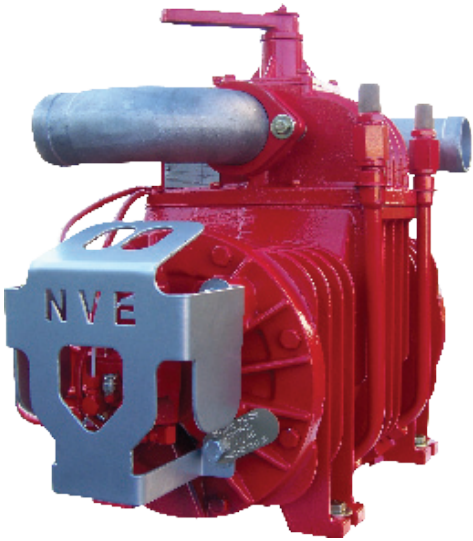
NVE

National Vacuum Equipment, Inc.

Owner's Manual
&
Operating Instructions

Defender 500 Vacuum Pumps



Defender 500

Owner's Record

Date of Purchase: _____

Purchased from: _____

Serial Number: _____

National Vacuum Equipment, Inc.

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LIMITED WARRANTY

NVE Defender 500

Warranty

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 ensure 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. 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 deliver will qualify 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 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.

Notes

Model-Specific Information

General Suggestions

- **Designed for extended operation**
- Ordinary and extraordinary maintenance has to be done while the unit is stopped and the drive disconnected.
- Repairs on plumbing have to be done after disconnecting pressure/vacuum from the same.
- Never start the pump if adequate safety devices are not installed. Damaged safety equipment must be immediately replaced.
- Be aware that the pump's body can reach temperature of over 280° Fahrenheit.
- **Maximum speed shown in the technical specifications tables must not be exceeded.**

Technical Data and Performances

The sliding vane vacuum pump, cooled by ballast air induction, are supplied complete with:

- High temperature asbestos-free vanes
- Forced lubrication, oil pump with a remote oil tank
- 4-way vacuum/pressure changeover valve
- Non-return check valve
- Aluminum inlet/outlet connections
- "Ballast Port" cooling

Pump Specifications

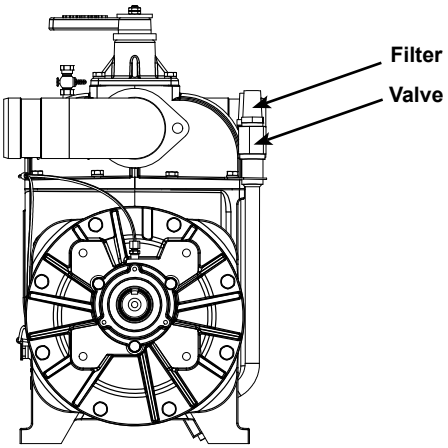
PERFORMANCE AT 1200 R.P.M. - MAX SPEED

Air Flow - CFM free air	301
Air Flow - CFM 60% vacuum	257
Max vacuum - %	92
Max absolute pressure-PSI	21.8
Weight-LBS	397
Oil consumption g/h=(drops / min) total	135 (80)
Remote Oil tank capacity - QT	5
Sound level at 60% vac. 7 m, dist - db(A) - with silencer	84

Normal Use

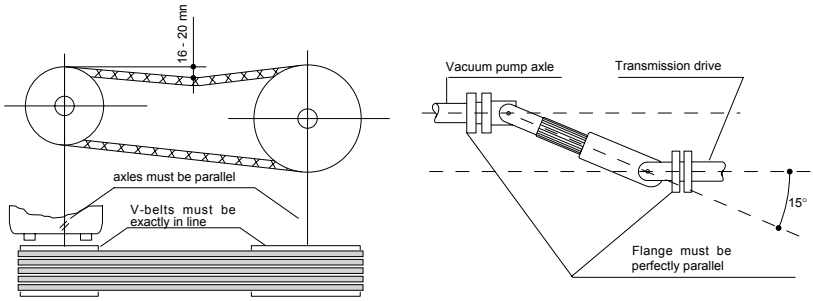
- The Defender 500 used for the suction of air for the movement of liquids. Should be run at a max pressure of 21.8 PSI and a max vacuum rate of 92%.
- As cooling is given by atmospheric air through the ballast system pumps used to pressurize are for non-continuous duty.
- Overheating the pump will cause serious damage to the pump and/or rotor seizure.
- In order to maximize efficiency of the ballast air cooling system, the filters must be kept clean.

