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The information herein is correct at the time of issue but may be subject to change without prior notice

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EC Declaration of Conformity

The designated company

Alfa Laval Tank Equipment Inc.

Company name

604 Jeffers Circle – Exton, PA – 19341, United States

Address

+1 610 408 9940

Phone no.

hereby declare that

<table>
<thead>
<tr>
<th>Tank Cleaning Machine</th>
<th>Alfa Laval Gamajet PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denomination</td>
<td>Type</td>
</tr>
</tbody>
</table>

From serial numbers from P-100 to P-9999

is in conformity with the following regulations and directives with amendments:

- The Machinery Directive 2006/42/EC
  DS/EN ISO 12100:2011

- The Pressure Directive 97/23/EC
  According to its own volume and the rated pressure range the product is regarded an Article 3, paragraph 3 Equipment

The person authorised to compile the technical file is the signer of this document.

Andrew Delaney

Name

2015-05-18

Date

Exton, United States

Place
2. Safety

Unsafe practices and other important information are emphasized in this manual. Warnings are emphasized by means of special signs. 
Always read the manual before using the tank cleaning machine!

2.1 Important information

WARNING
Indicates that special procedures must be followed to avoid serious personal injury.

CAUTION
Indicates that special procedures must be followed to avoid damage to the tank cleaning machine.

NOTE
Indicates important information to simplify or clarify procedures.

2.2 Warning signs

General warning:

Dangerous electrical voltage:

Caustic agents:
2. Safety

All warnings in the manual are summarized on this page. Pay special attention to the instructions below so that severe personal injury and/or damage to the tank cleaning machine are avoided.

2.3 Safety precautions

Installation:

**Always** read the technical data thoroughly. (See chapter 7 Technical Data)

Any tank-cleaning machine can develop a static electricity charge while in operation.

If the tank being cleaned contains a combustible liquid or vapor having a risk of ignition or explosion, it is imperative to have the Alfa Laval Gamajet properly grounded using the provided location on the unit.

Operation:

**Always** read the technical data thoroughly. (See chapter 7 Technical Data)

Necessary precautions must be taken if leakage occurs as this can lead to hazardous situations.

**Always** handle lye and acid with great care.

When an Alfa Laval Gamajet is operating, there should be covers over every tank opening.

These covers should be sealed well enough to withstand the full force of the jet striking the cover plate.

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

**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 risk of ignition or explosion, it is imperative to have the Alfa Laval Gamajet properly grounded using the provided location on the unit.

Maintenance:

**Always** read the technical data thoroughly. (See chapter 7 Technical Data).

**Never** service the tank cleaning machine when it is hot.

**Always** use Alfa Laval genuine spare parts.

Transportation of the tank cleaning machine:

**Always** drain the tank cleaning machine head and accessories of any liquid

**Always** use original packaging or similar during transportation.
3. Introduction

3.1 Description

The Alfa Laval GJ PF is a fluid-driven (turbine-driven) 360° rotary nozzle machine designed for cleaning the interior surfaces of a wide variety of process vessels. With a minimum opening of 174.7 mm (6.875 inches) in diameter for a pin drive machine or 98.5 mm (3.875 inches) for a clutch machine and the nozzles in the vertical position and 97.3 mm (3.830 inches) for the low profile machine regardless of nozzle position. It is powered entirely by the cleaning solution and it requires no electricity, compressed air or lubricant for operation. The Alfa Laval GJ PF is designed for both portable and CIP (Clean In Place) applications. If the Alfa Laval GJ PF is permanently mounted inside a tank, we strongly recommend inspecting the unit every few hundred hours of operation. (See Section 6 - Preventative Maintenance for more information.)

Warning: In some conditions, the Alfa Laval GJ PF may be allowed to be immersed while left in the tank. It is strongly recommended that you have prior approval from Alfa Laval to ensure this will not harm the machine in any way. Failure to comply with this restriction may void the warranty!

In order to handle the broadest possible range of applications, the stainless steel Alfa Laval GJ PF is available with an extensive selection of nozzle sizes, stators (non-rotating turbine), and O-ring materials. The nozzles are available in several interchangeable sizes that range from 1/4” to 3/8”. The Alfa Laval Gamajet wash cycle time can be adjusted for special applications by changing the stator and/or nozzle size. Interchangeable stators and nozzle sizes are available for either low or high pressures and/or flow rates. The performance capabilities of these options are detailed in Section 7 Technical data.

3.2 Intended Use

It is to be verified by the end-user:
- that the tank cleaning machine is in conformity with respect to tank, vessel or container size in which it will be used.
- that the construction materials (both metallic and non-metallic) are compatible with product, flushing media, cleaning media, temperatures and pressure under the intended use.

3.3 Patents and trademarks

This Instruction Manual is published by Alfa Laval Tank Equipment without any warranty. Improvements and changes to this Instruction Manual may at any time be made by Alfa Laval Tank Equipment without prior notice. Such changes will, however, be incorporated in new editions of this Instruction Manual.

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The Alfa Laval logotype is a trademark or a registered trademark of Alfa Laval Corporate AB. "Gamajet" is a trademark or registered trademark of Alfa Laval Tank Equipment. The Alfa Laval GJ PF product has patent in the US (US 6,123,271 & US 6,561,199). Other products or company names mentioned herein may be the trademarks of their respective owners. Any rights not expressly granted herein are reserved.

3.4 Marking

Alfa Laval tank cleaning machines are all marked to allow recognition of machine type, machine name, Serial number and manufacturing address. The marking is placed on the body of the tank cleaning machine.

