

# ULTRAVAC<sup>®</sup> 2100

Vacuum Chamber Packaging Machine



## UltraSource<sup>®</sup>

### Owner's Manual



Effective Serial 5512+

860804 • Revision AE • 02/19

THE NEW STANDARD FOR INNOVATION



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# ULTRASOURCE LLC

## Ultravac<sup>®</sup> 2100

### Vacuum Chamber Packaging Machine Owner's Manual

Congratulations on your Ultravac<sup>®</sup> 2100 vacuum packaging machine purchase. This machine was designed to provide years of trouble-free operation and to help in the packaging of your quality food products.

Please read this owner's manual to gain the maximum benefits of your vacuum packaging machine and its different components.

**A note about cleaning:** Given all the various ways equipment is used in different environments, we recommend the owner consult sanitation experts on how to properly clean each piece of machinery in their plant and to do bacterial testing to insure that the equipment is cleaned properly.

#### **For Sales, Call:**

Phone (816) 753-2150 • Fax (816) 753-4976  
Toll-Free (800) 777-5624

#### **For Replacement Parts, Call:**

Phone (816) 753-2150 • Fax (816) 561-2854  
Toll-Free (800) 777-5624

#### **For Technical Support, Call:**

Phone (816) 753-2150 • Fax (816) 753-4976  
Toll-Free (800) 777-5624

## General

This owner's manual contains information pertinent to your Ultravac<sup>®</sup> 2100. Basic instructions and maintenance information is provided. Please read carefully. Failure to do so could result in bodily injury and/or damage to the equipment.

**Receiving Problems:** As in all cases, before signing the bill of lading, be sure all items have been received as listed and there is no damage in shipment. If needed, a claim must be made immediately to the local truck line office and noted on the bill of lading.

Please fill in the information from the bill of lading and the product identification tag.

Model No. \_\_\_\_\_

Serial No. \_\_\_\_\_

Ship Date: \_\_\_\_\_

Owner: \_\_\_\_\_

Location: \_\_\_\_\_

Electrical service size for your Ultravac<sup>®</sup> 2100 (check one):

- 208 Volt, 3 phase, 60 Hz
- 230 Volt, 3 phase, 60 Hz
- 230 Volt, Single phase, 60 Hz
- 380 Volt, 3 phase, 50 Hz
- 460 Volt, 3 phase, 60 Hz
- 575 Volt, 3 phase, 60 Hz

Pump horsepower size for your Ultravac<sup>®</sup> 2100 (check one):

- 5-horsepower
- 7.5-horsepower
- 10-horsepower
- 12-horsepower

Please fill in the serial numbers from the pump identification tags:

Serial No. \_\_\_\_\_

## Specifications

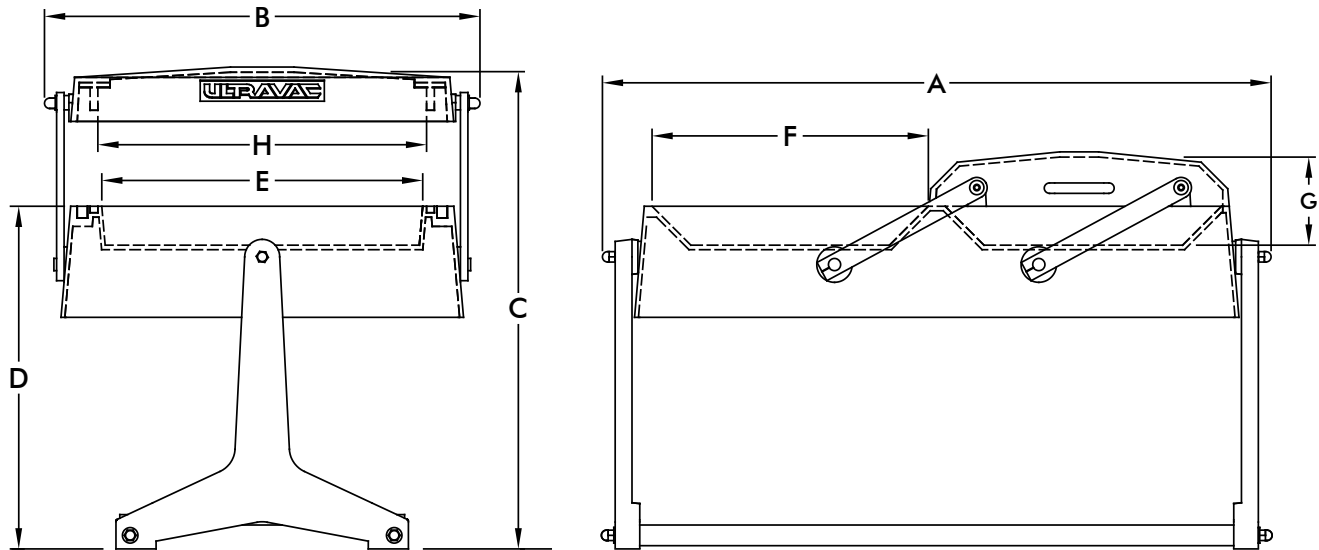


Figure 0.1

	<b>8-in. Model</b>	<b>12-in. Model</b>
Length (A):	1638mm (64.5-in.)	64.5-in. (1638.3mm)
Width (B):	1067mm (42-in.)	1067mm (42-in.)
Maximum Height (C):	1194mm (47-in.)	1295mm (51-in.)
Working Height (D):	874mm (34.4-in.)	874mm (34.4-in.)
Chamber Width (E):	785mm (30.9-in.)	785mm (30.9-in.)
Chamber Length (F):	676mm (26.6-in.)	676mm (26.6-in.)
Chamber Depth (G):	203mm (8-in.)	305mm (12-in.)
Between Seal Bars (H):	813mm (32-in.)	813mm (32-in.)
Seal Bar Length:	673mm (26.5-in.)	673mm (26.5-in.)
Vacuum Pump:	200 m <sup>3</sup> /h, (117 cfm) 5.6 kW (7½ hp) [8-in. Model Only]	
	306 m <sup>3</sup> /h, (180 cfm) 7.5 kW (10 hp)	
	360 m <sup>3</sup> /h, (212 cfm) 8.9 kW (12 hp)	
Cycle Time:	15-25 seconds	15-25 seconds
Net Weight:	500kg (1104-lbs.)	559kg (1232-lbs.)
Construction:	USDA Acceptable for use in federally-inspected meat/poultry plants	
	ETL-approved	
	Cast Aluminum	

# SAFETY

## Personal Safety

The procedures and guidelines herein must be followed precisely to avoid problems that can result in property damage, personal injury, or death. If you have any questions related to this information, please contact Ultravac Services Inc. at (800) 777-5624.

**⚠ DANGER** Hazardous voltage.

Disconnect and lockout power before servicing machine or cleaning. Do not remove panels unless power has been disconnected and locked out at risk of electric shock hazard.

**⚠ DANGER** Hot oil.

Hot oil poses scalding risk. Take necessary precautions while draining warm oil.

**⚠ WARNING**

Read and understand owner's manual before using this machine. Failure to follow operating instructions could result in personal injury or damage to equipment.

**⚠ WARNING** Explosion hazard.

Do not use a gas with an oxygen content greater than 22% with gas flush option.

**⚠ CAUTION** Blade hazard.

Do not remove, install, or replace blades without protective gloves. Perforating knife blade is sharp. Use care when handling.

**⚠ CAUTION** Blade hazard.

Do not remove, install, or replace blades without protective gloves. Precut knife blade is sharp. Use care when handling.

**⚠ CAUTION** Cleaning agents.

Do not get the cleaning agents in eyes, on skin, or on clothing. Always wear rubber gloves, goggles, and protective clothing when contact is likely. Consult product manufacturer for specific details.

Signal words used in classification of potential hazards are defined as follows:

**DANGER:** Indicates an imminently hazardous situation, which, if not avoided, may result in death or serious injury.

**WARNING:** Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

**CAUTION:** Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. Caution also indicates actions that may cause property damage.

## Food Safety

### Food Packaging

While this machine is often used for food packaging and vacuum cooking, there are inherent risks associated with this packaging technique that could cause serious illness or death to the consumer of the food product. If you are using this machine for a food application, you must consult with a reputable food technologist or specialist in vacuum/modified atmosphere packaging (M.A.P.) to review the safety of your application.

### Gas Flush

In order to ensure proper shelf life of the food product packaged in this machine, you must contact a reputable food technologist or specialist in vacuum/modified atmosphere packaging (M.A.P.) to review and develop the appropriate gas mixture for your package, and you must perform quality control and gas analysis on your finished M.A.P. packages.

## General Safety Guidelines

**Obvious safety guidelines should be observed.**

- Use a certified electrician to install permanent electrical connection for your packaging machine. Failure to do so may result in death or serious injury and/or permanent damage to the machine.
- Be sure to turn off power to your packaging machine before any maintenance work is performed.
- Disconnect and lockout power to your packaging machine before any maintenance work is performed.
- Place machine on a flat, stable surface.
- Do not place tools, parts, or other objects on or inside machine while operating.



## Safety Decal Locations

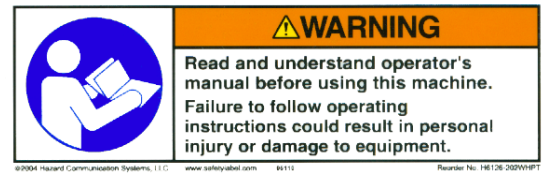
Part # 861196 Qty. 1  
(attached to power cord)



Part # 835440 (Qty. 2)



Part # 860988 (Qty. 1)



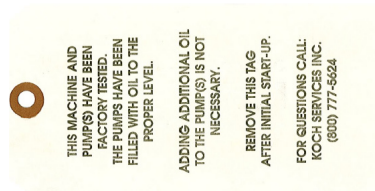
Part # 860360 Qty. 1  
(attached to power cord)



Part # 889599 (Qty. 1)



Factory Tested / Oil Filled  
(Hanging Tag)



## Machine Conformity

This machine has been manufactured to conform to the following safety standards:

### **UL 73, Motor Operated Appliances, USA**

The Ultravac 2100 is manufactured to conform to the relevant provisions of ANSI/UL-73, Tenth Edition dated 03/2011, Revised 01/2012.

### **CSA 22.2, No. 68, Motor Operated Appliances, Canada**

The Ultravac 2100 is manufactured to conform to the relevant provisions of CSA C22.2 No. 68-09, Seventh Edition, Update #2 dated 09/2010.

### **CE Low Voltage Directive (LVD) 2006/95/EC**

The Ultravac 2100 is manufactured to conform to the relevant provisions of

- EN 60335-1-2012 relating to "Safety of household and similar electrical appliances,"
- EN 60335-2-64:2000 relating to "Particular requirements for commercial electric kitchen machines."

and overall the provisions of Low Voltage Directive (LVD) 2006/95/EC relating to "Equipment designed for use within certain voltage limits of 12 December 2006."

### **CE Electromagnetic Compatibility (EMC) Directive 89/336/EEC**

The Ultravac 2100 is manufactured to conform to the relevant provisions of

- EN 61000-6-4 relating to "Emissions, Radiated, 30Mhz - 1Ghz"
- EN 61000-6-2 relating to "Emissions, Conducted, 150kHz - 30Mhz"
- EN 61000-4-2 relating to "Immunity ESD  $\pm$  4kV Contact/  $\pm$ 8kV air discharge "
- EN 61000-4-3 relating to "Immunity Radiated RF, 10V/m, 80Mhz - 2.7Ghz"
- EN 61000-4-4 relating to "Immunity EFT (Mains)  $\pm$ 1kV"
- EN 61000-4-5 relating to "Immunity Surge AC,  $\pm$ 2kV"
- EN 61000-4-6 relating to "Immunity Conducted RF (Mains), 10Vrms."

and overall the provisions of "Electromagnetic Compatibility (EMC) Directive 89/336/EEC of 15 December 2004."

### **USDA / AMI Sanitary Design Standards**

The Ultravac 2100 is designed for sanitary conditions in USDA inspected facilities. All UltraSource equipment is manufactured with respect to AMI Sanitary Design Standards. All materials that are in food contact areas meet relevant USDA standards.

The Design and Technical Construction files for this machine are maintained at:

**UltraSource LLC**  
**1414 West 29th Street**  
**Kansas City, MO 64108-3604 USA**



# STARTUP

## Unpacking

1. Carefully remove crate from the skid.
2. Remove machine from skid.
3. Wipe down outside of the machine.

## Power Requirements

The machine is available with a 7½ horsepower vacuum pump for the 200mm (8-in.) model and a 10 horsepower vacuum pump for the 300mm (12-in.) model. The standard machine is rated 220 volt, 60 Hertz, 3 phase and is supplied with a 30 amp, 250 volt, 3 phase plug.

The owner must supply the correct 3 phase or single phase power source in accordance with the National Electric Code. The table below is based on the National Electric Code and is to be used as a guide in wire size selection and short circuit protection. The requirements noted in the table may change. Please consult an electrician prior to installation.

UV2100 POWER CABLE SIZING CHART	
208/230v (5&7.5hp Pumps)	10 gauge/ 4 conductor
380v	12 gauge/ 5 conductor
460v	10 gauge/ 4 conductor
208/230v (10&12hp Pumps)	8 gauge/ 4 conductor
380v w/o neutral	12 gauge/ 4 conductor

Customer Voltage	Pump Motor Full Load Amps				<u>Supply conductor shall have an ampacity not less than 125% of the Pump Motor Full Load Amps</u>
	5 HP	7.5 HP	10 HP	12 HP	
208, 60 Hz 3 Phase		21	26.5	32	
230, 60 Hz 3 Phase		20.5	26	30	
380, 50 Hz 3 Phase		12	14	15	
460, 60 Hz 3 Phase		10.5	13	15	
575, 60 Hz 3 Phase		9	10.5	12.5	
230, 60 Hz Single Phase	22.5	-	-	-	

Customer Voltage	Inverse Time Circuit Breaker				Fused Disconnect Dual Element (Time Delay)			
	5 HP	7.5 HP	10 HP	12 HP	5 HP	7.5 HP	10 HP	12 HP
208, 60 Hz 3 Phase		50	60	70		35	45	50
230, 60 Hz 3 Phase		50	60	60		35	45	50
380, 50 Hz 3 Phase		25	30	35		20	20	25
460, 60 Hz 3 Phase		25	30	35		15	20	25
575, 60 Hz 3 Phase		20	25	30		15	15	20
230, 60 Hz Single Phase	60	-	-	-	45	-	-	-

## Grounding Instructions

The Ultravac<sup>®</sup> 2100 must be grounded. In the event of malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. The unit is equipped with an equipment-grounding conductor cord and a grounding plug. The plug must be plugged into an appropriate outlet that is properly installed and grounded in accordance with all local codes and ordinances.

**⚠ DANGER** *Hazardous voltage.*

*Improper connection of the equipment-grounding conductor can result in a risk of electric shock.*

The equipment-grounding conductor outer surface is green with or without yellow stripes. If repair or replacement of the cord or plug is necessary, do not connect the equipment-grounding conductor to a live terminal. Check with a qualified electrician or Ultravac Services Inc. technician if the grounding instructions are not completely understood, or if there is doubt as to whether the unit is properly grounded. Do not modify the plug provided with the unit – if it will not fit the outlet; have a proper outlet installed by a qualified electrician.

**⚠ DANGER** OXYGEN ENRICHED USE

ULTRASOURCE TRAY SEALING AND VACUUM CHAMBER MACHINES ARE NOT DESIGNED FOR USE WITH OXYGEN ENRICHED PROCESS GASES. ANY APPLICATION THAT REQUIRES A PROCESS GAS CONTAINING 25% OR MORE OXYGEN SHOULD CONTACT ULTRAVAC SERVICES AT (800) 777-5624 AS RETROFIT OPTIONS ARE REQUIRED.

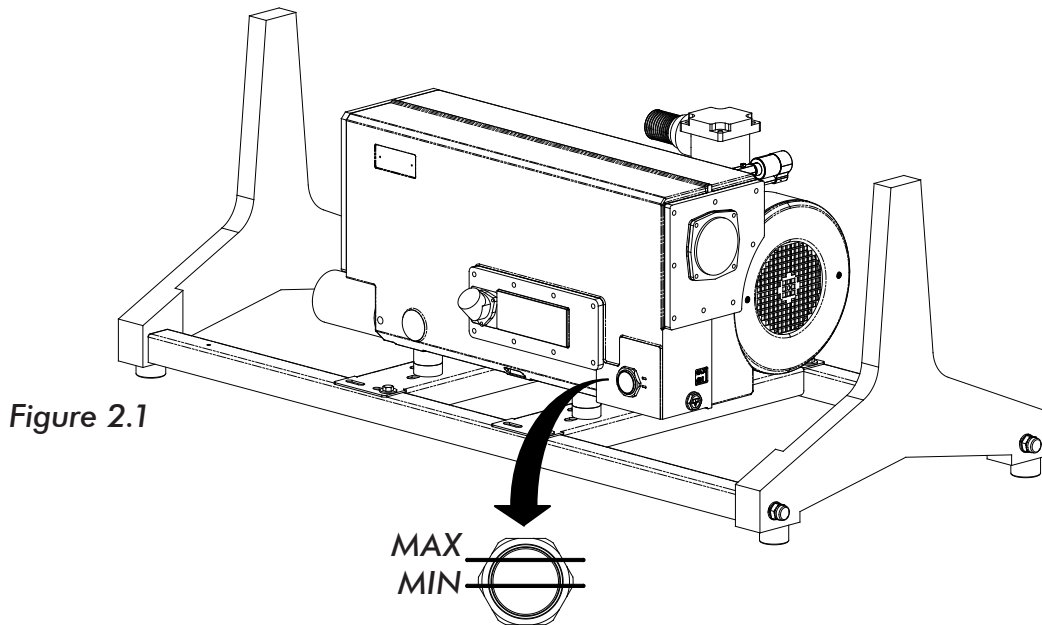
RUNNING THIS MACHINE WITH AN OXYGEN ENRICHED PROCESS GAS, WITHOUT THE NECESSARY RETROFIT KIT COULD CAUSE SEVERE INJURY, DAMAGE OR DEATH.

ULTRASOURCE TRAY SEALING AND VACUUM CHAMBER THAT ARE RETROFITTED WITH THE NECESSARY KIT WILL HAVE A DECAL ABOVE OR BESIDE THE GAS SUPPLY CONNECTION INDICATING THE MACHINE'S READINESS TO RUN OXYGEN ENRICHED PROCESS GASES.

## Vacuum Pump

It is essential to check the oil level daily and to change the oil after every 500 hours of operation. Read the oil level with the machine turned off. Oil may be added until the level reaches the MAX level shown below. Refer to page 4.18 for details on changing the oil.

**NOTE: ALL ULTRAVAC 2100 CHAMBER MACHINES ARE SHIPPED WITH OIL IN THE PUMP. ALTHOUGH THE FACTORY RECOMMENDS CHECKING THE OIL LEVEL PRIOR TO FIRST USE!**



## Checking Vacuum Pump Rotation

**Caution:** Check oil level of pump before starting pump (please refer to pump manual). To check the direction of the pump rotation, briefly engage the “POWER ON” switch and observe the motor fan at the end of the pump. The fan should rotate as indicated by the arrow on the fan cover. To correct the rotation, switch any two phases in the plug.

## Gas Flush Connection

The owner must supply a suitable regulator with a range of 0 to 60 p.s.i. We recommend using food-grade flexible hose with a 1/4-in. I.D. and a maximum length of 15-ft. Maximum regulator pressure is 55 p.s.i.

## Air-Assist Connection

The machine is equipped with a regulator for air-assisted sealing. The hose barb will accept 1/4-in. I.D. hose. The recommended air supply is 75 p.s.i. at 6 c.f.m. The maximum regulator setting is 40 p.s.i.

## Installation of Perforating Knives

**⚠ CAUTION** Blade hazard.

Do not remove, install, or replace blades without protective gloves. Perforating knife blade is sharp. Use care when handling.

Remove standard seal bars. Install perforating bars with the cutting blade facing toward the outside of the lid. The use of air-assist is required for proper operation. The air-assist regulator should be set at 20 to 30 p.s.i., not to exceed 40 p.s.i.

As the backup strip wears, it can be removed and changed end for end for a better surface. The strip may also be turned upside down when one side is worn.

## Installation of Precut Knives

**⚠ CAUTION** Blade hazard.

Do not remove, install, or replace blades without protective gloves. Precut knife blade is sharp. Use care when handling.

Remove standard seal bars. Install precut seal bars with the blade facing toward the outside of the lid. The use of air-assist is required for proper operation. The air-assist regulator should be set at 20 to 30 p.s.i., not to exceed 40 p.s.i.

As the backup strip wears, it can be removed and changed end for end for a better surface. The strip may also be turned upside down when one side is worn.

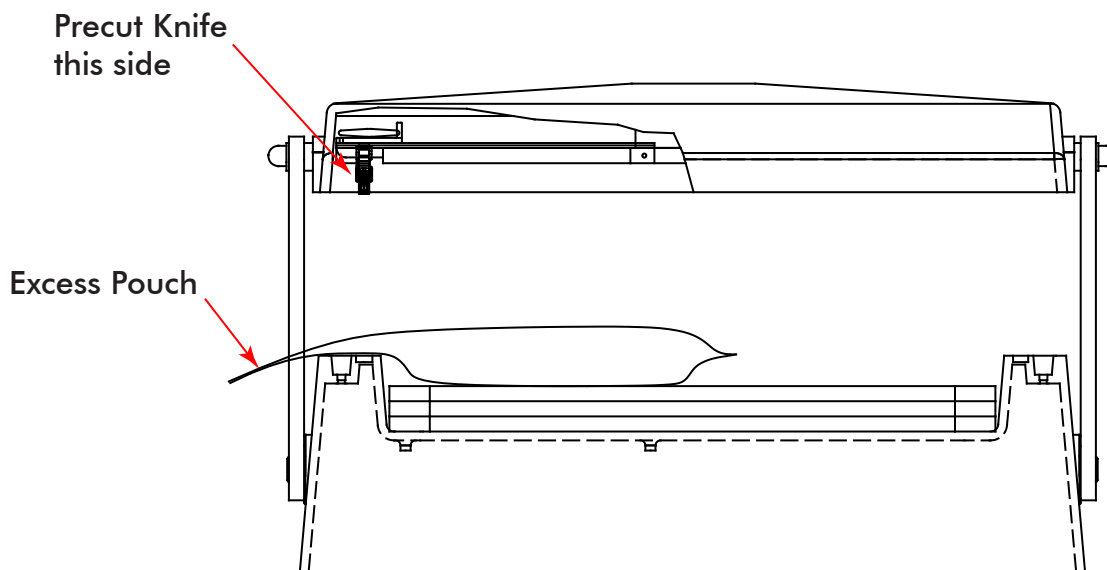


Figure 2.2

# OPERATION

## Placement of Product

For best sealing results, it is important to:

- Check the pump oil level **daily**.
- Select a pouch that fits the product.
- Carefully load the product into the pouch.
- Keep the product and the product residue away from the seal area of the pouch.
- Place the product as far into the pouch as possible.
- Maintain an equal amount of the product above and below the seal bar (see figure below on use of filler plates).
- Lay the pouch flat on the seal area, keeping the pouch free of wrinkles.
- Place the pouch so that the open end is inside the chamber when the lid is closed.

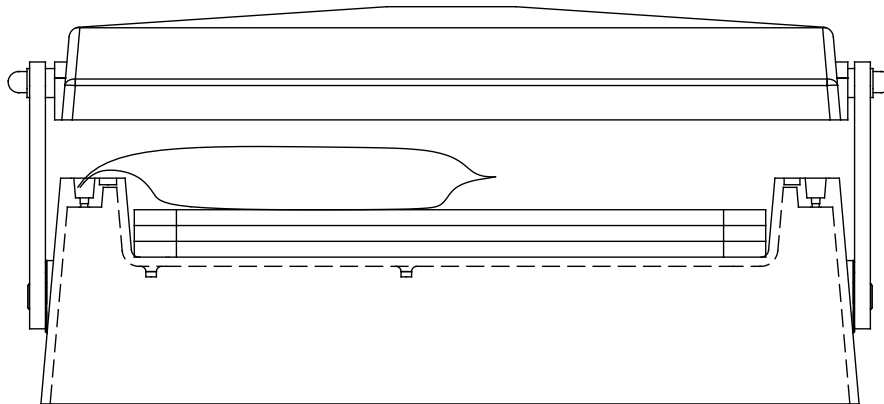


Figure 3.1

Products containing liquid or loose particles can be packaged by slightly loosening the nuts on each end of the machine and tilting the machine to the desired angle. Retighten the nuts to secure the machine.

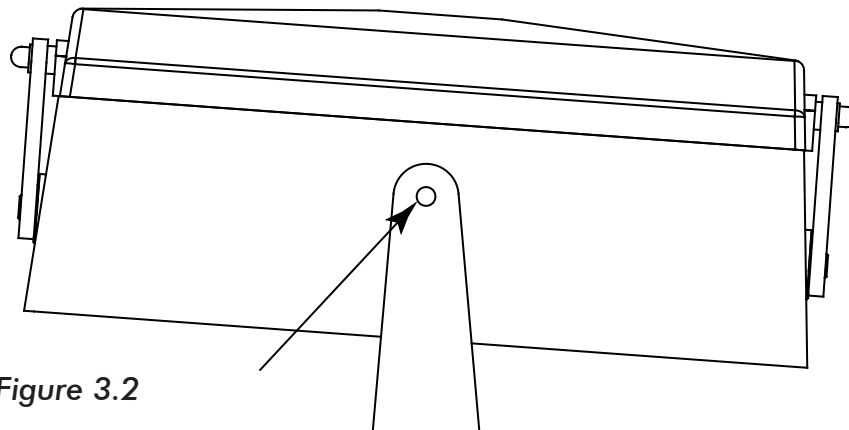


Figure 3.2

## Operation with Digital Control Panel

The digital control panel allows the user more options than the standard control panel. The embedded microprocessor controls each sequence of the packaging operation. Settings for the vacuum, gas, and sealing are entered as parameters through the keypad. This allows the user to custom program every step of the packaging process. The precise vacuum and gas pressures are controlled by a pressure based sensor. The vacuum pressure, gas pressure, and seal time are displayed on a large 16-character LCD backlit readout, which is easily readable in all lighting conditions. As each sequence is performed, the real-time pressure level or cycle time is displayed.

The digital front panel can save up to ten pre-programmed routines, which can be retrieved at any time for specific packaging applications. With the supervisor security feature turned on, these programs cannot be inadvertently changed.

The Vacplus option allows the operator to run the pump from 0 to 20 seconds after the set vacuum level is achieved.

The Gas Flush option allows the operator to introduce an inert gas into the chamber after the vacuum stage. This option can be used as a filler to prevent crushing of the product after sealing, as a means to prolong shelf life, or as a means to maintain desirable product appearance.

The digital front panel has an auto stop, which will automatically seal if the preset vacuum is not reached. This feature decreases the cycle time and optimizes the vacuum level of each product.

The digital front panel, which includes the keypad, illuminated display, and microprocessor, use sealed components and is conformal coated in a moisture-proof coating. The digital front panel meets or exceeds the requirements of NEMA 4. The front of the digital display is sealed and flush for easy cleaning.

The digital control has both pulsed vacuum and pulsed venting options for fragile product.

The digital control has a maintenance screen for testing valves and a special loop option for multiple vacuum/gas cycles before sealing.

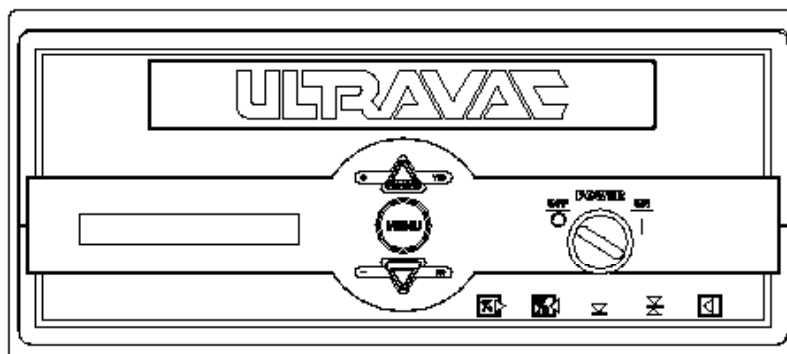
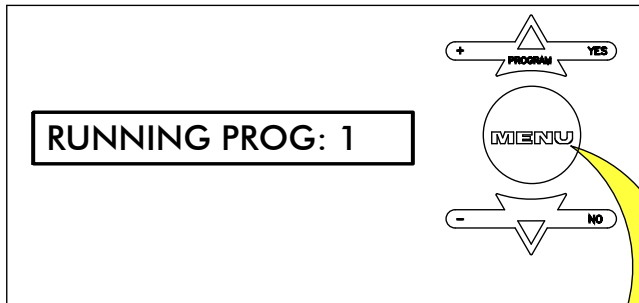


Figure 3.4

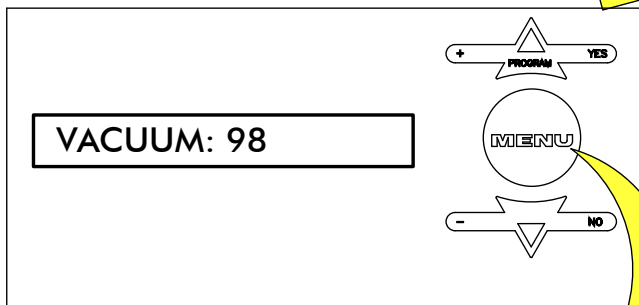


## Operator Menu on Digital Panel

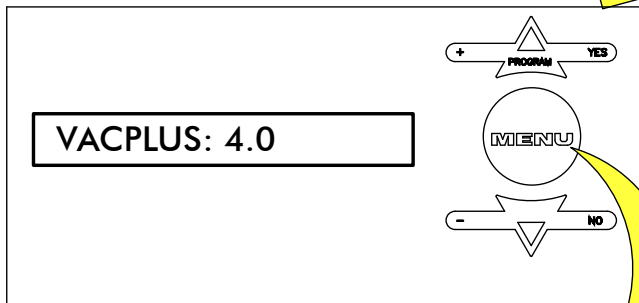
**NOTE:** if the supervisor has set security on, these settings cannot be changed.



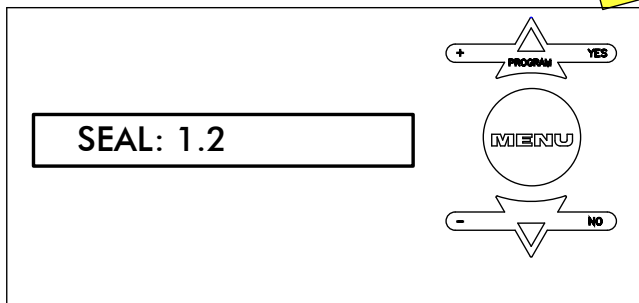
This is the Main Menu screen. When the machine starts up, the last program that was run will be the current program shown in the window. To set the operating parameters for the program shown press the MENU Key.



VACUUM is set to % vacuum using the UP and DOWN arrow keys. The range is 30% to 99%. Press the MENU Key.



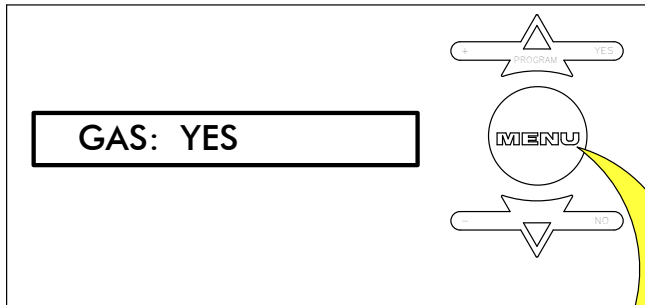
VACPLUS may be set greater than zero to allow the pump to continue evacuating the chamber (for the specified number of seconds) after the pressure in the chamber has reached the % vacuum set in the vacuum menu. The range is 0 to 20 seconds. Press the MENU Key.



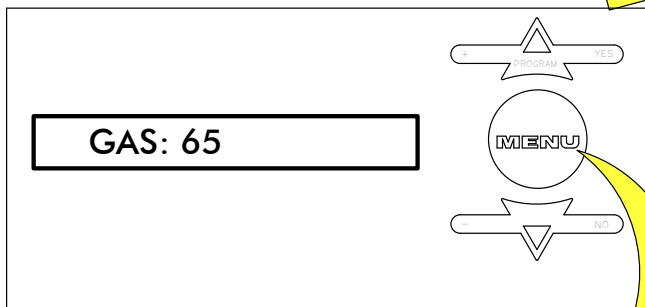
The SEAL setting is in seconds. Use the UP and DOWN arrow keys to change the seal time. The range is 0 to 2 seconds. Press the MENU Key.

Figure 3.5

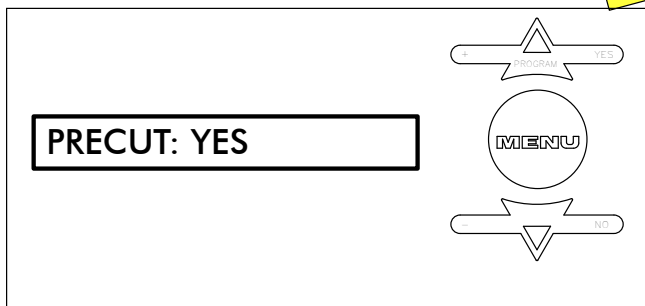
## Operator Menu on Digital Panel (continued)



If the machine is equipped with the gas option, it can be turned ON or OFF by pressing the UP or DOWN arrow keys. Press the MENU Key.



GAS is set to % gas using the UP and DOWN arrow keys. This value also corresponds to the vacuum reading inside the chamber. It is recommended to use Pulse Vent when gas flushing to a low % vacuum. The range is 98% to 30%. Press the MENU Key.



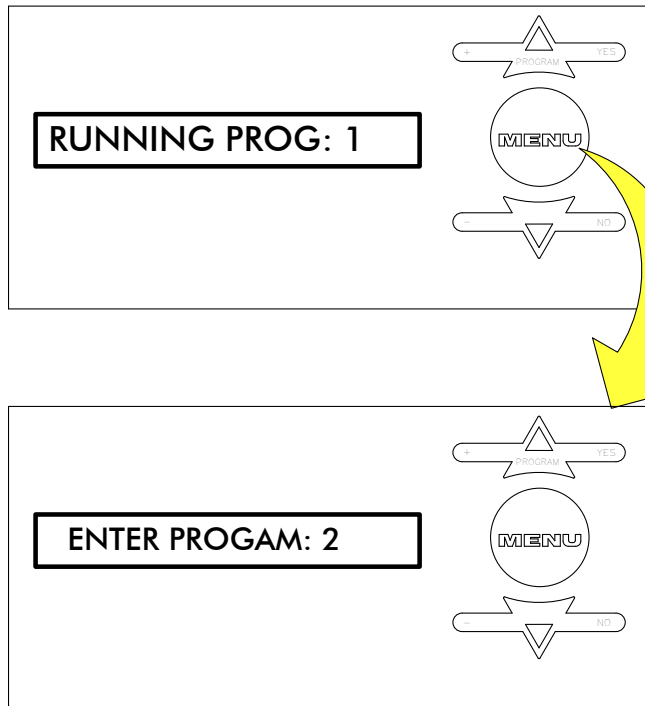
If the machine is equipped with the PRECUT option, it can be turned ON or OFF by pressing the UP or DOWN arrow keys. Press the MENU Key.

Figure 3.5

**⚠ WARNING** Explosion hazard.

Do not use a gas with an oxygen content greater than 22% with gas flush option.

## Selecting a New Program



From the Main Menu, use the UP and DOWN arrow keys to select a new program.

Press the UP arrow to switch to Program 2 (or any of the 10 programs).

New parameters may be set for Vacuum, Seal Time, and Gas for Program 2 (following the procedures described in the previous example) or simply close the lid on the machine and run Program 2.

Figure 3.6

## Operation with Touch Screen

The touch screen control panel allows the user more options than the digital control panel. The embedded microprocessor controls each sequence of the packaging operation. Settings for the vacuum, gas, and sealing are entered as parameters through the keypad. This allows the user to custom program every step of the packaging process. The precise vacuum and gas pressures are controlled by a pressure based sensor. The vacuum pressure, gas pressure, and seal time are displayed on a large 4.3" LCD touch screen, which can be read easily in all lighting conditions. As each sequence is performed, the real-time pressure level or cycle time is displayed.

The touch screen panel can save up to 99 pre-programmed routines, which can be retrieved at any time for specific packaging applications. [With the supervisor security feature turned on, these programs cannot be inadvertently changed.]

The VACPLUS option allows the operator to run the pump from .1 to 6 seconds after the set vacuum level is achieved.

The Gas Flush option allows the operator to introduce an inert gas into the chamber after the vacuum stage. This option can be used as a filler to prevent crushing of the product after sealing, as a means to prolong shelf life or as a means to maintain desirable product appearance.

