Operations & Repair Manual

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Product Type : Tank Cleaning Machine
Rotating Jet-Head

Model : LTQFT

Manufacturer : Butterworth®, Inc.

Model Number : _____

Manual Number : 169.2008.01.23
Release Date : Pending

Project Number : _____

Serial Number(s) :

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INTRODUCTION

This manual has been prepared as a guide for the persons who will be operating and maintaining your Butterworth® tank cleaning machine. The key to long life for your tank cleaning machine will always be a system of carefully planned maintenance. Tank cleaning machines are expected to perform various types of cleaning jobs. Some applications will require that maintenance is performed more often than with less stringent applications. A properly designed and maintained CIP (Clean In Place) System is paramount to the service life of any tank cleaning machine.

It is in your own interest to get the best and most economical performance from your tank cleaning machine. Neglect of maintenance means poor performance, unscheduled stoppages, shorter life and expense. Good maintenance means good performance; no unscheduled stoppages and better total economy.

You will find the information contained in this manual simple to follow, but should you require further assistance, our Technical Department and worldwide net of Distributors will be pleased to help you. Please quote the type, model, and serial number with all your inquiries; this will help us to help you. The type and serial number are placed on the main body, just below the nozzle body

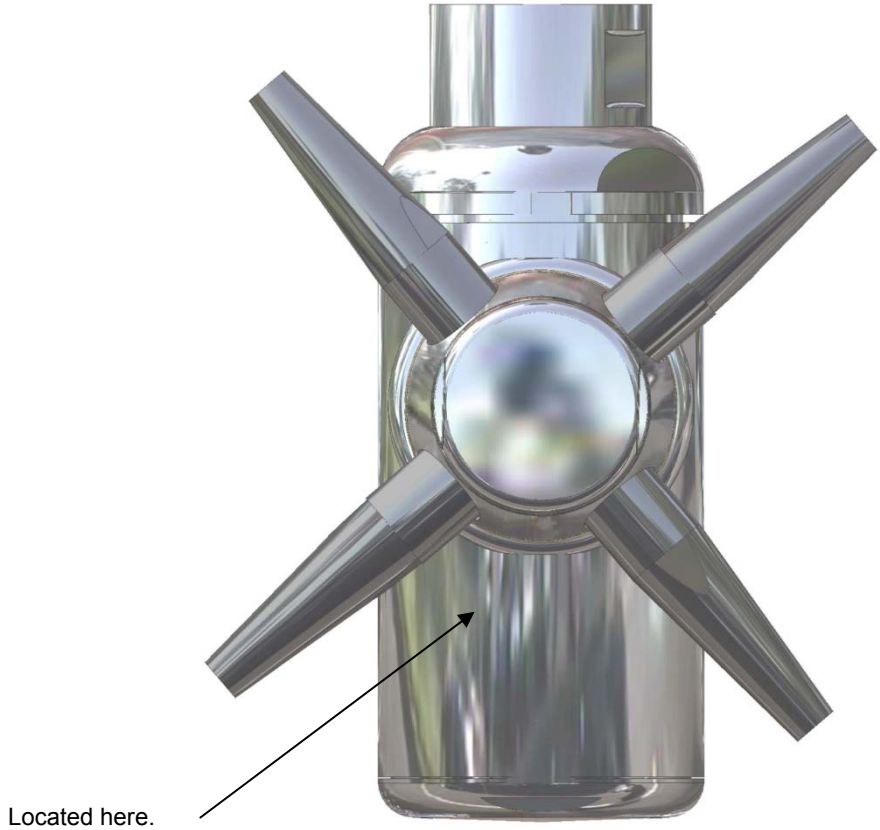
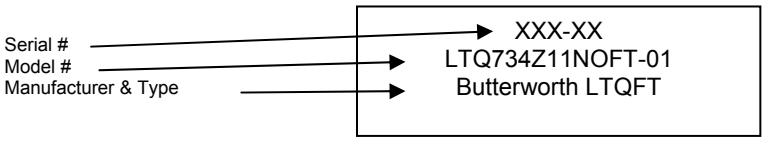


Figure 1



GENERAL DESCRIPTION

The Butterworth® LTQFT is a media driven and media lubricated tank cleaning machine. As it is self lubricating, there is no lubricating substance such as oil, grease, etc. in the machine which needs to be regularly changed.

How It Works

The flow of the cleaning fluid into the tank cleaning machine passes through a turbine, which is set into rotation. The turbine rotation is through a gearbox transformed into a combined horizontal rotation of the body and a vertical rotation of the nozzles.

The combined motion of the machine body and the nozzle body creates a pattern matrix on the tank walls similar to the images below, keeping in mind that this pattern will propagate differently in geometries other than those shown here. In other words, the pattern would look different in a vertical cylindrical tank when compared to a horizontal cylindrical tank for a given location of the machine. The LTQFT requires 65 axial revolutions to complete one pattern before it begins to rotate over the same location for a given coordinate within the tank. The images below show a progressive build up of the pattern matrix for a horizontal cylindrical tank. The far left image shows a course build up of the matrix, with the middle image showing a more progressive view and the far right image showing a complete pattern. The far right image is representative of the maximum density for this geometry.

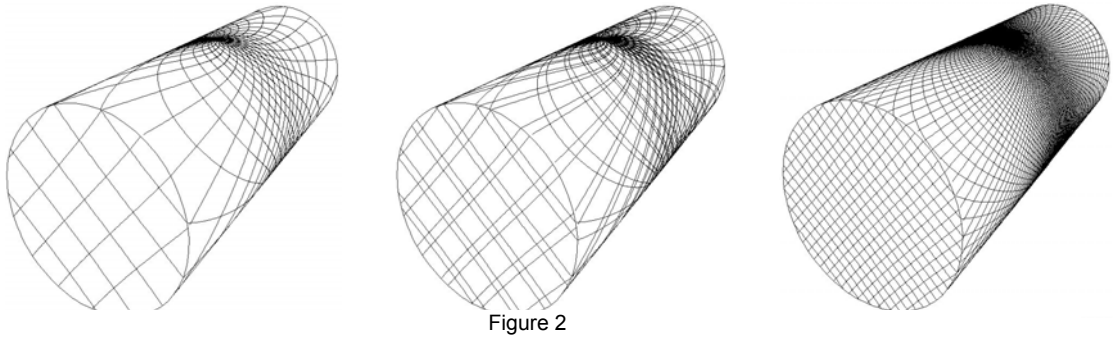


Figure 2

The speed of rotation of the turbine depends on the flow rate through the machine and the type of stator/turbine employed within the tank cleaning machine. The higher the flow rate is, the higher the speed of rotation will be; subject to the style of the guide vane (stator) and impeller (turbine) within the machine In order to control the RPM of the machine for a wide range of flow rates, the proper machine configuration should be reviewed, relative to the cleaning application.

Apart from the jet flow through the nozzles, fluid is expelled through the bottom of the machine via two weep holes in the bottom end-plate. This is by design to lubricate the gearbox, dissipate heat, and allow for drainage of the cleaning media out of the machine when the cleaning operation is complete.

GENERAL DESCRIPTION

Standard configurations:

√	Model Number	Nozzles (# of Nozzles x Orifice)	Guide Vane & Impeller Configuration	Inlet	Maximum Rotational PSIG	Minimum Rotational Start-Up PSIG	Lubrication	Surface Finish (Exterior)
	LTQ634Z21NOFT-01	4 x 6.0mm	21	1.50″ NPT(F)	300 PSIG	25 PSIG	Media	≥ 25 Ra µ Inch
	LTQ634Z21BOFT-01	4 x 6.0mm	21	1.50″ BSP(F)	300 PSIG	25 PSIG		
	LTQ634Z21NMOFT-01	4 x 6.0mm	21	1.50″ NPT(M)	300 PSIG	25 PSIG		
	LTQ634Z21BMOFT-01	4 x 6.0mm	21	1.50″ BSP(M)	300 PSIG	25 PSIG		
	LTQ734Z11NOFT-01	4 x 7.0mm	11	1.50″ NPT(F)	300 PSIG	25 PSIG		
	LTQ734Z11BOFT-01	4 x 7.0mm	11	1.50″ BSP(F)	300 PSIG	25 PSIG		
	LTQ734Z11NMOFT-01	4 x 7.0mm	11	1.50″ NPT(M)	300 PSIG	25 PSIG		
	LTQ734Z11BMOFT-01	4 x 7.0mm	11	1.50″ BSP(M)	300 PSIG	25 PSIG		
	LTQ734Z21NOFT-01	4 x 7.0mm	21	1.50″ NPT(F)	200 PSIG	15 PSIG		
	LTQ734Z21BOFT-01	4 x 7.0mm	21	1.50″ BSP(F)	200 PSIG	15 PSIG		
	LTQ734Z21NMOFT-01	4 x 7.0mm	21	1.50″ NPT(M)	200 PSIG	15 PSIG		
	LTQ734Z21BMOFT-01	4 x 7.0mm	21	1.50″ BSP(M)	200 PSIG	15 PSIG		
	LTQ834Z11NOFT-01	4 x 8.0mm	11	1.50″ NPT(F)	300 PSIG	25 PSIG		
	LTQ834Z11BOFT-01	4 x 8.0mm	11	1.50″ BSP(F)	300 PSIG	25 PSIG		
	LTQ834Z11NMOFT-01	4 x 8.0mm	11	1.50″ NPT(M)	300 PSIG	25 PSIG		
	LTQ834Z11BMOFT-01	4 x 8.0mm	11	1.50″ BSP(M)	300 PSIG	25 PSIG		
	LTQ834Z21NOFT-01	4 x 8.0mm	21	1.50″ NPT(F)	200 PSIG	15 PSIG		
	LTQ834Z21BOFT-01	4 x 8.0mm	21	1.50″ BSP(F)	200 PSIG	15 PSIG		
	LTQ834Z21NMOFT-01	4 x 8.0mm	21	1.50″ NPT(M)	200 PSIG	15 PSIG		
	LTQ834Z21BMOFT-01	4 x 8.0mm	21	1.50″ BSP(M)	200 PSIG	15 PSIG		

Note:
Maximum Rotational PSIG:
If the maximum rotational PSIG is exceeded, reduced runtime between maintenance intervals will also be reduced. This is a result of increased RPM load from the turbine.
Minimum Rotational Start-Up PSIG:
Based on new machine conditions and/or newly refurbished conditions.

This machine is equipped with a fixed hub. Care should be taken when installing and removing the machine to insure that the nozzles are not inadvertently hit or knocked with any hard blows, as this would transmit forces on the gearing that is best avoided to insure long life and reduced wear.

(Note: Optional configurations are available as non-standard products by contacting your nearest agent or distributor.)

INSTALLATION INSTRUCTIONS

Never attach the LTQFT by grabbing the nozzles to Tighten the machine onto the connection (Figure 3). The Proper way to attach the LTQFT can be seen in Figure 4.

Figure 3

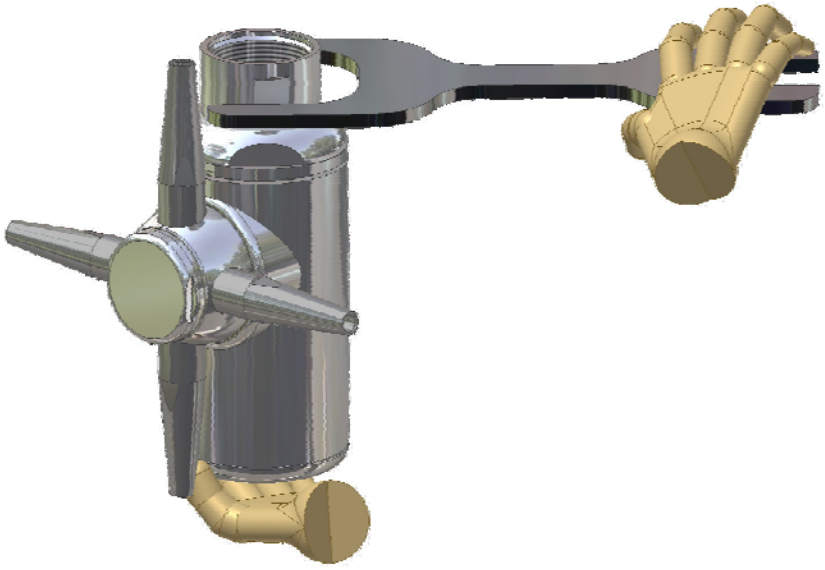
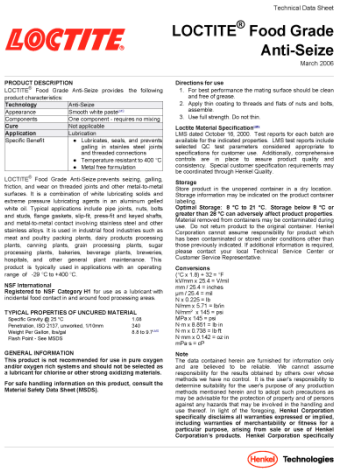


Figure 4

The nature of stainless steel against itself can cause galling. When threading the inlet connection onto your fluid connection, it is recommended that you employ either Teflon tape or another appropriated anti-seizing compound to avoid this event. See comments on conductivity; page 11.

