

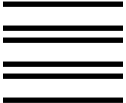
NVE/506 Pump

Owner's Record

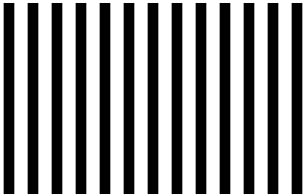
Date of Purchase: \_\_\_\_\_

Purchased from: \_\_\_\_\_

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



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**BUSINESS REPLY MAIL**  
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**NATIONAL VACUUM EQUIPMENT, INC.**  
P.O. BOX 685  
TRAVERSE CITY, MI 49685-0685

National Vacuum Equipment, Inc.

## WARRANTY REGISTRATION

Model #: \_\_\_\_\_ Serial #: \_\_\_\_\_

Business Name: \_\_\_\_\_

Address: \_\_\_\_\_ Telephone: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Date Purchased: \_\_\_\_\_ Tank Size: \_\_\_\_\_

Purchased From: \_\_\_\_\_

Is this your first National Vacuum Equipment pump purchase?     YES     NO

Previous pump used? \_\_\_\_\_

Intended use:     Agricultural     Septic     Commercial     Industrial     Other \_\_\_\_\_

Comments: \_\_\_\_\_

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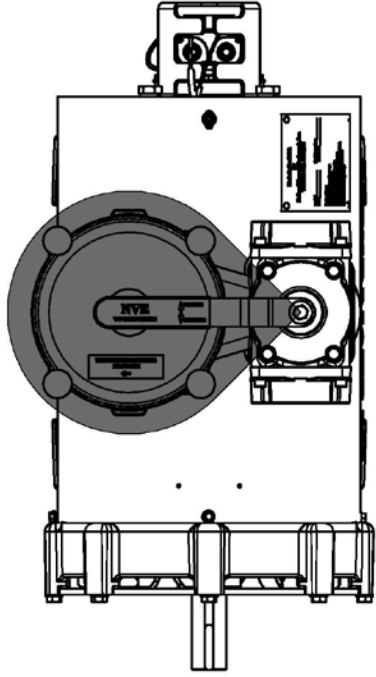
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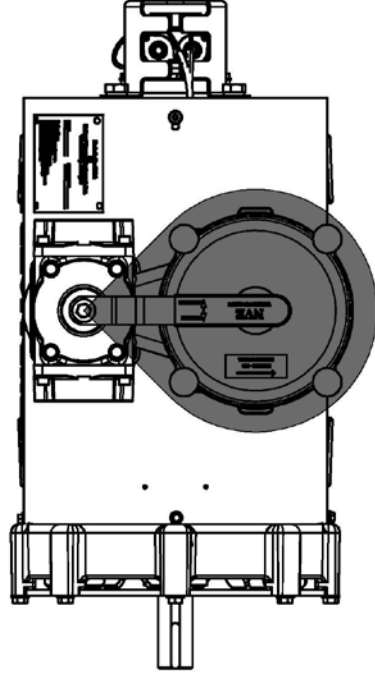
## IMPORTANT INFORMATION FOR INSTALLING PUMP