Figure 1



- The pump must be installed so that it is easily accessible for inspection and maintenance.
- The vacuum pump must be installed on a rigid base or stand. The drive can be by shaft, belts and pulley, or hydraulic motor.
- The drive shaft must be mounted so that it does not create any axial thrust; the inclination of the shaft must not exceed 15 degrees (see fig. 2)

Figure 2



- When using belts and pulley, the pulley can be mounted directly on the rotor shaft on the larger diameter inboard portion of the shaft. The alignment between the pulley of the pump and the driving pulley must be thoroughly checked. The tension must be adjusted so the belts flex for about 1/16th between pulleys.

Direction of Rotation

- The direction of rotation and RPM are marked on the front of the pump.
- 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 pump should consume 12oz - 15oz of oil per hour. Please contact us if oil usage is outside of these parameters.

- It is the responsibility of the installer to ensure proper vacuum relief settings, pressure relief settings and RPM.

Oil Usage Checking

Before starting-up the pump, check oil level in translucent tank.
If refill is needed, use the recommended oils shown in the next section.

Verify oil is flowing through each line at a reasonable rate.
Oil lines are translucent to allow viewing oil.

OPERATING INSTRUCTIONS

Recommended Lubricant

- We recommend that non-synthetic 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. Penzoil 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.

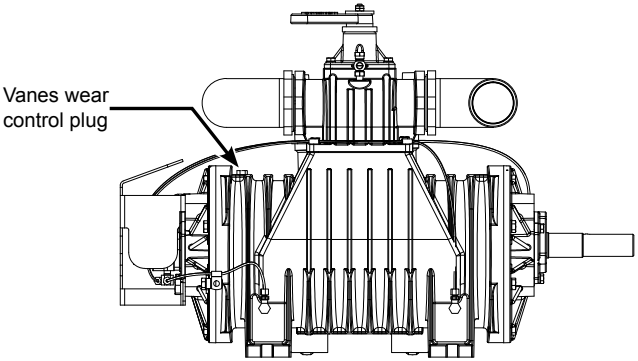
Ordinary maintenance

- Re-fill the lubrication oil tank periodically
- Check that the drive protections are properly fixed
- Clean the filters of the injection valves (ballast ports)

Checking Vane Wear

- We recommend checking vane wear at least every 12 months.
- A new vane is flush with the outside diameter of the rotor.
- Unscrew the plug (fig. 3) and insert a rod of dia. 1/4” and turn the shaft by hand. With the checking rod touching the outside diameter of the rotor, mark it a first time with a scribe. Continue turning the shaft until the checking rod falls inside a vane groove touching the vane. Mark the rod a second time. If the distance between the two marks exceeds 3/16” the vanes must be replaced. Once finished the checking procedure replace the plug of (fig. 3).
- Vanes should be replaced in sets and it is always a good idea to have an extra set of vanes on hand for emergencies.

Figure 3



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, 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.

TROUBLESHOOTING

Defender 500
Vacuum Pump

Pump overheats

Cause	Correction
Faulty lubrication	Check the lubrication
Oil missing	Re-fill the tank
RPM to high	Reduce RPM
Operation-time too long at high vacuum	Stop the pump for a while and let it cool down.
Clogged filters of “ballast port” injection valves.	Thoroughly clean the filters

Pump uses too much oil

Cause	Correction
Drip-oiler/s badly adjusted	Adjustment as described
Oiler’s pin not sealing	Clean the related seat.

