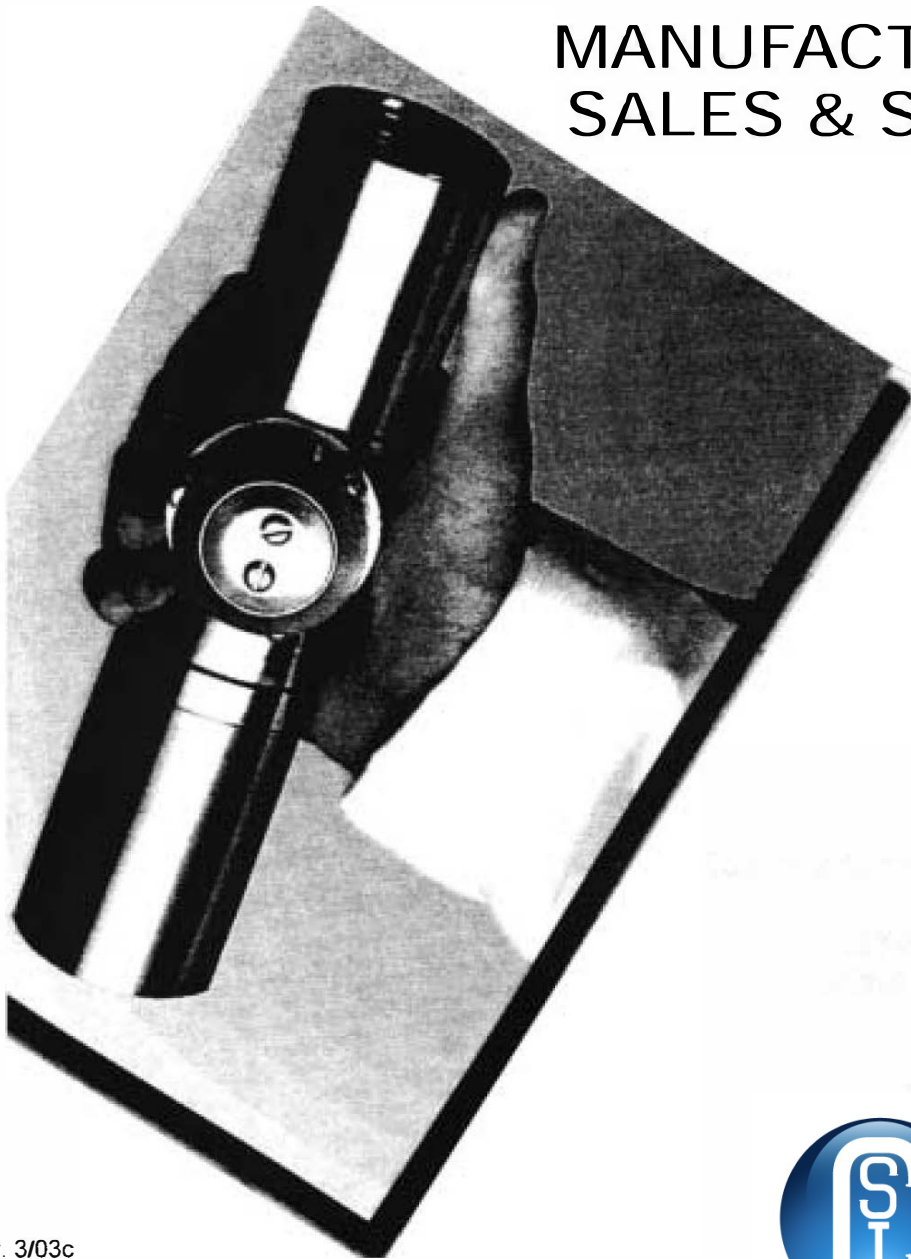


GamaJet V

OWNER'S MANUAL

MANUFACTURING,
SALES & SERVICE



v. 3/03c
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TABLE OF CONTENTS

1. Introduction

- 1.1 Description
- 1.2 Installation of New Machines
 - 1.2.1 Assembly
 - 1.2.2 Inlet Connections
 - 1.2.3 Mounting
 - 1.2.4 Location inside the Tank
 - 1.2.5 Entry Opening
 - 1.2.6 Drainage
 - 1.2.7 Filters or Strainers
 - 1.2.8 Capacity of Supply Pump
- 1.3 Safety

2. Disassembly, Repair, and Reassembly

- 2.1 Tools required
- 2.2 General Disassembly
- 2.3 Inspection & Service of Components
 - 2.3.1 Nozzle Housing
 - 2.3.2 Tee Housing
 - 2.3.3 Gearbox
 - 2.3.4 Gearbox Nose
 - 2.3.5 Stem
- 2.4 Reassembly

3. Preventative Maintenance

- 3.1 Storage
- 3.2 Gearbox Maintenance
- 3.3 Inspection Interval
- 3.4 Tips

4. Troubleshooting Guide

- 4.1 Tee Housing does not rotate
- 4.2 Nozzle Housing rotates slowly or not at all
- 4.3 Cleaning Solution leakage
- 4.4 Poor cleaning performance

5. Appendix

- A. Dimensional Data & Technical Specifications
- B. Parts List & Exploded View
- C. Performance Data

1. INTRODUCTION

1.1 DESCRIPTION

The Gamajet V is a fluid-driven (turbine-driven) 360° or 180° Directional rotary nozzle machine designed for cleaning the interior surfaces of a wide variety of small process, transport and storage tanks or tanks with a minimum opening of 3 inches (76.2 mm) in diameter. **It is powered entirely by the cleaning solution;** it requires no electricity or compressed air or lubricant for operation. The Gamajet V is designed primarily for portable service; the unit may also be permanently installed in a vessel. If the Gamajet V is permanently mounted inside a tank, we strongly recommend that you inspect the unit every few hundred hours of operation (see section 3 for details about Preventative Maintenance).

WARNING: Under no conditions whatsoever should the Gamajet V ever be immersed in anything. Failure to comply with this restriction will void the warranty!!

To handle the broadest possible range of applications, the Gamajet V is available in stainless steel construction with dual and triple nozzles, and an extensive selection of nozzle sizes, stators, O-ring material and gear ratios. Gamajet nozzles are available in seven interchangeable sizes - 0.110", 0.125", 0.135", 0.150", 0.165", 0.187", and 0.200". Longer nozzles are available for tougher deposits but require a 3-1/2" opening; optional smaller and larger orifice diameters are also available. The standard 0.187" nozzle is recommended for normal use in tank cleaning. The Gamajet wash cycle time can be adjusted for special applications by changing the stators, nozzle sizes, and gears. Interchangeable stators (non-rotating turbine), nozzle sizes, and gears are available for either low or high pressures and/or flow rates. The performance capabilities of these options are detailed in Appendix C. A complete description of the technical specifications and materials of construction of the Gamajet V 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.** Your Gamajet has also been configured to meet the operating conditions that you have given us, e.g. pressure, flow, temperature, cycle time, etc.

1.2.2 INLET CONNECTIONS

The Gamajet V is supplied with a 1-1/4" 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

While the dual nozzle unit is hydraulically balanced, the Gamajet V should be mounted on a rigid pipe. In most applications, the Gamajet V will be mounted in the "upright" position (inlet connection pointing up); however, if required, the Gamajet will function equally well inverted or horizontally. We do not recommend this form of mounting since the hose is not rigid and, thus, will not maintain the Gamajet's position should it become unbalanced due to clogging of the nozzles.

NOTE: When attaching the Gamajet V onto the supply pipe, ALWAYS use the wrench flats on the Inlet Collar at the top or inlet of the unit. **Never place the wrench on the outside of the gearbox, or bottom, of the unit to tighten the unit onto the pipe.** If you do, you'll unscrew the unit or break internal screws or both.

1.2.4 LOCATION INSIDE THE TANK

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

Tanks with internal mechanisms or structures such as an agitator shaft or 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 or "striping."

Refer to Appendix A for dimensions describing the Gamajet's operating clearances.

1.2.5 ENTRY OPENINGS

When using the Gamajet V, the tanks being cleaned must provide entry openings large enough to avoid interference during insertion and removal. The minimum opening size required for the Gamajet V is 3.0 inches in diameter (76.2 mm).

1.2.6 DRAINAGE

If it is necessary to clean the floor of a tank, 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 wash fluid as fast as the Gamajet is putting it in. In extreme cases, it may be necessary to mount smaller nozzles on the Gamajet, or even to operate it intermittently to allow time for draining.

1.2.7 FILTERS OR STRAINERS

All tank cleaning systems should be equipped with a filter or strainer that will trap solids 1/16" or larger, as these will not pass through the Gamajet. These large particles will not harm the machine, but they can become caught in the turbines or nozzles and cause it to stop turning or to reduce its cleaning effectiveness due to loss of flow. It will then be necessary to disassemble the Gamajet and remove the blockage.

In recirculating cleaning or any other application where the cleaning solution may carry abrasive solids in suspension, adequate filtration is a must. These particles can be extremely destructive to the Gamajet, as well as pumps, valves, and other system components. Filters, properly installed and maintained, will more than pay for themselves with lower overall operating costs in these applications. Furthermore, to ensure that clogged filters or strainers are cleaned, we recommend that you use automatic self-cleaning models.

1.2.8 CAPACITY OF SUPPLY PUMP

The Gamajet V should be sized to match the pressure and flow capability of the supply pump at its best efficiency point (BEP). For example, if the pump is rated for 23 GPM at 250 PSI, then the nozzles for the Gamajet V must be configured for the same 23 GPM at 250 PSI. If not, then you will increase the probability of experiencing premature failure of Gamajet V parts as well as shaft seals on the pump the farther away from the BEP that you operate the pump. **You may void the Gamajet V warranty.**

For high-pressure applications (over 300 psig), the pump must “ramp up” slowly (at least 15 seconds) to its operating pressure. If the pump goes from a standstill to operating pressure in about 1 second or less and if there is no dampening or slow-opening valve between the pump and the Gamajet, you will experience premature failure of Gamajet V parts (most likely, certain gears). This is because of a water hammer effect or a pressure spike.

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 is hot, corrosive, or toxic a leak would present a serious hazard to any personnel in the immediate vicinity or to any exposed electrical equipment.

WARNING

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 considerable risk of ignition or explosion, it is imperative to that the Gamajet be properly grounded.

2. DISASSEMBLY, REPAIR, AND REASSEMBLY

2.1 TOOLS REQUIRED

Point Head Pliers (Needle Nose Pliers)
9/64", 7/64", and 5/64" Hex Ball-point L-wrenches (7/64" Allen Wrench)
Screwdrivers (both Slotted (flat blade) & Phillips)
11/32" Hex Deep Socket
7/16" Hex Deep Socket
Socket Wrench Ratchet Handle
2" Socket Extension
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 reference numbers appearing below may be used to identify parts in the exploded view (numbers enclosed in circular box) in Appendix B.*

2.2.1 Remove the Stem Collar Retainer Screw #36 with the appropriate Hex Ball-point L-wrench. If not removed, be sure to **unscrew the Retainer Screw far enough** so that its top extends beyond the surface of the Inlet Stem Collar.

Do not mistake or confuse the Gearhead Retainer Screw #2, at the bottom of the unit, with the Stem Collar Retainer Screw, at the top. If you do, **immediately** tighten the Gearhead Retainer Screw before twisting or rotating any parts of the unit.

2.2.2 Unscrew the Inlet Stem Collar #37 from the Stem #24.

WARNING: This is a **left-hand** thread, so turn the Collar **CLOCKWISE** to **unscrew it!** The unit must be in the vertical position, standing on its base when **unscrewing the Inlet Stem Collar; otherwise, the threads will gall.**

If the Collar feels like it is binding on the threads, DO NOT force the Collar to turn by applying more force with a wrench as you will damage the threads; rather, keep spraying a Teflon-based penetrating solution into the threads and work the solution into the threads by turning the collar back and forth until it works loose. Lift out the Stator #28.

2.2.3 Insert a Screwdriver between the vanes of the Rotor #25 (to prevent it from turning) and unscrew the Rotor Retaining Nut #27 with 11/32" Deep Socket and 2" Extension. Lift out the Rotor with the Pliers or invert the machine and shake it out.

2.2.4 Lift the Tee Housing #35 (#55 for Directional) off the Stem #24. If the Tee Housing cannot be removed easily, pry carefully at the gap between the Tee Housing and the Gearbox Nose #14.

2.2.5 Remove the two Nameplate Screws #47 with a Slotted Screwdriver and pull the Nozzle Housing #44 (#56 for Directional) off the Tee Housing #35/#55. If tight Bearings prevent removal, pry carefully between the Nozzle Housing and Tee Housing.

2.2.6 Unscrew the four Gearbox Screws #22 with a 7/64" Hex Ball-point L-wrench and pull the Gearbox #1 off the Gearbox Nose #14.

2.2.7 Unscrew the four Gearbox Nose-Stem Screws #10 with a 7/64" Hex Ball-point L-wrench and pull the Gearbox Nose #14 off the Stem #24.

2.3 INSPECTION AND SERVICE OF COMPONENTS

2.3.1 NOZZLE HOUSING #44/#56

2.3.1.1 Nozzle #45

Unscrew the Nozzle Tips with a 7/16" Socket and inspect for debris plugging the Stream Straightener #49. Remove the Stream Straighteners for cleaning by pressing them out with a small rod inserted through the Nozzle bore.

The Nozzle bores must be smooth, round, and free of damage (especially any nicks) for maximum jet impact. Replace worn or oversized nozzles if the original flow rate is required. The Stream Straighteners must be reinstalled in the Nozzle Tips if they were removed for cleaning.

2.3.1.2 Bevel Gear #42 (#58 Spur Gear in Directional)

Remove the Bevel Gear Retaining Ring #41 with a Slotted Screwdriver and lift off the Nozzle Housing Bevel Gear #42/#58. Inspect the Bevel Gear for wear such as sharp/pointed or broken teeth, and replace as required.

2.3.1.3 Clutch O-ring #43 [Not Used in New Production]

Removing the Nozzle Housing Bevel Gear #42/#58 will expose the Clutch O-ring #43 on the Nozzle Housing. Inspect the O-ring and replace it if it is worn out (deeply sunken into its groove or chemically eroded), or if it has become hardened or deformed. Inspect also for wear (such as the presence of metal shavings) caused by slippage between the Nozzle Housing Bevel Gear and the Nozzle Housing #44/#56. Slippage can result from incorrectly installed Nozzle Housing Bearings #38/#59 (#59 for Directional), deposit build-up, or anything else that could make the Nozzle Housing difficult to turn.

2.3.1.4 Nozzle Housing Bearings #38/#59

Inspect the Nozzle Housing Bearings #38/#59 and discard any that are broken, cracked, or deeply scored. Clean any deposits from the bearings

and check their fit in the Nozzle Housing Cup #40 (#60 for Directional Machine). While they should turn freely in their Cups, the Nozzle Housing Bearings should be replaced if the diameter of the **outside wall** is **less than 0.990"** to avoid shortening the life of the Seals or Bevel Gears.

2.3.1.5 Nozzle Housing Seals #39 (#61 for Directional)

Examine the Nozzle Housing Seals #39/#61 for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring) or excessive wear on the sealing lips (the sealing lips are worn smooth) and replace as required. When installing the Seal, make sure that the spring side of the Seal faces towards the Nozzle Housing Cup #40/#60.

2.3.1.6 Nozzle Housing Cups #40/#60

Clean any deposits from the Cups and examine for excessive wear. Light scoring is acceptable, but the Cups should be replaced if they are grooved in the seal contact area or if the diameter of their **inside wall** is **greater than 1.020"**.

If you have many Gamajet units (about 2 dozen or more), you will be replacing many cups as part of a good maintenance program. Therefore, it may be worthwhile to make or obtain press tools for pressing the Cups off of the Nozzle Housing. The press tools are available from Gamajet Cleaning Systems as part of the repair kit.

Before installing new Cups, clean the housing bores and remove any burrs resulting from Cup removal. Lubricate the outside of the new Cups and press them in so that their flanges are fully and flush-seated against the Housing.

2.3.1.7 Reassembly

If the Nozzle Housing Bearing Cups #40/#60 need to be replaced, refer to section 2.3.1.6 for installation. If the Clutch O-ring #43 was removed, replace the old one with a new one and use a flat screwdriver blade to press it evenly all the way around into its groove. Place the Nozzle Housing Bevel Gear #42/#58 on the Nozzle Housing, install the Bevel Gear Retaining Ring #41 and verify that it is fully seated in its groove all the way around; also verify that the I.D. of the Ring does not extend inwards into the path of the teeth of the Bevel Gear. Screw in the Nozzle Tip #45 and tighten with a 7/16" socket. The Nozzle Housing Bearings #38/#59 and Nozzle Housing Seals #39/#61 will be assembled later when the Nozzle Housing #44/#56 is remounted onto the Tee Housing #35/#55; refer to steps 2.4.3 to 2.4.6 for details.

2.3.2 TEE HOUSING #35/#55

2.3.2.1 Disassembly

Remove the Ring Gear Retaining Ring #29 with a Slotted Screwdriver and lift out the Ring Gear #30. If the Gear is tight in the Tee Housing #35/#55, carefully pry it out with flat screwdrivers. Next, lift out the Tee Housing Bevel Gear #31, Tee Housing Bearings #32, and Tee Housing Seals #33.

2.3.2.2 Tee Housing #35/#55

Inspect the Tee Housing #35/#55 for damage to the Tee Housing key way that engages the Ring Gear #30. If the Ring Gear was difficult to remove, check to see if the Tee Housing is out-of-round (as the result of an external blow, such as dropping) where the Gear seats.

2.3.2.3 Bevel Gear #31

Inspect the Tee Housing Bevel Gear #31 for worn, damaged or sharp/pointed teeth, and for damage to the key that engages the slot on the Gearbox Nose #14.

2.3.2.4 Ring Gear #30

Inspect the Ring Gear #30 for worn, damaged or sharp/pointed teeth, and for damage to the key that engages the slot on the Tee Housing #35/#55.

2.3.2.5 Tee Housing Bearing #32

Inspect the Tee Housing Bearings #32 and discard any that are broken, cracked, or deeply scored. Clean any deposits from the Bearings and check their fit in the Tee Housing Bearing Cups #34. While they should turn freely in their Cups, the Tee Housing Bearings should be replaced if the diameter of the **outside wall** is **less than 1.490"** to avoid shortening the life of the Seals or Bevel Gears.

2.3.2.6 Tee Housing Seals #33

Examine the Seals for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring) or excessive wear on the sealing lips (the sealing lip is worn to a smooth surface) and replace as required. When installing the Seals, make sure that the spring side of the Seal faces towards the Tee Housing Bearing Cup #34.

2.3.2.7 Tee Housing Bearing Cups #34

Clean any deposits from the Cups and examine for excessive wear. Light scoring is acceptable, but the cups should be replaced if they are grooved in the seal contact area or if the diameter of their **inside wall** is **greater than 1.520"**. If the Bearing Cups require replacement, follow the procedure given for the Nozzle Housing Cups #40/#60 in section 2.3.1.6.

