



# DEAN PUMP® SERIES | RA

FAN COOLED HOT OIL PUMPS

INSTALLATION

OPERATION

MAINTENANCE MANUAL



DO NOT INSTALL, OPERATE OR  
SERVICE THIS PUMP BEFORE  
READING THE ENTIRE MANUAL

# DEAN

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## ORDERING REPLACEMENT PARTS

For future reference fill in the following information from the pump nameplate. This will be necessary to ensure accuracy when ordering replacement parts.

Model \_\_\_\_\_

Size \_\_\_\_\_

Serial Number \_\_\_\_\_

Impeller Diameter Installed \_\_\_\_\_

Seal Type \_\_\_\_\_

Material of Construction \_\_\_\_\_

# AUTHORIZED SERVICE CENTERS

Tusk Industrial's Authorized Service Center (ASC) program offers unparalleled value for Dean and Fybroc customers. By partnering with an ASC, customers gain access to OEM-certified parts and specialized maintenance services that ensure peak performance and reliability.

Each ASC is staffed with factory-trained technicians who provide troubleshooting, startup assistance, and repair services—helping to reduce downtime, extend equipment lifespan, and enhance operational efficiency.

## **ADVANTAGES OF PARTNERING WITH AN ASC**

### **UNMATCHED EXPERTISE AND CERTIFICATION**

Certified and factory-trained, ASC technicians deliver expert service and repairs for all Dean and Fybroc pumps—ensuring peak performance, reliability, and peace of mind.

### **RELIABLE SERVICE, GUARANTEED**

The ASC program includes a comprehensive 1-year warranty covering both parts and labor.

All service work is performed by certified ASC technicians, with Tusk Industrial supplying genuine OEM parts—guaranteeing exceptional service quality, equipment reliability, and long-term performance.

### **24/7 SPECIALIZED SUPPORT**

ASCs provide 24/7 expert support to minimize downtime and keep your operations running smoothly—ultimately saving you time and money.










## **[AUTHORIZED SERVICE CENTERS | TUSK INDUSTRIAL](#)**

**[tuskind.com/who-we-are/authorized-service-centers](https://tuskind.com/who-we-are/authorized-service-centers)**



## SYMBOLOLOGY TABLE

The following table contains the various safety symbols and explanations used throughout the manual.






	THIS SYMBOL REPRESENTS SAFETY INSTRUCTIONS THAT MUST BE FOLLOWED TO PREVENT PERSONAL INJURY OR LOSS OF LIFE.
	THIS SYMBOL REPRESENTS AN AREA OR SITUATION WHERE CAUTION MUST BE TAKEN TO PREVENT PERSONNEL FROM BEING CAUGHT IN ROTATING MACHINERY.
	THIS SYMBOL REPRESENTS THE POTENTIAL FOR A HOT SURFACE WHERE PRECAUTIONS MUST BE TAKEN TO PREVENT PERSONAL INJURY OR LOSS OF LIFE.
	THIS SYMBOL REPRESENTS THE POTENTIAL FOR STRONG MAGNETIC FIELDS EXISTS WHERE PRECAUTIONS MUST BE TAKEN TO PREVENT PERSONAL INJURY OR LOSS OF LIFE.
	THIS SYMBOL REPRESENTS THE POTENTIAL FOR AN ELECTRICAL SHOCK HAZARD IS PRESENT WHERE PRECAUTIONS MUST BE TAKEN TO PREVENT PERSONAL INJURY OR LOSS OF LIFE.
	THIS SYMBOL REPRESENTS THE POTENTIAL FOR FLAMMABLE MATERIALS IN SOLID, LIQUID OR GAS FORMS CAN BE PRESENT AND WHERE PRECAUTIONS MUST BE TAKEN TO PREVENT PERSONAL INJURY OR LOSS OF LIFE.
	HIGH RISK TO PERSONNEL SAFETY OR LOSS OF LIFE. DANGER
	MODERATE RISK TO PERSONNEL SAFETY OR POSSIBLE DAMAGE TO THE EQUIPMENT OR INSTALLATION. CAUTION
	SYMBOL REPRESENTS THE ATEX MARKING FOR EXPLOSIVE ATMOSPHERE ZONES.

## GENERAL

The instructions detailed in this manual must be read in their entirety prior to installation, maintenance, operation, or start-up of the equipment. The equipment must not be put into service until all the conditions related to safety, noted in this manual, have been met. Failure to follow the given instructions is considered misuse of the product and shall not be covered under Tusk Industrial / Dean Pump warranty.





## ACTIONS

The following are safety concerns and actions related to the proper use and maintenance of the equipment to prevent personal injury or damage to the equipment, installation, or environment.

-  All equipment should be de-energized prior to starting any work. Follow proper lock out / tag out procedures.
-  Guards must be in place and secure while the equipment is operational.
-  Pump may be extremely hot depending upon the service. Proper personal safety equipment must be used and the pump should be allowed to cool prior to any work being done.
-  Block in and isolate the equipment from the attached process piping. Drain the equipment and piping prior to performing any work.
-  Never apply heat to remove the impeller from the shaft. Trapped vapor could cause an explosion.

## WARNING

SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE MAY OCCUR UNLESS THIS EQUIPMENT IS APPLIED, INSTALLED, OPERATED, AND MAINTAINED BY THOROUGHLY QUALIFIED PERSONNEL IN STRICT ACCORDANCE WITH THE INSTRUCTION MANUAL AND ALL APPLICABLE DRAWINGS AND CODES.

-  READ THE INSTRUCTION MANUAL COMPLETELY BEFORE INSTALLING, FILLING, OPERATING, OR MAINTAINING THIS EQUIPMENT.
-  OBTAIN, READ AND HEED THE MSDS (MATERIAL SAFETY DATA SHEET) FOR THE FLUIDS BEING HANDLED BEFORE ATTEMPTING TO FILL, OPERATE OR MAINTAIN THIS EQUIPMENT. OBTAIN INSTRUCTIONS FROM THE SAFETY ENGINEER RESPONSIBLE FOR YOUR FACILITY BEFORE PERFORMING ANY WORK ON THE PUMPING EQUIPMENT AND SYSTEMS.
-  PROPER STORAGE WHILE NOT IN USE AND PROPER INSTALLATION AND STARTUP ARE ESSENTIAL FOR SUCCESSFUL PUMP OPERATION. MISUSE OR IMPROPER STORAGE, INSTALLATION OR OPERATION OF PUMPS MAY RESULT IN SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE. TUSK INDUSTRIAL IS NOT RESPONSIBLE FOR ANY LOSS OR DAMAGE RESULTING FROM CAUSES BEYOND ITS CONTROL, AND IS NOT LIABLE FOR CHARGES FOR WORK PERFORMED OR MATERIALS FURNISHED TO REPAIR SUCH LOSS OR DAMAGE.
-  ALL INSTALLATION, OPERATION, AND MAINTENANCE MUST BE DONE BY THOROUGHLY QUALIFIED PERSONNEL IN STRICT ACCORDANCE WITH THIS MANUAL AND MUST COMPLY WITH ALL LOCAL, STATE AND FEDERAL CODES. ONLY DEAN AUTHORIZED SERVICE PARTS MUST BE USED IN THE REPAIR OF THESE PUMPS.

# SAFETY

## WARNING LABELS AND TAGS

The following warning labels are affixed to the pump by the manufacturer.



### WARNING: HOT SURFACE

THE PUMP IS DESIGNED TO PUMP HIGH TEMPERATURE FLUIDS AND THE SURFACE TEMPERATURE OF THE PUMP CAN EXCEED 800° F / 430° C. SEVERE BURNS, INJURY OR DEATH CAN RESULT IN CONTACTING THE SURFACE OF THE PUMP DURING OPERATION. THE PUMP MUST BE SHUTDOWN AND ALLOWED TO COOL TO A SAFE TEMPERATURE PRIOR TO SERVICING.



### WARNING: ROTATING EQUIPMENT KEEP GUARDS IN PLACE

ALL GUARDS SHALL BE KEPT IN PLACE AND SECURE DURING OPERATION. NEVER SHOULD THE EQUIPMENT BE ENERGIZED WITHOUT THE GUARDS IN PLACE AND SECURE. SEVERE INJURY OR DEATH CAN RESULT IN CONTACTING THE ROTATING COMPONENTS OF THIS EQUIPMENT. LOOSE CLOTHING, JEWELRY AND HAIR SHOULD BE SECURED OR REMOVED PRIOR TO SERVICING THE EQUIPMENT.



### WARNING: AUTOMATIC STOP AND START

THE EQUIPMENT HAS THE POTENTIAL OF BEING STARTED AND STOPPED AUTOMATICALLY. PROPER LOCK OUT / TAG OUT PROCEDURES SHALL BE FOLLOWED TO ENSURE THAT THE EQUIPMENT IS COMPLETELY DE-ENERGIZED PRIOR TO SERVICING.



### NOTE: GROUNDING LUG

THE EQUIPMENT IS FURNISHED WITH A GROUNDING LUG TO BE USED TO PROPERLY GROUND THE COMPONENTS.

 <b>TUSK</b>		<b>DEAN</b> 6040 GUION ROAD INDIANAPOLIS, IN 46254 WWW.TUSKIND.COM		 SERVICE SCAN	
MADE IN USA		MODEL & SIZE			
DESIGNATION	SERIAL #	MAT'L OF CONST.			
IMP. DIA (mm)	SEAL TYPE	ITEM #			
MAX PRES (BAR) @	TEMP (°C)	MAX TEMP (°C) @	PRES (BAR)		
FLOWRATE (M <sup>3</sup> /HR)	TDH (M)	R.P.M.	K.W.		

# SAFETY

## RECEIVING AND INSPECTION

Dean Pump Division products are manufactured under established quality control procedures intended to promote proper operation in conformity with applicable performance standards. On completion of inspection, each unit is coated with rust preventative, sealed against the entrance of dirt, and tagged with a signed certificate of inspection prior to shipment.

## RECEIVING PUMP

WHEN THE PUMP IS RECEIVED FROM THE TRANSPORTATION COMPANY IT SHALL BE PROMPTLY INSPECTED FOR DAMAGE AND SUCH DAMAGE NOTED ON THE BILL OF LADING BEFORE IT IS SIGNED. CLAIMS FOR SHIPPING DAMAGE MUST BE FILED AGAINST THE CARRIER.

CARE SHOULD BE EXERCISED IN UNLOADING AND HANDLING THE PUMP.



CAUTION

## STORAGE

PUMPS MUST BE PROPERLY COVERED AND PROTECTED AGAINST MOISTURE, DIRT, AND PHYSICAL DAMAGE DURING STORAGE PRIOR TO INSTALLATION. IF PROLONGED STORAGE IS ANTICIPATED, A HEAVY PROTECTIVE COATING SHALL BE APPLIED TO BEARINGS AND ALL EXPOSED MACHINED SURFACES.

A RUST PREVENTATIVE MUST BE USED TO PROTECT ALL STEEL OR CAST IRON PARTS. COMPRESSION PACKING OR MECHANICAL SEALS SHOULD BE REMOVED AND STORED AS WELL AS PROTECTED SEPARATELY.

PUMPS MUST ALSO BE PROTECTED FROM MOISTURE, DIRT, AND PHYSICAL DAMAGE DURING AND AFTER INSTALLATION WHILE THE SYSTEM IS BEING COMPLETED. PUMPS "STORED" ON THEIR FOUNDATIONS MUST BE COMPLETELY CHECKED FOR PROPER INSTALLATION PRIOR TO START-UP.

PROPER STORAGE AND INSTALLATION HELP PRESERVE THE INTENDED PERFORMANCE OF DEAN PRODUCTS.

## LIFTING AND HANDLING INSTRUCTIONS

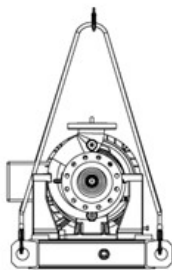


Figure 1

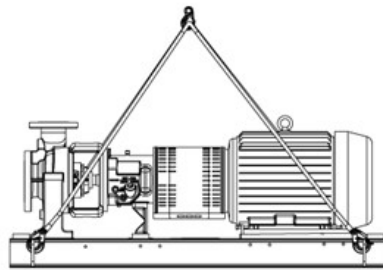


Figure 2

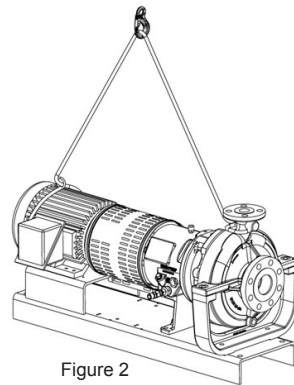


Figure 3



ALWAYS WEAR THE APPROPRIATE PROTECTIVE APPAREL WHEN WORKING ON OR AROUND THE PUMPING EQUIPMENT. SAFETY GLASSES WITH SIDE SHIELDS, HEAVY WORK GLOVES (USE INSULATED WORK GLOVES WHEN HANDLING HOT ITEMS), STEEL-TOED SHOES, HARD HAT, AND ANY OTHER PROTECTIVE GEAR AS NEEDED FOR PROTECTION. ONE EXAMPLE OF OTHER GEAR WOULD BE BREATHING APPARATUS WHEN WORKING NEAR TOXIC MATERIALS. USE LIFTING DEVICES, MANUFACTURED EXPRESSLY FOR THE PURPOSE OF LIFTING, TO MOVE THE PUMPING MACHINERY. DO NOT ATTEMPT TO LIFT THE ASSEMBLY OR ITS COMPONENTS MANUALLY. USE ONLY DEVICES WITH LIFTING CAPABILITIES IN EXCESS OF THE WEIGHT OF THE UNIT BEING LIFTED. INSPECT STRAPS, CHAINS, HOOKS, ETC. FOR DAMAGE AND LIFTING CAPABILITY BEFORE USE. LIFT ONLY AT THE CENTER OF GRAVITY.

PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE COULD OCCUR IF GOOD LIFTING PRACTICES ARE NOT USED.

# WARRANTY

## WARRANTY

We warrant to the purchaser from us of Dean Pump products and parts of our own manufacture (Dean Products) that the Dean Products are free under rated use and service from defects in design, material and workmanship for a period of one (1) year from the date of installation, but not to exceed eighteen (18) months from the date of shipment by us. This warranty does not cover (I) any loss or damage resulting from wear, corrosion, abrasion or deterioration due to normal use in rated service; (II) replacement of service items such as shaft packing and mechanical seals; (III) products or parts manufactured by others but furnished by us which, if defective, shall be repaired or replaced only to the extent of the original manufacturer's warranty; (IV) any loss or damage to or defects in any Dean Products resulting from the misuse or improper storage, installation, or operation thereof; or (V) any loss or damages to or defects in any Dean Products resulting from any alteration or modification thereof not expressly authorized and approved by us in writing.

**IN NO EVENT SHALL WE BE RESPONSIBLE FOR ANY INDIRECT, INCIDENTAL, OR CONSEQUENTIAL ECONOMIC LOSSES OR DAMAGES, INCLUDING, WITHOUT LIMITATION, (I) LOSS OF BUSINESS, REVENUE, OR PROFITS, OR (II) LABOR, MATERIAL, OR OTHER FINANCIAL COSTS, CLAIMS, OR EXPENSES ARISING OUT OF OR RELATING TO THE SERVICING, ALTERATION, OR REPAIR OF ANY DEAN PRODUCTS BY ANYONE OTHER THAN US.**

**OUR LIABILITY FOR BREACH OF WARRANTY HEREUNDER IS LIMITED SOLELY TO THE REPAIR IN OUR FACTORY OR THE REPLACEMENT F.O.B. OUR FACTORY, AS THE CASE MAY BE, OR ANY DEAN PRODUCTS WHICH SHALL HAVE BEEN DETERMINED BY US, AFTER NOTICE TO US AND INSPECTION BY US WITHIN THE WARRANTY PERIOD, TO BE SO DEFECTIVE WHEN SHIPPED BY US. THIS WARRANTY AND THE LIABILITY SET FORTH HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER LIABILITIES AND WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE. NOTHING IN THIS WARRANTY SHALL BE CONSTRUED TO LIMIT OR EXCLUDE LIABILITY FOR PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE TO THE EXTENT SUCH LIMITATION OR EXCLUSION IS PROHIBITED BY APPLICABLE LAW.**

# SPECIFICATIONS

## MECHANICAL DESIGN SPECIFICATIONS

	RA2096	RA3146 / 3186	RA3246
Direction of Rotation (Viewed from the Coupling End)	CW	CCW	
Casing Thickness, Minimum	0.3125 in. / 7.9 mm		
Corrosion Allowance	0.125 in. / 3.2 mm		
Impeller - Standard	Single Plane Balance ISO G2.5		
Optional Extra	Dynamically Balanced ISO G2.5		
Flanges - ASME/ANSI B16.5 Rating	Class 150#	Class 300#	
Facing - Standard	Standard Raised Face	Standard Raised Face	
Finish	125 Ra	125 Ra	
Flanges - DIN Flange Rating (Optional)	PN 10	PN 25	
Facing - Standard	Standard Raised Face	Standard Raised Face	
Finish	125 Ra	125 Ra	
Suction Pressure - Maximum	100 psig / 689 kPa		

