

# Dean

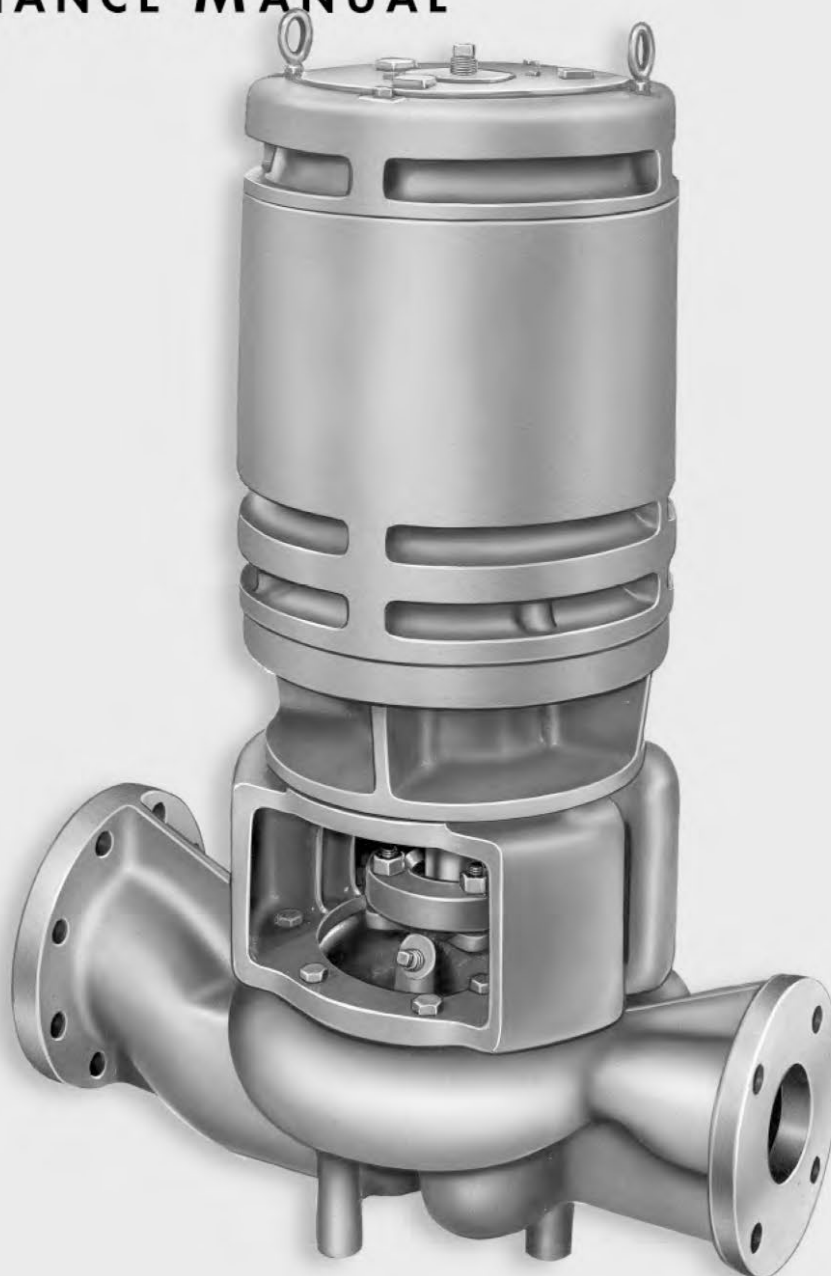
## DEAN PUMP® SERIES DL200/DL230

### Inline Centrifugal Process Pumps

**I** NSTALLATION

**O** PERATION

**M** AINTENANCE **M** ANUAL



# TABLE OF CONTENTS

Mechanical Design Specifications	1
Product Inspection and Test	2
Product Warranty	2
Receiving Pump	2
Storage	2
Installation	4
Application and Reapplication	4
Pump Mounting	4
Suction and Discharge Piping	4
Pump Cooling Requirements	5
Stuffing Box Cooling	5
Cooling Water Piping	5
Cooling Water Flow Rates	5
Motor Bearing Lubrication	6
Starting the Pump	6
Filling the Pump	6
Operating the Pump	6
Pump Start-Up Checklist	7
Spare Parts	7
Ordering Spare Parts	7

## **DL200 SERIES PUMPS**

Pump Section Views, Type Designations	8
Parts List	8
Exploded View and Parts List	9
Disassembly and Assembly Procedures	10

## **DL230 SERIES PUMPS**

Pump Section Views, Type Designations	8
Parts List	8
Exploded View and Parts List	9
Disassembly and Assembly Procedures	13

## **DL200 AND DL230**

Installation and Maintenance of Stuffing Box Packing	16
Purpose of Lantern Ring	16
Internal Seal Connection to the Lantern Ring	16
External Seal Connection to the Lantern Ring	16
Lantern Ring Not Used	16
Packing Installation	17
Usual Causes of Packing Failure and Excessive Stuffing Box Leakage	17
Installation of Standard Mechanical Seals	18
Single Inside Seals	18
Single Outside Unbalanced Seals	18
Double Inside Unbalanced Seals	19

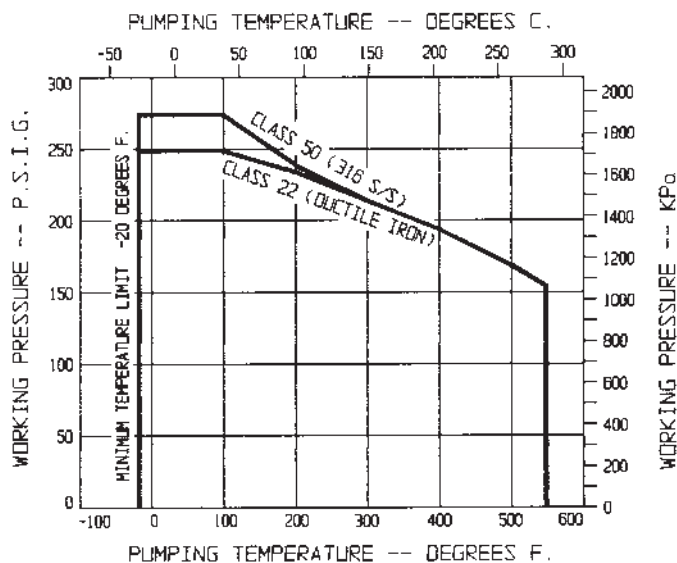
**STANDARD, INLINE, SINGLE STAGE, OPEN IMPELLER, CENTRIFUGAL PROCESS PUMPS**  
**TYPES DL201, DL202; DL231, DL232**

**MECHANICAL DESIGN SPECIFICATIONS**

Direction of Rotation from Motor End .....CW  
Bearings in Motor .....Ball Type  
Bearing Lubrication .....Grease  
Casing Thickness, Minimum .....5/16"  
Flanges — ASME/ANSI Rating:  
Ductile Iron (CL 22), 316 S/S (CL 50) .....Class 150  
Facing .....FF  
Finish .....125 Ra  
Impeller Balance .....Single Plane Dynamic Balance  
Allowable Pump Suction Pressure (2 year min. thrust bearing life) .....100 psig  
Stuffing Box Jacket Pressure, Maximum .....125 psig

	DL201 DL202	DL231 DL232
Horsepower Rating — max. rated Driver HP not to exceed @ 1750 rpm @ 3500 rpm	7 1/2 HP 15 HP	50 HP 100 HP
Max. Hydrostatic Test Pressure Ductile Iron (CL 22), and 316 S/S (CL 50)	430 psig	430 psig
Shaft Packing Size (square)	5/16"	3/8"
Rings with Lantern Ring	5	5
Spacing	2-R-3	2-R-3
Rings without Lantern Ring	6	7
Stuffing Box Dimensions Length (depth)	2 1/8"	2 3/4"
Inside Diameter (bore dia.)	1 5/8"	2 1/2"
Shaft Sleeve Diameter	1"	1 3/4"
Lantern Gland Width	7/16"	5/8"
Distance Lantern Gland to Open End of Stuffing Box	1 3/8"	1 3/4"

**ALLOWABLE WORKING PRESSURE  
VS. PUMPING TEMPERATURE**



All mechanically sealed pumps contain a seal face flushing connection in the gland and internal seal circulating piping as standard.

All mechanically sealed DL202 and DL232 pumps used with cooling jackets require a Min-Flo Bushing.

