nozzle Housing Bevel Gear	1
7-419	Foot	1
7-420	Lower Output Shaft	1
7-422	Input Shaft	1
7-423	Foot Bushing	2
7-424	Output Shaft Lower Bushing	1
7-425	Supply Tube	1
7-426	Stopper	1
7-428	Input Shaft Upper Bearing Housing	1
7-429	Gearhead Lower Bearing Housing	1
7-430	Stem Cap	1
7-431-L	Tee Housing Seal & Bearing (Lower)	1
7-431-U	Tee Housing Seal & Bearing (Upper)	1
7-432	Foot Spring	1
7-433	Nozzle Housing Seal & Bearing	2
7-434	Lower Foot Retaining Ring	1
7-435	Upper Foot Retaining Ring	1
7-436	OS Upper Seal Spacer	1
7-437	Output Shaft Coupling	1
7-438	Vacuum Chamber	1
7-439	Stopper Locking Knob	1
7-440	Tee Housing Bevel Gear Pin	1
7-442	Inlet Valve Assembly	1

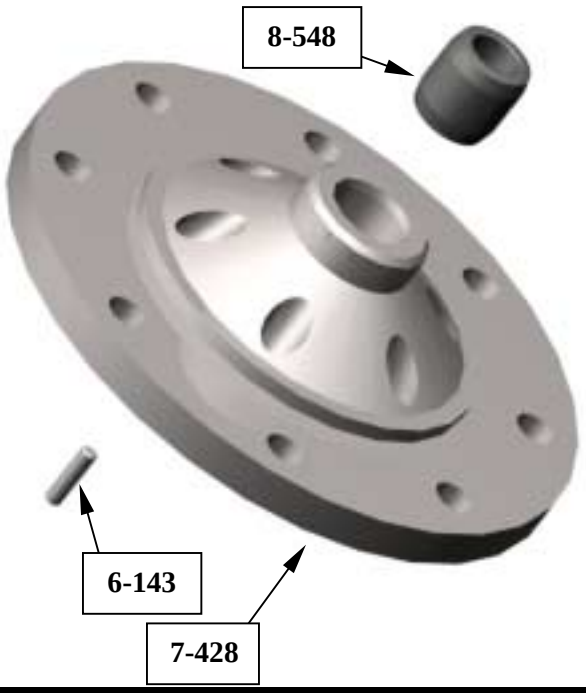
GAMAJET AIO Complete Bill Of Materials		
7-444	Housing	1
7-445	Output Shaft Mid Bearing	1
7-446	Output Cap	1
7-447	Input Pinion Spacer	1
7-450	Output Shaft Lower Seal	1
7-451	Output Shaft Mid Seal	1
7-452	Output Cap Screw	8
7-453	Output Shaft Coupling Pin	1
7-454	Output Shaft Set Screw	1
7-455	Output Shaft Jam Screw	1
7-456	GHLBH Small O-ring	1
7-457	Output Cap O-ring	1
7-458	Housing O-ring	2
7-459	Supply Tube O-ring	1
7-461	Tee Housing O-ring	1
7-463	Nozzle Housing Cover Plate O-ring	1
7-464	OS Mid Seal Retaining Ring	1
7-465	Stem Cap Snap Ring	1
7-466	NH Bevel Gear Snap Ring	1
9-109	Stator	1
9-110	Rotor	1
9-115	Gearbox Seal	1
9-116	Input shaft lower housing seal	1
9-119	Supply Tube Retaining Ring	1
9-120	Output Shaft upper seal	1
9-123	Output Shaft Upper Seal Retaining Ring	1
9-127	Input Shaft lower Bearing Housing	1
9-138	Input Cap Screw	8
9-139	Planetary Gearhead screw	3
9-140	Collar Set Screw	1
9-141-E	Collar Small O-ring	1
9-142-E	Collar Large O-ring	1
9-145	Output Shaft Upper Bearing	1
6-143	Planetary Gearhead Pin	1
8-544	Rotor / Output Cap Washer	9
8-545	Rotor Nut	1
8-548	Input Shaft Carbide Bearing	3
8-552	Input Cap Lock Washer	8
E-866	Drive Pin	1

GAMAJET AIO Complete Bill Of Materials		
E-867	Input Shaft Seal	1
640-E	GHLBH Large O-ring & S.T. Lower	2
642-E	I.S. Lower Bearing Housing O-ring	1
751-E	Stem Cap O-ring	1
758	Nozzle Housing Bevel Gear Pin	1

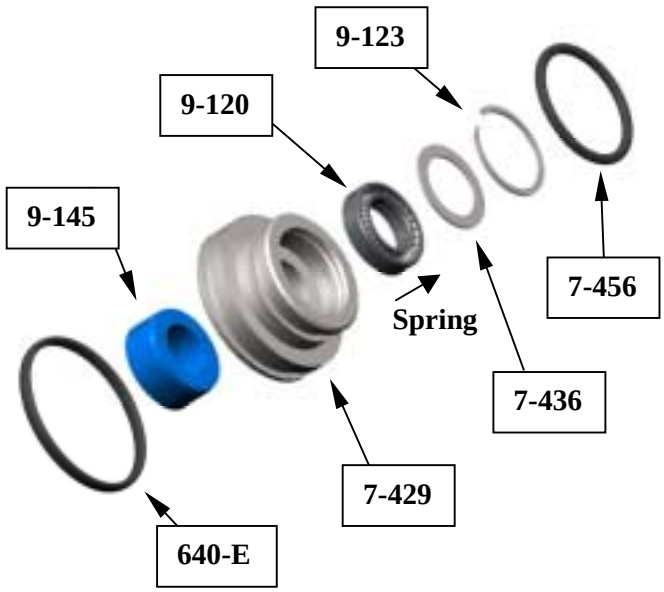
Appendix C – Assembly / Disassembly Steps

GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE

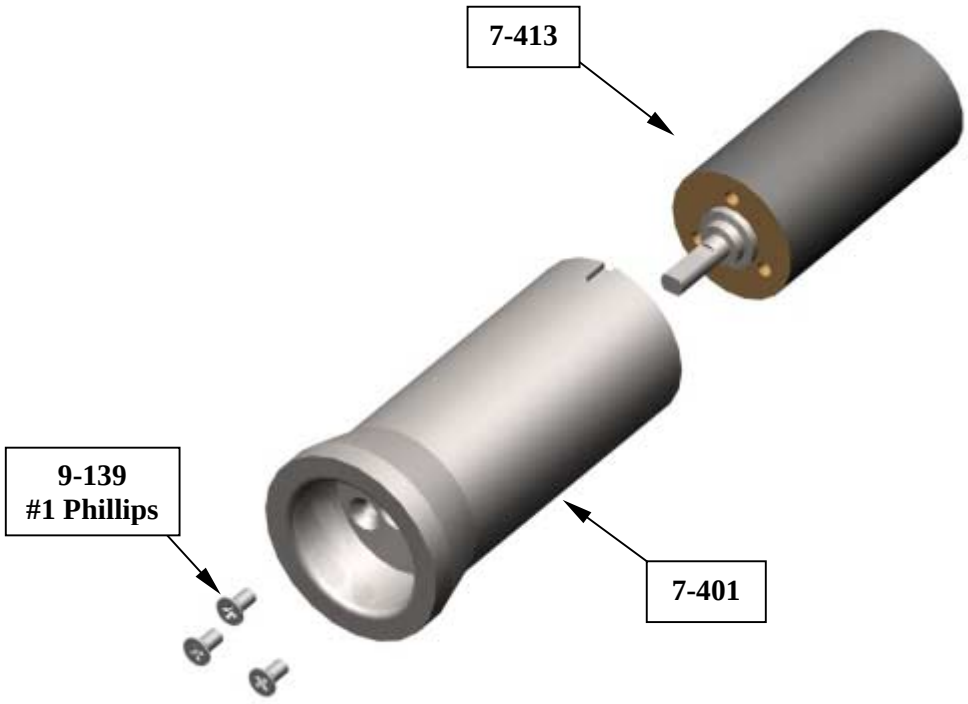
STEP 1: INPUT SHAFT UPPER BEARING HOUSING



STEP 2: GEARHEAD LOWER BEARING HOUSING

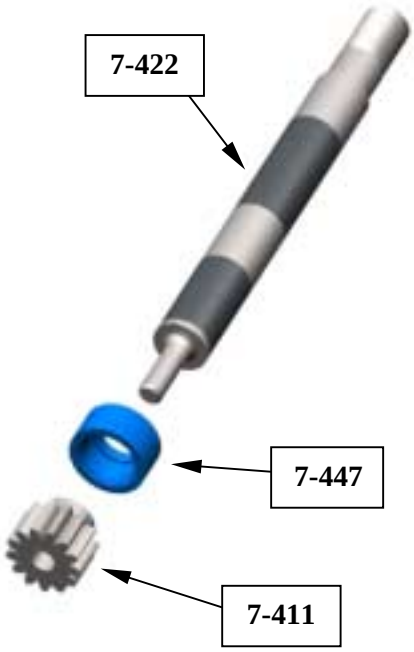


