

Operation Manual (EN)
Original version of the operation manual

ProBoost



Series 1392

Warning: Never use hydrocarbon pump oil as working fluid in the ProBoost pump to avoid risk of fire. Only use Welch silicone pump oil as working fluid (cat. no. 1391K). No other oil is recommended. **Add oil per section 4.4 prior to operation.** Read owner's manual prior to operation. of ProBoost

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1 Important Information

1.1 Meaning of the Warning and Information notes

Take note of the warning notes which are in the following boxes:

	CAUTION ! / WARNING !
Hazard which may lead to serious injuries or material damage.	

	WARNING !
Hot surface which may lead to serious injuries or material damage.	

1.2 General Information

	CAUTION !
IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS To reduce the risks of fire or explosion, electrical shock, and the injury to persons, read and understand all instructions included in this manual. Be familiar with the controls and the proper usage of the equipment.	

Note: The English version is the original version of the operation manual.

Our products are sold worldwide and can therefore be equipped with the typical national plugs and for the various voltages.

1.3 Target Groups

This operating manual is intended for the personnel planning, operating and maintaining standard ProBoost.

This group of people includes:

- Designers and fitters of vacuum apparatus
- Employees working on commercial laboratory and industrial vacuum technology applications
- Service personnel for ProBoost

The personnel operating and maintaining the ProBoost must have the technical competence required to perform the work that has to be done and understand the hazards involved. The user must authorize the operating personnel to do the work that has to be done. The personnel must have read and understood the complete operating manual before using ProBoost.

The operating manual must be kept at the place of use and be available to the personnel when required.

1.4 Intended Use

The layout of ProBoost jet pump (i.e. diffusion pump) must be appropriate for the conditions of use. The user bears the sole responsibility for this.

The ProBoost may only be operated under the conditions stated:

- in the “Technical Data” chapter
- on the name plate and
- in the technical specification for the order concerned

1.5 Use for an Unauthorized Purpose

It is forbidden to use ProBoost for applications deviating from the technical data stated on the type plate, in the operating manual or the conditions stated in the supply contract, or to operate it with missing or defective protective devices.

The ProBoost Model 1392 is not suited for pumping liquids.

1.6 Product Standards, Safety Regulations

Observe the standards and regulations applying in your country when you use the ProBoost Jet Pump (ie diffusion pump).

2. Basic Safety Instructions

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

2.1 General Information

	CAUTION !
To reduce the risks of fire or explosion, electrical shock, and the injury to persons, read and understand all instructions included in this manual. Be familiar with the controls and the proper usage of the equipment	

- Warning notices must be observed. Disregarding them may lead to damage to health and property.
- The ProBoost must be operated by personnel who can detect impending dangers and take action to prevent them from materializing.
- The ProBoost is intended for indoor use only.
- The manufacturer or authorized workshops will only service or maintain the rotary vane pump if it is accompanied by a fully completed damage report. Precise information about the contamination (also negative information if necessary) and thorough cleaning of the ProBoost are legally binding parts of the contract.
- Contaminated ProBoost pumps and their individual parts must be disposed of in accordance with the legal regulations. The local regulations apply in foreign countries.
- Use only Welch Silicone Oil, cat. No. 1391K, in the ProBoost. No other oil is recommended.

2.2 Electricity

Please note the following when connecting to the electrical power supply system:

- The protective connector should not have any breaks.
- The connecting cable should not be damaged.

2.3 Mechanical Systems

Improper use can lead to injuries or material damage. Observe the following instructions:

- Only operate the ProBoost with the specified flange-mounting components.
- Hazardous substances must be separated out as far as this is technically possible before they reach the pump.
- Use flexible metal vacuum hoses or solid metal tubing for connecting ProBoost to rest of your vacuum system. Gum Rubber hose will outgas at the pressures the ProBoost operates limiting maximum vacuum obtainable and outgas vapors will diminish ProBoost's pumping efficiency.
- Use flexible metal hose or solid metal tubing to connect ProBoost to the backing pump (i.e. rotary vane pump).
- The pump should never be used to suck up fluids.
- Maintain a space of least 20 cm between the ProBoost and vacuum system and to enable fan to cool pump after shutdown.

