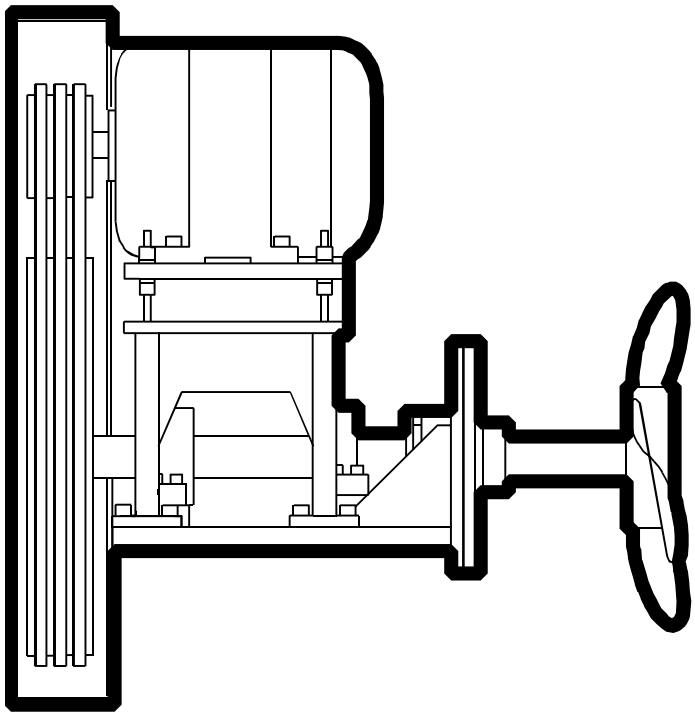
Prochem

Manual 601

PB Side Entering Mixers Installation, Operation Maintenance Manual

Equipment Reference
PB Style Mixers



For Service and
Information Contact

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RECEIVING AND INSPECTION

Step 1: Inspect crates: Upon receipt, inspect all crates and equipment for shipping damage. Report shipping damage to your local Chemineer representative or the factory in Dayton, Ohio. A claim should be filed immediately with the carrier involved.

Step 2: Uncrate. Check the contents: Do not uncrate the equipment until you have read the complete Installation section of this manual and reviewed the general data sheet and certified dimension drawings. Be careful when uncrating and handling. Do not discard the crating without carefully making sure that all parts have been removed. Installation and on-site assembly of the equipment require reference to both the data sheet and the appropriate manual section.

Step 3: Questions? Call Chemineer. If the shipment is not complete or you do not understand what you have received, please contact *your local Chemineer office* immediately.

Note: Two common service tools supplied with the mixer include a Shaft Holding Device, usually fastened to the shaft in front of the stuffing box and a Belt Tensiometer (Spring Scale), usually packaged with the belt drive components. ***Do not discard or misplace these important service items.*** *Instructions for use of these items are in this manual.*

CHEMINEER ASSISTANCE

Chemineer maintains a fully staffed Parts and Field Service Department ready to help you with any service requirement. Simply contact *your local Chemineer Office*, or you can contact directly Parts and Field Service at the Chemineer Factory in Dayton, Ohio:

Chemineer, Inc.
P.O. Box 1123
Dayton, Ohio 45401
Phone: (937) 454-3200
FAX: (937) 454-3375

Services available are as follows: installation and maintenance training seminars, installation and start-up supervision, preventive maintenance planning, parts order service and special instructions.

STORAGE

Do not remove protective coatings (if applicable) until the agitator is to be put into service. If the equipment is to be stored, do not stack the skids or crates. Store in a clean, dry, indoor location that is free from wide variations in ambient temperature.

Rotate the agitator shaft and motor shaft monthly to coat the bearings with lubricant and retard oxidation and corrosion. At two-month intervals inspect for rust. Apply a rust preventive as required. **Outdoor storage of the agitator and motor is not recommended.**

Consider the unit in storage when:

1. It has been delivered to the job site and is awaiting installation.
2. The agitator is installed, but operation is delayed.
3. When long (30 days) periods between operating cycles occur.
4. The plant or operation is shut down.

A rust preventive has been applied to all unpainted machine surfaces on equipment incorporating carbon steel wetted parts. This protective coating can be removed with mineral spirits.

The belts must not be stored under tension. If the drive has been factory installed, the tension must be released. The belts should be thoroughly inspected before retensioning in case deterioration of the rubber has occurred. Ideally the agitator should be stored without belts and have new belts installed at start-up. Full belt drive installation instructions are contained on *page 18*.

Rubber-covered components must be stored away from direct sunlight, arc welding flash, heat or outdoor seasonal weathering. It is recommended that rubber-covered equipment be stored indoors away from extreme temperature conditions (below 32 F^{o} [0 C] or above 120 F^{o} [50 C]).

Storage requirements vary depending on the length of storage and the climatic environment. For storage periods longer than three months or when adverse climate conditions exist, consult Chemineer, Inc. for specific advice on adequate protection.

INSTALLATION

The following procedure is intended as a general guide for installing all Prochem PB model agitators. It is possible that not all the information presented here will be required. Before installing the agitator, check to ensure that the serial number on the equipment nameplate corresponds with the general data sheet and assembly drawing.

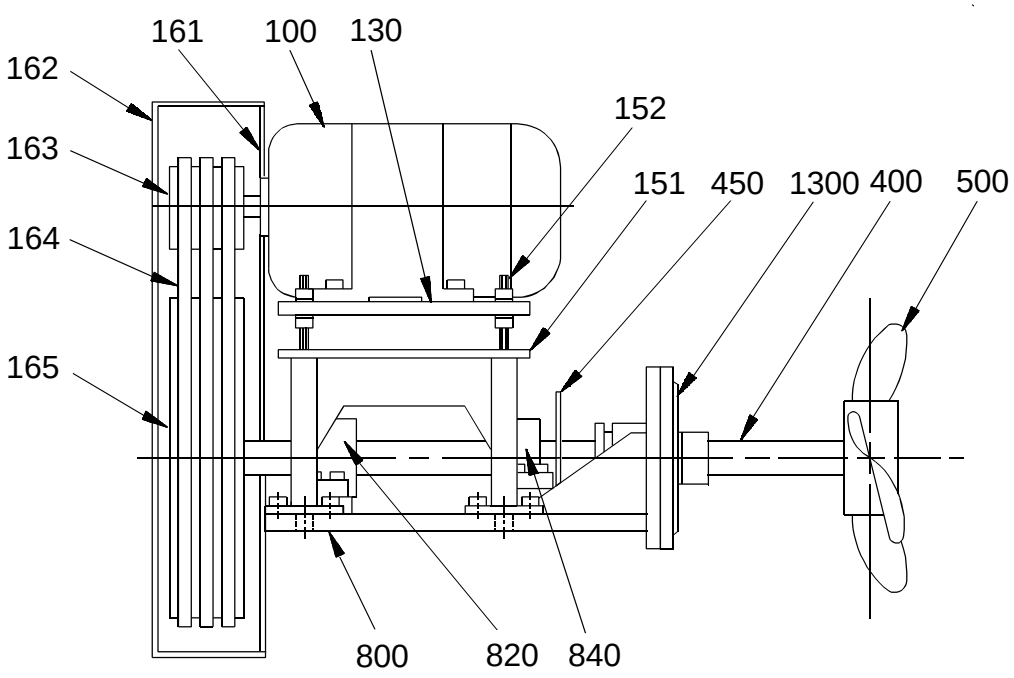


Figure 1: General Assembly

Item	Description	Item	Description
100	Motor	165	Driven Sheave
130	Motor Mount	400	Shaft
151	Support - Motor Mount	450	Shaft Slinger
152	Adjusters (4) - Motor Mount	500	Impeller
161	Back Plate - Belt Guard	800	Support Base
162	Cover - Belt Guard	820	Outboard Bearing Assembly
163	Drive Sheave	840	Inboard Bearing Assembly
164	Belts	1300	Seal/Flange Assembly

MOUNTING

The most frequent cause of mechanical difficulty with an agitator is improper mounting. The Prochem PB model agitator is designed to operate in a horizontal position, unless otherwise specified, and to handle the fluid forces exerted on the impeller during normal operation by transmitting these forces directly to the mounting support. As a result, the mounting system must be rigid enough to support the agitator weight and the live reactions caused by torque, bending moment and thrust. The support system must also handle additional stress experienced during more severe momentary loads, such as those caused by chunks of material in the process or liquid level changes.

The general data sheet and certified dimension drawing for the equipment supplies all design load values for which the support structure should be designed. If additional information is required to provide adequate agitator support, contact your local representative or factory.

NOTE: PB model agitators are assembled at the factory with the shaft pre-aligned through the stuffing box and mounting flange. No additional alignment is necessary unless accidental movement has occurred during shipping or installation. Refer to the alignment section, page 78 of this manual, for alignment instructions. Be careful, the base can be distorted as hold-down bolts are tightened, if the base is not properly shimmed and leveled.

CAUTION: Do not lift the agitator from any other point but the lifting lugs provided. Two lugs are located on either side of the drive end of the base plate. The other two are holes on either side of the tank end of the base plate support wings, Figure 2.

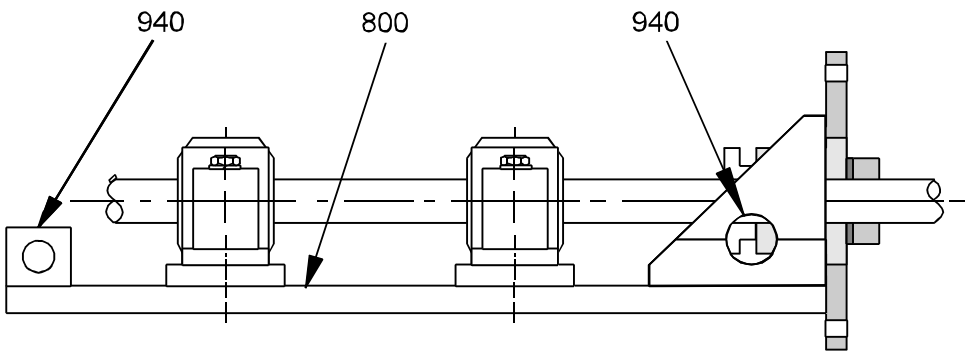


Figure 2: Lifting Lug Location

Item	Description	Item	Description
800	Base Plate	940	Lifting Lugs

AGITATOR

Note: Correct installation requires both the equipment certification package and this manual.

1. Ensure that the agitator is completely free of all shipping restraints and packaging material. A hoist or crane system must be available for lifting the agitator into position. *Refer to the assembly drawing for static equipment weight.*

2. Remove the impeller from the end of the shaft by unfastening the square head setscrews and locknuts that bear down on the shaft and key and pull off. Use a penetrating lubricant to aid in the removal. If the impeller cannot be easily removed, place a block of wood against the hub end of the impeller and knock it loose with a soft mallet, *see **Figure 4**, page 8.*

NOTE: An optional threaded jack screw hole may exist in the vertical outside face of the impeller hub to help in the removal. Size ranges from 3/8 inch to 3/4 inch UNC (8X1.25 mm to 20X2.5 mm), depending on the impeller diameter.

TIP: To aid impeller removal, install a fitting and inject grease through the jack screw hole.

3. Remove the belt guard cover. On units with a horizontal drive, rotating the belt guard backplate to the proper position may be necessary. *Refer to the assembly drawing for drive orientation.*

4. Lift the agitator with a portable hoist or equivalent, using the designed lifting points shown in ***Figure 2**, page 5.* Ensure that the four slotted holes in the agitator base plate (800) drop over the anchor studs in the support base. Do not rest the base plate on the support until the agitator is fastened to the tank nozzle or wall insert.

5. Install a gasket *(supplied by others)* between the seal flange and the face of the wall-insert flange.

6. While the agitator is supported by the hoist, align it perpendicular to the tank mounting surface. Move the agitator forward to mate with the connecting surfaces of the flange and wall insert or tank nozzle. Tighten the flange bolts to aid alignment but do not torque the fasteners until the base plate has been shimmed.

7. Begin to shim the agitator base plate to the support structure below, maintaining the natural perpendicular alignment set by fastening the flange to the tank nozzle or wall insert. Use varying thicknesses of shimming bar and plates until this position is achieved.

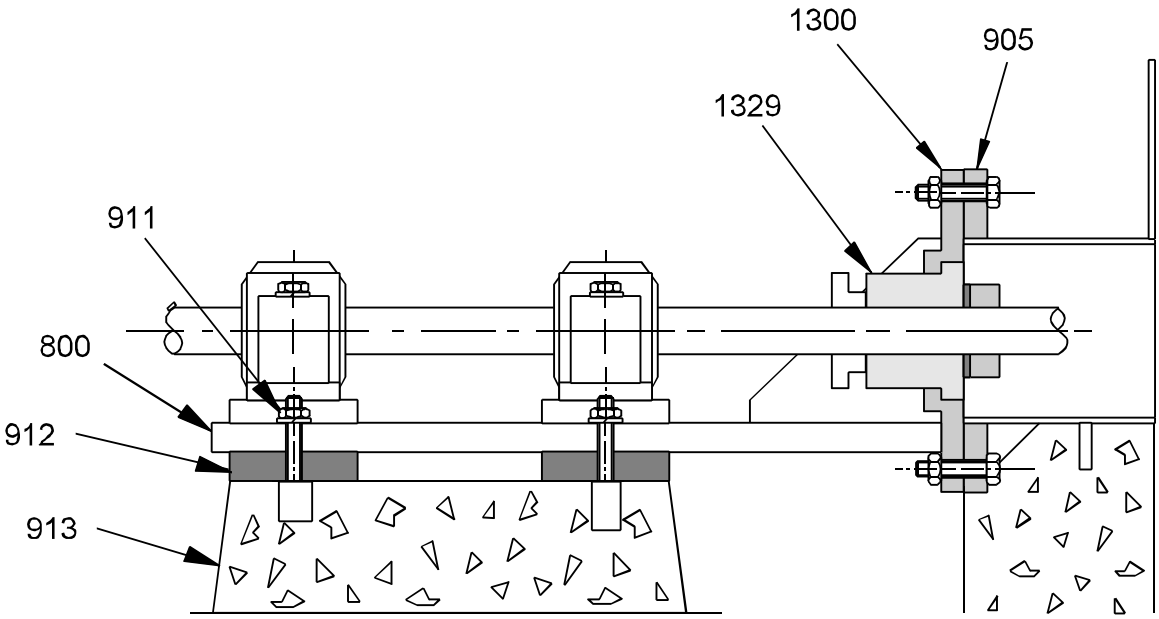
8. Torque all the flange fasteners to the appropriate values, ***Table 17**, page 76 or **Table 18**, page 77.*

CAUTION! Do not allow the agitator to drop downward out of alignment with the tank mounting surface. Such action could cause undue stress that could lead to support failure or tank leakage.

9. Once the agitator base plate is in position, tighten the four anchor nuts to secure the position. Torque each nut to the appropriate value, ***Table 17**, page 76 or **Table 18**, page 77.*

10. Where the support structure is a concrete pedestal, fill the area between the base plate and the pedestal with grout. Allow sufficient time for grout to harden before proceeding with other assembly work.

Note: The anchor bolts should be at the tank end of the slot in the support base to allow clearance for the studs in the wall insert and movement of the agitator for connection to the mounting flange.



Figue 3: Agitator Installation

Item	Description	Item	Description
800	Base Plate	913	Support Base
905	Wall Insert or Tank Nozzle	1300	Stuffing Box Flange
911	Hold-Down Nut and Anchor	1329	Stuffing Box Housing
912	Hard Shims and/or Grout		

IMPELLER

The standard impeller for a PB mixer is a Prochem Mark II impeller. Mark II impellers are built with bolted blades for the large sizes (25A through 87D) and welded blades for the small sizes, 13A through 23D. A bolted-blades impeller is used so that the hub and blades can be handled separately. Bolted blades make the impeller easier to install and may be put through a smaller opening in the tank or chest. Impellers with welded blades are small enough to be installed through a 24-inch (610 mm) manway. Mark II impellers can have either three (3) or six (6) blades. A bolted, three (3) blade Mark II is shown below *in **Figure 4***

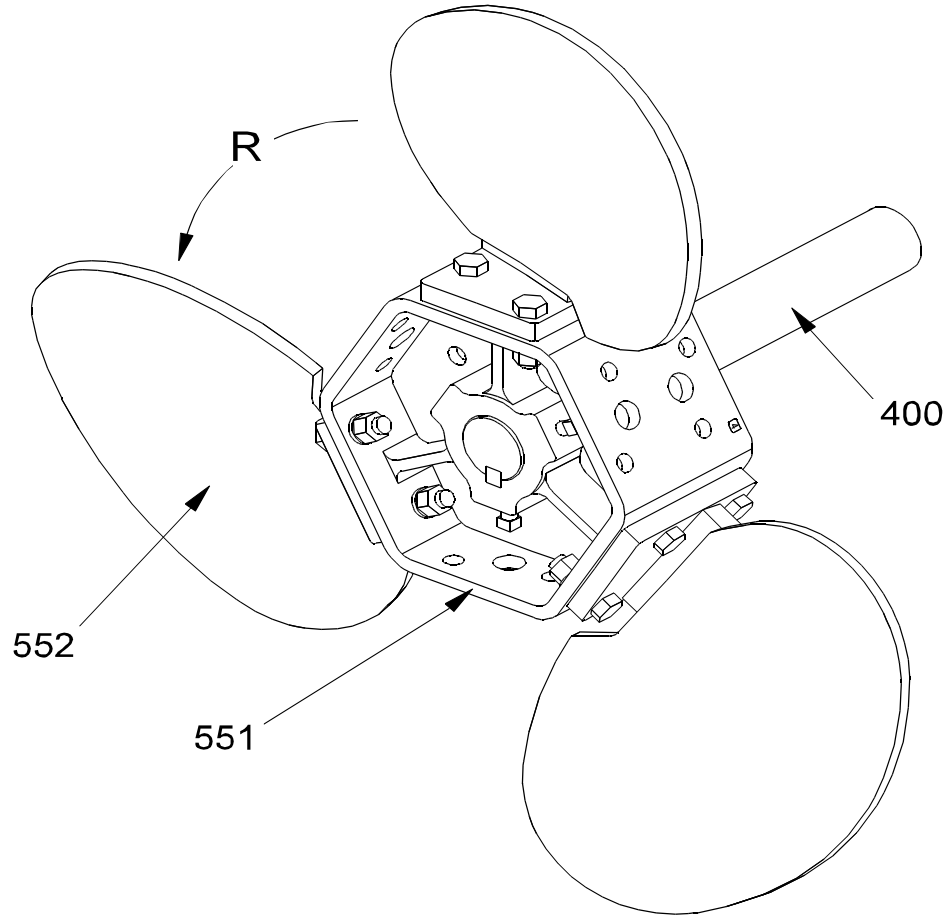


Figure 4: Maxflo Mark II Impeller

Item	Description	Item	Description
400	Shaft	552	Impeller Blade - Mark II
551	Impeller Body - Mark II		
R	Direction of Rotation		

Most Mark II impellers are installed on the end of the mixer shaft and are attached with a key and setscrews. The unit assembly drawing will show any special assembly features.

Bolted Blade Impellers

Most impellers are shipped assembled to avoid lost parts and fasteners. The first step in impeller installation is the removal of the bolted blades from the hub. The individual impeller parts are easier to handle and should fit through typical tank openings. Minimum opening diameters for various sizes of bolted Mark II impellers are shown *in* ***Table 1***.

Table 1: Minimum Tank Openings for Bolted Blade Mark II Impellers

Impeller Diameter	Minimum Opening Diameters					
	Disassembled 3 or 6 Blade		Assembled 3 Blade		Assembled 6 Blade	
[inches]	[inches]	[mm]	[inches]	[mm]	[inches]	[mm]
25A - 25D	13	330	23.5	597	25	635
27A - 27D	13	330	25.5	648	27	686
30A - 30D	13	330	28.5	724	30	762
32A - 32D	13	330	30.0	762	32	813
35A - 35D	17	432	33.0	868	35	889
38A - 38D	17	432	36.0	914	38	965
41A - 41D	17	432	38.5	978	41	1041
45A - 45D	17	432	42.5	1080	45	1143
49A - 49D	23	584	46.0	1168	49	1245
53A - 53D	23	584	50.0	1270	53	1346
57A - 57D	23	584	53.5	1359	57	1448
62A - 62D	23	584	58.5	1486	62	1575
68A - 68D	32	819	64.0		68	
74A - 74D	32	819	69.5		74	
80A - 80D	32	819	75.5		80	
87A - 87D	32	819	82.0		87	

SAFETY CAUTION!! To Avoid Possible Injury, use mechanical assistance when handling impeller components weighing more than 40 lbs. (18 kg).