STEP 3: GEARHEAD

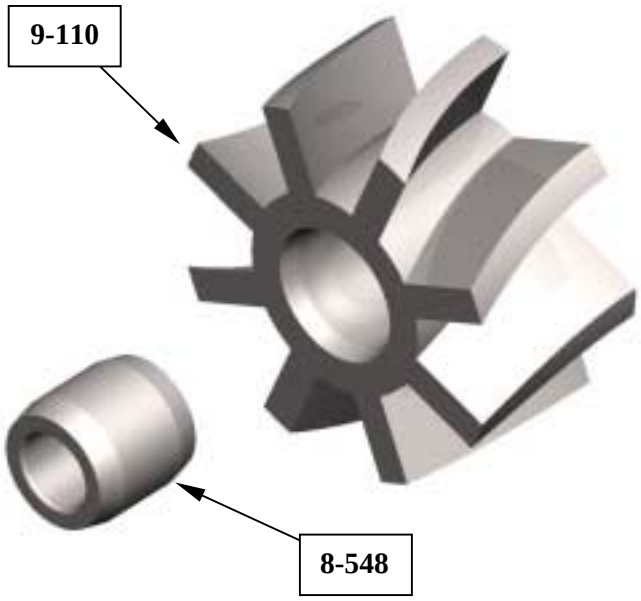


GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE

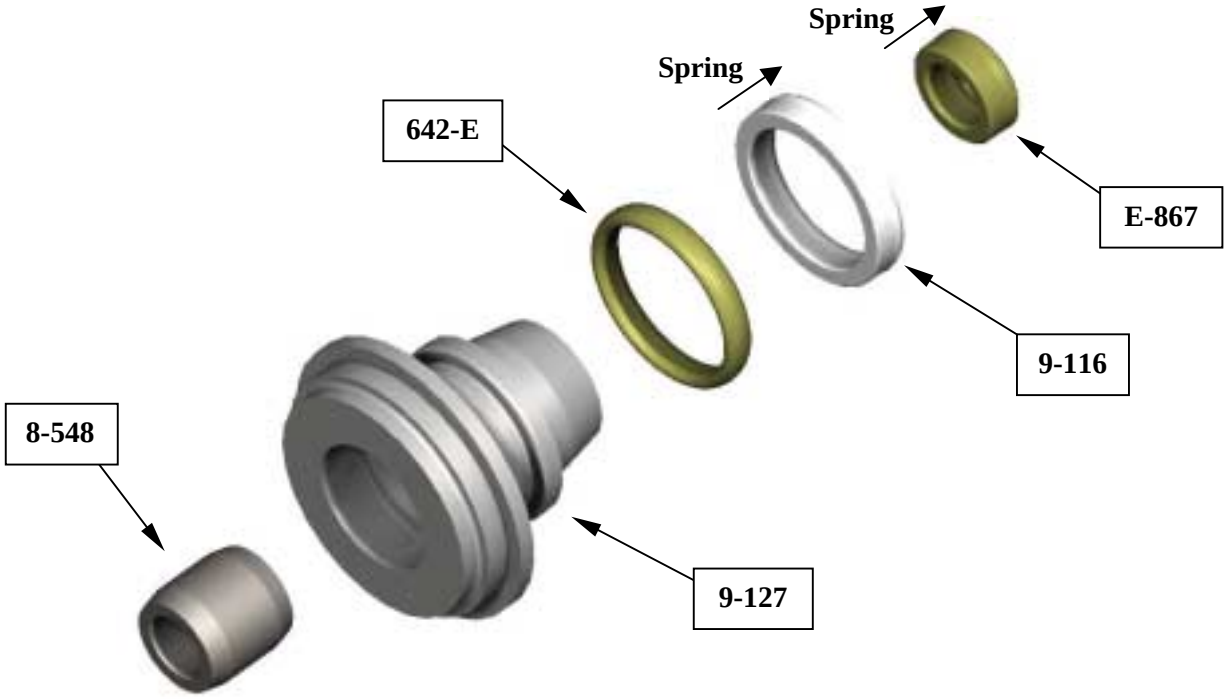
STEP 4: INPUT SHAFT



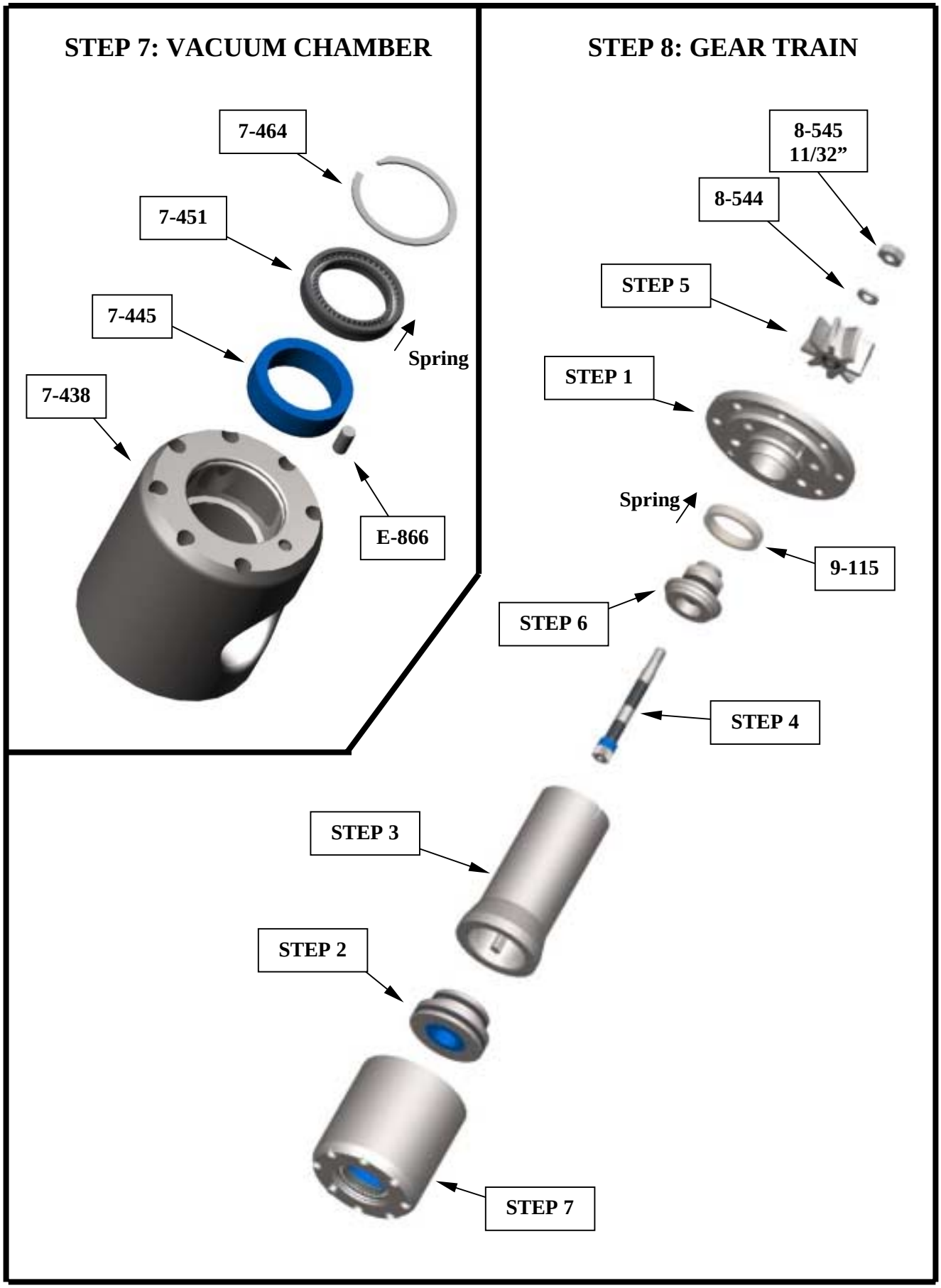