Replacement Cups must be fully seated in order for the Tee Housing to turn freely when the machine is reassembled.

2.3.2.8 Reassembly

Install the **first** of the two Tee Housing Seals #33 in the Tee Housing Bearing Cup #34 with its spring side facing into the Cup (the **second** Tee Housing Seal will be installed later in section 2.4.10). Next, install the Tee Housing Bearing #32 and, then, the Tee Housing Bevel Gear #31. Locate the key on the Ring Gear #30 and install the Gear so that the key engages the key slot on the Tee Housing #35/#55. Finally, install the Ring Gear Retaining Ring #29.

2.3.3 GEARBOX #1

2.3.3.1 Disassembly

Unscrew the Gearhead Retainer Screw #2 with the appropriate Hex Ball-point L-wrench and pull the **Gear Train Assembly** out of the Gearbox #1.

2.3.3.2 Inspection

Check for liquid (wash fluid, water, etc.) in the Gearbox #1. If there is just a slight amount (dampness or vapor) of liquid in the Gearbox, wipe out the water with a towel or paper towel and replace the Output Pinion Seal #12 in the Gearbox Nose #14. (Refer to section 2.3.4. Gearbox Nose for replacement of the Output Pinion Seal #12). If the Gearbox is much more than damp (about 1/4 or more filled with liquid), it is possible that the liquid will get inside the Planetary Gearhead #4. If so, refer to section 2.3.3.5 for service details.

2.3.3.3 Output Pinion #8

Inspect the Output Pinion #8 for worn or damaged or sharp/pointed teeth. Check for any wear, such as scoring, or cracks in the seal contact area (Chromium Oxide coating area). Examine the Input Shaft Seal #11 for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring) or excessive wear on the back of the seal and the sealing lips (the sealing lips are worn smooth), and replace as required.

To replace the Output Pinion, remove the four Planetary Gearhead Screws #3 with a Phillips Screwdriver and pull out the Output Pinion #8. Remove the Input Shaft #6 from the **old** Output Pinion. Inspect the Input Shaft Seal #11 for damage or wear (the sealing lips are worn smooth/there is no drag between the Seal #11 and the Input Shaft #6) and replace as needed.

In the new version (Gamajet V with Serial No.V700 or later), the Output Pinion has two components, the Output Pinion Housing Assembly (8-

511-H) and the Output Pinion Gear (8-511-B). Therefore, if the gear of the Output Pinion Assembly is worn out, unscrew the Gear (8-511-B) and replace the Gear only. Refer to Step 1 of the Assembly Procedure at the end of the Manual for details.

2.3.3.4 Input Shaft #6 & Input Pinion #5

Inspect the Input Pinion #5 for worn or damaged or sharp/pointed teeth. Check for any wear (scoring) or cracks on the Input Shaft #6, especially in the seal contact area. The Pinion is both pressed on tightly and then welded onto the Shaft and should not be able to be rotated around the Shaft.

2.3.3.5 Planetary Gearhead #4

WARNING: *Proceed in a cautious manner when performing any work to the Planetary Gearhead due to the complexity and size of the internal parts.*

Inspect the Planetary Gearhead by rotating the Input Shaft #6 by hand. If the Input Shaft does not turn smoothly in both directions or feels stuck, return the entire Gamajet unit to Gamajet Cleaning Systems, Inc. for service.

The Planetary Gears can be inspected by loosening the Planetary Gearhead Screws #3 and lifting the Output Pinion Assembly #8 from the Gearhead. If the grease inside the Gearhead is completely or partially filled with liquid (cleaning fluid, water, etc.) or if the inside of the Gearhead is dry, the grease lubricant inside the Gearhead may have dissolved. If this is the case, please refer to the below steps for adding grease to the Gearhead. In this case, it is also recommended that the 524-S seal be checked for failure. If the Gearhead rotates freely and is adequately greased, the Gearhead can be reassembled by lining up and tightening the Planetary Gearhead Screws #3.

If the Gearhead rotates freely, but lacks adequate grease as lubrication, the following steps can be taken to adequately grease the planetary Gearhead.

Please note that the following steps must be taken in a cautious manner. If you have any concerns, please return the unit to Gamajet for service.

In order to adequately grease the planetary gears, the Planetary Ring Gear must be removed. When removing the Planetary Ring Gear, the top tier of Planetary Gears must be held in place with downward pressure. The Planetary Ring Gear can then be pulled away. The internal components (three individual tiers of planetary gears) of the Planetary Gearhead must remain together as a single unit.

If the planetary gears are removed as a single unit, any debris can be loosened and removed using an aerosol degreaser and air to dry. Once dry, the Planetary Gears can be lightly hand packed with grease. Gamajet recommends using a Chevron FM NLGI 2 grease for food grade applications and a Fuch's ST-80 grease for aggressive chemical environments. Please consult your lubricant specialist for compatibility. Once the planetary gears are packed with grease, the planetary ring gear can be reinstalled by aligning the Planetary Gears with the Planetary Ring Gear on tier at a time. The Output Pinion Assembly #8 can then be secured using the Planetary Gearhead Screws #3.

If any of the Planetary Gears are damaged, Gamajet can supply reconditioned individual gears.

2.3.3.6 Reassembly

If the Output Pinion #8 was removed for replacement, install the Input Shaft Seal #7 into the Output Pinion Housing #8D so that the spring side of the Seal faces inwards (towards) the Output Pinion Housing #8D. Apply grease around the O-ring of the Seal #7 before installing for easy installation. Insert the Input Shaft Assembly #6 into the Output Pinion Assembly. Mount this assembly onto the Planetary Gearhead #4. Align the four holes on the Output Pinion with the four holes on the Planetary Gearhead by rotating the Output Pinion while holding the Gearhead still. Attach the Gearhead onto the Output Pinion with the four Planetary Gearhead Screws #3.

Then insert the entire Planetary Gearhead assembly into the Gearbox #1 while lining up the flat side of the Output Shaft of the Gearhead with the Retainer Screw #2. Make sure that the Gearhead fully seats in the Gearbox before tightening the Retainer Screw. The Gearhead assembly is fully seated when the distance from the face of the Output Pinion #8 to the rim or top of the shoulder of the Gearbox #1 is 0.09"-0.10". The flat side of the Output Shaft is darker than the rest of the shaft so you can also locate the flat side visually by rotating the Gearhead inside the Gearbox until the darker color is visible.

2.3.4 GEARBOX NOSE #14

2.3.4.1 Disassembly

Remove the Idler Shaft #18 with a Slotted Screwdriver and take out the Idler Gear #16 and the Idler Gear Thrust Washer #15. Pull the Rotor Shaft Upper Bearing #20 off the Gearbox Nose #14 with the Pliers.

2.3.4.2 Inspection

Inspect the Gearbox Nose for any sign of being bent. Check for any sign of damage to the key slot that engages the Tee Housing Bevel Gear #31.

2.3.4.3 Idler Gear #16

Inspect the Idler Gears for any worn, damaged or sharp/pointed teeth, or worn bushing flanges (the thickness of the flange or the lip should not be less than 0.050"). Check the Idler Bushings #17 for looseness. If the diameter of the **inside wall** of the Bushing is **greater than 0.215"**, replace the Bushing. Also, check the Thrust Washer #15 for wear (the thickness of the washer should not be less than 0.050") and replace if necessary.

2.3.4.4 Idler Shaft #18

Examine the Idler Shaft for damage or wear (scoring) and replace if the **outside diameter** of the Shaft is **less than 0.196"**. The original O.D. of the Shaft is 0.200" \pm 0.001".

2.3.4.5 O-rings #9, #19 & #21

Inspect the O-rings #9, #19, and #21 for deterioration (they have become hardened or deformed) or damage and replace if necessary.

2.3.4.6 Output Pinion Bearing #7 and Seal #12

If the Output Pinion Seal #12 needs replacement (the seal is loose (it should not be able to be rotated in the bore without any resistance) in the Gearbox Nose bore or if the sealing lip has worn smooth), carefully pry the Output Pinion Seal #12 out of the Gearbox Nose. Check the Seal #12 for wear or damage and replace if necessary. The Carbide Bearing #7 should not be loose in the Gearbox Nose. Replace the Bearing if it is cracked or worn.

Check the Input Shaft Seal #11, in the bottom of the Output Pinion, for wear and replace if the I.D. of the seal is worn smooth.

2.3.4.7 Rotor Shaft Upper Bearing #20 & Lower Bearing #13

Check both Bearings for wear, damage or looseness. If the **inside diameter** of either Bearing is **greater than 0.190"** or either Bearing is cracked, they should be replaced.

To replace the Lower Bearing, insert a small rod (with an O.D. of 0.200 to 0.250") in the Gearbox Nose, support the Gearbox Nose on its thick base (the base that has four holes) against the Arbor Press base, and carefully press the Bearing out with the Arbor Press. If the Bearing is extremely tight and resists removal, lubricate the Bearing before pressing it out. If an Arbor Press is not available, press the Bearing out by gently tapping the small rod, above, with a Hammer.

2.3.4.8 Reassembly

Install the Rotor Shaft Lower Bearing #13 if it was removed. Before pressing the Bearing, be sure to clean the bore and remove any burrs resulting from Bearing removal, lubricate the outside of the Bearing and press it in until the flange is fully and flush-seated against the Gearbox Nose #14.

Install the Output Pinion Seal #12 with its spring side facing towards the Rotor Shaft Lower Bearing #13 until its flange is fully and flush-seated against the Gearbox Nose. Reinstall the Idler Gears #16 and Idler Gear Thrust Washers #15 so that the Thrust Washers are at the side of the hole with thread. Refer to the Exploded View of the Gamajet V for a pictorial illustration of the location of these Washers. Then screw the Idler Shaft #18 into the Gearbox Nose.

Replace the O-ring #19 if necessary and then press the Rotor Shaft Upper Bearing #20 into the Gearbox Nose.

2.3.5 STEM #24

2.3.5.1 Inspection

Inspect the Stem #24 for damaged threads and wear. The Stem should be replaced if it is grooved in the seal contact area or bent or its threads are damaged.

2.3.5.2 Gearbox Nose Screw O-ring #23

Remove the four O-rings #23 from their seats around the screw holes in the bottom of the Stem and discard them. These should always be replaced with new ones whenever the machine is disassembled.

2.4 REASSEMBLY

Note: *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.*

Apply a dab of a Teflon-based anti-seize compound to all threads (especially the threads on the Stem) when reassembling; this will prevent galling of threads and ease any future disassembly.

Whenever lubrication of parts is required for assembly, lithium-based soap grease (Calypsol SF 3-097) is satisfactory.

2.4.1 Lubricate the Gearbox-Nose Stem O-ring #21 on the Gearbox Nose #14. Place the four Gearbox Nose Screw O-rings #23 on their seats at the bottom of the Stem #24. Slide the assembled Gearbox Nose into the Stem. Rotate one of them until the four holes line up. Attach the Gearbox Nose to the Stem with the four Gearbox Nose-Stem Screws #10 and Lockwashers #51.

2.4.2 Lubricate the Gearbox O-ring #9 on the Gearbox Nose. Slide the assembled Gearbox #1 into the assembled Stem-Gearbox Nose. Rotate the Gearbox to line up the four holes. Fasten the assembly with the four Gearbox Screws #22 and Lockwashers #51.

2.4.3 Install the Nozzle Bearing #38/#59 on the Tee Housing nose #35/#55. Then place the **first** Nozzle Housing Seal #39/#61 next to the Bearing with its spring side facing away from the Tee Housing body.

2.4.4 Place the assembled Nozzle Housing #44/#56 onto the Tee Housing #35/#55. Rotate the Nozzle Housing #44/#56 slightly to mesh the Bevel Gears #31 and #42/#58.

2.4.5 Install the **second** Nozzle Housing Seal #39/#61 onto the Tee Housing with its spring side facing the Nozzle Housing Bearing Cup #40/#60.

2.4.6 Insert the Nozzle Housing Bearing #38/#59 into the Nameplate #46 (#57 for Directional). While keeping the Nameplate and Bearing together, push them all the way onto the Tee Housing #35/#55. Rotate the Nameplate to align the two screw holes. Install the two Nameplate Screws #47 and tighten with a Slotted Screwdriver.

2.4.7 Slide the above assembly onto the Gearbox-Stem assembly. While firmly pressing down the above assembly, rotate the Nozzle Housing #44/#56 until the Tee Housing Bevel Gear #31 engages with the key slot on the Gearbox Nose #14 (you'll feel it click or engage). Now that everything is properly lined up, press the above assembly all the way down until it is firmly seated. You will know you've got it seated properly when the gap between the Tee Housing and the base of the Gearbox Nose is about 0.050", and the Nozzle Housing can not be rotated more than a few degrees.

2.4.8 Stand the machine upright. Place the Rotor #25 on the Input Shaft #6 followed by the Rotor Shaft Lockwasher #26 and Rotor Retaining Nut #27. Insert a Screwdriver downward through its blades to prevent the Rotor from turning, then tighten the Nut, **very tightly**, with an 11/32" Hex Deep Socket and 2" Extension. If you do not hold the Rotor still by this method, you run the risk of not tightening the Rotor tight enough, which, eventually will allow the Rotor to turn freely on the Input Shaft. This means both that the unit will not rotate properly and the Tee Housing Seals may become damaged.

2.4.9 Test for proper assembly by turning the Rotor with a pencil or Screwdriver. The Input Shaft should turn very easily and the Rotor vanes must not strike the stem wall. Continue turning and check to see that the Tee Housing turns also.

2.4.10 Place the **second** Tee Housing Seal #33 onto the Stem #24 with its spring side facing the Tee Housing Bearing Cup #34. Then place the Tee Housing Bearing #32 above it.

2.4.11 Drop the Stator #28 onto the top of the Stem #24. Make sure that the Stator doesn't touch any part of the Input Shaft assembly when it is fully seated.

2.4.12 Screw the Inlet Stem Collar #37 onto the Stem #24 until the Stator #28 stops it. The Collar needs to be only hand-tight; do NOT tighten by using a wrench as you'll damage the threads. Insert and tighten the Stem-Collar Retainer Screw #36 with the appropriate Hex Ball-point L-wrench to lock the Collar.

This completes the assembly process.

3. PREVENTATIVE 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 100 hours is recommended initially.*

Note: *Reference numbers appearing below may be used to identify parts on the exploded view in Appendix B .*

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 or recirculated wash water that could adversely affect the seals and O-rings during prolonged contact in storage. The best position to store the Gamajet is to stand it up side down with the inlet connection facing down.

3.2 GEARBOX MAINTENANCE

3.2.1 Disassemble the machine by following the instructions in section 2.2.

3.2.2 Inspect the condition of the Gearbox. If cleaning solution is present, refer to section 2.3.3 Gearbox and disassemble the Gamajet to replace the Seal #12 and other parts as required. If the Gearbox is free of contamination, go to step 3.2.3.

3.2.3 Reassemble the machine.

3.2.4 Return the machine to service.

3.3 INSPECTION INTERVALS

The Gamajet V should be inspected every 100-300 hours of operation, depending on the severity of use. An interval of 100 hours is recommended initially.

3.4 TIPS

3.4.1 All the Bearings, Bushings, Seals and O-rings are wear parts. Ideally, they should all be replaced, **as a group**, every 300-40/#600 hours of operation, depending on the severity of use. At first, an interval of 300 hours is recommended.

3.4.2 If just one Bearing or Seal is worn or damaged, replace both it and its mate, not just the worn or damaged part.

3.4.3 *Reminder to never retighten Gearbox Nose Stem & Gearbox Screws, P/N 8-542 & 8-543. ALWAYS use new screws. Also, always resplit or use new Lockwashers, P/N 8-552.*

4. TROUBLESHOOTING GUIDE

Note: *Reference numbers appearing below may be used to identify parts on the exploded view in Appendix B .*

4.1 TEE HOUSING DOES NOT ROTATE

4.1.1 INSUFFICIENT FLOW

Are the assumed operating conditions being met? Your Gamajet was built to meet certain operating conditions that your firm supplied to us. These are conditions such as gpm, 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. Inspect also for partially plugged Nozzle Tips, as that will have the same effect.

4.1.2 TIGHT CLEARANCES

In low-flow applications (below 10 gpm), a newly-overhauled Gamajet V may fail to operate when first returned to service. If the machine seems otherwise fine, try running it with at least one Nozzle Tip removed. The additional flow will invariably be enough to overcome the extra resistance of new Bearings and Seals. A few minutes of operation should loosen tight the clearances enough for the machine to run normally with the Nozzle(s) remounted.

Note: *When following the corrective actions in steps 4.1.1 and 4.1.2, be sure to allow enough time (about 1/2 to 2 minutes) for any accumulated liquid to drain completely from the inside of the Gamajet V before resuming operation.*

4.1.3 DEBRIS INSIDE

Loosen the Stem-Collar Retainer Screw #36, and remove the Inlet Stem Collar #37, then lift out the Stator #28. Look for and remove any debris caught between the Stator and Rotor vanes. Remove any material wound around the Input Shaft #6.

4.1.4 INPUT SHAFT BINDING

After completing step 4.1.3., try to spin the Rotor #25 by hand. The Input Shaft should turn very easily with a pencil and should be approximately centered in the Stem bore. If the Rotor is difficult to turn or is visibly off-center, look for a bent Gearbox Nose #14 or Stem #24. This kind of damage is particularly likely if the Gamajet has been struck hard or dropped.

If the Shaft will turn freely in one direction, but not the reverse, check inside the Planetary Gearhead #4 for damaged or broken gears.

4.1.5 GEAR TRAIN DAMAGE

If the Input Shaft turns freely (from section 4.1.4) continue turning it to see if the Tee Housing #35/#55 also rotates. Failure to rotate may indicate worn or damaged parts inside the Planetary Gearhead #4 or to the Idler Gears or the Input or Output Pinion gears. Another check on the gear train can be made by trying to rotate the Tee Housing directly by hand. It should have a small amount of free play (just a few degrees), but it should not turn in a full circle. If the Tee Housing can be rotated in a full circle, make sure that the Tee Housing Bevel Gear #31 is engaged in the key slot of the Gearbox Nose #14 and that the Set Screw at the bottom of the Gearbox is tight and on the flat of the shaft. Also check to see if the key has shorn off the Tee Housing Bevel Gear. Correct the problem or replace the parts as needed. Also, see section 4.1.6 for similar problems.

4.1.6 DAMAGED TEE HOUSING KEY SLOT

If the Tee Housing #35/#55 rotates freely (from section 4.1.5), also look for damage to the key slot that engages the Ring Gear #30. Inspect the Ring Gear for damage where it contacts the Tee Housing key slot.

4.2 NOZZLE HOUSING ROTATES SLOWLY OR NOT AT ALL

4.2.1 INSUFFICIENT FLOW & TIGHT CLEARANCES

See the instructions in Sections 4.1.1 and 4.1.2.

