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OPERATION AND MAINTENANCE MANUAL

MICROtorr 11 HIGH VACUUM PUMPING STATION

P/N 40110 AND 40220

TABLE OF CONTENTS

			Page
I.	Contents		4
II.	Description		4
III.	Installation		5
IV.	Operation		6
V.	Normal Operation Check List		7
VI.	Routine Maintenance		8
VII.	Troubleshooting Guide		9
VIII.	Spare Parts List		11
IX.	Accessory Items		12
X.	Technical Data		13
XI.	APPENDIX		A-1
	A-2, A-3:	Vacuum Pump Data	
	A-4:	Vacuum Pump Parts	
	A-5:	Port Termination Pump Connections	
	A-6:	Separator Pump Connections	
	A-7:	Bayonet Connections	
	VBC Dwg. No. A-39176:	Wiring and Hook-Up Diagram- Vacuum Pump (115V/60Hz, 220V/50Hz)	

I. CONTENTS

The box should contain the following items:

1	High vacuum pumping station	115V/60Hz or 220V/50Hz	P/N 40110 P/N 40220
1	Foreline hose		P/N 16508
1	Copper adapter		P/N 15352
1	Exhaust port adapter		P/N 16389
1	Tygon vacuum hose, pre-greased with Apiezon		P/N 7130
2	Hose clamps		P/N 6790
1	Installation and Maintenance Manual		

NOTE: The Alcatel mechanical pump manual is appended at the end and can be used for supplemental information.

II. DESCRIPTION - Refer to A-2 Thru A-4 in Appendix

MICROtorr 11 is a small, highly reliable, high vacuum pumping station. Primary use of the MICROtorr 11 is for the maintenance of an insulating vacuum in SEMIFLEX® cryogenic pipe systems. It is a complete unit requiring only connection to the annulus of the system to be evacuated, and an appropriate source of electric power.

The basic unit consists of a two-stage mechanical forepump, air-cooled oil diffusion pump and cooling fan, all assembled on a small base which includes rubber foot pads.

Internally, the mechanical pump is equipped with an "anti-suckback" valve, which effectively isolates the high vacuum side when the shaft ceases to rotate, as would occur with power failure or motor problems.

Accessories available include Convectron vacuum measuring tube and gauges, manual operated vacuum valve, and exhaust port oil mist filter.

III. INSTALLATION - Refer to A-5 Thru A-7 in Appendix

A. Remove the six lag screws from the bottom of all four sides which secure box cover to base (as noted on outside of box cover). Remove box cover.

B. Unfasten the four lag screws from wooden braces securing pump base to box base.

C. Remove clamp, centering ring and brass cap from mechanical pump outlet (red dot) and mount Exhaust Port Adapter (P/N 16389) matching red dot, with clamp and centering ring.

CAUTION: PUMP MUST NEVER BE OPERATED WITH EXHAUST PORT CAPPED OR PLUGGED.

D. Remove clamp, centering ring and brass cap from mechanical pump inlet. Remove black dust caps from diffusion pump connections.

E. Connect Foreline Hose (P/N 16508) between mechanical pump inlet and diffusion pump (matching blue dots) using the standard clamps and centering rings.

F. 55 cc of Diffusion Pump Oil (P/N 3396) has been installed prior to shipment.

G. Connect Copper Adapter (P/N 15352) to vertical diffusion pump port with clamp and centering ring (matching yellow dots).

H. Remove dust plugs from Tygon Hose (P/N 7130) and insert over end of Copper Adapter (P/N 15352). Tighten hose clamp.

I. Connection from Tygon open end to the appropriate SEMIFLEX® piping or phase separator vacuum connection should be made with 1" nominal copper (1.125" OD or 28 mm OD). This line must be vacuum tight, clean and any intermediate joints must be brazed with silver solder (NOT soft soldered). VBC recommends use of Tygon hose pump connection as shown on Fig. 1 to assure proper alignment of flanges and to facilitate removal of pump for servicing in the future.

NOTE: ***Pumping station should be as close as practical to system to be evacuated. However, where circumstances dictate a connection length greater than 70 feet, the size of the tubing must increase to assure adequate pumping. Consult VBC with specific information***.

J. A suitable amount of mechanical pump oil has been added at the factory. However, a check of the oil level should be made after the pump has reached operating temperature and conditions.

K. The unit should be protected from the environment and maintained within the 40°F to 100°F (5°C to 40°C) operating temperature range.

L. Electrical Considerations -- The vacuum pump is provided with overcurrent protection.**.**

See the following chart.