	CAUTION !
Solid particles in the pumping medium impair the pumping action and can lead to damage. Prevent solid particles penetrating into the ProBoost!	

2.4 Hazardous Substances

	CAUTION !
The operating company bears the responsibility for the use of the ProBoost.	

Hazardous substances in the gases to be pumped can cause personal injuries and property damage. Pay attention to the warning notices for handling hazardous substances.

The local regulations apply in foreign countries.

Combustible and explosive Gases and vapor atmosphere

Examine before switching on whether combustible gas/air mixtures are in atmosphere around the pump. Pump is not explosion proof so should not be turned on until room is vented and source of leak is found and repaired.

2.5 High Temperature

The ProBoost heats up as a result of the temperature of the gas being pumped and through intrinsic heating. Independent of the operation mode, a fan is used to cool the outer housing to allow the pump to condense the vapor jet inside the pump. Prevent the following maximum permissible temperature from being exceeded.

+ 10-35 °C for the environment

3 Description

3.1 Principle of Operation

ProBoost is an air cooled gas-jet pump (commonly called a diffusion pump). Since there are no internal moving parts, the pump operation is very simple. The gas jet is formed by directing boiling silicone vapors thru a hollow cone. More than one cone are in the pump. The vapors from the boiling silicone capture molecules (air, water and other chemical vapors). The silicone vapors hit the wall area cooled by fan and condense. The cooling forces the molecules trapped in the silicone vapor to be released in downward direction. This creates an area near bottom of ProBoost that is higher in pressure than at Inlet. A standard rotary vane pump (i.e. CRVpro) or CHEMSTAR DRY, is then used to remove this higher pressure gas.

The pumping action commences when the vacuum pressure in the vacuum system goes below 0.2 Torr (0.27 mBar). The silicone oil in ProBoost cannot be exposed to atmosphere when hot. If this occurs, the oil will decompose, form a gel that requires pump to be cleaned and then replaced with fresh silicone oil.

On an empty, leak free vacuum chamber, ProBoost backed by a rotary vane pump lowers the vacuum pressure to 0.00002 Torr) (20x lower in pressure than a 2-stage rotary vane pump can do alone).

3.2 Structural Description

ProBoost consists of the diffusion pump, metal shroud, control board, switch, and line cord. The diffusion pump consists of a shell, pump core, evaporator pan, heater, cooling fan, inlet connection (NW50) and exhaust connection (NW25). A bottle of 100 milliliters of Welch silicone oil (cat. No. 1391K) is included with the pump to allow four charges of oil (see installation instructions for details on how to add silicone oil).

The metal shroud creates a protective space between the hot surface of evaporator pan and heater (which can reach 275C) and the user to prevent the user from touching the hot surface during operation. The metal shroud also holds the control board for fan and heater, and an on/off switch.

The outer shell of the pump is used to isolate the pump core from atmosphere and condense the silicone oil vapor. The pump core forms the flow path of the oil vapor and changes the direction of the oil vapor to create an oil skirt that forces molecules downward. The evaporator pan and heater are used to evaporate the silicone oil from the liquid state to the gas state. The cooling fan cools the surface of pump shell to condense oil vapor generating the pumping action.

The pump core is removable and allows for easy cleaning.

A backing pump is required for the ProBoost is required to remove the molecules driven from top of pump to the bottom of the pump. (Examples of backing pumps are CHEMSTAR DRY and CRVpro rotary vane pump).

3.3 Scope of Use

ProBoost is suitable for the pumping system of variety of bench mounted instruments such as vacuum coating systems and mass spectrometers and chambers found on wiped film distillation stills.

The rapid warm-up capability of the pump (5-10 minutes) will enable the pump to be used without an isolation valve, but one is preferred. The pump is not intended for use on valve-less systems where rapid cycling from atmospheric pressure thru the hot pump.

The pump will remove variety of gas molecules which have no chemical reaction to the silicone oil working fluid in the ProBoost.