Weights for impeller hubs and blades are summarized in ***Table 2***,

Table 2: Blade and Hub Weights for Bolted Blade Mark II Impellers

Impeller Diameter	Hub Weight		Blade Weight (each)	
[inches]	[lbs]	[kg]	[lbs]	[kg]
25A-25D	42.4	19.3	12.3	5.6
27A-27D	42.4	19.3	13.4	6.1
30A-30D	42.4	19.3	14.8	6.7
32A-32D	42.4	19.3	16.4	7.5
35A-35D	102	46.4	27.5	12.5
38A-38D	102	46.4	30.2	13.7
41A-41D	102	46.4	33.7	15.3
45A-45D	102	46.4	43.2	19.6
49A-49D	208	94.5	65.7	29.9
53A-53D	208	94.5	72.7	33.0
57A-57D	208	94.5	81.2	36.9
62A-62D	208	94.5	102	46.4
68A-69D	498	226	161	73.2
74A-74D	498	226	177	80.5
80A-80D	498	226	197	89.5
87A-87D	498	226	222	101

All blades are match marked. The impeller was balanced with the blades in the matched locations. To maintain the impeller balance, the blades must be installed in the same relative positions.

Impeller Installation

Impellers are usually disassembled before installation. The hub is installed on the shaft and the blades assembled to it. If the top of the tank is open and adequate lifting capabilities are available, the impeller may be installed as an assembly. When the impeller is installed as an assembly, only the first two steps apply.

1. Install the key (595) in the keyway at the end of the shaft (400). *See **Figure 5**, page 12.*

2. Slide the hub (551) onto the end of the shaft (400) with the key (595) in position. One side of the hub is marked "**This Side Toward Drive**" and goes on the shaft first. Tighten the four setscrews (596) to the torque values shown in ***Table 17*** or ***Table 18***, on pages 76 and 77. The tapped holes for the setscrews have been made with a self-locking (Spiralock®) thread. Auxiliar locking fasteners are not necessary. The setscrews must be tightened to the prescribed torque values to function properly.

3. Bolt the blades (552) to the hub in their match marked positions. Use the bolts (591), lockwashers (592), and hex nuts (594) as shown in ***Figure 5*** on page 12. Keep the bolt heads on the outside of the blade attachments. Torque all fasteners to the recommended values, ***Table 17**, page 76 or **Table 18**, page 77*.

   For three-blade impellers, the blades are installed on the hub sides marked 1, 2, and 3. The numbering of the hub sides is not consecutive, so the blades are spaced evenly around the hub. The bolt pattern is not symmetrical, so the blades can only be mounted one way.

   For six-blade impellers, the blades are mounted on all sides of the hub. All of the blades are match marked to correspond to the sides of the hub. The pattern is different for the first three sides than for the second three sides.

   *Note: Holes should **never** be redrilled or enlarged. Bolt tolerances are tight to hold blade pitch. Holes that do not match are probably the wrong holes, the wrong blade, or the wrong blade orientation.*

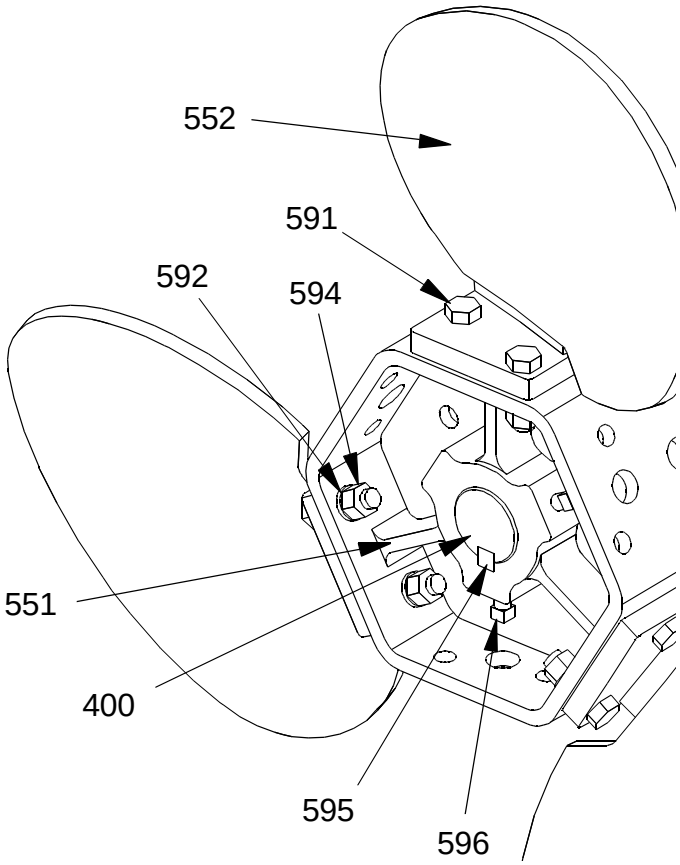


Figure 5: Maxflo Mark II Bolted Blades

Item	Description	Item	Description
400	Shaft	592	Lockwasher
551	Impeller Body - Mark II	594	Hex. Nut
552	Impeller Blade - Mark II	595	Impeller Key
591	Hex. Head Bolt	596	Sq. Hd. Setscrew

Welded Blade Impellers

Maxflo Mark II impellers from 13 inches to 23 inches in diameter are an all welded construction as shown in ***Figure 6***, on page 13. Impeller sizes from 13 inches through 17 inches are held and driven by setscrews. Impeller sizes from 18 inches through 23 inches are held and driven by setscrews and a key.

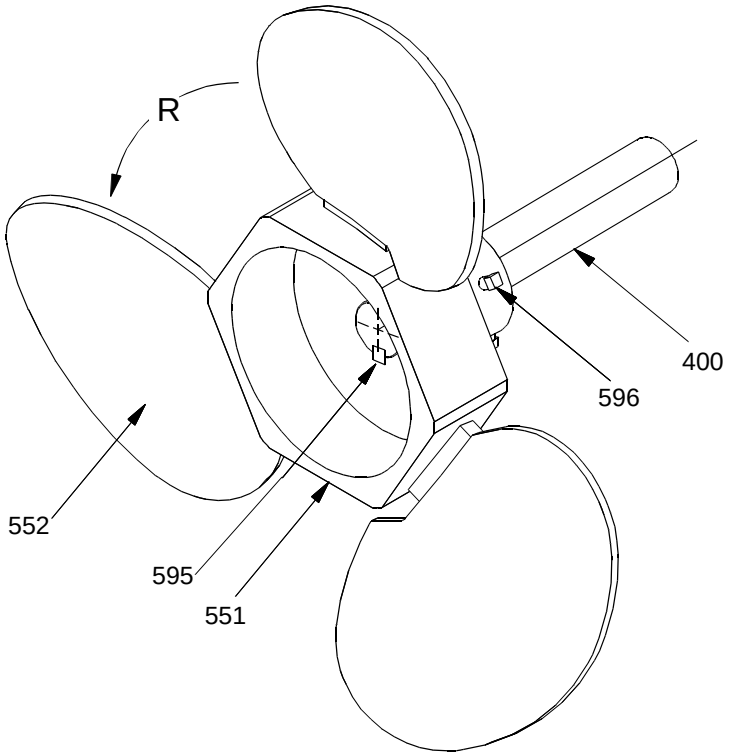


Figure 6: Maxflo Mark II Welded Blades

Item	Description	Item	Description
400	Shaft	595	Impeller Key (18 inch through 23 inch only)
551	Impeller Body - Mark II		
552	Impeller Blade - Mark II	596	Sq. Hd. Setscrew

Welded Mark II impellers can go through tank openings in different ways depending on the number of blades. Impellers with three blades will go through an opening smaller than the impeller diameter by rotating through the opening. A six blade impeller will not go through an opening smaller than the impeller diameter. A Mark II impeller is shown going through a nozzle without rotation, ***Figure 7*** on page 14 and with rotation, ***Figure 8*** on page 14. The impeller diameter and number of blades for a specific mixer can be found in the equipment certification package.

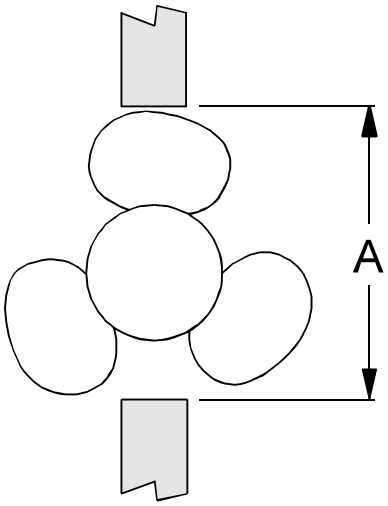


Figure 7: No Rotation

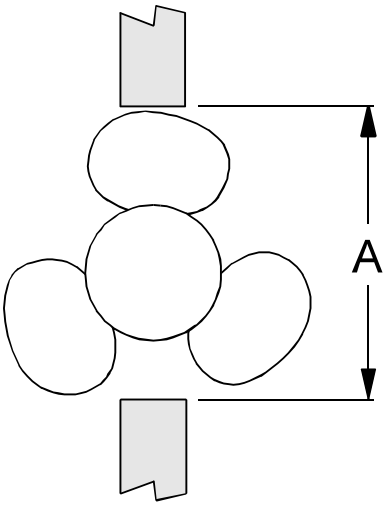


Figure 8: With Rotation

A Minimum Opening Diameter

Minimum opening diameters are shown in. The minimum opening diameter for a three blade Mark II impeller depends on the length of the nozzle, see ***Figure 9*** on page 15. If the nozzle length is greater than the maximum “B” dimension shown in ***Table 3*** on page 15, the minimum opening diameter for “No Rotation” should be used.

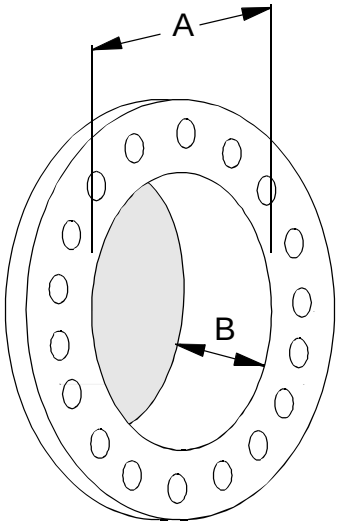


Figure 9: Typical Tank Opening

A Minimum Opening Diameter B Maximum Opening Length

Table 3: Minimum Openings for Welded Blade Impellers

Impeller Diameter	Minimum Opening Diameter							
	3 Blade						6 Blade	
	No Rotation		With Rotation		B (Max)			
[inches]	[inches]	[mm]	[inches]	[mm]	[inches]	[mm]	[inches]	[mm]
13A-13-D	12.0	305	9.2	234	3.0	76	13	330
14A-14D	13.0	330	9.9	251	3.3	84	14	357
16A-16D	14.5	368	11.3	287	3.8	97	16	406
17A-17D	15.5	394	11.9	302	3.9	99	17	432
18A-18D	16.5	419	12.7	323	4.2	107	18	457
20A-20D	18.5	470	14.0	356	4.5	114	20	508
21A-21D	19.5	495	14.8	376	4.8	122	21	533
23A-23D	21.5	546	16.2	412	5.3	135	23	584

Weights for welded three and six blade impellers are shown in ***Table 4*** on page 16. Mechanical assistance should be used to help install all impellers weighing more than 40 pounds (18.2 kg).

Table 4: Welded Blade Impeller Weights

Welded Impellers				
Impeller Diameter	3 Blade Impeller Weight		6 Blade Impeller Weight	
[inches]	[lbs]	[kg]	[lbs]	[kg]
13A-13D	5.70	2.59	7.40	3.36
14A-14D	6.00	2.73	8.00	3.64
16A-16D	6.40	2.91	8.80	4.00
17A-17D	6.80	3.09	9.70	4.41
18A-18D	26.0	11.8	37.5	17.0
20A-20D	27.1	12.3	39.7	18.0
21A-21D	28.5	13.0	42.4	19.3
23A-23D	30.1	13.7	45.6	20.7

Install impellers 13 inch through 17 inch diameter
*Refer to **Figure 4** on page 8*

1. Slide the hub (551) on to the end of the shaft (400) with the open side of the hub facing away from the drive.

2. Tighten the four set screws (596) to the values shown in ***Table 17*** on page 76 or ***Table 18*** on page 77. The tapped holes for the setscrews have been made with a self-locking thread. Auxiliary fastener locking is not needed. These setscrews will work only if they are tightened to the correct values.

Install impellers 18 inch through 23 inch diameter
*Refer to **Figure 4** on page 8*

1. Install the key (595) on the end of the shaft (400).

2. Slide the hub (551) on to the end of the shaft (400) with the key (595) in position. The open side of the hub should be facing away from the drive.

3. Tighten the four set screws (596) to the values shown in ***Table 17*** on page 76 or ***Table 18*** on page 77. The tapped holes for the setscrews have been made with a self-locking thread. Auxiliary fastener locking is not needed. These setscrews will work only if they are tightened to the correct values.

MOTOR

Correct installation requires both the equipment certification package and this manual.

NOTE: Air circulation is very important to get full performance and long life from an electric motor. Do not block the suction inlets on fan cooled motors. Life of the motor will be decreased if its temperature exceeds the thermal rating of the motor.

1. Check to ensure that the motor specifications match the drive design requirements of the agitator. *Refer to the certified data sheet or dimension drawing for designed motor requirements.*

2. Check the nameplate data on the motor to ensure that the available power supply agrees with the motor requirements. Protective devices should be of the proper size and rating to carry the load safely and interrupt the circuit on overloads.

3. Turn the shaft by hand to check that it turns freely and that the insulation resistance is no less than 1 megohm.

4. If the motor has been stored in a damp location, the windings may require drying. The motor may be dried by placing heaters around it or by running a small current through the windings.

5. Make sure the motor shaft is parallel to the agitator shaft and tightly secured to the mounting base. The motor may need to be shimmed to correct any motor shaft to agitator shaft alignment problems.

6. Bolt the motor to the predrilled holes in the adjustable motor mount and torque the bolts to the appropriate values, ***Table 17****, page 76 or* ***Table 18****, page 77*.

7. Connect the motor according to the local electrical code, but do not make the connections permanent until the motor rotation has been checked with the agitator's direction of rotation. The direction of agitator rotation is shown by a label on the belt guard cover and on a plate on the tank mounting flange.

Additional electrical wiring details can usually be found in the motor junction box.

BELT DRIVE

Correct installation requires both the equipment certification package and this manual.

1. Ensure that the sheave bore and mating bushing surfaces are clean and free of any particles that may cause the sheave to wobble when rotating.

2. Determine the bushing flange orientation that will provide the best shaft contact upon completion of installation, *i.e.*, "Hub Flange-in Mounting," ***Figure 10****, page 19* or "Hub Flange-out Mounting," ***Figure 11****, page 20*. The most desirable orientation is with the bushing flange-in toward the tank.

Mounting Flange-In Hub

1. Line up the clearance holes (A) in the sheave hub with the threaded holes (B) in the bushing flange, ***Figure 10****, page 19*. Insert the capscrews with lockwashers through the hub of the sheave and engage the threaded holes in the bushing flange.

2. Slip the loosely assembled unit on the shaft, bushing flange first, and align both sheaves to their desired position on the shaft. V-belts can tolerate misalignment up to 1/32 inch per foot (3 mm/meter) of center distance. Use a straight edge across four points on both sheaves to help obtain proper alignment, ***Figure 12****, page 20*.

3. Using a torque wrench tighten each capscrew alternately, applying no more torque than is recommended, ***Table 5****, page 21*. The split tapered "QD" bushing will then grip the full circumference of the shaft tightly. No additional leverage is necessary.

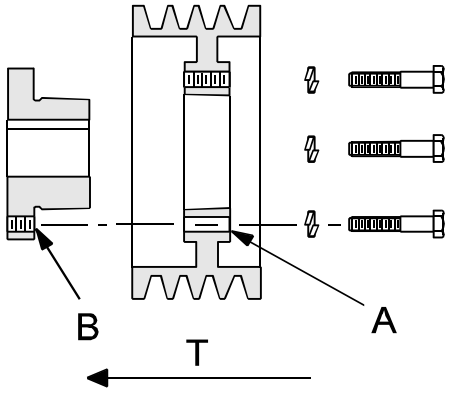


Figure 10: Hub Flange-In Mounting

A	Clearance Holes
B	Threaded Holes
T	Tank Side

Mounting Flange-Out Hub

1. Line up the clearance holes (A) in the bushing flange with the threaded holes (B) in the sheave hub, ***Figure 12****, page 20*. Insert the capscrews with lockwashers through the flange of the bushing and engage the threaded holes in the sheave hub.

2. Slip the loosely assembled unit on the shaft, sheave hub first, and align both sheaves to their desired position on the shaft. V-belts can tolerate misalignment up to 1/32 inch per foot (3 mm/meter) of center distance. Use a straight edge across four points on both sheaves to help obtain proper alignment, ***Figure 12**, page 20.*

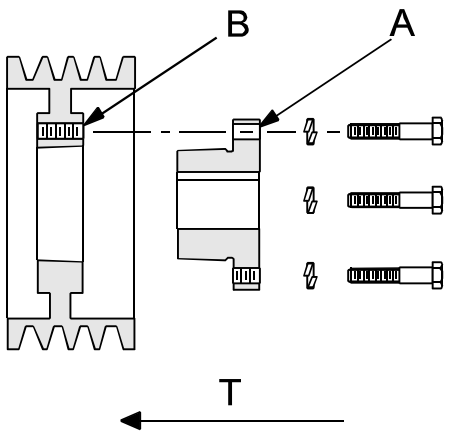


Figure 11: Hub Flange-Out Mounting

A	Clearance Holes
B	Threaded Holes
T	Tank Side

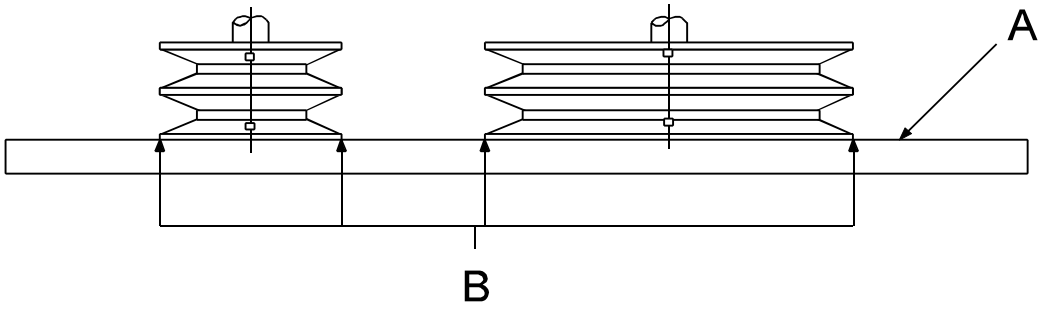


Figure 12: Sheave Alignment

A	Straight Edge	B	All Four (4) Points Should Touch

3. Using a torque wrench tighten each capscrew alternately, applying no more pressure than is recommended, ***Table 5**, page 21*. The split tapered "QD" bushing will then grip the full circumference of the shaft tightly. No additional leverage is necessary.

Table 5: Torque Values - "QD" Style Bushings

Use this table to determine the proper torque to apply to the capscrews when engaging the sheave bushings.

BUSHING TYPE	CAPSCREW	TORQUE (ft. lbs.)	TORQUE (N·m)
JA	#10-24 UNC	5	7
SH, SDS, SD	1/4-20 UNC	9	12
DK	5/16-18 UNC	15	20
SF	3/8-16 UNC	30	41
E	1/2-13 UNC	60	81
F	9/16-12 UNC	75	102
J	5/8-11 UNC	135	183
M	3/4-10 UNC	225	305
N	7/8-9 UNC	300	407
P	1-8 UNC	450	610
W	1 1/8-7 UNC	600	814
S	1 1/4-7 UNC	750	1017

Without exception, the most important factor in the successful operation of a belt drive is proper belt tensioning. To achieve the long, trouble-free service associated with belt drives, the belt tension must be sufficient to overcome slipping under maximum peak loads. The general method to increase the tension of the belt drive is to increase the center distance between the two sheaves.

NOTE: Keep all new belts together as a set, separate from other belts. Mixing new and used belts during installation may result in a loss of power transmitting capability.

1. Reduce the center distance between the sheaves by lowering the motor with the adjustable motor support base.

2. Make sure the motor shaft remains parallel with the agitator shaft and that the sheaves are aligned with each other.

3. Place the belts over the sheaves and in the grooves, do not force them over the sides of the grooves. Arrange the belts so that all have about the same amount of sag before tensioning.

4. Apply tension to the belts by increasing the center distance until the belts are snug. Increasing the center distance is achieved by raising the motor with the adjustable motor support base. Operate the agitator drive for a few minutes to seat the belts in the sheave grooves.

5. Stop the drive and tension the belts to the maximum deflection force recommended, ***Table 6****, page 23 and* ***Table 8****, page 24*. Measure the deflection value using a tensiometer or equivalent spring scale. Apply a perpendicular force to any one belt at the mid point of the span, ***Figure 13***.

