instructions

Vaclon®
pump control unit
and 8, 20, 30, and
60 ℓ/s Vaclon pumps

varian

palo alto
vacuum
division

VacIon Pump Control Unit Model 921-0062

20ℓ/s Triode VacIon Pump Models 911-5030, 911-5031

30ℓ/s Triode VacIon Pump Models 911-5032, 911-5033

60ℓ/s Triode VacIon Pump Model 911-5034

8ℓ/s VacIon (Diode) Pump and Magnet Models 911-5005, 911-0030

varian vacuum division/ 611 hansen way/palo alto, california 94303

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF ILLUSTRATIONS

GENERAL DESCRIPTION

A typical vacuum system, as illustrated in Figure 1, consists of:

The VacIon® Pump and its magnet.

The Control Unit for the VacIon Pump.

A Roughing Pump.

A roughing pressure gauge with a range from atmospheric pressure to one micron (10^{-3} mm of Hg).

A valve or other device to seal off the roughing pump from the rest of the system.

Roughing lines, usually of stainless steel or copper tubing, or rubber hose.

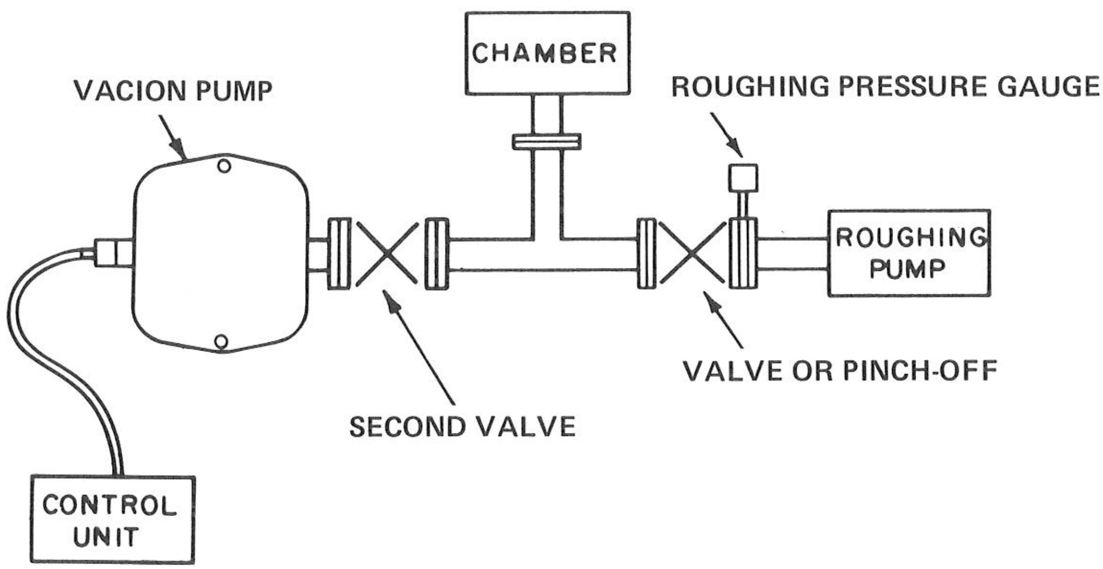


Figure 1. Preferred Vacuum System Schematic

PUMP INSTALLATION

INSPECTION PROCEDURE — PUMP

The following information and procedure can be used to establish the vacuum integrity of a VacIon Pump before installation

Condition When Shipped

VacIon Pumps are baked out, evacuated down to 1×10^{-8} Torr or below, and sealed at the factory.

Visual Inspection

Inspect the pump and magnet for physical damage which may have occurred during shipment. Examine particularly, the brazed joints on the high-voltage feedthrough. Inspect the pinch-off seal. If it is open, the pump will be at atmospheric pressure.

A VacIon Pump that has been exposed to the atmosphere during shipment, or while in storage, will operate properly if it has not been damaged. The pump is not harmed by such exposure, although it is good practice to keep it under vacuum when not in use to exclude dust and the accumulation of water vapor from the environment.

Vacuum Evaluation

To determine the existing vacuum level of the pump:

a. Connect the pump to the control unit as directed by "Connection to Pump" on Page 9 of this manual. Verify that the ground return lead is securely attached to the system and the grounding spring is properly installed on the pump.

b. Plug the control unit into a suitable power source.

c. Place the METER RANGE Switch in the PRESSURE position.

d. Place the START PROTECTION Switch in the START position.

e. Turn the POWER ON.

f. Observe the log scale reading for an indication of one of the following conditions:

   If the pump is free of leaks and is at a low pressure, the meter will first indicate a pressure (which depends on how long the pump has been in storage), and will then fall as the accumulated volume gas is pumped. Normally, the pressure will drop quickly to a value below the calibrated portion of the pressure scale (1×10^{-8} Torr).

   If the pressure inside the pump is at or near atmospheric level, an arc may strike inside the high voltage feedthrough with a popping sound. The fluctuating pump current will cause the needle on the log scale to waver. TURN POWER OFF IMMEDIATELY.

g. If the vacuum integrity has been lost, the unit should be leak-checked immediately with a good leak detector of the mass-spectrometer type.

Short Circuits

If there is a short circuit between the anode and cathodes in the pump, the short-circuit current of the control unit will be drawn and zero voltage will be indicated on the voltage scale. If a short circuit exists in the control unit or high-voltage cable and connector, zero voltage will also be observed when the high-voltage connector is disconnected from the pump.

Storage

To prevent dust particles from entering the VacIon Pump, leave its pinch-off tubulation sealed until ready to attach it to the vacuum system.

Breaking Pinch-Off Seal

With the control unit turned off, break the pinch-off seal on the copper tubulation by squeezing with pliers. Listen for the sound of air rushing into the pump. A sound will heard only if a good positive opening is made, since a small leak will allow the pump to gradually attain atmoshperic pressure without a noise. Avoid drawing metal particles into the pump.

MOUNTING PUMP

VacIon Pumps can be mounted in any orientation. For convenience, a pump is usually mounted vertically with the inlet up, or placed horizontally. Pumps can be supported by the mounting flange in the vertical position. When mounted horizontally, or when transported, all pumps should be supported.

The pump should be mounted to fulfill two space requirements. First, a minimum of six inches of clearance is necessary for the removal of the high-voltage connector. Second, the effect of the pump's fringing magnetic field should be considered. The stray field is lowest along a line passing through the magnet assembly in the long direction. If magnetic shielding is necessary, place the shield around the experiment itself. Appendix A contains magnetic field data for the pumps.

INLET FLANGE CONNECTION

When ready to install the pump, release the vacuum under which it was shipped, as discussed on page 3. Remove the ConFlat® Flange that was used to close the pump. Some particles of copper oxide may adhere to the outer edge of the flange gasket. Be careful not to allow them to fall into the pump.

Connect the pump to the system with tubing of the largest practical diameter. This tubing should be as short as possible to avoid a large pressure differential between the VacIon Pump and the system. Then proceed as follows:

1. Inspect the mating flanges for cleanliness and large scratches or nicks.
2. Use a new gasket each time the flanges are reassembled.
3. Use washers with all flanges except 2-3/4 inch OD flange. Use Type 300-series stainless steel screws, nuts, and washers for the required strength and thermal expansion.
4. Apply high temperature lubricant to the screw threads that extend through the flange and between the nuts and flange. Proper lubrication simplifies sealing and disassembly. A recommended lubricant is Fel-Pro-C-100, Model No. 953-0031. Note: Lubrication is essential to prevent galling of the nut and screw after bakeout.
5. Attach the nuts and tighten each one in turn to approximately 5 to 8 ft-lbs of torque. This will partially close the gap between the flange faces.

6. Repeat the sequential tightening for two more cycles.
7. Continue tightening the bolts until the flange faces meet and a pronounced increase in torque is felt.

LEAK CHECKING

Check the entire system for leaks with a leak detector of high quality, such as a Varian 925, 936 or 940 Series mass spectrometer leak detector.

CONTROL UNIT INSTALLATION

POWER REQUIREMENTS

WARNING

THE VOLTAGES DEVELOPED IN THIS CONTROL UNIT ARE DANGEROUS.

These VacIon Pump Control Units will operate from power input as shown in the Specifications. Line power is supplied to the primary winding of the Transformer by a three-conductor power cord. As a standard procedure the Transformer is connected at the factory for 120 V service. The connection itself should be checked to verify that its voltage is the same as the supply line voltage.

CAUTION

For 240V Operation, Use a Hubbell No. 5664 Plug, or Equivalent. Do Not Use Belden Plug No. 17627 (NEMA-rated for 15 A, 125 V).

Belden No. 17627 (120 V Service)

Hubbell No. 5664 (240 V Service)

Figure 2. 120 and 240 Volt Plugs

VOLTAGE CHANGEOVER PROCEDURE

8 ℓ/s Diode Pump — 3300 Vdc Output; Triode* Pumps (and Diode Pumps Larger Than 8ℓ/s) — 5200 Vdc**

1. Disconnect Control Unit from power source
2. Remove cover
3. Change the lead on transformer T1 to terminals 6 or 7

   Terminal 6 is 1180 V rms or 3300 Vdc

   Terminal 7 is 1850 V rms or 5200 Vdc

   Make sure terminal screw is tight.
4. Replace cover and connect to power source.

*Factory set.

120 Vac or 240 Vac Input Power

1. Disconnect the control unit from its power source. Wait 30 seconds for the capacitors to discharge.
2. Remove the perforated cover and discharge the capacitors again to make certain that they are completely discharged.
3. Change the jumper links on the terminal board of Transformer T1 to correspond with the legend on the terminal board, or the schematic diagram, for the desired line voltage .
4. Tighten all transformer terminals and replace the cover.
5. When changing from 120 volts input to 240 volts input, be sure to remove the molded power input plug and replace it with a plug that is rated for 240 volts. (See the recommended electrical connectors on Page 6.)

PUMP SELECTOR SWITCH AND OUTPUT POLARITY

1. On the rear panel, check that the pump selector switch is in the correct position.
2. Also on the rear panel, check the polarity switch: negative (-) for Triode pumps and positive (+) for diode pumps.

> **CAUTION**
>
> Do Not Change The Position of the Polarity Switch While the Unit is Turned On.

LOCATION

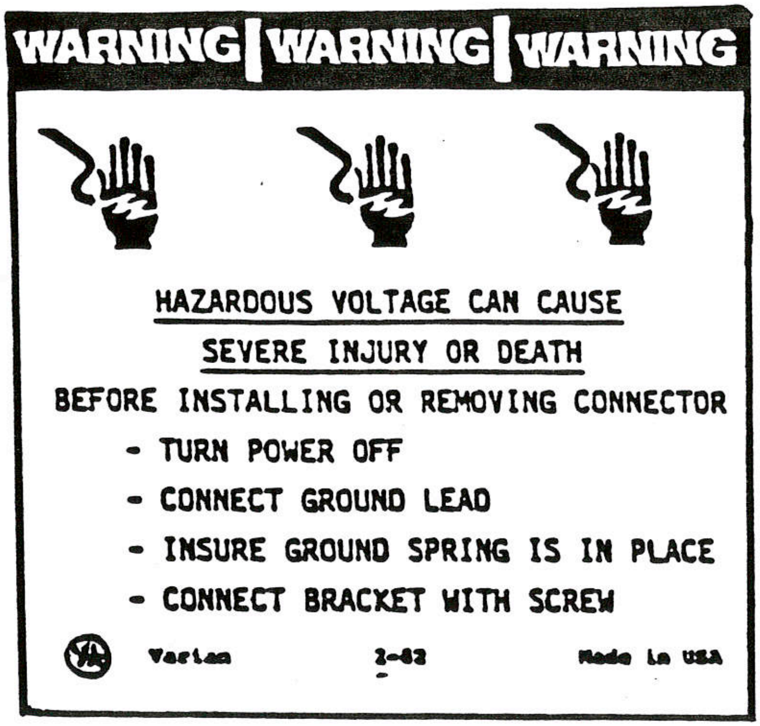
Place the control unit so as to accommodate the 10-foot length of the high-voltage cable which connects it to the VacIon Pump. If desired, special longer cables can be used because the high voltages and low currents can be carried through

INSERT

January 4, 1984

CORRECTION OF THE CONNECTION TO PUMP SEQUENCE IN:

Manuals	Page No.
87-400 130	2-6 & 2-7
87-400 200	14
87-400 256	9
87-400 275	6, 7
87-400 376	10



The pump is connected to the control unit by a COAXIAL High-Voltage cable assembly as follows:

1. Switch control unit's main power switch off.
2. Connect the pump body to the control unit by attaching the braided ground lead from the control unit to the pump body. (Latest models have insulated interlock conductor instead of grounder braid).
3. Position the "Grounding Spring" on the pump voltage feedthrough in the recess between the ceramic and the weld sleeve.
4. Push the cable connector over the high voltage feedthrough.
5. Always twist the connector until the cable connector slides OVER the grounding spring and will go no further.
6. Always align hole in connector with pump bracket and install screw.
7. NEVER APPLY POWER UNTIL YOU HAVE CHECKED AND VERIFIED THAT PROPER GROUNDING HAS BEEN ACHIEVED.

any length of cable normally required. Keep the control unit away from ventilation outlets which may introduce corrosive and conductive agents or dust. Avoid extremely humid locations. The ambient operating temperature range is 32°F to 105°F.

CONNECTION TO PUMP

> **WARNING**
>
> VOLTAGE DEVELOPED IN THE CONTROL UNIT IS DANGEROUS TO LIFE.

The pump is connected to the control unit by a coaxial high-voltage cable assembly as follows:

1. Position the "grounding spring" on the pump high voltage feedthrough in the recessed part between the ceramic and the weld sleeve (Figure 3).
2. Push the cable connector over the high-voltage feedthrough.
3. Twist the connector until the cable connector slides over the grounding spring and will go no farther. The grounding spring provides one means of grounding the pump.
4. It is very important that the pump case is completely grounded to and through the power supply. Otherwise, the pump case will rise to a high-voltage condition and would constitute a severe safety hazard to the operator. Therefore, for reasons of safety, also connect the grounding wire from the control unit to the pump.

Before disconnecting the high-voltage feedthrough from the pump: Wait at least 30 seconds after turning off the high voltage to allow the capacitors to discharge completely, then confirm the absence of voltage by reading the High Voltage meter on the front panel.

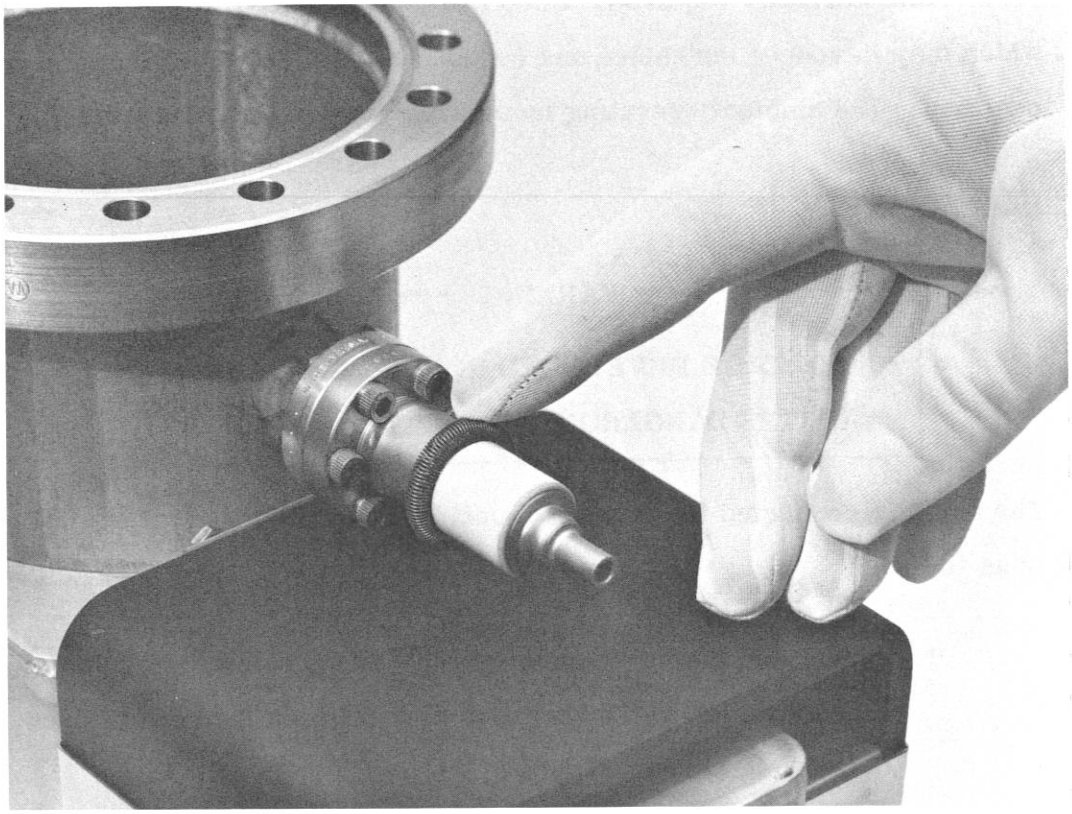


Figure 3. Grounding Spring Installation

USE WITH PRESSURE RELAY

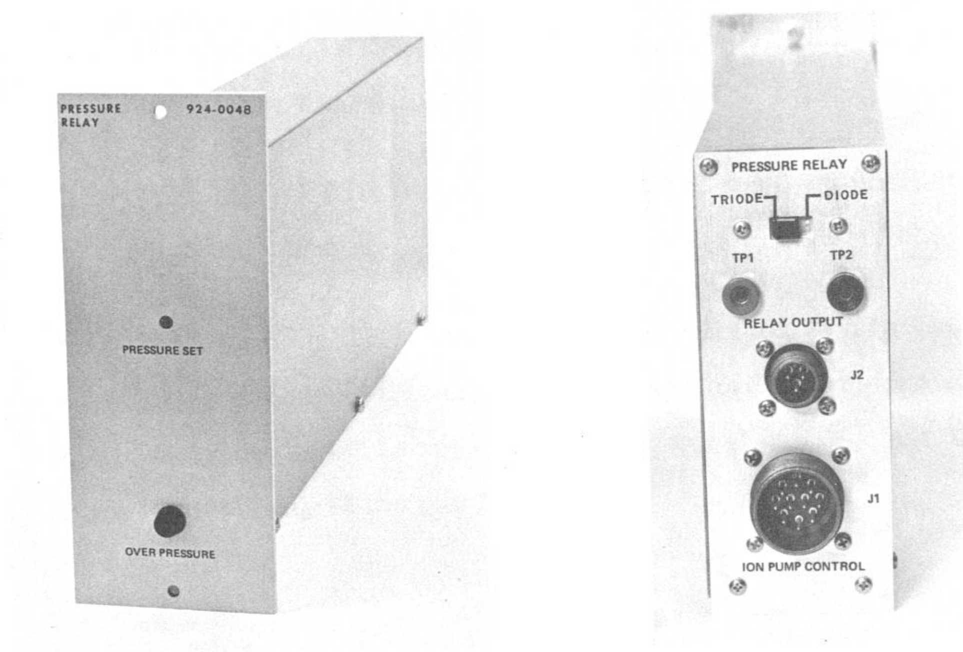
The multipin connector on the rear of the control unit is for the pressure relay model 924-0048. See Figure 4. This connector supplies the ac power and the pressure signal continuously when the control unit is on. See the pressure relay Manual No. 87-400-277 for instructions. This relay operates a contact which can be used to open and close a circuit carrying a current of up to 2 amperes. The contact is normally closed and opens at an adjustable set point.

RECORDER

The recorder output is 0-100 mV and indicates pressure continously regardless of the position of the meter switch. To find the millivolt output vs pressure, convert millivolts linear divisions on the meter (0-20) and read pressure on the log scale. Example: a. 50 mV is 10, (50% of scale) on linear scale and 1×10^{-6} on pressure scale, b. 75 mV is 15 on linear scale or 2×10^{-5} on the log scale, etc.

CAUTION

To Prevent Overloading and to Insure the Specified Accuracy of the Meter and Recorder Circuits, the Input Impedance of Any Recorder Used to Monitor the Control Unit Meter or Pressure Output Should be Higher than 500,000 ohms.



(a) Front View (b) Rear View

Figure 4. Pressure Relay

OPERATION

Rough pump the pump and system to 10^{-2} Torr or less and proceed as follows:

1. On the rear panel check the pump selector switch in correct position for size of pump in use (Figure 5).

2. Also on the rear panel check the polarity switch: (-) negative for Triode pumps, (+) positive for diode pumps.

3. Place the START-PROTECT switch in the START position. The light above the switch will glow (Figure 6).

4. Turn the METER RANGE SELECTOR to the 6 kV position to read the voltage.

5. Turn the POWER switch to ON. The light above this switch will glow, indicating that voltage is applied to the transformer. No warm-up period is required by the control unit; voltage is present immediately at the pump.

