

**DELAVAL**

**IMO PUMP<sup>®</sup>**

**INSTRUCTIONS and PARTS LIST**

**SERIES 3NB-550**



Instructions 3NB-550-6

May 1972

**IMO PUMP DIVISION**

P. O. BOX 321  
TRENTON, N. J. 08602

## 3NB-550

### DESCRIPTION

The 3NB-550 pump is a constant displacement, rotary, screw type pump. It is a vertical mounted unit designed for lube oil service and the moving parts (power rotor and two idler rotors) are lubricated by the fluid being pumped.

HYDRAULIC BALANCE - The rotors are hydraulically balanced to minimize axial thrust. High pressure oil from the discharge chamber is directed through drilled passages in the idlers (024) to a hydrostatic balance area on the outboard end of the idler. The balance piston (007) fitted on the power rotor (006) between the discharge chamber and the seal chamber provides hydraulic balance for the axial hydraulic force on the power rotor threads. Pressure in the seal chamber is vented to the suction via passages in the balance piston housing (011) and the rotor housing (022).

BALL BEARING - The ball bearing positions the power rotor axially within the pump and is located inboard of the mechanical seal. The type used is a #310SZZ - MRC.

MECHANICAL SEAL - The mechanical seal prevents leakage of oil where the power rotor shaft emerges from the balance piston housing. The type used is a Crane Type 21, BF-171, Dwg. CF-SP-17403.

### INSTALLATION

FOUNDATION & ALIGNMENT - Place unit on a smooth, level and rigid surface. Initial alignment established when pump and driver are factory mounted must be maintained. Coupling alignment should be within .003" to .005" FIR, radial and parallel.

PIPING - Make suction pipe as short and direct as possible and use pipe at least one size larger than the suction opening of the pump. All joints must be air tight. Whenever possible have liquid flow to the pump but if this is not possible a foot valve or check valve should be installed at the end of the suction piping or as far from the pump as possible.

Support all piping independently of the pump. Avoid pockets or loops. Always submerge return pipe openings to avoid oil foaming or picking up air and place as far as possible from suction pipe opening.

In making up the piping always provide a priming connection on the suction side and a venting connection on the discharge side of the pump.

SUCTION STRAINER - A suitable strainer should be installed in the suction piping to insure protection of the pump. Gages should be placed on both sides of the strainer to detect any excessive pressure drop. In addition it is recommended that a low pressure cutout be installed between the strainer and the pump as an additional safety measure.

RELIEF VALVE - A relief valve should be installed in the discharge line and should be set no higher than 5 to 10 PSI above the maximum pressure rating on the pump. Relief lines should always be returned to tank or reservoir if possible.

## OPERATION

INITIAL STARTING - Before a unit is started for the first time, it is advisable to make sure that the motor has been wired for rotation in the direction indicated by the arrow on the driver bracket. This should be done with the pump disconnected.

If possible, test system with liquid pressure on lines before starting pump for the first time. Flush all lines, especially the suction line, free from dirt, weld beads, thread turnings, pipe scale, etc., before starting pump. Such trash will damage the pump and any regulating or control equipment installed in the system.

Since it is necessary to be sure that the pump is full of oil it is always best to prime the unit on initial starting. On new installations the system is full of air which must be removed. If not removed the performance of the unit is erratic and in some cases can be the cause of the unit not pumping. Priming the pump should preferably consist of filling not only the pump case with oil but as much of the suction line as possible.

The discharge side of the pump should be vented on the initial starting. Venting is especially essential where the suction line is long or the pump is discharging against a system pressure upon starting.

LOSS OF SUCTION - If the pump does not discharge after being started the unit should be shut down right away. The pump then should be primed and tried again. If it still does not pick up the oil right away there may be a leak in the suction pipe or perhaps excessive lift due to an obstruction, throttled valve, or other causes. Attaching a compound gauge to the suction pipe will help find the trouble.

NOISY OPERATION - Should the pump develop a noise after satisfactory operation this is usually indicative of either excessive suction lift due to cold oil, air in the oil, low fluid level in tank or reservoir, misalignment of the coupling, or in the cause of an old pump, an indication of excessive wear.

SHUTTING DOWN - Whenever the unit is shut down, if the operation of the system permits, both suction and discharge valves should be closed. This is particularly important if the shutdown is to be for an extended period. Leakage in the foot valve, if the main supply is below the pump elevation, could drain the oil from the system and necessitate repriming as though it was the initial starting of the system.

ROUTINE CARE - If installation precautions are observed carefully, the pump should operate satisfactorily with little attention other than periodic checks on capacity, as well as suction and discharge pressures.