Voltage	Current Protection Required
120 VAC 50-60 Hz	**20 Amps**
220 VAC 50-60 Hz	**16 Amps**

IV. OPERATION

A. Starting condition is with both pump switches OFF, power connected and all vacuum piping and connections secured.

B. Turn ON mechanical pump. At first a "popping" or gurgling noise is heard, accompanied by noticeable exhaust vapor from the exhaust port. This is normal and should slowly disappear as the vacuum improves. Failure of the "popping" to slowly diminish may be due to:

1. Vacuum leak in system
2. Wet or dirty system
3. Pump oil level low
4. Faulty pump

The mechanical pump is equipped with a gas ballast valve. If moisture is present or suspected, pump down may be enhanced by opening the valve (turn counterclockwise) for about 1/2 hour, then closing and observing vacuum change.

C. When "popping" and exhaust vapor disappear (within one to two hours per 100 feet of SEMIFLEX® piping or when the pressure drops below 100 millitorr for a system with a vacuum gauge) turn ON diffusion pump. At this time leave mechanical pump ON. Pressure should continue to drop and stabilize in the low millitorr range and pump conditions should be as shown in Section V. Normal Operation Check List.

D. The pumping unit is designed for long, trouble-free life and should be left running continuously (24 hours/day) for optimum performance.

E. Routine maintenance should be performed periodically to insure optimum performance and long system life. See Section VI.

V. NORMAL OPERATION CHECK LIST - After initial pumpdown

	ITEM	CONDITION
1.	Mechanical pump switch	ON
2.	Diffusion pump switch	ON
3.	Gas ballast valve	CLOSED (CLOCKWISE)
4.	Oil level and color	Center of sight glass, Light amber color
5.	Mechanical pump temperature	Approximately 95°F (35°C)*
6.	Motor temperature	Approximately 100°F (38°C)*
7.	Diffusion pump cooling fan	Operating
8.	Gurgling or "popping" noise	None
9.	Oil leakage	None

*With ambient temperature 70°(20°C)

VI. ROUTINE MAINTENANCE

A. Periodic Inspection

	ITEM	FREQUENCY
1.	Review items on Normal Operation Check List	Every month
2.	Change mechanical pump oil	Every 3 months
3.	Change diffusion pump oil	Every 2 years or if system was down because of vacuum failure.

B. Oil Change - Mechanical Pump

1. Isolate pumping station from system being evacuated by closing the appropriate valves.
2. Shut OFF diffusion pump.
3. Wait 20 minutes then turn OFF mechanical pump.

4. Draining the pump - An oil change is most easily accomplished when the pump is warm and the oil is less viscous. Remove drain plug allowing old oil to drain into a container. At this point run the pump for several seconds to expel oil trapped inside the pump stages. Replace drain plug.

5. Refilling the pump - Open fill plug and add Alcatel 100 oil to bring oil level to center of sight glass (approx. .85 liters). Re-install fill plug. Turn ON mechanical pump with local isolation valve still closed. A gurgling noise is characteristic when air is drawn through the pump. It should disappear quickly as pressure within the pump is reduced.

C. Oil Change - Diffusion Pump

1. Isolate pumping station from system being evacuated by closing appropriate vacuum valves.

2. Turn OFF diffusion pump.

3. After 20 minutes turn OFF mechanical pump and disconnect power.

4. Disconnect pumping station from connecting line to system being evacuated.

5 Disconnect foreline hose between mechanical pump and diffusion pump.

6. Remove two screws through diffusion pump mounting ears.

7. Carefully lift the pump and tip it to empty out oil. The electrical leads should be long enough to do this without their being removed or disconnected.

8. Put small amount (about 4 oz, 120cc.) of acetone or alcohol in the vertical port to flush remainder of oil. Shake then empty as before. Repeat flushing once more.

9. Dry inside of diffusion pump with dry nitrogen.

10. Reposition pump on mount and re-install the two screws through the ears.

11 Pour 55 cc. of diffusion pump oil (P/N 3396) into the vertical port.

12. Reinstall foreline hose and reconnect the pumping station to the system being evacuated.

13. Reconnect power, start mechanical pump, and follow the procedure described in Section IV. Operation, above. ***NOTE: As the diffusion pump oil heats up, the pressure will rise as a result of outgassing. This is normal, and the pressure will soon resume its drop toward the lower end of the scale.***

VII. TROUBLESHOOTING GUIDE

SYMPTOM A. Poor vacuum accompanied by "popping" and smoking.