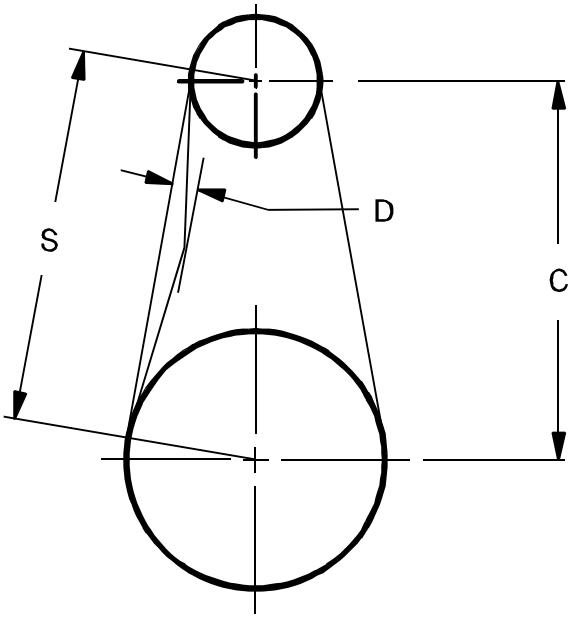


Figure 13: Belt Tensioning

C	Center Distance	S	Span Length
D	Deflection		

6. Observe the force required to deflect any one belt 1/64 inch for every inch (16 mm/meter) of span length. For example, the deflection for a 32 inch (820 mm) span would be 1/64 inch x 32 inch (16 mm/meter x 0.82 meter), which equals ½ inch (13 mm) of deflection.

7. Achieve correct belt deflection by increasing or decreasing the sheave center distance using the adjustable motor support base. The correct operating tension for a V-belt drive (if applicable) is the lowest tension at which the belts will not slip under peak load conditions.

Check the tension on the new belt drive at least twice during the first day's operation and adjust as required. Normally a rapid decrease in belt tension will occur until belts have run in. After a few days of operation the belts will seat themselves in the sheave grooves and it may become necessary to readjust the tension again.

Table 6: Recommended Deflection Force per Belt - Ultra-V Belts

Force required to deflect any one of the belts 1/64 inch for every inch (16 mm/m) of span length.

ULTRA-V BELTS						
BELT SECTION	SMALL SHEAVE DIAMETER (inch)	SMALL SHEAVE DIAMETER (mm)	DEFLECTION FORCE			
			MINIMUM (lbs)	MINIMUM (N)	MAXIMUM (lbs)	MAXIMUM (N)
3V	2.65 - 3.65	67.3 - 92.7	3.5	15.6	5.5	24.5
	4.75 - 6.90	121 - 175	5.0	22.2	7.5	33.4
5V	7.1 - 9.0	180 - 229	11.0	49.0	16.0	71.2
	14.0 - 21.2	356 - 539	13.0	57.8	19.5	86.8
8V	12.5 - 17.0	318 - 432	27.0	120.1	40.5	180.2
	21.2 - 24.8	538 - 630	30.0	133.5	45.0	200.2

Table 7: Recommended Deflection Force per Belt - Ultra-V Cog Belts

Force required to deflect any one of the belts 1/64 inch for every inch (16 mm/m) of span length.

ULTRA-V COG BELTS						
BELT SECTION	SMALL SHEAVE DIAMETER (inch)	SMALL SHEAVE DIAMETER (mm)	DEFLECTION FORCE			
			MINIMUM (lbs)	MINIMUM (N)	MAXIMUM (lbs)	MAXIMUM (N)
3VX	2.2 - 3.0	55.9 - 76.2	4.0	17.8	6.0	26.7
	4.12 - 6.90	105 - 175	5.5	24.5	8.0	35.6
5VX	4.4 - 5.2	112 - 132	10.0	44.5	15.0	66.8
	6.3 - 7.1	160 - 180	12.0	53.4	18.0	80.1
	9.0 - 14.0	229 - 356	15.0	66.8	22.0	97.9

Table 8: Recommended Deflection Force per Belt - HTD Belts

Force required to deflect any one of the belts 1/64 inch for every inch (16 mm/m) of span length.

HTD BELTS					
PITCH	BELT WIDTH	DEFLECTION FORCE			
		MINIMUM (lbs)	MINIMUM (N)	MAXIMUM (lbs)	MAXIMUM (N)
5 mm	15 mm	1	4	2	9
	25 mm	1.5	7	3	13
8 mm	20 mm	2	9	4	18
	30 mm	3	13	6	27
	50 mm	6	27	11	49
	85 mm	10	44	19	85
14 mm	40 mm	5	22	11	49
	55 mm	8	36	16	71
	85 mm	13	58	26	116
	115 mm	19	85	27	128
	170 mm	29	129	58	258
20 mm	115 mm	28	125	56	249
	170 mm	43	191	86	383
	230 mm	60	267	120	534
	290 mm	76	338	150	668
	340 mm	90	400	180	801

OPERATION

AGITATOR

Your Pillowblock side entry agitator has been designed for your specific application. Proper operating procedures will allow maximum performance. The following list will aid in the safe operation of your unit. Should there be problems operating the unit, review the installation and trouble shooting sections of this manual. If you are unable to resolve a problem, contact your local representative or factory.

Do not operate the agitator before reading and following the instructions on all tags, decals and nameplates attached to the equipment.

Do not operate the agitator in an empty tank or in a fluid with a specific gravity or viscosity higher than that for which the unit was designed.

Do not operate the stuffing box dry. Ensure that the flushing fluid and/or lubrication fluid is operating and that the run-in procedure has been followed. *Refer to page 29 for run-in procedure.*

Do not modify the agitator (i.e., motor horsepower, agitator speed, impeller diameter or blade pitch, etc.) without consulting a Chemineer representative.

Start-up Check List

After installation, the following areas should be checked before putting the agitator into service.

Check that the agitator is correctly positioned (see certified location drawing) and that all fasteners are tightened to the recommended torque values, ***Table 17****, page 76 or* ***Table 18****, page 77.*

Check that the motor, starting and control device connections agree with wiring diagrams commonly found in motor conduit boxes.

Check that the motor is wired for the correct direction of impeller rotation. The correct rotation is important so as not to endanger the mechanical integrity of the agitator.

Check that the lubrication and/or flushing fluid supply to the stuffing box is operating and that the run-in packing procedure has been followed. *Refer to page 29 for packing procedure.*

STUFFING BOX SEALS

Flush Requirements - Type L Stuffing Box

All type L stuffing box seals are designed to be run with a proper flushing fluid supplied to the appropriate stuffing box inlet. The most common fluid supply to the stuffing box is cool, clean water. Any selected fluid should be compatible with the process fluid.

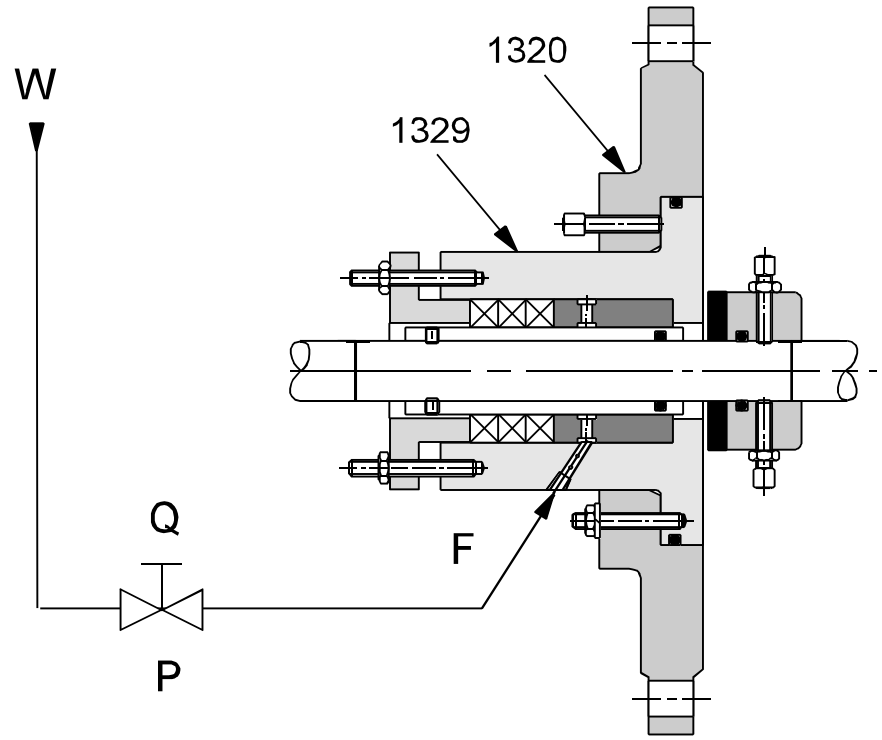


Figure 14: Type L Stuffing Box Lubrication

Item	Description	Item	Description
1320	Stuffing Box Flange	1329	Stuffing Box Housing
F	Flushing Inlet	Q	3gph (11 liter/hr) flow rate
P	20 psi (140 kPa) above tank	W	Clean Water Supply

Flushing Fluid Supply

The flushing fluid should be introduced to the stuffing box flushing inlet at a rate of 3 gph (11 liter/hr) and a pressure 20 psi (140 kPa) above tank head pressure. In units with a type L seal, the back flushing fluid also serves as a lubricant for the packing rings with some leakage. Although no simple definition of an acceptable leakage rate exists, a drop of lubricant every few seconds is needed during normal operation, ***Figure 14***.

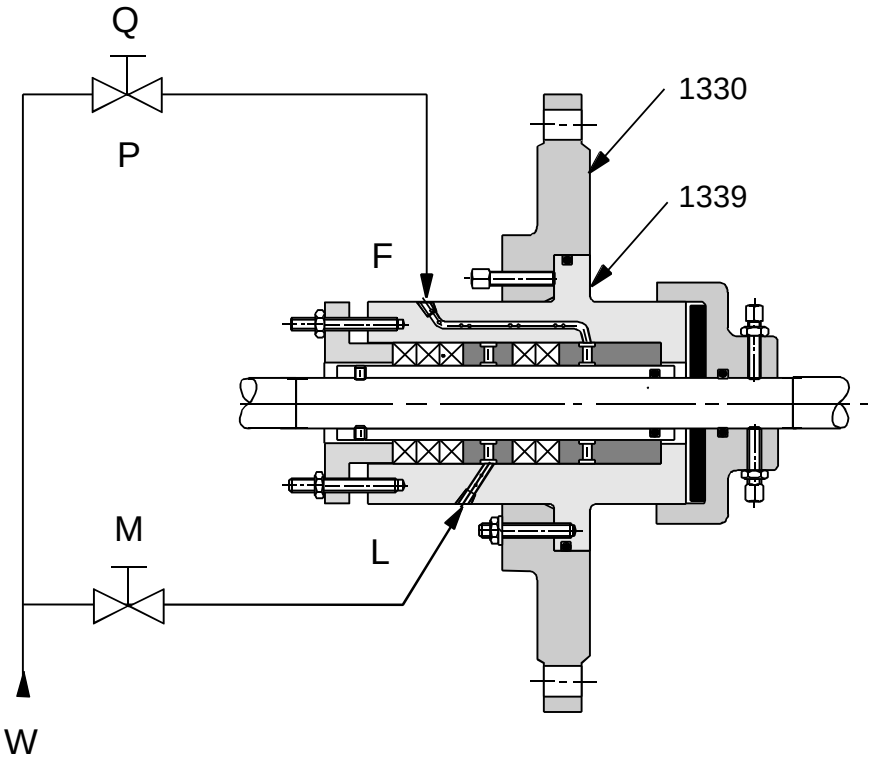


Figure15: Type DL Stuffing Box Lubrication

Lubrication and Flush Requirements - Type DL Stuffing Box

All type DL stuffing box seals are designed to be run with proper lubrication and flushing fluid supplied to the appropriate stuffing box inlets. The most common fluid supply to the stuffing box is clean water. However, any selected fluid should be compatible with the process fluid.

Item	Description	Item	Description
1330	Stuffing Box Flange	1339	Stuffing Box Housing

F	Flushing Inlet	P	20 psi (140 kPa) above tank
L	Lubricant Inlet	Q	3gph (11 liter/hr) flow rate
M	Maintain leakage rate	W	Clean Water Supply

Lubrication Fluid Supply

The fluid introduced to the lubrication inlet in the stuffing box should be sufficient to maintain the desired leakage rate. Although no simple definition of an acceptable leakage rate exists, a drop of lubricant every few seconds, during normal operation, is needed.

Flushing Fluid Supply

Flushing fluid should be introduced to the stuffing box flushing inlet at a rate of 3 gph (11 liter/hr) and a pressure 20 psi (140 kPa) above tank head pressure, ***Figure 15****, page 28.*

NOTE: The stuffing boxes of Pillowblock agitators are preassembled at the factory and are ready to go into service once the fluid supply is operating and the Run-In procedure has been followed.

Packing Run-In Procedure

1. Introduce the fluid supply to the stuffing box with sufficient pressure to allow an abnormal rate of leakage, not less than one pint per minute for one hour to lubricate the packing properly.

2. Tighten the gland nuts until the lockwashers are compressed.

SAFETY CAUTION!! To Avoid Possible Injury, check to make sure all belt and shaft guards are in place and tools are clear of moving parts. Turn on the lubricant supply and flushing water to the stuffing box (if applicable). Take all necessary precautions and follow applicable safety procedures before starting the agitator.

3. Start the agitator.

4. Tighten the gland nuts uniformly and gradually (no more than one flat on the nuts every 15 minutes) until the leakage rate is acceptable. Do not over tighten the gland nuts and make sure the gland plate remains square with the shaft. Always strive for satisfactory sealing with the least gland force possible.

MECHANICAL SEALS

Flush Requirements - Type OM - Outside Mounted (Split Design)

All type OM mechanical seals have built-in flushing ports for reliable service in high solids applications. A 3/8 NPT fitting is provided in the end of each gland half. The most common fluid supply to the mechanical is clean water. However, any selected fluid should be compatible with the process fluid.

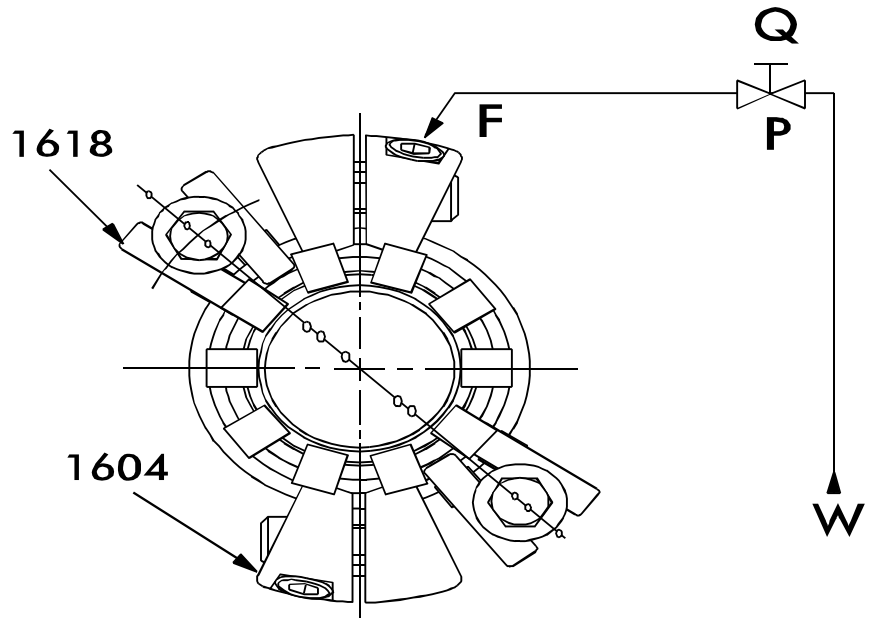


Figure 16: Mechanical Seal Lubrication - Chesterton 442

Item	Description	Item	Description
1604	Gland - split	1618	Gland Tabs - adjustable
F	Flushing Inlet (3/8 NPT)	Q	3gph (11 liter/hr) flow rate
P	20 psi (140 kPa) above tank	W	Clean Water Supply

Flushing Fluid Supply

The flushing fluid should be introduced to the seal housing inlet at a rate of 3 gph (11 liter/hr) and a pressure 20 psi (140 kPa) above tank head pressure. The back flushing fluid also serves as a clean lubricant for the sealing faces with some leakage. Although no simple definition of an acceptable leakage rate exists, a drop of lubricant every few seconds is needed during normal operation, ***Figure 16***.

Flush Requirements - Other Mechanical Seals

Most other types of mechanical seals are designed to be run with a proper flushing fluid supplied to the appropriate seal housing inlet. The most common fluid supply to the mechanical seal flush is cool, clean water. Any selected fluid should be compatible with the process fluid. Typically, the flushing fluid should be introduced to the seal housing flushing inlet at a rate of 3 gph (11 liter/hr) and a pressure 20 psi (140 kPa) above tank head pressure.

Because there are many types of mechanical seals, some of which require pressurized lubrication, details of the exact type of mechanical seal installed on the agitator should be carefully understood. Refer to supplemental drawings and manuals supplied separately or with the agitator.

CAUTION: These instructions are general in nature. It is assumed that the installer is familiar with seals and certainly with the requirements of the application for successful use of mechanical seals. If in doubt, get assistance from someone in the plant who is familiar with seals or delay the installation until your local Chemineer representative or a representative of the seal manufacturer is available. All necessary auxiliary arrangements for successful operation (cooling and flushing) as well as safety devices must be employed. These decisions are to be made by the user.

BELT DRIVE

During the first 24 hours of operation the initial tension on the belt drive will drop rapidly. Check the tension frequently during this time and adjust as required, *page 68.*

During the start-up period inspect the agitator for any signs of vibration, heat buildup, belt squealing or any other unusual noises. Any of these signs could lead to early failure of the agitator so the cause should be determined and corrective action should be taken immediately. *Refer to the trouble shooting guide on page 82.*

NORMAL OPERATION

During normal operation Chemineer recommends a program of routine maintenance to prolong the useful life of your agitator. A weekly walk through inspection of the agitator should include a visual inspection of the belt drive, mechanical seal or stuffing box, and a check of the bearings for smooth operation. Things to look for include overturned, broken or damaged belts, seal leakage rate, bearing temperature, unusual noises or vibrations. Refer to maintenance section for additional instructions on routine maintenance. If any problem should be discovered, the cause must be determined and the problem corrected immediately. *Refer to the trouble shooting guide on page 82.*

MAINTENANCE

Chemineer recommends a weekly-walk through inspection to check the following:

INSPECT:
1. Seal leakage rate
2. Bearing temperature
3. Belt drive wear and tension
4. For unusual noises or vibrations

Through a good program of routine maintenance and diagnostic practices, many causes of premature agitator failure can be avoided, thus prolonging the equipment life.

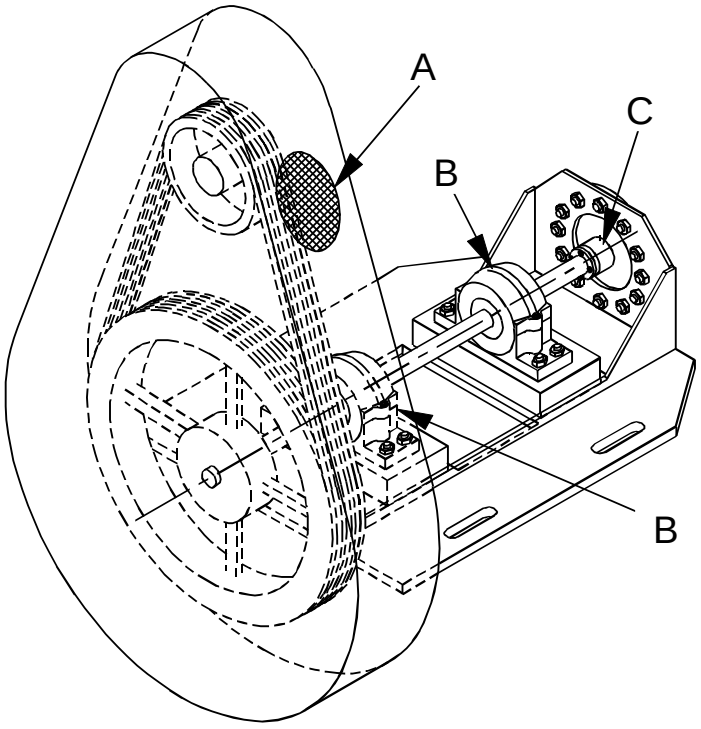


Figure 17: Agitator Overview

Item	Description	Item	Description
A	Inspect Belt Drive	C	Inspect Seal
B	Inspect Bearings		

TANK SHUT-OFF ACTIVATION

(optional feature)

SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).

1. Back off the three flange stud nuts (1366) but ***do not remove***. *Refer to* ***Figure 18****, page 36.*

2. Evenly apply proper torque, *see* ***Table 10***, to the three jackscrews (1364) causing the stuffing box housing (1329) to move forward and compress the shut-off seal ring between the stuffing box housing and the shut-off collar (1360), thus activating the tank shut-off feature.

NOTE: If the packing is so tight that it hinders activation of the shut-off, loosen slightly the packing gland nuts (1323).

NOTE: If the jack screws turn with almost no resistance and the stuffing box moves more than 1/16 inch (1.6 mm) compared with the mounting flange, the shut-off collar (1360) has moved from the original secured position, making positive activation of the shut-off feature impossible. Corrective action must be taken, see page 37 for shut-off collar inspection instructions.

Complete activation of the tank shut-off feature will have effectively sealed the tank contents from leakage to allow servicing of the stuffing box. If your agitator does not have the shut-off feature, draining the tank below the agitator shaft will be necessary.

Table 9: Torque Values - Tank Shut-Off Activation

Use this table to determine the proper torque to apply to the jackscrews when activating the tank shut-off feature.