Alfa Laval Tank Equipment – Exton, PA  
Patent #: 6,123,271 & 6,561,199
4. Installation

Read the instructions carefully and pay special attention to the warnings! Always check the tank cleaning machine before operation.

4.1 Unpacking/delivery

Step 1

CAUTION
Alfa Laval cannot be held responsible for incorrect unpacking.

Check the delivery for:
1. Complete Cleaning Machine
2. Delivery note

Step 2

Remove any packing material

Step 3

Inspect the tank cleaning machine for visible transport damage.

Inspection!
4. Installation

Read the instructions carefully and pay special attention to the warnings! Always check the tank cleaning machine before operation.

4.2 Installation

Step 1

⚠️ Always read the technical data thoroughly. (See chapter 7 Technical Data)

Step 2

Assembly

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

Note: Any change to the originally supplied operating conditions will affect the performance of the Alfa Laval Gamajet accordingly.

Step 3

Inlet Connections

The standard inlet connections for the Alfa Laval GJ PF are a 1-1/2" NPT female/2" male camlock or a 1-1/2" Tri-Clover. Others inlets are available. It is recommended that when using the pipe thread 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.

Step 4

Mounting

Before mounting the Alfa Laval GJ PF, make sure the supply line has been adequately flushed. It can be mounted on a rigid 1-1/2" pipe using a pipe wrench. In most applications, the Alfa Laval Gamajet will be mounted with the inlet connection pointing up; however, the Alfa Laval GJ PF will function at any orientation. The Alfa Laval GJ PF can also be mounted to a 1-1/2" Tri-Clover ferrule via the use of a Tri-Clover gasket and clamp or a 2" female camlock.

The Alfa Laval Gamajet can be suspended from the top of the tank via a flexible hose. The dual nozzle machine is designed to have balanced forces in order to keep it centered even while hanging. We do not, however, recommend attaching the machine to a flexible hose while in the inverted or horizontal orientation. This form of mounting is not rigid and, thus, will not maintain the Alfa Laval Gamajet's position in the tank.

⚠️ Warning: When attaching the Alfa Laval GJ PF onto the supply pipe, ALWAYS apply the wrench to the Inlet Collar (13) at the top/inlet of the unit. Never use a wrench on Stem Pos. 9, Tee Housing Pos. 10 or Tee Housing Cap Pos. 17 to tighten the unit onto the pipe. Doing so risks internally damaging the machine.
4. Installation

*Read the instructions carefully and pay special attention to the warnings! Always check the tank cleaning machine before operation.*

---

**Step 5**

**Location inside Tank**

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

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

---

**Step 6**

**Entry Openings**

When using the Alfa Laval GJ PF, the vessels being cleaned must provide entry openings large enough to avoid interference during insertion and removal. The minimum opening size required for the Alfa Laval GJ PF is 98.5 mm diameter (3.875 inches in) for free-hand installation of a clutch driven machine and the nozzles in the vertical position. For a pin drive machine, the minimum opening size required is 174.7 mm (6.875 inches). A 97.3mm (3.830 inches) opening is needed for the low profile version of the Alfa Laval GJ PF regardless of the nozzle position.

---

**Step 7**

**Vessel Drainage**

If it is necessary to clean the floor of a vessel, remember that standing liquid will diminish the effectiveness of the Alfa Laval Gamajet by covering any soils underneath. Wherever possible, the tank floor should be pitched toward the drain and the drainage opening should be large enough to eliminate or reduce any liquid buildup or puddling. If gravity alone is insufficient, a scavenger or stripper pump should be connected to the drain to suck out the excess wash fluid. In extreme cases, it may be necessary to use smaller nozzles on the Alfa Laval Gamajet or even to operate it intermittently to allow time for draining.

---

**Step 8**

**Filters and Strainers**

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

In recirculated (closed-loop) 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 Alfa Laval Gamajet, 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 using automatic self-cleaning models.
4. Installation

Read the instructions carefully and pay special attention to the warnings! Always check the tank cleaning machine before operation.

Step 9

Capacity Of Supply Pump

The Alfa Laval GJ PF can be used with either a centrifugal or positive displacement (constant volume), PD, style pump. In most cases, if the machine is to be used with a centrifugal pump, the machine should be configured so that the pump will operate close to its best efficiency point. The end user must, therefore, take all of the plumbing, elevation, and machine pressure/flow rate requirements into account.

If a PD style pump (i.e. piston pump, plunger pump, or mechanical diaphragm pump, etc.) will be supplying the wash fluid to the Alfa Laval GJ PF, a different set of rules apply. 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 Alfa Laval GJ PF / plumbing system. If a PD pump is used, the Alfa Laval GJ PF should be sized to, first, match the flow capability of the pump and, second, not exceed the machine’s or pump’s maximum operating pressure (taking the pressure rating of the plumbing system into account, also).

Warning: For high-pressure applications (over 10bar (150 psi)), the pressure of the system must “ramp up” to its operating pressure. If the system experiences a pressure spike or pressure increases at a rate of more than 10bar (150 psi) per second, the machine may be damaged and parts will wear out prematurely. Damage resulting from this water hammer affect is not covered by the warranty.

4.3 Recycling Information

- **Unpacking**
  - Packing material consists of wood, plastics, cardboard boxes and in some cases metal straps.
  - Wood and cardboard boxes can be reused, recycled or used for energy recovery.
  - Plastics should be recycled or burnt at a licensed waste incineration plant.
  - Metal straps should be sent for material recycling.

- **Maintenance**
  - All metal parts should be sent for material recycling.