**STANDARD MATERIALS OF CONSTRUCTION**

Part No.	Part Name	Class 22	Class 50
3	Impeller	C.I. (1)	316 S/S (10)
5	Casing	D.I. (5)	316 S/S (10)
* 5D	Casing Cap Screw	Steel (11)	
7	Adapter Cradle	Cast Iron (1)	
7G	Adapter Cradle Cap Screw	Steel (4)	
* 10†	Shaft Sleeve	316 S/S (2)	
* 10A	Shaft Packing	Standard Sets	
* 10K †	Shaft Sleeve Key [DL231, DL232 only]	Steel (4)	316 S/S (2)
* 13 †	Gland	Steel (3)	316 S/S (10)

Part No.	Part Name	Class 22	Class 50
* 14 †	Gland Stud	AISI 304	
* 15 †	Gland Stud Nut	AISI 304	
17 †	Lantern Ring	Teflon (9)	
* 18 †	Splash Collar	Cadmium Plated Steel	
* 22	Backhead	Steel (3)	316 S/S (10)
* 22A †	Backhead Indexing Cap Screw	Steel (4)	
* 37 †	Clearance Shim	Steel	
* 77 †	Casing Gasket	Teflon (9)	
* 77A †	Impeller Gasket	Teflon (9)	

\* Denotes DL200 Series parts interchangeable with pH200 Series Pumps, and DL230 Series parts interchangeable with pH230 Series Pumps.

† Denotes part interchangeable within DL200 Series Pumps, or within DL230 Series Pumps.

NOTE: MECHANICAL SEAL MATERIALS: Please refer to specific seal drawing.

**MATERIAL SPECIFICATIONS**

- |  |                            |
|--|----------------------------|
| (1) Cast Iron                            | (4) AISI 1020              |
| (2) AISI 316 S/S                         | (5) Ductile Iron ASTM A395 |
| (3) Cast Steel — ASTM #216,<br>Grade WCB | (6) ASTM A193, Grade B7    |
|  | (7) ASTM A194, Grade 2     |

- |  |
|--|
| (9) TM E.I. du Pont de Nemours & Co.   |
| (10) 316 S/S — ASTM #A744, Grade CF-8M |
| (11) ASTM A449                         |

Specifications are subject to change without notice

## PRODUCT INSPECTION AND TEST

The Products of Dean Pump Division are subject to thorough and rigorous quality control and inspection procedures throughout the whole of the manufacturing process to assure proper operation in full conformity with established performance standards. On completion of inspection, each unit is oiled, sealed against the

entrance of dirt, and tagged with a signed certificate of inspection prior to shipment. Each pump when shipped is ready to perform the service for which it was designed with minimum maintenance and expense if properly installed and operated in accordance with the instructions furnished.

## DEAN PRODUCT 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 packings, 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. We shall not be liable, directly

or indirectly, under any circumstances for consequential or incidental damages, including, but not limited, to: (I) any loss of business or profits; and (II) labor, material or other charges, claims, losses or damages incurred or suffered from, in connection with or in consequence of the working upon, alteration, or repair of any defective Dean Products by persons or firms 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, of 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, EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.

## WARNING

**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.

Proper storage while not in use and proper installation and start-up are essential for successful pump operation. Misuse or improper storage, installation or operation of pumps may result in serious loss or damage. Dean Pump Division 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.**

### RECEIVING PUMP

When the pump is received from the transportation company, it should 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 must be exercised in unloading and handling the pump.**

### STORAGE

Pumps must be properly covered and protected against moisture, dirt, and physical damage during storage prior to installation and operation.

If prolonged storage is anticipated, do the following:

- 1) Seal the suction opening of the pump with a blind flange, gasket, and bolts.
- 2) Position the pump on its side so that the motor shaft is horizontal, the suction flange is down, and the discharge flange is up.
- 3) Fill through the discharge opening of the pump a corrosion inhibiting liquid that is also compatible with the liquid that will later be pumped. Evaluation of compatibility must include consideration of the temperature at which the system will later operate. Be sure to also vent air from any auxiliary piping connection to the pump and fill it with the same inhibitor.

- 4) When the pump is completely filled, seal the discharge opening with a blind flange, gasket, and bolts.
- 5) Apply a heavy protective coating to any exposed metal surfaces. A rust preventative must be used to protect all steel and iron parts.
- 6) Rotate the motor shaft "by hand" each month. Wear heavy gloves when rotating the shaft, to protect your hands. It will most likely be necessary to remove the motor fan cover to gain access to the motor fan to rotate the shaft.

When you are ready to place the pump in service:

- 1) Drain the storage liquid from the pump and any auxiliary piping. Draining can be through the casing drain connection, the auxiliary piping, the suction flanged connection, and the discharge flanged connection.
- 2) Remove and discard the blind suction flange, gasket, and bolts. Remove and discard the blind discharge flange, gasket, and bolts.
- 3) Flush all remains of the storage liquid from the pump and the auxiliary piping. Use a flush liquid that is compatible with the liquid to be pumped. Evaluation of compatibility must include consideration of the temperature at which the system will later operate.
- 4) Discard the storage liquid and the flush liquid. Be sure to comply with governmental regulations in any disposal.

**WARNING:**

**Be sure that there is nothing remaining in the pump or piping that could react with the liquid that will be pumped or that would have an excessive vapor pressure at the system operating temperature. For example, solvent residue left in the pump, when exposed to the operating temperature of the system, could create a vapor pressure in excess of the capability of the system to retain it, therefore causing an explosion that could prove fatal.**

- 5) Replace all pipe plugs and tighten them. Tighten any and all auxiliary piping connections that may have been loosened.
- 6) Remove the "storage" protective coatings from the external surfaces of the pump.

Pumps must also be protected from moisture, dirt, and physical damage, during and after installation while the system is being completed. Pumps "stored" as installed in the piping system must be completely checked for proper installation prior to start-up.

## 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.

### 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 assure 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. 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.

### PUMP MOUNTING

It is recommended that DL200 Series and DL230 Series pumps be mounted with the motor vertically upright. Other positions are possible if adequate support is provided.

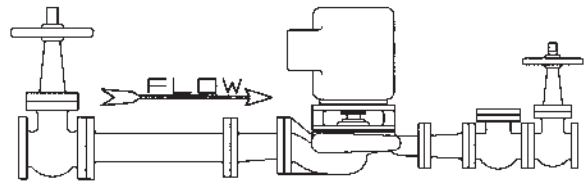
A pump support base for vertically upright mounting is required in accordance with this tabulation:

Pump Size	Use Base Above HP
1 x 1 1/2 x 6 DL200 Series	Base not required
1 1/2 x 3 x 6 DL200 Series	Base not required
All DL230 Series	15

When a pump support base is not used, adequate pipe supports must be provided for the piping at locations close on either side of the pump.

The foundation for the pump support base need not be elaborate. Four hold down bolt holes are provided in each base and the foundation should include four studs to match these holes. The support base should be seated in a thin layer of grout to assure even support.

### TYPICAL PUMP PIPING



### 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 should be as short and straight as possible with a pipe diameter as large as economically feasible for the flow rate handled. Suction piping should 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 should 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.

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, mechanical seal faces, or stuffing box packing. Mechanical seal parts 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. In addition, special filtering and mechanical seal flushing guards may be required. Consult your Dean representative. 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.

Remember 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.

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. Connect the suction and discharge piping without forcing the piping into position. The pipe flanges must line up with the pump flanges "freely".

**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.

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.

Connect all other (auxiliary) piping necessary for safe and successful operation of the equipment in the specific service conditions of the application.

## PUMP COOLING REQUIREMENTS

Pumps may be furnished with optional stuffing box jacket and/or jacketed mechanical seal gland, according to the pump service.