506 CHALLENGER SERIES PUMPS AERIAL VIEW

SHADED AREA MUST BE KEPT CLEAR  
FOR SERVICING THE FILTER



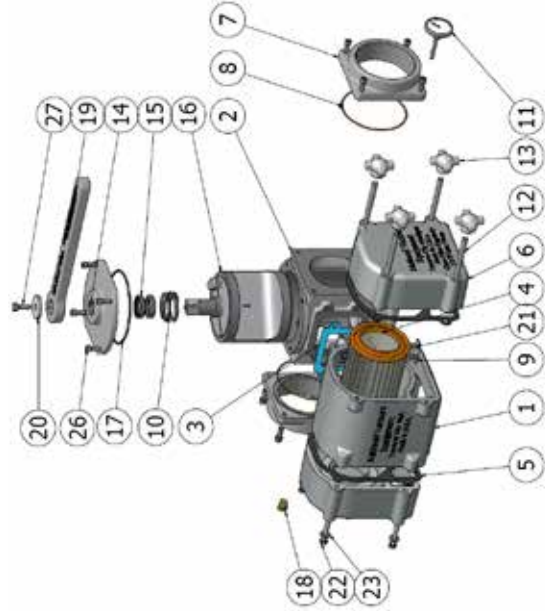
Clockwise  
Rotation



Counter Clockwise  
Rotation

### 506 Challenger™ - 4" 4-Way Valve and Filter Assembly

120-318-506



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	120-309-506	Filter Housing, 4"
2	1	120-067-506	4-Way Housing, 4" w/ Filter
3	1	120-311	Gasket, Valve to Filter Hsg.
4	1	120-314	Filter Element, 4-Way
5	2	120-315	Gasket, Filter Cover
6	2	120-310	Filter Cover
7	2	120-063-506	Flange, 4" NPT
8	2	120-064-506	Oring, 2-154 Silicone
9	1	808-SCR-SS	2" Screen for Filter Housing
10	1	120-045	4-Way FV Spring (Compressed)
11	1	120-220	1/4" NPT Thermometer 400 F
12	4	120-313	Stud, 3/8-16UNC-2A x 4-3/8"
13	4	120-312	Knob, 3/8"-16UNC
14	1	120-065	Tower, 4-Way w/ Filter
15	2	120-040	4-Way Valve Seal 3" & 4" Viton
16	1	120-062-506	Plug, 4-Way w/ Filter
17	1	120-068	Oring, 2-210 Viton
18	1	120-058-506	Plug, Brass 1/8" NPT, Hex Hd.
19	1	120-060	Handle, 3" & 4" 4-way Valve
20	1	120-085	Washer, 4-way handle
21	2	B2-0403	Screw, 1/4" x 3/8" Button Head
22	4	B1-0528	Bolt, HHCS 5/16"-18UNC x 3.5"
23	4	B8-0501	5/16 Flat Washer
24	4	B1-0518	Bolt, HHCS 5/16"-18UNC x 2.25"
25	4	B8-0503	5/16 Lock Washer
26	12	B2-0507	SSCS, 5/16"-18UNC x 7/8"
27	1	B1-0608	Bolt, HHCS 3/8" x 1"

## LIQUID PARTS LIST – 506 CHALLENGER

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	120-001-506-L	HOUSING, 506 LIQUID COOLED
3	1	120-005-506-(D OR S)	Rotor, 506 (CW OR CCM)
4	2	120-009-506	Seal Sleeve, 460, 466 & 506
5	1	120-054-506	Bearing Cover
6	1	120-042-506	Retainer, 4" Check Valve
7	1	120-080-506	Bearing Cover, 506 Oil Pump
8	2	120-021-506	COVER PLATE, 506 TOP JACKET
9	1	120-041-506	Check Valve, 4"
11	1	120-098-506	BALLAST PORT, CHECK POPPET
12	1	120-318-506	4-Way & Filter Ass., 4"
13	3	320-004	Oil Fitting (4mm x 1/8"BSPT 90 Elbow)
14	6	120-007-506	Vane: 506
15	2	120-022-506	GASKET, 506 TOP COVER PLATE
17	2	120-019-506	Bearing, NJ309
18	2	120-004-506	Gasket, End Plate 466
19	4	120-018-506	SEAL, 65 X 85 X 8 VITON
20	2	120-039-506	Gasket, 4" Int/Exh Flange
21	2	120-053-506	Seal, 45x62x8 Viton
22	1	120-006	Key, 3/8"x3/8"x1
23	1	320-LF8	Drive Tab
24	2	120-055-506	Gasket, Bearing Cover
25	1	120-102	Valve, Drain 1/8" NPT
26	3	120-047	Drain Plug, 3/4" NPT
27	1	120-047-1	Drain Plug, 3/4" NPT Magnetic
28	1	120-049	Bushing, 3/4"NPTx1/8"NPT
30	1	120-003-506-D	Endplate, CW 466 & 506
31	1	120-003-506-S	Endplate, CCM 466 & 506

