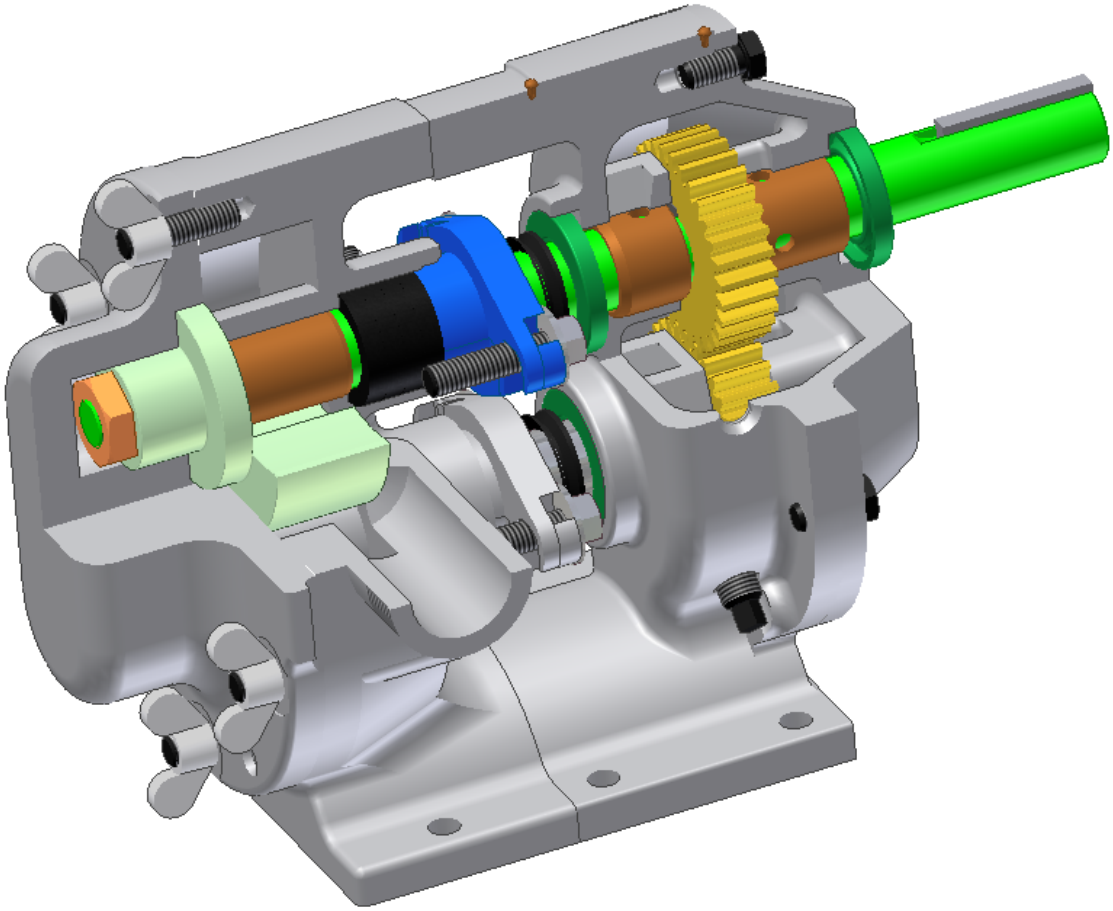
INSTALLATION AND SERVICE INSTRUCTIONS

HD SERIES PUMPS

STANDARD DUTY MODELS



TUTHILL Pump Group

12500 South Pulaski Road
Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
www.tuthill.com

WARNING  **WARNING**

Read Manual before operating or working on a Tuthill HD pump.

Table Of Contents

Page 3:	Introduction
Page 4:	General Description / Pumping Principle / HD Models
Page 5:	HD Model Numbering System
Page 6:	Temperature Limits
Page 7:	Installation
Page 8:	Packing Adjustments
Page 9:	Lubrication Requirements / Recommended Lubricants
Page 10:	Inspection and Repair
Page 11:	Parts Diagram
Page 12:	General Parts List (5A, 10, 16, 25A, 65 & 125A Pumps)
Page 13:	Minor Disassembly Instructions (5A, 10, 16, 25A, 65 & 125A Pumps)
Page 13:	Minor Assembly Instructions (5A, 10, 16, 25A, 65 & 125A Pumps)
Page 14:	Pump Clearances (5A, 10, 16, 25A, 65 & 125A Pumps)
Page 15:	Major Disassembly Instructions (5A, 10, 16 & 25A Pumps)
Page 16-17:	Major Assembly Instructions (5A, 10, 16 & 25A Pumps)
Page 17-18:	Major Disassembly Instructions (65 & 125A)
Page 18-19:	Major Assembly Instructions (65 & 125A)
Page 20:	Disassembly of 3:1 Gear Reduction Unit (5A, 10 & 16)
Page 20:	Assembly of 3:1 Gear Reduction Unit (5A, 10 & 16)
Page 21:	Disassembly of Relief Valve (5A, 10, 16 & 25A)
Page 22:	Reassembly of Relief Valve (5A, 10, 16 & 25A)
Page 22:	Disassembly of Relief Valve (65, 125A & 125H)
Page 22:	Assembly of Relief Valve (65, 125A & 125H)
Page 23-24:	Packing Section
Page 25:	Serial Number Location
Page 26:	Common Pump Problems
Page 27:	Troubleshooting
Page 28:	Material Returns / Warranty / Contact Information

Introduction

The HD Series pumps have been certified to the requirements of the ATEX Directive 94/9/EC for use in Category II, Group 2 G applications. Read this manual before operating or working on the HD Series pumps. If additional information is required to facilitate operation or maintenance, contact the authorized Tuthill distributor shown at the back of this service manual.

HD Series pumps have been designed and manufactured to provide years of service under normal operating conditions.

Illustrations used in this manual are for reference purposes only. Consult the factory or an authorized Tuthill distributor for proper part identification.

When ordering replacement parts, provide as much detail as possible to ensure correct parts are provided. Details should include the full model number (typically 12-13 digits but can be 18 digits), serial number, name of part, part number (if known), and part material.

Service Manual # 72 for the HD Series pumps is available at www.tuthillpump.com

The materials furnished for each pump are selected to suit individual applications.

WARNING  **WARNING**

Failure to follow these instructions could result in serious bodily injury or death.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

All Tuthill pumps contain residual hydraulic oil from the factory production test.
Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, then the pump must be fully flushed prior to use.

If the pump is to be operated at elevated temperatures, the pump should be brought up to operating temperatures gradually. Rapid or sudden introduction of liquids at elevated temperatures into the cold liquid chamber of the pump could cause damage to pump externals, seals or other internal parts.

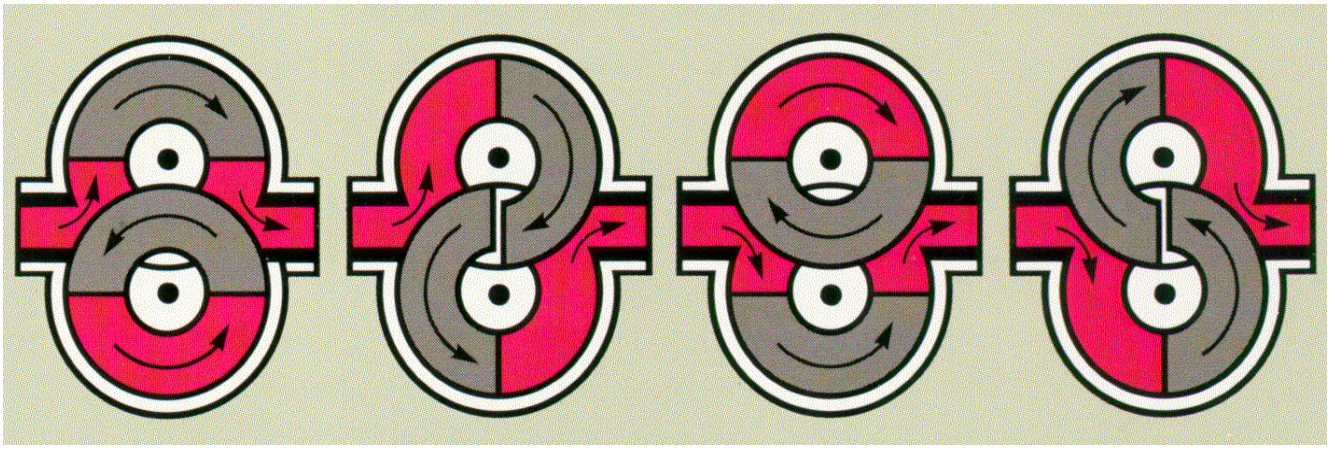
Pumps can run dry provided provisions are made for the mechanical seal if one is used. Failure to comply with this could cause severe damage to the mechanical seal parts.