### STUFFING BOX COOLING

Cooling is generally recommended under these conditions:

- 1) With a mechanical seal when the pumping temperature is above 350°F. Individual plant specifications may

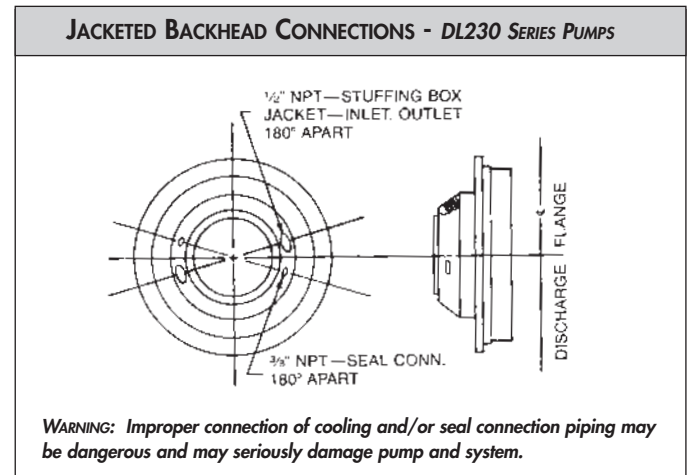
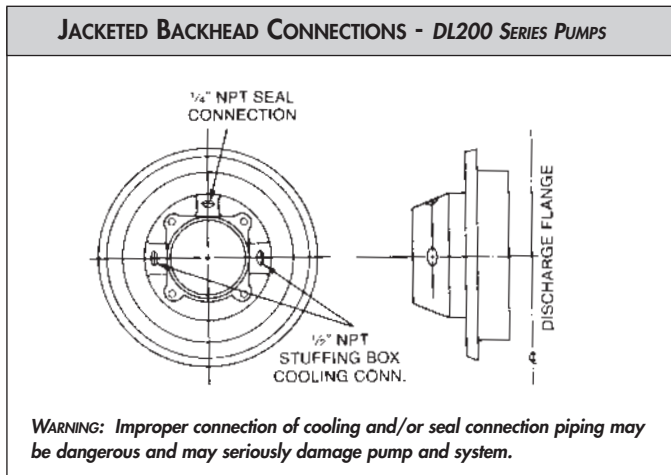
**WARNING:**

Make sure that all piping is install 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 pressure exceeds allowable.

require cooling above 250°F. **Specific applications (such as water) may require cooling at lower temperatures.**

- 2) With a mechanical seal when pumping liquids of 0.75 specific gravity or less when the pumping temperature permits further cooling.
- 3) With packing at temperatures above 250°F.



### COOLING WATER PIPING

No cooling water piping is furnished with the pump. The customer must provide the piping. The cooling inlet piping will probably include an isolation valve. The cooling outlet piping must have a flow control valve and a pressure relief valve. The pressure relief valve must be installed between the pump and the flow control (or isolation) valve. The pressure relief valve must not be set any higher than 135 PSIG. The outlet piping should lead to an open sight drain or through a suitable flow metering device.

### COOLING WATER FLOW RATES

**Stuffing box jacket cooling** water flow rates are related to pumping temperature. A rate of 2 to 5 GPM is advisable, the higher rate at the higher pumping temperature.

**WARNING — EXTREME HAZARD TO PERSONNEL:** Improper connection of cooling water piping may result in the injection of cooling water into the pump stuffing box and into the pumpage. Depending on temperature this may cause a violent steam explosion in the pump, piping, or associated equipment with extreme hazard to personnel. It may also cause serious contamination of the pumpage and heavy corrosion of pump or equipment parts.

**WARNING — EXTREME HAZARD TO PERSONNEL:** When cooling water is used to cool the pump, it is mandatory that the cooling water be allowed to flow at any time the pump is running. Closing the inlet and/or outlet valves under running conditions may result in the water in the jackets reaching high pressure which may lead to the rupture of a water jacket with extreme hazard to personnel.



## MOTOR BEARING LUBRICATION

Pump motor bearings are properly lubricated for nominal service conditions when the unit is shipped from the factory. The bearings are of standard regreasable type and inlet and outlet channels closed with pipe plugs are provided. To regrease the motor bearings, remove the two pipe plugs for each bearing and insert a grease fitting in the inlet hole. Use a low pressure grease gun to inject the proper grade of new grease. The grease cavity should be filled no more than three fourths (3/4) full. Over-lubrication may cause early bearing failure. Run the motor until it has warmed up and then remove the grease fitting and replace the pipe plugs.

The proper grease lubricant depends on the ambient temperature, the pumping temperature, and the atmospheric contamination at each pump installation. Specific lubricants, lubrication schedule, and lubrication instructions must be obtained by the customer from his local lubrication specialist.

In general, for reasonable ambient and contamination free atmospheres, a high quality lithium #2 grease will usually give satisfactory performance up to a pumping temperature of 350°F. Above this, a high quality high temperature grease will be required. The lubrication schedule must be suited to the particular installation.

## STARTING THE PUMP

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

It is important that a pump should never be subjected to thermal or pressure shock. The liquid should 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 THE PUMP

**WARNING:** Before filling the pump with liquid, check to see that all possible leak locations are sealed. See that the point where the pump shaft enters the pressure containing cavity is sealed. This sealing is accomplished with a mechanical face seal. 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. Use a wrench on all bolted joints to apply torque to assure 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.

When the source of liquid supplied to the pump is below atmospheric pressure or located below the pump, the pump must be primed prior to start-up. The priming may be accomplished in any of several ways, three of which are listed.

- 1) An exhaustor may be connected to the discharge piping between the pump and the discharge shut-off valve. With the discharge shut-off valve closed and the suction valve open, the air can be exhausted from the pump and piping.
- 2) With a foot valve installed in the suction piping, the pump may be filled with liquid introduced somewhere above the pump in the discharge line. The stuffing box should be vented to allow complete filling. A foot valve may create extensive losses and should be taken into consideration in calculating the available NPSH.
- 3) A vacuum pump (preferably a wet vacuum pump) may be used for evacuating air from the pump and piping. The vacuum pump should be connected as is the exhaustor covered in No. 1.

When the source of liquid supplied to the pump is above atmospheric pressure or above the pump centerline, the pump may be filled by venting through a bleed off line to atmosphere or back to the pump suction source.

If the pump is equipped with cooling water piping this should be turned on before filling the pump.

**It is most important to check the direction of rotation of the pump before allowing the pump to come up to speed.** To check rotation direction, push the starting button and instantly push the stop button. This will allow the motor to turn over a few revolutions and the direction of the rotation to be observed. A direction of rotation arrow is shown on the side of the pump casing. If rotation is incorrect, change the wiring connections and recheck rotation. **Operating the pump in reverse rotation will cause extensive damage.**

### OPERATING THE PUMP

**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, 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 assure 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 result in high pressure in the pump in a short time. Such pressure may result in a rupture of the pressure-containing parts and cause severe hazard to personnel and/or damage to the system.

**A centrifugal pump should never be run without liquid in the casing. Extensive damage may result, particularly to the mechanical seal or stuffing box packing. Vent the pump seal chamber through the seal connection to provide lubrication to the mechanical seal faces.**

When the pump is equipped with a mechanical seal, lubrication of the mechanical seal faces must occur very quickly after start-up. Unless special external flushing is employed or the pump is fitted



with a double mechanical seal, a seal circulation line is furnished. When the pump is properly filled and started, pumpage will flush the seal faces and will also expel any air or vapors from the seal chamber.

It is important that a pump should never be subjected to thermal or pressure shock. The liquid should 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.

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

If rotation direction is correct and the pump properly filled with liquid, it may now be started.

After the pump is up to speed, the discharge valve must be opened slowly. A centrifugal pump should not be operated for any appreciable time against a closed discharge valve since the liquid in the casing will begin to heat up. During the first several minutes of operating watch the pump carefully for overheating, vibration, and other abnormal conditions. If trouble develops, stop pump at once and correct the problem.

## PUMP START-UP CHECKLIST

Check these points carefully after pump installation and before starting up the pump.

- 1) Read instruction manual thoroughly and understand it.
- 2) Review pump order acknowledgment sheet for the service rating of the pump and any special features.
- 3) Check all piping connections, making certain that connections are to the correct openings and that all connections are tight.
- 4) If a pump support base is being used, make sure that it has been installed properly.
- 5) Lock out, and tag, the electrical supply to the motor. Remove the motor fan cover. Rotate the motor shaft, by hand, to be sure that there is no binding or rubbing within the pump or the motor. Correct any difficulties at once. Replace and secure the motor fan cover.
- 6) Check to see that the motor bearings have been properly lubricated.
- 7) Check the electrical connections to the motor. Unlock and remove tag from the electrical supply to the motor.
- 8) If pump stuffing box is packed, check to be sure that gland stud nuts are pulled up only finger tight and that the gland is not cocked.
- 9) "Bump" the motor starting button to check motor rotation. Operating the pump in reverse rotation may cause extensive damage. If the rotation is not correct, lock out and tag the electrical supply. Reconnect the wiring for proper rotation. Unlock and remove tag from the electrical supply to the motor. Go through the above procedure again to check the motor rotation.
- 10) Remove all dirt, waste, tools, and construction debris from the area.