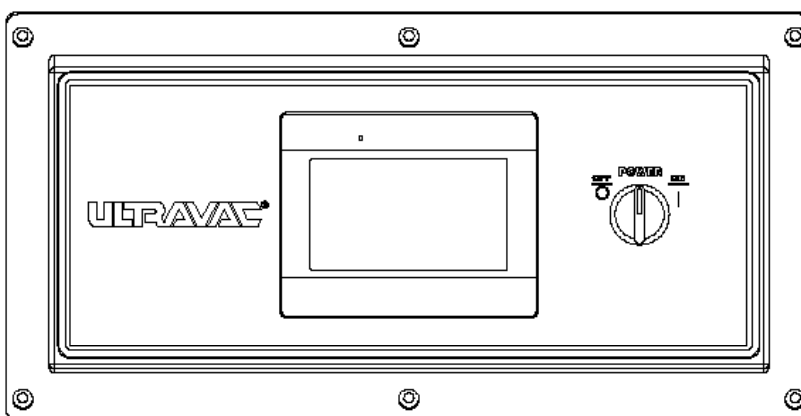
The touch screen panel has an auto stop, which will automatically seal if the preset vacuum is not reached. This feature decreases the cycle time and optimizes the vacuum level of each product.

The touch screen panel meets or exceeds the requirements of NEMA 4. The front of the touch screen is sealed and flush mounted for easy cleaning.

The touch screen has both pulsed vacuum and pulsed venting options for fragile product.

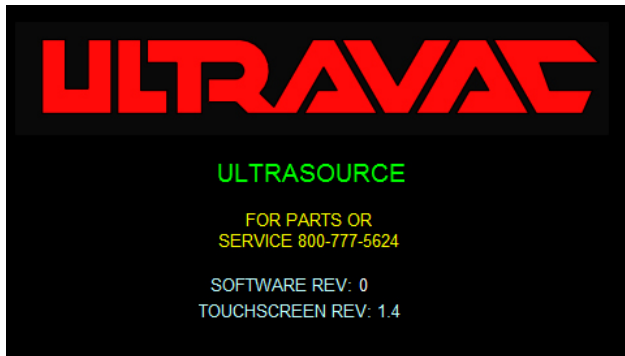
The touch screen has a maintenance screen for testing valves and a special loop option for multiple vacuum/gas cycles before sealing.

Figure 3.4

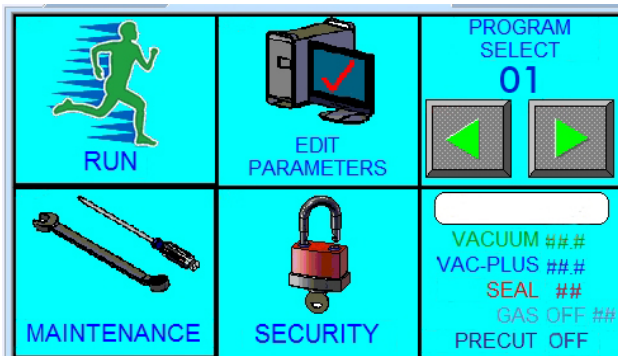


## Operation with Touch Screen (continued)

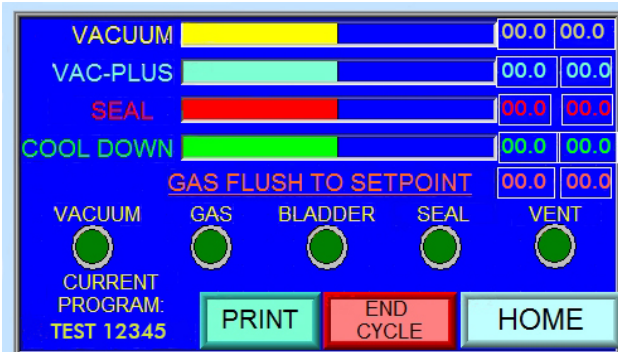
**NOTE:** If the supervisor has set security on, program settings cannot be changed.



This is the splash screen. When the machine starts up, this screen will display for a period of time during bootup. Once the bootup sequence has been completed, the screen will automatically change to the Main Menu.



This is the Main Menu. This screen allows access to all of the other functions of the machine. A program can be selected from this menu, and run from this menu. Maintenance, Security, and Program Parameters can also be edited from this menu if the correct level of access is used.

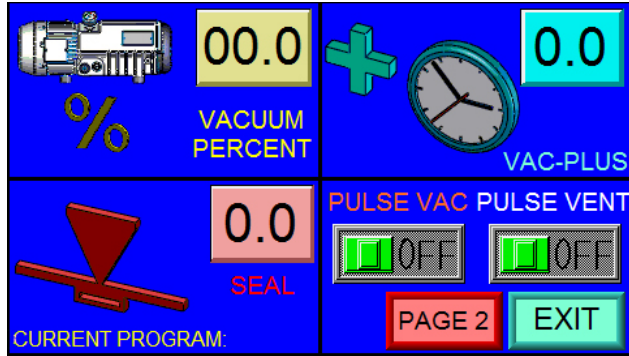


This is the RUN Screen. This screen shows the status of the program that is currently being run, as well as the name of that program.

## Operation with Touch Screen (continued)

**NOTE:** If the supervisor has set security on, program settings cannot be changed.

Some options may not apply to every machine.



This is the Edit Parameters screen. Every program consists of multiple parameters. These parameters are defined on the Edit Parameters screen for each saved program.

### VACUUM PERCENT:

This defines the percentage of vacuum to achieve prior to sealing. The range is up to 99%.

### VAC-PLUS:

This may be set from 0.1 to 6 seconds. A setting greater than 0 allows the pump to continue evacuating the chamber (for the specified number of seconds) after the pressure in the chamber has reached the % vacuum set in the vacuum menu.

### SEAL TIME:

The seal time setting is in seconds. The range is 0 to 3 seconds.

### PULSE VAC:

Pulse Vac allows for a more controlled vacuuming process. Rather than simply opening the vacuum valve for a continuous vacuum, the valve is opened and closed repeatedly until the chamber reaches the set "Pulse Vac" vacuum level as defined in the "Maintenance" screen.

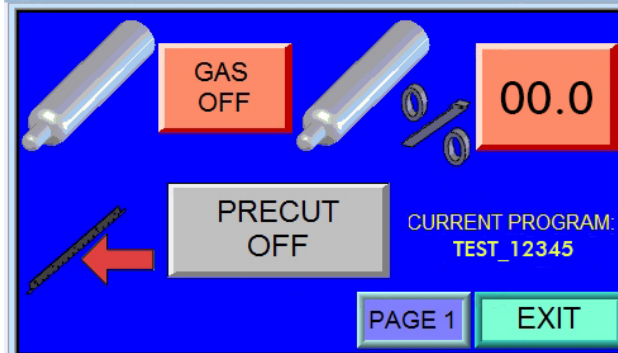
### PULSE VENT:

Pulse Vent allows for a more controlled venting process. Rather than simply opening up the valve for a continuous vent the valve is opened and closed repeatedly until the chamber vents back to the "Pulse Vent" pressure setting as defined in the "Maintenance" screen.

## Operation with Touch Screen (continued)

**NOTE:** If the supervisor has set security on, program settings cannot be changed.

Some options may not apply to every machine.



### GAS OFF:

The Gas state button tells whether Gas Flushing is turned on or off. Enable Gas by turning this button to the ON position.

### GAS %:

Gas is set to % gas by pressing the value button on the touch screen and directly editing the value using the provided keypad. This value also corresponds to the vacuum reading inside the chamber. It is recommended to use pulse vent when gas flushing to a low % vacuum. The range is 0.1% to 99%.

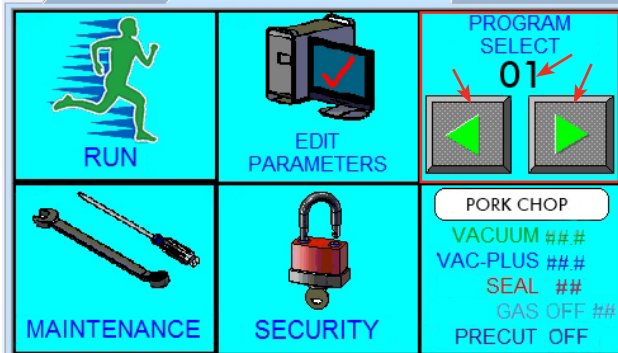
### PRECUT OFF:

If equipped, This activates or deactivates the Precut knife option

## Operation with Touch Screen (continued)

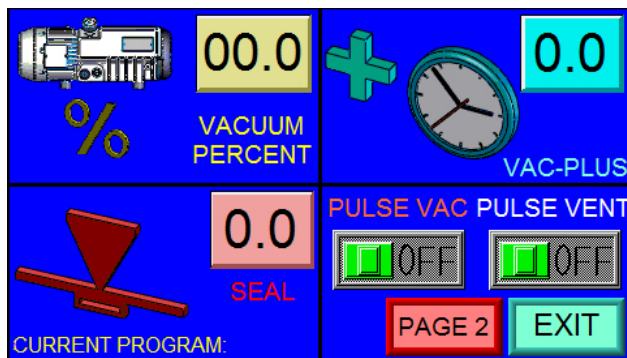
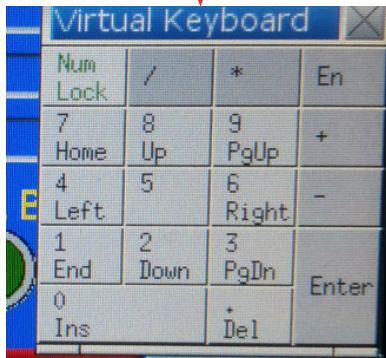
**NOTE:** If the supervisor has set security on, program settings cannot be changed.

Some options may not apply to every machine.



Program selection:

The Program Select feature has 99 different user definable presets. To set a program number, use the left and right arrows, or press on the program select number to bring up a keypad for number selection.. Once the program number you desire has been selected, press on the White box to pull up the keyboard screen, enter a name for your program (up to 10 characters) and press enter. You will be returned to the main menu.



Press Edit Parameters. From the Edit Parameters screen, enter the desired settings for your product requirements. When finished, press Exit. Your parameters are now saved to the program number you selected.



## Sealing with Air-Assist

All machines are equipped with regulators for air-assisted sealing. Set the air pressure regulator to 20 p.s.i. increasing to a maximum of 40 p.s.i. While a good seal can be obtained without air-assist, use air-assist when:

- Gas back-flushing above average pressure.
- Using shrink pouches.
- Packaging a product that easily contaminates the seal area of the pouch.
- Trying to overlap pouches.
- Wrinkles cannot be avoided in the seal area.
- Using the Double Seam Seal option.
- Always use air-assist when using the Perforating Knife Option.
- Always use air-assist when using the Precut Option.
- Always use air-assist when using the 10mm Wide Seal Band Option

## Gas Flush Option

Gas flushing is the introduction of an inert gas into the chamber after the vacuum stage is finished. Gas can be used as a filler to prevent crushing of the product after sealing, as a means to prolong shelf life, or as a means to maintain desirable product appearance. Commonly used gasses include nitrogen, carbon dioxide, or a mixture of both. Consult your local gas supplier to select the proper gas for your product.

**⚠ WARNING** Explosion hazard.

Do not use a gas with an oxygen content greater than 22% with gas flush option.

## Double Seam Seal Option

All machines are equipped with standard seal bars having a single seal element per seal bar. The Double Seam seal bars have two seal elements per seal bar. We strongly recommend using air-assisted sealing with this option to achieve best results.

## 10mm Wide Seam Seal Option

All machines are equipped with standard seal bars having a single seal element per seal bar. The 10mm Wide Seam seal bars have a wide seal element. It is required to use air-assisted sealing with this option to achieve best results.

## Perforating Knife Option

Perforating knives are used to facilitate the removal of excess pouch material. Perforating knives are not intended to cut pouches off completely, only to perforate so that excess material can be easily removed by hand.

## Precut Option

The precut option is a patented system designed by UltraSource to increase the versatility of the Ultravac<sup>®</sup> 2100. This option increases the speed in which this machine can be loaded with product. The user simply places the pouch full of product into the machine and pulls it close to the seal bar allowing the excess material to hang on the outside of the machine. Not only does this increase the loading speed, but it also improves the appearance of the final product. The precut option also allows the end user to stock fewer sizes of pouches because excess pouch material is trimmed away.

When using this option, the bag or pouch containing product is placed inside the machine as usual. However, rather than having to carefully tuck the bag inside the slot in the machine before closing the lid, the open end of the bag is placed outside the machine by simply draping the bag over the side of the machine. When the lid is closed, the seal bar is brought down and the special precut blade cuts evacuation slits in the bag or pouch, which allow the air inside the bag to escape during the normal evacuation process.

Start by making sure the Precut menu is set to the "ON" position. With precut, air-assisted sealing is required. Place the bag containing product inside the chamber. Drape the open end of the bag over the side of the machine and close the lid. When the evacuation process is finished, the bag will have "slits" pierced in it by the precut knife. The slits allow the air to be evacuated from the bag. The slits also facilitate the removal of excess bag material after the completion of the cycle.

# MAINTENANCE

## Prior to Cleaning

Every environment and application is different; therefore, UltraSource LLC cannot provide cleaning instructions to guarantee microbiological sanitation. UltraSource requests that the owner of this machine consult with sanitation experts to review the unit working in their particular environment to develop a robust cleaning schedule and methodology, followed by bacterial testing to ensure satisfactory cleaning procedures are followed.

## Cleaning Recommendations

Before cleaning the machine, turn power off; disconnect the main power, and lockout the connection.

**⚠ DANGER** *Hazardous voltage.*

*Disconnect and lockout power before servicing machine or cleaning. Do not remove panels unless power has been disconnected and locked out at risk of electric shock hazard.*

Check with the detergent and sanitizer manufacturers that their products are compatible with the listed materials.

**⚠ CAUTION** *Cleaning agents.*

*Do not get the cleaning agents in eyes, on skin, or on clothing. Always wear rubber gloves, goggles, and protective clothing when contact is likely. Consult product manufacturer for specific details.*

Never hose down the machine. Damage caused by hosing or high pressure washing is not covered under warranty.

1. **Filler Plates:** Remove filler plates. The filler plates are made from polyethylene. Clean, sanitize, and dry. High pressure water spray can be used on the filler plates.
2. **Lid, Chamber, and Base:** These components are made of aluminum. Clean the lid, chamber, base, and silicone seal backup strip with a non-ionic cleaning solution such as Crystal Simple Green.
3. **Seal Bars:** Remove the seal bars. The seal bars are made of phenolic. Clean, sanitize, and dry. Also clean under the seal bar bladder in the lid, which is not removable.
4. Clean under the machine.
5. Reinstall the seal bars.
6. Use bacteriological testing to insure cleaning process.

**⚠ WARNING** *Electrical Supply Cord.*

*The supply cord must be replaced by an Ultravac Services Service Technician or similarly qualified person in order to avoid hazard.*

## Vacuum Pump Maintenance

Consult the pump manufacturer's manual provided with the machine for detailed information.

## Seal Bar Maintenance

The following illustrations show replacement of the seal elements for the seal bars.

### Step 1.

Remove the seal bars from the machine. Pull off the Teflon® tape strip and discard. Clean off any remaining Teflon® tape adhesive using acetone or an equivalent solvent.

Teflon® tape.

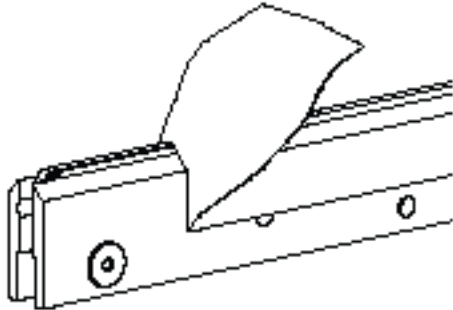


Figure 4.1

### Step 2.

Using a 2mm Allen wrench, loosen the set screws for the cut-off wire and the seal element on both ends of the seal bar and discard.

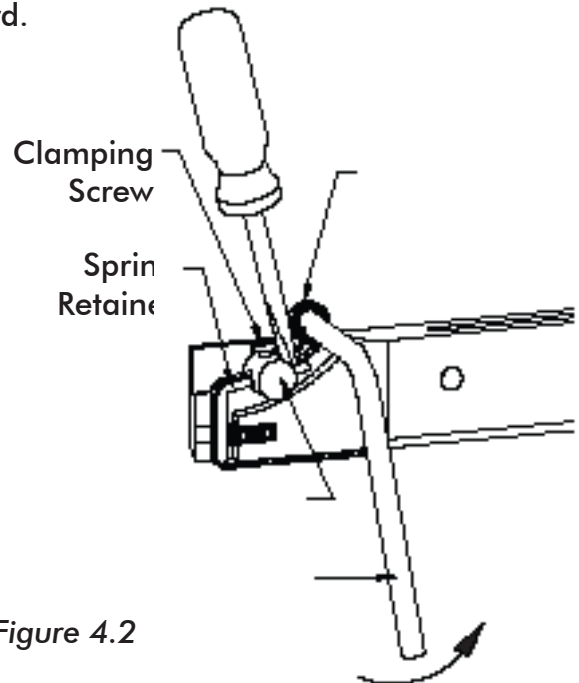
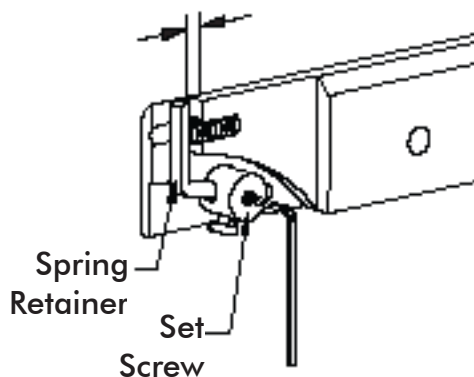


Figure 4.2

### Step 3.

If you are replacing the L-shaped spring retainer and the spring at this time, loosen the set screw and remove the old spring retainer and spring and install the new ones. Adjust the spring retainer to allow a 1/8-in. gap between the spring retainer and the seal bar. This will allow the seal element to remain under tension after tightening the seal element.



4.3

## Seal Bar Maintenance (continued)

### Step 4.

Insert the new seal element through the hole in the brass contact. Leave about 3/4-in. of excess seal element extending past the brass contact and tighten the clamping screw. Insert the other end of the element through brass contact on the opposite end of the seal bar. Place a slotted tip screwdriver on top of the seal element and against the brass contact where the seal element exits. Using the tightening tool provided (or needle nose pliers), tighten the seal element as shown.

### Step 5.

While maintaining tension on the tightening tool, use the slotted tip screwdriver to tighten the clamping screw.

**NOTE:** A 1.5mm Allen wrench will be needed to tighten the clamping screws on a Double Seam seal bar.

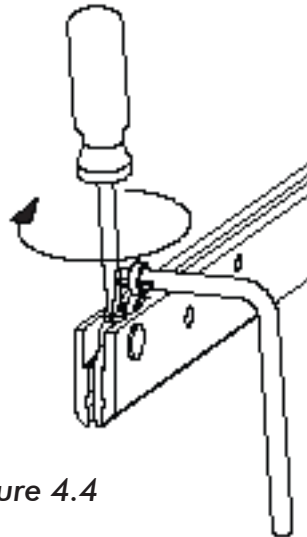


Figure 4.4

### Step 6.

Check the tension of the seal element by pulling it up at the middle of the bar. The seal element should not pull beyond 3/16-in. of the seal bar. If there is not enough tension, tighten as necessary. Elements may break in the middle of the bar if tension is not set properly. Install the new Teflon® tape strip over the bar.

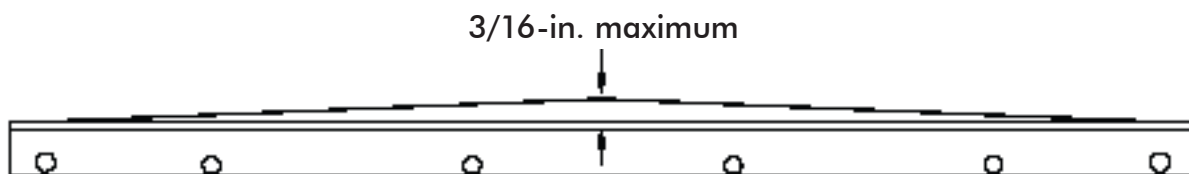







Figure 4.5

## Reading the Indicators

All machines are controlled by an analog control module (with knobs) or a digital control module (with touch pad) designed to aid in troubleshooting. The analog control module, mounted behind the front control panel, has five red indicator lights (LEDs) mounted to it. To view the indicator lights on the analog control module during operation remove the six screws on the front of the control panel and pull the control panel out. The digital panel has indicator lights mounted on the front below the ON/OFF switch. The indicator lights correspond to the operating devices and should turn on and off in the following sequence when the machine lid is closed:

1.  Vacuum Valve [SOL-1]
2.  Gas Flush Valve [SOL-2] (Optional)
3.  Seal Bladder Valve [SOL-3]  
(Stays on until completion of cycle)
4.  Seal Impulse Contractor [C-2]
5.  Ventilation Valve [SOL-4]

The device should be operating when the LED is illuminated. If the LEDs illuminate in the proper sequence, but there is still a problem, look for the problem in the operating device itself. If the LEDs do not sequence properly, look for a problem in the related potentiometer or the control module.

## Troubleshooting

Problem	Indications	Remedy
Machine will not start	Green power "ON" light not lit when switch is turned on	Make sure that the power requirements match those given on the nameplate. Also, check fuse F-3; replace if blown.
	Vacuum pump does not run	Make sure that the power requirements match those given on the nameplate. Also, check the overload OL-1; reset if necessary.
No vacuum	When lid is closed, indicator light (VAC) is "OFF" on the control module	Check lid switches LS-1 and LS-2 for proper adjustment
	Vacuum not pulling lid down on both sides	Check intake screen in vacuum pump hose barb for blockage, pieces of bags, labels, bone, etc.
	Longer vacuum cycle times	Check intake screen in vacuum pump hose barb for blockage
No gas flush (optional)	If indicator light (GAS) is lit	Check for proper gas pressure going into gas inlet
	If indicator light (GAS) is not lit	Check for proper operation of gas flush valve (SOL-2) possible defective control module
	Gas flushes to one chamber side only	Check gas flush selector valve (V-1) for proper adjust
Chamber not venting (lid will not open)	Lid will not open and red indicator light "VENT" on control module is lit	Check ventilation valve SOL-4 for proper operation
	"VENT" indicator light is not lit	possible defective control module
<b>NOTE:</b> Lid can be released by pulling the hose off of the vacuum gauge to remove product.		

## Troubleshooting

Problem	Indications	Remedy
Improper or no sealing	Bladder light on control module is lit but the seal bar does not come down	Check to make sure that the regulator knob is turned fully clockwise, or, if air-assist is used, set to the recommended pressure Check seal bladder valve SOL-3 for proper operation
	The seal bar is not heating up even though the red seal light on the front panel comes on	Check seal bar connection points and clips for corrosion and proper tension
	The red seal light on the front panel either does not light for the proper length of time (1/2 to 1 second) or does not light at all	Check for broken seal element
		Check seal bar fuse F-1 for front seal bar and F-2 for rear seal bar*
Front or rear seal bar heating, but not both	Check seal bar fuse F-1 for front seal bar and F-2 for rear seal bar*	

\* Fuses F-1 and F-2 only apply to machines shipped before 1/1/2006.

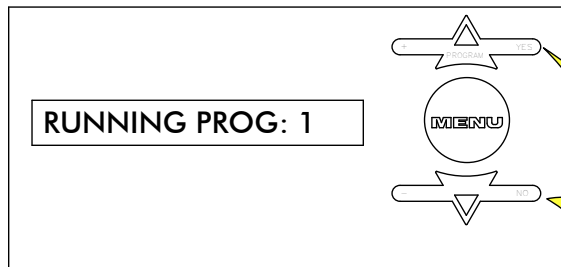
**NOTE:** For proper sealing, three things must occur:

1. The seal bar must come down and place adequate pressure between the seal bar and the backup strip.
2. The seal element must heat up sufficiently to fuse the pouch.
3. The pouch must be allowed to cool for a time to ensure a good "set."

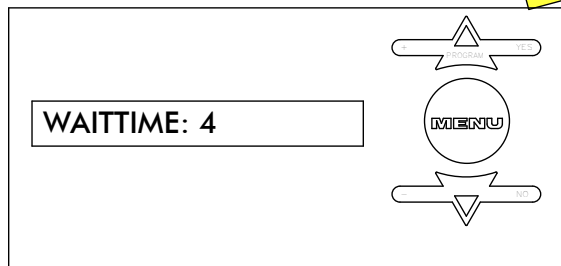
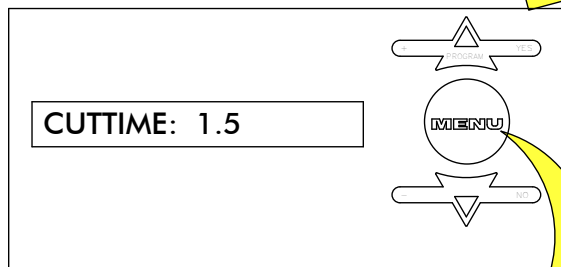
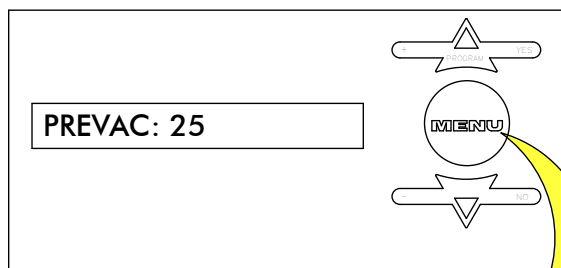


## Supervisor Menu on Digital Panel

**Untrained personnel should not alter any setting in the supervisor menu.**



The following are parameters that can only be set in the supervisor menu.



This is the main menu screen. When the machine starts up, the last program that was run will be the current program shown in the window.

Press and hold down both arrow keys for at least 3 seconds to enter the supervisor menu.

**NOTE:** If your machine is not installed with the precut option, disregard the PREVAC, CUTTIME, and WAITTIME parameters.

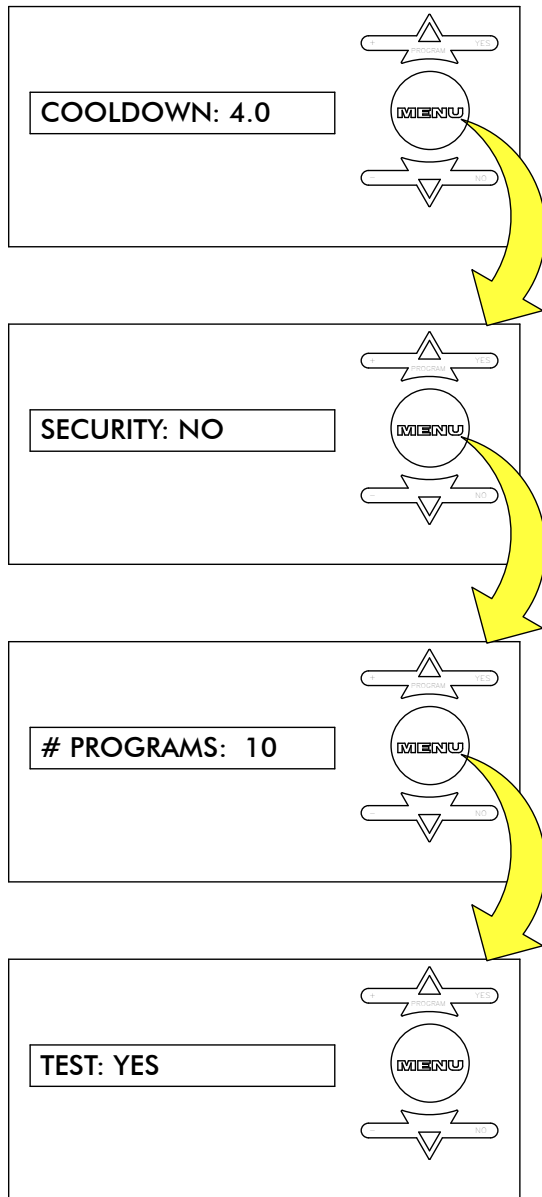
PREVAC is the % vacuum that you wish to reach before activating the knife, which makes slits in the bag for precut. Use the up or down arrow keys to change the current setting. The range is from 5% to 20% vacuum. Press the MENU key.

CUTTIME is the number of seconds that the seal valve is activated. This is the time when the knife actually makes the evacuation slits in the bag/pouch for precut. The range is from 0 to 3 seconds. Press the MENU key.

WAITTIME is the number of seconds the machine waits for the knife to retract before resuming the vacuum cycle. The range is from 0 to 6 seconds. Press the MENU key.

Figure 4.6

## Supervisor Menu on Digital Panel



COOLDOWN is the time that the machine waits after sealing the bag/pouch before the seal bars retract. This allows time for the actual seal to cool down and take a set. The range is from 1 to 8 seconds. Press the MENU key.

SECURITY can be turned on by selecting yes. If security is on, the operator menu will be read only and the operator will not be able to change any settings. Press the MENU key.

This is how you specify the maximum number of programs that may be saved in memory. Each program may have its own set of unique parameters. This range is from 1 to 10. Press the MENU key.

If TEST is set to YES (using the up arrow key), the vacuum valve and vent valve may be operated manually. The up arrow key activates the vacuum valve, the down arrow key activates the vent valve, and pressing both at the same time turns them both off. As you activate either valve, the vacuum pressure is displayed. Press the MENU key.

Figure 4.7

## Supervisor Menu on Digital Panel

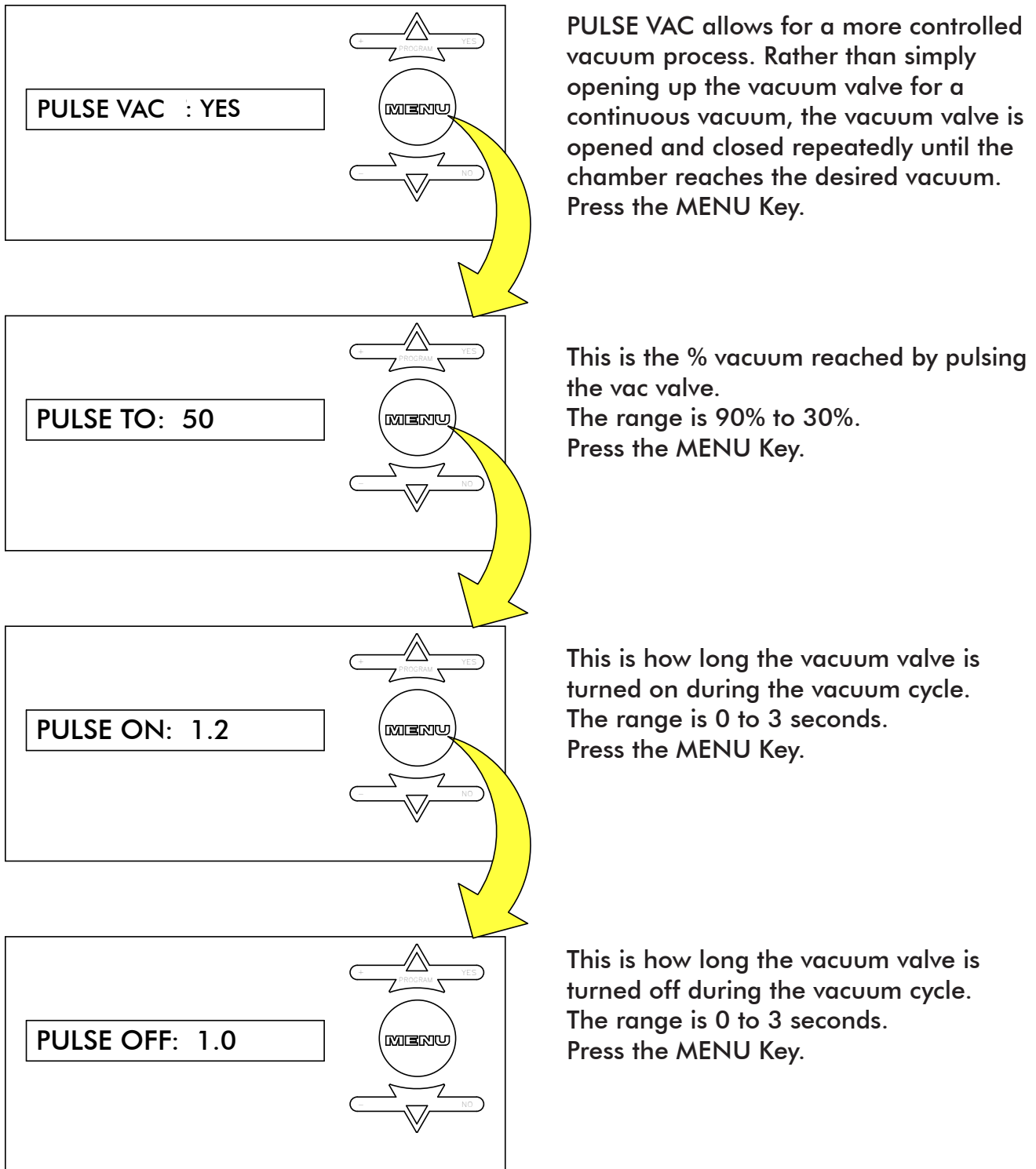
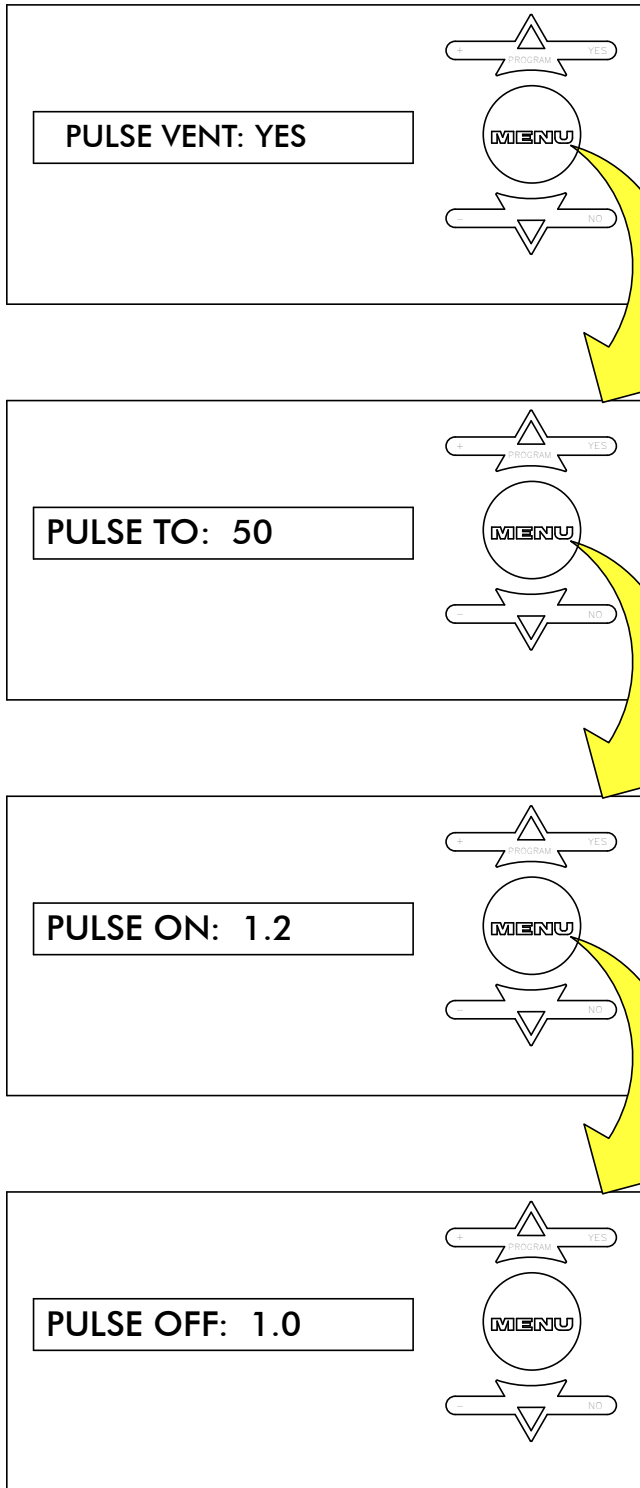


Figure 4.9

## Supervisor Menu on Digital Panel



PULSE VENT allows for a more controlled venting process. Rather than simply opening up the vent valve for a continuous vent, the vent valve is opened and closed repeatedly until the chamber vents back to atmospheric pressure. Press the MENU Key.

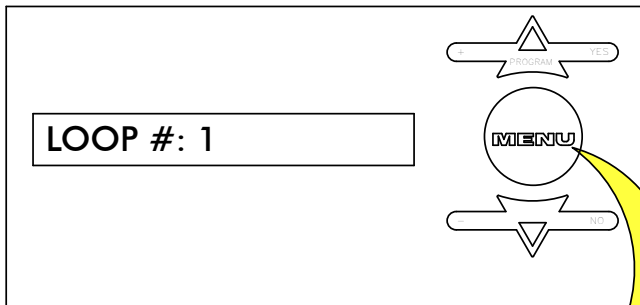
This is the % vacuum reached by pulsing the vent valve before the vent valve opens completely to fully vent the chamber. The range is 90% to 30%. Press the MENU Key.

This is how long the vent valve is turned on during the vent cycle. The range is 0 to 3 seconds. Press the MENU Key.