- **Scraping**
  - At end of use, the equipment must be recycled according to relevant, local regulations. Beside the equipment itself, any hazardous residues from the process liquid must be considered and dealt with in a proper manner. When in doubt, or in the absence of local regulations, please contact your local Alfa Laval sales company.
5. Operation

Read the instruction carefully and pay special attention to the warnings!

5.1 Operation/Control

Step 1

⚠️
Always read the technical data thoroughly. See chapter 7 Technical Data

CAUTION
Alfa Laval cannot be held responsible for incorrect operation/control.

Step 2

⚠️
Never touch the tank cleaning machine or the pipelines when pumping hot liquids.

Step 3

Initial Startup

Every Alfa Laval GJ PF that ships is accompanied by a Birth Certificate. This document indicates how the Alfa Laval GJ PF performed in our testing tank before it shipped based on the operating conditions supplied to Alfa Laval Tank Equipment Inc. To ensure the longest possible life of the Alfa Laval GJ PF, please verify the operating conditions and, most importantly, the machine’s cycle time. The cycle time can be measured by, first, picking a fixed point inside of a vessel as a reference and, second, 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.) The measured time in seconds directly corresponds to the machines full cycle time in minutes. In other words, a single 10-second rotation translates to a 10 minute full cycle time.
5. Operation

Pay attention to possible faults
Read the instructions carefully

5.2 Trouble Shooting

- **Does Rotor (pos. 39) turn freely by hand?**
  - **No**
    - Cracked/ Loose Input Pinion (pos. 3) – Section 5.4 Inspection and Service of Components
    - Damaged Planetary Gearhead (pos. 16) – Section 5.4 Inspection and Service of Components
  - **Yes**
    - Do Nozzle (pos.11) and Tee Housing (pos. 10) both index when Rotor (pos. 39) is turned?
      - **No**
        - Worn Tee Housing Bevel Gear (pos. 18) or Nozzle Housing Bevel Gear (pos. 19) – Section 5.4 Inspection and Service of Components
      - **Yes**
        - Worn Nozzle Housing Bearing & Cup (pos. 26) & (pos. 27) – Section 5.4 Inspection and Service of Components
  - **Yes**
    - Worn Tee Housing Bearings & Cups (pos. 24) & (pos. 25) – Section 5.4 Inspection and Service of Components
    - Worn Nozzle Housing Bearing & Cup (pos. 26) & (pos. 27) – Section 5.4 Inspection and Service of Components
5. Operation

Pay attention to possible faults
Read the instructions carefully

Step 1

INSUFFICIENT FLOW
The Alfa Laval Gamajet was configured to meet certain operating conditions outlined at the time of the initial sale, such as flow rate (m3/h)(GPM), pressure (bar)(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.

Step 2

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

Step 3

DEBRIS INSIDE
Loosen the Collar Set Screw (32), remove the Collar (13), and then lift out the Stator (14). Look for and remove any debris caught in the Stator and the vanes of the Rotor (39). Remove any material wound around the Input Shaft (40). In addition, check for any debris caught in the outlet holes of the Stem (9), the nose of the Tee Housing (10), the Nozzle Housing (11), and the Nozzles (38).
5. Operation

Pay attention to possible faults
Read the instructions carefully

5.3 Cleaning Solution Leakage

- Cleaning Solution Leakage
The Alfa Laval GJ PF is a self-flushing machine and thus has 5% leakage designed into the machine. Excessive leakage may indicate a larger issue.

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

- Worn Housing Cups
Inspect the Housing Cups (27) and (25) for excessive wear (grooved or scored). Replace any that show distinct grooves.

- Worn Collar O-Rings
Severe leakage between the Collar (13) and Cap (8) may indicate worn or damaged Collar O-rings (2) and (52). Remove the Collar as described in Section 6, and inspect the O-rings for signs of damage or wear.

- Worn Clutch O-Ring
Severe leakage above the Tee Housing may be the result of excess wear on the Clutch O-ring (31). There will be leakage through this point regardless due to the normal clutch operation, but severe leakage is not ordinary. Remove the Tee Housing as described in the general disassembly instructions and inspect the Clutch O-ring (31) for damage or wear.
Pay attention to possible faults
Read the instructions carefully

5. Operation

5.4 Poor Cleaning Performance

- Inadequate Flow and Pressure
Check the pressure at the Alfa Laval 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 Alfa Laval 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 Alfa Laval Tank Equipment Inc. if assistance is required.

- 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.

- Plugged Nozzles
Unscrew the Nozzles (38) and inspect for any debris.

- Slow or no Rotation of the Housings
This will result in partial or erratic washing coverage. Refer to previous sections for more information.

- Alfa Laval 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 Alfa Laval 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 an Alfa Laval Tank Equipment Inc. representative if assistance is required.

- Inadequate Drainage
Ensure that the vessel drains the effluent (used wash fluid) as fast as it's being sprayed in through the Alfa Laval 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 remove the effluent.
5. Operation

The Tank Cleaning machine is designed for cleaning in place (CIP). CIP = Cleaning In Place. Study the instructions carefully and pay special attention to the warnings! NaOH = Caustic Soda, HNO3 = Nitric acid.

5.5 Recommended Cleaning

Step 1

Always handle lye and acid with great care. Caustic danger!

always use rubber gloves! Always use protective goggles!

Step 2

Never touch the pump or the pipelines when sterilizing. Danger of burns!

Step 3

Always rinse well with clean water after using a cleaning agent. Always rinse!

Clean Water Cleaning agent

NOTE
Cleaning agents must be stored/disposed of in accordance with current regulations/directives.
6. Maintenance

Maintain the Tank Cleaning Machine with care. Read the instructions carefully and pay special attention to the warnings! Always keep Minor spare parts kit in stock.

