



**OWNER'S MANUAL  
FOR  
DRY VACUUM PUMPS  
MODELS 2016, 2024, and 8111**

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**WARNING**  
Be sure to properly identify intake and  
discharge before using pump. See Section 2.5



**CAUTION**  
Do not pump liquids with the pump.  
Pumping liquids will cause the pump to stop working.

**Welch Rietschle Thomas**  
7301 North Central Avenue  
Skokie, IL 60077  
Phone: (847) 676-8800  
Fax: (847) 677-8606  
E-Mail: [welchvacuum@thomasind.com](mailto:welchvacuum@thomasind.com)  
Web-Page: [www.welchvacuum.com](http://www.welchvacuum.com)

**Part No. 67-0830R2.4**  
**Printed in the U.S.A.**

## Welch Rietschle Thomas

**Read and understand the following information and instructions included with you Welch Dry Vacuum Pumps before using. This information is for your safety and to prevent damage to the pumps.**

### Section 1: SAFETY INFORMATION

#### 1.1 CAUTION: TO PREVENT INJURY...

**1.1a** Never operate this product if it has a damaged cord or plug. If it is not working properly, has been dropped, damaged or has fallen into water, please return the product to a Welch service center for examination and repair.

**1.1b** Keep the cord away from heated surfaces.

**1.1c** Never block any air openings or place it on a soft surface where the openings may be blocked. The air openings are for ventilation of the motor inside the housing. Keep all air openings free of lint, dirt and other foreign objects.

**1.1d** Models 8111, 2024 and 2016 are thermally protected and can automatically restart when the protector resets. Always disconnect power source before servicing.

**1.1e** Wear safety glasses or goggles when operating this product.

**1.1f** Use only in well ventilated areas. The more on all pumps are fan cooled. Be sure to attach the fan supplied loose to the shaft. **Warning: Do not operate the pumps in an atmosphere containing flammable or explosive gases/vapors.**

**1.1g Warning: Never block the outlet port. If the outlet is blocked, pressure will build-up in the pump with the potential for the pump head bursting and causing possible injury to personnel in the area.**

**1.1k** All electrical products generate heat. To avoid serious burns never touch unit during or immediately after operation.

**1.1l** Be sure to properly identify intake and outlet before using pump. See Section 2.5.

**1.1m.** Warning! Remove plug from Inlet Port before Using. One outlet port on the side of the pump head. See Section 2.5 for additional information.

#### 1.2 CAUTION: TO REDUCE RISK OF ELECTRICAL SHOCK...

**1.2a** Do not disassemble. Disassembly or attempted repairs if accomplished incorrectly can create electrical shock hazard. Refer servicing to qualified service agencies only.

**1.2b** Unit is supplied with a three pronged plug. Be sure to connect pump to a properly grounded outlet only.

#### 1.3 WARNING: TO REDUCE RISK OF ELECTROCUTION...

**1.3a** Do not use this product in or near area where it can fall or be pulled into water or other liquids.

**1.3b** Do not use this product in or near area where it can fall or be pulled into water or other liquids.

**1.3c** Do not reach for this product if it has fallen into liquid. Unplug immediately.

**1.3d** Never operate this product outdoors in the rain or in a wet area.

#### 1.4 DANGER: TO REDUCE RISK OF EXPLOSION OR FIRE...

**1.4a** Do not use this pump in or near explosive atmospheres or where aerosol (spray) products are being used.

**1.4b** Do not use this product near flames.

**FAILURE TO OBSERVE THE ABOVE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY, INCLUDING DEATH IN EXTREME CASES.**

## **Section 2: INSTALLATION**

### **2.1 Introduction**

This manual has been compiled not only for the care and maintenance of the Welch Dry Vacuum pump now in your possession, but as a helpful reference and guide to prevent many problems which can occur if used improperly.

### **2.2 Unpacking**

Carefully remove the Dry Vacuum pump from the shipping carton. Preserve all paperwork for future reference. If damage has occurred from shipment a claim must be filed with the carrier immediately; preserve the shipping carton for inspection by the carrier. If you are required to communicate with your dealer or Welch Vacuum be sure to include your order numbers for quick identification. Do not return the pump to the factory without first calling for a returned goods number.

## 2.3 Pump Mounting

Rubber feet are attached to the pump. Rubber feet are excellent for applications involving a semi-flexible surface such as a bench top; they help to isolate noise and eliminate creeping. Dry Vacuum Pump Model 2024 can be installed in any position. However, the horizontal position of the motor shaft should be preferred. Attach the fan to the shaft.