STEP 5: ROTOR



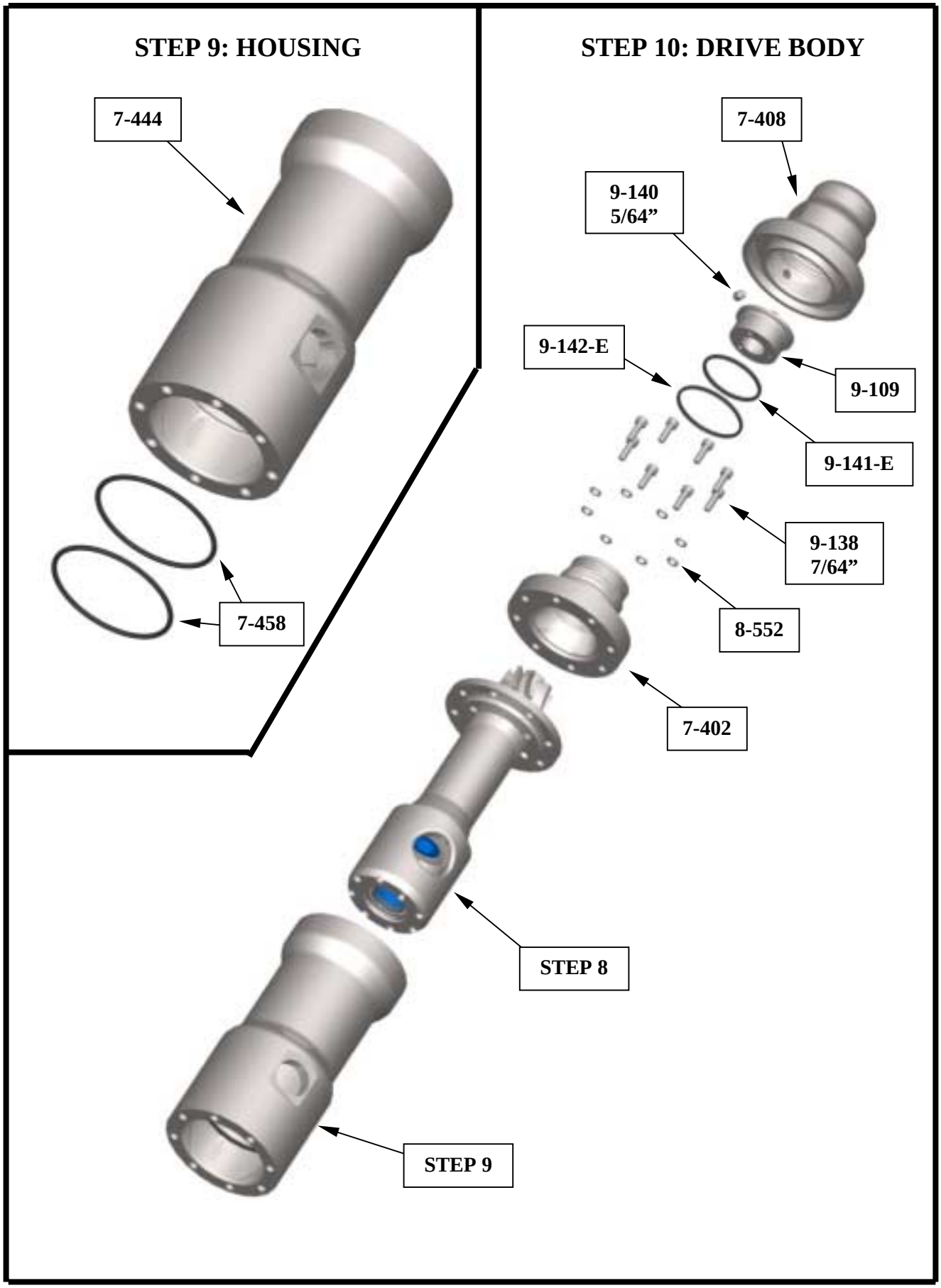
STEP 6: INPUT SHAFT LOWER BEARING HOUSING



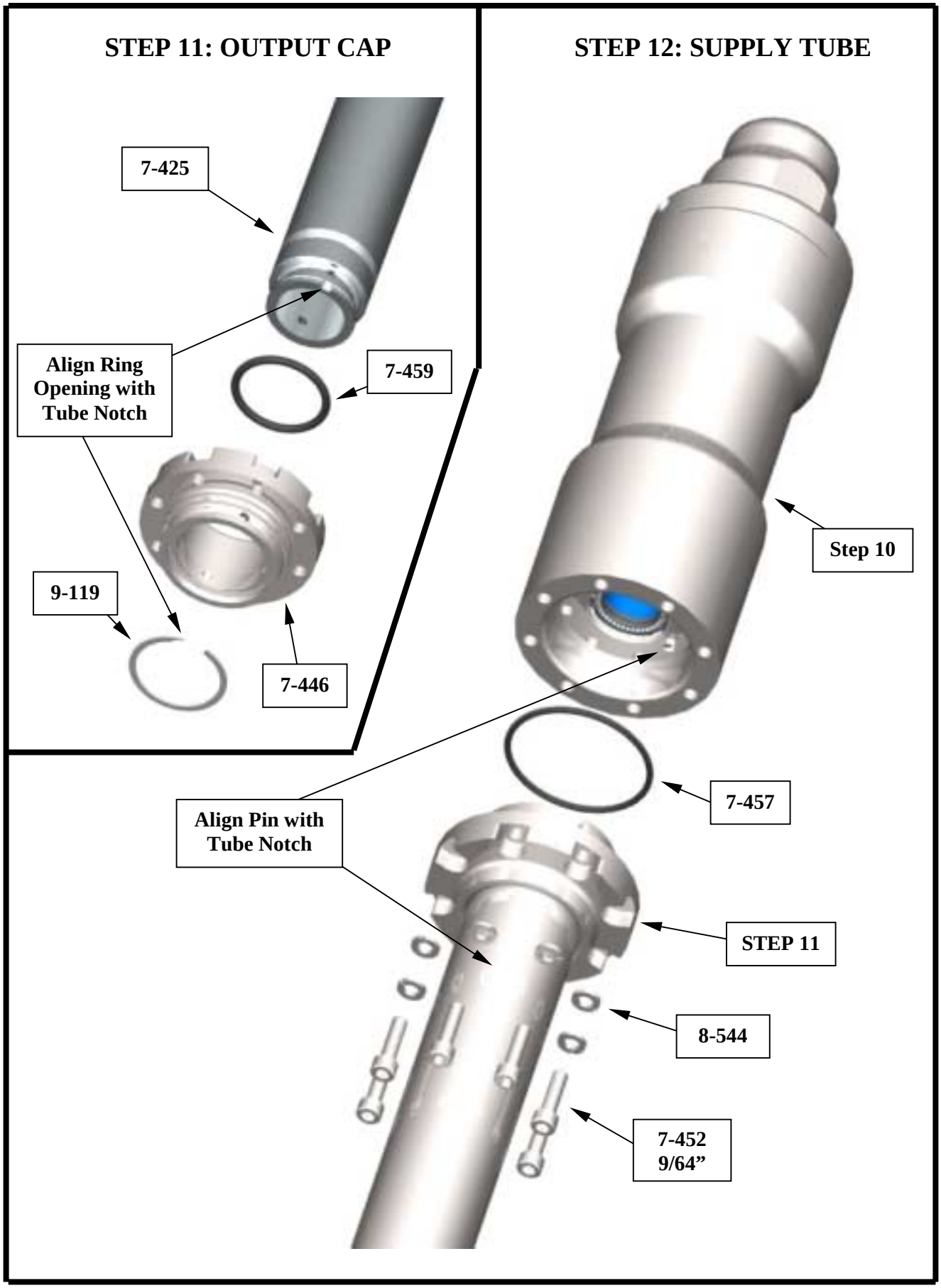
GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE



GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE

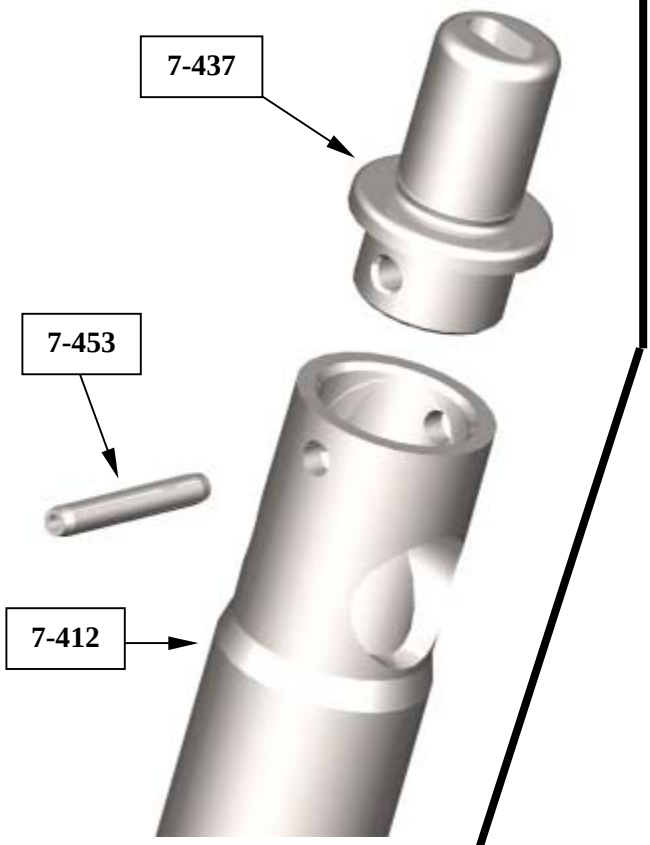


GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE

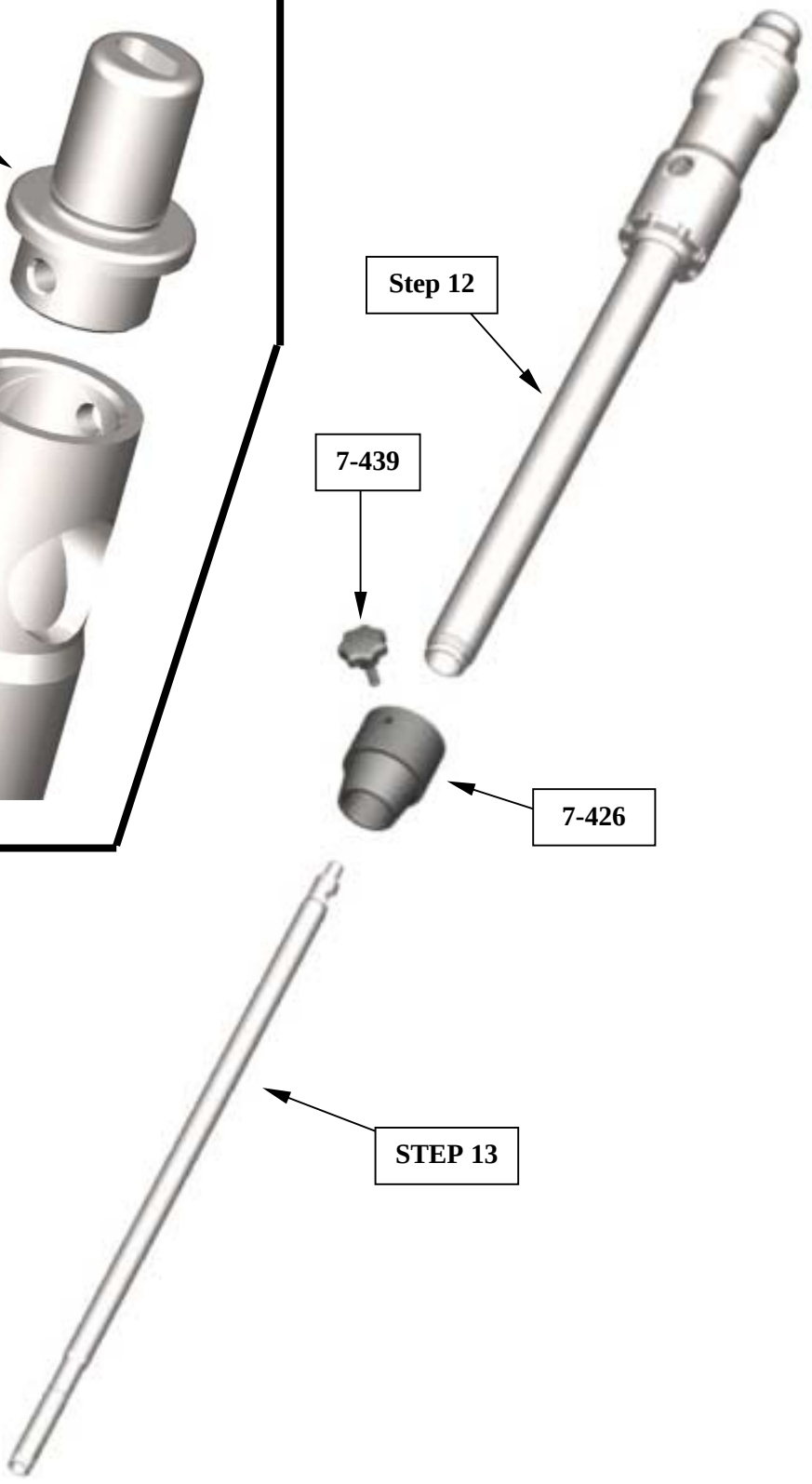


GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE

STEP 13: OUTPUT SHAFT COUPLING

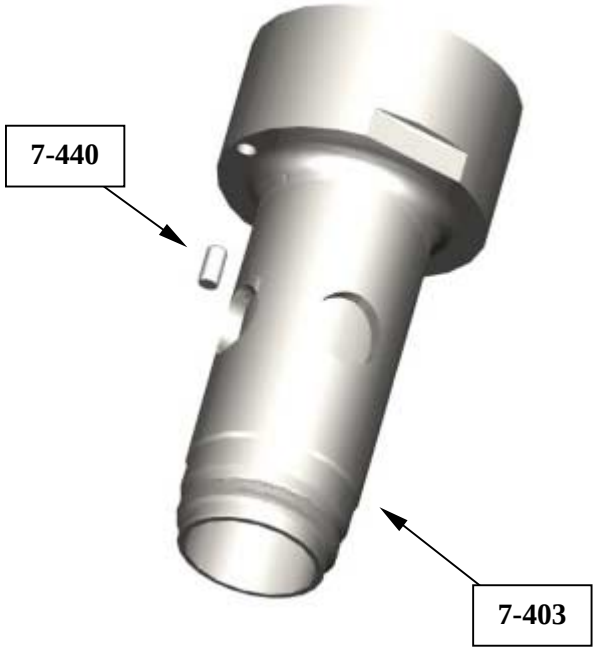


STEP 14: OUTPUT SHAFT

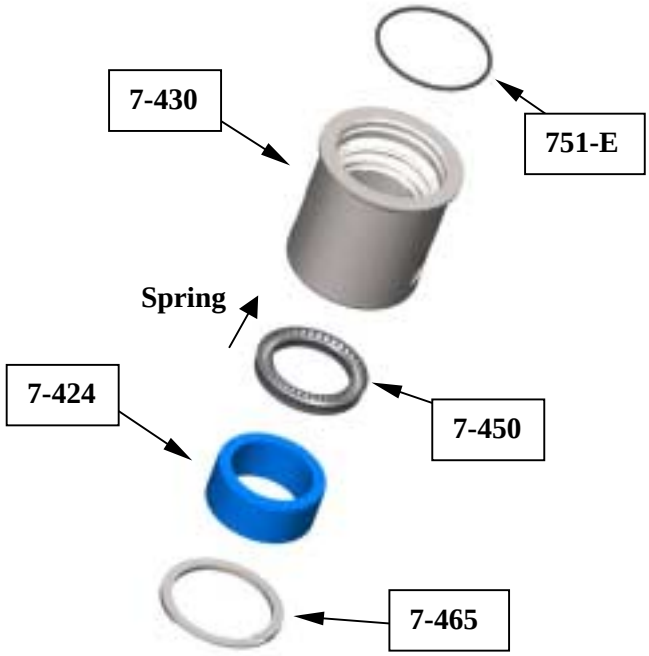


GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE

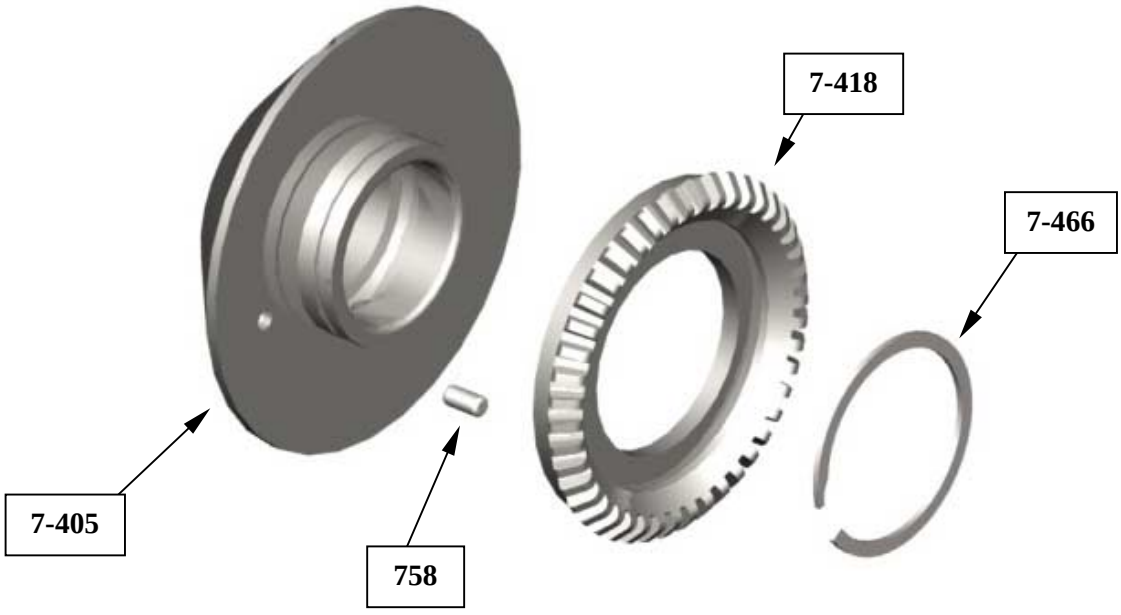