This is how long the vent valve is turned off during the vent cycle. The range is 0 to 3 seconds. Press the MENU Key.

Figure 4.8

## Supervisor Menu on Digital Panel

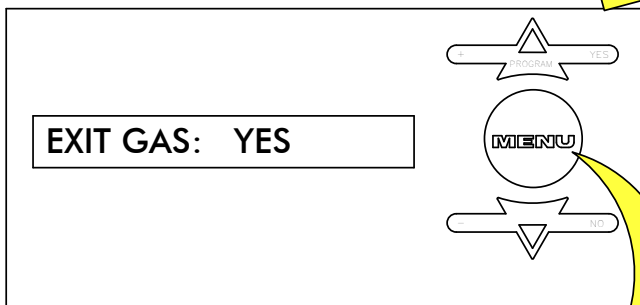


If the machine is equipped with the LOOP option, this is the number of vacuum/gas cycles the control will perform prior to the seal and vent.

The range is 1 to 5 cycles.

The default value is 1 cycle.

Press the MENU Key.

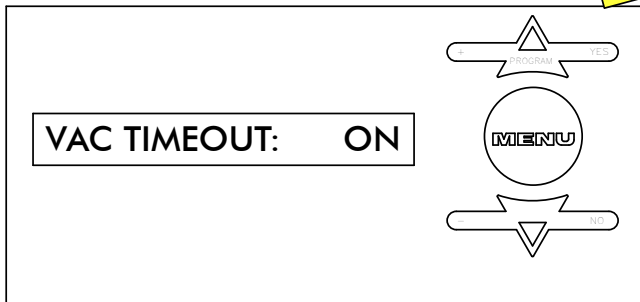


If the Loop # is set greater than 1, the control can be set to exit this loop on either the last gas cycle or the last vacuum cycle prior to sealing.

The DOWN arrow key indicates NO.

The UP arrow key indicates YES.

Press the MENU Key.

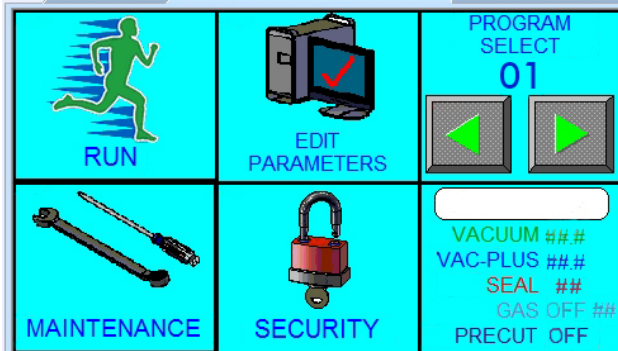


VAC TIMEOUT is an option that is turned ON or OFF. If set OFF, default, the machine will time out if the preset vacuum is not reached in 6 seconds, and the machine will complete the cycle. If set ON and the machine does not reach the preset vacuum in thirty seconds, then the panel will display VAC ERROR and vent the chamber without sealing.

Figure 4.10

## Supervisor Menu with Touch Screen

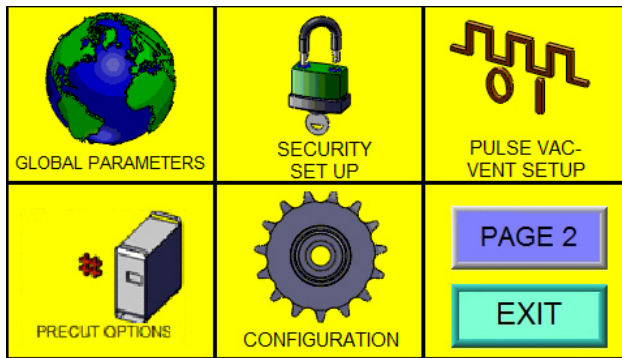
**NOTE:** If the supervisor has set security on, program settings cannot be changed.



This is the Main Menu. This screen allows access to all of the other functions of the machine. The supervisory menu can be accessed by entering the required maintenance password in Security, and then pressing the Maintenance button.

Default Maintenance Password is listed in the security setup section of this manual.

This is the primary Maintenance menu. This allows access to all of the various supervisory and maintenance related screens.

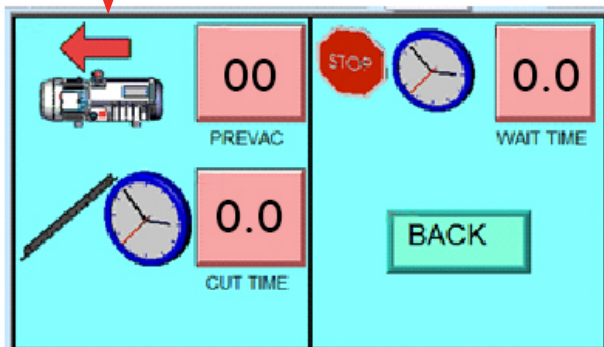


Global Parameters consist of machine specific global parameters such as Vacuum Time Out limits, Cool Down times, and Language Selection.

Security Setup allows the default passwords to be changed, and allows the supervisor to restrict the editing of program parameters to Maintenance level supervisors or to allow anyone using the machine to make these changes.

Pulse Vac-Vent Setup allows the supervisor to configure the behavior of the Pulse Vac and Pulse Vent operations if being used.

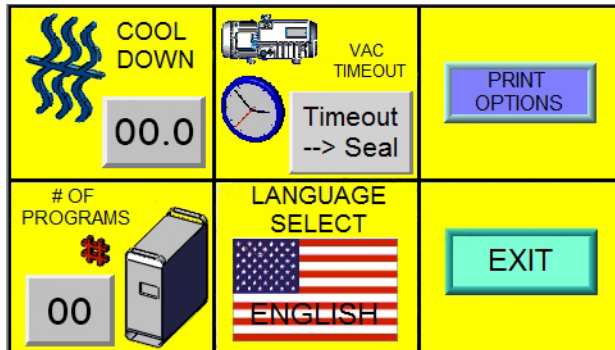
Configuration is a factory configuration menu that allows the touch screen to be properly configured for operation on a specifically equipped machine. These settings should NEVER be changed in the field unless instructed to do so by an Ultravac Services technician.



Precut Options: If the machine is equipped with the PRECUT option, selecting this icon allows the parameters to be set. See precut and looping options for details

## Supervisor Menu with Touch Screen (continued)

### Global Parameters



**Cool Down:** This parameter determines how long the cool down period is in each cycle. This can be set by pressing the value button and changing the value using the provided keypad. The range for this value is 0 to 10.

**Vac Timeout:** The Vacuum Timeout parameter determines how the machine behaves if the Vacuum Timeout is reached before the cycle completes.

**Timeout --> Seal:** This will cause the machine to seal the package immediately if a Vacuum Timeout fault occurs.

**Timeout --> Vent:** This will cause the machine to stop the vacuum process, vent the chamber and leave the package unsealed.

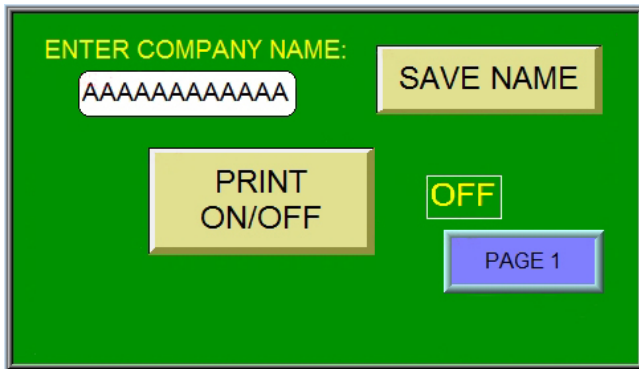
**Print Options:** This is used to enable/disable the printer function.

**# of Programs:** This parameter defines the number of programs that can be stored. The range for this value is 1 to 99.

**Language Select:** This allows the user to select a different operating language for the touch screen. The machine is equipped with four base languages including English, French, German and Spanish. The language can be selected simply by pressing the flag like button and cycling through the options. Press Exit when done and this will save your changes.

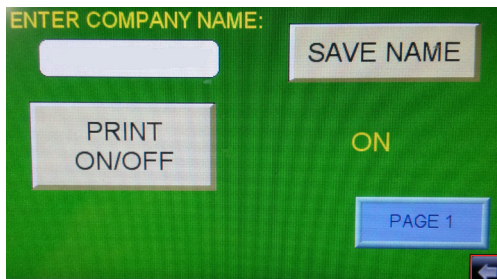
## Supervisor Menu with Touch Screen (continued)

### Print Options

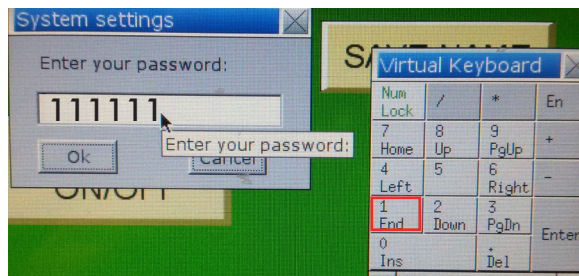
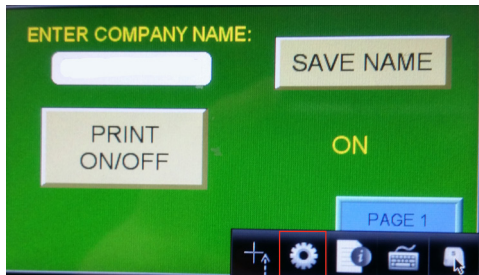


Following the selection of Print Options in Global parameters, this screen will appear. Enabling or disabling the printer feature is done by selecting the Print ON/OFF button.

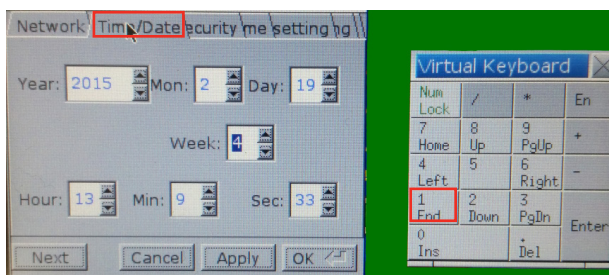
The Company name field contains up to 12 characters. This field may be used for any text, such as Lot Number, for any given product run. Enter desired text, press and hold Save name until you hear two beeps..



ULTRASOURCE	LOT 12345678
02/19/2015	02/19/2015
10:00 AM	10:00 AM
1: PORK CHOP	1: PORK CHOP
SEAL 1.0 SEC	SEAL 1.0 SEC
VAC 99.0 PCT	VAC 99.0 PCT



The default time is set to CST (GMT-6:00). You will need a pencil eraser to perform this operation. Press the arrow key in the lower RH corner and the Icon group will appear to the left. Press the Gear Icon and the virtual keypad will appear. Press the number 1 six times, and press enter. The System settings screen will appear, and you will be in the network settings tab, which does not apply to these machines. Please note the time is formatted as a 24 hour clock!!! Select the Time/Date tab at the top of the system settings screen, and using your eraser adjust the time and date. When finished, press apply, and press OK. The time and date have now been saved.

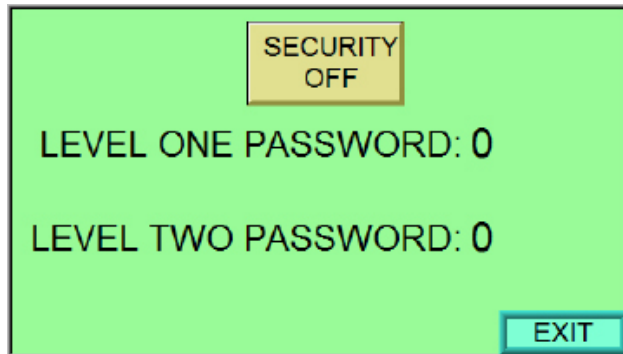


The remaining tabs SHOULD NOT be used! Changes to these features should only be performed or under direction of a trained Ultravac Services technician!!



## Supervisor Menu with Touch Screen (continued)

### Security Setup



The security setup screen allows the maintenance supervisor to enable a certain level of security and to change the default passwords assigned to the machine.

The default passwords are as follows:

Level One: 456

Level Two: 789

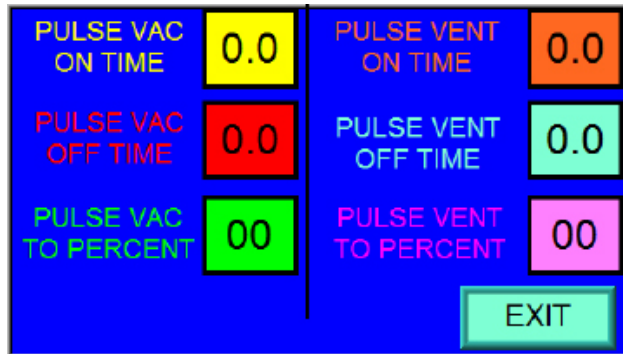
Turning Security On in this menu will restrict the editing of program parameters to those with a value Level One password. The Maintenance menu will always remain secured by the Level Two password.

If Security is set to Security Off (as shown in the corresponding image to the left), running program parameters will be editable by anyone.

Changing the default passwords can be done by setting the new password in this screen. Keep in mind that these passwords are NOT recoverable should they be forgotten.

## Supervisor Menu with Touch Screen (continued)

### Pulse Vac and Pulse Vent Setup



Pulse Vac and Pulse Vent Setup allows the maintenance supervisor to configure the appropriate Pulse Vac and Vent limits.

#### Pulse Vac On Time:

This value determines how long each pulse is fired during a Pulse Vac operation.

#### Pulse Vac Off Time:

This value determines how long each pulse is in the off position during a Pulse Vac operation.

#### Pulse Vac to Percent:

This value determines the final desired vacuum percentage to be reached during a Pulse Vac operation.

#### Pulse Vent On Time:

This value determines how long each pulse is fired during a Pulse Vent operation.

#### Pulse Vent Off Time:

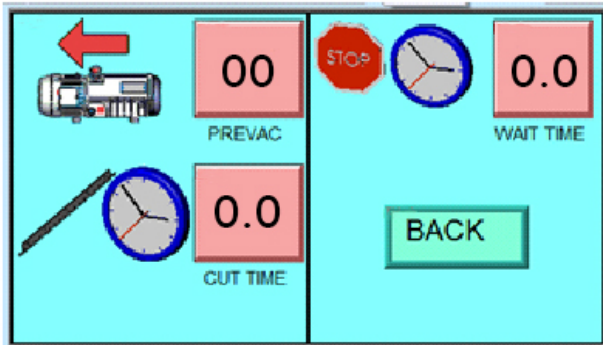
This value determines how long each pulse is in the off position during a Pulse Vent operation.

#### Pulse Vent to Percent:

This value determines the final desired vacuum percentage to be reached during a Pulse Vent operation.

## Supervisor Menu with Touch Screen (continued)

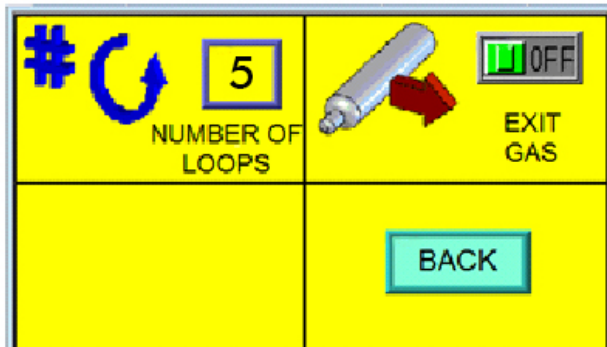
### Precut and Looping options



Prevac - 0-99% of vacuum before slits are cut in the bag. Default 25%

Cut time - Amount of time allotted for the cut cycle, 0.1 - 9 seconds Default 1.5 seconds

Wait time - Amount of time from Cut cycle finish to Vacuum cycle startup 0.1 - 9 seconds, Default 4 seconds.



If the machine is equipped with the loop option, this is the number of vacuum/gas cycles the control will perform prior to the seal and vent. The range is 1 to 5 cycles. The default is 1.

If the loop # is set to greater than 1, the control can be set to exit the loop on either the last gas cycle or the last vacuum cycle prior to sealing.

## Changing Vacuum Pump Oil and Filter

**NOTE:** The pump should have been running for at least 15 minutes to warm the pump oil.

1. Turn the power switch to the “OFF” position and disconnect the power.

**⚠ DANGER** Hot oil.

*Hot oil poses scalding risk. Take necessary precautions while draining warm oil.*

**⚠ DANGER** Hazardous voltage.

*Disconnect and lockout power before servicing machine or cleaning. Do not remove panels unless power has been disconnected and locked out at risk of electric shock hazard.*

2. Position an oil collection pan underneath the Oil Drain Plug.
3. Loosen and remove the Oil Fill Plug with a 1¼-in. open end wrench.
4. Loosen the Oil Drain Plug located to the front and lower middle on the pump with a 1¼-in. open end wrench. Remove the plug slowly to control the flow of oil.
5. Replace auto-type oil filter with a filter wrench (strap wrench.) Coat face of gasket on new filter with oil and hand tighten until gasket contacts base, then tighten two-thirds turn more. **DO NOT OVER TIGHTEN.**
6. With the oil drained, replace the Oil Drain Plug and wipe any excess oil off of the pump.
7. Fill the pump with oil until the level is at the maximum lines on the Oil Sight Glass. Replace the Oil Filler Cap.
8. Reconnect the power cord back into the wall receptacle.
9. Cycle the machine a couple of times, unplug, and check the Oil Level. Add oil to the maximum line. **DO NOT OVER FILL.**

## Maintenance Log

A maintenance log is a journal of all maintenance performed. Each entry includes a date, maintenance performed (details about the type of work done), and technician (who performed the maintenance). The maintenance log is also a place where a schedule is kept for further maintenance.

A maintenance log will clearly show oil changes, daily inspections, Teflon<sup>®</sup> tape replacement, and so on. A master copy has been provided on page 4.20, please create a copy and store in the back of this owner's manual.

## Service Log

A service log is a journal of all service work performed. Each entry includes a date, service provided (details about the type of service), and technician (who performed the service).

A service log will clearly show training provided, frequent wear items, and so on. A master copy has been provided on page 4.21, please create a copy and store in the back of this owner's manual.





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# SCHEMATICS

## Designation and Function of Controls

The following designations are found on the Electrical Diagrams:

### Manually Activated Switches and Buttons:

SW-1	On/off control power
SW-3	On/off gas flush
SW-4	Quick seal (Optional)

### Solenoid Valves:

SOL-1	Vacuum flush solenoid
SOL-2	Gas flush solenoid
SOL-3	Seal bladder solenoid
SOL-4	Ventilation solenoid

### Limit Switches:

LS-1	Left chamber cycle start
LS-2	Right chamber cycle start

### Mechanically Activated Switches

(Pneumatic Diagram only):

V-1	Gas selector valve
-----	--------------------

### Contactors:

C-1	Vacuum pump
C-2	Seal impulse
C-3	Redundant seal impulse

### Overloads and Fusing:

OL-1	Vacuum pump motor
F-3	Control power fuse

### Control Modules:

MCM	Master control module
R-1	Redundant seal impulse contactor timer

### Control Lights:

LT-1	On/off control power light (green)
LT-2	Seal impulse on light (red)

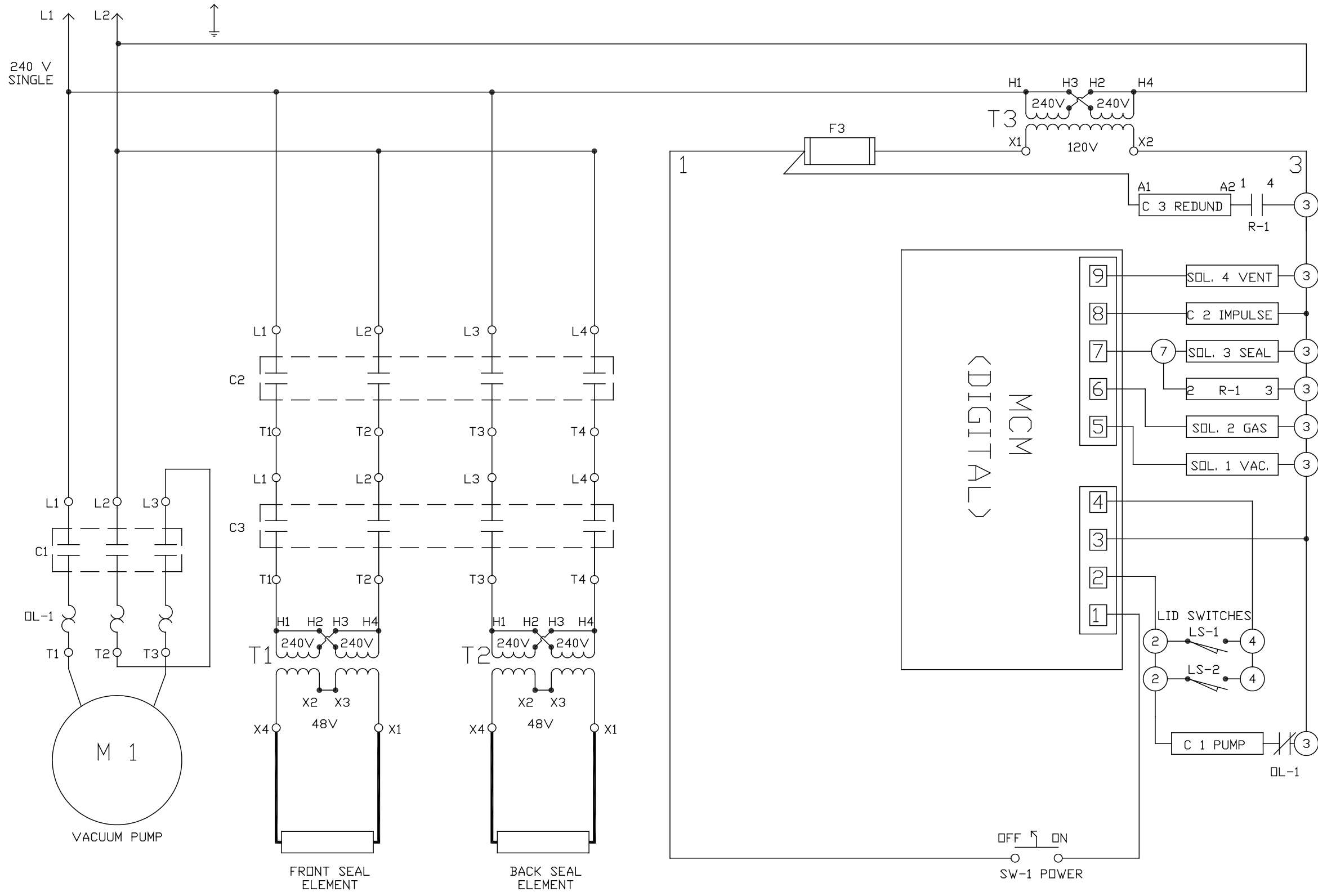
### Transformers:

T-1	Seal impulse, front
T-2	Seal impulse, rear
T-3	Control power

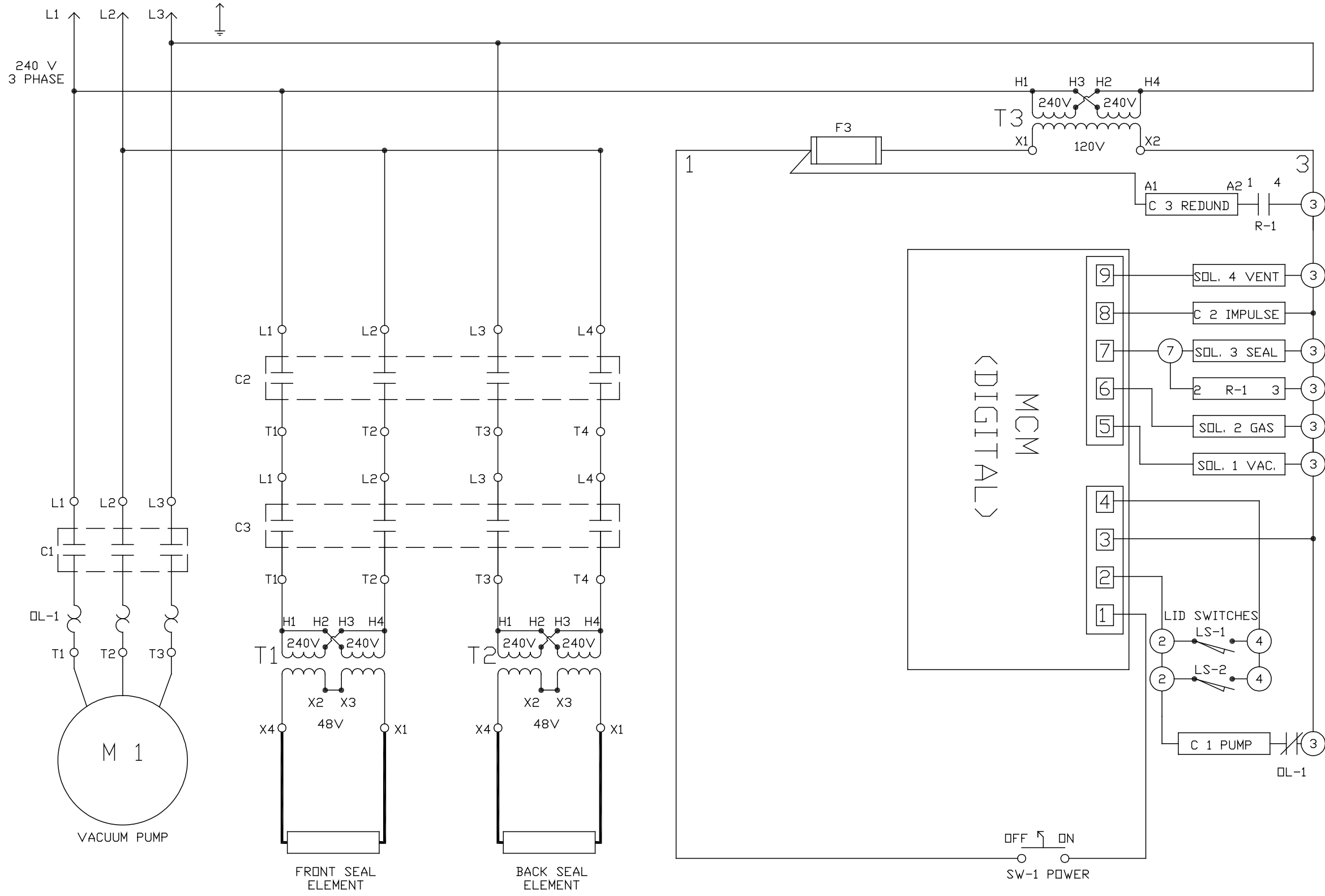
### Motors:

M-1	Vacuum pump
-----	-------------

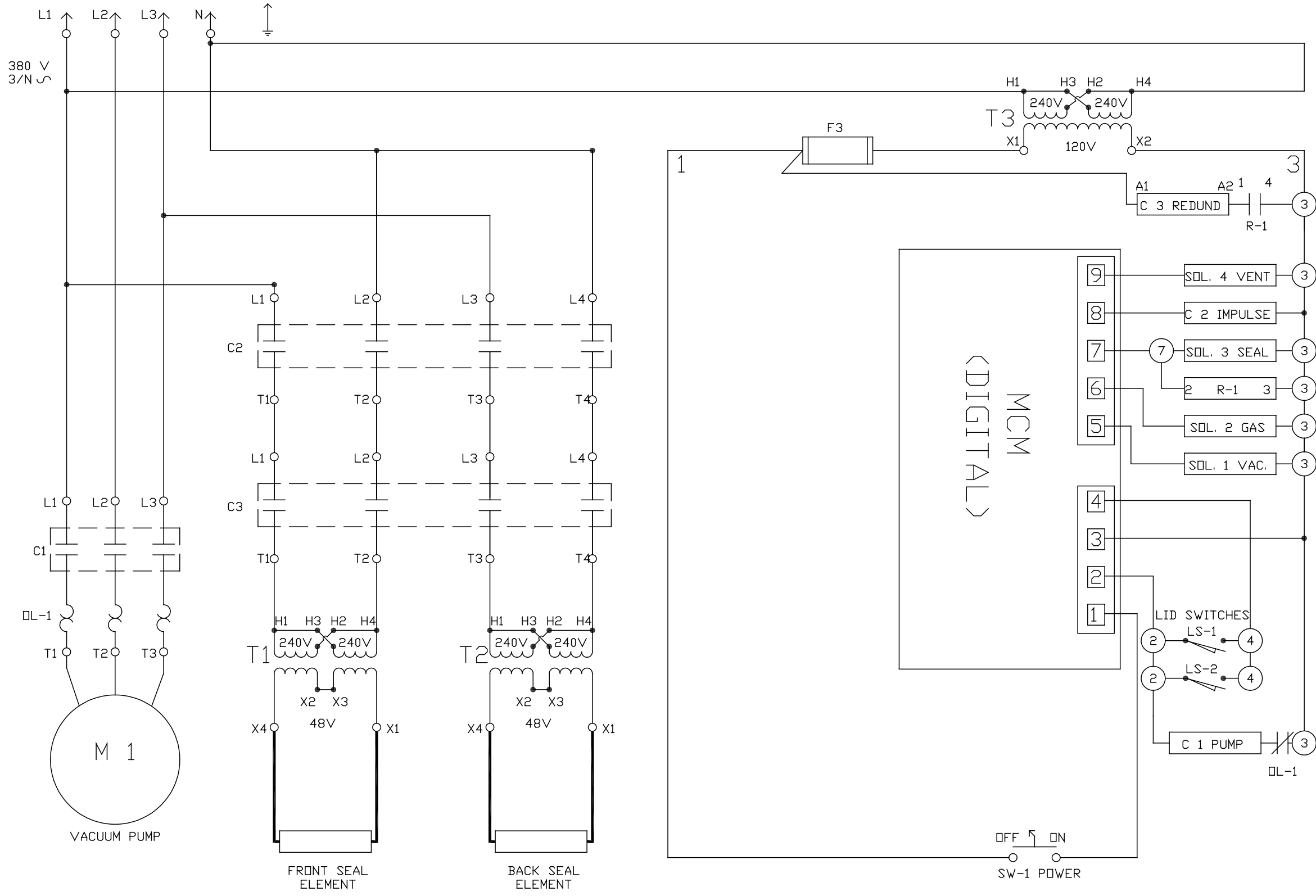
## 230 Volt, Single Phase, Digital Panel



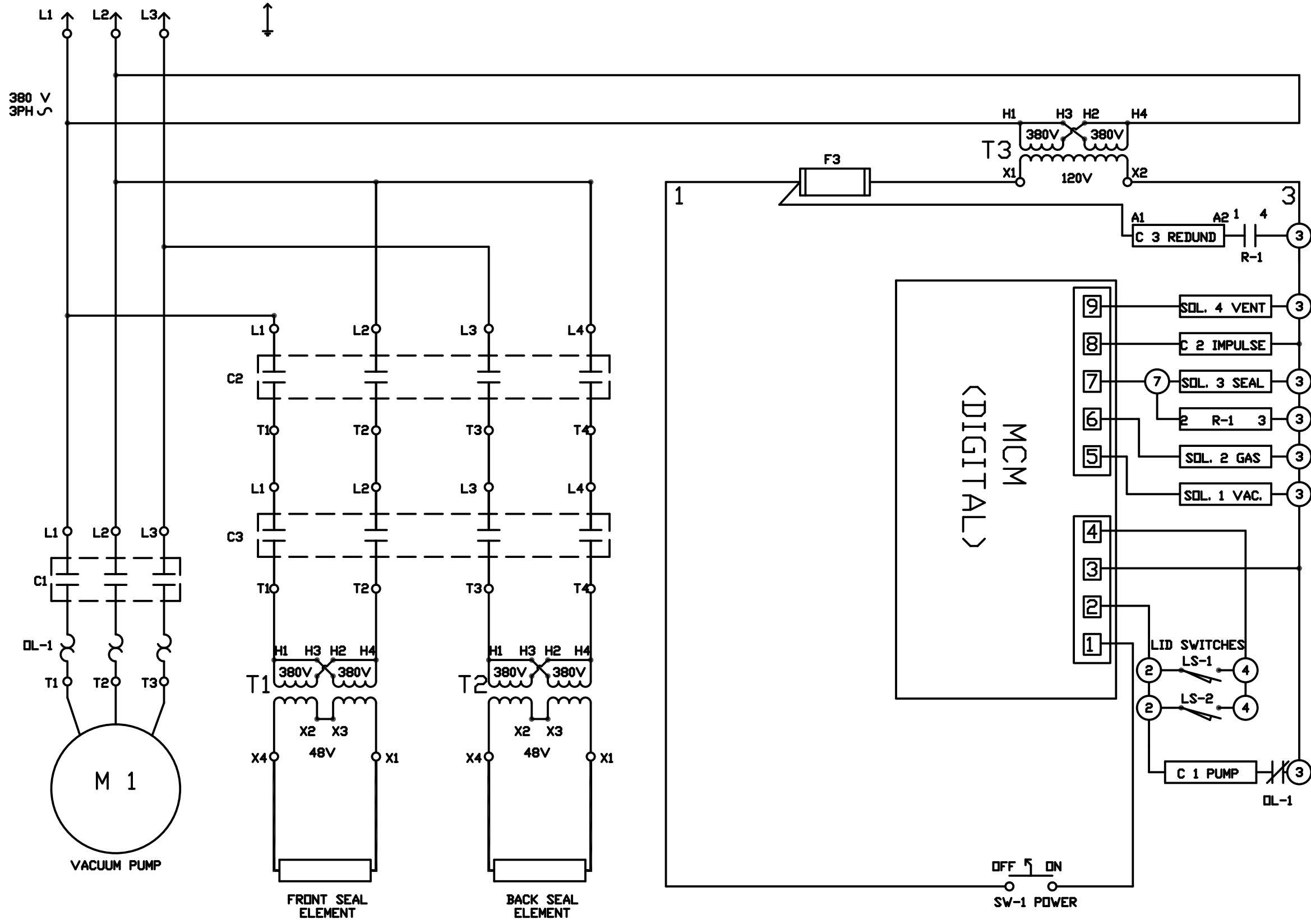
## 230 Volt, 3 Phase, Digital Panel



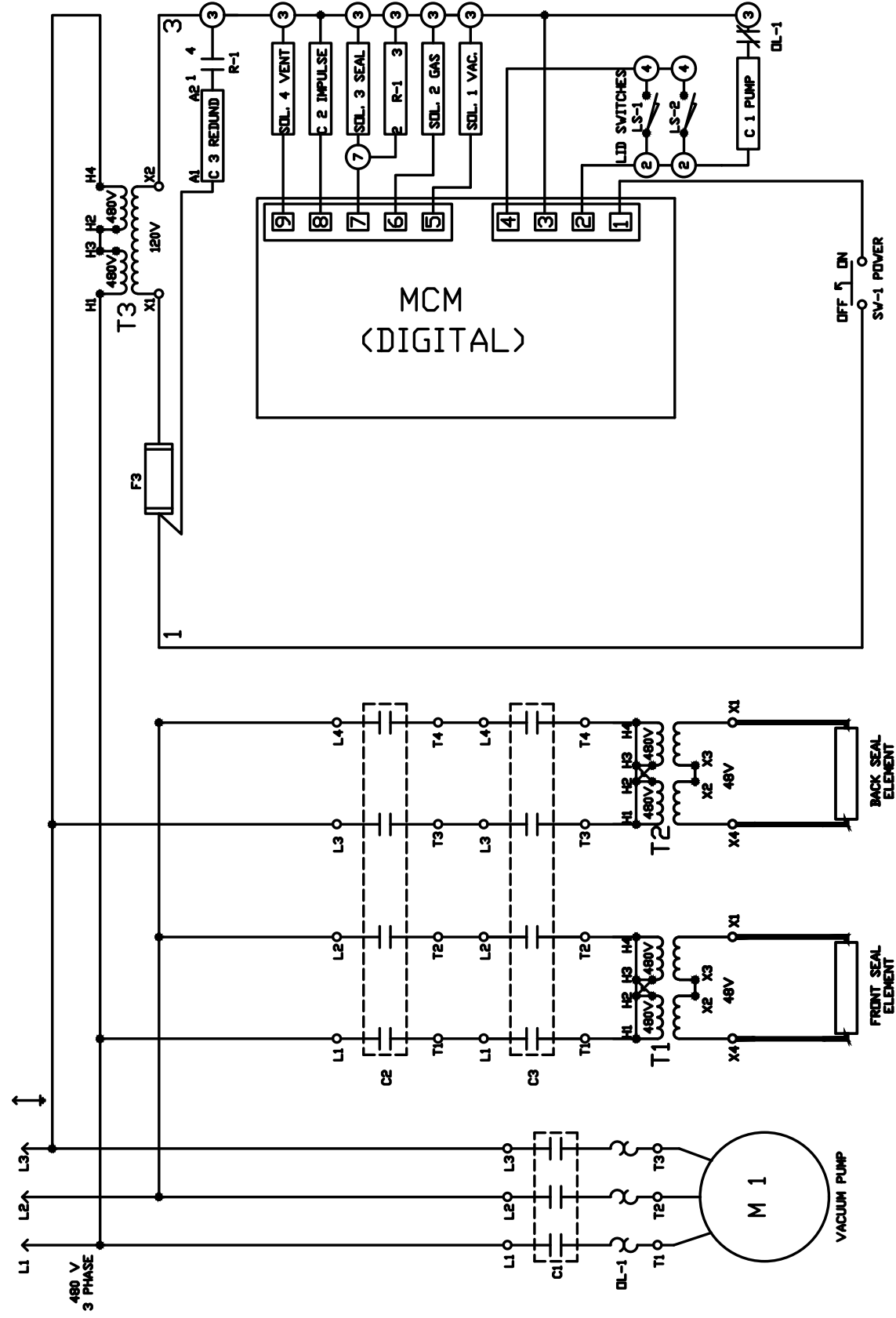
### 380 Volt, 50 Hz, Digital Panel



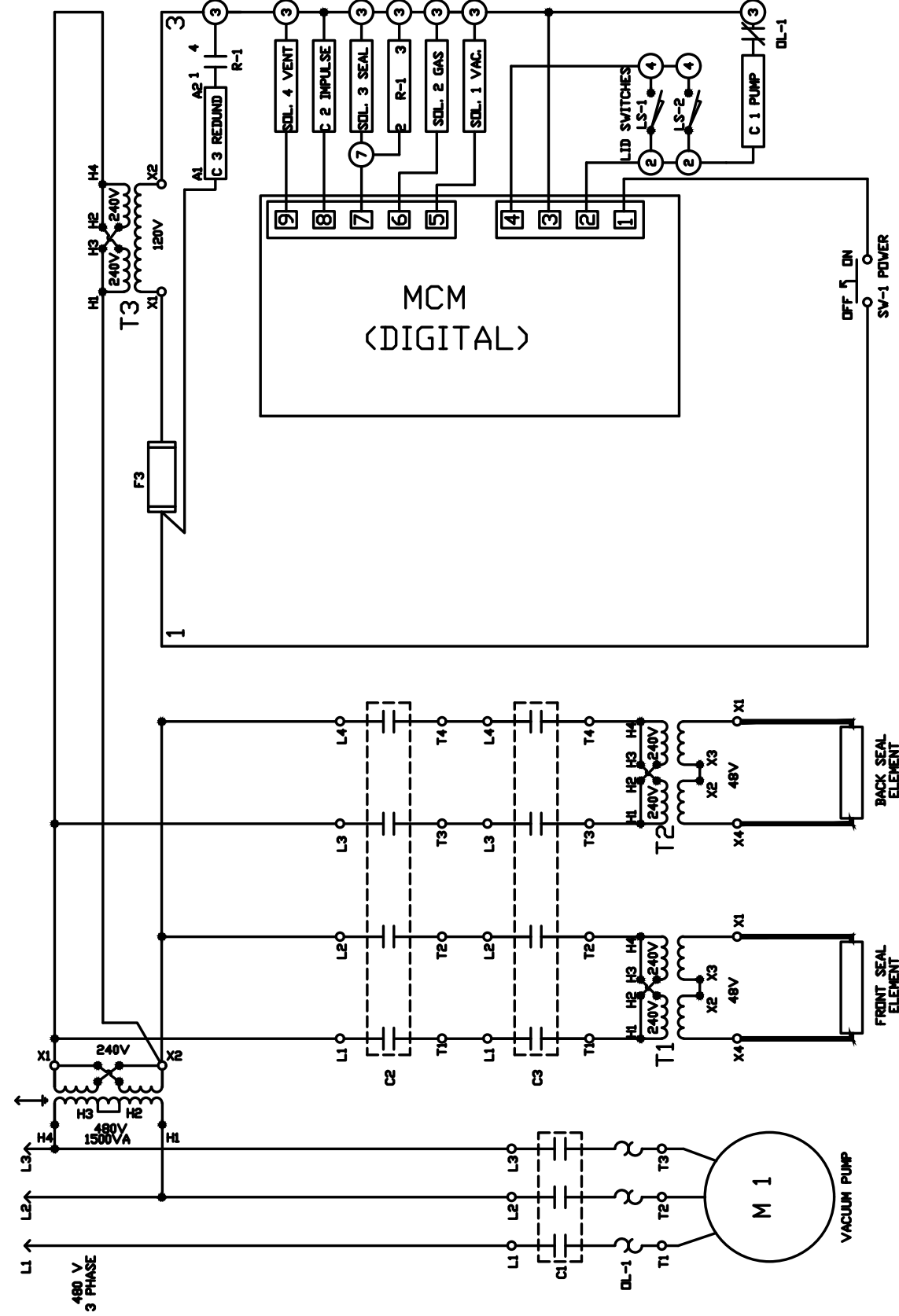
### 380 Volt, 50 Hz, W/O Neutral Digital Panel



