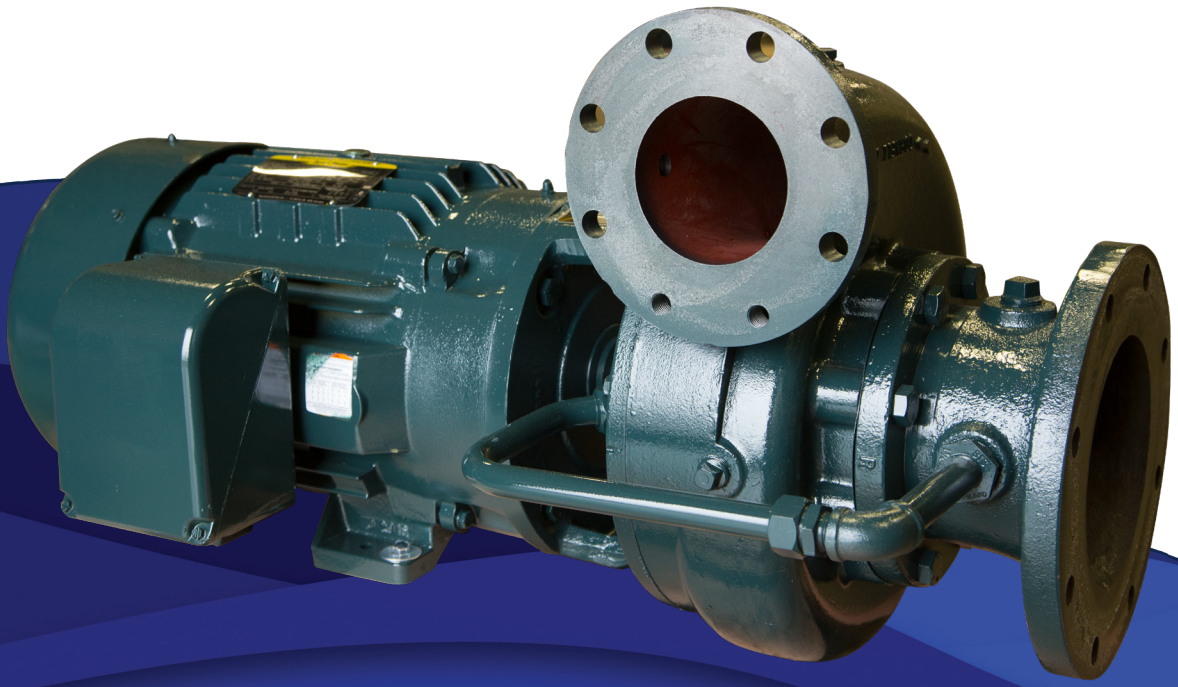
CORNELL

PUMP MAINTENANCE HANDOUT



AGRICULTURE FOOD INDUSTRIAL MINING MUNICIPAL OIL & GAS REFRIGERATION RENTAL

CONTENTS

GREASE FRAME LUBRICATION INSTRUCTIONS

Bearings in all frames are greased at the factory before shipment

Lubrication requirements vary with speed, power, load, ambient temperatures, exposure to contamination and moisture, seasonal or continuous operation, and other factors. The brief recommendations which follow are general in nature and must be coupled with good judgment and consideration of the application conditions. For regreasing periods, refer to table below. When adding grease be sure the grease and fittings are absolutely clean.

Grease used for these bearings should be equivalent to one of the following manufacturers' products:

- G.E. Long Life Grease No. D682C5
- Mobil Mobilux No. EP2
- Shell Gadus S2 V220 2 (formerly Alvania EP2)
- Texaco Multifak AFB 2

To lubricate frame bearings, remove plastic cover from zerk fittings and be sure the fitting and end of grease gun are clean. Use hand-operated grease gun only and pump a small amount of grease into each bearing cavity. The surplus grease will go through the bearing and into the center part of the frame. Over greasing can cause shortened bearing life.

For regreasing periods and approximate quantity, refer to table below for the frame size associated with the pump (located on serial number plate).

Examples: the 4NNT-VF16 uses the frame size 16, and a 10YB-F18DB uses the frame size 18.

RECOMMENDED REGREASING PERIODS FOR FRAMES

FRAME SIZE	5	16; 85	12; 13; 13D; 18; 18D	20; 24	30
Total Running Time	2,000 hours	1,500 hours	1,000 hours	1,350 hours	2,000 hours
8-Hour Day Service	36 weeks	27 weeks	18 weeks	24 weeks	36 weeks
24-Hour Day Service	12 weeks	9 weeks	6 weeks	8 weeks	12 weeks
Approximate Amount of Grease per Line Fitting	.5 cubic inch	1.25 cubic inch	2 cubic inches	3 cubic inches	4 cubic inches
Approximately (grease gun hand operated)	3 pumps	6 pumps	12 pumps	18 pumps	23 pumps

OIL FRAME LUBRICATION INSTRUCTIONS

The ball bearings are lubricated by the oil in the frame housing.

Add oil through the pipe plug opening at the top of the housing and fill to the level indicated on the side of the housing. Be careful to keep out dirt and moisture. The oil level must be maintained; check and fill when pump is not operating. The type and grade of oil used is very important for maintenance-free operation.

Oil used should be a turbine oil equivalent to one of the following manufacturers' products:

OIL TEMPERATURE TO 150° F	OIL TEMPERATURE OVER 150° F
ISO VG32	**ISO VG68**
Mobil DTE 797	Mobil DTE Oil Heavy Medium
Lubriplate HO-0	Lubriplate HO-2
Chevron Turbine Oil GST 32	Chevron Turbine Oil GST 68
Shell Turbo T Oil 32	Shell Turbo T Oil 68

If checking oil temperature is not feasible, measure the bearing frame temperature at the drain connection. In general, the bearing frame temperature will be approximately 100°F lower than the oil temperature.

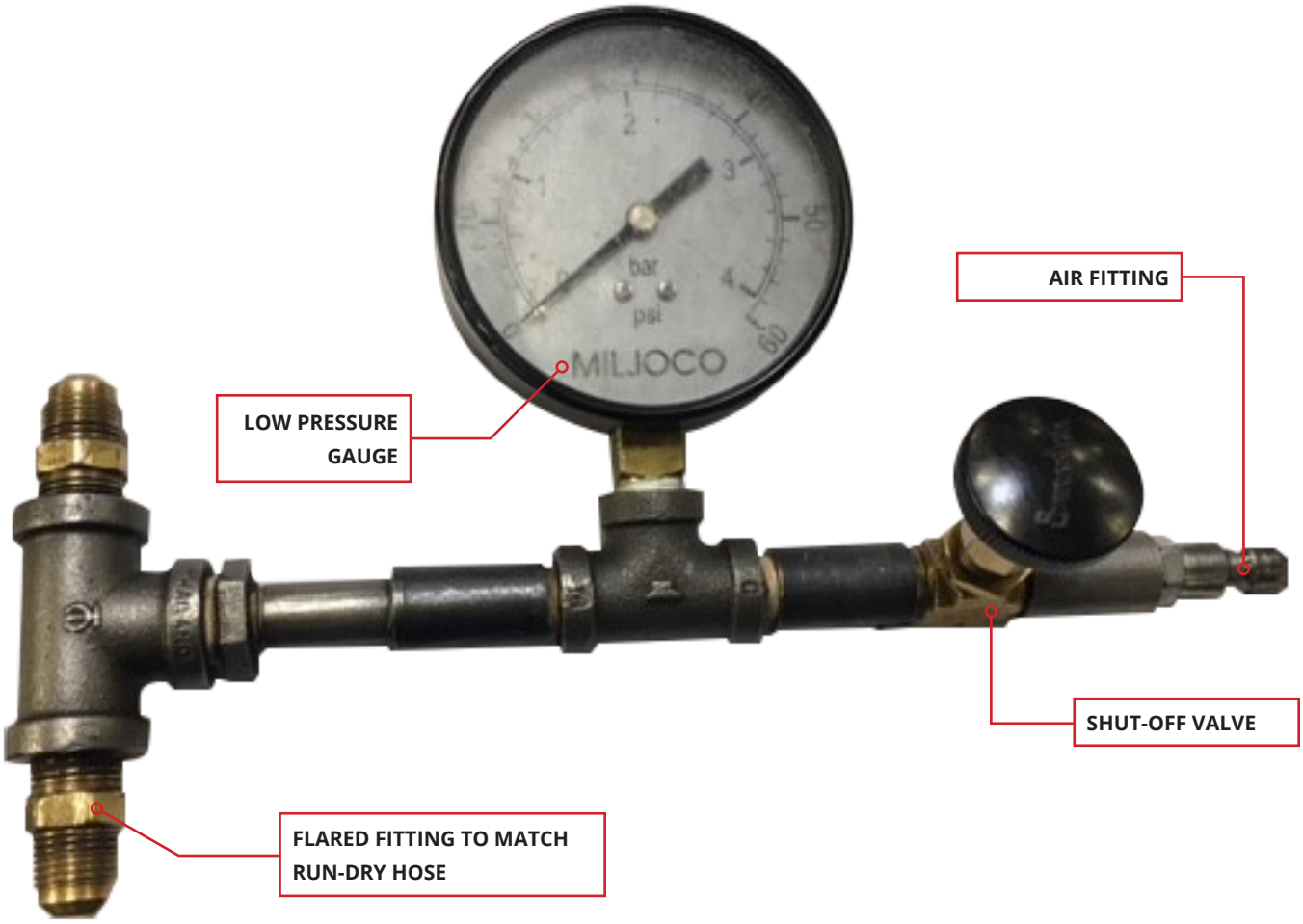
Oil recommendation is based on a minimum of 70 SSU at operating temperature.