## 2.4 Pump Location

The Dry Vacuum pumps should be located preferably in a clean, dry and well-ventilated instrumentation box. This pump is designed for OEM applications. Please be sure not to block the ventilation ports located on the motor.



### **WARNING**

**Don't pump operate this pump in an atmosphere containing flammable or explosive gases or vapors.**



### **WARNING**

**The motor is thermally protected on Models 2016, 2024, and 8111 and will automatically restart unexpectedly when the overload device resets.**

The pump should be placed where the surrounding temperature remains between 10°C and 40°C (50°F and 104°F). Always check to insure the location choose is protected from direct or indirect moisture contact. Welch recommends that the pump be installed at the highest point within the system to prevent possible vapor condensate from entering the pump. The pump should be located as closely to the system in order to utilize it most efficiently.

## 2.5 Inlet, Outlet and Gas Ballast Provisions

Inlet connections ¼" female NPT thread makes it easy to connect the pump to your vacuum system. The Outlet connection is ¼" female NPT. The Gas Ballast Port is 1/8" female NPT and located on the head of the second stage. A valve with full open and close can be used to activate this feature.

Be sure to call Welch technical service prior to start-up at (847) 676-8800 Ext. 1 if you have questions.



### **WARNING**

**Never Block the Discharge Port(s). If the exhaust is blocked, pressure will build-up in the pump with can lead the pump to stop.  
Remove plug(s) from exhaust port(s).**

## 2.6 Electrical Power

### 2.6a Power Source Review

Review the power source and the motor rating to be sure they agree in voltage, phase and frequency. Serious damage may occur to the motor if it is connected to improper voltage. All Welch pumps must be grounded. Grounding reduces the risk of electric shock in the event of an electrical short circuit. The plug must be plugged into an outlet properly grounded. Consult your local electrical codes if you have doubts.

## **2.8 Dial Vacuum Gauge**

A dial vacuum gauge is commonly used to indicate vacuum level when operating in the rough vacuum range (0 to 29.9”Hg). Dial vacuum gauges give negative pressure – that is pressure below atmospheric. The reference point for the gauges is atmospheric pressure. Please keep in mind that atmospheric pressure tends to vary from day to day. As a result of this variability, dial vacuum gauge will indicate slightly different maximum vacuum readings from day to day.

## **2.9 Traps**

### **2.9a When to Use A Trap**

The use of PTFE or fluorinated plastics for all wetted parts resists chemical attack allowing the pump to handle aggressive solvent, base and acid vapors. A totally oil free diaphragm mechanism removes the need for a lubricating and sealing fluid for pulling a vacuum. When pumping gases or low vapor loads, a trap is not necessary unless you want to capture vapors evolved from the process.

When a heavy load of water or organic vapor is evolved from the vacuum process, condensation of vapor in the pump mechanism may occur. The reason is the pump is compressing the vapor in the pump mechanism. The valve system in the pump mechanism is designed to pass the small quantity of liquefied vapor formed when pumping heavy vapor loads. The liquid formed will be ejected from the exhaust port(s). See Section 4 on pump maintenance on suggestions for the purging the vacuum pump of condensed liquids prior to shutting it off.

The ejected liquid from the exhaust port(s) can either be collected in a liquid trap attached to the exhaust port or the vapor trapped in a cold trap placed in-line between the pump and the vacuum chamber. A simple, inexpensive liquid trap will act to muffle the pump’s noise.

The use of a cold trap when pumping heavy vapor loads will eliminate the need for a liquid trap attached to the exhaust port. The cold trap is installed between the pump and the vacuum chamber. A simple, inexpensive liquid trap can be made from a filtering flask. The filtering flask is connected by hose to the outlet port. The liquid trap will act to muffle the pump’s noise.

The use of a cold trap when pumping heavy vapor loads will eliminate the need for a liquid trap attached to the exhaust port. The cold trap is installed between the pump and the vacuum chamber. The water or organic vapors evolved from the vacuum process will, entering the cold trap, come in contact with the surfaces of the trap and condense. Commonly used refrigerants are liquid nitrogen or dry ice with alcohol slurry. Dry ice provides sufficient cooling to freeze out most heavy water vapor loads. A variety of cold traps are available from Welch. Please call our customer service department for additional information at (847) 676-8800.

### **2.9b The care of a Liquid Trap**

A liquid trap needs no refrigerant. The key maintenance issue when pumping high vapor loads is to regularly drain the trap of liquid ejected from the dry vacuum pump.