Pump needs to be earthed separately to avoid a buildup of electro-static charge.

General Description

The design of the Tuthill Industrial Series incorporates externally timed impellers, which are supported in the fluid chamber by double row, ball bearings located out of the product stream. This design enables the Industrial Series to handle highly viscous abrasive slurries, corrosive acids or suspended solids without degradation, aeration or contamination of the product.

PUMPING PRINCIPLE:



Here's how it works:
Rotating impellers develop a vacuum at inlet, drawing material into the cavity…positive action of the impellers displaces material, forcing discharge at pump outlet. Ports are always open; sealing action between impellers and housing prevents fluid flow return.

HD Models

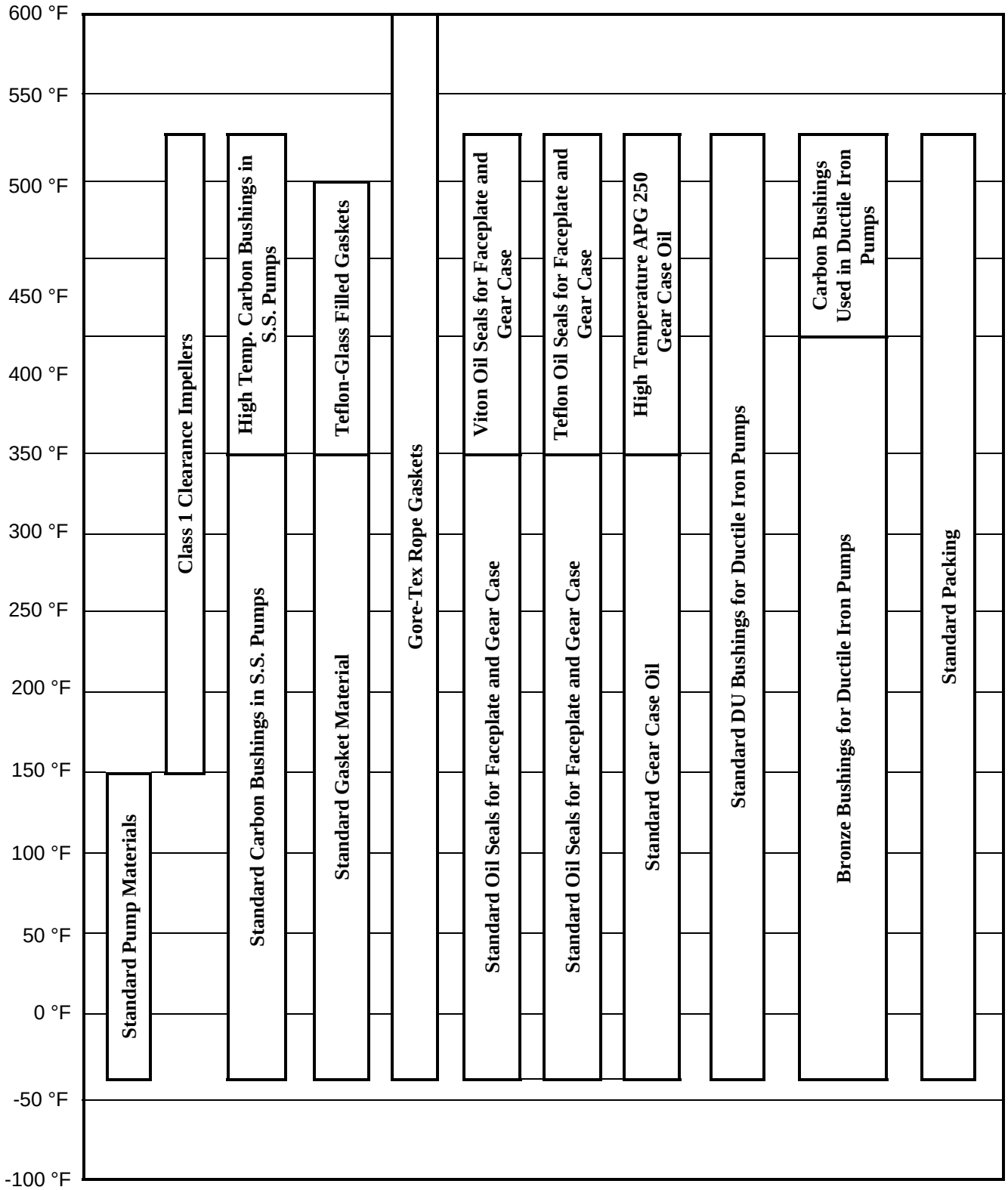
Material of Construction	Size	Max. Speed	Max. Capacity		Max. Pressure		Weight		Port Size (External NPT)
			USGPM	LPM	PSI	BAR	LB	KG	
Ductile Iron	5A	600	4.8	18.1	200	10.3	35	16	1"
	10	600	7.8	29.5	200	10.3	40	18	1"
	16	600	16.8	63.6	200	10.3	45	20	1-1/2"
	25A	450	24.7	93.5	200	10.3	65	29	1-1/2"
	65	450	67.5	255	200	10.3	180	81	2"
	125A	450	112	424	200	10.3	215	97	2-1/2"
Stainless Steel	5A	600	4.8	18.1	150	10.3	35	16	Same As Above
	10	600	7.8	29.5	150	10.3	40	18	Same As Above
	16	600	16.8	63.6	150	10.3	45	20	Same As Above
	25A	450	24.7	93.5	150	10.3	65	29	Same As Above
	65	450	67.5	255	150	10.3	180	81	Same As Above
	125A	450	112	424	150	10.3	215	97	Same As Above

HD PROCESS PUMP NUMBERING SYSTEM

1	2	3	4	5	6	7	8	9	10	11	12	13

DIGITS 1 & 2	**O1-INDUSTRIAL DUTY (ID)**	**O2-STANDARD DUTY (SD) Ductile Iron Only**	**O4-STANDARD DUTY (SD) Stainless Steel Only**
DIGITS 3 & 4	**05 – Model 30 14 – Model 2A 16 – Model 70A 29 – Model 3A 31 – Model 120A 75 – Model 330 91 – Model 600**	**01 – Model 5A 02 – Model 10 03 – Model 16 05 – Model 25A 14 – Model 65 26 – Model 125A**	
DIGITS 5 & 6	**04 – 316 Stainless Steel (O1 & O4 Models) 09 – Ductile Iron (O1 & O2 Models)**		
DIGIT 7	**0 – Internal NPT (Std. on ID models) 1 – External NPT (Standard on SD models)**		
DIGIT 8	**0 – No Relief Valve 1 – Relief Valve (Available on all SD models & ID models 30, 2A, 3A, 70A, 120A)**		
DIGITS 9 & 10	**01 – Hot Clearance 02 – Special Shaft Material 05 – Special Packing 06 – Special Packing Configuration 08 – Mechanical Seals 09 – Special Bushings 10 – Special Clearances 13 – Steam Jacket/Tracing 19 – Special Ports (Flanged, etc.) 21 – Tutriding 26 – Interference Fit Gears 27 – Special U-Cup/Lip Seals 28 - Miscellaneous**		
DIGITS 11 & 12	**01, 02, Etc. (Serialized at the factory)**		
DIGIT 13 (If Required)	**D – Double Lobe (Available on ID models only) T – Teflon housing and faceplate bushings (SD Models)**		

TEMPERATURE LIMITS OF HD PROCESS PUMP MATERIALS



Note:

- Viton and Teflon oil seals can be used in place of standard oil seals upon request.
- Teflon and Gore-Tex gaskets can be used in place of standard seals upon request.

WARNING  **WARNING**

Failure to follow these instructions could result in serious bodily injury or death.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

All Tuthill pumps contain residual hydraulic oil from the factory production test.
Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, then the pump must be fully flushed prior to use.

If the pump is to be operated at elevated temperatures, the pump should be brought up to operating temperatures gradually. Rapid or sudden introduction of liquids at elevated temperatures into the cold liquid chamber of the pump could cause damage to pump externals, seals or other internal parts.

Pumps can run dry provided provisions are made for the mechanical seal if one is used. Failure to comply with this could cause severe damage to the mechanical seal parts.

Pump needs to be earthed separately to avoid a buildup of electro-static charge.

Installation

For optimum pump performance the suction line must be at least as large as the corresponding pump port. It should be as short as possible in order to avoid excessive pressure drops and must be airtight. Locate the pump as close to the source of supply as conditions permit, and if possible, below the level of the liquid in the reservoir. When necessary to locate the pump in a pit, provisions should be made to safeguard against flooding.