	RA2096		RA3146		RA3186		RA3246	
Power Rating – Maximum	HP	KW	HP	KW	HP	KW	HP	KW
@ 3600 rpm	35	26	100	75	250	200	250	200
@ 3000 rpm	35	26	100	75	250	200	250	200
@ 1800 rpm	15	12	40	30	125	100	125	100
@ 1500 rpm	15	12	40	30	125	100	125	100
@ 1200 rpm	10	7.5	25	20	75	60	75	60
@ 1000 rpm	10	7.5	25	20	75	60	75	60
Bearings, Type Ball Bearings, Grease Lubricated								
Thrust Bearing (Angular Contact Pair)	5306 2RS		7308 BG		7311 BG		7314 BG	
Radial Sleeve Bearing	CARBON		CARBON		CARBON		CARBON	
Seal Chamber Dimensions	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
Length (Depth)	1.63	41.3	2.81	71.5	3.88	98.4	3.68	93.6
Inside Diameter (Bore Diameter)	2.06	52.4	3.13	79.4	4.31	109.5	5.00	127.0
Shaft Diameter	1.13	28.6	1.75	44.5	2.25	57.2	3.00	76.2
Pump Shaft Dimensions	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
Span Between Bearings C to C	8.69	220.7	11.44	290.5	14.63	371.5	18.97	482.0
Span Between Radial Bearing C and Impeller C	1.63	41.3	2.31	58.7	3.25	82.6	4.15	105.5
Diameter at Coupling	0.88	22.2	1.06	27.0	1.63	41.3	2.38	60.3
Diameter Between Bearings	0.94	23.8	1.56	39.7	1.88	47.6	2.63	66.8
Diameter at Impeller	0.75	19.1	1.13	28.6	1.50	38.1	2.25	57.2
L <sup>3</sup> /D <sup>4</sup>								
Solid	4.3		2.1		2.8		1.5	
Material Class	22 (Ductile Iron)		22 (Ductile Iron)		22 (Ductile Iron)		22 (Ductile Iron)	
Maximum Ambient Temperature	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius
	104	40	118	48	118	48	118	48

# SPECIFICATIONS

STANDARD MATERIALS OF CONSTRUCTION					
Part No.	Part Name	RA2096 CLASS 22	RA3146 CLASS 22	RA3186 CLASS 22	RA3246 CLASS 22
3	Impeller	C.I. (1)	C.I. (1)	C.I. (1)	C.I. (1)
*4	Impeller Key	Steel (2)	Steel (2)	Steel (2)	Steel (2)
5	Casing	D.I. (10)	D.I. (10)	D.I. (10)	D.I. (10)
5A	Casing Drain Plug	Steel (2)	Steel (2)	Steel (2)	Steel (2)
5C	Casing Stud Nut	N.A.	Steel (5)	Steel (5)	Steel (5)
5D	Casing Stud/Cap Screw	Steel (3) Screw	Steel (4) Stud	Steel (4) Stud	Steel (4) Stud
6A	Casing Ring (Only Some Sizes)	N.A.	Iron (7)	Iron (7)	Iron (7)
9	Bearing Housing Foot	Steel (2)	Steel (2)	Steel (2)	Steel (2)
*12	Impeller Bolt / Nut	Steel (2) Nut	Steel (2) Bolt	Steel (2) Bolt	Steel (2) Bolt
*12A	Impeller Washer	Steel (2)	Steel (2)	Steel (2)	Steel (2)
*13	Mechanical Seal Gland	Steel (2)	Steel (2)	Steel (2)	Steel (2)
*25A	Shaft Bearing - Thrust - Ball	Double Row	Angular Contact Pair	Angular Contact Pair	Angular Contact Pair
26	Bearing Housing	D.I. (10)	D.I. (10)	D.I. (10)	D.I. (10)
*28	Bearing End Cover	C.I. (1)	Steel (2)	D.I. (9)	D.I. (9)
*29	Pump Shaft	11-13 S/S (12)	11-13 S/S (12)	11-13/316 S/S (8)	11-13 S/S (12)
*31	Thrust Bearing Lock Nut	N.A.	Steel (2)	Steel (2)	Steel (2)
*31A	Thrust Bearing Lock Washer	N.A.	Steel (2)	Steel (2)	Steel (2)
56	Casing Foot	N.A.	C.I. (1)	C.I. (1)	C.I. (1)
*75	Snap Ring	N.A.	Steel (2)	N.A.	N.A.
*75A	Snap Ring	Steel (2)	N.A.	N.A.	N.A.
*76	Grease Seal - Front	Viton (13)	Viton (13)	Viton (13)	Viton (13)
*76A	Grease Seal - Rear	N.A.	Buna (14)	Buna (14)	Buna (14)
77	Casing Gasket Grafoil (11)	Grafoil (11)	Grafoil (11)	Grafoil (11)	Grafoil (11)
*77B	Bearing End Cover Gasket Buna (14)	N.A.	Buna (14)	Buna (14)	Buna (14)
*84	Barrier Oil Fill Plug	Steel (2)	Steel (2)	Steel (2)	Steel (2)
*92	Barrier Oil Drain Plug	Steel (2)	Steel (2)	Steel (2)	Steel (2)
*95A	Mechanical Seal Stationary	Silicon Carbide & Viton	Silicon Carbide & Viton	Silicon Carbide & Viton	Silicon Carbide & Viton
*95B	Mechanical Seal Rotary	S/S, Carbon & Viton	S/S, Carbon & Viton	S/S, Carbon & Viton	S/S, Carbon & Viton
98	Coupling Guard	Steel (2)	Steel (2)	Steel (2)	Steel (2)
*120	Fan	Aluminum	Aluminum	Aluminum	Stainless Steel
*121	Fan Collar	N.A.	Steel (2)	Steel (2)	Steel (2)
*122	Fan Clamp Ring	Steel (2)	Steel (2)	Steel (2)	Steel (2)
*180	Radial Bearing Cartridge	Carbon & Steel	Carbon & Steel	Carbon & 416 S/S	Carbon & 416 S/S
*325	Seal Gland Gasket	Viton (13)	Viton (13)	Viton (13)	Viton (13)
*365	Mechanical Seal Retainer	Steel (2)	Steel (2)	Steel (2)	Steel (2)
*370	Seal Retainer Set Screw	Steel	Steel	Steel	Steel
*375	Anti-Rotation Pin	N.A.	N.A.	316 S/S	316 S/S

\* Denotes parts interchangeability in all pumps of a given series.

## NOTES

(1)	Cast Iron	(8)	ANSI 316 S/S with ANSI 416 S/S at Sleeve Bearing
(2)	AISI 1020	(9)	Ductile Iron - ASTM A536
(3)	SAE Grade 5 or ASTM A449 Type 1 Steel	(10)	Ductile Iron - ASTM A395
(4)	AISI 4140 ASTM A193-B7 Steel	(11)	Grafoil®
(5)	ASTM A194 Grade 2 Steel	(12)	ANSI - 420 S/S
(7)	Hardened Iron	(13)	Viton® Elastomer
		(14)	Buna N Rubber

Viton® is a registered Trademark of E.I. DuPont Co.  
Grafoil® is a registered Trademark of Union Carbide Co.

# SPECIFICATIONS

RA3000 Series - Noise Characteristics - Typical Sound Pressure Levels									
		3500 RPM		2900 RPM		1750 RPM		1450 RPM	
KW	HP	PUMP	PUMP & MOTOR	PUMP	PUMP & MOTOR	PUMP	PUMP & MOTOR	PUMP	PUMP & MOTOR
0.55	< .75	55	67	51	62	50	56	50	54
0.75	1	57	68	53	63	51	57	51	56
1.1	1.5	59	69	55	64	54	59	53	57
1.5	2	61	70	57	67	56	61	55	59
2.2	3	62	71	59	68	58	63	57	60
3	4	63	74	60	70	59	64	58	62
4	5	64	74	62	71	61	66	60	63
5.5	7.5	66	75	64	72	63	67	62	65
7.5	10	68	76	65	73	64	69	63	67
11	15	70	78	67	75	66	71	65	69
15	20	71	79	69	76	68	72	67	70
18.5	25	72	80	70	76	69	72	68	71
22	30	74	81	71	78	70	73	69	71
30	40	75	81	73	78	71	74	70	72
37	50	76	82	74	79	72	75	71	74
45	60	77	83	75	80	73	77	72	75
55	75	79	84	76	81	75	78	74	76
75	100	80	85	78	82	76	79	75	77
90	120	81	86	79	83	77	80	76	78
110	150	82	87	80	84	78	81	77	79
150	200	84	89	82	86	81	82	80	80

Sound pressure level LpA measured at 1m reference distance from pump  
Tolerance = +/- 3 dBA

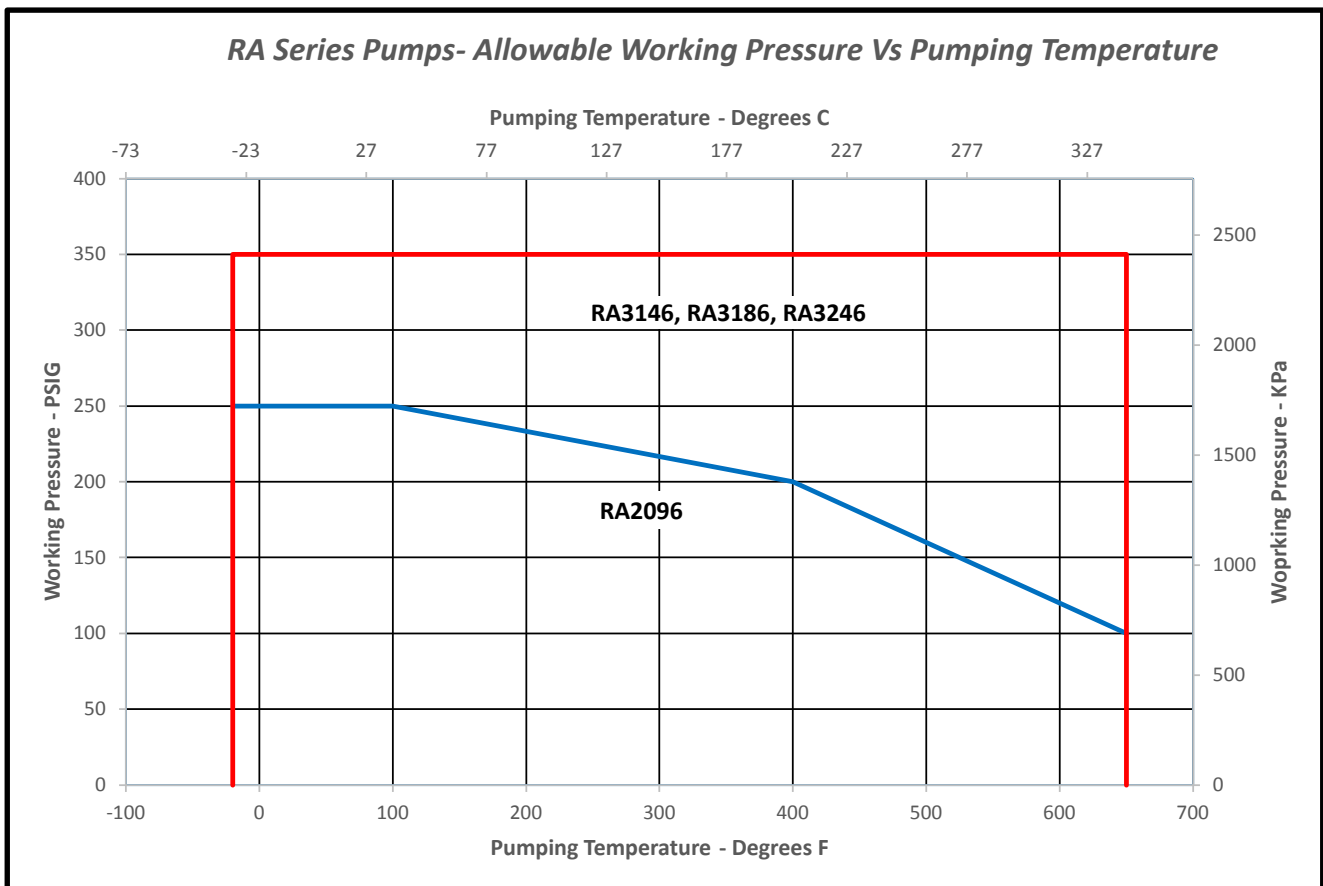


Figure 4

# INSTALLATION

## APPLICATION AND REAPPLICATION

At the time of installation, the equipment received should have already been selected for the service required. You must read the paperwork for the installation and check the serial number of the pump to ensure that you are installing the correct pump into the service for which it was selected.



### WARNING

MANY PUMPS LOOK IDENTICAL FROM THE OUTSIDE BUT CAN BE MADE OF DIFFERENT MATERIALS AND/OR BE CONSTRUCTED DIFFERENTLY INSIDE. PERSONAL INJURY, DEATH, EQUIPMENT DAMAGE, PRODUCT (PUMPAGE) DAMAGE, AND/OR PRODUCT LOSS COULD OCCUR IF THE INCORRECT PUMP IS INSTALLED

Do not transfer an existing pump to any other service conditions until you have thoroughly reviewed the pump construction, materials, sizing, sealing, pressure containing capability, head/capacity capability, and temperature capability with respect to the required service. Consult the Dean Pump sales engineer with all the service requirements and a full description of the existing pump (including the serial number), seal, and sub-systems so that we can assist you in a successful reapplication.

## PUMP FOUNDATION

The pump foundation provides rigid support to the baseplate and maintains the alignment of the pumping unit. Baseplates are intended to rigidly support the pump and driver without vibration or distortion only when they are properly set, leveled, and secured to the foundation.

The purchaser may elect to mount the pump without grouting the baseplate. In any case the baseplate must be fully supported by the customer's mounting means to prevent vibration and distortion.

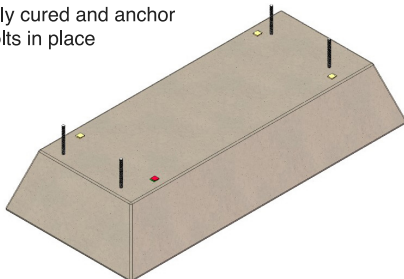
## BASEPLATE MOUNTING AND ALIGNMENT

The sequence of mounting which must be observed for proper baseplate and pump mounting is:

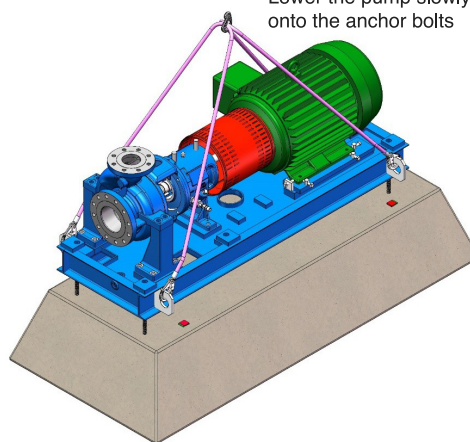
- 1) Place baseplate, with pump and driver mounted, on the pump foundation.
- 2) Use wedges under the baseplate edges, at each foundation bolt, to properly support and level the unit. Check this with a spirit level on **pump and motor machined surfaces**. Pull down the baseplate mounting bolt nuts tightly and recheck for level. Correct as necessary.
- 3) Align the driver to the pump. See "Pump and Driver Alignment" on page 13.

## PUMP ASSEMBLY INSTALLATION

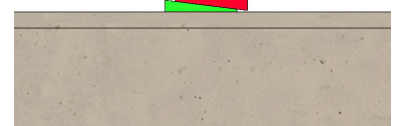
Foundation should be fully cured and anchor bolts in place



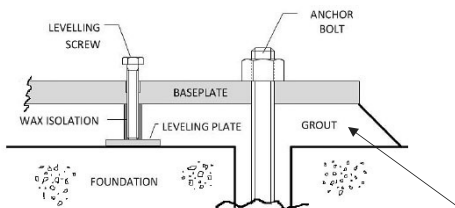
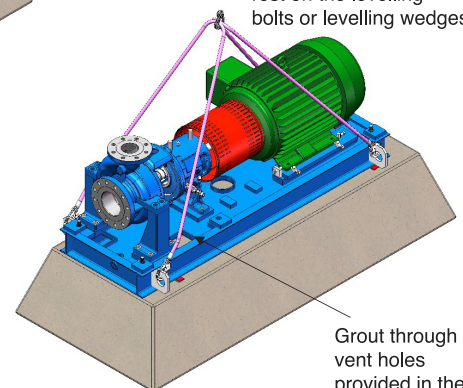
Lower the pump slowly onto the anchor bolts



If levelling screws are not provided levelling wedges can be used at each corner



Pump baseplate should rest on the levelling bolts or levelling wedges



Grout should fill the entire space between the underside of the baseplate and the foundation

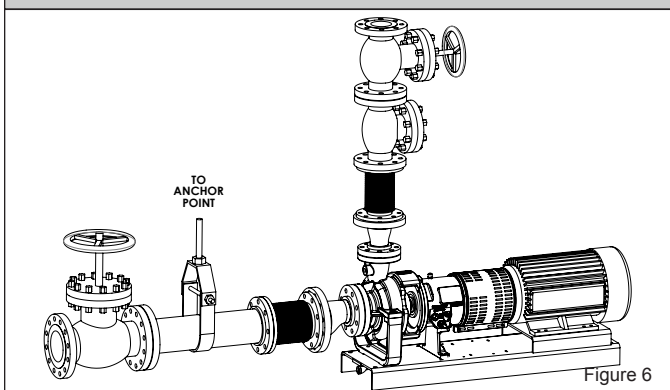
Figure 5

# INSTALLATION

- 4) Grout the baseplate. Do not grout the baseplate to the foundation until the pump and driver are correctly aligned. Channel type baseplates are made with open ends to allow easy grouting and do not require grouting holes in the baseplate. Fabricated structural steel baseplates are provided with grouting holes. Fill the entire void under the baseplate with grout and firmly embed the baseplate edges.
- 5) Connect the suction and discharge piping without forcing the piping into position. See “Suction and Discharge Piping” on page 12. The pipe flanges must line up with the pump flanges “freely” to prevent pipe loads and moments being transferred to the pump. Install a “new” bolt, of the correct size per ASME/ANSI B16.5 and the correct material per ASME/ANSI B16.5, in every bolt hole. Tighten all bolts evenly. Use only new uncorroded fasteners.

Install “new” gaskets, of the correct material for the service, and the correct size per ASME B16.20, or ASME B16.21 at the suction and the discharge flanges of the pump. Use only new gaskets.