SHAFT DIAMETER		TORQUE		SHAFT DIAMETER		TORQUE	
(inch)	(mm)	(ft-lb)	(N-m)	(inch)	(mm)	(ft-lb)	(N-m)
2.00	50.8	10	14	6.00	152.4	60	81
3.00	76.2	25	34	7.00	177.8	90	122
4.00	101.6	35	47	8.00	203.2	130	176
5.00	127.0	40	54				

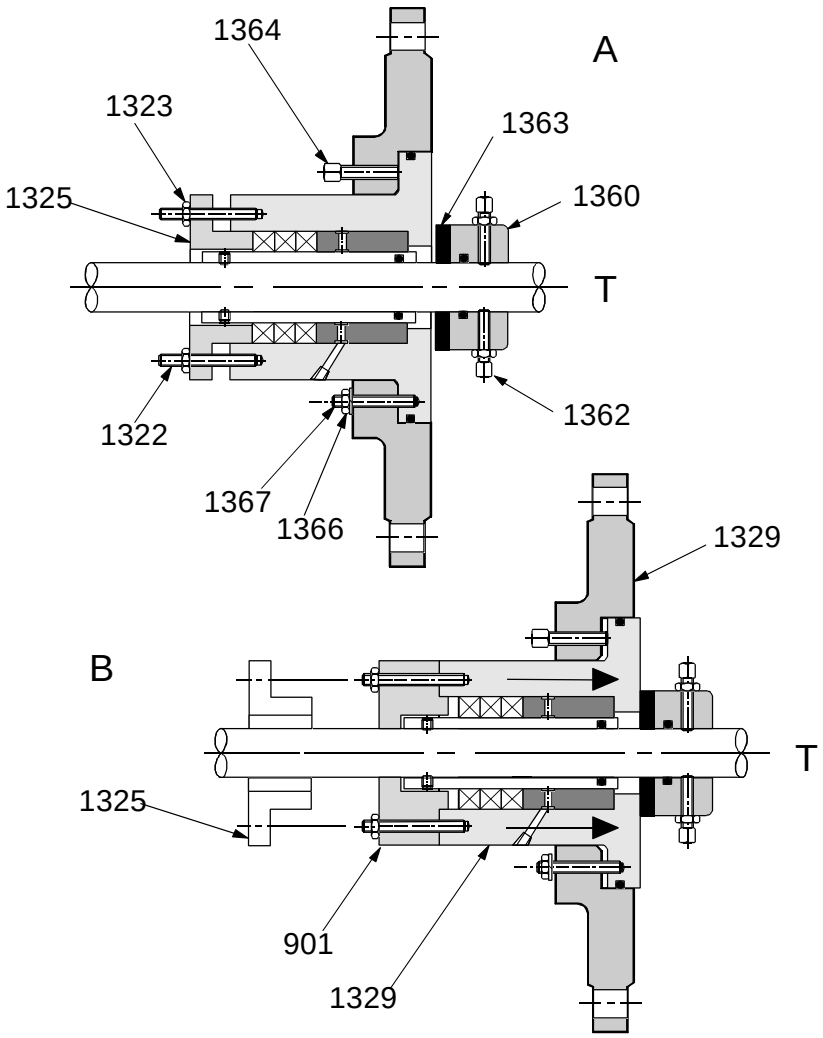


Figure 18: Tank Shut-Off Activation Feature

Item	Description	Item	Description
901	Shaft Holding Device	1361	O-Ring - Collar
1320	Stuffing Box Flange	1362	Sq. Hd. Setscrew
1322	Gland Adjuster Stud	1363	Shut-Off Seal Ring
1323	Gland Adjuster Nut	1364	Jackscrew
1325	Gland (split)	1366	Flange Stud
1329	Stuffing Box Housing	1367	Flange Nut
1360	Shut-Off Collar Assembly		

A	Operating Position	T	Tank Side
B	Activated Position		

TANK SHUT-OFF

Tank Shut-Off Inspection

*Refer to **Figure 18**, page 36.*

> ***SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).***

Note: The tank shut-off collar (1360) and shut-off seal ring (1363) can usually be reached from inside the tank provided the wall insert or nozzle is not too deep. If inspection of the collar assembly or tightening of the collar fasteners cannot be accomplished from inside the tank, the agitator must be removed from the nozzle.

The fasteners that hold the shut-off collar (1360) in place are spotted to the shaft. If the collar has moved from its original position, during an attempt to activate the shut-off, repositioning the collar with the fasteners bearing down on new or old spot holes in the shaft will be necessary. Spot holes will properly secure the shut-off collar to prevent movement.

1. Inspect the shut-off collar (1360) for signs of movement from the original position and check the condition of the shut-off seal ring (1363).

2. If all parts are in satisfactory condition but the collar has moved, reposition the collar to the original location, so that the setscrews return to the spot hole in the shaft. Check to ensure that the shut-off seal ring is snug but free to turn between the shut-off collar and stuffing box face. Torque the square head setscrew (1362) and lock nuts to the recommended value, ***Table 17**, page 76 or **Table 18**, page 77.*

Tank Shut-Off Replacement

*Refer to **Figure 18**, page 36*

> ***SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).***

Note: This task can only be accomplished with the tank empty and the agitator completely removed from the tank.

1. Remove the impeller from the end of the shaft by unfastening the square head setscrews and locknuts that hold the shaft and key. *See **Figure 4**, page 8 for typical hub mounting arrangements.* Pull the impeller off the end of the shaft. Use a penetrating lubricant to aid in the removal. If the impeller cannot be easily removed, place a block of wood against the hub end of the impeller and knock it loose with a soft mallet.

NOTE: An optional threaded jack screw hole may exist in the outside end of the impeller hub to help in the removal. Jack-screw hole sizes range from 3/8 inch UNC (8 mm) to 3/4 inch UNC (20 mm), depending on the impeller diameter.

TIP: To aid impeller removal, install a fitting and inject grease through the jack screw hole.

2. Disconnect and remove the belt guard cover (162), the drive assembly, *see page 68 for instructions,* and belt guard backplate (161).

3. Unbolt the seal flange (1300) from the tank and the mixer housing from the pedestal base (800), ***Figure 3**, page 7*.

4. Unfasten the collar square head setscrews (1362) and lock nuts. *See **Figure 19**, **Figure 20**, **Figure 21**, **Figure 22**, or **Figure 23** for seal details.*

5. Clean the shaft thoroughly and apply a thin coat of oil to help the collar (1360) with o-ring (1361) to slide along the shaft and off the end.

6. Replace the shut-off collar (1610) and seal ring (1363). Insert a new o-ring (1361) into the collar.

7. Check the spot holes in the shaft used to position the square head setscrews for the shut-off collar. If the spots are damaged, redrilling holes may be necessary to secure the shut-off collar for future use.

8. Position the seal ring (1363) followed by the shut-off collar (1360) assembly on the shaft. Carefully slide the collar along the shaft avoiding damage to the o-ring (1361). Use a thin oil on the shaft to help slide into position.

9. Reposition the collar to the original location so the setscrews return to new or old spot holes in the shaft. Check to ensure that the shut-off seal ring is snug but free to turn between the shut-off collar and stuffing box face. Torque the square head setscrew (1362) and lock nuts to the recommended value, ***Table 17**, page 76 or **Table 18**, page 77*.

Note: If the original spot holes are damaged or the shaft has been replaced, spotting the shaft with a drill for the setscrews to seat securely will be necessary.

Care must be exercised during the replacement of the shut-off collar as damage to the o-ring cannot be detected once the assembly is in place.

STUFFING BOX

A visual inspection of the stuffing box leakage rate should be carried out weekly (minimum) to ensure correct operation. A noticeable amount of lubricant should be seen leaking from the stuffing box. Although no simple definition of an acceptable leakage rate exists, a drop of lubricant every few seconds is necessary.

If the leakage of lubricant from the stuffing box seems excessive, check the lubricant flow rate and/or back flushing pressure. If they are acceptable, then the packing gland needs to be tightened evenly until the desired leakage rate is obtained.

NOTE: Repacking is required when satisfactory control over leakage is not attainable or when the packing gland flange meets the outboard end of the stuffing box housing. If no noticeable lubricant drops are leaking and/or there are signs of a heat buildup, corrective action must be taken immediately to prevent permanent damage to the stuffing box components and the shaft.

Repacking Procedure

*Refer to **Figure 19**, page 42 and **Figure 20**, page 43.*

*NOTE: Ensure the correct order of all stuffing box components as shown in **Figure 19** and **Figure 20**. Refer to the equipment specifications for the composition the components. For special Stuffing Box design, refer to the certified equipment drawings or contact your local representative for assistance.*

Due to the nature of packing seals, wear occurs and the stuffing box must be repacked eventually. When it becomes necessary to repack the stuffing box, follow the steps listed below. Spare parts for this procedure are readily available through your local Chemineer representative or an industrial supplier.

1. Activate the optional tank shut-off feature, if available, *page 34*, or drain the tank.

2. Unfasten gland adjusters (1323). Slide the gland (1325) toward the drive or separate it and remove completely from the shaft. With packing tools remove old packing (1327 or 1337), throttle bushing (1340) and/or lantern ring (1328). All bushings and rings have sufficient clearance to aid in removal with hook type tools.

   TIP: With the tank shut-off feature activated, you can use the seal lubricant water pressure to push the packing out of the stuffing box. With the stuffing box empty, activate the lubricant lines to flush out the housing and assure adequate flow.

   NOTE: Be sure the flow channels in the throttle bushing align with the flush inlet.

3. Check shaft or shaft sleeve (1350) for nicks, score marks or other damage. Replace damaged parts. Clean the stuffing box bore and ensure free entry of lubricant. Check that the channels and holes in the throttle bushing and/or lantern ring are not plugged. Replace parts if necessary.

   NOTE: Never add new packing on top of old packing as this will cause accelerated wear and scoring of the shaft or shaft sleeve. If the shaft sleeve is being replicated, it should protrude 5/8 inch (16 mm) from the drive-end of the stuffing box (1320 or 1330).

Repack the stuffing box by installing the throttle bushing and/or lantern ring and packing ensuring that each ring is seated squarely with scarfed joints staggered 120 degrees apart. A little grease or oil smeared on the packing I.D. will make the installation easier.

4. Install the gland and seat the packing rings, throttle bushing and/or lantern ring by tightening the gland nuts. Seat the packing according to the "Packing Run-In Procedure," *page 41*.

5. Reintroduce the lubricant to the stuffing box with sufficient pressure to allow an abnormal rate of leakage, not less than one pint per minute for one hour to lubricate the packing properly.

6. Tighten the gland nuts uniformly and gradually (one sixth of a turn at a time every ten minutes) until the leakage rate is acceptable. Make sure the gland plate remains square with the shaft.

Do not over tighten gland nuts. Always strive for satisfactory sealing with the least gland force possible. At any sign of an excessive heat buildup back off the gland nuts and gland until the stuffing box is again cool to touch. This process may take several hours until the desired conditions are attained.

Packing Run-In Procedure

1. Introduce the fluid supply to the stuffing box with sufficient pressure to allow an abnormal rate of leakage, not less than one pint per minute for one hour to lubricate the packing properly.

2. Tighten the gland nuts until the lockwashers are compressed.

SAFETY CAUTION!! To Avoid Possible Injury, check to make sure all belt and shaft guards are in place and tools are clear of moving parts. Turn on the lubricant supply and flushing water to the stuffing box (if applicable). Take all necessary precautions and follow applicable safety procedures before starting the agitator.

3. Start the agitator.

4. Tighten the gland nuts uniformly and gradually (no more than one flat on the nuts every 15 minutes) until the leakage rate is acceptable. Do not over tighten the gland nuts and make sure the gland plate remains square with the shaft. Always strive for satisfactory sealing with the least gland force possible.

Table 10: Packing Sizes

Use this table as a guide to determine the proper packing size for a given shaft diameter.

SHAFT DIA. (inches)	PACKING SIZE	SHAFT DIA. (Inches)	PACKING SIZE
2.00 / 3.00 / 4.00	½ inch sq.	7.00	3/4 inch sq.
5.00	5/8 inch sq.	8.00	7/8 inch sq.

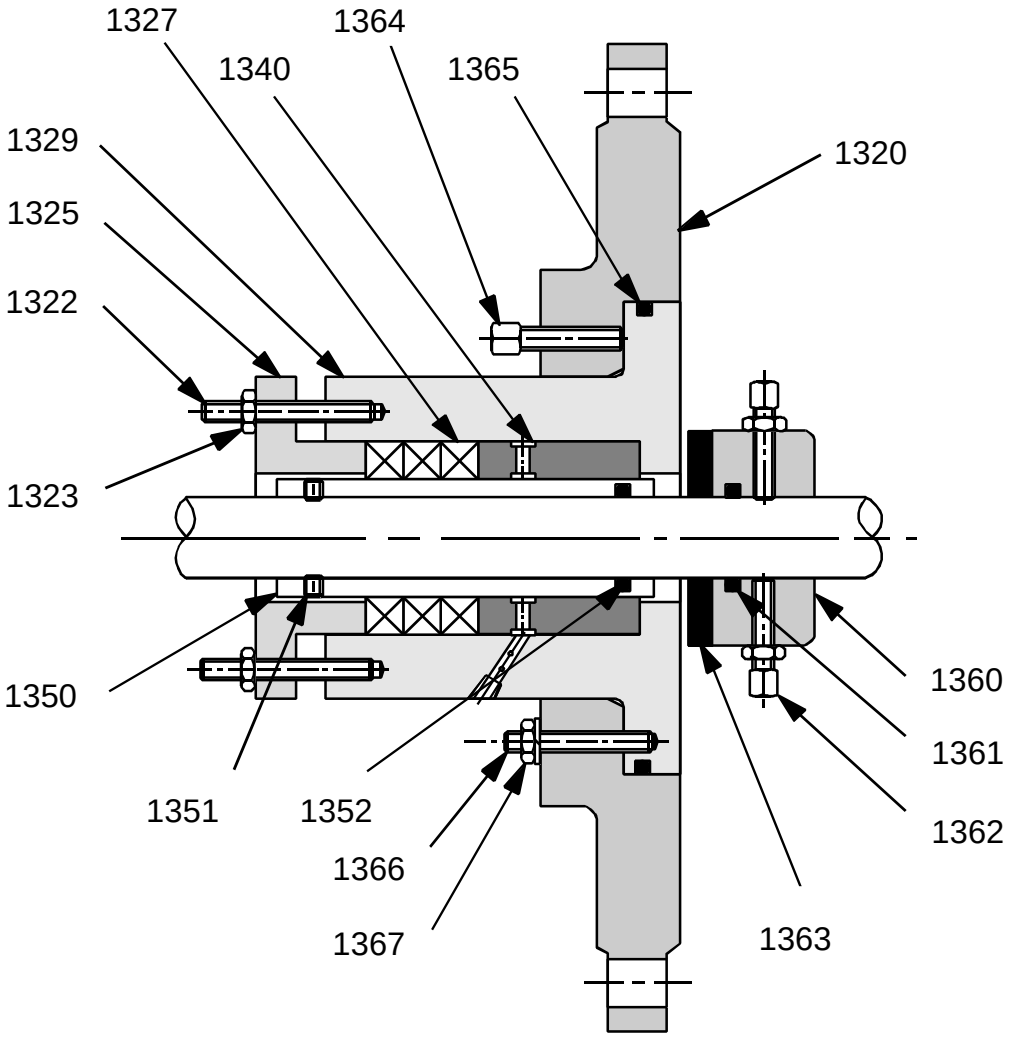


Figure 19: Type L Stuffing Box

Item	Description	Item	Description
1320	Seal Flange	1352	O-Ring - Sleeve
1322	Gland Adjuster Stud (4)	1360	Shut-Off Collar (optional)
1323	Gland Adjuster Nut (4)	1361	O-Ring - Collar (optional)
1325	Gland - split	1362	Sq. Hd. Setscrews (optional)
1327	Packing Rings (3)	1363	Shut-Off Seal Ring (optional)
1329	Stuffing Box Housing	1364	Jack Screws (3)
1340	Throttle bushing	1365	O-Ring - Flange
1350	Shaft Sleeve	1366	Flange Stud (3)
1351	Setscrews	1367	Flange Nut (3)

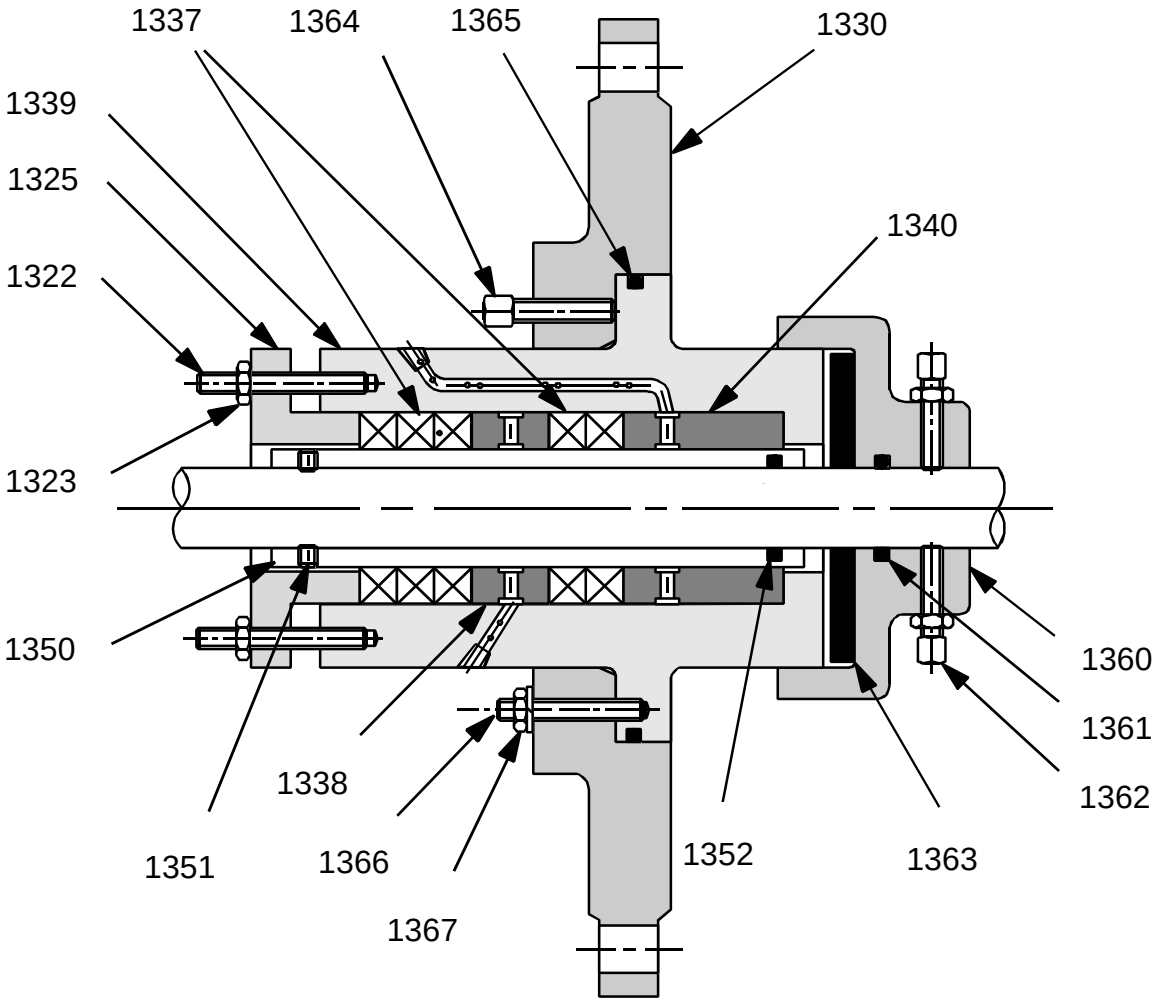


Figure 20: Type DL Stuffing Box

Item	Description	Item	Description
1322	Gland Adjuster Stud (4)	1352	O-Ring - Sleeve
1323	Gland Adjuster Nut (4)	1360	Shut-Off Collar (optional)
1325	Gland - split	1361	O-Ring - Collar (optional)
1330	Seal Flange	1361	Sq. Hd. Setscrews (optional)
1337	Packing Rings, Type DL	1363	Shut-Off Seal Ring (optional)
1338	Lantern Ring	1364	Jack Screws (3)
1339	Stuffing Box Housing	1365	O-Ring - Flange
1340	Throttle bushing	1366	Flange Stud
1350	Shaft Sleeve	1367	Flange Nut (3)
1351	Setscrews		

MECHANICAL SEAL

Outside Mounted (Split Design)

*Refer to **Figure 21**, **Figure 22**, or **Figure 23**, page 47, 48, or 49*

NOTE: If the leakage from the mechanical seal seems excessive, check the flushing flow rate and/or pressure is not excessive. If the flushing is acceptable and the leakage is greater than 60 drops per minute, investigate the seal condition and correct immediately.

Repair Procedure

The following instructions are general in nature and should only be used as a guide along with the specific instructions supplied with by the mechanical seal manufacturer. It is also assumed that the maintenance personal/installer is familiar with mechanical seals and the requirements of the application for the successful use. If in doubt, contact your local Chemineer representative for assistance.

