

Roots Blower

High Vacuum Booster Pump
Setup, Operation & Maintenance

OPTICAL COATING FACILITIES

I-RGS (HV)-568



ROOTS® BLOWER AND VACUUM PUMP DIV.

DRESSER INDUSTRIES, INC.
Connersville, Indiana

Rotary Lobe

RGS HIGH VACUUM BOOSTERS

**INSTRUCTIONS for
INSTALLATION
OPERATION
and MAINTENANCE**



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Regional Manager

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OPTICAL COATING FACILITIES

ROOTS HIGH VACUUM BOOSTERS

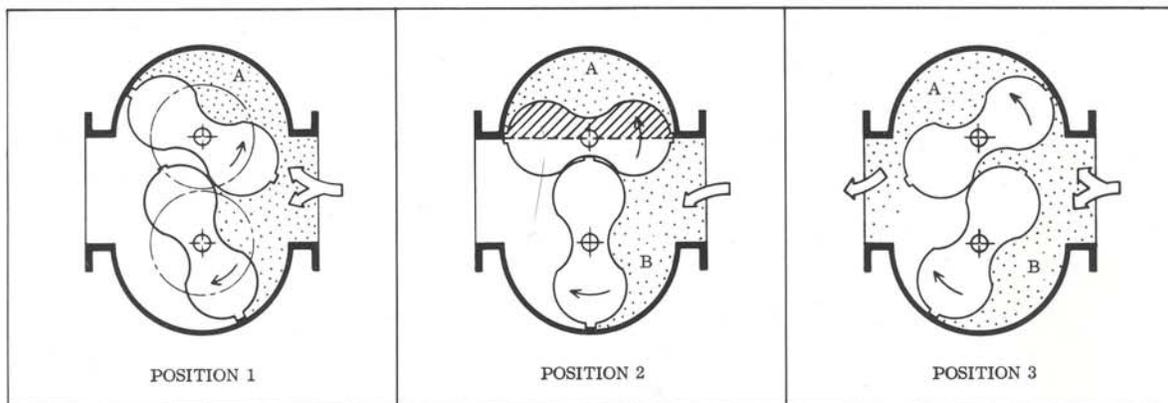
(Units Having 6" or Smaller Gear Diameters)

Type RGS high vacuum booster pumps incorporate the time-proven ROOTS rotary positive displacement principle. They are manufactured in a vertical arrangement, the inlet and discharge connections being located on the sides of the cylinder while the two impellers are positioned one above the other.

Basically, the ROOTS pump consists of a pair of "figure 8" shaped impellers mounted on parallel shafts in a one-piece cylinder closed at either end by a headplate. The impellers are maintained in a relative position to each other, and are also rotated in opposite directions, by a pair of timing gears located on their shafts. Accurate machining of the impellers and cylinder, and proper rotative timing of the impellers, assures operation without internal contact.

The operating clearances are made very small - only a few thousandths of an inch - to keep "back leakage" (slip) to a minimum. At the same time these clearances eliminate the need of lubrication within the cylinder and thus prevent the possibility of oil back-streaming.

As shown below, rotation of the impellers alternately traps a definite quantity of air between each impeller and the cylinder. Further rotation carries the trapped volume around the cylinder and pushes it out through the discharge opening. During one complete drive shaft revolution, four such volumes of air are trapped (two by each impeller) and positively discharged in a continuous flow.



Impeller Rotation and Gas Flow through a Vertical Roots Pump

INSTALLATION

Remove crating carefully, and inspect all material to insure that any separate unmounted parts are not discarded. Check all parts against the shipping list. At this time do not remove wooden covers, tape or surface coating protecting various parts of the pump; these should be left in place as long as possible prior to operation.

Handling of the pump, from receiving to installation, should be accomplished with care, using methods conforming to good, safe practice. In most cases the use of a lift truck will best satisfy these requirements. Eyebolts may be used for lifting the unit alone, before it is mounted on any base, but they should not be employed when lifting additional or unbalanced weight.

In most installations it is probable that the pump will be mounted on a welded steel baseplate, along with

other equipment. The area where the pump is to rest should consist of a flat plate or raised pads with their top surfaces finish machined and leveled carefully. The overall variation from level should not exceed .001" per horizontal foot in any direction. These same conditions apply to any other type of baseplate installation as well.