## SPARE PARTS

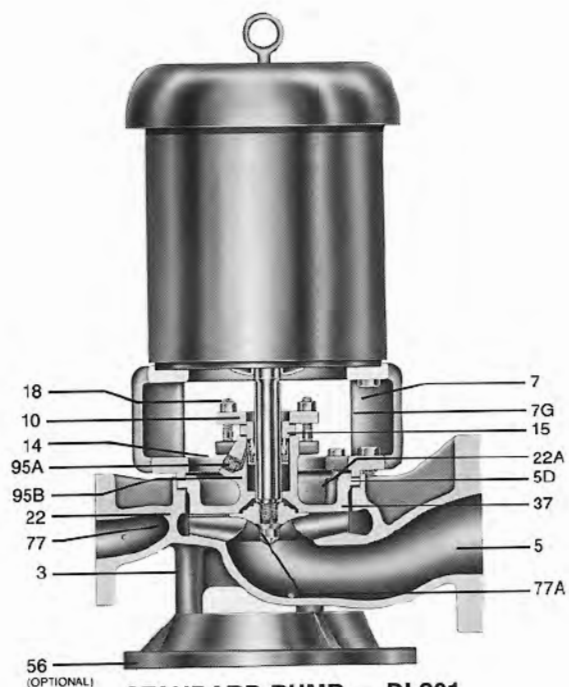
To avoid prolonged down time and facilitate rapid repair of damaged pump parts, Dean recommends the pump user maintain a minimum stock of spare parts. If the pump service is critical or the pump parts are of special materials, a spare parts stock is even more important to the user. Such a spares inventory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

### ORDERING SPARE PARTS

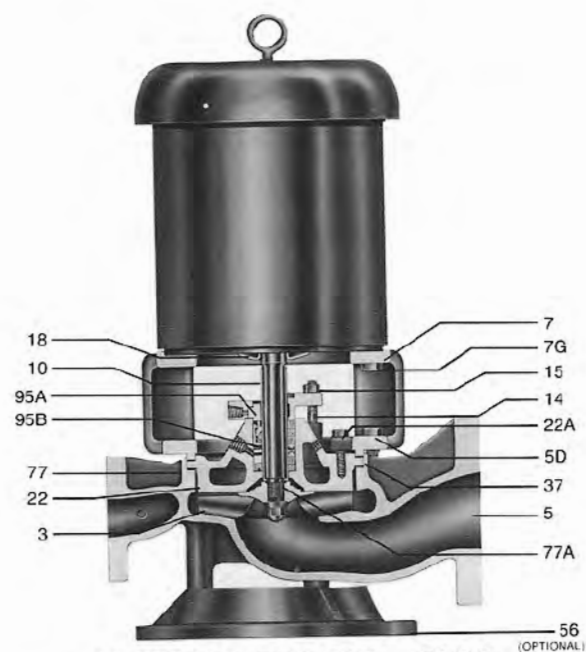
Spare part orders will be handled with a minimum delay if the following information is furnished by the customer with the order:

- 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 of the pump.
- 2) Give the part name, part number and material of part. These should agree with the standard parts list nomenclature.
- 3) Give the quantity of each part required.
- 4) Give complete shipping instructions.

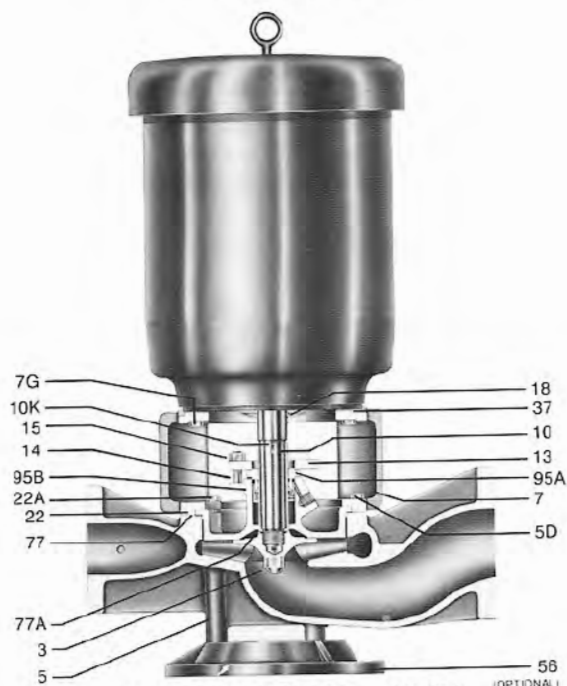
## DL200-DL230 SERIES PUMPS



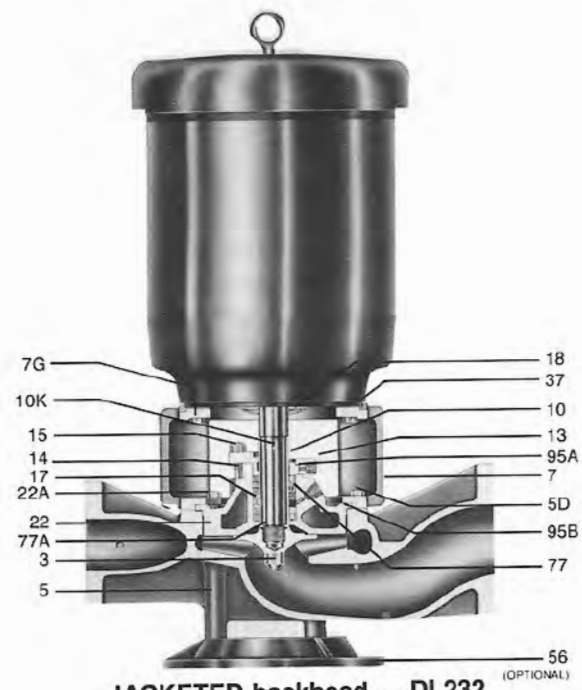
**STANDARD PUMP — DL201**  
Section Drawing 01934-1