The following product is recommended:



Technical Data Sheet

LOCTITE® Food Grade Anti-Seize

March 2006

PRODUCT DESCRIPTION

LOCTITE® Food Grade Anti-Seize provides the following product characteristics:

Technology	Anti-Seize
Appearance	Smooth white paste[LMS]
Components	One component - requires no mixing
Cure	Not applicable
Application	Lubrication
Specific Benefit	• Lubricates, seals, and prevents galling in stainless steel joints and threaded connections • Temperature resistant to 400 °C • Metal free formulation

LOCTITE® Food Grade Anti-Seize prevents seizing, galling, friction, and wear on threaded joints and other metal-to-metal surfaces. It is a combination of white lubricating solids and extreme pressure lubricating agents in an aluminum gelled white oil. Typical applications include pipe joints, nuts, bolts and studs, flange gaskets, slip-fit, press-fit and keyed shafts, and metal-to-metal contact involving stainless steel and other stainless alloys. It is used in industrial food industries such as meat and poultry packing plants, dairy products processing plants, canning plants, grain processing plants, sugar processing plants, bakeries, beverage plants, breweries, hospitals, and other general plant maintenance. This product is typically used in applications with an operating range of -29 °C to +400 °C.

NSF International
Registered to NSF Category H1 for use as a lubricant with incidental food contact in and around food processing areas.

TYPICAL PROPERTIES OF UNCURED MATERIAL

Specific Gravity @ 25 °C	1.08
Penetration, ISO 2137, unworked, 1/10mm	340
Weight Per Gallon, lbs/gal	8.9 to 9.7[LMS]
Flash Point - See MSDS	

GENERAL INFORMATION

This product is not recommended for use in pure oxygen and/or oxygen rich systems and should not be selected as a lubricant for chlorine or other strong oxidizing materials.

For safe handling information on this product, consult the Material Safety Data Sheet (MSDS).

Directions for use

1. For best performance the mating surface should be clean and free of grease.
2. Apply thin coating to threads and flats of nuts and bolts, assemble.
3. Use full strength. Do not thin.

Loctite Material Specification℠

LMS dated March 2006. Test reports for each batch are available for the indicated properties. LMS test reports include selected QC test parameters considered appropriate to specifications for customer use. Additionally, comprehensive controls are in place to assure product quality and consistency. Special customer specification requirements may be coordinated through Henkel Quality.

Storage

Store product in the unopened container in a dry location. Storage information may be indicated on the product container labeling.

Optimal Storage: 8 °C to 21 °C. Storage below 8 °C or greater than 28 °C can adversely affect product properties. Material removed from containers may be contaminated during use. Do not return product to the original container. Henkel Corporation cannot assume responsibility for product which has been stored or handled under conditions other than those previously indicated. If additional information is required, please contact your local Technical Service Center or Customer Service Representative.

Conversions

(°C x 1.8) + 32 = °F
kV/mm x 25.4 = V/mil
mm / 25.4 = inches
µm / 25.4 = mil
N x 0.225 = lb
N/mm x 5.71 = lb/in
N/mm² x 145 = psi
MPa x 145 = psi
N m x 8.851 = lb in
N m x 0.738 = lb ft
N·mm x 0.142 = oz in
mPa·s = cP

Note

The data contained herein are furnished for information only and are believed to be reliable. We cannot assume responsibility for the results obtained by others over whose methods we have no control. It is the user's responsibility to determine suitability for the user's purpose of any production methods mentioned herein and to adopt such precautions as may be advisable for the protection of property and of persons against any hazards that may be involved in the handling and use thereof. In light of the foregoing, **Henkel Corporation specifically disclaims all warranties expressed or implied, including warranties of merchantability or fitness for a particular purpose, arising from sale or use of Henkel Corporation's products. Henkel Corporation specifically**

Henkel Technologies

Loctite Product Numbers:

51168: Food Grade Anti-Seize; 8 oz. brush top
51170: Food Grade Anti-Seize; 2 lb. can
51171: Food Grade Anti-Seize; 40 lb. pail

TECHNICAL DATA

Dimensions and Weight

Weight of machine	:	14 lbs (6.35 kgs)
Working pressure	:	0-300 PSIG (0-21 Bar)
Working temperature max.	:	300° F (95° C) Standard Configuration
Materials of Construction	:	See exploded view drawing (Figure 32)

Principal dimensions in inches and [mm]:

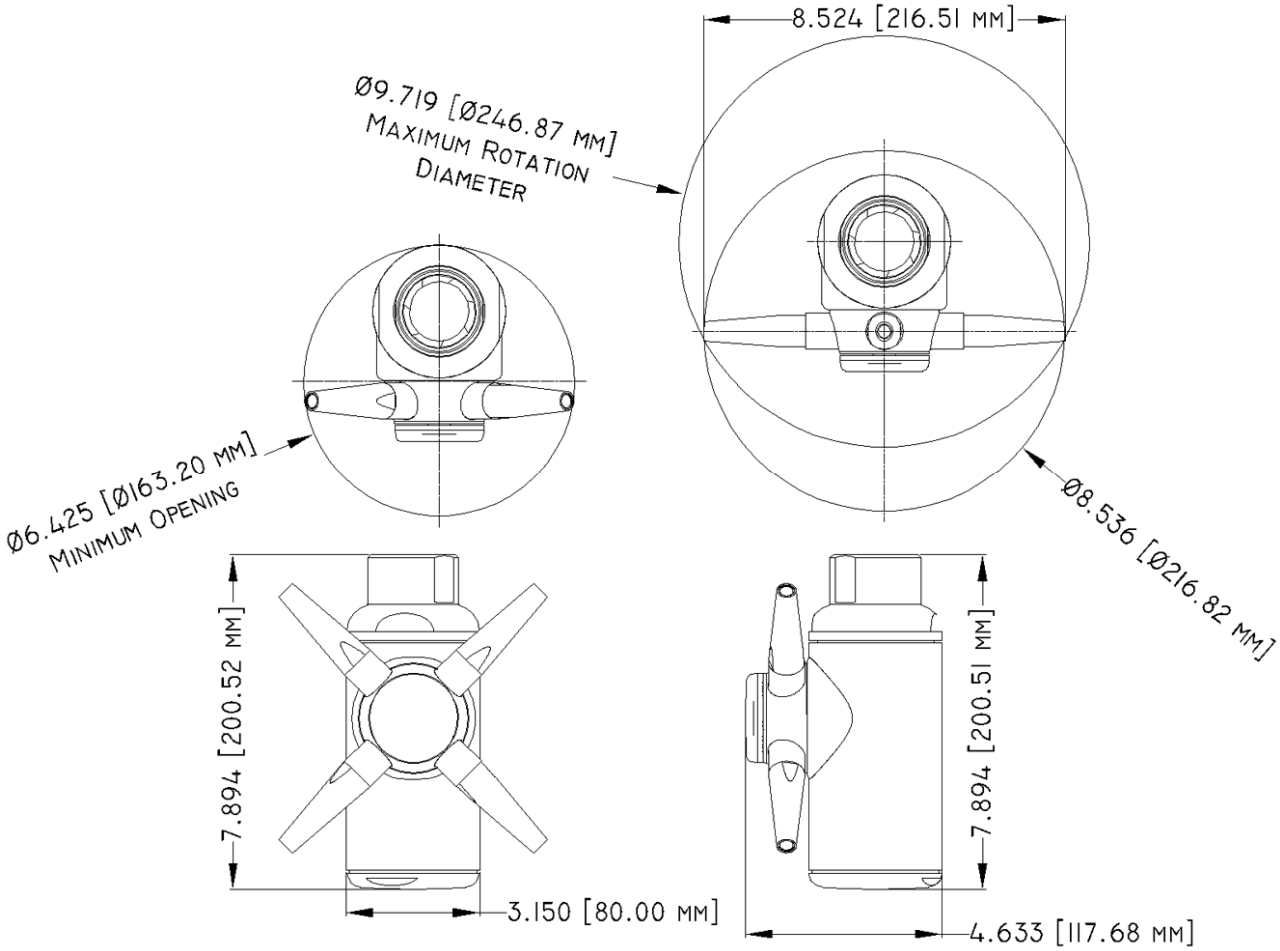


Figure 5

TECHNICAL DATA

Performance Curves – PRESSURE & FLOW

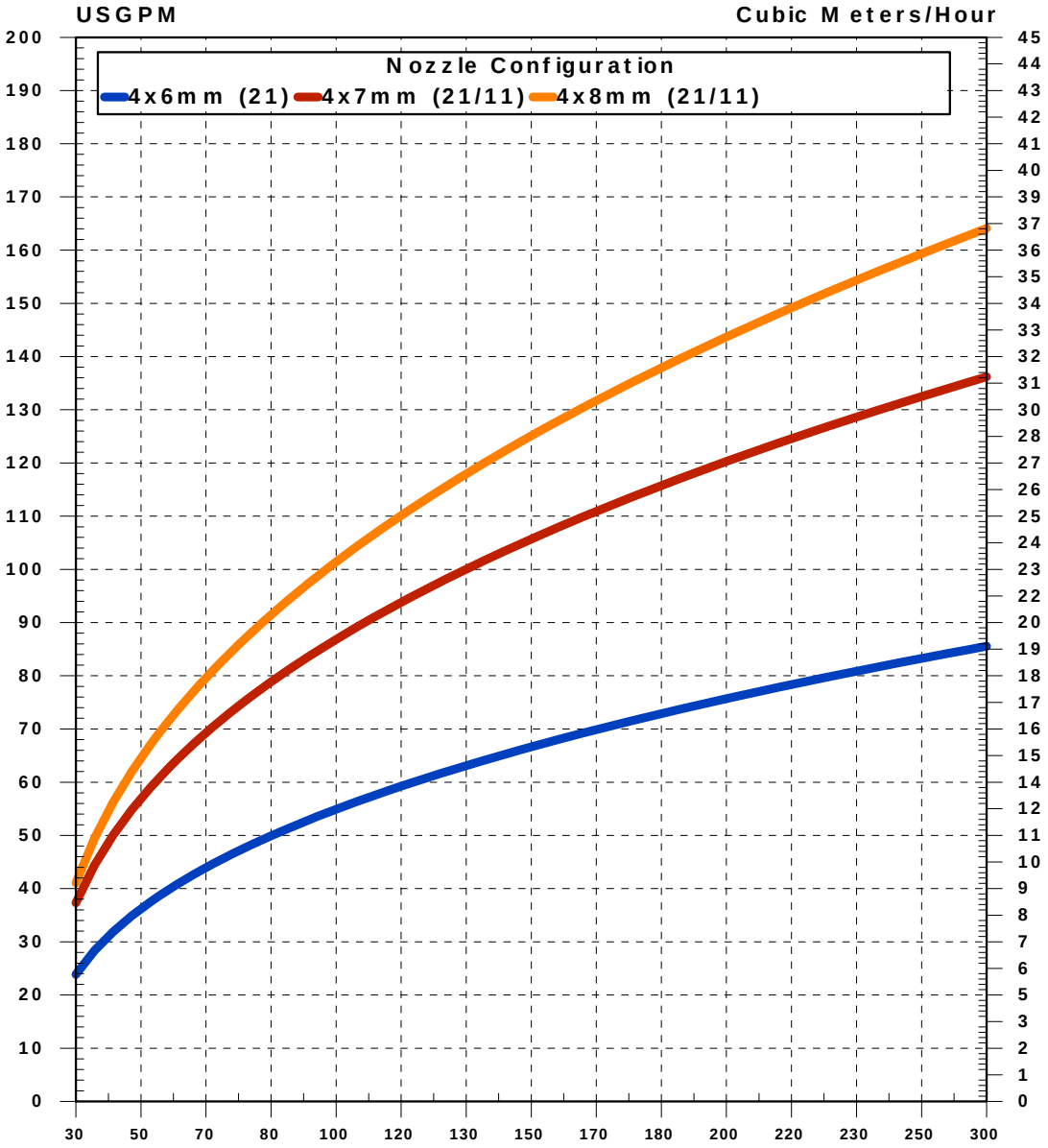


Figure 6

Related as number of nozzles x orifice and guide vane/turbine configuration.
For Example: 4x7 (21) is: 4 nozzles at 7mm each with a type 2 guide vane and type 1 impeller

Note: Throw lengths are measured as horizontal throw length at static condition. Vertical throw length upwards is approximately 1/3rd less. Effective throw length varies depending on jet peripheral speeds over the surface, substance to be removed, cleaning procedure and cleaning agent. The inlet pressure has been taken immediately before the machine inlet. To achieve the performance indicated in the curves, allowance must be made for pressure drop in the supply lines between pump and machine.