When ready to mount the pump, first set it on the base surfaces and determine whether there is any "rock". If it is not solid, use feeler blades to find the total clearance under one foot of the pump when the other three are in contact with the base. Obtain shim stock of suitable size equal in thickness to this clearance, divide it into two approximately equal sections, and place them under the diagonal short feet.

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Before tightening the pump mounting bolts, check the shaft height of the direct coupled driving motor. If it is higher than the pump shaft, place equal solid shims of sufficient additional thickness under all of the pump feet to bring its shaft slightly higher than the motor. Final alignment of the two shafts for coupling may then be accomplished by shimming under the motor feet. In general, follow the coupling manufacturer's instructions for shaft gap and alignment, but also consider the following limitations: While misalignment can be either offset or angular, it will usually be a combination of both types. Maximum allowable deviation in offset is .005" total indicator reading, while the two inside faces of the coupling should vary more than .001" from parallel.

After completing the alignment, tighten all driver and pump mounting bolts securely and recheck the alignment. Also rotate the pump several times by hand to make sure that there is no scraping, binding, or impeller contact; then assemble the coupling. Now remove protective covers from inlet and discharge connections of pump and make up the piping. Pumps for oxygen service have been purged with nitrogen and are sealed under five to ten pounds per square inch gauge nitrogen pressure. This pressure should be relieved by slowly loosening one of the pipe plugs and the inlet flange at the cylinder. Now remove protective covers from inlet and discharge connections of the pump and remove any rolled-up sections of corrosion inhibitor paper (if present) from inlet and discharge of pump; then make up the piping. It is extremely important at this point to be absolutely certain that pipe and fittings are free of dirt, scale,

chips, or any foreign material. It is equally important that the piping be both square and in line with the pump connections, and that it be adequately supported so that no strains are placed on the pump.

For water cooling for the drive shaft seal housing, bring a water supply line to the connections provided. Arrange to throttle the supply line so that maximum flow will not exceed 0.4 GPM. The maximum seal housing water pressure is 25 PSIG.

BEFORE STARTING, remove the oil filler plug in the top of the gear house and add lubricating oil of the grade indicated in lubrication. When the oil level rises to about 1/8" inside the oil level gauge circle, stop filling. Wait five minutes so the oil can equalize on both sides of the internal baffle, then recheck the level. Add or drain oil as required, so that the final static level is not higher than the gauge point specified above. In replacing drain and filler plugs, make sure they are recoated with sealant and carefully tightened. Now remove tape from the drive shaft seal housing oil hole, fill the reservoir fitting with the same grade of oil as used in the gear house, and press the reservoir into the hole.

As a final check, again turn pump shaft by hand to insure that impellers rotate freely at all points, and that no foreign material has entered the casing. With pump inlet and discharge open to atmosphere, apply a short power pulse to check for correct rotation of driver. At the same time, listen for any excessive noises in the pump.

LUBRICATION

Timing gears on ROOTS vacuum boosters are lubricated by dipping into the oil in the bottom of the gearhouse. Splash from the gears lubricates both shaft bearings and the shaft seals at this end of the pump. Splash from the gears also collects in a trough leading into the headplate, and from here it is conducted through tubing to the drive end bearings. A return line from the drive end to the gearhouse completes the closed lubrication system. The external

drive shaft seal is independently lubricated by a static head of oil carried in a reservoir.

Suitable low vapor pressure oil for high vacuum service is Cities Service 500T. Equivalent products of other suppliers are assumed to be equally satisfactory. The following tabulation indicates the approximate normal oil capacities of the gearhouses on the various sizes of booster pumps:

Pump Size	Oil Capacity
3-1/2"	1.0 Pint
6"	5.0 Pints

RIGHT - Sight Glass for Oil Level Indication in Gearhouse of Booster



OPTICAL COATING FACILITIES

OPERATION

After the fore pump has brought the system down to desired vacuum, start the ROOTS booster pump. During the first 5 minutes of operation, watch the oil level through the oil sight glass. The oil level should be adjusted, if this level, while the unit is running or while it is stopped, goes below the bottom or above the top oil level lines. Stop the unit before adjusting the oil level. Be sure to recoat the drain or filling plugs before replacing them.