Pump doesn’t turn

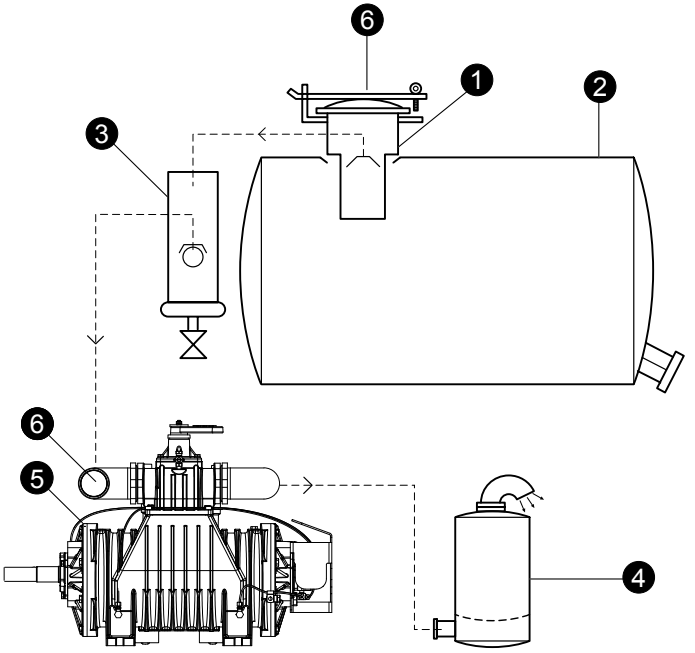
Cause	Correction
Broken vanes due to suction of damaged parts, foreign objects, or bad lubrication.	Dismount the pump and replace damaged parts. Check primary shut-off and lubrication system.
Frozen pump	Unfreeze the vacuum pump
Damaged drive system	Check and replace damaged parts.
Flange bolts too tight	Loosen the bolts

No vacuum

Cause	Correction
Change-over lever in neutral position	Place lever in correct position as shown.
Worn sliding-vanes	Replace the vanes
Loose check-valve	Replace the valve
Worn lip seals	Replace the seals
Blocked vacuum pump	See previous instructions
Leaking of the gate-valves on the tank	Tighten the valves
Leaking of the seals on the tank	Repair or replace the seals
Primary shut-off blocked	Dismount and clean the parts
Clogged connecting pipeline	Clean the metal pipelines or replace the rubber ones.