	POSSIBLE CAUSE		ACTION
l.	Large system volume	1.	Allow appropriate time.
2.	Large leak in system.	2.	Leak check and repair.
3.	Wet or dirty system.	3.	Open gas ballast valve. Change oil in mechanical pump.
4.	Low mechanical pump oil level.	4.	Add oil.
5.	Faulty pump.	5.	Troubleshoot. Contact VBC

SYMPTOM B. Poor vacuum but without noticeable "popping" or smoking.

	POSSIBLE CAUSE		ACTION
1.	Small leak in system being evacuated	1.	Leak check system and repair.
2.	Diffusion pump switch off.	2.	Turn switch on.
3.	No oil in diffusion pump.	3.	Add oil.
4.	Diffusion pump heater burned out.	4.	Replace heater.
5.	Fan burned out.	5.	Replace fan.

SYMPTOM C. Unit will not operate.

	POSSIBLE CAUSE		ACTION
1.	No power.	1.	Check fuses and main power
2.	Mechanical pump is seized.	2.	Replace pump. Contact VBC
3.	Motor burned out.	3.	Replace pump. Contact VBC

SYMPTOM D. Diffusion pump body cold even though power & system are on.

	POSSIBLE CAUSE		ACTION
1.	Diffusion pump heater burned out.	1.	Electrically test; replace
2.	Faulty wire connection.	2.	Electrically test; repair.

SYMPTOM E. Fan does not operate though power and switch are on

	POSSIBLE CAUSE		ACTION
1.	Fan motor burned out.	1.	Replace.
2.	Faulty wire connection.	2.	Electrically test; repair.

SYMPTOM F. Evidence of oil accumulation around unit or in mounting base cavity.

	POSSIBLE CAUSE		ACTION
1.	Splash from initial pump-down	1.	Clean up and observe for several days.
2.	Shaft seal leakage.	2.	Replace seal. Contact VBC
3.	Main seal leakage.	3.	Replace seal. Contact VBC
4.	Sight glass leakage.	4.	Replace seal. Contact VBC

VIII. SPARE PARTS LIST

QTY	DESCRIPTION		VBC P/N
1	MICROtorr 11 High Vacuum Pump System	115V/60Hz 220V/50Hz	40110 40220
1	Heater - Diffusion Pump	115V/60Hz 220V/50Hz	4275 4842
1	Oil, Mechanical Pump - 1 Liter		16647
1	Oil, Diffusion Pump - 55 cc		3396
1	Fan	115V/60Hz 220V/50Hz	16380 16496
1	Clamp - Vacuum flange		14770
1	Centering Ring Assembly		14768
1	O-Ring - for Centering Ring		15341
1	Plastic Blank Flange		17841
1	Copper Adapter		15352
1	Tygon Hose Assemlby		7130
1	Hose Clamp		6790
1	Foreline Hose		16508
1	Exhaust Port Adapter		16389
1	Rocker Switch Body		36970
1	Rocker Switch Operator		36971
1	Minor Maintenance Kit		39638
1	Major Maintenance Kit		39639
1	Exhaust Oil Mist Replacement Filter (Set of five)		31614

IX. ACCESSORY ITEMS

QTY	DESCRIPTION	VBC P/N
2	Convectron Gauge Tube	23399
1	Vacuum Gauge With Digital Readout Single set point (Unmounted)23397	23397
1	Vacuum Gauge With Digital Readout Single set point (Console)	23398
1	Vacuum Ball Valve - Manual	15099
1	Exhaust Oil Mist Filter	31613