Lip Seals (grease)

All oil-filled frames will have lip seals in their bearing covers. All lip seals must be lubricated through the grease fittings placed in the bearing cover at either end of the frame. Lubricate with a small amount of multiple-purpose grease after every two to six months, depending upon environment.

FRAME SIZE	CAPACITY	OIL RENEWAL
F5k	.5 Quart	3-4 Months
F85k/85dbk	.8 Quart	3-4 Months
F13k/13dbk	1 Quart	3-4 Months
F16k	2 Quarts	5-6 Months
F18k/18dbk	2 Quarts	5-6 Months
F12k	2 Quarts	5-6 Months
F24dbk	6 Quarts	5-6 Months
F20dbk/Tbk	11.8 Quarts	5-6 Months
F45	.3 Quart	3-4 Months
F55	.4 Quart	3-4 Months
F65	.8 Quart	3-4 Months
F85	.8 Quart	3-4 Months
F170	13.4 Quarts	5-6 Months
Fs120	.5 Quart	5-6 Months
Fs150	1 Quart	5-6 Months
Fs190	1.8 Quarts	5-6 Months
Fs215	2.5 Quarts	5-6 Months
Fs230	5 Quarts	5-6 Months

AIR TEST APPARATUS



Test Procedure

1. Connect run-dry hoses to air test apparatus
2. Verify shut off valve is closed
3. Connect air hose
4. Fill run-dry with 7PSI of air (more than 7PSI pressure can damage seal)
5. Close valve, disconnect air hose.
6. Let sit 5 minutes, rotate shaft by hand a few revolutions.
   A. If pressure drops, check hose connections. Spray soapy water around shaft and run-dry lip seal, if no leak is detected suspect mechanical seal. Carefully remove mechanical seal and inspect/clean all surfaces. Check o-rings for nicks or tears. Replace seal, spring and impeller. Repeat test.
   B. If no leaks detected, release pressure and continue with rebuild.

F16/F18 SHIMMING

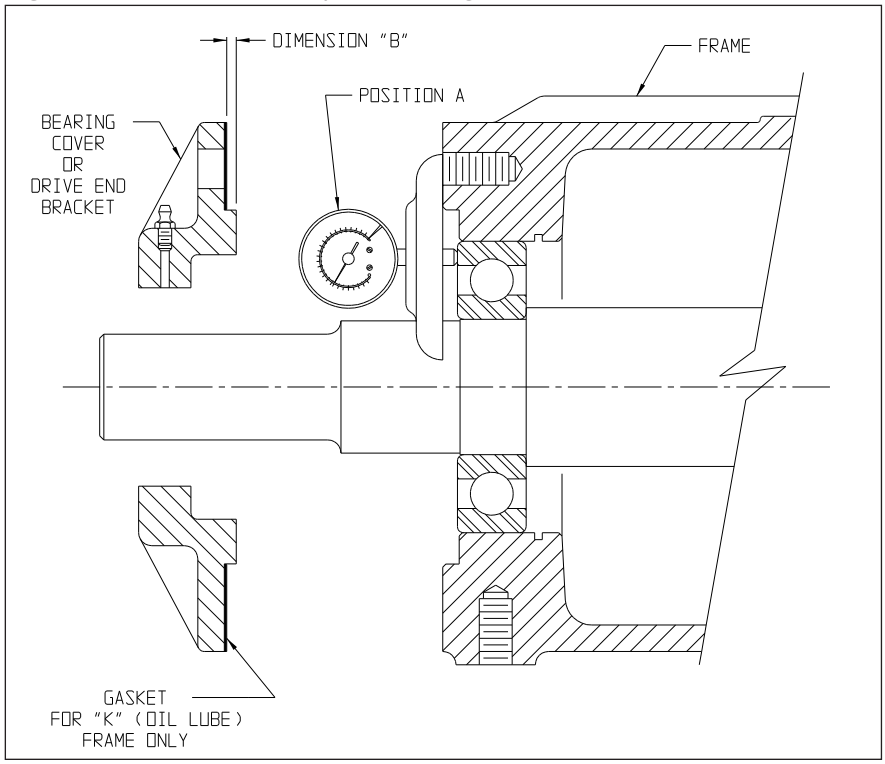
These instructions apply to: F16, F16K, F16X, F16XK, EM16, VC16, VF16, F18, F18K, EM18, VC18, and VF18 frames.

Instructions

Review *Figure 1 - Frame Shim Gap Measuring.*

1. Push shaft all the way toward pump end bracket. Place dial indicator on the frame with probe on outer race of bearing (Position A). Zero the indicator.
2. Move indicator to bearing cover or drive end bracket and measure dimension B. (If oil lubed frame, make sure gasket is in place on bearing cover.) This is the shim gap. If shim gap is less than .007" (.005 for F16X (K)), recheck the measurement. If it is still less than .007" (.005 for F16X (K), stop because something is wrong.
3. For the shim gap measured, select the shims required from the table.

Figure 1 - Frame Shim Gap Measuring



SHIM SIZES
All measurements in inches

SHIM GAP	SHIM SIZE REQUIRED	SHIM GAP	SHIM SIZE REQUIRED FOR F16X (K) ONLY
.007 to less than .012	None	**.005 to less than .010**	None
.012 to less than .017	0.005	**.010 to less than .015**	0.005
.017 to less than .022	0.01	**.015 to less than .020**	0.01
.022 to less than .027	0.015	**.020 to less than .025**	0.015
.027 to less than .032	0.02	**.025 to less than .030**	0.02
.032 to less than .037	0.025	**.030 to less than .035**	0.025

4. Install shims and bearing cover or drive end bracket and tighten fasteners.
5. Verify that total shaft endplay is between .007" and .012" (.005" and 0.10" for F16X(K)) by pushing the shaft in each direction and measuring the travel with a dial indicator. (Mount dial indicator base on pump end bracket, not on assembly table.) Adjust shim pack, as necessary, to maintain .007" to .012" (.005" and 0.10" for F16X (K)) shaft endplay.

