

Owner's Manual

304 Challenger Series Rotary Vane Vacuum Pumps



Visit our web site to download pump setup guides,
brochures and other technical information.



304 Challenger

Owner's Record

Date of Purchase: _____

Purchased from: _____

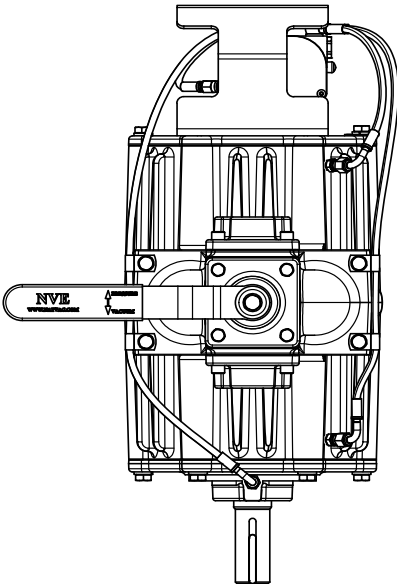
Serial Number: _____

© 2015 National Vacuum Equipment, Inc.
Revision: 1 (Released) April, 2015

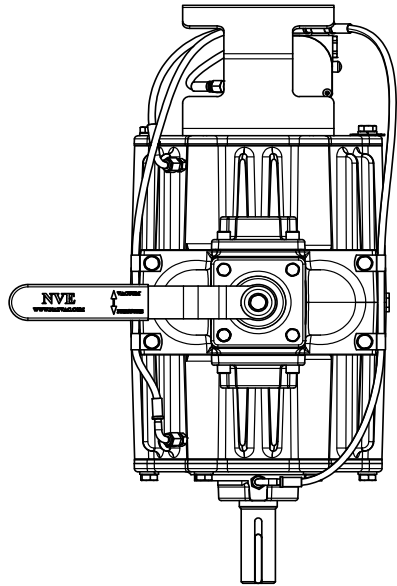
*No part of this manual may be reproduced without the written permission of
National Vacuum Equipment, Inc.*

IMPORTANT INFORMATION FOR INSTALLING PUMP

304 CHALLENGER SERIES PUMPS AERIAL VIEW



Clockwise
Rotation



Counter - Clockwise
Rotation

Contents

Introduction	5
General Information	5
Limited Warranty	6
Warranty	6
304 Challenger	9
Application	9
Pump Specifications	9
System Requirements	9
Pressure and Vacuum Settings	10
Drive System	11
Factory Settings.....	11
Adjusting Factory Oil Settings	12
Operating Instructions	14
Normal Operation	14
Recommended Lubricant	15
Maintenance	16
Cold Weather Operation.....	17
Troubleshooting	18
Pump overheats	18
Pump uses too much oil	18
Pump doesn't turn	18
No vacuum	19
System Troubleshooting	19
Making a vacuum tester	20
Parts Breakdown	21
304 Parts Diagram.....	21
304 Challenger Series Vacuum Pumps Parts List.....	22
Vane Replacement	25
304 Vane Replacement Instructions.....	26

Introduction

General Information



About National Vacuum Equipment

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 putting your trust in National Vacuum Equipment.

Our Mission

We are dedicated to the production 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 fabrication of its own line of components, purchased and developed its own line of vacuum pumps, and began purchasing for resale, various valves and accessories.

Today, NVE has full service machine, fabrication and powder-coating 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.

Limited Warranty

304 Challenger



Warranty

National Vacuum Equipment, Inc.

Guarantees that the product it provides is free of manufacturer's defects, including materials and workmanship. When properly installed and maintained this product is warranted for a period of two (2) 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 two (2) 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 two (2) 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 the delivery of the final product to the end user.
12. NVE is not responsible for pump coupling tightness or alignment. Customer needs to inspect periodically to ensure proper alignment and to check tightness of set screws.

Any items found to be defective after delivery to the end user that should have been discovered prior to delivery will qualify for 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.

Warranty Procedures

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 materials authorization (RMA) form from NVE before returning product.
- All serial-numbered products must retain the original 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.

304 Challenger

Model-Specific Information



Application

- Duty cycle will vary depending on several factors, such as altitude, RPM & ambient temperature.