When handling high viscosity liquids, the speed of the pump must be reduced and the size of the inlet lines increased to prevent cavitation. Refer to the NPSHr data for the pump.

Pumps should be filled with liquid at installation.

The placement of a strainer on the suction side of the pump will restrict any solids or abrasives from entering the pump, which could cause internal damage.

Under no conditions should the pump be used to support external piping loads (weight or expansion). Piping and other equipment should be independently supported. Piping strain can result in misalignment, hot bearings, worn couplings, vibration, etc. It is important that the piping used be clean and free of chips and scales.

The discharge line must be designed with the maximum pressure rating of the pump in mind. Excessive pressure could cause damage to your motor and/or pump. If a pressure relief valve has not been supplied with the pump, some other means of pressure protection must be utilized. This could include in-line safety valves, pressure shutdown switches or other similar devices.

Pumps are positive displacement pumps and must be used in conjunction with a pressure relief mechanism.

Every pump installation should have a good foundation. Its structure should be sufficiently strong to hold the pump rigid and to absorb any strain or shock that may be encountered. The installation should be leveled, checked for proper piping alignment, and then fastened securely. The alignment should be rechecked after the pump's temperature has reached its operating temperature.

Direct drive through a traditional flexible coupling is recommended. However, do not expect the coupling to compensate for misalignment. Contact the coupling manufacturer to determine the maximum amount of misalignment that the coupling can be subjected to.

Never operate the pumps without all the guards in place.

Direction of Flow:

Tuthill Industrial Process Pumps may be operated in either direction. The direction of flow is dependent on the direction of rotation of the pump drive shaft. When facing the drive shaft of the pump, a clockwise rotation provides a left hand suction port and a right hand discharge port. Flow would be from the left to right when facing the drive shaft.

Packing Adjustment

WARNING  **WARNING**

Packing is designed to leak. Therefore, when pumping hazardous liquids, a mechanical seal is recommended to minimize any potential source of leakage that could result in a hazardous condition.

All packings must leak to perform properly. Their purpose is to control leakage—not to prevent it.

The slight leakage along the shaft provides proper lubrication to the packing. Pump packings have a lubricant that acts as a primary sealant for the start-up and break-in phases, during which this lubricant acts to reduce friction. Once the pump is on the line, external lubrication must be supplied to the packing to keep it running properly and to attain longer life. If external lubrication is not supplied, the lubrication in the packings will bleed out due to heat generation. Heat is a primary cause of packing failure.

Pumps with packing will require periodic adjustment.

To accomplish this, gently and evenly tighten the packing gland nuts, which will further compress the packing. Do not over tighten. Packing is designed to keep leakage to a slight weep. Normally 2-3 drops per minute is acceptable.

If excessive leakage persists after complete adjustment, consider re-packing the stuffing box or using another packing type.

Lubrication Requirements

Housing Bushing:

Housing bushings are fully lubricated by the pumped fluid and are maintenance free.

Gear Case Bearings:

Bearings are splashed lubricated. Bearings are designed to provide a minimum L10 life of 15,000 hours at maximum speed and pressure conditions and are splashed lubricated.

Lubrication Instructions For Tuthill Process Pumps

The oil used in the gear case of the process pumps is “Lubriplate” APG9. Lubriplate is a trade name of Fiske Brothers Refining Company – Toledo, Ohio.

Oil specifications are as follows:

Viscosity at 100°F: 816 SSU Viscosity at 212°F: 86 SSU
API Gravity: 26.5 Flash Point: 39°F
Fire Point: 440°F Extreme Pressure Additives
Any 90-weight gear oil may be substituted if equivalent to above.

The grease used in the faceplate ball bearing of the Industrial Series pump is “Lubriplate” 1200-2.

Grease specifications are as follows:

Lithium Base N.L.G.I. #2
Work Penetration: 280 A.S.T.M. Dropping Point: 450°F
Minimum Oil Viscosity at 100°F: 950SSU
Water resistant with rust and corrosion inhibitors added.
Any #2 bearing grease may be substituted if equivalent to above.

The following charts on lubrication requirements are offered as a guide only. Common sense approach to preventative maintenance must be exercised for best pump service life. Ambient conditions (temperature, humidity, dust, etc.) can alter schedule:

Model No.	Gear Case Capacity - CC	First Oil Change – Hrs.	Subsequent Change – Hrs.
5A, 10 & 16	150	500	3000
25A	150	500	3000
65 & 125A	1650	500	3000

Above standard lubricants are adequate for operating temperatures between –100°F and +350°F. If temperature exceeds 350°F, use the following:

Oil Specification: Lubriplate APG 250 or equal
Bearing Grease: 930-AA or equal

Inspection and Repair

Should it be necessary to remove the pump from service for periodic inspection of components and/or a major repair, the following steps should be taken. See following pages for exploded pump view and instructions.

WARNING  **WARNING**

Failure to follow these instructions could result in serious bodily injury or death.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

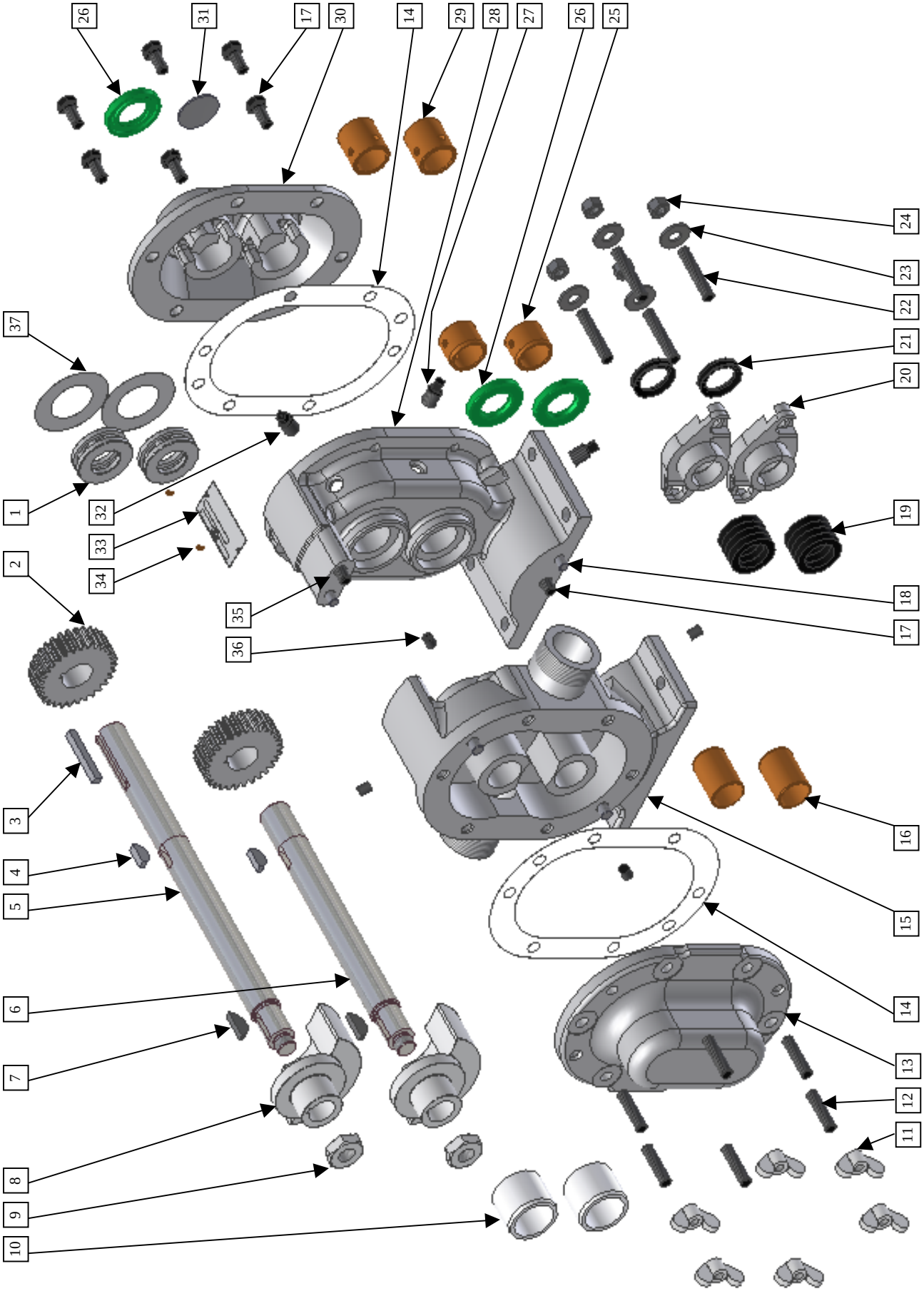
Only authorized personnel who are familiar with the repair of mechanical products should perform the necessary repair work. You must familiarize yourself with the entire contents of this manual prior to performing any work.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

Ensure that the pump has cooled to a safe temperature prior to performing any work on the pump.