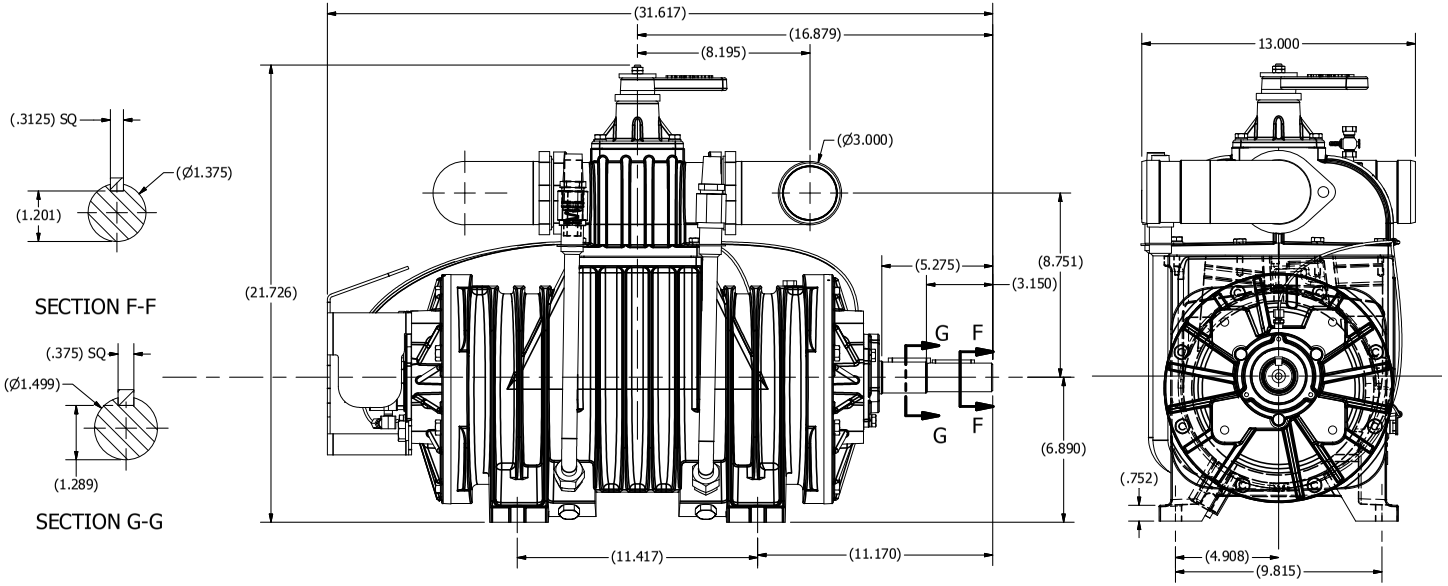
PUMP LAYOUT

Layout of vacuum line

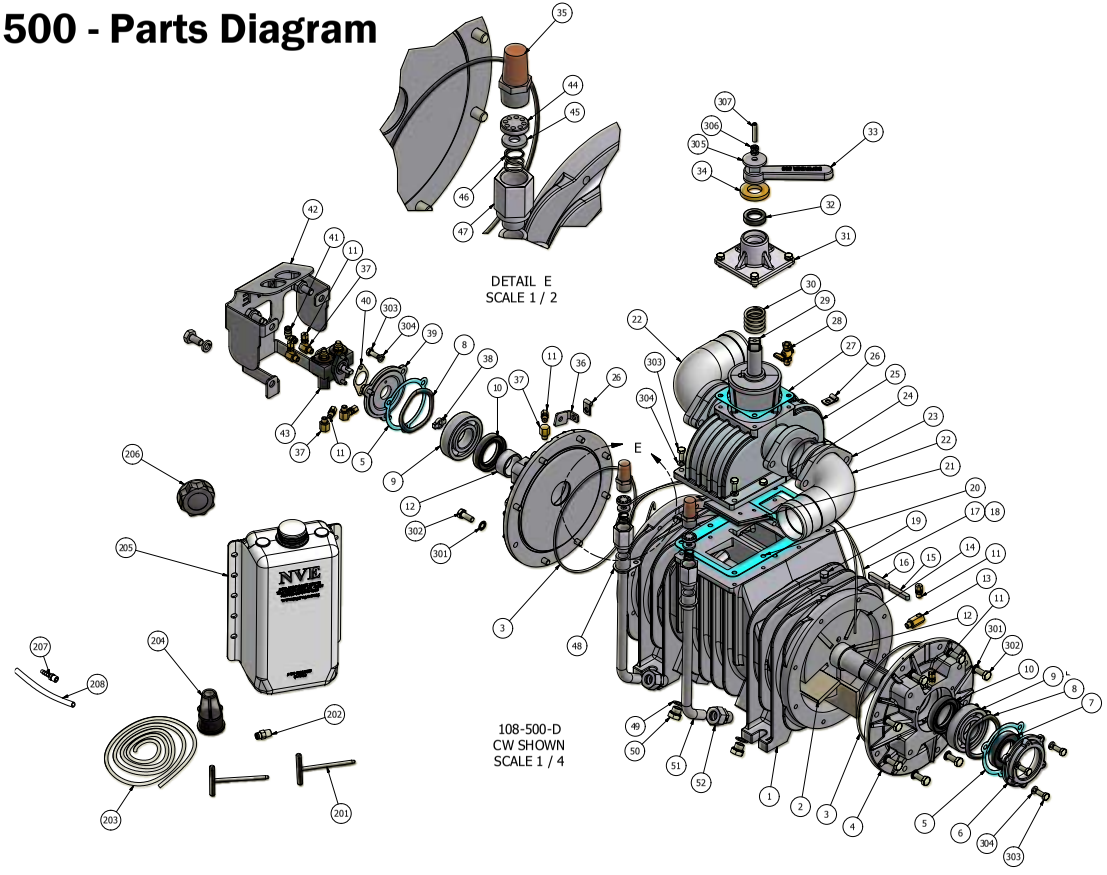


1. **Primary shutoff**
2. **Tank**
3. **Secondary Shutoff**
4. **Silencer and Oil Catch Muffler**
5. **Vacuum Pump**
6. **Safety Relief Valve**

- The mounting of a secondary shutoff (pos. 3) is suggested in between the pump and the tank, for protecting the vacuum pump.
- A silencer (pos. 4) is suggested in order to reduce sound level.


(.3125) SQ
(Ø1.375)
(1.201)
SECTION F-F
(.375) SQ
(Ø1.499)
(1.289)
SECTION G-G
(31.617)
(16.879)
(8.195)
(Ø3.000)
(21.726)
(5.275)
(3.150)
(8.751)
G
F
G
F
(6.890)
(11.417)
(11.170)
13.000
(.752)
(4.908)
(9.815)

Defender 500 - Parts Diagram



Defender 500 - Parts List

PARTS LIST				
ITEM	QTY	UOM	PART NUMBER	DESCRIPTION
1	1	EA	120-001-260	D500, HOUSING, MACHINED
2	5	EA	120-007-260	VANE, DEFENDER 500
3	2	EA	120-064-010	O-RING, 2-267 VITON
4	2	EA	120-003-500	D500 GEN2, ENDPLATE, MACHINED
5	2	EA	120-056-2601	GASKET, END CAP, 260
6	1	EA	120-054-004	D500 BEARING COVER, MACHINED
7	1	EA	120-018-500-3	SEAL, 40 X 72 X 15 DC, VITON
8	2	EA	120-046-001	WAVE WASHER, D500
9	2	EA	120-019-406	BEARING, BALL-6308
10	2	EA	120-018-260-2	SEAL, 48 X 72 X 15 DC, VITON
11	9	EA	320-408-004	FITTING, STRT 1/8 NPT-TUBE
12	2	EA	120-009-260	SEAL SLEEVE, D500
13	2	EA	320-408-003	ADAPTER, LONG ELBOW 1/8 MBSPT-FNPT
14	1	EA	120-005-500	ROTOR, D500 STUFFED
15	1	EA	120-006-500	KEY, 5/16 x 5/16 x 2" 1018 BER
16	1	EA	120-006	KEY, 3/8" X3/8" X 2
17	6.865	FT	320-407-001	OIL LINE, 1/8" OD PFA
18	6.198	FT	320-409-002	OIL LINE PROTECTOR, 1/4"