Pump Specifications

Air Flow @ Free Air.....	210 CFM
Maximum Intermittent Vacuum.....	27-1/2" Hg
Maximum Intermittent Pressure	20 psi
Operating Speed	1000 - 1400 RPM
Porting Size.....	2" (optional 1-1/2")
Shaft Size (1/4" Key).....	1-1/4"
Approximate Weight.....	179 lbs

System Requirements

Shutoffs

- We recommend a primary shut-off, secondary shut-off, and an oil catch muffler be installed on the system.

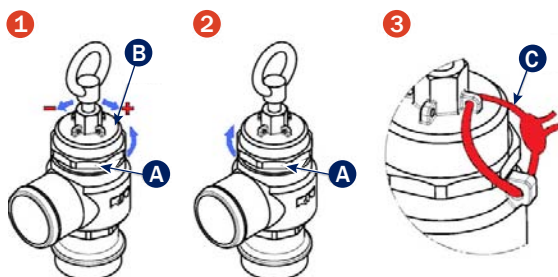
Hose

- Use 2" 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 and Vacuum Relief Valves

- Properly adjusted pressure relief and vacuum relief valves should also be incorporated in the system between the secondary shutoff and the pump.
- The relief valves should be set to where the pump operates at a maximum temperature of 375 degrees Fahrenheit.

Pressure and Vacuum Relief Valve Setting Instructions



Pressure Relief Valve

Picture 1.

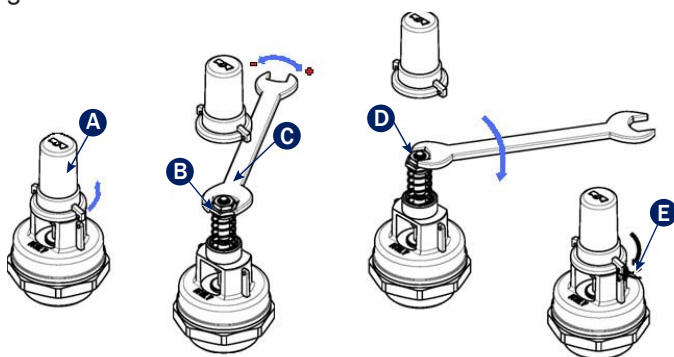
1. Unscrew the lock nut "A"
2. Turn the spring-tightener "B"

Picture 2.

1. Once obtained the desired pressure, screw down the lock nut "A"

Picture 3.

1. Fix the setting, using the rings "C" Situated on the body and on the spring tightener



Vacuum Relief Valve

1. Remove the protection cap "A"
2. Turn the spring-tightener "B", through a spanner "C", clockwise to increase the pressure, counter-clockwise to reduce the pressure
3. Once obtained the desired pressure, screw down the lock nut "D"
4. Screw down the protection cap and fix it using the rings "E" situated on the valve body and on the cap

Drive System

- The pump should be mounted on a level, horizontal surface, secured with grade 8 fasteners.
- The drive system should be sized to supply the required horsepower to the pump plus a reserve to insure long life.
- The power take off (PTO) must be slowly engaged or it will damage the pump and drive components.
- Make certain that all shafts, pulleys or turning parts are properly guarded.
- 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

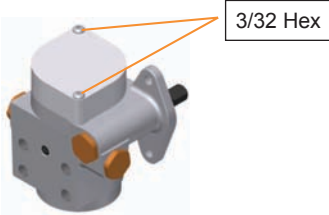
- The direction of rotation required by your drive system should be determined prior to ordering the pump.

Factory Settings

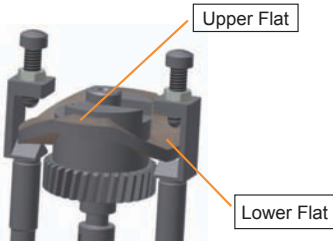
- The automatic lubrication pumps are set at the factory during pump testing and should require no further adjustment during pump installation. The oil pump is easily adjustable from 5-24 ounces per hour.
- It is the responsibility of the installer to ensure proper vacuum and pressure settings and RPM.