**JACKETED BACKHEAD — DL202**  
Section Drawing 01934-3



**STANDARD PUMP — DL231**  
Section Drawing 01935-1

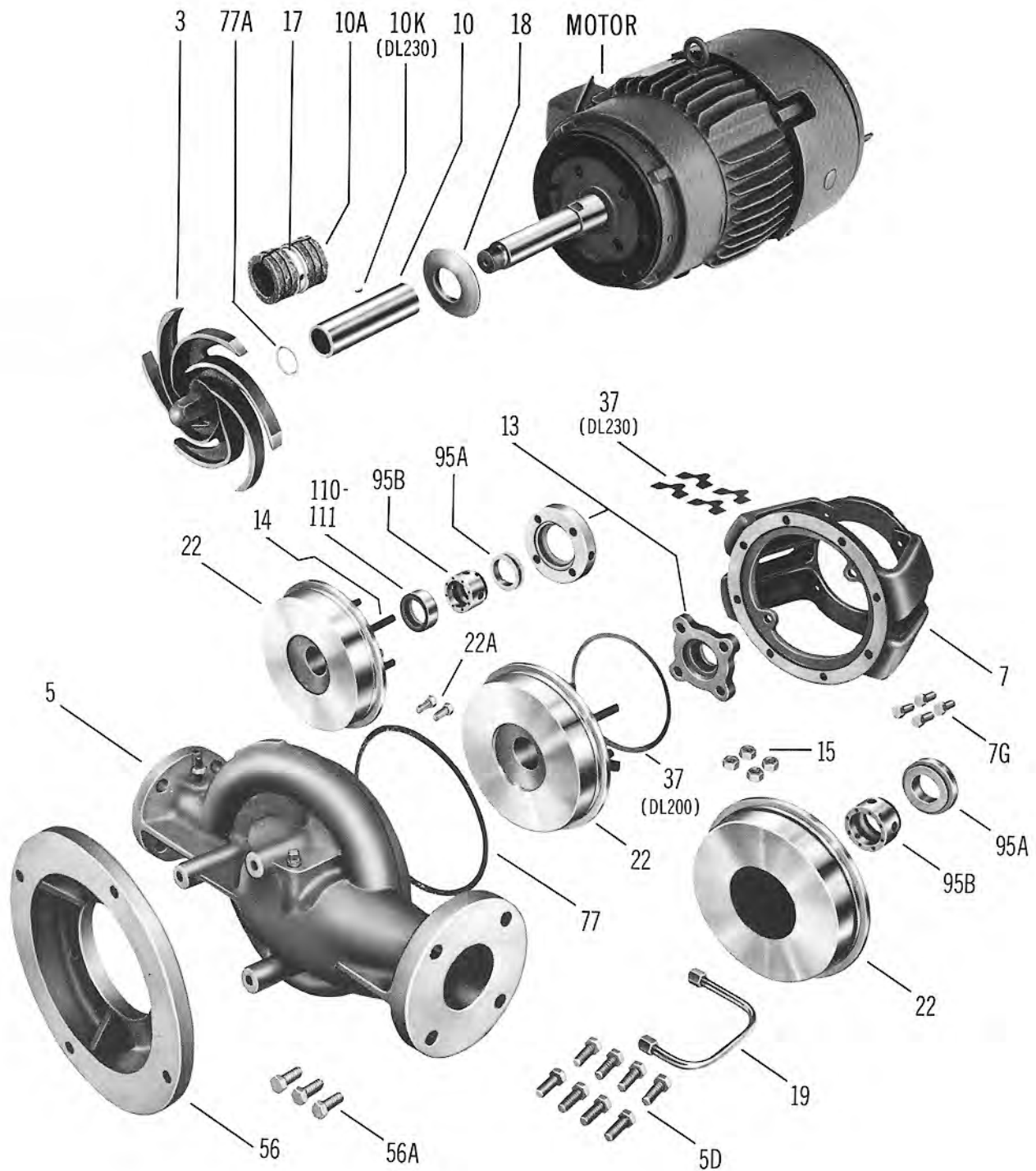


**JACKETED backhead — DL232**  
Section Drawing 01935-3

Part #	Part Name	Part #	Part Name	Part #	Part Name	Part #	Part Name
3*	Impeller	10*	Shaft Sleeve	17*	Lantern Ring	56	Base (Optional)
5	Casing	10K*	Shaft Sleeve Key	18*	Splash Collar	77*	Casing Gasket
5D*	Casing Cap Screw	13*	Packing Gland	22*	Backhead	77A*	Impeller Gasket
7	Cradle Spacer	14*	Stuffing Box Gland Stud	22A	Backhead Cap Screw	95A*	Stationary Seal Element
7G	Cradle Spacer Cap Screw	15*	Stuffing Box Gland Stud Nut	37*	Clearance Shim	95B*	Rotating Seal Face

\* Denotes parts interchangeable in DL230 and pH230 series pumps in matching sizes.

# EXPLODED VIEW AND PARTS LIST



Part #	Part Name	Part #	Part Name	Part #	Part Name	Part #	Part Name
3*	Impeller	10A*	Shaft Packing	18*	Splash Collar	56A	Baseplate Cap Screw
5	Casing	10K*	Shaft Sleeve Key	19	Internal Seal Circ. Piping	77*	Casing Gasket
5D*	Casing Cap Screw	13*	Packing Gland	22*	Backhead	77A*	Impeller Gasket
7	Cradle Spacer	14*	Stuffing Box Gland Stud	22A	Backhead Cap Screw	95A*	Stationary Seal Element
7G	Cradle Spacer Cap Screw	15*	Stuffing Box Gland Stud Nut	37*	Clearance Shim	95B*	Rotating Seal Face
10*	Shaft Sleeve	17*	Lantern Ring	56	Baseplate	110-111*	Min Flo Bushing

\* Denotes parts interchangeable in DL230 and pH230 series pumps in matching sizes.

# DL200 SERIES PUMPS — DISASSEMBLY AND ASSEMBLY PROCEDURES

## TYPES DL201 and DL202

**WARNING:** Work must be performed only by thoroughly trained and qualified personnel to assure 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.

- a) 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 can not be restarted. Tag the switching device so that no one will attempt to restart the unit.
- b) Disconnect the electrical wiring and the conduit from the electric motor at the conduit box of the motor. We strongly suggest that you mark the motor leads and the power supply leads to assure that they will be reconnected in the same way so that the motor rotation will be correct when the pump is restarted.
- c) 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.
- d) 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 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.

- e) 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 values of the liquid 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.

- f) 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.

- g) Because of the above possibility, when you loosen the gasketed joint at the back of the casing (5), loosen the casing cap screws (5D) only one full turn, and then use jack screws in the flange of the adapter cradle (7) 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.

**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.

- h) Remove any auxiliary piping that is attached to the pump.
- i) Remove the casing cap screws (5D) and using a mechanical lifting apparatus lift the rotating unit from the casing (5).
- j) Flush the wetted parts, now exposed, with a compatible, non-toxic, non-hazardous, stable liquid.
- k) Remove the gasket from the face of the casing (5) or the casing back cover (22) dependent on which one the gasket



may have adhered to. Exercise care not to damage the pump sealing surfaces. 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. Place all of the gasket residue in a plastic bag, seal the bag and dispose.

- l) The casing back cover-impeller-motor 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 PROCEDURE

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

**WARNING: 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 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.**

The unit may be turned over and set on the motor to afford easy access.

- a) The shaft has two flats just in front of the flinger (18). Using a wrench, the shaft should be held as the impeller is unscrewed. The impeller has a hex boss which may be fitted with a wrench to aid in removal. The impeller thread is right handed.

**WARNING: Heat is not to be applied to the impeller (3) to loosen it from the shaft (29). This is a potentially hazardous procedure and is to be avoided.**

- b) Remove the gland stud nuts (15) and lower the gland against the shaft flinger (18).
- c) Remove packing from stuffing box if pump is packed.
- d) Remove the two backhead to spacer cradle cap screws (22A) and lift out the backhead (22). Remove the clearance shims (37) and save them.
- e) If the pump is fitted with a mechanical seal, loosen the set screws and remove the seal rotary unit. Remove the seal stationary insert and the gland (13).

- f) Remove the impeller gasket (77A) and shaft sleeve (10), from the pump shaft.
- g) Take out the four cap screws (7G) securing the adapter cradle to the motor and lift off the adapter cradle (7).
- h) The splash collar (18) may be carefully pried off from its press fit on the shaft.
- i) Clean and inspect all parts.

The pump has now been disassembled to the components parts.

## 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. Motor bearings must be replaced by a motor service shop. Replace all parts that have worn, corroded, eroded, or otherwise deteriorated.**

**Use only Dean Pump/Met-Pro Corporation parts.**

Reassemble the pump by reversing the steps described above. In assembling the pump, using old or new parts, be sure that no foreign material, dirt, or grime is left on the parts.

- a) Clean all parts thoroughly.
- b) Replace the splash collar (18) on the shaft and adjust to a close, no interference fit to the motor face.
- c) Place the adapter cradle (7) onto the motor pilot fit after assuring that the fits are clean. Replace the adapter cradle cap screws (7G) and tighten them to the following torque value.  
  
3/8" cap screws - torque to 20 ft. lb.  
1/2" cap screws - torque to 45 ft. lb.
- d) To determine the impeller clearance and the thickness of the shims (37) necessary in the reassembly, slide the shaft sleeve (10) into place. Put the backhead (22) into position. Be sure no dirt is between the mating faces. Screw the impeller (3) on to the shaft firmly against the hook end of the sleeve. With a feeler gauge, carefully measure the minimum distance between the back of the impeller vanes and the face of the backhead. Subtract .010 inches from this measurement. The remainder is the thickness of the adjusting shims (37) required.
- e) Remove the impeller (3), and the backhead (22) and insert the clearance shim. A new set of clearance shims together with the new impeller and casing gaskets should be on hand to use as needed in the reassembly.
- f) If the pump is to be fitted with a mechanical seal, see "Installation of Standard Mechanical Seals," page 18, for detailed instructions.
- g) If the pump is to be fitted with stuffing box packing, slide the gland (13) over the shaft and back against the splash collar.

- h) Put the backhead (22) in place and secure with the backhead indexing cap screws (22A). Make sure that the shims (37) are in place. Tighten the cap screws to 20 ft. lb of torque.
- i) Clean the impeller (3) threads and the shaft threads thoroughly. Spray the inside threads of the impeller and the shaft threads with Loctite Primer T and allow the primer to dry. See instructions on the primer can. Apply Loctite Grade AA compound to the inside threads of the impeller only until all parts of the threads are wet. Avoid getting the compound on the gasket recess in the impeller or on the face of the impeller. Install the impeller gasket (77A). Screw the impeller onto the shaft and tighten to 50 ft. lb. Using a feeler gauge, check the clearance between the impeller (3) and the backhead (22). This clearance should be 0.009" to 0.013". If not, add or remove shims to obtain this clearance.  
  