Tank Shut-Off Activation for Mechanical Seal (optional feature)

*Refer to **Figure 18**, page 36.*

SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the flushing water to the mechanical seal (if applicable).

1. Back off the three plate retaining stud nuts (1606) but do not remove.

2. Evenly apply the proper torque to the three jackscrews (1607) causing the shut-off plate (1602) to move forward compressing the shut-off seal ring between the shut-off plate & the shut-off collar (1610) thus activating the tank shut-off feature. *See **Table 9**, page 35 for the appropriate torque values.*

NOTE: If movement of the spool continues without resistance and the gap increases easily beyond a 1/16 inch (1.6 mm), the shut-off collar (1610) has moved from the original secured position making positive activation of the shut-off feature impossible. In this event corrective action must be taken. *See page 37 for shut-off collar replacement instructions.*

3. Complete activation of the tank shut-off feature will have effectively sealed the tank contents from leakage allowing servicing of the mechanical seal. If your Agitator does not have this feature, draining the tank to the required level will be necessary.

Mechanical Seal Removal

*Refer to **Figure 21**, **Figure 22**, or **Figure 23**, page 47, 48, or 49*

1. Prepare a clean work surface on which to place parts during disassembly.

2. Slide the split gland (1621) toward the drive and separate the halves by unfastening the gland cap screws (1626) and remove from the shaft.

3. Disassemble the remaining seal, noting the condition of the parts. A spare parts kit is readily available, upon request, to repair the mechanical seal. Only the gland and rotary holder (1663) are reused.

4. Follow the specific instructions for mechanical seal removal supplied with the original seal assembly or the spare part kit.

NOTE: The gland holder and face halves are matched pairs. Do not mix halves from different seals since this will cause seal failure.

5. Check the condition of the seal flange (1601) particularly the mating face that contacts the mechanical seal. It must be flat and smooth enough to seal a gasket; Maximum 125 microinches (3.2 microns) AA finish.

6. If misalignment of the seal housing compared with the shaft is suspected, corrective action must be taken before proceeding with the installation of a new seal. Use a dial indicator to check the run out of the shaft at the mechanical seal. Run out should not exceed 0.003 inch TIR per inch (0.003 mm TIR per millimeter) of shaft diameter.

7. Remove all burrs and scratches in the seal area of the shaft and polish if necessary to achieve a 32-microinch (0.8 microns) AA finish.

8. Use a dial indicator to measure the shaft run out just outside the seal flange. Readings should not exceed 0.001 inch TIR per inch (0.001 mm TIR per millimeter) of shaft diameter.

Mechanical Seal Installation
*Refer to **Figure 21**, **Figure 22**, or **Figure 23**, page 47, 48, or 49*

1. Prepare a clean work surface on which to place parts during assembly.

2. Read the manufacturer's instructions for mechanical seal installation carefully and make sure you understand them before installing new seal parts.

3. Handle and install the parts are carefully making sure your hands are clean. Any dirt particles placed on the seal faces or scratches caused during handling may cause seal failure.

4. Follow the specific instructions for mechanical seal installation supplied with the original seal assembly or the spare part kit. Ensure that the flushing inlet, located in gland halves (1621), is in the original position for reconnecting the plumbing.

5. Upon completing the mechanical seal installation, rotate the shaft by hand to ensure no metal-to-metal contact within the seal. A slight drag may be found due to the seal faces but the shaft should rotate freely.

6. Deactivate the tank shut-off feature by reversing the previous activation procedure.

7. Reconnect the flushing line to the gland. Reconnect all power to the drive motor and any optional device. Reintroduce the flushing supply to the seal with sufficient pressure to expel solids from the seal.

SAFETY CAUTION!! To Avoid Possible Injury, check to make sure all belt and shaft guards are in place and tools are clear of moving parts. Reconnect and turn on the lubricant supply and flushing water to the stuffing box (if applicable). Take all necessary precautions and follow applicable safety procedures before starting the agitator.

8. Depending on how carefully the seal components were handled during installation, split seals may leak on startup. For example, greasy fingerprints on the faces or misaligned face splits may cause leakage. This type of leakage usually decreases and stops over a period as a carbon face wears in or leak paths are clogged.

9. Seal leakage greater than 60 drops per minute should be investigated immediately. If leakage remains steady, check o-rings and gaskets for proper installation and check the faces for chips and scratches.

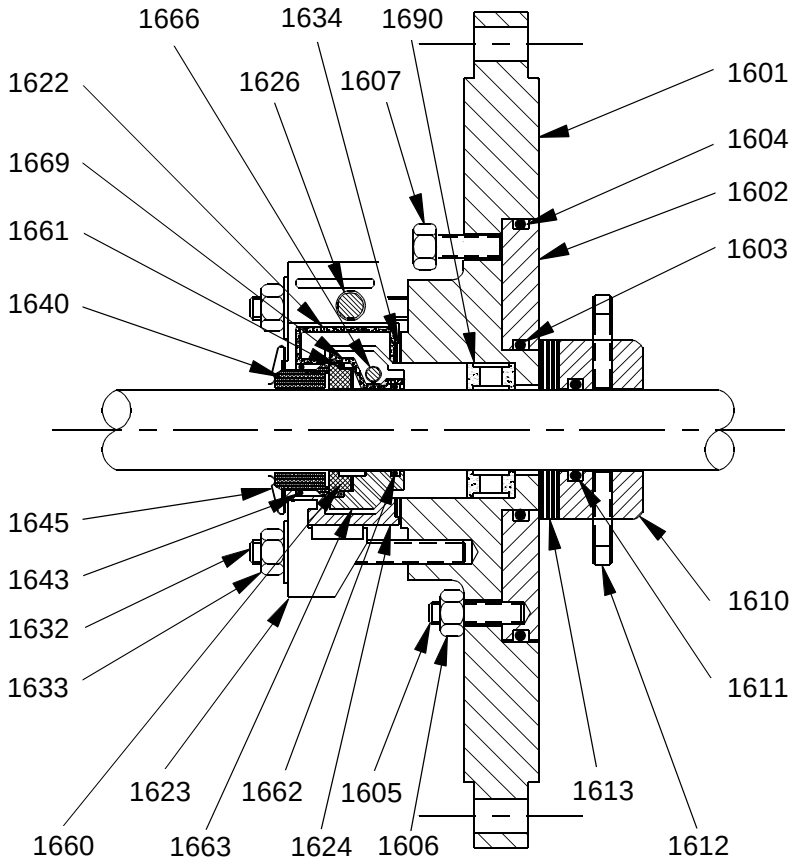


Figure 21: Split Mechanical Seal - Chesterton 442

Item	Description	Item	Description
1601	Mechanical Seal Flange	1632	Mounting Stud
1602	Shut-Off Plate	1633	Mounting Nut & Washer
1603	O-Ring - Plate (Inner)	1634	Mounting Gasket
1604	O-Ring - Plate (Outer)	1640	Stationary Seat
1605	Shut-Off Stud	1643	O-Ring - Stationary Seat
1606	Shut-Off - Nut & Washer	1645	Spring Clips
1607	Jack Screw	1660	Rotary Head
1610	Shut-Off Collar Assembly	1661	O-Ring - Rotary Head
1611	O-Ring - Collar	1662	O-Ring - Shaft
1612	Sq.Hd. Setscrews	1663	Rotary Holder
1613	Shut-Off Seal Ring	1666	Cap Screws - Rotary Holder
1622	Gland Gasket	1669	Holder Gasket
1623	Gland Retainer	1671	Drive Pins
1624	Gland Ring	1690	Throttle Bushing
1626	Cap Screws - Gland		

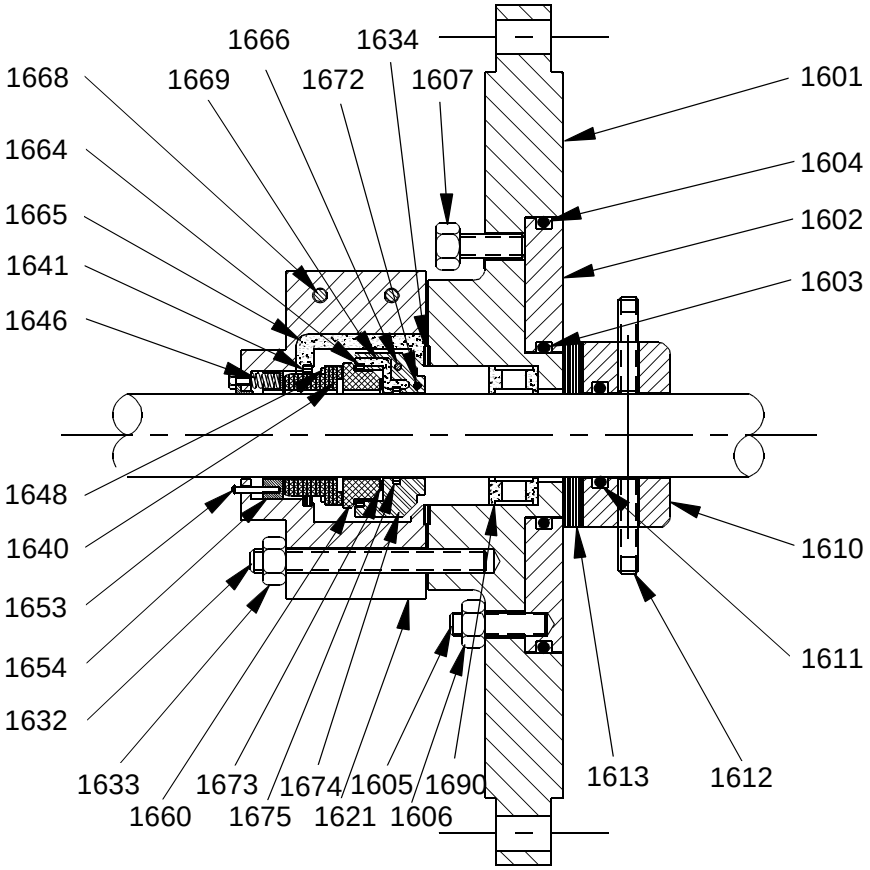


Figure 22: Split Mechanical Seal - Durametallic PSSA

Item	Description	Item	Description
1601	Mechanical Seal Flange	1641	Stationary Mounting
1602	Shut-Off Plate	1646	Springs
1603	O-Ring - Plate (Inner)	1648	Hold Ring
1604	O-Ring - Plate (Outer)	1653	Spring Pins & E-Ring
1605	Shut-Off Stud	1654	Spring Retainer
1606	Shut-Off - Nut & Washer	1660	Rotary Head
1607	Jack Screw	1664	Rotary Mounting
1610	Shut-Off Collar Assembly	1665	Face Gasket
1611	O-Ring - Collar	1666	Cap Screws - Rotary Holder
1612	Sq.Hd. Setscrews	1668	Shoulder Screw
1613	Shut-Off Seal Ring	1669	Holder Gasket
1621	Gland - Split	1672	Location Pin
1632	Mounting Stud	1673	Drive Pad
1633	Mounting Nut & Washer	1674	Collar
1634	Mounting Gasket	1675	Collar Packing
1640	Stationary Seat	1690	Throttle Bushing

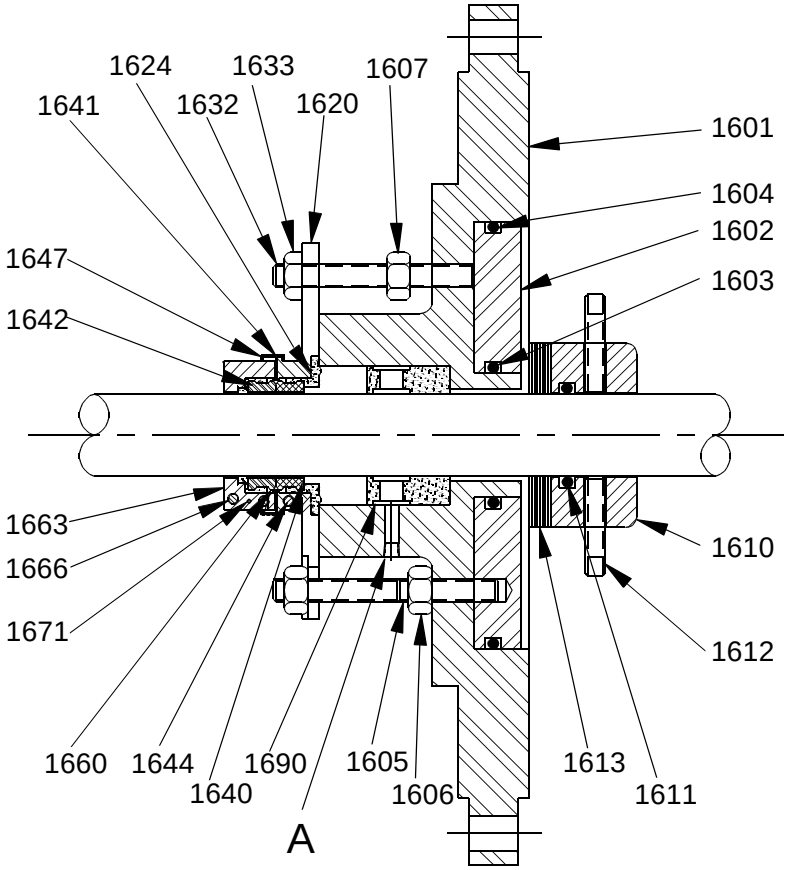


Figure 23: Split Mechanical Seal - Crane 37FS

Item	Description	Item	Description
1601	Mechanical Seal Flange	1632	Mounting Stud
1602	Shut-Off Plate	1633	Mounting Nut & Washer
1603	O-Ring - Plate (Inner)	1640	Stationary Seat
1604	O-Ring - Plate (Outer)	1641	Stationary Mounting
1605	Shut-Off Stud	1642	Secondary Seal Ring
1606	Shut-Off - Nut & Washer	1644	Cap Screw - Stationary Holder
1607	Jack Screw	1647	Shroud
1610	Shut-Off Collar Assembly	1660	Rotary Head
1611	O-Ring - Collar	1663	Rotary Holder
1612	Sq.Hd. Setscrews	1666	Cap Screws - Rotary Holder
1613	Shut-Off Seal Ring	1670	Shaft Sleeve Assembly
1623	Gland Retainer	1690	Throttle Bushing
1624	Gland Ring		

A Flush Inlet

BEARINGS

NOTE: All pillowblock bearing assemblies are shipped from the factory pre-lubricated to the specification outlined by the bearing manufacturer and are ready for use. Additional bearing lubrication at start-up time is not necessary and should be avoided to prevent over lubrication.

A routine maintenance inspection of the pillowblock bearings should be carried out weekly (minimum) to ensure correct operation and maintenance. These bearings are designed to run from cool to slightly warm to the touch. If a bearing is running HOT or overheating, corrective action must be taken to prevent any permanent damage to the bearing rollers and housing components. If during the routine maintenance inspection any unusual noises or vibrations are detected, the cause should be determined and corrective action taken immediately. Refer to the trouble shooting guide, *page 82*, for solutions to any noticeable bearing problems.

Lubrication

Always rotate bearings while regreasing. Grease can be injected with a gun into the upper housing half through the regular 1/4 inch N.P.T. fitting on-center. Always use the same type of grease previously used in the bearing. Some greases lose lubricating capability when mixed with another grease. Never mix greases with unlike bases without first checking compatibility with the supplier. Chemineer prelubricates the bearings with Lithium EP, NLGI Grade 2, nonchanneling grease (Quaker State) and recommends using the same type of grease or compatible equivalent.

Routine Greasing

As a guide to frequency of lubrication, under moderate operating conditions of dirt, temperature and moisture, one or two shots from a grease gun every two weeks are adequate. Lubricating more frequently is necessary in applications where a risk of heavy contamination exists. The same applies to bearings in wet environments such as papermaking machinery.

NOTE: Pillowblock model agitators are equipped with self-aligning spherical roller bearings on the outboard end (drive end) and optional on the inboard end (tank end). These bearings include the W33 feature (with grooves and three holes around the outer ring). This feature allows grease flow through the center holes to the bearing rollers. When reordering replacement bearings, be sure this feature is present.

Replacing Old Grease

The life expectancy of a grease depends on several factors such as the type of grease, speed and operating temperature of the bearings. **Old grease should be removed and replaced once a year on all non-split type bearing assemblies.**

SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).

NOTE: Before servicing the bearings, steadying the shaft from any upward movement is important. (Refer to page 54 for the shaft steady installation instruction).

Outboard Bearing Inspection and Regreasing

Refer to **Figure 24**, page 65.

1. Remove the upper housing half (824) by unbolting it from lower half (827).

2. Inspect the bearing for signs of damage and wear to decide if replacement of any components is necessary. If replacement is necessary, go to the appropriate section in this manual.

3. Without any bearing disassembly, remove as much old grease by hand as possible from the lower housing half and bearing rollers.

4. Work new grease into all cavities of the bearing. To ensure complete greasing, work the grease from one side of the bearing until it appears on the opposite side all the way around.

5. Hand pack the reservoir in the lower housing half with grease to a minimum level of 1/2 full, equally on both sides. Where speeds are slow and contamination is a problem, fill the reservoir completely.

6. Re-attach the upper housing half and torque the fasteners to the recommended values, ***Table 17**, page 76 or **Table 18**, page 77*.

CAUTION! Never assemble the bearing housing dry and inject grease after closing.

Inboard Bearing Inspection and Regreasing (non-split design)
*Refer to **Figure 25**, page 66.*

Repeat the procedure as specified for the Outboard Bearing.

Inboard Bearing Inspection and Regreasing (split design)
*Refer to **Figure 26**, page 67.*

1. Remove the pedestal cap (865) from pedestal base (866) by unscrewing the two socket head capscrews (not shown). Lift the pedestal cap squarely when removing.

2. Separate the upper cartridge half (867) from the lower cartridge half (868) by unscrewing the four socket head capscrews (not shown). Lift the upper half squarely to ease removal.

3. If replacement is necessary, go to the appropriate section in this manual.

4. Without any bearing disassembly, remove by hand as much of the old grease as possible from the lower housing half and bearing rollers.

5. Work new grease into all cavities of the bearing. To ensure complete greasing, work the grease from one side of the bearing until it appears on the opposite side all the way around.

6. Pack the reservoir in the lower housing half with grease to the maximum level equally on both sides. Depending on shaft speed and diameter, the inboard bearing is to be packed 75 to 100% with grease once reassembled.

7. Re-attach the upper housing half and pedestal cap. Torque all fasteners to the recommended values, ***Table 17**, page 76 or **Table 18**, page 77*.

CAUTION! Never assemble the bearing housing dry and inject grease after closing.

BEARING REPLACEMENT

SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable). Do not attempt any bearing removal without activating the tank shut-off feature, installing the shaft holding device (901), and securing the shaft with a shaft steady as described on page 54.

This section provides instructions for the removal, replacement and mounting of pillowblock bearings with split housing assemblies. To aid in this procedure, the agitator may be equipped with an optional split bearing. A split bearing allows removal and replacement from the shaft without the removal of the drive and other components.

NOTE: The mating surfaces of the bearing housing halves have been accurately machined to form a complete unit that prevents grease from escaping. They are not interchangeable with other similar split housing assemblies.

Tank Shut-Off Activation (optional feature)
*Refer to **Figure 18**, page 36.*

1. Back off three flange stud nuts (1367) but do not remove.

2. Evenly apply the proper torque *(**Table 9**, page 35)* to three jackscrews (1364) causing stuffing box housing (1329 or 1339) to move forward compressing the shut-off seal ring between the stuffing box and the shut-off collar (1360) thus activating the tank shut-off feature.

3. Slide the gland (1325) toward the drive or separate it completely from the shaft.

4. Install shaft holding device (901) in the gland location using the gland fasteners. Tighten the gland nuts to secure the shaft holding device against the face of the stuffing box housing.

5. Secure the shaft holding device to the shaft by tightening the halves together. This device will prevent shaft movement and maintain activation of the tank shut-off feature.

6. Complete activation of the tank shut-off feature will have effectively sealed the tank contents from leakage while servicing the bearings. If your agitator does not have this feature, drain the tank below the shaft centerline and install the shaft holding device as described in preceding steps 3, 4 and 5.

NOTE: Before servicing the bearings, holding the shaft concentric with the I.D. of the stuffing box housing is important. The shaft and impeller weight along with tank loads will force the shaft downward inside the stuffing box causing permanent damage to the components. Misalignment through the bearing centers will also make bearing replacement difficult.

Shaft Steady Installation

After activation of the tank shut-off feature, steadying the shaft from any upward movement is necessary. The purpose of the shaft steady is to maintain a true horizontal shaft position during bearing replacement by counteracting the cantilever effect caused by the weight of the impeller in the tank. Shaft support can be achieved with a block and tackle arrangement or the fabrication of a reusable service tool from mild steel, cut, split and drilled to suit the shaft and existing support base. We recommend an initial installation location close to the tank side of the outboard bearing.

NOTE: Blocking the shaft on the tank side of the inboard bearing to prevent any downward movement before servicing the inboard bearing is particularly important (split design only). This movement occurs if the tank shut-off feature has not been activated or a shaft holding device is not in place.

CAUTION! Improper installation of a shaft steady apparatus may damage the tank shut-off feature causing leakage and could also damage the stuffing box assembly.