F18DB SHIMMING

These instructions apply to: F18, F18DB, F18DR, VC18, VC18DB, VC18DR, F18K, F18DBK, F18DRK, VF18, VF18DB, VF18DR, EM18, EM18DB, and EM18DR frames

Instructions

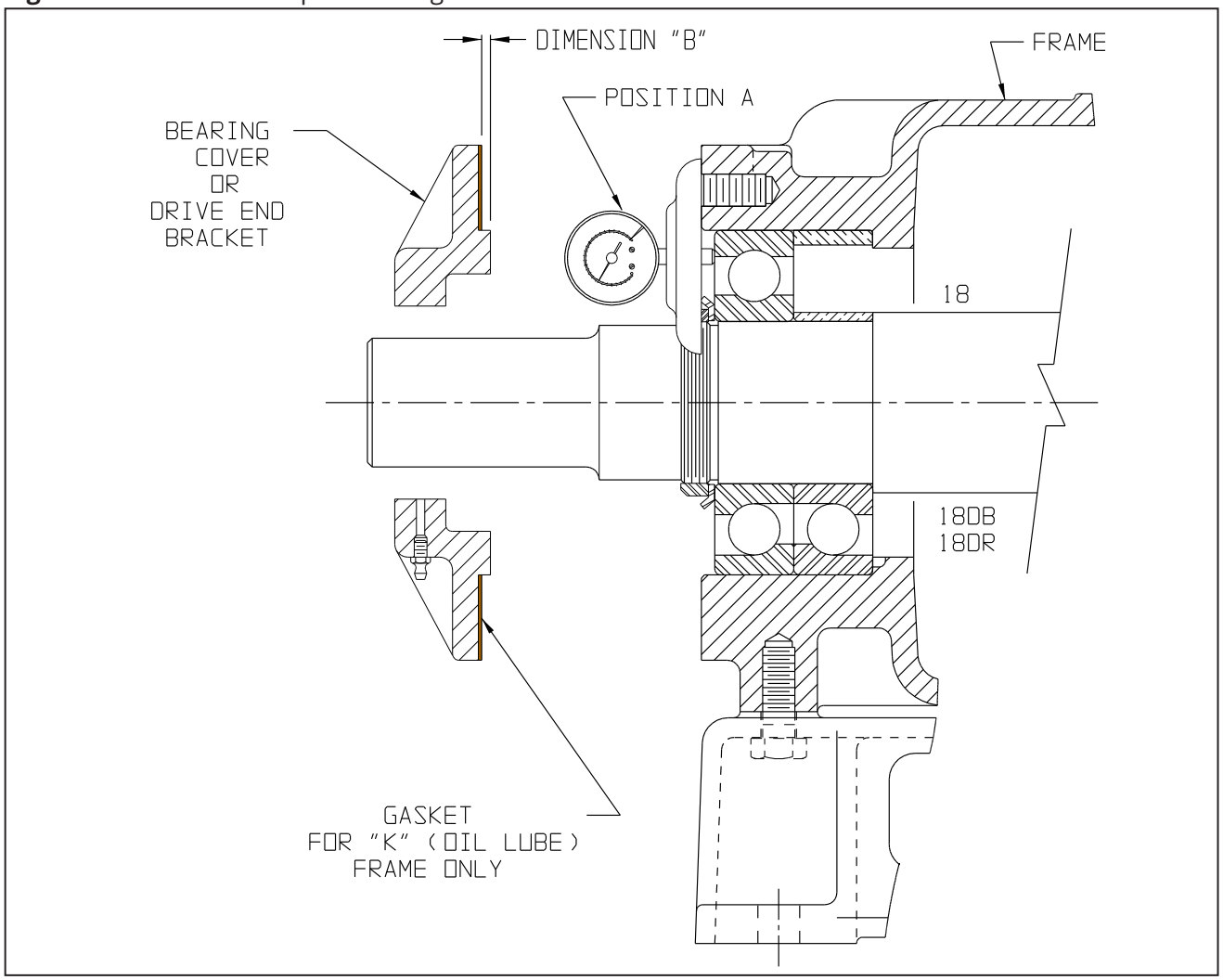
Review *Figure 2 - Frame Shim Gap Measuring*.

1. Place dial indicator on frame with probe on outer race of bearing (Position A). Zero indicator.
2. Move indicator to bearing cover or drive end bracket and measure distance B. (If oil lubed frame, make sure gasket is in place on bearing cover.) This is the shim gap.
3. For the shim gap measured, select the shims required from the table.

SHIM SIZES
All measurements in inches

SHIM GAP	SHIM SIZE REQUIRED
.002 to less than .007	None
.007 to less than .012	0.005
.012 to less than .017	0.01
.017 to less than .022	0.015
.022 to less than .027	0.02

Figure 2 - Frame Shim Gap Measuring



LOCKSCREW TORQUE SPECS

The following information applies to all impeller lockscrews installed at Cornell.

Instruction

Make sure parts are clean and dry. Apply permanent thread locker to lockscrew threads and shaft threads. Torque to value shown below for appropriate size and material of lockscrew.

SIZE	TORQUE
.38 -16UNC	20 ft-lb
.50 - 13UNC	40 ft-lb
.62 - 11UNC	90 ft -lb
.75 - 10UNC	135 ft-lb
1.00 - 8UNC	260 ft-lb
For Lockscrews of 302, 303, 304 Stainless Steel (Material Code: SD) and 316 Stainless Steel (Material Code: SE)	

CORNELL TOOLS

Cornell Pump Company has a number of tools that are designed specifically to be used with Cornell pumps. These tools are referenced throughout our pump assembly demonstration and can be purchased through your sales rep.

DESCRIPTION	PART NUMBER
3" PACKING SPUD	A21452-438-SA
F12 PRESS PLATE	A26441-438-SK
F16 PRESS PLATE	A22332-438-SK
F18 PRESS PLATE	A22333-438-SK
F19 PRESS PLATE	A25523-438-SK
F20 PRESS PLATE	B25842-51-SK
FS215 PRESS PLATE	A25826-438-SK
FS230 PRESS PLATE	B35585-430-SK
PACKING INSTALLATION TOOL	A24718-438-SP
PACKING SIZING TOOLS	B4500-438-SK
F16/18 ASSEMBLY STAND	B25673-268-SK
IMPELLER PULLER	D5018-438
THREADED IMPELLER REMOVAL WRENCH	D6642-438-SK
SAE D SPLINE TO 2.5" SHAFT ADAPTER	A56327-438-SK
SAE C SPLINE TO 2.5" SHAFT ADAPTER	A56328-438-SK

OTHER TOOLS TO AID PUMP MAINTENANCE
DIAL INDICATOR - END PLAY MEASURE
DEPTH GAUGE
HEAT RESISTANT GLOVES - NOT WELDING
FEELER GAUGE
CLEANING FLUID (FAST DRYING, LEAVES NO RESIDUE)