19	1	EA	120-059-001	PLUG, 1/4" BSPT
20	1	EA	120-039-260	GASKET, MANIFOLD, 260
21	1	EA	120-041-260	D500, CHECK VALVE, EXHAUST
22	2	EA	802-063-500	ELBOW, ALUM D500
23	2	EA	120-063-001	FLANGE, D500 4-WAY
24	2	EA	120-064-009	O-RING, 2-336 VITON
25	1	EA	120-309-260	D500 MANIFOLD, MACHINED
26	3	EA	320-409-003	P-CLIP, OIL LINE 1/4" X 5/16
27	1	EA	120-040-260	GASKET, TOWER 260
28	1	EA	120-102	Valve, Drain 1/8" NPT
29	1	EA	120-062-260	D500, PLUG, MACHINED
30	1	EA	120-045-260	SPRING, 4-WAY VALVE, 260
31	1	EA	120-065-260	D500, TOWER, MACHINED
32	1	EA	120-018-260	SEAL, 27 X 41 X 10 ADL, NITRILE (27 X 41 X 7 ADL OPTIONAL)
33	1	EA	120-060-260	D500, HANDLE, 4-WAY
34	1	EA	120-099-260-B	WASHER, BRASS, VALVE HANDLE, D500
35	2	EA	120-099-406-S	Filter, 3/4"NPT
36	1	EA	320-083-007	BRACKET, OIL LINE D500
37	5	EA	320-408-001	ADAPTER, ELBOW 1/8 BSPTM-NTPF
38	1	EA	320-LF8	Drive Tab
39	1	EA	120-054-500	D500, OIL PUMP MOUNT, MACHINED
40	1	EA	320-R31	Gasket, Oil Pump
41	1	EA	320-006	FITTING, ELBOW 1/4" OD X 1/8" NPTF WORLD
42	1	EA	120-079-001	GUARD, OIL PUMP 607 POWDERCOAT
43	1	EA	320-LW32-BD 320-LW32-BS	OIL PUMP, 4 PORT CW OIL PUMP, 4 PORT CCW
44	2	EA	120-099-406-4	BALLAST PORT CHECK VALVE VENT
45	2	EA	120-099-406-3	WASHER, .920"ODx.406"IDx.135"
46	2	EA	120-099-406-6	SPRING, 406 BALLAST PORT CHECK
47	2	EA	120-099-406-5	Body, Ballast port check
48	2	EA	120-088-260	BRACKET, BALLAST TUBE, 260
49	2	EA	120-099-260-1	SEALING WASHER, ALUM 3/8" BSPP
50	2	EA	120-047-002	PLUG, 3/8" BSPP
51	2	EA	120-096-001	BALLAST TUBE WELDMENT, D500
52	2	EA	120-186-260C	FITTING, COMPRESSION 18MM X 1/2" NPT