## MAINTENANCE

GENERAL - Shut off driver. Close off suction and discharge lines and disconnect piping from pump. Uncouple pump from driver and remove driver.

### DISASSEMBLY

STEP 1 - Loosen set screw (018) and remove check nut (017). Remove coupling half from rotor shaft. Remove outlet head (031) from pump case (001) by removing nuts (035) and bolts (034).

STEP 2 - Using an extension and socket wrench, remove hex head bolts (023). Lift pump cartridge from pump case (001) for disassembly.

STEP 3 - Remove bolts (027), lockwasher (028), thrust plate (025), and spacers (026) from rotor housing (022). Spacers are machined as a set and should be wired together. Unscrew idler rotors (024) from rotor housing (022).

STEP 4 - Remove bolts (023) and remove balance piston housing (011) from rotor housing (022) together with power rotor (006), mechanical seal (008), bearing spacer (013), ball bearing (014) bearing locknut (015), and "O" ring (019).

Rotors and housing bores may now be inspected. No further disassembly is required unless it is necessary to service mechanical seal or ball bearing or

replace power rotor. If service to any or all of these is required proceed as follows:

STEP 5 - Remove hex head bolts (021) and bearing retainer (020). Remove locknut (015) from shaft. Remove ball bearing (014) from shaft. This may be accomplished by pressing on the threaded end of rotor until bearing is unseated or by pushing on opposite end of rotor until bearing is out of balance piston housing and can be removed with a puller. Remove bearing spacer (013) and stationary seal seat. Pull rotor out of balance piston housing and remove rotary seal member from shaft.

#### NOTE

Balance piston bushing (012) is of the floating design and may be removed before disassembly of the rotor by sliding it down over rotor threads.

#### REASSEMBLY

Inspect and clean all parts before starting reassembly. New "O" rings should be installed whenever the pump is rebuilt. A new mechanical seal should be installed if it was necessary to disturb the original seal. If original seal is to be reused it should be carefully checked, particularly the carbon ring and seat face. SAE-30 oil or equal should be used to assist pump reassembly. DO NOT USE GREASE.

STEP 1 - Reassemble balance piston housing (011) containing power rotor assembly. Bolt to rotor housing (022) with bolts (023). If power rotor was replaced or it was necessary to service mechanical seal (008) or ball bearing (014) refer to STEP 2 for instructions on rebuilding power rotor assembly.

#### NOTE

Check balance piston bushing (012). If balance piston bushing has been removed, it may be installed by passing it over rotor threads before mounting assembly to rotor housing.

STEP 2 - To install a type 21 seal proceed as follows: Obtain a piece of light weight flexible shim stock and wrap it around the power rotor shaft so it extends approximately 1/4" beyond the retaining ring groove and covers both grooves and the shoulder. Coat shaft, shim stock, and the ID of rotating seal member with oil. Install seal member. As the seal member is passed over the shim stock, twist it in the same direction as the direction of the wrap of the shim stock. Remove shim stock from the shaft. Insert power rotor into balance piston housing through large bore. Install gasket furnished with new

seal and push stationary seal member onto shaft and into balance piston housing. Install bearing spacer (013). Press or tap ball bearing (014) onto shaft and install locknut (015).

#### NOTE

Do not pound or use excessive force on outer race of bearing. Bolt bearing retainer (020) to balance piston housing with hex head bolts (021). Entire assembly may now be assembled to rotor housing (see STEP 1).