The addition of a fan cooled baffle produces a water-free pumping system capable of reaching 0.00002 Torr.

ProBoost cannot discharge directly into the atmosphere so a backing pump (examples are CRVpro rotary vane or CHEMSTAR DRY) is required. The silicone oil in ProBoost cannot be exposed to the atmosphere when hot. ProBoost must be allowed to cool down prior to venting to atmospheric pressure.

4. Installation and Operation

4.1 Safety

A trained person is required to install and operate a ProBoost. The person needs to have read the instructions, with particular focus on safety instructions, in this owner's manual.

4.2 Unpack and Inspect

Remove the ProBoost and bottle of Welch silicone oil from the packing material and look for any damage. If there is damage, notify Welch and the freight carrier within three days.

The pump will include:

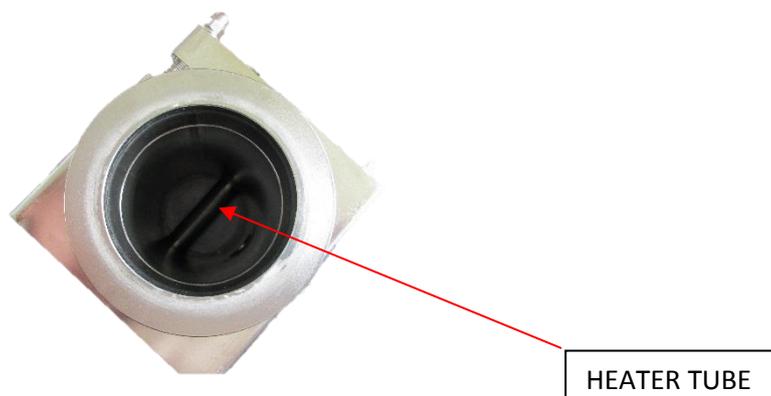
Qty	Description
1	ProBoost with NW50 and NW25 clamps mounted on flange
1	Bottle of Welch Silicone Oil (100 ml), cat. no. 1391K
1	Line cord(cat. no. 1392B-01 includes line cord with 115V N. American Plug) (cat. no. 1392C-02 includes two line cords – one with 230V N. American Plug and one with 230V Schuko plug)

4.3. Locating ProBoost

ProBoost is designed to operate with the NW50 flange horizontal and at the top.

A support is recommended when used free standing. If ProBoost is free standing it may fall over when flexible inlet tubing is attached.

4.4 Filling the pump with Welch silicone oil (cat. no. 1391K)



- DISASSEMBLE INTERNAL PUMP COMPONENTS
- ADD SILICONE OIL TO JUST COVER THE HEATER TUBE, APPROXIMATELY 30 ML, DO NOT OVERFILL.
- REASSEMBLE INTERNAL PUMP COMPONENTS

4.5 Vacuum Connections

The pumping speed is 80 l/s using Nominal ID 50 mm tubing. That is why a NW50 flange is on the inlet. Some applications may require the inlet flange be reduced to smaller ID to connect to the apparatus. Welch recommends that the connecting tubing be as short as possible to the apparatus and has the maximum possible internal diameter.

Welch recommends the use of flexible metal hose connection between ProBoost and the apparatus. Avoid using gum rubber vacuum hose to connect to the apparatus since at operating pressure of ProBoost the vacuum hose will outgas diminishing the pumping capacity of ProBoost.

On the exhaust port of ProBoost, Welch recommends the use of flexible metal hose or rigid metal hose that is as short as possible and has the maximum possible internal diameter. This will aid in keeping the back pressure on ProBoost at or below the maximum operating limit of 0.2 Torr.

Welch recommends the exhaust of backing pump to ProBoost be vented into a hood to keep pumped gases from entering the room the user is operating.

4.6 Cold Traps Installation and Maintenance

Welch recommends the use of a cold trap prior to inlet of ProBoost when pumping chemical vapors. When pumping only air, it is not required.