6.1 General Maintenance

Step 1

⚠️ Always read the technical data thoroughly. (see chapter 7 technical Data)

Step 2

Recommended spare parts:
Order service kits from the service kits list
(See 8.8 Minor Service Kit & 8.9 Major Service Kit)

Ordering spare parts:
Contact your local Alfa Laval Sales Company.
6. Maintenance

*Maintain the Tank Cleaning Machine with care. Read the instructions carefully and pay special attention to the warnings! Always keep Minor spare parts kit in stock.*

6.2 General dismantling set up

**Step 1**

**NOTE**

A rigorously implemented preventative maintenance program will significantly reduce repair costs over the life of the Alfa Laval 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.

**Step 2**

**STORAGE**

The Alfa Laval 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 Alfa Laval Gamajet to seize or lock up. A clean water rinse through the Alfa Laval 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 Alfa Laval Gamajet is to stand it up with the inlet connection facing down.

**Step 3**

**EXTERNAL INSPECTION INTERVALS**

Before every shift, the Stator Pos. 14 and the Nozzles (38) should be inspected for debris. Examine the (14) by loosening the Collar Set Screw (32), while holding on the flats of the Cap (8) and remove the main section of the machine from the Collar (13). Look into each Nozzle for signs of debris or build-up.

**Step 4**

**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 Alfa Laval Gamajet may then be inspected and routine preventive maintenance should be performed every 500 to 700 hours of operation, depending on the severity of use.

**Step 5**

**TIPS**

All the Bearings, Bushings, Seals and O-rings are wear parts. Ideally, they should all be replaced, as a group, every 500 to 700 hours of operation, depending on the severity of use. If just one Bearing or Seal is worn or damaged, replace both it and its mate, not just the worn or damaged part. Verify that the mating cups (25) and (27) are not scored. Replacing new bearings and seals in scored cups may prematurely wear the new bearings and may cause premature failure of the bearings and seals.
6. Maintenance

Read the instructions carefully. The items refer to the parts list and service kits section.

6.3 General dismantling

Step 1

Inlet Collar
Loosen the Collar Set Screw (32) with a 3/32” Hex Key, minimum 2 turns. Remove the Inlet Collar (13) and Stator (14).

Warning: Hold or turn on Stem. DO NOT hold or turn on Tee Housing or Tee Housing Cap. Doing so will damage the gear train.

Step 2

Nozzle Housing
Unscrew the Nose Plate (12) with a screwdriver.

Pull the Nozzle Housing (drawing 4a,4b) assembly from the nose of the Tee Housing with Thin Bearing (26) and Nozzle Housing Seal (29) included.

Remove the inner Nozzle Housing Seal (29) and inner Bearing (26).

Step 3

Cap and Geartrain
Using pliers or a bench vise on the flats of the Cap (8), unthread it from the body (drawing 8).

Warning: Hold or turn on Stem. DO NOT hold or turn on Tee Housing or Tee Housing Cap. Doing so may cause damage to the gear train.

Step 4

Body Assembly
Unthread the Tee Housing Cap (17) from the Tee Housing (drawing 11). Note: This is a Left Hand thread.

Remove the Stem Screws (30) with a 5/32” Hex Key, and Stem Base (drawing 11) from the Tee Housing (drawing 11).

Remove the Tee Housing (drawing 10) by pulling it from the Stem (drawing 12). The upper Tee Housing Seal (28) and Bearing (24) will pull off with the Tee Housing.

Remove the lower (28), (24) and Bevel Gear (drawing 9).
6. Maintenance

Read the instructions carefully. The items refer to the parts list and service kits section.

6.4 Inspection and Service of Components

Drawing 1

Stator
Inspect all the openings through the Stator (14) to be sure that they are clear and free of debris.

Drawing 7

Collar O-rings
Inspect the Small and Large Collar O-rings, (2) and (52), for damage (clipped or cut) or deterioration (compression set or hardening) and replace if necessary.
Inspect the Collar-Stem O-ring (53) for damage (clipped or cut) or deterioration (compression set or hardening) and replace if necessary.

Drawing 13-17

Planetary Gear Train Assembly

General Disassembly and Inspection

Turn to (drawing 13): Pull the Output Shaft (15) from the Planetary Gearhead (drawing 15). Unscrew the Rotor Nut (6) with an 11/32” socket and remove it with the Lockwasher (5) from the gear train. Remove the Rotor (39) (drawing 14). If needed, use a slotted screwdriver for assistance.

Turn to (drawing 14): Ensure the Carbide (45), pressed into (39), protrudes slightly, and is not chipped or cracked.

Viewing (drawing 15): Pull and twist the Gearhead Lower Bearing Housing (22) (drawing 16) and Input Shaft Upper Bearing Housing (21) (drawing 21) from the Gearbox (7) (drawing 17).
If the Gearbox Seals (43) did not come out of the (7) when the (22) and (21) were removed, remove them at this time.

Warning: To reduce the likelihood of scratching any seating surface, use a pick made from brass. Inspect the (43) for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring), replace as required.

Turn to (drawing 17): Using a #2 Phillips screwdriver, unscrew the Gearbox Screws (51) from the Gearbox (7). Remove the Planetary Gearhead (drawing 18) from (7) by pushing on its output shaft.

Gearhead Internals

Tip: To prevent the internal components of the Planetary Gearhead from unexpectedly 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 (33) from the Gearhead (16). Remove the Input Shaft Lower Bearing Housing (44) from (33).