26
31
17
30
14
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
37
1
32
33
34
2
35
36
3
4
5
6
7
8
9
10

General Parts List For 5A, 10, 16, 25A, 65, and 125A Pumps

Item #	Description	Qty
1	**Thrust Bearing**	**2**
2	**Timing Gears**	**2**
3	Square Key	1
4	**Gear Key**	**2**
5	**Drive Shaft (CI)**	**1**
	(SS)	
6	**Driven Shaft (CI)**	**1**
	(SS)	
7	**Impeller Key (CI)**	**2**
	(SS)	
8	**Impellers (CI) S.L.**	**2**
	(SS) S.L.	
9	Locknut	2
10	**Faceplate Bushing**	
	SS Pumps Only	**2**
11	Wing Nut	*
12	Stud	*
13	Faceplate (CI)	1
	(SS)	
14	**Gasket**	**2**
15	Impeller Housing (CI)	1
	(SS)	
16	**Housing Bushings**	**2**
	(CI) Bronze Bushing	
	(SS) Carbon Bushing	

Item #	Description	Qty
17	Cap Screw	*
18	Dowel Pin	4
19	**Packing**	**2 sets**
20	Packing Gland (CI)	2
	(SS)	4
21	V-Ring	2
22	Stud	4
23	Washer	4
24	Nut	4
25	**Gear Case Bushing**	**2**
26	**Lip Seal**	**3**
27	Pipe Plug	2
28	Gear Case	1
29	Gear Case Cover Bushing	2
30	Gear Case Cover	1
31	Expansion Plug	1
32	Vented Pipe Plug	1
33	Nametag	1
34	Drive Screw	2
35	Cap Screw	1
36	Pipe Plug (CI)	4
	(SS)	
37	Shim----------.003”	As Req.
	.005”	As Req.

Note:

- * Exact quantities will vary depending upon actual pump model.
- (CI) are Cast Iron pumps that will have corresponding steel and/or ductile iron components.
- (SS) are Stainless Steel pumps that will have corresponding stainless steel components.
- **Recommended spare parts are in bold text.**
- When ordering spare parts please specify pump model, serial number, part number & part name.

Disassembly & Reassembly Instructions for 5A, 10, 16, 25A, 65, and 125A Pumps

Minor Disassembly For Fluid Chamber Inspection:

Refer to Parts Diagram on Page 11.

1. Remove six faceplate wing nuts (11).
2. Remove faceplate (13). If faceplate does not pull off easily, it may require a slight tap with a mallet.
3. Remove lock nuts (9) from ends of shafts. To facilitate this operation, you can wedge a small block of wood or other soft material between the impellers. Loosen both nuts in this manner before removing
4. Slide impellers (8) from shafts. Mark impellers so they can be replaced on the same shaft.

The fluid chamber is now ready for inspection.

Reassemble In Accordance With Minor Reassembly Instructions:

Refer to Parts Diagram on Page 11.

1. Replace impeller (8) and impeller keys (7) on appropriate shafts.
2. Install lock nuts on end of shafts. Use piece of wood or other soft material wedged between the impellers as described above. The torque required to lock the shaft nuts is listed below.

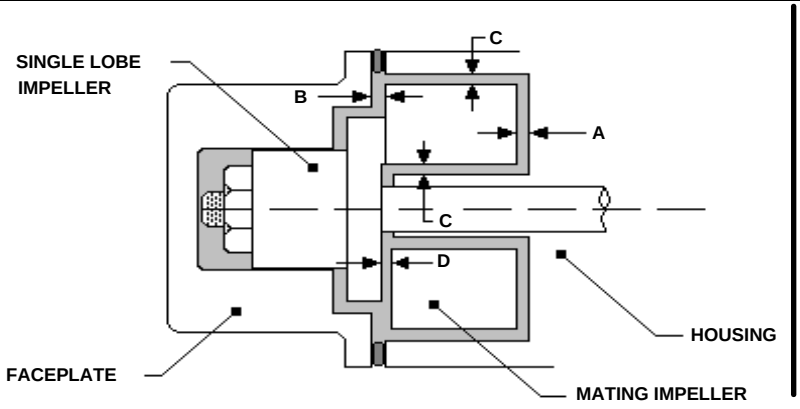
Standard Models	Torque (ft-lbs.)
5A, 10, 16, 25A	40 - 45
65, 125A	50 - 55

3. Check clearances between lobe face and housing bottom face (dimension B on page 14). If clearances are incorrect, reset clearances according to reassembly instructions on the following pages (Models 5A, 10, 16, 25A) or Section 6 (65, 125A).
4. Rotate driveshaft several revolutions to assure proper timing.
5. Clean housing gasket face of any burrs.
6. Place new gasket (14) on impeller housing. If original gasket is in good condition, it can be reused.
7. Replace faceplate (13) and six faceplate wing nuts (11).
8. Rotate assembled pump driveshaft several revolutions to be certain that there is no interference or rubbing. If no interference is apparent, the pump is ready to be put back in service.

Chamber Clearances:

Faceplate gaskets are compressed to approximately .003 - .004 inches when pump bolts are tightened. For impeller assembly settings and resultant clearances, see below.

MODEL MATERIAL CLEARANCES		A IMPELLER SETTING (SIDE)		B RESULTING SIDE CLEARANCE (OPPOSITE SIDE)		C ON RADII		D RESULTING PASS OVER	
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Models: 5A & 10									
Non-Gall	**Standard**	.001	.002	*	.004	.002	.004	.001	.003
	Hot	.002	.003	.003	.007	.004	.006	.003	.005
Gall	**Standard**	.003	.004	.005	.009	.004	.006	.006	.008
	Hot	.004	.005	.005	.009	.006	.008	.006	.008
Model: 16									
Non-Gall	**Standard**	.001	.002	*	.004	.002	.004	.001	.003
	Hot	.002	.003	.003	.007	.004	.006	.003	.005
Gall	**Standard**	.004	.005	.005	.009	.006	.008	.004	.006
	Hot	.004	.005	.005	.009	.006	.008	.004	.006
Model: 25A									
Non-Gall	**Standard**	.001	.002	*	.004	.002	.004	.001	.004
	Hot	.003	.004	.004	.008	.005	.007	.002	.005
Gall	**Standard**	.005	.006	.006	.010	.005	.007	.006	.009
	Hot	.007	.007	.007	.012	.008	.010	.006	.009
Models: 65, 125A & 125H									
Non-Gall	**Standard**	.002	.003	.003	.008	.004	.006	.001	.005
	Hot	.006	.007	.007	.012	.008	.010	.004	.008
Gall	**Standard**	.007	.007	.007	.013	.008	.010	.004	.008
	Hot	.011	.012	.011	.017	.012	.014	.006	.011



*** Check to ensure that pump still rotates freely**

Major Disassembly Instructions (Models: 5A, 10, 16, and 25A):

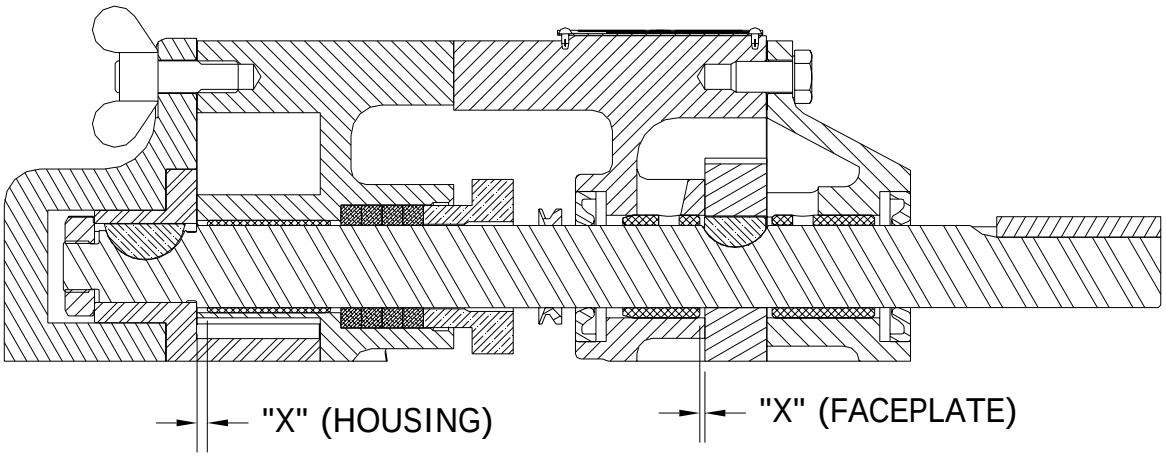
Refer to Parts Diagram on Page 11.