When chemical vapors or large quantities of condensable vapors are evolved from vacuum processing, a cold trap may be used in the connecting line to the pump. The trap will help prevent contamination and breakdown of the silicone oil in the ProBoost and the pump oil in the backing pump. The cold trap, immersed in a suitable dewar, is installed so that the vapors may come in contact with the surfaces of the trap and condense. Commonly used refrigerants are liquid nitrogen or dry ice/acetone slurry. The refrigerant to be used depends upon the freezing point of the chemical vapors.

When using a cold trap the refrigerant should be maintained at a high level in the flask to keep the trap at a uniformly low temperature. If the trap is allowed to warm up, it will allow re-evaporation of the condensate.

The refrigerant tube on the liquid trap should not be obstructed as the refrigerant boils-off as that can produce dangerously high pressures in the trap. If the trap becomes saturated, it should be disconnected from the system, drained and cleaned. An increase in pressure in the vacuum system will normally indicate that trap has become saturated.

To clean the trap, remove the trap from the system, allow the trap to warm up and rinse off the condensate with a suitable solvent in a hood. Thoroughly clean and dry the trap before reinstalling in the system.

4.7 Verify Vacuum System Leak Tight

ProBoost will lower the pressure in the apparatus when it is leak tight. Welch recommends leak testing the vacuum System prior to turning on ProBoost.

Leak testing is done when no chemicals are in the vacuum chamber. The backing pump is connected directly to the vacuum chamber with vacuum gauge attached to chamber and a vacuum valve located between the pump and chamber. After reaching maximum vacuum, close the valve and monitor pressure and chamber for a rise. A slight rise in pressure in chamber may occur due to outgassing of system components. Rapid rise indicates a leak which will need to be located and sealed.

4.8 Starting the ProBoost

- a. Prior to turning on the ProBoost, verify that the electrical supply voltage corresponds with the ProBoost label and plug matches with the power source connection.
- b. The backing pump must have the capacity to reach 0.020 torr ultimate pressure and be able to maintain 0.2 torr maximum discharge pressure to the ProBoost
- c. When a butterfly valve is installed on the inlet, the handle is closed when in-line with valve body. The handle is perpendicular to valve body in the open position.
- d. Verify system vacuum pressure is below 0.2 before turning on ProBoost
- e. Open the butterfly valve to apparatus after 5 minutes to allow heater to warm up.

4.9 Powering down ProBoost

- a. Close the butterfly valve on inlet of the diffusion pump.
- b. Turn off the on/off switch on ProBoost. The heater will turn off and the fan will run for 20 minutes to cool off pump body before shutting down.
- c. Do not open the pump to atmospheric pressure until it is cool.

4.10 Developing a Maintenance plan for Silicone Oil

A maintenance plan is required to obtain maximum performance in ultimate vacuum pressure and pumping speed.

4.10a. Determining a maintenance schedule to change oil

After using pump for 3 months (just air) after, 1 month when pumping daily heavy chemical vapors, or after seeing drop off in lowest ult. Vacuum pressure obtainable, Welch recommends the pump fluid level and quality be checked. From level and quality, a maintenance schedule needs to be defined.

- Disconnect the power cable
- Vent cooled pump to atmospheric pressure
- Disconnect the inlet from vacuum system
- Disconnect the exhaust from backing pump
- Referring to Figure 1, remove the clip, upper middle, and lower nozzle.
- Drain oil into a graduated cylinder to measure volume and note volume
So that you know how much silicone oil is lost after this maintenance interval.
- Inspect the pump fluid and interior of the pump
 - If oil is significantly discolored or gel/charred oil is on parts, the silicone pump oil must not be reused and replaced with new Welch silicone oil. If charred oil is on parts, the parts need to be cleaned prior to reuse. See section on cleaning pump for further details.
 - Slight discoloration of the silicone oil normally doesn't affect performance. If oil is in good condition, it is still good idea to refill with fresh oil after a full teardown of pump.
- Dry out inside of parts with a dry rag to remove old oil residue before refilling with fresh Welch silicone oil.
- Reassembly the pump
- Refill pump with fresh following procedure in section 4.4
- Welch recommends a maintenance logbook be kept to track maintenance history indicating amount of oil loss and color. This will help create a complete maintenance schedule for the pump.