ACCESSORIES LIST (PACKAGE SEPARATELY)				
ITEM	QTY	UOM	PART NUMBER	DESCRIPTION
201	2	EA	120-0T5	PIN, T-HANDLE, .250 X 4"
202	1	EA	320-005	FITTING, 1/4" TUBE X 1/8" NPTF WORLD
203	5	FT	320-407-002	OIL LINE, 1/4"OD X 3/16"ID PFA
204	1	EA	320-083-001	FILTER, OIL TANK PLASTIC
205	1	EA	320-082-001	OIL TANK, 5QT, W/LOGO
206	1	EA	320-083-002	CAP, OIL TANK, BLACK 2 1/4"
207	1	EA	310-LPS	HOSE BARB TO MALE PIPE
208	1	EA	320-R102-6IN	OIL LINE, 3/8" x 1/4" ID X 6" LG

FASTENERS: NON-INVENTORY			
ITEM	QTY	PART NUMBER	DESCRIPTION
301	16	DIN 6797 - J 10.5	Toothed Lock Washer
302	16	ANSI B18.2.3.1M - M10 x 1.5 x 25	Metric Hex Cap Screw
303	18	ANSI B18.2.3.1M - M8 x 1.25 x 20	Metric Hex Cap Screw
304	18	DIN 127 - A 8	Spring Washer
305	1	FW - 3_8 X 1.75	Washer, Fender 3/8" x 1 3/4" X 3/16" THICK, PLATED
306	2	ANSI B18.2.4.5M - M8 x 1.25	Hex Jam Nut
307	1	AS 1421 - M8 x 40 Flat Point	ISO metric hexagon socket set screws
308	2	SHCS - 1_4-20 UNC X 0.75	SHCS - 1_4-20 UNC X 0.75

National Vacuum Equipment, Inc.