### **2.9c The Care of a Cold Trap**

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 rewarmed it may allow re-evaporation of the condensate. 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 the trap has become saturated. To clean the trap, remove the trap from the system and allow the trap to warm up and rinse off the condensate with a suitable solvent in a fume hood.

Thoroughly clean and dry the trap before reinstalling the system.

If a liquid nitrogen trap is used, the refrigerant add tube on the liquid nitrogen trap should not be obstructed as the refrigerant boil-off can produce dangerously high pressures.

## **2.10 Gas Ballast Port**

Condensation of vapors ingested by the pump can place in the compression stroke of the second-stage of the Model 2024. Condensation takes place when the ratio between the initial pressure and the end pressure of the compression is high, that is, when the mixture of vapor and gas drawn from the inlet port is compressed from a low pressure to a high pressure. By adding air through the gas ballast valve to the mixture of vapor and gas being compressed, the pressure required for delivery past the exhaust valve is reached with a considerable smaller reduction of the volume of the mixture; thus, depending upon the amount of air added, condensation of the vapor is either entirely avoided or substantially reduced.

A port for attaching a gas ballast valve is supplied with the pump. The gas ballast port is 1/8" female NPT and located on the head of the second stage. A valve with full open and close can be used to activate this feature.

## **Section 3: OPERATION**

### **3.1 Starting Procedures**

#### **3.1a Starting A Welch Pressure/Vacuum Pump.**

Before attaching the pump to a system it is well to familiarize yourself with the function and action of the Dry Vacuum Pump which you have acquired. Review the power requirements as described in Section 2.6. Welch recommends running the pump for a few minutes to warm it up before use. The warm-up improves the pumps ability to pass water and organic vapor. A warm pump will handle more vapors without liquefying it than a cold pump.

#### **3.1b Cleanliness**

Take every precaution to prevent foreign particulates or liquid from entering the pump. Particulates or a flow of liquid will damage the pumps performance. If you find that particulates or liquid will come off the process during evacuation, a simple liquid trap can be made out of readily available material for protecting the pump. The trap would consist of a filtering flask between the pump and the vacuum chamber.

### **3.2 Leak Detection**

The importance of eliminating all leaks in a vacuum system is obvious. The pump must remove this added volume of leaked gas to maintain the desired vacuum. Leaks for these pumps can be located by slightly pressuring the system and painting the suspected area with a thick soap solution. Escaping air will produce soap bubbles.

### **3.3 Operating Pressure Range**

Vacuum pumps are designed to be run from slightly below atmospheric to their maximum vacuum level on the intake side. Consult the Specification Table in the back of this manual for the ratings for your specific model.

### **3.4 Shutdown Procedures**

After use, Welch recommends the pump be run about 2 minutes disconnected from the vacuum process. The air pumped through the mechanism will purge out water vapor or droplets of water condensate that may have formed on the inside of the pump. This purge of the pump mechanism helps prevent build-up of solute crystals inside of the pump head. Over time, these crystals will shorten pump lifetime.

## **Section 4: MAINTENANCE**

Welch dry vacuum units are 100% oil-free. The pump employs a diaphragm with an uninterrupted Teflon® coating. All bearings are sealed and permanently lubricated. Lubrication should not be attempted. The units are built for duty operation just like a water aspirator, but with the quietness, performance and durability of a diaphragm.

## **Section 5: TROUBLESHOOTING**

### **5.1 Vacuum Problems**

Leakage, contamination and unusual outgassing are the general causes of problems associated with poor vacuum. To operate at maximum efficiency a system must be thoroughly clean. If the system is completely clean and free from leaks, and unwarranted vacuum problems still exist, the pump should be checked. A simple criterion for the condition of the pump is the determination of its maximum vacuum capacity. This can be accomplished by blocking of the intake and reading the vacuum level on the gauge (see Section 2.8).