### 460 Volt, 3 Phase, Digital Panel

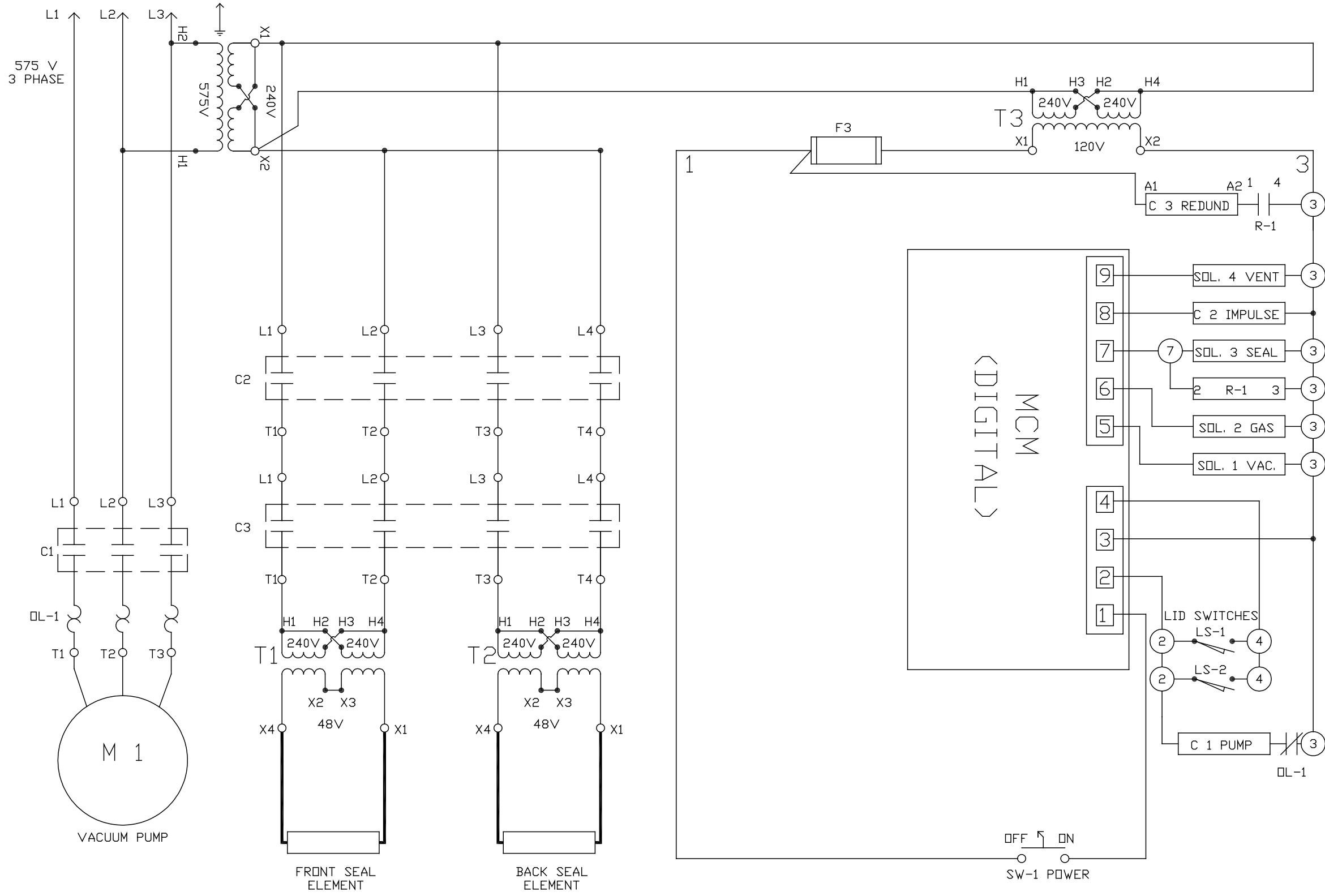


480 V, 3 PHASE, DIGITAL  
NARROW SS BAND SEAL ONLY

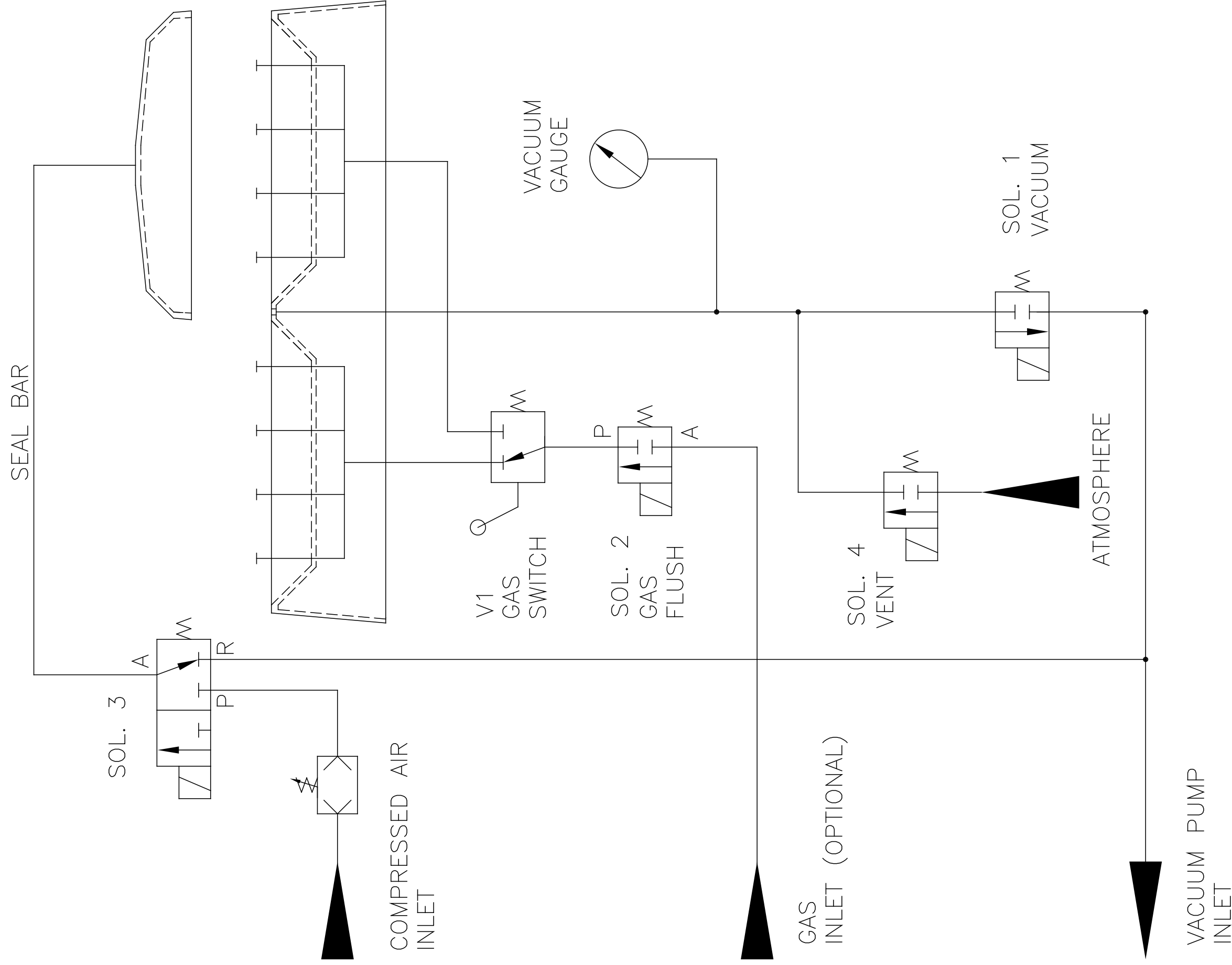


480 V, 3 PHASE, DIGITAL  
WIDE BAND SEAL ONLY

## 575 Volt, 3 Phase, Digital Panel



## Pneumatic Diagram





# PARTS

## Recommended Spare Parts

Qty.	UltraSource Part No.	Description
1 ea	861001	Seal Bar Assembly
10 ft	880431	Back Up Strip
4 ea	880443	Back Up Strip Textured
12 ft	880432	Lid Gasket
1 ea	880746	Seal Element
3 ft	885507	Teflon® Tape
1 ea	860908	DIN Coil
1 ea	860906	Vacuum Valve Diaphragm
1 ea	860907	Vent Valve Diaphragm
2 gal	Specify pump	Vacuum Pump Oil
1 ea	Specify pump	Vacuum Pump Oil Filter
1 ea	861002	Bladder Assembly
<b>Select your machine's configuration:</b>		
1 ea	860250	Double Seam Seal Bar Contact Kit
1 ea	863016	10mm Wide Seal Bar Contact Kit
1 ea	861013	Single Seam Seal Bar Contact Kit
<b>For Analog Control Panel:</b>		
5 ea	860337	Fuse for Control Power, 1A
1 ea	860313	Potentiometer, Evac/Gas
1 ea	860314	Potentiometer, Sealing
1 ea	860327	Relay Module

**For specific system replacement parts,  
Contact a parts representative for further assistance:**

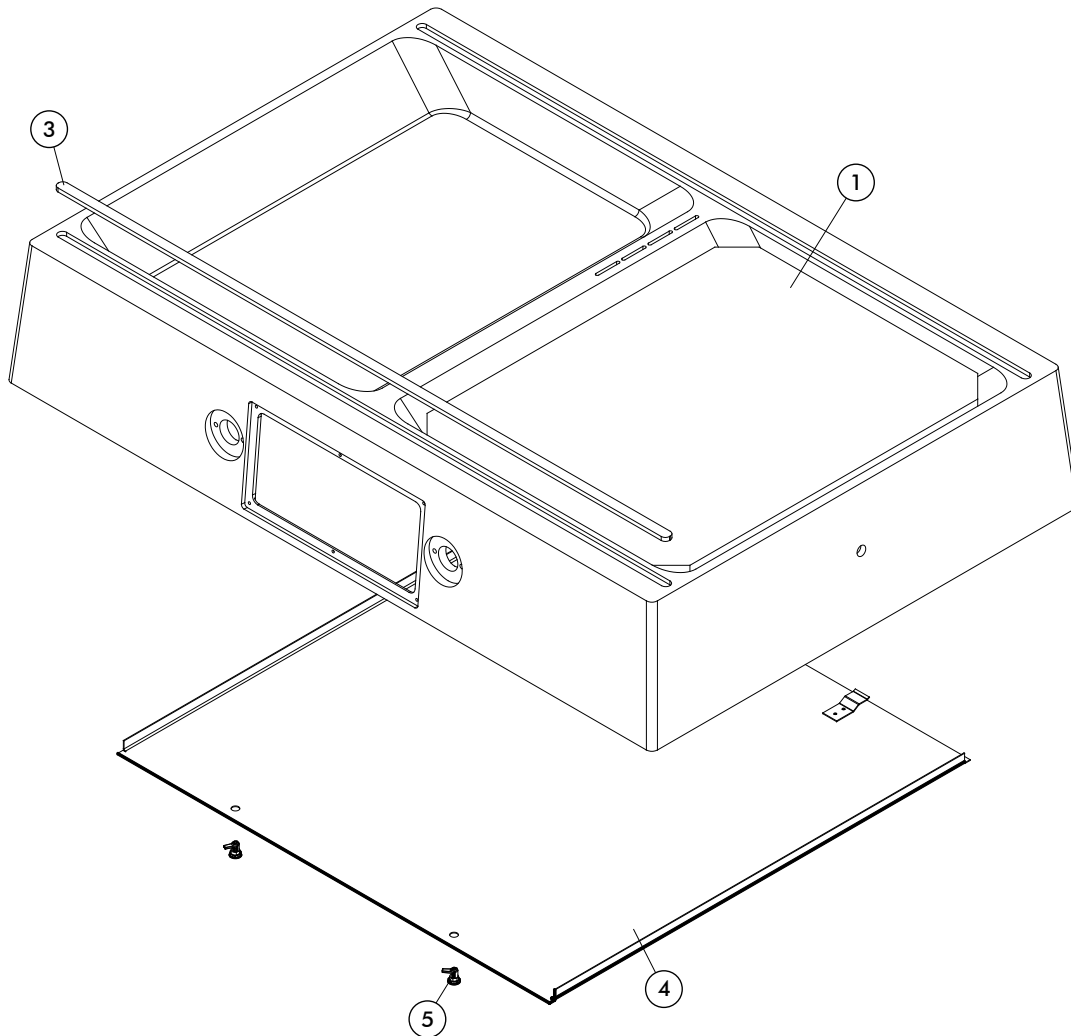
Phone (816) 753-2150 • Fax (816) 561-2854

Toll-Free (800) 777-5624

## Miscellaneous Machine Parts

### Parts List and Diagram

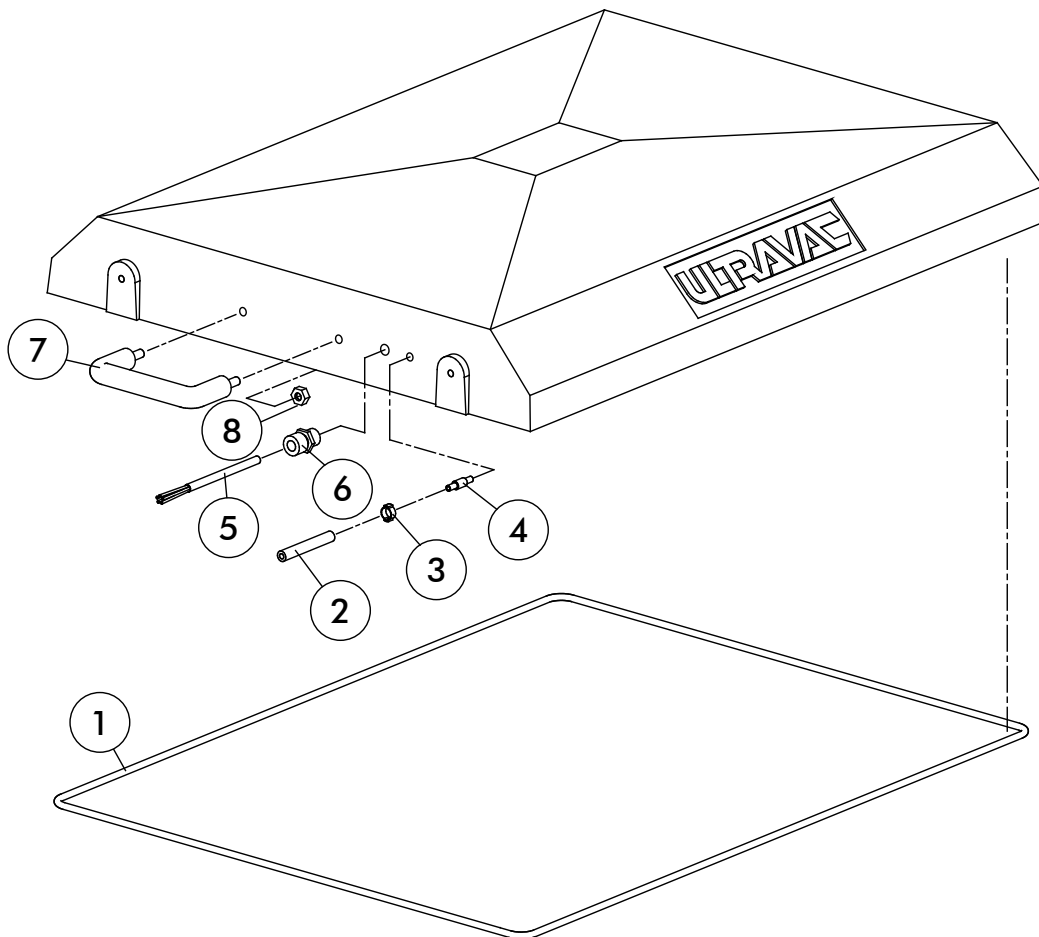
Item No.	UltraSource Part No.	Description
1	860402	Filler Plate Set (two sets per machine)
3	880431	Chamber Gasket (10-ft. required)
	860950	Chamber Gasket, Grey (10-ft. required) (for precut and perforating knife options)
	880443	Chamber Gasket - 4 pcs. - Textured
4	860844	Cover Panel with Latches
5	860409	Latch
	861228	Coiled Lanyard (between chassis and cover)



## Lid, External

### Parts List

Item No.	Part No.	Description
	860200	Lid casting, 8-in. (Lid Assy available, Call our Parts Dept.)
	860201	Lid casting, 12-in. (Lid Assy available, Call our Parts Dept.)
1	880432	Lid Gasket (12-ft. required)
2	860954	Hose, 1/4-in. Reinforced (35-in. required)
3	860110	Hose Clamp for 1/4-in. Reinforced Hose
4	860109	Brass Hose Barb
5	863031	Wire Harness, Complete
6	860009	Cord Grip, 1/2" NPT, .375"-.500"
7	860113	Lid Handle
8	860269	Nut, M10 Nylon Lock



## Lid, Internal

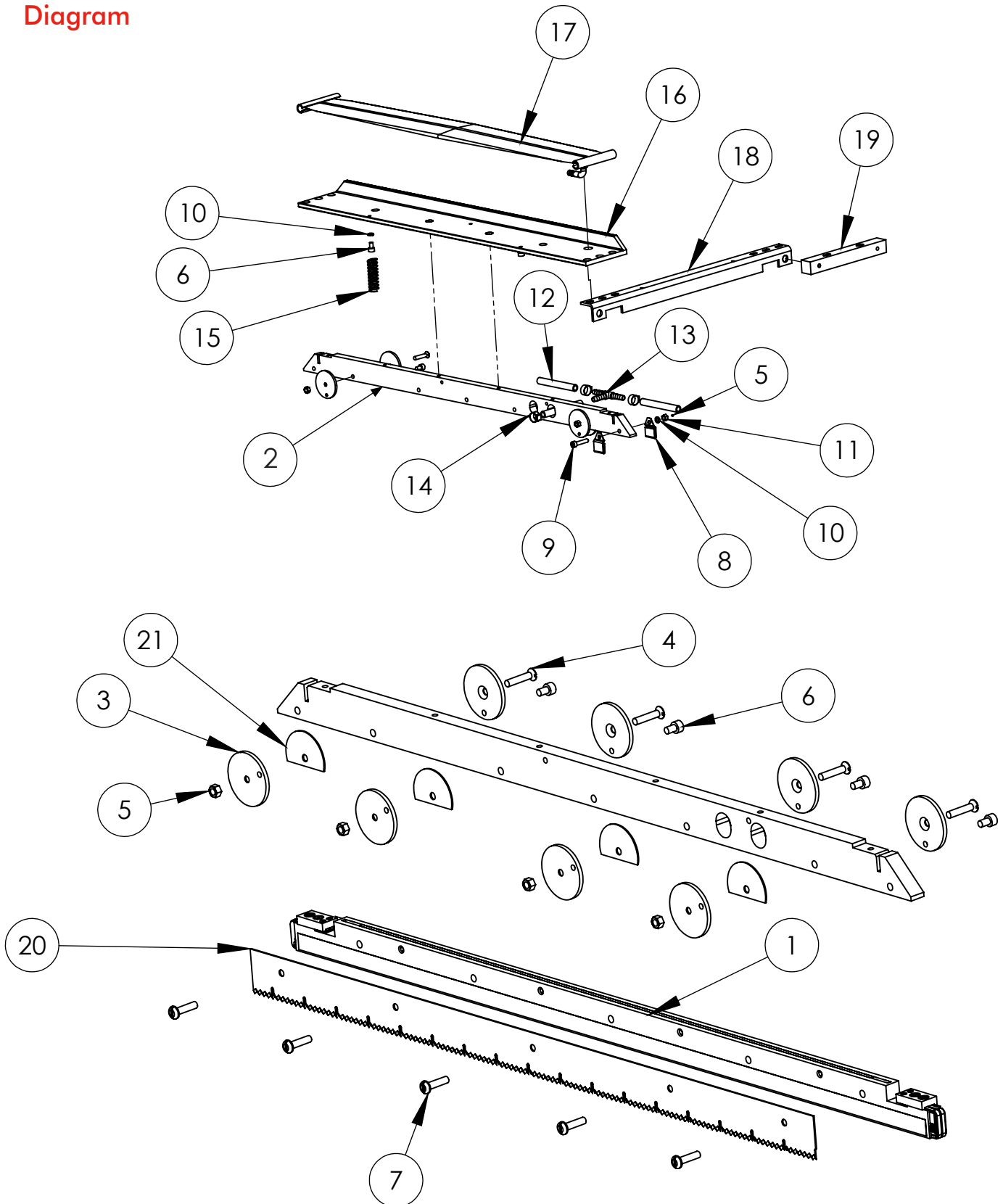
### Parts List

Item No.	UltraSource Part No.	Description
1	861071	10mm Wide Seal Bar Complete (refer to page 6.9)
	903037-10	10mm Wide Seal Bar with Knife (one complete assembly)
	861001	Single Seam Seal Bar Complete (refer to page 6.11)
	860001	Single Seam Seal Bar with Knife (one complete assembly)
2	860102	Seal Bar Support
3	860226	Seal Bar Support Washer
4	860254	Screw, M5x25 Slotted Flat Head
5	860261	Nut, 5mm Nylon Lock
6	860258	Screw, M5x8 SHCS
7	860257	Screw, M5x20 Slotted Pan Head
8	860005	Electrical Contact
9	866832	Screw, M5x35 SHCS
10	860260	Washer, 5mm Lock
11	866764	Nut, 5mm Hex
12	860954	1/4-in. Hose (specify length)
13	860107	1/4-in. Hose "T"
14	860110	Hose Clamp
15	860307	Bladder Return Spring
16	860030	Bladder Backup Plate
17	861002	Bladder Assembly
18	861232	Swing Arm
19	860202	Swing Arm Tie Block

#### Kit to add on knife blade (903055) includes:

3	860226	Seal Bar Support Washer
4	860254	Screw, M5x25 Slotted Flat Head
5	860261	Nut, 5mm Nylon Lock
6	860258	Screw, M5x8 SHCS
7	860257	Screw, M5x20 Slotted Pan Head
11	866764	Nut, 5mm Hex
20	860018	Knife Only
21	860991	Pre-cut Shim

# Lid, Internal Diagram



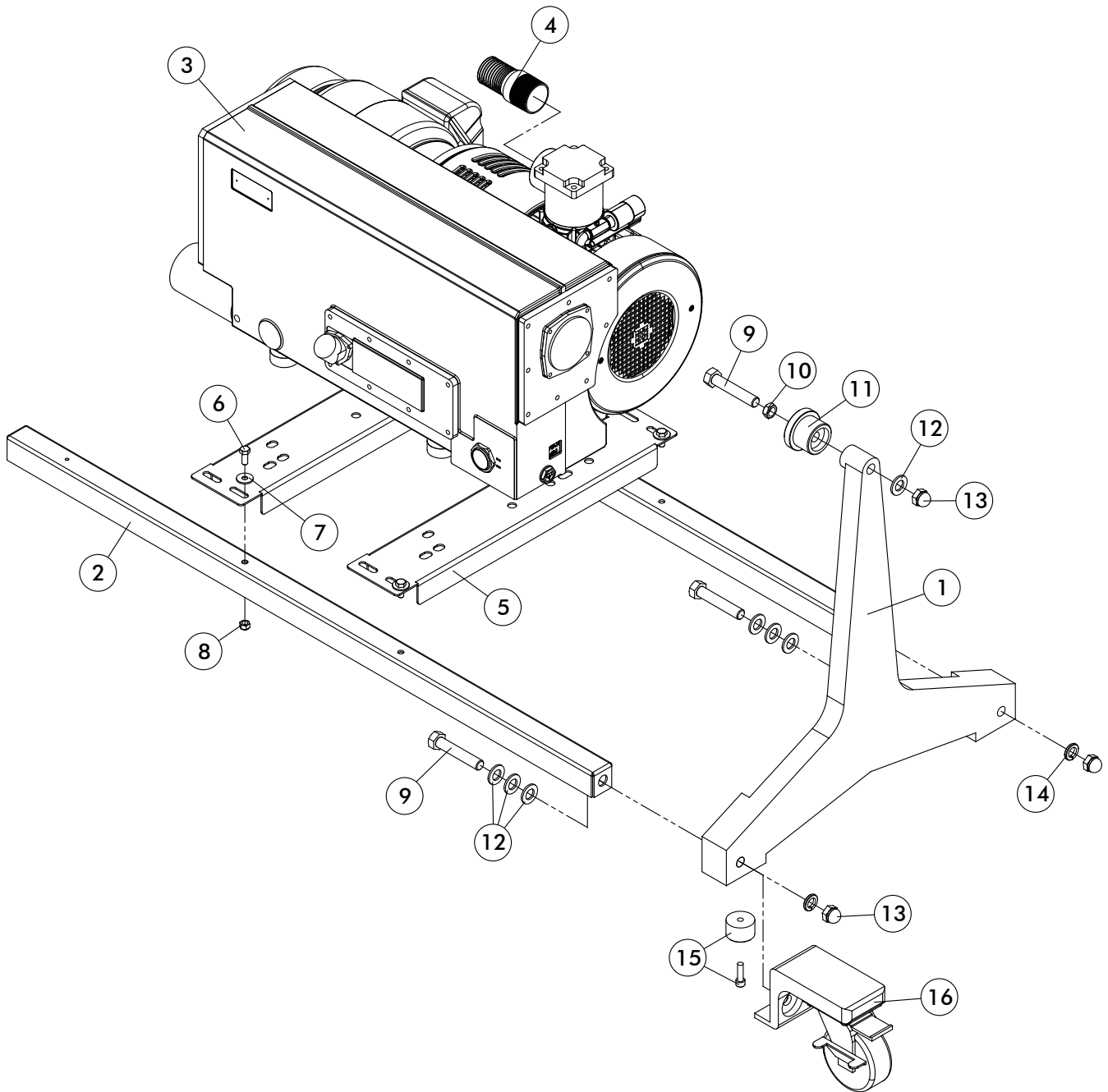
**WITH PERFORATION KNIFE**

## Legs and Pump

### Parts List

Item No.	UltraSource Part No.	Description
1	860705	Leg
2	860767	Pump Plate Brace
3	900039	Pump, 5-hp for 230V, 1-phase
	900165	Pump, 7- $\frac{1}{2}$ -hp for 230/380/460V, 3-phase
	900166	Pump, 7- $\frac{1}{2}$ -hp for 575V, 3-phase
	900253	Pump, 10-hp for 200V, 3-phase
	900255	Pump, 10-hp for 230/380/460V, 3-phase
	900257	Pump, 10-hp for 575V, 3-phase
	900305-200	Pump, 12-hp for 200V, 3-phase
	900305-230	Pump, 12-hp for 230/380/460V, 3-phase
	900305-575	Pump, 12-hp for 575V, 3-phase
4	860613	Hose Barb, 2-in.
5	860759	Pump Mounting Plate
6	810109	Bolt, M10x25 Hex Head
7	860268	Washer, 10mm Flat
8	860269	Nut, 10mm Lock
9	861164	Bolt, 3/4-10 Thread x 3-3/4-in., Hex Head
10	860733	Nut, 3/4-in. Jam
11	860730	Leg Spacer
12	860732	Washer, 3/4-in. Flat
13	860714	Nut, 3/4-in. Acorn
14	860736	Washer, 3/4-in. Lock
15	863080	Kit, Support Pads with M10x35 SHCS
16	903010	Kit, Caster (optional)

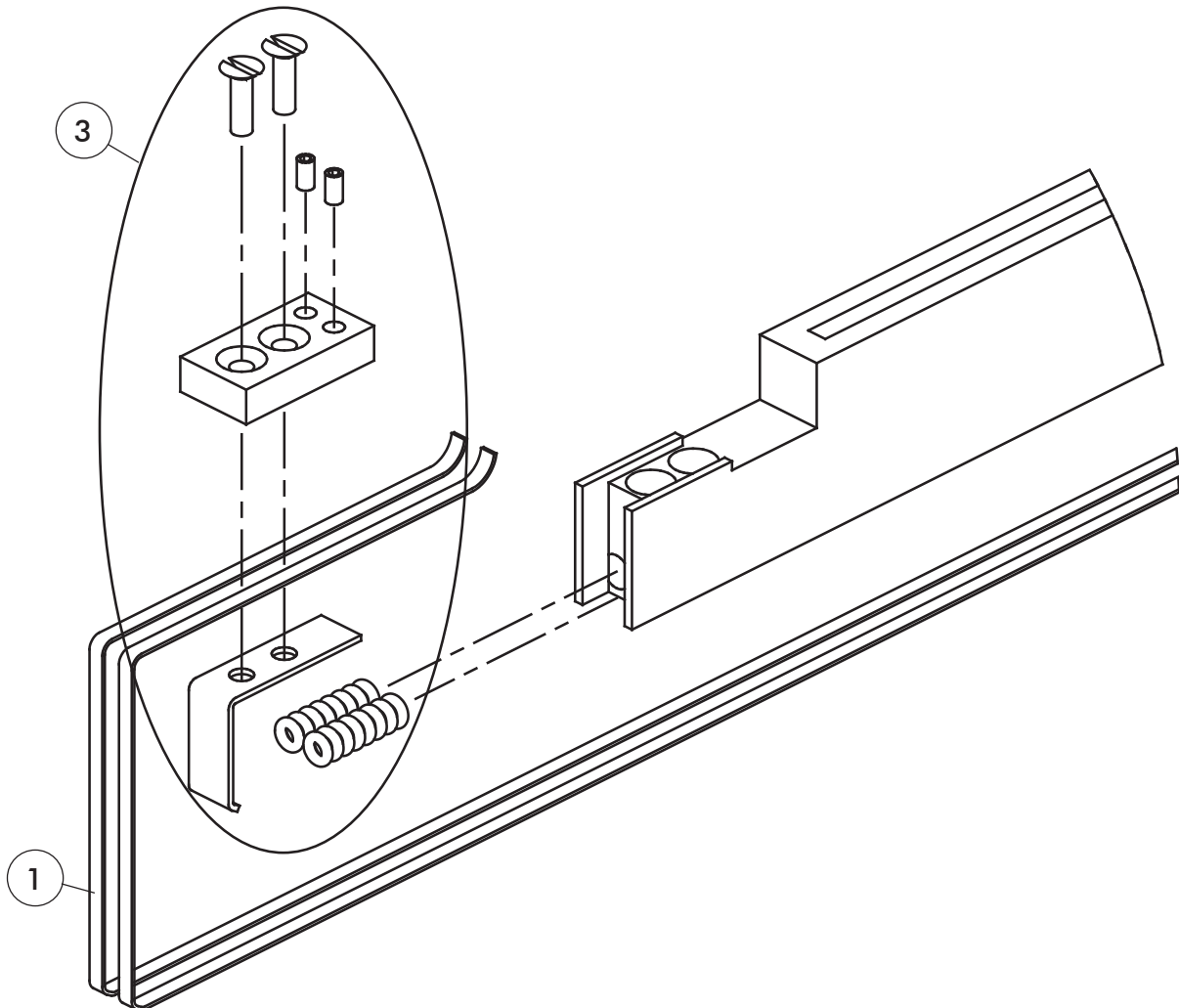
# Legs and Pump Diagram



## Double Seam Seal Bar

### Parts List and Diagram

Item No.		Description
	863017	Double Seam Seal Bar Complete
1	880746	Seal Element
2	885507	Teflon <sup>®</sup> Tape, (3-ft. required per seal bar) (not shown)
3	860250	Double Seam Seal Contact Kit
<b>Kit (860250) includes:</b>		
		Element Spring
		Element Clip
		Double Seam Contact
		Screw, M3x12 Slotted Flat Head
		Set screw, M4x6 Socket