ITEM	QTY	PART NUMBER	DESCRIPTION
37	2	120-046-367	SPRING, CHECK VALVE 367
41	2	90 Deg Street Elbow	Street Elbow
42	4	440-100	NIPPLE, KING 1" NPT
44	1	320-LW32-A(D OR S)	Oil Pump, 3 Port (CW or CCM)
45	1	320-R31	Gasket, Oil Pump
46	3	320-003	Oil Fitting (4mm x 1/8"BSPT STR)
47	2	120-058-506	Plug, Brass 1/8" NPT, Hex Hd.
48	1	320-017-506-L(D OR S)	OIL LINE, 506 LIQ REAR BEARING
49	1	120-079-506	GUARD, W506 OIL PUMP
50	1	320-015-506-L(D OR S)	OIL LINE, 506 FRT BNG TO OIL PUMP
51	1	320-016-506-L(D OR S)	OIL LINE, 506 INTAKE TO PUMP
52	12	B1-0612	Bolt, HHCS 3/8"x16UNC x 1 1/2"
53	12	B8-0601	Flat Washer (3/8")
54	14	B2-0507	SSCS, 5/16"-18UNC x 7/8"
55	41	B8-0503	5/16 Lock Washer
56	2	B2-0510	Screw, SHCS 5/16" UNC x 1 1/4"
57	18	B1-0508	Bolt, HHCS 5/16"UNC x 1"
58	1	320-116	Hose Barb, 5/32" x 1/8"NPT
59	1	320-112	1/8" Female NPT x 1/8" Male BSPT
60	2	B2-0404	Screw, SHCS 1/4" UNC x 1/2"
61	1	120-220	1/4" NPT Thermometer 400 F
X	1	REMOTE BALLAST	Remote Ballast Filter Assembly
69	2	CPF-1	1" Conduit Pipe Fitting Locknut

# Introduction

## General Information

## About National Vacuum Equipment, Inc.



Congratulations! You now own a quality vacuum/pressure pump proudly manufactured in the U.S.A. by National Vacuum Equipment, Inc. You have not only acquired a superior piece of equipment from a qualified dealer, you have hired a team of vacuum experts. We stand ready to work with your dealer to answer your questions and provide you with the information necessary to keep your equipment in peak working condition.

Thank you for using National Vacuum Equipment.