CRITICAL CLEARANCES

BEARING FRAME CLEARANCES

FRAMES	BEARING CLEARANCE	CLEARANCE BETWEEN BRG COVER & FRAME	BEARING CAPTURE
F5 (K), EM5	.005”-.010”	-	-
F12DTR, VF12DTR	-	.001”-.005”	.001”-.005”
F12 (K), VF12, F12DB (K)	-	.025”-.045” (W/O GSKT)	-
EM12, EM12DB	.002”-.007” (NO GSKT)	-	-
EM12DBK	.000”-.007” (W/ GSKT)	-	-
F13DB & F13DBK	.002”-.008”	-	-
F85DB (K), EM85DB		-	-
F16 (K), VF16, VC16, EM16	.007”-.012”	-	-
F18 (K), VF18, VC18, EM18, W/O LOCK NUT		-	
F85 (K)		-	-
F18, F18DB, F18DR (K), EM18, EM18DB, EM-18DR, VF18, VF18DB, VF18DR, VC18, VC18DB, VC18DR, HS16DB, HS18DB W/LOCK NUT	.002”-.007”	-	-
F18DTR, VC18DTR, EM18DTR, VC18DTB, VF18DTB	NO SHIMS REQUIRED; TORQUE DRIVE END BEARING COVER BOLTS TO 110 FT-LB		
F20DB, F20TB, (VF OR VC) (K)	-	.001”-.005”	
F24DB (K), VF24DB	.003”-.010”		
F30 (VF OR VC), (DOUBLE TAPER/BALL)		.003”-.005”	
F30BTB (VF OR VC), (BALL/TAPER/BALL)	.010”-.013”	(DO NOT CAPTURE BEARINGS)	
FS215SS (SPHERICAL, SPHERICAL)	-.005”-.000”	(CAPTURED TO NET/AXIAL INTERNAL CLEARANCE OF BEARING .030”)	
FS120TT, FD150TT, FD190TT (TAPER, TAPER)	.001”-.005”	-	-
F45K, F55, F65K, EM45K, EM55K, EM65K	.000” - .010”	(NO SHIMMING REQUIRED)	
C	.006” - .010”		
D	.007” - .011”		
E	.016” - .024”		
R	.003” - .008”	(NO ADJUSTMENT REQUIRED)	
ST		(NO ADJUSTMENT REQUIRED)	

BACKVANE CLEARANCE	
ALL PUMPS WITH BACKVANES SHIM TO .030" +/- .008"CLEARANCE EXCEPT FOR THE FOLLOWING PUMPS	
PUMP MODEL	**BACKVANE CLEARANCE**
1DA4	.020" - .030"
1.25DA1	
2.5DA1	
2.5DA2	
2.5HM	.090"
3517M	
3HM	.060"
4DA2	.020" - .030"
4HM	.055"
6822MX	.090"
SP, SM	NO ADJUSTMENT
12NHG24	.060"
12NHG28	

BACKVANE CLEARANCE	
ALL PUMPS WITH BACKVANES SHIM TO .030" +/- .008"CLEARANCE EXCEPT FOR THE FOLLOWING PUMPS	
PUMP MODEL	**BACKVANE CLEARANCE**
12NHTM	>1.00"(Do not shim)
14NHG28	.060"
14NHG34	
16NHG26	
16NHT32	
18NHFL	
18NHG	
18NHG34	.080"
20NHF	.060"
24NNG	
30NNT	.070"

WEAR RING CLEARANCES (UNINSTALLED)

	PUMP MODEL	WEAR RING	STANDARD CLEARANCE	WEAR RING OPEN	OPEN CLEARANCE	DOUBLE WEAR RINGS	STANDARD CLEARANCE	OPEN DOUBLE WEAR RINGS	OPEN CLEARANCE	REPLACE
CLEAR LIQUID	2.5H	A573 A574	.019" - .023" SUC.HUB	A16435 A16436	.039" - .043" SUC/HUB	-	-	-	-	0.069
	3HA	A466 A467	.021" - .025" SUC/HUB	A13861 A13862	.037" - .042" SUC/HUB	-	-	-	-	0.067
	3HC	A466	.021" - .025"	A13861	.037" - .042"	-	-	-	-	0.067
	4HC	A20338	.018" - .022"	A20638	.034" - .039"	A23827A/B	-	-	-	0.062
	4HH	A466 A467	.021" - .025" SUC/HUB	A13861 A13862	.037" - .042" SUC/HUB	A20259A/B A20260A/B	.021" - .025" SUC/HUB	-	-	0.067
	5H	A398 A399	.021" - .025" (SUC/HUB)	A13695 A16213	.041" - .046" SUCTION .041" - .045" HUB	-	-	-	-	0.074
	5HH	A11952	.019" - .023" SUC/HUB	A14039	.039" - .043" SUC/HUB	A21597A/B	.020" - .030" SUC/HUB			0.069
	5HHC	A11952	.019" - .023"	A14039	.039" - .043"	-	-	-	-	0.069
	6H	A8355 A8356	.021" - .025" SUCTION .019" - .023" HUB	A16434 A16444	.040" - .044" SUCTION .041" - .045" HUB	A16540A/B	-	-	-	0.072
	6HH	A11952	.019" - .023" SUC/HUB	A14039	.039" - .043" SUC/HUB	A21597A/B	.020" - .030" SUC/HUB	A21278A/B	.040" - .050" SUC/HUB	0.080
	8H	A12496	.020" - .024" SUC/HUB	A13694	.040" - .044" SUC/HUB	A20477A/B	.022" - .026" SUC/HUB	A20276A/B	.038" - .042" SUC/HUB	0.070
	2.5RB	A657B A4134	.014" - .018" SUCTION .022" - .026" HUB	A15119 A16432	.035" - .040" SUCTION .042" - .047" HUB	-	-	-	-	0.075
	3RB	A823 A528		A14409 A13863	.038" - .042" SUCTION .037" - .041" HUB	-	-	-	-	0.067
	4RB	A648 A528	.017" - .021" SUCTION .016" - .020" HUB	A13864 A13863	.037" - .042" SUCTION .037" - .041" HUB	A21856A/B A21855A/B	.029" - .033" SUCTION .034" - .038" HUB	-	-	0.067
	5RB	A398 A21472	.018" - .022" SUC/HUB	A13695 A21531	.038" - .043" SUC/HUB	-	-	-	-	0.069
	6RB	A12169	.020" - .024" SUC/HUB	A12971	.039" - .044" SUC/HUB	-	-	-	-	0.070
	10RB	A5190 A12169	.022" - .026" SUCTION .020" - .024" HUB	A14482 A12971	.052" - .057" SUCTION .039" - .044" HUB	A20235A/B	.022" - .026" SUCTION	A22329A/B	.041" - .045" SUCTION	0.091
	1W	A602 A824	.024" - .028"	A20555 A20415	.044" - .048"	A20318A/B	.028" - .030" SUCTION	-	-	0.077
	1WC	A602		A20555		-	-	-	-	0.077
	1.25W	A3219 A824	.017" - .021" SUCTION .021" - .025" HUB	A16638 A20416	.037" - .041" SUCTION .041" - .045" HUB	-	-	-	-	0.072

WEAR RING CLEARANCES (UNINSTALLED)