Outboard Bearing Removal

*Refer to **Figure 24**, page 65.*

SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).

1. Disconnect and remove the drive assembly. *Refer to page 69 for instructions on belt drive disassembly.*

2. Remove the upper housing half (824) by unbolting it from lower housing half (827). Match mark housing to assure proper reassembly. Lift the upper half squarely when removing the upper housing.

3. Remove split double lip seals (825) or split triple seal rings (826) if applicable, by driving out the two pins that hold the seal halves together.

4. Using the appropriate pliers, open retaining rings (831) and move them from their groove and onto the shaft on either side of the adapter sleeve (822).

5. Release the taper lock of the adapter sleeve by lifting the lockwasher tang, backing off locknut (823) and driving it with a soft steel bar and mallet away from the tank. Although the adapter sleeve will likely be replaced, care should be taken to avoid damage to the surrounding parts.

6. Remove fixing ring (832 or 833) or rings depending on the shaft diameter, by positioning the gap of the ring downward and pulling the ring up. The spring movement of the ring will allow the gap to open and permit removal of the ring.

7. Unbolt the lower housing half and remove it from the mounting base by sliding it away from the tank and off the drive end of the shaft along with all other outboard bearing components. Retain locating key (829) used to position the lower housing half to the mounting base accurately.

NOTE: If the inboard bearing is not a split design and both bearings are being replaced together, the inboard bearing must be serviced while the outboard bearing is removed. Removal of both bearings will require manipulation of one or more shaft steady apparatus to maintain a true horizontal shaft position while removing old bearing components and positioning new components for replacement.

Inboard Bearing Removal (non-split bearing design)

*Refer to **Figure 25**, page 66.*

NOTE: Before removal of the inboard bearing be sure that all instructions for removal of the outboard bearing have been followed to simplify the removal of all inboard bearing components from the drive end of the shaft. Ensure that the instructions to activate the tank shut-off feature and the installation of a shaft steady have been followed.

1. Remove the upper housing half (844) of the outboard bearing by unbolting it from lower housing half (847). Match mark housing to assure proper reassembly. Lift the upper half squarely when removing the upper housing.

2. Remove split double lip seals (845) or split triple seal rings (846) if applicable, by driving out the two pins that hold the halves together.

3. Although the adapter sleeve will likely be replaced, care should be taken to avoid damage to the surrounding parts.

4. Unbolt the lower housing half from the mounting base. Slide it off the base toward the drive and allow it to drop down and away once clear. Slide all the inboard bearing components off the drive end of the shaft.

NOTE: The above procedure will require the manipulation of one or more shaft steady apparatus to maintain a true horizontal shaft position while removing old bearing components and positioning new components for replacement.

Inboard Bearing Removal (split bearing design)

*Refer to **Figure 26**, page 67.*

NOTE: Before removal of the inboard bearing be sure that all instructions to activate the tank shut-off feature and to install the shaft holding device have been followed. When dismantling the bearing, care must be taken in removing the individual parts to prevent damage to the housing and other surrounding parts.

SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).

1. Remove the pedestal cap (865) from pedestal base (866) by unscrewing the two socket head capscrews (not shown). Match mark housing to assure proper reassembly. Lift the pedestal cap squarely when separating apart.

2. Separate the upper cartridge half (867) from the lower cartridge half (868) by unscrewing the four socket head capscrews (not shown). Lift the upper half squarely when removing the upper housing.

3. Separate the split roller cage by removing the two spring loaded joining clips, or joining plates on larger bearing sizes, on either side of the cage. Remove the roller cage halves completely from the shaft and lower housing half.

4. Unscrew the capscrews that hold clamping rings (863) together and carefully separate from inner bearing race (864). Remove the split inner bearing race from the shaft.

5. Remove split triple seal rings (866) by driving out the two pins that hold the seal halves together.

6. Clean all foreign material and old grease from the shaft and pedestal base.

Note: All pillowblock agitators are equipped with a non-split shaft slinger on the tank side of the inboard bearing. If replacement of the non-split slinger, handling it the same as replacing a non-split inboard bearing will be necessary. We recommend the replacement of the shaft slinger, when necessary, for added inboard bearing protection from exposure to the wet environmental conditions.

Inboard Bearing Replacement (non-split bearing design)
*Refer to **Figure 25**, page 66.*

NOTE: Before replacing the inboard bearing, be sure that all instructions for outboard bearing removal have been followed, the tank shut-off feature is activated (if applicable) and the shaft steady is securely in place.

Before mounting the tapered bore spherical roller bearing to the adapter sleeve, check the initial internal radial bearing clearance. Radial clearance can be measured before or after the bearing is positioned on the adapter sleeve without tightening. On larger sizes (4-inch shafts and larger) the bearing should be supported by the shaft weight when measurements are taken.

Note: To obtain satisfactory bearing performance, it is important that strict cleanliness be observed during the replacement procedure.

1. Inspect housing halves (844 and 847) for foreign material and burrs. Remove and clean thoroughly along with the shaft and adjacent surfaces. Replace double lip seals (845) or triple seal rings (846).

2. The rust inhibiting compound should be left intact except in the bearing bore. Wash the bore with a solvent and dry it with a clean, lint-free rag. If the bearing has been hot dipped, removing the preservative before mounting is advisable. Such a bearing can be recognized by the thick coat of greasy preservative covering it.

3. Spray a dry powder film lubricant on the tapered OD surface and threads of the adapter sleeve (842) and the inside surface of lock nut (843). Lubrication will greatly reduce the force required when mounting to the shaft.

Caution: Do not apply this lubricant to the adapter sleeve bore or shaft. These surfaces must remain dry.

4. Position the adapter sleeve (842) along with the bearing and all other components in the correct order on the shaft, with the threaded end toward the tank. *Refer to the assembly drawing,* ***Figure 25****, page 66.*

5. Place the bearing components and the seal rings into lower housing half (847) by bringing the lower housing half up from underneath and sliding it together onto the agitator mounting base.

6. Bolt down the lower housing half onto the mounting base and torque the fasteners to the recommended values, ***Table 17****, page 76.*

7. Mount the bearing to the adapter sleeve while measuring the reduction of radial clearance with a feeler gauge during the drive up procedure. *Refer to "Bearing to Adapter Sleeve Mounting" page 61.*

8. The inboard bearing is a floating bearing to allow for shaft expansion. Ensure that it is centered inside the housing when adapter sleeve mounting is completed.

9. Once assembled, grease the bearing before closing the housing according to the instructions for replacing old grease*, page 51.*

10. Ensure that the mating surfaces of the split housing are thoroughly clean and free of burrs before closing. The bearing seat in the upper housing half should be checked for burrs and thoroughly cleaned. Oil and place equally over the bearing. The two dowel pins will align the upper housing half during assembly.

11. Fasten the housing halves with the cap bolts and lockwashers then torque to the recommended values, ***Table 17****, page 76 or* ***Table 18****, page 77.*

Inboard Bearing Replacement (split bearing design)

*Refer to **Figure 26**, page 67.*

NOTE: Before replacing the split inboard bearing, be sure that the tank shut-off feature is activated (if applicable) and the shaft steady is securely in place.

The split inboard bearing is a floating or expanding EX type cylindrical roller bearing. It allows for shaft expansion in the design between the roller cage and the outer bearing race.

Note: To obtain satisfactory bearing performance, it is important that strict cleanliness be observed during the replacement procedure.

1. Inspect the cartridge halves (868 and 868) for foreign material and burrs. Remove and clean thoroughly along with the shaft and abutment surfaces. Replace the triple seal rings (870).

2. Do not remove the new bearing from its original package until immediately before it is to be mounted. Any rust inhibiting compound should be left intact.

3. Assemble the split bearing to the shaft and pedestal base by reversing the previous removal procedure and following the detailed assembly instructions supplied with the new replacement bearing.

4. Apply a generous layer of grease between the mating surfaces of the assembled housing (867 and 868) and the pedestal halves (865 and 866). Lubrication will allow free housing mobility for bearing alignment.

5. When fitting the clamping ring halves (863) to the inner race (864), ensure that the joint between the clamps and inner race are 90 degrees apart from each other.

6. Ensure that the inner race is properly seated on the shaft for central alignment with the housing halves and pedestal base. Before torquing the screws holding the pedestal cap (865), rotate the shaft by hand until the bearing housing aligns itself. Follow the torque values specified with the bearing instructions when tightening the clamping rings.

7. Position the split triple seal rings (870) into the lower cartridge half (868) and assemble.

8. Grease the split bearing once assembled before closing the housing according to the appropriate instructions. *(See page 52, for instructions on replacing old grease in the inboard bearing-split design)*

Outboard Bearing Replacement
*Refer to **Figure 24**, page 65.*

NOTE: Before replacing the outboard bearing it is assumed that all instructions for bearing removal have been followed, the tank shut-off feature is activated (if applicable) and the shaft holding device is securely in place.

Before mounting the tapered bore spherical roller bearing to the adapter sleeve, check the initial internal radial bearing clearance. Radial clearance can be measured before or after the bearing is positioned on the adapter sleeve without tightening. On larger sizes(4-inch and larger) the bearing should be supported by the shaft weight when measurements are taken.

Note: To obtain satisfactory bearing performance, it is important that strict cleanliness be observed during the replacement procedure.

1. Inspect housing halves (824 and 827) for foreign material and burrs. Remove and clean thoroughly along with the shaft and adjacent surfaces. Replace double lip seals (825) or triple seal rings (826).

2. Do not remove the new bearing from its original package until immediately before it is installed. The rust inhibiting compound should be left intact except in the bearing bore. Wash the bore with a solvent and dry it with a clean, lint-free rag. If the bearing has been hot dipped, removing the preservative before mounting is advisable. Such a bearing can be recognized by the thick coat of greasy preservative covering it.

3. Spray a dry powder film lubricant on the tapered OD surface and threads of the adapter sleeve (822) and the inside surface of lock nut (823). Lubrication will greatly reduce the force required when mounting to the shaft.

Caution: Do not apply this lubricant to the adapter sleeve bore or shaft. These surfaces must remain dry.

4. Position the adapter sleeve along with the bearing and all other components in the correct order on the shaft, with the threaded end toward the tank. *Refer to the assembly drawing, **Figure 24**, page 65.*

5. Place the bearing components and the seal rings into the lower housing half (827) by bringing the lower housing half up from underneath and sliding it together onto the agitator mounting base.

6. Position the bearing and associated components on the shaft in their original location by returning the retaining rings (831) to the shaft grooves with the adapter sleeve between them.

7. Bolt down the lower housing half onto the mounting base and torque the fasteners to the recommended values ***Table 17****, page 76 or* ***Table 18****, page 77*.

8. Mount the bearing to the adapter sleeve while checking the reduction of radial clearance with a feeler gauge during the drive-up procedure. *Refer to "Bearing to Adapter Sleeve Mounting" page 42*.

9. Install fixing ring (832 or 833) or rings depending on the shaft diameter, by positioning the gap of the ring downward and pushing it over the shaft. The spring movement of the ring will allow the gap to open permitting installation.

10. Grease the bearing after assembling but before closing the housing, according to the appropriate instructions. *(See page 51 for instructions on replacing old grease.)*

11. Ensure that the mating surfaces of the split housing are thoroughly clean and free of burrs before closing. The bearing seat in the upper housing half should be checked for foreign material, burrs and thoroughly cleaned. Oil the mating surfaces and place housing evenly over the bearing. The two dowel pins will align the upper housing half during assembly.

12. Fasten the housing halves with the cap bolts and lockwashers then torque to the recommended values ***Table 17****, page 76 or* ***Table 18****, page 77*.

NOTE: When bearing maintenance and reassembly are complete, remove the shaft holding device and deactivate the tank shut-off feature by reversing the previous activation steps.

Bearing to Adapter Sleeve Mounting
Refer to ***Figure 25****, page 66 and* ***Figure 26****, page 67.*

It is common practice to mount self-aligning spherical roller bearings to the shaft using a tapered adapter sleeve. The inner ring of the bearing is mounted to the adapter sleeve with an interference fit. How much interference depends on how far the bearing is driven up the sleeve. During the drive-up, the unmounted radial internal clearance of the bearing will be reduced gradually as the inner ring expands. That reduction in internal clearance is a measure of the interference.

NOTE: Before mounting the tapered bore spherical roller bearing to the adapter sleeve it is important that all associated components of the bearing assembly are clean and free of any foreign material and burrs.

1. Measure the unmounted radial initial clearance of the bearing to establish a starting point for mounting the bearing to the adapter sleeve. Normally, this is done by setting the bearing on a bench and measuring total clearance at the top roller. Insert progressively larger feeler gauge blades the full length of the roller between the most vertical unloaded roller and the outer ring sphere. Slide the feeler blade through the clearance, do not roll it. Record the measurement of the largest size blade that will slide through. This size is the unmounted radial internal clearance.

2. Begin tightening locknut (823), chamfered face is toward the bearing, with a hook spanner wrench. Lubricate the locknut threads and face where it contacts with the bearing to make easer mounting.

NOTE: Larger size bearings (4-inch [102 mm] and larger) will require a heavy duty spanner wrench and sledge hammer to obtain the required reduction in radial internal clearance. Do not attempt to tighten the locknut with a cold chisel and hammer as inadequate tightening and damage will result.

3. Remeasure the internal radial clearance during the tightening of the locknut with the feeler blades inserted between the most vertical unloaded roller and the outer ring sphere. Continue this measuring and tightening procedure until the radial internal clearance is less than unmounted radial internal clearance by the amount shown in ***Table 11****, page 63*.

4. When the desired reduction of internal radial clearance is achieved, tighten the locknut just enough to bend over the lockwasher tang into the nearest locknut slot. Do not loosen the locknut, but tighten to meet a washer tang.

   Example: Determine the amount to reduce the radial internal clearance for a 3 inch (76.2 mm) diameter shaft mounting.

   A) Unmounted radial internal clearance from Step 1 equals 0.004 inch (0.102 mm).

   B) Reduction in radial internal clearance from ***Table 11*** equals 0.0018 inch min. / 0.0024 inch max. (0.045 mm min. / 0.061 mm max.).

   C) Final mounted radial internal clearance equals 0.0016 inch (0.041 mm) minimum to 0.0022 inch (0.57 mm) maximum.
   (0.004 inch - 0.0024 inch = 0.0016 inch minimum)

[0.102 mm - 0.061 mm = 0.041 mm minimum]
(0.004 inch - 0.0018 inch = 0.0022 inch maximum)
[0.102 mm - 0.045 mm = 0.57 mm maximum]

Table 11: Reduction in Radial Internal Clearance

This table contains guideline values for the reduction in radial internal clearance and axial drive-up for the inboard spherical roller bearing with tapered bore. These values are measured at normal ambient temperature and zero measuring load before mounting.

AGITATOR SHAFT DIAMETER (Inches)	BEARING BORE DIAMETER (mm)	RADIAL INTERNAL CLEARANCE BEFORE MOUNTING (Inches)		REDUCTION IN RADIAL INTERNAL CLEARANCE (Inches)		AXIAL DRIVE-UP (Inches)		RESIDUAL CLEARANCE AFTER MOUNTING (Inches)
		MIN	MAX	MIN	MAX	MIN	MAX	MINIMUM
2.0	55	0.0022	0.0030	0.0012	0.0015	0.018	0.024	0.0010
3.0	85	0.0032	0.0044	0.0018	0.0024	0.027	0.035	0.0014
4.0	110	0.0039	0.0053	0.0020	0.0028	0.030	0.045	0.0020
5.0	140	0.0047	0.0063	0.0026	0.0035	0.045	0.055	0.0022
6.0	170	0.0055	0.0079	0.0030	0.0045	0.050	0.070	0.0024
7.0	200	0.0063	0.0088	0.0035	0.0050	0.055	0.080	0.0028

Table 12: Reduction in Radial Internal Clearance (Metric Dimensions)

This table contains guideline values for the reduction in radial internal clearance and axial drive-up for the inboard spherical roller bearing with tapered bore. These values are measured at normal ambient temperature and zero measuring load before mounting.

AGITATOR SHAFT DIAMETER (Inch) [mm]	BEARING BORE DIAMETER (mm)	RADIAL INTERNAL CLEARANCE BEFORE MOUNTING (mm)		REDUCTION IN RADIAL INTERNAL CLEARANCE (mm)		AXIAL DRIVE-UP (mm)		RESIDUAL CLEARANCE AFTER MOUNTING (mm)
		MIN	MAX	MIN	MAX	MIN	MAX	MINIMUM
2.0 [50.8]	55	0.056	0.076	0.030	0.038	0.48	0.61	0.025
3.0 [76.2]	85	0.081	0.112	0.045	0.061	0.69	0.89	0.036
4.0 [101.6]	110	0.099	0.135	0.051	0.071	0.76	1.14	0.051
5.0 [127.0]	140	0.119	0.160	0.066	0.089	1.14	1.40	0.056
6.0 [152.4]	170	0.140	0.200	0.076	0.114	1.27	1.78	0.061
7.0 [177.8]	200	0.160	0.224	0.089	0.127	1.40	2.03	0.071

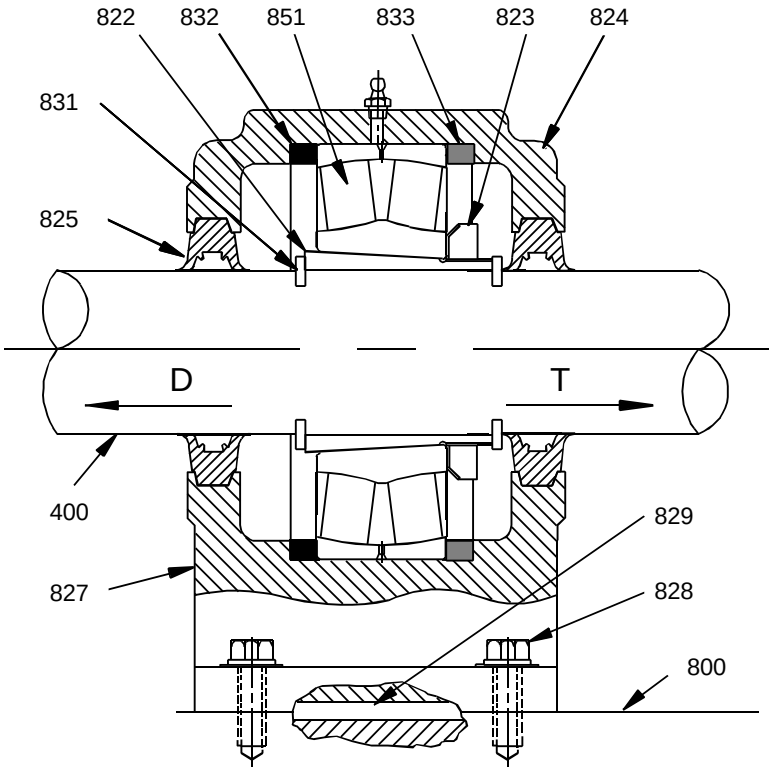


Figure 24: Outboard Bearing (non-split design)

Item	Description	Item	Description
400	Shaft	828	Capscrew and Washer
800	Base Plate	829	Locating Key
822	Adapter Sleeve-Out. Brg.	831	Retaining Ring
823	Locknut and Washer	832	Fixing Ring
824	Upper Housing Half	833	Fixing Ring (optional)
825	Double Lip Seal	851	Outboard Bearing
827	Lower Housing Half		
D	Drive	T	Tank

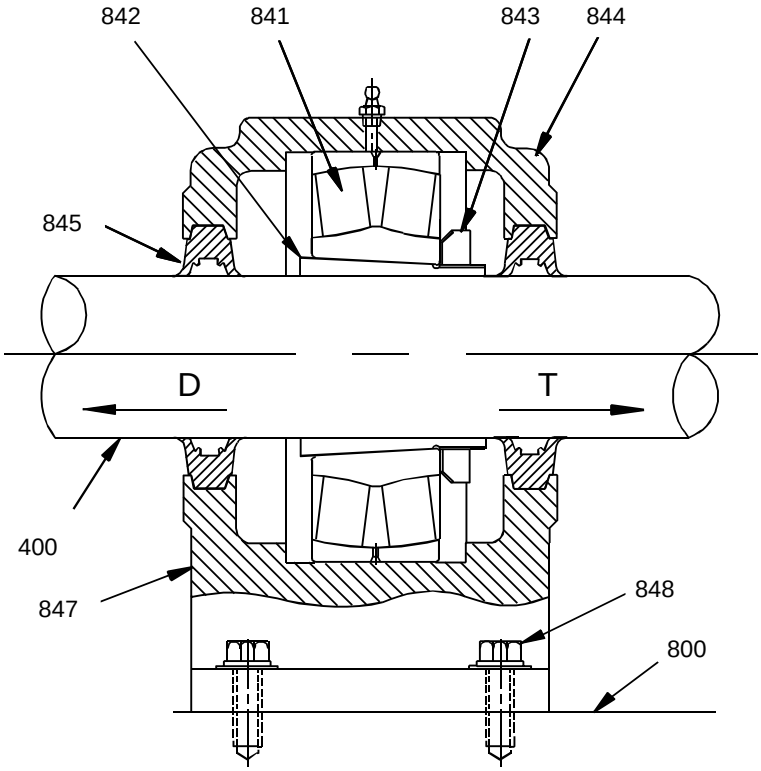


Figure 25: Inboard Bearing (non-split design)