Oil Pump Flow Rate Adjustment Procedures

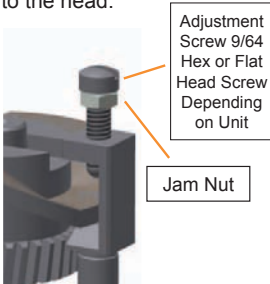
1. Remove oil pump cap (3/32 hex).
Ensure o-ring stays intact.



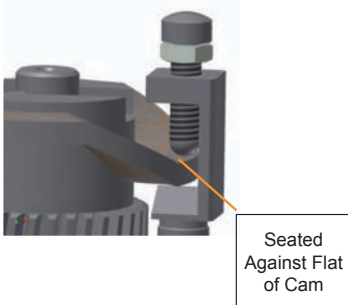
2. Move cam so adjustment screws are resting on lower flats



3. Hold adjustment screw (9/64 hex or flat head screw) while loosening jam nut (1/4" wrench). Spin jam nut all the way up to the head.



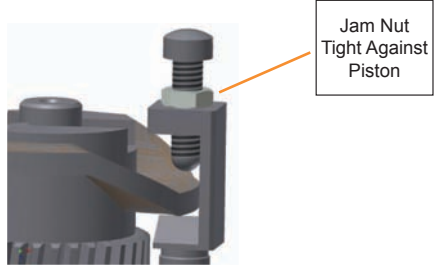
4. Tighten adjustment screw (CW) until it seats on the cam. (Do not force!)



5. Back the screw off the desired amount of turns (CCW).

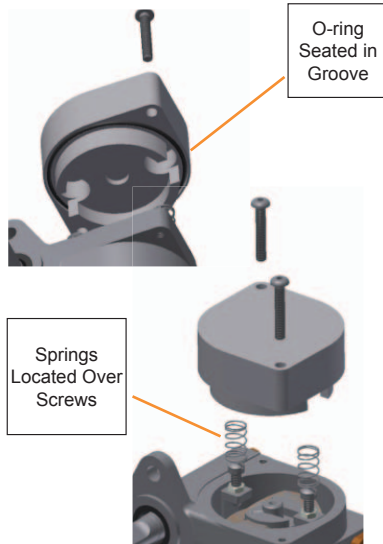
*Tip: More turns out equals less oil flow.
Fewer turns out equals more oil flow.*

6. Retighten jam nut while holding adjustment screw.



7. Repeat process for other adjustment screw.

8. Reassemble cover onto pump assuring o-ring does not fall out of groove, and springs are located over adjustment screws



**NVE 4 Port Oil Pump Adjustment Rate Chart
Tested at 1100 RPM**

Turns From Bottom	Ounces Per Hour
7.5	6
7.25	7
7	8
6.75	9
6.5	10
6	11
5.5	12
5	13
4.75	14
4.5	15
4.25	16

Operating Instructions

304 Challenger



Normal Operation

Oil Reservoir

- Check oil reservoir daily and fill as required.
- Drain and clean periodically depending on use.

Recommended RPM

- 1000 - 1400 RPM.
- Too low of an RPM can cause the vanes to clatter (inconsistent contact with the housing) causing wear.

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 375 degrees Fahrenheit exhaust gas temperature.

Guards

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

Recommended Lubricant

Recommended NVE Turbine Oils:

1. *NVE ISO 68 Oil (Winter Blend)
2. *NVE ISO 150 Oil (Summer Blend)

Other Acceptable Turbine Oils:

1. Shell Turbo 68
2. Mobil D.T.E. Heavy - Medium
3. Texaco Regal R & O 68
4. Chevron GST
5. Penzoi Penzabell 68 T.O.

** NVE ISO 68 and NVE ISO 150 Oils are recommended for the Challenger series vacuum pumps. Challenger Vacuum Pump Oil is sold by the case, (6) gallons per case.*

Although we recommend using a turbine oil for optimum use, you may use any type of oil you prefer, as long as you monitor your operating temperatures and keep your pump within the proper operating range (must not exceed 375 degrees). Using a non-turbine oil outside of the recommended range may cause problems such as overheating, lacquering and excessive wear, which can lead to severe damage to your equipment.

Maintenance

Washing

- Periodically wash the mud and dirt off of your pump as it must be clean to allow heat to radiate from it.