TECHNICAL DATA

Performance Curves – Pattern Time

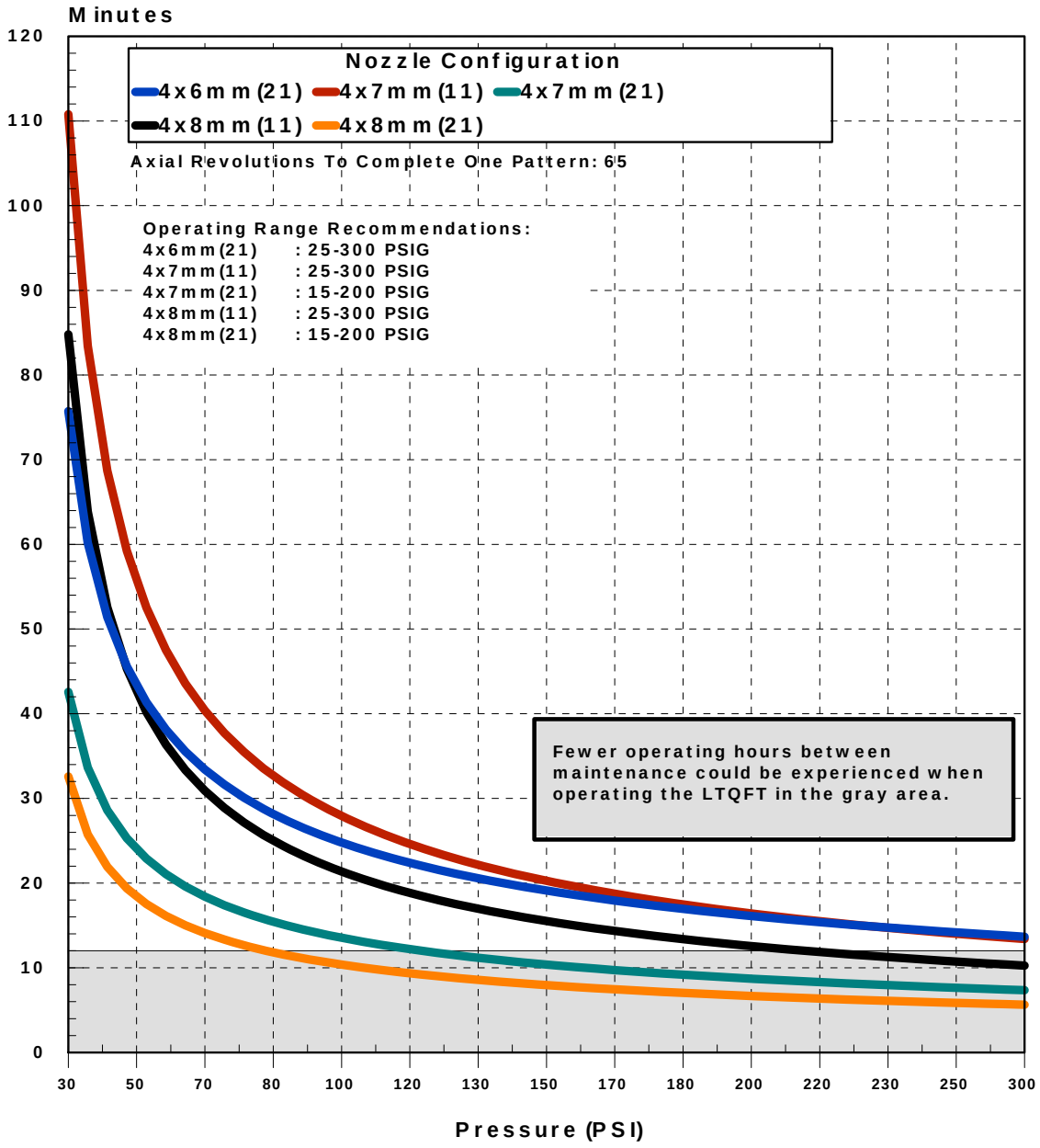
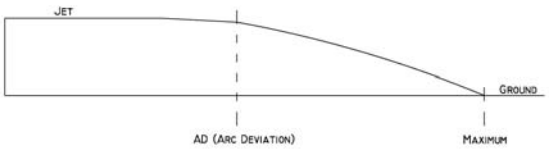


Figure 7

Note: The pattern time related in these curves is the time required to make 65 axial revolutions. Pattern time is not indicative of the time required to perform the required cleaning. Depending upon the application, the number of pattern completions will vary for the relative cleaning application.

TECHNICAL DATA



Performance Curves – Jet Length

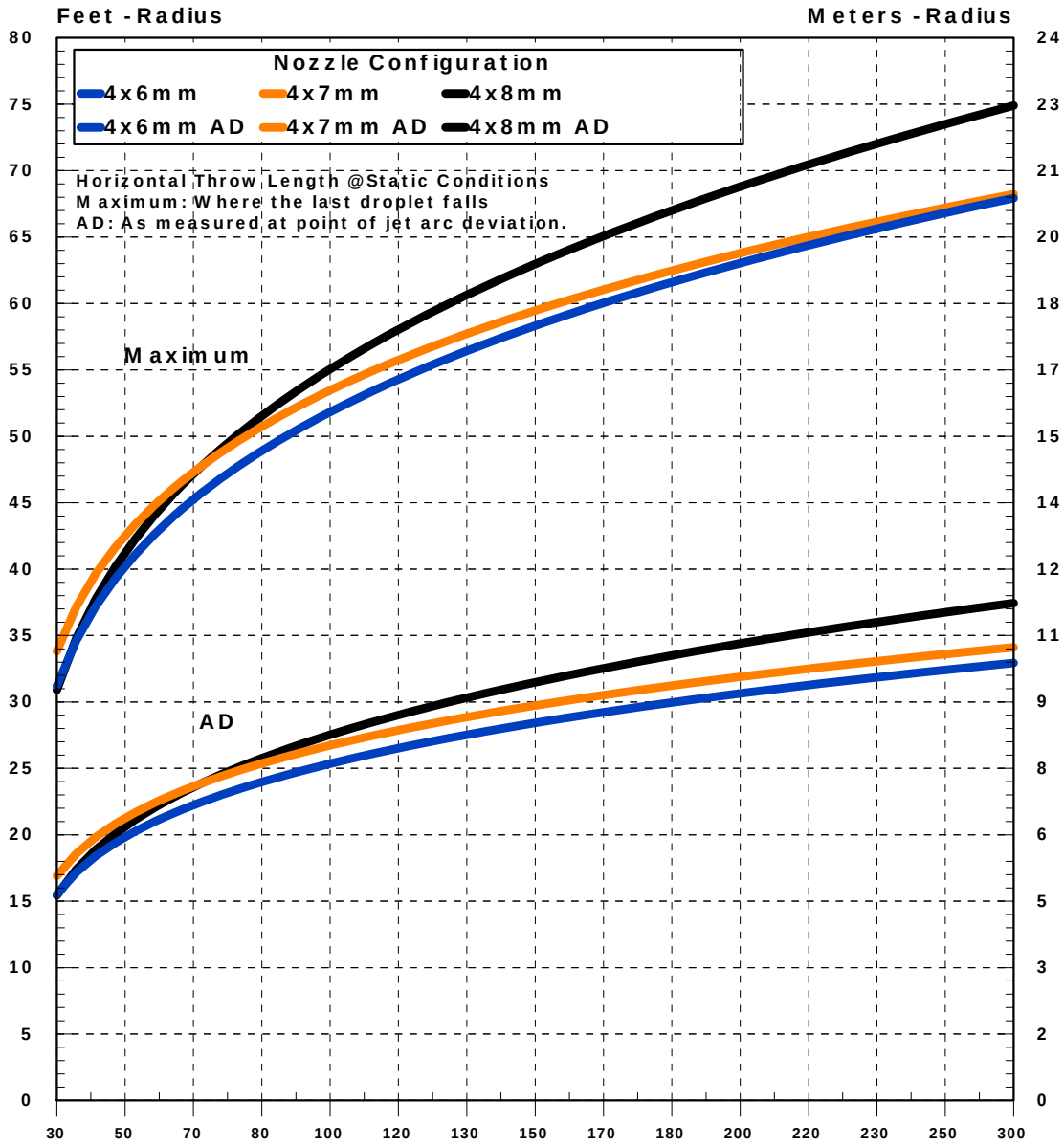


Figure 8

Maximum jet-length on this curve is measured at static conditions and where the last droplet falls. The effective range is subjective to the cleaning requirement. However in this curve effective is at the point of arc deviation.

INSTALLATION AND NORMAL OPERATION

General Installation Instructions

The Butterworth®tank cleaning machine should be installed in vertical position (upright or inverted). It is recommended to install a filter in the supply line in order to avoid large particles lodging inside the machine. Before connecting the machine into the system, all supply lines and valves should be flushed to remove foreign matter.

Recommended filtration: 100-200 micron

Warning: If the machine is *used in potential explosive atmospheres*, tapes or joint sealing compounds, which are electrical insulators, must not be used on threads or joints. In addition, connecting pipe work must be electrically conductive and grounded to the tank structure. This is essential to avoid the build-up of static electricity on the machine.

The Butterworth®tank cleaning machine as delivered has been tested at the factory before shipping.

Normal Operation

Cleaning Media: Use only media compatible with the materials as listed on the reference list of parts as indicated for your model; see page 29.

After Use Cleaning: Depending on the type of cleaning that is being performed and the type of cleaning solution used, a procedure for after use flushing of the cleaning system should be developed for your application. In general, a fresh water flush is recommended after each cleaning.

Pressure: Avoid Hydraulic shocks. Increase pressure gradually; ramping up the pressure over 5-7 seconds. Do not exceed 300 PSI (21 Bar) inlet pressure. High pressure in combination with high flow rate will increase consumption of wear parts and should be expected when compared to operations at lower pressures and flow rates.

MAINTENANCE AND REPAIR

PREVENTIVE MAINTENANCE

In order to keep your Butterworth® tank cleaning machine servicing you as an efficient tool in your tank cleaning operations, it is essential to maintain its high performance by following a simple preventive maintenance program, which will always keep your tank cleaning machine in good condition.

Good maintenance is careful and regular attention!

The following recommended preventive maintenance program is based on tank cleaning machines working in average conditions. However, you will appreciate that a tank cleaning machine, which has a rough and dirty job to do, will need more frequent attention than one working in ideal conditions. We trust that you will adjust your maintenance program to suit.

Always use **only** proper tools. Use Butterworth® standard tool kit (page 26). Never force, hammer or pry components together or apart. Always perform all assembly/disassembly steps in the order described in this manual. Never assemble components without previous cleaning. This is especially important at all mating surfaces. Work in a clear well lighted work area.

Every 400 working hours

1. Disassemble machine as described on the following pages leaving the gearbox intact; position 37.

2. Thoroughly flush the machine prior to disassembly and insure that no hazardous material remains in the machine.

3. Upon complete disassembly of the machine; except for position 37, all parts should be thoroughly washed and/or degreased in the appropriate manner, then inspected accordingly.

4. Inspect seals and bushings for wear; locate position numbers from the exploded view drawing on page 33 and bill of materials on page 29. Replace if unduly worn.

5. Inspect bevel gears located at position numbers 12.6 and 17. Replace if unduly worn.

6. Inspect gearbox rotation by inserting position 36 into position 32.3 then gearbox; position 37 observing gear timing into position 32.3. then rotate clockwise. If rotation is not consistent and smooth, then inspection of gears should be undertaken and replaced where necessary. For representation of gear timing; see Figure 19.

7. A service card is included with this manual; see page 37. This should be completed each time service is performed on your tank cleaning machine so that a proper record/history is maintained.

MAINTENANCE AND REPAIR

TOP ASSEMBLY

Disassembly

1. Secure tank cleaning machine in vice; using soft jaws to avoid damaging the finish.
2. Remove position 1 by rotating clockwise while holding inlet ring; position 12.4 using spanner wrenches as shown in Figure 23 and Figure 27 Also see Figure 9.
3. Remove position 2 by hand and slightly tapping with a rubber mallet from side to side.
4. Remove position 3 and 4.
5. Remove position 5.1 by prying out with a screw driver inserted under the vanes.
6. Remove position 8.1, 8.2, 8.3, and 8.4 as an assembly by lifting on position 8.1 and by hand. In some cases it may be necessary to pry this out with a screwdriver inserted under the vanes of position 8.1
7. Remove position 8.2 using snap-ring pliers (see Figure 9 and Figure 10)
8. Remove position 8.1 from 8.4 by manually pulling position 8.1 from 8.4. On occasion, it may be necessary to tap position 8.4 from position 8.1.
9. Remove position 8.3 from 8.4.

Reassembly

1. Reverse the procedure described in the disassembly process above.
2. It is advised to include the use of Anti-Seize as described on page 6 when connecting position 1 to position 12.4.