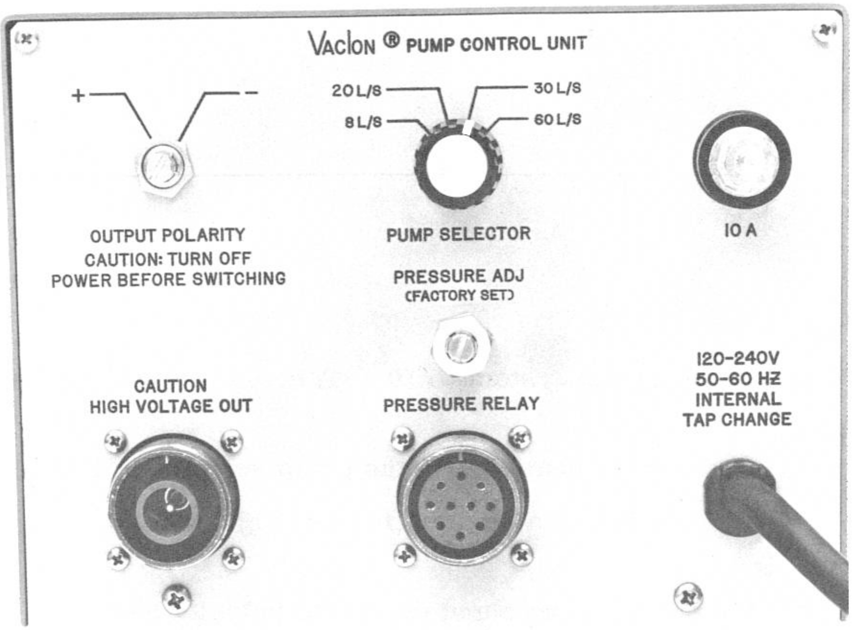


Figure 5. Pump Control Unit, Rear View

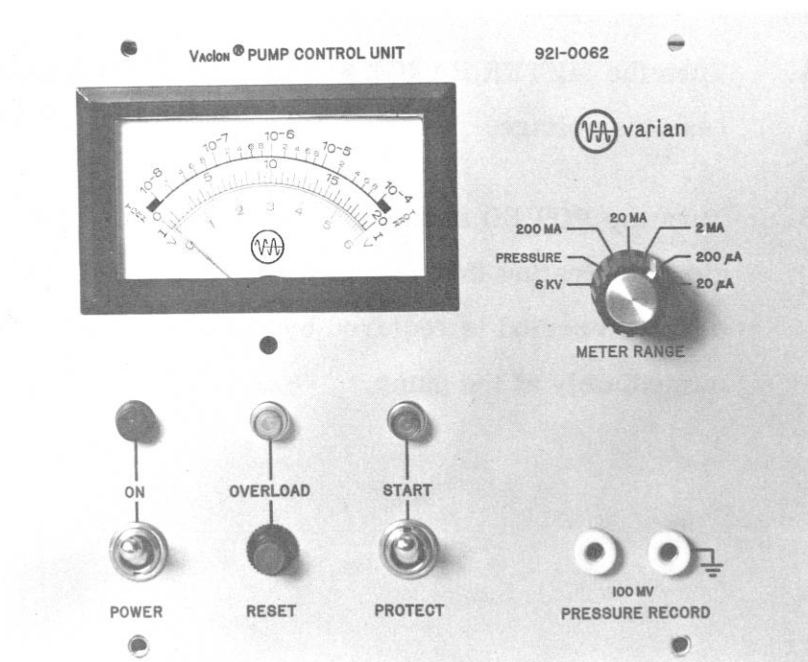


Figure 6. Pump Control Unit, Front View

6. Observe the voltage, current, and roughing pressure for the following: A voltage of approximately 1100 volts on triode pumps and 300 volts on diode pumps. A current value near the short circuit current of the control unit (see Specifications). These conditions indicate that a glow discharge exists in the pump. This will normally appear as a violet or blue glow in the pump. A temporary rise in pressure will usually occur with diode pumps.

7. Close the roughing pump valve when the base pressure of the roughing system is reached. However, if the pump voltage then falls, reopen the valve for the additional rough pumping. As the pressure decreases, the voltage again will rise (as the current falls). If the voltage continues to rise, leave the roughing pump valve closed.

8. When the voltage has increased to 2 kV, place the START-PROTECT switch in the PROTECT position. The light above the switch will go off. The system is now automatically protected against pressure rises above 5×10^{-4} Torr when the pump is left unattended. If such a rise should occur, the control unit will be turned off by a relay after a few seconds delay.

9. Shutdown: When operation of the VacIon Pump is to be terminated, turn the MAIN POWER switch OFF. Be sure to disconnect the power cable before touching anything inside the control unit.

PRESSURE DETERMINATION

1. Pressure at the pump inlet flange over the range from 10^{-4} to 10^{-8} Torr can be read directly on the PRESSURE scale by setting the METER RANGE switch at PRESSURE. Maximum accuracy has been achieved by factory adjustment of the PRESSURE ADJUST potentiometer on the back of the control unit.

2. Because the pressure within a VacIon Pump is proportional to the current drawn by the pump, it can be determined from the Pressure vs Current graph (Figure 7). Turn the METER RANGE SELECTOR to an appropriate setting between 200 mA and 20 μA. Read the current on the meter and locate the corresponding pressure on the appropriate curve for that pump. The accuracy obtained is comparable to that of a good ionization gauge.

An additional current flow resulting from electrical leakage or field emission can occur and can result in pressure determinations that are too high in the 10^{-8} Torr range. Degraded insulation, or the accumulation of dirt and moisture, in the control unit can cause electrical leakage. The build-up of minute sharp points within a VacIon Pump can cause field emission currents. These currents are of concern only when they affect the accuracy of pressure determination, they do not affect the pumping action.

An ionization gauge is essential for pressure determinations below 10^{-8} Torr.

RECORDING

A graphic recorder is an extremely useful tool for monitoring vacuum system performance because of the trends with time and the need to compare conditions from one run to another. A graphic recorder can be connected to the output jacks on the front panel of the control unit. The PRESSURE signal remains on these jacks at all times, regardless of the position of the METER SCALE SELECTOR.

PRESSURE RELAY

The control unit provides the power and signal to operate a Varian pressure-sensitive relay, Model 924-0048, which can be used to control a process or to provide shut-off protection in case of a rise in pressure (see Relay Instruction Manual No. 87-400 277). This relay has a single pole relay contact that operates NORMALLY CLOSED and can carry up to 2 Amperes. It will open when the pump pressure rises above the pressure selected by the operator. (See Installation, page 10.)

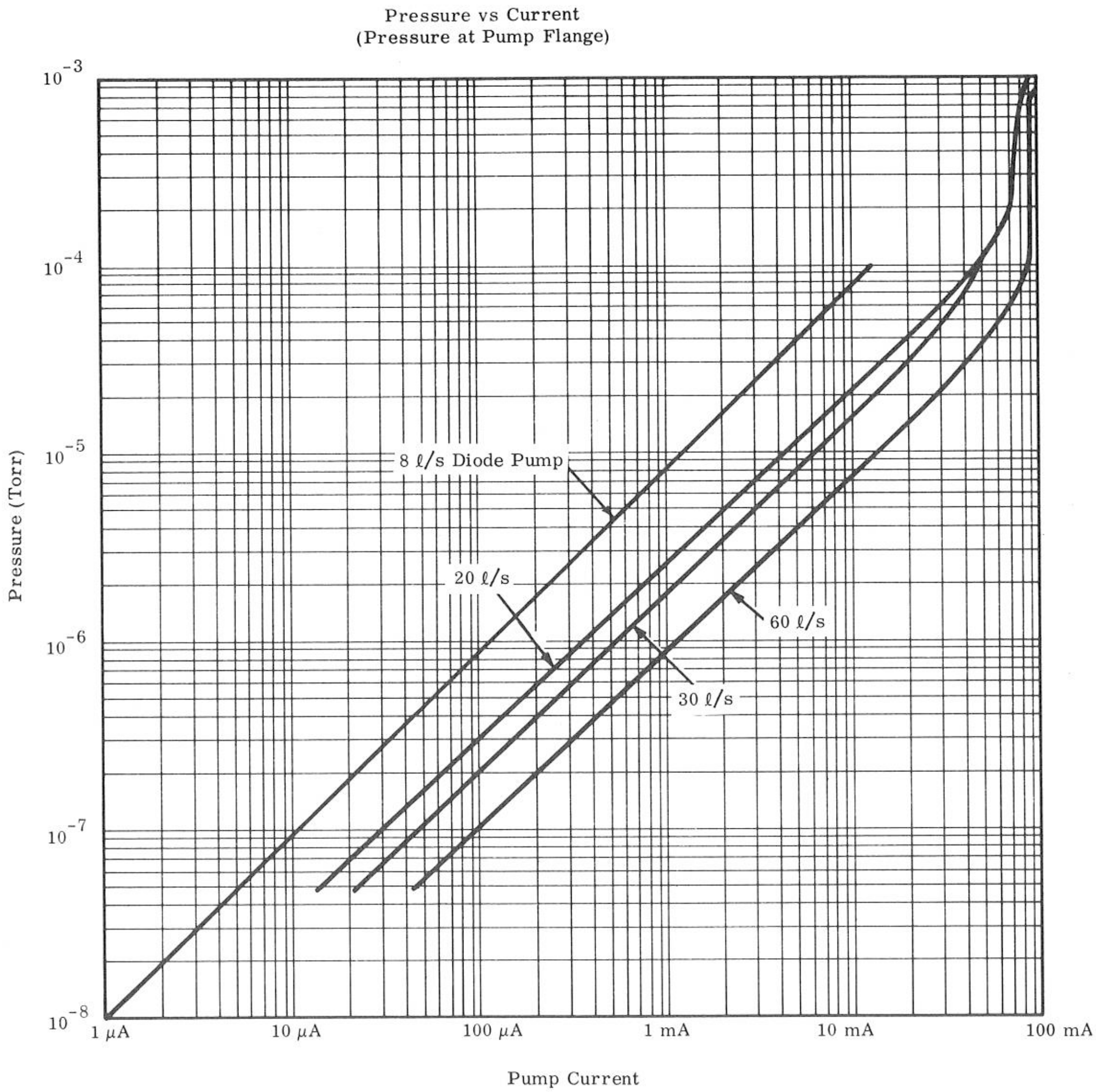


Figure 7. Pressure vs Current

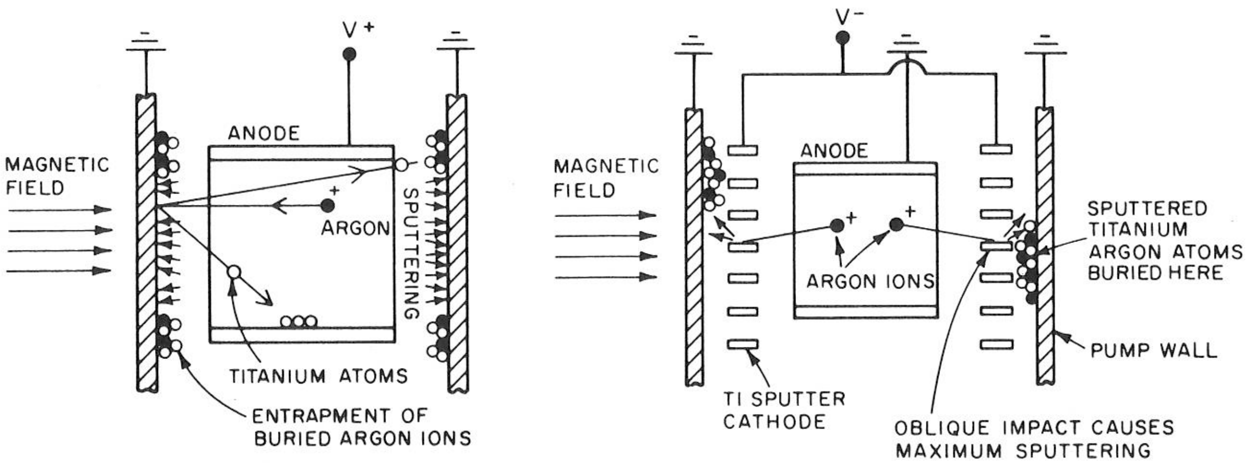
PUMPING MECHANISMS

VacIon Pumps operate by ionizing gas in a magnetically-confined cold-cathode discharge. The mechanisms which combine to pump virtually all gases encountered in vacuum systems are:

1. Trapping of electrons in orbits by a magnetic field.
2. Ionization of gas by collision with electrons.
3. Sputtering of titanium by ion bombardment.
4. Gettering of active gases by titanium.
5. Diffusion of hydrogen and helium into titanium.
6. Dissociation of complex molecules into simple ones for easy pumping. (For example, CH_4, is broken down into C and H_2. Hydrogen is pumped separately and carbon resides in solid form, no longer part of the residual gas.)

The basic mechanism for pumping heavy noble gases is burial. In the triode pump, Argon ions are neutralized by glancing collisions with the sputter cathode, impact the pump wall, and are covered with sputtered titanium (Figure 8b).

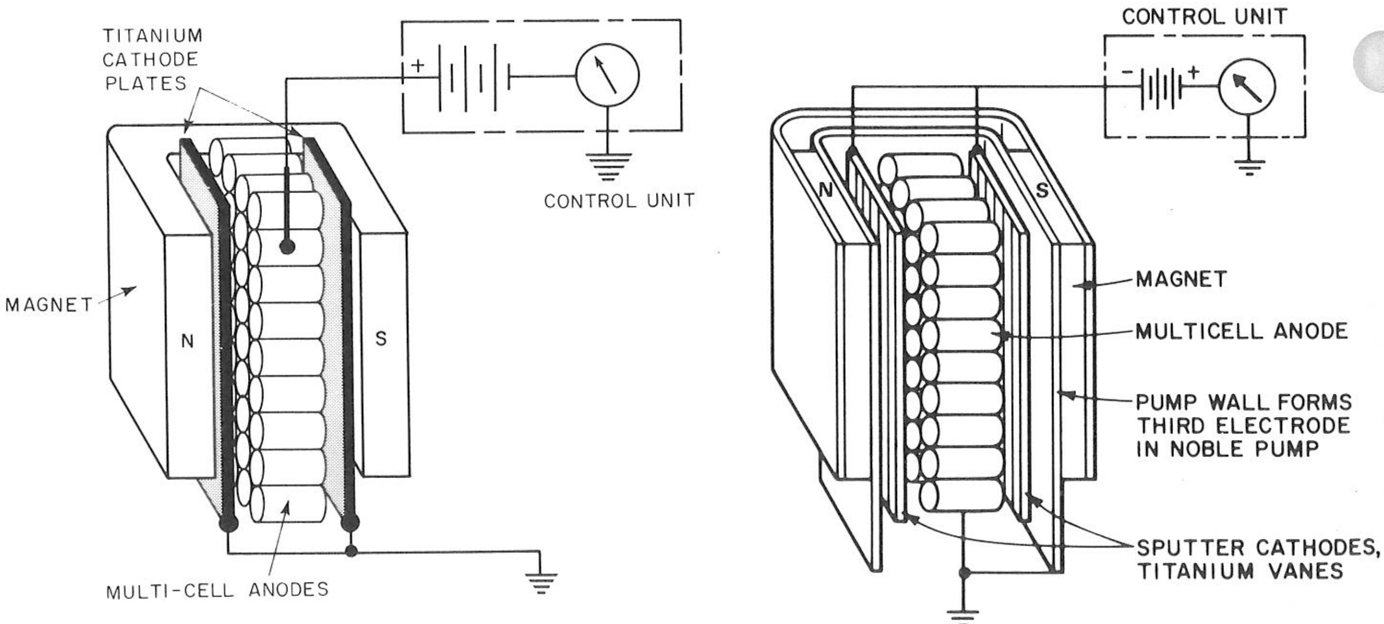
In Triode pumps, argon is permanently pumped on the wall behind the cathode (Figure 9b). This area receives titanium for inert gas burial but is not subjected to sufficient ion bombardment to resputter gases because of the retarding electric field between cathode and wall.



(a) Standard VacIon Pump

(b) Triode VacIon Pump

Figure 8. Argon Pumping Mechanism, Cross Section Views of Single Cells



(a) Diode Pump

(b) Triode (Noble) Pump

Figure 9. Schematic of VacIon Pumps

PUMP SPEED

Pumping speed varies with pressure and with different gases. Figure 10 illustrates pumping speed vs pressure and Table 1 lists pumping speeds for common gases.

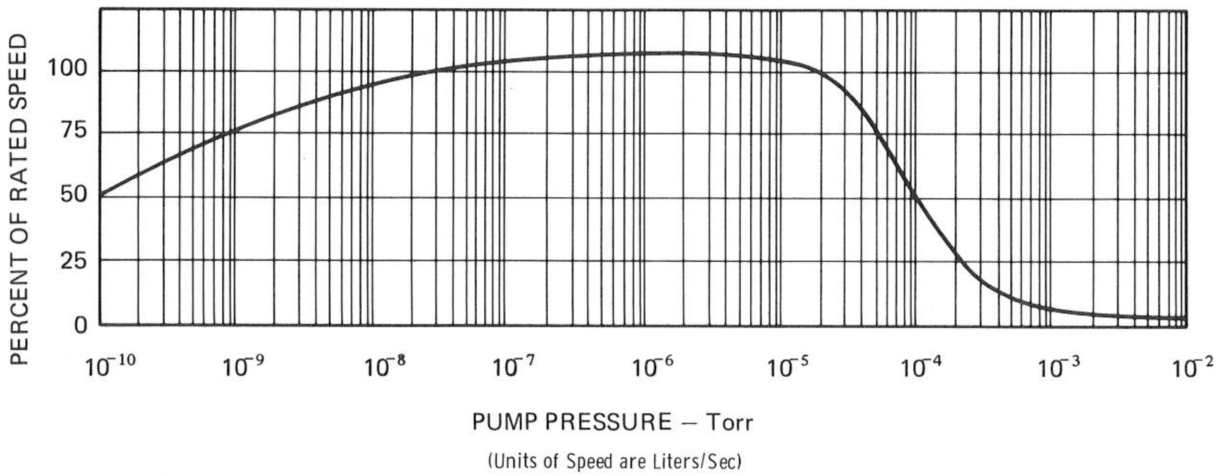


Figure 10. Pumping Speed vs Pressure

Table 1. Pumping Speeds for Common Gases Relative to that for Air For Triode VacIon Pumps

Air	100%	Argon	24%
Nitrogen	100%	Helium	30%
Water Vapor	100%	-	-

Uncommon Gases

Virtually all gases and vapors can be pumped without stopping the pumping action in VacIon Pumps. The sputtering action of the pump removes contaminants and continues to provide fresh titanium for pumping.

Argon and Other Inert Gases

An inert gas load in a vacuum system is typically only "volume gas" — inert gas adsorption to surfaces of the system is negligible. Thus, the need for long-term inert gas pumping only occurs when argon or air is introduced continuously into the system or if a large leak exists. Triode pumps are excellent for this purpose. They can pump pure argon at pressures up to 1×10^{-5} Torr with complete stability, at 24% of the pumping speed for nitrogen. Cyclical pumping occurs above 10^{-5} Torr on argon. These pressure variations cease immediately when the leak rate of argon is reduced.

STARTING PRESSURE AND ROUGHING REQUIREMENTS

Triode pumps will occasionally start at 5×10^{-2} Torr, however, a roughing pump is recommended to reduce the system pressure to 1×10^{-2} Torr or lower before a Triode VacIon Pump is started.

Rough pumping to below 1 x 10^{-3} Torr is recommended for the most rapid starting. When a mechanical pump is used for roughing, a trap in the roughing line is recommended to reduce pressure due to water vapor and oils from the mechanical pump. These oils are pumped by VacIon Pumps and are harmless to them — but their elimination is generally desirable because of gas load considerations. In systems where oils must be completely eliminated, VacSorb® Roughing Pumps should be used.

HIGH CAPACITY PUMPING SYSTEMS

Ultra-clean pumping systems have been designed on which VacIon Pumps have been used in conjunction with Titanium Sublimation Pumping. In these cases, the primary pumping is accomplished by the deposition of a fresh titanium film on a surface. The Triode VacIon Pump is used to evacuate the chemically inert gases such as methane, helium, and argon.

PUMP LIFE

Aging effects on the pumps depend on the species of gas and operating pressures. These affect the pumps in the following ways:

DEPLETION OF TITANIUM

Conditions: operation on nitrogen at a pressure of 1 x 10^{-6} Torr for 35,000 hours (over 3 years) or 50,000 hours with diode pumps. Titanium in the primary sputtering area cuts through the sputter cathode vanes and requires replacement.* Pumping of lighter gases, such as water vapor, gives longer life due to lower sputtering yield.

FLAKE FORMATION

Flake formation may cause field emission currents from sharp edges. As pumping continues, these currents increase until small arcs indicate the need to shake and brush out particles. This cleaning may have to be done after operating 9,000 hours at 1 x 10^{-6} Torr.

*Only the 60ℓ/s pump has replaceable pump elements; all other pumps must be replaced at end of life.

HYGROSCOPIC DEPOSITS AND HYDROGEN ADSORPTION

Hygroscopic deposits and hydrogen adsorption into titanium may cause starting times to increase with age. During exposure to air, the deposits of titanium compounds adsorb water vapor. In subsequent start ups, pump heating causes release of the water vapor and some previously pumped hydrogen; thus, the starting time may be lengthened.

MATERIALS AND TEMPERATURE LIMITS

The following table provides a guide for the temperature limits to be observed with the pumps.