	PUMP MODEL	WEAR RING	STANDARD CLEARANCE	WEAR RING OPEN	OPEN CLEARANCE	DOUBLE WEAR RINGS	STANDARD CLEARANCE	OPEN DOUBLE WEAR RINGS	OPEN CLEARANCE	REPLACE
CLEAR LIQUID	1.5W	A817 A824	.019" - .023" SUCTION .021" - .033" HUB	A20554 A20416	.039" - .043" SUCTION .041" - .053" HUB	A21857A/B A21858A/B	.025" - .029" SUCTION .032" - .036" HUB			0.085
	1.5WH	A817	.019" - .023"	A20554	.039" - .043"	-	-	-	-	0.069
	2WH	A818		A16928		-	-	-	-	0.069
	2.5WB	A819 A603	.019" - .023" SUCTION .021" - .033" HUB	A16844 A16845	.039" - .043" SUCTION .041" - .053" HUB	-	-	-	-	0.085
	2.5WH	A21657	.021" - .025" SUCTION .019" - .023" HUB	A22537	.031" - .035" SUCTION .019" - .023" HUB	-	-	-	-	0.056
	3WB	A603	.019" - .023" SUC/HUB	A16845	.038" - .043" SUC/HUB	-	-	-	-	0.069
	3WH	A823	.016" - .020" SUCTION .019" - .023" HUB	A14409	.040" - .044" SUCTION .019" - .023" HUB	-	-	-	-	0.070
	3WHA					-	-	-	-	
	4WB	A821 A3516	.021" - .025" SUCTION .019" - .023" HUB	A11981 A15122	.035" - .039" SUCTION .040" - .045" HUB	-	-	-	-	0.072
	4WH	A821 A21838		A11981 A25619		-	-	-	-	
	5WB	A3140 A572	.018" - .022" SUCTION .022" - .026" HUB	A12817 A15120	.038" - .042" SUCTION .043" - .048" HUB	-	-	-	-	0.077
	5WBH	A8355 A2959	.019" - .023" SUCTION .017" - .021" HUB	A16434 A13905	.041" - .045" SUCTION .037" - .041" HUB	-	-	-	-	0.072
	5WBQ					-	-	-	-	
	1.25Y	A5625 A788	.019" - .023" SUCTION .019" - .031" HUB	A13445 A13444	.038" - .042" SUCTION .038" - .050" HUB	-	-	-	-	0.080
	1.5Y					-	-	-	-	
	1.5YH	A5625	.019" - .023	A13445	.038" - .042"	-	-	-	-	0.067
	2.5YH	A823	.016" - .020" SUCTION .017" - .021" HUB	A14409	.040" - .044" SUCTION .017" - .021" HUB	-	-	-	-	0.070
	2.5YHB	A4133 A4134	.020" - .024" (SUC/HUB)	A12554 A16432	.040" - .044" SUCTION .040" - .045" HUB	-	-	-	-	0.072
	3YB	A5624 A687	.021" - .025" SUCTION .019" - .023" HUB	A16433 A15121	.040" - .044" SUCTION .040" - .045" HUB	-	-	-	-	0.072
	3YH	A823	.016" - .020" SUCTION .017" - .021" HUB	A14409	.040" - .044" SUCTION .017" - .021" HUB	-	-	-	-	0.070
	3YL					-	-	-	-	

WEAR RING CLEARANCES (UNINSTALLED)

	PUMP MODEL	WEAR RING	STANDARD CLEARANCE	WEAR RING OPEN	OPEN CLEARANCE	DOUBLE WEAR RINGS	STANDARD CLEARANCE	OPEN DOUBLE WEAR RINGS	OPEN CLEARANCE	REPLACE
CLEAR LIQUID	4YB	A3140	.021" - .025" SUC/HUB	A12817	.041" - .045" SUC/HUB	A14358A/B	.020" - .024" SUC/HUB	-	-	0.072
	5YB	A466		A13861	.037" - .042" SUC/HUB	A20932A/B	.019" - .023" SUC/HUB	-	-	0.067
	5YBH	A8355 A2959	.021" - .025" SUC/HUB	A16434 A13905	.037" - .042" SUC/HUB	-	-	-	-	0.067
	5YBQ			A16434 A13905		-	-	-	-	
	6YB	A12169 A8356	.020" - .024" SUCTION .019" - .023" HUB	A12971 A16444	.039" - .044" SUCTION .038" - .042" HUB	A21834A/B A21851A/B	.030" - .034" SUCTION .035" - .039" HUB			0.070
	6YBQ							-	-	
	10YB			A13903 A16444		A22063A/B	.037" - .041" SUCTION	-	-	0.085
	10YBQ							-	-	
DAF	1DA4	A602	.014" - .018"							
	1.25DA1	A22991	.019" - .023"	A22992	.039" - .043"					
	2.5DA1									
	2.5DA2	A657B	.014" - .018"	A15119	.035" - .040"					
	4DA2	A648	.025" - .029"	A13864	.045" - .050"					
REFRIDGERATION	1.5CB	-	.018" - .023" SUCTION .016" - .023" HUB	-	-	-	-	-	-	0.037
	1.5CBH	-	.015" - .020" SUCTION .012" - .017" HUB	-	-	-	-	-	-	0.032
	1.5CLB	-	.019" - .023" SUC/HUB	-	-	-	-	-	-	0.037
	2CB	-	.015" - .022" SUCTION .015" - .020" HUB	-	-	-	-	-	-	0.035
	2CBSR	-	.019" - .026" SUCTION .019" - .024" HUB	-	-	-	-	-	-	0.042
	2CBS	-		-	-	-	-	-	-	0.042
	2.5CBH	-	.020" - .025" SUCTION .018" - .023" HUB	-	-	-	-	-	-	0.040
	3CB	-	.021" - .027" SUC/HUB	-	-	-	-	-	-	0.043
	4CB	-	.020" - .025" SUC/HUB	-	-	-	-	-	-	0.043
SOLIDS	2315MP	-	.010" -.020" AXIAL	-	-	-	-	-	-	ADJUST
	3NLP	A1562	.020" - .024"	A12484	.040" - .044"	-	-	-	-	0.070
	3NLT					A14322A/B	.25" - .32"			
	3NNTL	A20265	.024" - .028"	A20490	.044" - .049"	A20484A/B	.28" - .32"	A21546A/B	.036" - .040"	0.078
	3308T	-	-	-	.040" - .044"	-	-	-	-	0.070

WEAR RING CLEARANCES (UNINSTALLED)

	PUMP MODEL	WEAR RING	STANDARD CLEARANCE	WEAR RING OPEN	OPEN CLEARANCE	DOUBLE WEAR RINGS	STANDARD CLEARANCE	OPEN DOUBLE WEAR RINGS	OPEN CLEARANCE	REPLACE
SOLIDS HANDLING	4414T	A11265	.027" - .031"	A20424	.037" - .041"	A14211A/B	.028" - .032"	A14211A/C	.038" - .042"	0.067
	4NHTA									
	4NHTB	A20871	.039" - .043"	A20943	.054" - .058"	A20956A/B	.028" - .032"	A20956A/C	.043" - .047"	0.093
	4NHTR	A1540		A16677	.051" - .055"	A21746A/B	.031" - .035"	A21642A/B	.041" - .045"	0.088
	4NMP	A1911	.030" - .034	A12048	.049" - .054"	-	-	-	-	0.086
	4NMPP	A1237		A12990		-	-	-	-	
	4NNT	A3058	.027" - .031"	A12056	.042" - .046"	A12887A/B	.030" - .034"	A14388A/B	.040" - .044"	0.074
	4NHTB19	-	-	-	-	A22439 CASE A22441 IMP	.042" - .046"	A22440 CASE A22441 IMP	.064" - .068"	0.109
	4514T	A20871	.036" - .043"	A20943	.054" - .058"	A20956A/B	.028" - .032"	A20956A/C	.043" - .047"	0.093
	4517MP	-	.025" - .035" AXIAL	-	-	-	-	-	-	ADJUST
	4NNTL	A20265	.024" - .028"	A20490	.044" - .049	A20484A/B	.028" - .032"	A21546A/B	.036" - .040"	0.078
	4409T	-	-	-	.072" - .076"	-	-	-	-	0.122
	6NHP	A1540	.035" - .039"	A16677	.058" - .062"	-	-	-	-	0.099
	6NHPP					-	-	-	-	
	6NHT	A1540	.021" - .026"	A16677	.044" - .049"	A14312A/B VOL-D5117	.017" - .024"	-	-	0.078
	6NHTA	A1540	.025" - .032"	A16677	.051" - .055"	A20426A/B	.031" - .035"	A22297 CASE A20426B IMP	.041" - .045"	0.088
	6NHTB	A5190	.031" - .035"	A14482	.061" - .066"	A16439A/B	.040" - .044"	A22121A/B	.051" - .055"	0.106
	6NHTB19	A12169	.042" - .046"	A12971	.064" - .068"	A22439 CASE A22441 IMP	.042" - .046"	A22440 CASE A22441 IMP	.064" - .068"	0.109
	6NHTC19	-	-	-	-	A22439 CASE A22441 IMP	.042" - .046"	A22440 CASE A22441 IMP	.064" - .068"	0.109
	6NHTH	A20312	.040" - .044"	A20312	.040" - .044"	21187A/B	.041" - .045"	A21187A/C	.051" - .055"	0.088
	6NHTR	A1540	.028" - .032"	A16677	.051" - .055"	A20426A/B	.031" - .035"	A22297 CASE A21746B IMP	.041" - .045"	0.088
	6NNTL									
	6NNT									
	6611T									
	6612T									
	61017MP	-	.025" - .035" AXIAL	-	-	-	-	-	-	ADJUST
	6819MP	-		-	-	-	-	-	-	
	6819MPC	-		-	-	-	-	-	-	
	8NHGA	A2616	.031" - .035"	A22234	.051" - .056"	A17385A/B	.040" - .044"	A17385B/C	.052" - .056"	0.090
	8NHPP	A2616	.031" - .035"	A22234	.051" - .056"	-	-	-	-	0.090
	8NHT	A2616	.031" - .035"	A22234	.051" - .056"	A17385A/B	.040" - .044"	A17385B/C	.052" - .056"	0.090
	8NHTA	A5190	.031" - .035"	A14482	.061" - .066"	A16439A/B	.040" - .044"	A22121A/B	.051" - .055"	0.106
	8NHTH	A6040	.030" - .035"	A20359	.055" - .060"	A14210A/B	.036" - .040"	A14210B/C	.046" - .050"	0.096