MAINTENANCE AND REPAIR

Top Assembly - Exploded View Drawing

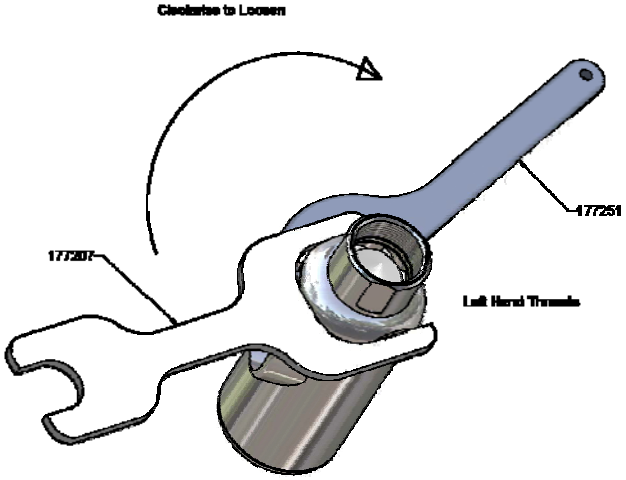


Figure 9

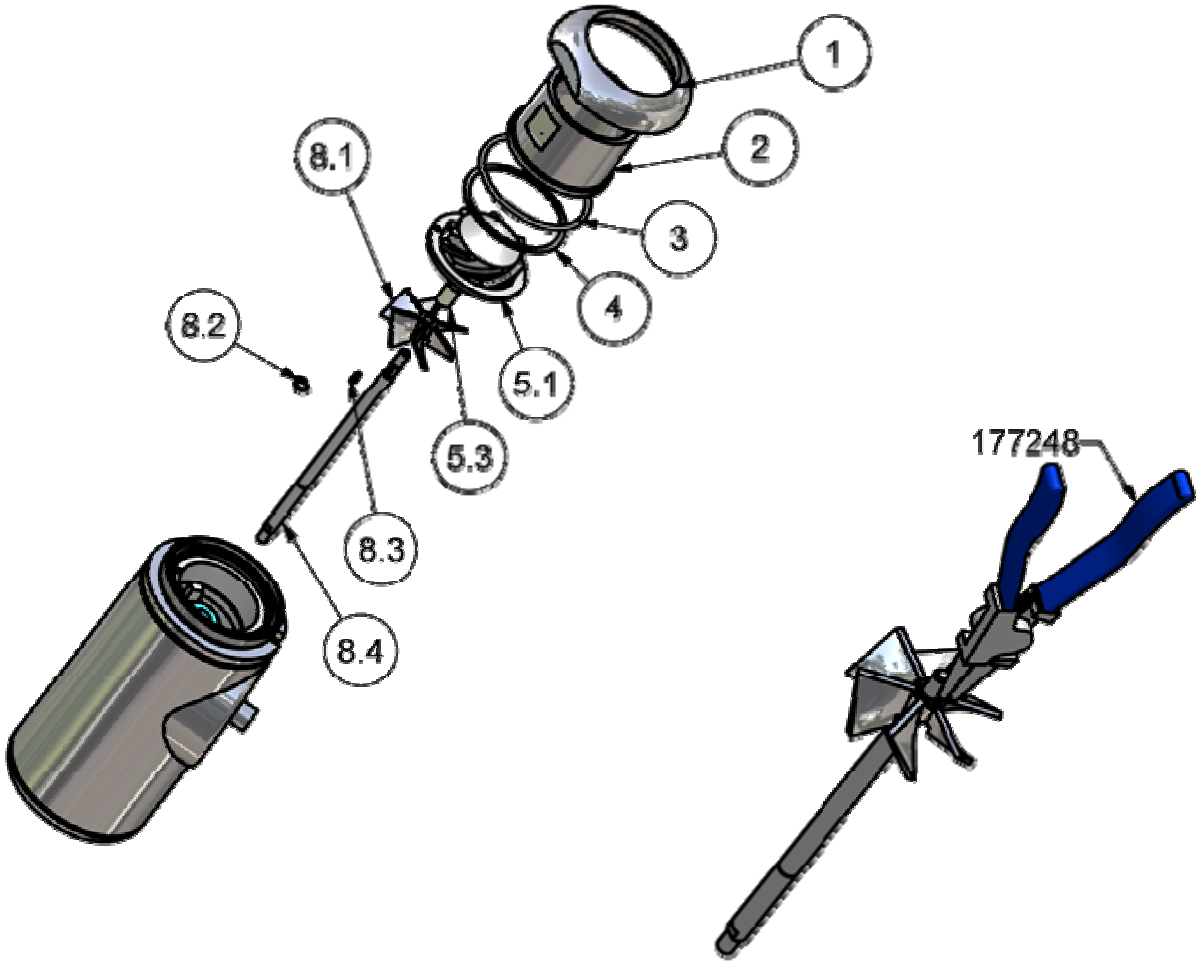


Figure 10

MAINTENANCE AND REPAIR

Impeller Housing Subassembly

Disassembly

1. Remove position 9 using snap-ring pliers (see Figure 24).
2. Remove with needle nose pliers (see Figure 30) position 10 from position 12.
3. Remove position 12 from position 15 using two regular screwdrivers by prying position 12 from position 15 using the upper lip of position 15 as a pivot point or screw the screw cap; position 1 back on with inlet; position 2 and pull the impeller housing assembly; position 12 from the main body; position 15.
4. Remove position 13 from position 12.
5. Remove position 11 using needle nose pliers (see Figure 30) from position 32.3.
6. Using a punch (see Figure 14) remove position 12.5 by tapping position 12.5 with the punch and hammer driving inward.
7. On completion of step 5 above remove positions 12.6 from 12.1 along with removing positions 12.1, 12.2, and 12.3. These items should be removable by hand or with a small regular screwdriver.

Reassembly

1. Reverse the above procedure in the steps mentioned.

MAINTENANCE AND REPAIR

Impeller Housing Sub-Assembly - Drawing

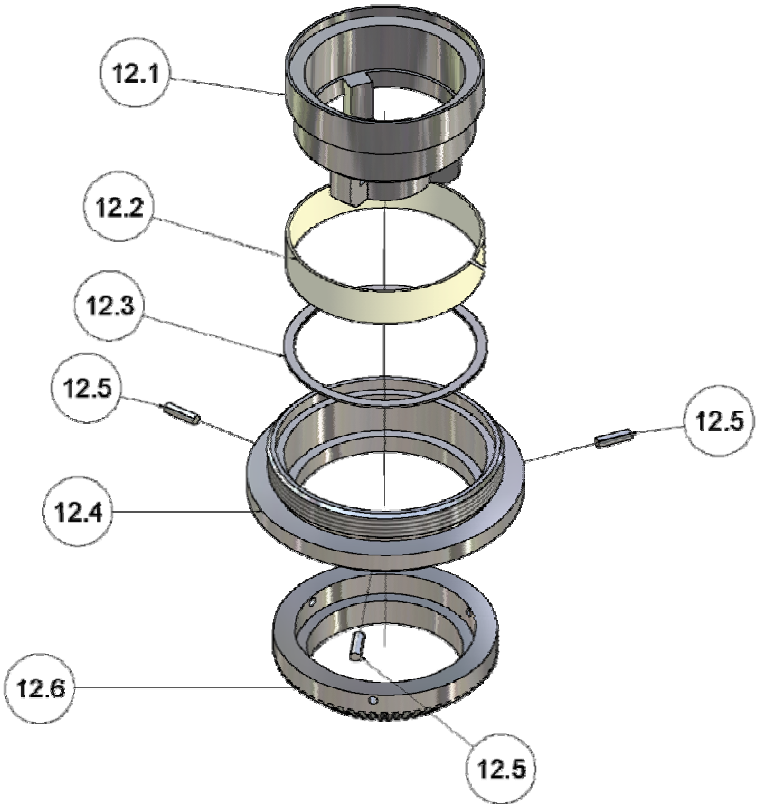


Figure 11

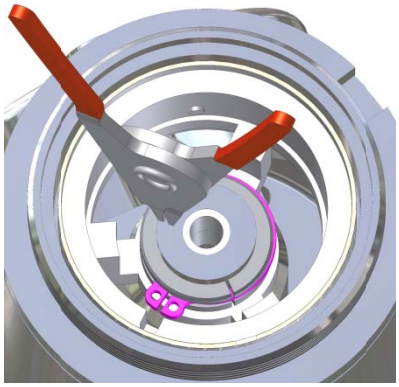


Figure 12

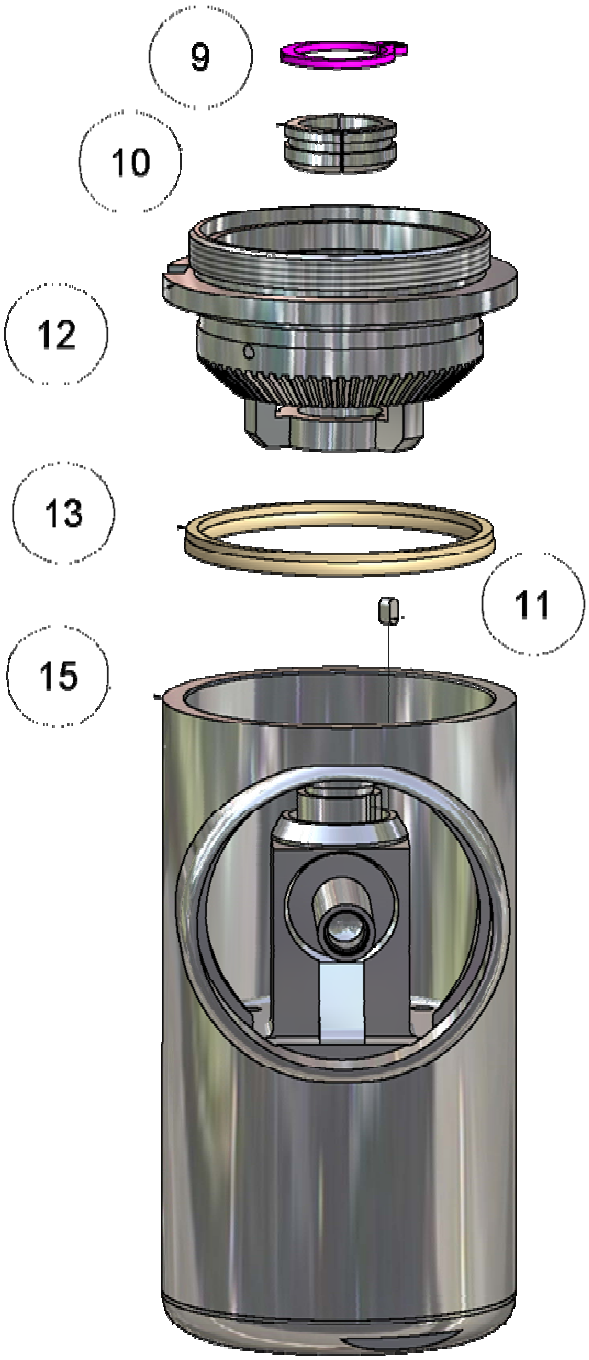


Figure 13

MAINTENANCE AND REPAIR

Bottom Assembly

Disassembly

1. Invert body and place in vice (with soft jaws) and remove position 41.3 from position 15 by rotating position 41.3 clockwise (these are left-hand threads); using torque cap tool (see Figure 29). Alternately, you can use the spanner wrench (see Figure 23).
2. Remove position 40 from atop position 37 (this will be loose and should be free after completing step 1.
3. Remove position 8.5 from position 39 by hand or with needle nose pliers (see Figure 30).
4. Remove position 39 from position 37. This should come off by hand; but use of needle nose pliers as previously mentioned may be necessary.
5. Ball race removal; position 41.1 is discussed on pages 23 and 24
6. Remove position 38 using snap-ring pliers (Figure 31) from position 32.3 and as shown in Figure 16.
7. Remove position 37 from position 32.3 using two regular screwdrivers and prying it loose from position 15, using the upper edge of position 15 as the pivot point.
8. Remove position 36 from inside of position 32.3
9. Remove position 32.3 from position 15.
10. To disassemble the main stem; position 32.3; remove pins; position 32.3b by punching the pins inward until they are free of position 32.3a. After this step, remove position 32.3c from 32.3a by tapping position 32.3a from 32.3c using a soft mallet and positioning position 32.3c in a vice on the lip of 32.3c.
11. Remove position 31 from position 30; this should be loose and is removable by hand.
12. For position 30 and 32.1, ball race removal; see pages 23 and 24.
13. Remove positions 32.2 and 32.4 by inserting a hooked probe past these positions and then pulling these positions out of position 32.3.
14. Remove position 29 from position 15 by hand or with a punch by inverting position 15 and tapping on the ledge of position 29.

Reassembly

1. Reverse process as stated above with the additional observance of using a torque wrench as shown Figure 14 to attach position 41.3 to position 15.
2. See for gear alignment instructions when placing position 37 back into position 32.3.