These high vacuum pumps are designed to be driven by direct coupling or V-belt at standard motor speeds.

The maximum permissible pump speeds are listed in the following tabulation:

Pump Size	Maximum RPM
3-1/2"	3600
6"	2380

MAINTENANCE

Check gearhouse oil level daily during the first week after initial start-up and at least once each week thereafter. At no time should the oil level be permitted to drop below the lower gauge line, nor should it rise above the upper line during operation. Frequency of oil changes will depend on operating conditions; in general, a period of 2000 hours operation may be considered normal.

Oil level in the reservoir supplying the external drive shaft seal will not drop very fast. The reservoir serves to keep the seal housing full of oil, and to replace any very small amount of oil lost through the seal during operation.

It is recommended that in-service maintenance procedures be limited to lubrication, periodic checking of shaft alignment or belt tension and condition, and to inspection of the pump for unusual operating noises or hot spots in the cylinder or headplates. Heating is generally caused by an impeller rubbing at some point, which in turn is commonly a result of a slightly twisted mounting condition. The normal internal clearances listed in the following tabulation may be used for checking purposes should this type of problem develop. If it is not possible to eliminate the problem by correcting the pump mounting, we recommend that internal mechanical adjustments not be attempted by inexperienced personnel.

STANDARD INTERNAL CLEARANCES OF ROOTS HIGH VACUUM BOOSTERS

Location	Booster Size				
	35	38	66	611	615
Impeller End Clearance:					
Drive End	.003-.004	.003-.004	.003-.005	.003-.005	.003-.005
Gear End	.007-.010	.010-.013	.006-.010	.011-.015	.015-.019
Total	.010-.014	.013-.017	.009-.015	.014-.020	.018-.024
Clearance Between Impeller Tip and Cylinder	.003-.004	.003-.004	.006-.008	.006-.008	.006-.008
Clearance Between Impellers:					
Fronts & Backs	.006-.010	.006-.010	.014-.018	.014-.018	.014-.018
Waist	.007-.010	.007-.010	.013-.017	.013-.017	.013-.017

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It is recommended that all units be returned to the Factory at Connersville, Indiana if a major repair should become necessary. However, since this may sometimes be impossible when a spare booster is not available, replacements or spare parts may be obtained from the Factory or through the nearest Field Sales Office. When ordering, refer to the correct

Item Numbers and their word descriptions as given in the following tabulation, and state the quantities required. Also include booster size, manufacturer's identification number (if shown) and serial number from the nameplate, to insure against delay in shipment or the furnishing of incorrect parts.