Description	Materials	Temperature Limits
Body	Type 304 Stainless Steel	400°C
ConFlat Flanges	Type 304 Stainless Steel	500°C
Anode Cells	Type 304 Stainless Steel	Not Controllable
Sputter Cathodes	Titanium	Not Controllable
Magnet	Ferrite	350°C
High Voltage Cable		
Standard	Polyethylene Insulation	100°C
Bakeable	Teflon Insulation and Stainless Steel Protective Shield	250°C

PUMPS SPECIFICATIONS

8 ℓ/s VacIon PUMP

WEIGHT (Pump and Magnet)	8.9 Pounds
STRAY MAGNETIC FIELD	See Appendix A
INTERNAL VOLUME	0.4 Liters

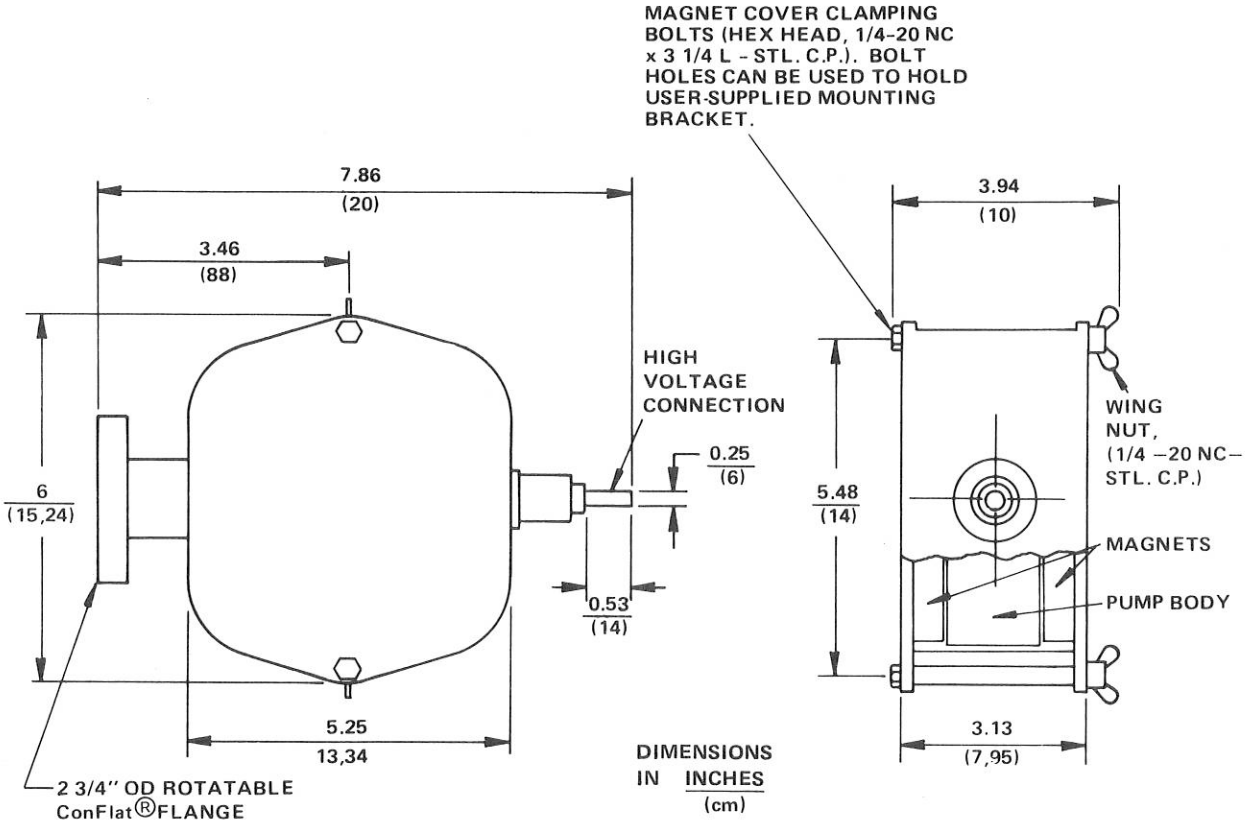


Figure 11. 8 ℓ/s VacIon Pump Outline

20 ℓ/s TRIODE VacIon PUMP

WEIGHT (Pump and Magnet)	21 Pounds
STRAY MAGNETIC FIELD	See Appendix A
BAKEOUT POWER	115 Vac, 5 A, Single Phase
INTERNAL VOLUME	1.4 Liters

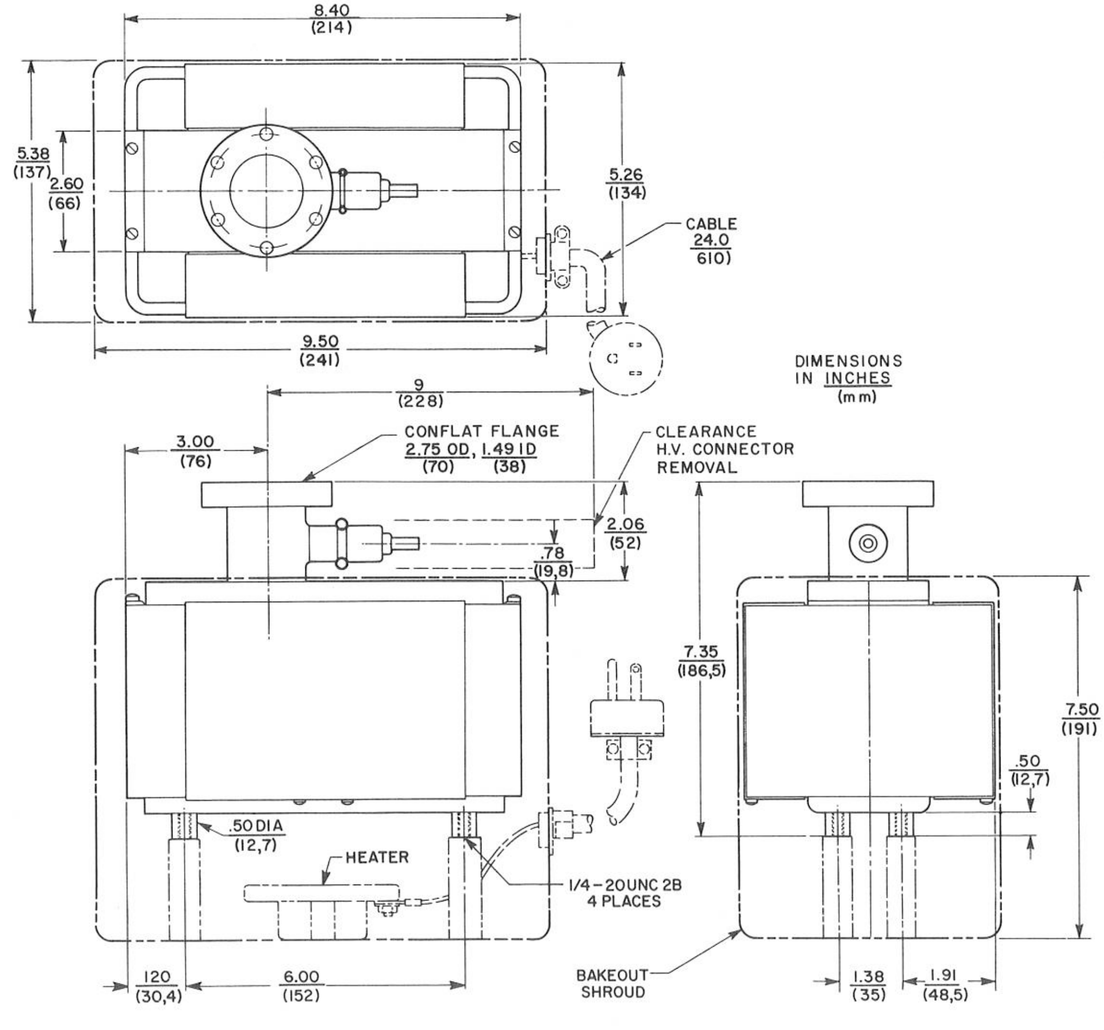


Figure 12. 20 ℓ/s Triode VacIon Pump Outline With Bakeout Unit (See Note 1, Page 28)

30 ℓ/s TRIODE VacIon PUMP

WEIGHT (Pump and Magnet)	26 Pounds
STRAY MAGNETIC FIELD	See Appendix A
BAKEOUT POWER	115 Vac, 5 A, Single Phase
INTERNAL VOLUME	1.9 Liters

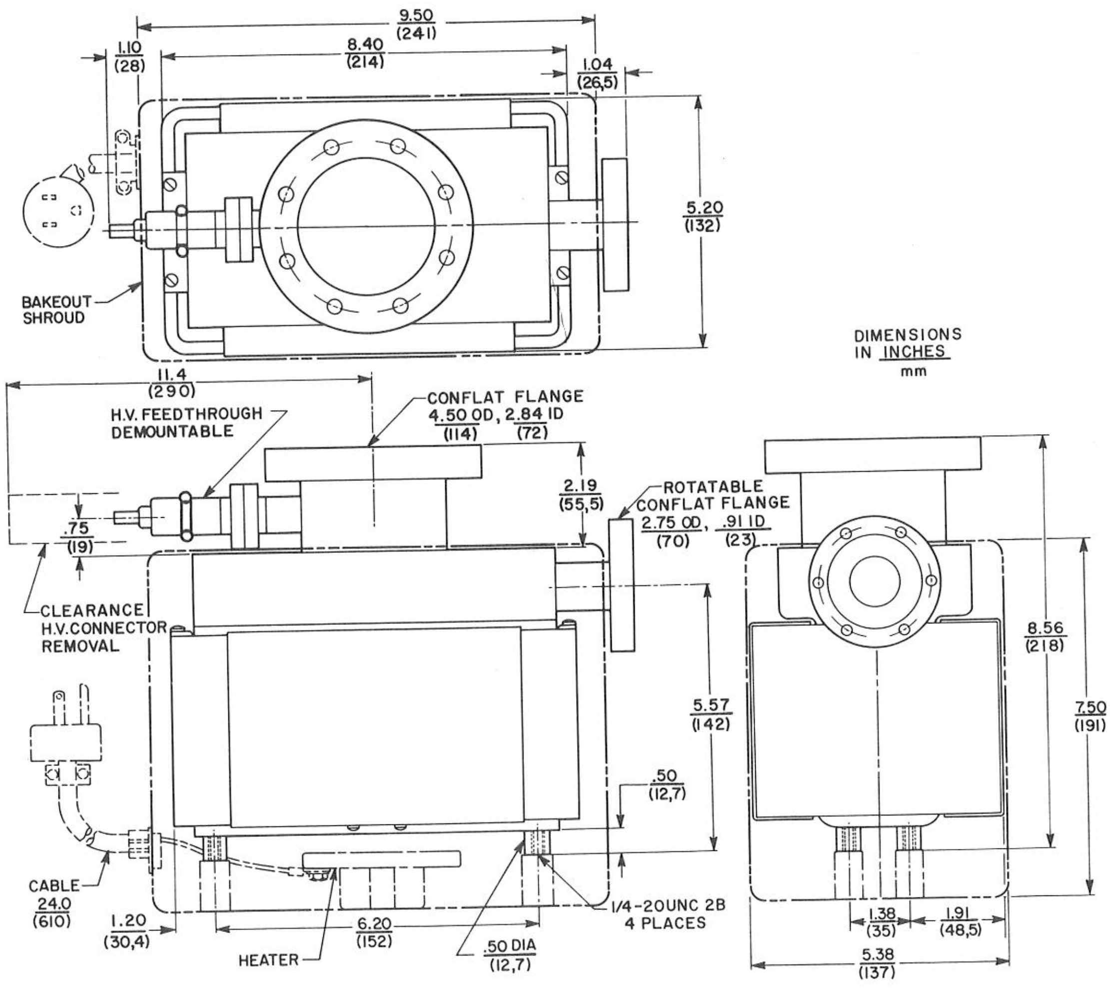


Figure 13. 30 ℓ/s Triode VacIon Pump Outline With Bakeout Unit (See Note 1, Page 28)

60 ℓ/s TRIODE VacIon PUMP

WEIGHT (Pump and Magnet)	40 Pounds
STRAY MAGNETIC FIELD	See Appendix A
BAKEOUT POWER	115 Vac, 10 A, Single Phase
INTERNAL VOLUME	6.2 Liters

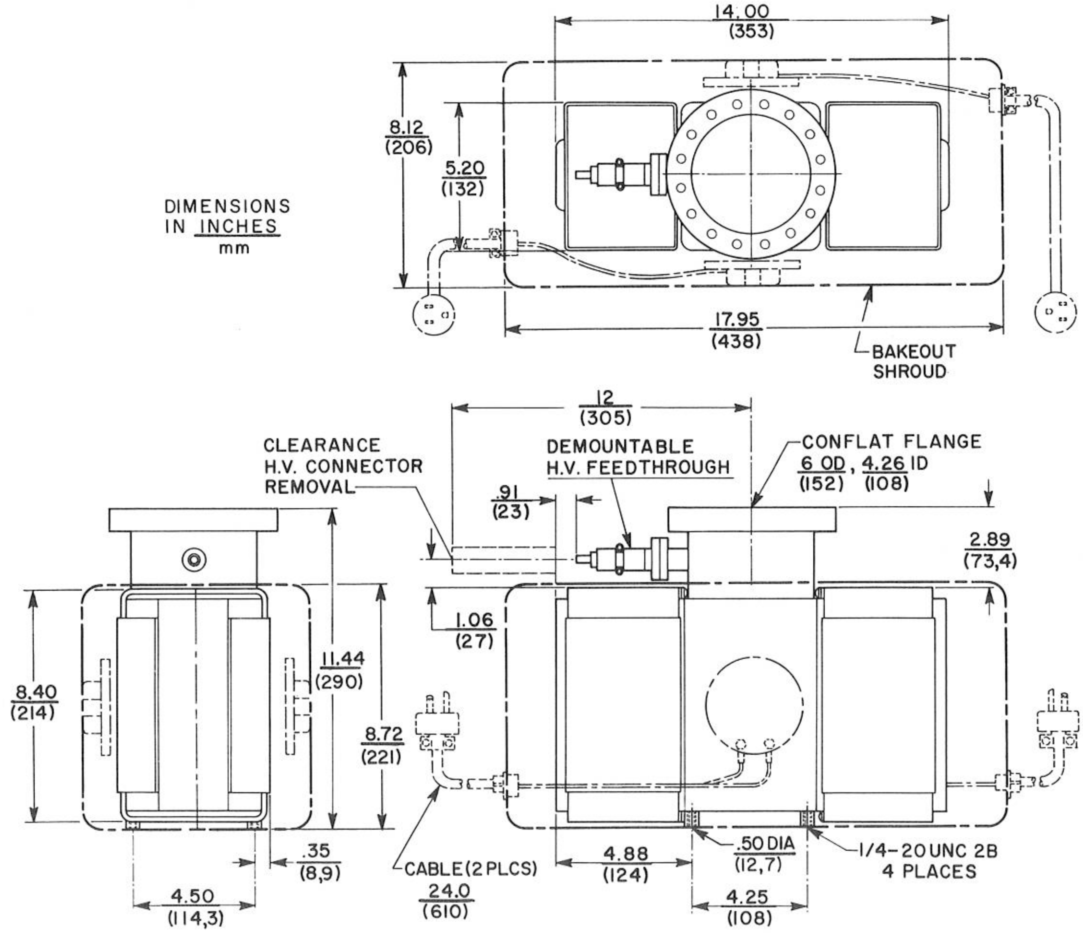


Figure 14. 60 ℓ/s Triode VacIon Pump Outline With Bakeout Unit
(See Note 1, Page 28)

Note 1. External heaters in aluminum enclosures give even heating for continuous low pressure operation. Pump walls reach uniform temperatures of 200 to 250°C.

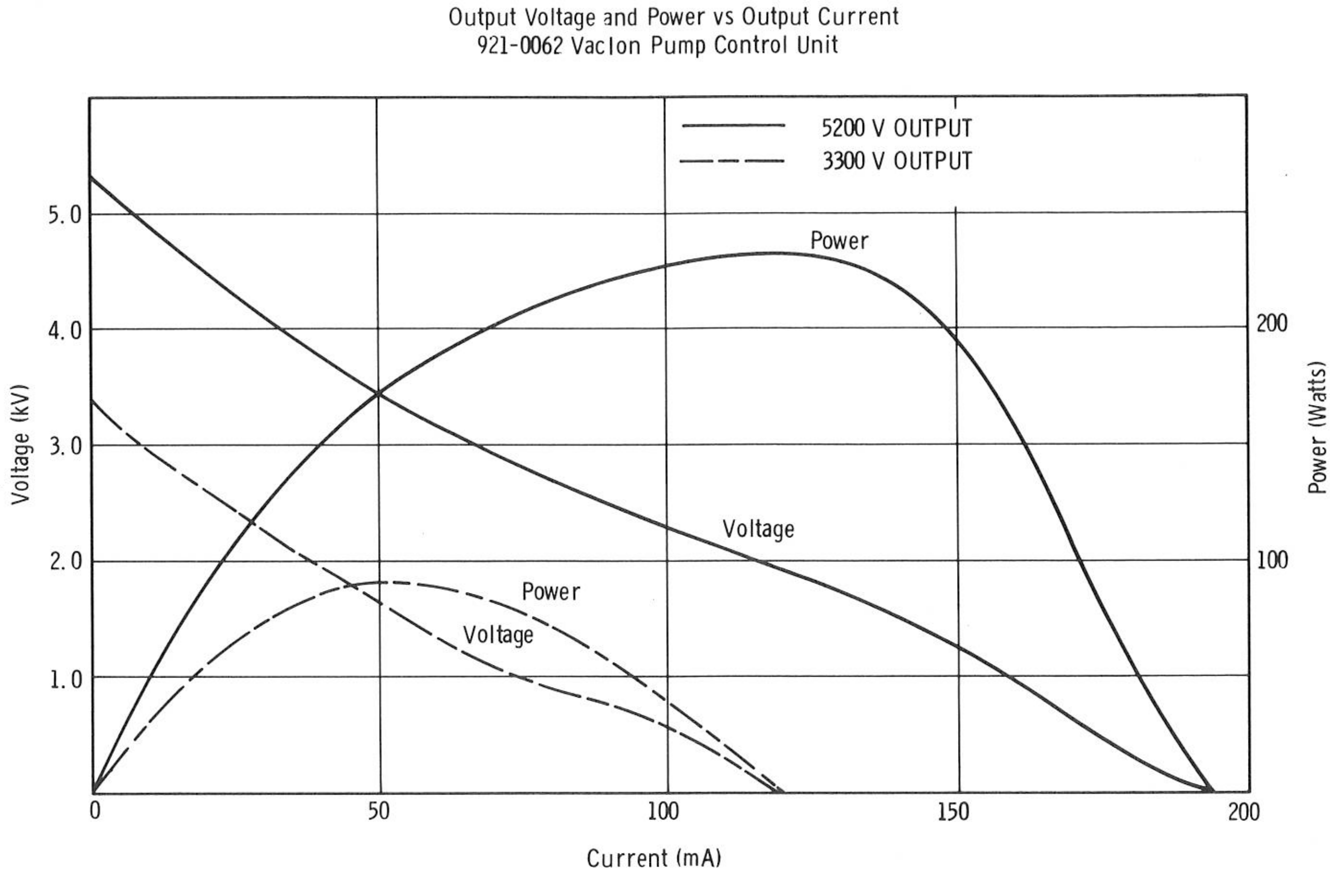


Figure 15. Medium Pump Control Unit, Voltage and Power vs Current

CONTROL UNIT SPECIFICATIONS

INPUT POWER

Voltage:	120/240 Vac, single phase, 50/60 Hz.	
	Internal taps for voltage change.	
Current:	10 A	
Output	(See Figure 15)	
Voltage (open circuit)	± 5200 or ± 3300 Vdc ± 10%	
	Internal taps for voltage change.	
	Polarity switch on rear panel.	
Current (short circuit)	60 Hz:	± 200 mA or
		± 120 mA ± 10%
	50 Hz:	± 167 mA or
		100 mA ± 10%

Overload Protection	Indicating fuse for line power. Relay turns dc power off at 5 x 10^{-4} Torr when START/PROTECT switch is in PROTECT position.
Protect Circuit (shuts off currents):	65 ± 20% mA on 8ℓ/s, 20 ℓ/s , 30 ℓ/s positions, 108 ± 20% mA on 60 ℓ/s position.
Metering	20 μA taut band 3-1/2" meter ± 2% .
Current Ranges	200 mA to 20 μA in 5 decade scales ± 10% .
Pressure scale	10^{-4} to 10^{-8} Torr, log scale ± 3 μA. Matches pump selected with pump selector switch.
Voltage scale	0-6 kV.
RECORDER OUTPUT	0-100 mV from pressure scale (continuous regardless of meter switch position). On front panel terminals and on connector for pressure relay.
CABLES	
Input	Power cable 7-1/2 ft long, 3 wire.
Output	10 ft long, polyethylene insulated, nonbakeable (supplied with control unit).
Heave Duty Replacement Cable	Bakeable to 250°C, Teflon-insulated, stainless steel wrapped, 12' long.
DIMENSIONS	
Panel	7" high x 8-5/16" wide.
Cabinet depth	15-1/8" (plus 4" cable clearance).
Weight	34 lb shipping weight - 40 lb.
AMBIENT TEMPERATURE	32°F to 105°F

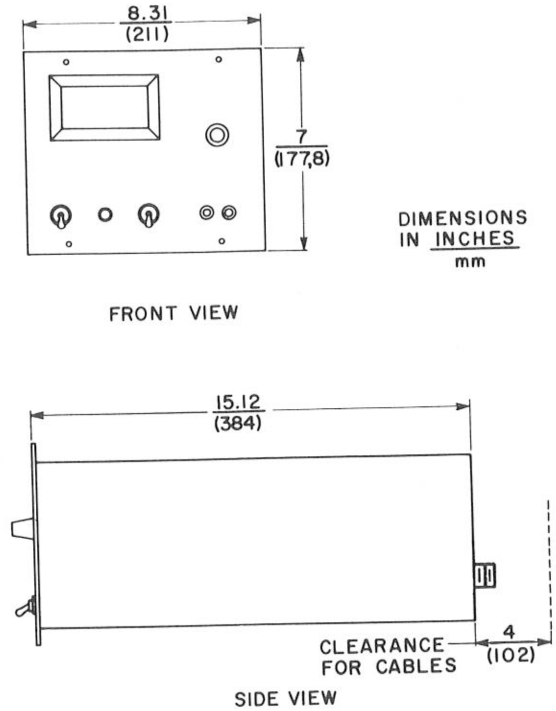


Figure 16. Control Unit for 8, 20, 30, and 60 ℓ/s VacIon Pumps, Outline

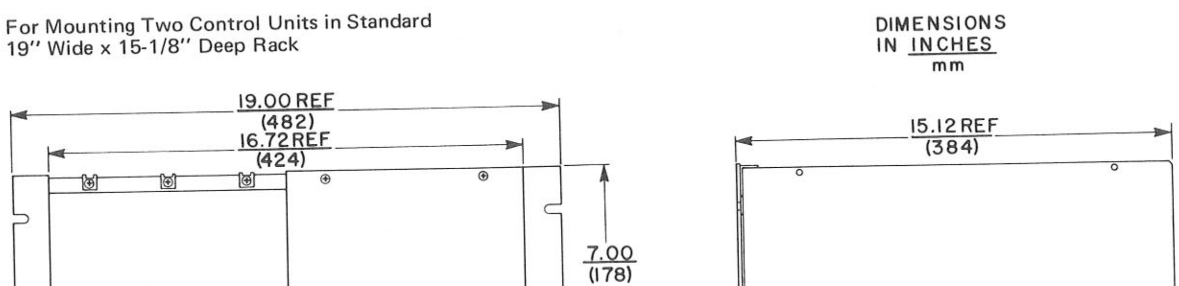


Figure 17. Rack Mount Chassis Outline

MAINTENANCE

This section contains maintenance information for the 8, 20, 30, and 60 ℓ/s Triode VacIon Pumps and for the control unit.