STEP 15: STEM



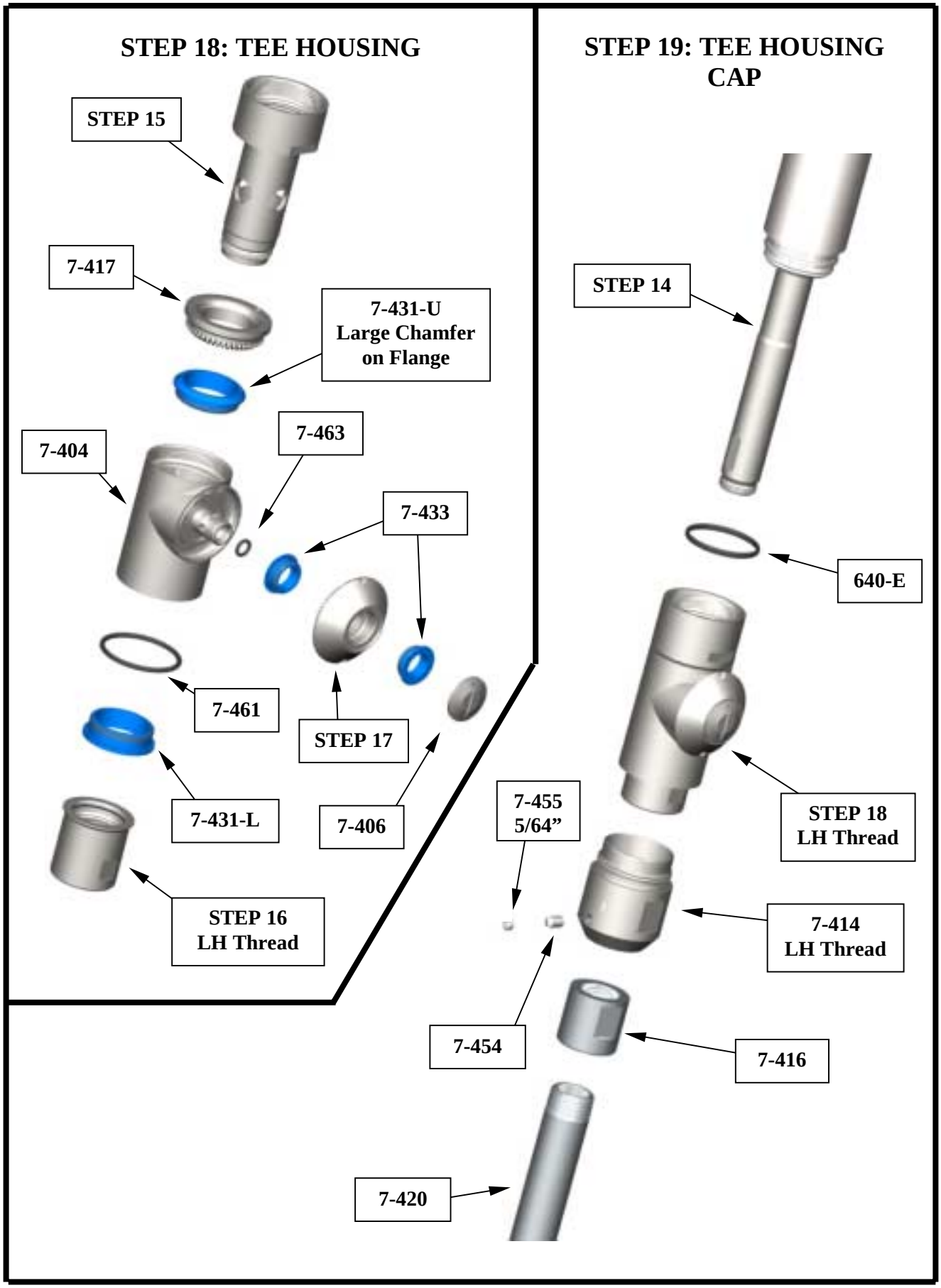
STEP 16: STEM CAP



STEP 17: NOZZLE HOUSING

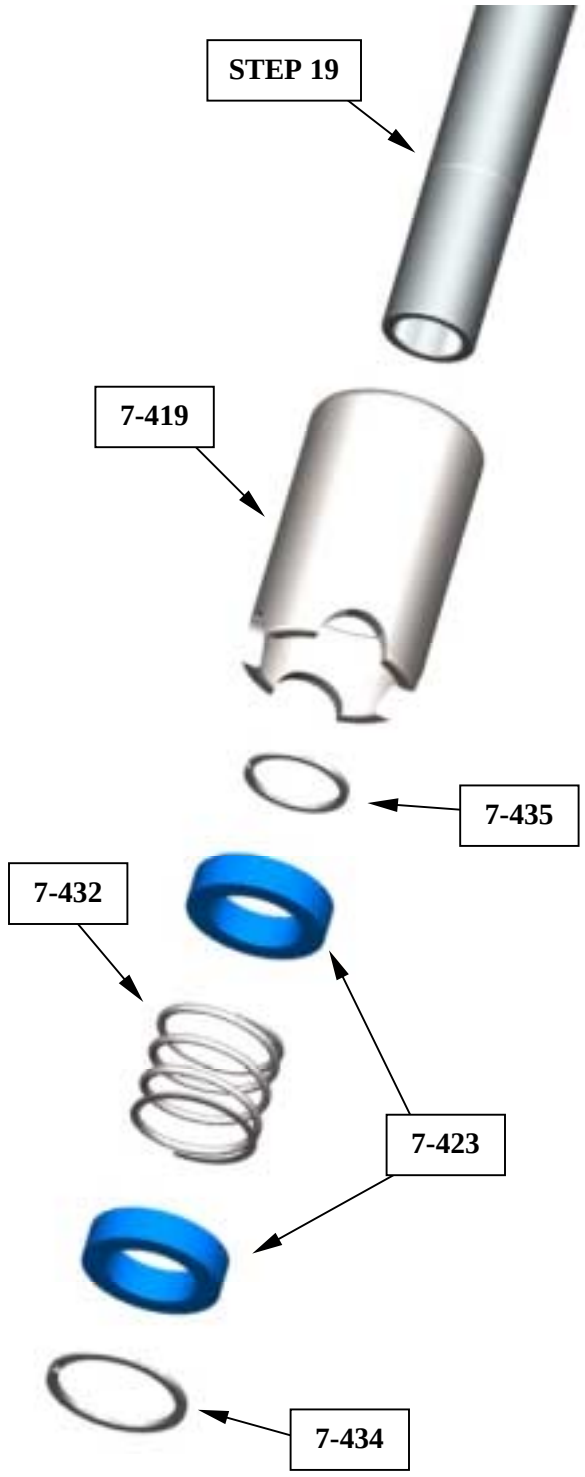


GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE



GAMAJET ALL-IN-ONE ASSEMBLY PROCEDURE