## TYPICAL PUMP PIPING



### WARNING

STRAIN CAUSED BY “FORCING”, IMPROPER FLANGE BOLTING, AND/OR MISALIGNMENT MAY CAUSE FAILURE OF THE PUMPING UNIT, FLANGES, PIPING AND/OR FLUID (PUMPAGE) RELEASE WHICH COULD CAUSE PERSONAL INJURY, DEATH, AND/OR DAMAGE TO THIS AND/OR OTHER EQUIPMENT.

- 6) Recheck the alignment between the driver (motor, turbine, or engine) and pump shafts. Installation of piping may have forced the pump out of alignment. If so, correct the piping to remove the distorting load, and realign the pump and driver.
- 7) The pump and driver alignment must again be checked at the operating temperature and alignment corrected under the hot condition.



### WARNING

MAKE SURE THAT ALL PIPING IS INSTALLED INTO ITS CORRECT CONNECTION. INSTALLATION OF A PIPE INTO AN INCORRECT LOCATION COULD RESULT IN AN EXPLOSION AND PERSONAL INJURY OR DEATH AS WELL AS DAMAGE TO THIS AND/OR OTHER EQUIPMENT.

INSTALL PRESSURE RELIEF VALVES IN ANY CAVITIES THAT COULD BE SUBJECTED TO PRESSURES IN EXCESS OF THE ALLOWABLE WORKING PRESSURE. EXPLOSION, PERSONAL INJURY, DEATH, AND/OR DAMAGE TO THIS AND/OR OTHER EQUIPMENT MAY OCCUR IF ALLOWABLE PRESSURE IS EXCEEDED.

- 8) After approximately 200 hours of normal pump operation, the driver alignment must be checked under the hot condition by qualified personnel, provided that site conditions and safety requirements permit. If the alignment remains correct, the driver feet should be doweled to the baseplate. If the alignment has changed, realign the unit and recheck after an additional 200 hours of normal pump operation. It is the responsibility of the installer or end user to perform this verification as part of normal maintenance procedures.

## SUCTION AND DISCHARGE PIPING

Suction and discharge nozzle sizes of Dean pumps are selected for proper performance of the pumping unit and are not intended to determine the suction and discharge pipe sizes. Pipe sizes must be determined by the user based on the system requirements.

Suction piping should have a minimum friction loss and thus must be as short and straight as possible with a pipe diameter as large as economically feasible for the flow rate handled.

Suction piping must never be smaller in diameter than the suction nozzle size. When the suction piping is larger than the suction nozzle size an eccentric reducer is required at the suction flange and must be installed with the taper located on the underside to eliminate air or vapor pockets. The section of piping attached to the suction flange of the pump must be straight for a length of eight pipe diameters or more.

Discharge piping may be the same size as, larger, or smaller than the discharge nozzle as the system flow may demand.

# INSTALLATION

In new installations or rebuilt systems, dirt, pipe scale, welding slag, and general construction debris may get into the piping. It is important to prevent this material from entering the pump and damaging pump parts, bearings, mechanical seal faces, or lip seals. Bearings, mechanical seals and lip seals are especially subject to damage even by very small particles. To prevent damage, a strainer or filter installed in the suction line is recommended. Commercially available strainers or filters as recommended by their manufacturers can do an excellent job.

Suction line screens or strainers may usually be removed when, after several days of use, no dirt has been collected and the system is clean.

Note that screens and filters in the suction line are restricting devices which reduce the net positive suction head (NPSH) available to the pump and should be considered at the time the system is designed. Failure to account for reduced NPSH may result in cavitation damage.

## PUMP AND DRIVER ALIGNMENT

Proper running life of a pump and driver unit depends on the accuracy with which the axis of the driver shaft coincides with the axis of the pump shaft when the unit is running. Although pumps and drivers are check aligned at the factory, this is only to confirm that the unit can be aligned in the field as handling during shipment and installation will cause the alignment to change. ***The pump and driver alignment must always be checked and corrected before the baseplate is grouted to the foundation and again before the pump is first started.*** Alignment is intended to be achievable if baseplate mounting instructions are followed. ***Failure to properly align the unit will result in vibration, short bearing life, and reduced mechanical seal life.***

Pumps are not constructed to be used as pipe anchors. Both suction and discharge piping must be supported independently of the pumping unit and thermal expansion joints provided to guard against expansion loads on the pump. Pipes must be anchored between the expansion joint and the pump and as close to the pump as possible. Failure to provide proper piping support and expansion joints may impose strains on the pumping unit which will result in serious misalignment. Maximum allowable piping loads are shown in Figure 8 on page 14 in this manual.

No allowance for thermal expansion is made for motor driven units in mounting the driver. Allowance for turbine mounting should be in accordance with the turbine manufacturer's recommendations.

***Final alignment must always be checked and corrected at the operating temperatures of the pump and driver.***

Misalignment of the two shafts is of two kinds. The first of these is angular misalignment where the axis of one shaft is at an angle from the other. The other is offset misalignment where the center of one shaft is offset from the center of the other shaft. These effects usually occur together so that both angular and offset misalignment are present.

Coincident alignment of the driver and pump shaft is measured at the faces of the coupling hubs. Because of the variety of coupling types that may be furnished at the customer's request, the procedure here given is general in nature but may be applied by simple adaptation to most coupling types.

The pump was shipped without the coupling spacer installed to allow for alignment and motor rotation check. If, however, for any reason this spacer assembly has already been installed, remove it at this time. The RA2096 pumps are shipped with one of the coupling spacer flanges bolted to the pump hub to secure the cooling fan (Item #120) for shipping. Loosen the four bolts that are securing this flange and remove it.

## DIAL INDICATOR METHOD

To one of the coupling hubs, either on the motor shaft or the pump shaft, attach a dial indicator. Mount the indicator so that the indicator button rides on the face of the other coupling hub near the outside diameter of the hub. Reference Figure 7 "TYPES OF MISALIGNMENT" on page 14. Rotate the shaft to which the dial indicator is clamped, allowing the indicator button to ride on the face of the stationary hub. The indicator dial movement will show the difference in the distance between the two hubs. This indicates the amount of angular misalignment between the hubs and therefore the shaft axes. Good practice suggest alignment to within 0.002" T.I.R. (Total Indicator Reading).

To check the offset alignment, mount the dial indicator as shown in Figure 7 "TYPES OF MISALIGNMENT" on page 14, with the indicator button on the outside diameter of the stationary hub, near the face of the hub closest to the end of the shaft. It may be necessary, on the RA2096 pumps, to slide the cooling fan (120) closer to the pump, to obtain enough clearance for the dial indicator, dependent of course upon the type of indicator used. If necessary, the fan may be removed, and replaced after the motor alignment is completed. Rotate the shaft, to which the dial indicator is clamped, allowing the indicator button to ride on the outside diameter of the stationary coupling hub. The indicator dial movement will show the difference in the center locations of the two shafts. Good practice suggest alignment to within 0.002" T.I.R.

## LASER ALIGNMENT METHOD

When using laser alignment equipment follow the recommendations and practices prescribed by the laser equipment manufacturer.

# INSTALLATION

Angular and offset alignment is adjusted by placing thin metal shims under the driver mounting feet to bring the driver into exact alignment with the bolted down pump. If misalignment is of major proportions, the baseplate has been improperly installed on the foundation and must be leveled before proceeding with alignment.

After each change, it is necessary to recheck both angular and offset alignment of the coupling. After the pump and driver are aligned, tighten all hold-down bolts and then recheck alignment. Closer alignment is intended to promote longer running life.

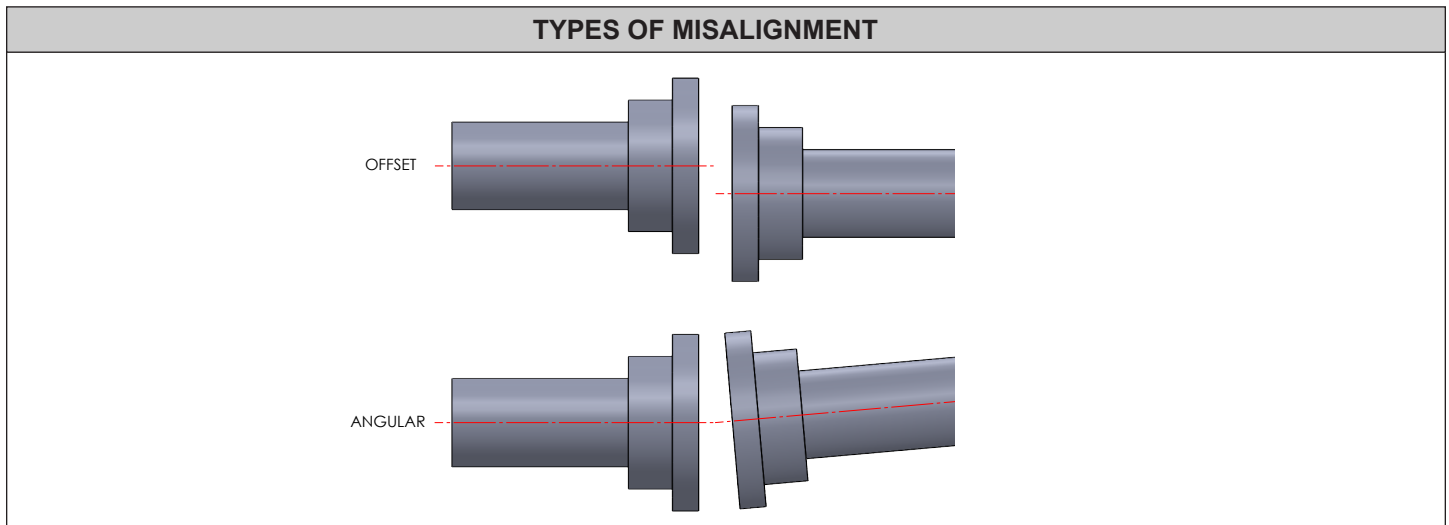


Figure 7

## ALLOWABLE PIPING LOADS FOR RA2096, RA3146, RA4186 AND RA3246

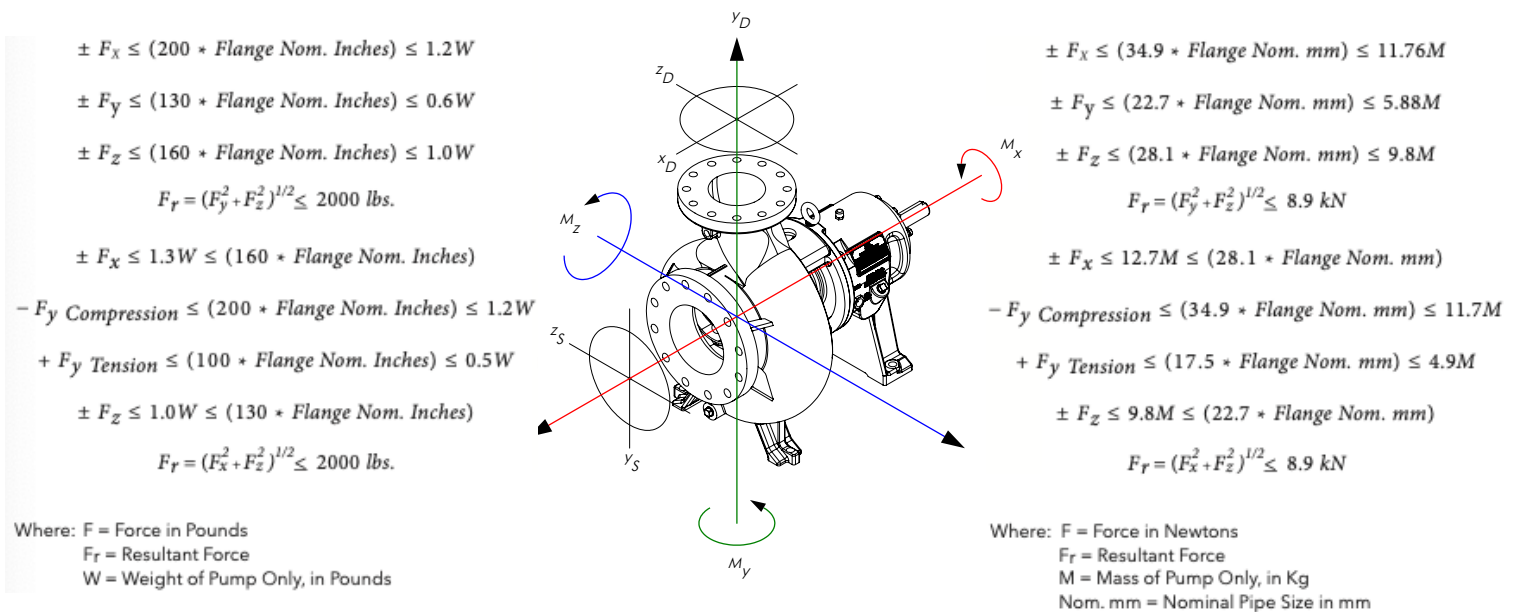


Figure 8

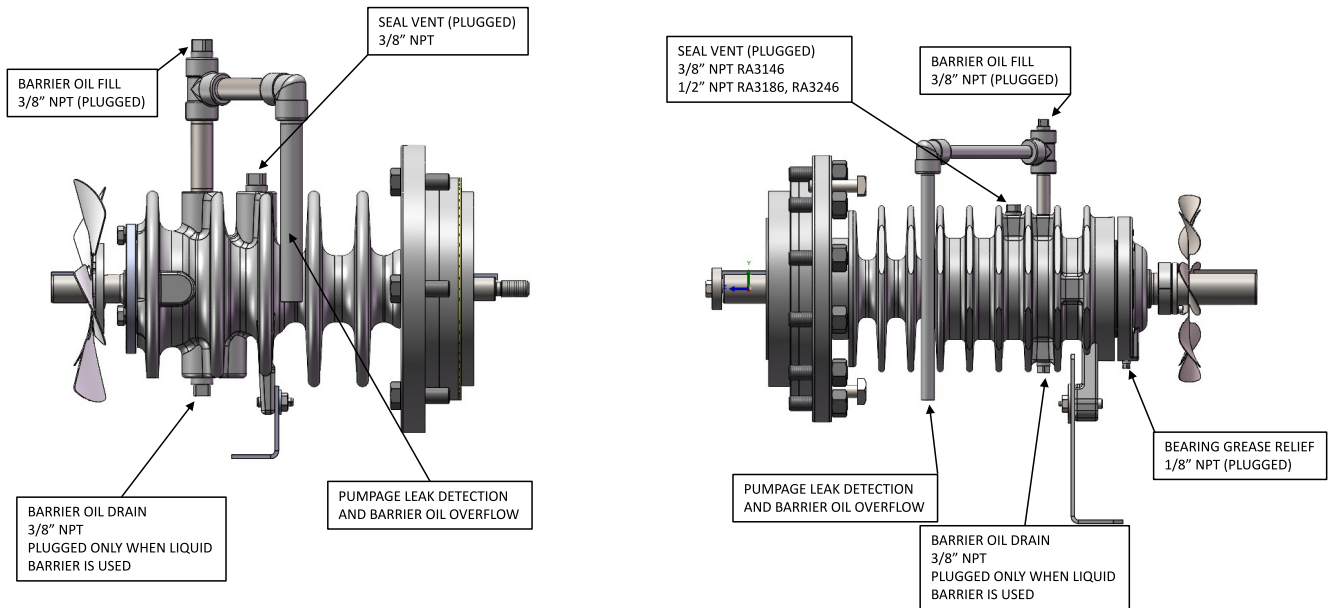
Pipe Load Diagram

# SMALL PIPING CONNECTIONS

**MAXIMUM MOMENTS APPLIED TO A PUMP ON A FULLY BOLTED AND GROUTED BASEPLATE.  
LOADS ARE TO BE APPLIED ONLY THROUGH THE SUCTION AND DISCHARGE FLANGES.**

Pump Size	Pump Type	Weight Pump Only		Mx		My		Mz	
		lbs.	kg	lb. ft.	N*m	lb. ft.	N*m	lb. ft.	N*m
1 X 1 1/2 X 6	RA2096	80	36	278	377.0	192	260.4	91	123.4
1 1/2 X 3 X 6	RA2096	90	41	277	375.6	265	359.3	91	123.4
1 X 1 1/2 X 8	RA2096	85	39	278	377.0	132	179.0	91	123.4
1 X 3 X 8 1/2	RA3146	260	118	690	935.6	340	461.0	725	983.1
1 1/2 X 3 X 8 1/2	RA3146	288	131	690	935.6	340	461.0	725	983.1
2 X 3 X 8 1/2	RA3146	316	143	690	935.6	340	461.0	725	983.1
3 X 4 X 8 1/2	RA3146	344	156	725	983.1	295	400.0	600	813.6
4 X 6 X 8 1/2	RA3146	390	177	785	1064.5	320	433.9	600	813.6
1 1/2 X 3 X 10	RA3146	318	144	760	1030.6	310	420.4	600	813.6
2 X 3 X 10	RA3146	350	159	760	1030.6	310	420.4	600	813.6
3 X 4 X 10	RA3146	385	175	830	1125.5	340	461.0	600	813.6
4 X 6 X 10 #2	RA3146	455	206	950	1288.2	340	461.0	600	813.6
1 X 2 X 1 1 1/2	RA3146	335	152	850	1152.6	350	474.6	600	813.6
1 1/2 X 3 X 1 1 1/2	RA3146	375	170	850	1152.6	350	474.6	600	813.6
2 X 3 X 1 1 1/2	RA3146	415	188	870	1179.72	355	481.38	600	813.6
3 X 4 X 1 1 1/2	RA3146	450	204	930	1261.08	335	454.26	575	779.7
4 X 6 X 1 1 1/2	RA3146	540	245	980	1328.88	350	474.6	760	1030.56
1 1/2 X 3 X 1 3 1/2	RA3186	540	245	1015	1376.34	365	494.94	525	711.9
2 X 3 X 1 3 1/2	RA3186	560	254	1015	1376.34	365	494.94	525	711.9
3 X 4 X 1 3 1/2	RA3186	570	259	1045	1417.02	375	508.5	630	854.28
4 X 6 X 10 #1	RA3186	510	231	2300	3118.8	1850	2508.6	800	1084.8
6 X 8 X 1 2 1/2	RA3186	660	299	2740	3715.44	1490	2020.44	800	1084.8
2 X 4 X 1 5 1/2	RA3186	672	305	2530	3430.68	1375	1864.5	800	1084.8
3 X 4 X 1 5 1/2	RA3186	694	315	2550	3457.8	1385	1878.06	800	1084.8
4 X 6 X 1 5 1/2	RA3186	650	295	2740	3715.44	1490	2020.44	800	1084.8
6 X 8 X 1 5 1/2	RA3246	1023	464	3000	4068	1615	2189.94	1500	2034
8 X 10 X 1 5 1/2	RA3246	1075	488	3340	4529.04	1810	2454.36	1500	2034

## BEARING HOUSING PORT CONNECTIONS



NPT: National Pipe Thread

RA2096

RA3146, RA3186, RA3246

Figure 9

# PUMP LUBRICATION

## BEARINGS

The radial bearing (180) is lubricated by the liquid being pumped and therefore needs no external lubrication.