CONDITIONS REQUIRING MAINTENANCE - Pump

The need for appropriate maintenance is indicated by one or more of the following conditions:

1. Pump Current Fluctuations, Internal Electrical Shorts, or Pressure Bursts

   These are usually caused by titanium compounds flaking from surfaces as the pump accumulates operating time.

2. Slow Starting

   The pump may require more time to start after exposure to air compared to starting times experienced when the pump was new, even though a good roughing system with high pumping speed for water vapor is used. Assuming the vacuum system has not changed, this condition is usually caused by water vapor adsorbed on the increasing surface area inside the pump. This increase of surface area is caused by titanium compound deposits, which are hygroscopic. Remove the deposit (60 ℓ /s pump only) by removing the elements and cleaning the body. Care should be taken to thoroughly remove cleaning solvents from the high voltage feedthrough well and other areas that could trap the solvents.

3. Slow Pumpdown

This condition can be caused by foreign material in the system or pump. An example is molecular sieve material from a trap or a sorption pump drawn into the vacuum system by accidential opening of the roughing valve at high pressure. This will cause molecular sieve particles to be deposited throughout the pump and vacuum system. Slow pumpdown caused by a leak can be quickly recognized because the pressure will reach and maintain a constant level. Most outgassing phenomena decrease with pumping time, although sometimes slowly.

4. Hydrogen Saturation of Sputter-Cathode Grids

Pumping hydrogen at a true pressure of 1×10^{-5} Torr for about 1500 hours will saturate the sputter-cathode grids. The time for saturation decreases rapidly at true pressures above 1×10^{-5} Torr. (It is important to note that the pressure indicated by the pump current or shown on an ionization gauge must be multiplied by 2.7 to obtain the true pressure of hydrogen.)

In the event of hydrogen saturation of the cathode grids, replace the pump element.* It is possible to achieve some rejuvenation by baking to 400°C or higher while evacuating with another pump for at least 24 hours.**

5. Sputter-Cathode Grid Erosion

The grid under each anode cell may become extremely eroded after the pump element has been used for a long time. Replace the sputter cathodes when one or more titanium vanes are nearly cut through under the centers of the anode cells.

*Only the 60 ℓ/s pump has replaceable elements.

**No bakeout unit is available for the 8 ℓ/s pump; this pump can be baked out by removing the magnet and wrapping the pump body with insulated heater tapes rated at no higher than 250 W.

6. <u>Short Circuit Across Insulators</u>

Short circuits may result from flakes or foreign materials. High-pressure arcs above 1 Torr can melt sputter shields and coat the ceramic insulators. However, the Protection Circuit in the standard control unit prevents this damage if the switch is in the PROTECT position.

Inspect insulator surfaces and sputter shields. Remove foreign materials as necessary.

On pumps that do not have removable elements, tap the pump firmly to dislodge flakes that may be causing the short circuit.

60 ℓ/s pumps have removable elements. Removal of a single element is shown in Figure 18.

7. <u>Field Emission Current</u>

A constant pump current when no leak exists is often caused by field emission currents which prevent the use of the pump current as a pressure indicator. High voltage can be applied to burn off the sharp edges that form sources of these field emission currents.

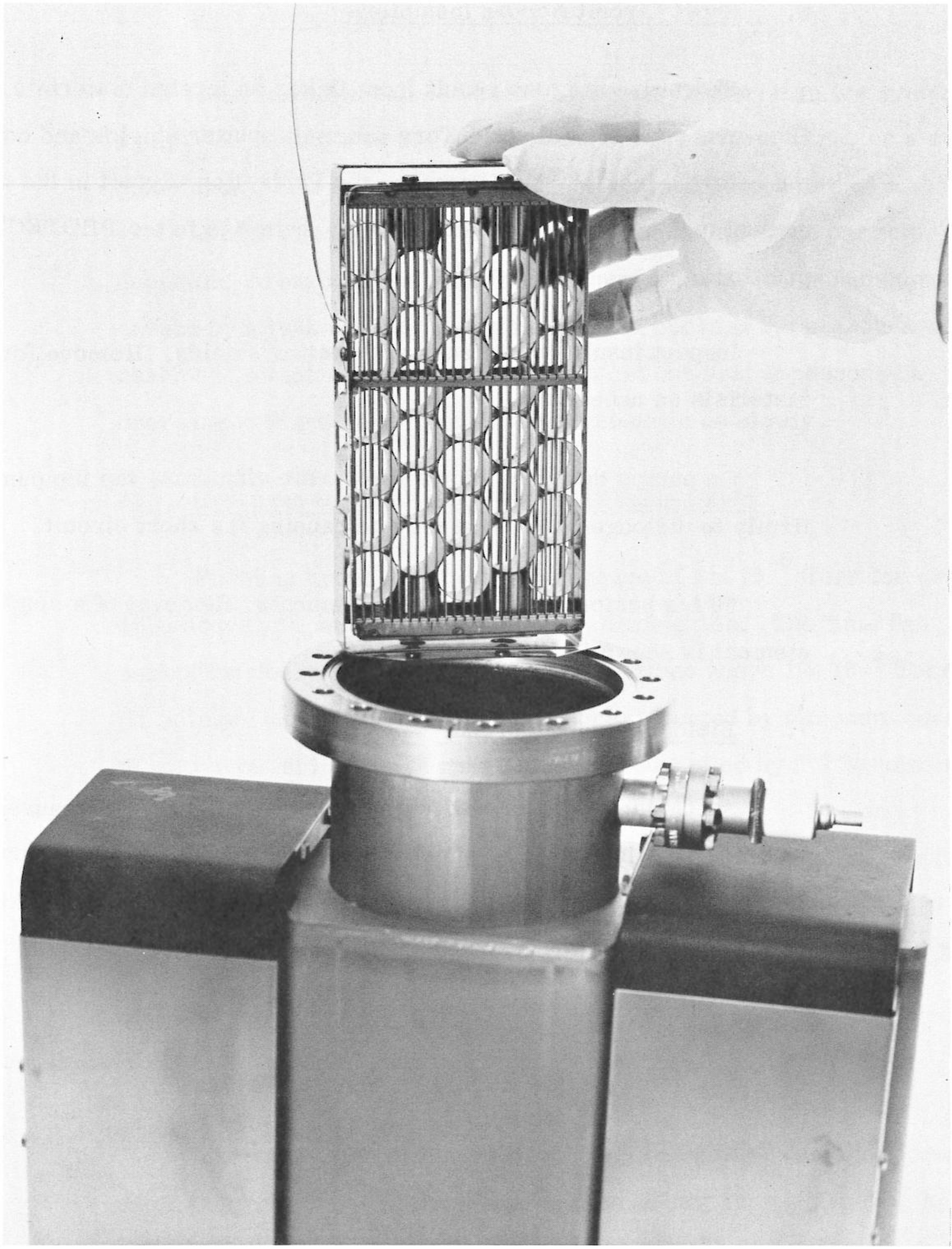


Figure 18. 60 ℓ/s Pump, Single Element Removed

CONDITIONS REQUIRING MAINTENANCE - CONTROL UNIT

Refer to Figure 19, Schematic No. 627117

SYMPTOM	POSSIBLE CAUSE	REMEDY
1. Indicator Lamp DS1 will not light when Power Switch S1 is ON and is plugged into power source.	Fuse F1 is blown.	Replace.
	No Line Power.	Check power fuse or circuit breaker.
	Indicator Lamp DS1 defective.	Replace.
	Power Switch S1 defective.	Replace.
	Open in power cord.	Repair or replace.
2. Transformer T1 overheats on 120 or 240 Vac while furnishing short circuit current.	One primary winding open.	Confirm with ohmmeter and replace.
	Transformer T1 windings partially shorted.	Replace.
3. When high-voltage cable is connected to control unit but not to VacIon Pump, Indicator Lamp DS1 lights but Meter M1 indicates zero voltage and current.	Capacitor C1 open.	Replace.
	Transformer T1 primary or secondary windings open.	Confirm with ohmmeter and replace.
	Diodes CR1 or CR2 open.	Replace.
	Meter M1 open or shorted.	Repair or replace Refer to Meter Tests.
	Resistor R2 open.	Replace.
4. Indicator Lamp DS1 lights and indicates open circuit voltage but no current on any range.	VacIon Pump is at a very low pressure corresponding to less than 1μA. This is a satisfactory condition indicating high vacuum in pump.	None required.
	VacIon Pump at atmospheric pressure.	Check pump pressure and rough pump system to 10 microns or lower.

SYMPTOM	POSSIBLE CAUSE	REMEDY
	Resistor R4 open.	Replace.
	Open circuit in high voltage cable.	Repair or replace.
5. Meter M1 gives a voltage and current indication, but one or both are suspected of being wrong.	Confirm by comparing Meter M1 voltage and current readings to Voltage vs Current curve (Figure 15). The difference between two corresponding values of current or voltage should not exceed the average value of the two readings by more than 20 per cent.	Test M1 meter. Repair or replace.
	Excessive leakage current in high voltage circuit, connector, cable or VacIon Pump.	Test for electrical leakage. Clean or replace.
6. Meter M1 reads short circuit current but zero volts. (Meter should read several hundred volts during normal starting conditions)	Short in VacIon Pump.	Remove connector from pump. Meter should read open circuit voltage and zero current. Test pump with ohmmeter.
	Short in high voltage cable.	Remove cable assembly from control unit. M1 should read open circuit voltage and zero current. Test cable through to pump with ohmmeter.
7. Meter M1 indicates zero voltage but reads correctly on all current ranges.	Resistor R2 open.	Replace.
	Resistor R3 shorted.	Replace.

SYMPTOM	POSSIBLE CAUSE	REMEDY
8. Meter M1 indicates low voltage but reads correctly on all current ranges.	Resistor R2 increased in resistance.	Replace as required.
	Resistor R3 decreased in resistance.	Replace.
	Line voltage low.	Check. (Not likely if short circuit current is correct.)
	Transformer taps not correctly connected for the line voltage.	Check line voltage. Compare transformer to schematic diagram.
9. Meter M1 indicates off-scale, or higher than rated voltage, but reads correctly on all current ranges.	Resistor R2 decreased in resistance.	Replace as required.
	Resistor R3 increased in resistance.	Replace.
	Line voltage high, Transformer incorrectly connected.	Check. (Not likely if short circuit current is correct.)
10. Meter M1 indicates voltage correctly but all current ranges (except 20 μA range) are incorrect.	R22-25 incorrect resistance.	Replace as required.
11. Meter M1 indicates incorrectly on all current and voltage ranges.	Meter defective. Accumulative problems.	Repair or replace.

PUMP PARTS LIST		
Description	Part or Model No.	Shipping Weight (Pounds)
8 ℓ/s Pump		
Pump Only	911-5005	6
Magnet Assembly	911-0030	8.9
Grounding Spring	A601410	1/4
20 ℓ/s Pump		
Pump Only	911-5031	27
Magnet Assembly	915-0114	19
Grounding Spring	A601410	1/4
30 ℓ/s Pump		
Pump Only	911-5033	34
Magnet Assembly	915-0114	19
High Voltage Feedthrough Assy. on Mini ConFlat Flange	954-5143	1-3/4
Grounding Spring	A601410	1/4
60 ℓ/s Pump		
Pump Only	D619735	45
Magnet Assembly	915-0114	19
H.V. Feedthrough Assy on Mini ConFlat Flange	954-5143	1-3/4
Pump Element Complete	915-0116	4
Grounding Spring	A601410	1/4

BAKEOUT UNIT PARTS LIST*		
Disc Heater (For all heaters; heater for 60 ℓ/s pump uses two discs.)	73-290 931	1/2

*Bakeout units are available for the 20, 30 and 60 ℓ/s pumps only.

CONTROL UNIT PARTS LIST (Ref MS 627116, W)

Reference Designation	Description	Manufacturer Reference	Varian Part/ Dwg. No.
C1	Capacitor-fixed 2 x 0.3 μf 5 kVdc	Chicago Cond.	C617654-07
C2	Capacitor-fixed 100 μf 50 V N.P.	Sprague TVAN 1310-1	41-506 798
C3,4,5	Capacitor-fixed 50 μf 15 V N.P.	Sprague 30D728	41-506 080
CR1	Diode-Silicon		66-244 650
CR5,7	Diode-Meter		B617642-01
CR6,8	Diode-Meter		B617642-02
DS1	Indicator Light-Red	Sloan 858-R-AIC-68K	55-219 906
DS2	Indicator Light-Amber	Sloan 858-A-AIC-68K	55-219 905
DS3	Indicator Light-Clear	Sloan 858-C-AIC-68K	55-219 902
F1	Fuse 10 A 250 V	Littelfuse Type 3AB	67-131 510
XF1	Fuseholder Indicating	Bussmann Mfg HKL	55-197 998
J1	Connector Box MTG		53-211 819
J2	Connector Box MTG	Amphenol MS3102A-18 19S	52-999 950
J3,4	Connector Jack YEL	E F Johnson 108-907	51-451 987
K1	Relay-Latching	Potter Brumfield KB 1537	72-919 603
M1	Meter Spec. 20 μA 6 kΩ	Weston Special	C627125

CONTROL UNIT PARTS LIST (Cont.)

Reference Designation	Description	Manufacturer Reference	Varian Part/ Dwg. No.
	Bezel-Meter	Weston 1909 1984870	76-999 950
R1	Resistor-Fixed 100 ± 5% 50 W	Ohmite 0400F	35-588 310
R2	Resistor-Fixed 100 MΩ ± 1% 4 W		34-491 931
R3	Resistor-Fixed 3010 Ω ± 1% 1 W		31-464 301
R4	Resistor-Fixed 200 Ω ± 5% 50 W	Ohmite 0400H	35-588 320
R7	Resistor-Fixed 15 kΩ ± 5% 1/2 W		32-201 515
R9	Resistor-Fixed 21 kΩ ± 1% 1/4 W		31-225 210
R10, 18	Resistor-Fixed 27 kΩ ± 5% 1/2 W		32-201 527
R11	Resistor-Fixed 4990 Ω ± 1% 1/2 W	Dale Type MFF-1/4 TI	31-224 499
R12, 8	Resistor-Fixed 18 kΩ ± 1% 1/2 W		32-201 518
R13, 17	Resistor-Fixed 12 kΩ ± 5% 1/2 W		32-201 512
R14	Resistor-Fixed 8.2 kΩ ± 5% 1/2 W		32-201 482
R15	Resistor-Fixed 10 MΩ ± 5% 5 W	Dale F54D	32-298 901

CONTROL UNIT PARTS LIST (Cont.)

Reference Designation	Description	Manufacturer Reference	Varian Part/ Dwg. No.
R19	Resistor-Fixed 100 kΩ ± 5% 1/2 W	Allen-Bradley Type EB	32-201 610
R20	Resistor-Fixed 6040 Ω ± 1% 1.25 W		31-464 604
R21	Resistor-Variable 5 kΩ 2 W		36-896 450
R22	Resistor-Fixed .665 Ω ± 1% 1.25 W	Dale Type RS-2C-23	31-459 809
R23	Resistor-Fixed 6.04 Ω ± 1% 1.25 W	Dale Type RS-2C-23	31-459 810
R24	Resistor-Fixed 60.4 Ω ± 1% 1.25 W	Dale Type MFF-1/8 TI	31-462 604
R25	Resistor-Fixed 604 Ω ± 1% 1.25 W	Dale Type MFF-1/8 TI	31-463 604
S1, 3	Switch-Toggle DPDT	Arrow-Hart 81027-CE	71-149 970
S2	Switch-Rotary Polarity	CTS 500690	C627120
S4	Switch-Rotary		D658868
S5	Switch-Rotary		D658868
S6	Switch-Pushbutton	GRN	71-219 852
T1	Transformer 120/240 V 1850/1180		D627126
W1	Cord, Assy No. 16-3 9 ft long	Belden 17419	81-821 488
R26	Resistor 2.74 Ω ± 1% 3 W		31-599 754
W2	Ground Braid		A607238
W3	Cable, HV 924-0750		C626724-02
R26	Resistor-Fixed 2.74 Ω ± 1% 3W	Dale RS-2B	31-599 754
R27	Resistor-Variable 2.5K 2W		36-896 425
	Pump Selector Sw (S4) Assy		658865
	Meter Range Sw (S5) Assy		658863

WARRANTY

Products manufactured by Seller are warranted against defects in materials and workmanship for twelve (12) months from date of shipment thereof to Customer, and Seller's liability under valid warranty claims is limited, at the option of Seller, to repair, replacement, or refund of an equitable portion of the purchase price of the Product. Items expendable in normal use are not covered by this warranty. All warranty replacement or repair of parts shall be limited to equipment malfunctions which, in the sole opinion of Seller, are due or traceable to defects in original materials or workmanship. All obligations of Seller under this warranty shall cease in the event of abuse, accident, alteration, misuse or neglect of the equipment. In-warranty repaired or replacement parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts. After expiration of the applicable warranty period, Customer shall be charged at the then current prices for parts, labor, and transportation.

Reasonable care must be used to avoid hazards. Seller expressly disclaims responsibility for loss or damage caused by use of its Products other than in accordance with proper operating procedures.

Where Seller specifically agrees in writing to provide installation and on-site acceptance testing of its Product, the warranty period may be extended, if agreed to in writing by Seller, to twelve (12) months from date of acceptance but in no event more than fifteen (15) months from date of shipment of the Product. Warranties given by suppliers of equipment or proprietary components not manufactured by Seller but incorporated by Seller into its Products shall be passed on to Customer; provided that in no event shall Seller have any liability for failure of any such supplier to perform on its warranty.

Except as stated herein, Seller makes no warranty, express or implied (either in fact or by operation of law), statutory or otherwise; and, except as stated herein, Seller shall have no liability under any warranty, express or implied (either in fact or by operation of law), statutory or otherwise. Statements made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty shall not be binding upon Seller unless reduced to writing and approved by an officer of Seller.

WARRANTY REPLACEMENT AND ADJUSTMENT

All claims under warranty must be made promptly after occurrence of circumstances giving rise thereto. and must be received within the applicable warranty period by Seller or its authorized representative. Such claims should include the Product serial number, the date of shipment, and a full description of the circumstances giving rise to the claim. Before any Products are returned for repair and/or adjustment, written authorization from Seller or its authorized representative for the return and instructions as to how and where these Products should be returned must be obtained. Any Product returned to Seller for examination shall be sent prepaid via the means of transportation indicated as acceptable by Seller. Seller reserves the right to reject any warranty claim not promptly reported and any warranty claim on any item that has been altered or has been returned by nonacceptable means of transportation. When any Product is returned for examination and inspection, or for any other reason, Customer shall be responsible for all damage resulting from improper packing or handling, and for loss in transit, notwithstanding any defect or nonconformity in the Product. In all cases Seller has sole responsibility for determining the cause and nature of failure, and Seller's determination with regard thereto shall be final.

If it is found that Seller's Product has been returned without cause and is still serviceable, Customer will be notified and the Product returned at its expense; in addition, a charge for testing and examination may be made on Products so returned.

varian
vacuum division

SERVICE ENGINEERING
RETURNED MATERIAL REPORT No.

THIS REPORT MUST ACCOMPANY all products returned for repair, replacement, or warranty evaluation. Full information regarding reasons for return of the product will expedite repair or adjustment. Please fill in all blanks below and furnish any other information which will help identify the nature and cause of failure.

REASON FOR RETURN (check appropriate box)

- ☐ Warranty Evaluation
- ☐ Corrective Shipment
- ☐ Paid Repair
- ☐ Advance Exchange
- ☐ Overshipment

PRODUCT INFORMATION (use separate forms if more than one model no.)

Varian Model No.__________ Serial No..__________ Quantity__________

PURCHASE INFORMATION (if product is being returned for warranty evaluation, show your original purchase order number and date purchased)

Varian Sales Order No. (if available)__________

Original Purchase Order No.__________ Purchase Order Date __________

COMPANY NAME & ADDRESS __________

CITY/STATE/ZIP __________

FAILURE REPORT (describe in detail suspected cause or nature of failure or malfunction)

____

____

____

____

____

____

RETURNED PRODUCTS

All products returned to Varian Vacuum Division for Warranty Evaluation must be sent PREPAID and Customer must comply with the WARRANTY REPLACEMENT AND ADJUSTMENT provision set forth on the reverse side.

Ship directly to:

VARIAN VACUUM DIVISION
SERVICE ENGINEERING
BUILDING 6, RECEIVING
611 HANSEN WAY
PALO ALTO, CA 94303

ALL PRODUCTS SOLD BY VARIAN AND RETURNED BY CUSTOMER ARE SUBJECT TO VARIAN VACUUM DIVISION STANDARD TERMS AND CONDITIONS OF SALE, INCLUDING, BUT NOT LIMITED TO, THE WARRANTY AND DAMAGES AND LIABILITY PROVISIONS SET FORTH ON THE REVERSE SIDE.

WARRANTY

Products manufactured by Seller are warranted against defects in materials and workmanship for twelve (12) months from date of shipment thereof to Customer, and Seller's liability under valid warranty claims is limited, at the option of Seller, to repair, replacement, or refund of an equitable portion of the purchase price of the Product. Items expendable in normal use are not covered by this warranty. All warranty replacement or repair of parts shall be limited to equipment malfunctions which, in the sole opinion of Seller, are due or traceable to defects in original materials or workmanship. All obligations of Seller under this warranty shall cease in the event of abuse, accident, alteration, misuse or neglect of the equipment. In-warranty repaired or replacement parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts. After expiration of the applicable warranty period, Customer shall be charged at the then current prices for parts, labor, and transportation.