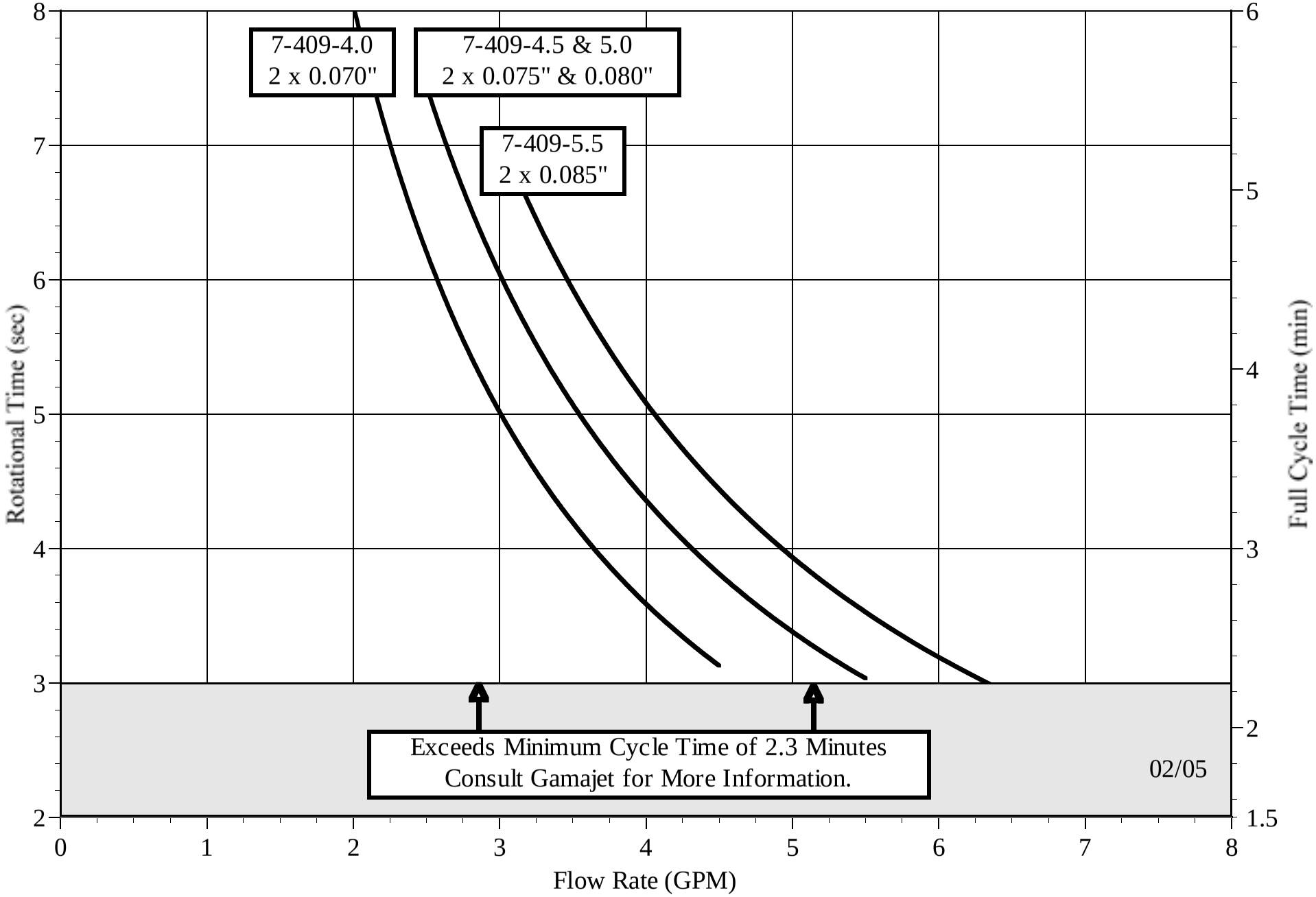
STEP 20: FOOT



COMPLETED ASSEMBLY

Appendix D – Performance Curves

GAMAJET All-In-One / Barrel Blaster HD
Flow Rate vs. Rotational Rate and Cycle Time



GAMAJET All-In-One / Barrel Blaster HD
Pressure vs. Flow Rate