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 container with 4-5 ounces 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

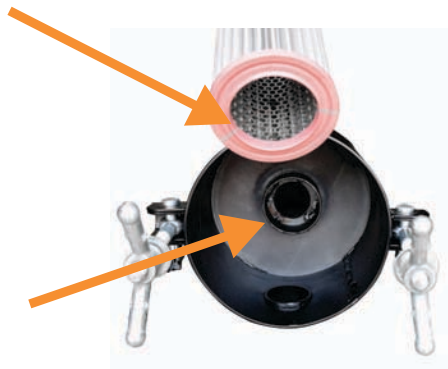
- We recommend checking vane wear at least once every 12 months.
- A new vane is flush with the outside diameter of the rotor.
- Remove the plug from the vane check port, insert a rod to rotor outside diameter, rotate rotor until the rod falls into one of the vane slots. If the rod falls more than a 1/4" into any of the 4 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.

Maintenance *Continued*

- If equipped with a filter, check filter regularly.
- Clean filter with compressed air or a cleaning solution.
The filter is made of stainless steel, please keep that in mind when choosing your cleaning solution.
- Before reinserting the filter into the housing, lube the inside end of the filter that will fit over the lip in the bottom of the housing.

*Properly apply lube here on
the inside lip of the filter...*

...before reinserting here.



Cold Weather Operation

Prior to engaging pump.

- Confirm pump is not frozen.

If pump is frozen, thaw it.

- If the pump is frozen, thaw it out by moving 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.

Troubleshooting

NVE 304 Vacuum Pump



Problem: Pump overheats

Causes:

- No oil in pump
- Oil adjustment set too lean
- RPM too fast
- Prolonged operation at excessive vacuum or pressure levels
- Pump is dirty
- Inlet filter is clogged (if equipped)

Problem: Pump uses too much oil

Causes:

- Oil pump set too rich
- Leaving pump under vacuum between jobs

Problem: Pump doesn't turn

Causes:

- Broken vane or bearing
- Pump is frozen
- Problem in the drive train

Problem: No vacuum**Causes:**

- Suction valve is in neutral
- Worn seals or vanes
- Pump is not turning fast enough
- Check valve or suction valve is clogged
- Leak in the tank or fittings
- Collapsed hose between the pump and shutoffs
- Inlet filter clogged (if equipped)

System Troubleshooting**Locating the source of the trouble**

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

- Remove the suction and discharge hoses at the pump.
- Start the pump and run it in vacuum mode at its recommended RPM.
- Check the vacuum level at the pump inlet. The 304 Challenger in new condition will develop 27" Hg.
- If the pump checks out okay, check the vacuum level at the secondary, then the primary shutoff. Keep working your way back until you find the problem.

For rebuild instructions please visit our website at www.natvac.com or call us at 800-253-5500.

Making a vacuum tester

1. Procure a flange to mount on your 4-way valve, a short 2" pipe nipple, a 2" pipe cap and a vacuum gage.
2. Drill and tap a 1/4" NPT 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 gauge.

This exploded view diagram illustrates the NVE 304 Challenger Fan Cooled compressor assembly. The central component is the compressor unit, which is shown with its internal piston and valve assembly. The fan is mounted on the front of the compressor. Various mounting brackets, bolts, and electrical components are shown in their relative positions for assembly. The diagram includes numerous numbered callouts (1 through 40) pointing to specific parts, such as the fan, compressor housing, mounting brackets, bolts, and electrical components like the fan motor and wiring harness.