MAINTENANCE AND REPAIR

Bottom Assembly - Exploded View Drawing

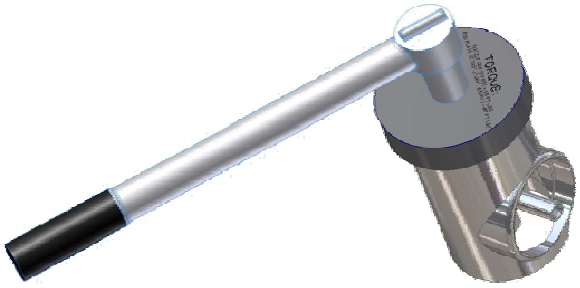


Figure 14

Note: This is a left-hand thread

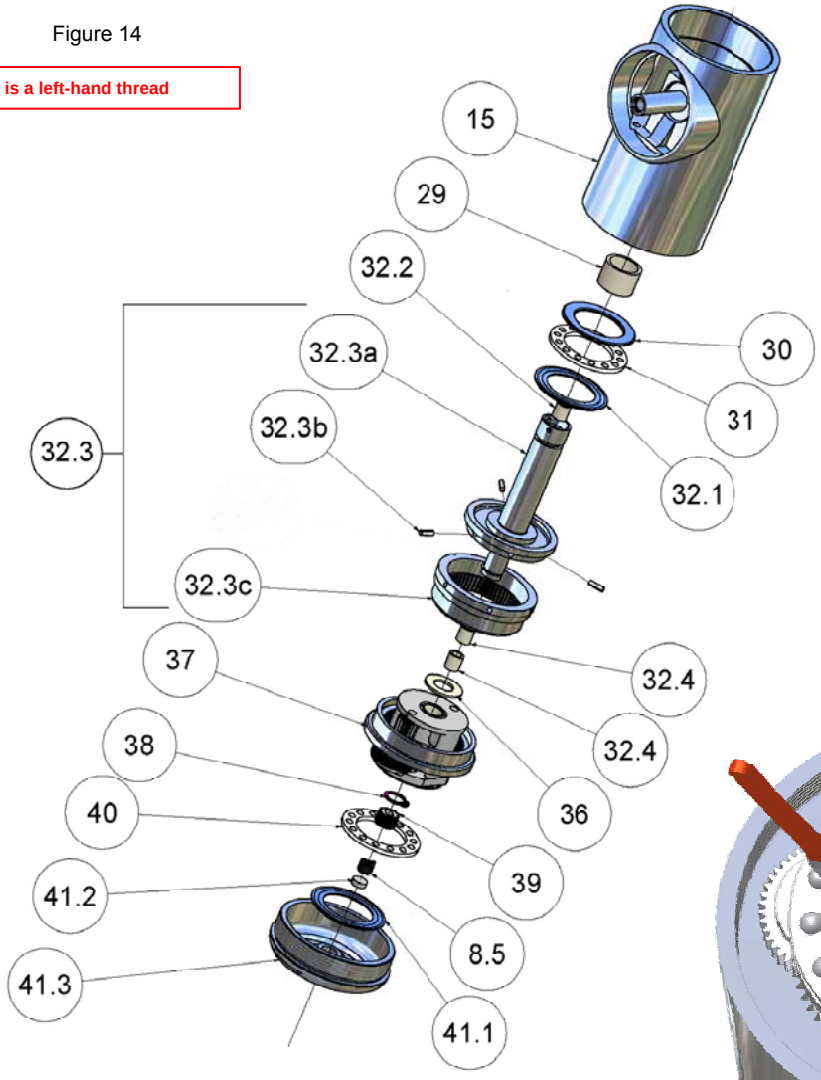


Figure 15

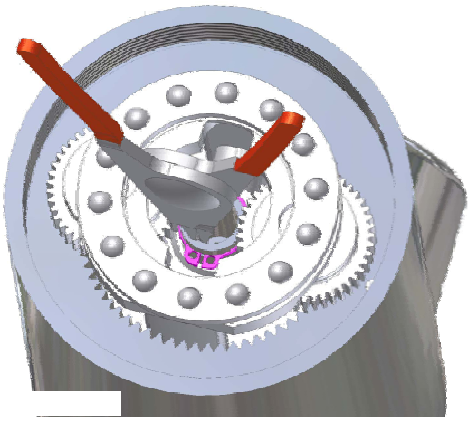


Figure 16

MAINTENANCE AND REPAIR

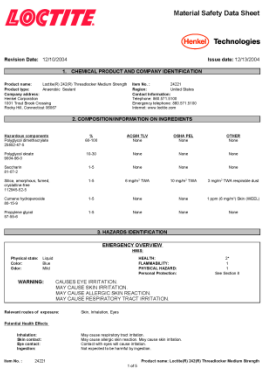
Hub Sub-Assembly

Disassembly

1. Place the tank cleaning machine; horizontally and with nozzles facing upwards, in a vice using soft jaws.
2. Remove position 28 from position 15 using spanner wrench (see Figure 28) and by turning counterclockwise (this is a right-hand thread) until removed; see Figure 17 for additional information.
3. Remove position 26; this should be loose and free.
4. Positions 25 and 27 are races; see pages 23 and 24.
5. Remove position 22 by hand.
6. Remove position 21 from 22.
7. Remove position 24 from 22 using tool in Figure 28. Position 23 should remain within position 24; except for possible cleaning.
8. Remove position 20 from 22.
9. Remove position 19 by hand.
10. Remove position 17 from position 15 by hand.
11. Remove position 18 from 17 using a regular screwdriver or by hand.
12. Remove position 16 from position 15 by hand.

Reassembly

1. Reverse the above procedure and it is recommended that position 28 is affixed to position 15 using Loctite 242.


LOCTITE

Material Safety Data Sheet

Henkel Technologies

Revision Date: 12/10/2004 Issue date: 12/13/2004

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

2. COMPOSITION/INFORMATION ON INGREDIENTS

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING: CAUSES EYE IRRITATION. MAY CAUSE SKIN IRRITATION. MAY CAUSE ALLERGIC SKIN REACTION. MAY CAUSE RESPIRATORY TRACT IRRITATION.

Potential Health Effects

Loctite Product Numbers:

24205: Threadlocker 242 Removable, 0.5ml capsule
24221: Threadlocker 242 Removable, 10ml bottle
24231: Threadlocker 242 Removable, 50 ml bottle

MAINTENANCE AND REPAIR

Hub Sub-Assembly - Drawing

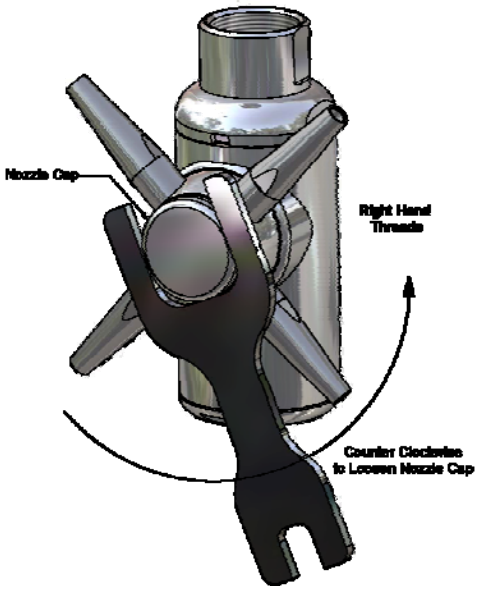


Figure 17

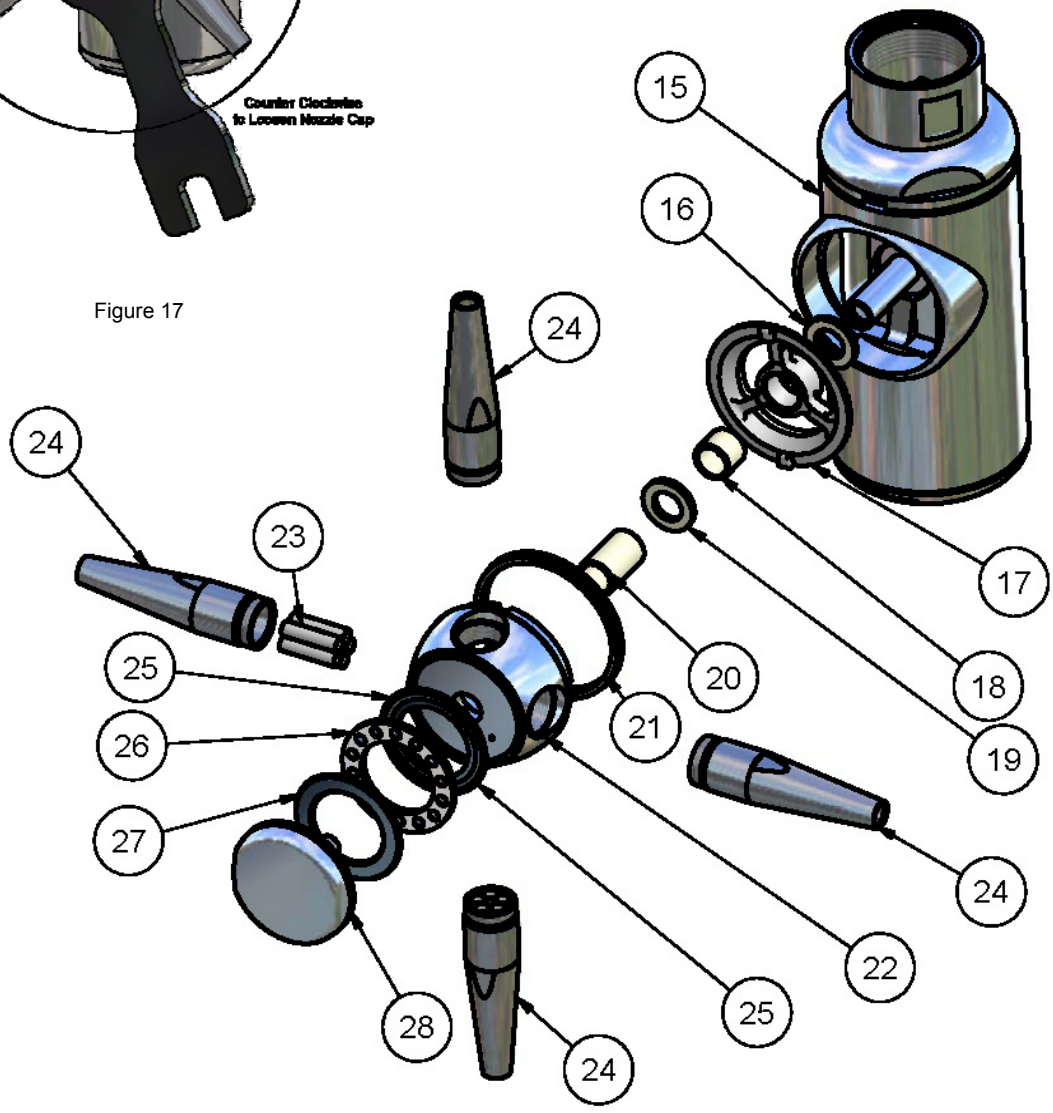


Figure 18

MAINTENANCE AND REPAIR

Gearbox Sub-Assembly

Disassembly

1. Remove position 37.3 from position 37.4.
2. Remove position 37.9 from position 37.4; this is a ball race; see pages 23 and 24.
3. Remove position 37.10 from position 37.4 using tool in Figure 25.
4. Remove position 37.8 from position 37.4 using tool in Figure 25. Tap gently so as not to damage.
5. Remove 37.2 from 37.5 by hand.
6. Remove position 37.5 from position 37.4 by hand.
7. Remove by hand positions 37.6 and 37.7.
8. Remove position 37.1 from position 37.2 using tool in Figure 14.
9. Position 37.5a is part of position 37.5 and sold/supplied as an assembly.