Warning: If you suspect that the (16) requires service, proceed with caution. If at any time you do not feel completely comfortable servicing (16), contact Alfa Laval Tank Equipment Inc. immediately.

Using a needle nose pliers carefully remove the internal components of the (16). 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 Alfa Laval Tank Equipment Inc. immediately.

The gears of the bottom (14 teeth) and top (17 teeth) stages must be reinstalled in their respective locations. The gears in the second and third level (18 teeth) are interchangeable, however.

During reassembly, Alfa Laval Gamajet recommends the Gearhead be lightly repacked using food-grade grease. Please contact Alfa Laval Tank Equipment Inc. for a specific grease recommendation.
6. Maintenance

Read the instructions carefully. The items refer to the parts list and service kits section.

Drawing 27-30

Input Shaft Lower Bearing Housing and Output Shaft

Turn to Drawing 19: Inspect the Input Pinion (3) for hairline cracks on the end face or for worn, damaged, or sharp/pointed teeth. (3) should be tight to the Input Shaft (40) and the Input Shaft Washer (47). (47) should not be able to spin on the (40). Press (3) back onto (40) if it has slipped, or replace if cracked or worn. Check for signs of scoring and wear on (40). Replace if the coating has been chipped or cracked.

Turn to Step 2: Inspect the Input Shaft Seal (55) (inside the Input Shaft Lower Bearing Housing (44) for wear by placing the (40) back through it. There will be drag if the (55) is still good. If it needs to be replaced, pry out the old (55) (using a brass pick), and replace it with a new one. Ensure that the seal is as square as possible to the (44) when installing it. The internal spring should be up and visible. Tip: Use a soft object, such as a pencil’s eraser, to apply even pressure when installing (55).
Check the Lower Bearing Housing O-ring (4) and Seal (41) for deterioration or damage, replace (using a brass pick to remove the old components) if necessary. The (41) should be installed so its internal spring is up and visible.

Viewing (drawing 21): The Pin (1) should be firmly pressed into the Input Shaft Upper Bearing Housing (21). The carbide (45) in the (21) should protrude slightly. In addition, its running surfaces should be smooth, flat, and free of chips and cracks.

Drawing 25

Gearhead Lower Bearing Housing and Output Shaft

Turn to (drawing 13): Check the Output Shaft (15) for signs of scoring or wear, especially in the area of contact with the Output Shaft Upper Seal (42). Replace if worn.

Turn to (drawing 16): Examine the (42) 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 (15) by passing the (15) through the center of the seal. There will be a noticeable drag if the seal is still good. If the (42) must be replaced, remove the Retaining Ring (49) using a small slotted screwdriver. Pry out the old (49) (using a brass pick), and replace it with a new one. Ensure that the seal is square to the (22) when installing it. The new (42) should be installed with the spring facing out and visible after it is installed. Reinstall the (49).

Drawing 12-15

Nozzle Housing

Unscrew the Nozzles (38) with pliers and inspect for debris caught on the Stream Straightener (35) or in the nozzle orifice. The inside diameter of (38) 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 and pressure are required.
Verify the (35) is tight in the bore of the (38).

Turn to (drawing 6): Inspect the Nozzle Housing Bevel Gear (19) for wear such as sharp/pointed or worn teeth. If it needs to be replaced, remove the Bevel Gear Retaining Ring (20) with a small slotted screwdriver and pry (19) from the Nozzle Housing (11). Clean any deposits from (27) and examine for excessive wear. Light scoring is acceptable, but the (27) should be replaced if they are grooved in the seal contact area. A good maintenance program will require replacing many (27), therefore, it may be worthwhile to make or obtain press tools for pressing (27) out of (11). The press tools are available from Alfa Laval Tank Equipment Inc. Before installing new (27), clean the housing bores and remove any burns resulting from (27) removal. Press them in so that their flanges are flush against (11).

Turn to (drawing 2): Inspect the Nozzle Housing Bearings (26) and Seals (29). Clean any deposits from the exterior of (26) and check their fit in the (27). While they should turn freely, (26) should be replaced if the thickness of the flange is 0.086”, or less, to avoid shortening the life of the Bevel Gears. Inspect the interior of (29) for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring), replace as required.
6. Maintenance

Read the instructions carefully. The items refer to the parts list and service kits section.

**Drawings 8, 9, 11**

**Tee Housing and Tee Housing Cap**

Turn to (drawing 8): Check the water outlets on the nose of the Tee Housing (10); they should be free of debris. Inspect the Tee Housing Bearings (24) and Seals (28). Clean any deposits from the exterior of (24) and check their fit in the Tee Housing Cups (25). While they should turn freely, (24) should be replaced if the thickness of the flange is 0.095”, or less, to avoid shortening the life of the Bevel Gears. Inspect the interior of (28) for loss of spring tension (indicated by excessive dry deposits of dirty or abrasive cleaning solution on the spring), replace as required. Inspect the Tee Housing Cap O-ring (2) for compression set or deterioration. Replace, if needed.

Turn to (drawing 9): Inspect the Tee Housing Bevel Gear (18) for worn, damaged or sharp/pointed teeth. Ensure that the Pin (36) is pressed firmly into (18).

Turn to Drawing (drawing 11): Clean any deposits from (25) and examine for excessive wear. Light scoring is acceptable, but the Cups should be replaced if they are grooved in the seal contact area. A good maintenance program will require replacing many (25), therefore, it may be worthwhile to make or obtain press tools for pressing (25) out of (10). The press tools are available from Alfa Laval Tank Equipment Inc. Before installing new (25), clean the housing bores and remove any burrs resulting from (25) removal. Press them in so that their flanges are flush against (10). Ensure that the Pin (36) is pressed firmly into (10).