4.2.2 BEARINGS BINDING

Grasp the Nozzle Housing #44/#56 and try to rotate it in both directions; it should have just a few degrees of free play. Do not be alarmed if you can manually turn the Nozzle Housing by hand; it is a clutch drive and will turn by hand when “broken in.” If there is **no free play**, remove the Housing and check the fit of the Bearings #38/#59 in the Cups #40/#60. If the Bearings do not spin freely in their Cups, look for a deposit build-up or damaged parts and correct as required.

4.2.3 CLUTCH DAMAGE [Not Used in New Production]

If the Nozzle Housing rotates **very freely** (when “broken in,” you will be able to turn the nozzle housing since it is a friction or clutch drive; however, you should feel some resistance), remove the Housing and disassemble the Bevel Gear Retaining Ring #41 and Nozzle Housing Bevel Gear #42/#58. Look for a damaged Clutch O-ring #43. The Clutch O-ring should be flush with the surface of the housing or slightly protruding. If it is deeply sunken into its groove, it may be frozen in place and unable to engage the Bevel Gear. Remove the O-ring, taking care not to scratch the groove walls. The O-ring should be replaced with a

new one if it is hard or deformed. Install the O-ring so that it protrudes slightly; it will be compressed when the Bevel Gear and Retaining Ring are reinstalled.

4.2.4 WORN HOUSING BEARINGS

Look for excessive wear on the Nozzle and Tee Housing Bearings #32 and #38/#59. An excessive clearance (over 0.015") between the Bearings and the Cups #34 and #40/#60 can allow the Bevel Gears to disengage under load. Replace worn parts as required.

4.2.5 WORN BEVEL GEAR

Examine the Bevel Gears #31 and #42/#58 for worn, damaged or sharp/pointed teeth, and replace as required.

4.2.6 DAMAGED GEARBOX NOSE SLOT KEY

Remove the Nozzle Housing #44/#56. Using a Screwdriver, try to rotate the Tee Housing Bevel Gear #31 where it is exposed near the bottom of the Tee Housing. If the gear can be turned more than a few degrees, look for a worn key slot that engages the Bevel Gear #31 on the Gearbox Nose #14. Inspect the Bevel Gear #31 for damage to its key where it engages the slot.

4.3 CLEANING SOLUTION LEAKAGE

4.3.1 WORN OR IMPROPERLY INSTALLED SEALS

Excessive leakage from the Tee Housing or Nozzle Housing usually indicates worn Housing Seals #33 and #39/#61. Inspect the Seals 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.

If the Seals were recently replaced, verify that they are installed in the correct direction. These Seals are designed to seal in one direction only and, therefore, must be **installed with their sealing lips facing toward the pressure**. They are also **installed correctly when the side of the Seal with the exposed spring faces away from the adjacent Bearing**.

4.3.2 WORN BEARING CUPS

Inspect the Bearing Cups #34 and #40/#60 for excessive wear (grooved or scored), particularly near the inside flange where they contact Seals #33 and #39/#61. Replace any that show distinct grooves.

4.3.3 WORN BEARINGS

Inspect the Bearings #32 and #38/#59 and replace any that are excessively worn (clearance between the Bearing and the new Bearing Cup is more than 0.015"). Bearing clearances greater than 0.015" can prevent the Seals from functioning properly.

4.3.4 WORN OR ERODED CASTINGS

Inspect the Seal contact surfaces of the Stem #24 and the Tee Housing #35/#55. If these are worn or grooved, new Seals will be ineffective. Replace the damaged parts as required.

4.3.5 CLUTCH O-RING DAMAGE

Severe leakage at the Nozzle Housing may indicate a damaged Clutch O-ring #43. Remove the Nozzle Housing Retaining Ring #41, and lift off the Nozzle Housing Bevel Gear #42 to inspect the O-ring. See section 4.2.3 for instructions about the clutch O-ring.

4.4 POOR CLEANING PERFORMANCE

4.4.1 INADEQUATE FLOW OR 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)!

4.4.2 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 NOZZLES

Unscrew the Nozzle Tips #45 to see if there is any debris caught in the Stream Straightener #49. If removal is required for cleaning, the Straighteners may be driven out with a rod through the Nozzle bore. These Straighteners are an essential part of the nozzle design and must be reinstalled in the Nozzles to ensure proper jet impact and integrity.

4.4.4 SLOW OR NO ROTATION OF THE HOUSINGS

This will result in partial or erratic washing coverage. Refer to sections 4.1 and 4.2.

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. Gamajet performance tables are available that show flow rate, cycle time, and jet impact force for various combinations of pressure, flow rate, nozzle size, stator, and gear ratio. Contact a Gamajet representative if assistance is required. See, also, the first paragraph of section 4.1.1 about the suitability of the Gamajet's configuration to the **actual** (not estimated) operating conditions.

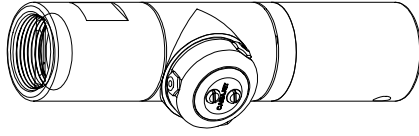
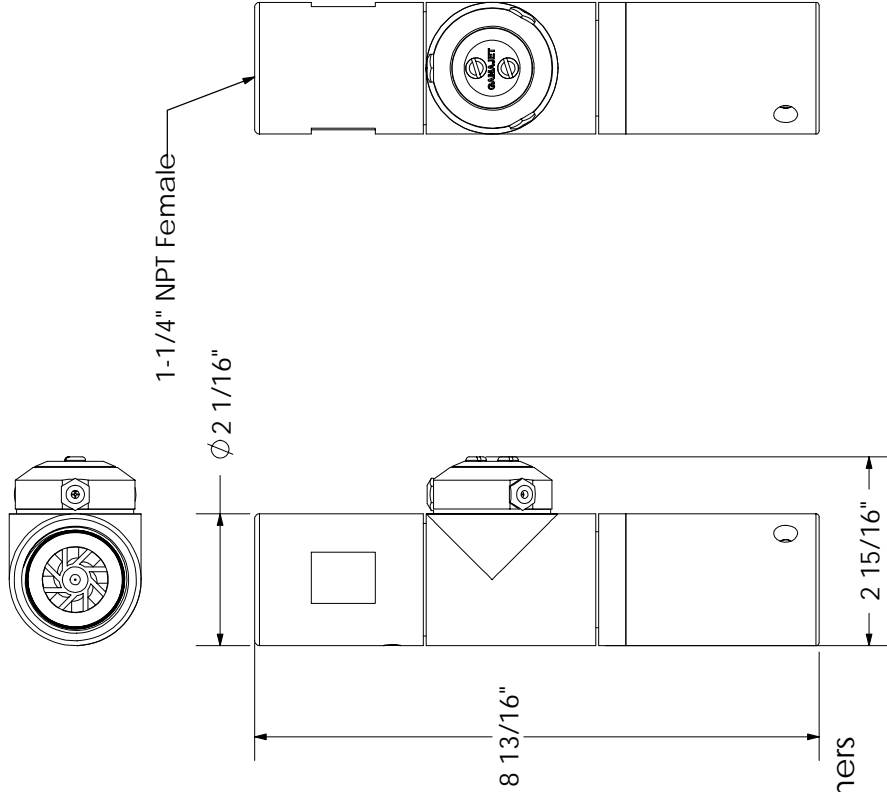
4.4.6 INADEQUATE DRAINAGE

Refer to section 1.2.6. Be sure 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.

Short Nozzle Insertion Clearance (Inches)		
	Dual	Triple
Free Hand	3	3
	3	3
Fixed Center Line	3-7/8	3-7/8
	3-7/8	3-7/8

Long Nozzle Insertion Clearance (Inches)		
	Dual	Triple
Free Hand	3	3-1/4
	3-7/16	3-3/16
Fixed Center Line	3-7/8	4
	4-1/4	4-1/4

- Notes:
- 316 SS, 18-8 Fasteners, Plastics, and Elastomers
 - Weight: 7 lbs.
 - Dual and Triple (Shown) Nozzle Available
 - Short (Shown) and Long Nozzles Available
 - Nozzle Sizes: range from .125" to .250"
 - Flow Range: 10 to 40 GPM
 - Pressure Range: 50 to 1200+ PSIG
 - Min Full Wash Cycle: 8 minutes



UNLESS OTHERWISE SPECIFIED
 * DIMENSIONS ARE IN INCHES
 * DIMENSIONS ARE FROM
 * DEBURR ALL SURFACES
 * FILLET RAD: 0.015
 * TOLERANCES:
 XX ±0.01
 XXX ±0.005
 ANGLE ±0.5°

MATERIAL: _____
 Material

FINISH (UNLESS OTHERWISE SPECIFIED):
 ??? Ra

SCALE: Full

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

TITLE: **Three View Marketing**

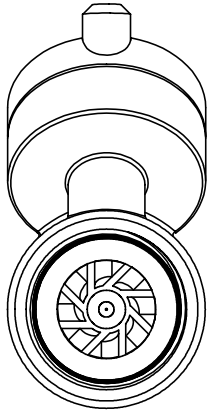
EQUIPMENT: **Gamajet V**

DWG. NO.: ---

SHEET 1 OF 1

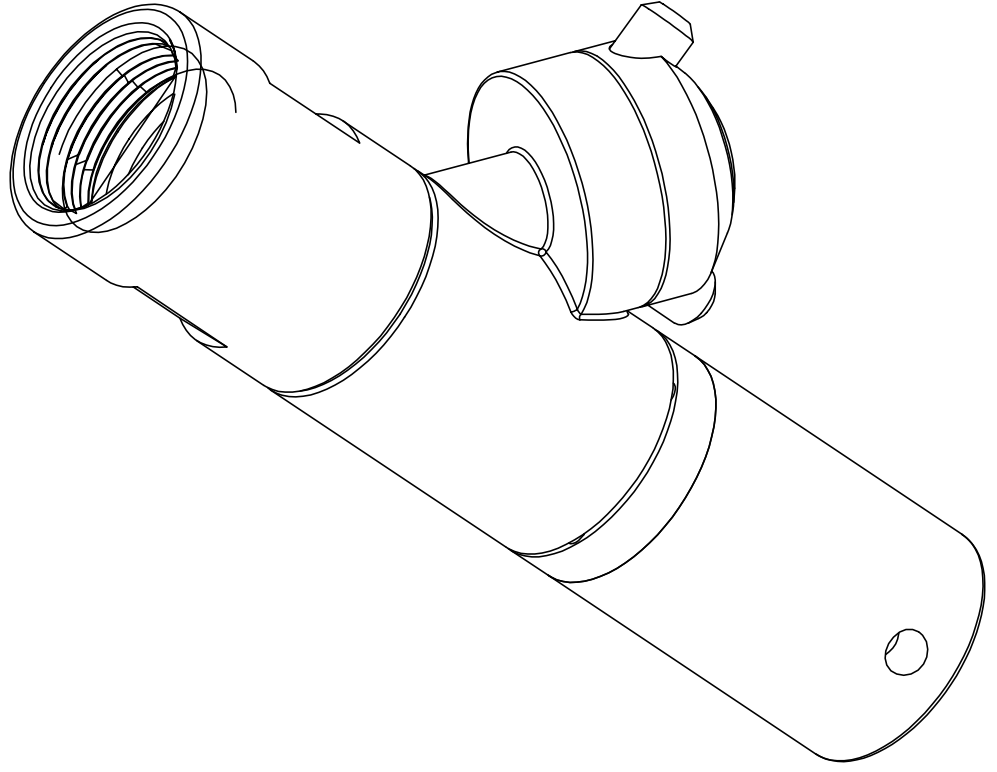
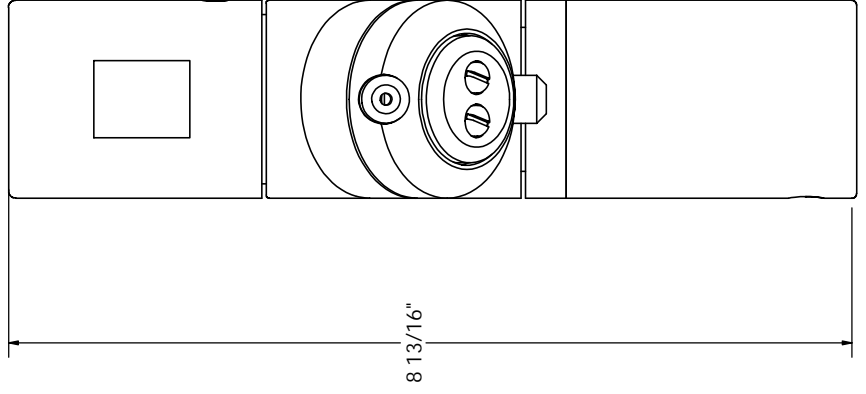
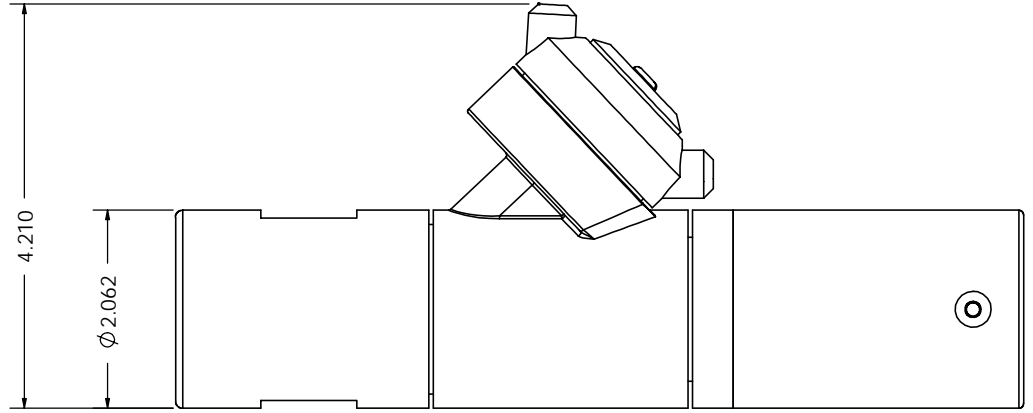
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	06/28/00	1	New Drawing

GAMAJET V - DIRECTIONAL - THREE VIEW MARKETING



- Notes:
- 316 SS, 18-8 SS Fasteners, Plastics, and Elastomers
 - Weight : 8.5 lbs
 - Dual (Shown) and Triple Nozzle Available
 - Nozzle Sizes : 0.125" to 0.250" Long
 - Flow Range: 10 to 40 GPM
 - Flow Range : 50 to 1200 PSIG
 - Min. Full Wash Cycle: 8 Minutes

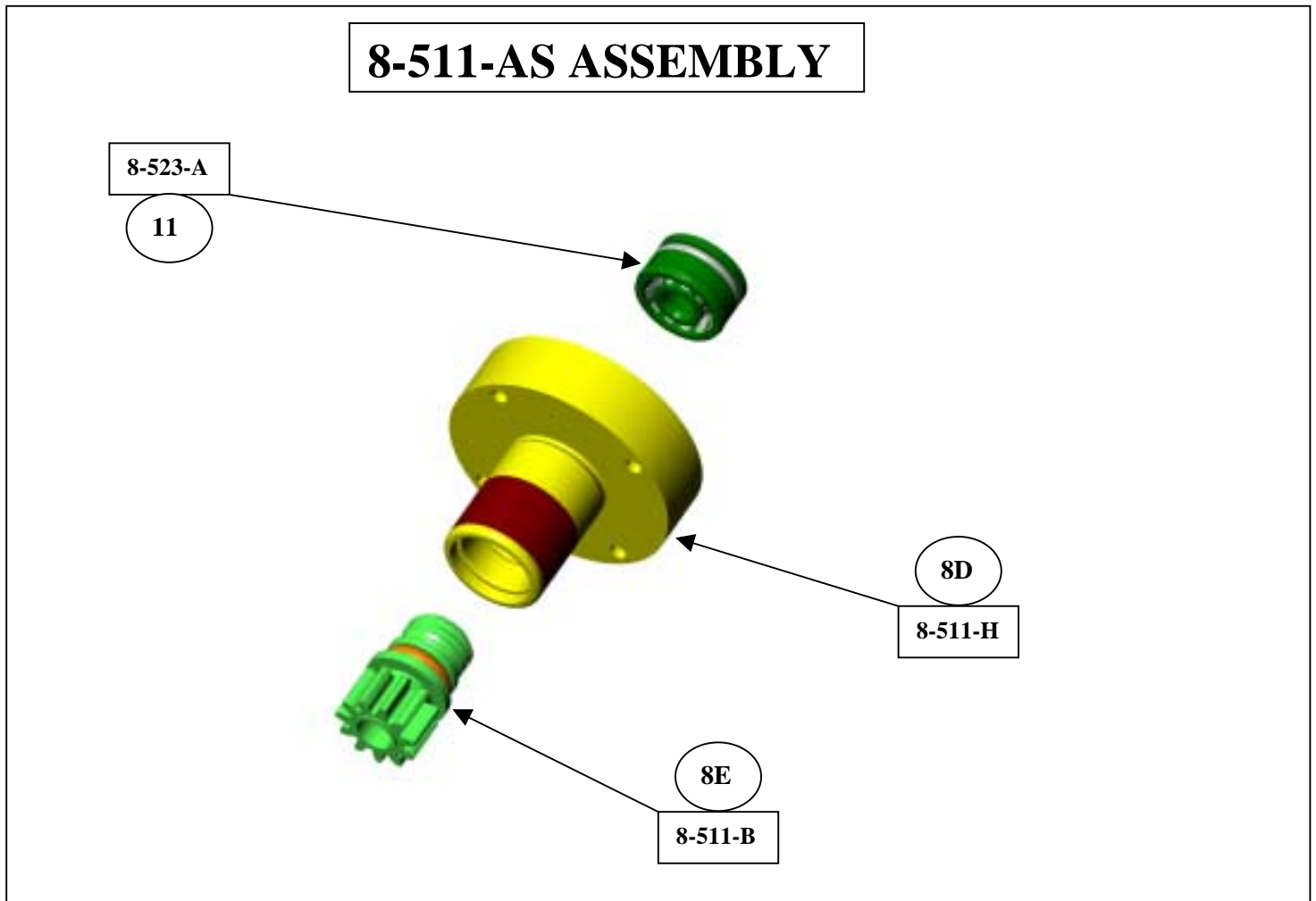
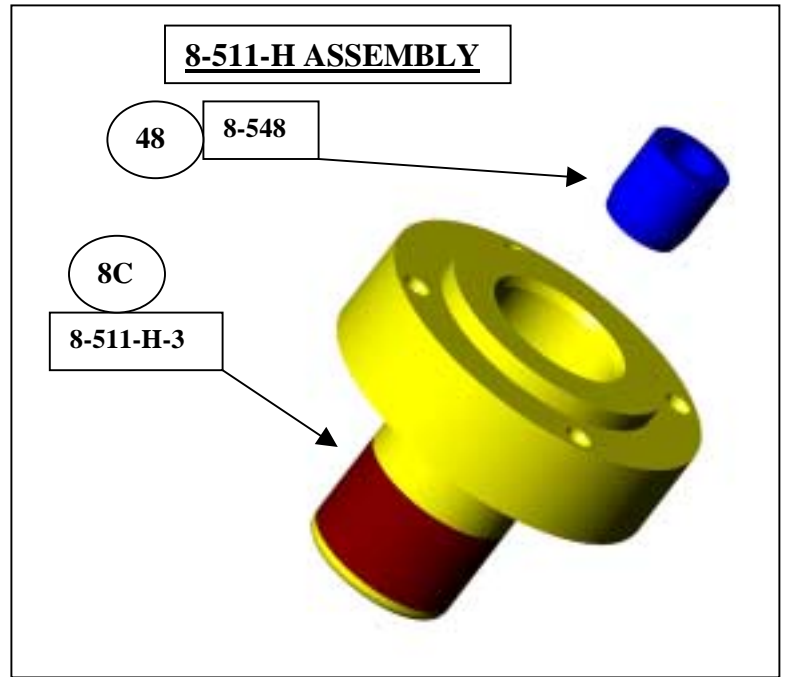
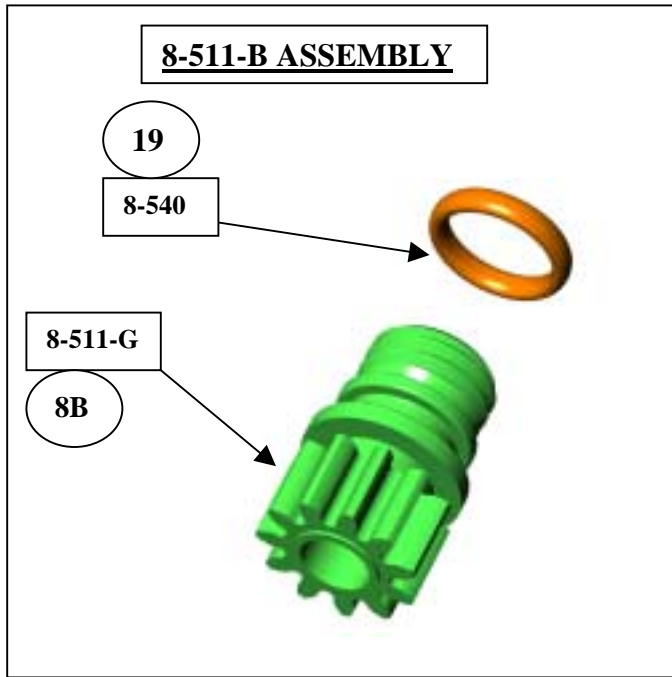
INSERTION CLEARANCES (INCHES)	
FREE HAND	4 - 3/8"
FIXED CENTER LINE	6 - 1/2"