4.10b. Indicators of when oil level is low

Low oil level indicated by loss of pumping capacity. When this occurs, clean pump and refill with 25 ml of fresh silicone oil.

4.11 Heater Replacement

	WARNING !
Do not allow anti-seize compound to come in contact with the heater electrical leads and electrical cables. If you do the cables and leads may be damaged and there may be a risk of electrical shock.	

Tools required:

Small Phillips screwdriver, 3/32" hex wrench, 9/32" or 7mm nut driver, a hollow 3/8" drift pin (3/8" OD straight metal tubing) may be required to help loosen the heater for removal.

1. Make sure that the diffusion pump is fully cooled to room temperature and electrical service is disconnected.
2. Drain the oil or fasten the supplied NW60 blind flange to the pump inlet so oil does not leak out while removing the diffusion pump to replace the heater.
3. Using the 3/32" hex wrench, first remove the (2) screws on the top of shroud and then the (4) screws on the bottom of shroud.
4. Using the 9/32" or 7mm nut driver, loosen and remove the nuts on one side of the (2) lower fan bolts, then pull out the bolts from the other side gripping the nuts to assist.
5. Slide the top/bottom shroud panel away from the NW25 exhaust port of the diffusion pump. See Fig 1.

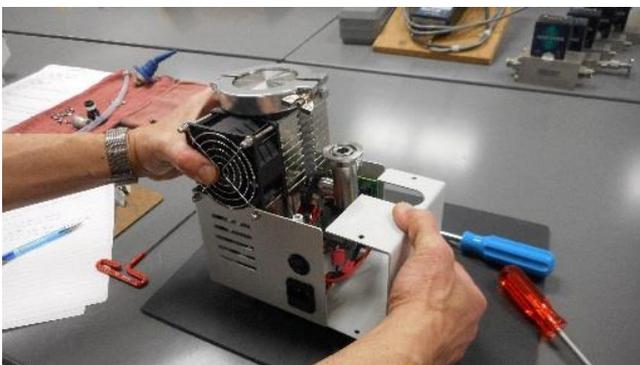


Fig 1

6. Lift out and rotate the diffusion pump to set aside from the shroud to gain access to heater and leads. See Fig 2.

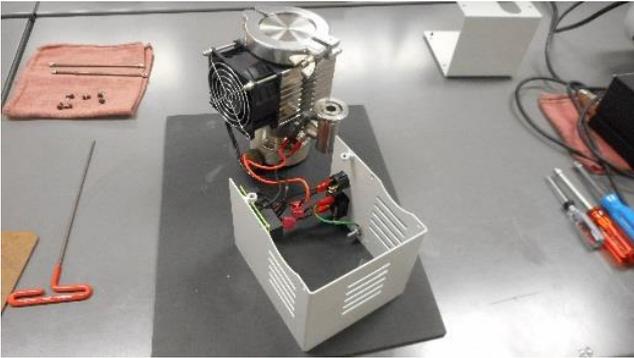


Fig 2

7. With the small Phillips screw driver, remove the red heater lead from the board terminal block. See Fig 3.

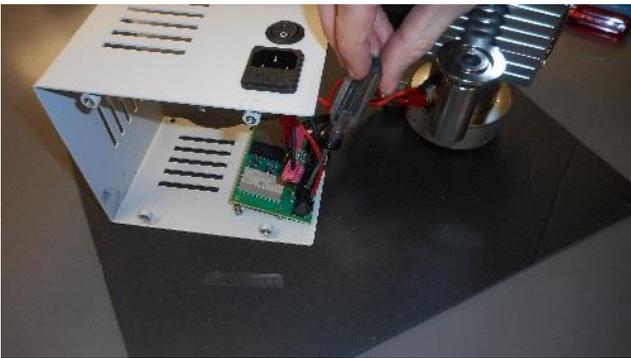


Fig 3

8. Remove the other spade connected red heater lead from the switch component. See Fig 4.