NVE 304 Challenger Series - Parts List

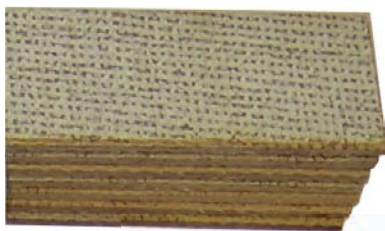
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	120-001-001	HOUSING 304
2	1	120-003-006	ENDPLATE 304 DRIVE
3	1	120-003-007	ENDPLATE 304 NON-DRIVE
4	2	120-004-304	GASKET ENDPLATE 304
5	1	120-005-003-D	ROTOR 304 CW
5	1	120-005-003-S	ROTOR 304 CCW
6	1	120-006-184	KEY 0.25" X 0.25" X 1.875"
7	2	120-009-002	BEARING SPACER 304
8	1	120-018-002	SEAL, 35 X 52 X 7 DOUBLE LIP
9	1	120-039-001	GASKET MANIFOLD 304
10	2	120-039-002	GASKET INTAKE MANIFOLD 304
11	1	120-041-003	SWING CHECK 304
12	1	120-045-003	SPRING 4-WAY 304
13	1	120-045-004	SPRING WAVE BEARING 304
14	1	120-058	PLUG, BRASS 1/8" NPT, HEX HD
15	1	120-060-005	GRIP 3/8" HANDLE W/LOGO
16	1	120-060-006	HANDLE 3/8"
17	1	120-062-003	PLUG 304 MACHINED
18	2	120-063-304	FLANGE 4-WAY 2" NPT
19	1	120-064-025	O-RING 2-120 VITON
20	1	120-064-026	O-RING 2-144 VITON
21	1	120-065-003	TOWER 304 MACHINED
22	1	120-079-007	GUARD NVE OIL PUMP 304
23	1	120-107	TAG, SERIAL NUMBER, BRASS
24	1	120-320-004	MANIFOLD 304 MACHINED
25	4	122-000-002	VANE 304
26	1	123-000-003	OIL PUMP 4 PORT BIDIRECTIONAL
27	8	123-013-001	WASHER 3/8" SEALING NBR
28	4	123-408-014	BANJO BOLT 1/8" BSPP
29	2	310-AM55	BEARING 6207
30	1	310-LP6	HOSE BARB, 1/4 TO 1/4 NPT STRT
31	1	320-082-001	OIL TANK, 5QT W/LOGO
32	1	320-083-009	OIL TANK FILTER, 100 MESH
33	1	320-083-010	FILTER FITTING, OIL TANK 1/4 NPT
34	1	320-083-011	CAP OIL PUMP FEED LINE FITTING
35	1	320-407-003	OIL LINE, BLK 1/4" ID 30R7
36	1	320-407-017	OIL LINE -3 SST FEMALE JIC TO BANJO 8.5"
37	1	320-407-018	OIL LINE -3 SST 90 DEG JIC TO BANJO 8.75" - CW
37	1	320-407-022	OIL LINE -3 SST 90 DEG JIC TO BANJO 11" - CCW
38	1	320-407-019	OIL LINE -3 SST 90 DEG JIC TO BANJO 20.25" - CW
38	1	320-407-023	OIL LINE -3 SST 90 DEG JIC TO BANJO 22.25" - CCW
39	1	320-407-020	OIL LINE -3 SST 90 DEG JIC TO BANJO 23.75" - CW
39	1	320-407-021	OIL LINE -3 SST 90 DEG JIC TO BANJO 22.75" - CCW
40	1	320-408-001	ADAPTER, ELBOW 1/8 BSPTM-NTPF
41	3	320-408-016	FITTING STR -3 MJIC X 1/8 MNPT
42	1	320-408-017	FITTING ELBOW -3 MJIC X 1/8 MNPT
43	4	320-409-003	P-CLIP, OIL LINE 1/4" X 5/16"
44	1	320-LF8	DRIVE TAB
45	1	320-R31	GASKET, OIL PUMP
46	1	412-020-001	WASHER, CUP 4-WAY

NVE 304 Challenger Series - Parts *Continued*

ITEM	QTY	PART NUMBER	DESCRIPTION
300	4	HHCS - 1/4-20 UNC X 0.75	HEX HEAD CAP SCREW - 1/4-20 UNC X 0.75
301	1	HHCS - 3/8-16 UNC X 0.75	HEX HEAD CAP SCREW - 1/4-20 UNC X 0.75
303	4	HHCS - 5/16-18 UNC X 1.00	HEX HEAD CAP SCREW - 5/16-18 UNC X 1.00
302	12	HHCS - 3/8-16 UNC X 1.25	HEX HEAD CAP SCREW - 3/8-16 UNC X 1.25
304	4	LW - 1/4	LOCK WASHER, 1/4"
305	13	LW - 3/8	LOCK WASHER, 3/8"
306	4	LW - 5/16	LOCK WASHER, 5/16"
307	1	SHCS - 1/4-20 UNC X 0.50	SHCS - 1/4-20 UNC X 0.50
308	2	SHCS - 1/4-20 UNC X 0.75	SHCS - 1/4-20 UNC X 0.75
309	8	SHCS - 5/16-18 UNC X 1	SHCS - 5/16-18 UNC X 1