Item	Description	Item	Description
800	Base Plate	845	Double Lip Seal
841	Inboard Bearing	846	Triple Seal Ring (optional)
842	Adapter Sleeve-Inb. Brg.	847	Lower Housing Half
843	Locknut and Washer	848	Capscrew and Washer
844	Upper Housing Half		
D	Drive	T	Tank

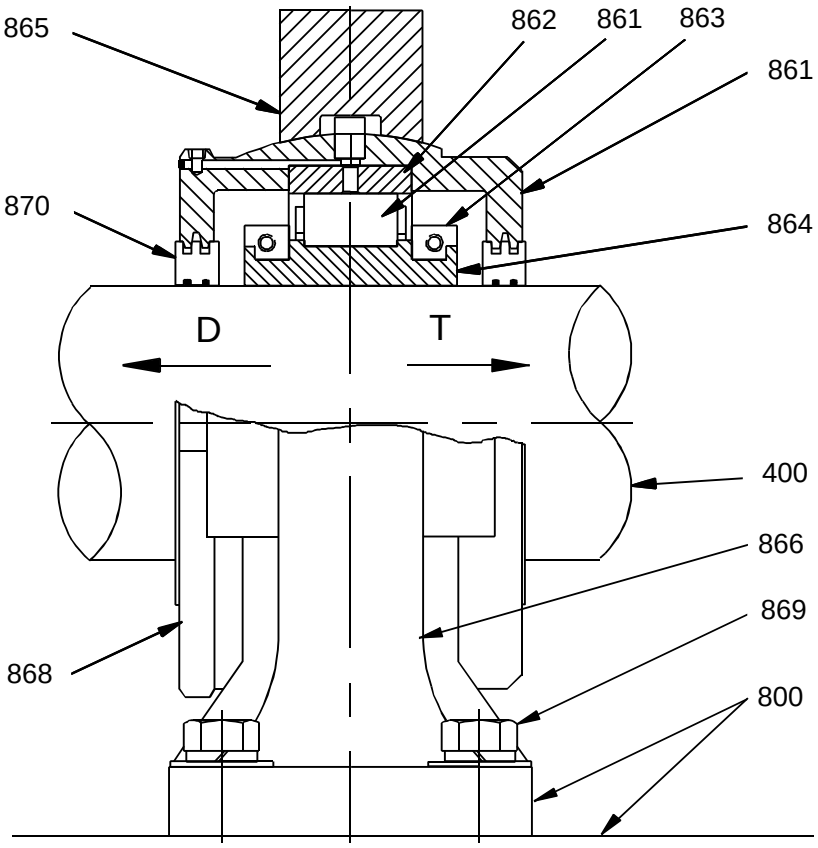


Figure 26: Inboard Bearing (split design)

Item	Description	Item	Description
800	Base Plate	866	Triple Seal Ring (2)
861	Inboard Bearing	867	Upper Cartridge Half
862	Outer Bearing Race	868	Lower Cartridge Half
863	Clamping Ring (2)	869	Capscrew and Washer
864	Inner Bearing Race		
865	Pedestal Cap		
D	Drive	T	Tank

BELT DRIVE

Checking Belt Tension

*Refer to **Figure 27**, page 70.*

> ***SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).***

NOTE: Do not apply belt dressing during the tensioning procedure as dressing will damage the belts and cause early failure.

Without exception, the most important factor in the successful operation of a belt drive is proper belt tensioning. To achieve the long, trouble-free service associated with belt drives, the belt tension must be sufficient to overcome slipping under maximum peak loads. The general method to increase the tension of the belt drive is to increase the center distance between the two sheaves.

1. Unbolt and slide the metal mesh on the side of the belt guard cover, allowing access to check the belt condition and tension. If excessive belt wear is evident, replace all belts as a complete set. *See page 69 for instructions on belt replacement.*

2. Check the tension of belts by measuring the deflection force using a tensiometer or equivalent spring scale. Apply a perpendicular force to any one of the belts or belt at the mid point of the span length, ***Figure 27**, page 70*.

3. Observe the force required to deflect any one belt 1/64 inch for every inch (16 mm/meter) of span length. For example, the deflection for a 32 inch (820 mm) span would be 1/64 inch x 32 inch (16 mm/meter x 0.82 meter), which equals ½ inch (13 mm) of deflection.

4. Achieve correct belt deflection by increasing or decreasing the sheave center distance using the adjustable motor support base. The correct operating tension for a V-belt drive (if applicable) is the lowest tension at which the belts will not slip under peak load conditions.

Belt Replacement

SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).

NOTE: Keep all new belts together as a set, separate from other belts. Mixing new and old belts during replacement may result in a loss of power transmitting capability.

1. Remove the belt guard cover from the supporting back panel.

2. Reduce the center distance between the sheaves by lowering the motor with the adjustable motor support base. Remove all the belts from the sheaves.

3. Make sure the motor shaft remains parallel with the agitator shaft and tightly secured to the mounting base. Shimming the motor may be required to correct any motor shaft to agitator shaft parallel misalignment.

4. Check that the sheaves remain properly aligned when installed. V-belts can tolerate only up to 1/32 inch per foot (2.6 mm/meter) of center distance misalignment. Use a straight edge to help obtain proper alignment

5. Place the belts over the sheaves and in the grooves without forcing them over the sides of the grooves. Arrange the belts so all have about the same amount of sag before tensioning.

6. Apply tension to the belts by increasing the center distance until the belts are snug. Increased center distance is achieved by raising the motor with the adjustable motor support base. Operate the agitator drive for a few minutes to seat the belts in the sheave grooves.

7. Stop the drive and tension the belts to the maximum deflection force recommended, *see **Table 13** and **Table 15***. Measure the deflection value using a tensiometer or equivalent spring scale. Apply a perpendicular force to any one belt at the mid point of the span, ***Figure 27**, page 70*.

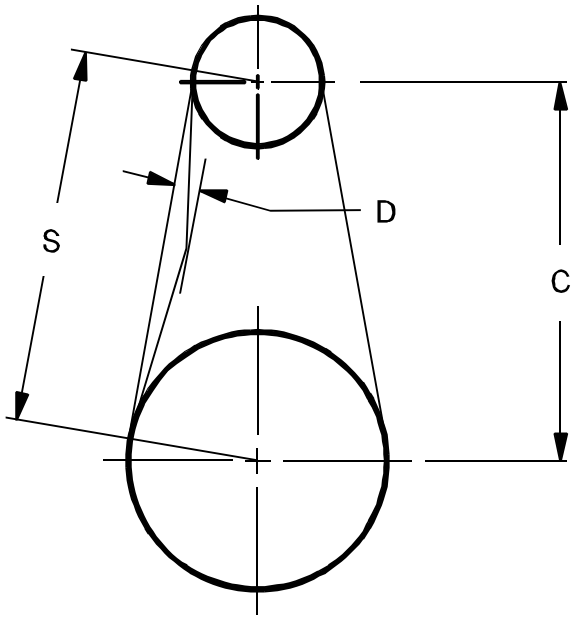


Figure27: Belt Tensioning

Item	Description	Item	Description
C	Center Distance	S	Span Length
D	Deflection		

8. Achieve correct belt deflection by increasing or decreasing the sheave center distance using the adjustable motor support base. The correct operating tension for a V-belt drive (if applicable) is the lowest tension at which the belts will not slip under peak load conditions.

Check the tension on the new belt drive at least twice during the first day of operation and adjust as required. Normally, a rapid decrease in belt tension will occur until belts have run in. After a few days of operation the belts will seat themselves in the sheave grooves and it may become necessary to readjust the tension again.

Table 13: Recommended Deflection Force per Belt - Ultra-V Belts

Force required to deflect any one of the belts 1/64 inch for every inch (16 mm/m) of span length.

ULTRA-V BELTS						
BELT SECTION	SMALL SHEAVE DIAMETER (inch)	SMALL SHEAVE DIAMETER (mm)	DEFLECTION FORCE			
			MINIMUM (lbs)	MINIMUM (N)	MAXIMUM (lbs)	MAXIMUM (N)
3V	2.65 - 3.65	67.3 - 92.7	3.5	15.6	5.5	24.5
	4.75 - 6.90	121 - 175	5.0	22.2	7.5	33.4
5V	7.1 - 9.0	180 - 229	11.0	49.0	16.0	71.2
	14.0 - 21.2	356 - 539	13.0	57.8	19.5	86.8
8V	12.5 - 17.0	318 - 432	27.0	120.1	40.5	180.2
	21.2 - 24.8	538 - 630	30.0	133.5	45.0	200.2

Table 14: Recommended Deflection Force per Belt - Ultra-V Cog Belts

Force required to deflect any one of the belts 1/64 inch for every inch (16 mm/m) of span length.

ULTRA-V COG BELTS						
BELT SECTION	SMALL SHEAVE DIAMETER (inch)	SMALL SHEAVE DIAMETER (mm)	DEFLECTION FORCE			
			MINIMUM (lbs)	MINIMUM (N)	MAXIMUM (lbs)	MAXIMUM (N)
3VX	2.2 - 3.0	55.9 - 76.2	4.0	17.8	6.0	26.7
	4.12 - 6.90	105 - 175	5.5	24.5	8.0	35.6
5VX	4.4 - 5.2	112 - 132	10.0	44.5	15.0	66.8
	6.3 - 7.1	160 - 180	12.0	53.4	18.0	80.1
	9.0 - 14.0	229 - 356	15.0	66.8	22.0	97.9

Table 15: Recommended Deflection Force per Belt - HTD Belts

Force required to deflect any one of the belts 1/64 inch for every inch (16 mm/m) of span length.

HTD BELTS					
PITCH	BELT WIDTH	DEFLECTION FORCE			
		MINIMUM (lbs)	MINIMUM (N)	MAXIMUM (lbs)	MAXIMUM (N)
5 mm	15 mm	1	4	2	9
	25 mm	1.5	7	3	13
8 mm	20 mm	2	9	4	18
	30 mm	3	13	6	27
	50 mm	6	27	11	49
	85 mm	10	44	19	85
14 mm	40 mm	5	22	11	49
	55 mm	8	36	16	71
	85 mm	13	58	26	116
	115 mm	19	85	27	128
	170 mm	29	129	58	258
20 mm	115 mm	28	125	56	249
	170 mm	43	191	86	383
	230 mm	60	267	120	534
	290 mm	76	338	150	668
	340 mm	90	400	180	801

SHEAVE REPLACEMENT

SAFETY CAUTION!! To Avoid Possible Injury, Turn Off the Agitator. Lock out and disconnect all power to the drive motor and any optional devices. Turn off and disconnect the lubricant supply and flushing water to the stuffing box (if applicable).

1. Remove the belt guard cover from the supporting back panel.

2. Reduce the center distance between the sheaves by lowering the motor with the adjustable motor support base. Remove all the belts from the sheaves.

3. Check the condition of the belts and replace (as a complete set only), if required. *See Belt Replacement on page 69.*

4. Note the mounting orientation of the sheave bushing flanges to decide if the sheaves have standard mounting (Flange-In) or reverse mounting (Flange-Out). This observation is important to ensure that the same mounting orientation is repeated after the sheave(s) has been replaced, ***Figure 28***.

Dismounting Flange-In Hub
*Refer to **Figure 28**.*

1. Remove the sheave(s) from the bushing by removing the connecting fasteners and inserting them into the threaded jacking screw holes (A) in the sheave hub.

2. Tighten the fasteners equally against the bushing flange to break the grip of the split "QD" bushing on the shaft and allow the sheave to slide off freely. No wheel puller or heavy tool is necessary to remove the sheave.

3. Loosen the setscrews in the bushing over the key. Remove the bushing from the shaft.

4. Install the new sheave and/or bushing as required by following the Belt Drive Installation instructions, *page 18*.

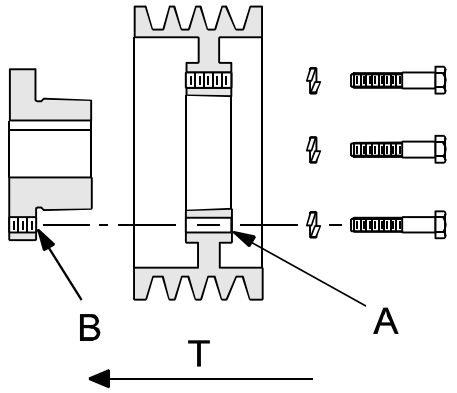


Figure 28: Hub Flange-In Dismounting

A	Clearance Holes
B	Threaded Holes
T	Tank Side

Dismounting Flange-Out Hub
*Refer to **32**, **Figure 29**.*

1. Remove the sheave(s) from the bushing by removing the connecting fasteners and inserting them into the threaded jacking screw holes (A) in the bushing flange.

2. Tighten the fasteners equally up against the bushing flange to break the grip of the split "QD" bushing on the shaft and allow the sheave to slide off freely. No wheel puller or heavy tool is necessary to remove the sheave.

3. Loosen the setscrews in the bushing over the key. Remove the bushing from the shaft.

4. Install the new sheave and/or bushing as required by following the Belt Drive Installation instructions, *page 18*.

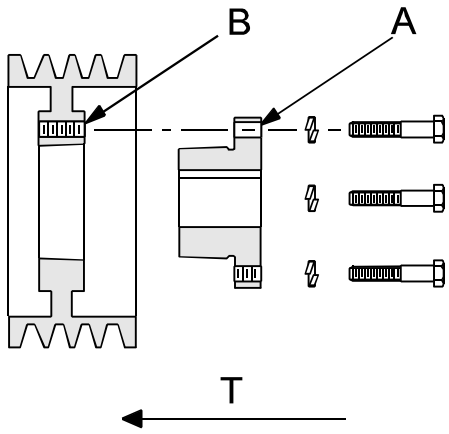


Figure 29: Hub Flange-Out Dismounting

A Clearance Holes
B Threaded Holes
T Tank Side

Table 16: Torque Values - "QD" Style Bushings

Use this table to determine the proper torque to apply to the capscrews when engaging the sheave bushings.

BUSHING TYPE	CAPSCREW	TORQUE (ft. lbs.)	TORQUE (N·m)
JA	#10-24 UNC	5	7
SH, SDS, SD	1/4-20 UNC	9	12
DK	5/16-18 UNC	15	20
SF	3/8-16 UNC	30	41
E	1/2-13 UNC	60	81
F	9/16-12 UNC	75	102
J	5/8-11 UNC	135	183
M	3/4-10 UNC	225	305
N	7/8-9 UNC	300	407
P	1-8 UNC	450	610
W	1 1/8-7 UNC	600	814
S	1 1/4-7 UNC	750	1017

Use ***Table 17***, *page 76 or* ***Table 18***, *page 77*. as a guide to decide the proper torque when tightening the fasteners on your equipment. Torque values listed are in both foot pounds (ft-lbs) and Newton meters (N·m). Values are based on fasteners with lubricated threads. When fasteners cannot be lubricated, multiply values by 1.33.

Table 17: Recommended Bolt Torque Values

Bolt Size	CARBON STEEL[3]				300 Series Stainless Steel, Alloy 20, Monels, Inconels, & Hastelloys B & C[4]	
	Grade 2		Grade 5			
	ft-lb	N·m	ft-lb	N·m	ft-lb	N·m
8-32	1.2	1.6	1.9	2.5	1.2	1.6
10-24	1.7	2.3	2.7	3.6	1.7	2.3
10-32	1.9	2.6	3.1	4.1	1.9	2.6
1/4-20	4.1	5.6	6	8.1	4.1	5.6
5/16-18	8.3	11	13	17	8.3	11
5/16-24	-	-	14	19	-	-
3/8-16	15	20	23	31	15	20
3/8-24	-	-	26	36	-	-
1/2-13	38	51	56	76	38	51
1/2-20	-	-	68	92	-	-
5/8-11	68	92	113	153	68	92
5/8-18	-	-	135	161	-	-
3/4-10	120	163	200	271	120	163
3/4-16	-	-	225	305	-	-
7/8-9	105	143	296	401	182	247
1-8	165	224	443	601	273	370
1!1/8-7	225	305	596	808	386	523
1!1/4-7	315	428	840	1139	545	739
1!3/8-6	417	566	1103	1495	715	969
1!1/2-6	555	752	1463	1983	948	1286
1-3/4-5	825	1118	2175	2948	1411	1912

(1) Tighten all fasteners to values shown in the table unless specifically instructed to do otherwise.
(2) Lubricate all fasteners at assembly with grease, oil or an anti-seize material. Bolt threads and contact surfaces of bolt heads and nuts should be lubricated.
(3) If fasteners cannot be lubricated, multiply table values by 1.33.
(4) If fasteners cannot be lubricated, multiply table values by 1.25.

Table 18: Recommended Bolt Torque Values - Metric Fasteners

Bolt Size (mm)	**CARBON STEEL**[3]				300 Series Stainless Steel, Alloy 20, Monels, Inconels, & Hastelloys B & C[4]	
	Grade 2		Grade 5			
	ft-lb	N·m	ft-lb	N·m	ft-lb	N·m
4 X 0.7	1.2	1.6	1.9	2.6	1.2	1.6
5 X 0.8	2.2	3.1	3.7	5	2.2	3.1
6 X 1	3.7	5.1	5.5	7.5	3.7	5.1
8 X 1.25	9	12	14	19	9	12
10 X 1.5	18	24	28	37	18	24
12 X 1.75	33	44	48	66	33	44
16 X 2	73	100	122	166	73	100
20 X 2.5	143	194	238	323	143	194
24 X 3	140	190	377	512	232	315
30 X 3.5	269	365	713	966	461	626
36 X 4	471	638	1246	1690	808	1095
42 X 4.5	755	1024	1992	2701	1291	1750
48 X 5	1133	1537	2989	4052	1936	2626
56 X 5.5	1826	2477	4815	6529	3120	4231
64 X 6	2756	3737	7265	9815	4708	6383

(1) Tighten all fasteners to values shown in the table unless specifically instructed to do otherwise.
(2) Lubricate all fasteners at assembly with grease, oil or an anti-seize material. Bolt threads and contact surfaces of bolt heads and nuts should be lubricated.
(3) If fasteners cannot be lubricated, multiply table values by 1.33.
(4) If fasteners cannot be lubricated, multiply table values by 1.25.

Use ***Table 19*** as a guide when sourcing bearing lubricants for Prochem mixers. Some of these lubricants are of the EP type and may contain toxic substances not allowed in the food processing industry. Check with lubricant manufacturer for approval.

Table 19: Compatible Bearing Lubricants

Manufacturer	Lubricant
Amoco Oil Co.	Amolith Grease No.2
Ashland Oil, Inc.	Multilube Lithium Grease
Atlantic Richfield Co.	Litholine H EP 2 Grease
Castrol	Spheerol AP2
Chevron U.S.A., Inc.	Industrial Grease Medium
Cities Service Co.	Premium Lithium Grease No.2
Conoco Inc.	EP Conolith Grease No.2
Esso	Beacon 2
Exxon Company, USA	Unirex N2
Gulf Oil Corp.	Gulfcrown Grease No.2
Gulf Canada Limited	Gulfcrown Medium
E.F. Houghton & Co.	Cosmolube 2
Imperial Oil Ltd.	Unirex N2L
Kendall Refining Co.	Multi-Purpose Lithium Grease L-421
Keystone Div Pennwalt Corp.	81 Light
Mobil Oil Corp.	Mobilux 2
Phillips Petroleum Co.	Philube IB and RB
Quaker State	Multi-Purpose Lithium NLGI No.2
Shell Oil Co.	Alvania Grease 2
Shell Canada Limited	Alvania Grease R2
Skf Canada Limited	LGEP 2
Standard Oil Co.	Factogard EP2
Sun Oil Co.	Prestige 42 Grease
Texaco Inc.	Premium RB Grease
Texaco Canada Inc.	Marfak MP2
Union Oil Co.	Unoba Ep

ALIGNING THE AGITATOR

Pillow Block agitators are assembled at the factory, pre-aligned through the stuffing box/mounting flange and shaft. No additional alignment should be necessary unless equipment damage has occurred or the support structure and/or the tank foundation has moved over time causing misalignment. Realignment is also necessary when installing major replacement components such as shafts and stuffing boxes. Agitator alignment is necessary to achieve concentricity of the shaft, or shaft sleeve, with the stuffing box bore and perpendicularity of the shaft to the face of the stuffing box housing. The following steps are necessary to achieve proper agitator alignment.

1. Ensure that the tank has been drained to the required level below the agitator nozzle (905).

2. Remove the gland (1325), gland studs/nuts (1322 and 1323) and all other seal components from inside the stuffing box housing, ***Figure 19****, page 42 and* ***Figure 20****, page 43.*

3. Check the shaft to stuffing box perpendicularity by clamping a small dial indicator (910) to the shaft as shown in ***Figure 30***. Take readings on the stuffing box housing (1320 or 1330) face at four equally spaced positions by turning the shaft by hand. The total indicated reading (T.I.R.) must not exceed 0.010 inch (0.25 mm), excluding surface irregularities.

4. If the total indicated reading exceeds the limits adjust the level of the baseplate (800) by backing off the hold down nuts (911) and shim as required until the variance of the readings fall within the limit. The same result can also be achieved by adjusting the leveling nuts or leveling bolts if applicable.