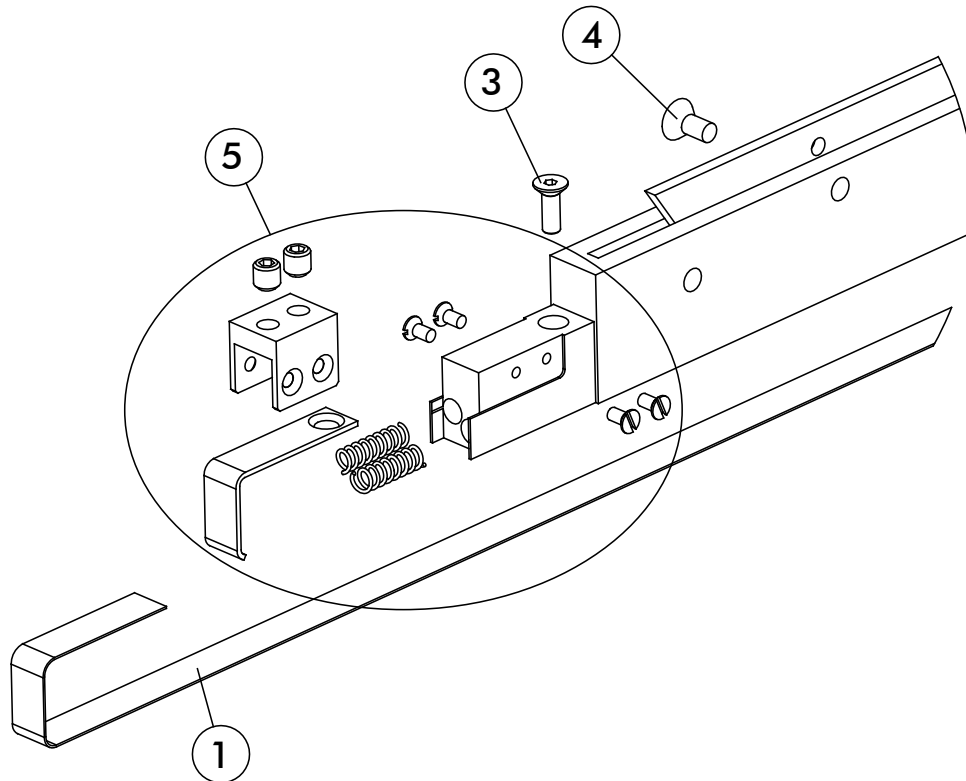




## 10mm Wide Seal Bar

### Parts List and Diagram

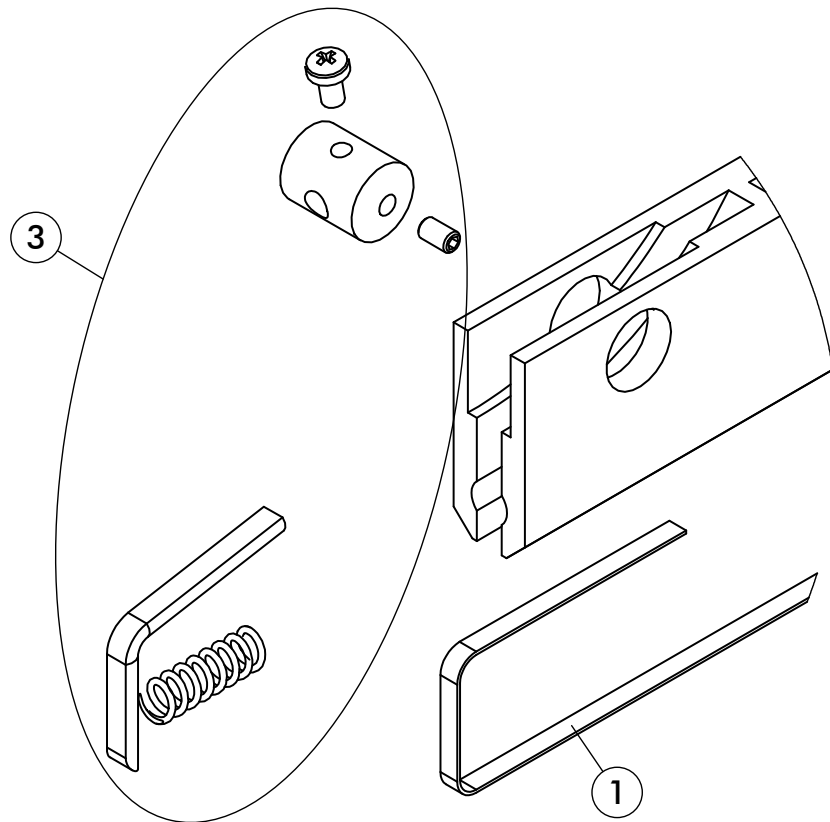
Item No.		Description
	861071	10mm Wide Seal Bar Complete
1	860512	Seal Element
2	885507	Teflon® Tape, (3-ft. required per seal bar) (not shown)
3	860174	Screw, M4x12 Slotted Flat Head
4	860251	Screw, M5x10 Slotted Flat Head
5	863016	10mm Wide Seal Contact Kit
<b>Kit (863016) includes:</b>		
		Element Spring
		Element Clip
		10mm Wide Seam Contact
		Set Screw, M5x6 Socket Head
		Screw, M3x6 Slotted Flat Head



## Single Seam Seal Bar

### Parts List and Diagram

Item No.		Description
	861001	Single Seam Seal Bar Complete
1	880746	Seal Element
2	885507	Teflon <sup>®</sup> Tape, (3-ft. required per seal bar) (not shown)
3	861013	Single Seam Seal Contact Kit
<b>Kit (861013) includes:</b>		
		Element Spring
		Element Clip
		Single Seam Contact
		Screw, M3x5 Slotted Panhead
		Set Screw, M3x5 Socket

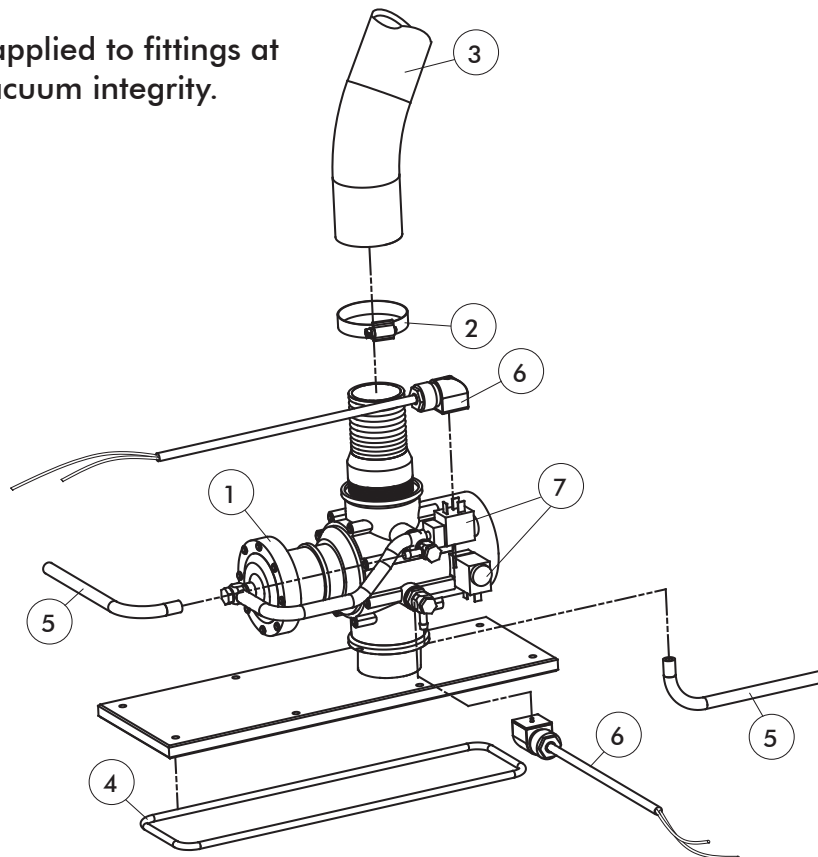


## Vacuum Manifold

### Parts List and Diagram

Item No.		Description
1	861152	Manifold Assembly
<b>Assembly (861152) includes:</b>		
		Valve Manifold Plate
		Valve, Mebner Vacuum and Vent
		Fitting, 2-in. Close Nipple
		Fitting, 2-in. Hose Barb
<b>NOTE:</b> New manifold o-ring (860603) recommended.		
2	860618	Hose Clamp, 2-in.
3	860617	Vacuum Hose (to vacuum pump), (5-ft. required)
4	860603	Manifold O-Ring
5	860954	Braided Hose, 1/4-in.
6	861020	Electrical Switch Cable
7	860908	DIN Coil, [SOL-1] [SOL-4]
8	860906	Replacement Vacuum Valve Diaphragm (not shown)
9	860907	Replacement Vent Valve Diaphragm (not shown)

**NOTE:** Epoxy is applied to fittings at valve inlets for vacuum integrity.



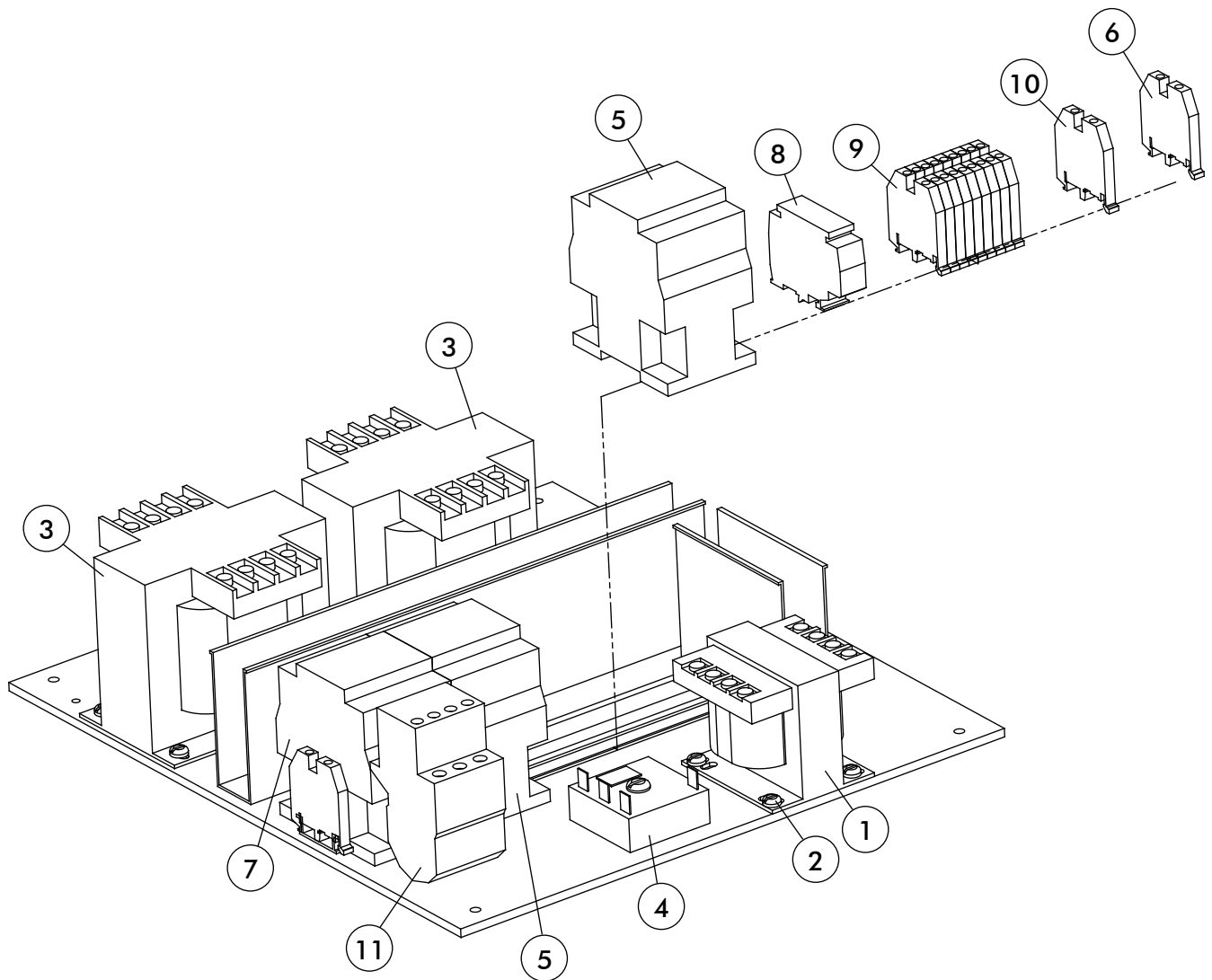
## Main Electrical Components

### Parts List

Item No.		Description
1	860311	Transformer, Control, 50VA, 460, 230/115 VAC
	860394	Transformer, Control, 50VA, 208/115 VAC
	809207	Transformer, 50VA, 380/400/415V-110/230V
2	860255	Screw, M5x6 Slotted Pan Head
3	860312	Transformer, Seal, 300KVA, 460, 230, 208/115 VAC
	860059	Transformer, Seal, 600VA, 460/230, 48 VAC (double seam seal)
	861286	Transformer, 380/400/415 24/48 350VA
	861289	Transformer, 380V, 48V, 600VA
	864106	Transformer, 480V 1500KV (Wideband seal only)
4	860703	Relay, Interval 4 sec. for Sealing
5	860793	Contactor, Sealing
6	860341	Terminal, End Cap
7	861179	Contactor, Pump, 32A, 600V, 110 Volt Coil
8	860339	Fuse Holder, Control
	860337	Fuse, 1A (not shown)
9	860340	Terminal Block
10	860342	Terminal, Ground Block
11	See Overload Table below	

Pump Size	Voltage	Overload Part No.	Pump Size	Voltage	Overload Part No.
7 ½ HP	208V	860795	10 HP	208V	860796
	230V			230V	
	380V	861214		380V	860797
	460V			460V	861214
	575V			575V	860797
5 HP	230V 1 PH	860796	12 HP	208V	860835
				230V	
	230V 1 PH	860796		380V	860797
				460V	
				575V	

# Main Electrical Components Diagram

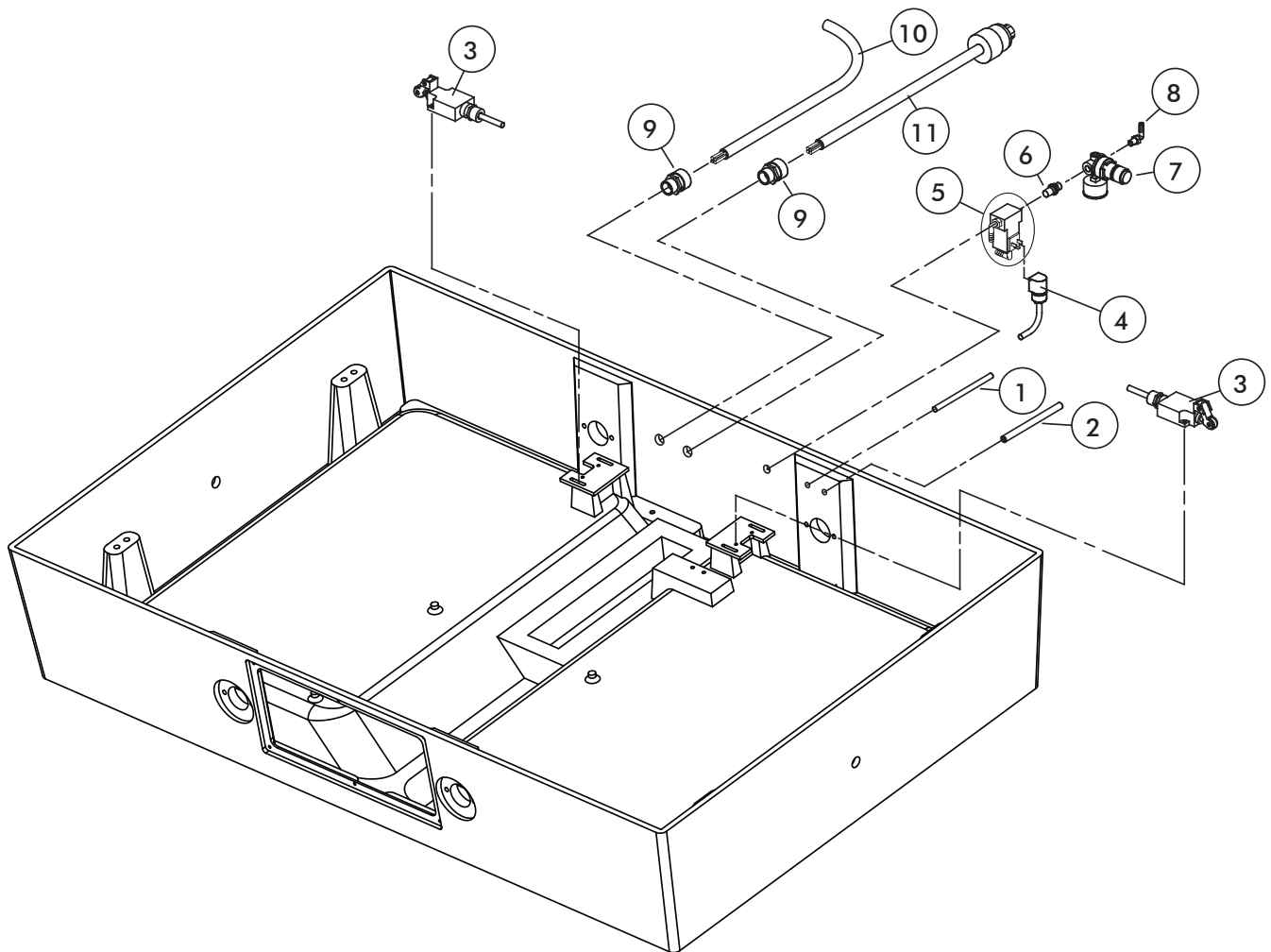


## Base

### Parts List

Item No.	UltraSource Part No.	Description
1	863012	Wire Harness, Complete
2	860954	1/4-in. Reinforced Hose (34-in. required)
3	861018	Cycle Switch Assembly Complete with Harness
	860309	Cycle Switch [LS-1] [LS-2]
4	861020	Harness for Valve, Complete with DIN Plug
5	861023	Valve Assembly, Seal Pilot with Fittings [SOL-3]
<b>Valve Assembly (861023) includes:</b>		
		Valve, 3-Way, NC, 1/4 NPT Ports, 120 Volt
		Hose Barb, 1/4-in. - 1/4-in. Elbow
		Hose Barb, 1/4-in. - 1/8-in. Elbow
6	860404	Brass Fitting
7	860775	Air Pressure Regulator and Gauge Assembly
8	860514	Hose Barb, 1/4-in. - 1/4-in. Elbow
9	861178	Electrical Compression Fitting, 230/460 Volt
	861131	Electrical Compression Fitting, 380 Volt
10	861045	Pump Harness, 208/230/460V, 5- and 7-1/2-hp Pump Harness, 460V, 10- and 12-hp
	861046	Pump Harness, 380V, 5-, 7-1/2-, 10-, and 12-hp
	861288	Pump Harness, 380V w/o Neutral (Special Option)
	861176	Pump Harness, 208/230V, 10- and 12-hp
11	861035	Power Harness, 208/230V, 5- and 7-1/2-hp
	861035-001	Power Harness, 230V, SINGLE PHASE 5-hp
	861036	Power Harness, 380V, 5-, 7-1/2-, 10-, and 12-hp
	861287	Power Harness, 380V w/o Neutral (Special Option)
	861037	Power Harness, 460V, 5-, 7-1/2-, 10-, and 12-hp

# Base Diagram



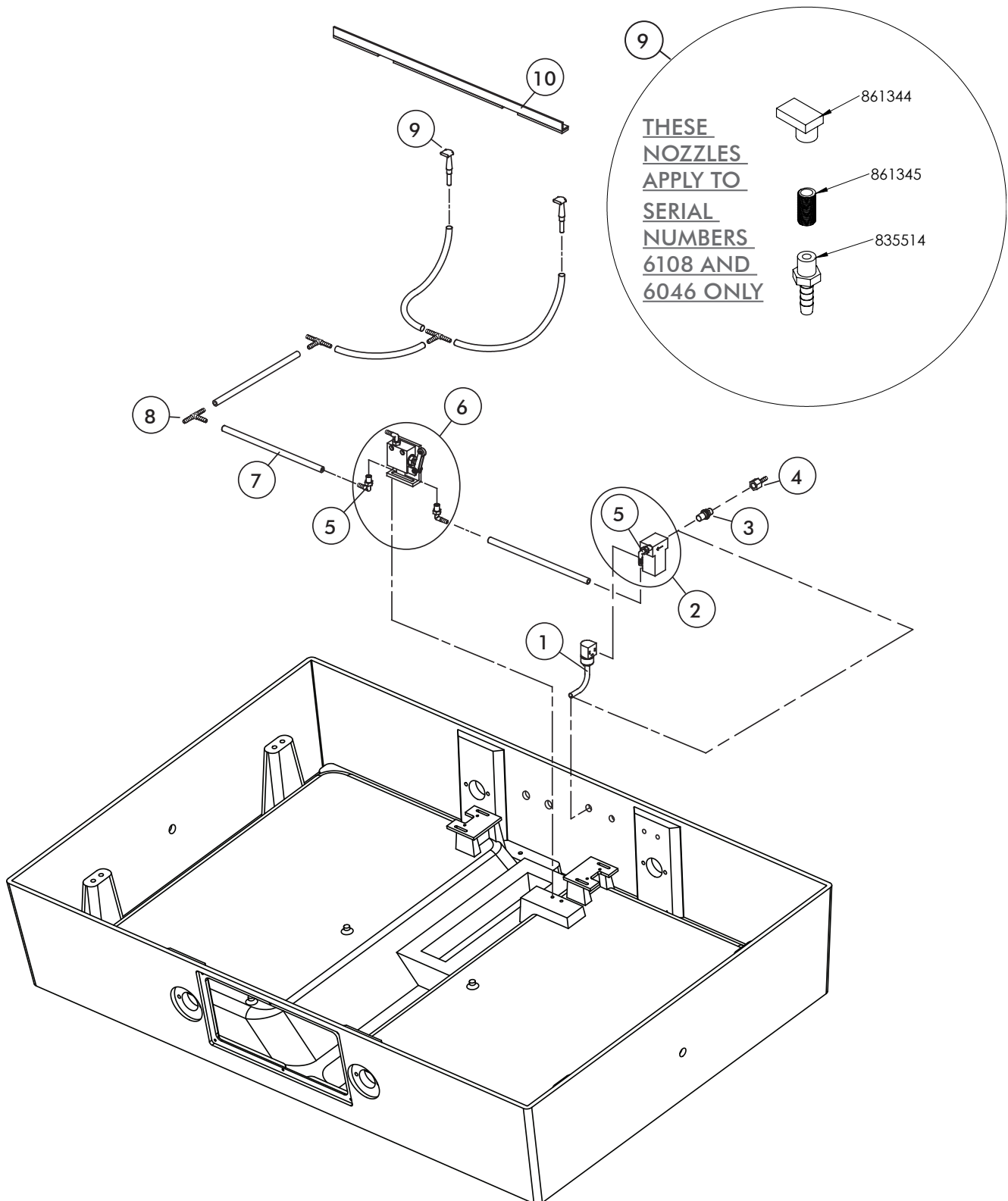
## Gas Flush

### Parts List

Item No.		Description
1	860352	Electrical Switch Cable
2	861024	Valve Assembly, Gas Pilot with Fitting
<b>Valve Assembly (861024) includes:</b>		
		Two-way Pilot Valve for Gas [SOL-2]
		Hose Barb, 1/4-in. - 1/4-in. Elbow
3	860404	Brass Fitting
4	860513	Gas Inlet Barb, 1/4-in.
5	860514	Hose Barb, 1/4-in. - 1/4-in. Elbow
6	861025	Valve Assembly, Gas Switching with Plate
<b>Valve Assembly (861025) includes:</b>		
		Gas Flush Selector Valve [V-1] (Serial #2090-Current)
		Hose Barb, 1/4-in. - 1/4-in. Elbow
		Valve Plate
		Nut, 6mm Nylon Lock
		Screw, M6x40 SHCS
	861010	Assembly, Gas Flush Hose [Items 7, 8, 9]
<b>NOTE:</b> Shown is 1/2 of the gas flush hose assembly (861010). One assembly required per chamber side.		
7	860954	Reinforced Hose, 1/4-in. (specify length)
8	860107	Hose Barb, 'T', 1/4-in.
9	860507	Gas Nozzle
10	863024	Bag Holder with Foam Padding (in machine lid)
	860203	Replacement Foam Padding Only



# Gas Flush Diagram

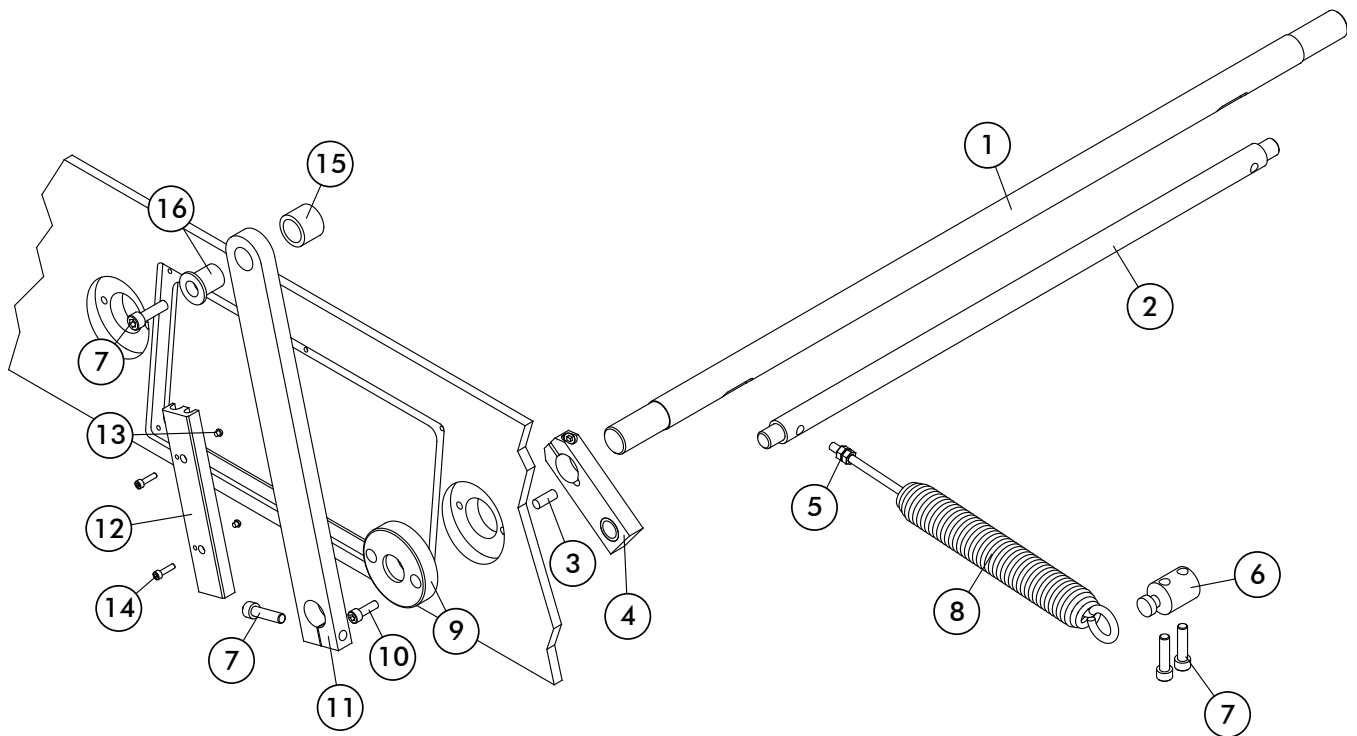


## Swing Arm Assembly

### Parts List

Item No.		Description
	861158	Lid Lever Shaft and Cam with Dowel Assembly [Items 1, 2, 3, 4]
1	861155	Lid Lever Shaft
2	860403	Connecting Shaft
3	861156	Dowel, M10x25mm long, Stainless Steel (Serial #4606 - Current)
4	861157	Cam Lever Complete Assembly
<b>Assembly (861157) includes:</b>		
		Cam Lever
		Cam Bushing
		Screw, M8x30 Socket Head
5	866766	Nut, M8
6	860424	Spring Retainer
7	866742	Screw, M10x35 Socket Head
8	860244	Lid Spring
9	861008	Bearing Hub Assembly
<b>Assembly (861008) includes:</b>		
		Bearing Retainer
		Shaft Bearing
		Bearing Hub
10	866739	Screw, M8x25 Socket Head
11	860114	Lid Lever
	860111	Lid Lever for Utilities Clamp (backside of machine)
12	860749	Utilities Clamp
13	860754	Button, Cable Clamp
14	866729	Screw, M5x20 Socket Head
15	860414	Bushing Spacer
16	860401	Lid Lever Bushing

# Swing Arm Assembly Diagram

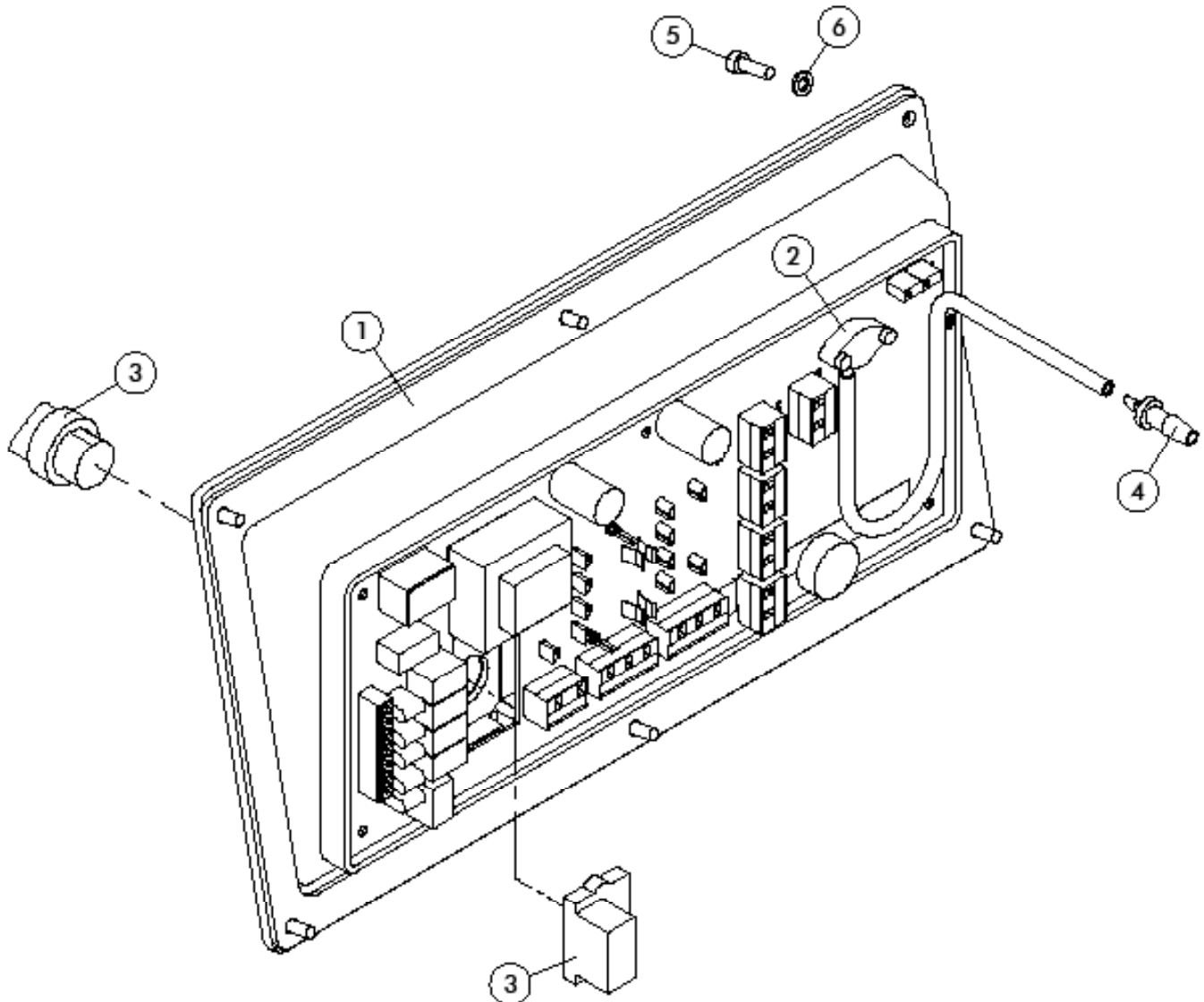


## Digital Control Panel

### Parts List and Diagram

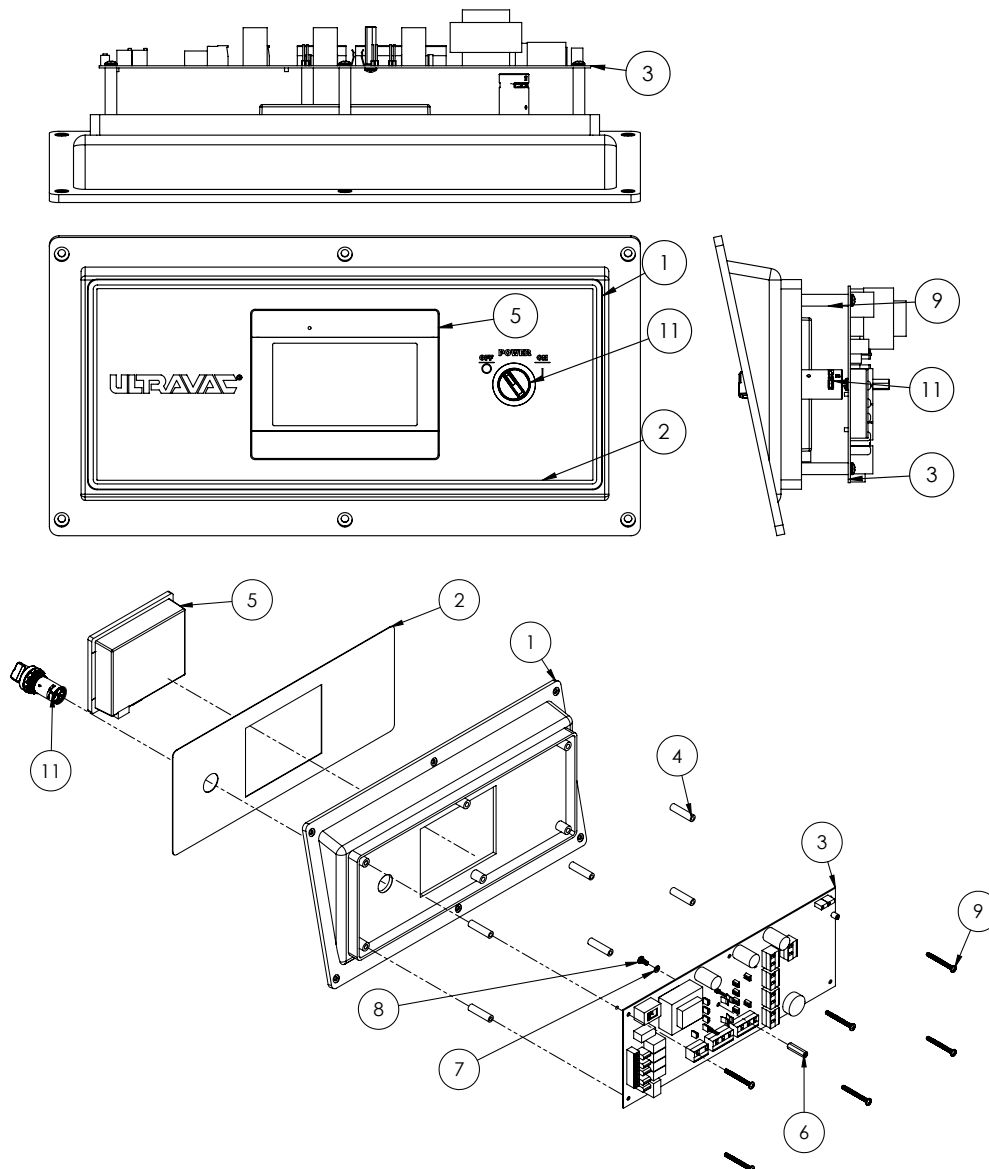
Item No.	UltraSource Part No.	Description
1	860995	Front Panel Assembly
2	860673	Vacuum Sensor
3	860316	Main Power On/Off Switch [SW-1]
4	860683	Fitting 1/4 x 1/8 Reducer
5	866728	Screw, M5x16 SHCS, SS
6	866773	Washer, M5 Flat

**NOTE:** Torque specification for 866728 (item 5) is 20 inch-pound.



## Touchscreen Control Panel 861300

ITEM	PART NUMBER	DESCRIPTION	QTY
1	861301	BEZEL, TOUCHSCREEN PANEL	1
2	861302	DECAL, TOUCHSCREEN	1
3	861304	PWB TOUCHSCREEN HMI5043N	1
4	866783	WASHER, M4, SPLIT LOCK, SS	1
5	861382	T.S. HMI5043LB, PROG'D, ZPL	1
6	869628	SCREW, 8-23 X 3/8-IN.	1
7	861324	STANDOFF, 8-32 X 1	1
8	861320	SCREW, M4 X 40 PAN HEAD	6
9	861325	SPACER, NYLON, 5/16" X 1 1/4"	6
10	861306	DECAL, CORELOK, F/TOUCH SCREEN (N/A)	1
11	860316	SWITCH, POWER ON/OFF & BODY ASSY	1

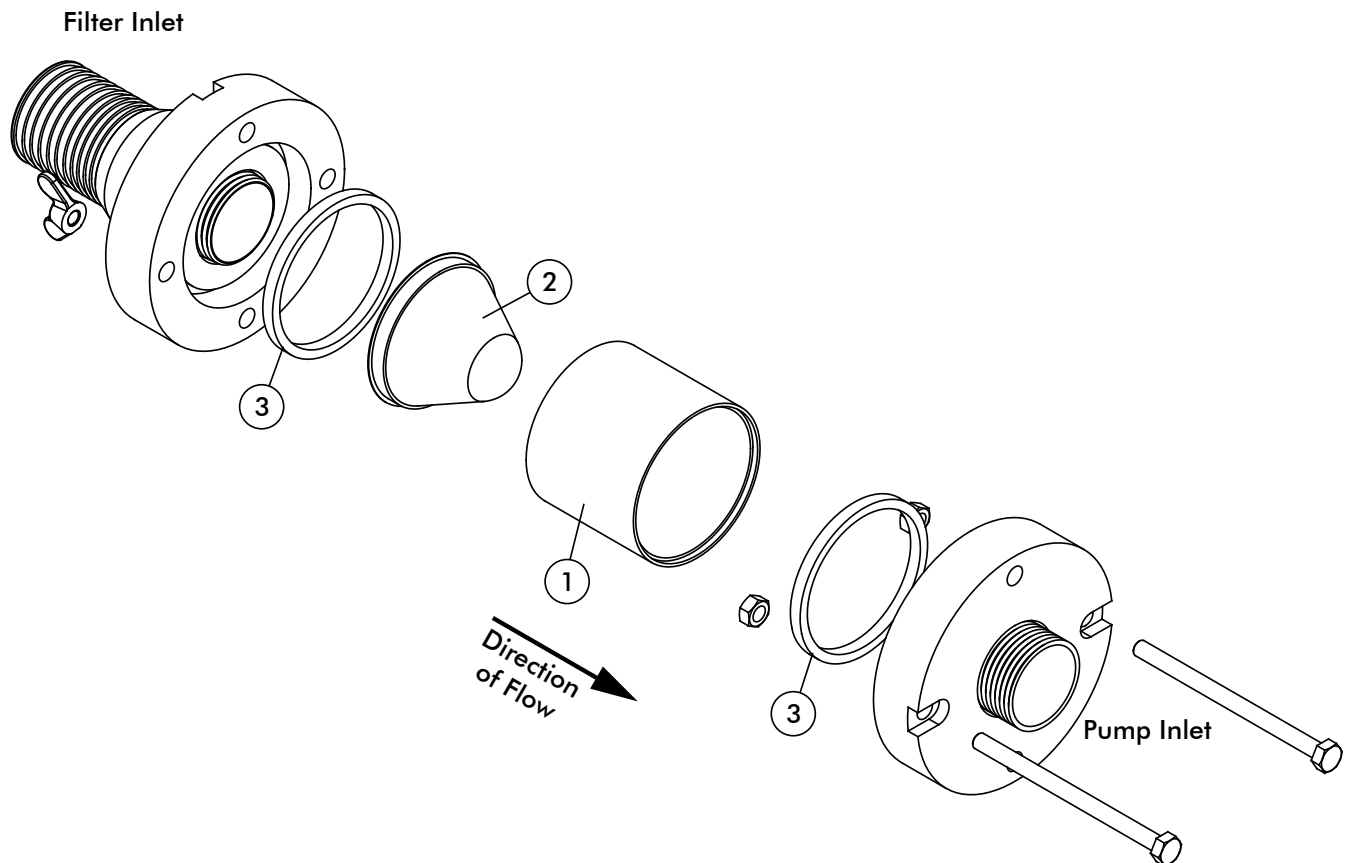


## Inline Filter

### Parts List and Diagram

Item No.	UltraSource Part No.	Description
	861153	Inline Filter Complete
1	835427	Tube, Inlet Filter
2	884250	Filter Screen
3	835429	Gasket, Inlet Filter
<b>Hardware included in complete assembly (861153):</b>		
		Screw, M8x120 Hex Head
		Nut, 8mm Hex
		Nut, 8mm Wing

**NOTE:** Epoxy is applied to fittings at filter and pump inlets for vacuum integrity.



## REFERENCE MANUALS

### R5 Series Vacuum Pumps

Included within Ultravac<sup>®</sup> 2100 owner's manual is an installation and operating manual for the vacuum pump equipped with this vacuum chamber machine.