Vane Replacement

Challenger Series Rotary Vane Vacuum Pumps



Vane Replacement Instructions

304 Challenger

304 Repair Kits
Part #115-304-0 (with Bearings)
Part #115-304-0B (without Bearings)

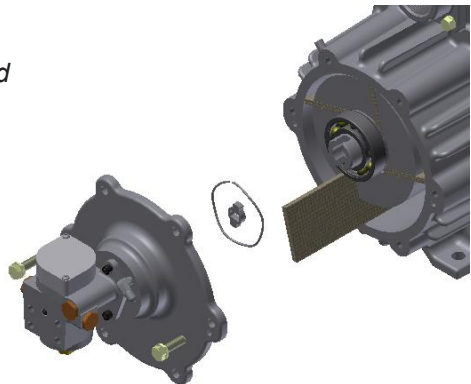


1. **Remove oil pump guard by removing (4) 3/8" bolts.**

2. **Remove (4) banjo bolts and (8) seal washers holding the oil lines to the oil pump** (note the location of the oil lines on the oil pump).
Note: Also remove the oil feed line on the bottom of the oil pump if it is still connected.



3. **Remove the remaining (2) 3/8" bolts holding the endplate to the housing.**
Pull the endplate off of the rotor and housing.
Note: Keep track of the oil pump drive tab that is seated in the non drive shaft of the rotor and the wave spring that is seated in the non drive endplate. The oil pump does not need to be removed from the endplate.



4. **Remove the (4) vanes.**
Note: The rotor will need to be rotated so that each vane will slide out from the bottom of the rotor.

Vane Replacement Instructions *Continued*

5. Prepare each of the (4) new vanes (122-000-002) by coating them evenly with ISO 68 Turbine Oil.

6. Insert the new vanes into the rotor.

7. Replace endplate gasket (120-004-304).

A thin coat of oil will help hold it in place on the housing.

8. Reinstall the non drive end plate over the rotor shaft. (make sure the wave spring is in the endplate and the oil pump drive tab is in the end of the rotor.)

9. Use (2) 1/4" pins to align the endplate with the housing.

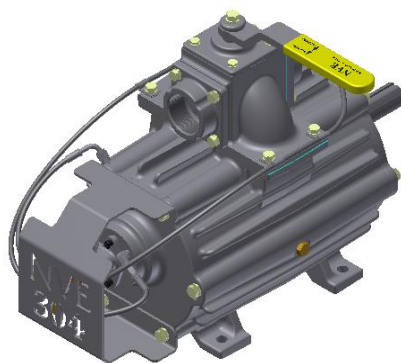
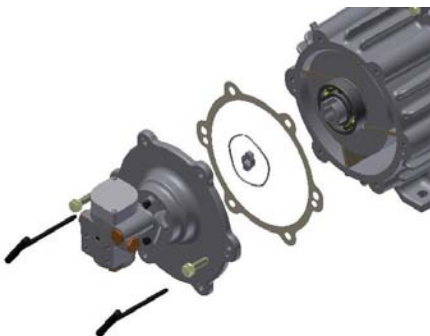
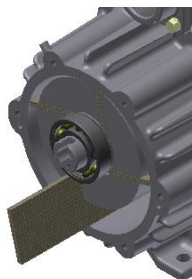
10. Install the (2) 3/8" bolts (along with the brass serial tag) just above the pin locations and retighten.

11. Reattach the oil lines to the oil pump using the banjo bolts and seal washers.

12. Reinstall the oil pump guard and the remaining (4) 3/8" bolts.

13. Remove the 1/4" pins after all of the bolts have been tightened down.

14. Make sure the rotor spins freely in the housing.



NVE

National Vacuum Equipment, Inc.