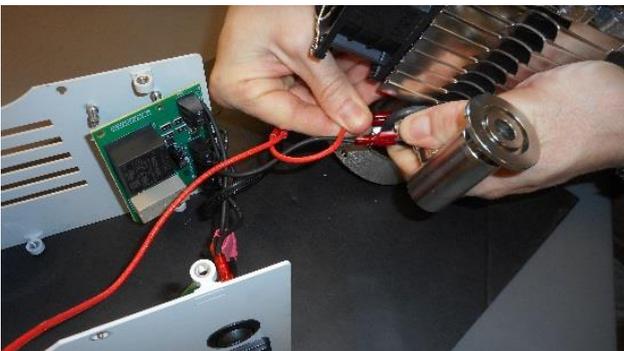


Fig 4

9. Loosen the heater lock nut and remove the heater from the diffusion pump heater well. You may need to use the 3.8" drift pin to assist in removing the heater by lightly tapping it from the end.
10. Lightly coat the entire length of the heater with copper or nickel anti-seize taking great care not to get any near the heater leads as this can create a shock hazard. See area indicated in photograph for coating anti-seize on heater element. See Fig 5.

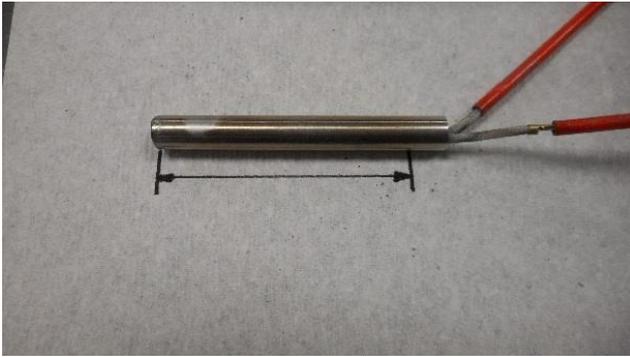


Fig 5

11. Slide heater element into place and back and forth a couple of times to evenly distribute the coating of anti-seize on the heater element.
12. Reconnect the red heater leads to the board terminal block and the switch component.
13. Reposition the diffusion pump back into the shroud.
14. Reassemble by following in reverse steps 8 to 3.
15. Verify the oil is contained in the pump, connect the diffusion pump to your vacuum system, connect to electrical service and follow start procedure described in Section 4.8.

5.1 Table 1

Specifications	Model 1392
Maximum Pumping Speed, Air	80 liters/sec for air
Ultimate Vacuum Pressure	0.00002 torr
Minimum Backing Pump FAD@60Hz	2.8 CFM
Maximum Discharge Pressure	0.2 torr
Ambient environmental temp	10 to 35 deg C
Heat-up time	7 minutes
Heater power	200 W
Inlet Connection	NW50
Discharge Connection	NW25
Silicone Oil Capacity*	Approximately 30 ml
Working Fluid	Welch Silicone Oil, cat. no. 1391K
Cool down time	20 minutes
Dimensions: L x W x H	5.5 x 5.4 x 7.5 in
ProBoost weight lbs. (kg)	5.6 lbs. (2.5 kg)
Ordering Information	
Cat. No. 115V, 60Hz, 1Ph with N. American cord set	1392B-01
Cat. No. 230V, 50/60Hz, 1Ph with N. American & Schuko cord sets	1392C-02