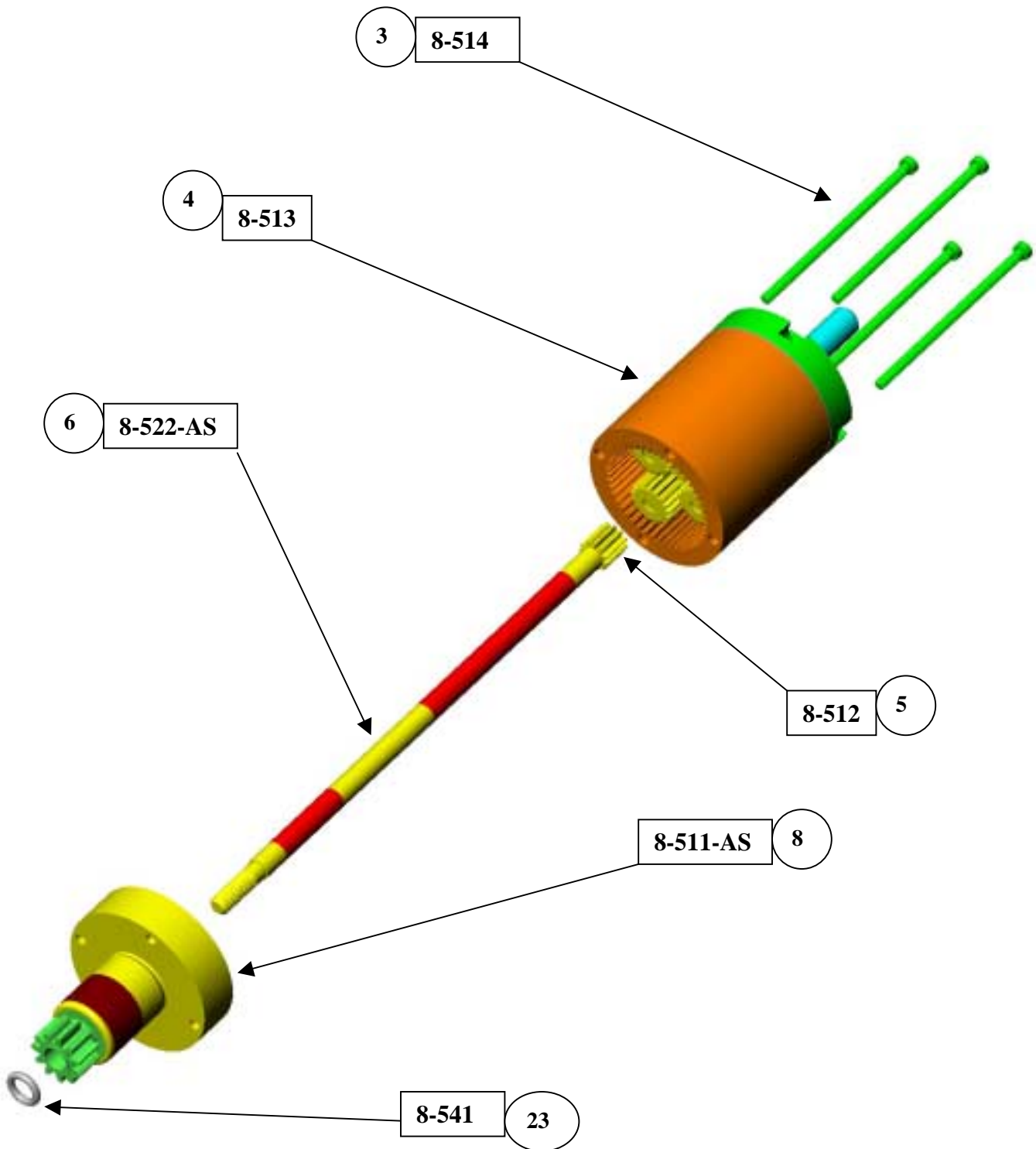
GAMAJET V

**UPDATE ASSEMBLY
PROCEDURE
&
EXPLODED VIEW**

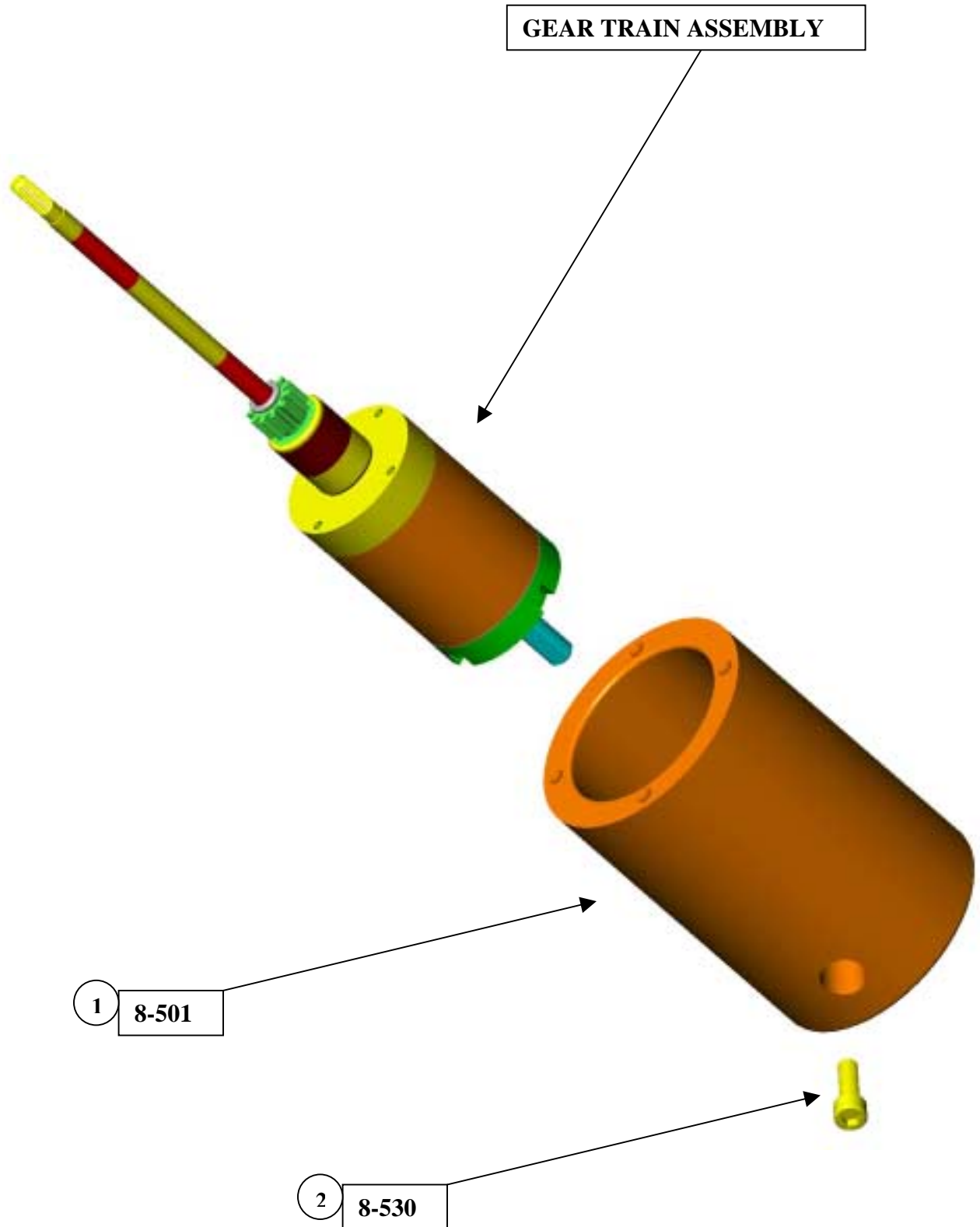
STEP 1: GAMAJET V UPGRADED OUTPUT PINION 8-511-AS ASSEMBLY EXPLODED VIEW



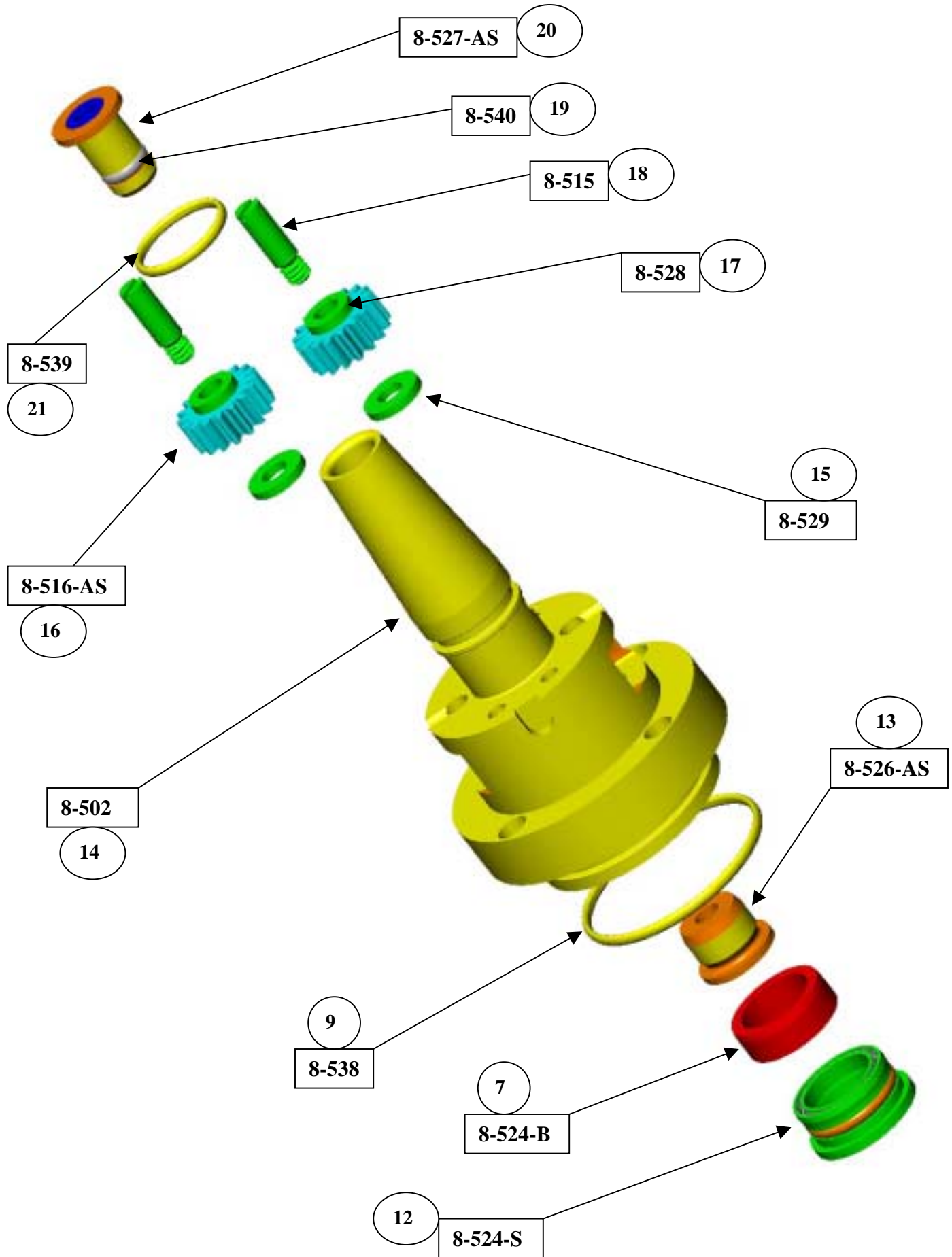
STEP 2:GAMAJET V GEAR TRAIN ASSEMBLY EXPLODED VIEW



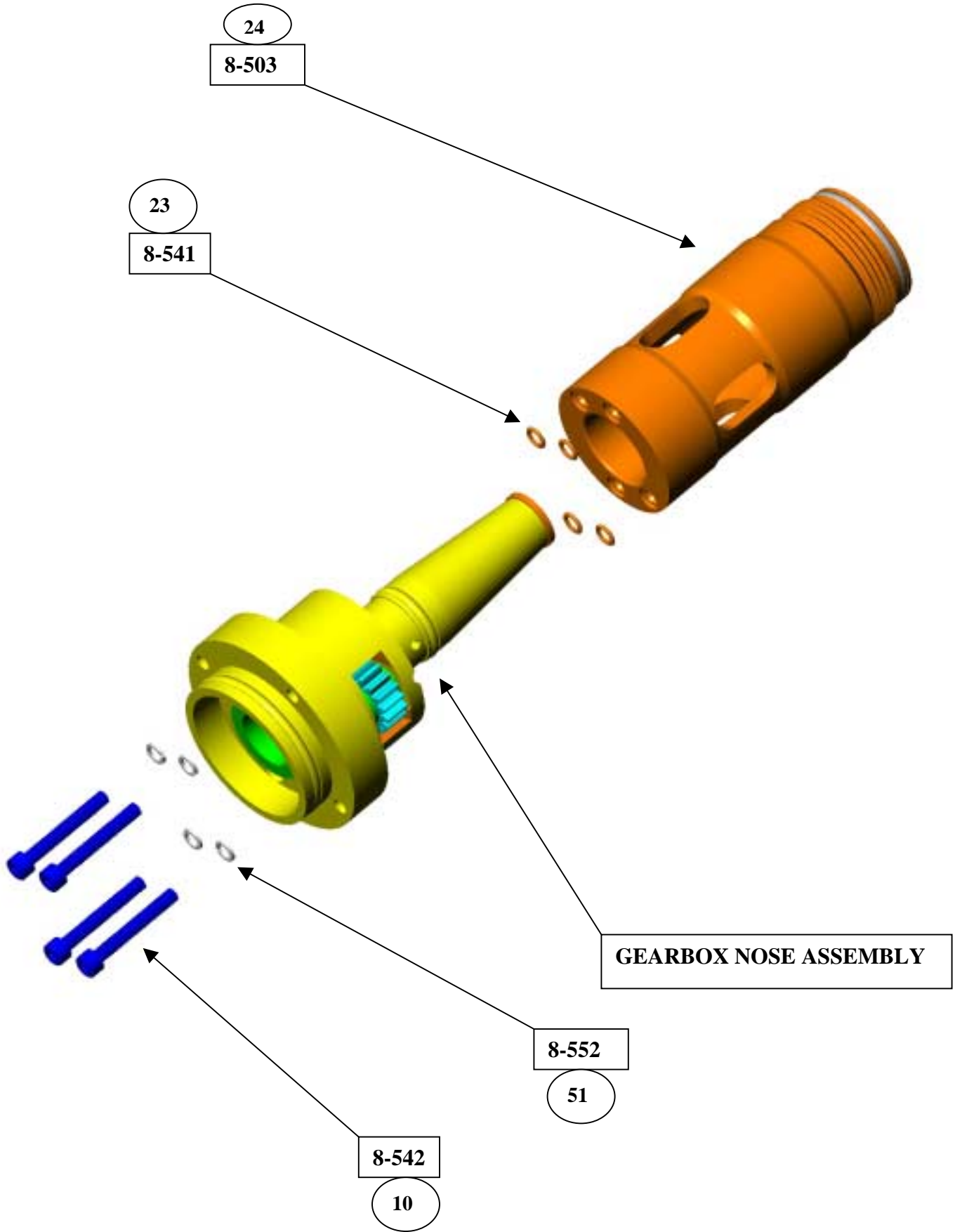
STEP 3:GAMAJET V GEARBOX ASSEMBLY EXPLODED VIEW



STEP 4: GAMAJET V GEARBOX NOSE ASSEMBLY EXPLODED VIEW

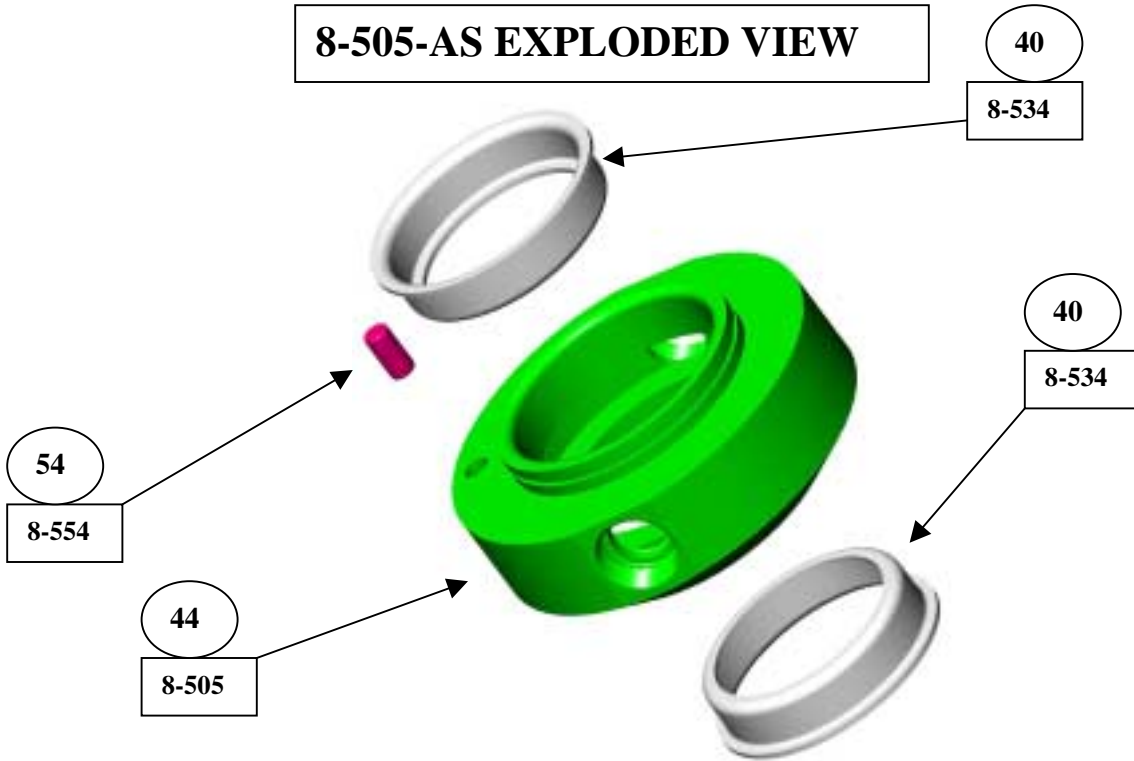


STEP 5: GAMAJET V GEARBOX NOSE & STEM ASSEMBLY EXPLODED VIEW

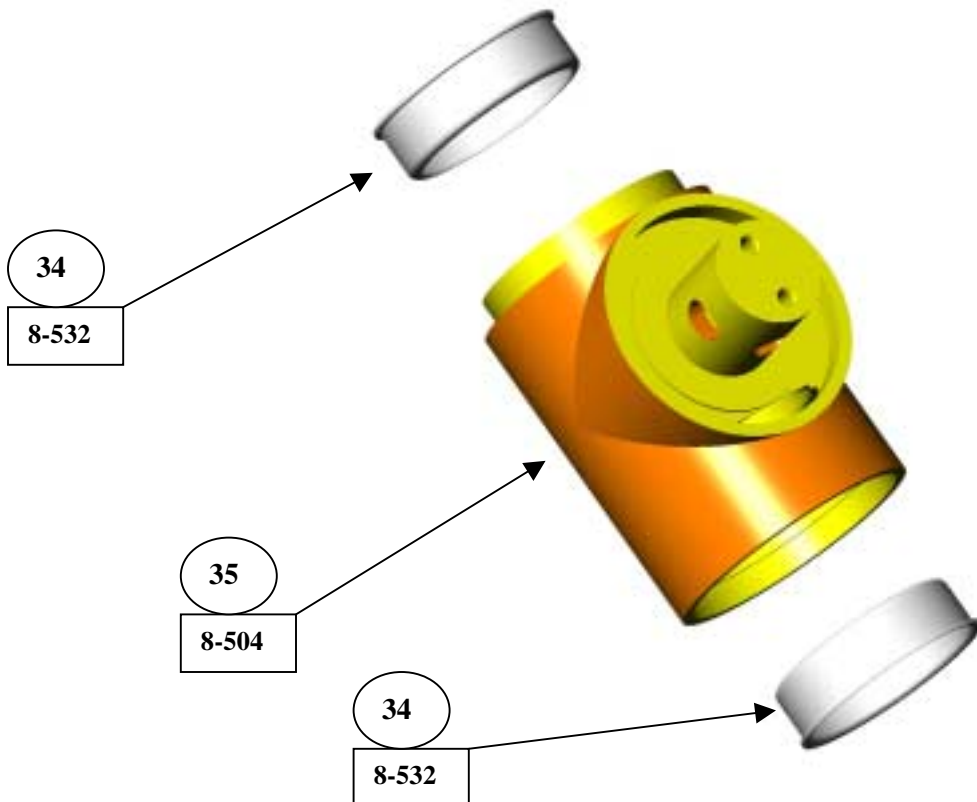


STEP 6: GAMAJET V TEE HOUSING & NOZZLE HOUSING ASSEMBLY

8-505-AS EXPLODED VIEW

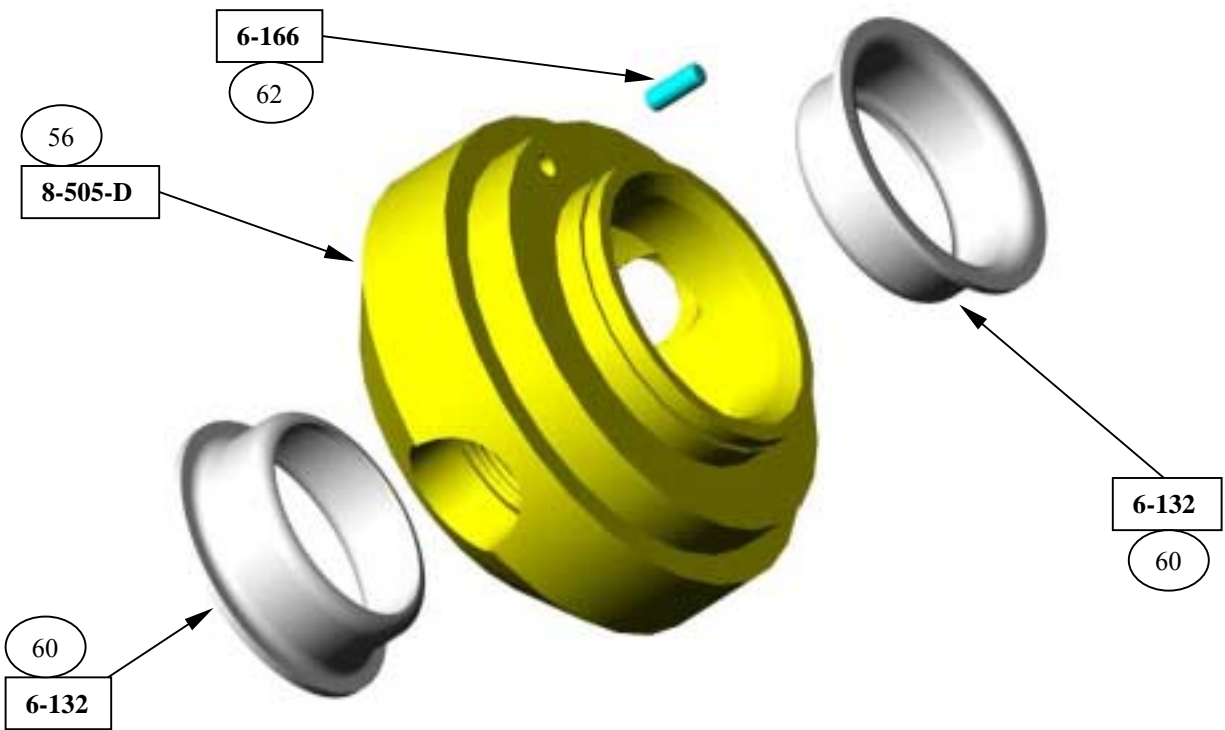


TEE HOUSING ASSEMBLY EXPLODED VIEW

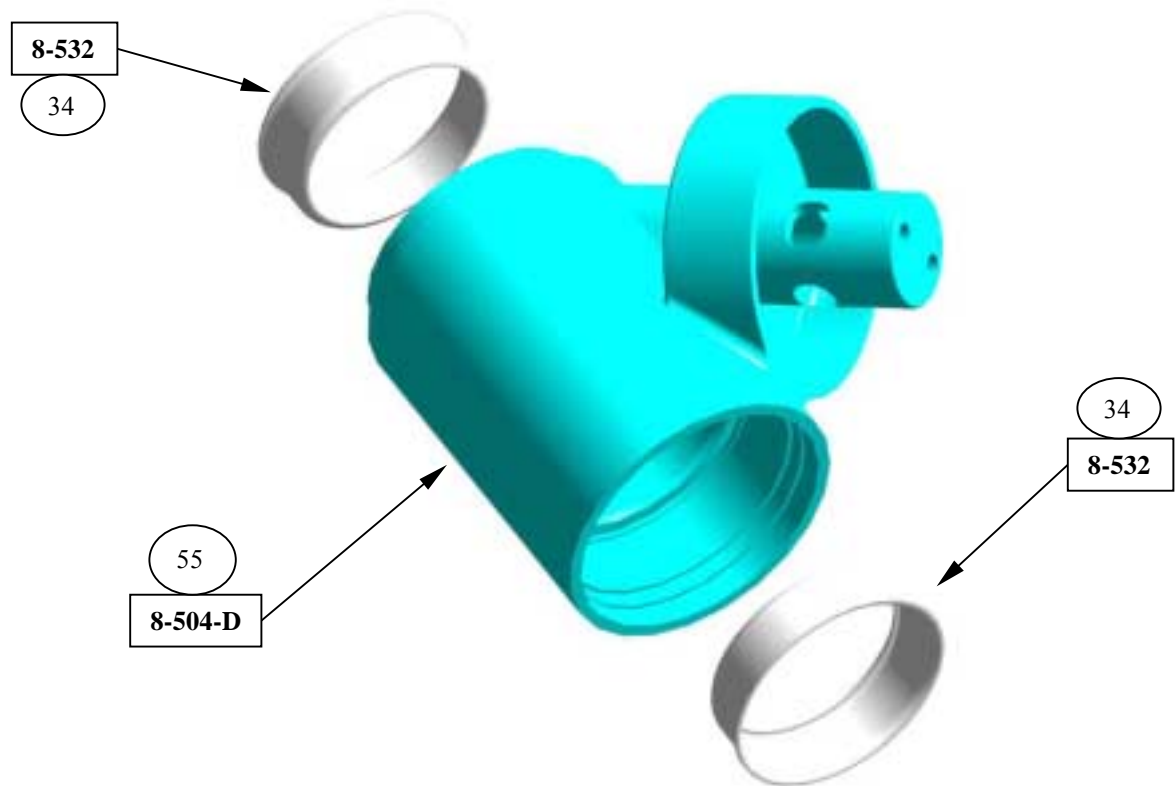


STEP 6: GAMAJET V DIRECTIONAL TEE HOUSING & NOZZLE HOUSING ASSEMBLY

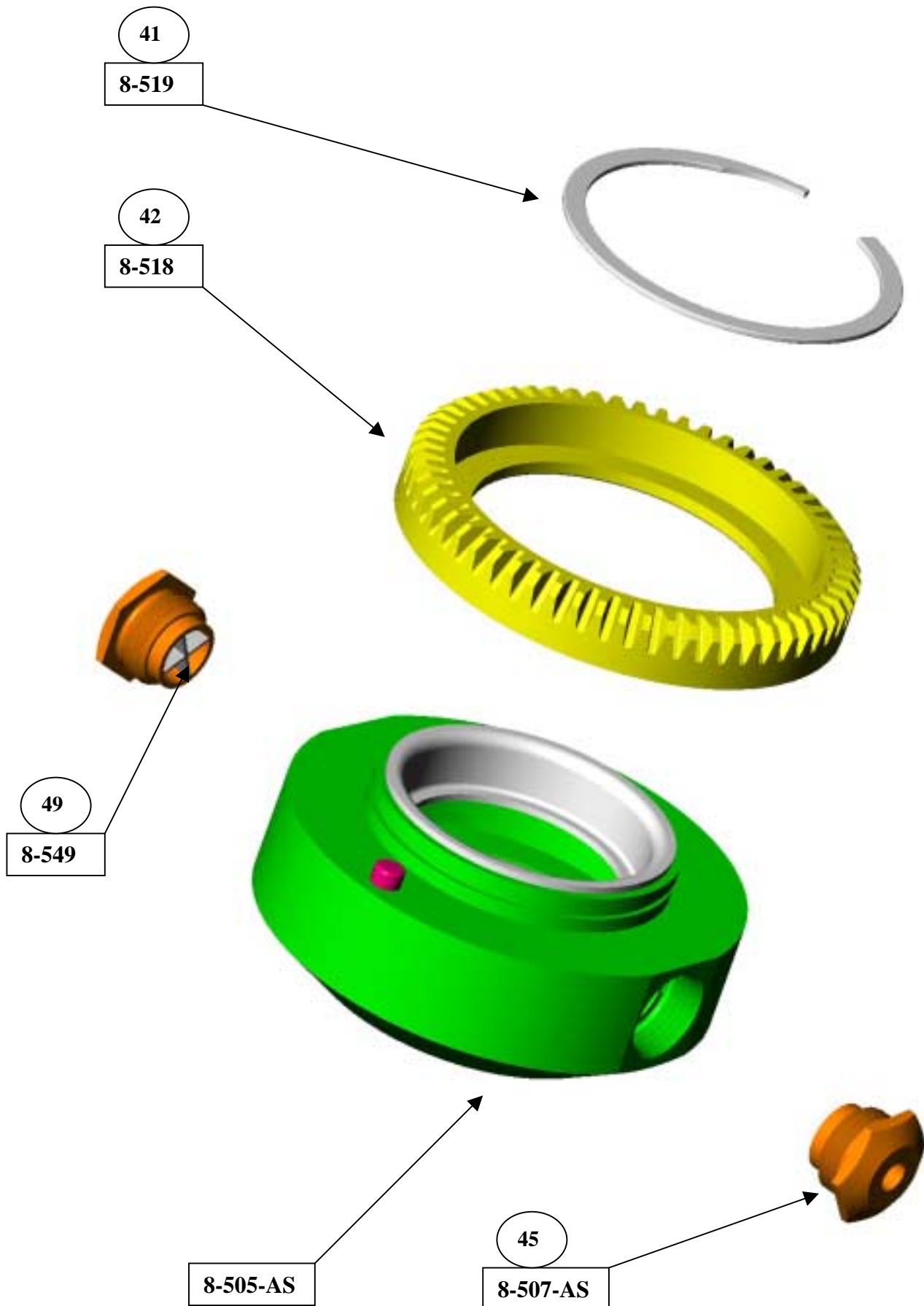
8-505-D DIRECTIONAL NOZZLE HOUSING ASSEMBLY EXPLODED VIEW



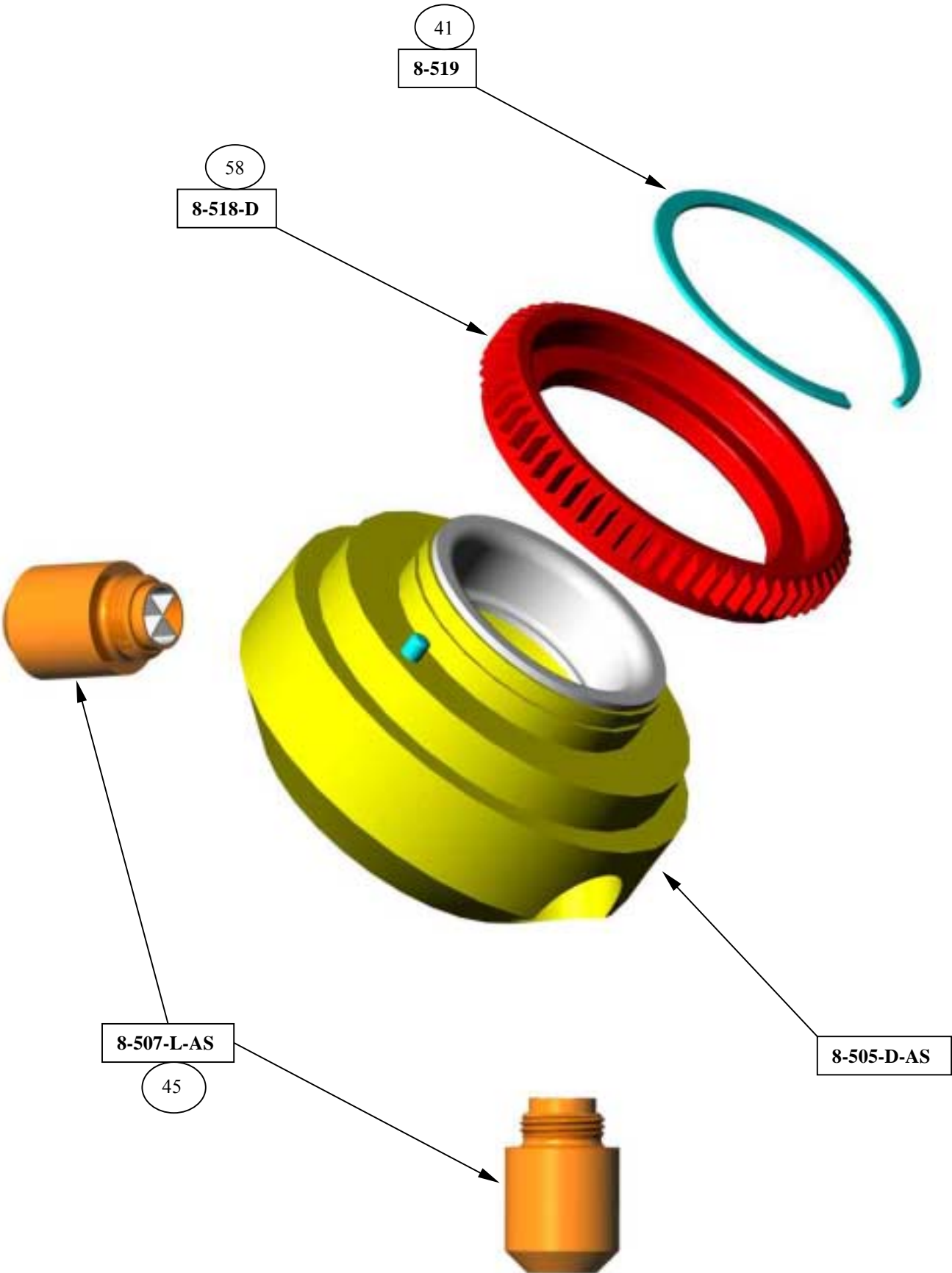
8-504-D DIRECTIONAL TEE HOUSING ASSEMBLY EXPLODED VIEW



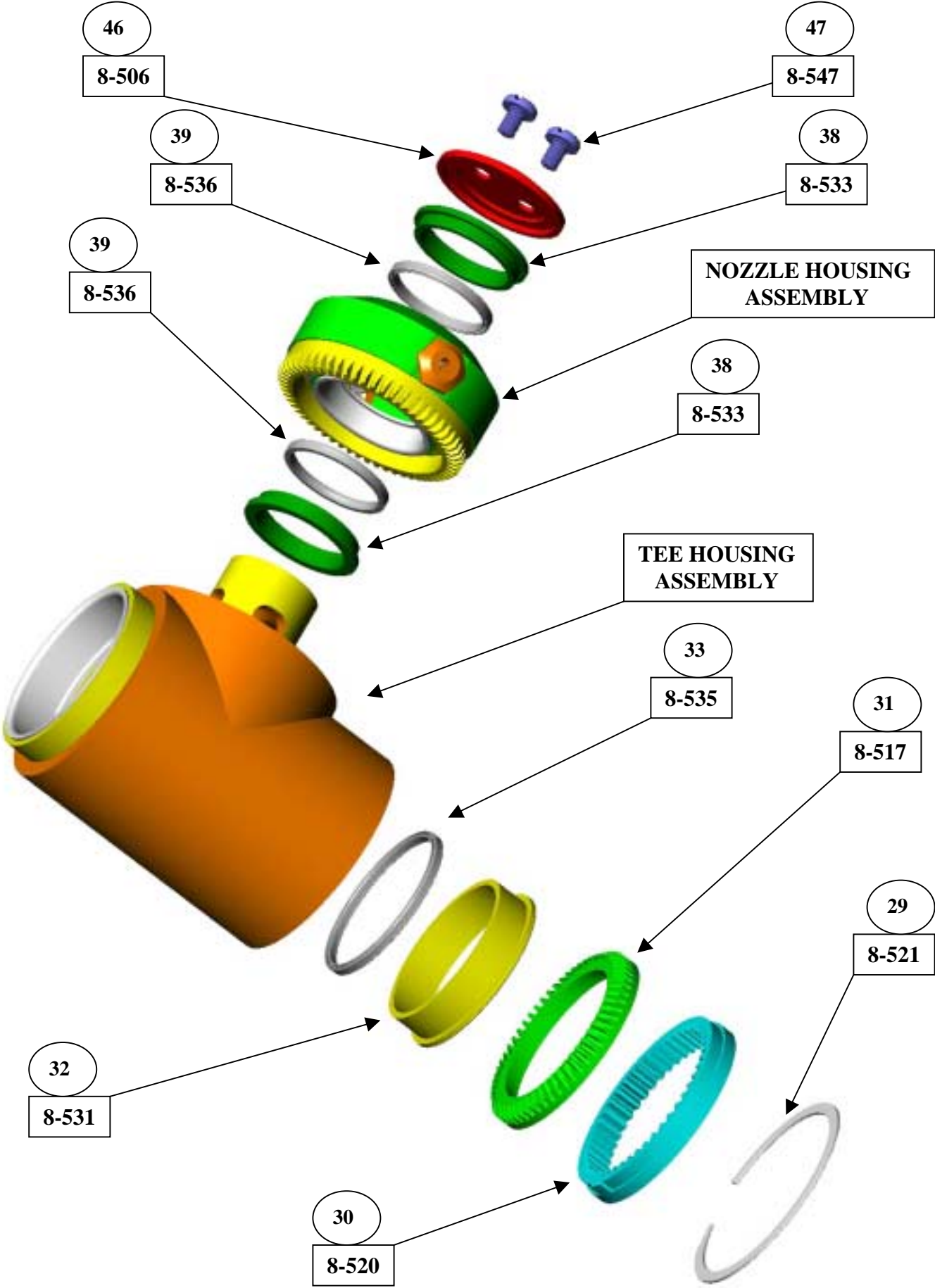
STEP 7: GAMAJET V NOZZLE HOUSING ASSEMBLY EXPLODED VIEW



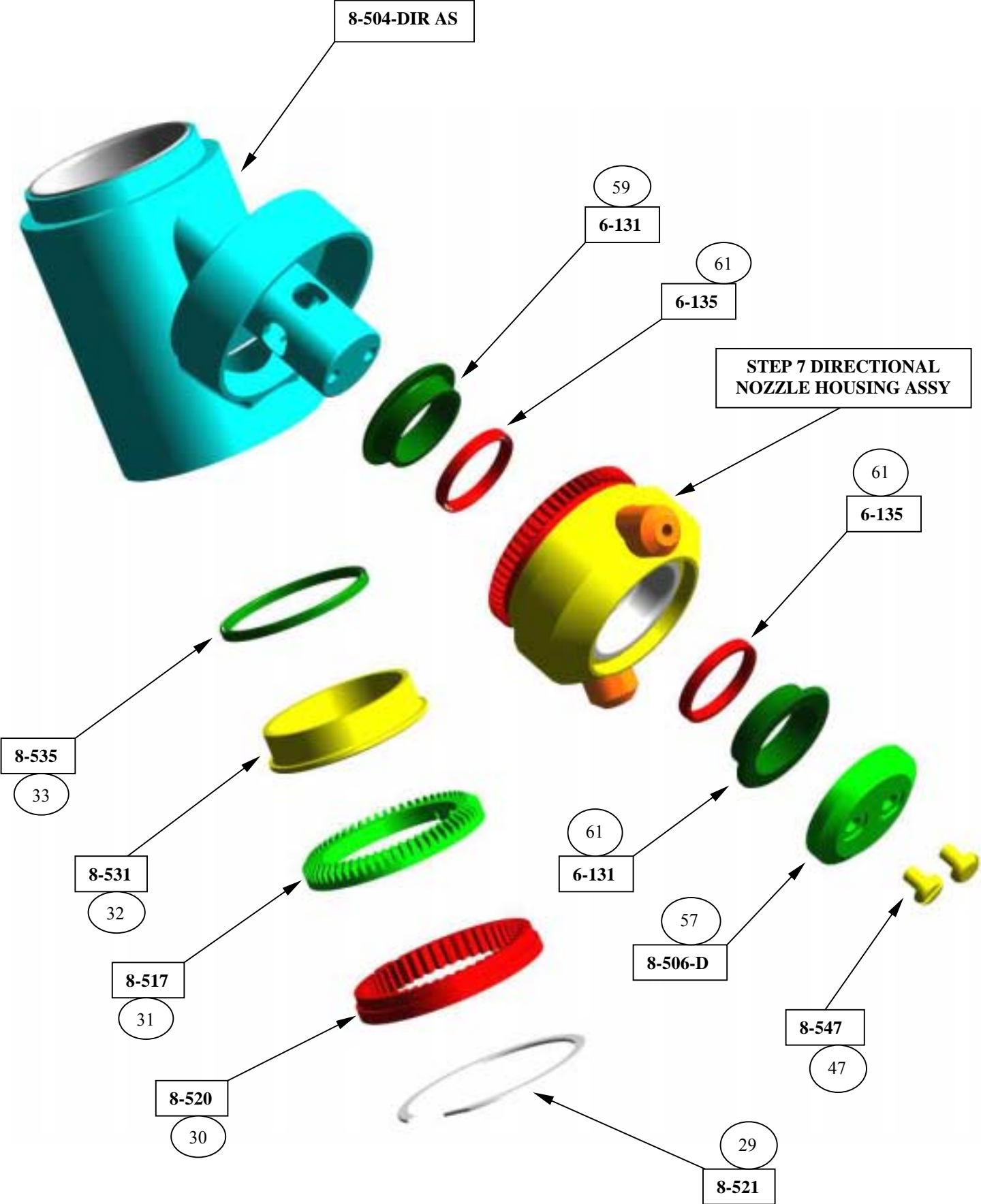
STEP 7: GAMAJET V DIRECTIONAL NOZZLE HOUSING ASSEMBLY EXPLODED VIEW



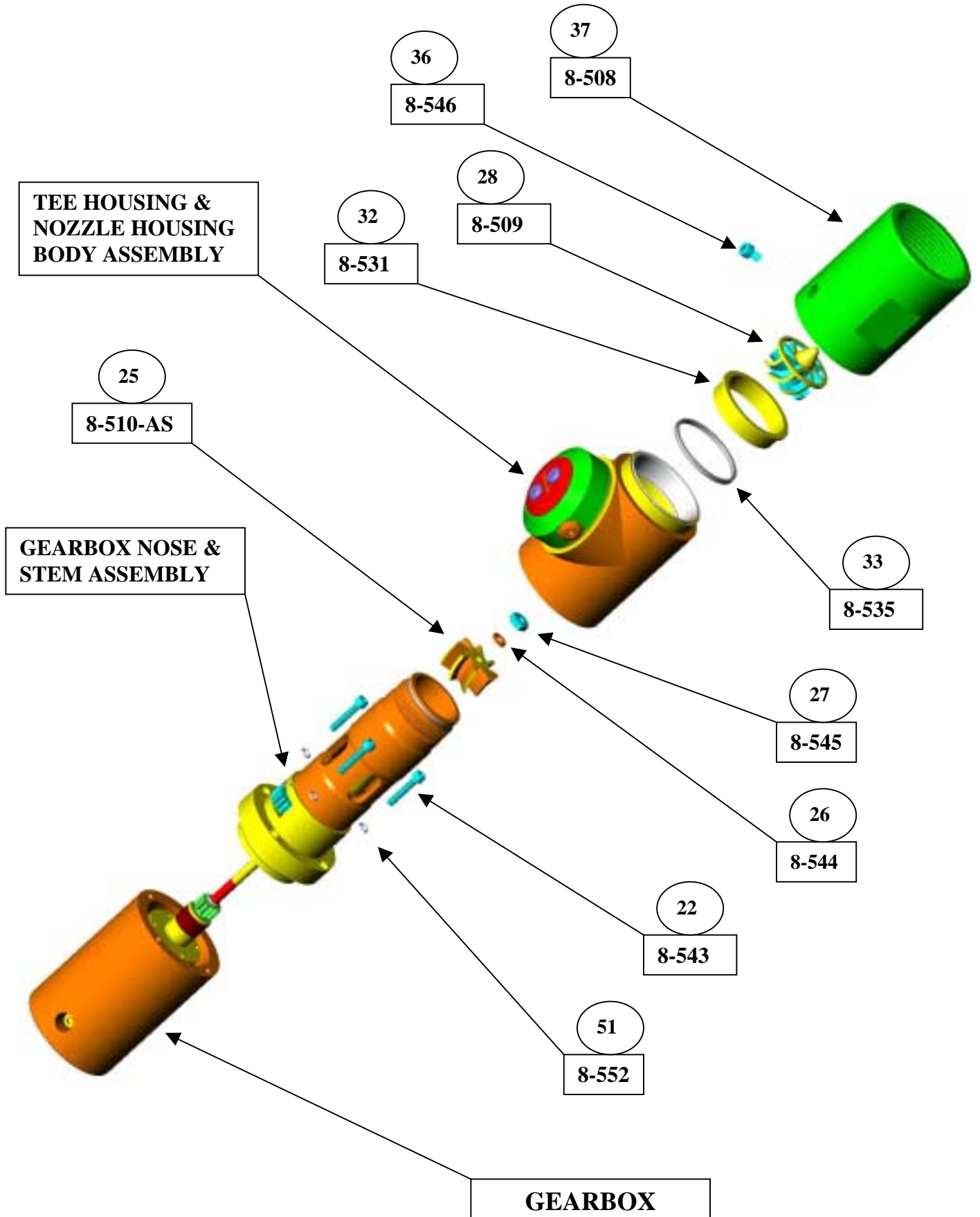
STEP 8: GAMAJET V TEE HOUSING & NOZZLE HOUSING BODY ASSEMBLY



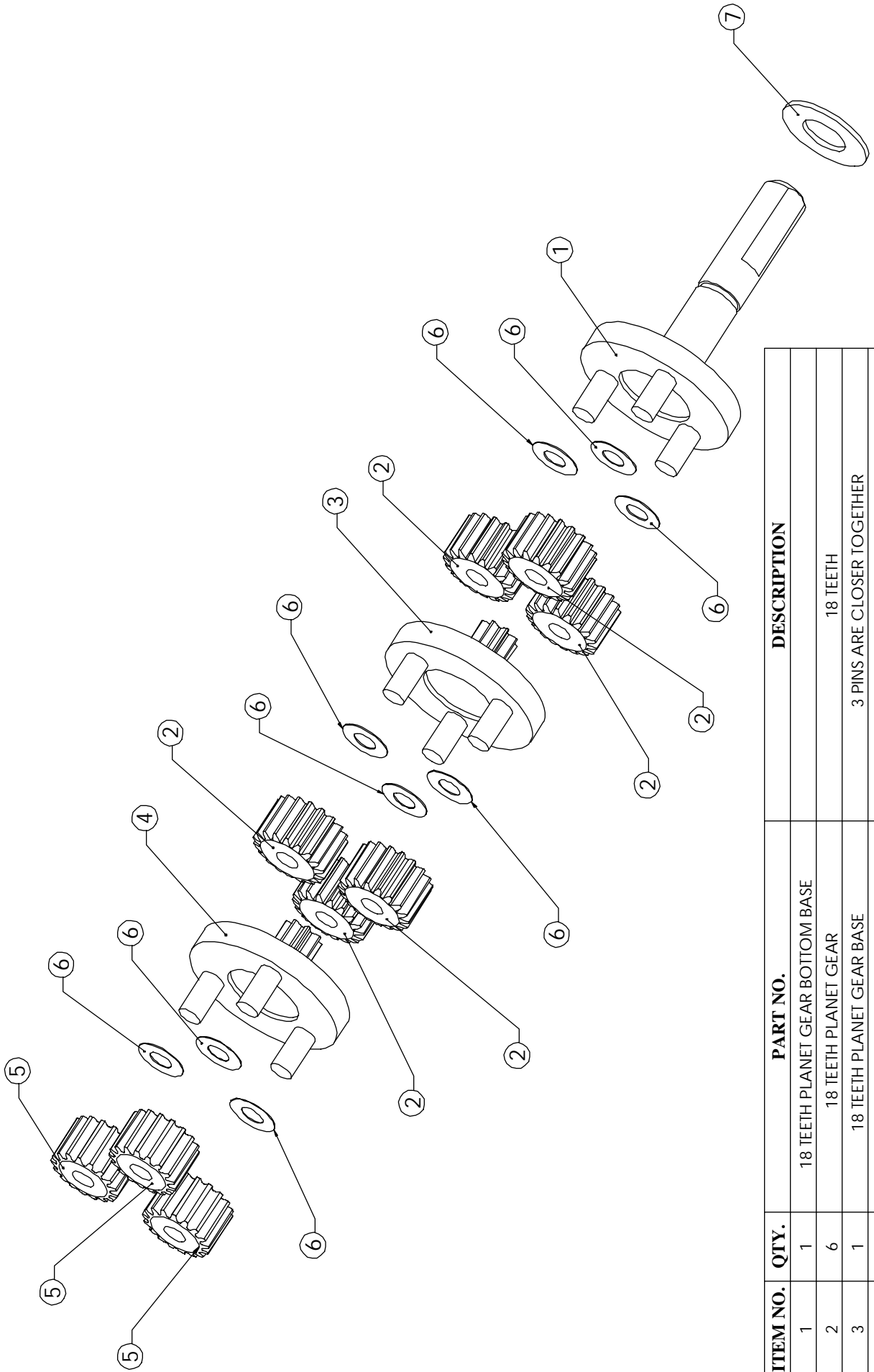
STEP 8: GAMAJET V DIECTIONAL TEE HOUSING & NOZZLE HOUSING BODY ASSEMBLY



STEP 9: GAMAJET V FINAL ASSEMBLY EXPLODED VIEW



GAMAJET V PLANETARY 236:1 GEAR TRAIN EXPLODED VIEW



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	18 TEETH PLANET GEAR BOTTOM BASE	