The thrust bearing(s) (25A) are grease packed and intended to require no further lubrication until the pump is rebuilt.

The RA2096 uses a bearing that is packed with grease by the ball bearing manufacturer.

The RA3146, RA3186, and RA3246 have ball bearings that are hand packed as an assembly procedure when the pump is assembled.

The grease is a lithium 12-hydroxystearate soap-thickened grease that has rust inhibitors and extreme pressure additives. This is a NLG1, Grade 2, which is available from various lubrication manufacturers.

Grease is also available from Dean Pump in individual containers. One container is required for a RA3146 pump. Two containers are required for a RA3186 / RA3246 pump. Order "RA3000" Grease #2 for bearing lubrication.

## MECHANICAL SEAL

The "RA" pumps are arranged with a mechanical face seal (95A and 95B) that was specifically selected for sealing the more commonly used heat transfer oils. Some of the heat transfer oils "oxidize". The manufacturer of any heat transfer oil that oxidizes will recommend that a nitrogen gas blanket be maintained on the expansion tank of the system to ensure that oxygen cannot come in contact with the oil. The "RA" pumps have a cavity provided between the mechanical seal stationary (95A) and the front grease seal (76) to allow the use of a barrier fluid to keep oxygen away from the mechanical seal faces when operating with an oxidizing oil.

All "oils" will oxidize at some point depending upon the amount of air contamination and the temperature. Most "oils" will begin to oxidize at 250°F (120°C). Some "oils" will oxidize as low as 150°F (66°C). The oxidation rate doubles for every 18 to 20°F (10 to 11°C) increase in temperature, so it is very important to not use a barrier fluid that has a low oxidation temperature. The user should consult the thermal oil manufacturer to determine the oxidation temperature of the oil.

When the oil being pumped is one that oxidizes, a barrier fluid is recommended. Select a fluid to be used as the barrier fluid that is compatible with the pumpage and not detrimental to the lip seal, bearings, mechanical seal, or the bearing housing. Nitrogen is commonly recommended as the barrier fluid, but many customers prefer to use a liquid instead of a gas. Many oil companies produce a (barrier) oil that would be compatible with the oil being pumped, mechanical seal elastomers, lip seal, bearings, bearing grease, and the bearing housing. The user should check with their oil supplier for their recommendation for a non-oxidizing or low oxidizing oil to use as a barrier. Sometimes

the oil being pumped can be used as the barrier fluid.

Since most customers are using a liquid as a barrier fluid, the pump is supplied with the barrier oil piping shown in Figure 10 on page 17.

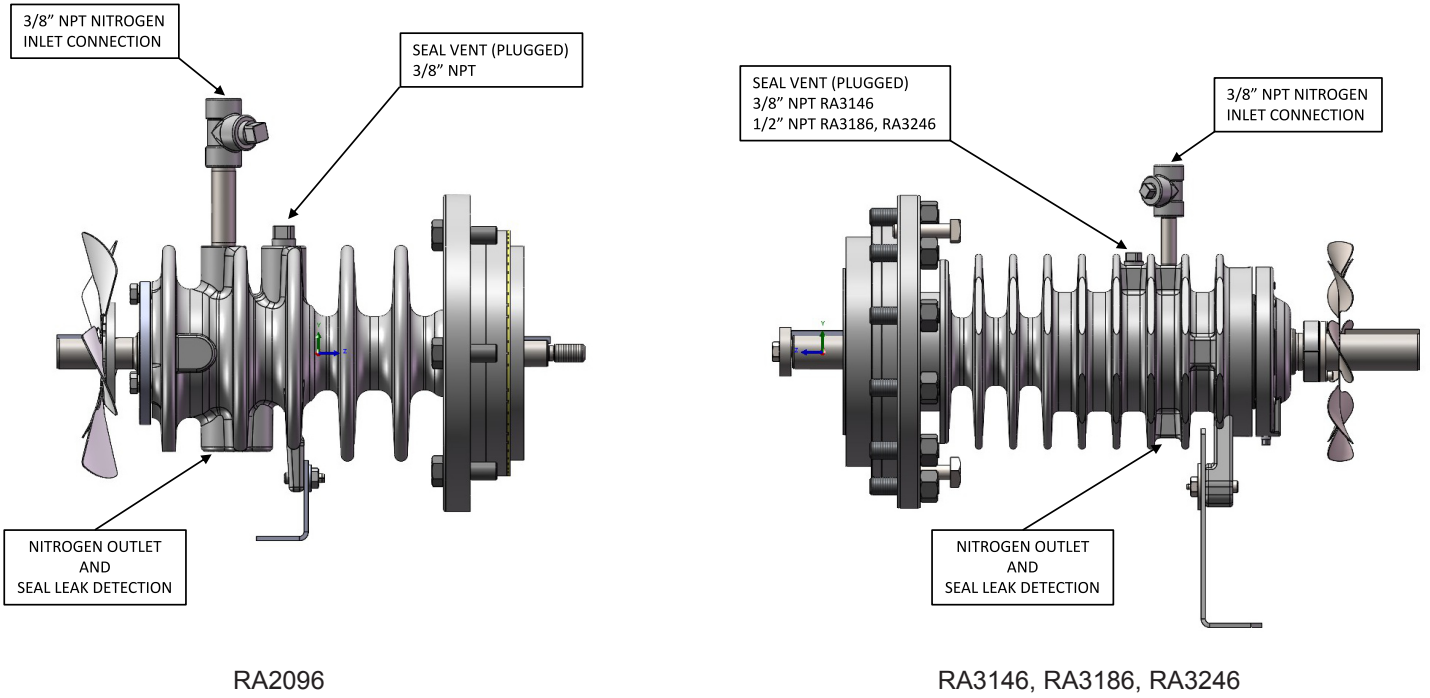
When using a liquid barrier fluid, the barrier cavity is filled through the pipe tee located directly above the cavity. Remove the 3/8" (9.525 mm) pipe plug (84) from the top of the tee (see Figure 10 on page 17) and pour the barrier liquid into the tee until the liquid level is flush with the bottom of the pipe nipple that extends horizontally out of the side of the tee. Any excess above this level will run out on to the baseplate. Rotate the shaft by hand (wear gloves for this operation) to help remove any trapped air pockets. Refill to previous level and replace the pipe plug (84).

If nitrogen is to be used as the barrier fluid, the barrier piping must be modified (failure to modify the barrier piping may result in mechanical seal or bearing damage), from that shown in Figure 9 on page 15, to that shown Figure 10 on page 17. Remove the vertical overflow pipe nipple, the 3/8" (9.525 mm) pipe elbow, and the horizontal pipe nipple connecting the pipe elbow to the pipe tee. Discard these parts. Move the pipe plug in the top of the pipe tee to the side connection of the pipe tee. Remove the 3/8" (9.525 mm) barrier oil drain plug from the bottom of the bearing housing, and discard it. Connect the nitrogen supply line to the top of the pipe tee and regulate the pressure to 1/4 P.S.I.G. (1.72kPa) maximum. The 3/8" (9.525 mm) connection at the bottom of the bearing housing will be left un-plugged to become an outlet for the nitrogen and serve as a leak detection in the event of mechanical seal failure.

When pumping a heat transfer oil that does not oxidize, a barrier fluid is not needed. Modify the barrier piping as described above for the use of nitrogen except plug both of the connections in the pipe tee. A collection pan could be placed on the baseplate under this drain opening to collect any condensed vapors or leakage from the mechanical seal when the faces wear.

# PUMP LUBRICATION

## PIPING MODIFICATION FOR NITROGEN BARRIER



NPT: National Pipe Thread

Figure 10

# STARTING THE PUMP

It is important that a pump must never be subjected to thermal or pressure shock. The liquid must therefore be allowed to flow into the casing slowly. A centrifugal pump should never be started until all the parts are up to the temperature of the liquid to be pumped.

## FILLING



### WARNING

BEFORE FILLING THE PUMP WITH LIQUID, CHECK TO SEE THAT ALL POSSIBLE LEAK LOCATIONS ARE SEALED. SEE THAT ALL OF THE CONNECTIONS INTO THE PRESSURE CONTAINING CAVITY ARE SEALED OR CONNECTED TO A RELATED PIPING SYSTEM THAT ALSO HAS ALL POSSIBLE LEAK PATHS SEALED. DO NOT PLUG UNUSED CAVITIES, AS THIS COULD DEVELOP DANGEROUS PRESSURE BUILD-UP. USE A WRENCH ON ALL BOLTED JOINTS TO APPLY TORQUE TO ENSURE THAT ALL GASKETS ARE SEALED IN A TIGHT JOINT. CHECK TO SEE THAT ALL THREADED PIPE CONNECTIONS ARE ALSO TIGHT ENOUGH TO SEAL THE LIQUID PRESSURE THAT WILL BE APPLIED WHEN THE SYSTEM IS STARTED.



### WARNING

FILLING DIRECTIONS BELOW REFER TO VENTING OF "AIR" TO THE ATMOSPHERE, BUT DEPENDENT UPON THE PHYSICAL PROPERTIES OF THE LIQUID INTENDED TO BE PUMPED, TEMPERATURE, PRESSURE, AND OTHER VARIABLES RELATED TO THE SYSTEM AND ITS OPERATIONAL REQUIREMENTS, THIS MAY NOT BE ALLOWED BY FEDERAL OR LOCAL REGULATIONS, OR MAY NOT BE ACCEPTABLE FOR WHATEVER OTHER REASONS. CONSULT YOUR PLANT OR CORPORATE SAFETY ENGINEER FOR INSTRUCTION ON POSSIBLE REQUIRED PROCEDURES FOR THE SPECIFIC LIQUID, OPERATING CONDITIONS AND LEGAL REQUIREMENTS.

When the source of the liquid to be pumped is below atmospheric pressure or located below the pump, the filling may be accomplished in any of several ways, three of which are listed below:

- 1) An exhauster may be connected to the discharge piping between the pump and the discharge isolation valve. With the discharge isolation valve closed and the suction valve open, the air can be exhausted from the pump and the suction piping. When all the air has been removed, close the suction valve, remove the exhauster, plug the access port where the exhauster was connected, and then open the discharge valve. Remove the seal vent plug from the top of the bearing housing, refer to Figure 10 on page 17. Allow the air to flow from this port until the pumpage starts to flow. This could take considerable time dependent upon the viscosity of the pumpage. Fifteen to twenty minutes is not unusual; however, some liquids may vent out in less than a minute. If the pump is a "RA2096" use a funnel and fill the seal cavity, through this connection with clean pumpage.
- 2) With a foot valve installed in the suction piping, the pump may be filled with pumpage introduced somewhere above the pump in the discharge piping. A foot valve may create extensive losses and therefore must be accounted for in calculating the available NPSH. When the pump is filled, plug the port through which you were filling. Remove the seal vent plug from the top of the bearing housing, refer to Figure 9 on page 15. Allow the air to flow from this port until the pumpage starts to flow. This could take considerable time dependent upon the viscosity of the pumpage. Fifteen to twenty minutes is not unusual; however, some liquids may vent out in less than a minute. If the pump is a "RA2096", use a funnel and fill the seal cavity, through this connection with clean pumpage.
- 3) A vacuum pump (preferably a wet vacuum pump) may be used for evacuating air from the pump and piping. The vacuum pump shall be connected as is the exhauster covered in No. 1 above and the procedure is the same.

When the source of liquid supplied to the pump is above atmospheric pressure or above the pumps discharge flange, the pump may be filled by venting through a bleed-off line to atmosphere. When the source of the liquid is above the pumps discharge flange the venting could be back to the suction source, instead of to atmosphere. When all of the air has been expelled through the bleed-off, seal it. Remove the seal vent plug from the top of the bearing housing, refer to Figure 9 on page 15. Allow the air to flow from this connection until the pumpage starts to flow. This could take a considerable amount of time, dependent upon the viscosity of the pumpage. Fifteen to twenty minutes is not unusual; however, some liquids may vent out in less than a minute. If the pump is a "RA2096", use a funnel to fill seal cavity, through this connection with clean pumpage.

# STARTING THE PUMP

***It is most important to check the direction of rotation of the pump before allowing the pump to come up to speed.*** The pump was shipped without the coupling spacer installed to allow for alignment and motor rotation check. If, however, for any reason this spacer assembly has already been installed, remove it at this time. To check rotation direction, push the starting button and immediately push the stop button. This will allow the motor to turn over a few revolutions and the direction of rotation to be observed. A direction of rotation arrow is shown on the front of the pump casing. If rotation is incorrect, change the wiring connections and recheck rotation. ***Operating the pump in reverse rotation may cause extensive damage.***



## WARNING

LOCK-OUT THE POWER TO THE DRIVER (MOTOR, TURBINE, ENGINE, ETC.) INSTALL THE SHAFT COUPLING SPACER. BE SURE THAT YOU INSTALL ALL THE RETAINING DEVICES AND BOLTS AND THAT THEY ARE TIGHT. READ AND COMPLY WITH THE COUPLING MANUFACTURER'S INSTRUCTIONS. PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE COULD OCCUR IF THE COUPLING SPACER IS NOT PROPERLY INSTALLED. REMOVE ALL DEBRIS AND TOOLS FROM THE AREA NEAR THE SHAFTS AND THE SHAFT COUPLING. DO THIS TO ENSURE THAT NOTHING IS CAUGHT AND THROWN BY THE ROTATING PARTS WHEN THE PUMP IS STARTED. BOLT THE COUPLING GUARD SECURELY TO THE BASEPLATE, CHECKING TO ENSURE THAT IT IS NOT CONTACTING ANY PARTS THAT WILL ROTATE WHEN THE PUMP IS STARTED.

## OPERATING



## WARNING

BEFORE STARTING THE UNIT, SEE THAT ALL PERSONNEL ARE A SAFE DISTANCE AWAY FROM ALL POSSIBLE HAZARDS, THAT ALL SUB-SYSTEMS ARE CONNECTED AND OPERATING, THAT ALL DEBRIS HAS BEEN REMOVED, THAT THE SHAFT COUPLING GUARD IS SECURELY IN PLACE, AND THAT THE PUMP IS FULL OF LIQUID. DO NOT OPERATE THIS PUMP AT SHUT-OFF (NO FLOW) AS AN EXPLOSION MAY RESULT. THIS CAN OCCUR WITH ANY LIQUID, EVEN "COLD WATER". PERSONAL INJURY, DEATH, EQUIPMENT DAMAGE, AND/OR LOSS OF PRODUCT (PUMPAGE) IS LIKELY TO

OCCUR. IF YOUR SYSTEM IS OPERATED WHERE IT IS POSSIBLE FOR ALL OUTLETS OF THE DISCHARGE FROM THE PUMP TO BE CLOSED WHILE THE PUMP IS STILL OPERATING, A MODIFICATION OF THE SYSTEM NEEDS TO BE MADE TO ENSURE A CONTINUAL FLOW OF PUMPAGE THROUGH THE PUMP. NOTE: SOME PEOPLE HAVE A BELIEF THAT A BYPASS LINE FROM THE DISCHARGE SIDE OF THE PUMP TO THE SUCTION SIDE OF THE PUMP WILL RELIEVE THIS PROBLEM, THIS IS "NOT TRUE"; DO NOT ATTEMPT THIS.



## WARNING

DO NOT OPERATE A PUMP AT A LOW FLOW CONDITION, UNLESS PROVISION HAS BEEN MADE TO PREVENT DANGEROUS HEAT BUILD UP WITHIN THE PUMP CASING. THE LIQUID IN THE PUMP WILL HEAT UP AND THIS MAY GENERATE HIGH INTERNAL PRESSURE IN A SHORT TIME. SUCH PRESSURE MAY RESULT IN A RUPTURE OF THE PRESSURE-CONTAINING PARTS AND POSE A SIGNIFICANT RISK TO PERSONNEL AND/OR THE SYSTEM.

A CENTRIFUGAL PUMP MUST NEVER BE RUN WITHOUT LIQUID IN THE CASING. EXTENSIVE DAMAGE MAY RESULT, PARTICULARLY TO THE BEARING OR THE MECHANICAL SEAL. VENT OR FILL THE PUMP SEAL CHAMBER THROUGH THE SEAL VENT CONNECTION TO PROVIDE LUBRICATION TO THE MECHANICAL SEAL FACES.

If the pump is a RA3146 / RA3186 / RA3246, remove the bearing grease relief plug from the bottom of the bearing end cover (28). Replace the coupling guard and securely fasten it in place.

Make sure that the coupling guard is installed with the expanded metal section nearest the motor, as shown in Figures 11, 12, 13, and 14 on pages 22, 23, 24, and 25.

A centrifugal pump shall be started with the suction valve fully open and the discharge valve opened a slight amount. Start the pump.

As soon as the pump is up to speed, the discharge valve must be opened slowly. A centrifugal pump cannot be operated with the discharge valve closed (dead head) without heating up dangerously. During the first several minutes of operating watch the pump carefully for overheating, vibration, and other abnormal conditions. If trouble develops, stop the pump at once and correct the problem.