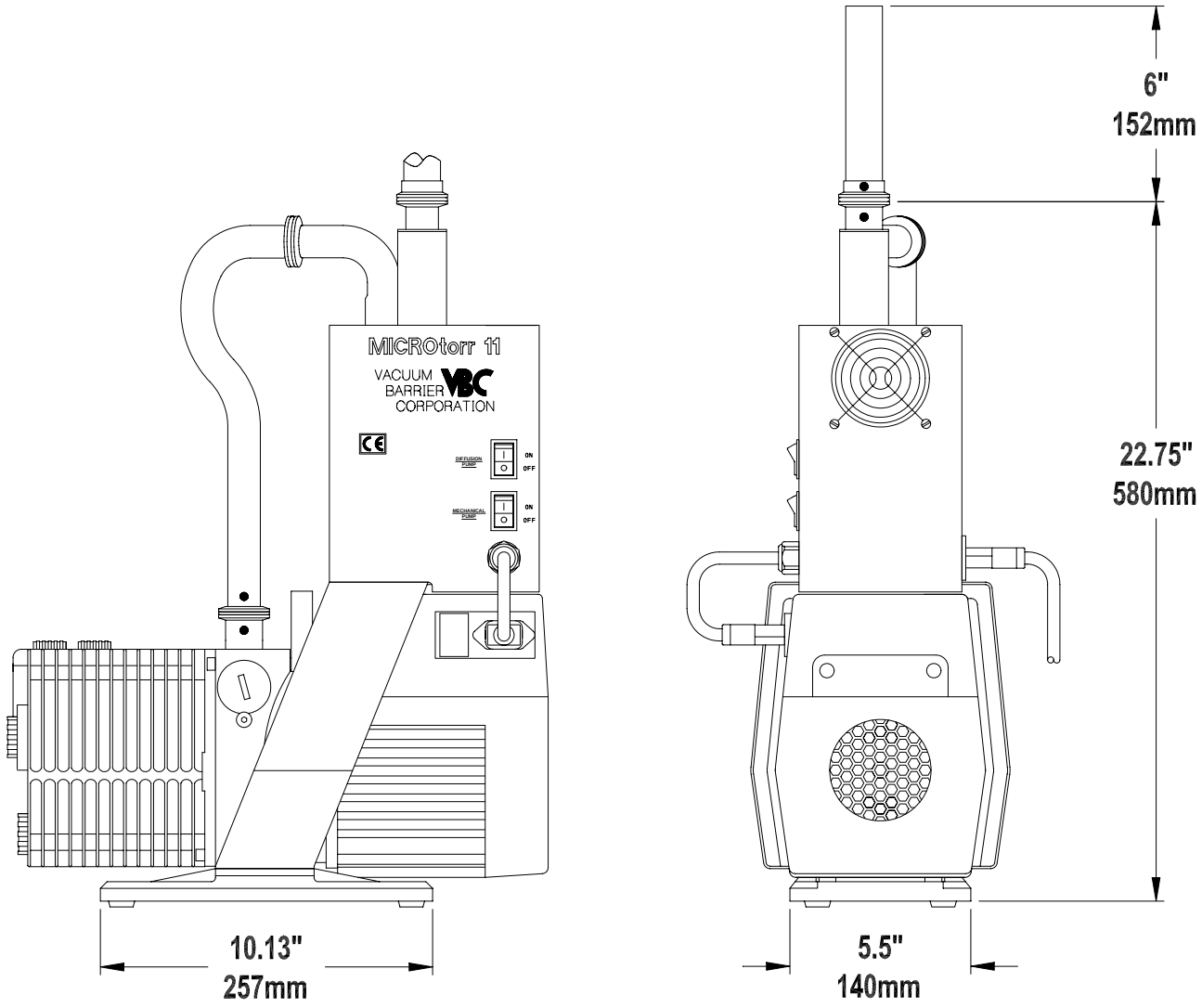
X. TECHNICAL DATA

MICROtorr 11 High Vacuum Pumping Station

Part Number	40110	40220
Voltage - Single Phase	115V/60Hz	220V/50Hz
Current	8.2 Amps.	4.3 Amps.
Power	950 Watts	
Dimensions - Overall Length	16.5"	420 mm
Overall Width	8.0"	205 mm
Overall Height	22.75"	580 mm
Weight	65 Lbs.	29.5Kg.
Shipping Weight	97 Lbs.	44.1 Kg.
Mechanical Pump Speed	3.4 CFM	4.8 M^3/Hr.
Diffusion Pump Speed	11 Liters/Sec.	
Ultimate Vacuum	9x10-6 Torr.	
Oil - Mechanical Pump - Capacity .	.83 Liters	
Oil - Mechanical Pump - Type	Alcatel 100 or Equivalent	
Oil - Diffusion Pump - Capacity	55 cc.	
Oil - Diffusion Pump - Type	Dow-Corning DC-704 or Equivalent	
Ambient Temperature Operating Range	40°F to 100°F (5°C to 40°C)	
Airborne noise emission level	Less than 70 dBA	
Altitude Rating	Equipment capable of operation at altitudes of 3000M (9840 ft)	
Humidity Rating	Operates at 30%-90% Relative Humidity (Noncondensing)	