2	6	18 TEETH PLANET GEAR	18 TEETH
3	1	18 TEETH PLANET GEAR BASE	3 PINS ARE CLOSER TOGETHER
4	1	17 TEETH PLANET GEAR BASE	3 PINS ARE FURTHER APART
5	3	17 TEETH PLANET GEAR	17 TEETH
6	9	PLANET GEAR WASHER	PLANET GEAR THIN WASHER
7	1	PLANETARY GEARHEAD WASHER	PLANETARY GEAR HEAD OUTPUT SHAFT WASHER

GAMAJET V PARTS LIST

NUMERICAL BY PART NUMBER

PART NUMBER	QTY / MACHINE	PART NAME	DESCRIPTION & MATERIAL	REF. NO.
8-501	1	GEARBOX	316L STAINLESS STEEL	1
8-502	1	GEARBOX NOSE	316L STAINLESS STEEL	14
8-503	1	STEM	316L STAINLESS STEEL	24
8-504	1	TEE HOUSING	316L STAINLESS STEEL	35
8-505	1	NOZZLE HOUSING	316L STAINLESS STEEL	44
8-506	1	NAMEPLATE	316L STAINLESS STEEL	46
8-507	2 OR 3	NOZZLE TIP	316L STAINLESS STEEL	45
8-508	1	INLET STEM COLLAR	316L STAINLESS STEEL	37
8-509	1	STATOR	316L STAINLESS STEEL	28
8-510	1	ROTOR	316L STAINLESS STEEL	25
8-511-AS	1	OUTPUT PINION ASSEMBLY	17-4 PH HT-H900 COND. STAINLESS STEEL	8
8-512	1	INPUT PINION	11 TEETH PINION (STAINLESS STEEL)	5
8-513	1	PLANETARY GEARHEAD	236:1 GEAR RATIO GEAR HEAD	4
8-514	4	PLANETARY GEARHEAD SCREW	SLOTTED PAN HEAD SCREW	3
8-515	2	IDLER SHAFT	17-4 PH HT-H900 COND. STAINLESS STEEL	18
8-516	2	IDLER GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	16
8-517	1	TEE-HOUSING BEVEL GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	31
8-518	1	NOZZLE-HOUSING BEVEL GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	42
8-519	1	BEVEL GEAR RETAINING RING	STAINLESS STEEL	41
8-520	1	RING GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	30
8-521	1	RING GEAR RETAINING RING	STAINLESS STEEL	29
8-522	1	INPUT SHAFT	17-4 PH HT-H900 COND. STAINLESS STEEL	6
8-523-A *	1	INPUT SHAFT LOWER SEAL	301 STAINLESS STEEL & FLUOROLOY 33	11