**Drawings 10, 12**

**Stem and Stem Base**

Turn to Drawing 10: The Pin (36) should be firmly pressed into the (23).

Turn to drawing 12: Inspect the water outlets of the Stem (9); they should be free of debris. The Pins (54) and (34) should be firmly pressed into the (9).

Check O-ring (31) for signs of damage (clipped or cut), deterioration (compression set or hardening) or wear (flat edge developing or ring has thinned) and replace if necessary.

**Drawing 12**

**Clutch to Pin Drive, Pin Drive to Clutch**

Turn to (drawing 12): The Pin (36) should not be present in the stem (23) if the machine is a clutch machine. In order to make the machine a pin driven machine, simply push a (36) pin into its hole in the stem (23) until it completely stops at the bottom of the hole. The clutch O-ring remains in place.

**Warning:** Once a machine is made into a pin drive, the Nozzle Housing (11) will no longer rotate freely. Forcing the Nozzle Housing ((11) to rotate will result in damage to the machine.

To make a pin machine into a clutch machine, use a pair of pliers to grip the pin (36) and pull it out of the stem (23). If the pin cannot be pulled out, use a grinder to grind away the exposed portion of the pin (this method will make it harder to return the machine to a pin drive if desired later). The clutch O-ring should already be installed and will run as a normal clutch machine.
6. Maintenance

Read the instructions carefully. The items refer to the parts list and service kits section.

6.5 Reassembly

General Notes
All Parts must be cleaned thoroughly before reassembling. Any deposits remaining on the parts can cause difficult disassembly the next time the Alfa Laval 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. Lithium-based grease is acceptable, for Viton® O-rings, however, Silicon based lubricant must be used for EP O-rings. Do not grease the clutch O-ring (31). Refer to the illustrations in Appendix C for clarification during reassembly.

Drawings 13, 15, 17, 18

Gear Train

Turn to (drawing 18): Insert the Gearbox Screws (33) through the Gearhead (16). Push the Input Shaft (drawing 19) through the Input Shaft Lower Bearing Housing (drawing 20). While installing the Lower Bearing Housing onto the 16), ensure the Input Pinion meshes properly with the top layer of gears. Using a #1 Phillips, screw the (33) into the Lower Bearing Housing (drawing 20).

Turn to (drawing 20): Install the Planetary Gearhead (drawing 18) back into the Gearbox (7). After aligning the screw holes, thread the Gearhead Screws (51) back into the Gearhead using a #2 Phillips screwdriver. Make hand tight.

Turn to (drawing 15): Install the Gearbox Seals (43) into Gearbox (drawing 17). The seal’s internal spring should be face out and be visible.

Install the Upper (drawing 21) and Lower (drawing 16) Bearing Housings into the proper ends of the Gearbox (drawing 17) by using equal pressure around parts. They will snap into place.

Turn to (drawing 13): Place the Rotor (39) (drawing 14) over the end of the Input Shaft (40). Install the Lockwasher (5) and Nut (6) using an 11/32” socket. Hold the (39) stationary with a pair of pliers while tightening the (6).

Drawing 8

Body Assembly

Slide the Tee Housing Bevel Gear (18) (drawing 9) over the end of the Stem (9) (drawing 12). Align the hole in the (18) with the Pin (54).

Place the first Tee Housing Bearing (24) and Seal (28) (spring side up) onto the (9).

Push the Tee Housing (10) (drawing 11) over it until it is flush and fully seated. Install the second (28), spring side down, over the (9).

Tip: Now, Place the second Tee Housing Bearing (24) into Stem Base (23) (drawing 10), aligning its hole with the Bearing Locating Pin (36). Now, invert the (10/9) assembly and place it over (24/23) assembly. This technique ensures correct alignment of (24) and (36). Apply pressure to (23) to drive it, (24), and (28) into (10).

Align the through holes of the (23) with the threaded holes in the top of the (9). Using a 5/32” Hex Key, thread Cap Screws (30) and Lockwasher (50) into the (9). Tighten in a star pattern.

Thread the Tee Housing Cap (17) to the end of the (10). Note: This is a Left Hand thread.

Drawing 7

Gear Train

Insert the Gear Train (drawing 13) from section 6.4 into the Body Assembly (drawing 8) of 6.4. Rotate the Tee Housing (10) until the Output Shaft (15) falls into the slot of the Tee Housing Cap (17).

Thread the Cap (8) into the Body Assembly. Be sure to use the flats provided on the (8). Tighten.

Warning: Hold or turn on Stem. DO NOT hold or turn on Tee Housing or Tee Housing Cap. Doing so will damage the gear train.
6. Maintenance

Read the instructions carefully. The items refer to the parts list and service kits section.

Drawing 2
Nozzle Housing

Place the first Nozzle Housing Bearing (26) and Seal (29) (spring side out) onto the nose of the Tee Housing (10). Ensure the Pin (36) is aligned with the hole in the (26).

Push the Nozzle Housing Assembly (drawing 4a, 4b) onto the nose of the (10). Rotate the Nozzle Housing Assembly slightly to mesh the Bevel Gears (18 and 49). Failure to ensure that the Bevel Gears have properly mated could damage them.

Place the outer (29) (spring side in) over the nose of the (10).

Install the Thin Bearing (26) into the Nose Plate (12) (drawing 3). Ensure the Pin (36) aligns with the hole in the (26). Then, using the (12/26), push the (29) into the annular space between the (10) and Nozzle Housing Cup (27).

Using a screwdriver, screw the Nose Plate (12) into the (10).