Refer to page 6.1 of the Ultravac<sup>®</sup> 2100 owner's manual for oil and replacement filter part numbers for this machine.

### **For Replacement Parts, Call:**

Phone (816) 753-2150 • Fax (816) 561-2854  
Toll-Free (800) 777-5624



# **INSTALLATION AND OPERATING MANUAL**

**R5 Series  
Current Models 0025, 0040, 0063, 0100 and 0250  
Single Stage Rotary Vane Vacuum Pumps**





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## MOTOR AND ELECTRICAL DATA

We reserve the right to change the product at any time without any form of notification. The information in this publication is accurate to the best of our ability at the time of printing. Busch, Inc. will not be responsible for errors encountered when attempting to perform tasks outlined in this publication.

## GENERAL

### Identification

For model identification, see the nameplate mounted on the side of the exhaust box.

This manual is written to cover RA and RC versions of models 0025, 0040, 0063, 0100, and 0250 with a "C" or "E" appearing as the seventh character in the model type number stamped into the nameplate. For example it would appear as follows:

RAXXXX - CXXX - XXXX

When ordering parts, it is helpful to include the identification code stamped into the side of the cylinder as well as the serial number from the nameplate.

### Operating Principles

All reference (Ref. XX) numbers listed in the text and on illustrations throughout this manual are related to the drawings and parts list near the center of this publication.

All R5 Series, Single Stage, Rotary Vacuum Pumps are direct-driven, air-cooled, oil-sealed rotary vane pumps which operate as positive displacement pumps. As Figure 1 shows, they consist of a rotor mounted concentrically on the drive shaft and positioned eccentrically in a cylindrical stator. The rotor has three radially sliding vanes which divide the pump chamber into three segments. The gas to be pumped enters at the inlet port (Ref. 260), passes through the inlet screen (Ref. 261) and the open anti-suck-back valve (Ref. 251) into the pump chamber. As the rotor rotates, the inlet aperture is closed, the gas is compressed and forced out through one-way valves between the pump cylinder and the exhaust box. This operation is repeated three times each revolution.

All R5 series pumps are designed to handle air. Vapor in the air stream can be tolerated when the pump is operated within certain operating parameters as defined by Busch, Inc. Engineering (see Section 2.2 Gas Ballast). When you desire to use the pump on an air stream that contains vapors, contact Busch, Inc. Engineering for operating recommendations; otherwise, the warranty could be void.

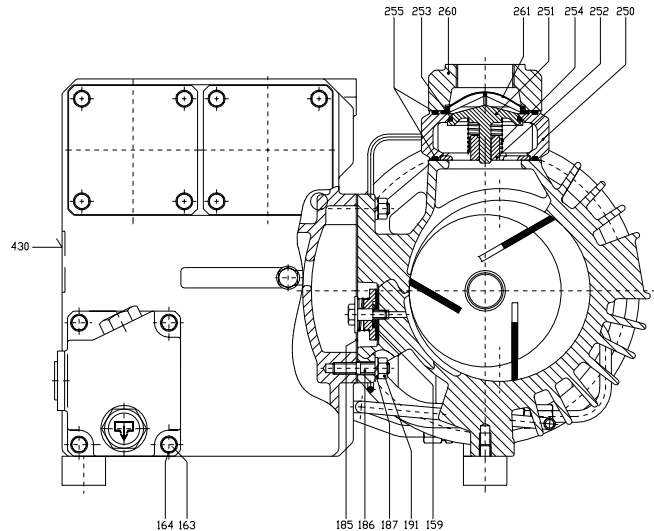


Figure 1 Module Cross Section

## 1.0 INSTALLATION

### 1.1 Unpacking

Inspect the box and pump carefully for any signs of damage incurred in transit. Since all pumps are ordinarily shipped FOB our factory, such damage is the normal responsibility of the carrier and should be reported to them.

Remove the nuts from the bottom of the box/crate and pull the pump out of the container, then unscrew the studs from the bottom of the rubber feet.

The inlet port of the pump is covered with a plastic cap prior to shipment to prevent dirt and other foreign material from entering the pump. Do not remove this cover until the pump is actually ready for connection to your system.

### 1.2 Location

The pump must be installed in a horizontal position on a level surface so that the pump is evenly supported on its rubber feet. Allow at least one foot (five feet for large pumps) of air space between the pump and any walls or other obstructions to the flow of cooling air.

Also, adequate ventilation must be provided for the fans on the pump and motor (i.e., do not locate the pump in a stagnant air location).

Whenever the pump is transported, be sure to drain the oil prior to shipping to avoid vane breakage when restarting the pump.

Do not tip the pump over if it is filled with oil.

Locate the pump for easy access to the oil sight glass (Ref. 83) in order to inspect and control the oil level properly. Allow clearance at the exhaust flange area to provide service access to the exhaust filters.

### 1.3 Power Requirements

The schematic diagram for the electrical connection is located in the junction box or on the nameplate of the pump motor.

The motor must be connected according to the electrical codes governing the installation. The power supply must be routed through a fused switch to protect the motor against electrical or mechanical overloads. The motor starter has to be set consistent with the motor current listed on the motor nameplate.

If the pump is supplied with a manual motor starter, it is preset at the factory in accordance with the customer's specification. For other voltage requirements, contact the factory for motor and/or starter information.

**NOTE:** See the motor manufacturer's manual for start-up maintenance of the motor.

Correct direction of rotation is marked by an arrow on the motor fan housing and is counterclockwise when looking at the motor from the motor's fan side.

**Caution: After the electrical connection has been made, but before the pinup is filled with oil, the rotation of the motor must be checked. Open the inlet port and jog the motor briefly to make sure rotation is correct. If it runs backwards and if it is wired three phase power, reverse any two leads of the three at the power connection.**

### 1.4 Vacuum Connections

Use a line size to the vacuum system that is at least as large as that of the pump inlet. Smaller lines will result in lower pumping speeds than the rated values.

Install a drip leg and drain on the vertical pipe near the pump inlet. Drain the drip leg often to prevent condensation from entering the pump.

**Caution: The built-in anti-suck-back valve is not positive action; do not use it as a system check valve.**

If more than one vacuum pump or a receiver tank is connected to a common main line, each pump should have its own manual or automatic operated shut-off valve or positive action check valve. The built-in anti-suck-back valve should not be used as a shut-off valve for the vacuum system.

Remove the plastic protective cap from the inlet port prior to connection of the pump to the system.

The following threads are provided at the inlet of the R5 Series pumps:

Pump Size	Size	Threads
0025/0040	1 1/4"	Female NPT
0063/0100	1 1/4"	Female NPT
0250	2"	Female NPT

If the gas that is pumped contains dust or other foreign solid particles, a suitable (10 micron rating or less) inlet filter should be connected to the inlet port. Consult the factory for recommendations.

**Caution: When using PVC pipe or any static enhancing material for the exhaust piping, make provisions to safeguard against arcing from static electricity. Arcing can ignite oil vapor that may be present.**

### 1.5 Oil Filling

The pump is shipped without oil. After level installation, and after correct rotation has been established, fill the pump with the recommended vacuum oil through the oil filling port (Ref. 88), observing the "MAX" and "MIN" position at the oil sight glass (Ref. 83).

Non-detergent oil should be used. **Do not use detergent motor oil** as additives in detergent oil will plug exhaust filter elements and shorten their life.

It is recommended that Busch R500 Series oil be used to receive the best performance from your vacuum equipment. R500 Series oil is a high quality vacuum oil which will give longer running time between oil changes, will provide better lubrication at high operating temperatures, and will prolong the life of exhaust filter elements. This oil can be obtained directly from Busch, Inc. in Virginia Beach, Virginia.

The strict use of Busch oils and parts from the day of purchase can extend the standard warranty to three years. Contact Busch, Inc. in Virginia Beach, Virginia for details. Refer to page 20 for the standard warranty.

For general applications, use R530 in most models. Use R590 or R570 in pumps that are operated in high ambient temperatures (above 90°F) or high operating pressure when the oil carbonizes (turns black) before the change interval. Use R590 or R570 on 0250 pumps. Contact the factory for recommendations when using other oils.

The following table gives the approximate quantities of oil required for each pump:

Pump Type	Oil Capacity (Qt.)
0025/0040	1.4
0063/0100	2.5/2.7
0250	7

The oil capacity chart should only be used as a guide, since oil capacity may be slightly lower, depending on whether the pump was filled previously, and whether all components such as oil filter, oil lines, etc., were allowed to completely drain. Use only the sight glass reading for proper level. Never overfill.

**Warning: Keep the oil fill plug tight as pressure in the exhaust box could cause bodily injury if the plug is blown out. Do not fill/add the pump with oil through the exhaust/inlet ports as there is danger of breaking the vanes!**

For ambient operating temperatures lower than 41°F, use Busch R580 synthetic oil. If this does not help (where the pump has difficulty starting due to high oil viscosity) contact the factory in Virginia Beach, Virginia.

Replace the oil fill plug (Ref. 88/90), making sure that the gasket (Ref. 89) is in place and properly seated and secured. Some pumps are equipped with an exhaust pressure gauge as an integral part of the oil fill plug.

## 2.0 OPERATION

### 2.1 Start-up

Check rotation of the motor as described in paragraph 1.3 - Power Requirements.

Fill the pump with oil as described in paragraph 1.5 - Oil Filling.

Start the pump and immediately close the inlet. Run the pump for a few minutes before checking the oil level again. With the pump shut off, the oil level should be visible in the oil sight glass (Ref. 83), between the "MIN" and "MAX" mark.

Add oil, if necessary, but only add it when the pump has been shut off and the circulating oil has

had sufficient time to return to the oil sump.

**NOTE:** *The oil separated by the exhaust filter element forms droplets on the outside of the exhaust filter which collect at a low point in the upper half of the exhaust box. From there the collected oil is drained back to the oil sump via an oil check valve (Pos 275) which opens on R5 RA Model Pumps when the pump is shut off. It is necessary to shut off the RA model pumps after every 8 hours of operation to allow the check valve to open. If the pump is not shut off after this time period, it is possible to starve the pump of oil since the oil is not allowed to drain back into the oil sump and/or oil droplets may be blown out of the exhaust. If the pump is operating at high pressure it may be necessary to shut it down sooner than 8 hours.*

On R5 (Standard) RC Model Pumps, the collected oil is drawn continuously during operation of the vacuum pump to the inlet flange (Pos 260) via the oil return line (Pos 290). The oil return line is connected directly to the area of the exhaust box, downstream of the exhaust filter, which is at atmospheric pressure. Therefore, a constant amount of air is sucked into the pump which is an additional reason that the R5 Standard Series Pumps do not achieve as low a vacuum as the R5 Series Super Vacuum Pumps.

## 2.2 Gas Ballast

All RA Series pumps are equipped with a gas ballast valve. The gas ballast valve (Ref. 440) is located between the inlet port and the exhaust box. RA Series pumps up to size 100 are equipped with a permanent gas ballast which cannot be shut off unless the sintered filter is removed and the orifice plugged. Larger pumps are equipped with an adjustable gas ballast valve.

The adjustable gas ballast valve should normally be left open. Its primary function is to prevent water vapor from condensing in the pump. Condensation causes emulsification of the oil, loss of lubricity, and possible rotor seizure.

## 2.3 Stopping Pump

To stop the pump, turn off the power. The pump

has a built-in anti-suck-back valve (Ref. 251 thru 255) to prevent the pump from rotating backwards when it is shut off.

**Caution: Do not use the anti-suck-back valve as a check or shut-off valve for your vacuum system. Do not depend on the anti-suck-back valve to prevent pump oil from migrating through the inlet into the system when the pump is shut down.**

Install an automatic operated valve (such as a check valve) in front of the pump, if more than one pump is pumping on the same line or if there is a sufficient volume of vacuum in the system to cause the pump oil to be drawn into the piping when that pump is shut down.

All R5 Series pumps are vented internally to atmospheric pressure through venting holes which are next to the exhaust valve assembly.

## 2.4 Water-Cooled Pumps

Water-cooled pumps are cooled by circulating the oil through a shell-and-tube type heat exchanger. The circulation of the pump oil through the shell is created by vacuum in the pump, but the circulation of the cooling water through the tubes is thermostatically controlled. The flow rate of the cooling water is controlled by a thermostatically activated valve that senses, through a capillary bulb mounted in the exhaust box, the pump's oil temperature as it is discharged from the compression chamber. The valve will open at its set point and close at approximately 3°F to 5°F below the set point. The valve set point is adjustable as follows:

(a) Rotate the valve adjustment screw counter-clockwise to cause the valve to open at a higher temperature.

(b) Rotate the valve adjustment screw clockwise to make the valve open at a lower temperature.

The thermostatic valve can be manually opened by inserting a screwdriver under each side of the spring guide and prying the spring and guide upward away from the valve body.

## 2.5 Oxygen Service Pumps

**Warning:** This pump is filled with a special operating fluid. Do not use any other type of fluid, oil and/or grease. Use one of the following:

- Fomblin LC 250
- Tyreno Fluid 12/25V (perfluorinated poly-ether)
- KRYTOX ® Vacuum pump fluid by Du Pont Company

If you have any questions, please phone our Customer Service Department for more information.

### Application

If this pump is contaminated by organic compounds do not attempt to use it on oxygen service until it has been decontaminated.

These Installation and Operating Instructions are valid for the following vacuum pumps:

RA/RC 0025	RA/RC 0100
RA/RC 0040	RA/RC 0250
RA/RC 0063	

These pumps have been manufactured, solvent washed (to remove organic contaminants) and assembled according to the latest technical standards and safety regulations. If this pump is not installed properly or not used as directed, a dangerous situation or damage might occur.

**It is mandatory that these operating instructions be read and understood prior to vacuum pump installation and start-up.**

### Pump Overhaul/Repair

Busch Inc. strongly recommends that all major repair operations be conducted at the factory. **Improper handling of repairs could result in extreme danger to personnel operating the pump.**

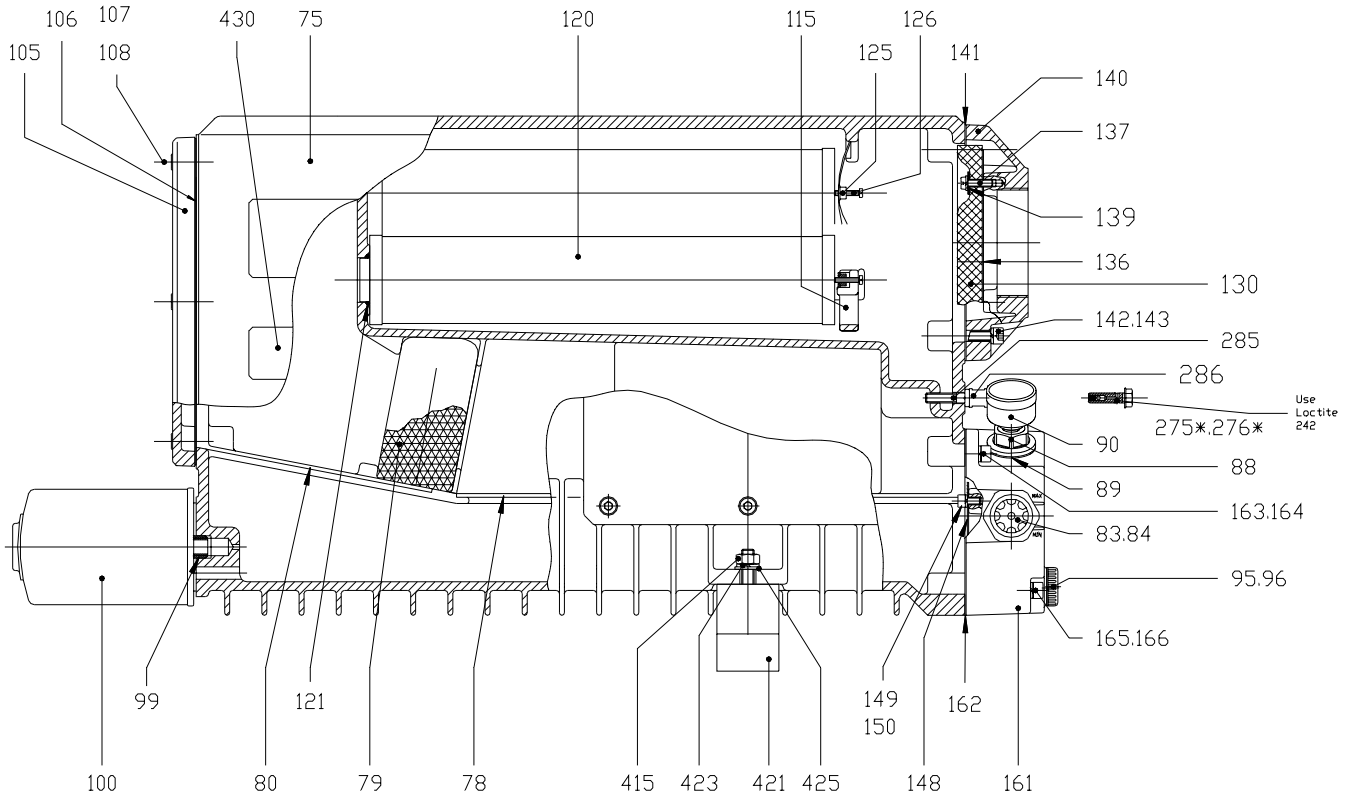


Figure 2 Typical Exhaust Box Cross Section

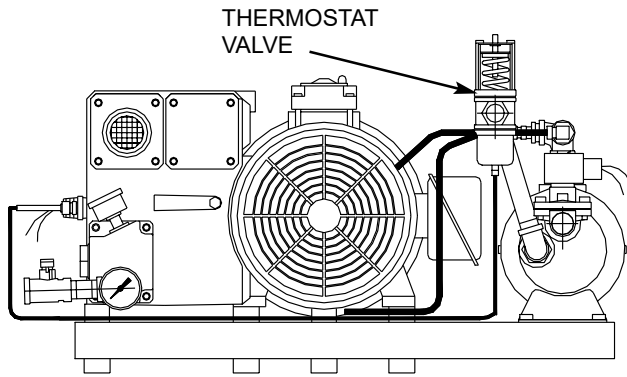


Figure 3 - Water Cooled Pump

### 3.0 MAINTENANCE

R5 Series, Single Stage, Rotary Vacuum Pumps require very little maintenance; however, to insure optimum pump performance, the following steps are recommended:

#### 3.1 Pump Oil

##### 3.1.1 Oil Level

With the pump installed relatively level, make sure that there is sufficient clean oil in the pump. The oil level should be observed on a daily basis and/or after 8 hours of operation and should be replenished if it drops below the 1/4 mark on the oil sight glass. On R5 series pumps you must first shut the pump off in order to let the oil flow back into the oil sump prior to checking the sight glass. Allowing insufficient time for the oil to drain back into the sump on R5 series pumps prior to adding oil could result in overfilling.

Oil level readings should be done only when the pump is turned off. Oil can be added to the oil fill port (Pos 88) if the pump is shut off and the circulating oil has sufficient time to return to the oil sump.

**Caution: Do not add oil while the pump is running since hot unfiltered oil vapor may escape through the oil fill port.**

Under normal circumstances, it should not be necessary to add or drain oil from the pump between recommended oil changes.

A significant drop in oil level means there is an oil leak or that an exhaust filter is broken, and the

pump should be smoking excessively. It is normal for the oil to be foamy and light in color in an operating pump. However, if the oil is milky colored, it is an indication that water is present in the oil. Normally, by operating the pump for an extended period, with the inlet suction blanked off and the gas ballast (Pos 440) open on RA pumps, the water will be purged from the oil. If the oil is dark colored, it is contaminated or carbonized and must be changed.

#### 3.1.2 Oil Type and Quantity

See Section 1.5 - Oil Filling - for details on oil type and quantity.

#### 3.1.3 Oil and Filter Change

**Caution: When changing the oil and filters, it may be necessary to flush the pump to remove any build-up of degraded oil from the sumps, oil lines, radiators, etc. to ensure proper oil flow through the pump. Reduced oil flow, especially through radiators and cooling coils, can cause mechanical damage or extreme overheating which could cause the oil vapors to ignite.**

Oil life is dependent upon the conditions to which it is exposed. A clean, dry air stream and an oil operating temperature under 210°F are ideal conditions. When using R530 (hydrocarbon oil) it is recommended that oil changes are made every three (3) to four (4) months or 500 to 750 hours of operation, or as necessary if high heat is contaminating the oil. The use of Busch R570 or R590 synthetic oils could extend the operating hours between oil changes under ideal conditions. Oil samples should be taken regularly when exceeding the 500-750 hour recommendation.

#### *Excessive Heat*

When the pump is subjected to operating conditions that will cause the oil to be heated above 210°F, the oil will carbonize and become contaminated after a relatively low number of operating hours. The higher the temperature, the quicker the oil becomes contaminated. If the oil temperature is too severe, Busch R570 or R590 synthetic oil should be used to withstand the elevated temperatures. If synthetic oil is used, the pump should be flushed with Busch R568 oil as outlined in the Maintenance



and Repair Manual. Auxiliary oil cooling is the most practical approach to a severe heating problem.



Figure 4 - Removing Exhaust Housing



Figure 5 - Removing Filter Spring

#### Contaminated Air Stream

When the air stream contains solids and/or liquid that contaminate the oil, it must be changed more often. If the air stream contains a small percentage of contaminants and/or they are slightly aggressive\* (mild acids, etc.), synthetic oil, such as Busch R570, will resist breakdown better than the standard Busch R530. The solution is to install a filter or knock-out pot to keep the contaminants out of the pump.

\*Process air streams with a large percentage of contaminants and/or are more than slightly aggressive must use a Once-Through-Sealant or dry type pump.

**WARNING: If the gas entering this pump is a health hazard, use rubber gloves and all necessary personal protection equipment when performing the exhaust filter replacement operation.**

**WARNING: Wear safety glasses when installing or removing the spring retainers. The retainers can, if not secured correctly, slip off and fly out of the exhaust box.**

Oil change intervals can only be established by experience with the pump operating in the actual conditions (see previous paragraph for some of the conditions). Develop the oil change interval by periodically checking an oil sample removed from the pump. When the oil sample has become dark in color (from solids and carbonized particles) or is milky looking (from solids), it is time to discard it.

### 3.2 Automotive-Type Oil Filter

The 0025-0250 Series, Single Stage, Rotary Vacuum Pumps are equipped with an automotive-type oil filter (Ref. 100). When replacing the automotive-type oil filter, use only a Busch genuine filter.

*Note: Make sure to tighten the Busch oil filter securely against the aluminum sealing surface so that leaks will not occur.*

### 3.3 Exhaust Filter (Ref. 120)

Every nine (9) to twelve (12) months, or as necessary, replace the exhaust filter elements. The service life of the exhaust filters varies widely with pump application. It is only necessary to change the filters when the elements become clogged with foreign material or burned oil. Indications of clogged filters are smoke and oil mist coming from the pump exhaust, higher than normal motor current or oil leaking from the gas ballast valve on RA models.

A pressure gauge (Pos 90) is now supplied with your R5 vacuum pump as part of the oil fill plug. This gauge has a green field and a red field. A pressure within the green field would indicate normal pressure. Any pressure, in or close to the red field,

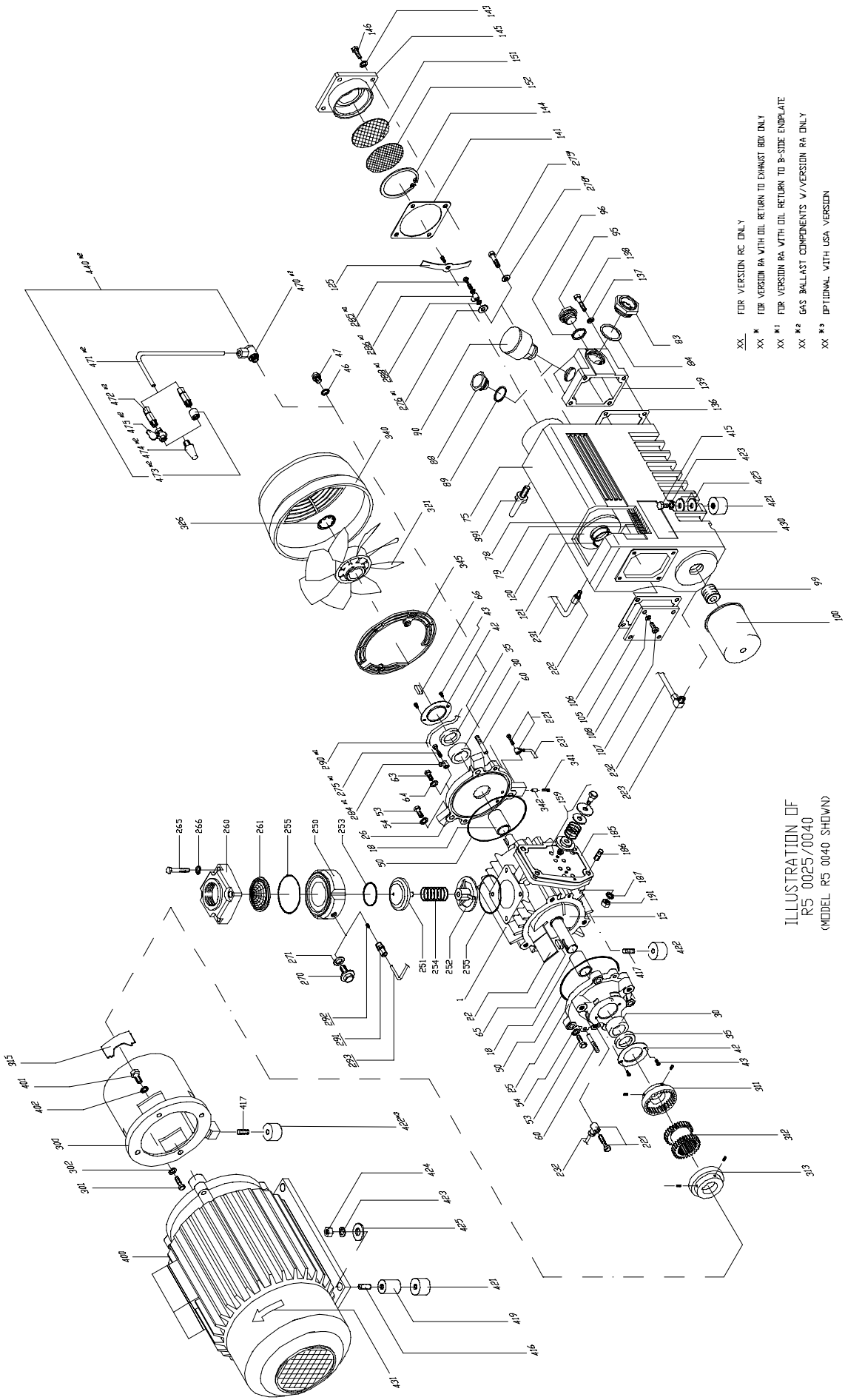


ILLUSTRATION OF  
 RS 0025/0040  
 (MODEL RS 0040 SHOWN)

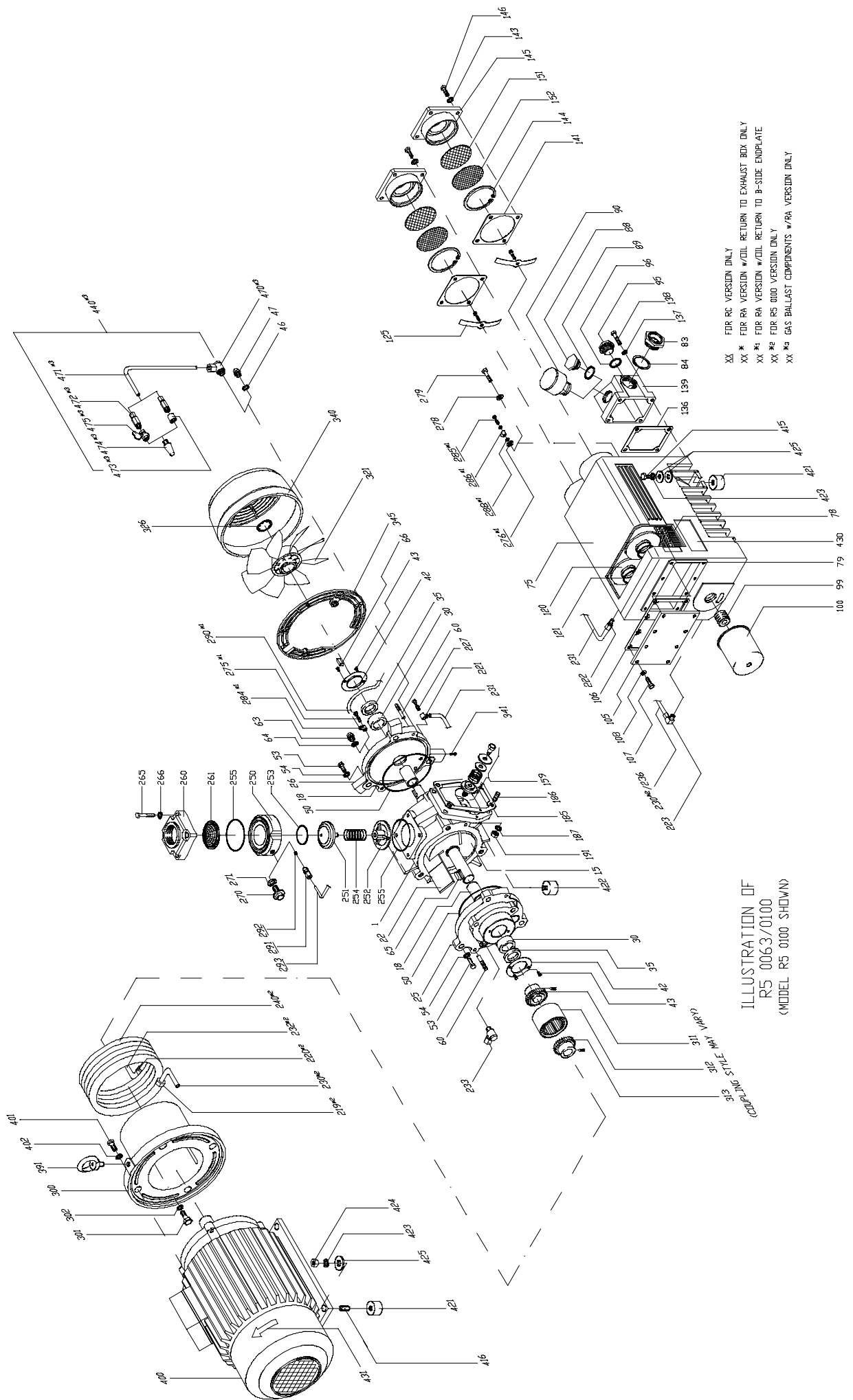


ILLUSTRATION OF  
 R5 0063/0100  
 (MODEL R5 0100 SHOWN)

## 0025 - 0250 "C" & "E" Parts List

Ref	Description	Ref	Description	Ref	Description
1	Cylinder	151	Exh. Screen, coarse	301	Screw hex head cap
5	Socket set screw	152	Exh. Screen, fine	302	Lockwasher
15	Rotor	159	Valve assembly, exhaust	306	Motor adapter flange
18	Bearing sleeve	161	Oil service block	307	Lockwasher
22	Vane	162	Oil service block gasket	311	Coupling half, pump side
25	Endplate, motor side	163	Hex head cap screw	312	Coupling insert
26	Endplate, fan side	164	Lockwasher	313	Coupling half, motor side
30	Bearing	165	Socket head cap screw	315	Plastic clip
31	Spacer, bearing to Seal	166	Lockwasher	320	Spacer
35	Shaft seal	168	O-ring	321	Fan
42	Retainer ring	169	Exhaust valve cover plate	322	Axial fan
43	Screw, hex head	175	Socket head cap screw	323	Socket set screw
46	Gasket-ring	176	Lockwasher	326	Retainer ring
47	Plug	185	Gasket, cylinder/exhaust box	331	Set screw
49	O-ring	186	Stud	333	Set screw
50	O-ring	187	Lockwasher	340	Fan guard
53	Screw, hex head	189	Stud	341	Screw, self tapping
54	Lockwasher	190	Lockwasher	342	Sleeve, plastic
57	Hex head screw	191	Nut	345	Fan cover shield
58	Lockwasher	205	Exhaust cover side plate	353	Socket head cap screw
60	Taper pin	206	Cover plate gasket	360	Lockwasher
63	Plug	207	Socket head cap screw	390	Eye bolt adapter
64	Gasket-ring	208	Lockwasher	391	Eye bolt
65	Shaft key	221	Hydraulic fitting banjo	392	Lockwasher
66	Shaft key	222	Hydraulic fitting, straight	393	Hex head screw
75	Exhaust box	223	Hydraulic fitting, elbow/banjo	400	Motor
78	Baffle, expanded metal	224	Pipe adapter	401	Screw, hex head cap
79	Demister pad	225	Hydraulic fitting	402	Lockwasher
80	Sheet metal baffle	230	Oil tubing	409	Motor foot spacer
83	Oil sight glass	231	Oil tubing	411	Flat Washer
84	Gasket ring, sight glass	232	Oil tubing	413	Slotted set screw
88	Oil fill plug	238	Socket head cap screw	415	Screw, hex. head cap
89	Gasket ring, fill plug	239	Lockwasher	416	Stud, motor foot
90	Exhaust pressure gauge	241	Oil cooler	417	Set screw
95	Oil drain plug	242	O-ring	419	Spacer, motor foot
96	O-ring	244	Fan cover	421	Foot, rubber
99	Pipe nipple	247	Socket head cap screw	422	Foot, rubber
100	Oil filter	250	Housing, lower, inlet	423	Lockwasher
105	Cover, exhaust box	251	Valve plate, inlet	424	Hex nut
106	Gasket, exhaust box cover	252	Valve plate guide	425	Stud
107	Screw, exhaust box	253	O-ring	430	Name plate
108	Lockwasher	254	Spring, valve plate	431	Label "arrow"
115	Exhaust filter bracket	255	O-ring	436	Maintenance label
120	Exhaust filter	260	Inlet flange, upper	440	Gas Ballast Assembly
121	O-ring	261	Inlet screen	470	Hyd. fitting banjo
125	Filter spring assembly	265	Screw, hex head cap	471	Tubing, gas ballast
126	Filter spring screw	266	Lockwasher	472	Valve, check gas ballast
130	Strainer	270	Plug	473	Coupling
136	Gasket, exh. box, service block	271	Gasket ring	474	Filter, gas ballast
137	Lockwasher	275	Oil return valve	475	Valve, pet cock
138	Screw	276	Gasket ring	476	Gas ballast elbow
139	Service block	284	Hydraulic, fitting banjo	477	Pet cock valve
140	Exhaust cover plate	285	Screw, oil recirculation	478	Hex head cap screw
141	Exhaust cover gasket	286	Banjo fitting housing	479	Lockwasher
142	Socket head cap screw	288	Gasket ring		
143	Lockwasher	289	Screw		
144	Retaining ring	290	Oil return line, RA version		
145	Housing, exhaust port	291	Hyd. fitting, straight		
146	Screw, exhaust housing	292	Carburator jet		
148	Service block oil baffle	293	Oil return line, RC version		
149	Socket head cap screw	297	Screen fan guard		
150	Lockwasher	300	Motor mounting bracket		

Note: This parts list includes parts for all the pumps covered by this manual. Your specific model might not necessarily have all the parts indicated in this list. Refer to the illustration for your specific model pump when comparing part numbers or consult the factory.