## Section 6: SPECIFICATIONS

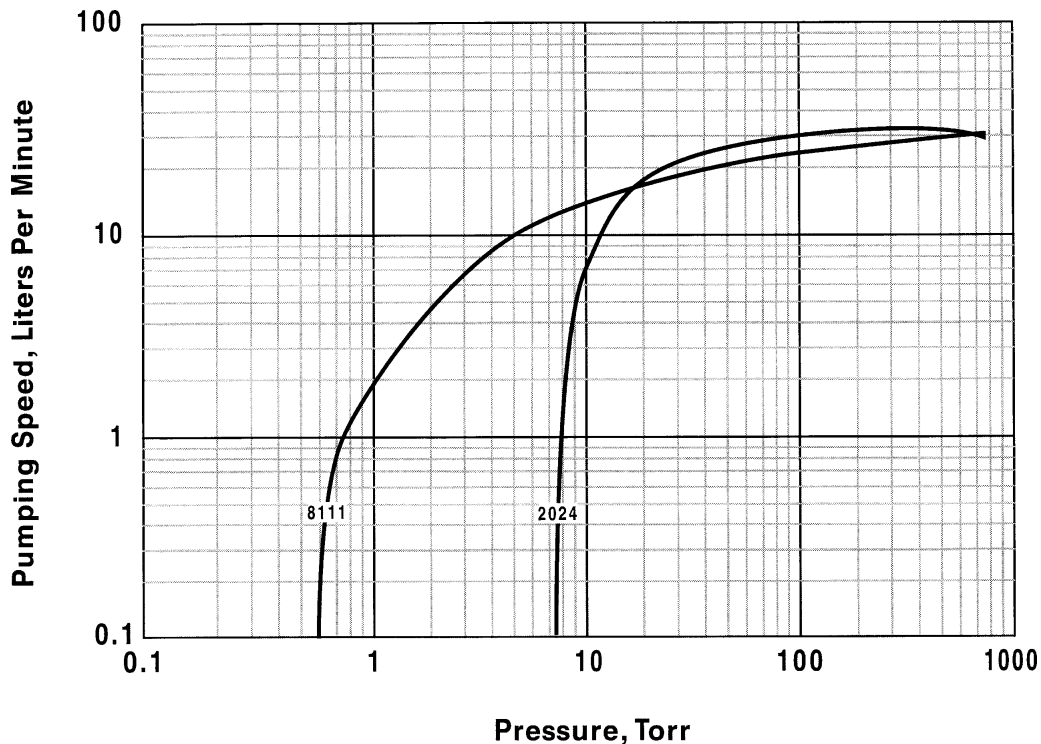
### 6.1 Pump Specification Chart

\*The pump is designed to be started with the inlet at atmospheric pressure. If the pump is switched on with a vacuum on the inlet, the motor will not turn over.

\*\*The recommended I.D. of the tubing to use with the pump is  $\frac{1}{4}$  inch. No hose barb is supplied with this OEM pump. The female thread on the inlet port is  $\frac{1}{4}$ " NPT.

\*\*\*Inlet is a NW16 flange No barb supplied,  $\frac{1}{4}$ " FPT thread.