### OUR MISSION:

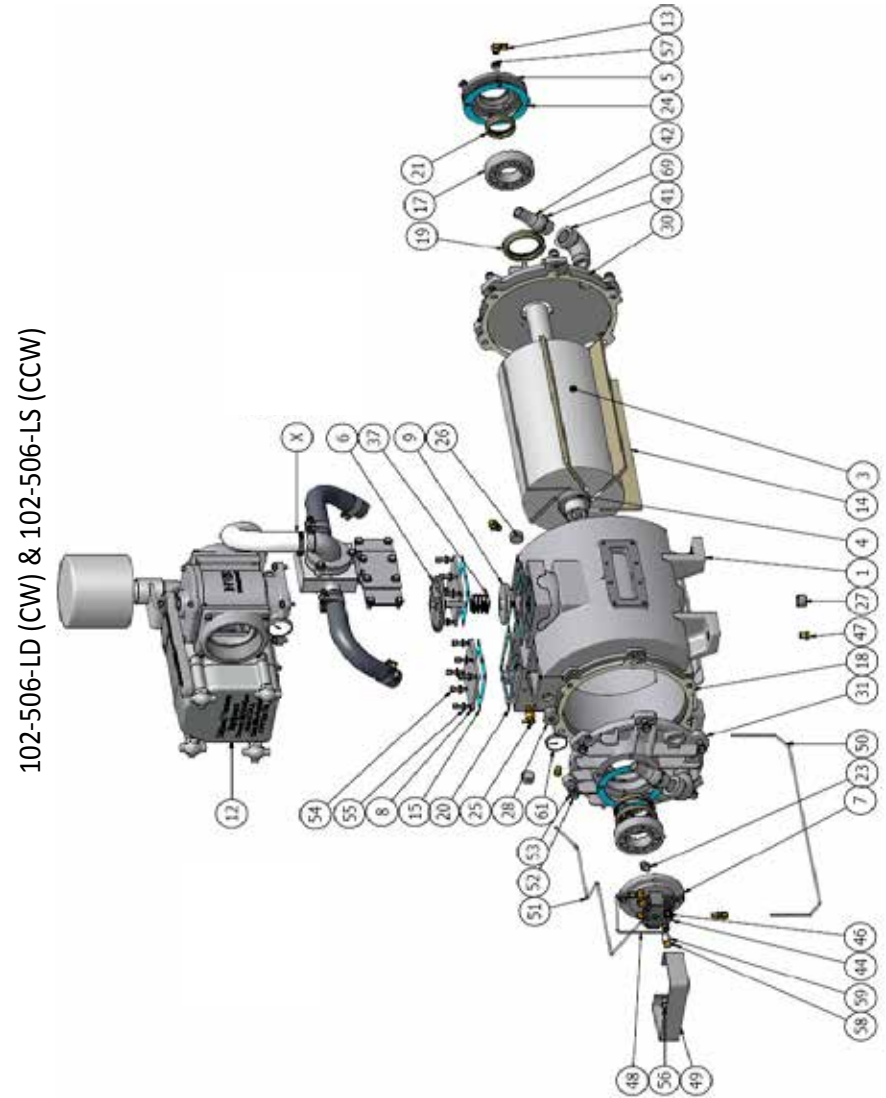
We are dedicated to the manufacture and wholesale distribution of quality vacuum system products at a reasonable price, on a timely basis. We are a “one-stop shop” for manufacturers and distributors of vacuum equipment.

**OUR HISTORY:**

National Vacuum Equipment, Inc. was founded in 1980 by Bruce Luoma. The Company started as a retailer of vacuum pumps. Soon after it started, the Company secured the rights to exclusive distribution of the Battioni vacuum pumps in North America. This helped the Company to evolve into its current status as a wholesale supplier.

To reach the goal of becoming a full service supplier of vacuum system components, the Company began fabricating its own line of componentry. Developed its own line of vacuum pumps, high vacuum blowers and piston gate valves while also purchasing for resale various valves and accessories.

Today, NVE has full service machine and fabrication shops complete with CNC-controlled production equipment designed for close tolerance work. The company has a highly trained staff all of whom are dedicated to quality.





20. Lubricate the seal surface on the rotor and reinstall the front bearing cover.



21. Reconnect the oil lines to the oil pump mount assembly from the front of the pump.

22. Reattach the intake oil line to the remote oil tank and fill tank with oil. The pump is now ready to run.

23. Start the pump at a slow r.p.m. and run for a few minutes to allow oil to fill the lines. Allow the pump to run for a few more minutes. The pump is now ready to go to work.

## Limited Warranty

*NVE/506*



**National Vacuum Equipment, Inc.**

**guarantees that the product it provides is free of manufacturer's defects, including materials and workmanship. Properly installed and maintained product is warranted for a period of one (1) year subject to the following conditions:**

1. A properly completed warranty registration card must be received by us within 30 days of sale to end user for pump sales to be considered warrantable. All pumps received for warranty consideration must retain the original NVE serial number tag.
2. The one (1) year period shall begin the day the product is shipped from our warehouse, unless we are provided with an authentic copy of the original resale invoice, in which case the one (1) year period shall begin at such invoice date.
3. The covered product must be used in an application for which it was intended. We do not recommend our product for particular uses or applications.