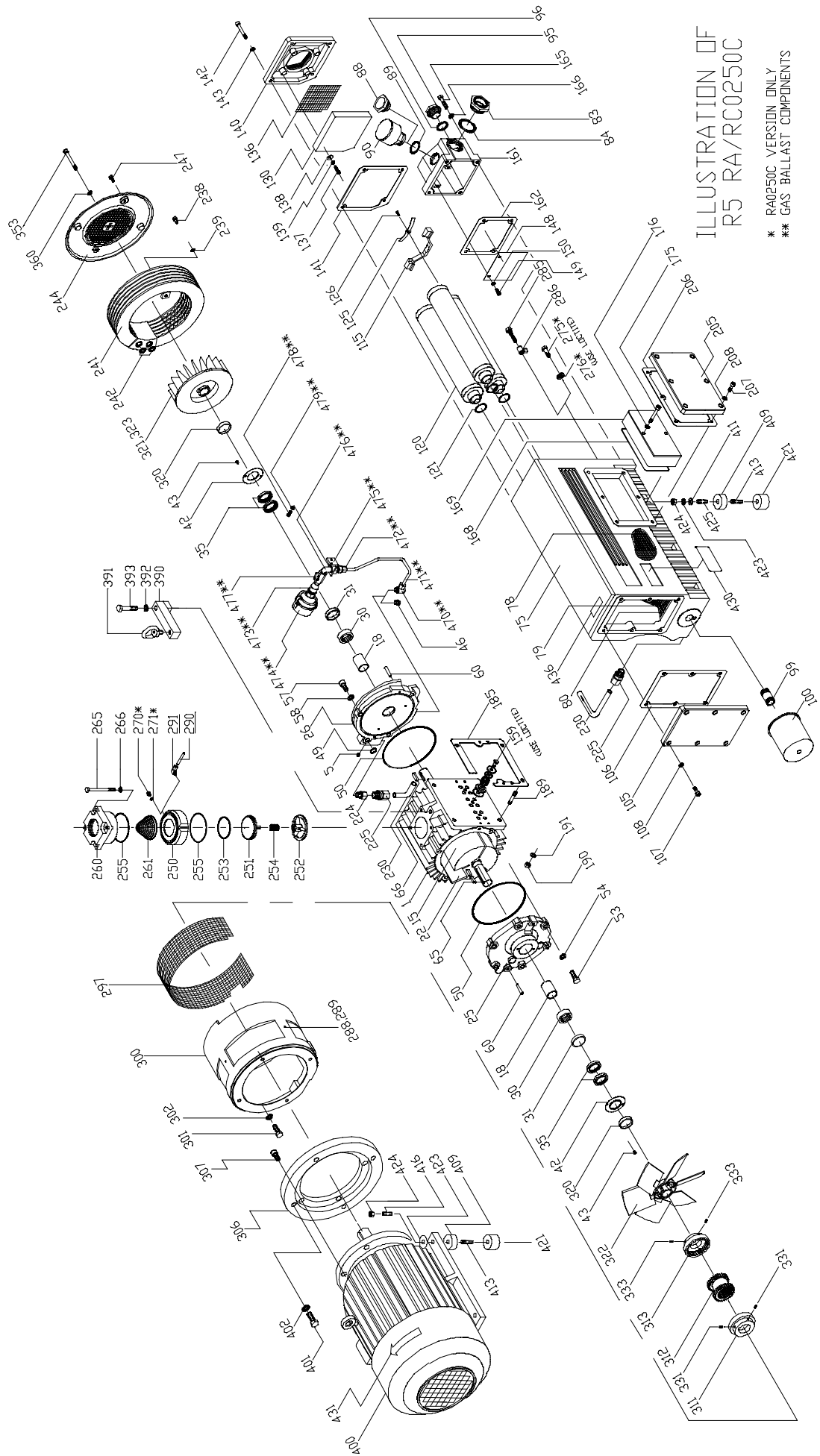


ILLUSTRATION OF  
R5 RA/RC0250C

\* RA0250C VERSION ONLY  
\*\* GAS BALLAST COMPONENTS

requires an immediate change of the exhaust filter.

In order to replace the filter, remove the four socket head cap screws (Ref. 155, 146) retaining the exhaust port housing. Pull the housing off the exhaust box and set it aside. Use a slotted head screw driver to loosen the exhaust filter retaining spring, then rotate and remove the spring. Pull the filter cartridge (Ref. 120) out of the exhaust box.

To field test an exhaust filter element, remove it from the pump, allow it to cool, clean the sealing end (or O-ring end), and use compressed air to blow through the element. Apply approximately 3 to 6 psi, which is the maximum allowable operating pressure across the filter. *Note: Use a shop rag to seal off the connection between the air hose and the filter.* If you can blow through it, the element is good. If not, discard it and install a new one. The filter cannot be cleaned successfully. Visually inspect the filter element for cracks.

**WARNING: Do not inhale through the filter or allow your mouth to come in direct contact with the filter.**

Reinstall the filter elements. Make sure the open end of the element is properly seated down in its recess in the exhaust box (see Figure 3) with the O-ring (Ref. 121) correctly positioned. Retain the filter with the spring clip, tighten the tension screw until the filter is secure. Place the exhaust port gasket and housing in position on the exhaust box and retain with the cap screws.

### 3.4 Vacuum Inlet Filter

If the pump is equipped with a special vacuum inlet filter in applications where powder, dust or grit is present, the filter cartridge should be cleaned on a weekly basis, or as required, depending on the amount of foreign particles to which the pump is exposed.

### 3.5 Maintenance Chart

**Daily:** Visually check oil level (see 3.1.1 and 3.1.2).

**Weekly:** Check oil for contamination (see

3.1.3). Inspect inlet filter (see Section 3.4).

**Every three (3) or four (4) months, 500 to 750 hours of operation, or as necessary:** See 3.1.3 and 1.5. Drain and discard oil from the hot pump. Replace the automotive-type oil filter and refill with fresh oil through the fill plug (see 3.1.2 through 3.1.3 and 3.2).

**Every nine (9) to twelve (12) months, or as necessary:** Replace exhaust filter elements (see 3.3).

### 3.6 Overhaul Kit/Filter

An overhaul kit containing a set of gaskets and O-rings, vanes, bearings and bearing sleeves, shaft seals and taper pins, is available from the factory.

Also, a filter kit containing oil drain plug, gaskets, automotive type oil filter (where applicable), exhaust filter, and exhaust filter, is available from the factory.

When ordering, please specify pump size and model (a 3-digit suffix after size), and serial number.

## 4.0 TROUBLESHOOTING

### 4.1 Trouble

Pump does not reach “blank-off” pressure which is the lowest absolute pressure (best vacuum) when running with the inlet closed via a blank flange or a valve; or the pump takes too long to evacuate the system. “Blank-off” pressure can be measured by using a good quality capsule gauge.

#### 4.1.1 Possible Cause

Contaminated oil is by far the most common cause of not reaching the ultimate pressure.

#### Remedy:

Shut off pump, after operating temperature has been reached, drain the warm oil from pump and exchange automotive-type oil filter (where applicable), if necessary. Flush and fill pump with new oil and take new “blank-off” measurement after operat-

ing temperature is reached (at least 20-30 minutes).

#### **4.1.2 Possible Cause**

Vacuum system or vacuum piping not leak-tight.

#### **Remedy:**

Check hose and pipe connections for possible leak.

#### **4.1.3 Possible Cause**

Wire mesh inlet screen plugged (Ref. 261).

#### **Remedy:**

Clean wire mesh inlet screen. Install inlet filter if problem repeats frequently.

#### **4.1.4 Possible Cause**

No oil or not enough oil in oil reservoir.

#### **Remedy:**

Shut off the pump, add the necessary oil, or if oil seems contaminated, drain balance of oil from pump, exchange automotive oil filter, and refill with fresh oil.

#### **4.1.5 Possible Cause**

Automotive-type oil filter is dirty or clogged (where applicable).

#### **Remedy:**

Replace automotive-type oil filter, exchange oil, if necessary, and refill with fresh oil.

#### **4.1.6 Possible Cause**

Inlet valve plate (Ref. 251) stuck in closed or partially open position due to contamination.

#### **Remedy:**

Disassemble inlet valve and screen. Clean as required.

#### **4.1.7 Possible Cause**

Oil tubing defect and/or leaking. Oil return line broken on RC model.

#### **Remedy:**

Replace or retighten the oil fittings or oil tubing. Replace only with same size tubing.

#### **4.1.8 Possible Cause**

Shaft seal leaking.

#### **Remedy:**

Replace the shaft seal following disassembly and assembly steps outlined in the Maintenance and Repair Manual. Check the shaft seal. It should have a spring installed inside and around the shaft sealing lip.

#### **4.1.9 Possible Cause**

Exhaust valve (Ref. 159) is not properly seated or it is partially stuck open.

#### **Remedy:**

Follow disassembly and assembly steps outlined in the Maintenance and Repair Manual.

#### **4.1.10 Possible Cause**

The vanes are blocked in the rotor or are otherwise damaged.

#### **Remedy:**

Free vanes or replace with new ones following disassembly and assembly steps outlined in the Maintenance and Repair Manual.

#### **4.1.11 Possible Cause**

Radial clearance between the rotor and cylinder is no longer adequate.

**Remedy:**

Follow disassembly and assembly steps outlined in the Maintenance and Repair Manual on resetting the radial clearance correctly.

**4.1.12 Possible Cause**

Internal parts worn or damaged.

**Remedy:**

Follow disassembly and assembly steps outlined in the Maintenance and Repair Manual and replace worn or damaged parts.

**4.1.13 Possible Cause on RC Models Only**

The oil return line (Ref. 290) is connected directly to atmospheric pressure in the exhaust area. On small model pumps, a fairly large amount of air is sucked through the oil return line, and it may not be possible to reach 15 torr or 29.4 inches Hg. blank-off on the inlet of the pump under these conditions.

Blank-off of 29.4 inches Hg or 15 torr can be reached by temporarily disconnecting and closing the oil return line; also by squirting oil through the exhaust opening into the exhaust filter area. Oil will be sucked into the oil return line, and no air will reach the inlet, thus affecting the "blank-off" pressure.

**4.2 Trouble**

Pump will not start.

**4.2.1 Possible Cause**

Motor does not have proper supply voltage or is overloaded; motor starter overload settings are too low or wrong setting; fuses are burned; or wire is too small or too long, causing a voltage drop at the pump.

**Remedy:**

Check correct supply voltage; check overload settings in motor starter for size and setting accord-

ing to motor nameplate data; check fuses; and install proper size wire. If ambient temperature is high, use larger size overloads or adjust setting 5% above nominal motor nameplate value.

**4.2.2 Possible Cause**

Pump or motor is blocked.

**Remedy:**

Remove fan cover and try to turn pump and motor by hand. If frozen, remove motor from pump and check motor and pump separately. If pump is frozen, disassemble completely per the Maintenance and Repair Manual and remove foreign objects in the pump or replace broken vanes.

**4.3 Trouble**

Pump starts, but labors and draws a very high current.

**4.3.1 Possible Cause**

Oil too heavy (viscosity too high) or ambient temperature below 5 degrees C (41°F).

**Remedy:**

Change to R580 vacuum oil if very cold, or warm up oil before filling.

**4.3.2 Possible Cause**

Pump runs in the wrong direction.

**Remedy:**

Check for correct rotation which is counter-clockwise when looking at the motor from the motor's fan side.

**4.3.3 Possible Cause**

Pump is overfilled with oil or the wrong kind of oil is used.



**Remedy:**

Correct the oil level and quality per Section 1.5 and use recommended motor oil.

**4.3.4 Possible Cause**

Exhaust filters in exhaust chamber are clogged and appear burned black with pump oil.

**Remedy:**

Replace exhaust filters, maintain proper oil condition, oil level, and use only Busch recommended vacuum oil.

**4.3.5 Possible Cause**

The exhaust filter is clogged due to process material.

**Remedy:**

Contact the factory for recommendation or proper filter cartridge.

**4.3.6 Possible Cause**

Loose connection in motor terminal box; not all motor coils are properly connected. Motor operates on two phases only.

**Remedy:**

Check motor wiring diagram for proper hookup, especially on motors with six internal motor windings, tighten and/or replace loose connections.

**4.3.7 Possible Cause**

Foreign particle in pump, vanes broken, bearing seizing.

**Remedy:**

Follow disassembly and assembly steps outlined in the Maintenance and Repair Manual and remove foreign parts, and replace vanes and bearings.

**4.4 Trouble**

Pump smokes at the exhaust side or expels oil droplets from the exhaust.

**4.4.1 Possible Cause**

Exhaust filter is not properly seated with O-ring (Ref. 121) in filter base or filter material is cracked.

**Remedy:**

Check condition and placement of exhaust filters in filter base. Replace if necessary.

**4.4.2 Possible Cause**

Exhaust filter is clogged with foreign particles.

**Remedy:**

Replace exhaust filter. Install other factory recommended filter cartridges if pump application requires other filter cartridges.

**4.4.3 Possible Cause**

The oil return valve (Ref. 275) is not properly working, clogged. Proper function is that when blowing into check valve, it should close. When applying vacuum on it, check valve should open.

**WARNING: Do not apply pressure or vacuum by mouth.**

**Remedy:**

Free or replace the oil return check valve.

**4.4.4 Possible Cause**

If RA Series vacuum pumps run continuously over 8 hours without ever being shut down, it may be possible that oil accumulates behind the exhaust box cover (Ref. 275) to the extent that oil is blown out of the exhaust with the exhaust gas.

**Remedy:**

Shut pump down during break periods or install an additional oil return line assembly. Check that oil return valve (Ref. 275) is free and drains oil back into pump when RA Series pump is stopped.

#### 4.4.5 Possible Cause

Oil return line (Ref. 290) on RC Standard pump is clogged or broken.

#### Remedy:

Free clogged line, replace broken line, but only with proper size, and check that oil is pumped out of oil sump while vacuum pump is operating.

*NOTE: An oil filling plug with pressure gauge is provided on all R5 Series pumps, so that the pressure in front of the exhaust filters can be monitored. The green field indicates that the filters are still effective. Any back pressure close to the red field requires immediate change of the exhaust filter (Ref 120).*

#### 4.5 Trouble

Pump runs very noisily.

#### 4.5.1 Possible Cause

Coupling insert worn.

#### Remedy:

Replace coupling insert in motor/pump coupling.

#### 4.5.2 Possible Cause

Bearing noise.

#### Remedy:

Follow disassembly and assembly steps outlined in the Maintenance and Repair Manual and replace bearings.

#### 4.5.3 Possible Cause

Vanes stuck.

#### Remedy:

Follow disassembly/assembly instructions outlined in the Maintenance and Repair Manual and

replace vanes.

#### 4.6 Trouble

The pump runs very hot. See Technical Data for typical oil sump temperature.

#### 4.6.1 Possible Cause

Not enough air ventilation to the pump.

#### Remedy:

Clean motor and pump air grills. Do not install the pump in an enclosed cabinet unless a sufficient amount of fresh air is supplied to the pump. On pumps with oil cooling coils, clean outside fin assembly. Bring ambient air temperature down.

#### 4.6.2 Possible Cause

Automotive-type oil filter clogged and pump does not receive enough oil.

#### Remedy:

Change automotive oil filter.

#### 4.6.3 Possible Cause

Not enough oil in oil reservoir or badly burned oil is used for pump lubrication.

#### Remedy:

Drain and refill only with non-detergent oil, increase oil change intervals.

*NOTE: On some high temperature applications, it may be necessary to change to a high temperature oil such as R590 or R570. Contact the factory for recommendations.*

#### 4.7 Trouble

Pump is seized.

#### 4.7.1 Possible Cause

Pump operated without oil and vanes broke.

**Remedy:**

Disassemble and exchange vanes as outlined in the Maintenance and Repair Manual.

**4.7.2 Possible Cause**

Pump was operated for an extended period of time in the wrong rotation.

**Remedy:**

Inspect vanes and replace.

**4.7.3 Possible Cause**

Liquid carryover into the pump cylinder broke vanes while pump was running, or oil broke vanes on start-up.

**Remedy:**

(a) Install condensate trap on the inlet of the pump.

(b) Pump was overfilled with oil in oil reservoir. Follow oil filling procedure (see Section 1.5) and do not overfill.

(c) Built-in anti-suck-back valve (Ref. 250 through 255) leaking while pump was shut down and vacuum was left in manifold. Clean valve seat and check that anti-suck-back valve holds vacuum on inlet when pump is shut down.

(d) Two pumps or a receiver is on the same main line. Install a manual or automatic operated valve in front of each pump.

**4.8 Trouble**

Automotive-type oil filter (Ref. 100) does not get warm within two to five minutes when cold pump is started.

**4.8.1 Possible Cause**

Automotive-type oil filter is clogged.

**Remedy:**

Replace automotive-type filter per Section 3.2 and exchange oil per Section 1.5.

**4.8.2 Possible Cause**

Wrong automotive-type filter is used and/or oil lines leading to pump are clogged.

**Remedy:**

Use only automotive filter as listed in Section 3.2 and blow lines free.

## 5.0 LIMITED STANDARD WARRANTY

Busch, Inc. warrants that all products furnished by it are free from defects in material and workmanship at the time of shipment for a period of 18 months from the date of shipment, or 12 months from the date of installation, whichever occurs first. Claims must be made during that period and are limited to the replacement or repair of parts claimed to be defective.

In the case of components purchased by Busch, Inc., such as starters, controls, mechanical seals, motors, couplings, etc., the warranty of that manufacturer will be extended to the purchaser in lieu of any warranty by Busch, Inc. The replacement of wear items including, but not limited to, seals, bearings, couplings, exhaust cover gaskets, oil drain plugs, oil fill plugs etc., made in connection with normal service, are not covered by this Warranty.

The Limited Standard Warranty is valid only when the product has been properly installed, used in a normal manner, and serviced according to the operating manual. This warranty shall not extend to products that have been misused, neglected, altered, or repaired without factory authorization during the warranty period. We highly recommend the use of Busch oils and parts to achieve documented performance and efficient operation. The use of oils or parts other than Busch could limit the life expectancy of the equipment and could void any warranties if they are the cause of any damage. Operating conditions beyond our control such as improper voltage or water pressure, excessive ambient temperatures, or other conditions that would affect the performance or life of the product will also cause the warranty to become void.

Permission to return parts for warranty repair must be obtained, and all returns must be prepaid to the factory. If, after examination, the product or part is found to be defective, it will be repaired or replaced on a no-charge basis and returned, FOB the factory. If it is determined that the Warranty has not been breached by Busch, Inc., then the usual charges for repair or replacement will be made, FOB the factory. Parts or products that are obsolete or those made to special order are not returnable.

This Limited Standard Warranty applies only to the above and is for the period set forth. Busch, Inc.'s maximum liability shall not, in any case, exceed the contract price for the product, part, or component claimed to be defective; and Busch, Inc. assumes no liability for any special, indirect, or consequential damages arising from defective equipment.

**THERE ARE NO WARRANTIES IMPLIED OR EXPRESSED THAT EXTEND BEYOND THOSE CONTAINED IN THIS LIMITED STANDARD WARRANTY.**

Note: For extended warranties on your new equipment contact Busch, Inc. Headquarters at:

1-800-USA-PUMP

## TECHNICAL DATA “C” and “E” SERIES

	Type	0025	0040	0063	0100	0250
Theoretical Displacement	CFM	20	28	41	63	180
Typical oil sump temperature*		188°F	195°F	190°F	204°F	204°F
Guaranteed Vacuum without gas ballast - RA models	Torr	.5	.5	.5	.5	.5
RC models (standard)	Torr	15	15	15	15	15
Maximum sound level one meter from pump	dBA	70	70	70	71	81
Motor size - 3 phase	HP	1½	2	3	5	10
Motor size - 1 phase	HP	1½	2	3	5	NA
Pump motor speed	RPM	1730	1730	1730	1730	1745
Oil capacity	Quart	1.4	1.6	2.5	2.7	7
Inlet connection	NPT	1¼"	1¼"	1¼"	1¼"	2"
Pump weight	lbs.	106	120	172	198	460
Shipping weight (approximate)	lbs.	154	161	217	243	555

\* Maximum oil temperature with 80°F ambient temperature and no supplemental oil cooling.

## MOTOR AND ELECTRICAL DATA "C"/"E" SERIES

PUMP TYPE		0025	0040	0063	0100	0250
Motor 60Hz 3 Phase	US Mfg. HP Motor Frame Rpm Volt  Full load Amperage	1 1/2 145TC 1725 208-230/460  5.0-4.4 / 2.2	2 145TC 1735 208/230/460  6.5/5.8/2.9	3 182TC 1735 208-230/460  9.0-7.8/3.9	5 184TC 1735 208-230/460  13.6-12.6/6.3	10 215TC 1745 208-230/460  27- 25/12.5
Starter	Teleme- 230/460 Range Amp canique	4-6.3/1.6-2.5	6-10/2.5-4	6-10/4-6.3	9-14/6-10	25-40/13-18
Motor 60 Hz 1 Phase	US Mfg. HP Motor Frame Rpm Volt Full Load Amperage	1 1/2 145TC 1730 115/208/230 16/8.4/8	2 145TC 1730 115/208/230 24/13/12	NA	NA	NA



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## Installation and Operating Instructions



### Rotary Vane Vacuum Pumps R 5 RA 0165, 0205, 0255 and 0305 D

Busch, Inc.  
516 Viking Drive  
Va. Beach, VA 23452  
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## GENERAL

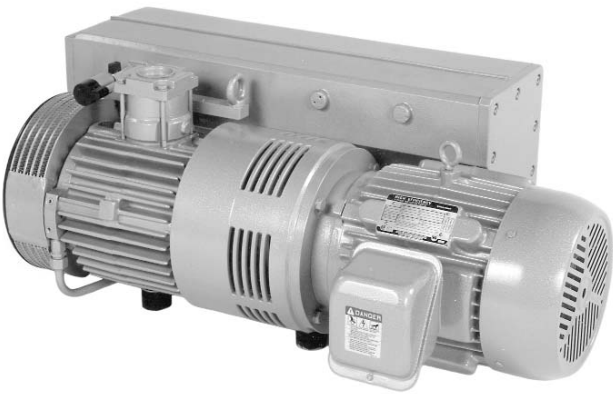
### Identification

For model identification, see the nameplate mounted on the side of the exhaust box.

This manual is written to cover installation and operation of the RA version of models 0165, 0205, 0255 and 0305 with a "D" appearing as the seventh character in the model type number stamped into the nameplate. For example it would appear as follows:

RA0XXX - DXXX - XXXX

When ordering parts, it is helpful to include the identification code stamped into the side of the cylinder as well as the serial number from the nameplate.



**Fig. 1 - R 5 0255 D Pump**

### Operating Principles

All reference (Ref. XX) numbers listed in the text and on illustrations throughout this manual are related to the drawings and parts list near the end of this publication.

R 5 Series, Single Stage, Rotary Vacuum Pumps are direct-driven, air-cooled, oil-sealed rotary vane pumps which operate as positive displacement pumps (see Fig. 1). They consist of a rotor positioned eccentrically in a cylindrical stator (see Fig. 2). When the rotor spins, centrifugal force pushes the vanes, which glide in slots, towards the wall of the cylinder. The rotor has three vanes which divide the pump chamber into three segments. The gas to be pumped enters at the inlet port, passes through the inlet screen and the open anti-suck-back valve into the pump chamber. As the rotor rotates, the inlet aperture is closed, the gas is compressed and forced out through one-way valves between the pump cylinder and the exhaust box. Differential pressure constantly causes oil to be pressed into the compression chambers. The gas/oil mixture is separated by the discharge filters (Ref. 120). The oil-free medium is discharged through the exhaust cover plate (Ref. 140) to atmosphere. This operation is repeated three times each revolution.

All R 5 series pumps are designed to handle air. Vapor in the air stream can be tolerated when the pump is operated within certain operating parameters as defined by Busch, Inc. Engineering (see Section 2.2 - Gas Ballast). When you desire to use the pump on an air stream that contains vapors, contact Busch, Inc. Engineering for operating recommendations; otherwise, the warranty could be void.

## 1.0 INSTALLATION

### 1.1 Unpacking

Inspect the box and pump carefully for any signs of damage incurred in transit. R 5 Pumps pass a rigorous operating test in the factory and are packed carefully to avoid transit damage. Since all pumps are ordinarily shipped FOB our factory, such damage is the normal responsibility of the carrier and should be reported to them.

Remove any nuts from the bottom of the box/crate and pull the pump out of the container using a suitable lifting device and the lifting eye bolt (Ref. 391). Then, unscrew any remaining studs that secured the bottom of the rubber feet to the bottom of the crate.

The inlet port of the pump is covered with a plastic cap prior to shipment to prevent dirt and other foreign material from entering the pump. Do not remove this cover until the pump is actually ready for connection to your system.

### 1.2 Location

The pump must be installed in a horizontal position on a level surface so that the pump is evenly supported on its rubber feet. Allow sufficient air space between the pump and any walls or other obstructions; adequate ventilation must be provided for the fans on the pump and motor (i.e., do not locate the pump in a stagnant air location).

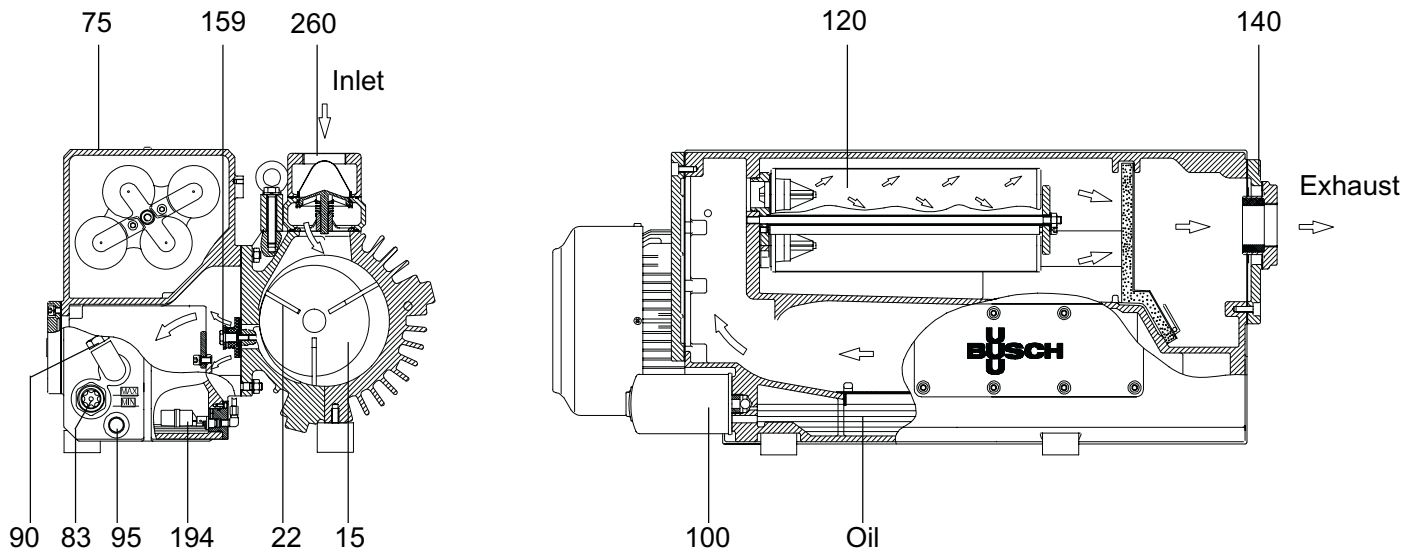
Whenever the pump is transported, be sure to drain the oil prior to shipping to avoid vane breakage when restarting the pump.

Do not tip the pump over if it is filled with oil.

Locate the pump for easy access to the oil sight glass (Ref. 83) in order to inspect and control the oil level properly. Allow clearance at the exhaust flange area to provide service access to the exhaust filters.

### 1.3 Power Requirements

The schematic diagram for the electrical connection is located in the junction box or on the nameplate of the pump motor.



**Fig. 2 - Basic R 5 RA0165, 0205, 0255 and 0305 D Series Pump**

The motor must be connected according to the electrical codes governing the installation. The power supply must be routed through a fused switch to protect the motor against electrical or mechanical overloads. The motor starter has to be set consistent with the motor current listed on the motor nameplate.

**CAUTION: After the electrical connection has been made, but before the pump is filled with oil, the rotation of the motor must be checked. Open the inlet port and jog the motor briefly to make sure rotation is correct. If it runs backwards and if it is wired three phase power, reverse any two leads of the three at the power connection.**

If the pump is supplied with a manual motor starter, it is preset at the factory in accordance with the customer's specification. For other voltage requirements, contact the factory for motor and/or starter information.

**Note:** See the motor manufacturer's manual for start-up maintenance of the motor.

Correct direction of rotation is marked by an arrow on the motor fan housing and is counterclockwise when looking at the motor from the motor's fan side.

#### 1.4 Vacuum Connections

Use a line size to the vacuum system that is at least as large as that of the pump inlet. Smaller lines will result in lower pumping speeds than the rated values.

Install a drip leg and drain on the vertical pipe near the pump inlet. Drain the drip leg often to prevent condensation from entering the pump. Also, when installing discharge piping, a drip leg should be installed.

If more than one vacuum pump or a receiver tank is connected to a common main line, each pump should have its own manual or automatic operated shut-off valve or positive action check valve. The built-in anti-suck-back valve should not be used as a shut-off valve for the vacuum system.

**CAUTION: Do not use the anti-suck-back valve as a check or shut-off valve for your vacuum system.**

Remove the plastic protective cap from the inlet port prior to connection of the pump to the system. Vertical connection of the vacuum line can be made directly to the pump inlet (Ref. 260).

The type and size of the inlet connections of the R 5 Series pump is shown in the TECHNICAL DATA page 12.

If the gas that is pumped contains dust or other foreign solid particles, a suitable (10 micron rating or less) inlet filter should be connected to the inlet port. Consult the factory for recommendations.

#### 1.5 Oil Filling

The pump is shipped without oil. After level installation, after correct rotation has been established and with the pump switched "off" and secured against accidental start-up, fill the pump with the recommended vacuum oil through the oil filling port (Ref. 88), observing the "MAX" and "MIN" position at the oil sight glass (Ref. 83).

Non-detergent oil should be used. **Do not use detergent motor oil** as additives in detergent oil will plug exhaust filter elements and shorten their life.

It is recommended that Busch R500 Series oil be used to receive the best performance from your vacuum equipment. R500 Series oil is a high quality vacuum oil which will give longer running time between oil changes, will provide better lubrication at high operating temperatures, and will prolong the life of exhaust filter elements. This oil can be obtained directly from Busch, Inc. in Virginia Beach, Virginia.

The strict use of Busch oils and parts from the day of purchase can extend the standard warranty to three years. Contact Busch, Inc. in Virginia Beach, Virginia for details. Refer to page 11 for the Limited Standard Warranty.

For general applications, use R530 in most models covered by this manual. Use R590 or R570 in pumps that are operated in high ambient temperatures (above 90°F) or when the oil can carbonize (turns black) before the change interval. Contact the factory for recommendations when using other oils.

The TECHNICAL DATA chart on page 13 gives the approximate quantities of oil required for each pump. The oil capacity chart should only be used as a guide, since oil capacity may be slightly lower, depending on whether the pump was filled previously, and whether all components such as oil filter, oil lines, etc., were allowed to completely drain. Use only the sight glass reading for proper level. **Never overfill!**

**WARNING: Keep the oil fill plug tight as pressure in the exhaust box could cause bodily injury if the plug is blown out. Do not fill/add the pump with oil through the exhaust/inlet ports as there is danger of breaking the vanes!**

For ambient operating temperatures lower than 41°F, use Busch R580 synthetic oil. If this does not help (where the pump has difficulty starting due to high oil viscosity) contact the factory in Virginia Beach, Virginia.

Replace the oil fill plug (Ref. 88) and pressure gauge (Ref. 90), making sure that the gasket (Ref. 89) is in place and properly seated and secured. Pumps are equipped with an exhaust pressure gauge as an integral part of the oil fill plug. Switch the power back into the "on" position.

## 2.0 OPERATION

### 2.1 Start-up

Check rotation of the motor as described in Section 1.3 - Power Requirements.

Fill the pump with oil as described in Section 1.5 - Oil Filling.

Start the pump and immediately close the inlet. Run the pump for a few minutes before checking the oil level again. With the pump shut off, the oil level should be visible in the oil sight glass (Ref. 83), between the "MIN" and "MAX" mark.

Add oil, if necessary, but only add it when the pump has been shut off and the circulating oil has had sufficient time to return to the oil sump.

### 2.2 Gas Ballast

R 5 Series RA 0165 through 0305 D pumps are equipped with an adjustable gas ballast valve (Ref. 474). The adjustable gas ballast valve should normally be left open. Its primary function is to prevent water vapor from condensing in the pump. Condensation causes emulsification of the oil, loss of lubricity, and possible rotor seizure.

Check the gas ballast filter periodically to ensure that air is flowing through it properly.

### 2.3 Process Gas

The R 5 series pumps are designed to pump air and are not intended for use when water vapor is being pumped. In some applications, when the quantity of the water vapor is moderate, R 5 pumps have been used with good results. On these occasions, the pump is run until it is up to operating temperature before it is allowed to pump the process gas. The pump is also operated for a period of time off process and on air (to clear it of process gas) before it is shut down. This operating technique prevents the vapor from condensing in the pump. Before attempting to pump a gas laden with water vapor, contact Busch Engineering for advice.

### 2.4 Stopping Pump

To stop the pump, turn off the power. The pump has a built-in anti-suck-back valve (Ref. 251 thru 255) to prevent the pump from rotating backwards when it is shut off.

**CAUTION: Do not use the anti-suck-back valve as a check or shut-off valve for your vacuum system.**

Install a manual or automatic valve or check valve in each pipe leading to each pump when multiple pumps are pumping on a common header.

All R 5 Series pumps are vented internally to atmospheric pressure through venting holes which are next to the exhaust valve assembly.

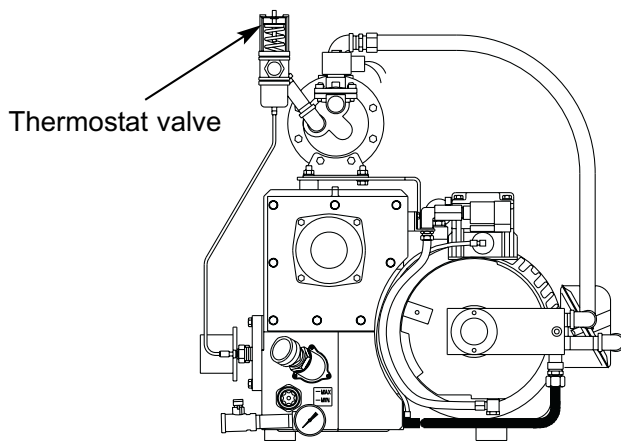
### 2.5 Water-Cooled Pumps (Optional)

Water-cooled pumps are cooled by circulating the oil

through a shell-and-tube type heat exchanger. The circulation of the pump oil through the shell is created by vacuum in the pump, but the circulation of the cooling water through the pump, but the circulation of the cooling water through the tubes is thermostatically controlled. The flow rate of the cooling water is controlled by a thermostatically activated valve (see Fig. 3) that senses, through a capillary bulb mounted in the exhaust box, the pump's oil temperature as it is discharged from the compression chamber. The valve will open at its set point and close at approximately 3°F to 5°F below the set point. The valve set point is adjustable as follows:

(a) Rotate the valve adjustment screw counter-clockwise to cause the valve to open at a higher temperature. This makes the pump run hotter.