Drawing 1
Completed Assembly

Rotate the Rotor (39) using a Hex Key. It should spin easily and its veins must not strike the walls of the Cap (8). Continue turning the Rotor several dozen times. The Nozzle and Tee Housing will slowly rotate if everything has been assembled correctly.

Insert the Stator (14) into the (8).

Screw on the Collar (13) (hand-tight only), and tighten the Collar Set Screw (32) with a 3/32" Hex Key

Warning: Hold or turn on Stem. DO NOT hold or turn on Tee Housing or Tee Housing Cap. Doing so will damage the gear train.
7. Technical Data

It is important to observe the technical data during installation, operation and maintenance. Inform personnel about the technical data.

7.1 Technical Data

The Alfa Laval GJ PF Tank Cleaning Machine is a highly efficient machine at a range of pressures and flows. The instruction manual is part of the delivery. Read the instructions carefully.

**TECHNICAL DATA**

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<th>Lubricant</th>
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<td>Max. throw length</td>
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**Pressure**

| Working pressure | 3 - 28+ bar (40 - 400+ PSI) |
| Recommended pressure | 4 - 20 bar (50 - 300 PSI) |

**Cleaning Pattern**

![First Cycle](image1)  
First Cycle  

![Full Pattern](image2)  
Full Pattern

The above drawings show the cleaning pattern achieved on a cylindrical horizontal vessel. The difference between the first cycle and the full pattern represents the number of additional cycles available to increase the density of the cleaning.

**Certificate**

2.1 material certificate

**PHYSICAL DATA**

**Materials**

316L, PPS, PTFE, EPDM (FKM and FFKM available).

**Temperature**

| Max. working temperature | 90°C (195°F) |
| Max. ambient temperature | 140°C (284°F) |
| Weight                    | 4.5 kg (10 lbs.) |

**Connections**

| Standard thread | 1½” Rp (BSP) or NPT, female |
| Available option | 1.5” weld, 1.5” tri-clamp, 1.5” ISO 2037 slip fit, 1.5” DIN R1 slip fit, 1.5” DIN R2 slip fit |

**Options**

Electronic rotation sensor to verify 3D coverage.

**Caution**

Do not use for gas evacuation or air dispersion.
7. Technical Data

It is important to observe the technical data during installation, operation and maintenance. Inform personnel about the technical data.

7.2 Performance Data

Flow Rate

Impact Throw Length

Cleaning Time
7. Technical Data

It is important to observe the technical data during installation, operation and maintenance. Inform personnel about the technical data.

7.3 Dimensions

Dimensions

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NOTE 1: 1-1/2” FNPT/2” CAMLOCK OR 1-1/2” BSP/2” CAMLOCK (option shown above)

Dimensions 180˚ directional version

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NOTE 1: 1-1/2” FNPT/2” CAMLOCK OR 1-1/2” BSP/2” CAMLOCK (option shown above)
7. Technical Data

It is important to observe the technical data during installation, operation and maintenance. Inform personnel about the technical data.

7.4 Trax Simulation Tool

Standard Design
The choice of nozzle diameters can optimize jet impact length and flow rate at the desired pressure. As standard documentation, the Alfa Laval GJt PF can be supplied with a “Declaration of Conformity” for material specifications.

TRAX simulation tool
TRAX is an unique software that simulates how the Alfa Laval GJ PF performs in a specific tank or vessel. The simulation gives information on wetting intensity, pattern mesh width and cleaning jet velocity. This information is used to determine the best location of the tank cleaning device and the correct combination of flow, time, and pressure to implement.
A TRAX demo containing different cleaning simulations covering a variety of applications can be used as a reference and documentation for tank cleaning applications. The TRAX demo is free and available upon request.

Wetting Intensity

![Wetting Intensity Chart]

D9.1m (360°), H14.7m (580°), 2xØ7.94mm (2xØ5/16") Time = 4.25 min.

D9.1m (360°), H14.7m (580°), 2xØ7.94mm (2xØ5/16") Time = 17 min.
8. Parts List and Service Kits

The drawing shows Alfa Laval GJ PF Tank Cleaning Machine

8.1 GJ PF View
8. Parts List and Service Kits

The drawing shows Alfa Laval GJ PF Tank Cleaning Machine

8.2 Assembly Drawings - 1 & 2

**Drawing 1** - Completed Assembly
A: Drawing 2

**Drawing 2** - Nozzle Housing Installation
A: Drawing 12
B: Drawing 4
8. Parts List and Service Kits

The drawing shows Alfa Laval GJ PF Tank Cleaning Machine

8.3 Assembly Drawings – 3, 4, 5, 6 & 7

Drawing 3: Nose Plate
A: Press Fit

Drawing 4: Nozzle Housing Assembly
A: Drawing 5
A: Drawing 6
8. Parts List and Service Kits

The drawing shows Alfa Laval GJ PF Tank Cleaning Machine

**Drawing 5:** Nozzles
A: Press Fit

**Drawing 6:** Nozzle Housing
A: Press Fit

**Drawing 7:** Installing the Gear Train
A: Drawing 12
B: Drawing 13
8. Parts List and Service Kits

The drawing shows Alfa Laval GJ PF Tank Cleaning Machine

8.4 Assembly Drawings – 8, 9, 10, 11

**Drawing 8:** Body Assembly  
A: Drawing 11  
B: Drawing 9  
C: Drawing 12

**Drawing 10:** Base plate  
A: Press Fit

**Drawing 9:** Bevel Gear  
A: Press Fit

**Drawing 11:** Tee Housing  
A: Press Fit
8. Parts List and Service Kits

The drawing shows Alfa Laval GJ 8 Tank Cleaning Machine

8.5 Assembly Drawings – 12, 13, 14 & 15

**Drawing 12:** Stem  
A: Press Fit  
53: Press Fit If Pin Drive

**Drawing 13:** Gear Train  
A: Drawing 17  
B: Drawing 14

**Drawing 14:** Rotor  
A: Press Fit

**Drawing 15:** Geartrain Housing  
A: Spring  
B: Drawing 21  
C: Drawing 17  
D: Drawing 16
8. Parts List and Service Kits