### 6.2 Pumping Speed Curves

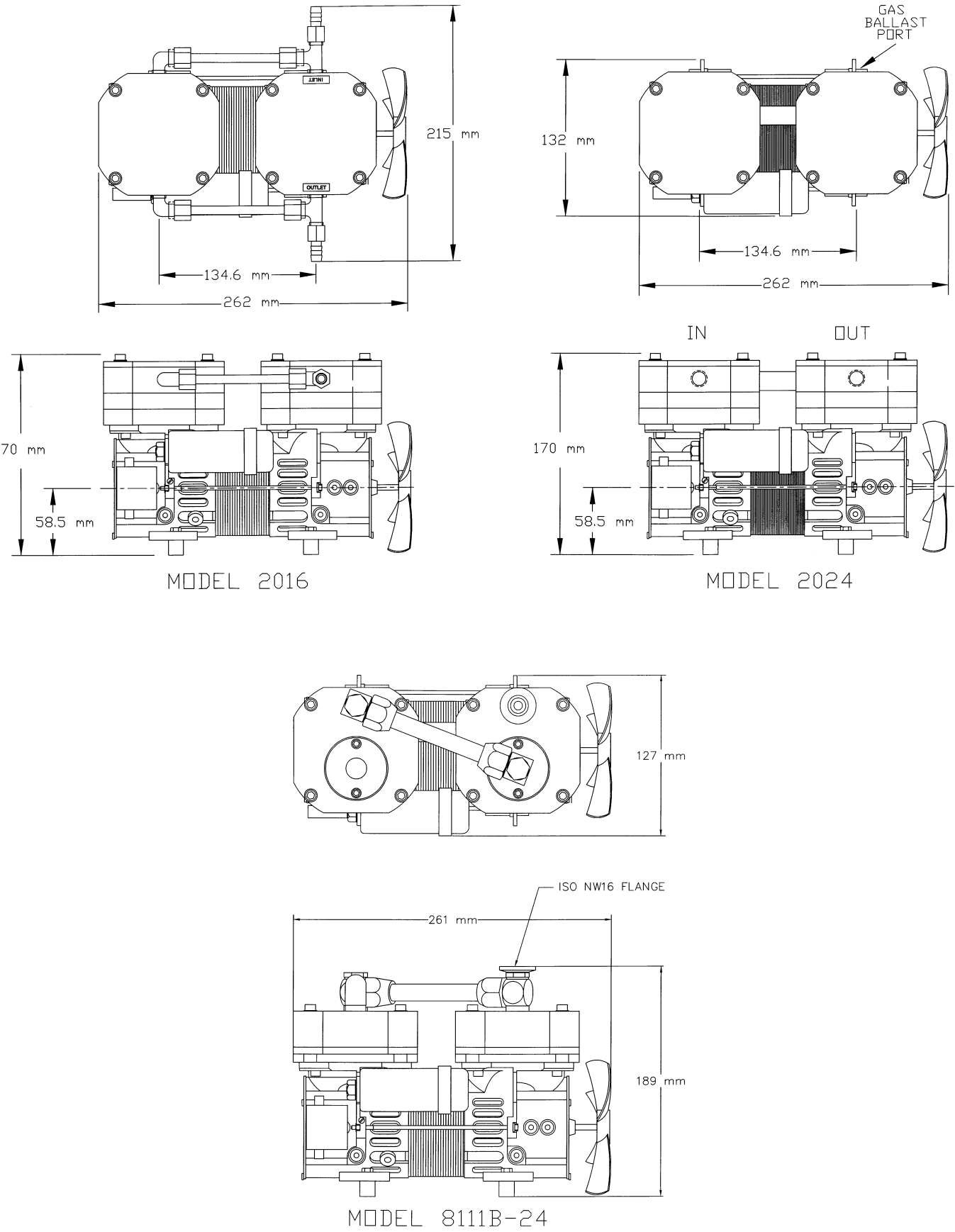