1. Remove six faceplate wing nuts (11).
2. Remove faceplate (13). If faceplate does not pull off easily, it may require a slight tap with a mallet.
3. Remove lock nuts (9) from ends of shafts. To facilitate this operation, you can wedge a small block of wood or other soft material between the impellers. Loosen both nuts in this manner before removing.
4. Slide impellers from shafts. Mark impellers so they can be replaced on the same shaft.
5. Remove all burrs on drive shaft with a mill file or emery paper. Also remove any deposits of paint. Special care should be taken around the keyway and shaft-end. This is where burrs are most likely to be found.
6. Drain the oil from the gear case by removing lower drainpipe plug.
7. Remove six cap screws (17) from gear case cover (30). Remove gear case cover by sliding over drive shaft.
8. Loosen packing gland nuts (24) and slide packing glands out of stuffing boxes. **Note:** Pumps with mechanical seals require special handling and these instructions are shipped with the pump.
9. Examine gears for factory timing marks prior to removal. Timing marks should be visible at gear tooth base and consist of two punch marks on the drive shaft gear and one punch mark on the mating tooth cavity on the driven shaft gear. In the event these marks are not provided, gears should be marked at this time.
10. Timing gears are press-fitted on the shafts, and this feature maintains pump clearance setting. Use a gear puller to remove timing gears.
11. Remove gear keys.
12. Pull drive (5) and driven shaft (6) out through the faceplate side. V-rings (21) will also need to be removed from the opposite end of the shafts at this time.
13. All parts should be inspected for wear and damage. Replace worn or damaged parts.
14. Bushings in the housing, gear case and gear case cover are removed by being pressed out.
15. Faceplate bushings (10), if supplied, are either carbon or glass-filled Teflon. To remove excessively worn Teflon bushings, carefully slit them and remove. To remove excessively worn carbon bushings, carefully break them and remove the pieces.
16. Lip seals (26) in gear case will be pressed out at the same time as the bushings.
17. Lip seal and expansion plug (31) in gear case cover will be pressed out at the same time as the bushings.

Major Reassembly Instructions (Models: 5A, 10, 16, and 25A):

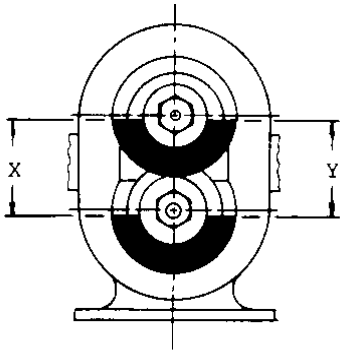
Refer to Parts Diagram on Page 11.

1. Press new bushings into housing, gear case and gear case cover. Press lip seals into place. Refer to diagram for proper installation. When replacing gear case bushings, make sure oil holes line up with cast grooves in the hubs.



Pump Model	"X" Housing	"X" Gear Case
5A, 10 & 16	5/32" (4 mm)	5/32" (4 mm)
25A	5/32" (4 mm)	0
65 & 125	3/8" (10 mm)	0

2. Replace expansion plug (31).
3. Faceplate bushings (10), if supplied, are pressed in until bottomed.
4. Replace packing glands (20) and thread packing gland nuts loosely on studs.
5. Assemble impeller keys (7), impellers (8), and shaft nuts (9) on the shafts. Use a soft-faced vise to hold shaft and impeller while the shaft nuts are torqued per Page 13.
6. Slide the shaft/gear assemblies through the housing, but not yet into the gear case.
7. Install the V-rings (21) on the shafts. V-rings should be staggered such that the bottom ring is closer to the gear case. This is easily adjusted after pump is completely assembled by sliding the rings on the shaft.
8. Continue sliding shaft/gear assemblies through the gear case until the impeller contacts the housing.
9. Assemble timing gear keys (4).
10. Slide timing gears (2) over shafts until they are partially engaged with the keys.
11. Set the timing per the picture shown below. Gears that have been in service and marked may be used, as timing will be correct. "X" and "Y" dimensions should be equal when meshing gears to set timing. The normal identification method for timing is two punch marks on the drive shaft gear tooth and one mark on the driven shaft gear-mating cavity. Rotate shaft one full revolution to assure correct timing.



12. Press both timing gears onto shafts.
13. Remove shaft nut and impeller from **driven** shaft. See Page 15, Steps 3 and 4 for proper procedure.
14. Press or tap gear case end of **drive** shaft (5) to required setting clearance. Clearance is checked with a feeler gage between impeller lobe face and impeller housing bottom face. This clearance will vary with material of construction and pumping temperature (See Page 14). Hot clearances are for pumps rated for applications in excess of 150°F (66°C). Hot clearance impellers have an "H" stamped on hub face closest to impeller housing. Standard clearance impellers are not stamped.
15. Replace impeller and nut on **driven** shaft and torque nut as required.
16. Remove shaft nut and impeller from **drive** shaft.
17. Repeat Step 13 for **driven** shaft.
18. Replace impeller and nut on **drive** shaft and torque nut as required.
19. Recheck clearance and timing.
20. Apply grease to gear case face and press gasket in place.
21. Assemble gear case cover and tighten screws. Rotate drive shaft to assure smooth operation.
22. Assemble housing gasket and faceplate and tighten nuts. Rotate drive shaft to assure smooth operation.
23. Install drain pipe plug.
24. Remove oil level plug and fill plug. Fill with oil to level hole. See Lubrication Schedule on Pg. 9.
25. Install oil level plug and fill plug. **Note:** Use vented plug (32) for the fill hole.
26. Repack stuffing box. See Page 23 for proper installation of packing rings.
27. Snug up packing gland nuts.
28. Pump is now ready for service. Adjust packing leakage gradually for 2 to 3 drops a minute.

WARNING  **WARNING**

Coupling hubs or sheaves must be slip-fit on drive shaft. Shock loads from a hammer or mallet can upset impeller clearances, resulting in immediate pump failure.

Major Disassembly Instructions (Models: 65 and 125A):

Refer to Parts Diagram on Page 11.

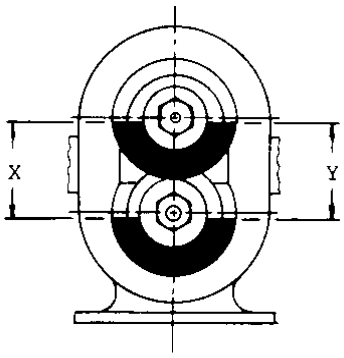
1. Remove six faceplate wing nuts (11).
2. Remove faceplate (13). If faceplate does not pull off easily, it may require a slight tap with a mallet.
3. Remove lock nuts (9) from ends of shafts. To facilitate this operation, you can wedge a small block of wood or other soft material between the impellers. Loosen both nuts in this manner before removing
4. Slide impellers from shafts. Mark impellers so they can be replaced on the same shaft.
5. Remove all burrs on drive shaft with a mill file or emery paper. Also remove any deposits of paint. Special care should be taken around the keyway and shaft end. This is where burrs are most likely to be found.
6. Drain the oil from the gear case by removing lower drainpipe plug.
7. Remove six cap screws (17) from gear case cover. Remove gear case cover by sliding over drive shaft.
8. Remove thrust bearings (1) and shims (37) and identify them so they can be correctly reassembled later.
9. Examine gears for factory timing marks prior to removal. Timing marks should be visible at gear tooth base and consist of two punch marks on the drive shaft gear and one punch mark on the mating tooth cavity on the driven shaft gear. In the event these marks are not provided, gears should be marked at this time.
10. Timing gears are press-fitted on the shafts, and this feature maintains pump clearance setting. Use a gear puller to remove timing gears.
11. Remove gear keys.

12. Remove any burrs on the shaft that may have occurred during gear removal.
13. Loosen packing gland nuts and slide packing glands out of stuffing boxes. **Note:** Pumps with mechanical seals require special handling and these instructions are shipped with the pump.
14. Pull shafts out of pump from faceplate side. V-rings (21) will also need to be removed from the opposite end of the shafts at this time.
15. All parts should be inspected for wear and damage. Replace worn or damaged parts.
16. Bushings in the housing, gear case and gear case cover are removed by being pressed out.
17. Faceplate bushings, if supplied, are either carbon or glass-filled Teflon. To remove excessively worn Teflon bushings, carefully slit them and remove. To remove excessively worn carbon bushings, carefully break them and remove the pieces.
18. Lip seals (26) in gear case will be pressed out at the same time as the bushings.
19. Lip seal and expansion plug (31) in gear case cover will be pressed out at the same time as the bushings.