X. APPENDIX.

MICROtorr 11 VACUUM PUMP



MICROtorr 11 ENGINEERING DATA		
Part Number	**40110**	**40220**
Ultimate Vacuum	**10^{-6} torr range**	**10^{-6} torr range**
Diffusion Pump Speed	**11 liters/sec**	**11 liters/sec**
Mechanical Pump Speed	**3.4 CFM**	**4.8M^3/hr**
Electrical	**115 VAC, 60 Hz, 8.2 amps**	**220 VAC, 50 Hz, 4.3 amps**
Dimensions		
Length	**16.5 in**	**470 mm**
Width	**8 in**	**213 mm**
Height	**22.75 in**	**457 mm**
Weight	**65 lbs**	**29.5kg**
Wiring Diagram	**A-39176**	**A-39176**

MICROtorr 11 VACUUM PUMP

P/N 40110 - 115V 60Hz
P/N 40220 - 220V 50Hz

PURPOSE

To maintain high vacuum in the annulus of SEMIFLEX® liquid nitrogen pipe systems.

DESCRIPTION

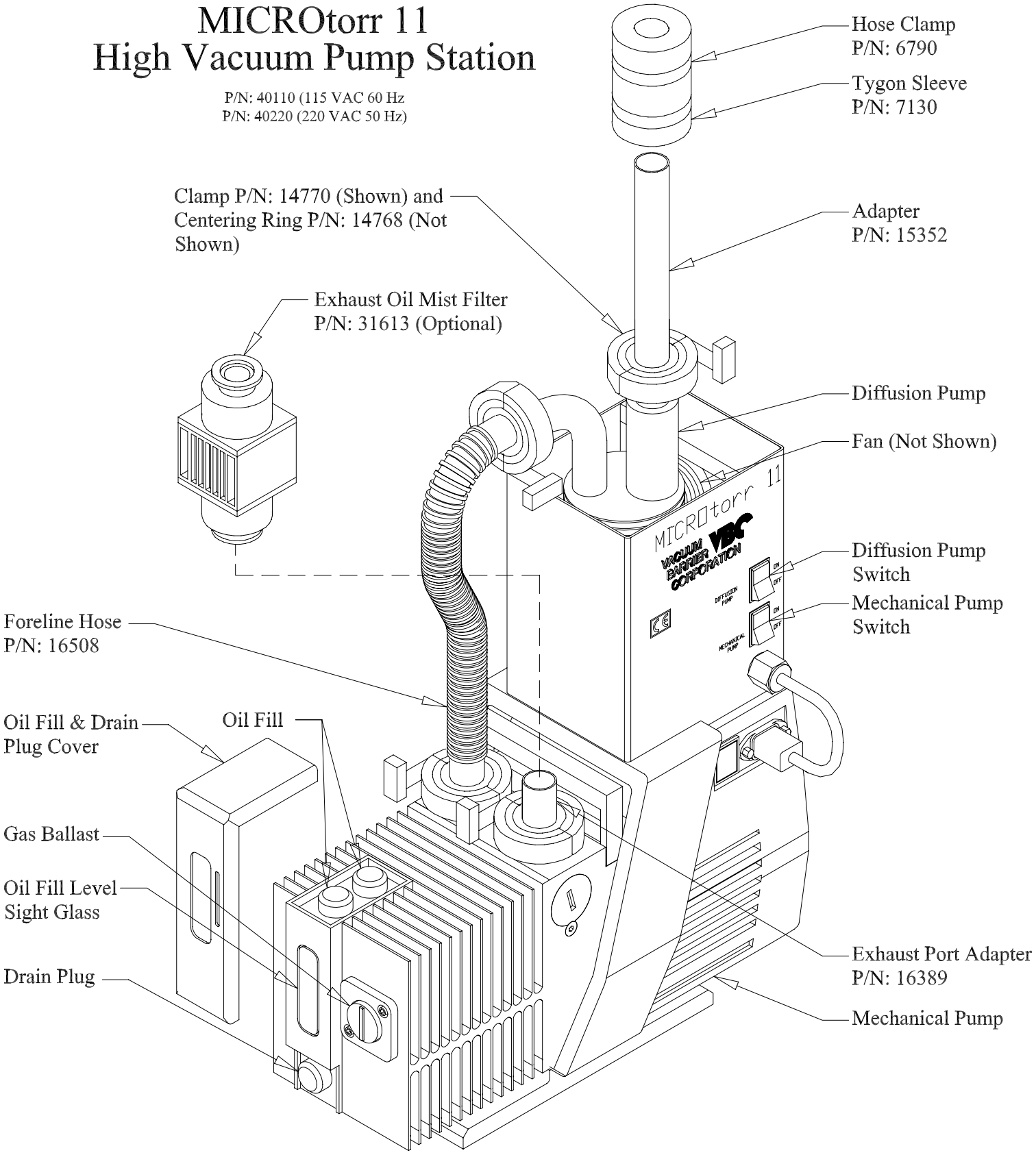
An air-cooled diffusion pump is backed by two-stage mechanical (roughing) pump, compactly mounted on a small frame. Internal mechanical pump valve closes high vacuum side in the event of power interruption.