8-524-B	1	OUTPUT PINION CARBIDE BEARING	94% TUNGSTEN-6% NICKEL	7
8-524-C *	1	OUTPUT PINION SEAL	301 STAINLESS STEEL & FLUOROLOY 33	12
8-526	1	ROTOR SHAFT LOWER BEARING	17-4 PH HT-H900 ST.STL with CARBIDE BUSHING	13
8-527	1	ROTOR SHAFT UPPER BEARING	316L ST.STL with CARBIDE BUSHING	20
8-528 *	2	IDLER GEAR BUSHING	FLUROLOY B	17
8-529 *	2	IDLER GEAR THRUST WASHER	FLUROLOY B	15
8-530	1	GEARHEAD RETAINER SCREW	SOCKET HEAD CAP SCREW	2
8-531 *	2	TEE-HOUSING BEARING	PPS-CF (PolyPhenylene Surfide Carbon-Fiber reinforced)	32
8-532	2	TEE-HOUSING BEARING CUP	316L STAINLESS STEEL	34
8-533 *	2	NOZZLE HOUSING BEARING	PPS-CF (PolyPhenylene Surfide Carbon-Fiber reinforced)	38
8-534	2	NOZZLE HOUSING BEARING CUP	316L STAINLESS STEEL	40
8-535 *	2	TEE-HOUSING SEAL	ELGILOY "4" & FLUROLOY 58	33
8-536 *	2	NOZZLE HOUSING SEAL	ELGILOY "4" & FLUROLOY 58	39
8-538 *	1	GEARBOX O-RING	VITON, EP, ZALAK OR KALREZ O-RING	9
8-539 *	1	GEARBOX NOSE-STEM O-RING	VITON, EP, ZALAK OR KALREZ O-RING	21
8-540 *	2	UPPER BEARING O-RING	VITON, EP, ZALAK OR KALREZ O-RING	19
8-541 *	5	GEARBOX NOSE SCREW O-RING	VITON, EP, ZALAK OR KALREZ O-RING	23
8-542	4	GEARBOX NOSE-STEM SCREW	SOCKET HEAD CAP SCREW	10
8-543	4	GEARBOX SCREW	SOCKET HEAD CAP SCREW	22
8-544	1	ROTOR SHAFT LOCKWASHER	REGULAR ST. STL LOCKWASHER	26
8-545	1	ROTOR RETAINING NUT	HEXAGON MACHINE SCREW NUT ST.STL	27
8-546	1	STEM-COLLAR RETAINER SCREW	SOCKET HEAD CAP SCREW	36
8-547	2	NAMEPLATE SCREW	SLOTTED PAN HEAD SCREW	47
8-548	3	CARBIDE BUSHING	94% TUNGSTEN-6% NICKEL	48
8-549	2 OR 3	STREAM STRAIGHTENER	STAINLESS STEEL	49
8-550	1	ROTOR SHAFT SEAL WASHER	STAINLESS STEEL	50
8-552	8	LOCKWASHERS	STAINLESS STEEL HIGH COLLAR LOCKWASHER	51
8-554	1	DRIVE PIN	STAINLES STEEL	54