4. Vane breakage, or damage caused by vane breakage, is not warrantable.
5. Damage caused by improper use or lack of proper maintenance is not warrantable.
6. Manufacturer's liability under this or any other warranty, whether express or implied, is limited to repair of or, at the manufacturer's option, replacement of parts which are shown to have been defective when shipped.
7. Manufacturer's liability shall not be enforceable for any product until National Vacuum Equipment, Inc. has been paid in full for such product.
8. Except to the extent expressly stated herein, manufacturer's liability for incidental and consequential damage is hereby excluded to the full extent permitted by law.
9. Manufacturer's liability as stated herein cannot be altered except in writing signed by an officer of National Vacuum Equipment, Inc.
10. Certain products provided by National Vacuum Equipment, Inc. are covered by their respective manufacturer's warranties (e.g., engines used in the NVE engine drive packages). These products are not covered by the National Vacuum Equipment, Inc. Manufacturer's Warranty.
11. Final assemblers responsibility. NVE goes to great lengths to insure the quality and proper functionality of the products it supplies. Many products we supply are purchased for resale or are impossible or impractical to test prior to the installation of the item in a vacuum system. It is therefore the responsibility of the final assembler to thoroughly test the vacuum system and components supplied to the assembler by NVE prior to delivery of the final product to the end user.

Any items found to be defective after delivery to the end



19. Replace the pump drive key, lubricate the seal surface on the rotor and reinstall the rear bearing cover.

Reinstall the oil pump drive key

Be sure to line up the oil pump drive key and the oil pump shaft prior to tightening the assembly to the pump.





15. Remove the dowel pins after tightening the endplate bolts.



16. Turn the pump around and use the same procedure to mount the front endplate.



17. Seat the bearings in both endplates with a bearing driver or punch.



18. At this point you should be able to turn the pump by hand.

Any items found to be defective after delivery to the end user that should have been discovered prior to delivery will quality replacement of the defective part only with absolutely no compensation for outside labor or travel expenses. Any subsequent damage to other components caused by the defective part will be the sole responsibility of the assembler.

---

**Should a potential warranty situation arise, the following procedures must be followed:**

- Contact your dealer or NVE immediately upon the occurrence of the event and within the warranty period.
- Customer must receive a return goods authorization (RGA) before returning product.
- All serial-numbered products must retain the NVE serial number tag to be qualified for warranty.
- Product must be returned to NVE intact for inspection before warranty will be honored.
- Product must be returned to NVE freight prepaid in the most economical way.
- Credit will be issued for material found to be defective upon our inspection, based upon prices at the time of purchase.

# NVE/506 Pump

## Model-Specific Information



## Application


### Designed for extended operation

- The NVE/506 is a severe duty vacuum pump, designed to be used in liquid waste pumping systems where extended operation is desired.
- This pump incorporates a water cooling system with full length cowling to provide superior cooling allowing for extended operation.

## Pump Specification

RPM	PRESSURE PSI						VACUUM – INCHES OF MERCURY										
	25	20	15	10	5	0	3	6	9	12	15	18	21	24	27		
1150	HP	49	43	36	27	25	18	20	21	22	23	24	25	26	28	29	
	CFM	408	431	438	447	457	519	500	470	458	453	440	438	425	404	351	
1000	HP	43	38	32	24	20	15	17	18	19	20	21	22	23	24	25	
	CFM	355	375	381	389	398	452	435	409	399	394	390	381	370	352	306	
800	H.P	36	32	25	19	15	13	14	14	15	16	17	18	19	20	21	
	CFM	302	319	324	331	342	385	374	348	339	333	331	324	315	303	242	

1500 RPM  
Intermittent Operation Only

 Recommended Setup  
for optimum performance



11. Insert the new lubed up vanes, they should slide easily into the rotor slots.



12. Locate two pieces of threaded rod 3/8–16 thd. to use as guides and screw them into the two top holes in the housing. Find the two 1/4” dowel pins and insert them into the dowel holes on each side of the housing.

Locate the gaskets and slide it on the threaded rods and dowel pins.

Do not use any gasket sealer.