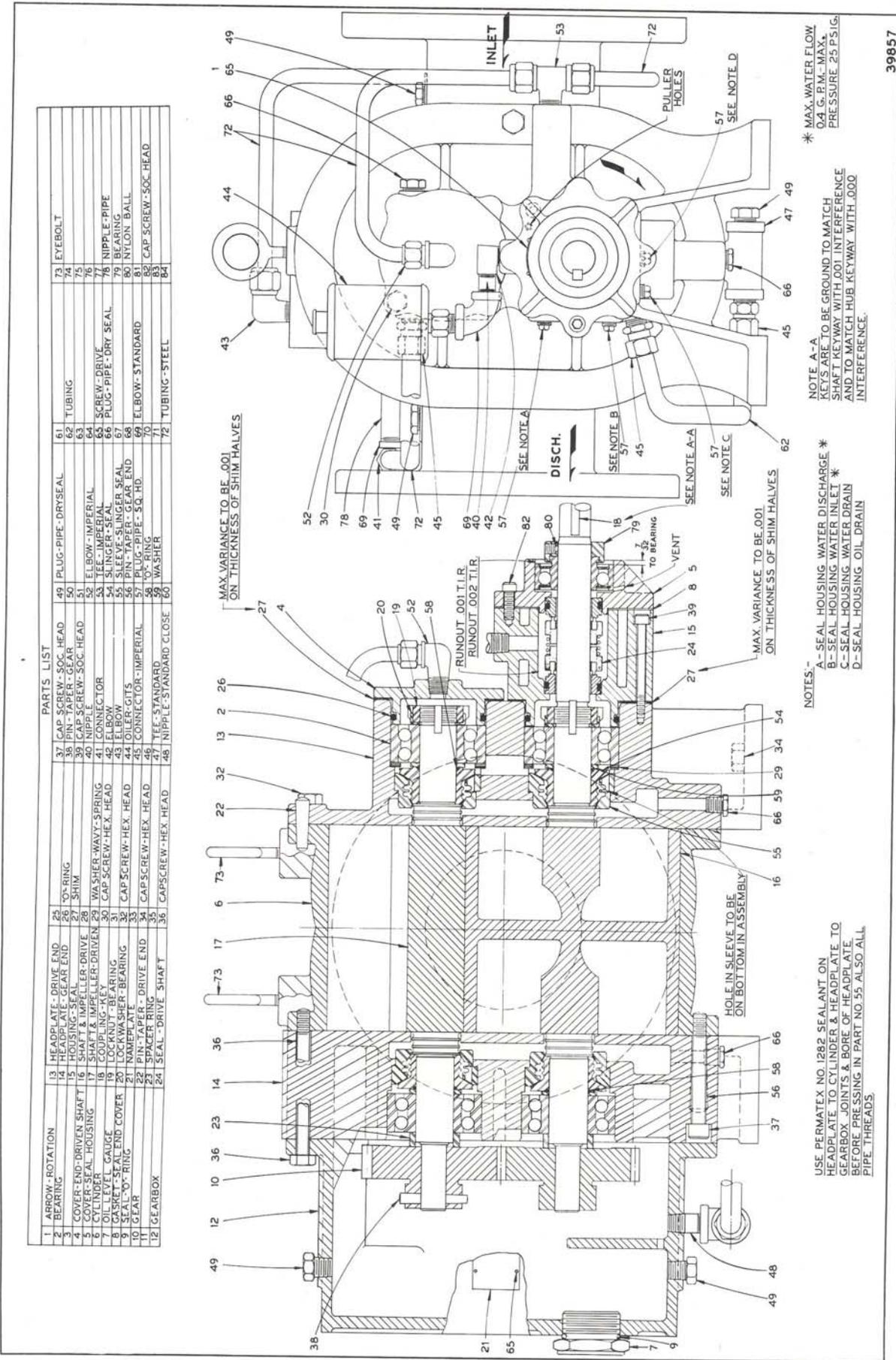
RECOMMENDED SPARE PARTS FOR BOOSTER PUMPS

Refer to Sectional Drawings 39857 and 39856

Item No.	Quantity Used	Description	3-1/2"	6"
			Manufacturer's Part Designation	
2	4	Shaft Bearing	5305 Special	5207 Special
10	2	Timing Gear	3-1/2"	6"
19	2	Bearing Lockwasher	---	W-07
20	2	Bearing Lockwasher	W-05	---
22	2	Gear Taper Pin	---	6 x 3"
24	1	Drive Shaft Seal	Varies	Varies
26	2	End Cover O-ring	PRP-227	PRP-230
29	4	Shaft Seal O-ring	---	PRP-126
38	2	Gear Taper Pin	5 x 2"	----
58	4	Shaft Seal O-ring	PRP-022	---
79	1	Bearing, Inboard	RA014PP	---

Specifications herein are correct as of the date of publication. The right is reserved to make design or material changes without notice and without obligation.