* = Included in spare parts kit

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GAMAJET V PARTS LIST

NUMERICAL BY REFERENCE NUMBER

REF. NO.	PART NUMBER	PART NAME	DESCRIPTION	QTY/MACHINE
1	8-501	GEARBOX	316L STAINLESS STEEL	1
2	8-530	GEARHEAD RETAINER SCREW	SOCKET HEAD CAP SCREW	1
3	8-514	PLANETARY GEARHEAD SCREW	SLOTTED PAN HEAD SCREW	4
4	8-513	PLANETARY GEARHEAD	236:1 GEAR RATIO GEAR HEAD	1
5	8-512	INPUT PINION	11 TEETH PINION (STAINLESS STEEL)	1
6	8-522	INPUT SHAFT	17-4 PH HT-H900 COND. STAINLESS STEEL	1
8	8-511-AS	OUTPUT PINION ASSEMBLY	17-4 PH HT-H900 COND. STAINLESS STEEL	1
9 *	8-538	GEARBOX O-RING	VITON, EP, ZALAK OR KALREZ O-RING	1
10	8-542	GEARBOX NOSE-STEM SCREW	SOCKET HEAD CAP SCREW	4
11 *	8-523-A	INPUT SHAFT LOWER SEAL	301 STAINLESS STEEL & FLUOROLOY 33	1
7	8-524-B	OUTPUT PINION BEARING	94% TUNGSTEN-6% NICKEL	1
12 *	8-524-S	OUTPUT PINION SEAL	301 STAINLESS STEEL & FLUOROLOY 33	1
13	8-526	ROTOR SHAFT LOWER BEARING	17-4 PH HT-H900 ST.STL with CARBIDE BUSHING	1
14	8-502	GEARBOX NOSE	316L STAINLESS STEEL	1
15 *	8-529	IDLER GEAR THRUST WASHER	FLUROLOY B	2
16	8-516	IDLER GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	2
17 *	8-528	IDLER GEAR BUSHING	FLUROLOY B	2
18	8-515	IDLER SHAFT	17-4 PH HT-H900 COND. STAINLESS STEEL	2
19 *	8-540	UPPER BEARING O-RING	VITON, EP, ZALAK OR KALREZ O-RING	2
20	8-527	ROTOR SHAFT UPPER BEARING	316L ST.STL with CARBIDE BUSHING	1
21 *	8-539	GEARBOX NOSE-STEM O-RING	VITON, EP, ZALAK OR KALREZ O-RING	1
22	8-543	GEARBOX SCREW	SOCKET HEAD CAP SCREW	4
23 *	8-541	GEARBOX NOSE SCREW O-RING	VITON, EP, ZALAK OR KALREZ O-RING	5
24	8-503	STEM	316L STAINLESS STEEL	1
25	8-510	ROTOR	316L STAINLESS STEEL	1
26	8-544	ROTOR SHAFT LOCKWASHER	REGULAR ST. STL LOCKWASHER	1
27	8-545	ROTOR RETAINING NUT	HEXAGON MACHINE SCREW NUT ST.STL	1
28	8-509	STATOR	316L STAINLESS STEEL	1
29	8-521	RING GEAR RETAINING RING	STAINLESS STEEL	1
30	8-520	RING GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	1
31	8-517	TEE-HOUSING BEVEL GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	1
32 *	8-531	TEE-HOUSING BEARING	PPS-CF (PolyPhenylene Surfide Carbon-Fiber reinforced)	2
33 *	8-535	TEE-HOUSING SEAL	ELGILOY "4" & FLUROLOY 58	2
34	8-532	TEE-HOUSING BEARING CUP	316L STAINLESS STEEL	2
35	8-504	TEE HOUSING	316L STAINLESS STEEL	1
36	8-546	STEM-COLLAR RETAINER SCREW	HEX HEAD SET SCREW	1
37	8-508	INLET STEM COLLAR	316L STAINLESS STEEL	1
38 *	8-533	NOZZLE HOUSING BEARING	PPS-CF (PolyPhenylene Surfide Carbon-Fiber reinforced)	2
39 *	8-536	NOZZLE HOUSING SEAL	ELGILOY "4" & FLUROLOY 58	2
40	8-534	NOZZLE HOUSING BEARING CUP	316L STAINLESS STEEL	2
41	8-519	BEVEL GEAR RETAINING RING	STAINLESS STEEL	1
42	8-518	NOZZLE-HOUSING BEVEL GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	1
44	8-505	NOZZLE HOUSING	316L STAINLESS STEEL	1
45	8-507	NOZZLE TIP	316L STAINLESS STEEL	2 OR 3
46	8-506	NAMEPLATE	316L STAINLESS STEEL	1
47	8-547	NAMEPLATE SCREW	SLOTTED PAN HEAD SCREW	2
48	8-548	CARBIDE BUSHING	94% TUNGSTEN-6% NICKEL	3
49	8-549	STREAM STRAIGHTENER	STAINLESS STEEL	2 OR 3
50	8-550	ROTOR SHAFT SEAL WASHER	STAINLESS STEEL	1
51	8-552	LOCKWASHERS	STAINLESS STEEL HIGH COLLAR LOCKWASHER	8
54	8-554	DRIVE PIN	STAINLESS STEEL	1

* = Included in spare parts kit

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GAMAJET V DIRECTIONAL PARTS LIST

NUMERICAL BY PART NUMBER

PART NUMBER	QTY / MACHINE	PART NAME	DESCRIPTION & MATERIAL	REF. NO.
6-131 *	2	NOZZLE HOUSING BEARING	PPS-CF (PolyPhenylene Surfide Carbon-Fiber reinforced)	59
6-132	2	NOZZLE HOUSING BEARING CUP	STAINLESS STEEL	60
6-135 *	2	NOZZLE HOUSING SEAL	ELGILOY "4" & FLUROLOY 58	61
6-166	1	NOZZLE HOUSING GEAR DRIVE PIN	STAINLESS STEEL	62
8-501	1	GEARBOX	316L STAINLESS STEEL	1
8-502	1	GEARBOX NOSE	316L STAINLESS STEEL	14
8-503	1	STEM	316L STAINLESS STEEL	24
8-504-D	1	DIRECTIONAL TEE HOUSING	STAINLESS STEEL	55
8-505-D	1	DIRECTIONAL NOZZLE HOUSING	STAINLESS STEEL	56
8-506-D	1	DIRECTIONAL NAMEPLATE	STAINLESS STEEL	57
8-507-L	2 OR 3	LONG NOZZLE TIP	316L STAINLESS STEEL	45
8-508	1	INLET STEM COLLAR	316L STAINLESS STEEL	37
8-509	1	STATOR	316L STAINLESS STEEL	28
8-510	1	ROTOR	316L STAINLESS STEEL	25
8-511-AS	1	OUTPUT PINION ASSEMBLY	17-4 PH HT-H900 COND. STAINLESS STEEL	8
8-512	1	INPUT PINION	11 TEETH PINION (STAINLESS STEEL)	5
8-513	1	PLANETARY GEARHEAD	236:1 GEAR RATIO GEAR HEAD	4
8-514	4	PLANETARY GEARHEAD SCREW	2-56 x 1.750" SLOTTED PAN HEAD SCREW	3
8-515	2	IDLER SHAFT	17-4 PH HT-H900 COND. STAINLESS STEEL	18
8-516	2	IDLER GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	16
8-517	1	TEE-HOUSING BEVEL GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	31
8-518-D	1	DIRECTIONAL NOZZLE HOUSING GEAR	STAINLESS STEEL	58
8-519	1	BEVEL GEAR RETAINING RING	STAINLESS STEEL	41
8-520	1	RING GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	30
8-521	1	RING GEAR RETAINING RING	STAINLESS STEEL	29
8-522	1	INPUT SHAFT	17-4 PH HT-H900 COND. STAINLESS STEEL	6
8-523-A *	1	INPUT SHAFT LOWER SEAL	301 STAINLESS STEEL & FLUROLOY 33	11
8-524-B	1	OUTPUT PINION CARBIDE BEARING	94% TUNGSTEN-6% NICKEL	7
8-524-ξ *	1	OUTPUT PINION SEAL	301 STAINLESS STEEL & FLUROLOY 33	12
8-526	1	ROTOR SHAFT LOWER BEARING	17-4 PH HT-H900 ST.STL with CARBIDE BUSHING	13
8-527	1	ROTOR SHAFT UPPER BEARING	316L ST.STL with CARBIDE BUSHING	20
8-528 *	2	IDLER GEAR BUSHING	FLUROLOY B	17
8-529 *	2	IDLER GEAR THRUST WASHER	FLUROLOY B	15
8-530	1	GEARHEAD RETAINER SCREW	8-32 x 1/2" SOCKET HEX HEAD CAP SCREW	2
8-531 *	2	TEE-HOUSING BEARING	PPS-CF (PolyPhenylene Surfide Carbon-Fiber reinforced)	32
8-534	2	NOZZLE HOUSING BEARING CUP	316L STAINLESS STEEL	40
8-535 *	2	TEE-HOUSING SEAL	ELGILOY "4" & FLUROLOY 58	33
8-538 *	1	GEARBOX O-RING	VITON, EP, ZALAK OR KALREZ O-RING	9
8-539 *	1	GEARBOX NOSE-STEM O-RING	VITON, EP, ZALAK OR KALREZ O-RING	21
8-540 *	2	UPPER BEARING O-RING	VITON, EP, ZALAK OR KALREZ O-RING	19
8-541 *	5	GEARBOX NOSE SCREW O-RING	VITON, EP, ZALAK OR KALREZ O-RING	23
8-542	4	GEARBOX NOSE-STEM SCREW	6-32 x 1" SOCKET HEX HEAD CAP SCREW	10
8-543	4	GEARBOX SCREW	6-32 x 3/4" SOCKET HEX HEAD CAP SCREW	22
8-544	1	ROTOR SHAFT LOCKWASHER	NO. 8 REGULAR ST. STL LOCKWASHER	26
8-545	1	ROTOR RETAINING NUT	NO. 8 HEXAGON MACHINE SCREW NUT ST.STL	27
8-546	1	STEM-COLLAR RETAINER SCREW	8-32 x 1/4" SOCKET HEX HEAD CAP SCREW	36
8-547	2	NAMEPLATE SCREW	8-32 x 1/4" SLOTTED PAN HEAD SCREW	47
8-548	3	CARBIDE BUSHING	94% TUNGSTEN-6% NICKEL	48
8-549-L	2 OR 3	LONG STREAM STRAIGHTENER	STAINLESS STEEL	49
8-550	1	ROTOR SHAFT SEAL WASHER	STAINLESS STEEL	50
8-552	8	LOCKWASHERS	STAINLESS STEEL NO. 6 HIGH COLLAR LOCKWASHER	51

* = Included in spare parts kit

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GAMAJET V DIRECTIONAL PARTS LIST