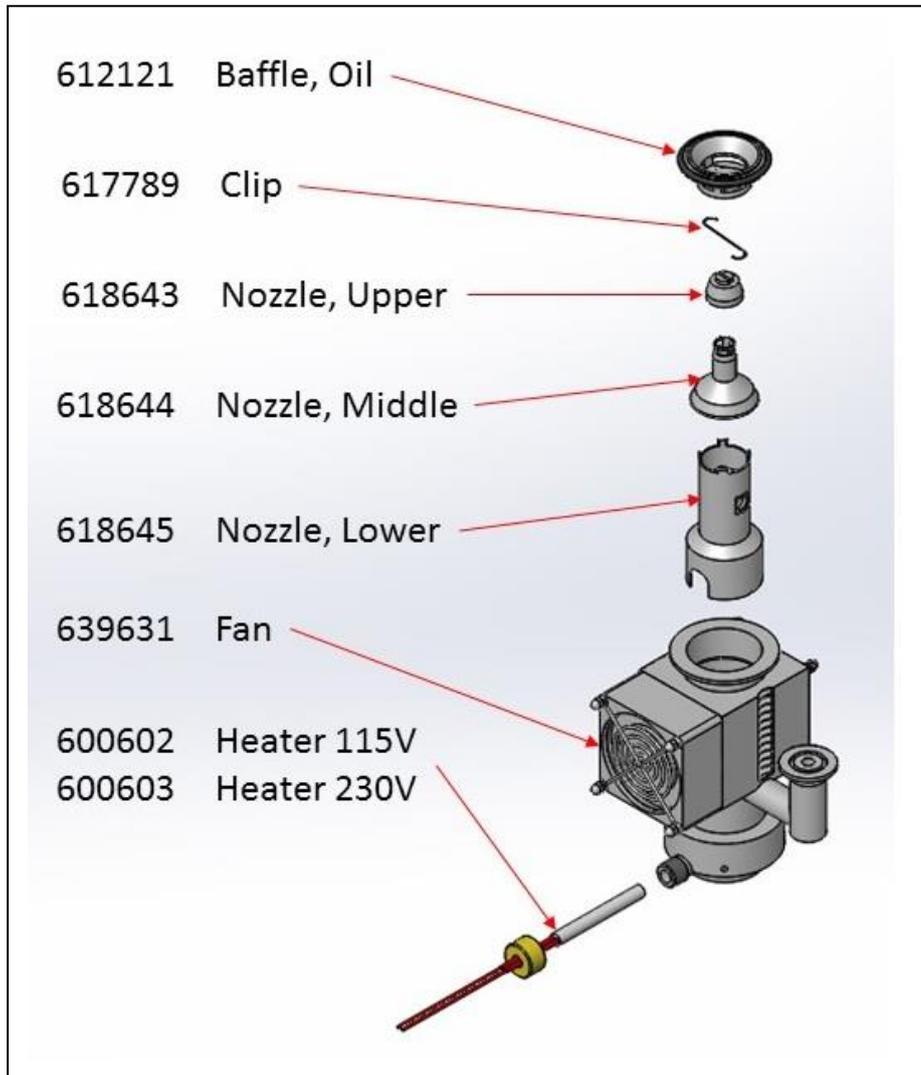
*See manual instruction section 4.4 for filling pump with Welch Silicone Oil.

5.2 Exploded View

Exploded View of Diffusion Pump

Full Diffusion Pump Assembly

- p/n 668573 115V assembly
- p/n 668574 230V assembly



7 Warranty

This Welch product is warranted to be free from defects in material and workmanship. The liability of Gardner Denver Thomas, Inc. under this warranty is limited to servicing, adjusting, repairing or replacing any unit or component part which in the judgment of Gardner Denver Thomas, Inc. has not been misused, abused or altered in any way causing impaired performance or rendering it inoperative. No other warranties are expressed or implied. The method of executing this warranty: servicing, adjusting, repairing or replacing shall be at the discretion of Gardner Denver Thomas, Inc. Vacuum pumps that have been used for any period, however short, will be repaired under this warranty rather than replaced. The warranty is effective for one year from the date of original purchase when:

- The warranty card has been completed and returned.
- The product is returned to the factory or other designated service centers, freight prepaid.
- The product in our judgment is defective through no action or fault of the user.

If the product has become defective through misuse, abuse, or alteration, repairs will be billed regardless of the age of the product. In this event, an estimate of the repair costs will be submitted and authorization of these charges will be required before the product is repaired and returned. To reduce additional charges and delays either within or outside of the warranty period, contact Welch for a return authorization number. Products without a return authorization number will be refused by our receiving department. Before shipping, properly pack the pump, insure it against loss or damage, and on the outside of the pump packaging and the packing slip write in the return authorization number. Pumps damaged due to improper packaging are the customer's responsibility.