Reasonable care must be used to avoid hazards. Seller expressly disclaims responsibility for loss or damage caused by use of its Products other than in accordance with proper operating procedures.

Where Seller specifically agrees in writing to provide installation and on-site acceptance testing of its Product, the warranty period may be extended, if agreed to in writing by Seller, to twelve (12) months from date of acceptance but in no event more than fifteen (15) months from date of shipment of the Product. Warranties given by suppliers of equipment or proprietary components not manufactured by Seller but incorporated by Seller into its Products shall be passed on to Customer; provided that in no event shall Seller have any liability for failure of any such supplier to perform on its warranty.

EXCEPT AS STATED HEREIN, SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED (EITHER IN FACT OR BY OPERATION OF LAW), STATUTORY OR OTHERWISE; AND, EXCEPT AS STATED HEREIN, SELLER SHALL HAVE NO LIABILITY UNDER ANY WARRANTY, EXPRESS OR IMPLIED (EITHER IN FACT OR BY OPERATION OF LAW), STATUTORY OR OTHERWISE. STATEMENTS MADE BY ANY PERSON, INCLUDING REPRESENTATIVES OF SELLER, WHICH ARE INCONSISTENT OR IN CONFLICT WITH THE TERMS OF THIS WARRANTY SHALL NOT BE BINDING UPON SELLER UNLESS REDUCED TO WRITING AND APPROVED BY AN OFFICER OF SELLER.

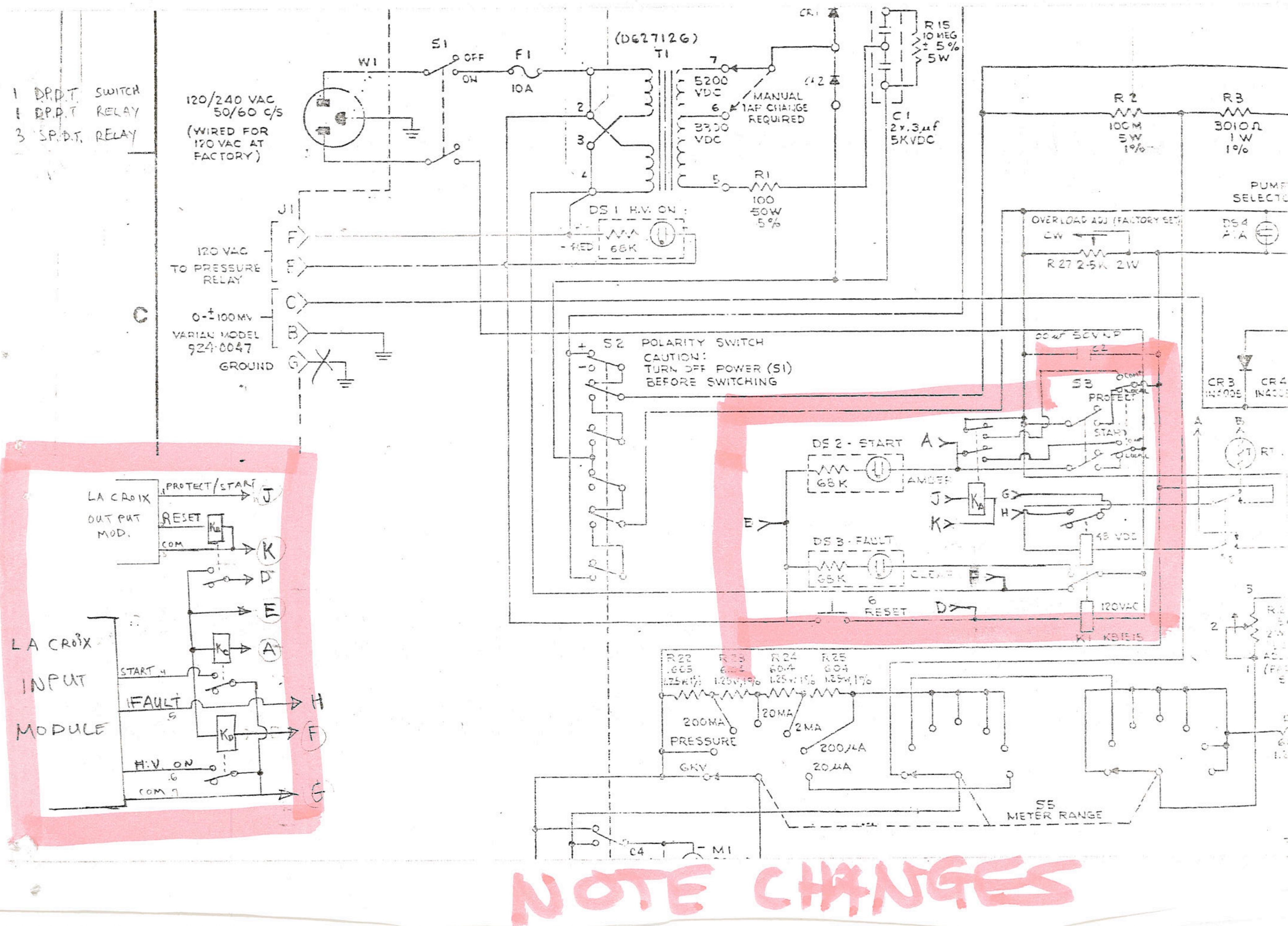
WARRANTY REPLACEMENT AND ADJUSTMENT

All claims under warranty must be made promptly after occurrence of circumstances giving rise thereto, and must be received within the applicable warranty period by Seller or its authorized representative. Such claims should include the Product serial number, the date of shipment, and a full description of the circumstances giving rise to the claim. Before any Products are returned for repair and/or adjustment, written authorization from Seller or its authorized representative for the return and instructions as to how and where these Products should be returned must be obtained. Any Product returned to Seller for examination shall be sent prepaid via the means of transportation indicated as acceptable by Seller. Seller reserves the right to reject any warranty claim not promptly reported and any warranty claim on any item that has been altered or has been returned by non-acceptable means of transportation. When any Product is returned for examination and inspection, or for any other reason, Customer shall be responsible for all damage resulting from improper packing or handling, and for loss in transit, notwithstanding any defect or non-conformity in the Product. In all cases Seller has sole responsibility for determining the cause and nature of failure, and Seller's determination with regard thereto shall be final.

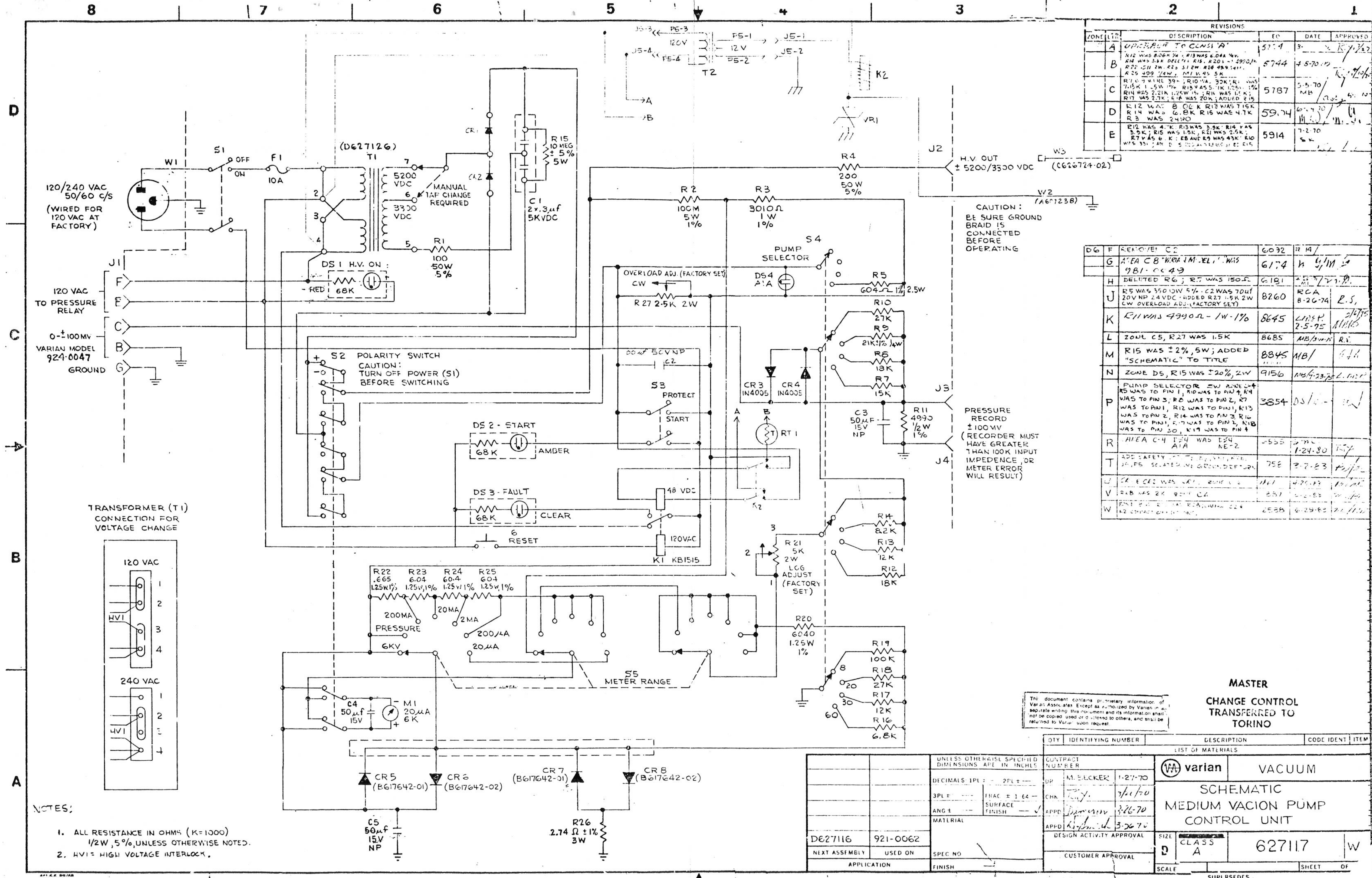
If it is found that Seller's Product has been returned without cause and is still serviceable, Customer will be notified and the Product returned at its expense; in addition, a charge for testing and examination may be made on Products so returned.

DAMAGES AND LIABILITY

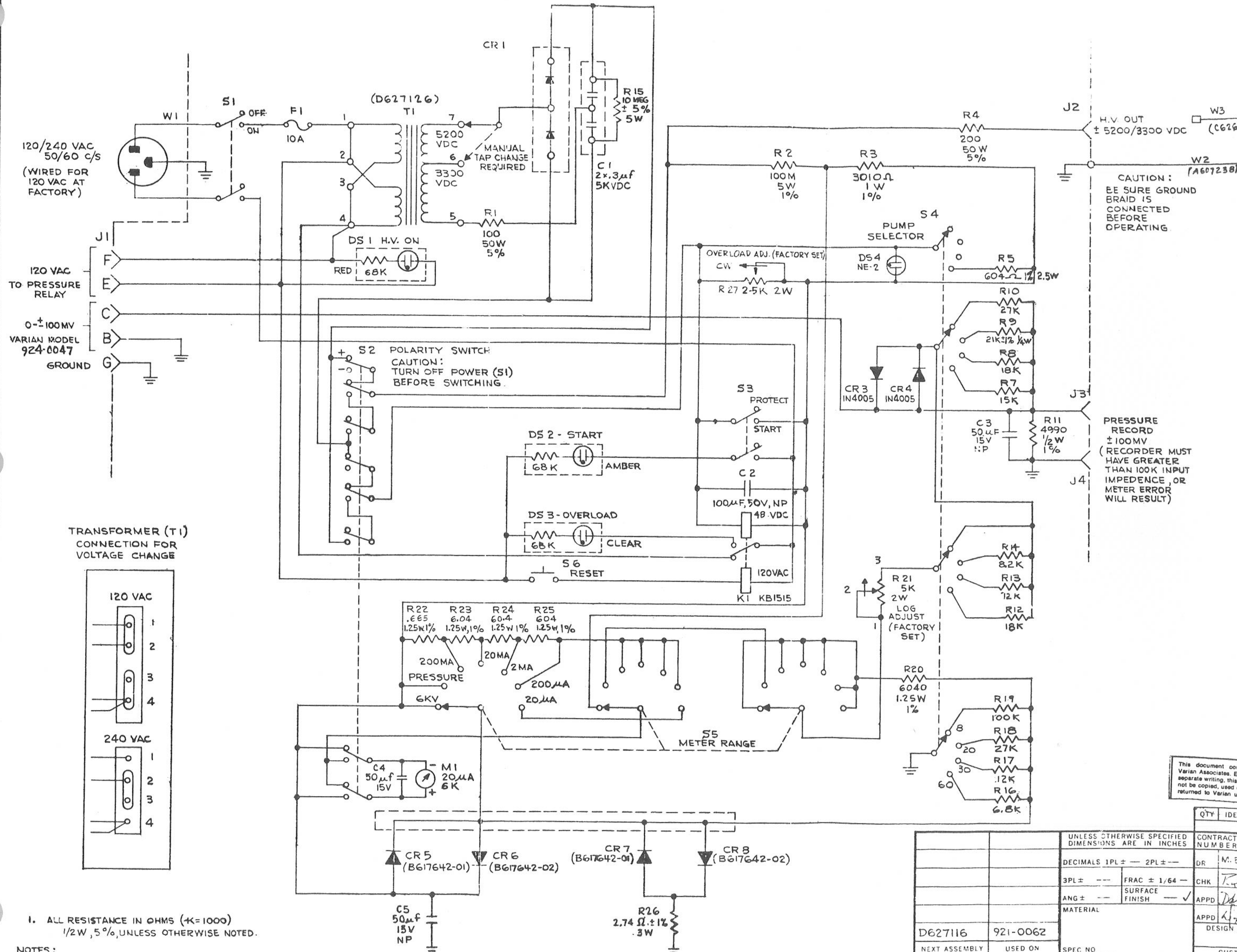
Seller's liability for damages shall not exceed the amount Seller actually receives for the Product furnished, or to be furnished, or service rendered, or to be rendered, as the case may be, which is the subject of claim or dispute, and in no event shall Seller be liable for incidental, consequential or special damages. Liability to third parties for bodily injury, including death, resulting from Seller's performance shall be determined accordance with applicable law and the total liability limitation stated above shall not be construed a a limitation on Seller for damages for any such bodily injury, including death.



1 D.P.D.T. SWITCH
1 D.P.D.T. RELAY
3 S.P.D.T. RELAY
120/240 VAC 50/60 c/s (WIRED FOR 120 VAC AT FACTORY)
W1
S1
OFF
ON
F1
10A
(D627126)
T1
5200 VDC
3300 VDC
MANUAL TAP CHANGE REQUIRED
R1
100
50W
5%
R15
10 MEG
± 5%
5W
C1
2 x .3 µf
5KVDC
R2
100M
5W
1%
R3
3010 Ω
1W
1%
J1
120 VAC TO PRESSURE RELAY
0-± 100 MV VARIAN MODEL 924-0047
GROUND
DS 1 H.V. ON
RED
68K
OVERLOAD ADJ (FACTORY SET)
CW
R27 2.5K 2W
S2 POLARITY SWITCH
CAUTION: TURN OFF POWER (S1) BEFORE SWITCHING
S3
PROTECT
START
CR3
CR4
LA CROIX OUT PUT MOD.
PROTECT/START
RESET
COM
LA CROIX INPUT MODULE
START
FAULT
H.V. ON
COM
DS 2 - START
AMBER
DS 3 - FAULT
CLEAR
RESET
48 VDC
120VAC
K1 KB1615
R22
R23
R24
R25
200MA
PRESSURE
20MA
2MA
200µA
20µA
S5 METER RANGE
C4
M1
NOTE CHANGES



REVISIONS
120/240 VAC 50/60 c/s (WIRED FOR 120 VAC AT FACTORY)
W1
S1
OFF
ON
F1
10A
(D627126) T1
5200 VDC
3300 VDC
MANUAL TAP CHANGE REQUIRED
R15 10 MEG ± 5% 5W
C1 2 x .3 µf 5KVDC
R1 100 50W 5%
DS1 H.V. ON
RED
68K
J1
120 VAC TO PRESSURE RELAY
0-±100MV VARIAN MODEL 924-0047
GROUND
S2 POLARITY SWITCH
CAUTION: TURN OFF POWER (S1) BEFORE SWITCHING
T2
K2
VR1
R2 100M 5W 1%
R3 3010Ω 1W 1%
R4 200 50W 5%
J2
H.V. OUT ± 5200/3300 VDC
W3 (C626724-02)
W2 (A601238)
CAUTION: BE SURE GROUND BRAID IS CONNECTED BEFORE OPERATING
S4 PUMP SELECTOR
OVERLOAD ADJ (FACTORY SET)
CW
R27 2.5K 2W
DS4 A1A
R5 604Ω 1% 2.5W
R10 27K
R9 21K 1% 1/4W
R8 18K
R7 15K
C2
S3 PROTECT START
CR3 IN4005
CR4 IN4005
RT1
C3 50 µF 15V NP
R11 4990 1/2W 1%
J3
J4
PRESSURE RECORD ±100MV (RECORDER MUST HAVE GREATER THAN 100K INPUT IMPEDENCE, OR METER ERROR WILL RESULT)
DS2 - START
68K
AMBER
DS3 - FAULT
68K
CLEAR
48 VDC
120VAC
K1 KB1515
6 RESET
R21 5K 2W LOG ADJUST (FACTORY SET)
R14 8.2K
R13 12K
R12 18K
TRANSFORMER (T1) CONNECTION FOR VOLTAGE CHANGE
120 VAC
240 VAC
HV1
R22 .665 1.25W 1%
R23 6.04 1.25W 1%
R24 60.4 1.25W 1%
R25 604 1.25W 1%
200MA
20MA
2MA
200µA
20µA
PRESSURE
6KV
S5 METER RANGE
R20 6040 1.25W 1%
R19 100K
R18 27K
R17 12K
R16 6.8K
C4 50 µf 15V
M1 20µA 6K
CR5 (B617642-01)
CR6 (B617642-02)
CR7 (B617642-01)
CR8 (B617642-02)
C5 50µf 15V NP
R26 2.74 Ω ± 1% 3W
NOTES:
1. ALL RESISTANCE IN OHMS (K=1000) 1/2W, 5%, UNLESS OTHERWISE NOTED.
2. HV1 = HIGH VOLTAGE INTERLOCK.
MASTER
CHANGE CONTROL TRANSFERRED TO TORINO
LIST OF MATERIALS
varian VACUUM
SCHEMATIC MEDIUM VACION PUMP CONTROL UNIT
D627116
921-0062
NEXT ASSEMBLY
USED ON
APPLICATION
M. ELCKER 1-27-70
SIZE D
CLASS A
627117
W



NOTES:

1. ALL RESISTANCE IN OHMS (K=1000) 1/2W, 5%, UNLESS OTHERWISE NOTED.

REVISIONS

ZONE	LTR	DESCRIPTION	EO	DATE	APPROVED
	A	UPGRADE TO CLASS 'A'	57?4	3-	K.Y.
	B	R12 WAS 8.06K ¼W. R13 WAS 6.04K ¼W. R14 WAS 3.3K. DELETED R15. R20 WAS 4990, 1W. R22 .511 1W. R23 5.1 2W. R24 49.9 ¼W. R25 499 ¼W. M1 WAS 5K	5744	4-8-70	K.
	C	[illegible] R13 WAS 5.?K .25 1%. R14 WAS 2.21K .25W; R1? WAS 1.?K; R17 WAS 2.7K; R18 WAS 20K. ADDED R15	5787	5-5-70 MB	
	D	R12 WAS 8.?K R13 WAS 7.15K R14 WAS 6.8K R15 WAS 4.7K R3 WAS 2490	59?4	6-?-70	
	E	R12 WAS 4.?K; R13 WAS 3.9K; R14 WAS 3.9K; R15 WAS 1.5K; R21 WAS 2.5K; R7 WAS 6.?K; R8 AND R9 WAS 43K; R10 WAS 33.?; ADDED CR5, R26, AND REASSIGNED R15	5914	7-2-70 SK	
D6	F	REMOVED C2	6092	12/14	
	G	AREA C8 "VARIAN MODEL ..." WAS 981-0049	6174		
	H	DELETED R6; R7 WAS 150Ω	6181	4-26-71	
	J	R5 WAS 350 10W 5%. C2 WAS 70uf 20V NP 24VDC. ADDED R27 1.5K 2W CW OVERLOAD ADJ. (FACTORY SET)	8260	RCA 8-26-74	R.S.
	K	R11 WAS 4990Ω - 1W - 1%	8645	LMcP. 2-5-75	2/6/75
	L	ZONE C5, R27 WAS 1.5K	8685	MB/3-10-75	R.S.
	M	R15 WAS ±2%, 5W; ADDED "SCHEMATIC" TO TITLE	8845	MB/	
	N	ZONE D5, R15 WAS ±20%, 2W	9156	MB/9-23-75	L. McP.
	P	PUMP SELECTOR SW. ZONE C4 R5 WAS TO PIN 1, R10 WAS TO PIN 4, R9 WAS TO PIN 3, R8 WAS TO PIN 2, R7 WAS TO PIN 1, R12 WAS TO PIN 1, R13 WAS TO PIN 2, R14 WAS TO PIN 3, R16 WAS TO PIN 1, R17 WAS TO PIN 2, R18 WAS TO PIN 30, R19 WAS TO PIN 4	3854	DS/9/1/78	

QTY	IDENTIFYING NUMBER	DESCRIPTION	CODE IDENT	ITEM

LIST OF MATERIALS

NEXT ASSEMBLY	USED ON
D627116	921-0062

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMALS 1PL ± — 2PL ± —
3PL ± — FRAC ± 1/64 —
ANG ± — SURFACE FINISH — √
MATERIAL
SPEC NO
FINISH —

CONTRACT NUMBER
DR M. BECKER 1-27-70
CHK 7/20/70
APPD 7-26-70
APPD 3-30-76
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

varian — VACUUM

SCHEMATIC MEDIUM VACION PUMP CONTROL UNIT

SIZE D | CLASS A | 627117 | P
SCALE | SHEET OF

D 627117

8 ℓ/s VacIon® PUMP AND MAGNET PACKAGE

Magnetic field data for the new 8 ℓ/s VacIon pump and magnet package are provided in the plots below. The magnet assembly for the standard 8 ℓ/s VacIon pump has been redesigned to provide a pump and magnet package that has virtually no stray magnetic field.