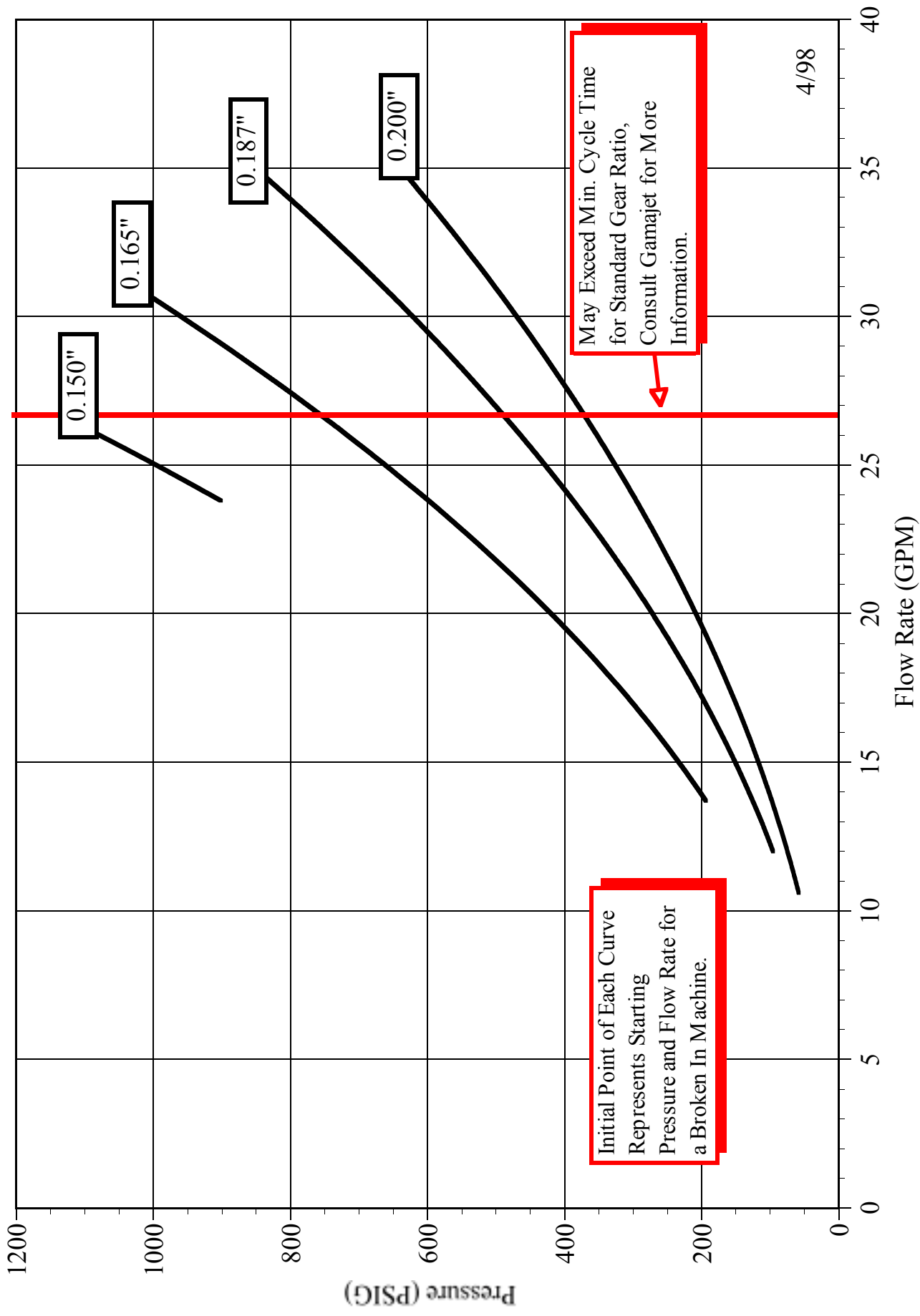
NUMERICAL BY REFERENCE NUMBER

REF. NO.	PART NUMBER	PART NAME	DESCRIPTION	QTY/ MACHINE
1	8-501	GEARBOX	316L STAINLESS STEEL	1
2	8-530	GEARHEAD RETAINER SCREW	8-32 x 1/2" SOCKET HEX HEAD CAP SCREW	1
3	8-514	PLANETARY GEARHEAD SCREW	2-56 x 1.750" SLOTTED PAN HEAD SCREW	4
4	8-513	PLANETARY GEARHEAD	236:1 GEAR RATIO GEAR HEAD	1
5	8-512	INPUT PINION	11 TEETH PINION (STAINLESS STEEL)	1
6	8-522	INPUT SHAFT	17-4 PH HT-H900 COND. STAINLESS STEEL	1
7	8-524-B	OUTPUT PINION BEARING	94% TUNGSTEN-6% NICKEL	1
8	8-511-AS	OUTPUT PINION ASSEMBLY	17-4 PH HT-H900 COND. STAINLESS STEEL	1
9	* 8-538	GEARBOX O-RING	VITON, EP, ZALAK OR KALREZ O-RING	1
10	8-542	GEARBOX NOSE-STEM SCREW	6-32 x 1" SOCKET HEX HEAD CAP SCREW	4
11	* 8-523-A	INPUT SHAFT LOWER SEAL	301 STAINLESS STEEL & FLUOROLOY 33	1
12	* 8-524-S	OUTPUT PINION SEAL	301 STAINLESS STEEL & FLUOROLOY 33	1
13	8-526	ROTOR SHAFT LOWER BEARING	17-4 PH HT-H900 ST.STL with CARBIDE BUSHING	1
14	8-502	GEARBOX NOSE	316L STAINLESS STEEL	1
15	* 8-529	IDLER GEAR THRUST WASHER	FLUROLOY B	2
16	8-516	IDLER GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	2
17	* 8-528	IDLER GEAR BUSHING	FLUROLOY B	2
18	8-515	IDLER SHAFT	17-4 PH HT-H900 COND. STAINLESS STEEL	2
19	* 8-540	UPPER BEARING O-RING	VITON, EP, ZALAK OR KALREZ O-RING	2
20	8-527	ROTOR SHAFT UPPER BEARING	316L ST.STL with CARBIDE BUSHING	1
21	* 8-539	GEARBOX NOSE-STEM O-RING	VITON, EP, ZALAK OR KALREZ O-RING	1
22	8-543	GEARBOX SCREW	6-32 x 3/4" SOCKET HEX HEAD CAP SCREW	5
23	* 8-541	GEARBOX NOSE SCREW O-RING	VITON, EP, ZALAK OR KALREZ O-RING	4
24	8-503	STEM	316L STAINLESS STEEL	1
25	8-510	ROTOR	316L STAINLESS STEEL	1
26	8-544	ROTOR SHAFT LOCKWASHER	NO. 8 REGULAR ST. STL LOCKWASHER	1
27	8-545	ROTOR RETAINING NUT	NO. 8 HEXAGON MACHINE SCREW NUT ST.STL	1
28	8-509	STATOR	316L STAINLESS STEEL	1
29	8-521	RING GEAR RETAINING RING	STAINLESS STEEL	1
30	8-520	RING GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	1
31	8-517	TEE-HOUSING BEVEL GEAR	17-4 PH HT-H900 COND. STAINLESS STEEL	1
32	* 8-531	TEE-HOUSING BEARING	PPS-CF (PolyPhenylene Surfide Carbon-Fiber reinforced)	2
33	* 8-535	TEE-HOUSING SEAL	ELGILOY "4" & FLUROLOY 58	2
34	8-532	TEE-HOUSING BEARING CUP	316L STAINLESS STEEL	2
36	8-546	STEM-COLLAR RETAINER SCREW	8-32 x 1/4" SOCKET HEX HEAD CAP SCREW	1
37	8-508	INLET STEM COLLAR	316L STAINLESS STEEL	1
41	8-519	BEVEL GEAR RETAINING RING	STAINLESS STEEL	1
45	8-507-L	LONG NOZZLE TIP	316L STAINLESS STEEL	2 OR 3
47	8-547	NAMEPLATE SCREW	8-32 x 1/4" SLOTTED PAN HEAD SCREW	2
48	8-548	CARBIDE BUSHING	94% TUNGSTEN-6% NICKEL	3
49	8-549-L	LONG STREAM STRAIGHTENER	STAINLESS STEEL	2 OR 3
50	8-550	ROTOR SHAFT SEAL WASHER	STAINLESS STEEL	1
51	8-552	LOCKWASHERS	STAINLESS STEEL NO. 6 HIGH COLLAR LOCKWASHER	8
55	8-504-D	DIRECTIONAL TEE HOUSING	STAINLESS STEEL	1
56	8-505-D	DIRECTIONAL NOZZLE HOUSING	STAINLESS STEEL	1
57	8-506-D	DIRECTIONAL NAMEPLATE	STAINLESS STEEL	1
58	8-518-D	DIRECTIONAL NOZZLE HOUSING GEAR	STAINLESS STEEL	1
59	* 6-131	NOZZLE HOUSING BEARING	PPS-CF (PolyPhenylene Surfide Carbon-Fiber reinforced)	2
60	6-132	NOZZLE HOUSING BEARING CUP	STAINLESS STEEL	2
61	* 6-135	NOZZLE HOUSING SEAL	ELGILOY "4" & FLUROLOY 58	2
62	6-166	NOZZLE HOUSING GEAR DRIVE PIN	STAINLESS STEEL	1

* = Included in spare parts kit

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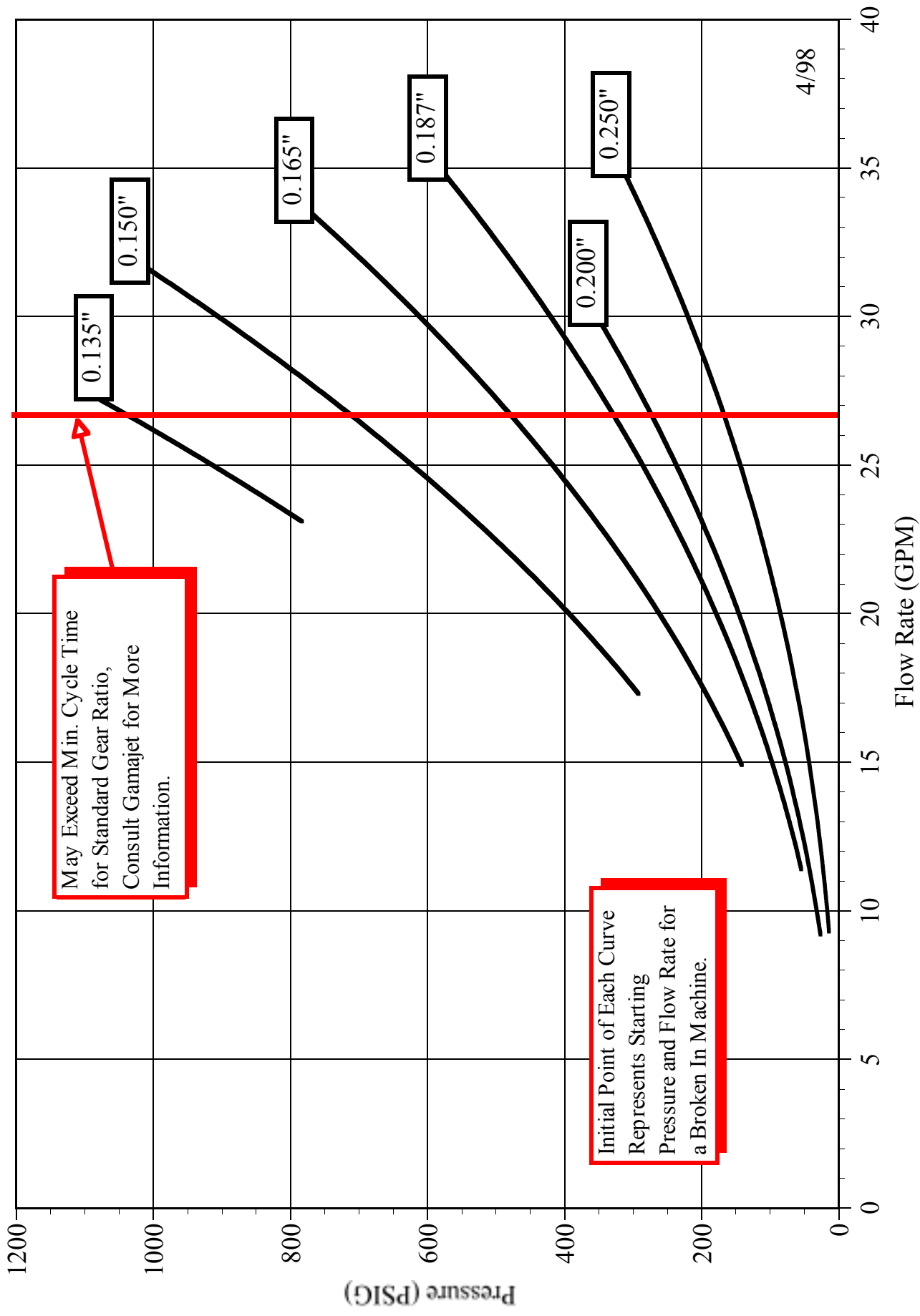
GJ V - Pressure vs. Flow Rate Standard Stator w/ 2 Short Nozzles



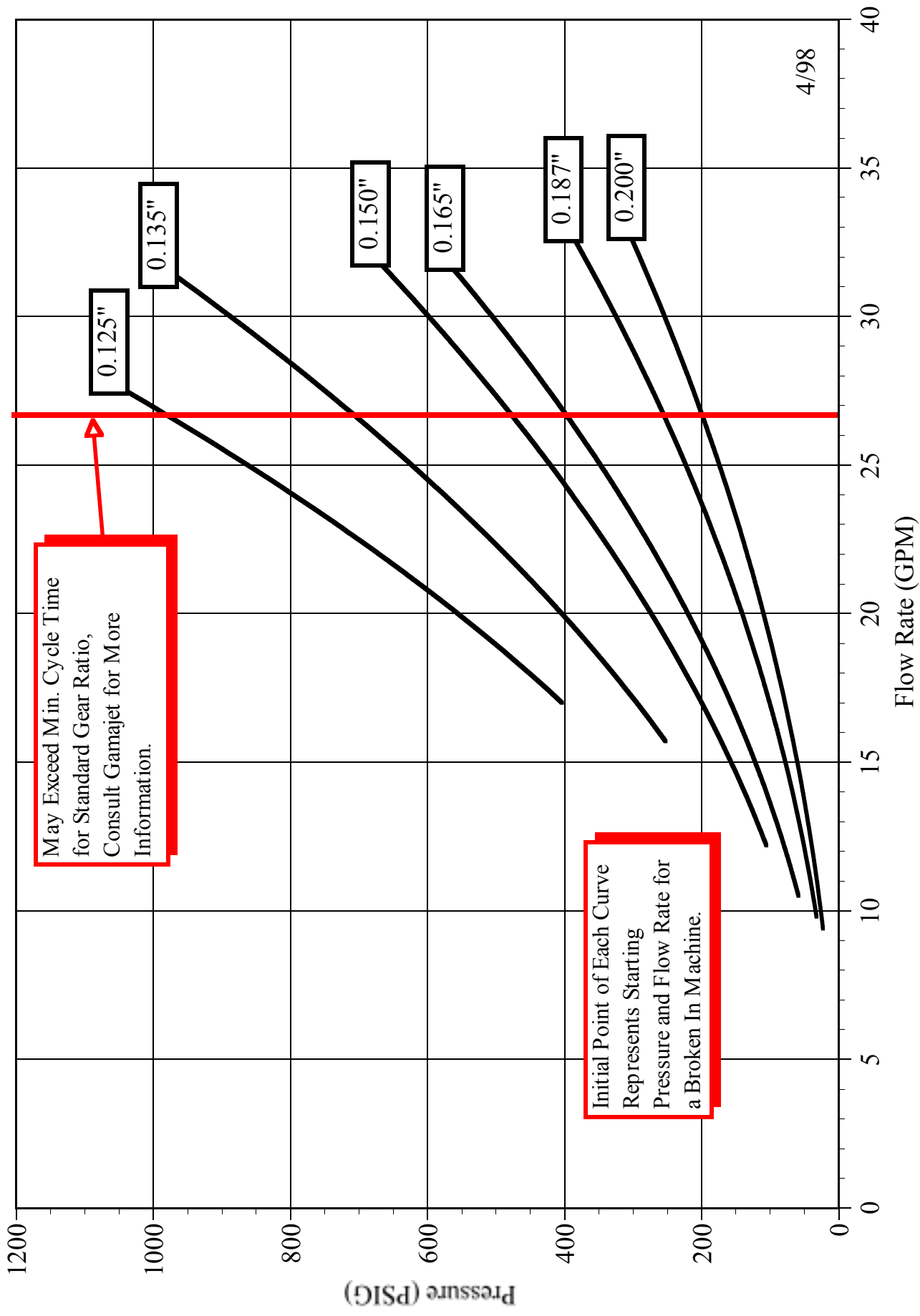
Initial Point of Each Curve Represents Starting Pressure and Flow Rate for a Broken In Machine.

May Exceed Min. Cycle Time for Standard Gear Ratio, Consult Gamajet for More Information.

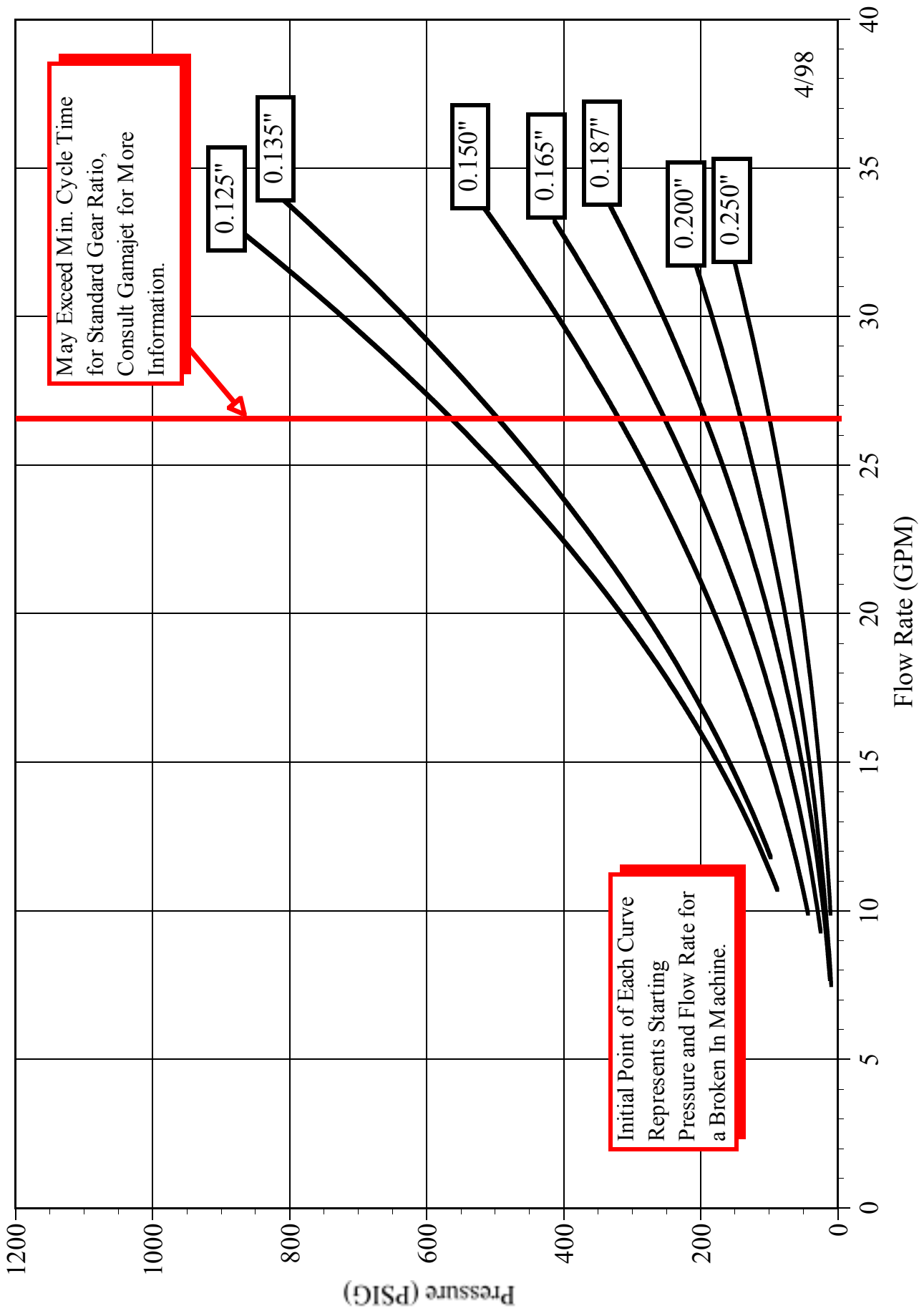
GJ V - Pressure vs. Flow Rate Standard Stator w/ 2 Long Nozzles



GJ V - Pressure vs. Flow Rate Standard Stator w/ 3 Short Nozzles

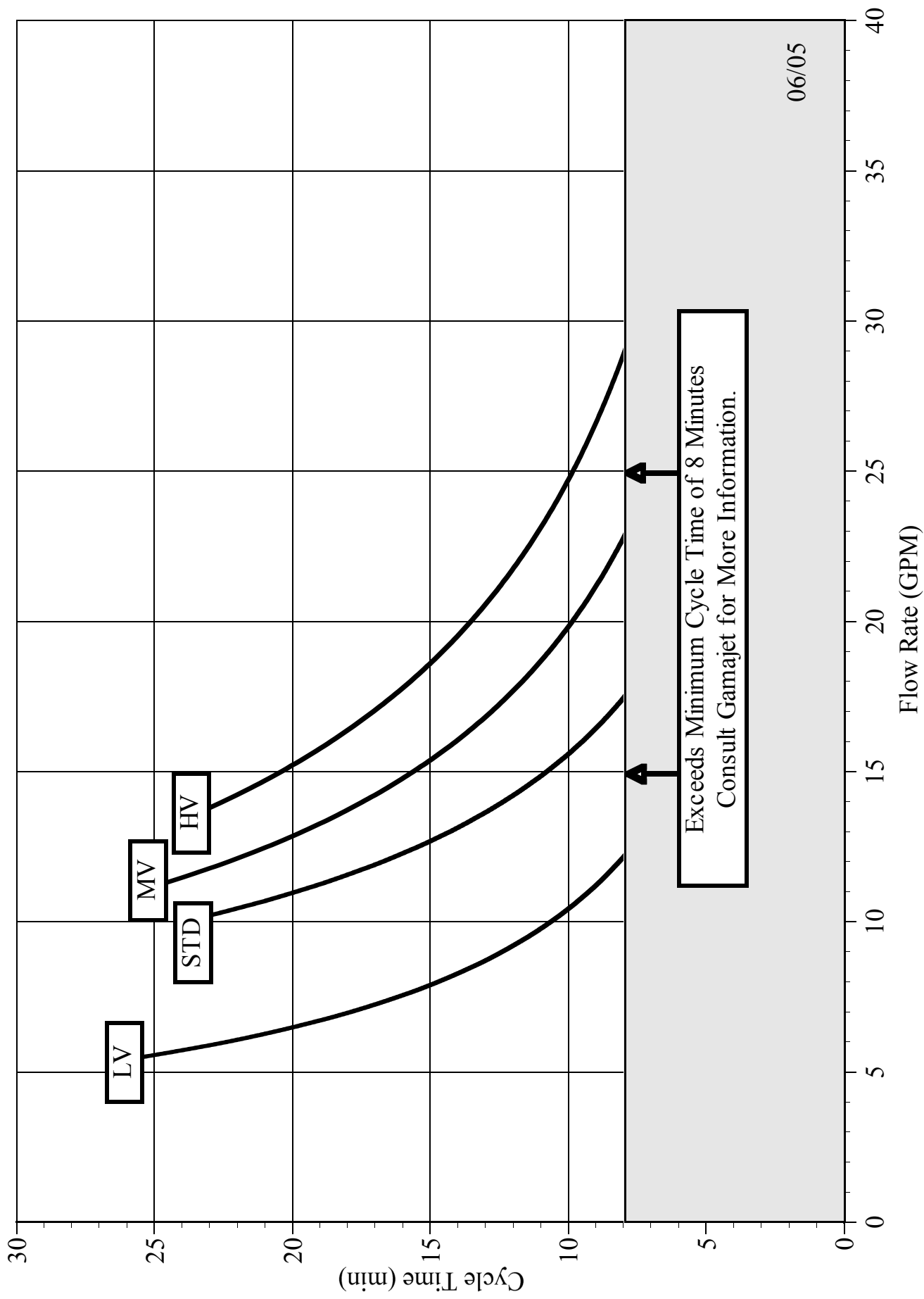


GJ V - Pressure vs. Flow Rate Standard Stator w/ 3 Long Nozzles



GAMAJET V - Injector Stators

Flow Rate vs. Cycle Time



06/05