Reassembly

1. Reverse the above procedure and be sure to time the gears as indicated in Figure 19.

MAINTENANCE AND REPAIR

Gearbox Sub-Assembly - Drawing

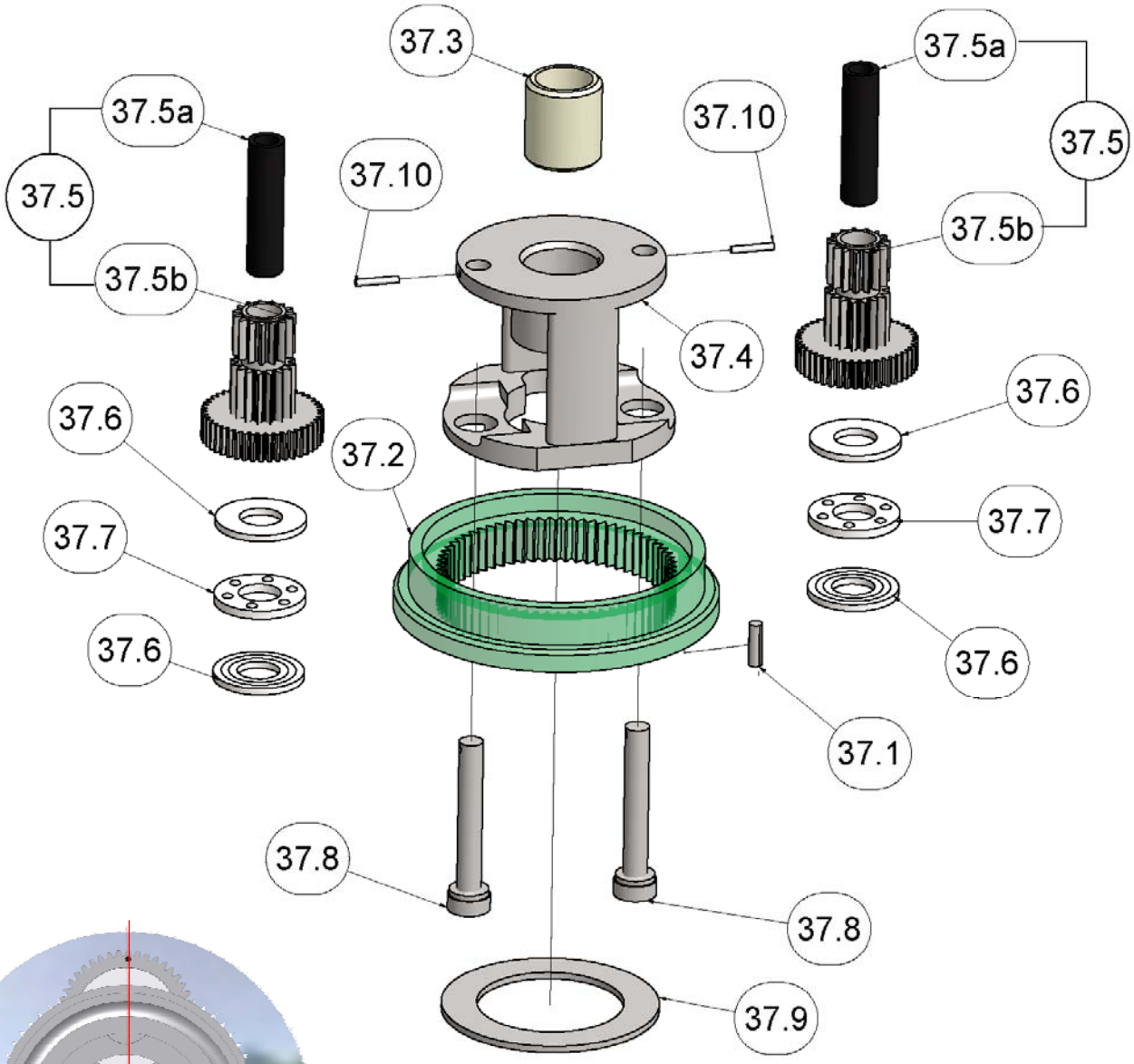
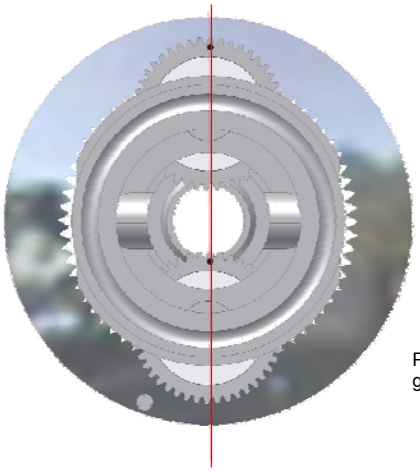


Figure 20



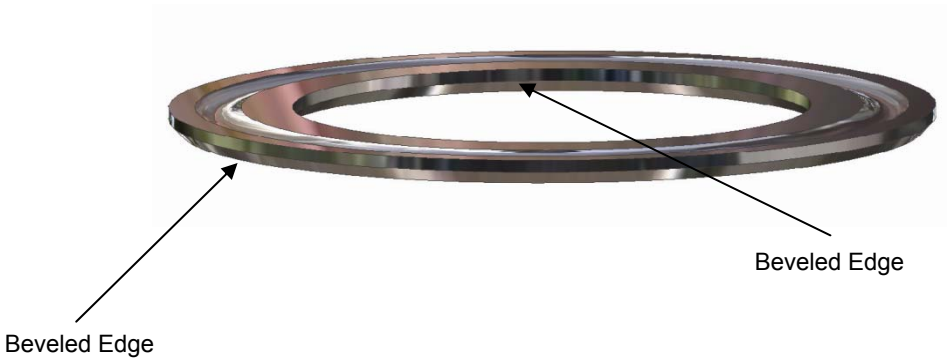
Planet gears should be aligned to the dots on the gears as indicated below on the red line.

Figure 19

MAINTENANCE AND REPAIR

Replacement of Ball Races

Referring to the images on page 24, ball races are employed in a number of positions within this tank cleaning machine. To remove the ball race, a screwdriver as show in Figure 21 can be placed on the inside edge or outer edge of the race (depending on which race is being removed). There is slight bevel on the races edge that will allow for the race to be cantilevered out of position.



MAINTENANCE AND REPAIR

Replacement of Ball Races - Drawing

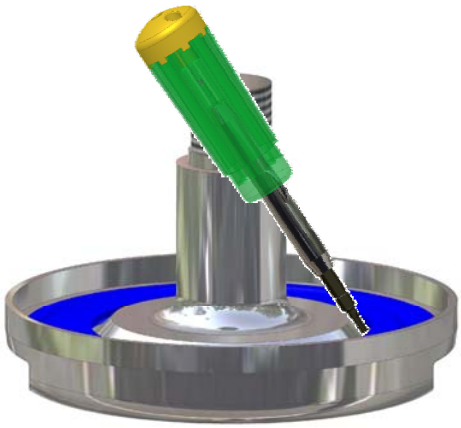
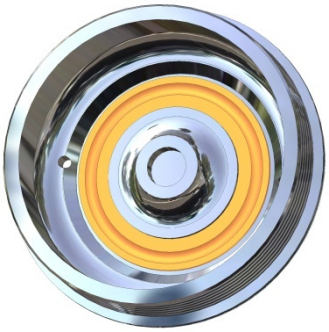


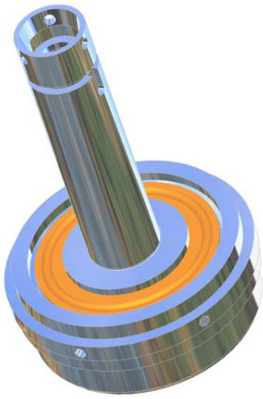
Figure 21

Pos. 22 & 25

Pos. 37.4 & 37.9



Pos. 41.3 & 41.1



Pos. 32.3 & 32.1

Pos. 15 & 30

Pos. 28 & 27

MAINTENANCE AND REPAIR

Tool Listing

LTQFT Tool Kit Part Number: 5696

Consisting of:

1. 1 each 177207 Spanner Wrench; see Figure 23.
2. 1 each 177208 Spanner Wrench; see Figure 26.
3. 1 each 177245 Circlip Pliers; not shown.
4. 1 each 177246 3mm Punch; see Figure 26.
5. 1 each 177247 1.5mm Punch; see Figure 25.
6. 1 each 177248 5mm Circlip pliers; straight nose; see Figure 22.
7. 1 each 177249 10-20mm Circlip pliers; see Figure 24.
8. 1 each 177250 Pointed nose pliers; see Figure 30.
9. 1 each 177251 3 inch hook spanner; see Figure 27.
10. 1 each 177254 3-10mm circlip pliers; straight nose; Figure 31.
11. 1 each 177255 Torque socket tool; see Figure 29

TOOLS

Figure 23

Figure 22

Figure 25

Figure 24

Figure 26

TOOLS

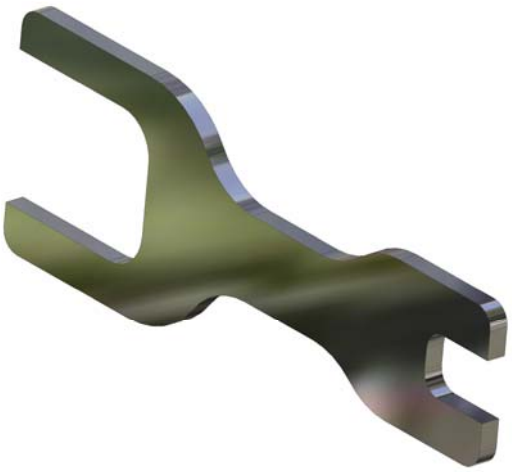


Figure 28

Figure 27

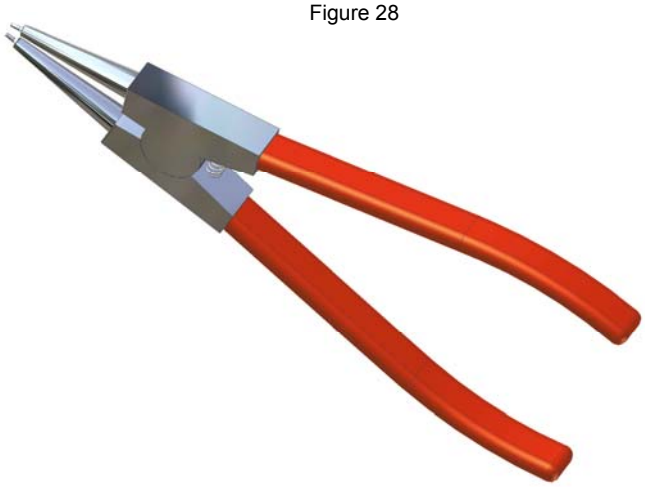


Figure 31

Figure 30

Figure 29

TROUBLE SHOOTING GUIDE

Symptom: Tank cleaning machine will not rotate.

Possible causes are:

1. No or insufficient liquid flow
    a. Check fluid supply to insure that pressure and flow as per the operating curves are being observed. For this to be properly accomplished, you should install a pressure gauge as close to the machine inlet as possible. In any case the pressure gauge should not be any further from the tank cleaning machine than 15 feet.
2. Tank cleaning machine inlet is blocked.
    a. Check inlet of machine; position 2; and insure that no debris or foreign matter is present. Remember that it was advised earlier in this manual to employ a 100 micron filter.
3. Tank cleaning nozzles are blocked.
    a. Remove the nozzles; position 24 and check for any foreign matter. If present, remove and then replace nozzles.
4. Bevel gears are blocked.
    a. If foreign matter has entered the machine and passed through the body, it may have lodged itself in the bevel gears; position 12.6 and 17. To check these areas refer to Figure 17 for instructions on removal of the hub. Take care to review the gearing and ensure that there is no damage that could prevent operation.
5. Impeller rotation is restricted.
    a. If foreign matter has passed through the inlet and past the guide vane; position 5.1 you would not be able to see that matter by looking into the inlet. To check for blockage here; see Figure 10 and disassemble as required to perform your inspection.
6. Gearbox rotation is restricted.
    a. If foreign matter has entered into this area; position 37; to perform an inspection see Figure 14 and Figure 15 for disassembly instructions.
7. Worn parts; replacements required.
    a. After items 1-6 above have been checked; it may be necessary to replace parts due to normal wear associated with your type of operation. One of the best ways to determine the need to replace parts is a visual inspection of the primary wear parts as listed in the reference list of parts on page 29. Additionally, the working mechanism of the machine can be checked by rotating the impeller; position 8.1. By rotating this position, the turbine shaft and various gearing within the tank cleaning machine is engaged. Rotation should be smooth and consistent. If that is not the case then parts replacement is most probably required.

REFERENCE LIST OF PARTS

Note: Shaded gray areas are variables for the LTQFT, depending on your model number.