The following data is presented:

1. Magnetic field in gap of horseshoe and confined field magnets.
2. 8 ℓ/s pump magnet field free region.
3. Magnetic field on pump flange axis.
4. Magnetic field off of flat of pump magnet package.

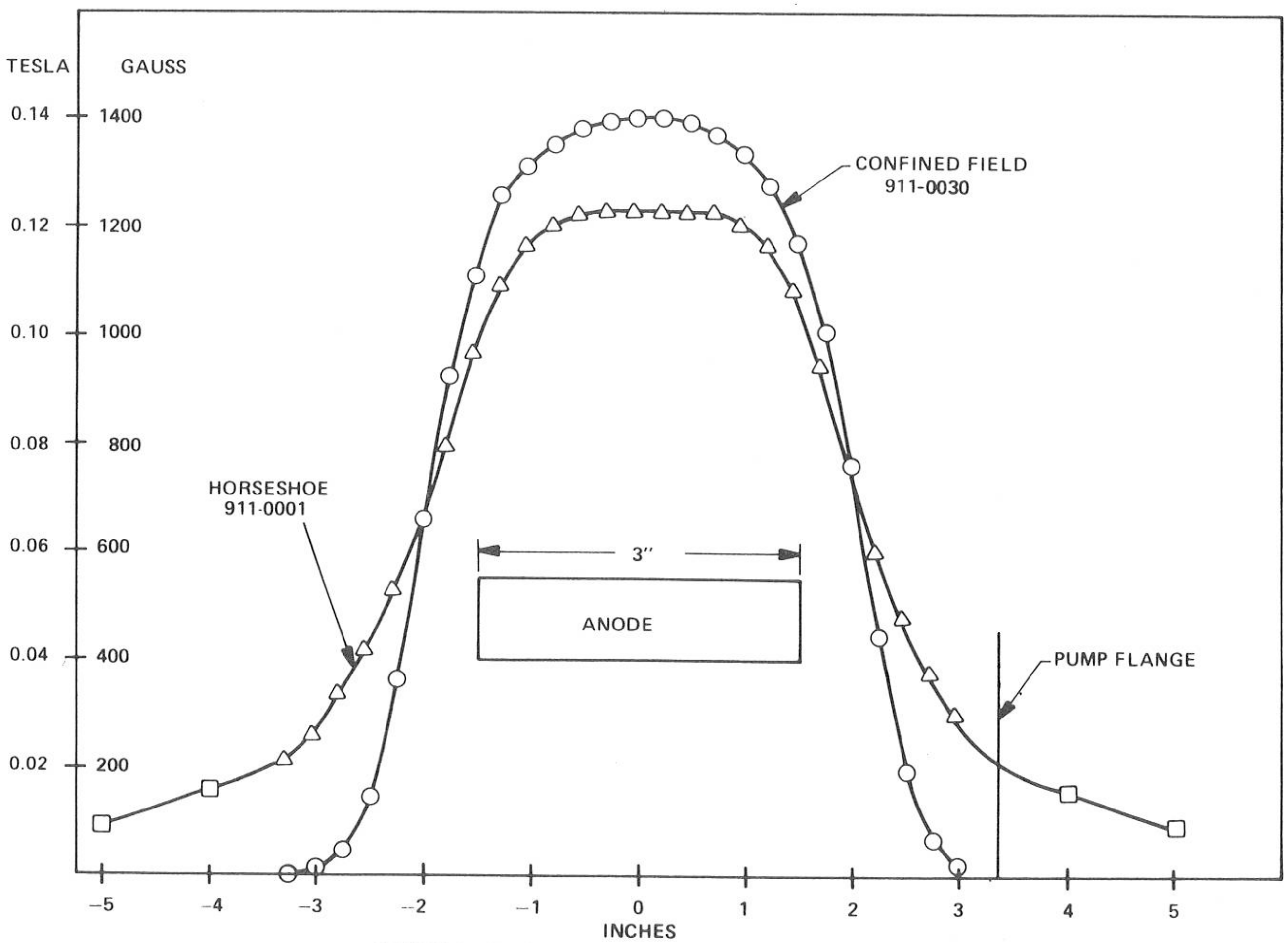


FIGURE 1. MAGNETIC FIELD IN GAP OF HORSESHOE AND CONFINED FIELD MAGNETS

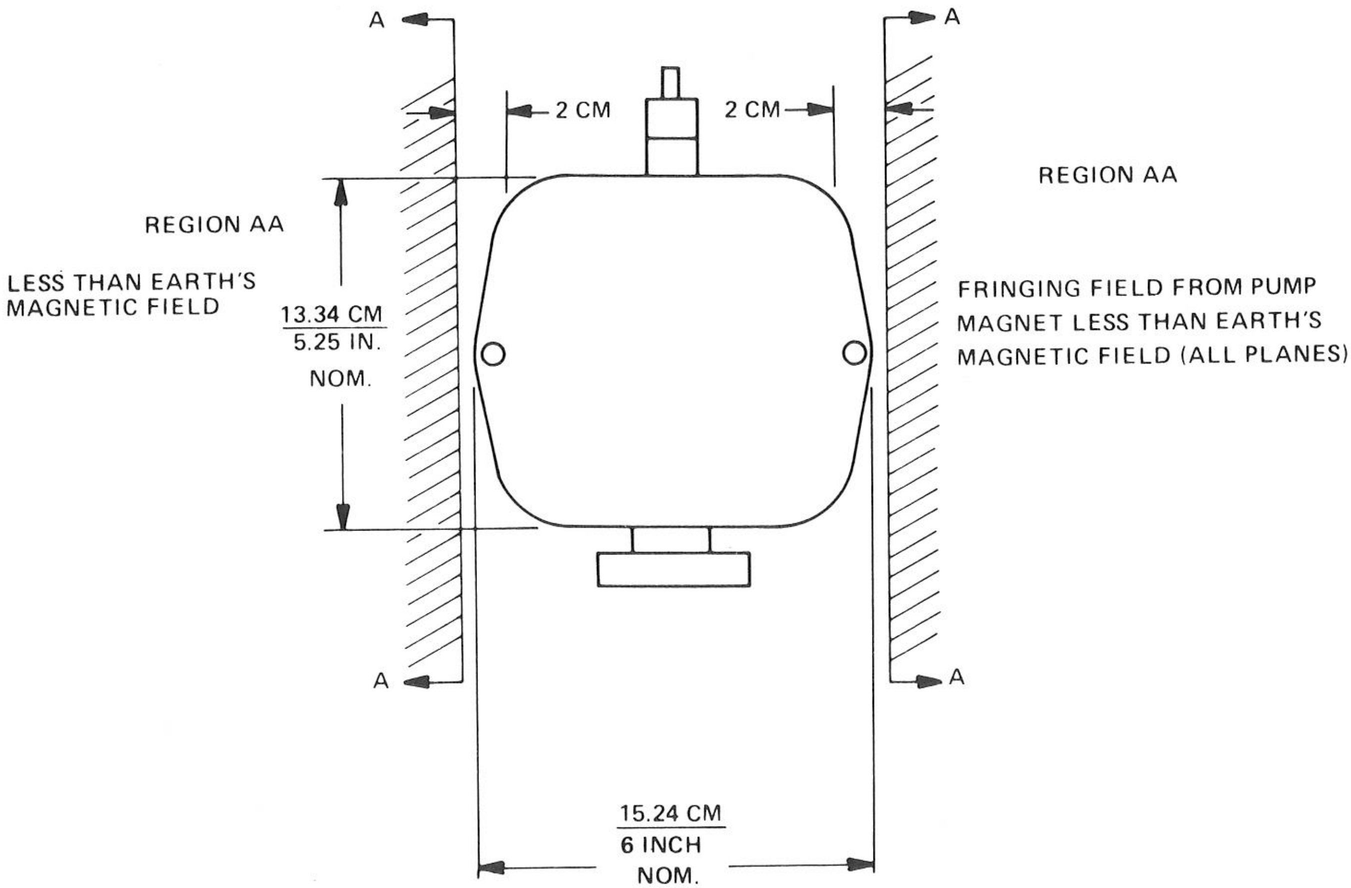


FIGURE 2. 8 L/SEC PUMP MAGNET FIELD FREE REGION

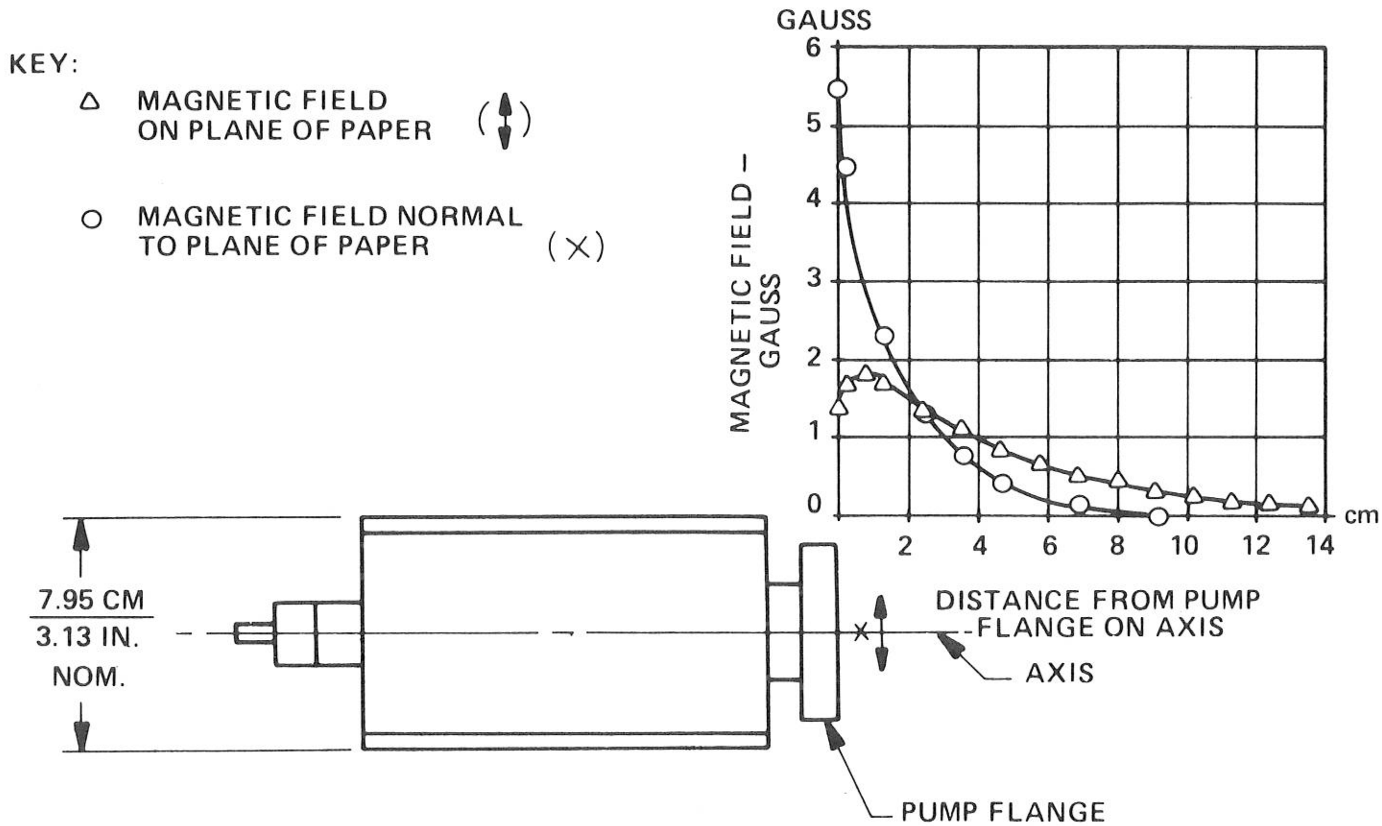


FIGURE 3. MAGNETIC FIELD ON PUMP FLANGE AXIS

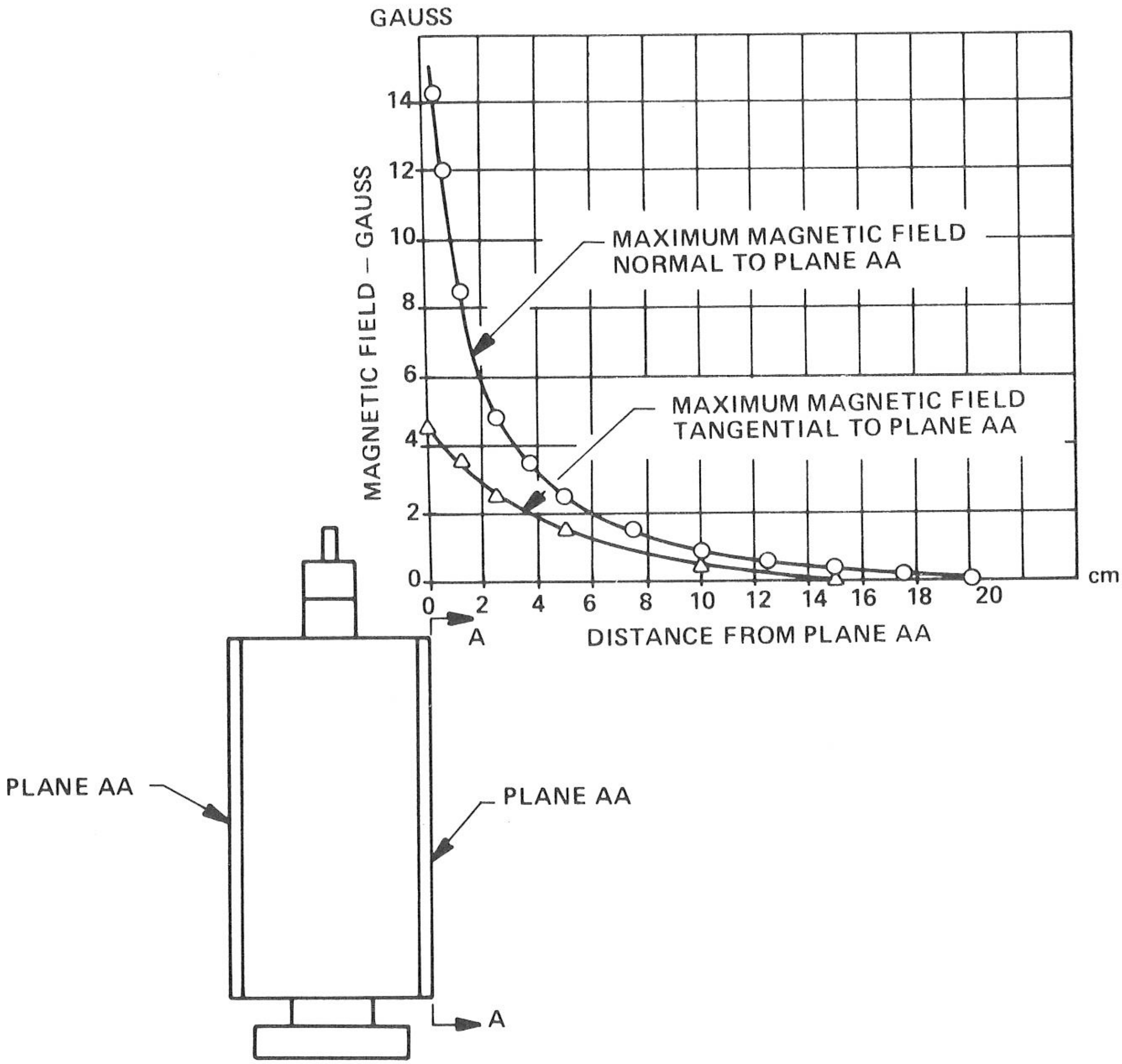


FIGURE 4. MAGNETIC FIELD OFF OF FLAT

20 ℓ/s VacIon® PUMP

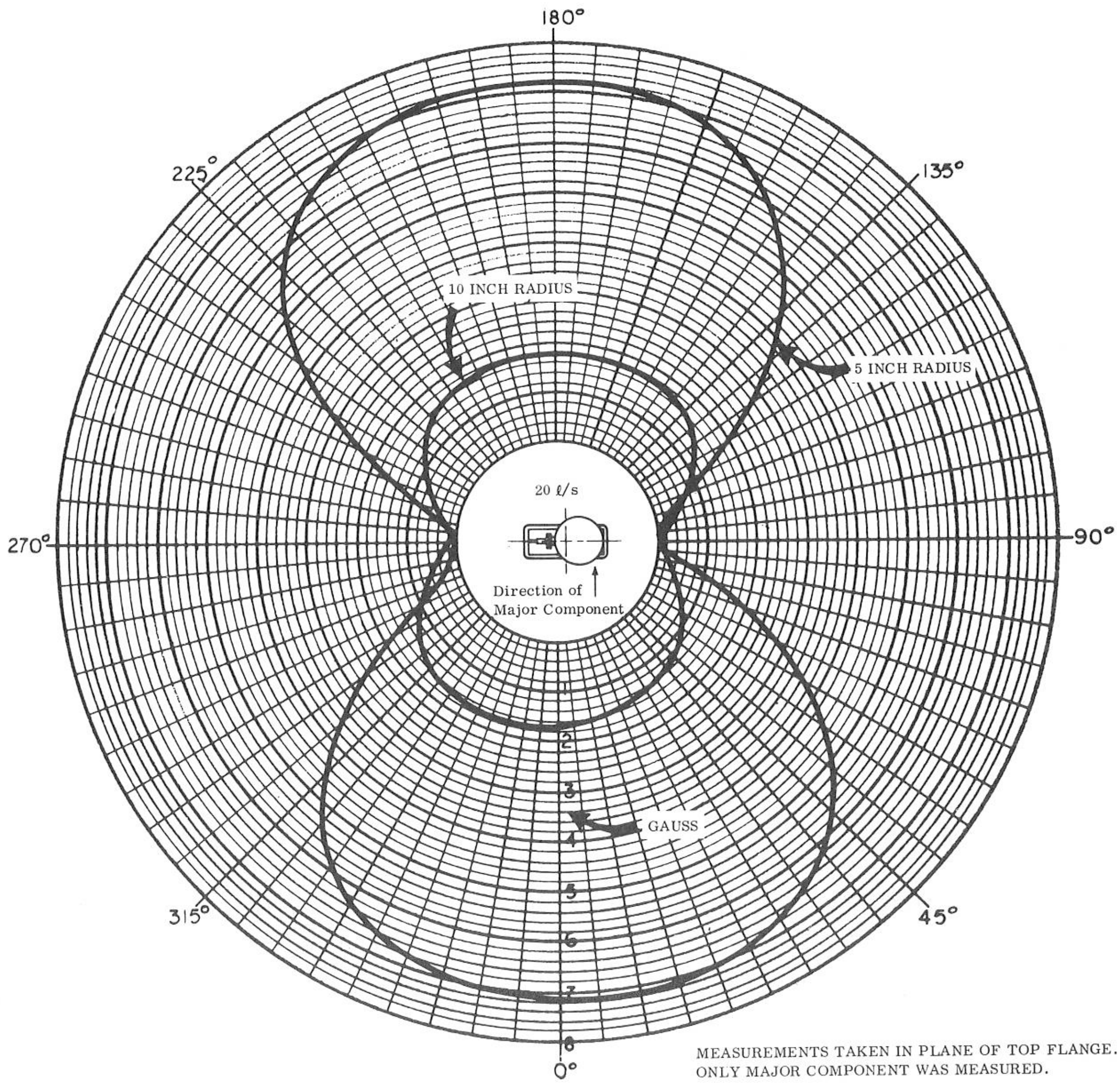
The following magnetic field data for the 20 ℓ/s Triode VacIon® Pump is presented:

1. Polar plots of field strengths in the plane of the top flange for radii of 5 and 10 inches from the center of the pump.
2. Curves of field strength along the centerline of the pump and in the plane of the flange as a function of distance from the pump, as shown on the individual plots.