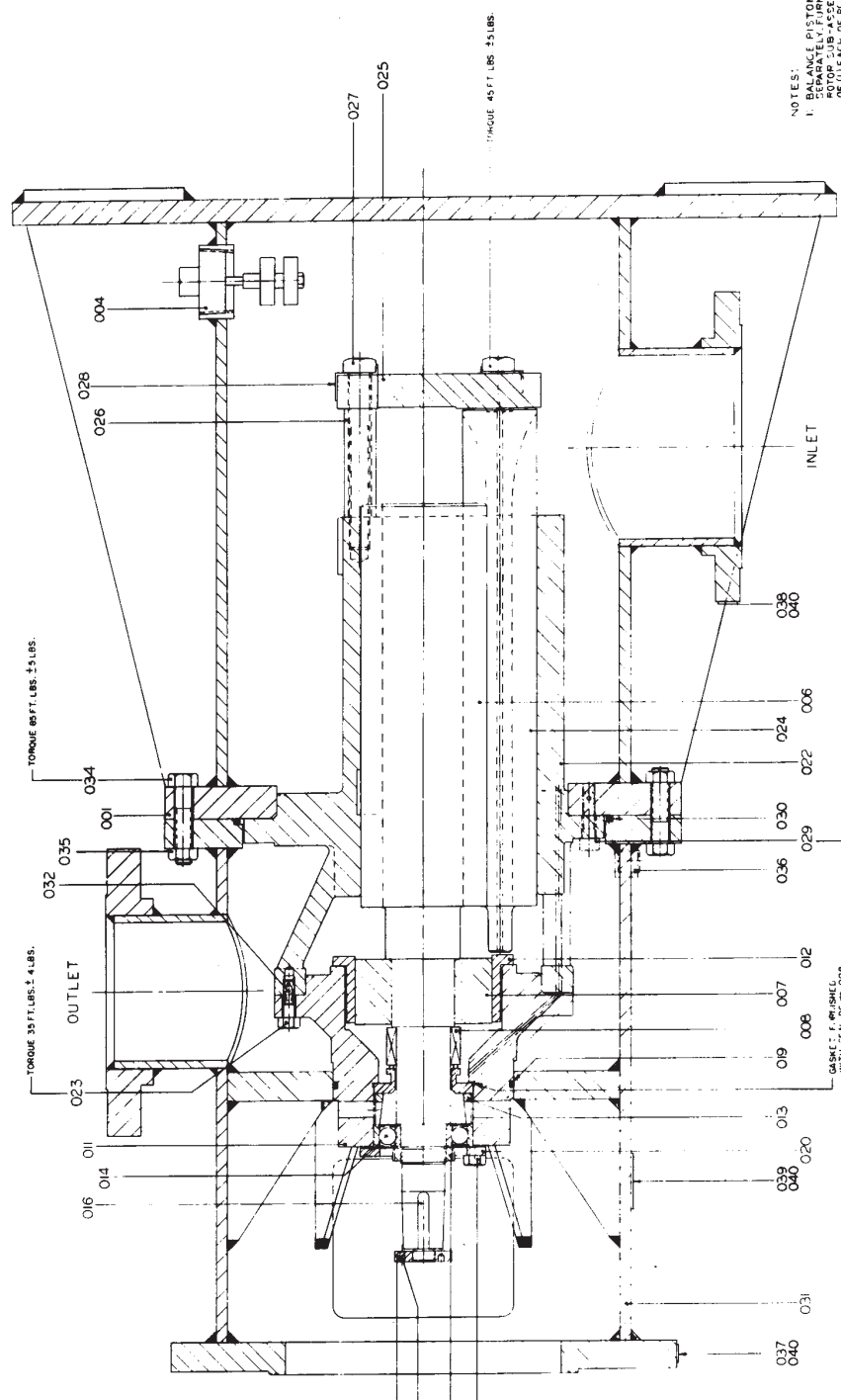
STEP 3 - Apply a light coat of oil and screw idler rotors (024) into housing bores. Assemble thrust plate (025) using bolts (027), lockwashers (028) and spacer set (026). To avoid distorting spacers and to insure proper setting, the bolts should be uniformly torqued to approximately  $45 \pm 5$  foot - pounds.

STEP 4 - Install new "O" ring (019) into groove on outside of balance piston housing. Lower assembled cartridge into pump case.

Use extension and socket wrench and bolt cartridge to case using hex head bolts (023). Torque to  $55 \pm 5$  foot - pounds.

STEP 5 - Install new "O" ring (030) in outlet head (031) and mount outlet head (031) to case (001) using bolts (034) and nuts (035). Torque to  $85 \pm 5$  foot - pounds.

STEP 6 - Mount driver and align with pump before connecting. Refer to "INSTALLATION" and "OPERATION" sections when replacing unit and placing it back in service.



NOTES:  
 1. THE ROTOR PISTON ROD NOT SERVICED SEPARATELY FURNISHED AS PART OF POWER ROTOR SUB ASSEMBLY PC-005 CONSISTING OF ITEMS 001-004.  
 2. MATERIAL SPECIFICATIONS SEE STRIP BILL OF MATERIAL PART NUMBERS CORRESPOND WITH PC NUMBERS SHOWN ON BILL OF MATERIAL.  
 3. FOR RETIATIVE POSITION OF INLET AND OUTLET SEE PART 1 SEE APPLICABLE DUTY DRAWING.

DE LAVAL TURBINE INC.	
TYPE	DM-21-B-550M-15
REV.	1
DATE	10/1/54
BY	J. J. ...
CHECKED	...
APPROVED	...
SCALE	AS SHOWN
DRAWING NO.	SF-5514