CHARACTERISTICS

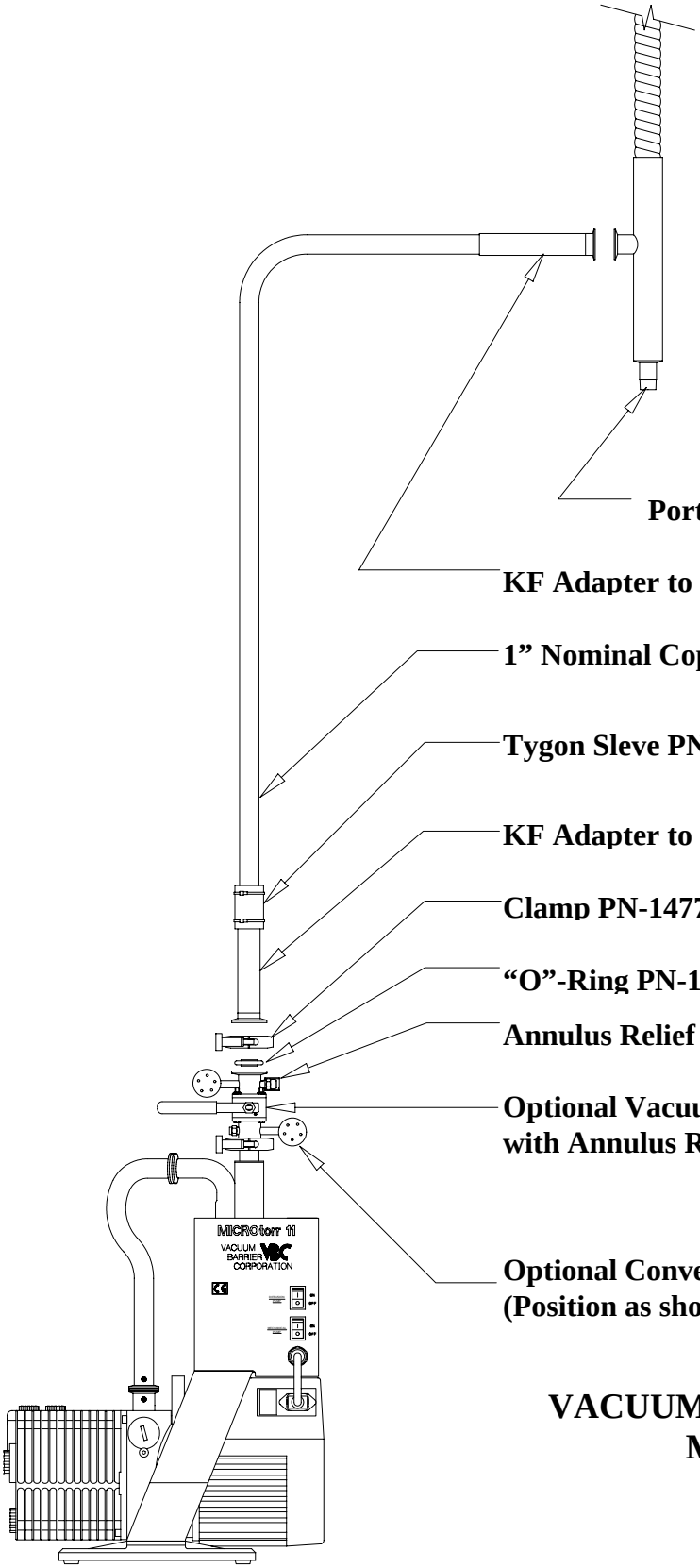
- Low power requirements.
- Continuous duty.
- Low maintenance requirements.
- Includes gas ballast valve (for initial pumping).
  NOTE - Do not open this valve when pump is stopped - with vacuum on system.
- Operating temperature 40º F to 100º F (5º C to 40º C).
- Accessories include manual and automatic valving, exhaust oil mist filter, and vacuum monitoring equipment.