13. Lubricate seal sleeve and slide the proper endplate on the end of the rotor.



14. When the endplate is close enough to the housing bolt it into place. Tighten endplate bolts to 35–40 ft. lb of torque.



7. Locate the replacement seals and install them in the endplates with the seals positioned back to back.



8. Lubricate and install the bearings in the endplates.



9. Place the inner races onto a hot plate and get them hot. Do not leave them on the plate so long that they become discolored.



10. Use a welding glove to take the hot inner race from the hot plate and slide it onto the rotor shaft. So that the bearing race shoulder is tight against the seal sleeve.

Install on both sides of the rotor.

## System requirements

### Cooling System 10 to 20 GPM

- Connect the 3/4" NPT coolant ports to a remote cooling system or the trucks cooling system. Inlet water should be taken from the coolest point possible, (bottom of the radiator) for maximum cooling of the pump.

### High quality components

- The NVE/506 is a high performance vacuum pump and requires compatible, high quality components.

### Shutoffs

- We recommend the use of our part F-802C, 12" portal shutoff and our part F-901-5C, 14 gallon scrubber/secondary shutoff.

### Hose

- Use 4" or larger hose to plumb your system. We recommend you use a hose that can withstand high temperatures such as hot tar-asphalt hose.

### Pressure relief and vacuum relief valves

- A pressure relief valve and vacuum relief valve should also be incorporated in the system.

- Our relief manifold A-301-4A contains both the vacuum and pressure relief along with a pressure/ vacuum gauge and diesel flush port
- The relief valves should be set to where the pump operates at a maximum exhaust temperature of 350° F.

### Muffler

- We recommend the use of an oil catch muffler with filter element, our part F-1002-2C

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### Drive system

- The pump should be mounted on a level, horizontal surface, secured with Grade 5 or better fasteners.
- The drive system should be sized to supply the required horsepower to the pump plus a reserve to insure long life.
- Make certain that all shafts, pulleys or turning parts are properly guarded and aligned.
- Check the ratio of the drive system prior to installation to verify that the pump will be turning at the proper speed.

---

### Direction of rotation

- The direction of rotation is marked on the housing of the pump.
- The direction of rotation required by your drive system should be determined prior to ordering the pump.



4. Once the rotor is removed, cut off the old bearing inner race on both ends of the rotor. Be sure to line up the cutting wheel with one of the vane slots so as not to damage the rotor or seal sleeve.



5. Clean the rotor, rotor slots and housing, inspect for wear or damage.

If the housing needs to be bored or honed, remove only as much material as is necessary to give a smooth clean bore.

The maximum overbore we recommend is .060 inch. A new housing has a bore of 10.000 inches.

If you bore or hone the housing, remove the four way valve assembly and internal check valve prior to machining.



6. After the housing is clean lube the inside of the housing and place the clean rotor inside with the drive end in the same orientation it originally was.

---

## Complete Rebuild



1. Follow steps 1-6 in the vane replacement instructions.

2. Place a cushion under the rotor to prevent damage when the front endplate is unbolted.



3. Remove the front bearing plate and endplate from the rotor.



4. Put an identifying mark on the endplate so as to not confuse it with the rear.

---

## Factory Settings

- The automatic lubrication pumps are set at the factory during pump testing and should require no further adjustment during pump installation.
- The pumps are adjusted to one drop every two seconds per outlet. This oil rate equals 16 fluid oz. per hour, per port, or approximately 1 gallon in 8 hours.

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## Adjusting Factory Settings

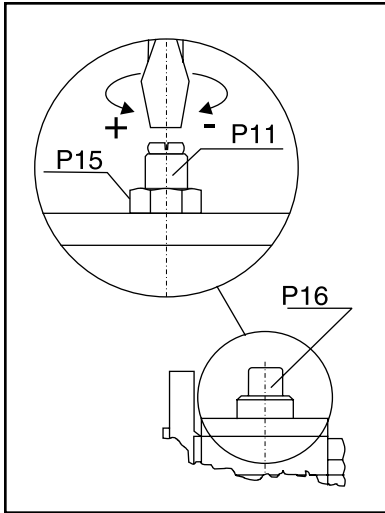
The automatic oil pump is a metered piston-type pump. If you wish to adjust the pump, please follow these instructions:

### Adjusting the oil rate

Oil flow is changed by adjusting the length of the stroke of the piston.