## STARTING THE PUMP

After thirty minutes of operation, stop the pump. If the pump is using a barrier fluid, check the level by removing the 3/8" pipe plug (84) from the pipe tee, and refill, if necessary, to a level flush with the bottom of the pipe nipple that extends horizontally out of the tee.

A small amount of barrier oil may be observed during initial heat expansion; operators should monitor to confirm this does not increase over time.

The barrier overflow pipe is also used to detect mechanical seal leakage. If, after the pump has run for a few hours at system temperature, oil starts to spill from this pipe, it is an indication of impending mechanical seal failure. The mechanical seal (95A and 95B) should be replaced before the leakage becomes excessive.

If the pump is a RA3146 / RA3186 / RA3246, replace the grease relief plug into the bottom of the bearing end cover (28) and tighten to 7 ft. lb (10 N-m). Replace the coupling guard and securely fasten it in place.

Make sure that the coupling guard is installed with the expanded metal section nearest the motor, as shown in Figures 11, 12, 13, and 14 on pages 22, 23, 24, and 25.

Restart the pump.

# PUMP START UP CHECK LIST

## ***These points must be checked after pump installation and before starting up the pump.***

- 1) Read instruction manual thoroughly and understand it.
- 2) Review pump order head sheet for the service rating of the pump and any special features.
- 3) Check to see that the seal chamber has been vented.
- 4) Check all piping connections making certain that they are both tight and in the proper places. All piping includes the small piping described in Figure 9 on page 15.
- 5) Make sure that the baseplate has been properly installed.
- 6) Check to see that the motor is of the fan cooled type. A fan cooled motor is necessary for successful operation of the pump.
- 7) Check the electrical connections to the driver.
- 8) Break the coupling by removing the coupling spacer and bump the motor starting button to check motor rotation. Operating the pump in reverse rotation may cause extensive damage. If driver rotation is correct, replace the coupling spacer. If not, connect the wiring for proper rotation and recheck.

- 9) Check the coupling for proper alignment. Realign if necessary.
- 10) Check to see that the barrier fluid has been installed, if a barrier fluid is required for your operation.
- 11) Check to be sure that the pumpage leak detection connection is open for proper operation.
- 12) Rotate the pump shaft by hand to be sure that there is no binding or rubbing within the pump or driver. Wear heavy gloves to protect your hands. Correct any problems before proceeding.
- 13) Remove the bearing grease relief plug, if the pump is a RA3146 / RA3186 / RA3246.
- 14) Remove all dirt, waste, tools, and construction debris from the area.
- 15) Check to see that the coupling guard is fastened securely in place.

# SPARE PARTS

To avoid prolonged down time and facilitate rapid repair of damaged pump parts, Dean recommends that the pump user maintain a minimum stock of spare parts. If the pump service is critical, a spare parts stock is even more important to the user. Such spares inventory may extend from a spare mechanical seal through complete impeller-bearing housing assemblies prepared for immediate insertion in the pump casing. Consult your Dean representative who will assist you in selecting your spares stock.

## **ORDERING SPARE PARTS**

Spare part orders can be processed more efficiently if the following information is provided with the order:

- 1) Give the pump serial number and size. These may be found on the pump name plate. The serial number is also stamped on the suction flange or the top edge of the bearing housing front flange.
- 2) Give the part name, part number, and material of part. These should agree with the standard parts list.
- 3) Give the quantity of each part required.
- 4) Give complete shipping instructions.

# RA2096 SERIES PUMP DESIGNATION AND PARTS LIST

PARTS LIST											
ITEM NO.	PART NO.	DESCRIPTION	QTY.	ITEM NO.	PART NO.	DESCRIPTION	QTY.	ITEM NO.	PART NO.	DESCRIPTION	QTY.
3	CONSULT FACTORY	IMPELLER	1	26B	9455525	3/8 PIPE TEE	1	25	6010104	RADIAL BEARING CARTRIDGE	1
5	CONSULT FACTORY	CASING	1	26D	9452040	3/8 X 90 DEG. ELBOW	1	325	9710571	3-1/4 X 3-1/2 X 1/8 O-RING	2
5A	9454036	1/2 MALE PIPE PLUG	2	26E	9453397	3/8 X 6.00 SCH 40 TOE PIPE	1	365	1769019	LOCATE COLLAR	1
5D	9051509	1/2-1-1/2 HEX HEAD CAP SCREW	6	28	1085814	BEARING END COVER	1	370	9053506	COLLAR SET SCREW	4
9	1721483	BEARING HOUSING FOOT	1	28B	9650510	5/16 LOCK WASHER	3	26 F	9454027	3/8 MALE PIPE PLUG	1
9B	9651505	5/16 WASHER	2	29	1138153	PUMP SHAFT	1	84			1
9C	9690504	1/4 X 1-1/4 DOWL	1	75	9714520	SNAP RING	1	92			1
12	9250534	IMPELLER JAM NUT	2	76	9603006	GREASE SEAL FRONT	1	26A	9453429	3/8X3 PIPE NIPPLE	1
12A	1216780	IMPELLER WASHER	1	77	9155518	CASING GASKET	1	26C			1
12B	9651570	IMPELLER JAM WASHER	1	95	6765938	MECHANICAL SEAL ASSEMBLY	1	28A	9051024	5/16 X 3/4 CAP SCREW	3
13	1762482	MECHANICAL SEAL GLAND	1				9A	2			
25A	9010173	THRUST BEARING	1	120	1721483	FAN	1	4	9715134	IMPELLER KEY	1
26	CONSULT FACTORY	BEARING HOUSING	1	122	1210008	FAN CLAMP RING	1	36H		COUPLING KEY	1

## RA2096 PUMP

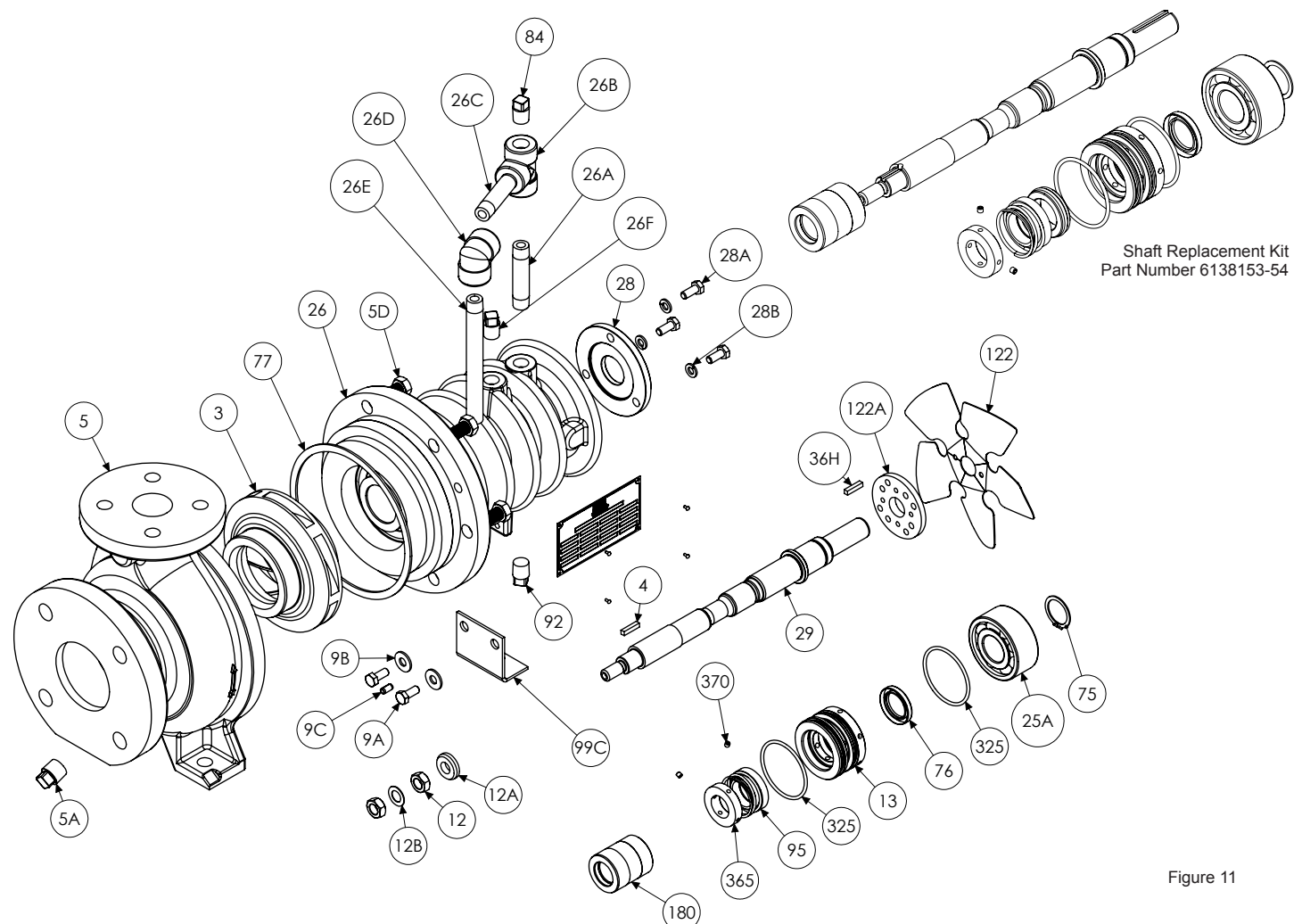
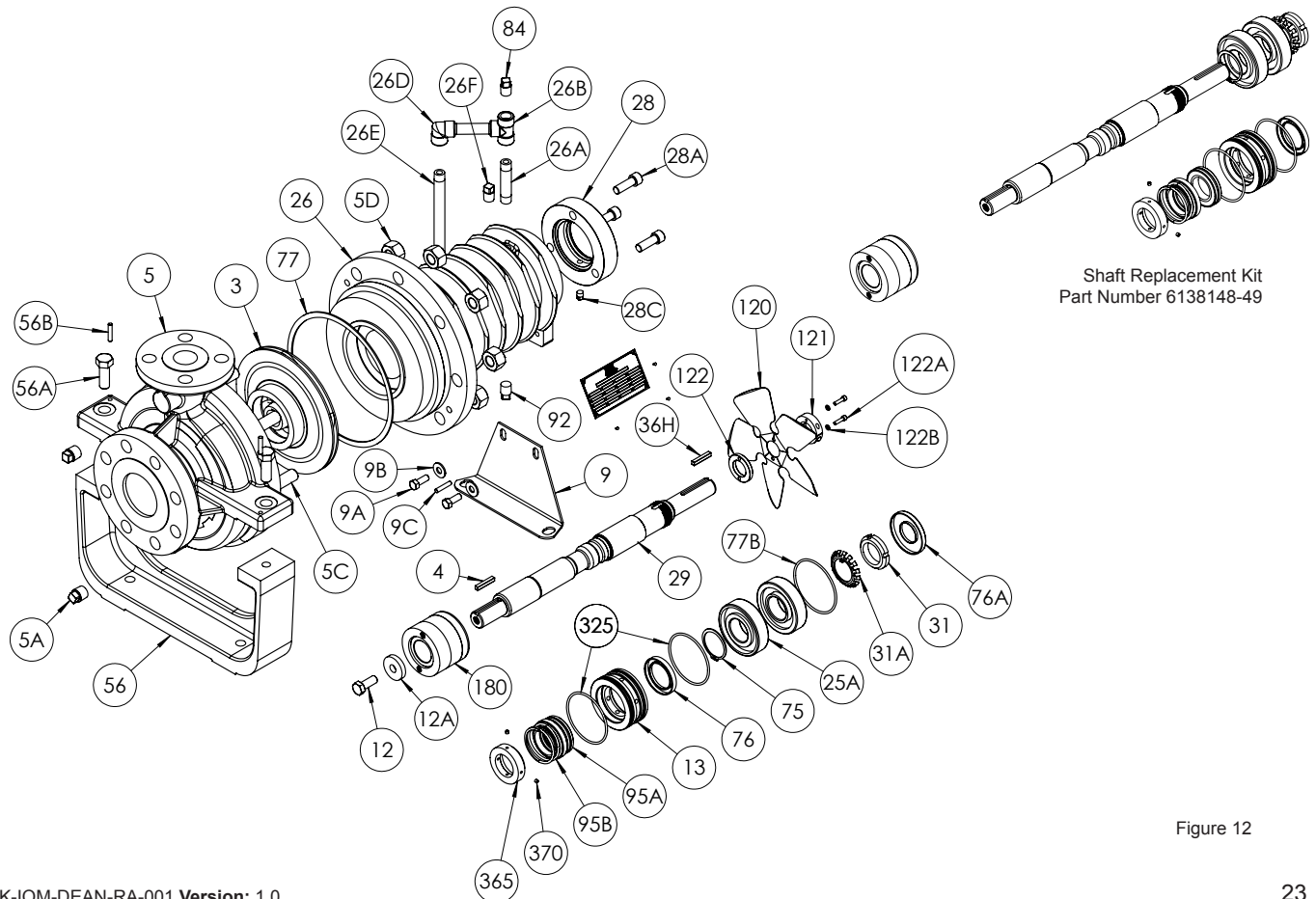


Figure 11

# RA3146 SERIES PUMP DESIGNATION AND PARTS LIST

PARTS LIST											
ITEM NO.	PART NO.	DESCRIPTION	QTY.	ITEM NO.	PART NO.	DESCRIPTION	QTY.	ITEM NO.	PART NO.	DESCRIPTION	QTY.
3	CONSULT FACTORY	IMPELLER	1	28A	9052060	1/2 X 1-1/2 SOCKET HEAD CAP SCREW	3	122A	9052003	10-24 SOCKET HEAD CAP SCREW	2
5	CONSULT FACTORY	CASING	1	28C	9454009	1/8 PIPE PLUG	1	122B	9650503	#10 LOCK WASHER	2
5A	9454036	1/2 MALE PIPE PLUG	2	29	1138149	PUMP SHAFT	1	180	1254050	RADIAL BEARING CARTRIDGE	1
5D	9252630	NUT	8	31	9212509	BEARING LOCKNUT 08	1	325	9710565	O-RING	2
5C	9552512	STUD, 5/8" x 2.5"	8	31A	9656512	W11 BEARING LOCKWASHER	1	365	1769023	SEAL COLLAR	1
9	CONSULT FACTORY	BEARING HOUSING FOOT	1	56	CONSULT FACTORY	CASING FOOT	1	370	9053525	1/4-20X1/2 SOC. HEAD CAP SCREW	2
9A	9051056	3/8-16X1X1 H BOLT	2	56A	9051539	5/8 X 1-3/4 HEX BOLT	2	4	9715051	IMPELLER KEY	1
9B	9651510	WASHER	2	75	9714519	SNAP RING	1	36H		MOTOR KEY	1
12	9051502	IMPELLER BOLT	1	76	9603036	GREASE SEAL FRONT	1	56B	9690150	CASING PIN	2
12A	1216708	IMPELLER WASHER	1	76A	9603013	GREASE SEAL REAR	1	9C		BEARING HOUSING FOOT PIN	1
13	1762481	MECHANICAL SEAL GLAND	1	77	CONSULT FACTORY	CASING GASKET	1	26F	9454027	3/8 MALE PIPE PLUG	1
25A	9010169	THRUST BEARING	2	77B	9710635	BEARING END COVER GASKET	1	84			1
26	CONSULT FACTORY	BEARING HOUSING	1	95A	6765942	MECHANICAL SEAL STATIONARY	1	92			1
26B	9455525	3/8 TEE	1	95B		MECHANICAL SEAL ROTARY	1	26A	9453429	3/8 X 3 PIPE NIPPLE	1
26D	9452040	3/8 X 90 ELBOW	1	120	1280016	FAN	1	26C			1
26E	9453397	3/8 X 6 PIPE NIPPLE	1	121	1609910	FAN COLLAR	1				
28	1085811	BEARING END COVER	1	122	1210012	FAN CLAMP RING	1				

## RA3146 PUMP



Shaft Replacement Kit  
Part Number 6138148-49

Figure 12



# RA3246 SERIES PUMP DESIGNATION AND PARTS LIST

RA3246 PARTS LIST											
ITEM NO.	PART NO.	DESCRIPTION	QTY.	ITEM NO.	PART NO.	DESCRIPTION	QTY.	ITEM NO.	PART NO.	DESCRIPTION	QTY.
3	CONSULT FACTORY	IMPELLER	1	26C	9453667	1/2" X 8" SCH80 NIPPLE	1	95A	6765590	MECHANICAL SEAL STATIONARY	1
4	9715070	IMPELLER KEY	1	26D	9452077	1/2" 90 DEGREE ELBOW	1	95B		MECHANICAL SEAL ROTARY	1
5	CONSULT FACTORY	CASING	1	26E	550488	1/2" X 8" SCH80 TOE	1	98	9180730	COUPLING GUARD L.H.	1
5A	9454041	3/4" NPT MALE PIPE PLUG	1	28	1085820	BEARING HOUSING END COVER	1		9180732	COUPLING GUARD R.H.	1
5C	9553012	7/8" X 3.5" CASING STUD	16	28A	9052020	END COVER BOLTS	4	120	1280020	FAN	1
5D	9252660	7/8-9 HEX NUT	16	28C	9454018	1/8" PIPE PLUG	1	121	1609914	FAN COLLAR	1
5E	9053028	5/8" X 2.5" JACK BOLT	2	29	1138155	PUMP SHAFT	1	122	1210014	FAN CLAMP	1
9	1721492	BEARING FRAME FOOT	1	31	9212530	BEARING LOCK NUT	1	122A	9052009	FAN CLAMP SCREWS	2
9A	9051572	3/4" X 2" HEX BOLTS	2	31A	9656530	BEARING LOCK WASHER	1	122B	9650505	FAN CLAMP LOCK WASHERS	2
9C	9690506	1/4" X 1.5" DOWEL PIN	1	36H	9715076	SHAFT KEY	1	180	6010120	RADIAL BEARING	1
12	9051594	IMPELLER BOLT	1	56	1720139	CASING FOOT	2	325	9710691	GLAND O-RINGS	2
12A	1216726	IMPELLER WASHER	1	56A	9051589	CASING FOOT BOLTS	4	365	1769049	LOCATING COLLAR	1
13	1762492	MECHANICAL SEAL GLAND	1	56B	9690507	1/4" X 2" DOWEL PIN	2	370	9053536	COLLAR SET SCREWS	4
25A	9010272	THRUST BEARINGS	2	76	9603056	GLAND LIP SEAL	1	375	9690128	ANTI-ROTATION PIN	1
26	1082588	BEARING HOUSING	1	76A	9603051	END COVER LIP SEAL	1	26F	9454036	1/2" NPT PLUG	1
26A	9453654	1/2" X 4" SCH80 NIPPLE	1	77	9156173	CASING GASKET	1	84			1
26B	9455542	1/2" 3000LB PIPE TEE	1	77B	9710878	END COVER GASKET	1	92			1