Major Reassembly Instructions (Models: 65 and 125A):

Refer to Parts Diagram on Page 11.

1. Press new bushings into housing, gear case and gear case cover. Press oil seals into place. Refer to Page 16 for proper installation. When replacing gear case bushings, make sure oil holes line up with cast grooves in the hubs.
2. Replace expansion plug.
3. Faceplate bushings, if supplied, are pressed in until bottomed.
4. Replace packing glands and thread packing gland nuts loosely on studs.
5. Assemble impeller keys, impellers and shaft nuts on the shafts. Use a soft-faced vise to hold shaft and impeller while the shaft nuts are torqued per Page 13.
6. Slide the shaft/gear assemblies through the housing, but not yet into the gear case.
7. Install the V-rings on the shafts. V-rings should be staggered such that the bottom ring is closer to the gear case. This is easily adjusted after pump is completely assembled by sliding the rings on the shaft.
8. Continue sliding shaft/gear assemblies through the gear case until the impeller contacts the housing.
9. Assemble timing gear keys.
10. Slide timing gears over shafts until they are partially engaged with the keys.
11. Set the timing per picture below. Gears that have been in service and marked may be used, as timing will be correct. "X" and "Y" dimensions should be equal when meshing gears to set timing. The normal identification method for timing is two punch marks on the drive shaft gear tooth and one mark on the driven shaft gear-mating cavity. Rotate shaft one full revolution to assure correct timing.



12. Press both timing gears onto shafts.
13. Remove shaft nut and impeller from **driven** shaft. See Page 17, Steps 3 and 4 for proper procedure.
14. Press or tap gear case end of **drive** shaft to required setting clearance. Clearance is checked with a feeler gage between impeller lobe face and impeller housing bottom face. This clearance will vary with material of construction and pumping temperature (See Page 14). Hot clearances are for pumps rated for applications in excess of 150°F (66°C). Hot clearance impellers have an

"H" stamped on hub face closest to impeller housing. Standard clearance impellers are not stamped.

15. Replace impeller and nut on **driven** shaft and torque nut as required.
16. Remove shaft nut and impeller from **drive** shaft.
17. Repeat Step 13 for **driven** shaft.
18. Replace impeller and nut on **drive** shaft and torque nut as required.
19. Recheck clearance and timing.
20. Apply grease to gear case face and press gasket in place.
21. Install thrust bearing and shims into timing gear counter-bore.
22. If necessary, add or remove shims to provide 0.0005" - 0.0010" (0.013 - 0.025 mm) axial shaft play.
23. Assemble gear case cover and tighten screws. Rotate drive shaft to assure smooth operation.
24. Assemble housing gasket and faceplate and tighten nuts. Rotate drive shaft to assure smooth operation.
25. Install drain pipe plug.
26. Remove oil level plug and fill plug. Fill with oil to level hole. See Lubrication Schedule on Pg. 9.
27. Install oil level plug and fill plug. **Note:** Use vented plug (32) for the fill hole.
28. Repack stuffing box. See Page 23 for proper installation of packing rings.
29. Snug up packing gland nuts.
30. Pump is now ready for service. Adjust packing leakage gradually for 2-3 drops a minute.

WARNING  **WARNING**

Coupling hubs or sheaves must be slip-fit on drive shaft. Shock loads from a hammer or mallet can upset impeller clearances, resulting in immediate pump failure.

Disassembly of 3:1 Gear Reduction Unit for Models 5A, 10 & 16

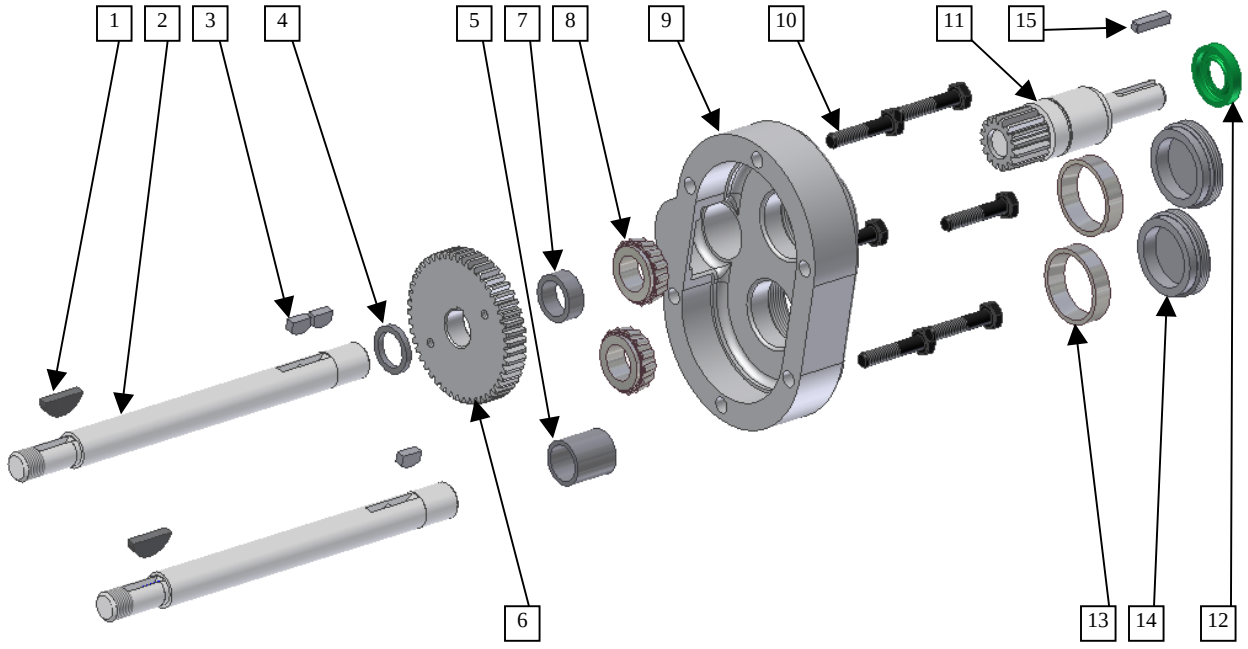
The following instructions pertain only to the Models 5A, 10 and 16 pumps with optional 3:1 gear reduction unit. Refer to Page 21 for part identification.

1. Drain oil from gear case by removing lower drain plug.
2. Remove size screws (10) on face of gear reduction cover. Remove cover (9) by sliding over shafts.
3. Remove cone bearing (8), long spacer (7), reduction gear (6), short spacer (5), and timing gear from top gear reduction shaft. Also, remove cone bearing, spacer and timing gear from lower gear reduction shaft. **Note:** Check timing gears for timing marks per Page 17, Step 9. If timing gears are not marked, mark them before removing.
4. To replace pinion shaft assembly (1), press assembly out of hub. Oil seal (12) will remain on shaft. Press new shaft assembly in place. Slip oil seal over shaft and press into oil seal bore.
5. To replace cup bearing, first remove adjusting plug (14) with spanner wrench. Insert new bearing cup and screw adjusting plug partially in. Adjust plugs after reassembly of gear reduction unit. All play should be removed from cone bearing.
6. To disassemble entire pump, see instructions on Page 15.

Reassembly of 3:1 Gear Reduction Unit for Models 5A, 10 & 16

The following instructions pertain only to the Models 5A, 10 and 16 pumps with optional 3:1 gear reduction unit. Refer to Page 21 for part identification.

1. Assemble entire pump except for the gear reduction unit per Pages 16-17, Steps 1-17.
2. If timing is correct, place short spacer (4), reduction gear (6), a long spacer (7) and cone bearing (8) on upper gear reduction shaft. Also, place spacer (5) and cone bearing (8) on bottom shaft.
3. Apply grease to housing gasket seal surface. Press gasket in place.
4. Slide gear reduction cover over shafts, revolving pinion shaft to mesh with gear reduction gears.
5. Tighten six screws holding cover in place.
6. Remove oil level plug and fill plug. Fill with oil to level hole. See lubrication recommendations on Page 9.