MICROtorr 11 High Vacuum Pump Station

P/N: 40110 (115 VAC 60 Hz
P/N: 40220 (220 VAC 50 Hz)



PUMP CONNECTIONS Bayonet



Port Termination

KF Adapter to 1" Nominal Copper. PN-15352

1" Nominal Copper Tubing by others

Tygon Sleve PN-7130 w/clamps

KF Adapter to 1" Nominal Copper PN-15352

Clamp PN-14770

"O"-Ring PN-15341

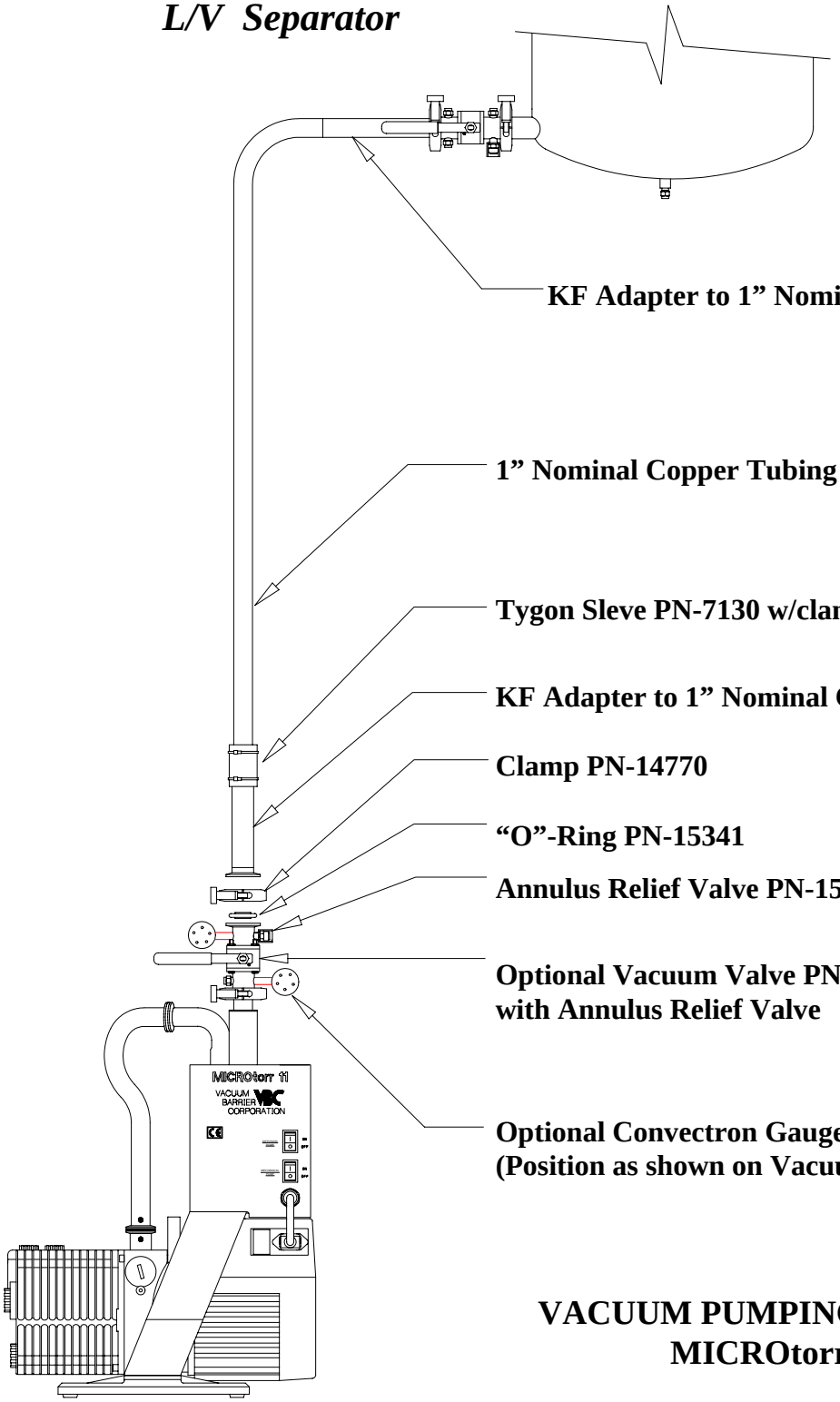
Annulus Relief Valve PN-15342 (Towards System)

Optional Vacuum Valve PN-15099 with Annulus Relief Valve

Optional Convectron Gauge Tubes PN-23399 (Position as shown on Vacuum Valve)