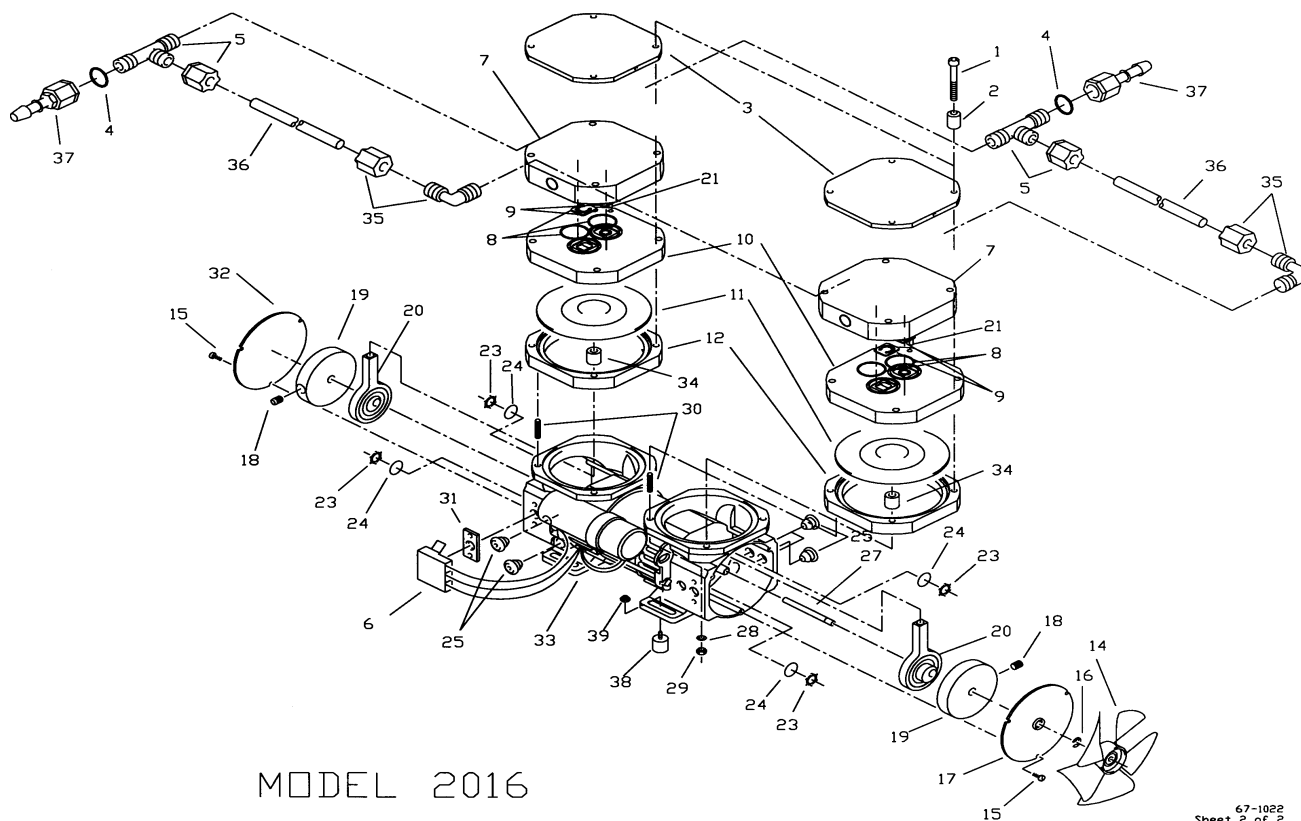
**\*Note:** Pumping speed curves for 60Hz models shown.