Curing time of the Loctite Grade AA compound when used with Loctite Primer T is about 30 minutes.
- j) Rotate the motor shaft by turning the impeller (3) by hand (wear heavy gloves) to be certain that there is no internal interference.
- k) If the pump is to be packed, see "Installation and Maintenance of Stuffing Box Packing" for proper procedure.
- l) The rotating assembly is now ready to be returned to the installation site for final assembly.
- m) Place a new casing gasket (77) into the recess in the casing (5). Use a mechanical lifting apparatus to lower the rotating assembly into the casing (5). Install the casing cap screws (5D) and tighten them to 50 ft. lb.
- n) Remove the motor fan cover and rotate the motor shaft by turning the motor fan by hand (wear heavy gloves) to be certain that there is no internal interference. Replace the motor fan cover and fasten it securely in place.
- o) Reinstall all auxiliary piping, systems and equipment.
- p) Check to see that all openings have been sealed before filling the pump with liquid.
- q) Reconnect the electrical wiring and conduit.
- r) Follow the instructions under "STARTING THE PUMP" and "PUMP START-UP CHECKLIST".



## DL230 SERIES PUMPS — DISASSEMBLY AND ASSEMBLY PROCEDURES

### TYPES DL231 and DL232

**WARNING:** Work must be performed only by thoroughly trained and qualified personnel to assure 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.

- a) 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 can not be restarted. Tag the switching device so that no one will attempt to restart the unit.
- b) Disconnect the electrical wiring and the conduit from the electric motor at the conduit box of the motor. We strongly suggest that you mark the motor leads and the power supply leads to assure that they will be reconnected in the same way so that the motor rotation will be correct when the pump is restarted.
- c) 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.
- d) 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.
- e) 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 values of the liquid 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.
- f) 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.

- g) Because of the above possibility, when you loosen the gasketed joint at the back of the casing (5), loosen the casing cap screws (5D) only one full turn, and then use jack screws in the flange of the adapter cradle (7) 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.

**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.

- h) Remove any auxiliary piping that is attached to the pump.

**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 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.

- i) Remove the casing cap screws (5D) and using a mechanical lifting apparatus lift the rotating unit from the casing (5).
- j) Flush the wetted parts, now exposed, with a compatible, non-toxic, non-hazardous, stable liquid.
- k) Remove the gasket from the face of the casing (5) or the casing back cover (22) dependent on which one the gasket may have adhered to. Exercise care not to damage the pump sealing surfaces. 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. Place all of the gasket residue in a plastic bag, seal the bag and dispose.
- l) The casing back cover-impeller-motor 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 PROCEDURE

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

**WARNING: 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 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.**

The unit may be turned over and set on the motor to afford easy access.

- a) The shaft has two flats just in front of the flinger (18). Using a wrench, the shaft should be held as the impeller is unscrewed. The impeller has a hex boss which may be fitted with a wrench to aid in removal. The impeller thread is right handed.

**WARNING: Heat is not to be applied to the impeller (3) to loosen it from the shaft (29). This is a potentially hazardous procedure and is to be avoided.**

- b) Remove the gland stud nuts (15) and lower the gland against the shaft flinger (18).

- c) Remove packing from stuffing box if pump is packed.
- d) Remove the two backhead to spacer cradle cap screws (22A) and lift out the backhead (22).
- e) If the pump is fitted with a mechanical seal, loosen the set screws and remove the seal rotary unit. Remove the seal stationary insert and the gland (13).
- f) Remove the impeller gasket (77A) and shaft sleeve (10), and shaft sleeve key (10K), from the pump shaft.
- g) Take out the four cap screws (7G) securing the adapter cradle to the motor and lift off the adapter cradle (7). The impeller clearance adjusting shims (37) should be saved.
- h) The splash collar (18) may be carefully pried off from its press fit on the shaft.
- i) Clean and inspect all parts.

The pump has now been disassembled to the components parts.

## 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. Motor bearings must be replaced by a motor service shop. Replace all parts that have worn, corroded, eroded, or otherwise deteriorated.**

**Use only Dean Pump Division of Met-Pro Corporation parts.**

Reassemble the pump by reversing the steps described above. In assembling the pump, using old or new parts, be sure that no foreign material, dirt, or grime is left on the parts.

- a) Clean all parts thoroughly.
- b) Replace the splash collar (18) on the shaft and adjust to a close, no interference fit to the motor face.
- c) Replace the adapter cradle (7) and screw the adapter cradle cap screws (7G) into place, finger tight. Be sure no dirt or grit is between the faces.
- d) To determine the impeller clearance and the thickness of the shims (37) necessary in the reassembly, slide the shaft sleeve (10) and sleeve key (10K) into place. Put the backhead (22) into position. Be sure no dirt is between the mating faces. Screw the impeller (3) on to the shaft firmly against the hook end of the sleeve. With a feeler gauge, carefully measure the minimum distance between the back of the impeller vanes and the face of the backhead. Subtract .010 inches from this measurement. The remainder is the thickness of the adjusting shims (37) required.
- e) Loosen the four adapter cradle cap screws (7G) and insert the necessary thickness of shims at each cap screw and between the face of the motor and the back of the adapter

cradle (7). A new set of clearance shims together with the new impeller and casing gaskets should be on hand to use as needed in the reassembly. Tighten the adapter cradle cap screws (7G) to the following torque value.

1/2" cap screws - torque to 45 ft. lb.

5/8" cap screws - torque to 70 ft. lb.

Using a feeler gauge, check the clearance between the impeller (3) and the backhead (22). This clearance should be 0.009" to 0.013", if not, add or remove shims to obtain this clearance.

- f) If the pump is to be fitted with a mechanical seal, see "Installation of Standard Mechanical Seals," page 18, for detailed instructions.
- g) If the pump is to be fitted with stuffing box packing, remove the impeller (3) and backhead (22). Slide the gland (13) over the shaft and back against the splash collar (18).
- h) Put the backhead (22) in place and secure with the backhead indexing cap screws (22A). Tighten the cap screws to 20 ft. lb.
- i) Clean the impeller (3) threads and the shaft threads thoroughly. Spray the inside threads of the impeller and the shaft threads with Loctite Primer T and allow the primer to dry. See instructions on the primer can. Apply Loctite Grade AA compound to the inside threads of the impeller only until all parts of the threads are wet. Avoid getting the compound on the gasket recess in the impeller. Install the impeller gasket. Screw the impeller in place and tighten to 60 ft. lb.

Curing time of the Loctite Grade AA compound when used with Loctite Primer T is about 30 minutes.

- j) Rotate the motor shaft by turning the impeller (3) by hand (wear heavy gloves) to be certain that there is no internal interference.
- k) If the pump is to be packed, see "Installation and Maintenance of Stuffing Box Packing" for proper procedure.
- l) The rotating assembly is now ready to be returned to the installation site for final assembly.
- m) Place a new casing gasket (77) into the recess in the casing (5). Use a mechanical lifting apparatus to lower the rotating assembly into the casing (5). Install the casing cap screws (5D) and tighten them to the following values.

1/2" cap screws - torque to 50 ft. lb.  
5/8" cap screws - torque to 75 ft. lb.
- n) Remove the motor fan cover and rotate the motor shaft by turning the motor fan by hand (wear heavy gloves) to be certain that there is no internal interference. Replace the motor fan cover and fasten it securely in place.
- o) Reinstall all auxiliary piping, systems and equipment.
- p) Check to see that all openings have been sealed before filling the pump with liquid.
- q) Reconnect the electrical wiring and conduit.
- r) Follow the instructions under "STARTING THE PUMP" and "PUMP START-UP CHECKLIST".

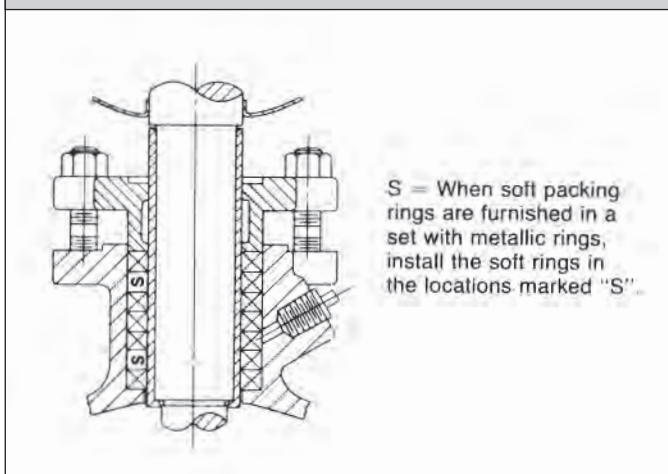
## INSTALLATION AND MAINTENANCE OF STUFFING BOX PACKING

The proper installation and maintenance of packing to seal a pump shaft is not difficult but must be properly done to provide good packing and pump shaft sleeve life. All packing must be allowed to leak. This leakage is the only lubrication for the packing and additionally provides cooling to remove part of the frictional heat built up between the shaft sleeve and the packing. Failure to allow sufficient leakage will result in short packing and shaft sleeve life and increased power consumption of the pumping unit. It is entirely possible to stall a centrifugal pump by clamping the packing gland down.