Version: LTQFT-Master BOM-2008.01.03

POS	QTY	√	PART NUMBER	DESCRIPTION	M.O.C.	STANDARD	WETTED	STATUS	CROSS REFERENCE	Note
1	1		177063	Screw cap	316 SS	ASTM A351-CF8M	Yes	Obsolete	577063	
		√	577063		316 SS	ASTM A351-CF8M	Yes	Standard	None	
2	1		177005	Inlet housing 1.5" BSP(F)	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			272302	Inlet housing 1.5" NPT(F)	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			472302	Inlet housing 1.5" NPT(M)	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			477005	Inlet housing 1.5" BSP(M)	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			572302-01	Inlet housing 1.5" NPS(F)	316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
3	1	√	177041	Inlet o-ring	PTFE	Contact Butterworth	Yes	Standard	None	
			177041-01		Buna-N	ASTM D1418	Yes	Non Standard	None	
			177041-02		Viton	Contact Butterworth	Yes	Non Standard	None	
4	1		177066	Washer	Monel	ASTM A494-M35-2	Yes	Obsolete	177066-01	
		√	177066-01		316 SS	ASTM A351-CF8M	Yes	Standard	None	
5	1		5660	Guide vane assembly; type 3	See individual parts	See individual parts	Yes	Standard	None	
			5661	Guide vane assembly; type 2	See individual parts	See individual parts	Yes	Standard	None	
			5662	Guide vane assembly; type M	See individual parts	See individual parts	Yes	Standard	None	
			5664	Guide vane assembly; type 4	See individual parts	See individual parts	Yes	Standard	None	
			6664	Guide vane assembly; type 1	See individual parts	See individual parts	Yes	Standard	None	
			5660-01	Guide vane assembly; type 3; ver. 01	See individual parts	See individual parts	Yes	Non Standard	None	
			5660-02	Guide vane assembly; type 3; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
			5661-01	Guide vane assembly; type 2; ver. 01	See individual parts	See individual parts	Yes	Non Standard	None	
			5661-02	Guide vane assembly; type 2; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
			5662-01	Guide vane assembly; type M; ver. 01	See individual parts	See individual parts	Yes	Non Standard	None	
			5662-02	Guide vane assembly; type M; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
			5664-01	Guide vane assembly; type 4; ver. 01	See individual parts	See individual parts	Yes	Non Standard	None	
			5664-02	Guide vane assembly; type 4; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
			6664-01	Guide vane assembly; type 1; ver. 01	See individual parts	See individual parts	Yes	Non Standard	None	
			6664-02	Guide vane assembly; type 1; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
5.1	1		177022	Guide vane, Type 2	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			177023	Guide vane, Type 3	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			177104	Guide vane, Type M	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			577104	Guide vane, Type 4	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			677022-00	Guide vane, Type 1	316 SS	ASTM A351-CF8M	Yes	Standard	None	
5.2	1	√	177034	Groove pin	316 SS	ASTM A351-CF8M	Yes	Standard	None	
5.3	1	√	177033	Top drive shaft bushing	10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177033-01	Top drive shaft bushing	Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177033-02	Top drive shaft bushing	UHMW	Contact Butterworth	Yes	Non Standard	None	
8	1		8663	Impeller shaft assembly; type 1	See individual parts	See individual parts	Yes	Standard	None	
			8668	Impeller shaft assembly; type 3	See individual parts	See individual parts	Yes	Standard	None	
			8663-02	Impeller shaft assembly; type 1; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
			8668-02	Impeller shaft assembly; type 3; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
8.1	1		477021	Impeller, Type 1	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			477106	Impeller, Type 3	316 SS	ASTM A351-CF8M	Yes	Standard	None	
8.2	1	√	270504	Impeller circlip	316 SS	ASTM A351-CF8M	Yes	Standard	None	
8.3	1	√	170541	Shaft key	316 SS	ASTM A351-CF8M	Yes	Standard	None	
8.4	1	√	477011	Shaft	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
8.5	1	√	477044-01	Thrust pad	Carbon filled PEEK w/PTFE	Contact Butterworth	Yes	Standard	None	
			477044-02		Tungsten Carbide	Contact Butterworth	Yes	Non Standard	None	
			477044-03		Carbon filled PEEK	Contact Butterworth	Yes	Non Standard	None	
9	1	√	277603	Circlip	316 SS	ASTM A351-CF8M	Yes	Standard	None	

REFERENCE LIST OF PARTS

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POS	QTY	√	PART NUMBER	DESCRIPTION	M.O.C.	STANDARD	WETTED	STATUS	CROSS REFERENCE	Note
10	2	√	277604	H Retainer	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
11	1	√	272604	Key, 3 mm	316 SS	ASTM A351-CF8M	Yes	Standard	None	
12	1	√	5667	Impeller housing assembly	See individual parts	See individual parts	Yes	Standard	None	
			5667-02	Impeller housing assembly; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
12.1	1	√	277602	Impeller housing	CD-4MCu duplex	ASTM A744, A890	Yes	Standard	None	
12.2	1	√	177067	Strip	PTFE	Contact Butterworth	Yes	Standard	None	
			177067-02	Strip	UHMW	Contact Butterworth	Yes	Non Standard	None	
12.3	1		177066	Washer	Monel	ASTM A494-M35-2	Yes	Obsolete	177066-01	
	1	√	177066-01	Washer	316 SS	ASTM A351-CF8M	Yes	Standard	None	
12.4	1	√	177062	Inlet Ring	316 SS	ASTM A351-CF8M	Yes	Standard	None	
12.5	3	√	177034	Groove pin	316 SS	ASTM A351-CF8M	Yes	Standard	None	
12.6	1	√	177007	Body bevel gear	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
13	1	√	177038	Rotary seal	Elgiloy,10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177038-01		Elgiloy,Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177038-02		Elgiloy,UHMW	Contact Butterworth	Yes	Non Standard	None	
14	1	√	177025	Main stem bushing	10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177025-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177025-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
15	1		577500-00	Main body	CD-4MCu duplex	ASTM A744, A890	Yes	Obsolete	577500-01	
		√	577500-01		CD-4MCu duplex	ASTM A744, A890	Yes	Standard	None	
16	1		177032	Nozzle thrust pad	10% Ekanol PTFE	Contact Butterworth	Yes	Non Standard	None	
		√	477032		10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177032-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177032-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
			477032-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			477032-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
17	1		577008-00	Nozzle bevel gear	316 SS	ASTM A351-CF8M	Yes	Obsolete	577008-01	
			577008-01		316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
			577008-02		316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
		√	577008-03		17-4ph SS	ASTM A747-CCBCU-1	Yes	Standard	None	
			577008-04		316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
18	1	√	677027	Nozzle bushing	10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			677027-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			677027-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
19	1		177032	Nozzle thrust pad	10% Ekanol PTFE	Contact Butterworth	Yes	Non Standard	None	
		√	477032		10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177032-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177032-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
			477032-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			477032-02		UHMW	Contact Butterworth	Yes	Non Standard	None	

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POS	QTY	√	PART NUMBER	DESCRIPTION	M.O.C.	STANDARD	WETTED	STATUS	CROSS REFERENCE	Note
20	1		177027	Nozzle bushing	10% Ekanol PTFE	Contact Butterworth	Yes	Non Standard	None	
		√	477027		10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177027-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177027-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
			477027-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			477027-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
21	1	√	177039	Rotary seal	Elgiloy,10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177039-01		Elgiloy,Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177039-02		Elgiloy,UHMW	Contact Butterworth	Yes	Non Standard	None	
22	1		677002-00	Nozzle body	316 SS	ASTM A351-CF8M	Yes	Obsolete	677002-03	
			677002-01		316 SS	ASTM A351-CF8M	Yes	Obsolete	677002-03	
			677002-02		316 SS	ASTM A351-CF8M	Yes	Obsolete	677002-03	
		√	677002-03		316 SS	ASTM A351-CF8M	Yes	Standard	None	
23	20	√	677018	Stream straightener	316 SS	ASTM A351-CF8M	Yes	Standard	None	
24	2		677055	Nozzle Tip Plug	316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
	4		677058	Nozzle Tip Type 3 6MM	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			677059	Nozzle Tip Type 3 7MM	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			677060	Nozzle Tip Type 3 8MM	316 SS	ASTM A351-CF8M	Yes	Standard	None	
			677061-00	Nozzle Tip Type 3 10.85MM	316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
			677062-00	Nozzle Tip Type 3 11.50MM	316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
			677063-00	Nozzle Tip Type 3 13.50MM	316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
			677064-00	Nozzle Tip Type 3 11.00MM	316SS	ASTMA351-CF8M	Yes	Non Standard	None	
25	1	√	377702	Large race	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
26	1	√	7006	Thrust retainer assembly	Tefzel w/ ceramic balls	Contact Butterworth	Yes	Standard	None	
			7006-01		Tefzel w/ 316L SS balls	Contact Butterworth	Yes	Non Standard	None	
			7006-02		PEEK w/ ceramic balls	Contact Butterworth	Yes	Non Standard	None	
			7006-03		PEEK w/ 316L SS balls	Contact Butterworth	Yes	Non Standard	None	
27	1	√	377702	Large race	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
28	1		677019-00	Nozzle cap	316 SS	ASTM A351-CF8M	Yes	Obsolete	677019-01	
		√	677019-01		316 SS	ASTM A351-CF8M	Yes	Standard	None	
29	1	√	177025	Main stem bushing	10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177025-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177025-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
30	1	√	377702	Large race	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
31	1	√	7006	Thrust retainer assembly	Tefzel w/ ceramic balls	Contact Butterworth	Yes	Standard	None	
			7006-01		Tefzel w/ 316L SS balls	Contact Butterworth	Yes	Non Standard	None	
			7006-02		PEEK w/ ceramic balls	Contact Butterworth	Yes	Non Standard	None	
			7006-03		PEEK w/ 316L SS balls	Contact Butterworth	Yes	Non Standard	None	
32	1		7666	Main stem assembly	See individual parts	See individual parts	Yes	Non Standard	None	
		√	7666-01	Main stem assembly; ver. 01	See individual parts	See individual parts	Yes	Standard	None	
			7666-02	Main stem assembly; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
32.1	1	√	377702	Large race	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
32.2	2	√	177024	Drive shaft bushing	10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177024-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177024-02		UHMW	Contact Butterworth	Yes	Non Standard	None	

REFERENCE LIST OF PARTS

Note: Shaded gray areas are variables for the LTQFT, depending on your model number.

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POS	QTY	√	PART NUMBER	DESCRIPTION	M.O.C.	STANDARD	WETTED	STATUS	CROSS REFERENCE	Note
32.3	1		377601	Main stem	CD4-Mcu duplex SS	ASTM A744, A890	Yes	Obsolete	377601-01	
		√	377601 -01	Main stem assembly (Includes positions 32.3a, 32.3b, & 32.3c)	CD4-Mcu duplex SS	ASTM A744, A890	Yes	Standard	None	
32.3a	1	√	477600	Main stem shaft	316 SS	ASTM A351-CF8M	Yes	Standard	None	
32.3b	3	√	177034	Pin	316 SS	ASTM A351-CF8M	Yes	Standard	None	
32.3c	1		477601	Main stem gear	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Obsolete	477601-01	
		√	477601-01		CD-4MCu duplex	ASTM A744, A890	Yes	Standard	None	
32.4	2	√	177024	Drive shaft bushing	10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177024-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177024-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
36	1	√	177030	Carrier thrust pad	10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177030-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177030-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
37	1		7665	LTFT gearbox assembly	See individual parts	See individual parts	Yes	Obsolete	7665-01	
		√	7665-01		See individual parts	See individual parts	Yes	Non Standard	None	
			7665-02		See individual parts	See individual parts	Yes	Non Standard	None	
37.1	1	√	177034	Groove pin	316 SS	ASTM A351-CF8M	Yes	Standard	None	
37.2	1	√	370302	Internal gear	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
37.3	1	√	177026	Carrier bushing	10% Ekanol PTFE	Contact Butterworth	Yes	Standard	None	
			177026-01		Mineral filled PTFE	Contact Butterworth	Yes	Non Standard	None	
			177026-02		UHMW	Contact Butterworth	Yes	Non Standard	None	
37.4	1	√	377009	Carrier, Flow Through	316 SS	ASTM A351-CF8M	Yes	Standard	None	
37.5	1	√	7659	Planet gear assembly	See individual parts	See individual parts	Yes	Standard	None	
			7659-02	Planet gear assembly; ver. 02	See individual parts	See individual parts	Yes	Non Standard	None	
37.5a	2	√	177028	Planet gear bushing	Carbon filled PEEK w/PTFE	Contact Butterworth	Yes	Standard	None	
			177028-02		Carbon filled PEEK	Contact Butterworth	Yes	Non Standard	None	1
37.5b	2		377014	Planet gear	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Obsolete	7659A	1
	2		377102	Star gear	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Obsolete	7659A	
	2	√	7659A	Planet gear	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
37.6	4	√	377707	Race	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
37.7	2	√	377706	Thrust retainer assembly	Tefzel w/ 316 SS balls	Contact Butterworth	Yes	Standard	None	
			377706-02		Nylon w/ 440c SS balls	Contact Butterworth	Yes	Obsolete	377706	
37.8	2		377020-02	Gear shaft	17-4ph SS	Contact Butterworth	Yes	Non Standard	None	
		√	377020-01		MP35N	ASTM F562	Yes	Standard	None	
37.9	1	√	377702	Large race	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
37.10	2	√	270506	Pin	316 SS	ASTM A351-CF8M	Yes	Standard	None	
38	1	√	177035	Circlip	316 SS	ASTM A351-CF8M	Yes	Standard	None	
39	1	√	377101	Drive gear	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
40	1	√	7006	Thrust retainer assembly	Tefzel w/ ceramic balls	Contact Butterworth	Yes	Standard	None	
			7006-01		Tefzel w/ 316L SS balls	Contact Butterworth	Yes	Non Standard	None	
			7006-02		PEEK w/ ceramic balls	Contact Butterworth	Yes	Non Standard	None	
			7006-03		PEEK w/ 316L SS balls	Contact Butterworth	Yes	Non Standard	None	
41	1	√	6657	End plate assembly	See individual parts	See individual parts	Yes	Standard	None	
			7657		See individual parts	See individual parts	Yes	Non Standard	None	
41.1	1	√	377702	Large race	17-4ph SS	ASTM A747-CCB7CU-1	Yes	Standard	None	
41.2	1		177044	End plate thrust pad	Tungsten Carbide	Contact Butterworth	Yes	Non Standard	None	
		√	177044-01		MP35N	ASTM F562	Yes	Standard	None	
41.3	1		370807	End plate, Flow Through	316 SS	ASTM A351-CF8M	Yes	Non Standard	None	
		√	670807		316 SS	ASTM A351-CF8M	Yes	Standard	None	