The drawing shows Alfa Laval GJ 8 Tank Cleaning Machine

8.6 Assembly Drawings – 16, 17, 18, 19, 20 & 21

**Drawing 16**: Lower Gear Head Bearing Housing  
**A**: Press Fit

**Drawing 17**: Gear Head  
**A**: Drawing 18

**Drawing 18**: Gear Head  
**A**: Drawing 19  
**B**: Drawing 20

**Drawing 19**: Input Shaft  
**A**: Press Fit
The drawing shows Alfa Laval GJ 8 Tank Cleaning Machine

**Drawing 20**: Input shaft lower bearing housing
- **A**: Press fit

**Drawing 21**: Input gearhead bearing housing
- **A**: Press fit
## 8. Parts List and Service Kits

### 8.7 Parts List

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### 8. Parts List and Service Kits

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## 8. Parts List and Service Kits

### 8.8 Minor Service Kit

The document includes two lists of parts:

**Part List 1:**
- **Article no:** 9614648001 10PFEPDMKIT ALFA LAVAL GAMAJET PF KIT - EPDM
  - **Table:**
    | Pos.no. | Part No. | Gamajet Part No. | Description                  | No.  |
    |---------|----------|------------------|------------------------------|------|
    | 24      | 9614644601 | 10131            | GJ 10 TEE HOUSING BEARING    | 2 pcs. |
    | 25      | 9614644901 | 10133            | GJ 10 NOZZLE HOUSING BEARING | 1 pcs. |
    | 26      | 9614645001 | 10133PF          | GJ PF NOZZLE HOUSING BEARING | 1 pcs. |
    | 28      | 9614645501 | 10135PF          | GJ PF TEE HOUSING SEAL       | 2 pcs. |
    | 29      | 9614645701 | 10136PF          | GJ PF NOZZLE HOUSING SEAL    | 2 pcs. |
    | 31      | 9614646401 | 10147E           | GJ PF CLUTCH O-RING          | 1 pcs. |
    | 41      | 9614607501 | E823             | GJ VIII RS STATIC SEAL       | 1 pcs. |
    | 42      | 9614607602 | E826             | GJ VIII OS UPPER SEAL        | 1 pcs. |
    | 43      | 9614607701 | E826             | GJ VIII GEARBOX STATIC SEAL  | 2 pcs. |
    | 52      | 9614610802 | E862E            | GJ VIII COLLAR STEM SM O-RING| 1 pcs. |
    | 53      | 9614610902 | E863E            | GJ VIII COLLAR STEM LG O-RING| 1 pcs. |
    | 55      | 9614611202 | E867PF           | GJ VIII GEARHEAD SEAL        | 1 pcs. |
    | 5        | 9614636801 | 7458             | HOUSING O-RING               | 2 pcs. |
    | 3        | 9614674601 | 8512             | GJ V/VIII INPUT PINION       | 1 pcs. |
    | 4        | 9614677702 | 8539EP           | GJ V GB NS/VIII RSLBH O-RING | 1 pcs. |

**Part List 2:**
- **Article no:** 9614648201 10PFKALREZKIT ALFA LAVAL GAMAJET PF KIT - KALREZ
  - **Table:**
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    | 25      | 9614644901 | 10133            | GJ 10 NOZZLE HOUSING BEARING | 1 pcs. |
    | 26      | 9614645001 | 10133PF          | GJ PF NOZZLE HOUSING BEARING | 1 pcs. |
    | 28      | 9614645501 | 10135PF          | GJ PF TEE HOUSING SEAL       | 2 pcs. |
    | 29      | 9614645701 | 10136PF          | GJ PF NOZZLE HOUSING SEAL    | 2 pcs. |
    | 31      | 9614646401 | 10147K           | GJ PF CLUTCH O-RING          | 1 pcs. |
    | 41      | 9614607501 | E823             | GJ VIII RS STATIC SEAL       | 1 pcs. |
    | 42      | 9614607602 | E824PF           | GJ VIII OS UPPER SEAL        | 1 pcs. |
    | 43      | 9614607701 | E826             | GJ VIII GEARBOX STATIC SEAL  | 2 pcs. |
    | 52      | 9614610802 | E862E            | GJ VIII COLLAR STEM SM O-RING| 1 pcs. |
    | 53      | 9614610902 | E863E            | GJ VIII COLLAR STEM LG O-RING| 1 pcs. |
    | 55      | 9614611202 | E867PF           | GJ VIII GEARHEAD SEAL        | 1 pcs. |
    | 2        | 9614636801 | 7458             | HOUSING O-RING               | 2 pcs. |
    | 3        | 9614674601 | 8512             | GJ V/VIII INPUT PINION       | 1 pcs. |
    | 4        | 9614677702 | 8539K            | GJ V GB NS/VIII RSLBH O-RING | 1 pcs. |
## 8. Parts List and Service Kits

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8. Parts List and Service Kits

8.9 Major Service Kit

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Article no: 9614648101 10PFEPDMMAJKIT ALFA LAVAL GAMAJET PF MAJOR KIT - EPDM
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