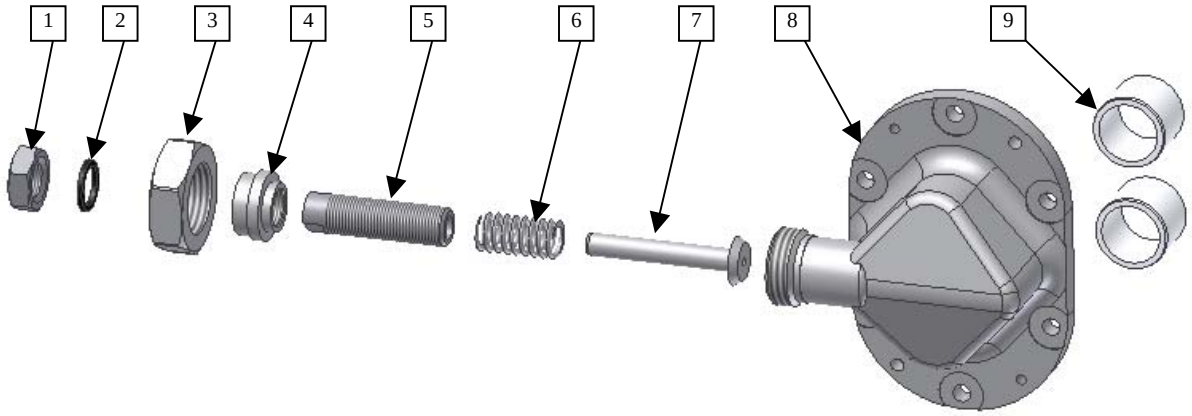


Item	Part Description	Qty.	Part Numbers		
			5A	10	16
1	Impeller Key	2	P500-19-S4	P500-19-S4	P500-19-S4
2	Gear Reduction Shaft	2	10619300	10619300	10619400
3	Gear Key	3	10511700	10511700	10511700
4	Short Upper Spacer	1	10618700	10618700	10618700
5	Lower Shaft Spacer	1	10618800	10618800	10618800
6	Reduction Gear	1	10618600	10618600	10618600
7	Long Upper Spacer	1	10636500		
8	Cone Bearing	2	P652-9	P652-9	P652-9
9	Gear Reduction Cover	1	10618300	10618300	10618300
10	Hex Cap Screw	6	P101-6-H	P101-6-H	P101-6-H
11	Pinion Shaft Assembly	1	10673700	10673700	10673700
12	Pinion Shaft Seal	1	P941-14	P941-14	P941-14
13	Bearing Cup	2	P652-10	P652-10	P652-10
14	Adjusting Plug	2	10606300	10606300	10606300
15	Key	1	12313700	12313700	12313700

Disassembly of Relief Valve for Models 5A, 10, 16 & 25A

All Standard Duty pumps are available with optional pressure relief valves. The valve, when supplied, is built into the faceplate. Therefore, servicing of the valve is a minor disassembly procedure, which can be performed without disturbing the pump mounting, piping or installation. **Note:** The adjustment end of the valve must be on the suction side of the pump for proper operation.

1. Remove locknut and O-ring.
2. Remove sanitary nut.
3. Plug and valve housing subassembly may then be removed and separated.
4. Remove spring and valve.



Item	Part Description	Material	Qty.	Part Number	
				5A, 10 & 16	25A
1	Locknut	Stainless Steel	1	10596800	10597500
2	Locknut O-Ring	Viton (std.)	1	P701-22-77	P701-26-77
3	Sanitary Nut	Nickel Alloy	1	P208-1-S	P208-2-S
4	Threaded Plug	Stainless Steel	1	10596700	10597400
5	Valve Housing	Stainless Steel	1	10596500	10597200
6	Spring	Stainless Steel	1	10597000	10597700
7	Valve	Stainless Steel	1	10596400	10597100
8	Faceplate	Cast Iron	1	13900901	13903401
		Stainless Steel	1	42002601*	42004700*
9	Faceplate Bushing	Teflon	2	10541800	10543300

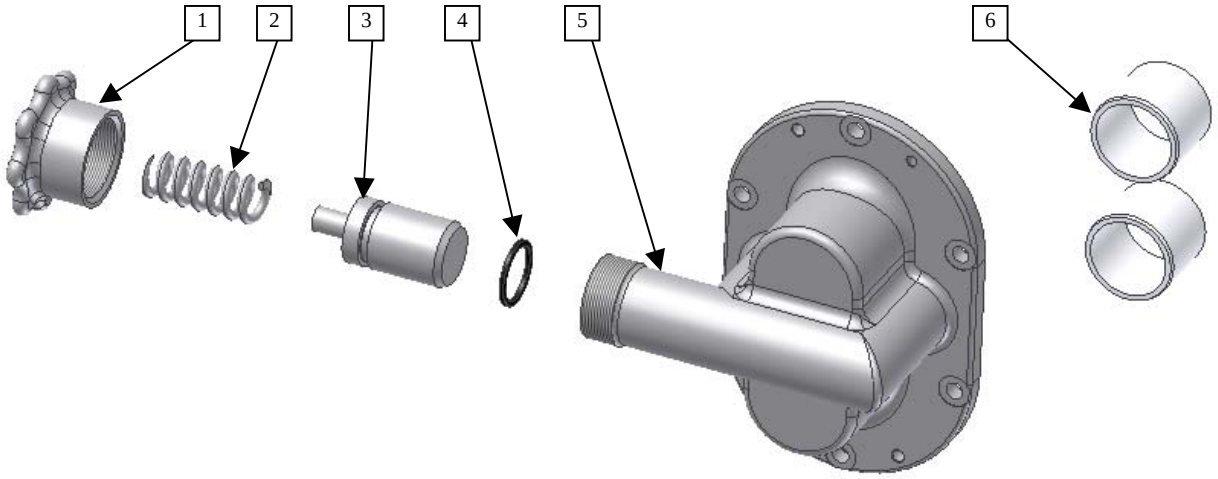
* Includes bushings.

Reassembly of Relief Valve for Models 5A, 10, 16 & 25A

1. Check beveled end of valve for burrs or damage. If present, correct before assembly.
2. Install valve on seat in faceplate.
3. Place spring on valve stem.
4. Engage threaded plug approximately ¾" of the length of the valve housing. Place plug and valve subassembly over valve stem.
5. Tighten sanitary nut to capture valve assembly.
6. Set valve for bypass pressure. To do this, first install a pressure gauge in the discharge line. Turn valve housing clockwise until pressure stops increasing. More turns will cause the relief valve to operate at higher pressure. The valve is now seated and pump is discharging at full capacity.
7. Install O-ring and locknut.

Disassembly of Relief Valve for Models 65, 125A & 125H

1. Remove adjustment nut or hand wheel.
2. Remove spring, valve and O-ring subassembly.



Item	Part Description	Material	Qty.	Part Number
				65, 125A & 125H
1	Hand Wheel	Stainless Steel	1	10592700
2	Spring	Stainless Steel	1	20386800
3	Valve	Stainless Steel	1	20339600
4	O-ring	Buna (std.)	1	P701-36-37
		Viton (opt.)	1	P701-36-77
5	Faceplate	Cast Iron	1	13904109
		Stainless Steel	1	50314600*
6	Bushing	Carbon	2	50309600

* Includes bushings.

Reassembly of Relief Valve for Models 65, 125A & 125H

1. Check beveled end of valve for burrs or damage. If present, correct before assembly.
2. Place O-ring and valve assembly in valve seat.
3. Place spring over stem.
4. Engage hand wheel 2 full threads.
5. Set valve for bypass pressure. To do this, first install a pressure gage in the discharge line. Turn hand wheel clockwise until pressure stops increasing. More turns will cause the relief valve to operate at higher pressure. The valve is now seated and the pump is discharging at full capacity.

Packing for HD Standard Duty Pumps

Installing Packing in Pumps:

1. Remove all old packing using a packing hook. Clean stuffing box and shaft thoroughly and examine shaft for wear or scoring. Check bearings for wear as this can cause an eccentric shaft rotation resulting in excessive leakage. Packings will not act as a bearing. If shaft surface is worn, replace shaft or have seal surface area resurfaced.

2. Be certain the proper size packing is used. The following packing sizes will apply:

Pump Model	Packing Size	Shaft Diameter	No. of Rings
5A, 10 & 16	1/4" Square	3/4"	4
25A	1/4" Square	1"	4
65	1/4" Square	1-3/8"	4
125A	1/4" Square	1-3/8"	6

3. Always cut packings into separate rings. Never coil around shaft (standard factory packings are pre-cut and pre-formed). If bulk packing is used, cut each ring on a mandrel the same size as the pump shaft. Try rings in stuffing box to be certain that each ring fills the seal chamber and that there is no gap between packing joints.
4. Install one ring at a time, seating each ring independently. Use clean oil to lubricate shaft and inside of stuffing box. Joints should be staggered and kept at least 90° apart. Each individual ring should be firmly seated with a tamping tool. Never depend entirely on the gland to seat a set of packings. This practice will jam the last rings installed but leave the front rings loose. The result is excessive and rapid wear.
5. After last ring is installed, tighten gland nuts finger tight. Then start pump and take up nuts until leakage is decreased. Stopping leakage at this point will cause packing to burn. If temperature rises in seal area, back off on packing nuts, as this indicates excessive gland pressure.
6. Allow packing to leak freely for at least one hour when starting up a newly packed pump. Take up gland nuts gradually, 1/16 turn every 5-10 minutes, until leakage stabilizes at about 2-3 drops per minute. If temperature in seal area increases, back off and start over.