WEAR RING CLEARANCES (UNINSTALLED)

	PUMP MODEL	WEAR RING	STANDARD CLEARANCE	WEAR RING OPEN	OPEN CLEARANCE	DOUBLE WEAR RINGS	STANDARD CLEARANCE	OPEN DOUBLE WEAR RINGS	OPEN CLEARANCE	REPLACE
SOLIDS HANDLING	8NHTR	A2616	.031" - .035"	A22234	.051" - .056"	A17385A/B	.040" - .044"	A17385B/C	.052" - .056"	0.090
	8NNT	A2616	.031" - .035"	A22234	.051" - .056"	A17385A/B	.040" - .044"	A17385B/C	.052" - .056"	0.090
	8NNTL	A2616	.031" - .035"	A22234	.051" - .056"	A17385A/B	.040" - .044"	A17385B/C	.052" - .056"	0.090
	8NHG19	-	-	-	-	-	-	A23699 CASE A15168B IMP	.041" - .045"	0.072
	8NHG22	A6040	.031" - .036"	A20359	.056" - .061	A14210A/B	.036" - .040"	A14210B/C	.046" - .050"	0.098
	81022MP	-	.025" - .035" AXIAL	-	-	-	-	-	-	ADJUST
	81222SB		.040"-.050" AXIAL							ADJUST
	10NHPP	A10180	.044" - .048"	A10180A	.064" - .071"	-	-	-	-	0.114
	10NHTA	A6040	.030" - .035"	A20359	.055" - .060"	A14210A/B	.036" - .040"	A14210B/C	.046" - .050"	0.096
	10NHTB	A21312	.030" - .034"	A22104	.061" - .065"	A21083A/B	.032" - .036"	A21083A/C	.061" - .065"	0.104
	10NHTBH	A21312	.030" - .034"	A22104	.061" - .065"	A21083A/B	.032" - .036"	A21083A/C	.061" - .065"	0.104
	10NNT	A21911	.035" - .039"	A22220	.050" - .054"	-	-	A22562A/B	.050" - .054"	0.086
	101219MPW	-	.025" - .035" AXIAL	-	-	-	-	-	-	ADJUST
	12NHPP	A21221	.030" - .034"	A26209	.065" - .069	-	-	-	-	0.090
	12NHTL	A2616	.030" - .035"	A22234	.050" - .056"	A17385A/B	.040" - .044"	A17385B/C	.052" - .056"	0.090
	12NHTM	A6040	.030" - .035"	A20359	.055" - .060"	A14210A/B	.036" - .040"	A14210B/C	.046" - .050"	0.096
	12NHTB	A21312	.030" - .034"	A22104	.061" - .065"	A21083A/B	.032" - .036"	A21083A/C	.061" - .065"	0.104
	12NHTR	A21312	.030" - .034"	A22104	.061" - .065"	A21083A/B	.032" - .036"	A21083A/C	.061" - .065"	0.104
	12NNGL	A21107	.041" - .045"	A21214	.051" - .055"	A23133B/C	.030" - .034"	A23133A/B	.042" - .046"	0.088
	12NNF	A21107	.041" - .045"	A21214	.051" - .055"	A23133B/C	.030" - .034"	A23133A/B	.042" - .046"	0.088
	12NNG	A21037	.041" - .045"	-	-	-	-	-	-	0.072
	12NNT	A2616	.030" - .035"	A22234	.050" - .056"	A17385A/B	.040" - .044"	A17385B/C	.052" - .056"	0.090
	12NHG28	A21211	.030" - .034"	A22618	.046" - .050"	A20976A/B	.038" - .048"	A22479 CASE A20976B IMP	.048" - .058"	0.093
	14NHG	A20456	.030" - .034"	A20489	.040" - .045"	A20685A/B	.036" - .040"	A21288A/B	.053" - .057"	0.091
	14NHGH	A20586	.030" - .035"	A20751	.030" - .035"	A21061A/B	.041" - .045"	A22135A/B	.050" - .054"	0.086
	14NHG28	A21209	.040" - .045"	A23795	.056" - .061"	A20824A/B	.043" - .047"	A21424A/B	.053" - .057"	0.098
	14NHGA	A20456	.030" - .034"	A20489	.040" - .045"	A20685A/B	.036" - .040"	A21288A/B	.053" - .057"	0.091
	14NHG34	A22018	.058' - .064"	-	-	A22426A/B	.071" - .077"	A22426A/C	.081" - .087"	0.139
	16NHG	A20456	.030" - .035"	A20489	.040" - .045"	A20685A/B	.036" - .040"	A21288A/B	.053" - .057"	0.091
	16NHG22	A20859	.040" - .045"	A21332	.080" - .085"	A21849A/B	.042" - .047"	A21625A/B	.050" - .055"	0.136
	16NHGH	A20586	.030" - .035"	A20751	.030" - .035"	A21061A/B	.041" - .045"	A22135A/B	.050" - .054"	0.086
	16NHG26	A22018	.055" - .065"	-	-	A22426A/B	.071" - .077"	A22426A/C	.081" - .087"	0.139
	16NHT32	-	-	-	-	A21826A/B	.060" - .064"	-	-	0.102
	18NHFL	B4456	.055" - .060"	A22822	.075" - .080"	A21336A/B	.057" - .063	A21336A/C	.070" - .076"	0.122
	18NHG	A20814	.050" - .055"	A21691	.070" - .075"	A20794A/B	.053" - .057"	-	-	0.120
	18NHG22	A20859	.040" - .045"	A21332	.080" - .085"	A21849A/B	.042" - .047"	A21625A/B	.050" - .055"	0.136

	WEAR RING CLEARANCES (UNINSTALLED)									
	PUMP MODEL	WEAR RING	STANDARD CLEARANCE	WEAR RING OPEN	OPEN CLEARANCE	DOUBLE WEAR RINGS	STANDARD CLEARANCE	OPEN DOUBLE WEAR RINGS	OPEN CLEARANCE	REPLACE
SOLIDS	18NHF34	A20814	.050" - .055"	A21691	.070" - .075"	A20794A/B	.053" - .057"	-	-	0.120
	18NHG34	A20814	.050" - .055"	A21691	.070" - .075"	A20794A/B	.053" - .057"	-	-	0.120
	20NHF	A20684	.055" - .060"	A21692	.075" - .080"	A20754A/B	.070" - .076"	A20754A/C	.080" - .086"	0.138
	24NNG	-	-	-	-	A21186A/B	.060" - .075"	A22387A/B	.095" - .117"	0.187
	30NNT	-	-	-	-	A21163A/B	.065" - .080"	-	-	0.128
	MP SERIES		.025" - .035" AXIAL							ADJUST
	SM SERIES	-		-	-	-	-	-	-	
	SP SERIES	-		-	-	-	-	-	-	