5. Using inside calipers (914) or feelers, measure the distance between the shaft and shaft sleeve. The stuffing box housing bore (1329 or 1339) at four equally spaced positions. Variation of these measurements must not exceed 0.010 inch (0.25 mm), ***Figure 31****, page 81*.

6. Set the shaft to stuffing box concentricity within the 0.010 inch (0.25 mm) limit by unfastening the two positioning bolts (920) that connect the stuffing box flange (1320 or 1330) to the agitator frame. Allowing free movement before making this adjustment may be necessary to back-off all of the nozzle/wall insert fastening nuts.

When the shaft or shaft sleeve is concentric with the stuffing box housing bore and perpendicular to the stuffing housing face, retighten the hold down nuts to the recommended torque values, ***Table 17****, page 76 or* ***Table 18****, page 77*. Double check the agitator alignment before continuing. Reinstall all the stuffing box components. *See repacking procedure, page 39.*

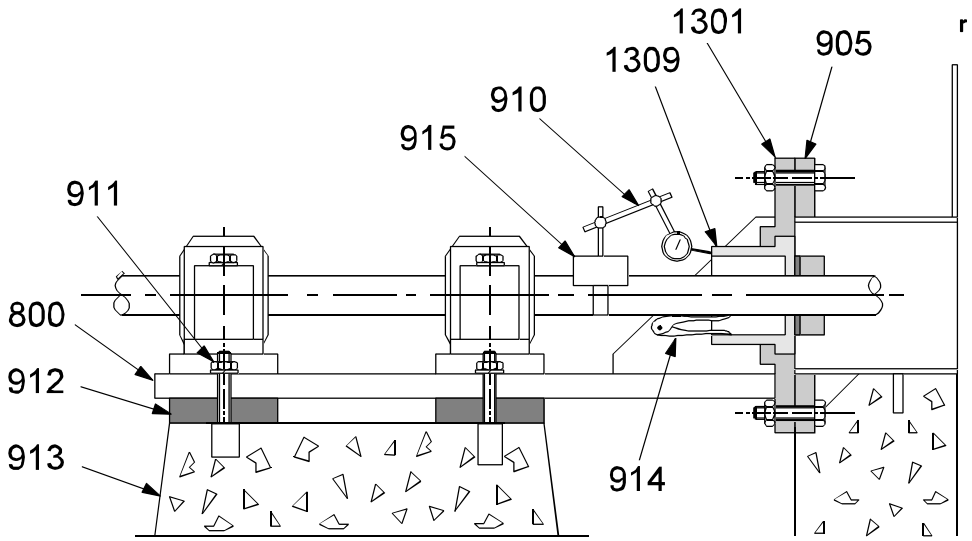


Figure 30: Perpendicular Alignment

Item	Description	Item	Description
800	Baseplate	913	Support Base
905	Wall Insert or Nozzle	914	Calipers
910	Dial Indicator	915	Vee Block
911	Hold Down Nut & Anchor	1301	Stuffing Box Flange
912	Hard Shims and/or Grout	1309	Stuffing Box Housing

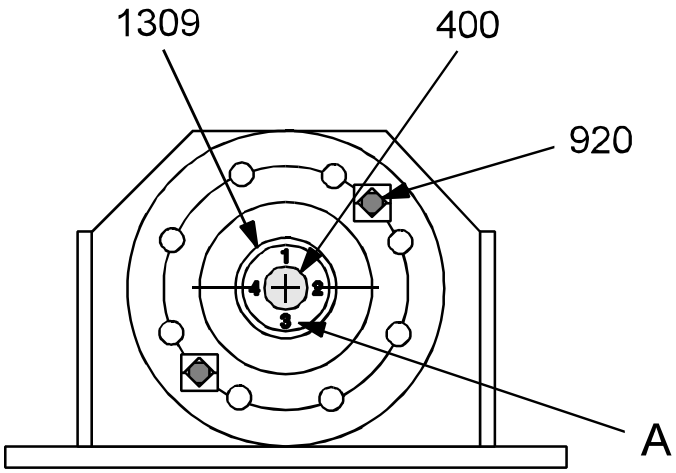


Figure 31: Concentric Alignment

Item	Description	Item	Description
400	Shaft	1309	Stuffing Box Housing
920	Positioning Bolts		
A	Numbers represent measurement locations.		

TROUBLESHOOTING

The troubleshooting guide has been divided into a series of tables dealing with different problem areas to be as concise and complete as possible.

Table 20: Troubleshooting - Electric Motor

OBSERVATION	POSSIBLE CAUSE	ACTION
Motor won't start	Usually line trouble - single phasing at starter	Check source of power supply.
	Improper connection	Check connections with diagram.
	Load too heavy	Disconnect motor from agitator to see if it starts without load.
Excessive hum	High voltage	Check input voltage.
		Check connections.
Regular clicking	Foreign matter in air gap	Take out rotor; remove matter.
Rapid knocking	See bearing guide	-----
Motor overheating (Check with thermometer don't depend on hand)	Overload	Measure load. Check for excessive friction in motor, drive, or machine. Potential process problem - contact Chemineer. Do not reduce the load or replace motor with one of greater capacity without first consulting Chemineer.
	Single phase	Check current, all phases.
	Dirt in motor	Check air flow at ventilation ducts. Blow out motor. Use solvent on wound section if necessary.
	Unbalanced voltage	Check voltage, all phases.
	Rotor rubbing on stator	Check alignment. Clean air gap. Check and replace bearings, as necessary.

Table 20: Troubleshooting - Electric Motor (continued)

OBSERVATION	POSSIBLE CAUSE	ACTION
Motor overheating (cont.) (Check with thermometer don't depend on hand)	Open stator windings	Disconnect motor from load. Check idle amps balance in all three phases. Check stator resistance in all three phases for balance.
	Open voltage	Check voltage.
	Grounding (short circuiting)	Locate with test lamp and repair.
	Improper connections	Recheck connections.

Table 21: Troubleshooting - V-Belt Drive

OBSERVATION	POSSIBLE CAUSE	ACTION
Rapid belt wear	Worn sheave grooves	Inspect sheave grooves. Replace if necessary.
	Mismatched belts	Replace with matched set.
	Belts slipping	Apply correct tension (use tensiometer).
	Improper installation	Replace belts - install properly.
	Improper belt storage	Replace belts.
	Sheave misalignment	Realign sheaves.
	Shock loads from process	Contact Chemineer.
	Foreign objects in drive	Provide drive shroud.
Belt turned over	Broken cord in belt, due to improper installation	Replace belts - install properly.
	Impulse loads	Apply proper tension.
	Misalignment of sheave and shaft	Realign drive.
	Worn sheave grooves	Replace sheave grooves.
	Loose belts	Tighten belts.
	Excessive belt vibration	Check alignment.
		Check equipment for solid mounting.

Table 21: Troubleshooting - V-Belt Drive (continued)

OBSERVATION	POSSIBLE CAUSE	ACTION
Belts slipping	Insufficient tension	Increase tension.
	Worn sheave grooves	Inspect sheave grooves, replace if necessary.
Belt Squealing	Insufficient tension	Increase tension.
	Belt bottoming grooves	Replace sheave and/or belts.
	Heavy starting load	Investigate load source and contact Chemineer.
Checked or cracked belts	Excessive heat due to slippage	Replace belts and apply correct tension.
	Excessive ambient temperature	Improve ventilation.
Mismatched belts	Sheave grooves worn unevenly; Improper groove angle. Give appearance of mismatched belts.	Replace sheaves, belt set and align.
	Sheave shafts not parallel. Give appearance of mismatched belts.	Align drive.
Hot bearings	Excessive tension	Apply correct tension.
	Excessive heat due to slippage	See belt slippage.

Table 22: Troubleshooting - Stuffing Box

OBSERVATION	POSSIBLE CAUSE	ACTION
No leakage at start-up	Packing gland too tight on packing in stuffing box	Back off gland to encourage generous leakage.
Excessive leakage at start-up	Incorrect size packing	Install correct size packing.
	Incorrect installation	Install packing in accordance with instructions and diagrams outlined in manual.
Packing rings flat-tened out on I.D. under the shaft	Shaft misalignment	Realign shaft and repack stuffing box.
	Bent shaft	Check run out at stuffing box and shaft end. Refer to Chemineer with results.
	Worn bearings	Check bearings and replace if necessary.
	Unbalanced impeller	Check impeller for damage.
Sealing face of rings are dried up and charred, while the rest of the packing remains in good condition	High temperature with lack of lubricants	Increase lubrication. Select packing with a higher heat conductivity. Reduce gland follower pressure to a minimum. Repack stuffing box.

Table 22: Troubleshooting - Stuffing Box (continued)

OBSERVATION	POSSIBLE CAUSE	ACTION
Torn packing	Burns on sleeve	Check shaft sleeve. Replace if necessary.
	In contact with abrasive medium	Clean fluid lubrication/flushing required. Abrasion resistant packing may be considered.
Packing hardens	See burned rings	----
Unexplained leakage	Leakage may be from under shaft sleeve sealing) - rings missing or damaged	Replace sleeve seal under sleeve.
Distinct bulge on side of ring	Adjacent rings cut too short	Cut rings to precise dimensions on shaft or mandrel having the same diameter.
One or more rings missing from the bottom of the set	Bottom of the stuffing box badly worn and packing is being extruded into system	Install neck bushing to prevent extrusion or use end rings of adequate densities to prevent extrusion into system.
Gland end rings in poor condition, bottom rings O.K.	Improper installation	Install packing in accordance with instructions and diagrams outlined in manual.
Rings extruding past gland follower	Excessive gland pressure	Reduce gland follower pressure.

Table 23: Troubleshooting - Bearings

OBSERVATION	POSSIBLE CAUSE	ACTION
Overheating bearing	Wrong type of grease or oil causing break-down of lubricant	Consult reliable lubricant manufacturer for proper type of lubricant.
	Inadequate amount of lubricant	Consult reliable lubricant manufacturer for proper amount of lubricant.
	Excessive amount of lubricant	Clean and repack bearing with correct amount of lubricant.
	Excessive distortion of the housing	Check and scrape housing bore to relieve pinching of bearing. Be sure pedestal surface is flat. Ensure that shims cover the entire area of pillowblock base.
	Adapter tightened	Loosen locknut and sleeve assembly. Retighten, but be sure that bearing turns freely.
	Housing bore too large	Replace housing with one having proper size.
	Incorrect linear or angular alignment of two or more shafts with two or more bearings	Shim housing bases. Be sure that shafts are coupled in a straight line.
	Prong rubbing against bearing	Remove lockwasher. Straighten prong or replace with a new washer.
Hard turning of shaft	Wrong type of grease or oil causing break-down of lubricant	Consult reliable lubricant manufacturer for proper type of lubricant.
	Inadequate amount of lubricant	Consult reliable lubricant manufacturer for proper amount of lubricant.
	Excessive amount of lubricant	Check and repack with correct amount of lubricant.
	Excessive distortion of housing	Check and scrape housing bore to relieve pinching of bearing. Be sure pedestal surface is flat. Ensure that shims cover the entire area of pillowblock base.

Table 23: Troubleshooting - Bearings (continued)

OBSERVATION	POSSIBLE CAUSE	ACTION
Hard turning of shaft (contd.)	Adapter tightened excessively	Loosen locknut and sleeve assembly. Retighten, but be sure that bearing turns freely.
	Foreign matter in housing	Clean out bearing housing. Replace worn-out seals, or improve seal design to obtain adequate protection of bearings.
	Corrosive agents entering the bearing housing	Addition of a shroud or flinger to throw off foreign matter.
	Distortion of out housing and ring. Pinching of bearing.	Remachine housing fillet to obtain proper support.
	Distortion of shaft and inner ring. Uneven expansion of bearing inner ring.	Remachine shaft fillet to obtain proper support.
	Inadequate support in housing causing cocking of outer ring	Remachine housing fillet to relieve stress. May require shoulder collar.
	Inadequate shoulder support causing bending of shaft	Remachine shaft fillet to relieve stress. May require shoulder collar.
Noisy bearing	Wrong type of grease or oil causing break-down of lubricant	Consult reliable lubricant manufacturer for proper type of lubricant.
	Insufficient amount of lubricant	Consult reliable lubricant manufacturer for proper amount of lubricant.
	Foreign matter in housing	Clean out housing. Replace worn-out seals, or improve seal design to obtain adequate protection of bearings.
	Corrosive agents entering the bearing housing	Addition of a shroud or flinger to throw off foreign matter.
	Excessive distortion of housing	Check and scrape housing to relieve pinching of bearing. Be sure pedestal surface is flat. Ensure that shims cover the entire area of pillowblock base.

Table 23: Troubleshooting - Bearings (continued)

OBSERVATION	POSSIBLE CAUSE	ACTION
Noisy bearing (cont.)	Shaft diameter too small	Metallize shaft and regrind to obtain proper fit.
	Adapter not tightened sufficiently	Retighten adapter.
	Adapter tightened excessively	Loosen locknut and sleeve assembly. Retighten, but be sure that bearing turns freely.
	Flat on roller due to skidding (result of fast starting)	Carefully examine rollers, looking for flat spots on the surface. Replace bearing.
	Prong rubbing against bearing	Remove lockwasher, straighten prong or replace with a new washer.
	Incorrect method of mounting, hammer blows on bearing	Replace with new bearing. Never hammer any part of bearing when mounting.
	Distorted shaft and other parts of bearing assembly	Only in extreme case should a blow torch be used to facilitate removal of a failed bearing. Care should be exercised to avoid high heat concentration at any one point so distortion is eliminated.
	Bearing exposed to vibration while machine is idle	Carefully examine bearing for wear spots separated by distance equal to the spacing of the balls or rollers. Replace bearing.
	Unbalanced load. Housing bore too large.	Rebalance unit. Replace housing with one having proper bore.
	Bearing seat diameter machined oversize causing excessive expansion of shaft and bearing inner ring, thus reducing clearance in bearing	Grind shaft to get proper fit between inner ring of bearing and shaft.

Table 23 Troubleshooting - Bearings (continued)

OBSERVATION	POSSIBLE CAUSE	ACTION
Vibration	Foreign matter entering housing	Clean out bearing housing. Replace worn-out seals or improve seal design to obtain adequate protection of bearing.
	Corrosive agents entering the bearing housing	Addition of a shroud or flinger to throw off foreign matter.
	Excessive distortion of housing	Check and scrape housing to relieve pinching of bearing. Be sure pedestal surface is flat. Ensure that shims cover the entire area of pillowblock base.
	Shaft diameter too small	Metallize shaft and regrind to obtain proper fit.
	Adapter not tightened sufficiently	Retighten adapter.
	Flat on roller due to skidding (result of fast starting)	Carefully examine rollers, looking for flat spots on the surface. Replace bearing.
	Housing bore too large	Remove lockwasher, straighten prong or replace with a new washer.
	Incorrect method of mounting. Hammer blows on bearing.	Replace with new bearing. Never hammer any part of bearing when mounting.
	Excessive clearance in bearing, resulting in vibration	Use bearings with recommended internal clearances.
	Distortion of outer housing and ring. Pinching of bearing	Remachine housing fillet to obtain proper support.
	Distortion of shaft and inner ring. Uneven expansion of bearing inner ring.	Remachine shaft fillet to obtain proper support.
	Vibration of machine	Check balance of rotating parts.
	Inadequate support in housing causing cocking of outer ring	Remachine housing fillet to relieve stress. May require shoulder collar.
	Inadequate shoulder support causing bending of shaft	Remachine shaft fillet to relieve stress. May require shoulder collar.

PARTS

Item No.	Description	Qty.
100	**Motor**	**1**
130	Motor Mount	1
151	Support - motor mount	1
152	Adjuster - motor mount	1
160	Belt Drive Assembly	1
161	Back Plate - belt guard	1
162	Cover - belt guard	1
163	Drive Sheave	1
164	Belts	**
165	Driven Sheave	1
400	**Shaft**	
450	Shaft Slinger	
500	**Impeller Assembly**	**1**
550	Impeller Assembly (Mark II)	1
551	Body (removable Blade option) Mk II	1
552	Blade (removable Blade option) Mk II	*
560	Impeller Assembly (Mark III)	1
561	Body (removable Blade option) Mk III	1
562	Blade (removable Blade option) Mk III	*
591	Hex. Head Bolt (removable blade option)	*
592	Lock Washer (removable blade option)	*
593	Flat Washer (removable blade option)	*
594	Hex. Nut (removable blade option)	*
595	Impeller Key	1
596	Square Head Setscrew & Nut	*

* Number Depends on Agitator Size

Item No.	Description	Qty.
800	**Base Plate**	**1**
820	Outboard Bearing Assembly	1
822	Adapter Sleeve - Outboard Bearing	1
823	Locknut and Washer - Adapter Sleeve	1
824	Upper Housing Half	1
825	Double Lip Seal	1
826	Triple Seal Ring (Optional)	2
827	Lower Housing Half	1
828	Capscrew and Washer	4
829	Locating Key	1
831	Retaining Ring	1
832	Fixing Ring (2 inch - 4 inch diameter shafts)	2
833	Fixing Ring (5 inch diameter + shafts)	1
840	Inboard Bearing (non-split design)	1
841	Inboard Bearing	1
842	Adapter Sleeve - Outboard Bearing	1
843	Locknut and Washer - Adapter Sleeve	1
844	Upper Housing Half	1
845	Double Lip Seal	1
846	Triple Seal Ring (Optional)	2
847	Lower Housing Half	1
848	Capscrew and Washer	4
860	Inboard Bearing (split design)	1
861	Inboard Bearing	1
862	Outer Bearing Race	1
863	Clamping Rings	2
864	Inner Bearing Race	1
865	Pedestal Cap	1
866	Triple Seal Ring	2
867	Upper Cartridge Half	1
868	Lower Cartridge Half	1
869	Capscrew and Washer	4
870	Pedestal Base	1

Item No.	Description	Qty.
900	**Service Tools and Miscellaneous**	
901	Shaft Holding Device	1
902	Tensiometer	1
905	Wall Insert of Tank Nozzle	1
910	Dial Indicator	1
911	Hold Down Nut and Anchor	4
912	Hard Shims and/or Grout	4
913	Support Base	1
914	Calipers	1
1300	**Seal Flange Assembly**	**1**
1320	Stuffing Box Flange Type - L	1
1322	Gland Adjuster Stud	4
1323	Gland Adjuster Nut	4
1325	Gland - split	1
1327	Packing Ring - Type L	3
1328	Lantern Ring	1
1329	Stuffing Box Housing - Type L	1
1330	Stuffing Box Flange Type - DL	1
1337	Packing Ring - Type DL	5
1339	Stuffing Box Housing - Type DL	1
1340	Throttle Bushing	1
1350	Shaft Sleeve Assembly	1
1351	Setscrews	6
1352	O-Ring - Sleeve	1
1360	Shut-Off Collar assembly (optional)	1
1361	O-Ring - Collar	1
1362	Sq. Hd. Setscrews	1
1363	Shut-Off Seal Ring (optional)	1
1364	Jack Screws	4
1365	O-Ring, Flange	1
1366	Flange Stud	3
1367	Flange Nut	3

Item No.	Description	Qty.
1600	**Mechanical Seal Assembly**	**1**
1601	Mechanical Seal Flange	1
1602	Shut-Off Plate	1
1603	O-Ring - Plate (Inner)	1
1604	O-Ring - Plate (Outer)	1
1605	Shut-Off Stud	3
1606	Shut-Off - Nut & Washer	3
1607	Jack Screw	3
1608	Seal Housing	1
1610	Shut-Off Collar Assembly	1
1611	O-Ring - Collar	1
1612	Sq.Hd. Setscrews	4
1613	Shut-Off Seal Ring	1
1620	Gland	1
1621	Gland - Split	2
1622	Gland Gasket	1
1623	Gland Retainer	1
1624	Gland Ring	1
1625	O-Ring - Gland	1
1626	Cap Screws - Gland	2
1631	Mounting Bolt	2
1632	Mounting Stud	2
1633	Mounting Nut & Washer	2
1634	Mounting Gasket	1
1635	O-Ring - Mounting	1
1640	Stationary Seat	1
1641	Stationary Mounting	1
1642	Secondary Seal Ring	1
1643	O-Ring - Stationary Seat	1
1644	Cap Screw - Stationary Holder	2
1645	Spring Clips	2
1646	Springs	2
1647	Shroud	1
1648	Hold Ring	1
1649	Centering Tab & Screws	1
1651	Drive Pad	1
1652	Collar Packing	1
1653	Spring Pins & E-Ring	2
1654	Spring Retainer	2
1655	Pin	2

1660	Rotary Head	1
1661	O-Ring - Rotary Head	1
1662	O-Ring - Shaft	1
1663	Rotary Holder	1
1664	Rotary Mounting	1
1665	Face Gasket	1
1666	Cap Screws - Rotary Holder	1
1667	Setscrew	1
1668	Shoulder Screw	1
1669	Holder Gasket	1
1671	Drive Pins	2
1672	Location Pin	1
1672	Drive Pad	1
1674	Collar	1
1675	Collar Packing	1
1680	Shaft Sleeve Assembly	1
1681	Setscrews	2
1682	O-Ring - Sleeve	2
1690	Throttle Bushing	1

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