## RA3246 PUMP

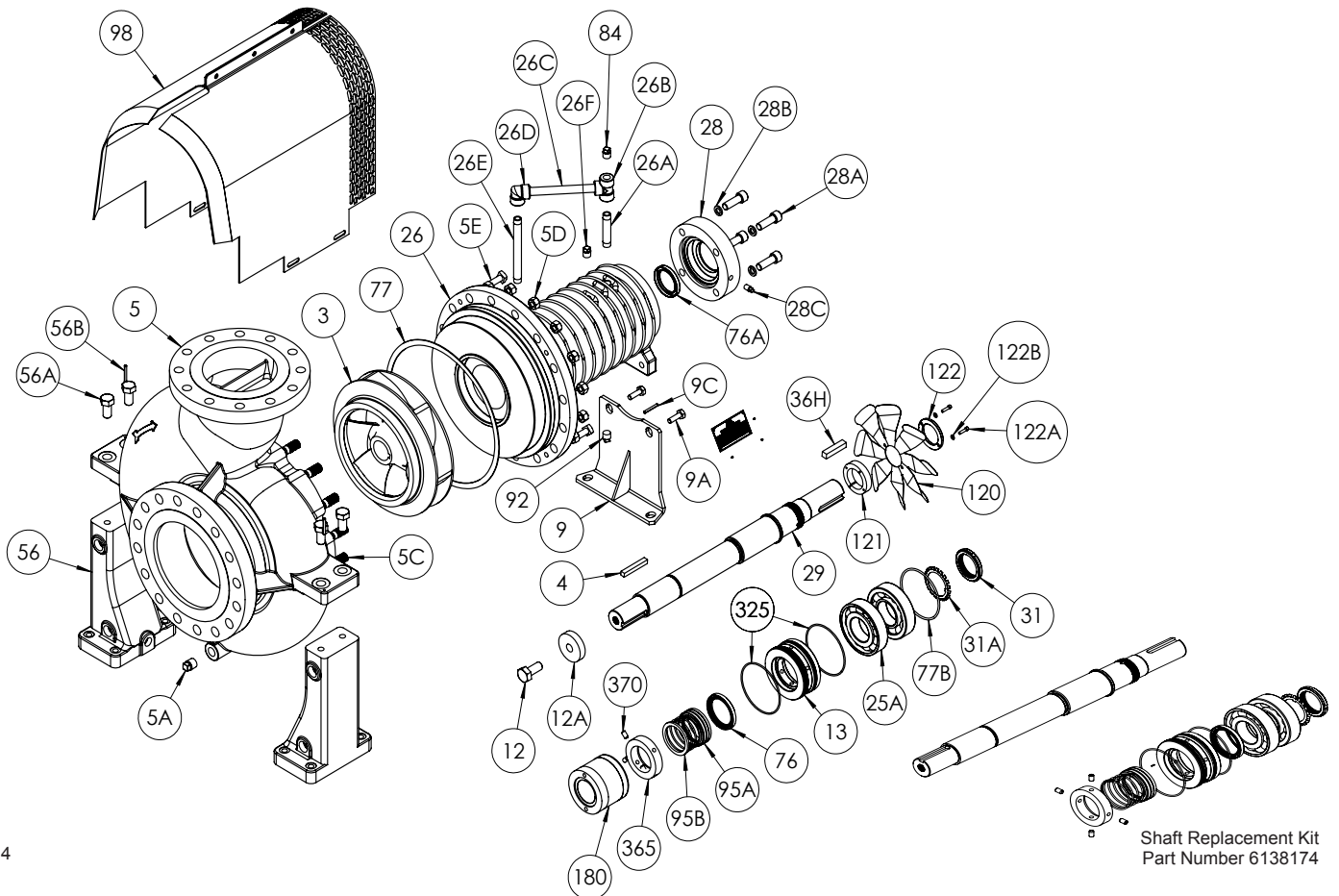


Figure 14

# ASSEMBLY / DISASSEMBLY TOOLS AND EQUIPMENT REQUIRED

ASSEMBLY / DISASSEMBLY TOOLS REQUIRED	
Item	Specifications
Box Wrench	9/16", 11/16", 3/4", 7/8", 15/16", 1 1/8", 1 1/4"
Socket Wrench	Socket- 9/16", 11/16", 3/4", 7/8", 15/16", 1 1/8", 1 1/4"
Dead Blow	
Allen Wrench	7/64", 5/32", 7/32", 1/4"
Square Head Wrench	1/8", 1/2", 3/4"
Pipe Wrench	12"
Snap Ring Pliers	Compressive
Scraper Tool	Flat-Head
Screwdriver	
Feeler Gauge	

PPE EQUIPMENT REQUIRED	
Item	Specifications
Safety Glasses	OSHA 1910.133(a) Compliant
Safety Shoes/Boots	OSHA 1910.136 Compliant
Gloves	

# DISASSEMBLY AND REASSEMBLY PROCEDURES



## WARNING

WORK MUST BE PERFORMED ONLY BY THOROUGHLY TRAINED AND QUALIFIED PERSONNEL TO ENSURE QUALITY REPAIR AND TO REDUCE THE POSSIBILITIES OF INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT. IF YOU DO NOT HAVE PERSONNEL WHO ARE CAPABLE OF SAFE QUALITY REPAIR OF THIS EQUIPMENT, WE ADVISE YOU TO RETURN THE EQUIPMENT TO DEAN PUMP TO BE REPAIRED.

WHEN IT IS NECESSARY TO OPEN THE PUMP AND/OR THE PUMPING SYSTEM THE FLUID WILL BE EXPOSED TO THE ATMOSPHERE AND PERSONNEL IN THE AREA. FOR THE SAFETY OF ALL INVOLVED, THE RISK OF EXPOSURE OF PERSONNEL TO THE HAZARDS OF THE PUMPAGE CAN BE REDUCED BY FLUSHING THE ENTIRE SYSTEM WITH A COMPATIBLE, NONTOXIC, NON-HAZARDOUS, STABLE LIQUID BEFORE OPENING THE PUMP OR THE SYSTEM. IN ALL CASES, WHETHER THE SYSTEM IS FLUSHED OR NOT, USE THE UTMOST CARE AROUND THE PUMPAGE AND THE PUMPING SYSTEM.

ALWAYS WEAR THE APPROPRIATE PROTECTIVE APPAREL WHEN WORKING ON OR AROUND THE PUMPING EQUIPMENT. SAFETY GLASSES WITH SIDE SHIELDS, HEAVY WORK GLOVES (USE INSULATED WORK GLOVES WHEN HANDLING HOT ITEMS), STEEL-TOED SHOES, HARD HAT, AND ANY OTHER PROTECTIVE GEAR AS NEEDED FOR PROTECTION. ONE EXAMPLE OF OTHER GEAR WOULD BE BREATHING APPARATUS WHEN WORKING NEAR TOXIC MATERIALS.

### ***Use only quality tools***

- A) Stop the pump. Turn off the power supply (electricity, steam, etc.) to the pump driver (motor, turbine, engine, etc.). Follow proper Lock Out / Tag Out Procedures to prevent restart of the equipment.
- B) Close the suction and discharge valves completely to isolate the pump from the system. Lock the valves in the closed position and tag them so that no one will attempt to open them.
- C) Turn off, lock out, and tag all sub-systems and auxiliary equipment and auxiliary supply lines to isolate the pumping unit from any and all power, energy, and/or fluids.



## WARNING

DO NOT ATTEMPT TO PERFORM ANY WORK ON THE UNIT UNTIL YOU ARE CONFIDENT THAT THE PUMP AND ITS CONTENTS HAVE BEEN STABILIZED AT AMBIENT TEMPERATURE, AND ATMOSPHERIC PRESSURE.

PUT ON PROTECTIVE WEAR TO PROTECT HUMAN TISSUE FROM ATTACK BY THE FLUIDS CONTAINED IN THE PUMP AND ANY SUB-SYSTEMS, AND FROM ANY VAPORS OR FUMES THAT COULD POSSIBLY BE RELEASED FROM THESE FLUIDS. THIS COULD MEAN BREATHING APPARATUS FACE SHIELDS, HEAVY LONG SLEEVE RUBBER GLOVES, RUBBER APRON, HOOD, AND POSSIBLY MORE, DEPENDENT, OF COURSE, ON THE PROPERTIES OF THE FLUIDS INVOLVED AND THE INSTALLED DRAIN AND VENT PIPING ARRANGEMENT. PERSONAL INJURY AND/OR DEATH CAN OCCUR IF ADEQUATE PRECAUTIONS ARE NOT TAKEN WITH REGARD TO THE FLUID, THE INSTALLATION AND THE POSSIBILITIES OF THE RELEASE OF FLUID, VAPORS, AND/OR FUMES.

- D) Remove the coupling guard. Remove the coupling spacer. Be careful to not bend the blades of the fan (120). If the pump is a RA2096, the removal of the spacer will also loosen the fan (120) from the face of the coupling hub.
- E) Drain all the fluids from all the auxiliary sub-systems (lubrication, cooling, heating, seal barrier, etc.) that are connected to the pump. Drain each fluid into a separate container. Use caution required for each fluid after reading the MSDS (Material Safety Data Sheet) for each.
- F) Flush each sub-system with a compatible, non-toxic, nonhazardous, stable liquid. Drain into individual containers for each fluid. Disconnect and remove all auxiliary piping.
- G) Carefully bleed off any pressure remaining in the pump. Pressure remaining in the pump will be dependent upon the pressure in the system when the pump was shutdown; the quality, type, and condition of the isolation valves; the thermal expansion values of the fluid and the pump material; and the change in the vapor pressure of the fluid between the temperature at the time the isolation valves were closed and the ambient temperature. Bleeding must be through a valved drain Line piped to a closed container mounted lower than the pump. The container must be arranged with a relief passage to some point where pressure and fumes will not be harmful to personnel. The container

# DISASSEMBLY AND REASSEMBLY PROCEDURES

must also have a Level device so that determination can be made that sufficient fluid has been drained to empty the pump cavity and the volume of fluid that was contained in the run of suction and discharge pipe between the isolation valves and the pump. After the initial rush of fluid from the pump relieves the pressure, the drain valve can be opened further to speed the draining operation. When fluid quits flowing into the drain tank, gauge the volume to see if it is sufficient to have fully drained the contents of the pump and the suction and discharge pipes between the isolation valves.

If the system was constructed without any drain connections, it will be necessary to consult the designers of the system for safe draining procedures.

- H) Now drain any small piping, that contains the fluid pumped, from all low points into the same container used to drain the pump. Do not drain any other fluids (different than the pumpage) into this container as they may not be compatible. Personal injury, death, and/or equipment damage could occur.



## WARNING

EVEN THOUGH IT MIGHT APPEAR THAT THE CAVITY BEING DRAINED HAS COMPLETELY DRAINED, BE EXTREMELY CAREFUL ABOUT OPENING THE SYSTEM AND/OR OPENING THE PUMP. IF SOMETHING SOLID IN THE PUMPAGE MOVES TO THE VICINITY OF THE DRAIN CONNECTION, IT COULD SEAL-OFF THE DRAIN AND MAINTAIN PRESSURE IN THE CAVITY THOUGHT TO HAVE BEEN DRAINED. IT IS ALSO POSSIBLE THAT THE ISOLATION VALVES ARE NOT SEALING AND THEREFORE ALLOWING LIQUID TO FLOW FROM THE SYSTEM INTO THE PUMP. PERSONAL INJURY, DEATH AND/OR EQUIPMENT DAMAGE MAY OCCUR IF GREAT CAUTION IS NOT EXERCISED.

- I) Remove the bolt(s) that retain the bearing housing foot (9) to the baseplate. Because of the above possibility, when you loosen the gasketed joint at the back of the casing (5), loosen the casing capscrews (5D) of the RA2096 or the casing nuts of the RA3146 or the RA3186, only one full turn. Then use jackscrews (two, 180° apart) through the flange of the bearing housing (26) to “break” the gasket seal. The bearing housing flange of the RA2096 and RA3146 pumps have tapped holes for 1/2”-13 UNC screws, the RA3186 has 5/8”-11 UNC. If fluid and/or pressure remains in the pump, it will flow out now. Use extreme caution, wearing protective gear, to avoid injury. Do not proceed with disassembly until leakage ceases completely. If leakage does not

cease, the isolation valves may not be sealing. Note that if the pump was purchased without a drain, the pump may still contain fluid, which could flow out when the gasket seal is broken.



## WARNING

WHEN YOU OPEN THE PUMP, THE FLUID WILL BE EXPOSED TO THE ATMOSPHERE AND PERSONNEL IN THE AREA. FOR THE SAFETY OF ALL INVOLVED, THE RISK OF EXPOSURE CAN BE REDUCED BY FLUSHING THE CAVITY THAT WAS JUST DRAINED WITH A COMPATIBLE, NON-TOXIC, NON-HAZARDOUS, STABLE LIQUID, BEFORE DISASSEMBLING THE PUMP.

- J) Remove the casing capscrews (5D) of the RA2096 or the casing nuts (5C) of the RA3146 / RA3186 / RA3246, and using mechanical lifting apparatus to support the weight, pull the rotating unit from the casing (5). Unscrew the two jack-screws until they are not protruding through the “casing side” of the bearing housing (26) flange.
- K) Flush the wetted parts, now exposed, with a compatible, nontoxic, non-hazardous, stable liquid.
- L) Remove the gasket from the face of the casing (5) or the bearing housing (26) dependent on which one the gasket may have adhered to. The type of gasket and material of construction will vary with service requirements. Attack by prying and then, if necessary, layering off the old gasket with a sharp scraper, attempting to remove it in the largest possible pieces. Wear heavy Leather, long sleeve work gloves when using the scraper. Wet the gasket before and during the scraping operation to reduce the possibility of fibers becoming airborne. Wear a respirator during this operation and until all debris has been disposed of in a plastic bag. Remove all of the gasket material down to clean metal surfaces on both parts that contacted the gasket. Use care to not damage the metal faces. Place all of the gasket residue in a plastic bag, seal the bag and dispose.
- M) Inspect the inside of the casing (5) for any signs of wear, corrosion or any other damage. If the casing needs to be removed, remove the bolts from the suction and discharge flanges. Remove the bolts that hold the casing feet to the baseplate. The casing can now be removed. Remove the suction and discharge flange gaskets using the procedure as in paragraph “L” above.
- N) The rotating assembly of the pump can now be moved to a more convenient location for further disassembly. Use mechanical lifting equipment to move assemblies and components.

# DISASSEMBLY AND REASSEMBLY PROCEDURES

## DISASSEMBLY PROCEDURE

To further dismantle the pump, perform the following steps in the sequence shown:



### WARNING

USE ONLY HIGH-QUALITY TOOLS.

OBTAIN MSDS DATA SHEETS FOR ALL LIQUIDS (FROM THE MANUFACTURERS OF THOSE LIQUIDS) BEING USED WITH THE PUMP, AND HEED ALL CAUTIONS.

FLUSH PARTS AS DISASSEMBLED TO REMOVE HAZARDOUS RESIDUE FROM THE PUMPAGE AND/OR SUB-SYSTEM FLUIDS.

WEAR PROTECTIVE EQUIPMENT AS ADVISED AT THE BEGINNING OF THIS SECTION.

USE MECHANICAL LIFTING EQUIPMENT TO LIFT ASSEMBLIES AND COMPONENTS.

DO NOT APPLY HEAT TO PARTS TO ASSIST IN DISASSEMBLY. EXPLOSION COULD OCCUR CAUSING PERSONAL INJURY, DEATH, AND/OR DAMAGE TO EQUIPMENT.

DO NOT ATTEMPT TO DRILL, SAW OR OTHERWISE CUT PARTS TO REMOVE THEM. EXPLOSION AND/OR FUMING COULD OCCUR CAUSING PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE.

DO NOT HAMMER ON ANY PARTS. PERSONAL INJURY AND/OR DAMAGE TO EQUIPMENT MAY OCCUR.

- A) Remove the impeller nuts (12) of the RA2096 or the impeller bolt (12) of the RA3146 / RA3186 / RA3246 (all have right hand threads) while holding the pump shaft (29) against rotation with a wrench on the flats of the coupling hub. When loosening the impeller nuts (12) of the RA2096, be sure to loosen the outer nut and remove it, before loosening the nut that is closest to the impeller (3). Remove the impeller retaining washer (12A). Slide the impeller (3) off the shaft (29). Remove the impeller key (4) from the shaft (29).
- B) Remove the coupling hub from the pump shaft (29) by loosening the set screws and using a gear puller to pull the hub from the shaft. Do not hammer on the coupling hub or the shaft as it may result in personal injury and or equipment damage. Remove the coupling key. Be careful not to bend the blades of the fan (120).
- C) Remove the fan (120) from the pump shaft (29). If the pump is a RA2096, slide the fan (120) and the fan clamp ring (122) off of the end of the pump shaft (29). If the pump is a RA3146 / RA3186 / RA3246, loosen the radially positioned securing screw in the side of the fan

collar (121) and slide the fan (120), fan collar (121), fan clamp ring (122) assembly off the end of the pump shaft (29). If this assembly resists removal, loosen the two axially positioned screws that hold these parts together.