CUTTER WEAR RING CLEARANCES (UNINSTALLED)

PUMP MODEL	WEAR RING	IMPELLER CUTTER 1ST GENERATION	CLEARANCE 1ST GENERATION	WEAR RING	IMPELLER CUTTER 3RD GENERATION	CLEARANCE 3RD GENERATION	REPLACE
4NHTA	A14211A	B22728	.038" - .042"	-	-	-	0.067
4414T	A14211A	B22728	.038" - .042"	-	-	-	0.067
4NNT	A12887A	B22823	.030" - .034"	-	-	-	0.054
4NNTL	A23069	B23000	.028" - .032"	-	-	-	0.051
4NHTB	A20956A	B22945	.043" - .047"	-	-	-	0.075
4514T	A20956A	B22797	.028" - .032"	-	-	-	0.051
6NHTA	A22723	B23737	.041" - .045	-	-	-	0.072
6NHTB	A22378	B5310	.060" - .064"	-	-	-	0.102
8NHTA	A22378	B5310	.060" - .064"	-	-	-	0.102
6NHTB19	A22751	B22741	.030" - .034"	-	-	-	0.054
6NHTC19	A22751	B22741	.030" - .034"	-	-	-	0.054
6NHTH	A21187A	B22950	.039" - .043"	-	-	-	0.069
6NNT	A22077A	B22931	.029" - .033"	-	-	-	0.053
8NHTH	A14210A	B23066	.034" - .038"	-	-	-	0.053
8NHTR	A17385A	B22941	.040" - .044"	-	-	-	0.070
8NNT	A17385A	B22941	.040" - .044"	-	-	-	0.070
10NNT	A22562A	B25323	.050" - .054"	-	-	-	0.086
12NHTR	A23717	B23857	.061" - .065"	-	-	-	0.104
14NHG	A20685A	B22968	.062" - .066"	-	-	-	0.106
16NHG22	A21849A	B23037	.042" - .046"	-	-	-	0.074
16NHGH	A20745A	B24170	.041" - .045"	-	-	-	0.072
18NHG34	A20794A	B23563	.068" - .072"	-	-	-	0.115
4NNW	-	-	-	A12887A	B21907	.039" - .043"	0.069
4NHWB	-	-	-	A20956A	B23765	.043" - .047'	0.075
4414W	-	-	-	A20424	B21899	.049" - .053"	0.085
6611W	-	-	-	A22723	B24308A	.041" - .045"	0.072
6NNW	-	-	-	A22077A	B21486	.047" - .051"	0.082
6NHWA	-	-	-	A22723	B24308B	.041" - .045"	0.072
6NHWB	-	-	-	A14482	B24130	.061" - .066"	0.106
8NNW	-	-	-	A17385C	B24394	.052" - .056"	0.090
8NHWA	-	-	-	A14482	B24130	.061" - .066"	0.106
10NNW	-	-	-	A22562A	B24323	.050" - .054"	0.086
12NHWR	-	-	-	A23717	B24862	.061" - .066"	0.106
12NNW	-	-	-	A23032	B21920	.051" - .055"	0.088

IMPELLER OPEN VANE CLEARANCES +/- .015

PUMP MODEL	IMPELLER	VOLUTE/ SUCTION COVER	VANE CLEARANCE	PUMP MODEL	IMPELLER	VOLUTE/ SUCTION COVER	VANE CLEARANCE
1.25YM	B4460	D5815	(1)	**2STH**	D23992	A24008	.020" - .028"
1.25YML	B4495	D5815	(1)	**3STX**	D23284	A23331	.020" - .028"
2.5YM	B4277	B4249	(1)	**3STH**	D23879	A23900	.020" - .028"
2.5HM	B4167	E1136	(1)	**4STX**	D22916	A22977	.020" - .028"
3WM	D7128	D6301	(1)	**4STH**	D22930	A22980	.020" - .028"
3HM	D5262	E2955	(1)	**6STX**	D22930	A22980	.020" - .028"
3NLA	B398	B120	.075"	**8STL**	D23511	A24036	.020" - .028"
3517M	D6996	D6943	(1)	**8STX**	D24380	A24382	.020" - .028"
3NLHM	D6792	D6795	0.075"	**10STX**	E24801	A24907	.020" - .030"
3308CP	D23992	D24570	.030" - .045"				
4NHM17	D7182	D6853	.035"				
4NHM	D6163	D6174	.03"				
4NHDH	D1951	D2712	.160"				
4NLDL	D5496	B4121	>.48"				
4NLHM	D6792	D6795	.075"				
4NNDH	D3330	D5194	.075"				
4NNDL	D3331	D1197	>1.00"				
4614M	D6636	D6625	.049"				
4409CP	D24582	D23284	.030" - .045"				
4410CP	D22916	D24350	.030" - .045"				
6NHDH	B4731	D6608	0.135				
6NHM	D6576	D5116	0.135				
6NHDL	B3311	D6608	>.75"				
6NNDH	D6604	E4529	.143"				
6612CP	D22930	D24406	.030" - .045"				
8NNDH	D7222	D6342	.080"				
10NHM	D6755	D6694	.226"				

NOTE: ADD GASKETS UNTIL IMPELLER ROTATES FREELY, GAP SHOULD BE NO MORE THAN .030" OR THE THICKNESS OF A GASKET.

THREADED IMPELLER INSTALLATION

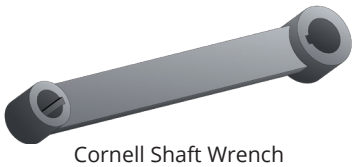
These instructions apply to all stainless threaded impellers.

Instruction

1. Before attempting to install a threaded impeller wash the threads with solvent or brake cleaner. Be sure the threads in the impeller and on the shaft are completely clean and free of all burrs or other debris.
2. Before installing the impeller several measurements need to be taken to determine if any shims are needed to achieve the proper backvane clearance. Using an adjustable square, measure the distance from the end of the sleeve or thrust washer (if a thrust washer is required) to the surface of the backplate. Compare this dimension with a measurement taken from the impeller hub to the backvane surface to determine how many shims are needed to achieve the proper backvane clearance. If there is a thrust washer between the impeller and the sleeve, the shims are to be installed behind the thrust washer in front of the sleeve.

PUMP MODEL	BACKVANE CLEARANCE +/-.008"
MOST MODELS	.030"
4HM	.055"
12NHG28, 14NHG28,18N-HG, 18NHG34, 20NHF, 24NNG, 30NNT, 81026MX	.060"
3HC	.085"
6822MX, 2.5HM	.090"
4NLDL	.293"
Additional clearances are listed in the *Critical Clearances* section.	

3. An alternative method for determining the shim(s) needed is to install the impeller and then measure the backvane clearance. Before installing the impeller apply anti-seize lubricant onto the shaft and the impeller threads.
4. Threaded impellers should not be "spun" onto the shaft. Support the impeller from a crane or other means. Be certain that the drive end or backside of the impeller is perpendicular and lined up to the shaft threads. Rotate the shaft by hand to install the impeller paying close attention not to cross thread. It may be beneficial to have a second person assist during this part of the installation. Remember; do not rotate (spin) the impeller on to the shaft.
5. When the impeller is against the sleeve (or thrust washer) the backvane, clearance can now be checked and the amount of impeller shims adjusted if necessary. NOTE: Once the impeller is tightened using the shaft wrench, the backvane clearance can be reduced .010-.015".
6. After the shaft is screwed into the impeller and the backvane clearance determined to be as specified, the impeller can be tightened against the sleeve with the use of a shaft wrench.