Pumping speed curves for 50Hz models is  $\frac{5}{6}$  that of 60Hz models.



6.3 Pump Dimensional Drawings





MODEL 2016

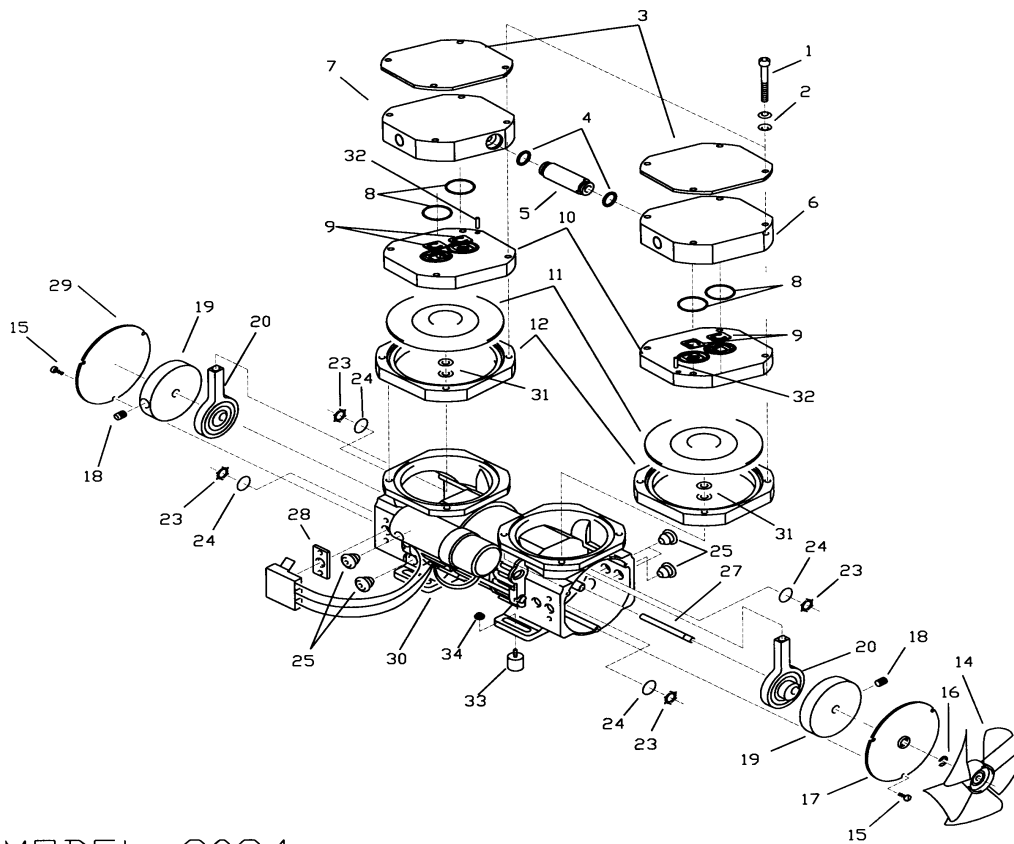
### PARTS LIST FOR 2016

ITEM	QTY	PC.NO.	A* DESCRIPTION	ITEM	QTY	PC.NO.	A* DESCRIPTION
01	8	62-0178	Screw M5 x 50 Socket Head S.S.	24	4	66-0171	Felt Washer White
02	48	62-0200	Washer Belleville 10 mm x 5 mm	25	8	66-0170	Rubber Stopper
03	2	61-3093	Plate Head 2024	26	2	61-3140	Ball Bearing, Shielded
04	2	66-0167	1 O-Ring 10.5 mm 3.0 mm C/S	27	1	61-3124	Extension Shaft
05	2	66-0125	Angle Right "T" Natural Kynar	31	1	66-0162	Pad Rubber
06	1	61-3026	Socket Adapter (used in 2016B-01)	32	1	61-3091	Plate Alum. Motor End
07	2	61-3480	Pump Head, One Stage	33*	1	61-3280	Motor Package, 115V 60Hz (2016B-01)
08	4	66-0166	2 O-Ring #021 FEP/Fluoroelast.	33*	1	61-3775	Motor Package, 230V 50Hz (2016C-02)
09	4	61-3061	2 Valve 8011	33*	1	61-3375	Motor Package, 100V 50/60Hz (2016C-05)
10	2	61-3479	Diaphragm Chamber PTFE	34	1	61-3102	Shim Diaphragm
11	2	61-3059	1 PTFE Diaphragm 2024	35	2	66-0131	Elbow, Male Union Kynar
12	2	61-3275	Plate Head Base Alum.	36	.52	66-0146	Tube 3/8"OD x 5/16"ID Kynar
14	1	66-0181	Fan (Lufter)	37*	2	61-5047	Connector, Bardbed Trap Inlet
15	6	62-0195	Screw 2.9 x 1 x 6.5 mm Pan Head	38	4	61-3070	Rubber Foot, M4 Thread
16	1	62-0198	Retaining Ring Ext. 7/32 Shaft	39	4	62-0218	Hex Nut, Crown M4 Brass
17	1	61-3092	Plate Alum. Shaft End	00*	1	12-2622	Power Cord, 115V 60Hz (2016B-01)
18	2	62-0190	Screw Set M6 x 8 mm Socket Hd	00*	1	61-2257	Power Cord 230V 50Hz (2016C-02)
19	2	61-3116	Momentum Weight	00*	1	61-8587	Power Cord, 100V 50/60Hz (2016C-05)
20*	2	61-3464	Connecting Rod Assembly	00*	1	61-8588	Power Adapter, 100V 50/60Hz (2016C-05)
20*	2	61-3464	Connecting Rod Assembly (2016C-02)			1-99-5126 1	Sealant
21	2	62-0202	Pin Dowel				
23	4	62-0199	Retaining Ring Internal 30 mm				

A\*: REPAIR KIT CAT # 2025K-01.

\*: Depending on the model

00: Items not shown but included with replacement pump.