1. To adjust the oil rate, remove cap #P16. Under this cap you will find a jam nut #P15 and adjusting screw #P11.
2. To adjust oil rate loosen jam nut and turn adjusting screw clockwise to reduce oil flow or counterclockwise to increase oil flow.
3. When making adjustments do so one quarter of a turn of the screw at a time and test before making further adjustments.

### Testing flow rate after adjustment



1. Disconnect oil line to observe oil drip rate ensuring adequate lubrication.
2. Adjustments should be done gradually so as not to starve the vacuum pump of oil.



17. Reconnect the oil lines to the bearing plates, oil inlet and to the oil pump mount assembly.
18. Reattach the intake oil line to the remote oil tank and fill tank with oil. The pump is now ready to run.
19. Start the pump at a slow RPM and run to allow oil to fill the lines. Allow the pump to run for a few more minutes. The pump is now ready to go to work.



13. Remove the dowel pins after tightening the endplate bolts.



14. At this point you should be able to turn the pump by hand. If you can not reseal the bearings in both endplates with a bearing driver or punch.



15. Reinstall the oil pump drive key and oil mount-oil pump assembly.



16. Be sure to line up the oil pump drive key and the oil pump shaft prior to tightening the assembly to the pump

# Operating Instructions

*NVE/506*



## Normal Operation

### Oil reservoir

- Check oil reservoir daily and fill as required. This pump is provided with a remote 5 qt. oil reservoir

### Temperature

- Check exhaust temperature it must not exceed 350° F at any time.

### Recommended rpm

- Do not continuously operate the pump faster than the recommended RPM. See chart on page10.

### Suction valve

- To operate the suction valve, move the handle in the appropriate direction for either vacuum or pressure; center is neutral.

### Vacuum levels

- Do not operate your pump for extended periods of time at vacuum levels which cause the pump to exceed 350° F exhaust gas temperature.

## Guards

- Make certain all guards are in place prior to running your pump. Think safety!

---

## Recommended Lubricant

- We recommend that turbine oil be used in our pumps. Turbine oil is much more resistant to breakdown due to heat than normal motor oil, thereby avoiding the problems associated with motor oil such as lacquering and excessive wear.
- Acceptable oils include:
  1. \*NVE ISO 68 Oil
  2. Penzoi Penzabell 68 T.O.
  3. Shell Turbo 68
  4. Mobil D.T.E. Heavy - Medium
  5. Texaco Regal R & O 68

\* NVE ISO 68 Oil is our recommended pump oil for the Challenger series vacuum pumps. Challenger Vacuum Pump Oil is sold by the case, six 1 gallon containers of oil per case.



9. Locate the two 3/8–16x2 1/2 inch bolts and insert them in bolt holes on either side of the endplate. Locate the long 1/4” dowels and place them into the housing to locate and guide the endplate into place.



10. Locate the gasket and install it on the endplate. Lubricate seal sleeve and install the endplate on the end of the rotor and



11. Carefully slide the endplate on the rotor and over the guide pins.



12. When the endplate is close enough to the housing bolt it into place. Tighten endplate bolts to 35–40 ft. lb of torque.



---

## Maintenance



7. A new vane is flush with the outside diameter of the rotor. If they are worn more than 1/4" they should be replaced.



8. We recommend replacing vanes in sets. If the ends of the vanes are chipped or delaminated they should be replaced. The seals should be soft and pliable. The bearing should turn smoothly.



9. Clean the vane slots. Coat the vanes with oil and install the vanes in the rotor. The vanes should slide freely in the vane slot.

### Washing

- Periodically wash the mud and dirt off your pump. The NVE/506 is a liquid cooled pump.