OPTICAL COATING FACILITIES



Assembly & Parts — 3-1/2" High Vacuum Booster Pumps

39857

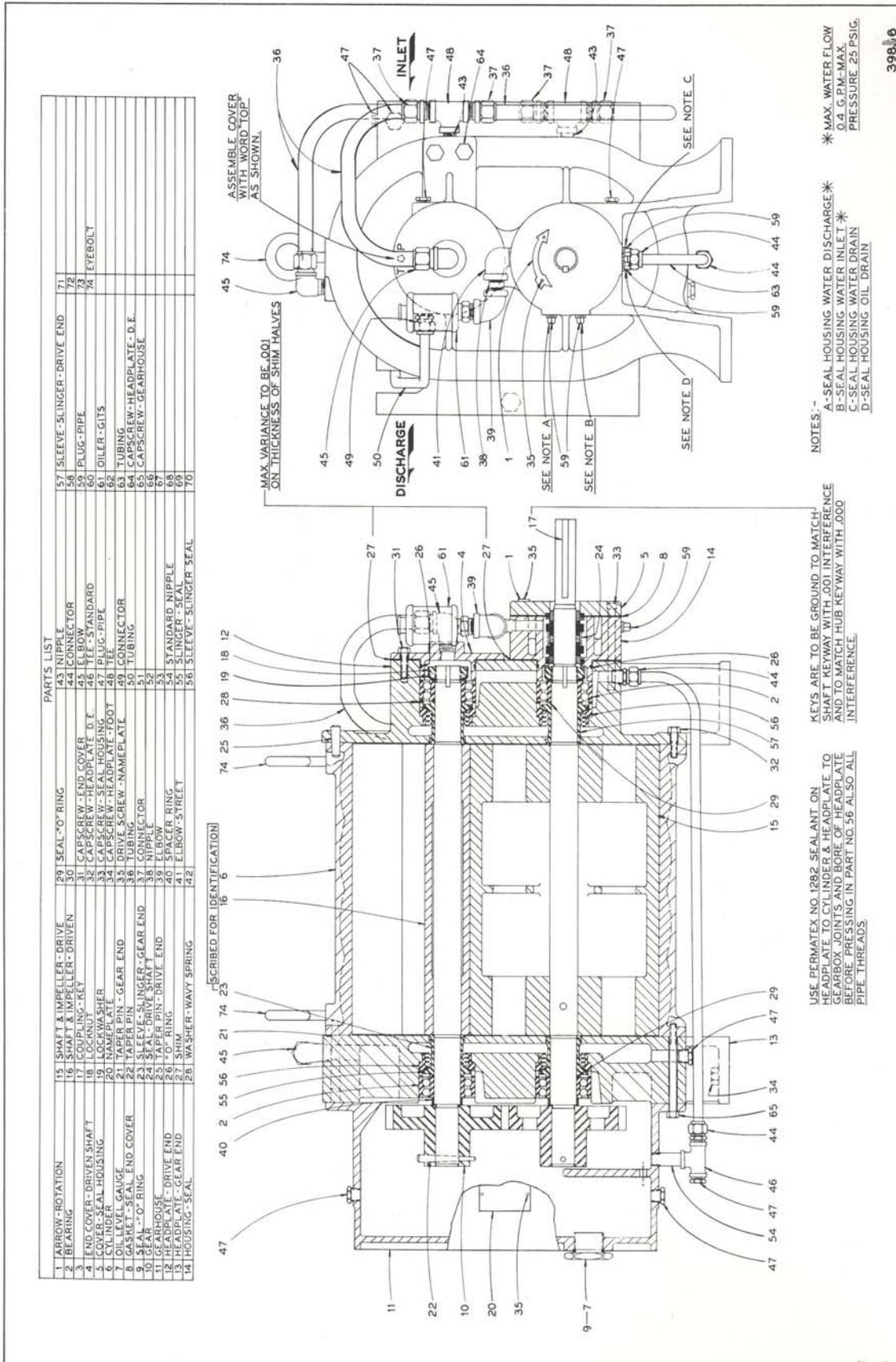
* MAX. WATER FLOW
0.4 G.P.M. - MAX.
PRESSURE 2.5 PSIG.

NOTE A-A
KEYS ARE TO BE GROUND TO MATCH
SHAFT KEYWAY WITH .001 INTERFERENCE
AND TO MATCH HUB KEYWAY WITH .0002
INTERFERENCE.

NOTES -
A - SEAL HOUSING WATER DISCHARGE *
B - SEAL HOUSING WATER INLET *
C - SEAL HOUSING WATER DRAIN
D - SEAL HOUSING OIL DRAIN

USE PERMATEX NO. 1282 SEALANT ON
HEADPLATE TO CYLINDER & HEADPLATE TO
GEARBOX JOINTS & BORE OF HEADPLATE TO
BEFORE PRESSING IN PART NO. 55 ALSO ALL
PIPE THREADS

OPTICAL COATING FACILITIES



Assembly & Parts — 6' High Vacuum Booster Pumps