Most Dean pumps are shipped from the factory without packing in the stuffing box. A complete set of die molded packing specified for the service is shipped with the pump in a separately labeled carton. The pump stuffing box must be properly packed before the pump is put into service.

The stuffing box may be packed either with or without a lantern ring (also known as a seal cage or lantern gland) as the service of the pump dictates. When the pump suction pressure is above 100 psig a lantern ring is not recommended.

**PACKED STUFFING BOX WITH LANTERN RING**



### PURPOSE OF LANTERN RING

Lantern rings are made of Teflon or suitable metal as the service demands. They are of split construction and may be easily installed or removed without disassembling the pump. A lantern ring is used in the stuffing box with packing for these reasons:

- 1) To permit the introduction of a sealing liquid into the stuffing box to prevent leakage of air into the pump through the packing when the pump suction pressure is less than atmospheric pressure. The sealing liquid may be from an internal seal connection or from an external source.
- 2) To permit introduction of grease, oil, or other suitable lubricant to the packing to provide lubrication or cooling.

### INTERNAL SEAL CONNECTION TO THE LANTERN RING

An internal seal connection is used to inject pumpage from the pump casing into the lantern ring through the lantern ring connection of the stuffing box to seal the pump against air leakage as noted above. It can be used only when the pumped liquid is clean and non-abrasive.

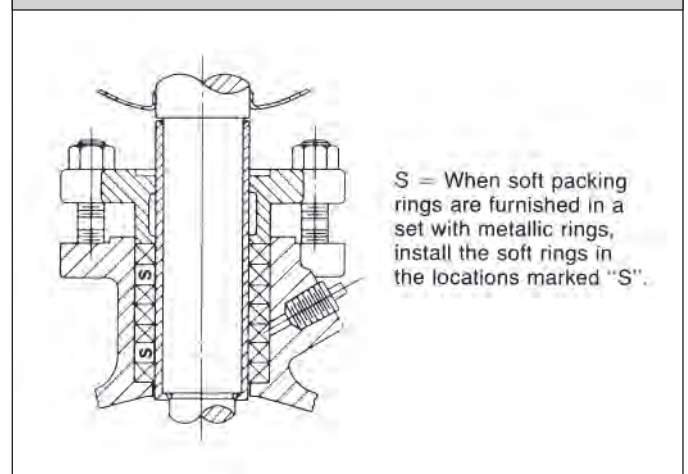
**The pumped liquid introduced through the internal seal connection to the lantern ring will not seal the pump against air leakage through the packing when the pump is idle or on stand-by service.**

### EXTERNAL SEAL CONNECTION TO THE LANTERN RING

The sealing liquid introduced to the lantern ring may be from a source external to the pump. It must be introduced at a pressure above stuffing box pressure and must be non-corrosive, non-abrasive and adequately cool. The connection is made to the lantern ring connection on the pump stuffing box.

The lantern ring connection on the pump stuffing box is also used to introduce grease, oil, or other suitable lubricants to the lantern ring.

**PACKED STUFFING BOX WITHOUT LANTERN RING**



### LANTERN RING NOT USED

When the pump suction pressure is above atmospheric pressure or the stuffing box is pressure sealed (no impeller balance holes) and neither internal nor external liquid or lubricant is required to the packing, the lantern ring is not used and the stuffing box is packed full with rings of packing.

## PACKING INSTALLATION

These instructions apply to the conventional woven, braided, folded, and wrapped packings. Packings of multifilament Teflon, braided carbon filament, compressed carbon sheet, and other special types or materials may require special installation techniques.

The way in which the packing is installed in the stuffing box is important to the good service life of the packing and the shaft sleeve. Incorrect installation will lead to excessive leakage and may cause high power requirements.

The use of a packing tamper (split bushing) is recommended to properly seat the packing rings. Such a tool is easily made from wood or metal in the form of a hollow cylinder. The inside diameter must be slightly larger than the shaft sleeve and the outside slightly smaller than the stuffing box bore. Split the piece lengthwise to allow insertion in the stuffing box. More than one length of packing tamper may be necessary. Suit the lengths to the particular pump.

All packing rings furnished by Dean Pump Division are die-molded to fit the stuffing box. To place a ring on the shaft sleeve, open the ring at the split at a right angle to the plane of the ring. This will best retain the molded form and avoid distortion. Successive rings should be installed with the joints at 90° intervals.

Foil wrapped packings must be installed with the foil laps running in the direction of shaft sleeve rotation on the inside of the ring. Metallic packing should be lubricated, on the wearing face only, with a dry graphite lubricant before insertion.

Foil wrapped packing sets are furnished with soft rings of packing which are placed between the hard metallic rings in the locations shown in the diagrams. These rings help to furnish lubrication during run-in period. Being soft, they are more sensitive to compression loads and care must be taken during the adjustment period.

Follow these steps:

- 1) With the packing gland slid back against the flinger, or removed if it is a two piece gland, place a ring of packing on the shaft sleeve and enter it carefully into the stuffing box. Insert the halves of the packing tamper and push the packing ring to the bottom of the stuffing box. Slide the packing gland up against the end of the packing tamper with the gland studs indexed in the gland holes, put on the gland stud nuts and tighten them firmly and evenly to seat the packing ring.
- 2) Back off the gland, remove the packing tamper, and insert a second ring of packing, staggering the ring joint 90° from that in the first ring. Repeat the seating procedure above.
- 3) If a lantern ring is to be used, check the pump specifications to determine its position in relation to the number of rings between the bottom of the stuffing box and the lantern ring. Insert packing rings as above until the lantern ring position is reached and then install the lantern ring.

- 4) If no lantern ring is to be used, or after the lantern ring is put in place, continue to add packing rings, one at a time, staggering joints at 90° intervals, until the stuffing box is nearly full.
- 5) Put the packing gland in place and pull up the gland stud nuts firmly. Back the gland stud nuts off to finger tightness.
- 6) Rotate the pump shaft by hand to be sure it is not locked.
- 7) **Final adjustment of the packing compression must be made with the pump running.** Start and stop the pump several times to begin the running-in period. Allow sufficient leakage to assume good lubrication during the adjustment. Pull up the gland stud nuts 1/8 turn at a time. Allow a running-in period between adjustments. Continue adjustment until the desired leakage control is reached. The minimum leakage rate depends on a number of things: liquid pumped, packing used, temperature, stuffing box pressure, and the condition of the pump. In any case, some leakage is necessary to both lubricate and cool the packing. Minimum rates may vary from a few drops per minute to as much as 1/2 pint per minute.
- 8) As the packing wears in service, the gland should be readjusted to maintain the minimum leakage.
- 9) After the gland has been taken up to full travel, an additional ring of packing may be placed in the stuffing box. When the gland has again been taken up to full travel the stuffing box should be repacked completely.

## USUAL CAUSES OF PACKING FAILURE AND EXCESSIVE STUFFING BOX LEAKAGE

- 1) Packing has not been installed properly.
- 2) Packing used is not suitable for the temperature and pressure involved or may be subject to attack by liquid handled.
- 3) Inner rings are not thoroughly seated in the stuffing box so that outer rings are carrying all the load.
- 4) Dirt and foreign particles in stuffing box are causing rapid scoring of shaft sleeve.
- 5) Stuffing box cooling water not turned on.
- 6) Packing gland pulled up too tight.

When ordering additional packing sets, always refer to packing set number and to pump serial number.



## INSTALLATION OF STANDARD MECHANICAL SEALS

### FOR PUMP TYPES DL201, DL202, DL231 and DL232

Clean, careful, and correct installation of the mechanical seal is essential to successful mechanical seal operation. Cleanliness and accuracy of setting cannot be overemphasized.

For instructions on pump disassembly and assembly see the instruction manual relating to the specific pump type.

A correct mechanical seal drawing is furnished with each pump and the mechanical seal setting dimension is given on this drawing.

Use the setting for the specific pump type in which the installation is being made.

The pump is first assembled according to the applicable assembly instructions through the step of proper impeller adjustment.

The mechanical seal rotary unit must be properly located in relation to the face of the pump stuffing box in order to establish the proper seal spring tension and resultant proper force on the seal faces. An error in setting of more than several thousandths may well cause seal failure by excessive or insufficient seal face pressure.