(b) Rotate the valve adjustment screw clockwise to make the valve open at a lower temperature. This makes the pump run cooler.



**Fig. 3 - Water Cooled Pump**

The thermostatic valve can be manually opened by inserting a screwdriver under each side of the spring guide and prying the spring and guide upward away from the valve body.

The water cooling option can be used to cool pumps operating in high ambient temperatures, or it can be used to maintain a pump at elevated temperatures to prevent condensation inside the pump in wet applications. Contact Busch Engineering in Virginia Beach for details.

## 2.6 Oxygen Service Pumps

Oxygen service pumps must be used in oxygen enriched applications that are defined as any application which has a process gas that is 25% or more oxygen. If this pump is contaminated by organic compounds do not attempt to use it on oxygen service until it has been decontaminated.

These pumps have been manufactured, solvent washed (to remove organic contaminants) and assembled according to the latest technical standards and safety regulations. If this pump is not installed properly

or not used as directed, a dangerous situation or damage might occur.

**WARNING: This pump is filled with a special operating fluid. Do not use any other type of fluid, oil and/or grease. Use one of the following:**

- **Fomblin LC 250**
- **Tyreno Fluid 12/25V (perfluorinated poly ether)**
- **KRYTOX<sup>®</sup> Vacuum pump fluid by Du Pont Company**

If you have any questions, please phone our Customer Service Department for more information.

**It is mandatory that these operating instructions be read and understood prior to vacuum pump installation and start-up!**

**For overhaul/repair of oxygen service pumps, Busch Inc. strongly recommends that all major repair operations be conducted at the factory. Improper handling of repairs could result in extreme danger to personnel operating the pump.**

## 3.0 MAINTENANCE

R5 Series, Single Stage, Rotary Vacuum Pumps require very little maintenance; however, to insure optimum pump performance, the following steps are recommended.

### 3.1 Pump Oil

#### 3.1.1 Oil Level

**CAUTION: Do not add oil while the pump is running since hot unfiltered oil vapor may escape through the oil fill port.**

**WARNING: Insufficient oil quantity in the pump has the potential, under certain conditions, to lead to self-ignition of the remaining oil in the pump.**

With the pump installed relatively level, make sure that there is sufficient clean oil in the pump (see Section 1.5). The oil level should be observed on a daily basis and/or after 8 hours of operation and should be replenished if it drops below the 1/4 mark on the oil sight glass.

Oil level readings should be done only when the pump is turned off. Oil can be added to the oil fill port (Ref. 88) if the pump is shut off and the circulating oil has sufficient time to return to the oil sump. The oil might appear to be foamy, which is a normal phenomenon with aerated oil.

Under normal circumstances, it should not be necessary to add or drain oil from the pump between recommended oil changes.

A significant drop in oil level means there is an oil leak or that an exhaust filter is broken, and the pump should be smoking excessively. It is normal for the oil to be foamy and light in color in an operating pump. However, if the oil is milky colored, it is an indication that water is present in the oil. Normally, by operating the pump for an extended period, with the inlet suction blanked off and the gas ballast open, the water will be purged from the oil. If the oil is dark colored, it is contaminated or carbonized and must be changed. Depending on the severity of the contamination, a thorough flushing may be required. Contact the factory for flushing oil (Busch R568) and instructions.

### 3.1.2 Oil Type and Quantity

See Section 1.5 and the Technical Data page 13 for details on oil type and quantity.

**CAUTION: When changing the oil and filters, it may be necessary to flush the pump to remove any build-up of degraded oil from the sumps, oil lines, radiators, etc. to ensure proper oil flow through the pump. Reduced oil flow, especially through radiators and cooling coils, can cause mechanical damage or extreme overheating which could cause the oil vapors to ignite.**

**WARNING: Always take the necessary precautions concerning personal protective equipment when changing oil and make sure the pump is switched to the "off" so that accidental starting will not occur. Oil temperature can reach 212°F and may pose a danger of scalding.**

### 3.1.3 Oil and Filter Change

Check the oil for contamination on a weekly basis by shutting the pump off and draining some of the oil into a small glass or a similar transparent container through the oil drain port (Ref. 95).

Oil life is dependent upon the conditions to which it is exposed. A clean, dry air stream and an oil operating temperature under 210°F are ideal conditions. Oil must be changed after the first 100 initial hours of operation. After the initial oil change, and when using R530 (hydrocarbon oil), it is recommended that oil changes are made every three (3) to four (4) months or 500 to 750 hours of operation, or as necessary if high heat is contaminating the oil. The use of Busch R570 (synthetic) or R590 (semi-synthetic) oil may significantly extend the operating hours between oil changes; however, you may need to flush out the pump before chang-

ing. Contact the factory Service Department for advice or refer to Section 3.1.4 for the flushing procedure.

To change the oil, the pump must be switched off and ventilated to reach atmospheric pressure. Remove the oil drain plug (Ref. 95) and drain the oil. Dispose of the oil in compliance with local or national regulations. When the oil stops draining, replace the oil drain plug.

Start the pump again for a few seconds. Stop the pump once again, and then reopen the drain plug and discharge any remaining oil.

Refasten the oil drain plug. Remove the oil filter (Ref. 100) and replace it with a new one using a Busch genuine oil filter. Make sure to tighten the filter securely against the aluminum sealing surface so that leaks will not occur.

### Excessive Heat

When the pump is subjected to operating conditions that will cause the oil to be heated above 210°F, the oil will carbonize and become contaminated after a relatively low number of operating hours. The higher the temperature, the quicker the oil becomes contaminated. If the oil temperature is too severe, Busch R570 or R590 synthetic oil should be used to withstand the elevated temperatures. When changing to synthetic oil, the pump should be flushed with Busch R568 oil. Contact the factory for instructions on the flushing procedure. Auxiliary oil cooling is the most practical approach to a severe heating problem.

### Contaminated Air Stream

When the air stream contains solids and/or liquid that contaminate the oil, the oil must be changed more often. If the air stream contains a small percentage of contaminants and/or they are slightly aggressive\* (mild acids, etc.), synthetic oil, such as Busch R570, will resist breakdown better than the standard Busch R530. The solution is to install a filter or knock-out pot to keep the contaminants out of the pump.

\*Process air streams with a large percentage of contaminants and/or are more than slightly aggressive must use a chemical duty pump.

Oil change intervals can only be established by experience with the pump operating in the actual conditions (see previous paragraph for some of the conditions). Develop the oil change interval by periodically checking an oil sample removed from the pump. When the oil sample has become dark in color (from solids and carbonized particles) or is milky looking (from water), it is time to discard it. As mentioned before, a thorough flushing may be required.

### 3.1.4 Oil Flushing Procedure

Flushing is needed under certain conditions. Some pumps will be beyond flushing and will need to be overhauled.

To help determine if flushing is needed, observe the condition of the oil as it is drained from the pump. Is it black and tar like or contaminated in any way? Was the pump noisy, overheating, or was the motor overload shutting the pump off? How old is the pump and when was the last time the oil was changed?

If the above conditions exist or you don't know when the last oil change was performed further investigation is needed. Also, when changing from one oil type such as R530 to another type such as R590 or R570 it will be beneficial to flush. Although the oils are compatible, mixing a lesser grade oil such as R530 with a synthetic oil like R570 will reduce the effectiveness of the synthetic oil.

All of the oil will be removed and replaced with the flushing oil (Busch R-568), and eventually that will be replaced by whatever Busch oil is needed for your particular application. Have enough oil and oil filters on hand for a couple of flushes. The following describes the steps in the flushing procedure:

Shut the pump off and drain all the oil from the pump and remove the access plates (Ref. 205) from the exhaust box (Ref. 075). Remove the metal baffle (Ref. 078) and take a good look at the internal walls of the oil sump. If the walls are discolored but have no build up of any kind one can proceed with the flushing. If gelled or burnt oil is clinging to the walls this material must be scraped and removed prior to flushing. Proceed by scraping and cleaning as much of the exhaust box as possible. The more debris that is removed now the more effective the flushing will be later. Re-install the metal baffle, cover and proceed with the flushing. At this point one must remember that the oil lines and oil cooler might also be plugged to a point where no amount of flushing will make a difference and a complete overhaul will be the only option. Depending on the severity of the oil contamination flushing may be a last ditch effort.

Drain all of the oil from the pump. The more contaminated oil you remove now the more effective the oil flushing will be.

Remove the oil filter (Ref. 100) and install a new one. It is recommended that you do not change the exhaust filter or filters until after the flushing to prevent contamination of any new filters.

Fill the exhaust box with the proper amount of flushing oil (Busch R-568).

If possible run the pump with the inlet closed and off of the process. Run the pump for approximately six hours, shut the pump off and drain a small sample of oil into a clear container.

Examine it. If it is clear to amber run the pump for another six hours and examine it again. If after the first six hours it is black drain it and fill again using another new oil filter.

If after the second flushing the oil still remains black the pump may have too much contaminated oil in it to flush out properly. There may be residue remaining in the lines and cooler that will not flush out. An overhaul will be necessary.

If after the second six hour period the oil still remains clear to amber in color drain it, change the oil filter and fill with the regular oil. At this point also change the exhaust filters.

Run the pump with a fresh charge of the oil to be used in your application (not R-568), and monitor the operating conditions closely. Check for noise, overheating and oil condition until a regular oil change schedule can be established.

Do not let the oil turn black. Change it before it fails. If the oil is kept in good condition the pump will last for years. If the oil starts to turn black do not hesitate to flush again. Keeping on top of the oil changes will prevent costly overhauls.

If you are just switching from one type of oil to another a single six hour flush is all that is necessary (follow the above instructions). Remember to change to a new exhaust filter or filters after the flushing and not before.

### 3.2 Automotive-Type Oil Filter

**WARNING: Always wear safety glasses and other appropriate personal protective equipment when performing any maintenance or repair to your R 5 pump.**

The pump is equipped with an automotive-type oil filter (Ref. 100). When replacing the automotive-type oil filter, use only a Busch genuine filter.

**Note:** Make sure to tighten the Busch oil filter securely against the aluminum sealing surface so that leaks will not occur.

### 3.3 Exhaust Filter

**WARNING: If the gas entering this pump is a health hazard, use rubber gloves and all necessary personal protection equipment when performing the exhaust filter replacement operation.**



Exhaust filters (Ref. 120) should be checked monthly. A pressure gauge (Ref. 90) is supplied with your R5 vacuum pump as part of the oil fill plug. This gauge has a green field and a red field. A pressure within the green field would indicate normal pressure. Any pressure in the red field (for a continuous period of time) requires an immediate change of the exhaust filter(s). Every nine (9) to twelve (12) months, or as necessary, replace the exhaust filter elements. The service life of the exhaust filters varies widely with pump application. It is only necessary to change the filters when the elements become clogged with foreign material or burned oil. Indications of clogged filters are smoke and oil mist coming from the pump exhaust or higher than normal motor current.

**CAUTION: Excessively contaminated and/or clogged exhaust filters could possibly lead to elevated pump temperatures which could, under certain circumstances, cause the lubricating oil to self-ignite.**

In order to replace the exhaust filters, unscrew the screws and washers (Ref. 142/143) from the exhaust cover plate (Ref. 140). Remove the cover plate and gasket (Ref. 141).

Remove the distance pin (Ref. 137), the baffle strainer (Ref. 130) and the sheet metal plate (Ref. 136).

Remove the discharge filter assembly by unscrewing the nut (Ref. 134) and removing the lockwasher (Ref. 132). Carefully slide the assembly out of the exhaust box (Ref. 75). Stand the filter assembly up on a clean flat surface.

To have access to the individual filters, unscrew the two cylinder cover screws (Fig. 126), and remove the two lockwashers (Ref. 128) and the exhaust filter grip plate (Ref. 115).

Remove the exhaust filters (Ref. 120) and O-rings (Ref. 121). Remove the filter support (Ref. 118) and O-rings (Ref. 119).

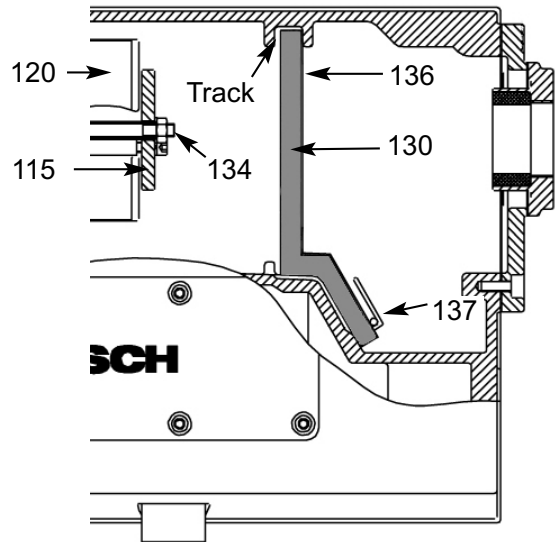
Replace the support and O-rings with new ones. Make sure that the O-rings are fitted securely and that the filter elements (Ref. 120) fit securely into the depressions on the filter support (Ref. 118). The indicating arrow on each element must be pointing upward toward the top of the exhaust box after the assembly has been installed.

Carefully position the filter support tube (Ref. 133) between the exhaust filter grip (Ref. 115) and the filter support without displacing the filters from their seated position in the filter support. Install the two lockwashers (Ref. 128) and two screws (Ref. 126).

Insert the support and filter assembly into the exhaust

box using the stud (Ref. 131) as a guide. The stud should slide through the hole in the support (Ref. 133). Secure the assembly with the lockwasher (Ref. 132) and hexagon nut (Ref. 134).

Reinstall the sheet metal plate (Ref. 136) and the baffle strainer (Ref. 130) into the guide track of the exhaust box (see Fig. 4). Press to the bottom of the exhaust box. Make sure that the baffle strainer touches all sides of the exhaust box. Insert the distance sleeve (Ref. 137) into the two grooves. This holds the sheet metal plate and baffle strainer in place.



**Fig. 4 - Exhaust Filters and Strainer**

Inspect the exhaust box end cover gasket (Ref. 141) for damage and replace if damaged. With the gasket in place, secure the exhaust cover end plate (Ref. 140) to the exhaust box using eight hex head cap screws (Ref. 142) and eight lockwashers (Ref. 143).

To field test an exhaust filter element, remove it from the pump, allow it to cool, clean the sealing end (or O-ring end), and use compressed air to blow through the element. Apply approximately 3 to 6 psi, which is the maximum allowable operating pressure across the filter.

Use a shop rag to seal off the connection between the air hose and the filter.

If you can blow through it, the element is good. If not, discard it and install a new one. The filter cannot be cleaned successfully. Visually inspect the filter element for cracks.

Reinstall the filter elements as described previously.

### 3.4 Inlet Flange

The standard inlet flange assembly contains an inlet screen (Ref. 261) which may require occasional cleaning. The frequency of cleaning can only be determined

by experience and is affected by hours of operation and particle size being trapped. An optional vacuum inlet filter is offered and can help minimize the need or frequency of cleaning the inlet screen.

To clean the screen, disconnect the flange from the process piping. Remove the four screws and lockwashers (Ref. 265/266). Remove the inlet flange (Ref. 260). Remove the screen (Ref. 261) and clean with compressed air. After cleaning, install the screen and inlet securing them with the screws and lockwashers. Make sure the O-ring (Ref. 265) is in place prior to securing the screws. Reattach the process piping to the inlet.

### 3.5 Vacuum Inlet Filter (optional)

If the pump is equipped with an optional special vacuum inlet filter in applications where powder, dust or grit is present, the filter cartridge should be cleaned on a weekly basis, or as required, depending on the amount of foreign particles to which the pump is exposed.

To clean the inlet filter, unsnap the lid clamps or remove the knobs and lift off the filter lid. Remove cartridge, being careful not to knock any foreign particles present inside the canister into the pump suction. Clean foreign particles from the canister with an air hose, and carefully back flush the filter cartridge with shop air. If the filter cartridge has been subjected to moisture or is extremely dirty, it may need replacement.

### 3.6 Maintenance Chart

**Note:** See the motor manufacturer's manual for the periodic motor maintenance.

**Note:** Lack of proper maintenance can result in blocked filters, radiators, oil lines, etc. This condition can lead to excessive heat causing mechanical failure or ignition of the oil vapors.

**Daily:** Visually check oil level (see 3.1.1 and 3.1.2).

**Weekly:** Check oil for contamination (see 3.1.3). Inspect inlet filter (see Section 3.5).

**Every three (3) or four (4) months, 500 to 750 hours of operation, or as necessary:** See 3.1.3 and 1.5. Drain and discard oil from the hot pump. Replace the automotive-type oil filter and refill with fresh oil through the fill plug (see 3.1.2 through 3.2).

**Every nine (9) to twelve (12) months, or as necessary:** Replace exhaust filter elements (see 3.3).

**As necessary:** Check and/or clean the standard inlet screen. If the optional inlet filter is used, replace the filter material as practice determines.

**As necessary:** The radiator (Ref. 241), fan hood (Ref. 244) and motor cover should be inspected regularly for debris. Soiling prevents cool air intake and may lead to overheating of the pump.

## 3.7 Overhaul Kit/Filter Kit

An overhaul kit containing a set of gaskets and O-rings, vanes, bearings and bearing sleeves, shaft seals and taper pins, is available from the factory. Also, a filter kit containing oil drain plug, gaskets, automotive type oil filter, exhaust filter and synthetic baffle strainer is available from the factory. When ordering, please specify pump size and model (a 4-digit suffix after size), and serial number.

## 4.0 TROUBLESHOOTING

### 4.1 Trouble

**The pump does not reach "blank-off" pressure which is the lowest absolute pressure (best vacuum) when running with the inlet closed via a blank flange or a valve; or the pump takes too long to evacuate the system. "Blank-off" pressure can be measured by using a good quality capsule gauge.**

**Possible Cause:** Contaminated oil is by far the most common cause of not reaching the ultimate pressure.

**Remedy:** Shut off the pump, after the operating temperature has been reached, drain the warm oil from pump and exchange the automotive-type oil filter (where applicable), if necessary. Flush and fill the pump with new oil and take a new "blank-off" measurement after operating temperature is reached (at least 20-30 minutes).

**Possible Cause:** The vacuum system or vacuum piping is not leak-tight.

**Remedy:** Check the hose and pipe connections for possible leak.

**Possible Cause:** The wire mesh inlet screen is plugged (Ref. 261).

**Remedy:** Clean the wire mesh inlet screen. Install an inlet filter if the problem repeats frequently.

**Possible Cause:** No oil or not enough oil in the oil reservoir.

**Remedy:** Shut off the pump, add the necessary oil, or if oil seems contaminated, drain the balance of the oil from the pump, exchange the automotive oil filter, and refill with fresh oil. Flush if necessary.

**Possible Cause:** The automotive-type oil filter is dirty

or clogged (where applicable).

**Remedy:** Replace the automotive-type oil filter, exchange the oil, if necessary, and refill with fresh oil.

**Possible Cause:** The inlet anti-suck-back valve plate (Ref. 251) is stuck in closed or partially open position due to contamination.

**Remedy:** Disassemble the inlet valve and screen. Clean as required.

**Possible Cause:** The oil tubing fittings are loose and leaking.

**Remedy:** Replace or retighten the oil fittings or oil tubing. Replace only with same size tubing.

**Possible Cause:** Shaft seal leaking.

**Remedy:** Replace the shaft seal following disassembly and assembly steps outlined in the Maintenance and Repair Manual. Check the shaft seal. It should have a spring installed inside and around the shaft sealing lip.

**Possible Cause:** Exhaust valve (Ref. 159) is not properly seated or it is partially stuck open.

**Remedy:** Contact the nearest Busch Factory Service Center for instructions.

**Possible Cause:** Vanes are blocked in rotor or are otherwise damaged.

**Remedy:** Free vanes or replace with new ones. Contact the nearest Busch Factory Service Center for instructions.

**Possible Cause:** The radial clearance between the rotor and cylinder is no longer adequate.

**Remedy:** Contact the nearest Busch Factory Service Center for instructions.

**Possible Cause:** The internal parts are worn or damaged.

**Remedy:** Contact the nearest Busch Factory Service Center for instructions.

**Possible Cause:** The inlet filter is clogged due to process material.

**Remedy:** Contact the factory for recommendation on proper filter cartridge.

## 4.2 Trouble

### Pump will not start.

**Possible Cause:** The motor does not have the proper supply voltage or is overloaded; the motor starter overload settings are too low or are the wrong setting; fuses are burned; or the wire is too small or too long, causing a voltage drop at the pump.

**Remedy:** Check correct supply voltage; check overload settings in motor starter for size and setting according to motor nameplate data; check fuses; and install proper size wire. If the ambient temperature is high, use larger size overloads or adjust the setting 5% above nominal motor nameplate value.

**Possible Cause:** The pump or motor is blocked.

**Remedy:** Remove the fan cover and try to turn pump and motor by hand. If frozen, remove the motor from the pump and check the motor and the pump separately. If the pump is frozen, contact the nearest Busch Factory Service Center for instructions.

## 4.3 Trouble

### The pump starts, but labors and draws a very high current.

**Possible Cause:** The oil is too heavy (viscosity too high) or the ambient temperature is below 5 degrees C (41°F).

**Remedy:** Change to R580 vacuum oil if very cold, or warm up the oil before filling.

**Possible Cause:** Pump is running in the wrong direction.

**Remedy:** Check for the correct rotation which is counterclockwise when looking at the motor from the motor's fan side. Reverse any two leads on the motor to change the direction of rotation.

**Possible Cause:** The pump is overfilled with oil or the wrong kind of oil is used.

**Remedy:** Correct the oil level and quality per Section 1.5 and use recommended motor oil.

**Possible Cause:** Exhaust filters in exhaust chamber are clogged and appear burned black with pump oil.

**Remedy:** Replace the exhaust filters, maintain proper oil condition, oil level, and use only Busch recommended vacuum oil and filters.

**Possible Cause:** Loose connection in motor terminal box; not all motor coils are properly connected. The motor operates on two phases only.

**Remedy:** Check the motor wiring diagram for proper hookup, especially on motors with six internal motor

windings, tighten and/or replace loose connections.

**Possible Cause:** Foreign particle in pump, vanes broken, bearings seized.

**Remedy:** Contact the nearest Busch Factory Service Center for instructions.

#### 4.4 Trouble

**Pump smokes at the exhaust side or expels oil droplets from the exhaust.**

**Possible Cause:** Inlet to pump is in a wide open condition.

**Remedy:** Do not operate pump at high inlet pressures for more than a few minutes (pressures = 0.00-10.0" Hg vac.)

**Possible Cause:** The exhaust filter is not properly seated with the O-ring (Ref. 121) in filter base or the filter material is cracked.

**Remedy:** Check the condition and check for proper seating of the exhaust filters. Replace if necessary. Also, check the filter spring clips for tightness.

**Possible Cause:** The exhaust filter is clogged with foreign particles.

**Remedy:** Replace the exhaust filter.

**Possible Cause:** The oil return float valve (Ref. 194) is not working properly.

**Remedy:** Make sure the float valve and oil return line are not plugged. Replace components if necessary.

#### 4.5 Trouble

**Pump runs very noisily.**

**Possible Cause:** Coupling insert is worn.

**Remedy:** Replace the coupling insert in motor/pump coupling.

**Possible Cause:** Bearing noise.

**Remedy:** Contact the nearest Busch Factory Service Center for instructions.

**Possible Cause:** Vanes stuck.

**Remedy:** Contact the nearest Busch Factory Service Center for instructions. Use only the recommended Busch oil and change oil more frequently.

#### 4.6 Trouble

**The pump runs very hot. See Technical Data for typical oil sump temperature.**

**Note:** The oil temperature with a closed inlet should be approximately 185-225°F depending on pump type. At 24 in. Hg, the oil in the pump can go above 225°F. These values are taken at an ambient temperature of 68°F. The maximum recommended ambient operating temperature for an R 5 is 100°F on a continuous basis. When it is necessary to operate a pump in ambient temperatures above this limit, careful oil monitoring and/or optional water cooling is necessary. Contact the factory at Virginia Beach for details.

**Possible Cause:** Not enough air ventilation to the pump.

**Remedy:** Clean the motor and pump air grills. Clean the radiator. Do not install the pump in an enclosed cabinet unless a sufficient amount of fresh air is supplied to the pump. Bring the ambient air temperature down.

**Possible Cause:** The automotive-type oil filter clogged and pump does not receive enough oil.

**Remedy:** Change the automotive oil filter.

**Possible Cause:** Not enough oil in oil reservoir or badly burned oil is used for pump lubrication.

**Remedy:** Drain and refill the pump only with non-detergent oil and increase oil change intervals.

**Note:** On some high temperature applications, it may be necessary to change to a high temperature oil such as R590 or R570. Contact the factory for recommendations.

#### 4.7 Trouble

**Pump is seized.**

**Possible Cause:** The pump operated without oil and vanes broke.

**Remedy:** Contact the nearest Busch Factory Service Center for instructions.

**Possible Cause:** The pump was operated for an extended period of time in the wrong rotation.

**Remedy:** Inspect vanes and replace. Contact the nearest Busch Factory Service Center for instructions.

**Possible Cause:** Liquid carryover into the pump cylinder broke vanes while pump was running, or oil broke vanes on start-up.

**Remedy:** Install a condensate trap on the inlet of the pump. Or, pump was overfilled with oil in oil reservoir. Follow oil filling procedure (see Section 1.5) and do not overfill. Or, the built-in anti-suck-back valve (Ref. 250 through 255) is leaking while pump was shut down and vacuum was left in manifold. Clean the valve seat and check that anti-suck-back valve holds vacuum on inlet when pump is shut down.

#### 4.8 Trouble

**The automotive-type oil filter (Ref. 100) does not get warm within two to five minutes when cold pump is started.**

**Possible Cause:** The automotive-type oil filter is clogged.

**Remedy:** Replace the automotive-type filter per Section 3.2 and exchange oil per Section 1.5.

**Possible Cause:** The wrong automotive-type filter is used and/or oil lines leading to pump are clogged.

**Remedy:** Use only automotive filter as listed in Section 3.2 and blow lines free. Flush oil cooler.

**Possible Cause:** The oil cooler is plugged internally with burnt oil.

**Remedy:** Remove oil cooler and flush. Pump may have to be disassembled completely to correct a severely contaminated condition.

#### 5.0 LIMITED STANDARD WARRANTY

Busch, Inc. warrants that all products furnished by it are free from defects in material and workmanship at the time of shipment for a period of 18 months from the date of shipment, or 12 months from the date of installation, whichever occurs first. Claims must be made during that period and are limited to the replacement or repair of parts claimed to be defective.

In the case of components purchased by Busch, Inc., such as starters, controls, mechanical seals, motors, couplings, etc., the warranty of that manufacturer will be extended to the purchaser in lieu of any warranty by Busch, Inc. The replacement of wear items including, but not limited to, seals, bearings, couplings, exhaust cover gaskets, oil drain plugs, oil fill plugs etc., made in connection with normal service, are not covered by this Warranty.

The Limited Standard Warranty is valid only when the product has been properly installed, used in a normal manner, and serviced according to the operating manual. This warranty shall not extend to products that have been misused, neglected, altered, or repaired

without factory authorization during the warranty period. We highly recommend the use of Busch oils and parts to achieve documented performance and efficient operation. The use of oils or parts other than Busch could limit the life expectancy of the equipment and could void any warranties if they are the cause of any damage. Operating conditions beyond our control such as improper voltage or water pressure, excessive ambient temperatures, or other conditions that would affect the performance or life of the product will also cause the warranty to become void.

Permission to return parts for warranty repair must be obtained, and all returns must be prepaid to the factory. If, after examination, the product or part is found to be defective, it will be repaired or replaced on a no-charge basis and returned, FOB the factory. If it is determined that the Warranty has not been breached by Busch, Inc., then the usual charges for repair or replacement will be made, FOB the factory. Parts or products that are obsolete or those made to special order are not returnable.

This Limited Standard Warranty applies only to the above and is for the period set forth. Busch, Inc.'s maximum liability shall not, in any case, exceed the contract price for the product, part, or component claimed to be defective; and Busch, Inc. assumes no liability for any special, indirect, or consequential damages arising from defective equipment.

**THERE ARE NO WARRANTIES IMPLIED OR EXPRESSED THAT EXTEND BEYOND THOSE CONTAINED IN THIS LIMITED STANDARD WARRANTY.**

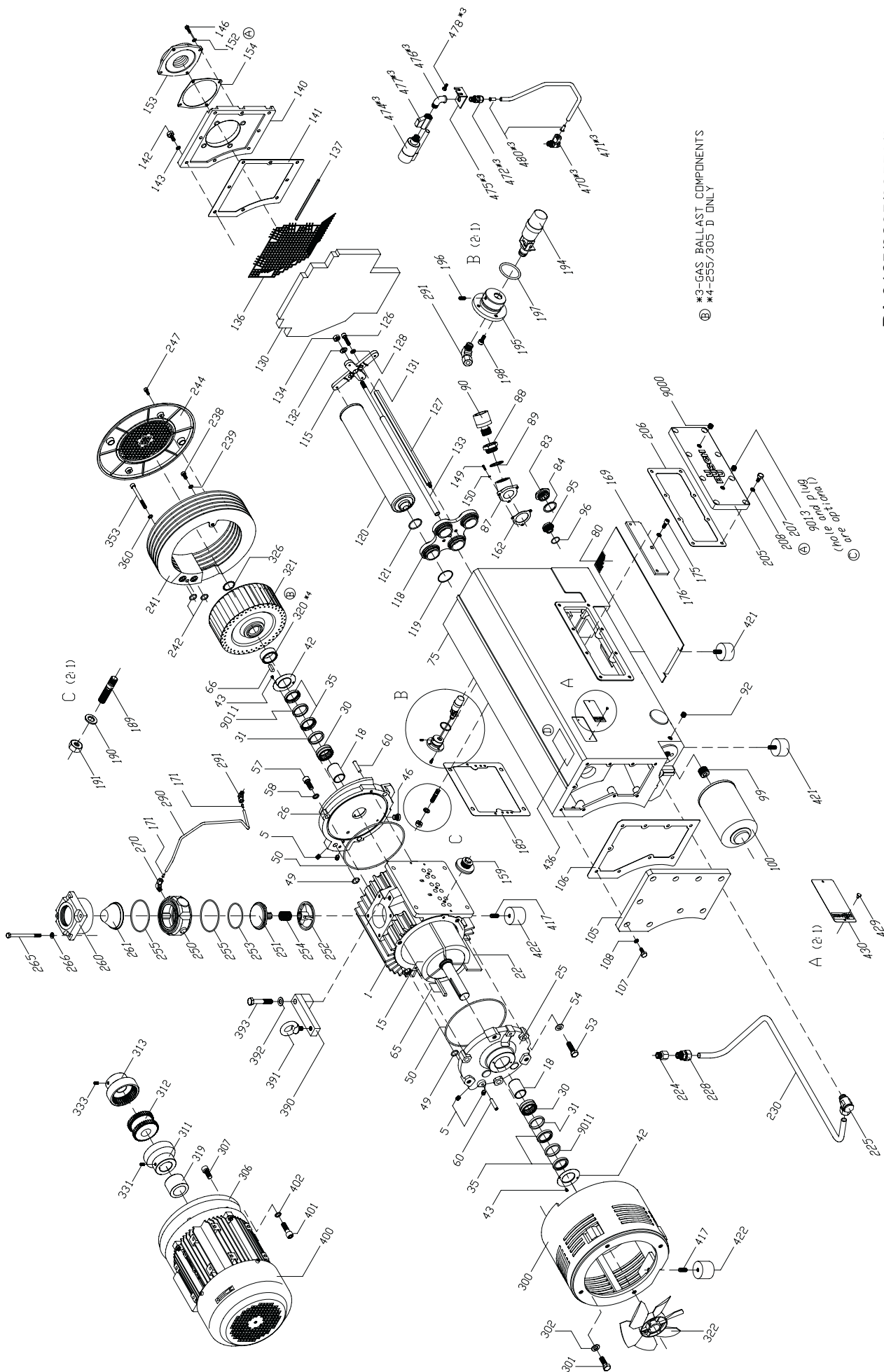
**Note:** For extended warranties on your new equipment contact Busch Headquarters at 1-800-USA-PUMP.

**TECHNICAL DATA**

<b>Model</b>	<b>0165</b>	<b>0205</b>	<b>0255</b>	<b>0305</b>
Nominal pumping speed (ACFM)	115	130	170	196
Free air displacement (CFM)	117	141	180	212
End Vacuum (Torr)	.5	.5	.5	.5
End Vacuum (inches Hg)	29.9	29.9	29.9	29.9
Maximum sound level (dBA)	79	80	81	81
Motor size - 3 phase (HP)	7.5	7.5	10	12
Nominal motor speed (RPM)	1750	1750	1750	1750
Motor frame size	213TC	213TC	215TCZ	215TCZ
Nominal motor amps (@230/460v)	20.4/10.2	20.4/10.2	25.6/12.8	29/14.9
Oil capacity (Quarts)	6.9	6.9	6.9	6.9
Inlet connection (NPT)	2"	2"	2"	2"
Exhaust connection (NPT)	2"	2"	2"	2"
Approximate weight (lbs.)	416	435	460	575

**Parts List for 0165, 0205, 0255 and 0305**

<b>Ref</b>	<b>Description</b>	<b>Ref</b>	<b>Description</b>	<b>Ref</b>	<b>Description</b>
1	Cylinder	143	Lockwasher	313	Coupling half, pump side
5	Set screw plug	146	Hex head cap screw	319	Motor spacer
15	Rotor	149	Socket head cap screw	321	Fan
18	Bearing sleeve	150	Lockwasher	322	Axial fan
22	Vane	152	Lockwasher	326	Retainer ring
25	Endplate, motor side	153	Exhaust adapter	353	Socket head cap screw
26	Endplate, fan side	154	Exh. cover adapter gasket	360	Lockwasher
30	Needle bearing	159	Exhaust valve	390	Eye bolt adapter
31	Endplate spacer	162	Oil fill elbow gasket	391	Eye bolt
35	Shaft seal	169	Valve cover plate	392	Lockwasher
42	Shaft seal retaining plate	171	Insert, gas ballast	393	Hex head screw
43	Screw, hex head	175	Socket head cap screw	400	Motor
49	O-ring	176	Lockwasher	401	Screw, hex head cap
50	O-ring	185	Gasket, cylinder/exh. box	402	Lockwasher
53	Screw, hex head	189	Stud	417	Set screw
54	Lockwasher	190	Lockwasher	421	Foot, rubber
57	Hex head screw	191	Nut	422	Foot, rubber
58	Lockwasher	194	Level switch	429	Screw
60	Taper pin	195	Level switch support	430	Name plate
65	Shaft key	196	Socket set screw	431	Label "arrow"
66	Shaft key	197	O-ring	470	Hyd. fitting banjo
75	Exhaust box	198	Socket head screw	471	Tubing, gas ballast
80	Sheet metal baffle	205	Exh. cover side plate	472	Hyd. fitting, straight
83	Oil sight glass	206	Exh. cover plate gasket	474	Filter, gas ballast
84	Gasket, oil sight glass	207	Socket head cap screw	475	Bracket
87	Elbow, oil fill	208	Lockwasher	476	Elbow
88	Oil fill plug	224	Pipe adapter	477	Ball valve
89	Gasket ring, fill plug	225	Hydraulic fitting	478	Hex head cap screw
90	Exhaust pressure gauge	228	Hydraulic fitting	480	Oil tube insert
92	Socket head plug	230	Oil tubing	9000	Plug, socket
95	Oil drain plug	238	Socket head cap screw	9011	Endplate spacer
96	O-ring	239	Lockwasher		
99	Pipe nipple	241	Oil cooler		
100	Oil filter, automotive type	242	O-ring		
105	Cover, exhaust box	244	Fan cover		
106	Gasket, exhaust box cover	247	Socket head cap screw		
107	Hex head cap screw	250	Flange, lower, inlet		
108	Lockwasher	251	Valve plate, inlet		
115	Exhaust filter grip plate	252	Valve plate guide		
118	Filter support	253	O-ring		
119	O-ring	254	Spring, valve plate		
120	Exhaust filter	255	O-ring		
121	O-ring	260	Inlet flange, upper		
126	Screw, socket head cap	261	Inlet screen		
127	Distance sleeve	265	Screw, hex head cap		
128	Lockwasher	266	Lockwasher		
130	Baffle strainer	270	Hyd. fitting, elbow		
131	Stud	290	Oil return line		
132	Washer	291	Hyd. fitting, elbow		
133	Filter support tube	300	Motor mounting bracket		
134	Hex nut	301	Screw hex head cap		
136	Exh. baffle strainer screen	302	Lockwasher		
137	Distance sleeve	306	Motor adapter flange		
140	Exhaust cover plate	307	Socket head screw		
141	Exhaust cover gasket	311	Coupling half, motor side		
142	Socket head cap screw	312	Coupling insert		



**Fig. 5 - Exploded View Drawing of Pump**



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