### Flushing

We recommend periodic flushing of your pump. To do this:

1. Connect the hose to the flush valve located on the side of the inlet port.
2. Put the end of the hose in a one pint container of diesel fuel. Start your pump and run as slow as possible.
3. With the suction valve in the vacuum position, monitor the diesel flow to your pump.
4. When the diesel fuel is gone switch the suction valve to neutral and run the pump for 2 minutes.
5. Speed the pump up to normal RPM, switch the suction valve to vacuum.
6. Remove the hose and close the valve.
7. Properly dispose of used oil and flushing fluid.

### Checking vane wear

- We recommend checking vane wear at least every 6 months.
- A new vane is flush with the outside diameter of the rotor.





- Remove the plug from the vane check port, insert a 3/16" rod to the rotor O.D., rotate the rotor until the rod falls into one of the vane slots. If the rod falls more than a 1/4" into any of the 6 vane slots, it's time to replace the vanes.

- Vanes should be replaced in sets and it is always a good idea to have an extra set of vanes on hand for

emergencies.

---

## Cold Weather Operation

### Confirm pump is not frozen.

- Prior to engaging the pump, turn by hand to confirm it is not frozen.

### If pump is frozen, thaw it.

- If the pump is frozen circulate warm engine coolant through the pump housing if your plumbing allows, or thaw it out by heating the bottom of the pump with a torch or move the truck into a heated building.

### Avoid freezing problems.

- You can avoid freezing problems by putting a small amount of diesel fuel into the pump at the end of the day.



3. Remove the four bolts that hold the oil pump mount to the end plate, and remove the pump and pump mount.



4. Remove the oil pump drive key from the end of the rotor.



5. Remove the eight bolts that attach the rear end plate and slide the end plate off the rotor shaft.



6. Remove the old vanes.

# Pump Rebuilding

## *NVE/506 Pump*

**Please read these instructions completely before attempting repair.**

There are two types of pump repair—vane replacement and total rebuilding.

---

### Vane Replacement



1. Clean off the exterior of the pump.



2. Disconnect and remove the oil lines that go to the front bearings and pump inlet from the oil pump.

# Troubleshooting

## *NVE/506 Pump*



---

### Pump overheats

- No oil in pump
- Oil adjustment set too lean
- RPM too fast
- Prolonged operation at excessive vacuum or pressure levels
- Pump dirty
- Clogged inlet filter
- No Coolant Flow

---

### Pump uses too much oil

- Oil pump set too rich; see operating instructions
- Leaving Pump under Vacuum

---

### Pump doesn't turn

- Broken vane or bearing
- Frozen
- Problem in the drive train

---

## No vacuum or low vacuum

- Suction valve in neutral
- Worn seals or vanes
- Pump not turning fast enough
- Check valve or suction valve clogged
- Leak in tank or fittings
- Collapsed hose between pump & shutoffs
- Clogged inlet filter

---

## System Troubleshooting—Locating the source of the trouble

If you notice a decrease in pumping performance, start troubleshooting at the pump.

1. Remove the suction and discharge hoses at the pump.
2. Start the pump and run it in vacuum only at its normal RPM.
3. Check the vacuum level at the pump inlet. The NVE/506W in new condition will develop 27.5-28.5" hg.
4. If the pump checks out OK, check the vacuum level at the secondary, then the primary shutoff. Keep working your way back until you find the problem.

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## Making a vacuum tester

1. Procure a flange to mount on your four-way valve, a short 4" pipe nipple, a 4" pipe cap and a vacuum gage.
2. Drill and tap a 1/4" N.P.T. thread in the pipe cap.
3. Assemble the flange, nipple, pipe cap and vacuum gage.
4. Remove a flange from the four-way valve on your pump.
5. Start the pump and confirm the location you have chosen to test from is at vacuum.
6. Using the existing O-ring, fasten the testing flange to your pump.
7. Start your pump and read the vacuum level on the gage.