### WARNING

WEAR GLOVES WHEN REMOVING THE FAN (120) TO PROTECT YOUR HANDS AS THE FAN IS MADE OF THIN METAL AND COULD CUT YOU.

- D) Remove the bearing end cover (28) from the bearing housing. Remove bearing end cover gasket (77B) if pump is a RA3146 / RA3186 / RA3246.
- E) Press the grease seal (76A) from the bearing end cover (28), if the pump is an RA3146 / RA3186 / RA3246.
- F) Pull the pump shaft (29) from the bearing housing (26), using care to keep the shaft in line with the bearing housing so as not to damage any parts. Wear heavy work gloves. Compression of the mechanical seal spring will be detected during this operation.
- G) Remove the set screws (370) from the mechanical seal collar (365) and then slide it from the shaft (29). Slide the mechanical seal rotary (95B) from the shaft (29). It may take a considerable amount of force to remove the rotary (95B) as the elastomeric shaft sealing element may grip the shaft quite tightly.
- H) Remove the mechanical seal gland (13) from the shaft. Remove the seal gland gaskets (325) from the seal gland (13). Remove the mechanical seal stationary (95A) from the mechanical seal gland (13). If the pump is a RA3186 / RA3246, remove the “mechanical seal stationary O ring” from the inside of the mechanical seal gland (13) and, if needed, pull the anti-rotation pin (375) from the mechanical seal gland.
- I) Remove the grease seal (76) from the seal gland (13). This can be removed by inserting a screwdriver or a small drive pin punch into the open side of the seal and driving it out of the seal gland.
- J) If the pump is a RA2096, remove the snap ring (75A) from the pump shaft (29). If the pump is a RA3146 / RA3186 / RA3246, bend the tab of the bearing lock washer (31A) out of the slot in the bearing lock nut (31). Remove the bearing lock nut and the bearing lock washer from the pump shaft (29). Press the thrust bearing(s) (25A) from the pump shaft. Exercise care to push only on the inner race of the bearings. Do not press on the shaft snap ring (75) of the RA3146. Do not hammer on the bearing(s) or the shaft in any manner as this may result in damage to the shaft. Remove the snap ring (75) from the pump shaft of the RA3146, only if it is damaged.
- K) Press or drive the bearing cartridge (180) from the bearing housing (26).

# DISASSEMBLY AND REASSEMBLY PROCEDURES

## 1) RA2096 procedure:

Use a 1-¼" (32mm) diameter bar, 12" long (30.5 cm), cut square on the ends. Insert the bar into the coupling end of the bearing housing (26) until it stops against the bearing cartridge (180). Use a hydraulic press to press the bearing cartridge (180) from the bearing housing (26).

## 2) RA3146 procedure:

The bearing cartridge (180) has two 3/8"-16 UNC (M10 x 1.5) tapped holes that are accessible from the impeller end of the bearing housing. Securely bolt a 1/2" (12.7 mm) Class 300 flange to the cartridge, using washers on the bolts. Use a 14" (36 cm) long piece of 1" (25.4 mm) pipe (1-5/16" (33.3 mm) outside diameter), cut square on the ends, to reach down through the bearing housing (26) to press the bearing cartridge out.

## 3) RA3186 / RA3246 procedure:

The bearing cartridge (180) has two 1/2"-13 UNC (M14 x 2) tapped holes that are accessible from the impeller end of the bearing housing. Securely bolt a 1" (25.4 mm) Class 300 flange to the cartridge, using washers on the bolts. Use a 22" (56 cm) long piece of 1-1/4" (31.8 mm) pipe (1-5/8" (41.3 mm) outside diameter), cut square on the ends, to reach down through the bearing housing (26) to press the bearing cartridge out.

- L) Remove the seal vent plug from the top of the bearing housing (26) and discard it. The RA2096 and RA3146 pumps have a 3/8" (9.5 mm) plug and the RA3186 / RA3246 pumps have a 1/2" (12.7 mm) plug. Refer to Figure 9 on page 15.
- M) If there is any reason to remove the bearing housing foot (9), it is secured by two bolts and located by a dowel pin.

## REASSEMBLY PROCEDURE



### WARNING

USE ONLY HIGH QUALITY TOOLS.

WEAR PROTECTIVE EQUIPMENT AS ADVISED AT THE BEGINNING OF THIS SECTION.

USE MECHANICAL LIFTING EQUIPMENT TO LIFT ASSEMBLIES AND COMPONENTS.

DO NOT HAMMER ON ANY PARTS. PERSONAL INJURY AND/OR DAMAGE TO EQUIPMENT MAY OCCUR.

DO NOT ATTEMPT TO MANUFACTURE PARTS OR MODIFY DEAN PUMP PARTS IN ANY MANNER. DEATH, PERSONAL INJURY, AND/OR DAMAGE TO EQUIPMENT MAY OCCUR.

REPLACE ALL GASKETS, SEALS, BEARINGS, AND LUBRICANTS. REPLACE ALL PARTS THAT HAVE WORN, CORRODED, ERODED, OR OTHERWISE DETERIORATED.

USE ONLY DEAN PUMP PARTS.

- A) Clean all parts, thoroughly inspect them, and replace where necessary. If the pump shaft (29) has two lip contact wear patterns (lip seal contact area) under the lip seal (76), replace the shaft. If the shaft is scored under the bearing (180), replace the shaft.
- B) Install a new seal vent plug into the top of the bearing housing (26), but do not apply any pipe sealant, and do not tighten the plug. The plug will need to be removed again later, for venting, when the pump is installed into the system. Refer to Figure 9 on page 15.
- C) Press a new bearing cartridge (180) into the bearing housing (26) until it seats firmly against the shoulder in the bearing housing. On the RA2096, install with the exposed carbon bearing face facing outward (see Figure 11 on page 22). On the RA3146 / RA3186 / RA3246, install with the two tapped holes facing outward and the 1/8" (3.2 mm) diameter "through hole" positioned at the top of the bearing housing (see Figures 12, 13, and 14 on pages 23, 24, and 25). Use a press and a pad over the end of the bearing cartridge (180). Do not hammer on the bearing cartridge; the bearing could be broken. If a press is not available, the bearing cartridge could be pulled into the bearing housing by using a piece of threaded rod through the bearing housing with a large washer and a nut on each end.
- D) If the pump is a RA3146, install the snap ring (75) onto the pump shaft (29) ensuring that it is securely into the snap ring groove.
- E) If you are reinstalling a previously used pump shaft (29), inspect the shaft for wear under the grease seal(s) as directed in paragraphs "H" and "R" below. Press the thrust bearing(s) (25A) onto the pump shaft (29).

### 1) RA2096 procedure:

Press the thrust bearing (25A) onto the pump shaft (29) and firmly against the shaft shoulder. Do not hammer on the bearing or shaft in any manner as this will cause damage.

### 2) RA3146 procedure:

Press the thrust bearings (25A) onto the pump shaft (29) and firmly against the snap ring (75). The thrust bearings are angular-contact type, ground specifically for duplex mounting and must be assembled back-to-back (see Figure 15 on page 31). Note the direction that the races of the bearing are mounted. Do not hammer on the bearings or shaft in any manner as this will cause damage.

# DISASSEMBLY AND REASSEMBLY PROCEDURES

## 3) RA3186 / RA3246 procedure:

Press the thrust bearings (25A) onto the pump shaft (29) and firmly against the shaft shoulder. The thrust bearings are angular-contact type, ground specifically for duplex mounting and must be assembled back-to-back (see Figure 15 below). Note the direction that the races of the bearing are mounted. Do not hammer on the bearings or shaft in any manner as this will cause damage.

### THRUST BEARING POSITION - RA3146 / RA3186 / RA3246

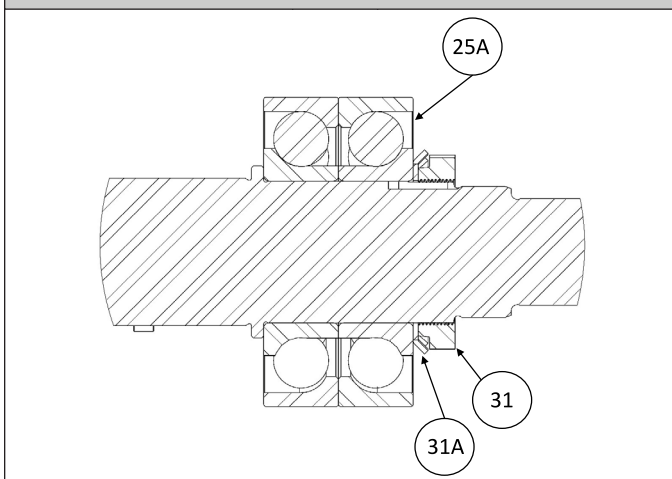


Figure 15

F) Secure the thrust bearing(s) (25A) to the pump shaft (29).

### 1) RA2096 procedure:

Install the bearing retaining snap ring (75A) with tapered side away from the bearing (see Figure 16 below).

### 2) RA3146, RA3186, and RA3246 procedure:

Install a new bearing lock nut washer (31A). Install the bearing lock nut (31). Bend a tab of the bearing lock nut washer (31A) into an aligned slot of the bearing lock nut (31).

G) Thrust bearing lubrication.

### SNAP RING ORIENTATION - RA2096

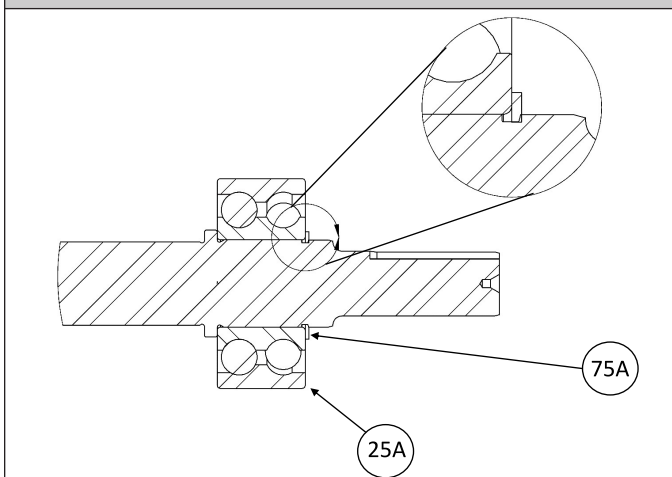


Figure 16

## 1) RA2096 procedure:

The thrust bearing(25A) of the RA2096 is already packed with grease and not intended for relubrication under normal service conditions.

## 2) RA3146, RA3186, and RA3246 procedure:

Pack the thrust bearings (25A) with grease.

- The RA3146 requires 2.9 cubic inches (48 cc) of grease.
- The RA3186 requires 6.8 cubic inches (112 cc) of grease.
- The RA3246 requires 9.2 cubic inches (151 cc) of grease.

Attempt to force all of the grease into the bearings. The grease must be a lithium 12-hydroxystearate soap thickened grease that has rust inhibitors and extreme pressure additives and must be a NLG1, Grade 2, which is available from various lubrication manufacturers. Grease is also available from Dean Pump in individual containers, Order RA3000 Grease #2 for bearing lubrication. One container is required for each RA3146 pump. Two containers are required for each RA3186 pump.

- H) Press a new grease seal (76) into the mechanical seal gland (13). Install with the lip pointing towards the impeller end of the pump as shown in Figures 11, 12, 13, and 14 on pages 22, 23, 24, and 25. Inspect the shaft (29) when installing a used shaft (if the shaft has been used before): determine if there is one or two grease seal lip contact wear patterns (grease seal lip contact area). If two contact areas are present, the pump shaft needs replacing. If one contact area is present, stop pressing on the seal when the outside face of the seal is 1/16" (1.6 mm) above the face of the mechanical seal gland (13). If the pump shaft (29) is new, press the seal into the mechanical seal gland (13) until it is seated within the bore of the mechanical seal gland.
- I) Install new seal gland gaskets (325) into the grooves in the outer diameter of the mechanical seal gland (13). Lubricate the gaskets, before installing, with an oil that is compatible with the liquid to be pumped, or with the pumped liquid itself. If the pump is a RA3186 / RA3246 and the anti-rotation pin (375) was removed, install a new one into the mechanical seal gland (13), controlling the exposed length to 0.020" to 0.040" (0.5 mm to 1 mm) less than the depth of the slot in the mechanical seal stationary (95A).
- J) Install a new mechanical seal stationary seat (95A) into the mechanical seal gland (13). If the pump is a RA2096 or a RA3146, be sure that there is an "O" ring installed in the groove in the outside diameter of the mechanical seal stationary seat (95A). If the pump is a RA3186 / RA3246, install the stationary seat "O" ring (the "O" ring is furnished with the mechanical seal stationary seat) into the groove in the bore of the

# DISASSEMBLY AND REASSEMBLY PROCEDURES

mechanical seal gland (13). Install the mechanical seal stationary seat (95A) with the polished face away from the lip seal (76). Lubricate the “O” ring before installing the mechanical seal stationary seat (95A) into the seal gland (13). An oil compatible with the liquid to be pumped, or the pumped liquid itself, should be used as a lubricant for the “O” ring.

- K) Lubricate the area of the shaft over which the lip seal will slide, then carefully slide the mechanical seal gland (13) assembly over the shaft, so as not to damage the lip seal (76) nor the mechanical seal stationary seat (95A). Push the mechanical seal gland snugly against the thrust bearing (25A).
- L) Lubricate the area of the shaft over which the mechanical seal rotary (95B) will slide. Carefully slide the mechanical seal rotary (95B) over the shaft (29) until it contacts the mechanical seal stationary (95A). Do not damage the seal on any of the shaft shoulders.
- M) Slide the mechanical seal collar (365) carefully over the shaft (29) until it is firmly against the shaft shoulder and compressing the spring of the mechanical seal rotary (95B). Tighten the set screws while holding the seal collar (365) firmly against the shaft shoulder.
- N) Lubricate the bore in the back of the bearing housing (26) so that the seal gland gaskets (325) will slide in without damage. Carefully slide the shaft assembly (29) into the bearing housing (26) from the bearing end cover end. Do not strike the carbon bearing (180) with the end of the pump shaft (29). Guide the mechanical seal gland (13) and the thrust bearings (25A) into the bearing housing (26) as the shaft assembly (29) is installed.
- O) If the pump is a RA2096 go to step “V”.
- P) Install a new end cover gasket (77B) over the thrust bearing (25A) and against the bearing housing (26).

- Q) Press the lip seal into the bearing end cover (28), from the bearing side, and up against the shoulder at the opposite side, when a new shaft is being used. If the pump shaft is not new, stop pressing on the lip seal 1/16” (1.6 mm) before it reaches the shoulder of the end cover, placing the sealing lip at a new location on the pump shaft (29).
- R) Lubricate the pump shaft (29) at the diameter where the lip seal (76A) contacts. Apply any remaining grease from packing the thrust bearings (25A) around the exposed face of the bearings (25A). Place the end cover (28) carefully over the pump shaft (29) and the thrust bearing (25A), with the plugged hole towards the baseplate. Bolt the end cover (28) securely to the bearing housing (26).  
Torque the end cover bolts to:
  - RA3146: 20 lb. ft. (27 N.m)
  - RA3186 / RA3246: 35 lb. ft. (48 N.m)
- S) Mark (pencil or light scribe) a line on the pump shaft (29), 3-1/4” (83 mm) for the RA3146, 5-1/16” (129 mm) for the RA3186, and 5” (127 mm) for the RA3246 from the coupling end. Place the fan collar (121), grooved face first, onto the pump shaft and up to the mark. Refer to Figure 17 below. Tighten the fan collar locking screw tightly.

Place the fan (120), with the concave side of the blades towards the pump, over the end of the pump shaft (29) and up against the fan collar (121). The concave side of the fan blade was indicated with a label “PUMP SIDE” at the time it was shipped from the factory. Rotate the fan until the holes in the fan align with the tapped holes in the fan collar.

Place the fan clamp ring (122) over the end of the pump shaft (29) and up against the fan (120). Align the holes

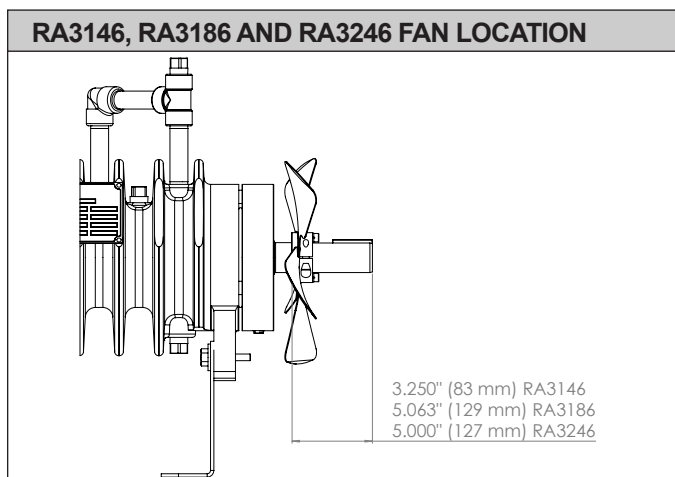


Figure 17

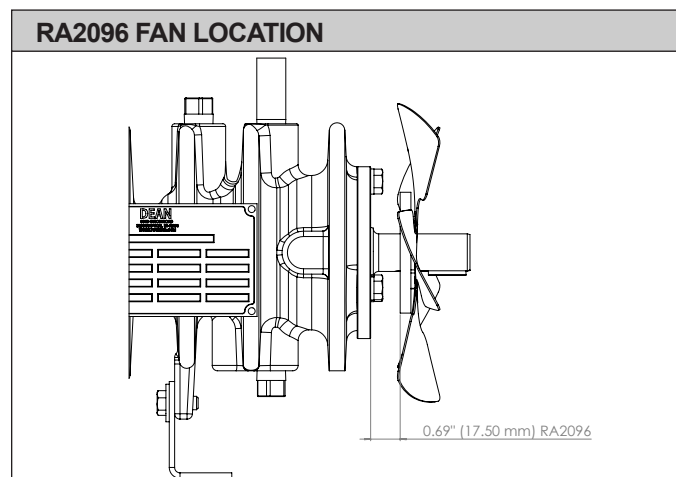


Figure 18

# DISASSEMBLY AND REASSEMBLY PROCEDURES

in the fan clamp ring with the holes in the fan and the holes in the fan collar (121).