VACUUM PUMPING STATION MICROtorr 11

PUMP CONNECTIONS
L/V Separator



L/V Separator

KF Adapter to 1” Nominal Copper PN-15352

1” Nominal Copper Tubing by others

Tygon Sleve PN-7130 w/clamps

KF Adapter to 1” Nominal Cu. PN-15352

Clamp PN-14770

“O”-Ring PN-15341

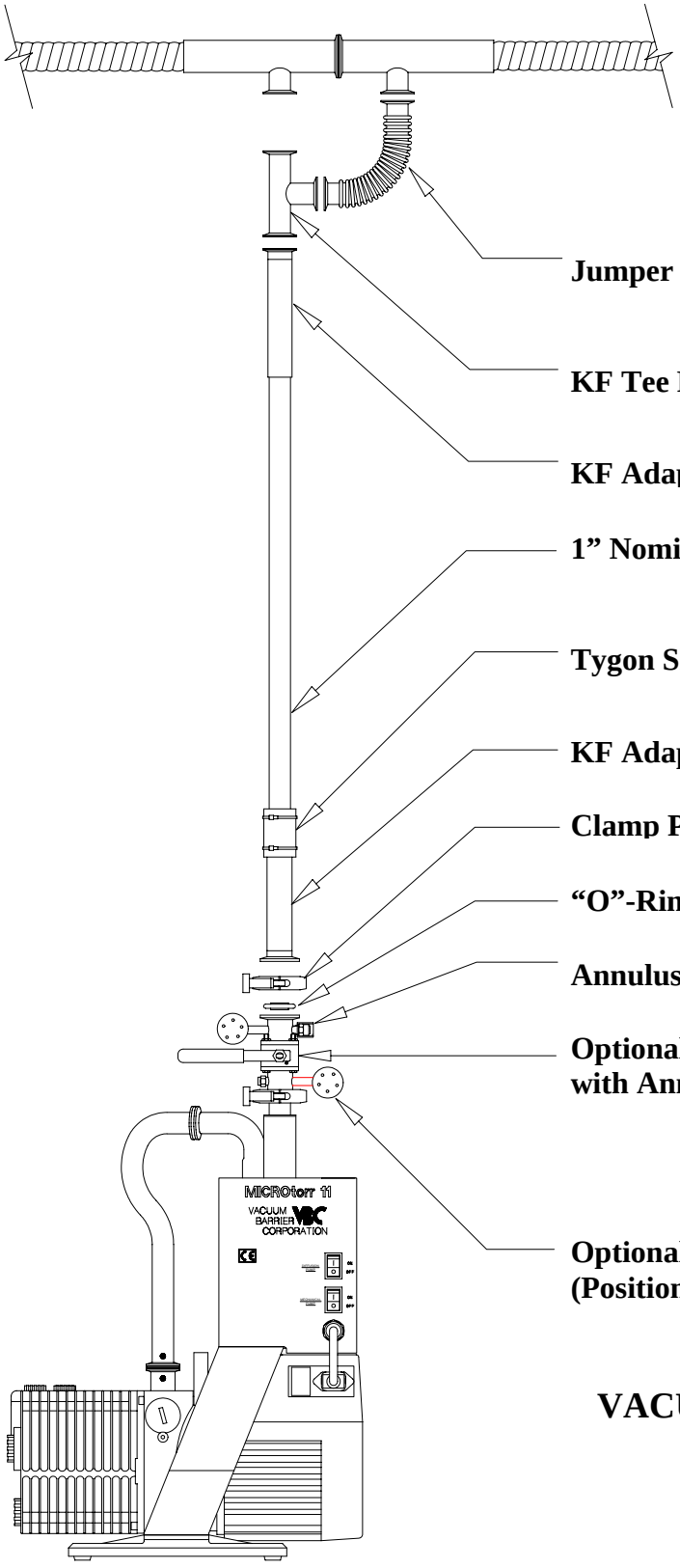
Annulus Relief Valve PN-15342 (Towards System)

Optional Vacuum Valve PN-15099 with Annulus Relief Valve

Optional Convectron Gauge Tubes PN-23399 (Position as shown on Vacuum Valve)

VACUUM PUMPING STATION MICROtorr 11

PUMP CONNECTIONS
Bayonet



Jumper Hose PN-16190

KF Tee PN-16040

KF Adapter to 1” Nominal Copper PN-15352

1” Nominal Copper. Tubing by others

Tygon Sleve PN-7130 w/clamps

KF Adapter to 1” Nominal Copper PN-15352

Clamp PN-14770

“O”-Ring PN-15341

Annulus Relief Valve PN-15342 (Towards System)

Optional Vacuum Valve PN-15099 with Annulus Relief Valve

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VACUUM PUMPING STATION MICROtorr 11