Note: Not sold separately

EXPLODED VIEW DRAWING

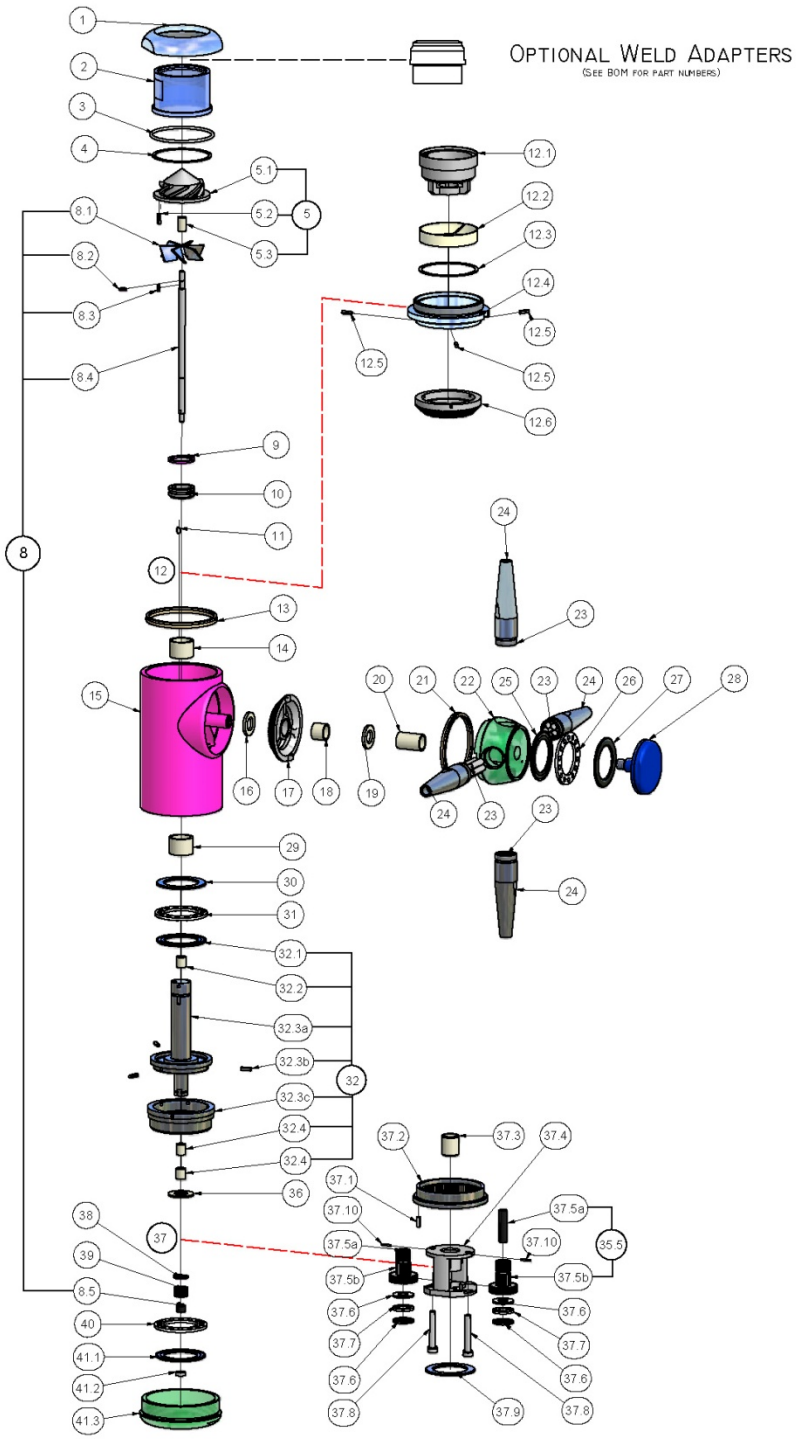

Figure 32

CROSSECTIONAL DRAWING

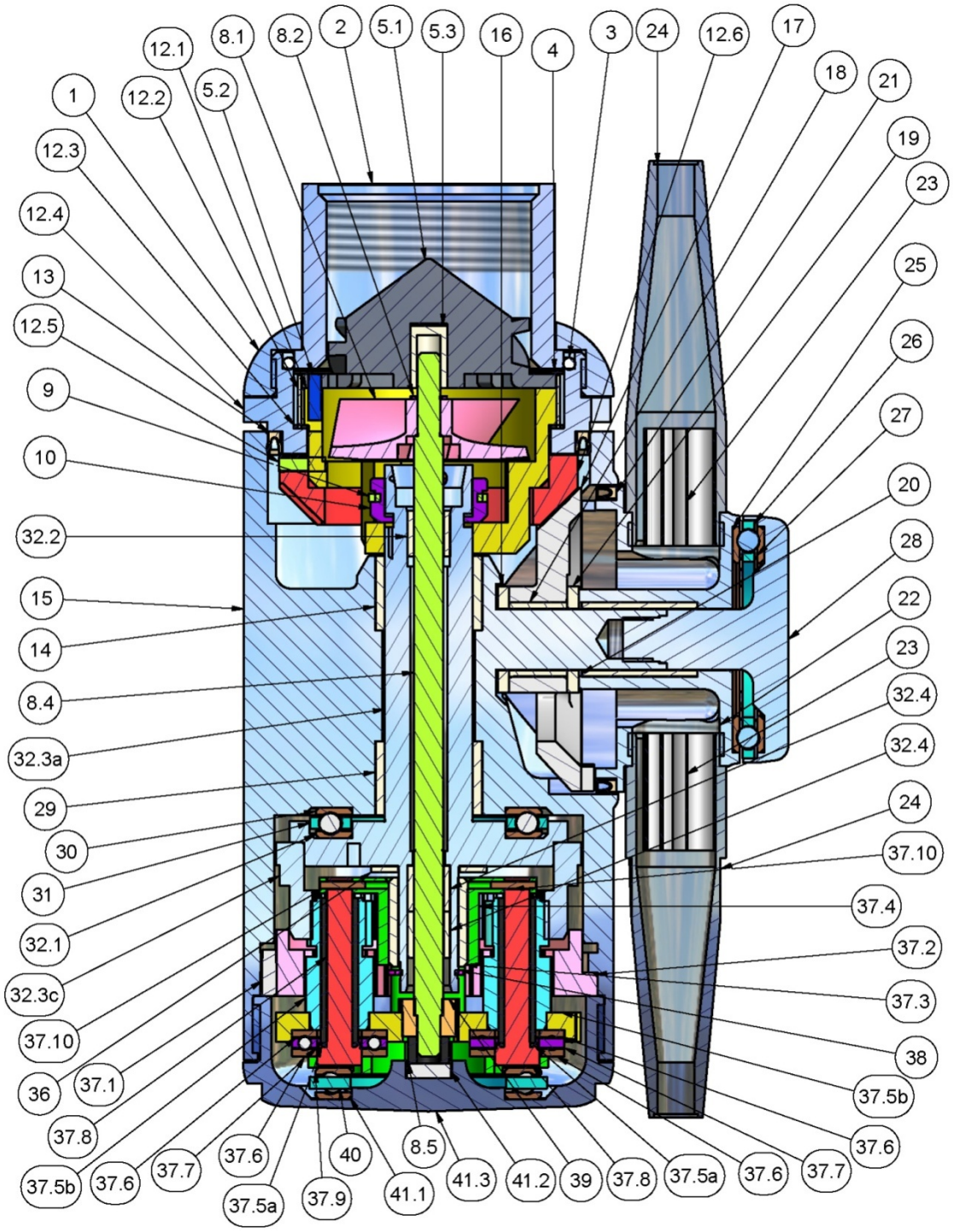

Figure 33

STANDARD SPARE PART KIT

Spare Part Kit Number: LTSPK-LTQFT-300

Recommended at ≤ 400 hours of operation.

Position	Part No.	Description	Quantity
8.3	170541	Key; 2mm x 2mm x 6mm	1
32.2; 32.4	177024	Drive shaft bushing	3
20	477027	Nozzle bearing	1
18	677027	Nozzle bearing	1
5.2; 12.5; 37.1	177034	Pin	6
38	177035	Circlip; external	1
13	177038	Rotary seal	1
21	177039	Rotary seal	2
8.2	270504	Circlip	1
37.10	270506	Groove pin type B	4
11	272604	Key; 3mm x 3mm x 6mm	1

Spare Part Kit / Gears: LTSPK-LTQFT-G

Recommended at ≤ 1200 hours of operation.

Position	Part No.	Description	Quantity
39	377101	Drive gear	1
37.2	370302	Ring gear	1
37.5	7659	Planet gear assembly	2
12.6	177007	Bevel gear (65)	1
17	577008-03	Bevel gear (63)	1

HOW TO ORDER SPARE PARTS AND WARRANTY CLAIM PROCEDURE

Ordering Spare Parts

To order spare parts, you will need to identify the serial number of your tank cleaning machine and correlate that to the manual that was issued at the time of purchase. The parts that were used to construct your machine will be indicated by a √ in the √ column of the reference list of parts beginning on page 29. If you are unable to find the manuals issued at the time of purchase, you can call the Butterworth® Sales desk and give them your machine serial numbers requesting that they identify the appropriate manual and to send you a copy. Our manuals are all in digital format and can be easily emailed to you for printing at your location.

When ordering, indicate the part number for the checked (√) position on the reference list of parts and the quantity required.

Warranty Claim Procedure

In the event of a malfunction of the equipment supplied under this manual and it is felt by the customer that it could be claimed under the terms of our Warranty, you will need to send the unit to Butterworth® for review and evaluation. A copy of our Warranty can be reviewed on page 39.

To send in a unit for warranty review, you will need to call the Butterworth® Sales Desk and advise the associate that you wish to return a machine(s) for warranty review. They will issue a Returned Goods Number for tracking your equipment once received by our company. This number must be included in your shipping documents else there will be a delay in evaluating this equipment. It is also necessary to complete the "WARRANTY CLAIM REPORT" located on page 38 in this manual. This report must be completed and returned with the equipment for the warranty claim process to commence. Be sure to affix the Returned Goods Number given to you by the Sales Desk in the appropriate box of the WARRANTY CLAIM REPORT.

SERVICE CARD

Model Number of Machines: _____ **Serial No:** _____

Configuration: **Nozzle Diameter** : _____**mm**

Impeller : _____

Guide Vane : _____

DATE	NO. OF WORKING HOURS	MAINTENANCE ACTIONS/EXCHANGED PARTS	SIGN
	0	**Machine put into operation**	

WARRANTY CLAIM REPORT

Returned Goods Number: _____

Contact Information:

Contact Name: _____ Contact Phone Number: _____

Contact Fax Number: _____ Contact Email Address: _____

Machine Model Number: _____ **Serial No:** _____

Configuration: Nozzles_____ x Ø _____mm Impeller Type: _____ Guide Vane Type: _____

Operating Conditions:

a) Inlet pressure at tank cleaning machine: _____ (PSI)

b) Type of Valve in inlet line: ☐ Ball Valve ☐ Butterfly Valve ☐ Gate Valve ☐ Other: _____

c) Can hydraulic shock be disregarded? ☐ Yes ☐ No

d) Ramp up time to full pressure on the tank cleaning machine occurs over how many seconds: _____

e) Was inlet line flushed before installation of tank cleaner? ☐ Yes ☐ No

f) Working hours before failure: _____ hours.

g) What is the micron filtration on the media (washing solution) prior to entering the machine: _____

h) Is the tank cleaning machine flushed with clean water or other clean fluid after cleaning has been finished. ☐ Yes ☐ No

i) Is steam injection being used for heating: ☐ Yes ☐ No

j) Is the tank cleaning machine submerged in the tank product or any other fluid while in use: ☐ Yes ☐ No

1.) If yes, describe the material and conditions: _____
_____

k) Chemicals and conditions that the tank cleaning machine is subjected to whether at rest or in operation:
_____
_____
_____

Cleaning Recipe:

Cleaning Media and Concentration	Temp (Indicate F or C)	Time (Minutes)	Recirculation?
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

Other Comments: _____

_____

_____

Date: _____ **Signature:** _____

GENERAL WARRANTY

Products supplied under the Agreement will be free from defects in materials and workmanship. The Company's sole and exclusive liability shall be its option either to repair or replace F.O.B. point of shipment, any defective Products, or to accept return, transportation prepaid, of such Products and refund the purchase price; in either case, provided that written notice of s u c h defect is given to the Company within twelve (12) months from date of shipment to the customer, the product is found by the Company to have been installed and/or operated in accordance with the Company's instructions, that no repairs, alterations or replacements have been made by another without the Company's written approval. In no event shall the aggregate liability of the Company in connection with breach of any warranty or warranties exceed the purchase price paid for the Product here under. The Company may at it s option, require the return of any Products, transportation and duties prepaid to establish any claim of defect made by the customer. Unless otherwise agreed in writing the Company will not accept and shall have no responsibility for the Products returned without its prior written consent. **THE COMPANY MAKES NO OTHER WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. THE COMPANY HEREBY EXPRESSLY DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS.**

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