MODEL 2024

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### PARTS LIST FOR 2024

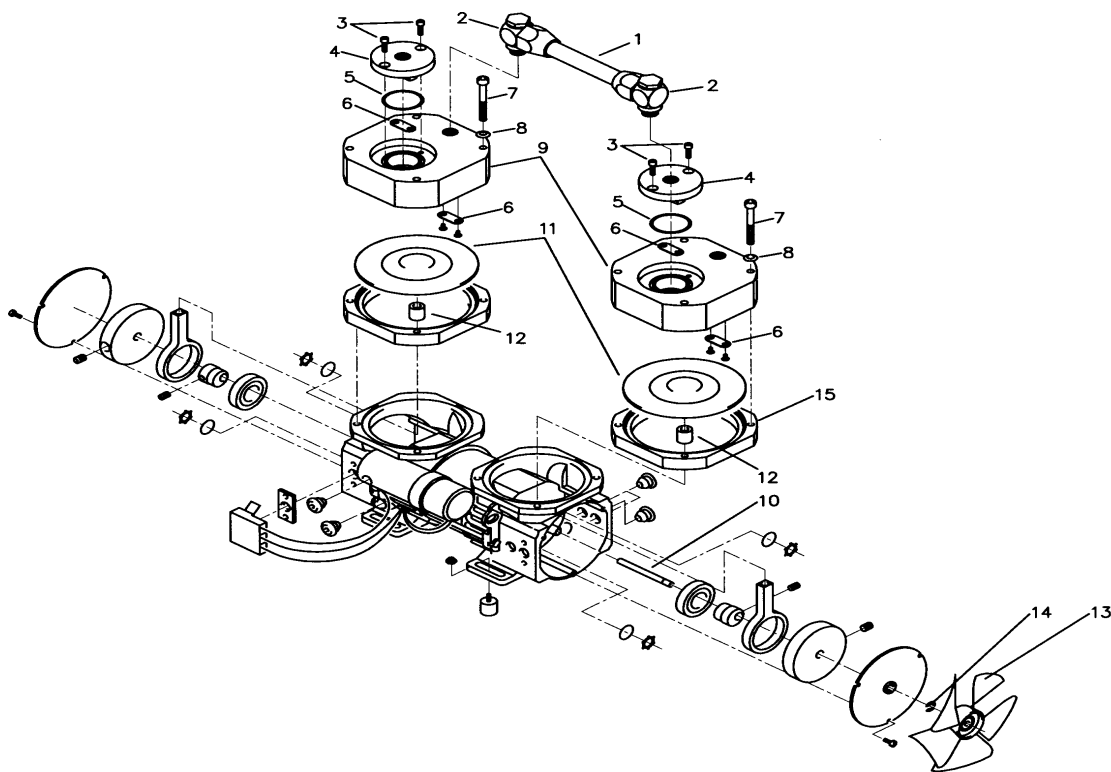
ITEM	QTY	PC.NO.	A*	DESCRIPTION	ITEM	QTY	PC.NO.	A*	DESCRIPTION
1	8	62-0369		Screw M5x65 Socket Head S.S.	23	4	62-0199		Retaining Ring Internal 30 mm
2	48	62-0200		Washer Belleville 10mmx5mm	24	4	66-0171		Felt Washer White
3	2	61-3093		Plate Head 2024	25	8	66-0170		Rubber Stopper
4	2	66-0167	1	O-Ring 10.5mm 3.0mm C/S	27	1	61-3124		Extension Shaft
5	1	61-3062		Tube Connection Dry Pump	28	1	66-0162		Pad Rubber
6	1	61-3522		Pump Head Exhaust PTFE	29	1	61-3091		Plate Alum. Motor End
7	1	61-3521		Pump Head Intake PTFE	30*	1	61-3280		Motor, 115V/ 60Hz (2024B-01)
8	4	66-0166	2	O-Ring #021 FEP/VITON	30*	1	61-3775		Motor, 230V/ 50Hz (2024C-02)
9	4	61-3061	2	Valve 8011	30*	1	61-3375		Motor, 100V/ 50/60Hz(2024C-05)
10	2	61-3479		Diaphragm Chamber PTFE	31	1	61-3102		Shim Diaphragm
11	2	61-3059	1	PTFE Diaphragm 2024	32	2	61-0202		Pin, Dowel
12	2	61-3275		Plate Head Base Plastic	33	4	61-3070		Rubber Foot, M4 Thread
14	1	66-0181		Fan (Lifter)	34	4	62-0218		Hex Nut, Crown M4 Brass
15	6	62-0195		Screw 2.9x1x6.5mm Pan Head	00*	1	61-3381		Cord Ass'y, 115V 60Hz (2024B-01)
16	1	62-0198		Retaining Ring Ext. 7/32 Shaft	00*	1	61-3382		Cord Ass'y, 230V 50Hz (2024C-02)
17	1	61-3092		Plate Alum. Shaft End	00*	1	61-3383		Cord Ass'y, 100V 50/60Hz (2024C-05)
18	2	62-0190		Screw Set M6 x 8 mm Socket Hd			1-99-5126	1	Loctite Sealant
19	2	61-3116		Momentum Weight					
20*	2	61-3464		Connecting Rod Ass'y					
20*	2	61-3789		Connecting Rod Ass'y (2024C-02)					

A\*: REPAIR KIT CAT # 2025K-01.

\*: Depending on the model

00: Items not shown but included with replacement pump.

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Rev. 10-1/2004



## Model 8111

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### PARTS LIST FOR 8111

ITEM	QTY	PC. NO.	A*	DESCRIPTION
01	2	61-3403		Tube
02	1	61-3392		Tube Fitting
03	4	61-3393		Screw
04	2	61-3394		Valve Plate
05	2	61-3395		O-Ring
06	4	61-3396		Valve
07	8	61-3397		Screw
08	8	61-3398		Washer
09	2	61-3400		Pump Head
10	1	61-3124		Shaft
11	2	61-3401		Diaphragm 8111
12	2	61-3402		Shim, Diaphragm
13	1	66-0181		Fan
14	1	62-0198		Retaining Clip
15	2	—		Transition Plate

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### Notes:

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**WELCH RIETSCHLE THOMAS**  
**Vacuum Pump Repair Facility**

7301 N. Central Ave.  
Skokie, IL 60077  
Phone: (847) 676-8800 Ext. 1  
Fax: (847) 677-8806

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**For**  
**DRY VACUUM PUMPS**  
**MODELS 2016, 2024, & 8111**  
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