Insert the two socket head bolts, with lock washers, through the fan clamp ring (122) and the fan (120), into the tapped holes of the fan collar (121) and tighten them securely.

- T) Insert the coupling bolts through the lockwashers and the pump coupling hub. Place the hub onto the pump shaft (29), positioning the outer face of the hub flush with the end of the pump shaft. Install the coupling key and tighten the hub set screw(s).
- U) For RA3146, RA3186, and RA3246 Continue to Step "Y".
- V) Place the end cover (28) carefully over the pump shaft (29) and bolt it securely into position against the bearing housing (26). Torque the end cover bolts to 11 lb.ft. (15 N.m).
- W) Insert the four coupling bolts through the lockwashers and the fan clamp ring (122) from the side opposite of the raised face. The clamp ring is made to fit three different sizes of couplings, so you must insert the bolts into the holes that match the coupling hub that you are using. Slide the clamp ring onto the pump shaft (29) with the raised face facing the motor.

Place the fan (120), with the concave side of the blades towards the pump, over the end of the pump shaft, onto the coupling bolts and up against the clamp ring. Refer to Figures 17 and 18 on page 32. The concave side of the fan blade was indicated with a label "PUMP SIDE" at the time it was shipped from the factory.

- X) Place the coupling hub over the end of the pump shaft (29) and onto the coupling bolts, until the face of the hub is flush with the end of the pump shaft. Install the coupling key, with the end of the key flush with the end of the pump shaft and the face of the hub. Tighten the hub set screw(s).
- Y) Place the impeller key (4) into the keyway of the pump shaft (29). Carefully slide the impeller (3) onto the pump shaft (29).
- 1) If the pump is a RA2096, slide the impeller washer (12A) over the pump shaft (29) and against the impeller (3). Thread one of the impeller nuts (12) onto the pump shaft (29) and tighten it to a torque of 40 lb. ft. (54 N.m). Thread the second impeller nut (12) onto the end of the pump shaft (29) and tighten it to a torque of 40 lb. ft. (54 N.m). Hold the pump shaft (29) against the tightening torque by placing a wrench on the flats of the coupling hub. Be careful to not bend the blades of the fan (120).
- 2) If the pump is a RA3146/RA3186/RA3246, place the impeller washer (12A) on to the impeller bolt (12) and

thread the impeller bolt (12) into the end of the pump shaft (29).

Tighten the impeller bolt to a torque of:

- RA3146: 60 lb. ft. (81 N.m)
- RA3186 / RA3246: 100 lb. ft. (135 N.m)

Hold the pump shaft against the tightening torque by placing a wrench on the flats of the coupling hub. Be careful to not bend the blades of the fan (120).

- AA) If the pump has a casing ring (6A), press it into the casing (5).
- AB) Carefully insert the bearing housing (26) assembly into the casing with a new casing gasket (77). Ensure that the bearing housing (26) assembly is fully into the casing (5) and that the bearing housing foot (9) is in full contact with the baseplate. Tighten the casing capscrews (5D) or the casing stud nuts (5C) slowly and evenly so that the casing gasket will compress evenly. Torque the casing capscrews (5D) or casing stud nuts (5C) to:
- RA2096: 50 lb. ft. (68 N.m).
  - RA3146 / RA3186 (3/4", 19 mm studs): 105 lb. ft. (142 N.m)
  - RA3186 / RA3246 (7/8", 22 mm studs): 165 lb. ft. (223 N.m)
- AC) Rotate the pump shaft (29) by hand to check for interference. Wear heavy gloves when rotating the shaft, to protect your hands. Correct if any rubbing is detected.
- AD) If the casing (5) was removed from the baseplate, reattach it with bolts through the casing feet to the baseplate. Reattach the suction and discharge flanges, installing new gaskets.
- AE) Bolt the bearing housing foot to the baseplate. Rotate the pump shaft (29) again by hand to check for rubbing. Wear heavy gloves when rotating the shaft, to protect your hands. Correct if any rubbing is detected.
- AF) Realign the pump and driver per instructions under "PUMP AND DRIVER ALIGNMENT" on page 13.
- AG) Follow the instructions under "PUMP LUBRICATION" (page 16), "STARTING THE PUMP" (page 18), and "PUMP START UP CHECKLIST" (page 21).

# CUSTOMER'S PLANT MAINTENANCE RECORD

Dean Pump Serial Number \_\_\_\_\_ Service \_\_\_\_\_

Plant Property Number \_\_\_\_\_ Location \_\_\_\_\_

Capacity \_\_\_\_\_ ; T.D.H. \_\_\_\_\_ ; Imp. Dia. \_\_\_\_\_ ; Temp. \_\_\_\_\_ ; RPM \_\_\_\_\_

Materials of Construction: \_ Casing \_\_\_\_\_ ; Impeller \_\_\_\_\_ ; Shaft \_\_\_\_\_ ; Shaft Sleeve \_\_\_\_\_

Spare Parts in Plant Stock Room \_\_\_\_\_

Interchangeable with Dean Serial Numbers \_\_\_\_\_

# READ WARNINGS

## HAZARDOUS SITUATIONS MAY OCCUR UNLESS THIS EQUIPMENT IS APPLIED, INSTALLED, OPERATED, AND MAINTAINED BY THOROUGHLY QUALIFIED PERSONNEL IN STRICT ACCORDANCE WITH THE INSTRUCTION MANUAL AND ALL APPLICABLE DRAWINGS AND CODES.

Read the instruction manual completely, before installing, filling, operating, or maintaining this equipment.

Obtain, read, and heed the MSDS (Material Safety Data Sheet) for the fluids being handled before attempting to fill, operate or maintain this equipment.

Obtain instructions from the Safety Engineer responsible for your facility before performing any work on the pumping equipment and systems.

**APPLICATION AND REAPPLICATION** - At the time of installation, the equipment received should have already been selected for the service required. You must read the paperwork for the installation and check serial number of the pump to ensure that you are installing the correct pump into the service for which it was selected.

Many pumps look identical from the outside but can be made of different materials and/or be constructed differently inside. Personal injury, death, equipment damage, product (pumpage) damage, and/or product loss could occur if the incorrect pump is installed.

Do not transfer an existing pump to any other service conditions until you have thoroughly reviewed the pump construction, materials, sizing, sealing, pressure containing capability, head/capacity capability, and temperature capability with respect to the required service. Failure to verify may result in personal injury, death, and/or equipment damage. Consult your DEAN PUMP sales engineer with all the service requirements and a full description of the existing pump (including the serial number), seal, and sub-systems so that we can assist you in a successful reapplication.

**INSTALLATION** - Always wear the appropriate protective apparel when working on or around the pumping equipment.

Safety glasses with side shields, heavy work gloves (use insulated work gloves when handling hot items), steel toed shoes, hard hat, and any other protective gear as needed for protection. One example of other gear would be breathing apparatus when working near toxic materials.

Use lifting devices, manufactured expressly for the purpose of lifting, to move the pumping machinery. Do not attempt to lift the assembly or its components manually. Use only devices with lifting capabilities in excess of the weight of the unit being lifted. Inspect straps, chains, hooks, etc. for damage and lifting capability before use. Lift only at the center of gravity.

Personal injury, death, and/or equipment damage could occur if good lifting practices are not used. Install the equipment on a properly designed and built foundation.

Ensure that the driver (motor, turbine, or engine) shaft is properly aligned to the pump shaft.

Connect the suction and discharge piping without forcing the piping into position. The pipe flanges must line up with the pump flanges "freely". Strain caused by "forcing" and/or misalignment may cause failure of the pumping unit, flanges, and/or the piping resulting in fluid (pumpage) release. This could cause personal injury, death and/or damage to this and/or other equipment.

Install a "new" bolt, of the correct size per ASME/ANSI B16.5 and the correct material per ASME/ANSI B16.5, in every bolt hole. Tighten all bolts evenly. Use only new uncorroded fasteners.

Improper flange bolting may cause failure of the pumping unit, flanges, piping, and/or fluid (pumpage) release which could cause personal injury, death, and/or damage to this and/or other equipment.

Connect all other (auxiliary) piping necessary for safe and successful operation of the equipment in the specific service conditions of the application. Make sure that all piping is installed into its correct connection. Installation of a pipe into an incorrect location could result in an explosion and personal injury or death as well as damage to this and/or other equipment.

Install pressure relief valves in any cavities that could be subjected to pressures in excess of the allowable working pressure of that cavity. Explosion, personal injury, death, and/or damage to this and/or other equipment may occur if pressure exceeds allowable.

Recheck the alignment between the driver (motor, turbine, or engine) and pump shafts. Installation of piping may have forced the pump out of alignment. If so, correct the piping to remove the distorting load.

Check to be certain that the shaft coupling spacer is not installed, and then gently bump the motor starter to check the rotational direction of the motor. If this is not in the direction of rotation required for the pump, make the necessary corrections.

Lock-out the power to the driver (motor, turbine, engine, etc.)

Install the shaft coupling spacer. Be sure that you install all the retaining devices and bolts and that they are tight.

Read and comply with the coupling manufacturer's instructions. Personal injury, death, and/or equipment damage could occur if the coupling spacer is not properly installed. Remove all debris and tools from the area near the shafts and the shaft coupling. Do this to ensure that nothing is caught and thrown by the rotating parts when the pump is started. Bolt the coupling guard securely to the baseplate, checking to ensure that it is not contacting any parts that will rotate when the pump is started.

**FILLING** - Before filling the pump with liquid, check to see that all possible leak locations are sealed. See that all of the connections into the pressure containing cavity are sealed or connected to a related piping system that also has all possible leak paths sealed. Do not plug unused jacket cavities, as this could develop dangerous pressure buildup.

Use a wrench on all bolted joints to apply torque to ensure that all gaskets are sealed in a tight joint. Check to see that all threaded pipe connections are also tight enough to seal the liquid pressure that will be applied when the system is started.

**OPERATING** - Before starting the unit, see that all personnel are a safe distance away from all possible hazards, that all sub-systems are connected and operating, that all debris has been removed, that the shaft coupling guard is securely in place, and that the pump is full of liquid.

Do not operate this pump at shut-off (no flow) as an explosion may result. This can occur with any liquid, even "cold water". Personal injury, death, equipment damage, and/or loss of product (pumpage) is likely to occur. If your system is operated where it is possible for all outlets for the discharge from the pump to be closed while the pump is still operating, a modification of the system needs to be made to ensure a continual flow of pumpage through the pump. Note that some people have a belief that a bypass line from the discharge side of the pump to the suction side of the pump will relieve this problem, this is "NOT TRUE"; DO NOT ATTEMPT THIS.

**MAINTENANCE, DISASSEMBLY AND REPAIR** - Work must be performed only by thoroughly trained and qualified personnel to ensure quality repair and to reduce the possibilities of injury to personnel and/or damage to equipment. If you do not have personnel who are capable of safe quality repair of this equipment, we advise you to return the equipment to DEAN PUMP to be repaired.

When it is necessary to open the pump and/or the pumping system, the fluid will be exposed to the atmosphere and personnel in the area. For the safety of all involved, the risk of exposure of personnel to the hazards of the pumpage can be reduced by flushing the entire system with a compatible non-toxic, non-hazardous, stable liquid before opening the pump or the system. In all cases, where the system is flushed or not, use the utmost care around the pumpage and the pumping system.

Always wear the appropriate protective apparel when working on or around the pumping equipment. Safety glasses with side shields, heavy work gloves (use insulated work gloves when handling hot items), steel-toed shoes, hard hat, and any other protective gear as needed for protection. One example of other gear would be breathing

apparatus when working near toxic materials.

Use only top quality tools.

Stop the pump. Turn off the power supply (electricity, steam, etc.) to the pump driver (motor, turbine, engine, etc.) and lock the switching device so that it cannot be restarted. Tag the switching device so that no one will attempt to restart the unit.

Close the suction and discharge valves completely to isolate the pump from the system. Lock the valves in the closed position and tag them so that no one will attempt to open them.

Turn off, lock out, and tag all sub-systems and auxiliary equipment and auxiliary supply lines to isolate the pumping unit from any and all power, energy, and/or fluids.

Do not attempt to perform any work on the unit until you are confident that the pump and its contents have been stabilized at ambient temperature, and atmospheric pressure.

Put on protective wear to protect human tissue from attack by the fluids contained in the pump and any sub-systems, and from any vapors or fumes that could possibly be released from these fluids. This could mean breathing apparatus, face shields, heavy long sleeve rubber gloves, rubber apron, hood, and possibly more, dependent of course on the properties of the fluids involved and the installed drain and vent piping arrangement. Personal injury and/or death can occur if adequate precautions are not taken with regard to the fluid, the installation, and the possibilities of the release of fluid, vapors, and/or fumes.

Remove the coupling guard. Remove the coupling spacer.

Drain all the fluids from the auxiliary sub-systems (lubrication, cooling, heating, seal barrier, etc.) that are connected to the pump. Drain each fluid into a separate container. Use caution required for each fluid after reading the MSDS (Material Safety Data Sheet) for each.

Flush each sub-system with a compatible, non-toxic, non-hazardous, stable liquid. Drain into individual containers for each fluid. Disconnect and remove all auxiliary piping.

Carefully bleed off any pressure remaining in the pump. Pressure remaining in the pump will be dependent upon the pressure in the system when the pump was stopped; the quality, type, and condition of the isolation valves; the thermal expansion valves of the fluid and the pump material; and the change in the vapor pressure of the fluid between the temperature at the time the isolation valves were closed and the ambient temperature. Bleeding must be through a valved drain line piped to a closed container mounted lower than the pump. The container must be arranged with a relief passage to some point where pressure and fumes will not be harmful to personnel. The container must also have a level device so that determination can be made that sufficient fluid has been drained to empty the pump cavity and the volume of fluid that was contained in the run of suction and discharge pipe between the isolation valves and the pump. After the initial rush of fluid from the pump relieves the pressure, the drain valve can be opened further to speed the draining operation. When fluid quits running into the drain tank, gauge the volume to see if it is sufficient to have fully drained the contents of the pump and the suction and discharge pipes between the isolation valves.

If the system was constructed without any drain connections, it will be necessary to consult the designers of the system for safe draining procedures.

Now drain any small piping that contains the fluid pumped from all low points into the same container used to drain the pump. Do not drain any other fluids (different than the pumpage) into this container as they may not be compatible. Personal injury, death, and/or equipment damage could occur.

Even though it might appear that the cavity being drained has completely drained, be extremely careful about opening the system and/or opening the pump. If something solid in the pumpage moves to the vicinity of the drain connection, it could seal-off the drain and maintain pressure in the cavity thought to have been drained. It is also possible that the isolation valves are not sealing and therefore allowing liquid to flow from the system into the pump.

Personal injury, death, and/or equipment damage may occur if intense caution is not exercised.

Because of the above possibility, when you loosen the gasketed joint at the back of the casing (5), loosen the bolts or nuts only one full turn, and then use jack screws to break the gasket seal. If fluid and/or pressure remains in the pump, it will spray out now. Use extreme caution, wearing protective gear, to avoid injury. Do not proceed with disassembly until leakage ceases completely. If leakage does not cease, the isolation valves may not be sealing. Note that if the pump was purchased without a drain, the pump will contain fluid which will flow out at the time the bolts are loosened and the gasket seal is broken.

When you open the pump, the fluid will be exposed to the atmosphere and personnel in the area. For the safety of all involved, the risk of exposure can be reduced by flushing the cavity that was just drained, with a compatible non-toxic, non-hazardous, stable liquid, before disassembling the pump.

Remove the casing bolts or nuts and using mechanical lifting apparatus to support the weight, pull the rotating unit from the casing.

Flush the wetted parts now exposed with compatible, non-toxic, non-hazardous, stable liquid.

Remove the gasket from the face of the casing (5) or the bearing housing (26) dependent on which one the gasket may have adhered to. The type of gasket and material of construction will vary with service requirements. Remove by prying and then, if necessary, layering off the old gasket with a sharp scraper, attempting to remove it in the largest possible pieces. Wear heavy leather, long sleeve work gloves when using the scraper. Wet the gasket before and during the scraping operation to reduce the possibility of fibers becoming airborne. Wear a respirator during this operation and until all debris has been disposed of in a plastic bag. Remove all of the gasket material down to clean metal surfaces on both parts that contacted the gasket. Place all of the gasket residue in a plastic bag, seal the bag and dispose of it in compliance with all government requirements.

The rotating assembly of the pump can now be moved to a more convenient location for further disassembly. Use only high quality tools. Flush parts as disassembled to remove hazardous residue from the pumpage and/or sub-system fluids.

Wear protective equipment as advised at the beginning of these warnings. Use mechanical lifting equipment to lift assemblies and components.

Do not apply heat to parts to assist in disassembly. Explosion could occur causing personal injury, death, and/or damage to equipment.

Do not attempt to drill, saw, or otherwise cut parts to remove them. Explosion and/or fuming could occur causing personal injury, death, and/or equipment damage.

Do not hammer on any parts. Personal injury and/or damage to equipment may occur.

Do not attempt to manufacture parts or modify Dean Pump parts in any manner. Death, personal injury, and/or damage to equipment may occur.

One example of the above would be over boring the seal chamber, which removes metal that is required to contain fluids. Removal of this metal reduces the pressure containing capability of the part and may create a leak path through the part.

Replace all gaskets, seals, bearings, and lubricants. Replace all parts that have worn, corroded, eroded, or otherwise deteriorated.

Use only Dean Pump Division of Dean Pump Parts.



# DEAN PUMP® SERIES | RA

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