Magnetic Shielding

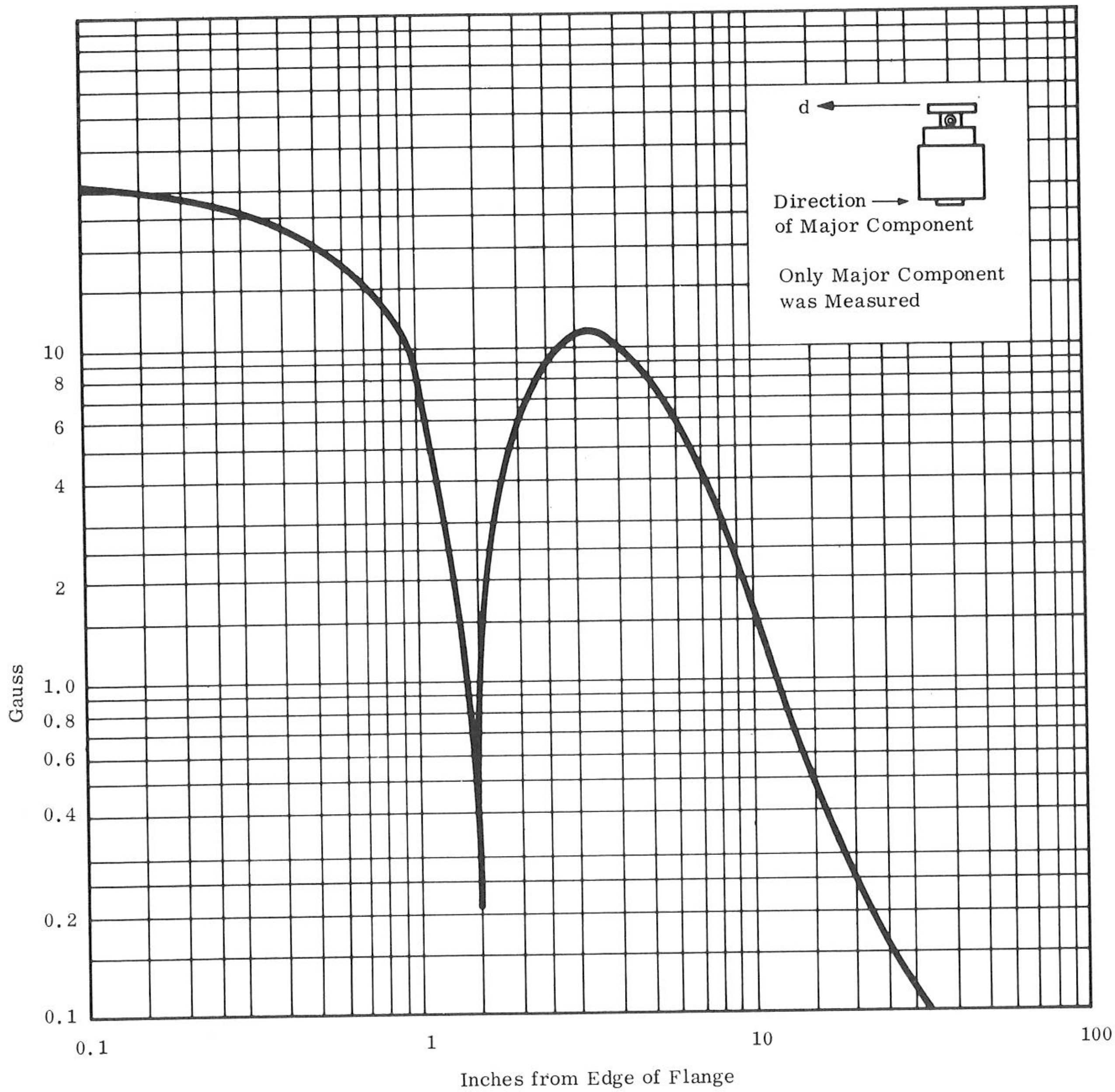
Pumping speed of the VacIon Pump is proportional to the strength of the magnetic field in the magnetic gaps. If magnetic shielding is necessary, place the shield around the experiment itself whenever possible. If the shield must be built around the pump, leave at least 2 inches between the shield and the magnet to minimize the loss of field strength and to minimize the thickness of shielding material required.

20 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS ANGLE POSITION ON
5 AND 10 INCH RADIUS CIRCLES

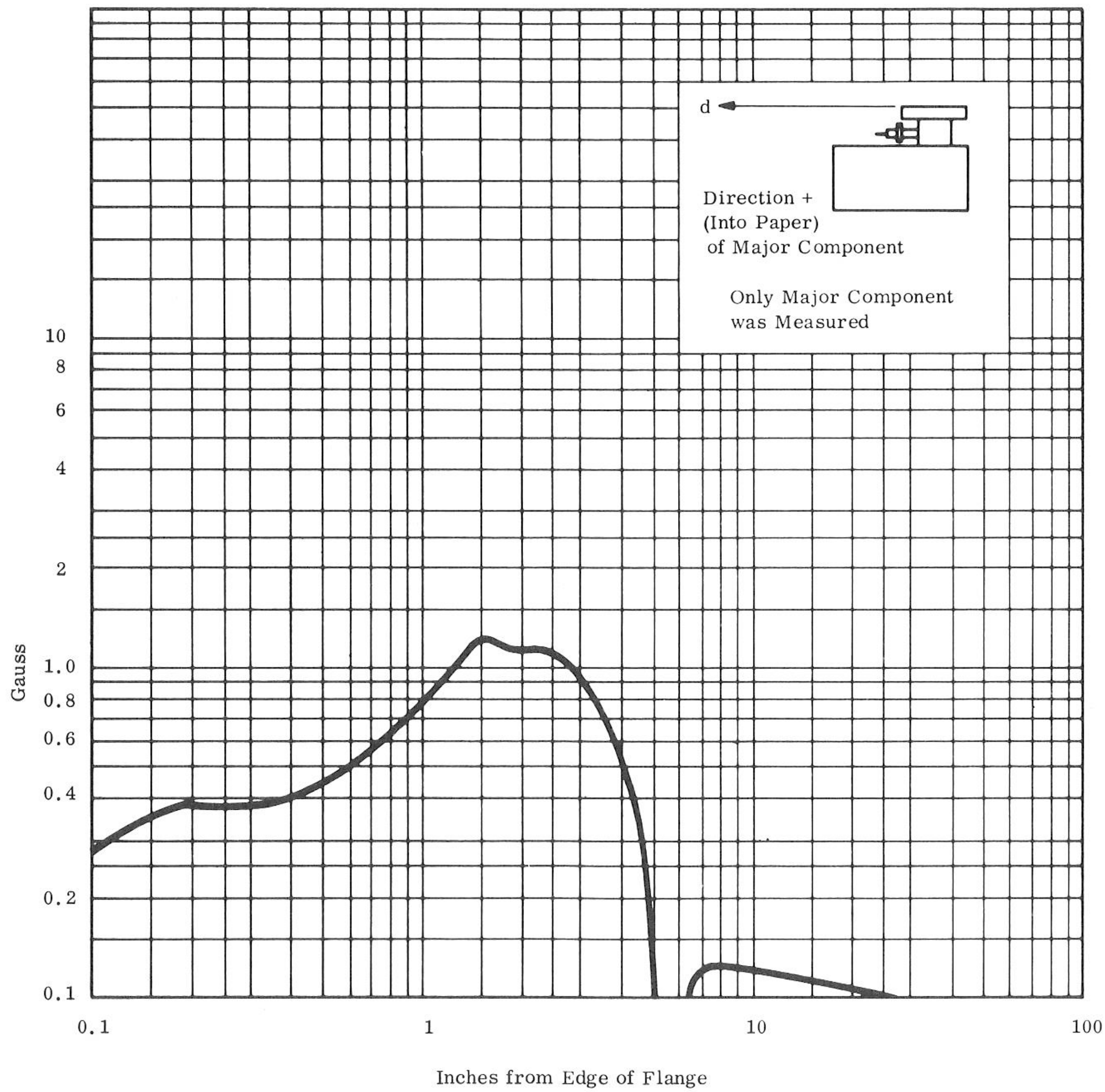


MEASUREMENTS TAKEN IN PLANE OF TOP FLANGE.
ONLY MAJOR COMPONENT WAS MEASURED.

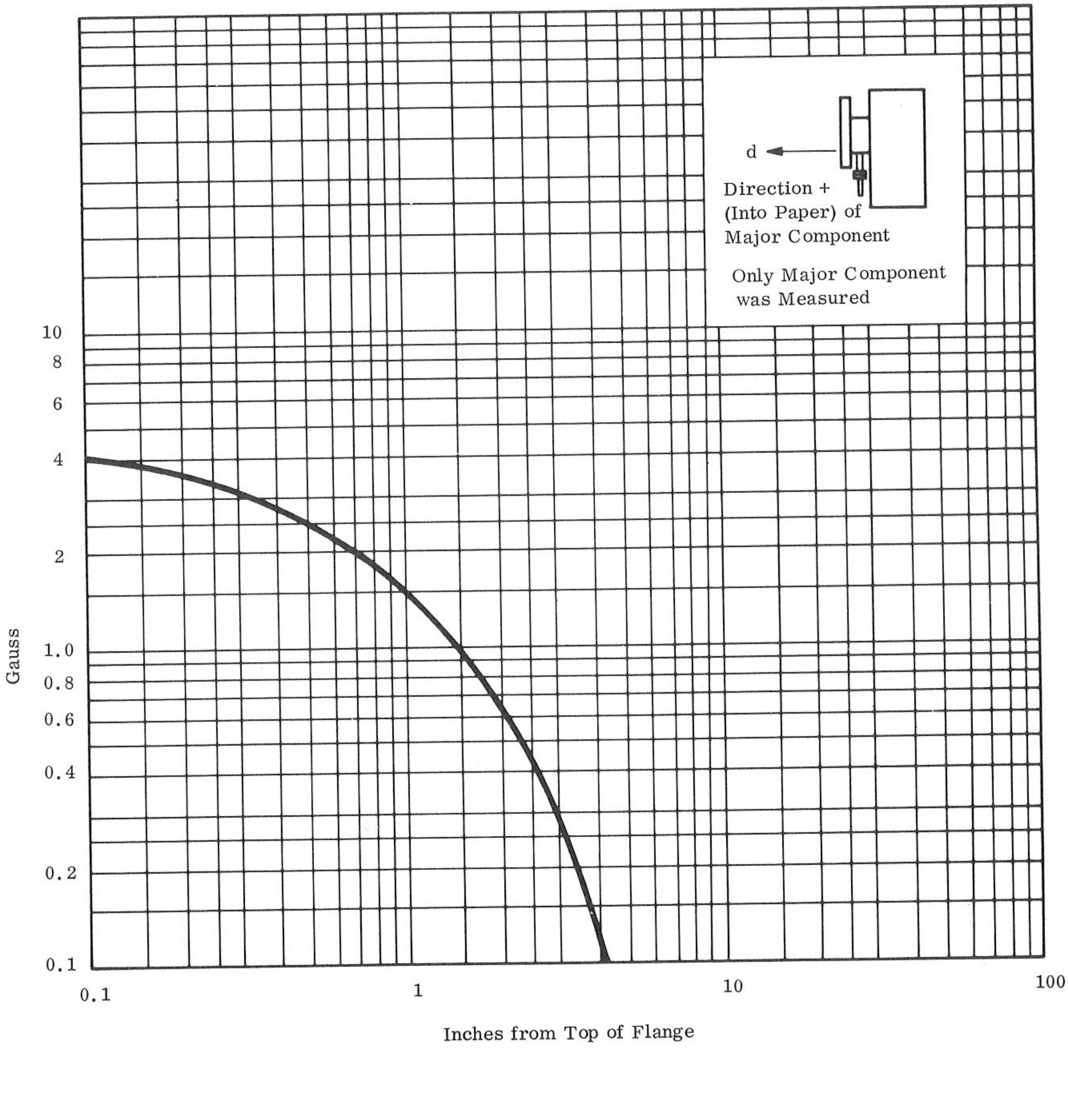
20 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



20 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



20 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



30 ℓ/s VacIon® PUMP

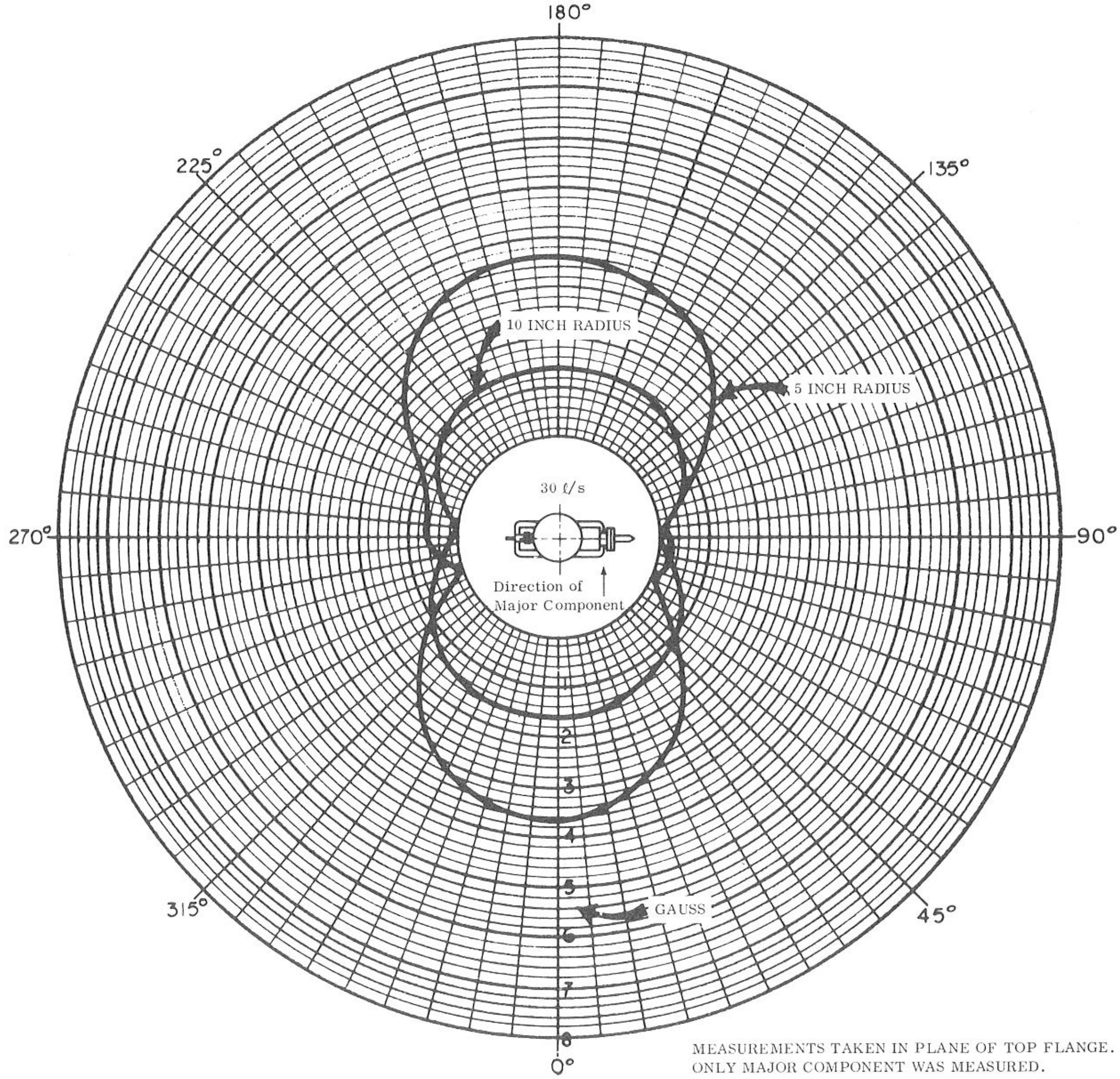
The following magnetic field data for the 30 ℓ/s Triode VacIon® Pump is presented:

1. Polar plots of field strengths in the plane of the top flange for radii of 5 and 10 inches from the center of the pump.
2. Curves of field strength along the centerline of the pump and in the plane of the flange as a function of distance from the pump, as shown on the individual plots.

Magnetic Shielding

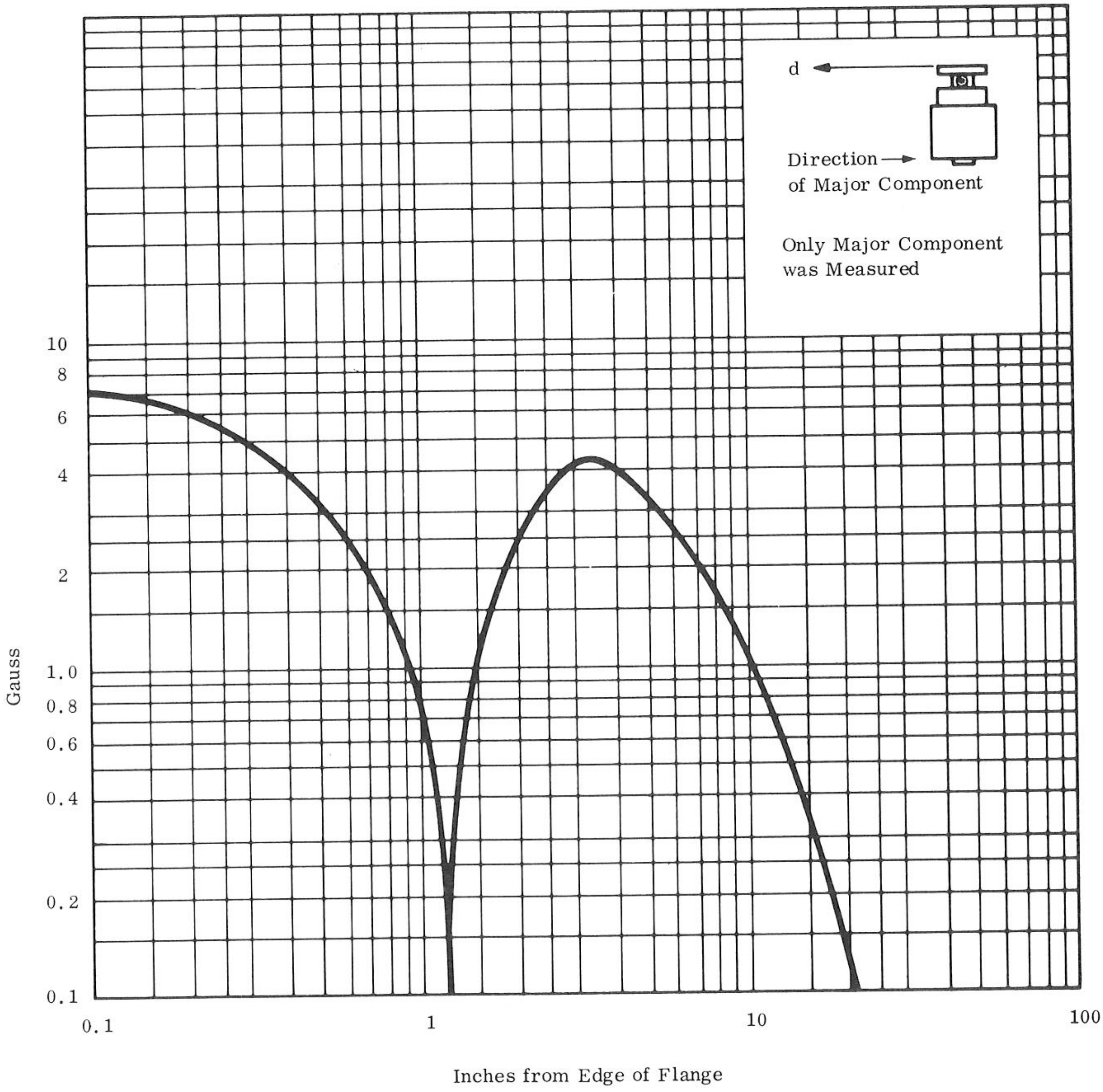
Pumping speed of the VacIon Pump is proportional to the strength of the magnetic field in the magnetic gaps. If magnetic shielding is necessary, place the shield around the experiment itself whenever possible. If the shield must be built around the pump, leave at least 2 inches between the shield and the magnet to minimize the loss of field strength and to minimize the thickness of shielding material required.

30 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS ANGLE POSITION ON
5 AND 10 INCH RADIUS CIRCLES

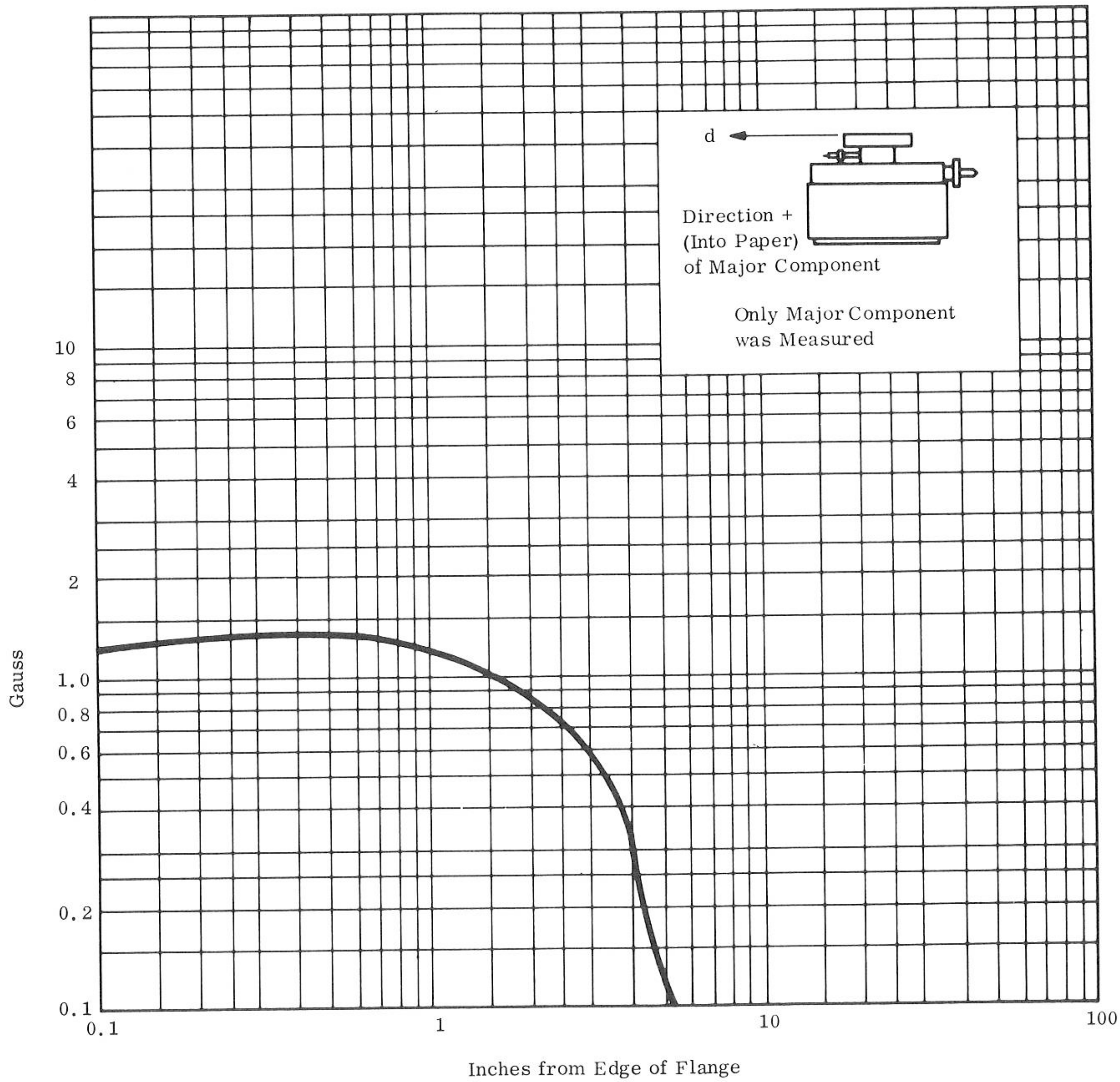


MEASUREMENTS TAKEN IN PLANE OF TOP FLANGE.
ONLY MAJOR COMPONENT WAS MEASURED.