Note:

- Replace packing when leakage cannot be controlled by further take-up of gland.
- Test results indicate that 70% of the wear occurs on the first two rings of packing nearest the gland. Rings next to the gland work the hardest. The rings in the bottom of the stuffing box serve to throttle some fluid pressure. On abrasive service the bottom ring takes most of the beating. Therefore, this ring should be a firm ring.

How to Pack for Abrasive Liquids:

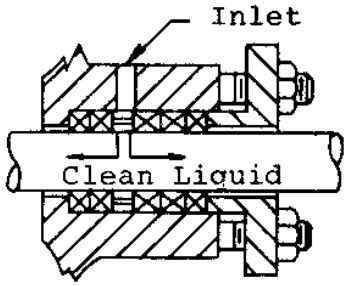
As used here "Abrasives" is a broad term intended to cover the problem of packing against slurries, congealing liquids and the likes. They cause the greatest damage to equipment, and present difficulties for packing. In general, this involves flush, purges and temperature control. Hard facing on the shaft seal surfaces, such as stellite or ceramic, are also recommended.

When pumping slurries and abrasives an external source of clear or otherwise suitable liquid must be force fed at a pressure higher than that existing in the stuffing box. This differential pressure is in the area of 10-25 psi.

Suspended Solids:

Solids which are suspended in liquids and which are an inherent part of their structure would include starch, clay slurry, muddy water and other similar slurries. This is best handled by an external

flush of clear liquid through a lantern ring as shown. This arrangement will result in a small amount of product dilution and is controlled by the differential pressure in the seal chamber.

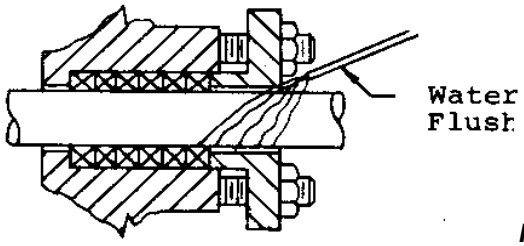


Packing with Internal Flush

How To Pack For Congealing Liquids:

These liquids congeal either because of a change in temperature or as a result in drying out after exposure to air. Clay coatings and latex fall into both categories. A good rule is to keep the fluid moving before congealing can take place. Control with cooling or heat and/or by flush or purge.

Some products harden to a solid state when exposed to air. Clay coatings, latex and sugars are examples. An effective flush is shown. Note that this type of flush does not enter the product, but only mixes with the product leakage. This arrangement also tends to serve as a cooling medium for the seal chamber.



Packing with External Flush

Serial Number Location

The Serial Number Nameplate is located as shown in the Parts Diagram on Page 11, Item 33. In addition to the nameplate, the serial number is also stamped on top of the impeller housing (15). This serial number should be furnished to Tuthill whenever service parts are required and when questions regarding pump design or construction arise.

Common Causes of Pump Problems

Symptoms								Possible Cause	Suggested Solution
Excessive Gland Leakage	Noisy	Excessive Heat	Wear	Starts, Then Loses Prime	Fails to Pump	Low Flow	Takes Too Much Power		
	✓			✓		✓		Suction life high for vapor pressure of liquid	Reduce vacuum requirements
	✓		✓			✓		Liquid too viscous for pump speed	Reduce pump speed
	✓			✓		✓		Air leakage in suction piping	Tighten and seal all joints
				✓	✓			Suction pipe not immersed in liquid	Lengthen suction pipe or add liquid to supply tank
	✓				✓			Suction strainer clogged or of insufficient area	Clean strainer or use larger size
✓	✓	✓	✓				✓	Misalignment between pump and driver	Re-align. Check coupling alignment with dial indicator
	✓	✓	✓				✓	Rotating elements binding	Disassemble and inspect
	✓	✓	✓				✓	Pipe strain on pump casing	Disassemble pipe and re-align before reassembling
	✓					✓		Relief valve chattering	Check setting and valve seating
✓			✓			✓	✓	Excessive system pressure	Check for obstructions in discharge line
✓		✓					✓	Stuffing box packed too tightly	Repack and adjust
						✓		Pump speed to low	Check pump impeller speed
✓						✓		Pump parts worn	Have pump reconditioned or replace worn parts
						✓	✓	Obstruction in discharge line	Check discharge piping and valves for obstruction
					✓			Wrong direction of rotation	Reverse motor
	✓					✓		Suction line sized too small	Increase suction piping size
						✓		Torque control coupling not adjusted	Readjust coupling

Troubleshooting

1. **Problem: No fluid is delivered.**

    a. Power is not on.
    b. Net positive suction head available (NPSHa) is lower than required for the vapor pressure of the liquid pumped. You should calculate NPSHa and redesign piping, if necessary.
    c. There are leaks in suction line.
    d. Direction of shaft rotation is incorrect.
    e. Relief valve setting is too low (if the pump is equipped with a relief valve). Liquid is discharging through the by-pass port.

2. **Problem: Capacity is too low.**

    a. There are air leaks in suction line.
    b. Suction losses are too high. The suction lift is too great or the suction line is too small or too long. This can be detected by installing a vacuum gauge directly at the pump suction. The maximum vacuum at the pump suction should never exceed 15" of mercury. Vaporization caused by higher vacuums will generally result in capacity drop off. Redesign suction conditions.
    c. Pump speed is too slow.
    d. Strainer is too small or obstructed.
    e. Suction pipe or port is not immersed in liquid deep enough
    f. Piping is improperly installed permitting an air pocket to form in the pump.
    g. Increased clearances or wear in the pump will sometimes cause the pump to deliver an insufficient supply of liquid.

3. **Problem: Pump works spasmodically.**

    a. Leaky suction lines.
    b. Suction conditions vary.
    c. Air or vapor is in the liquid.

4. **Problem: Excessive power draw.**

    a. Pressure is too high.
    b. Liquid is more viscous than originally expected.
    c. Suction or discharge line is obstructed.
    d. There is insufficient horsepower.
    e. There are mechanical defects:
        i. Drive shaft and pump are misaligned.
        ii. Pump is binding due to incorrect clearance setting.
        iii. Pump shaft is bent.
        iv. There is misalignment within pump due to bad piping or poor installation, causing strain or distortion.

5. **Problem: Pump is noisy.**

    a. Pump is cavitating due to inadequate suction conditions.
    b. There is misalignment of coupling.
    c. Coupling is set too close to pump.
    d. There is vibration of the pump due to a worn or bent shaft.
    e. There are air leaks on suction side of pump or air entrainment in the fluid.

6. **Problem: Pump leaks.**

    a. Bolts need tightening, allowing gaskets or O-rings to leak.
    b. Gaskets or O-rings are damaged.

Note: Packings are designed to leak. Leakage should be at a rate that will prevent excessive heating on the bracket at the packing area.

Material Returns

If it becomes necessary to return a pump to the factory, a Return Goods Authorization (RGA) must be obtained from either your local Authorized Distributor or our Alsip plant. No RGA can be issued until a completed Material Safety Data Sheet (MSDS) has been forwarded to our Alsip plant and return of the pump has been approved.

- Tuthill pumps are precision-built and must be handled with care.
- Pumps must be drained of all fluid and the ports plugged to prevent foreign material from getting into the pump.
- Pumps must be packaged securely to prevent damage while in transit.

WARRANTY

Tuthill Pump Group warrants its products against defective material and workmanship for 90 days from the date of startup or one year from date of shipment from Tuthill's plant, whichever comes first. This warranty does not include products damaged by tampering, improper installation, abuse, or wear. Nor does it cover consequential damages, or other losses due to pump failure.

Because of the unpredictable nature of fluids encountered, pumps are not warranted for any specific life.

Contact Information

If additional information is required to facilitate operation or maintenance, contact the authorized Tuthill distributor shown below. Information on Tuthill contacts can also be obtained at www.tuthillpump.com.

European Contact Info:

Tuthill Pump Group
Manners Industrial Estate
Ilkeston, Derbyshire DE7 8YA
England
tuthilluk@tuthill.com

North America Contact Info:

Tuthill Pump Group
12500 South Pulaski Road
Alsip, Illinois 60803
U.S.A.
www.tuthillpump.com.