Cornell Shaft Wrench

7. The shaft wrench is designed to be installed on the drive end of the bearing frame shaft. Tighten the impeller by rotating the impeller and shaft counterclockwise and then back clockwise rapidly until the wrench hits a workbench or other solid surface. This should be done until impeller is tightened. Make marks on impeller and backplate until impeller mark doesn't move more than ¼" from backplate mark after each hit.
8. After the impeller is installed, be sure to install the lock screw with a permanent thread locker, such as Loctite® 262 or equivalent and tighten to the torque listed in the impeller lockscrew torque chart.

LOCKSCREW SIZE	TORQUE
.38 – 16UNC	20 Ft-lb
.50 – 13UNC	40 Ft-lb
.62 – 11UNC	90 Ft-lb
.75 – 10UNC	135 Ft-lb
1.00 – 8UNC	265 Ft-lb
1.12 – 7UNC	360 Ft-lb
1.25 – 7UNC	510 Ft-lb
1.50 – 6UNC	875 Ft-lb

9. If the impeller washer contains 2 set screws, these should be installed with a removable thread locker, such as Loctite® 242 or equivalent.
10. Once installed, rotate pump shaft by hand to verify shaft and impeller spin freely.
11. To remove the impeller lockscrew, heat the head of the screw to at least 400°F (204°C) and let cool to release the thread locker. The two set screws should be loosened first and then the lock screw removed. The impeller can now be removed by following the installation instructions in reverse.

PRODUCT CHANGE BULLETIN

CORNELL PUMP COMPANY

Bulletin #18-102 1/22/2018

RUN-DRY FLUID CHANGE

Purpose
Prevent freezing of any moisture in run-dry cavity.

Provide a more environmentally friendly fluid.

Type of Change
Standard run-dry fluid is now Propylene Glycol whereas it was previously refrigerant compressor oil.

Pumps Affected
Any pump equipped with run-dry with the exception of self-primer pumps.

Note: All Redi-Prime and Venturi-Prime pumps have a Run-Dry seal protection system.

Timeline
New Redi-Prime® and venturi prime pumps are currently shipping with propylene glycol as the Run-Dry™ fluid. 1-gallon refill containers are available for order.

Dealer Impact
The run-dry fluid in existing pumps does not need to be changed.

If the customer wishes to change to propylene glycol, the old fluid must be thoroughly flushed out before filling with propylene glycol.

Do not mix oil or other liquids with propylene glycol.

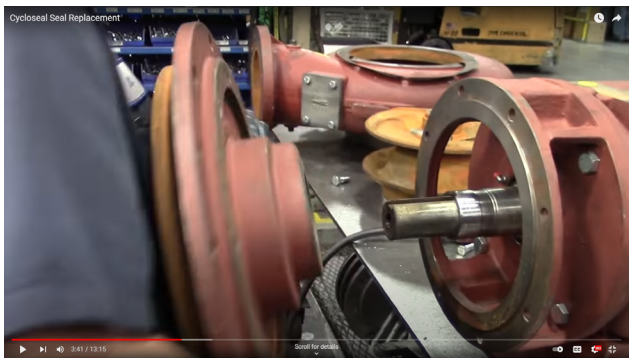
Ordering Information
Part number for 1 gallon container is N10263-415

Additional Information
For more information regarding this product change, contact the Cornell Factory directly at 503-653-0330

ACCESS GREAT CORNELL PUMP INFORMATION ON YOUTUBE!

Cornell maintains a YouTube® page with dozens of how-to and informational videos. You can visit our page at *https://www.youtube.com/cornellpumpcompany*

There you can see:



General pump repair

Replacing mechanical seal

Building a 6819MPC pump

Tips for threaded impellers

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WIRELESS PUMP MONITORING, TELEMATICS, & CONTROL

CORNELL Co·Pilot™

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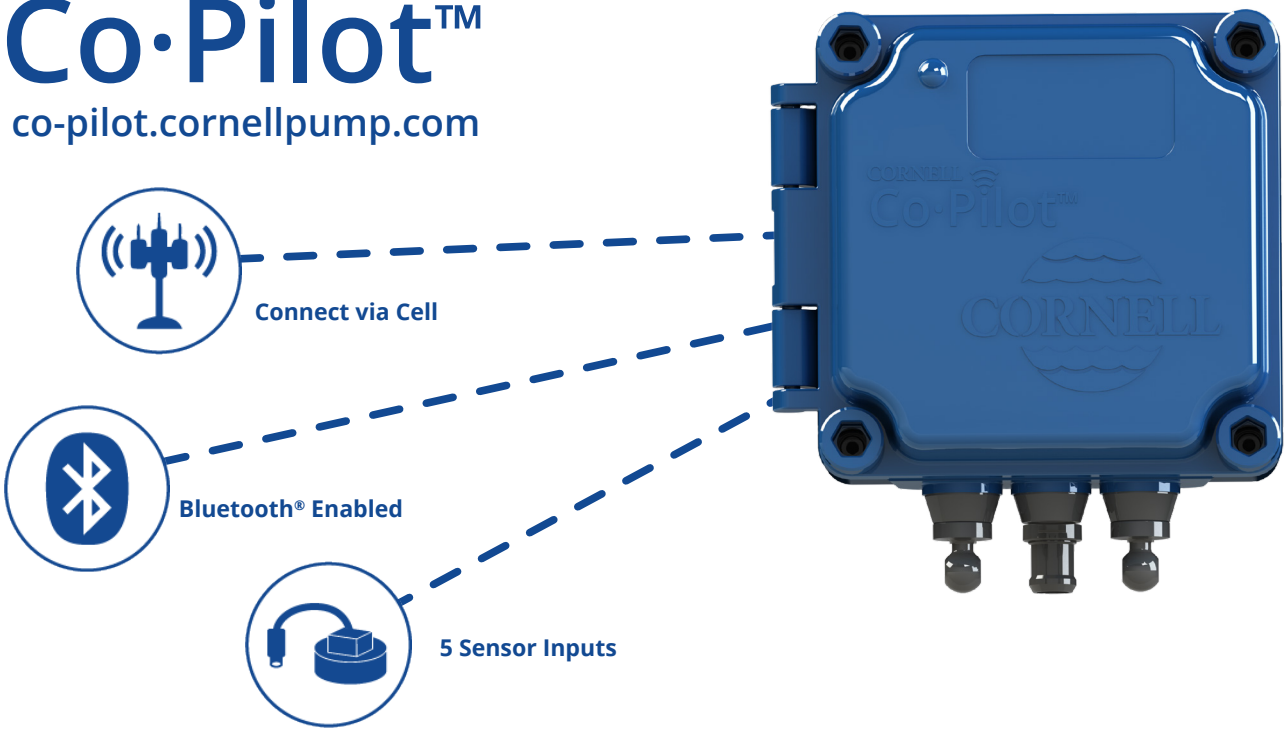

THE POWER OF IIOT

Cornell Co-Pilot connects to your pump to monitor temperature, vibration, and location via battery! Co-Pilot also works with continuous power to track additional parameters and interface with control systems such as SCADA. The Co-Pilot brand stands for Pumps Industrial Internet of Things and represents our commitment to innovative design and customer satisfaction.

USE THE CO-PILOT TO:

- Plan maintenance
- Check operation
- Reduce manual inspections
- Track pump location
- Demonstrate run conditions to customers on warranty claims
- Improve run time through maintenance program

MONITORING AT YOUR FINGER TIPS

Monitor via desktop, iOS or Android apps to see pump performance, receive alarms for out of condition operation, and see last GPS location of pump. Makes it easy to see your pump's performance.

CORNELL CO-PILOT ALLOWS YOU TO:

- Cloud monitor single and multiple pumps via IIOT
- With battery power, monitor temperature, vibration, and GPS location
- Through external power, additionally monitor pressure, flow, start/stop operations and more*
- Track data over time via web-based and mobile apps
- Real-time pump data for maintenance, monitoring performance degredation, and critical conditions
- Receive alerts for preset running conditions

**Requires external sensors; contact Cornell for details.*

NOTES

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