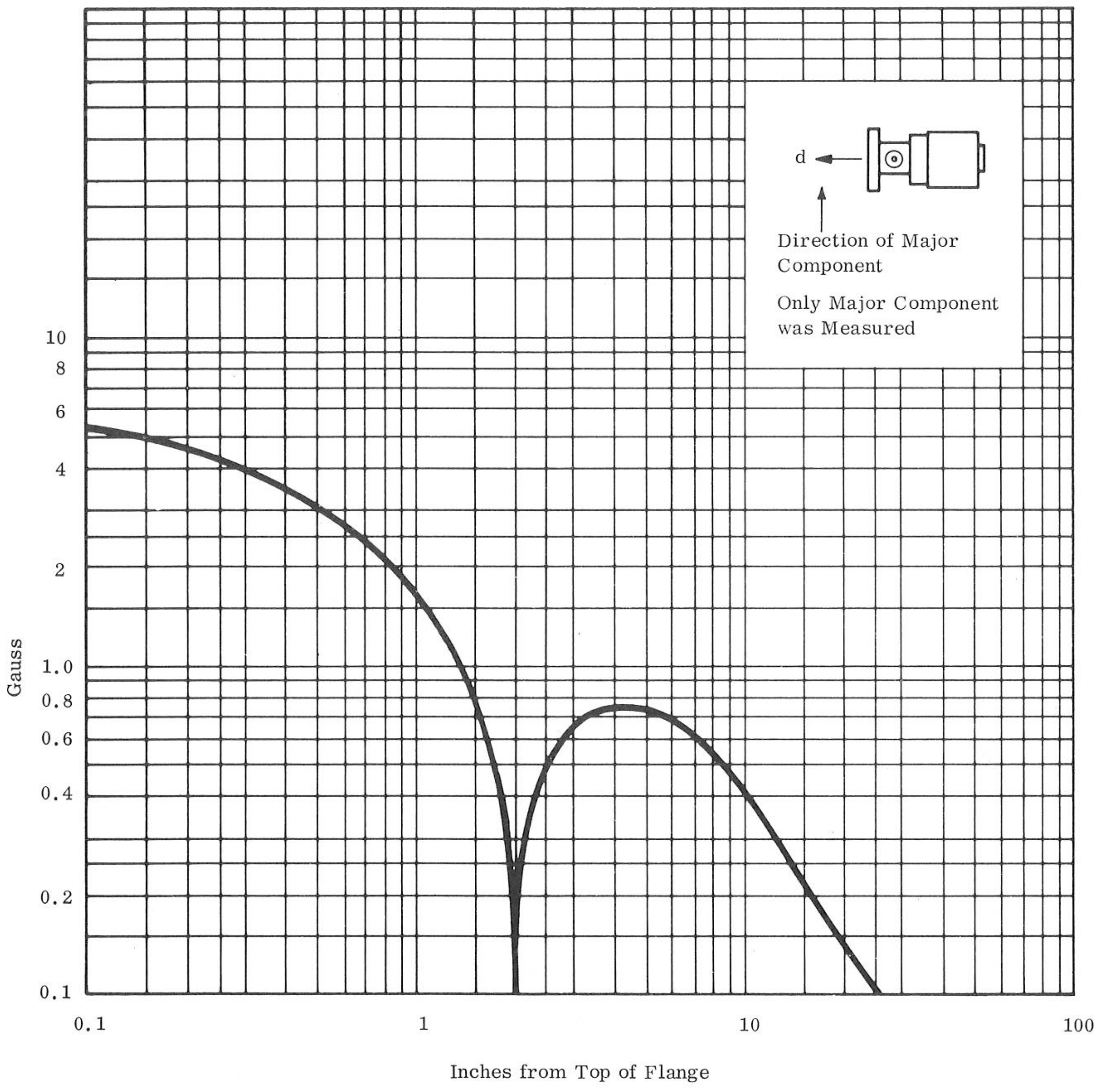
30 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



30 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



30 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



60 ℓ/s VacIon® PUMP

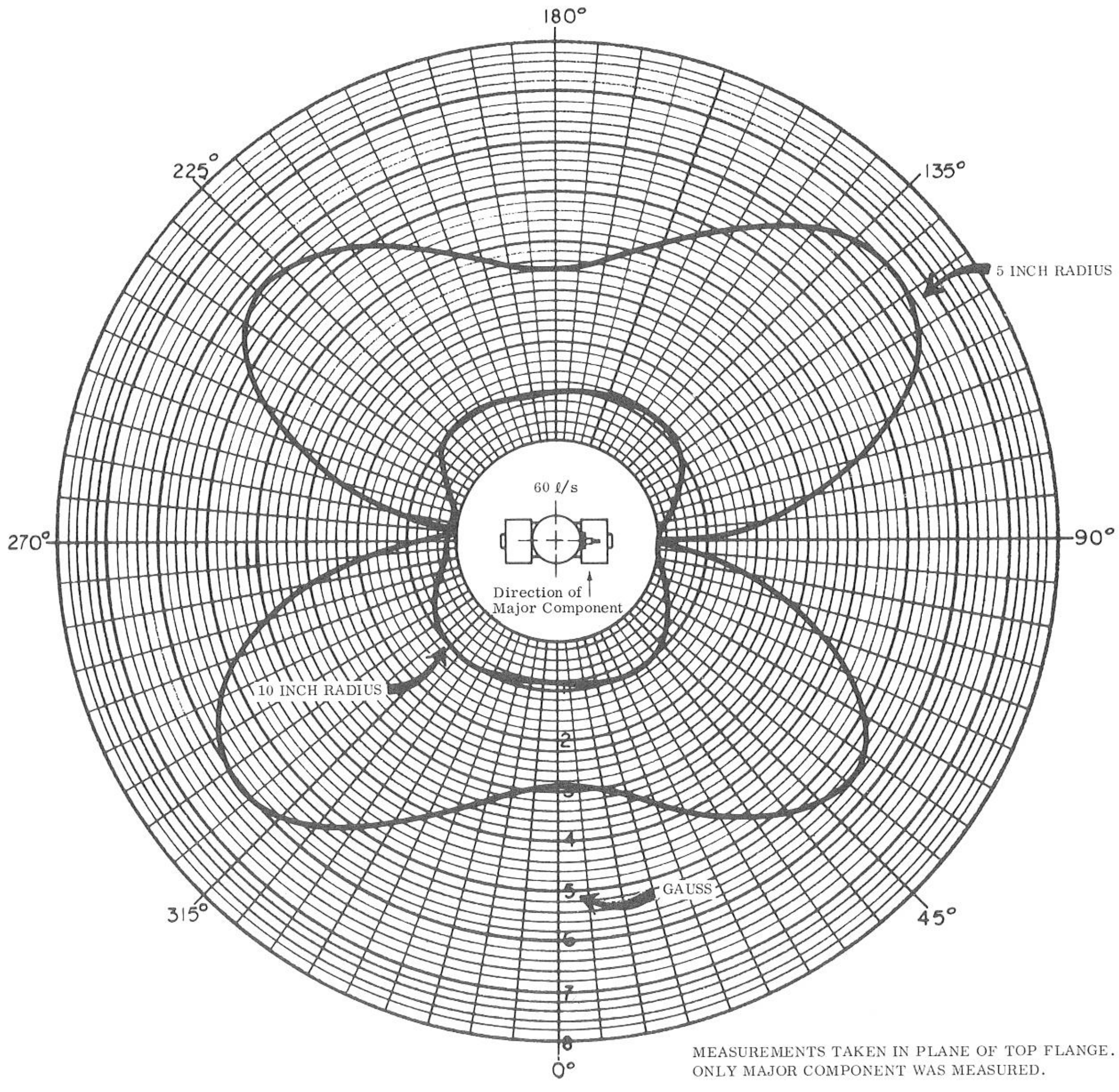
The following magnetic field data for the 60 ℓ/s Triode VacIon® Pump is presented:

1. Polar plots of field strengths in the plane of the top flange for radii of 5 and 10 inches from the center of the pump.
2. Curves of field strength along the centerline of the pump and in the plane of the flange as a function of distance from the pump, as shown on the individual plots.

Magnetic Shielding

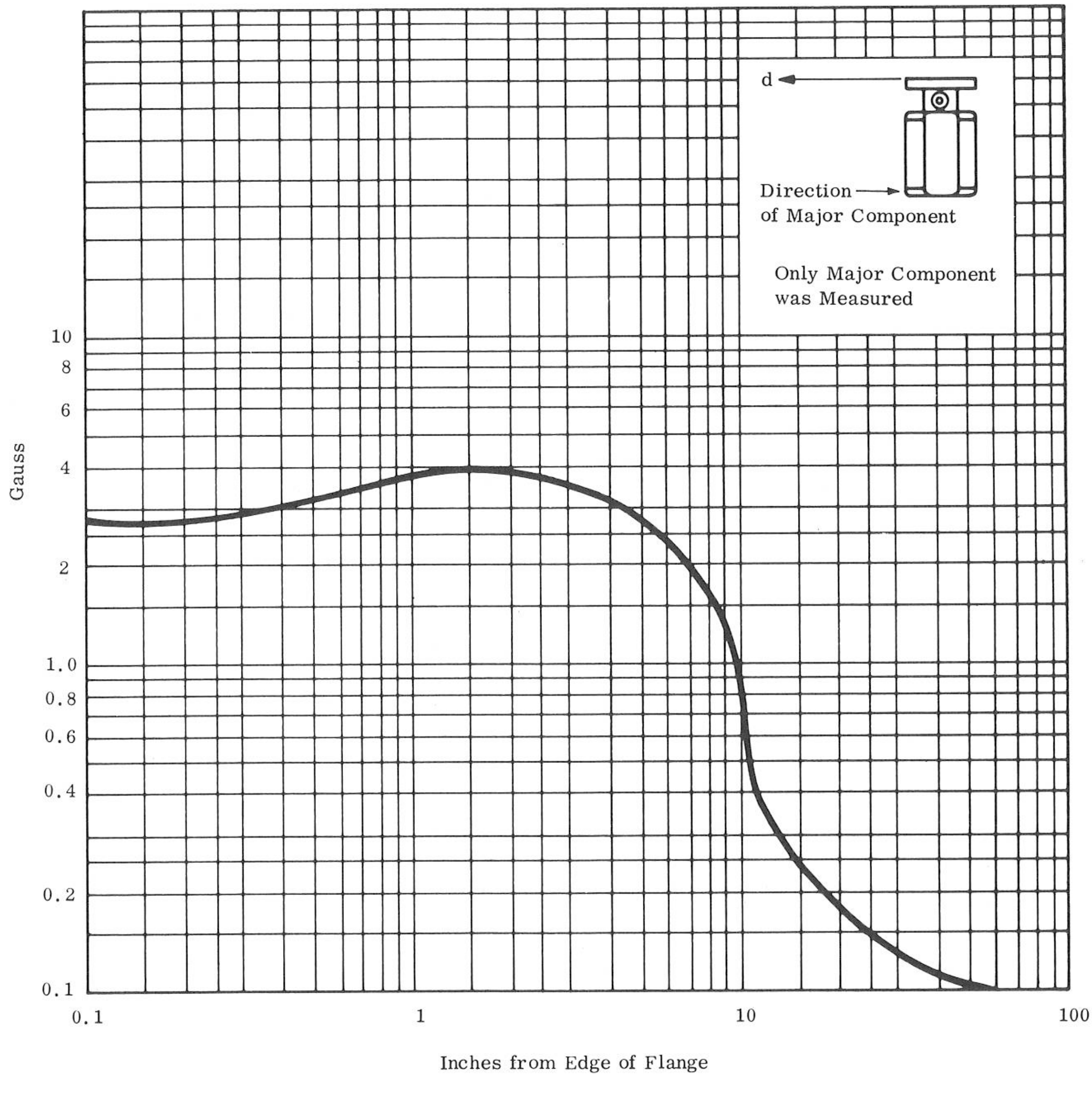
Pumping speed of the VacIon Pump is proportional to the strength of the magnetic field in the magnetic gaps. If magnetic shielding is necessary, place the shield around the experiment itself whenever possible. If the shield must be built around the pump, leave at least 2 inches between the shield and the magnet to minimize the loss of field strength and to minimize the thickness of shielding material required.

60 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS ANGLE POSITION ON
5 AND 10 INCH RADIUS CIRCLES

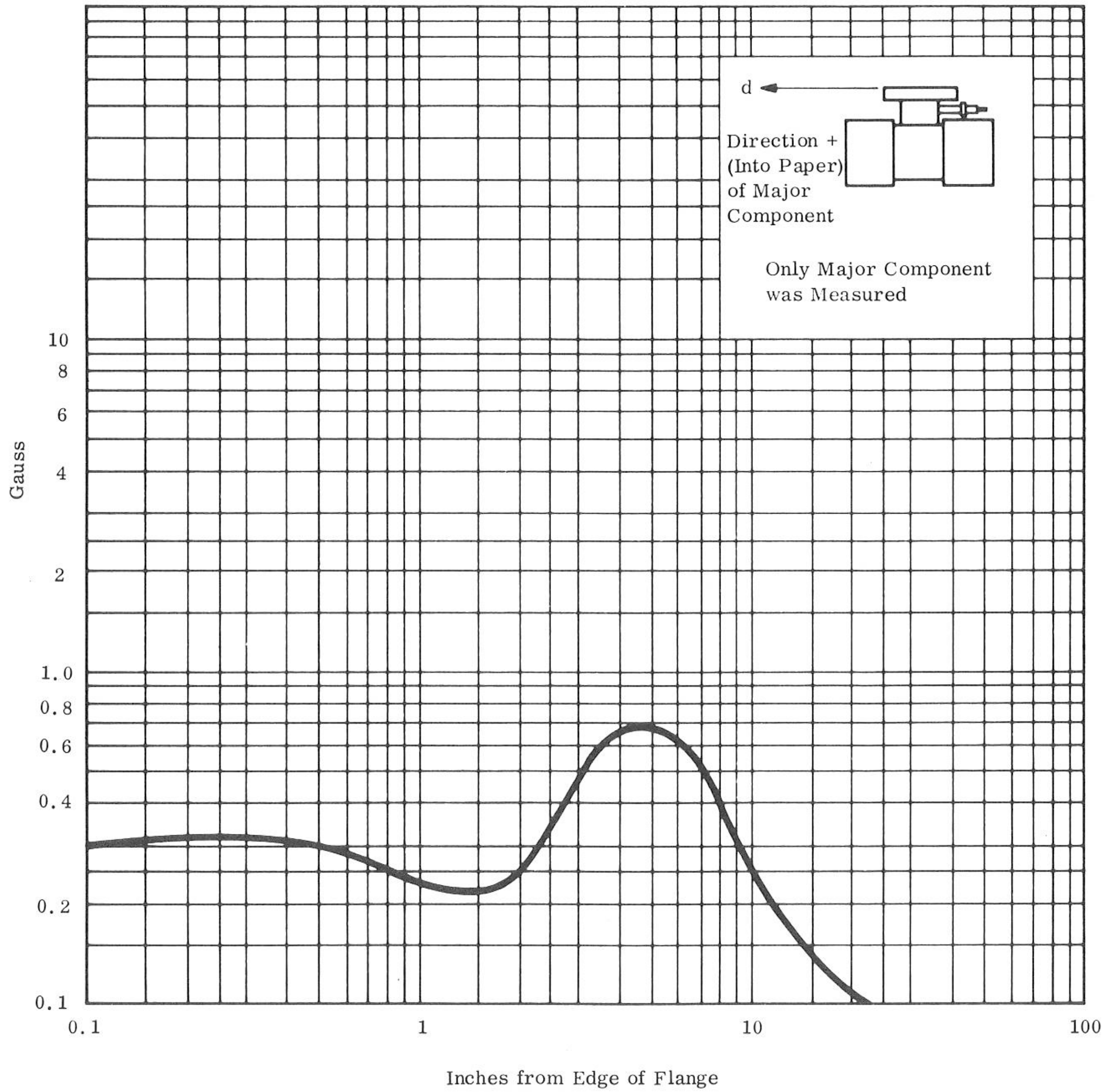


60 ℓ/s TRIODE VACION® PUMP

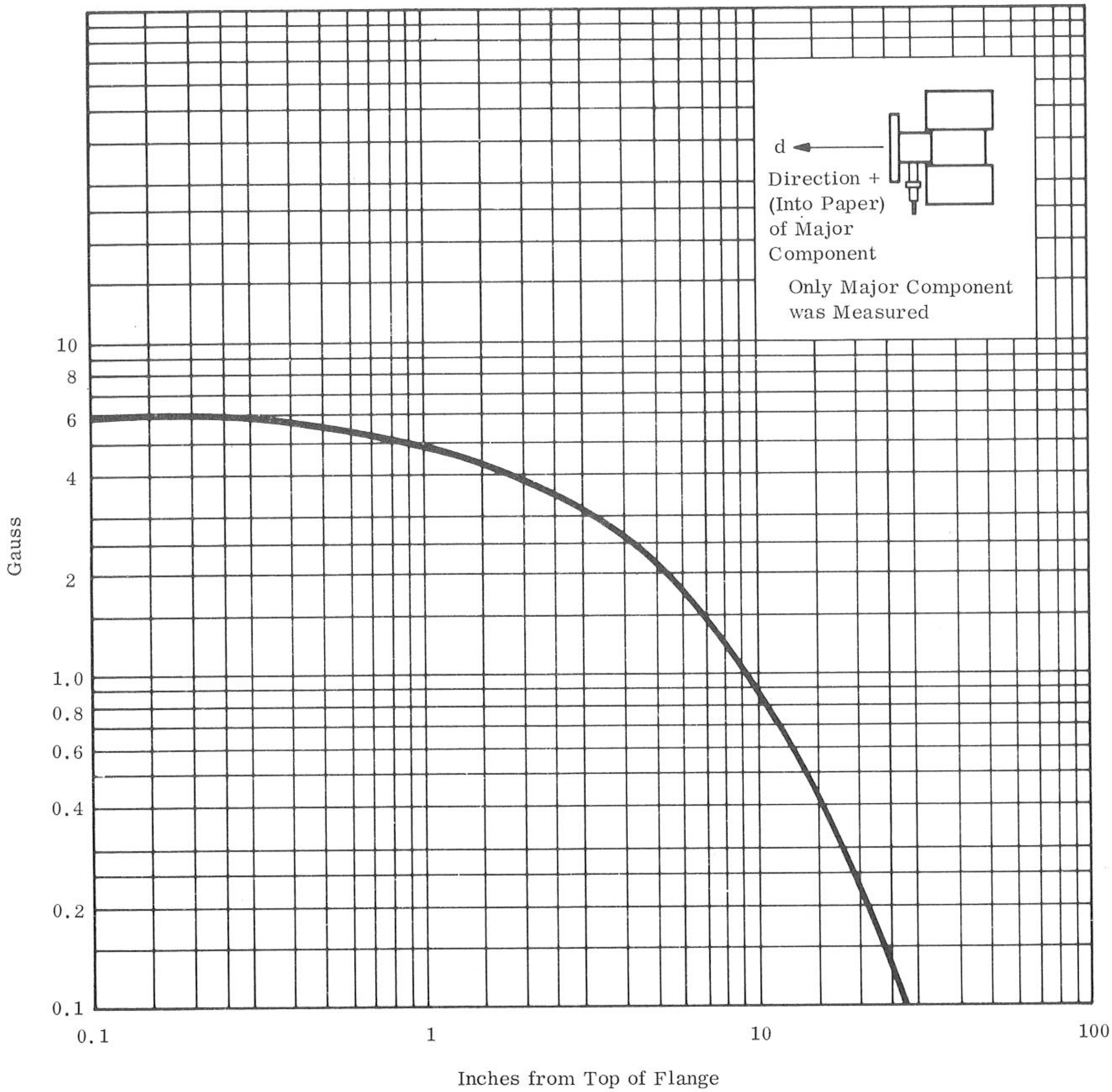
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



60 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



60 ℓ/s TRIODE VACION® PUMP
STRAY MAGNETIC FIELD VERSUS DISTANCE d FROM FLANGE



A D D E N D U M

The Varian VacIon® Pump Control unit, Model 921-0062 now incorporates a safety interlock circuit to reduce the risk of electrical shock if the control unit is not properly grounded.

An insulated safety interlock sensing wire is now substituted for the rear panel ground strap.

To make the connection between the control unit and pump, secure the safey interlock sensing wire to the pump body with any convenient grounded mounting screw on the pump body. Also, insure that the grounding spring is in place on the high voltage connector on the pump. To complete the connection, install the high voltage cable between the high voltage connector on the pump, and the control unit high voltage terminal.

Failure to make the connections as outlined above will cause the main power to be immediately removed from the unit when the main power switch is turned on. The front panel Fault Lamp will also light when this occurs. In such a case, pull the primary power cable from it's source and make the required connections. To restore power, reconnect the primary power cable and depress the front panel Reset button.

N O T E

The main power will also be removed from the unit and the Fault Lamp will light if an overload condition occurs during a normal operation. In that case, the overload condition must be rectified (for example, short circuit removed, or system re-roughed), and the front panel Reset button must be depressed to restore power to the unit.

Refer to schematic D 627117, revision W, attached.