### INSTALLATION OF SINGLE INSIDE SEALS

To make seal installation, with the pump partially assembled as noted above, scribe a mark on the shaft sleeve (10) exactly in line with the face of the pump stuffing box. (Note 1). The impeller (3), and backhead (22) are now removed from the pump. If the mark causes roughness on the shaft sleeve remove the burr carefully with crocus cloth. Any roughness on the shaft sleeve may damage the mechanical seal shaft packing when the seal is assembled.

Referring to the mechanical seal drawing, determine the proper "D" (or setting) dimension for the seal and pump type.

Measure carefully from the mark which you have made on the shaft sleeve and make a new mark on the shaft sleeve, towards the pump end, exactly to this dimension.

If the mechanical seal insert is of the clamped-in style, put the mechanical seal gland (300) on the pump shaft and slide it back against the flinger. Put one mechanical seal gland insert gasket (325), the gland insert (315) and the other gland insert gasket (326) on the shaft. Make sure that the lapped face of the gland insert is towards the stuffing box.

Flexibly mounted inserts are of two types, depending on the service of the pump. The insert may be of rectangular cross section grooved for an "O" ring or it may be of L-shaped cross-section used with a Teflon mounting ring.

To position the "O" ring mounted insert, lubricate the inside of the mechanical seal gland. Place the "O" ring in the groove of the insert and carefully slide the insert into position. Be careful not to damage the "O" ring. Make sure that the lapped face of the insert faces towards the pump.

To position the Teflon mounted insert, lubricate the inside of the mechanical seal gland. Carefully slide the Teflon mounting ring into position in the gland and then slide the insert into place. The slot (or pin) in the stationary insert must index with the drive pin (or slot) in the gland.

Put the mechanical seal gland and insert on the shaft and slide it back against the flinger. Be careful not to damage the insert or its mounting. Put the gland gasket (324) on the shaft. Slide the seal rotary unit assembly carefully onto the shaft sleeve being particularly careful not to damage the seal shaft packing (345). Be sure that the shaft sleeve hook is firmly against the shoulder on the shaft. Set the rotary unit carefully to the setting mark you have made on the shaft sleeve and lock it tightly in place with the set screws. Recheck the setting. Slide the pump backhead carefully into place and guide the seal gland insert and gaskets together with the gland carefully into position. Reassemble the pump. Now tighten the gland stud nuts carefully and evenly to avoid cocking the gland, making sure that the gland insert and gaskets are in place.

Before starting the pump, bleed the air from the stuffing box. The stuffing box must be full of liquid or the seal faces may be damaged by lack of lubrication when the pump is started.

Occasionally a seal may leak very slightly when the pump is first started. If the leakage continues more than a few moments the pump should be shut down and the seal removed to discover the cause.

NOTE 1 — Pumps using a single inside balanced seal (except metal bellows) are furnished with a short shaft sleeve. The mark is made on the shaft because the sleeve does not extend to this point. The second mark (setting mark) is made on the shaft sleeve and measured from the mark on the shaft.

### INSTALLATION OF SINGLE OUTSIDE UNBALANCED SEALS

If the seal rotary unit is scribed with a setting mark, the shaft marking procedure outlined below may be omitted. The setting mark can be found on the outer shell of the rotary unit running circumferentially between the four round holes in the shell.

Visible through each hole is the edge of the metal disc against which the seal springs bear. To set the seal with the proper spring pressure, first assemble the pump as noted below with the seal rotary unit slid back against the shaft flinger and left loose until the entire bearing housing-impeller assembly is bolted in place in the pump casing. Then slide the seal rotary unit into place against the stationary insert and compress the springs until the metal disc visible through the holes is aligned with the setting mark scribed on the shell. Tighten the set screws and check through each hole to determine that the seal rotary unit is correctly compressed and not cocked.

If the seal rotary unit is not marked with a setting line, a setting mark must be made on the shaft sleeve. To make the seal installation, with the pump partially assembled as noted above, scribe a mark on the shaft sleeve (10) exactly in line with the face of the pump stuffing box. The impeller (3), and backhead (22) are now removed from the pump. If the mark causes roughness on the shaft sleeve remove the burr carefully with crocus cloth. Any roughness on the shaft sleeve may damage the mechanical seal shaft packing when the seal is assembled.



Referring to the mechanical seal drawing, determine the proper "D" (or setting) dimension for the seal and pump type. Measure carefully from the mark which you have made on the shaft sleeve and make a new mark on the shaft sleeve, towards the bearing housing, exactly to this dimension. Remove the burr if necessary. This mark is the seal setting mark.

Some seals have measurable dimensions that will allow setting without using the shaft scribing method. If such is the case, the seal drawing will so indicate.

Put the mechanical seal rotary unit on the shaft and slide it back against the flinger. Assemble the seal insert gasket (326), the mechanical seal insert (315), and seal insert gasket (325) to the face of the stuffing box and, placing the gland (300) in position, pull down the gland stud nuts evenly to approximately 20 foot pounds of torque. Make sure that the lapped face of the seal insert is towards the rotary unit. Reassemble the pump. Now carefully slide the rotary unit against the seal insert, compress the rotary unit and set it to the mark on the shaft sleeve and lock the rotary unit tightly in place with the set screws. Be careful not to cock the rotary unit.

Before starting the pump, bleed the air from the stuffing box. The stuffing box must be full of liquid or the seal faces may be damaged by lack of lubrication when the pump is started.

Occasionally a seal may leak very slightly when the pump is first started. If the leakage continues more than a few moments the pump should be shut down and the seal removed to discover the cause.

## **INSTALLATION OF DOUBLE INSIDE UNBALANCED SEALS**

To make seal installation, with the pump partially assembled as noted above, scribe a mark on the shaft sleeve (10) exactly in line with the face of the pump stuffing box. The impeller (3), and backhead (22) are now removed from the pump. If this marking or subsequent marking causes roughness on the shaft sleeve remove the burr carefully with crocus cloth. Any roughness on the shaft sleeve may damage the mechanical seal shaft packing when the seal is assembled.

Referring to the mechanical seal drawing, determine the two "D" (or setting) dimensions for the two rotary units. Be sure to determine those for the particular pump type. Measure carefully from the mark which you have made on the shaft sleeve and make two new marks on the shaft sleeve, towards the pump end, exactly to these dimensions.

Double seal stationary inserts are of two types depending on the service conditions of the pump. The insert may be of rectangular cross section grooved for an o-ring or the insert may be of L-shaped cross-section used with a Teflon mounting ring.

To position the o-ring mounted insert, lubricate the inside of the stuffing box and the inside of the mechanical seal gland. Place the o-rings in the grooves and carefully slide the inserts into position in the stuffing box and seal gland. Be most careful not to damage the o-ring.

To position the Teflon mounted insert, lubricate the inside of the stuffing box and the inside of the seal gland. Carefully slide the Teflon mounting rings into position and then slide the stationary inserts into place. The slots (or pins) in the stationary inserts must index with the drive pins (or slots) in the gland and stuffing box.

Put the mechanical seal gland with insert installed, on the pump shaft sleeve and slide it back against the flinger. Put the seal gland gasket on the sleeve and slide it back against the gland. Slide one seal rotary unit on the sleeve with the carbon face towards the bearing housing. Be careful not to damage the seal shaft packing. Be sure that the shaft sleeve hook is firmly against the shoulder on the shaft. Set the rotary unit carefully to its setting mark on the shaft sleeve and lock it tightly in place with the set screws. Slide the second rotary unit onto the shaft sleeve with the carbon face away from the bearing housing. Set it carefully to its setting mark and lock it tightly in place. Recheck both rotary settings and correct if necessary. Slide the pump backhead very carefully in place over the seals. Slide the gland gasket and seal gland into place and carefully and evenly tighten the gland stud nuts. Do not cock the gland. The pump may now be reassembled.

Double seals require a liquid in the stuffing box between the seal inserts to provide lubrication. This barrier liquid must be supplied at a pressure of 10 to 15 psi above stuffing box throat pressure to activate the inboard seal. Before starting the pump, be sure that the stuffing box is full of this lubrication and that all supply lines for this liquid are in place and in operation.

Leakage from the outboard seal can be easily spotted. Leakage through the inboard seal can be detected only by the loss of the barrier (lubricating) liquid from between the seals. If leakage occurs, the pump must be disassembled and the cause of leakage determined.

**If you do not have the correct mechanical seal drawing, write to the Factory giving complete information on pump size, type, and serial number and the correct seal drawing will be sent to you.**

## 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 assure 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. 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. Assure 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 it's 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 assure 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 assure 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 build-up. Use a wrench on all bolted joints to apply torque to assure 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 assure 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 assure 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 with out 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. 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. 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 removed 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 overboring 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 MetPro Corporation parts.